Cascade Creek Project (FERC No. 12495-002)
License Application for Major Unconstructed Project

PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT

DRAFT FOR REVIEW & COMMENT

2/11/11

Cascade Creek Project (FERC No. 12495-002)
License Application for Major Unconstructed Project

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

PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT

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DEFINITION OF TERMS, ACRONYMS, AND ABBREVIATIONS

ACMP	Alaska Coastal Management Program
ADA	Americans With Disabilities Act
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
ADOL	Alaska Department of Labor
ADNR	Alaska Department of Natural Resources
ADOT	Alaska Department of Transportation
af	Acre-foot, the amount of water needed to cover one acre to a depth of one foot.
ALP	Alternative Licensing Process
AMTA	Alaska Mental Trust Authority
ANHP	Alaska Natural Heritage Program
AOHA	Alaska State Office of History and Archaeology
APE	Area of Potential Effect, as pertaining to Section 106 of the National Historic Preservation Act.
Applicant	Cascade Creek LLC
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMI	Benthic Macroinvertebrate Indices
BMP	Best Management Practices
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
CFS	Cubic-Feet per Second
Commission	Federal Energy Regulatory Commission

CSAP	Central/Southern Southeast Area Plan
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DLA	Draft License Application
DO	Dissolved Oxygen
DOE	US Department of Energy
DOI	US Department of Interior
DPS	Distinct Population Segment
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EL	Elevation
EPA	US Environmental Protection Agency
EPT	Ephemeroptera (mayfly), Plecoptera (stonefly), and Trichopera (caddisfly)
ESA	Endangered Species Act of 1973
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
FPA	Federal Power Act
FPC	Federal Power Commission
FWCA	Fish and Wildlife Coordination Act
GBP	Glacier Bay Preserve
GBNP	Glacier Bay National Park
GIS	Geographic Information Systems

GWh	Gigawatt-hour (equals one million kilowatt-hours)
Hp	Horsepower
HPMP	Historic Properties Management Plan
HSI	Habitat Suitability Index
Installed Capacity	The nameplate MW rating of a generator or group of generators
Interested Parties	The broad group of individuals and entities that may have an interest in a proceeding
kW	Kilowatt
kWh	kilowatt-hour
kV	Kilovolts
LUD	Land Use Designation
MIS	Management Indicator Species
MOA	Memorandum of Agreement
MSL	Mean Sea Level
MW	Megawatt
MWh	Megawatt-hour
NGO	Non-Governmental Organization
NIP	Non-Internet Public
NEPA	National Environmental Policy Act
NGO	Non-governmental organization
NMFS or NOAA Fisheries	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NOI	Notice of Intent

NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NRCS	Natural Resource Conservation Service
NRI	Nationwide Rivers Inventory
NWI	National Wetlands Inventory
PA	Programmatic Agreement
PDEA	Preliminary Draft Environmental Assessment
PME	Protection, Mitigation, and Enhancement
PRD	Petersburg Ranger District
Project	FERC Project No. 12495, Cascade Creek Project
project area	The area within the proposed FERC project boundary.
project boundary	The boundary line defined in the project license issued by FERC that surrounds those areas necessary for safe and efficient operation and maintenance of the Project or for other specified project purposes.
project vicinity	The general geographic area in which the Project is located; generally a 20-mile radius of the proposed Project
PSC	Power Site Classification
RD	Ranger District
RTE	Rare, Threatened, and Endangered
Run-of-river	A hydroelectric project that uses the flow of a stream with little or no reservoir capacity for storing water such that, at any given time, flow immediately downstream of the Project is equal to inflow to the project reservoir.
RUSLE	Revised Universal Soil Loss Equation
SCORP	State Comprehensive Outdoor Recreation Plan

SD	Scoping Document
Service List	A list maintained by FERC of parties who formally have intervened in a proceeding. In relicensing, there is no Service List until the license application is filed and accepted by FERC. Once FERC establishes a Service List, any documents filed with FERC also must be sent to the Service List.
SHPO	State Historic Preservation Office
SMP	Shoreline Management Plan
Tailrace	Channel through which water is discharged from the powerhouse turbines.
THPO	Tribal Historic Preservation Officer
TLRMP	Tongass Land and Resource Management Plan
TLO	Trust Land Office
TMDL	Total Maximum Daily Load
TNF	Tongass National Forest
TUS	Transport and Utility System
USACOE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USLE	Universal Soil Loss Equation
WQC	Water Quality Certificate

EXECUTIVE SUMMARY

Cascade Creek LLC (Applicant) proposes to construct and operate the new 70-megawatt (MW) Cascade Creek Hydroelectric Project (Project) within Power Site Classification No. 9 established by Order of the Secretary of the Department of the Interior on August 20, 1921. The lands within the Power Site Classification No. 9 have been ordered (Interpretation No. 174, August 20, 1931) to be construed as describing the following area:

TONGASS NATIONAL FOREST

In Power—Site Classification No. 9

All lands below the 1,650 foot contour above sea level which drain into Swan Lake, located in the Cascade Creek Basin about 2.5 miles inland from the east shore of Thomas Bay, Alaska; all lands south of Cascade Creek within one mile of the middle of said creek, and all lands north of Cascade Creek within one-eighth of a mile of the middle of said creek, extending from Swan Lake to the shore of Thomas Bay. Mouth of creek is in approximately Lat. 57°N., Long.132° 7' W.

The Applicant is seeking a 50-year license for the construction and operation of the proposed Project with the Federal Energy Regulatory Commission (FERC) as FERC Project No. 12495. The Applicant anticipates selling project power to local and regional markets.

The proposed Project consists of an intake siphon structure and an outlet control structure at Swan Lake, a power conduit consisting of a mostly unlined, 12-foot–diameter, rock tunnel and buried steel penstock, and powerhouse with three turbine-generators located adjacent to Thomas Bay. Appurtenant structures include a fixed pier, barge loading ramp, and two housing units. Transmission would be a combination of overland (primarily within existing road and utility corridors) and undersea cable to a point of connection at Petersburg, Alaska, approximately 20 miles to the southwest. The Applicant proposes to operate the Project within Swan Lake's normal, seasonal lake fluctuations to avoid effects to the lake and shoreline and proposes additional measures for the protection and enhancement of environmental, aesthetic, and recreational resources.

With the exception of portions of the transmission corridor, the proposed Project is within the US Forest Service's (USFS) Tongass National Forest (TNF).

The Applicant, in part, selected the Cascade Creek drainage over other potential hydroelectric sites because of the federal Power Site Classification (PSC) (Appendix A). The designation and site reservation for hydroelectric development is a federal recognition of the appropriateness of the Project; however, the Applicant acknowledges that the PSC does not preclude the need for adequate and appropriate investigation and analysis of potential effects to natural and cultural resources nor the need to manage the proposed Project consistent with the purposes of the TNF where consistent with hydroelectric generation. The Applicant will comply with any reasonable and necessary conditions for the protection of lands, wildlife, and recreation that are consistent with the PSC.

The Applicant implemented a consultation process under the Alternative Licensing Process (ALP). Under the ALP, there are several opportunities for resource agencies, Indian tribes, NGOs, and the public to provide input including during the scoping process, when the Applicant solicits comments regarding the scope of issues and analysis for the preparation of the Preliminary Draft Environmental Assessment (PDEA). The Applicant facilitated agency and public consultation through a series of site visits, meetings, and correspondence between June 2007 and December 2010. The Applicant originally presented a more complex, multi-project development proposal in 2007. In response to agency and stakeholder consultation, subsequent design analysis, and in an effort to minimize the environmental effects of development, the Applicant modified its proposal to that reflected within this PDEA. As the Applicant made significant changes to its originally proposed project footprint and operational parameters in response to stakeholder comments it determined that some studies requested in the early stages of consultation no longer had a project nexus. The Applicant advised stakeholders of its intent to undertake a specific subset of originally requested studies for resource. Appendix B includes the Applicants final study plans; Appendix C includes study reports. The results of these studies are included in this PDEA.

The purpose of this PDEA is to analyze the potential for both temporary effects from project construction activities and long-term effects from project structures and operation, and describe the proposed protection, mitigation, and/or enhancement (PME) measures for potentially affected resources. The Applicant proposes to continue consultation with state and federal agencies to collaboratively develop and implement post-licensing management and monitoring activities.

In an effort to support state and federal agency data gathering efforts and in anticipation of additional state and federal regulatory requirements, such as application for the USFS Special Use Permit, a US Army Corp of Engineers (USACOE) Section 10/404 Permit, and the requirement to development a Biological Assessment Under Section 7 of the Endangered Species Act, the Applicant anticipates additional field work and study during 2011. The Applicant is also developing an off-license agreement with the US Fish and Wildlife Services (USFWS) which will include additional studies that may provide data for broader agency management goals and objectives.

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

PRELIMINARY DRAFT ENVIRONMENTAL ASSESSMENT

1.0 INTRODUCTION

Cascade Creek LLC (Applicant) proposes to construct and operate the new 70-megawatt (MW) Cascade Creek Hydroelectric Project (Project), located on Swan Lake and Thomas Bay, approximately 15 miles northeast of the city of Petersburg in Southeast Alaska. The Applicant is seeking a 50-year license for the construction and operation of the proposed Project with the Federal Energy Regulatory Commission (FERC or Commission) as FERC Project No. 12495-002. The Applicant anticipates selling project power to local and regional markets. The project lies within Power Site Classification No. 9, established by Order of the Secretary of the Department of the Interior on August 20, 1921. The lands within the Power Site Classification No. 9 have been ordered (Interpretation No. 174, August 20, 1931) to be construed as describing the following area:

TONGASS NATIONAL FOREST
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All lands below the 1,650 foot contour above sea level which drain into Swan Lake, located in the Cascade Creek Basin about 2.5 miles inland from the east shore of Thomas Bay, Alaska; all lands south of Cascade Creek within one mile of the middle of said creek, and all lands north of Cascade Creek within one-eighth of a mile of the middle of said creek, extending from Swan Lake to the shore of Thomas Bay. Mouth of creek is in approximately Lat. 57°N., Long. 132° 7’ W.

In its 2003 Final Supplemental Environmental Impact Statement for the Tongass Land and Resource Management Plan (TLRMP) Revision, the USFS acknowledges the Power Site Classification designation and indicates the drainage is “withdrawn from other management considerations” (USFS, 2003).

The Applicant is seeking a 50-year license for the construction and operation of the proposed Project with the Federal Energy Regulatory Commission (FERC) as FERC Project No. 12495. The Applicant anticipates selling project power to local and regional markets.

The Applicant will enter into an Agreement with the USFS for the occupation and use of the property necessary for the development and operation of the proposed Project.

The Project would include an intake siphon structure and an outlet control structure at Swan Lake, a power conduit consisting of a mostly unlined, 12-foot-diameter tunnel and steel penstock, and a powerhouse located above tidewater on Thomas Bay. The proposed 140-feet by 80-feet powerhouse will be located at El. 58 feet msl, set back at least 200 feet from ordinary high-tide waterline, and incorporate three 23.3-megawatt (MW) turbine/generator units, with a nominal total capacity of approximately 70 MW. The expected annual average generation of the Project is 204,600 megawatt-hours (MWh). As proposed, the tailrace consists of a low gradient, open stream channel lined with natural rock/cobble/boulder materials approximately 450 feet long and 40 feet wide, discharging as a new outlet to Thomas Bay. It would exit the powerhouse in a southern direction for approximately 300 feet and then turn west to Thomas Bay for approximately 150 feet in order to maintain a tree screen to visually hide the powerhouse from Thomas Bay. The Applicant proposes to operate the Project within Swan Lake's average seasonal lake fluctuations to avoid effects to the lake, shoreline, and an existing population of stocked, non-native rainbow trout. The Applicant also proposes protection, mitigation, and enhancement measures (PME) to address potential effects of project construction on environmental and social resources of the project area.

1.1 Application

The Applicant is seeking a license for its proposed 70-MW Cascade Creek Hydroelectric Project under the Commission's Alternative Licensing Process (ALP). The Commission's regulations (18 CFR § 4.34 and 18 CFR § 4.38) require applicants to consult with appropriate state and federal resource agencies and the public before filing a license application. This consultation is required to comply with the Fish and Wildlife Coordination Act (FWCA), the Endangered Species Act (ESA), the National Historic

Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be complete and documented in accordance with the Commission's regulations.

On August 2, 2007, the Applicant requested approval from the Commission to use the ALP for licensing the proposed Project, which it received on September 13, 2007. Under the ALP, the Commission's standard pre-filing consultation process, portions of the NEPA scoping process, and any process and consultation associated with the Clean Water Act (CWA), ESA, NHPA, or other statutes are combined in the pre-filing stage. Pursuant to the process and schedule requirements of the ALP (18 CFR § 4.34), the Applicant is filing this Preliminary Draft Environmental Assessment (PDEA) with the Commission and participating agencies, NGOs, and the public.

1.2 Purpose of Action

In deciding whether to issue a license for a hydroelectric project, the Commission must determine that a project is adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (e.g., flood control, irrigation, and water supply), the Commission also considers the purposes of energy conservation; the protection, mitigation, and enhancement of fish and wildlife resources (including related spawning grounds and habitat); the protection of and provision for recreational opportunities; and the preservation of other aspects of environmental quality and social resources. Issuing an original license for the Project would permit the Applicant to generate electricity at the Project for the term of a new license, making electric power from a renewable resource available to the regional power market, as discussed in Exhibit B of the License Application. Issuance of this license would be consistent with the federal Power Site Classification No. 9 for the Cascade Creek drainage within the TNF.

This PDEA assesses the effects associated with construction and operation of the Project on environmental, cultural, land use, aesthetic, recreational and socio-economic resources and alternatives to the proposed Project. Specifically, Section 3.0 assesses the environmental, social, and economic effects of construction and operation of the Project:

(1) as proposed by the Applicant, including proposed PME measures and (2) under the no-action alternative, whereby the existing condition would prevail and the Project would not be constructed. A discussion of consistency with comprehensive plans is provided in Section 5.2.

1.3 Need for Power

The Project will be owned and operated by the Applicant and the energy generated will be sold at wholesale to public or municipal utility companies, aggregators, or other wholesale purchasers of electric generation.

As discussed in detail in Exhibit B, there is an anticipated increased energy demand in Southeast Alaska because of four major categories: 1) slow load growth increase; 2) a continued trend of fuel oil heat to electric heat conversion as the price of fuel oil increases; 3) the introduction of electric vehicles offsetting petroleum fuel in towns with short drive distances and high fuel prices; and 4) implementation of connecting large cruise ships to shore power in lieu of onboard diesel generation. All of these trends have resulted in substantially revised power need forecasts for Southeast Alaska. Projections included in Exhibit B anticipate energy demands increasing from 279,058 MWh in 2013 to 538,770 MWh in 2028. If no other hydroelectric facilities are approved and constructed, existing plant generation of approximately 268,000 MWh will be unable to meet this demand. Additional energy needs will continue to require fossil fuel generation (primarily diesel).

The Project will fulfill the public interest for reasonably priced, reliable, and environmentally sound sources of renewable energy. The approval of this Project would reduce greenhouse gas releases associated with fossil fuel generation.

1.4 Statutory and Regulatory Requirements

1.4.1 Federal Power Act

1.4.1.1 Section 18 Fishway Prescriptions

Section 18 of the Federal Power Act (FPA) states that FERC is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the Interior. Natural barriers from Cascade Creek Falls to the outlet of Swan Lake preclude passage. To date, no preliminary prescriptions have been filed for the Project.

1.4.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation.

With the exception of portions of the transmission corridor, the proposed Project is within the US Forest Service's (USFS) Tongass National Forest (TNF) and within Power Site No. 9. The Secretary of the Interior Order of August 20, 1921 established Power Site No. 9. The lands within the Power Site Classification No. 9 have been ordered (Interpretation No. 174, August 20, 1931) to be construed as describing the following area:

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In Power—Site Classification No. 9

All lands below the 1,650 foot contour above sea level which drain into Swan Lake, located in the Cascade Creek Basin about 2.5 miles inland from the east shore of Thomas Bay, Alaska; all lands south of Cascade Creek within one mile of the middle of said creek, and all lands north of Cascade Creek within one-eighth of a mile of the middle of said creek, extending from Swan Lake to the shore of Thomas Bay. Mouth of creek is in approximately Lat. 57°N., Long.

132° 7' W.

In its 2003 Final Supplemental Environmental Impact Statement for the Tongass Land and Resource Management Plan (TLRMP) Revision, the USFS acknowledges the Power Site Classification (PSC) designation and indicates the drainage is "withdrawn from other management considerations" (USFS, 2003). The Applicant has been in consultation with the USFS throughout the licensing process. Though the USFS has not requested preliminary conditions at this point, the Applicant will comply with any reasonable and necessary conditions for the protection of lands, wildlife, and recreation that are consistent with the PSC.

1.4.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the Project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

As part of the ALP, the Applicant has been in consultation with federal and state agencies, including Alaska Department of Fish and Game (ADFG) and US Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS). To date, no preliminary recommendations have been provided.

1.4.2 Section 401 of the Clean Water Act

Under Section 401(a)(l) of the Clean Water Act (CWA), an applicant for a federal license or permit to conduct an activity that may result in a discharge into waters of the United States must provide the licensing or permitting agency with water quality certification (WQC) that the discharge would not violate water quality standards from the applicable state. The federal agency, in this case FERC, may not authorize the activity unless certification has been obtained or the state has waived certification through failure to act on the request for certification within one year after receipt of that request.

The Applicant is subject to Water Quality Certification under Section 401(a)(1) of the federal Clean Water Act of 1977. The Alaska Department of Environmental Conservation (ADEC) establishes numeric water-quality standards consistent with Section 303(c) of the federal Clean Water Act (CWA), which are contained in Section 18 of the Alaska Administrative Code, Chapter 70 (18 AAC 70).

The Applicant intends to provide to the Commission a copy of the request for certification, including proof of the date on which the certifying agency received the request, upon issuance of notice the Commission has accepted the License Application pursuant to 18 C.F.R. Section 4.34(b)(5)(ii).

1.4.3 Section 404 of the Clean Water Act

Section 404 of the CWA requires the Applicant to apply for and receive permits from the US Army Corps of Engineers (USACOE) for the alteration of wetlands and for the discharge of dredged or fill material associated with construction into the waters of the United States.

The Applicant intends to file the necessary permit applications for review and approval by the USACOE contingent on the Commission's acceptance and subsequent issuance of the license, and prior to commencement of construction.

1.4.4 Endangered Species Act

Under provisions of Section 7(a)(2) of the Endangered Species Act (ESA), a federal agency that authorizes, permits, or carries out activities must consult with the USFWS and the NMFS to ensure that its actions will not jeopardize the continued existence of any listed species. A federal agency is required to consult USFWS and NMFS if an action "may affect" listed species or designated critical habitat, even if the effects are expected to be beneficial. A "may affect" determination includes actions that are "not likely to adversely affect," as well as "likely to adversely affect" listed species. If the action is "not likely to adversely affect" listed species (i.e., the effects are beneficial, insignificant, or discountable), and the agencies agree with that determination, they provide concurrence in writing and no further consultation is required. If the action is "likely to adversely affect" listed species, then the federal action agency must request initiation of formal consultation. This request is made in writing to the USFWS and NMFS, and must include a complete initiation package. Formal consultation concludes with the issuance of a biological opinion (BO) to the federal action agency.

The Applicant has consulted with the USFWS, and NMFS as part of the Section 7 consultation and has initiated development of a draft Biological Assessment (BA) for the proposed Project. The USFWS has indicated that no federally listed terrestrial RTE species are known to inhabit the project area. NMFS has identified three federally listed RTE marine species, in addition to 10 stocks of salmon, that may inhabit the project area and may be affected by project construction or operations. No designated critical habitat occurs in the project area. The Applicant will continue consultation with these agencies and, should previously unidentified RTE species be identified within the project area or as being affected by project construction or operation, would reinitiate Section 7 consultation and will implement species specific protection measures as part of conditions to the FERC license.

1.4.5 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), the Commission cannot issue a project License within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Applicant is in the process of consulting with the Alaska Coastal Management Program (ACMP), and will request guidance on the Project's coastal zone district and, if necessary, acquire appropriate consistency certification.

1.4.6 National Historic Preservation Act

The National Historic Preservation Act of 1966 (NHPA) (16 USC. § 470 *et seq*.) (as amended) requires federal agencies to manage cultural resources under their jurisdiction and authorizes the Secretary of the Interior to maintain the National Register of Historic Places (National Register or NRHP). Section 106 of the NHPA and its implementing regulation (36 CFR Part 800) requires Commission to take into account the effect of any proposed undertaking on properties listed or eligible for listing in the National Register. If FERC determines that an undertaking may have adverse effects on properties listed or eligible for listing in the National Register, the Commission must afford an opportunity for the Advisory Council on Historic Preservation (Advisory Council) to comment on the undertaking.

The law also provides for the appointment of a State Historic Preservation Office (SHPO) to facilitate the implementation of federal cultural resource policy at the state level, and for the responsible federal agency to consult with Native American Tribes and the Tribal Historic Preservation Office (THPO) of any Tribes who attach religious or cultural importance to cultural resources under their jurisdiction.

The USFS Petersburg Ranger District Archaeologists, Jane Smith and Gina Esposito, as well as personnel at the Alaska State Office of History and Archaeology (AOHA), have reviewed, and will continue to review each phase of heritage resource work, including the study plan and research report, and have provided or will provide comments following their reviews.

The Applicant proposes to develop a Historic Properties Management Plan (HPMP) for known or identified cultural resource sites and anticipates entering into a Programmatic Agreement with the SHPO, FERC, and USFS to provide necessary protection to known or newly identified historic and cultural resources.

1.4.7 Wild & Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to make a determination as to whether the operation of a project would affect the scenic, recreational, and/or fish and wildlife values present in a designated or study river corridor.

There are no known areas within the proposed project boundary that are included or have been designated for study for inclusion in the National Wild and Scenic Rivers system.

1.4.8 Magnuson-Stevens Fishery Conservation and Management Act

Pursuant to the amended Magnuson-Stevens Fishery Conservation and Management Act (Act), Congress mandated that habitats essential to federally managed commercial fish species be identified, and that measures be taken to conserve and enhance habitat. In the amended Act, Congress defined essential fish habitat (EFH) for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (PSMFC, 2007). EFH is only applicable to federally managed commercial fish species that live out at least one component of their lifecycle in marine waters.

EFH has not been designated within the project area. EFH is designated for the juvenile, immature, and maturing adult Chinook, sockeye, chum, coho, and pink salmon within Thomas Bay. There are no fishing restrictions within this EFH (NMFS, 2010a).

1.4.9 Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 prohibits the "take" of any marine animals, with few exceptions, where "take" includes any activity which results in injury, harm or harassment. Authority for the administration of the MMPA is divided between the USFWS and NMFS. The most common marine mammal species protected under the MMPA that are not already listed on the ESA include harbor seals, harbor porpoise, Dall's porpoise, minke whales, and killer whales.

The Applicant has consulted with the USFWS and NMFS as part of the Section 7 consultation process and in anticipation of a draft Biological Assessment for the proposed Project. The Applicant will continue consultation with these agencies. Should MMPA protected species be determined to be potentially affected by project activities, the Applicant will implement species specific protection measures as part of conditions to the FERC license and other federal permitting efforts.

1.5 Consultation

The Commission's regulations (18 CFR § 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. Under the ALP, the Applicant conducts scoping in collaboration with the FERC to fulfill the FERC's National Environmental Policy Act (NEPA) responsibilities[1]. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the Endangered Species Act, the National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

Under the ALP there are several opportunities for resource agencies, Indian Tribes, NGOs, and the public to provide input. During the public scoping process, the Applicant solicits oral and written comments regarding the scope of the issues and analysis for the PDEA, including study requests. After issuance of the Commission's ready for environmental analysis notice of the Final License Application, the Commission solicits comments, recommendations, terms, conditions, and prescriptions for the Project.

The following sections provide a summary of consultation efforts completed to date.

1.5.1 Scoping

Before preparing this PDEA, the Applicant conducted scoping to determine what issues and alternatives should be addressed. The Commission issued an Applicant-prepared Scoping Document (SD1) in May 2009. This

[1] FERC's NEPA regulations are found in 18 CFR Subchapter W-Revised General Rules, Part 380.

document presented potential issues to be addressed in the draft EA, as well as a discussion of the Applicant's approach to analyze the identified issues.

A site visit was conducted on June 17, 2009. Two public meetings were held on June 18, 2009 at the Tides Inn in Petersburg, Alaska to discuss and identify potential issues. A transcript of the meetings is part of the FERC public record. Agency meetings were held on August 12, 2010 and September 28, 2010 to discuss the process and proposed studies.

All interested agencies, Indian Tribes, NGOs, and individuals were invited to attend these meetings to assist the Commission in identifying the scope of environmental issues that should be analyzed in the EA. Announcement of these meetings was published in the local newspaper and in the Federal Register. A court reporter recorded the scoping meetings. During the meetings and the following comment period, the Applicant received comments on the Commission's SD1. In addition, licensing participants filed study requests.

A revised Scoping Document (SD2), submitted to the Commission on October 15, 2010, reflects comments the Applicant received during scoping, provides final proposed study plans, and presents the Applicant's understanding of issues and alternatives to be considered in this draft EA. Appendix B provides copies of the study plans determined through the scoping process, while Appendix C provides copies of the study reports completed to date. See Section 3.3 *Analysis of Proposed Action and Action Alternatives on Individual Resource Areas* for a full discussion of issues identified during scoping and a discussion of study results.

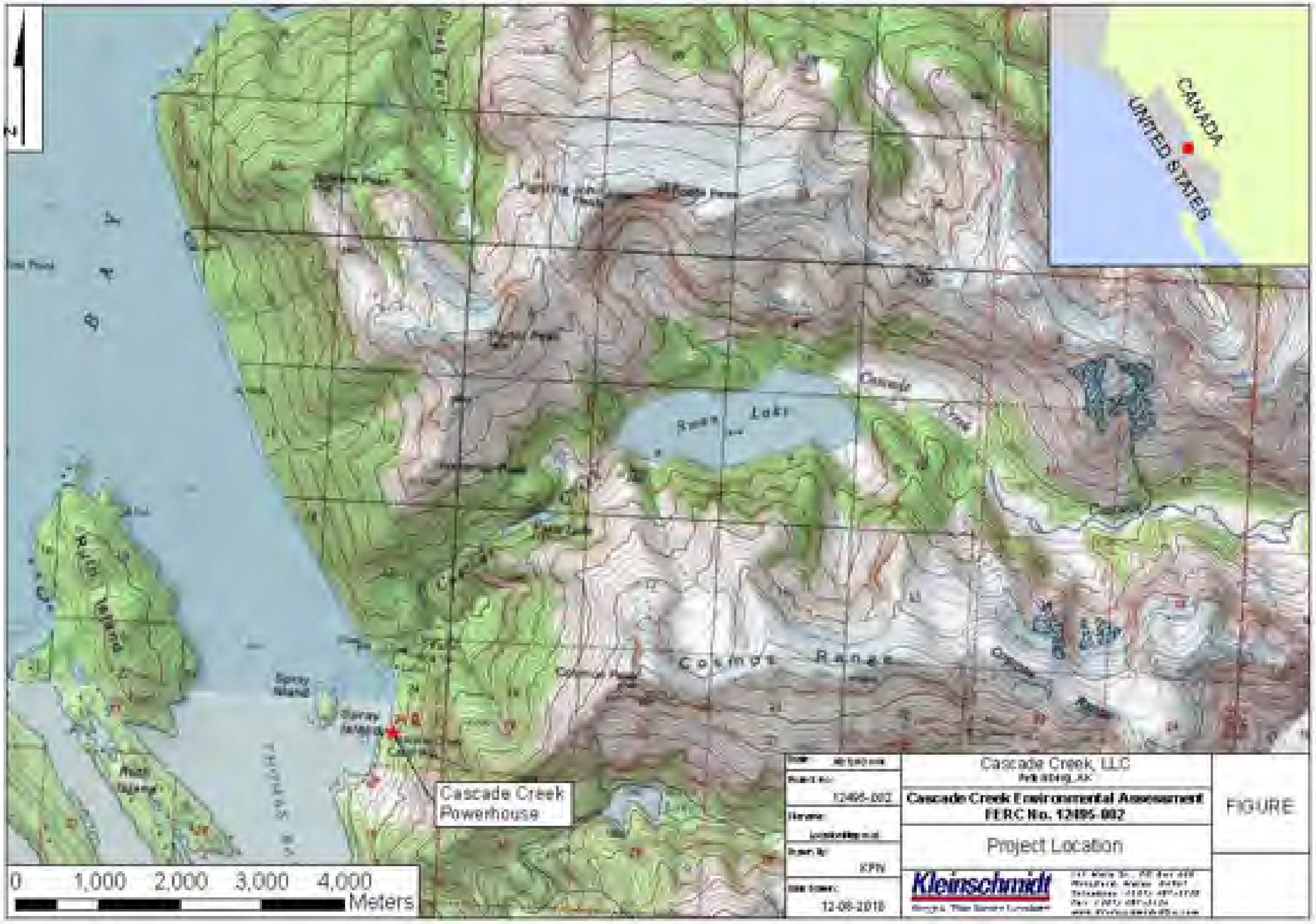
1.5.2 Interventions

This section is prepared by Commission staff after a final application is filed and notice of license application acceptance is issued by the Commission.

1.5.3 Comments on the Application

The Applicant is distributing the Draft License Application (DLA), including this PDEA, to the list of participants and other interested parties. As part of the ALP, the Applicant and participating stakeholders established a Communications Protocol instituting a 30-day review period for comments on major documents. Upon direction by FERC staff, the Applicant is providing the DLA and PDEA to stakeholders for a 90-day review period. Comments received thus far in the licensing process are included in Appendix E.

Figure 1-1. Project Location



2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 No Action Alternative

Under the no action alternative, the environmental resources in the proposed project area would remain as they currently exist, without the influence of project construction and operation. In turn, pre- and post-licensing resource assessment studies, aimed at providing further resource data to agencies, would not be performed and potential habitat enhancements and protection measures would not take place. Recreation access and facilities within the project area would remain in their current state, and recreationists would not benefit from the additional access facilities and upgrades proposed. The potential for the identification of previously unidentified cultural resources through further surveys would not occur through the licensing activities associated with this Project. The socioeconomic benefits of development, such as the provision of job opportunities, would not be realized. Energy would not be provided to replace regional reliance on petroleum dependent electric generation and subsequently emissions and potential hazards associated with this type of generation would not be replaced under the no action alternative.

2.2 Proposed Action

2.2.1 Proposed Project Facilities

The Project would include an intake siphon structure and an outlet control structure at Swan Lake, a power conduit consisting of a mostly unlined, 12-foot-diameter, tunnel and steel penstock, and a powerhouse located above tidewater on Thomas Bay. Exhibit A of the DLA provides detailed descriptions of project structures and facilities.

The screened lake siphon would be placed at an approximate depth of 40 feet. The Applicant proposes to construct a 58-feet-long by 49-feet-wide by 25-feet-high underground gate house controlling water flow to the power conduit near the Swan Lake shoreline.

The outlet control structure would consist of a low-head weir covered in native rock approximately 6 feet above the lowest lake elevation outlet where Swan Lake discharges into Cascade Creek. It would include a remotely controlled crest gate that could be lowered during extreme high flows to maintain lake levels at or below the natural high level.

The unlined, 12-feet-diameter, low pressure tunnel would originate at el. 1,430 near the gatehouse and extend to the powerhouse. The proposed 140-feet by 80-feet powerhouse will be located at El. 4658 feet msl (turbine centerline), set back approximately 200 feet from ordinary high tide waterline (Exhibit F). It would house three generating units, each consisting of a vertical-shaft Pelton turbine rated at 23,333300 kilowatts. Appurtenant facilities include an overhead crane, back-up generator, battery and accumulator banks, and power plant switchgear and controls. The expected annual average generation of the Project is 204,600 megawatt-hours (MWh).

Additional facilities will include a 30-feet by 228-feet shoreline barge landing ramp, a new dock that would be approximately 12 feet wide by 290 feet long on a fixed pier with an approximately 8-feet by 60-feet ramp down to a 60-feet by 30-feet floating dock stationed to pilings, and two housing units within the overall powerhouse footprint. The dock and adjacent barge landing ramp would provide direct access to the site during construction and operations. The Applicant intends to make the new dock available to the public after the Project begins commercial operation, barring any legal obstacles or stipulations from the USFS, as it has the potential to provide the public safe landing access for any upland use purposes. Two proposed housing units would be located north of the powerhouse to house workers during construction of the Project. The houses would remain after construction for use by plant operators and maintenance crews. Water, wastewater, and waste management will be compliant with Alaska Department of Environmental Conservation standards. Systems will be closed tank/containers if onsite development is not feasible. The proposed housing buildings would be separate from other structures and would be surrounded by proposed and existing vegetative screening. Localized transportation from the housing units to the powerhouse site would be by foot.

As proposed, water would drop vertically from the turbine units to the tailrace below. The project tailrace is proposed as a low-gradient, open-stream channel lined with natural rock/cobble/boulder materials approximately 450 feet long and 40 feet wide, discharging as a new outlet to Thomas Bay. The tailrace would exit the powerhouse in a southern direction for approximately 300 feet, and then turn west to Thomas Bay for approximately 150 feet. The tailrace design will incorporate a naturalized channel with barrier falls or obstructions to deter anadromous fish attraction.

With the exception of water-dependent structures, the Applicant proposes to site project structures at least 200 feet back from the marine shoreline on Thomas Bay to provide an aesthetic vegetative buffer and avoid affecting the coastal zone. It anticipates re-vegetation of most disturbed areas post construction.

The proposed transmission line, described in detail in Exhibit A and depicted in Exhibit G, extends approximately 18.7 miles from the proposed powerhouse located at the base of Cascade Creek to an interconnection point near Petersburg. The transmission line crosses Thomas Bay as an 8 inch diameter armored, submarine line. It subsequently crosses overland across the Patterson Delta to the shoreline of Frederick Sound to the south and continues as an undersea cable to Mitkof Island where it becomes an overhead line again to the existing substation southwest of Petersburg. The submarine cable will present a minimal profile being trenched and anchored to the sea floor. The majority of the transmission line will be installed within existing transmission rights of way, transportation corridors, and urban areas zones for this use. There would be a switchyard/transformer/circuit breaker on site at the powerhouse; however, the

Applicant is not proposing construction of new interconnect facilities and/or substations. It anticipates working through existing system upgrade requirements prior to and during interconnection discussions. The project boundary encloses Swan Lake and associated intake equipment, the power conduit complex, the powerhouse including the 200-foot setback for non-marine dependent project facilities, tailrace, and transmission line corridor.

2.2.2 Proposed Project Operation

The proposed Project will operate within the average natural fluctuations of Swan Lake. Water withdrawal from Swan Lake will be managed for power generation while maintaining lake levels within the calculated historical range of lake level fluctuation. Annual lake level fluctuation has been determined from over 38 years of U.S. Geological Service stream gaging records correlated to present and ongoing Swan Lake stage and same day outlet discharge monitoring. Water will enter the power tunnel via the intake siphon structure and travel approximately 3 miles through the power conduit to reach the powerhouse. Once water exits the powerhouse to the tailrace there would be approximately 450 feet of open, naturalized channel flow to tumble the discharge and expose it to natural atmospheric conditions before entering Thomas Bay. Combined tailrace and Cascade Creek post-development discharge volumes will closely resemble the pre-development discharge of Cascade Creek's natural regime on a seasonal, weekly basis, except that a portion of the pre-development discharge from Cascade Creek would be relocated approximately ¼ mile south of the mouth of Cascade Creek. No significant change in oceanographic conditions is anticipated as operations (i.e. water quantity and timing) will closely mimic the natural discharge regime.

2.2.3 Proposed Environmental Measures

The Applicant proposes to protect and enhance several environmental resources of the Project through the following measures:

1. Design the project facilities to ensure that size and architecture are consistent with USFS land use standards and that facilities are, where possible, screened from view. This will include:

    a. Minimizing shoreline disturbance and provide a 200-foot setback for non-marine dependent project facilities on Thomas Bay.

    b. Screening the powerhouse from saltwater view points by maintaining a forested tree screen and placing an earth/rockfill berm around powerhouse.

    c. Screening the lake intake siphon works to the maximum extent with earth materials and re-vegetative planting.

    d. Developing a re-vegetation program to naturalize disturbed areas not occupied by project facilities.

    e. Designing the project tailrace as a naturalized channel and/or falls in consultation with state and federal agencies.

2. Develop a construction Soil Erosion Control Plan and use best management practices (BMP) during and after construction to control erosion and minimize sedimentation.

3. Establish a post-construction erosion monitoring program to assess and, as needed, mitigate for post-construction erosion.

4. Develop a Hazardous Substances Spill Prevention and Cleanup Plan to prevent, reduce, and contain the release of any contaminants and monitor water quality parameters during construction.

5. Develop and implement a post-construction Water Quality Monitoring Plan to include maintenance of established gaging stations and provision of data to interested parties.

6. Develop a Water Management and Operation Plan that minimizes the effect of project operations on lake levels and establishes operational parameters for drought and high flow events.

7. Develop a Fisheries Management Plan for project waters identifying post-licensing study activities and project operations assessment on resident species. The Plan may include stock augmentation or other habitat

enhancement measures, if supported by pre-and post-licensing studies and deemed necessary by state and federal resource agencies.

8. Design the tailrace with a natural rock/boulder barrier falls at the outlet of the tailrace channel into Thomas Bay to deter use by anadromous fish.

9. Develop a noxious weed control program, as needed.

10. Develop construction timing and methods protocols to minimize disturbance to aquatic and terrestrial species in consultation with state and federal resource agencies.

11. Design the transmission line to conform to raptor safety standards and consider additional installation strategies if needed.

12. Conduct additional studies of terrestrial species as part of the required BA, anticipated USFS BE and Special Use Permit, and USACOE Section 10/404 permitting. As necessary, develop additional species specific, protection measures for any identified sensitive wildlife or botanical resources.

13. Develop a Recreational Use Monitoring Plan to provide ongoing, periodic assessment of public and commercial use of the project area.

14. Provide for a new USFS Cabin within the Thomas Bay vicinity.

15. Design and implement trail upgrades in consultation with the USFS.

16. Develop project infrastructure such as docks available to facilitate public use.

17. Enter into a Programmatic Agreement with the SHPO and/or the USFS for the protection of cultural resources.

18. Develop a Historic Properties Management Program (HPMP) in consultation with state and federal agencies. This plan would include pre-construction monitoring and site assessment protocols and a post-licensing monitoring program for any identified sensitive cultural sites.

19. Develop and implement a Bear Safety Program establishing safety procedures and protocols for construction workers and project staff.

2.2.4 Project Safety

The Applicant will implement safety procedures at the proposed Project over the course of the licensing and construction process and will continue safety procedures throughout the operation of the Project. As a part of any license that is issued, the FERC will include license articles to promote safety at the Project. In addition, the Commission may require an inspection and evaluation every five years by an independent consultant and submittal of the consultant's safety report for Commission review. Applicant proposed safety measures include the Bear Safety Program and the Hazardous Substances Spill Prevention and Clean-Up Program, discussed above.

The Applicant anticipates completion of these safety plans as license compliance activities.

2.3 Modifications to Applicant's Proposal

At this time, resource agencies have not provided preliminary mandatory conditions.

3.0 ENVIRONMENTAL ANALYSIS

In this section, the Applicant provides: (1) a general description of the project vicinity and specific description of the project area; (2) an explanation of the scope of cumulative effects analysis; and (3) analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area (aquatic, recreation, etc.). Under each resource area, historic and current conditions are first described. The existing condition is the baseline against which the Applicant compares environmental effects of the proposed action and alternatives, including an assessment of the effects of proposed PME measures, and any potential cumulative effects of the proposed action and alternatives.

3.1 General Description of the River Basin

3.1.1 River Basin System

The primary bodies of water in the project area include Swan Lake, Falls Lake, and Cascade Creek. Swan Lake is a naturally impounded, isolated, oligotrophic glacial lake with a surface area of about 579 acres at El 1,514 feet msl and a drainage area of 18.9 square miles. Falls Lake is part of Cascade Creek created by natural constrictions and geology within the Creek. Falls Lake is an approximately 15 acre lake about 354 feet in elevation below the Swan Lake outlet at approximate El. 1,160 feet msl.

Cascade Creek exists in two segments, one upstream and one downstream of Swan Lake. The upstream section (Upper Cascade Creek) serves as the primary inlet and water source for Swan Lake and extends approximately 7 miles upstream of its confluence with Swan Lake. Upper Cascade Creek is approximately 50 feet wide at its confluence with Swan Lake. Cascade Creek below Swan Lake (Lower Cascade Creek) flows approximately 2.5 miles from the outlet of Swan Lake to tidewater. For the first 0.75 mile downstream of Swan Lake, Lower Cascade Creek descends a series of cascades, which collectively take on the appearance of multiple waterfalls with a significant waterfall at Falls

Lake. These cascades continue below Falls Lake to the lower barrier falls, approximately 300 feet from the confluence of Cascade Creek and Thomas Bay. Lower Cascade Creek ranges in width from 65 feet at the Swan Lake outlet to approximately 50 feet at the tidewater.

3.1.2 Major Land Uses and Industries

As with the majority of land in the project vicinity, with the exception of portions of the transmission corridor, the proposed Project is within the USFS Tongass National Forest (TNF). Cascade Creek Hydroelectric Project (Project) lies within Power Site Classification No. 9 established by Order of the Secretary of the Department of the Interior on August 21, 1921. The lands within the Power Site Classification No. 9 have been ordered (Interpretation No. 174, August 20, 1931) to be construed as describing the following area:

TONGASS NATIONAL FOREST

In Power—Site Classification No. 9

All lands below the 1,650 foot contour above sea level which drain into Swan Lake, located in the Cascade Creek Basin about 2.5 miles inland from the east shore of Thomas Bay, Alaska; all lands south of Cascade Creek within one mile of the middle of said creek, and all lands north of Cascade Creek within one-eighth of a mile of the middle of said creek, extending from Swan Lake to the shore of Thomas Bay. Mouth of creek is in approximately Lat. 57°N., Long. 132° 7’ W.

In its 2003 Final Supplemental Environmental Impact Statement for the TLRMP Revision, the USFS acknowledges this designation and indicates the drainage is “withdrawn from other management considerations” (USFS, 2003).

The PSC coincides with the USFS Semi-Remote Land Use Designation (LUD) as described in the Tongass Land and Resource Management Plan (TLRMP) (USFS, 2008a). Goals of this designation are “to provide predominately natural or natural appearing settings for semi-primitive types of recreation and tourism and for occasional enclaves of concentrated recreation and tourism facilities; and to provide opportunities for a moderate degree of independence, closeness to nature, and self-reliance in environments requiring challenging motorized or non-motorized forms of transportation." With respect to non-recreation structures in this LUD, such as the proposed Project, design guidelines require that adverse effects to tourism and recreation opportunities are minimized. This LUD also includes a Transportation and Utility System (TUS) special use administration and provides opportunities for the future designation and location of transportation and utility sites (USFS, 2008a).

The Patterson Delta, southwest of the proposed powerhouse site, is currently an active gravel mining and timber production area. Gravel and log barges navigate the area and are moored at an existing docking facility in the southwest corner of Thomas Bay.

Petersburg, with a population of approximately 3000 (as of 2010), is the closest municipality to the Project, located approximately 15 miles southwest of the proposed project location (City data, 2010). Commercial fishing and seafood processing is the largest industry in Petersburg. National interest jobs with the USFS and US Coast Guard (USCG) provide the second largest economic base. Tourism has remained stable in Petersburg over the years as small cruise ship fleets make call there. Local companies provide support services for visitors including sightseeing, charter fishing, and adventure experiences (McDowell, 2001).

3.1.3 Topography

The entire project area is located on the Southeast Alaska mainland, with Canada to the east and the Pacific Ocean to the west. The region is extremely mountainous, with numerous peaks on the Canadian border rising more than 18,000 feet above sea level. Treeline elevations vary between 1,800 feet in the northern areas and 3,000 feet in the southern reaches. A vast series of sheltered waterways that separate the main islands of the region's Alexander Archipelago are known as the "Inside Passage" (SEC, 2006). The region abounds in steep drainages, high-elevation glacial lakes, and a considerable number of cascading creeks and rivers draining to the ocean. Thomas Bay is an arm of Frederick Sound into which several drainage basins on the mainland discharge (USFS, 2010h).

3.1.4 Climate

Moderate temperatures for this northerly latitude, including mild winters and cool summers, heavy precipitation and frequent cloud cover characterize the coastal climate of Southeast Alaska (SEC, 2006). Summer temperatures average 55 degrees F with an average of 109.9 inches of rainfall annually. Almost half of this precipitation occurs during the four-month period September through December. Precipitation on the mainland is significantly higher than that in Petersburg (SEC, 2006; US Climate Data, 2010).

Precipitation is much heavier in the mountains than at sea level and winter temperatures are lower. Winter temperatures varies from year to year, meaning some years the precipitation is in the form of snow and others in the form of rain, but the bulk of the winter precipitation in the mountains is snowfall (SEC, 2006; US Climate Data, 2010). In the upper reaches of the Cascade Creek drainage, glacial ice is present. No observations have been recorded of the long-range fluctuations in the quantity of these glaciations. Seasonality affects life throughout the region, particularly when daylight is minimal in the winter (6 hours) and vast in the summer (18 hours) (SEC, 2006).

3.2 Cumulative Effects

According to the Council on Environmental Quality's regulations for implementing NEPA (40 C.F.R. § 1508.7), a cumulative effect is defined as the incremental effect of a proposed action added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Based on comments received during Scoping Document development (SD1) and scoping meetings, the Applicant was asked to consider cumulative effects of regional hydroelectric development. As there are currently no other active or operational hydroelectric projects within the project vicinity and no other foreseeable developments, the Applicant determined that there are no cumulative effects related to hydroelectric development.

3.2.1 Geographic Scope

The Applicant's geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of the proposed action's effect on resources within the Thomas Bay and the Patterson Delta. Specifically, Swan Lake, Cascade Creek, Cascade Falls, Thomas Bay, and facilities provided by the USFS to access the project area are included within the Project's geographic scope. It is further defined by the potential regional use of the project area by the adjacent communities of Petersburg, Wrangell, and Kake.

3.2.2 Temporal Scope

The temporal scope of the cumulative analysis includes past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of an original license, the temporal scope will look 30-50 years into the future, with focus on how reasonably foreseeable future actions affect resources. The historical discussion is limited to available information for the resource areas.

3.3 Analysis of Proposed Action and Action Alternatives on Individual Resource Areas

3.3.1 Geologic and Soil Resources

As discussed above, the Project lies within the southeast region of Alaska, also designated as the Marine West Coast Forests Region by the Environmental Protection Agency (EPA) (CEC, 1997). This mountainous region includes the wettest climates of North America and is characterized by mountainous topography bordered by coastal plains. The region lies between the Coast Mountains and rocky beaches, with Canada to the east and the Pacific Ocean to the west. Southeast Alaska extends more than 500 miles in a band of the mainland and islands along the western edge of North America. The region encompasses approximately 29,000 square miles and includes steep mountains and active glaciers. Elevations range from 1,500 to 18,000 feet msl. The treeline elevation ranges from 1,800 to 3,000 feet msl (north to south) (SEC, 2006). On a broad scale, the entire region is underlain by igneous and sedimentary rock with colluvium and morainal deposits dominating surficial materials. Soils of the region are generally leached, nutrient poor forest soils (CEC, 1997).

3.3.1.1 Affected Environment

Geological Features

Southeastern Alaska includes a long and complex geologic history beginning in the Proterozoic and representing every Phanerzoic period continuing through the Halocene. The region is the result of volcanic activity as well as glaciations (particularly the Pleistocene). Maximum glaciation occurred approximately 40,000 years ago, and receded 6,000 to 7,000 years ago flooding valleys leaving marine terraces and beach deposits (SEC, 2006). The region includes a variety of stratified, plutonic, and metamorphic assemblages in depositional, intrusive, or unknown contact with the terranes. The dominant feature of the region is the Coast Range Batholith, which underlies the coastal mountains and serves as the prominent geologic marker for the region (Gehrels, 1988).

The region is dominated by granite and associated metamorphic rocks including gneiss and schist. Specifically, the Project is located within the Coast Mountains Terrane, Costal Shear Zone, and the Gravina Belt. The region has a well-developed jointing pattern, which is commonly steep (75-90°). The predominant rock within the project area is quartz diorite, which has a distinct gneissoid (banded) structure; this banding structure forms a northwesterly trend with a northeasterly dip. No major faults have been mapped within the project area, and seismic exposure has been classified as moderate to minor probable damage from earthquakes (HA, 1985). The area of the proposed intake structure, at the southern shoreline, is located between two large tension joints which are part the Coast Shear zone. Bedrock in this area is dominated by medium grained quartz-diorite. Areas of rock fall currently exist at the base of the escarpment (SADG, 2010). Some areas of limestone and/or marble are present at higher elevations east and north east of the proposed intake, but the extent of limestone and marble is limited.

The proposed outlet control structure location lies within a large near vertical tension joint with quartz-diorite rising to the north and south (SADG, 2010). Composition of bedrock features in this area is identical to that observed near the proposed intake. There is no evidence of major shear joints within the immediate area. Colluvium is present in the form of boulders. The proposed tunnel location is dominated by courser grained quartz diorite along with some outcrops of amphibolites nearer to the outlet of Cascade Creek (SADG, 2010). The proposed power conduit route crosses through a highly fractured area with NW-trending shear joints as well as NE trending tension joints (SADG, 2010). The proposed powerhouse location, at the edge of Thomas Bay, lies within the Coast Mountain Shear zone. The area is dominated by boulders deposited along the shoreline; these boulders are primarily quartz diorite in addition to an outcrop of fine grained amphibolites located along the shoreline (SADG, 2010). The proposed transmission corridor crosses both the Coast Shear zone as well as the Gravina Belt. Surficial materials in this area are dominated by outwash from the Patterson and La Conte glaciers.

Soil Resources

The Project lies within an area of active glaciers, high elevation, and harsh weather conditions. As such, the soils within the Project are derived from colluvium or weathered rock (residuum) primarily. In some cases, organic material or wind deposited sediment (loess) is present over weathered rock and bedrock (NRCS, 2010). While the majority of the project features (powerhouse, tunnel, and intake) occur in higher elevations and on sloping hillsides, the transmission component crosses floodplains, coastal terraces, and saltwater (via submerged cable). The following sections separate soils descriptions into three areas: 1) Swan Lake; 2) Cascade Creek and the proposed alignment of the tunnel; and 3), the proposed transmission line route. Official soil map unit symbols are shown parenthetically following the unit name.

Swan Lake Area Soils

The area immediately adjacent to Swan Lake is dominated by weathered rock, wind deposited sediment (loess), and organic soils (NRCS, 2010). The shoreline of the area is dominated by Mosman-McGlivery (28D), St. Nicholas-Typic Cryumbrepts (55F), Typic Cryumbrepts (73), and the Sunnyhay-Tolstoi complex (96) (Figure 3-1).

The Mosman-McGlivery (28F) is a well-drained soil found on 75-120% slopes in mountainous areas and is derived from granodiorite colluvium or residuum weathered from granodiorite. The pH range for this complex is 4.1-5.5. Erosion potential for the series ranges from .05-.37 Kw. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the K value, the more susceptible the soil is to sheet and rill erosion by water. In the case of the Mosman-McGlivery complex erosion potential, based on the estimated Kw, is low (NRCS, 2010).

The St. Nicholas-Typic Cryumbrepts (55F) series is a poorly drained soil found on 75-120% slopes often on very steep backslopes of hills, mountains, and valley sides. This unit is derived from weathered schist colluvium as well as residuum derived from schist. The pH range for this series is 3.6-6.0. Erosion potential for the series ranges from .05-.37 Kw, which is low-moderate.

Typic Cryumbrepts (73) are generally deep moderately well drained soils. This series occurs in areas with slopes of 60-120%. The series is derived from loess (wind deposited sediment) over residuum (weathered rock). The series has a pH range of 4.1-6.5. Erosion potential for the series ranges from .24-37 Kw, which is a moderate to high potential for erosion.

The Sunnyhay-Tolstoi complex (96) is a very poorly drained complex of alpine areas often sloping from 20-120%. The series is derived from weathered organic materials such as sedges and heaths. Depth to bedrock (for Sunnyhay) is generally shallow (within 20”). The pH of this complex ranges from 4.1-6.5. Erosion for the complex ranges from .05-.37 Kw, which is low-moderate. The majority of the soils associated with this complex are generally low in erosion potential.

Figure 3-1. Swan Lake and Cascade Creek Soils

Source: NRCS (2007) Survey Geographic (SSURGO) database for Stikine Area, Alaska.

Cascade Creek/Power Conduit Alignment and Powerhouse Soils

Cascade Creek flows from Swan Lake to meet Thomas Bay. The creek descends from the outlet of the lake approximately 1,514 feet to meet the bay at sea level. The Creek flows through slopes dominated by weathered rock, wind deposited sediment (loess), and organic soils with some areas dominated by colluvium over glaciofluvial materials (near Thomas Bay) (Figure 3-2). The Creek flows through soils units including Mosman-McGlivery (28F), Rock Outcrop (72), Mosman (33F/33D), Mitkof-Mosman (34D/34B), Sunnyhay-Tolstoi complex (95), and Kupreanof-Mosman (16D).

The proposed buried steel penstock crosses Kupreanof-Mosman (16D), Mitkof (46B), and Kupreanof (36B) (NRCS, 2010). The powerhouse footprint will be located within the Mitkof (46B) soil series. These soils are described further below.

The Mosman-McGlivery (28F) is a well drained soil found on 35-120% slopes in mountainous areas and is derived from granodiorite colluvium or residuum weathered from granodiorite. The pH range for this complex is 4.1-6.0. Erosion potential for the series ranges from .05-.37 Kw. In the case of the Mosman-McGlivery complex erosion potential, based on the estimated Kw, is low.

The Rock Outcrop (72) series is dominated by areas of exposed bedrock and is found in a wide range of topographies and slopes. This series, as it is bedrock, has no drainage class or erosion potential.

The two Mosman (33F/33D) units are gravelly loam soils present along Cascade Creek, 33D found on slopes ranging from 35-75% while 33F is found on slopes ranging from 75-120%. Both series are derived from colluvium and residuum derived from granodiorite. The series are well drained soils with pH ranging from 4.1-5.5. Erosion for these units ranges from .15-.32Kw which is low to moderate.

The Mitkof-Mosman (34D/34B) series is present along the creek as two units. The first is found on 5-35% slopes (34B) while the second is found on 35-75% slopes (34D). Both units are somewhat poorly drained soils derived from colluvium over glaciofluvial deposits. The pH ranges from 4.5-6.5 for both series. Erosion for these units ranges from .05-.37 Kw, which is low to moderate.

The Sunnyhay-Tolstoi complex (95) is a very poorly drained complex of alpine areas often sloping from 15-120%. The series is derived from weathered organic materials such as sedges and heaths. Depth to bedrock (for Sunnyhay) is generally shallow (within 20"). The pH of this complex ranges from 4.1-6.0. Erosion for the complex ranges from .05-.37 Kw, which is low-moderate. The majority of the soils associated with this complex are generally low in erosion potential.

The Kupreanof-Mosman (16D) complex is a somewhat poorly drained soil occurring on slopes of 35-75%. This complex is found primarily near the mouth of Cascade Creek and in the vicinity of the proposed powerhouse. The soils are derived from colluvium or glaciofluvial deposits. The pH ranges from 3.6-6.5 for the complex. Erosion potential ranges from .10-.37 Kw, which is low to moderate.

The Mitkof (46B) series is a somewhat poorly drained sandy loam found on 5-35% slopes and is derived from colluviums over glaciofluvial deposits. The series is strongly acidic with a pH of 5.0 in surface horizons. Erosion potential for the series is .37 Kw in the surface horizon which is moderate.

Kupreanof silt loam (36B) is somewhat poorly drained and found on 0-35% slopes and is derived from colluviums and/or glaciofluvial deposits. The series is very strongly acidic with a pH of 4.6 in the surface horizon. Erosion potential for this series is rated as .24 Kw in the surface horizon, which is moderate.

Transmission Line Interconnection Soils

The majority of soil types along the proposed route of the transmission line are derived from recent alluvium (floodplains), galcioflucvial deposits, beach deposits, or colluvium/residuum over glaciofluvial deposits. Dominant soils within the vicinity of the proposed transmission corridor are representative of the lower landscape position. Dominant soils along the proposed transmission corridor include: Fanshaw (15); Kupreanof-Mosman (16B/16D); Kupreanof (36B); Mitkof (46B); Kushneahin-Kina (22); Nakwasina (32B); and Maybeso (91B). Less dominant soils (not described in this section) include: Tonowek (4); Blashke-Sokolof (60); and Riverwash (77) (NRCS, 2010) (Figure 3-2 and Figure 3-3).

The Fanshaw series (15) is very gravelly coarse sand found on 0-15% slopes. Fanshaw is a well-drained series associated with gravelly glaciaofluvial deposits. The Point Agassiz Peninsula area is dominated by this soil type in the low lying level areas which the proposed transmission crosses. This series is strongly acidic with a pH of 5.0 in the surface horizon. Erosion potential for this series is rated as .10 Kw in the surface horizons, which is low.

The Kupreanof-Mosman (16B/16D) complex is a somewhat poorly drained soil occurring on slopes of 35-75%. This complex is found primarily near the mouth of Cascade Creek and in the vicinity of the proposed powerhouse. The soils are derived from colluvium or glaciofluvial deposits. The pH ranges from 3.6-6.5 for the complex. Erosion potential ranges from .10-.37 Kw, which is low to moderate.

Kupreanof silt loam (36B) is somewhat poorly drained and found on 0-35% slopes and is derived from colluviums and/or glaciofluvial deposits. The series is very strongly acidic with a pH of 4.6 in the surface horizon. Erosion potential for this series is rated as .24 Kw in the surface horizon, which is moderate.

The Mitkof (46B) series is a somewhat poorly drained sandy loam found on 5-35% slopes and is derived from colluviums over glaciofluvial deposits. The series is strongly acidic with a pH of 5.0 in surface horizons. Erosion potential for the series is .37 Kw in the surface horizon which is moderate.

The Kushneahin-Kina (22) is the dominant soils type within the Petersburg area. This association is derived from organic material and is found on 3-35% slopes. Both Kushneahin and Kina are deep, very poorly drained soils. The association is very strongly acidic with a pH of 4.5 in the surface horizon. Erosion potential for this association is estimated as .05 Kw, which is low.

The Nakwasina (32B) series is a shallow, poorly drained soil formed in glaciofluvial deposits over dense compact glaciofluvial deposits. This series is present in the Petersburg area in areas of level terrain with slopes ranging from 5-35%. The series is moderately acidic with a pH of 5.6 in the surface horizon. Erosion potential for this series is estimated as .05 Kw in the surface horizons, which is low.

The Maybeso (91B) series is a very deep, very poorly drained soil derived from organic material overlying glacial till in areas of 5-35% slope. This series is present in the Petersburg area. The series is strongly acidic with a pH of 5.1 in the surface horizon. Erosion potential for this series is estimated as .05 Kw in the surface horizons, which is low.

Figure 3-2. Transmission Line Soils

Source: NRCS (2007) Survey Geographic (SSURGO) database for Stikine Area, Alaska

Figure 3-3. Transmission Line Across Petersburg Soils

Source: NRCS (2007) Survey Geographic (SSURGO) database for Stikine Area, Alaska.

3.3.1.2 Environmental Effects

Effects of Project Construction on Ground Disturbance and the Potential for Erosion and Sedimentation

Earthwork activities during the construction of project facilities have the potential to affect soil stability contributing to the potential for landslides and rock falls. Such mass ground movement could result in soil erosion, sedimentation of waterways such as Swan Lake and Cascade Creek, and could potentially damage project infrastructure or construction equipment. In addition, construction of the underground tunnel and powerhouse excavation activities have the potential for encountering groundwater, which could lead to construction difficulties and increased soil erosion. Tunnel excavation for the power conduit will also require the disposal and dispersion of a large quantity of boulder, cobble and rock material, which will be re-purposed for construction fill and penstock burial or otherwise disposed of on-site, but which could affect the surrounding areas.

Proposed Action

As discussed in Section 2.2 and in Exhibit A, the proposed Project would involve the construction of an intake structure and an outlet control structure at Swan Lake, power conduit tunnel, powerhouse, and naturalized tailrace. Construction activities will involve the use of heavy equipment and will result in vegetation removal, blasting, excavation and other earth disturbance. While current geologic assessments do not indicate a high probability of rock slides and or cliff shearing, the Applicant anticipates undertaking additional, site-specific geologic evaluation as part of final project design and construction. The Applicant proposes to develop and implement an Erosion and Sedimentation Control Plan and use standard erosion control measures and approved Best

Management Practices (BMPs) that are expected to limit erosion and sedimentation and, as warranted address additional data provided by additional geologic assessments. The Plan will outline, in detail, specific actions to ensure that erosion and sedimentation are controlled during project construction such as silt fencing, rip-rap, and other standard BMPs. Furthermore, it is expected that any permits granted to the Applicant by the USACOE or USFS will contain additional provisions for erosion and sediment control and remediation.

The Applicant also proposes to re-vegetate any disturbed areas not occupied by project structures, which will stabilize shorelines and exposed soil. The Applicant will establish post-construction erosion monitoring as part of its water quality monitoring, discussed in greater detail in Section 3.3.2, *Water Quantity and Water Quality*. Should monitoring indicate that erosion and sedimentation are occurring post-construction as a result of construction activities, the Applicant will employ necessary measures for remediation in consultation with state and federal agencies.

Swan Lake

Much of the shoreline and immediately adjacent uplands are comprised of and armored with weathered rock. The soils of the Swan Lake area range from the low erosion potential of the Mosman-McGlivery complex to the high erosion potential of the Typic Cryumbrepts series. As discussed above, the intake structure will be constructed in an area of Typic Cryumbrepts series, which has a moderate to high potential for erosion; however, the area immediately adjacent to the intake and at the location of the outlet control structure is comprised of the Mosman-McGlivery complex, which has a low erosion potential (NRCS, 2010).

Any potential effects to soils and underlying bedrock from construction activities related to earth moving and construction equipment will be localized to the construction footprint of the intake structure and the outlet structure. Limited disturbance related to the construction of the lake siphon and outlet structure would be temporary during construction and would be minimized by the use of proper erosion and sediment control techniques, as per the proposed Erosion and Sediment Control Plan.

Permanent alterations will occur within the footprint of the proposed outlet control structure; in some cases changes to underlying bedrock features may be required for its construction. While these will be permanent alterations, they will only occur within the footprint of the structure and will not contribute to further effects once construction is complete. The permanent alteration of the landscape by the installation of the intake structure will largely take place within uplands where any changes to bedrock features are unlikely to have significant effect on erosion and sedimentation in Swan Lake. Following the development of the lake siphon and construction of the outlet control structure, additional effects to soils along the shoreline of the lake will be minimal.

The Applicant will monitor erosion and sedimentation of Swan Lake once the intake and outlet structures are constructed. Should erosion become evident once the Project is in operation, the Applicant will notify state and federal agencies and develop additional PME measures as necessary.

Proposed Power Conduit and Powerhouse

Potential impacts to geologic and soil resources are greatest in the proposed power conduit (tunnel and buried penstock) and powerhouse areas, and will include permanent and temporary effects. Blasting and site work associated with the tunnel and powerhouse construction will impact these resources to varying degrees.

As outlined in prior documentation and associated geotechnical reports the entire location of the tunnel lies within quartz diorite (HA, 1985). While numerous shear zones and joint features are present, they are readily visible on aerial photography and will be avoided during construction. Effects to soils within the vicinity of the proposed tunnel will be temporary, related to construction, and localized to the tunnel entrance and vertical shaft collar. Permanent effects related to tunnel construction will include blasting and removal of existing bedrock resources within the route of the proposed tunnel; however, as this work will occur underground, there will be limited effects to above-ground resources with the exception of managing rock spoil material.

Effects to soils in the footprint of the powerhouse and support facilities will be primarily the result of construction activities and movement of equipment. The primary soils within the powerhouse area are Kupreanof-Mosman, Kupreanof, and Mitkof. These soils have similar erosion potential, the erosion factors range from .24-.37 Kw, indicating moderate potential for erosion. Permanent effects related to soils and geologic resources within the footprint of the proposed powerhouse include the movement and placement of fill and blasting.

Rock excavated from the tunnel would be distributed onsite below the tunnel exit as an appropriately shaped geoform feathered into the adjacent topography and re-vegetated. The Applicant anticipates tunnel excavation materials will be placed within the lowest elevation, depressed and recessed areas below the tunnel outlet. After these areas are filled, any remainder will be layered over existing topography and tapered into the adjacent terrain to maintain a natural grade appearance. When a final grade is established, the Applicant proposes to top-dress disturbed areas with previously stockpiled soil and processed mulch recycled from the clearing phase of the powerhouse site preparation. These areas will then be replanted with native trees and shrubs selected in consultation with state and federal agencies. These actions will be conducted in concert with the Erosion and Sediment Control Plan for the Project in an effort to minimize erosion, sedimentation and stormwater run-off pollution.

Impacts related to soil erosion and sedimentation would be limited by implementing proper sediment and erosion control techniques. The Erosion and Sedimentation Control Plan would include, but not be limited to, BMPs that would minimize erosion and sediment mobilization during and following construction. This will include rip-rap, stream bank armoring, silt barrier fences, and cofferdams, as necessary. Post-construction erosion and sedimentation monitoring will identify and trigger any remediation requirements, as necessary. Re-vegetation of areas of the proposed power conduit tunnel and powerhouse will also help to reduce the potential for run-off.

Transmission Interconnection

The majority of the proposed transmission line will occur along preexisting road and utility corridors, roadways and also using submerged cable. Impacts to soil and geologic resources are minimal and will be related primarily to the placement of new utility poles in previously disturbed areas and the installation of the submerged cable. In general, soils along the proposed transmission route are low in erosion potential. Impacts would be localized at each new pole location and related to the excavation and setting of new poles, as well as along the submerged cable route.

Both temporary and some permanent impacts may be seen related to substrate disturbance during the laying of the submerged cable. This could include the temporary increase in turbidity due to the stirring up of bottom sediments during installation. The Fenshaw and Kushneahin-Kina series are the more dominant soils occurring along the transmission route. These soils have very low erosion potential ranging from .05-.10; however, based upon the relatively small footprint of the cable, these impacts are expected to be minor. Furthermore, the use of current sediment and erosion control techniques should keep impacts minimal.

Effects of Project Operation on the Potential for Erosion and Sedimentation

Project operations outside the naturally occurring hydrologic regime of Swan Lake could result in the potential for erosion of the shoreline and sedimentation of the waterway. Operations where inflow is equal to outflow provides relatively stable water levels in project impoundments and minimize the potential for erosion, which is generally more related to vegetation removal and ground disturbance activities, as discussed above.

Proposed Action

The Applicant proposes to operate the Project within the range of naturally occurring lake level fluctuations. As such, the hydrological regime of Swan Lake will be relatively unchanged. Flows will be discharged at the outlet of the tailrace channel, which will be constructed of rock and cobble, into Thomas Bay just south of the existing outlet of Cascade Creek.

In general, weathered rock dominates the Swan Lake and intertidal shoreline with smaller units of organic soils located in areas of level topography. Based on data from the Natural Resource Conservation Service (NRCS), soils are not overly prone to erosion along the shoreline with a range of erosion factors of .05-.37 Kw, low to moderate erosion potential. As the Project will mirror seasonal lake level fluctuations, there is no anticipated potential for effect.

Cascade Creek extends approximately 2.5 miles from the outlet of Swan Lake to its confluence with Thomas Bay. The Creek is dominated by exposed steep cliffs, glacial boulders and cobble. Flows within the Creek will remain within the range of natural conditions. No impacts to soils and geologic resources will result from the Project within Cascade Creek.

Effects of Project Area Seismicity on Project Structures

Potential seismic activity and mass earth movement have the potential to affect the safety of project structures and operations.

Proposed Action

The Applicant is proposing to construct hydroelectric facilities, as described in draft license Exhibit A and shown on Exhibit F, on lands within the Coast Mountains Terrane, Costal Shear Zone, and the Gravina Belt, dominated by granite and associated metamorphic rocks including gneiss and schist. No major faults have been mapped within the project area, and seismic exposure has been classified as moderate to minor probable damage from earthquakes (HA, 1985).

The Project lies along two regional faults – the Sumdum and Fenshaw faults. In general, large regional faults tend to produce great magnitude earthquakes, but because of the fault distances only moderate shaking may result. Utilizing the USGS National Earthquake Information Center (NEIC) a search of significant earthquakes (within a 10,000 mi area centered on Petersburg) was completed (SADG, 2010). The search included historic (1568-1989) and recorded (1973-2010) earthquakes. Five records were found with magnitudes measured from 2.6 to 3.8. All records returned were minor to micro earthquakes and none were located within the vicinity of Swan Lake, Cascade Creek, or areas proposed for the transmission corridor (SADG, 2010).

No Action Alternative

Under the No Action Alternative, no modifications to soil or geologic features would occur. Under this alternative, soil and geologic features within the project area including the transmission corridor and proposed submerged cable path would remain unchanged and in their current state.

3.3.1.3 Unavoidable Adverse Effects

Unavoidable adverse effects related to project construction, as proposed, include temporary increase in sedimentation and erosion related to earth moving activities. These effects are mitigated by the use of current erosion and sediment control techniques but some minor, temporary erosion and sedimentation is likely to occur during construction. Effects related to the transmission corridor and submerged cable will also include the potential for temporary erosion and sedimentation related to the placement of new poles. Temporary increases in turbidity and permanent changes to substrates, within the footprint of the cable, will result from the placement of the submerged cable.

3.3.2 Water Quantity and Water Quality

3.3.2.1 Affected Environment

The waters within the Project's catchment basin originate at elevations reaching a maximum of 6,270 feet msl at the eastern perimeter of the basin, and are subsequently deposited into Thomas Bay. The hydrologic cycle for the region as a whole consists of precipitation nearly year-round, with heavy precipitation occurring from September through December (USFS 2008b). As storms decrease substantially during the winter months, and much of the system's precipitation accumulates as snow in the upper basin, minimum flows within the system often reach a low during March or April. As snow melts during the June to July timeframe, runoff increases and is supplemented with fall rains during the September timeframe (Civil Science, 2011).

The Cascade Creek watershed occupies approximately 23 mi2 before its confluence with Thomas Bay. This watershed can subsequently be broken down into three distinct sub-basins for hydrology analyses (Figure 3-4): the Upper Cascade Creek Sub-basin; the Swan Lake Sub-basin; and the Falls Lake Sub-basin. These sub-basins, and their associated water bodies, are described in more detail below.

Figure 3-4. Cascade Creek Watershed Gaged Sub-Basins

Upper Cascade Creek Sub-Basin

Upper Cascade Creek extends for approximately 5 miles before its confluence with Swan Lake. Upper Cascade Creek is Swan Lake's primary water source. As documented during geomorphology surveys conducted during the licensing, Upper Cascade Creek is a broad, sinuous, low-gradient alluvial channel with an extensively developed floodplain and a generally stable pattern (Oasis, 2010b). According to the USFS, it is classified as an FP4 channel, described as "wide low gradient flood plain channel" (USFS, 1992). Its gradient is relatively well-anchored by near-surface bedrock at the head of the study reach and at several points farther downstream, and by the level of Swan Lake (under regularly occurring lake fluctuations). The Upper Cascade Creek drainage area is 11.07 square miles in size.

The Upper Cascade Creek channel has an ample supply of sand and gravel from the adjacent floodplain and supplied from upstream over the reach-bounding waterfall. A paucity of large woody debris along the channel suggests that landslide delivery from the adjacent valley walls is not a significant source (of either logs or sediment). The substrate is loose and well-graded, suggesting frequent mobility, but the floodplain vegetation is dense. Field observations and reference to historic aerial photos suggest that channel migration is limited. No evidence of vertical incision was observed or suggested by the channel data during studies conducted by the Applicant in 2010. Upper Cascade Creek is approximately 50 feet wide at its confluence with Swan Lake (Oasis, 2010b).

Spring Creek

Spring Creek, which flows into Swan Lake directly, has an entirely different character than Upper Cascade Creek, reflecting its small drainage area and limited sources of water and sediment. Geomorphology studies indicated that it is homogeneous in character. Avalanche chutes from the steep north valley wall fed the channel, but the flow paths were disconnected from Spring Creek. Subsurface flow through the broad debris cones flanking the base of the mountainsides deliver water more uniformly to Spring Creek through groundwater upwelling. Consequently, sediment sources were found to be limited. The channel gradient was determined by the relatively flat valley gradient. The channel itself is fine-bedded and only modestly sinuous (Oasis, 2010b).

Swan Lake Sub-basin

Swan Lake is a naturally impounded, isolated, glacial lake bordered by steep cliffs and ice-fields to the southwest (HA, 1985). Swan Lake is considered to be oligotrophic, with low nutrient inputs and organic production due to its mountainous setting, steep shorelines with a general lack of littoral zones, and meltwater stream inputs. Having a surface area of approximately 579 acres and a length of roughly two-miles, bathymetric data for Swan Lake indicates depths reaching 570 feet. The total drainage area of the Swan Lake system is 18.95 square miles, while the drainage area of the Swan Lake sub-basin is 7.88 square miles.570 feet.

Swan Lake is contained by porous colluvium materials forming a natural dam at the lake's outlet. These large (boulder-sized) materials permit a significant amount of subsurface seepage to flow through the colluvium to downstream reaches of Cascade Creek. Hydrologic analysis indicates that the combination of outflow seepage and surface flows contribute to an average lake level fluctuation of 5.8 feet annually (Civil Science, 2011).

A correlation formula relating historic discharge at the USGS gage at the mouth of Cascade Creek to same day/time elevation of Swan Lake was developed (Civil Science, 2011). Further analysis of Swan Lake stage and flow duration characteristics show that the effective elevation of the outlet sill forming the control at the outlet of Swan Lake is 1511.5 feet msl. For the period of historic record, the average annual minimum lake elevation is 1511.6 feet msl. The average annual maximum lake elevation is 1517.4 feet msl. While the average annual fluctuation of Swan Lake is approximately 5.8 feet, the minimum and maximum lake levels range from 1,511.4 feet to 1,519.1 feet – a total range of 7.7 feet (Figure 3-5). The lake elevation is estimated to have nearly reached or exceeded elevation 1,518 ft at least once for 10 of the past 39 years, and has been estimated to have dropped below elevation 1,512 ft during all of the 39 years of record. The estimated elevations of Swan Lake are depicted in Figure 3-6 (Civil Science, 2011).

Figure 3-5. Swan Lake Level from Historical Cascade Creek Flow

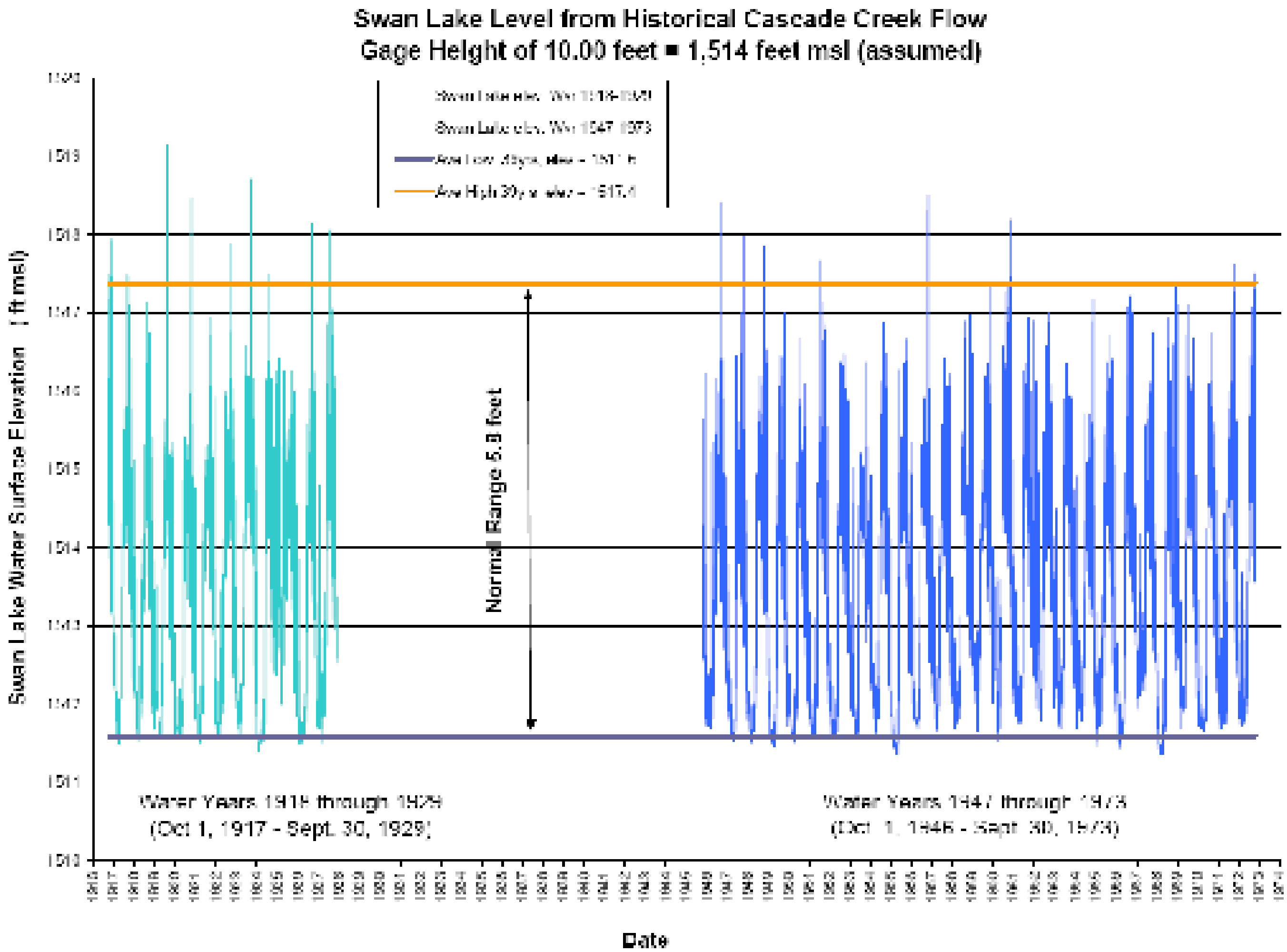
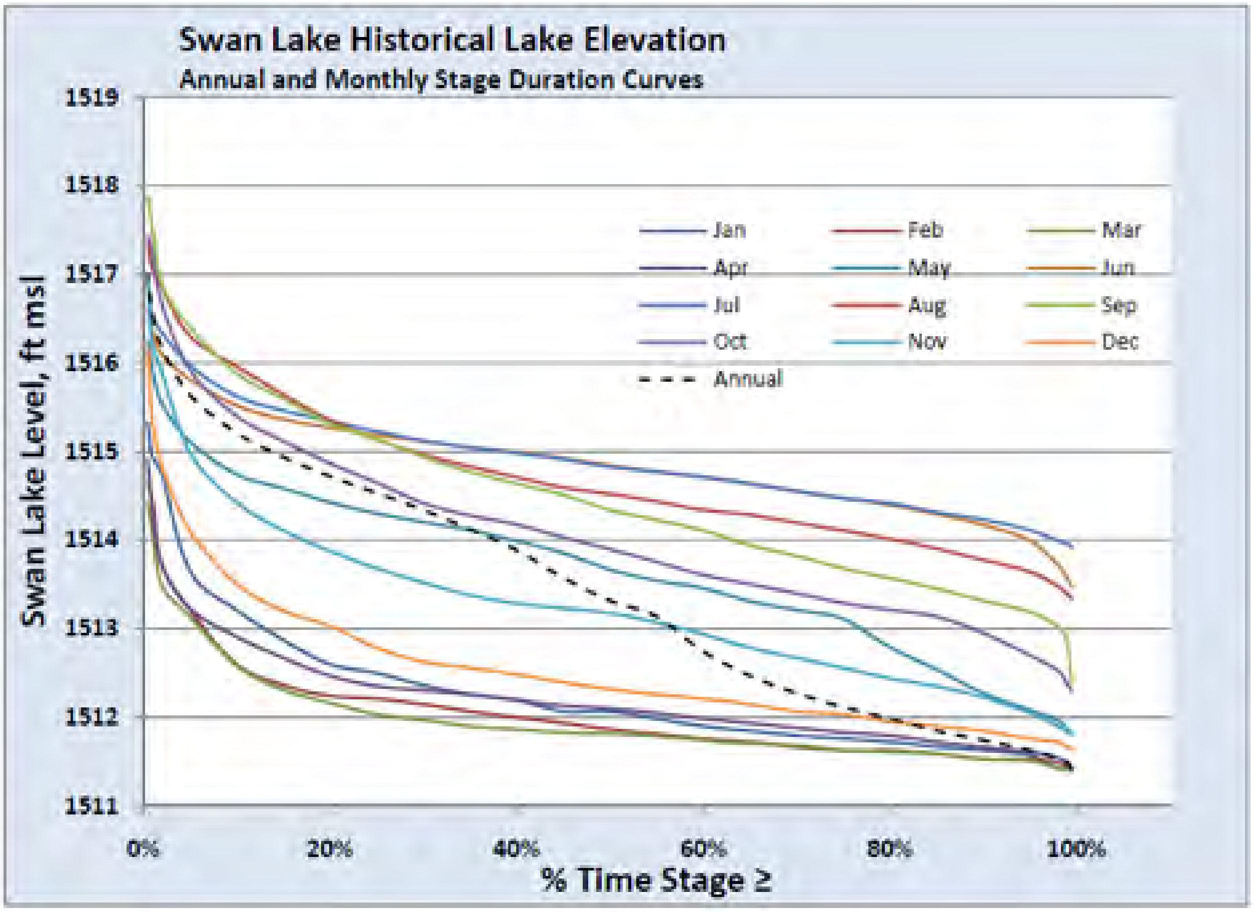


Figure 3-6. Swan Lake Stage Duration Curves



Falls Lake Sub-Basin

Lower Cascade Creek is broken up into two sections – the upper section flowing out of Swan Lake to Falls Lake and the lower section flowing out of Falls Lake to Thomas Bay. For the first 0.75-mile downstream of Swan Lake, lower Cascade Creek descends a series of cascades, which collectively take on the appearance of multiple waterfalls with a significant waterfall at Falls Lake. These cascades continue below Falls Lake to the lower barrier falls, approximately 300 feet upstream from the confluence of Lower Cascade Creek at Thomas Bay. Steep cliffs and nearly vertical forested topography characterize the shoreline of the Lower Cascade Creek from Swan Lake to tidewater at Thomas Bay. The Lower

Cascade Creek tributary ranges in width from 65 feet at the Swan Lake outlet to 50 feet at Thomas Bay (Oasis, 2010b).

The total drainage area of the Falls Lake system is 20.80 square miles, while the drainage area of the Falls Lake sub-basin is 1.85 square miles.

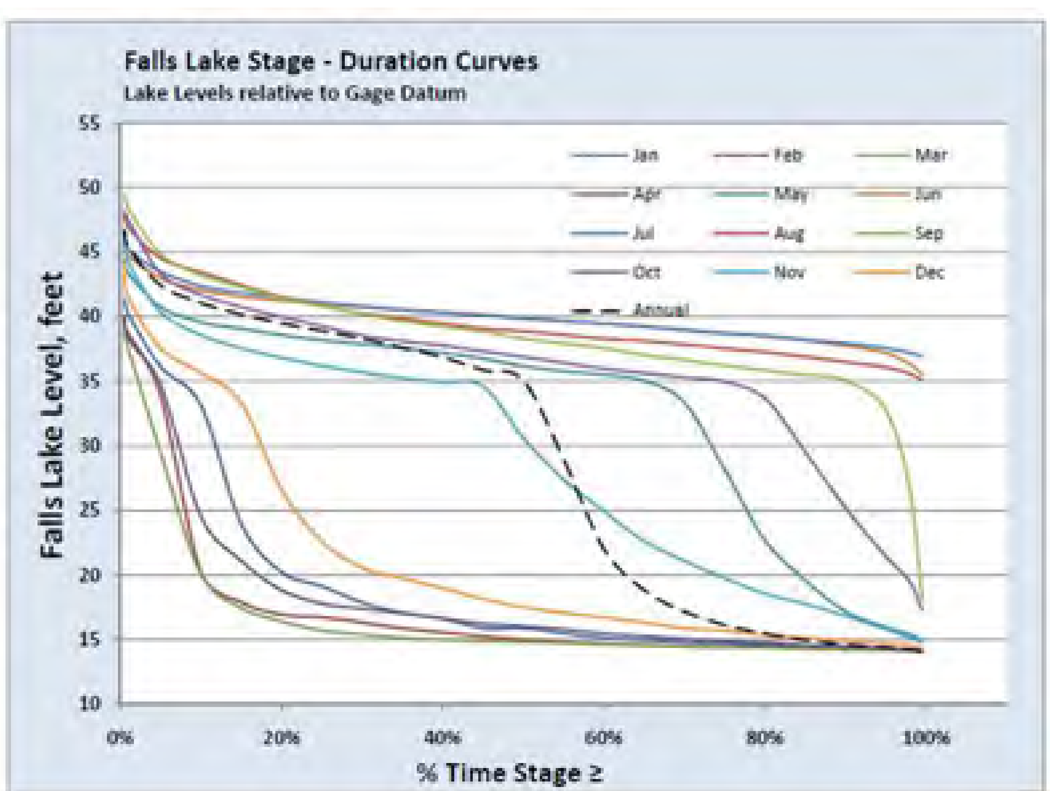
Gaging data indicates that Swan Lake discharges to Cascade Creek range from an average of 450 cfs in the summer to an average of 75 cfs in the winter. Hydrologic studies conducted in 2010 observed seepage flows emerge as surface flow at the base of the natural colluvium dam below Swan Lake, combining with surface flows just a short distance upstream of the falls that flow into Falls Lake. In an effort to further quantify seepage from Swan Lake the Applicant undertook a water budget model. This model determined that seepage averages 28.7% of the total outflow from Swan Lake during the summer months, and 39.7% during the winter months (December through mid-May). The higher relative contribution to downstream resources during the winter months is likely due to the fact that lake levels and surface water inflows are low. Conversely, seepage is a lower portion of the total outflow from Swan Lake during the summer months, as lake levels are higher and more surface water flows from the Swan Lake outlet, while seepage increases at a lower rate.

Falls Lake is approximately 15 acres in size and is impounded by an outlet created by boulder-sized colluvium materials. During all times of the year, water flows from Falls Lake below ground through the colluvium material making up the outlet. Total contributions to downstream flow are approximately 50 to 100 cubic feet per second (cfs) (Photo 3-1). Surface waters from Falls Lake overtop the outlet at the highest lake stages only.

Photo 3-1. Leakage Flows from Falls Lake through the Colluvium Outlet

Study results also show that Falls Lake water levels fluctuate greatly under natural conditions due to snowmelt and rainfall events. Falls Lake exhibited a range in recorded stage of 29.17 feet for the current period of record. Hydrology studies indicate that high lake levels are consistently seen in the summer months of June, July, and August. Winter months (December through April) all show low lake levels with a gage height less than or equal to 20 feet approximately 70% or more of the time. The fall transitional months (November, with October and September to a lesser degree) present a range of levels from summer high to winter lows. The spring transition occurs largely in May with no other spring month showing elevated lake levels for any significant amount of time. A Falls Lake Stage-Duration Curve was developed as part of hydrology studies and is included as Figure 3-7, below (Civil Science, 2011).

Figure 3-7. Falls Lake Stage-Duration Curves



Lower Cascade Creek Sub-Basin

Lower Cascade Creek continues below Falls Lake through a second series of cascades to its confluence with Thomas Bay, approximately 2.5 miles from its origin at Swan Lake. The total drainage area of the system, above Lower Cascade Creek's confluence with Thomas Bay is 23.25 square miles, while the drainage area of the Swan Lake sub-basin is 18.95 square miles. The drainage area of Lower Cascade Creek below Swan Lake is 4.30 square miles. Collectively, this system is designated by the HUC watershed code 19010201.

Thomas Bay

Thomas Bay is situated northeast of Petersburg as a part of Frederick Sound. Cascade Creek, located in the southern arm of Thomas Bay, is one of several tributaries into south Thomas Bay. These tributaries include Delta Creek and the Patterson River, with the Patterson River providing the greatest amount of freshwater. An analysis of discharge into Thomas Bay performed as a part of the Aquatic Resources Study (Appendix B) shows that Cascade Creek provides about 15% of the flow into southern arm of Thomas Bay during the summer months and roughly 28% during the winter months. As noted within the Aquatic Resources Study Report, the surface area and water volume of south Thomas Bay were calculated through GIS using sub-sea contour data of NOAA Chart # 317367, Scale 1:40,000. Thus, the calculated surface area of south Thomas Bay was 11,119,850 square meters (4.3 square miles) and water volume 219,930,524 cubic meters. Further discussion of this is included under *Environmental Effects* below.

Bathymetry of the Affected Environment

Bathymetric surveys were performed for Swan Lake, Falls Lake and Thomas Bay through the Aquatic Resources Study. Surveys were completed with conventional sounding equipment as well as utilizing an Automated Underwater Vehicle (AUV) and the resulting bathymetry maps for these areas are included as Figure 3-8 to Figure 3-11 below. Survey procedures are discussed further within the study report (Appendix C).

To obtain lake elevations, add 1,504 feet to the Swan Lake gage measurement of 10.47 ft in Figure 3-6. This puts the Swan Lake surface elevation in Figure 3-6 at 1,514.47 ft.

Figure 3-8. Swan Lake Delta

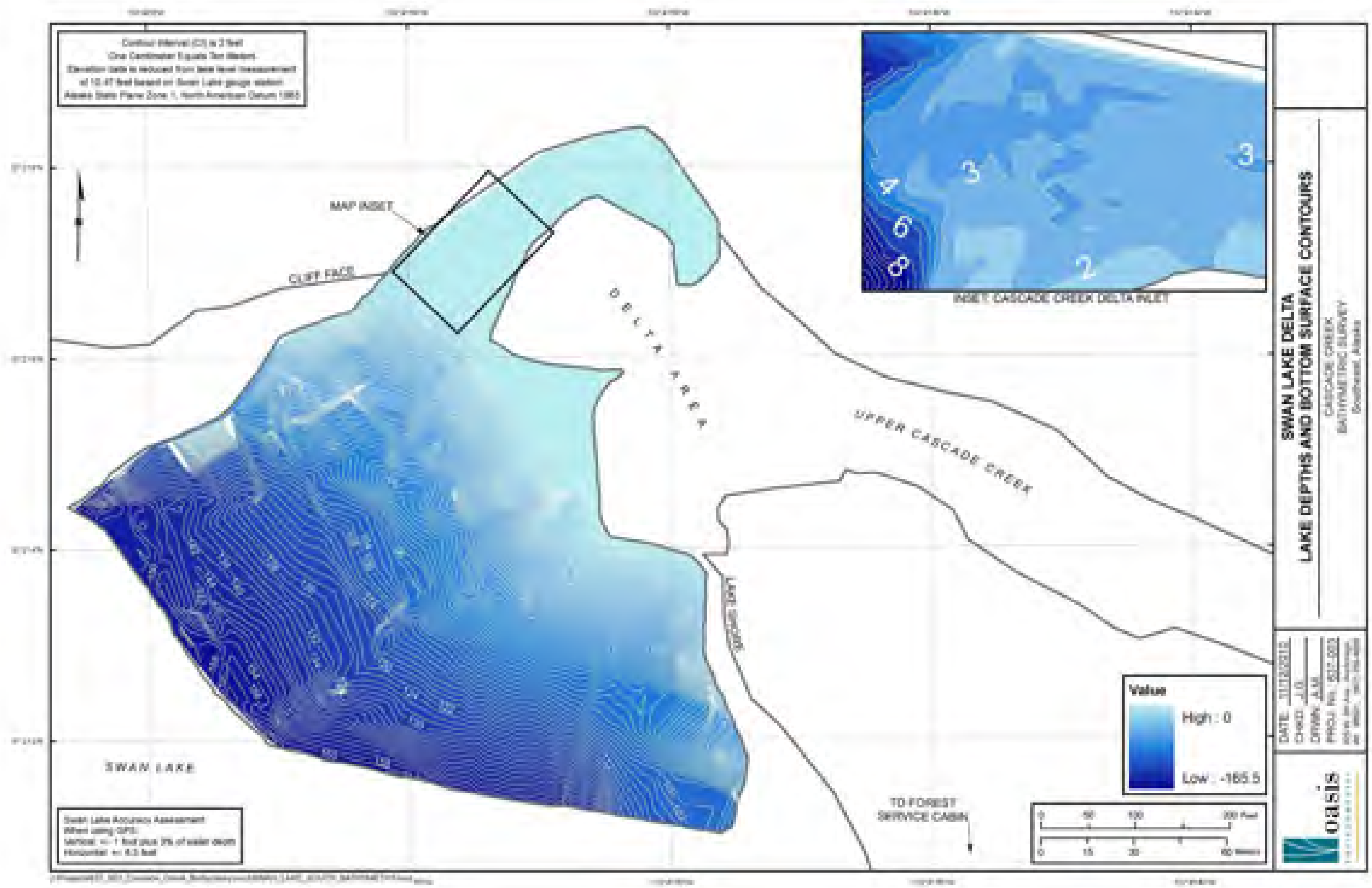


Figure 3-9. Upper Falls Lake Upper Lake Depths and Bottom Surface Contours

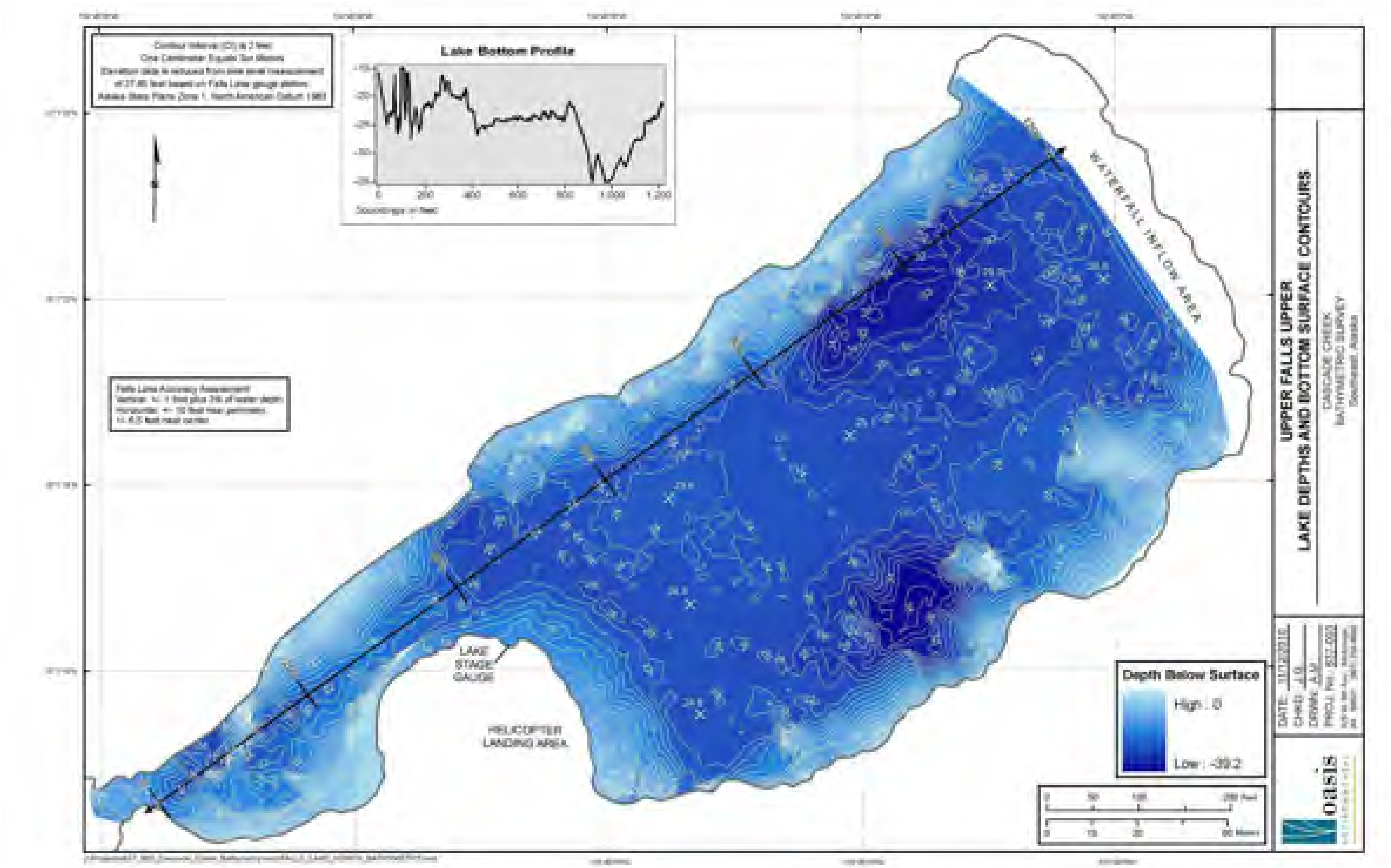


Figure 3-10. Lower Falls Lake Depths and Bottom Surface Contours

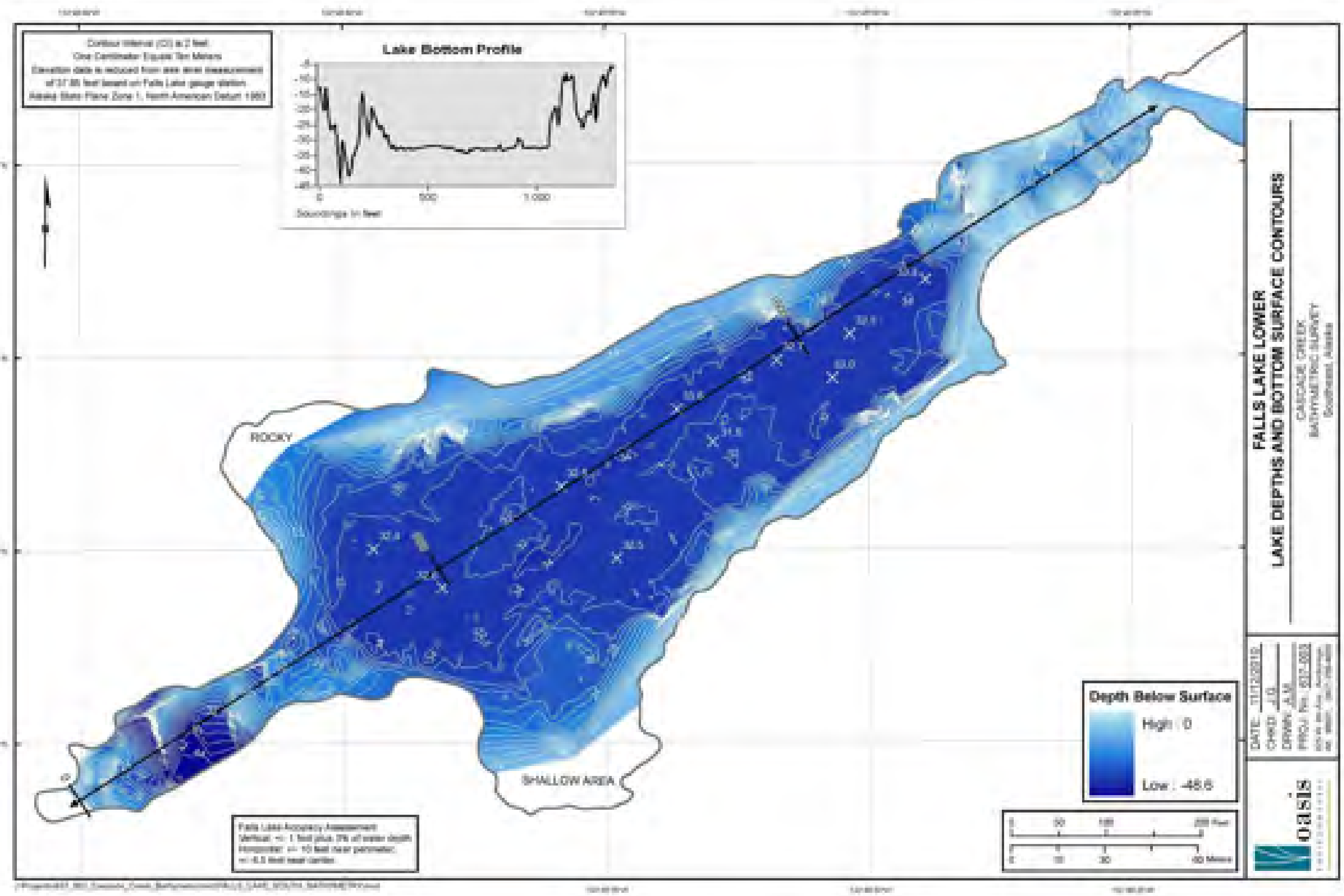
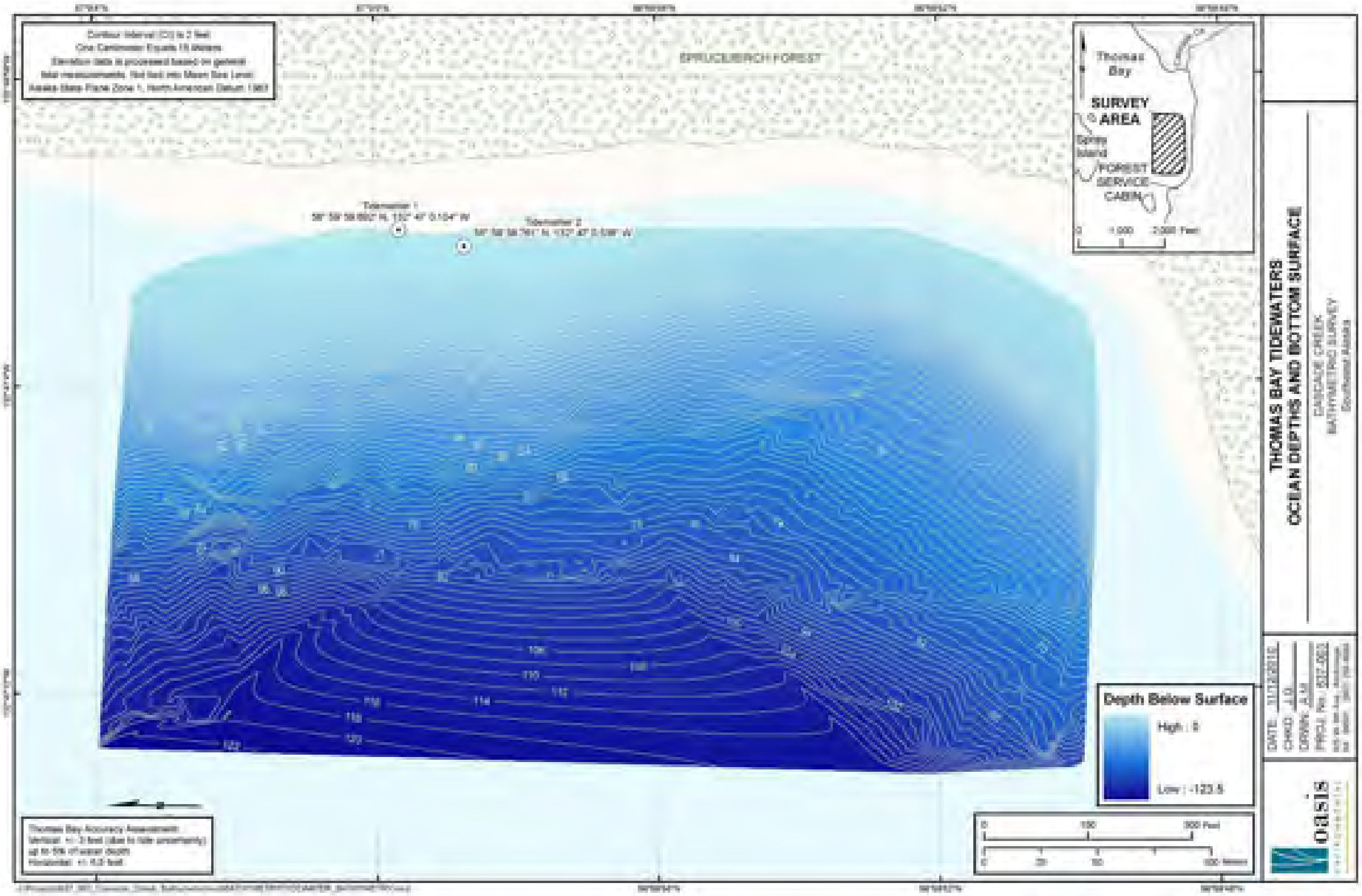


Figure 3-11. Thomas Bay Tidewaters Ocean Depths and Bottom Surface



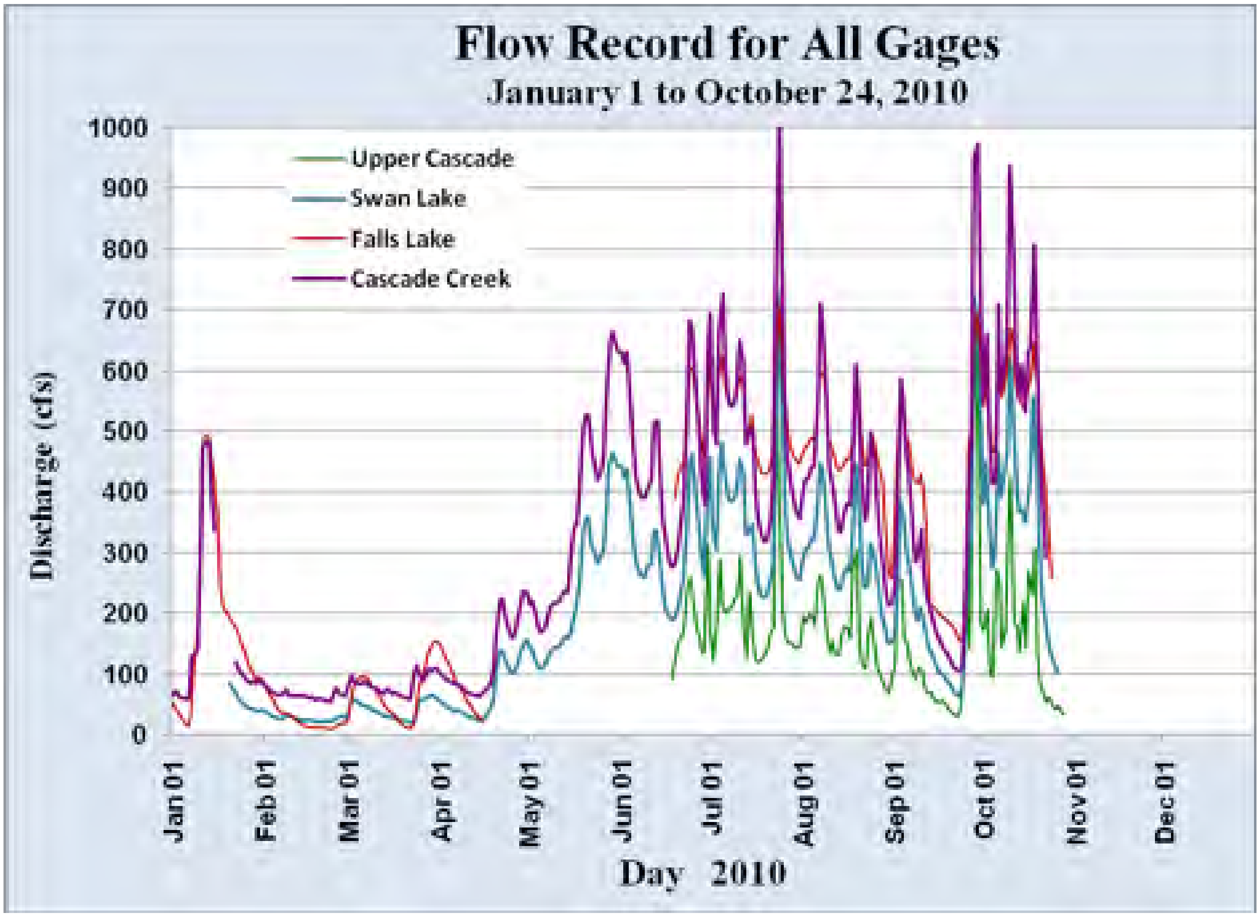
Stream Gage Data

The US Geological Survey (USGS) maintained a stream flow gage 0.2 miles upstream from the mouth of Cascade Creek from 1918-1928 and from 1947-1973 (USGS Gage No. 15026000, Cascade Creek near Petersburg). Data collected during these periods provides representative historical data aiding in projection of long-term hydrology trends. The 26-year data period mentioned in this report refers to January 1, 1947 through December 31, 1972.

To supplement existing data and project future conditions, the Applicant undertook individual field measurements and installed and monitored four new gaging stations. The Applicant installed gaging stations at: a) the Upper Cascade Creek inlet where it enters Swan Lake (approximately 1500' upstream of Swan Lake on the Cascade Creek inlet); b) the east end of Swan Lake; c) the midpoint of Falls Lake; d) the mouth of Lower Cascade Creek upstream of the lowest falls at the prior USGS gaging site. While the gages are still logging hydrologic data, the period of record for analysis presented herein is January 1, 2010, through October 24, 2010. Data will be downloaded again in February 2011, gaging will continue thereafter.

Through modeling efforts, flow records for each gage were developed from the gage's stage record and the gage's stage-discharge rating. These flows are illustrated in the figure below.

Figure 3-12. Gage Flow for Current Period of Record



Flows and lake levels for Swan Lake were synthesized from long-term gaging data from USGS gage 15026000 on lower Cascade Creek correlated with the recent stream gaging data obtained from Swan Lake Outlet. Flows from both the surface of Swan Lake and seepage through the outlet structure indicate a mean annual flow of approximately 226 cfs. Maximum daily mean annual flow (seepage and surface flows) at this location is 2,191 cfs. Minimum daily flow varies greatly by month, ranging from a low of 2.8 cfs in January and February to a high of 209 cfs during July. Considering this, the approximated mean minimum annual flow is 46 cfs. Monthly flow means range from 30 (March) to 443 (July) cfs at this site during the period of record (Table 3-1).

Table 3-1. Estimated Monthly Total Flows from Swan Lake (Surface Flow plus Seepage)

Estimated Monthly Total Flows from Swan Lake (Surface Flow plus Seepage)				
Month	**Mean (cfs)**	**Median (cfs)**	**Maximum(cfs)**	**Minimum(cfs)**
January	57	27	978	2.8
February	35	17	647	2.8
March	30	15	598	3.1
April	46	29	914	2.8
May	229	200	1,120	10.0
June	441	426	1,208	127
July	443	412	1,583	209
August	409	342	2,191	118
September	378	304	1,941	32
October	289	222	1,789	26
November	164	122	1,627	12.0
December	82	43	1,165	7.8

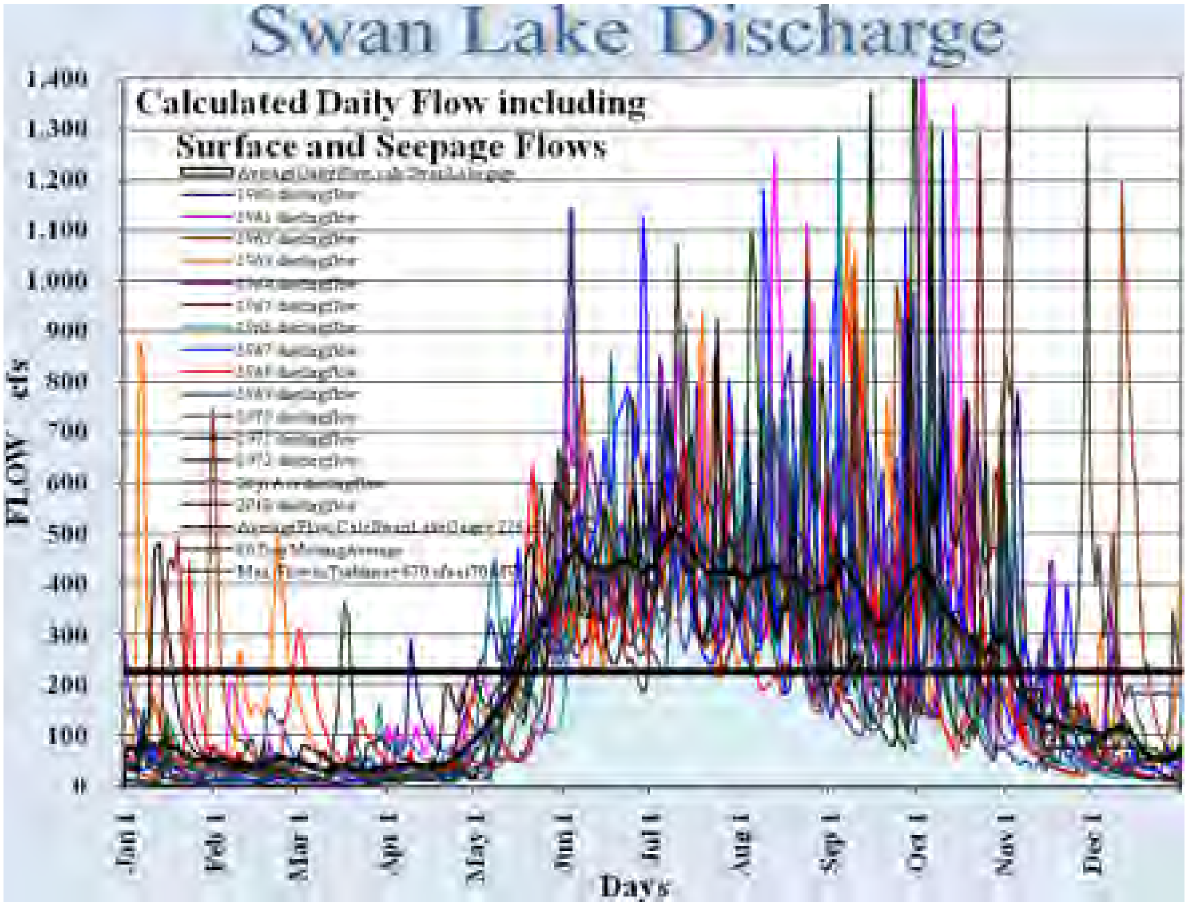
As discussed above, Swan Lake level fluctuations average 5.8 ft per year, but range as high as 7.7 feet during spring freshet and storm events throughout the year. The Applicant developed flow duration curves as part of its hydrologic analyses. These are contained within the Hydrology Report (Appendix C) and Exhibit B.

Photo 3-2. **Swan Lake drainage area showing Upper Cascade Creek and Swan Lake, looking east.**

The Swan Lake drainage area is 18.95 square miles. This is 81.5% of the total Cascade Creek drainage area. Upper Cascade Creek constitutes approximately 58% of the Swan Lake drainage area. Other inflows to Swan Lake include numerous creeks and waterfalls that originate from rainfall, hanging glaciers, or groundwater.

The following graph shows the calculated daily flow for Swan Lake using the historical Cascade Creek gage, factored for Swan Lake. These flows include 1960 through 1972, 2010, and a 26-year average. The 26-year average flow (Jan 1, 1947 to Dec 31, 1972) is 226 cfs.

Figure 3-13. **Swan Lake Discharge**



The Falls Lake drainage sub basin is 1.85 square miles. At these altitudes, the calculated average rainfall is over 148 inches of rain per year. The Falls Lake sub-basin is historically filled from Swan Lake discharge and from multiple creeks and waterfalls in the Falls Lake sub-basin. The photographs below show a waterfall flowing into Falls Lake.

Photo 3-3. **Distant View of Waterfall**

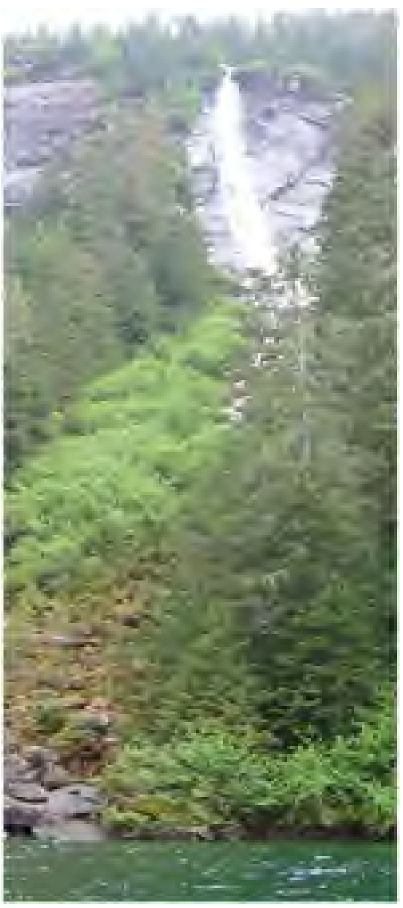
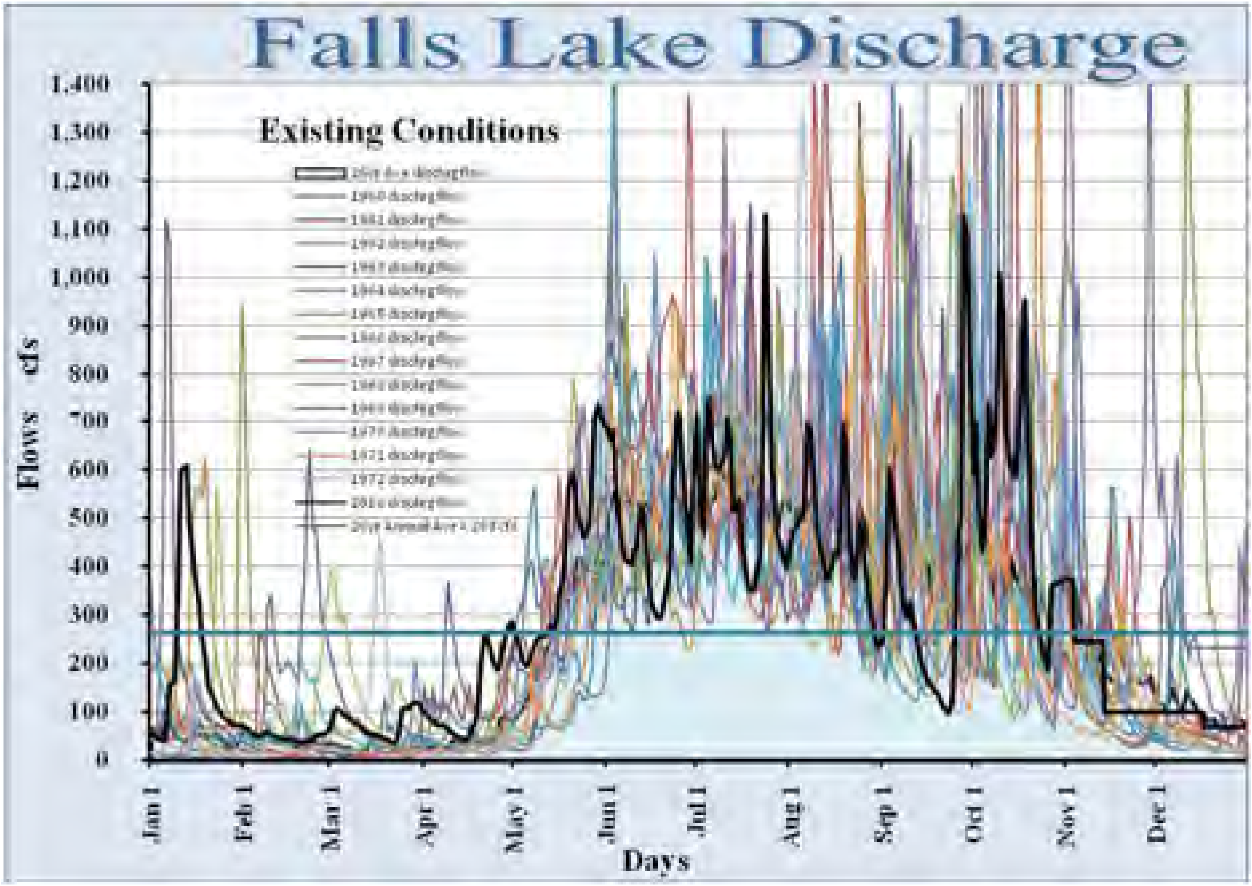


Photo 3-4. **Waterfall Flowing into Falls Lake**

Stage levels recorded within Falls Lake confirmed anecdotal observations that lake levels vary greatly due to hydrologic events. During gaging operations, Falls Lake exhibited an elevation range of 29.17 feet. The lowest elevation of 16 feet was recorded during a winter period after an extended period of sub-freezing weather. The maximum daily stage in Falls Lake during the gaging operations on August 18, 2009 was 45.22 feet. The calculated minimum elevation of Falls Lake, based on the historical period of record on the Cascade Creek gage would be 15 feet. The maximum calculated elevation of Falls Lake for this timeframe would be 50 feet, for a total fluctuation of 35 feet.

The following graph shows the calculated daily flow for Falls Lake using the historical Cascade Creek gage, factored for Swan Lake, then Falls Lake. These flows include 1960 through 1972, 2010, and a 26-year average. The 26-year average flow (Jan 1, 1947 to Dec 31, 1972) is 263 cfs.

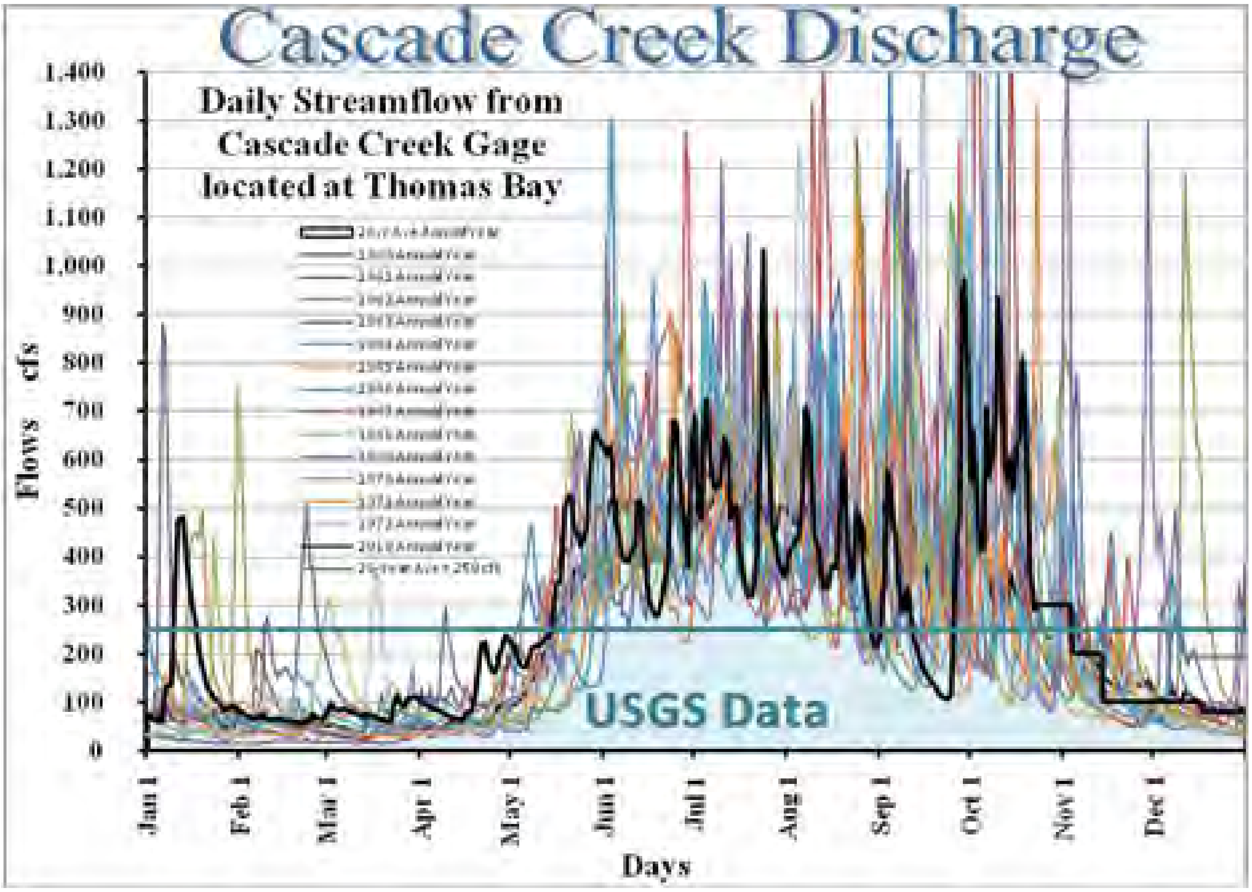
Figure 3-14. **Falls Lake Discharge -- Existing Conditions**



The Lower Cascade Creek drainage area is 23.25 square miles, including Swan Lake and Falls Lake drainage areas. The drainage area of Lower Cascade Creek sub-basin, below Falls Lake sub-basin, is 2.45 square miles. The drainage area below the Swan Lake outlet, which includes the Falls Lake and Lower Cascade sub basins is 4.30 square miles.

The following graph shows the daily flow for the historical Cascade Creek gage. These flows include 1960 through 1972, 2010, and a 26-year average. The 26-year average surface flow (Jan 1, 1947 to Dec 31, 1972) is 250 cfs. Cascade Creek has additional seepage flow at the historical gage site.

Figure 3-15. **Cascade Creek Discharge**



Annual Runoff Patterns

Precipitation in the project area occurs mainly during the months of September through December (US Climate Data, 2010). As the project area is influenced by small hanging glaciers and snowpack, higher stream flows are typically not realized until the spring and early summer snow melt affects stream-flows in June and July. Utilizing streamflow records for Cascade Creek, average annual flows correspond to an annual runoff of 148.7 inches.

Storage and Release of Project's Inflow and Description of Current Flow Regime

Swan Lake is a natural, glacially fed impoundment with a surface area of approximately 579 acres and a maximum water surface elevation of 1,514 feet msl. As discussed above, water elevations in Swan Lake vary throughout the year as a result of glacial run-off. Hydrologic analysis indicates an average range of 5.8 feet fluctuation. Project operations are proposed to mimic these natural fluctuation patterns, with flows less than or equal to 670 cfs diverted through the proposed hydroelectric facility.

Currently, lake levels are naturally controlled by the shape and elevation of the outlet channel, as well as leakage and the volume and the timing of the inflows from Upper Cascade Creek. The variation in flows is also evident in historical data from Cascade Creek. USGS data collected during the 38-year period of record (Cascade Creek near Petersburg) indicates that flows in Cascade Creek near the confluence with Thomas Bay could be as little as 15 cfs in the winter months, while up to 2,400 cfs during periods of peak run-off (these figures would include accretion and tributary flows downstream of the Swan Lake outlet).

Description of Water Rights

At this time, there are no water rights (existing or proposed) for Swan Lake, or any of the other water bodies that the Project has the potential to affect. Furthermore, to the Applicant's knowledge, there are no domestic, commercial or industrial uses of the waters located within the area of potential effect.

Water Quality

Existing State Water Quality Standards and Use Classifications

The DEC is tasked with the establishment and revision of State Water Quality Standards consistent with federal statutes. For application in Federal CWA actions, State Water Quality Standards (18 AAC 70) are reviewed and approved by the EPA. Most recently, in September of 2009, the USEPA Region 10 approved the revisions to Alaska's water quality criteria submitted in August of 2009. Subsequently, when applying water quality standards for federal purposes, one must identify which standards have been approved for each water quality parameter of interest. Furthermore, in accordance with 18 AAC 70, the following table provides the standards for Freshwater use classes[2] when a designated use class has not been applied:

[2] Unless natural conditions dictate otherwise

Table 3-2. **Water Quality Standards for Freshwater Use Classes**

Criteria	Water Quality Standard
DO	D.O. must be greater than 7 mg/l in surface waters. The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection.
Fecal Coliform	In a 30-day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml.
pH	May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
Temperature	May not exceed 15^{o}C.
Turbidity	May not exceed 5 nephelometric turbidity units (NTU) above natural conditions when the natural turbidity is 50 NTU or less, and may not have more than 10% increase in turbidity when the natural turbidity is more than 50 NTU, not to exceed a maximum increase of 25 NTU.

Streams and lakes can be further classified into several classes by the USFS based upon their fish production values (USFS, 2008b). These classes are as follows:

1. Class I streams and lakes have anadromous or adfluvial fish or fish habitat; or, high-quality resident fish waters, or habitat above fish migration barriers known to provide reasonable enhancement opportunities for anadromous fish.

2. Class II streams and lakes have resident fish or fish habitat and generally steep gradients (6 to 25 percent or higher) where no anadromous fish occur, and otherwise not meeting Class I criteria.

3. Class III streams are perennial and intermittent streams that have no fish populations or fish habitat, but have sufficient flow or sediment and debris transport to directly influence downstream water quality or fish habitat capability.

4. Class IV streams are intermittent, ephemeral, and small perennial channels with insufficient flow or sediment transport capability to directly influence downstream water quality or fish habitat capability.

> Class IV streams do not have characteristics of Class I, II, or III streams, and have a bankfull width of at least 0.3 meter (1 foot).

Swan Lake and Cascade Creek are generally classified as Class II, with potentially some intermittent sections being Class III (Pers. Communication, Chris Savage, USFS).

Basin Water Quality

The Cascade Creek Basin can be identified by HUC watershed code 19010201. There are currently no TMDL's for this watershed. Through their Forest Service Alaska Region Water Quality Management Plan, USFS implements Best Management Practices (BMP) to limit impacts to water quality from land/vegetation disturbing activities. Through a Memorandum of Agreement, dated April 6, 1992, the DEC has agreed that the Forest Service BMP's "are the primary means to protect water quality from nonpoint sources of pollution (USFS, 2008b).

Site-Specific Water Quality

Currently, no site-specific water quality criteria have been developed for Swan Lake or Cascade Creek. In an effort to quantify water quality data within Swan Lake, limnological profiles were collected in the vicinity of the proposed intake structure in 2010. As noted within the study plan, the objectives of the limnology investigation were to (1) describe the baseline conditions of temperature, dissolved oxygen (DO), pH, and conductivity within Swan Lake near the proposed intake, including any thermal stratification of the water column and (2) if thermal stratification is observed, identify the depths at which the summer epilimnion and thermocline exist.

As discussed within the study report (Appendix C) limnology measurements were conducted on Swan Lake during two sampling events, on August 15th and September 24th, 2010. Biologists used a YSI 556 multiparameter meter to simultaneously measure four parameters in the vicinity of the proposed intake: temperature (˚C), DO (mg/l), pH, and conductivity (µS/cm). During the August sampling event, parameters were measured at 1 feet (0.3 m) intervals from the lake surface, down to a depth of 30 feet (9.14 m), and then at 5 feet (1.52 m) intervals from 30 feet to 65 feet (19.81 m) (total n=38). During the September sampling event, parameters were sampled at 1 feet intervals down to a depth of 50 feet (15.24 m), then at 5 feet intervals to 60 feet, with the September depth profile ending at 63 feet (19.2 m) (total n=53).

Results of each parameter were plotted against depth to identify any patterns present in the water column, including the presence of a thermocline. The proposed Project would siphon water at a depth of approximately 40 feet (12 m) from Swan Lake. Therefore, this was a consideration when assessing the physical and chemical conditions of the lake, and is discussed further within *Environmental Effects*, below.

Results indicate that temperatures in August ranged from 14.5 °C at the lake surface to 5.4 °C at 20 m, while September temperatures ranged from 6.3-9.8 °C (Table 3-3). Although August temperatures were higher near the lake surface and decreased with depth, the temperature profile was relatively smooth, and no distinct temperature gradient was identified (Figure 3-16). Table 3-4 presents the temperature change per meter in August and September, within the first 9 m (30 feet) of the surface. Changes of greater than 1°C per meter were identified at three locations in August: between 1-2 m, at ~4.5 m, and between 6-7.5 m. This gradient was observed at approximately 7.5 m in September, which corresponded to the depth at which the water transitioned from isothermal, to slightly more varied in temperature (Table 3-3 and Figure 3-16).

Dissolved oxygen ranged from 10.1-11.9 mg/l in August and 10 to 11 mg/l in September. In August, DO was lowest at the lake surface and generally increased with depth, increasing slightly from ~11 to 11.9 mg/l at approximately 6.5 m, and returning to 11 mg/l just below 7 m. This pattern was not as distinct in September with a narrower variation of DO values.

In August, pH exhibited a wider range (5.1-8.1) than in September (6.2-6.5). August pH values were lowest near the lake surface and generally increased with depth, with the greatest increase occurring between 6-8 m. Conductivity ranged from 11-183 µS/cm in August and from 10-157 µS/cm in September. Conductivity values varied throughout the water column, with the greatest variability occurring between 4-9 m in August.

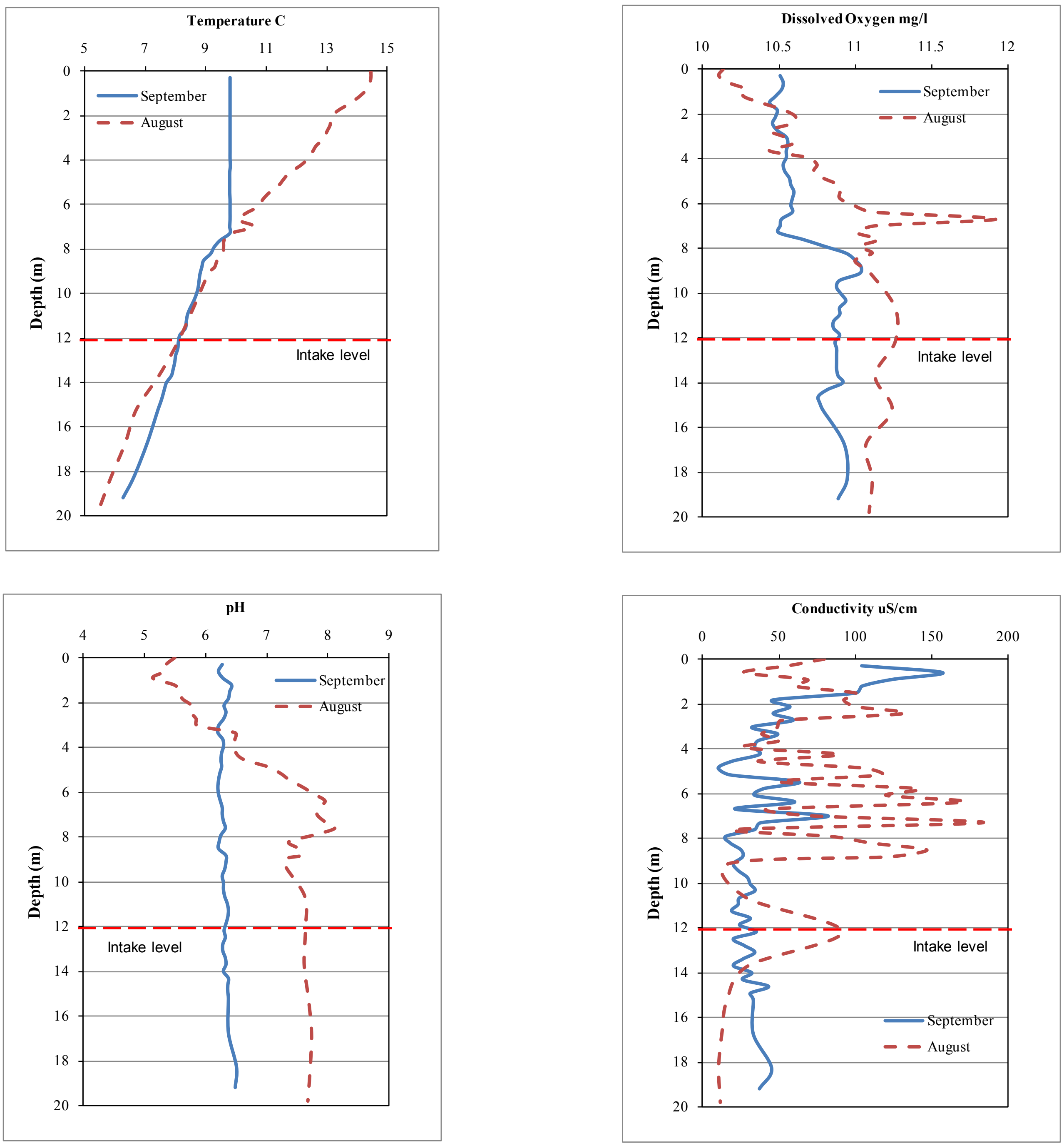
Table 3-3. Minimum and Maximum values for temperature, pH, conductivity and dissolved oxygen in Swan Lake in August and September

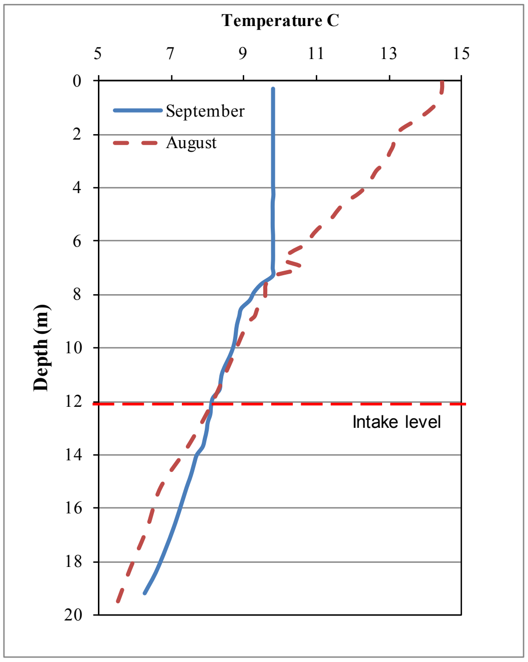
	August		September	
	Min	Max	Min	Max
Temperature (˚C)	5.44	14.47	6.27	9.80
Dissolved Oxygen (mg/l)	10.11	11.92	10.44	11.04
pH	5.14	8.11	6.21	6.51
Conductivity (µS/cm)	11	183	10	157

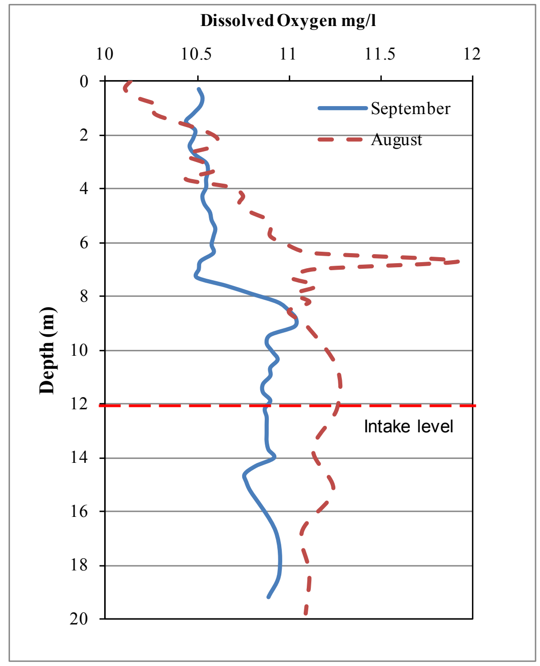
Table 3-4. Change in temperature per meter in the first 9.14 m (30 feet) in Swan Lake. Changes of >1°C per meter are bolded.

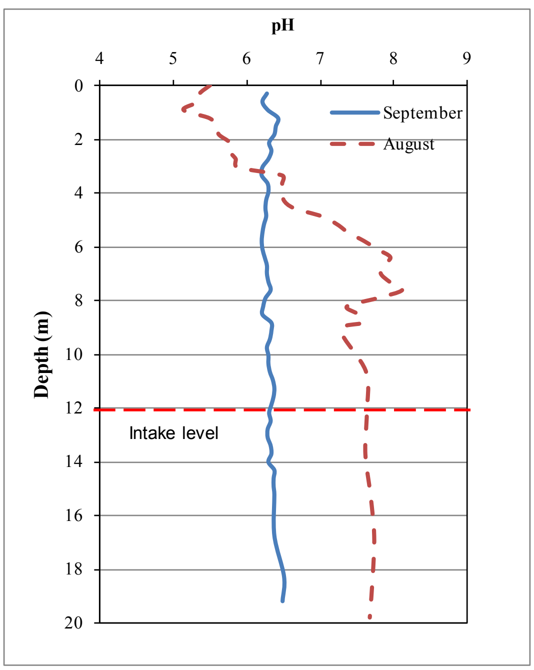
Depth (m)	Temp ˚C Aug	Aug Temp ˚C change/m	Temp ˚C Sept	Sept Temp ˚C change/m
0.00	14.47	NA	NA	NA
0.30	14.47	0.00	9.79	NA
0.61	14.42	0.16	9.79	0.00
0.91	14.28	0.46	9.79	0.00
1.22	14.03	0.82	9.79	0.00
1.52	13.7	**1.08**	9.79	0.00
1.83	13.34	**1.18**	9.79	0.00
2.13	13.15	0.62	9.79	0.00
2.44	13.12	0.10	9.79	0.00
2.74	13.01	0.36	9.79	0.00
3.05	12.92	0.30	9.79	0.00
3.35	12.67	0.82	9.79	0.00
3.66	12.53	0.46	9.79	0.00
3.96	12.38	0.49	9.79	0.00
4.27	12.13	0.82	9.8	-0.03
4.57	11.78	**1.15**	9.78	0.07
4.88	11.58	0.66	9.78	0.00
5.18	11.4	0.59	9.78	0.00
5.49	11.1	0.98	9.78	0.00
5.79	10.89	0.69	9.79	-0.03
6.10	10.76	0.43	9.79	0.00
6.40	10.34	**1.38**	9.79	0.00
6.71	10.07	0.89	9.79	0.00
7.01	10.6	**-1.74**	9.78	0.03
7.32	9.81	**2.59**	9.78	0.00
7.62	9.61	0.66	9.47	**1.02**
7.92	9.59	0.07	9.27	0.66
8.23	9.57	0.07	9.15	0.39
8.53	9.38	0.62	8.92	0.75
8.84	9.29	0.30	8.86	0.20
9.14	9.08	0.69	8.8	0.20

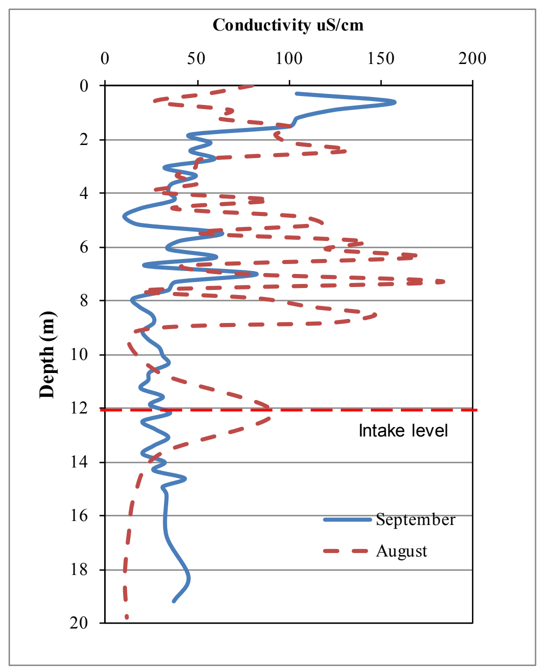
Figure 3-16. Temperature, dissolved oxygen, pH and conductivity in August and September at the proposed intake on Swan Lake




Temperature C
5
7
9
11
13
15
Depth (m)
0
2
4
6
8
10
12
14
16
18
20
September
August
Intake level


Dissolved Oxygen mg/l
10
10.5
11
11.5
12
Depth (m)
0
2
4
6
8
10
12
14
16
18
20
September
August
Intake level


pH
4
5
6
7
8
9
Depth (m)
0
2
4
6
8
10
12
14
16
18
20
September
August
Intake level


Conductivity uS/cm
0
50
100
150
200
Depth (m)
0
2
4
6
8
10
12
14
16
18
20
September
August
Intake level

As is depicted by the above figures and tables, no distinct thermal stratification was observed during the sampling period. Although a temperature gradient greater than 1°C per meter was identified at three depths in August, these areas of increased gradient were very narrow, (0.3 m to 1.5 m), and were not considered thick enough for distinction of a thermocline in the temperature profile. The Aquatic Resources study report suggests that the lack of thermal stratification could be a result of the flow-through dynamics of Swan Lake, which is fed by glacial streams.

In September, the isothermal temperatures observed from the surface down to approximately 7 m were expected for that time of year. The cooler, denser surface water resulting from cooler fall air temperatures and winds begin to cause vertical turbulence and mixing, until the entire water column is isothermal.

The study report explains that in both August and September Swan Lake exhibited an orthograde oxygen profile typical of oligotrophic lakes, with dissolved oxygen generally increasing with depth, as a function of decreasing temperature. The exception to this orthograde profile was observed at approximately 7 m in August, where DO temporarily spiked; however, this spike is considered minor.

The August pH profile generally corresponded with the DO profile, with lower pH values at the surface, spiking slightly at 7 m, and becoming relatively homogenous below 10 m. The study report describes that this profile was rather unexpected for an oligotrophic lake, where the pH vertical distribution is generally homogenous with depth, as seen in the September profile.

Conductivity values were within the range of natural variability for oligotrophic lakes, with the greatest variability observed in August.

All four of the parameters exhibit a distinct layer of water at approximately 7 m where DO, pH and conductivity temporarily increase. The study report describes that this could potentially be the result of the inlet stream water settling at this depth. As the cooler inlet stream water enters the lake it is denser than the surface water, causing the stream water to sink until it encounters cooler lake water of equivalent density. The inlet stream water is likely more aerated with higher mineral concentrations, resulting in elevated DO, pH, and conductivity levels at that depth.

Hosey (1985) also notes that water chemistry analyses conducted in 1975 show Swan Lake to be relatively productive compared to other Southeast Alaskan lakes. More specifically, it is noted that Swan Lake contained elevated levels of bicarbonate, total hardness, and pH conditions at the time of report issuance. It was noted that this unexpected increase in water chemistry data may be attributable to a localized marble, limestone or calcite deposit.

3.3.2.2 Environmental Effects

Proposed Action

Project operation and structures will maintain Swan Lake within natural, seasonal lake levels. While the project powerhouse has been designed to accommodate nearly 100 percent of the typical water year flow regime, high flows that exceed the plant capacity of 670 cfs would be subject to delayed release from Swan Lake if capacity below the normal high water was available, and/or released via the outlet structure, if storage capacity in Swan Lake was not available. Inflow would generally equal outflow. Considering this operational scenario, there will be times during the year where hydropower operation will be minimal or will, in some cases, be completely curtailed.

To assess the environmental effects of the proposed action, the Applicant undertook a series of aquatic resource studies focusing on water quality and quantity from 2009 through the fall of 2010, and utilizing historic gaged data. The objectives of the baseline limnology and water quantity studies are described above within the Affected Environment discussion. Thomas Bay was also assessed based on concerns expressed within a 1985 pre-feasibility assessment report commissioned by the City of Petersburg that discusses potential oceanographic impacts of hydroelectric development on Swan Lake, Scenery Lake and Ruth Lake. These concerns include: potential changes in water temperature; salinity and water density within the bay; changes in circulation and stratification of the water column; and potential changes in ice formation. These analyses are described below.

Potential Effects of Project Operations to Upper Cascade Creek and Swan Lake

Project operations are designed to follow the natural hydrograph of Swan Lake, mimicking the lake elevations that would occur under natural conditions. Therefore, the effects of project operations on Swan Lake are expected to be minimal, and there should be no effect on upstream movement from lake to Cascade Creek. Geomorphology study concluded that present bed topography for Cascade Creek at inlet was set by low pool elevation. Given project operations will not be lower than existing natural lake levels there should be no change in bed topography at the inlet.

The elevation of Swan Lake in Figure 3-17 (previously mentioned) is shown at 1,514.47 ft. The project will maintain lake levels between elevations 1,511 ft and 1,517 ft. This would be 3.5 ft lower and 2.5 ft higher than the lake surface elevation shown previously in Figure 3-6.

The following charts shows the calculated maximum, average and minimum lake using the historical Cascade Creek gage, and factored for Swan Lake.

Figure 3-17. **Swan Lake Elevation -- Prior to Project Start-up**

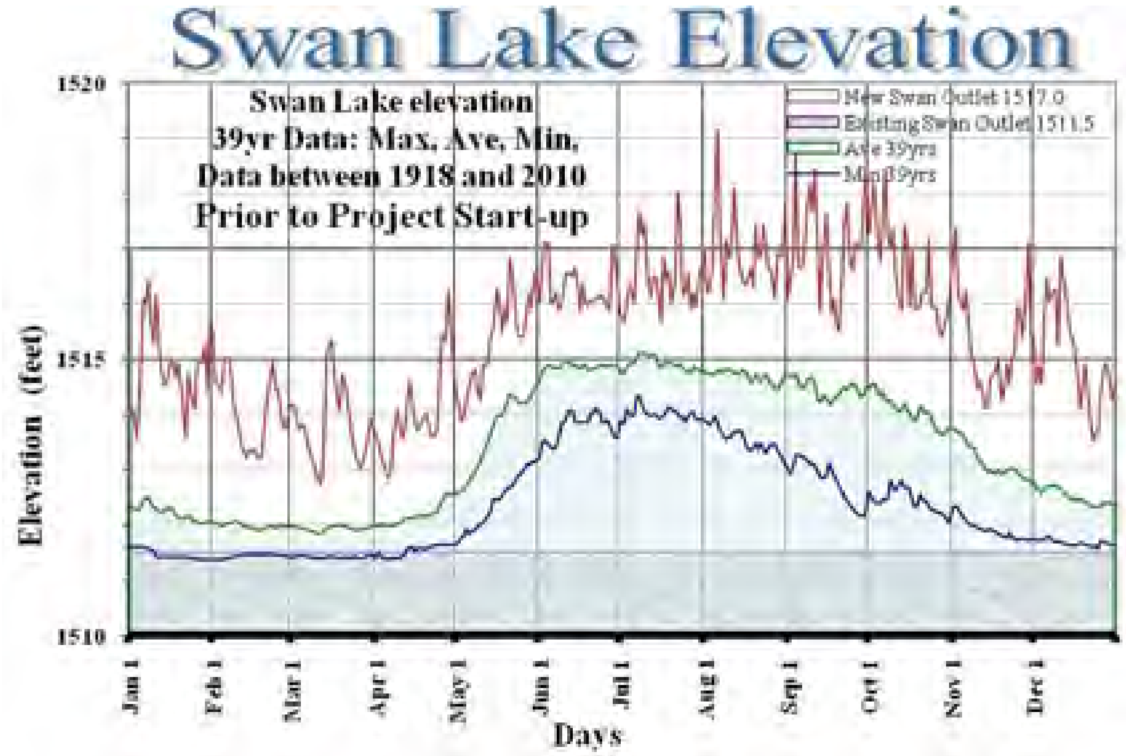
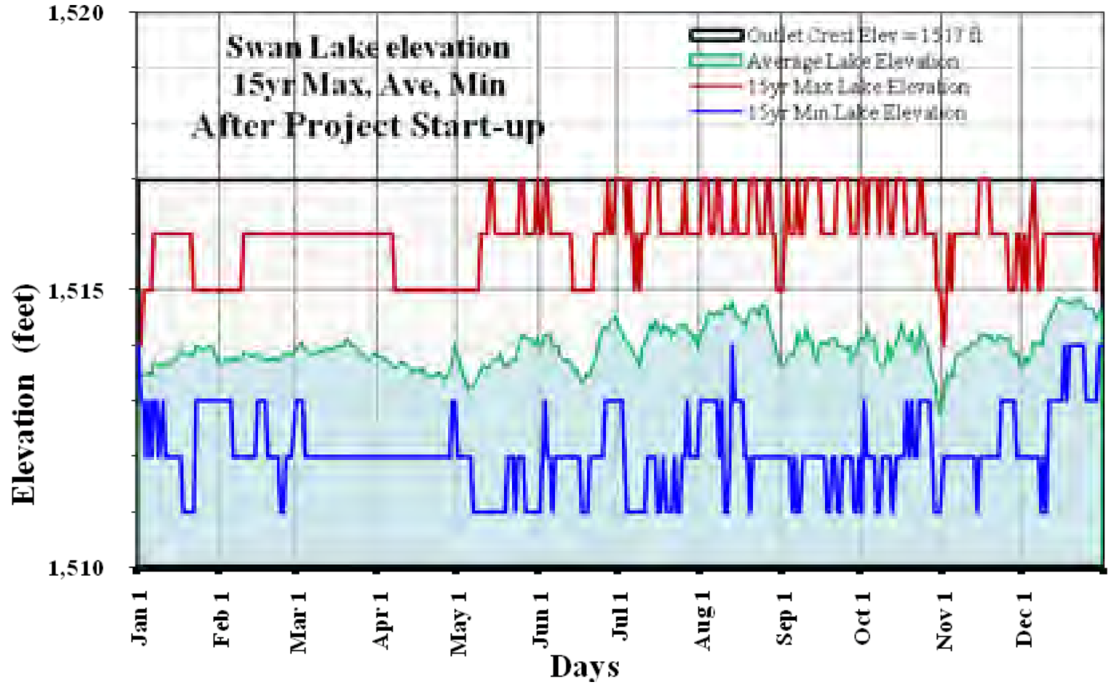


Figure 3-18. **Swan Lake Elevation Data – After Project Start-up**



The above graphs show Swan Lake elevations prior to project start-up and after project start-up.

When considering water quality conditions, the Aquatic Resources Study Report (Appendix C) notes that based on water quality sampling events, all of the variability in the vertical profiles of temperature, dissolved oxygen, pH and conductivity in Swan Lake during the sampling period appears to occur above 10 m, which is above the level of the 12-m proposed intake. Furthermore, water quality conditions are not anticipated to change as water travels through the power conduit complex, the turbines, or through the short tailrace.

Potential Effects of Project Operations to Falls Lake

Falls Lake obtains its flow from the outlet of Swan Lake and numerous creeks and waterfalls within its sub-basin. Once the project starts up, the inflow from Swan Lake will diminish, leaving some subsurface flow from Swan Lake and the numerous creeks and waterfalls from its sub-basin area.

The graphs below show the existing discharge from Falls Lake and the discharge after the Project is operational. The 26-year average flow is the daily average flows between January 1, 1947 and December 31, 1972.

Figure 3-19. **Falls Lake Discharge – Existing Conditions**

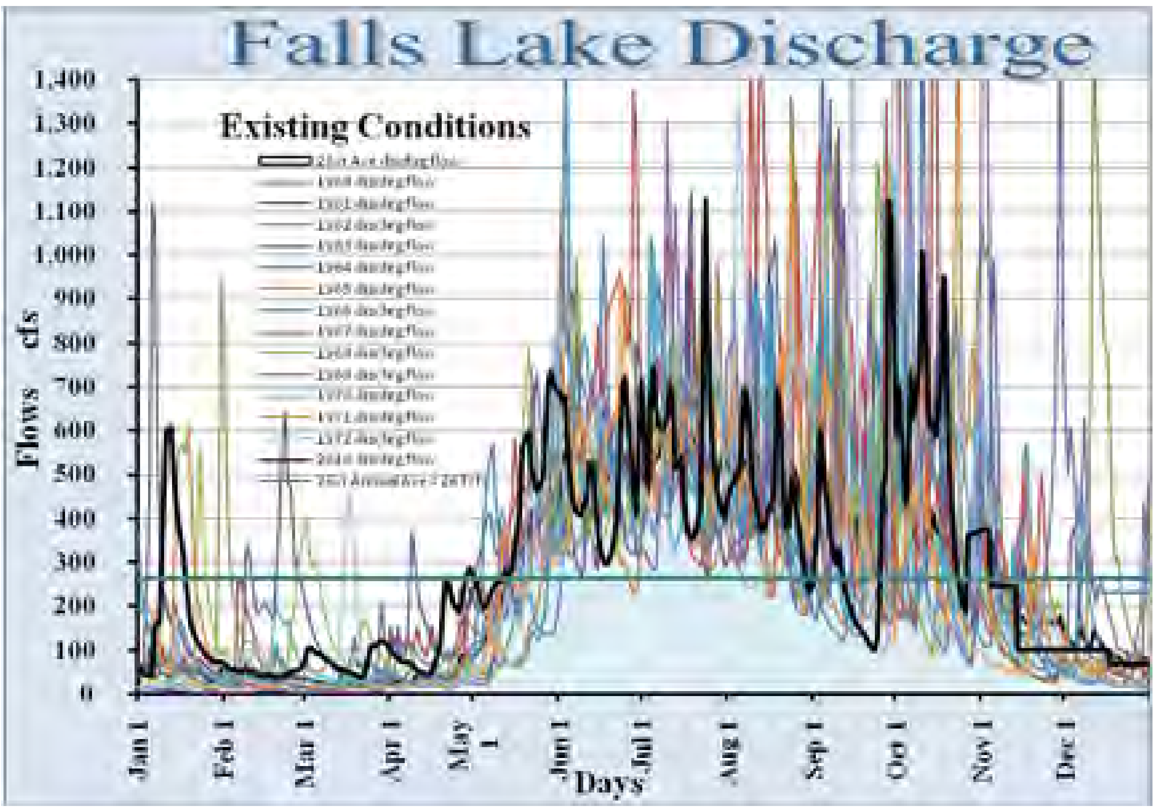
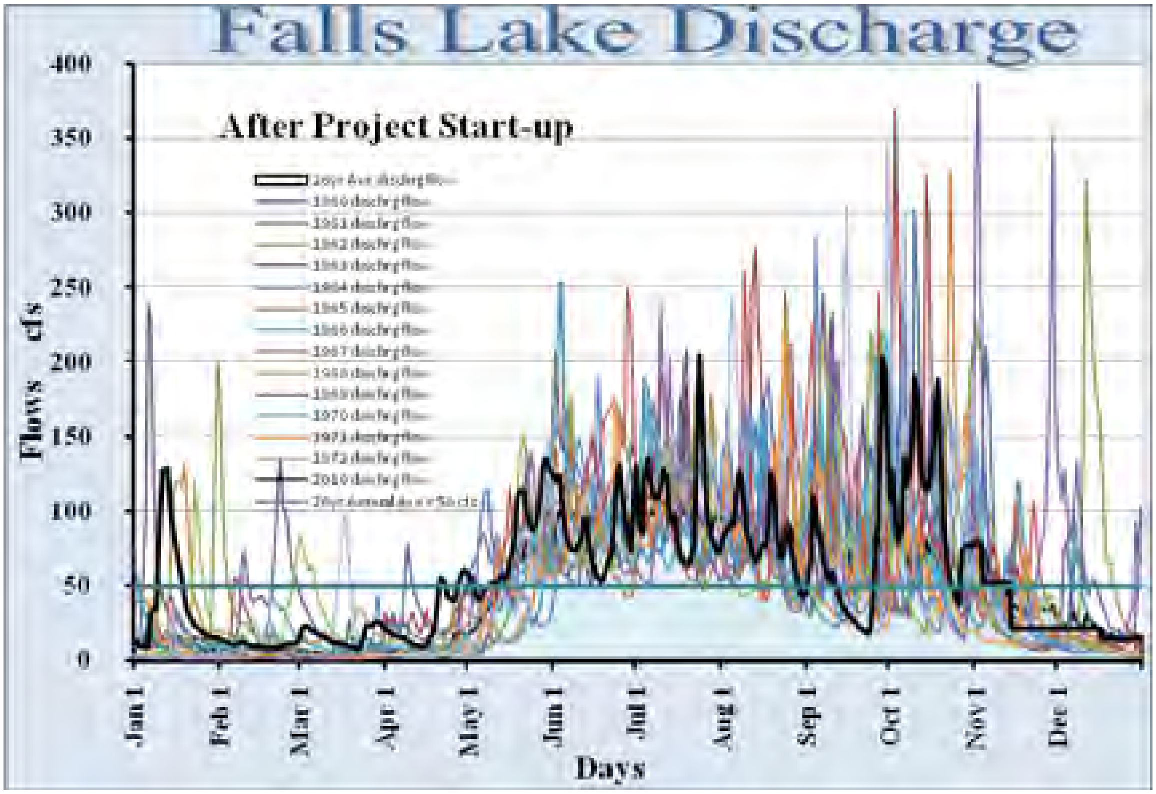


Figure 3-20. **Falls Lake Discharge After Project Start-Up**



As is discussed above, Falls Lake stage varies greatly throughout the year, with fluctuations ranging from a lake stage of 15 feet up to a flood stage of 50 ft. The existing average lake level stage is 31.2 feet prior to Project startup. Subsequent to Project startup, Falls Lake will fluctuate from a lake stage of 15 feet to 38 feet with an average lake level stage of 21 feet. Though this equates to a lower average lake stage under proposed conditions, fluctuations will still be within the band of fluctuation currently seen at Falls Lake. The lake outlet would be overtopped less frequently.

The following charts shows the calculated maximum, average and minimum lake using the historical Cascade Creek gage, factored for Swan Lake, and then Falls Lake.

Figure 3-21. Falls Lake Elevation -- Existing Conditions

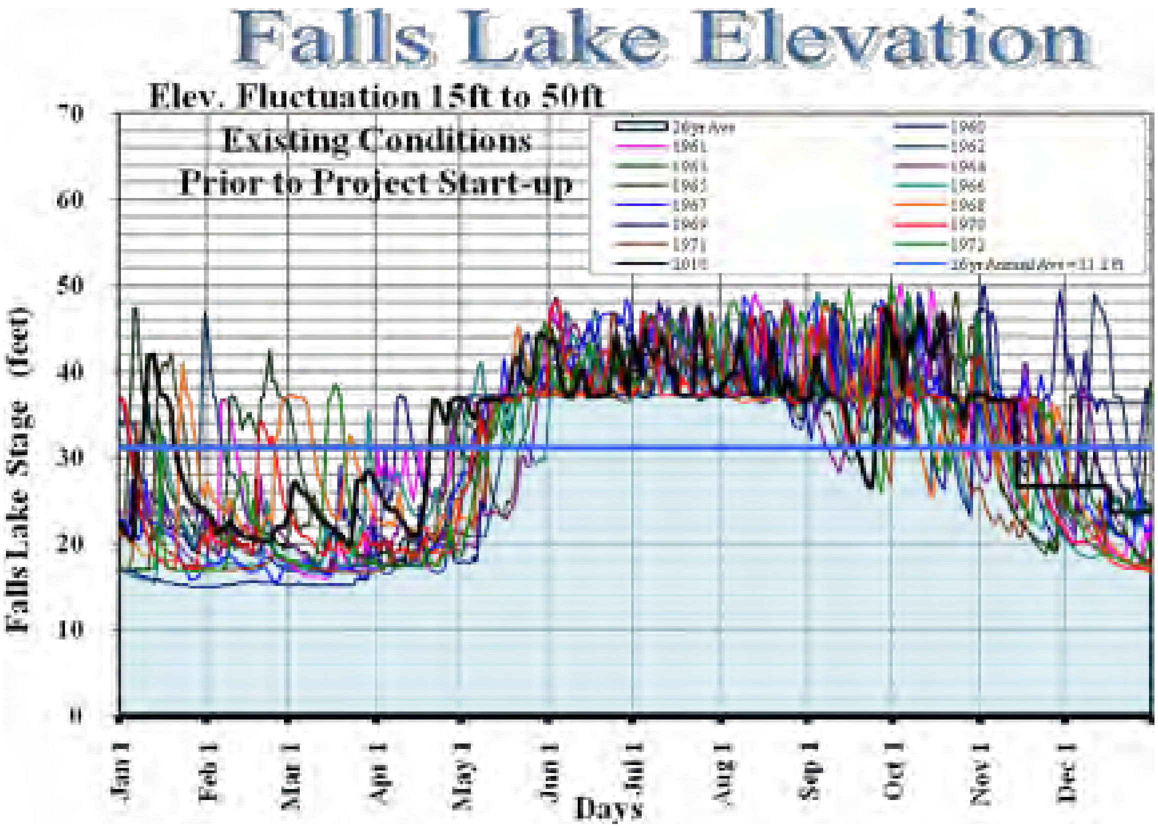


Figure 3-22. Falls Lake Elevation After Project Start-up

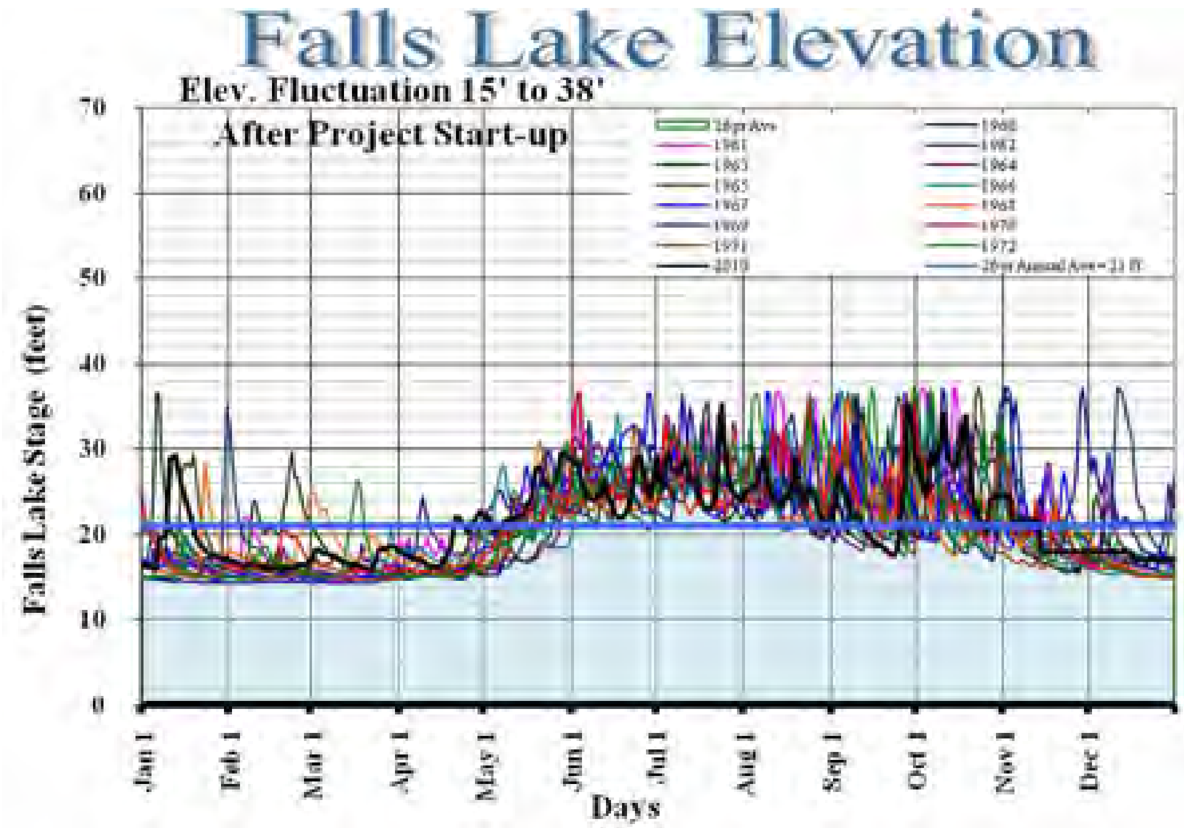
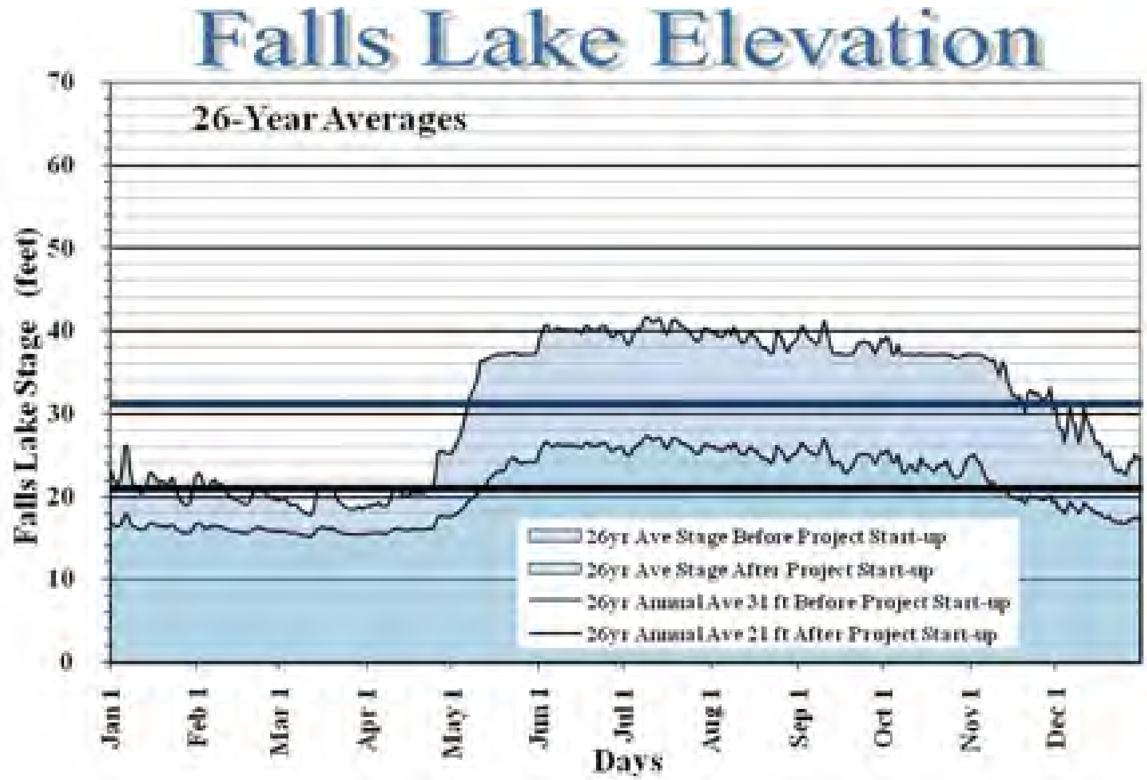


Figure 3-23. **Falls Lake Elevation 26-year Averages**



Potential Effects of Project Operations to Lower Cascade Creek

The results of hydrology studies indicate that under maximum project generation, 670 cfs (the hydraulic capacity of the hydroelectric facility) will be diverted through the power conduit rather than discharging into Lower Cascade Creek. Hydrologic studies also indicate that the average seepage contribution at the Swan Lake outlet range from 26 cfs in the winter to 135 cfs in the summer months. In analyzing the period of record, the average existing combined surface and seepage flow at the outlet to Swan Lake is 226 cfs.

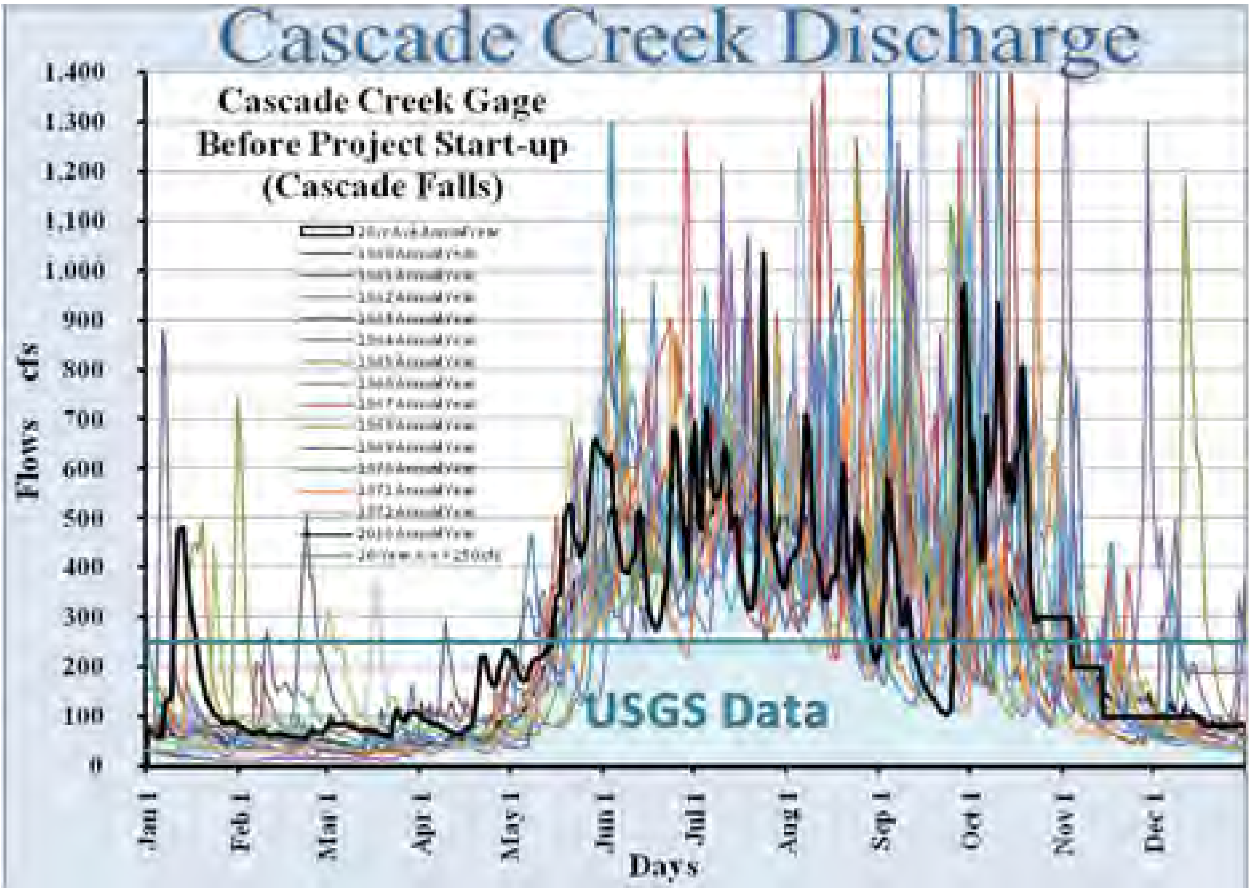
Existing inflow into Swan Lake from upper Cascade Creek is approximately 50% of the surface outflow from Swan Lake. Existing flows during winter months can be as low as zero cfs.

Observations of Lower Cascade Creek in 2010 (Oasis, Civil Science staff 2010) confirm that portions of the creek currently are completely subterranean for portions of the year; that is, there is no surface water within the stream bed. Discharge at the Cascade Creek mouth varies between 13 cfs during winter to over 2,460 cfs during peak runoff. Average discharge for the 26-year period, from January 1 1947 through December 31, 1972 is approximately 250 cfs.

Generation at full plant capacity is anticipated to occur 33.4% of the year. Subsequently, the daily outflow at the Swan Lake outlet following construction, with the plant at maximum generating capacity would likely closely resemble existing outlet flows between January and March for most of the year, which is subsurface. The Applicant proposes installing a crest gate system in the Swan Lake outlet structure to pass seasonal and storm high flow events. Accordingly, Lower Cascade Creek will continue to exhibit the same basic hydrology of having surface water during periods of high flow and accretion supplying the water during periods of low flow from Swan and Falls Lake.

The Applicant proposes installing a gate system in the Swan Lake outlet structure to pass seasonal and storm high flow events. Accordingly, Lower Cascade Creek will have lower flows than existing, but would continue to exhibit the same basic hydrology of higher flows during periods of storm high flow. There will also be accretion supplying water during periods of low flow from Swan and Falls Lake that would provide water at the historic Lower Cascade Creek gage near Cascade Falls.

Figure 3-24. **Cascade Creek Discharge Before Project Start-up**



There will always be flow in the Bypass Reach. There would be an average flow of 50 cfs from Falls Lake. However, some of that flow goes subsurface. The surface flow at the historic Cascade Creek gage would average 36 cfs. During the summer months, the flows would generally be 70 cfs, with higher flows during heavy rain.

The following two graphs show flow through the turbines from Swan Lake, and the surface flow at the historic Cascade Creek gage near Thomas Bay.

Figure 3-25. **Swan Lake Flow through Turbines**

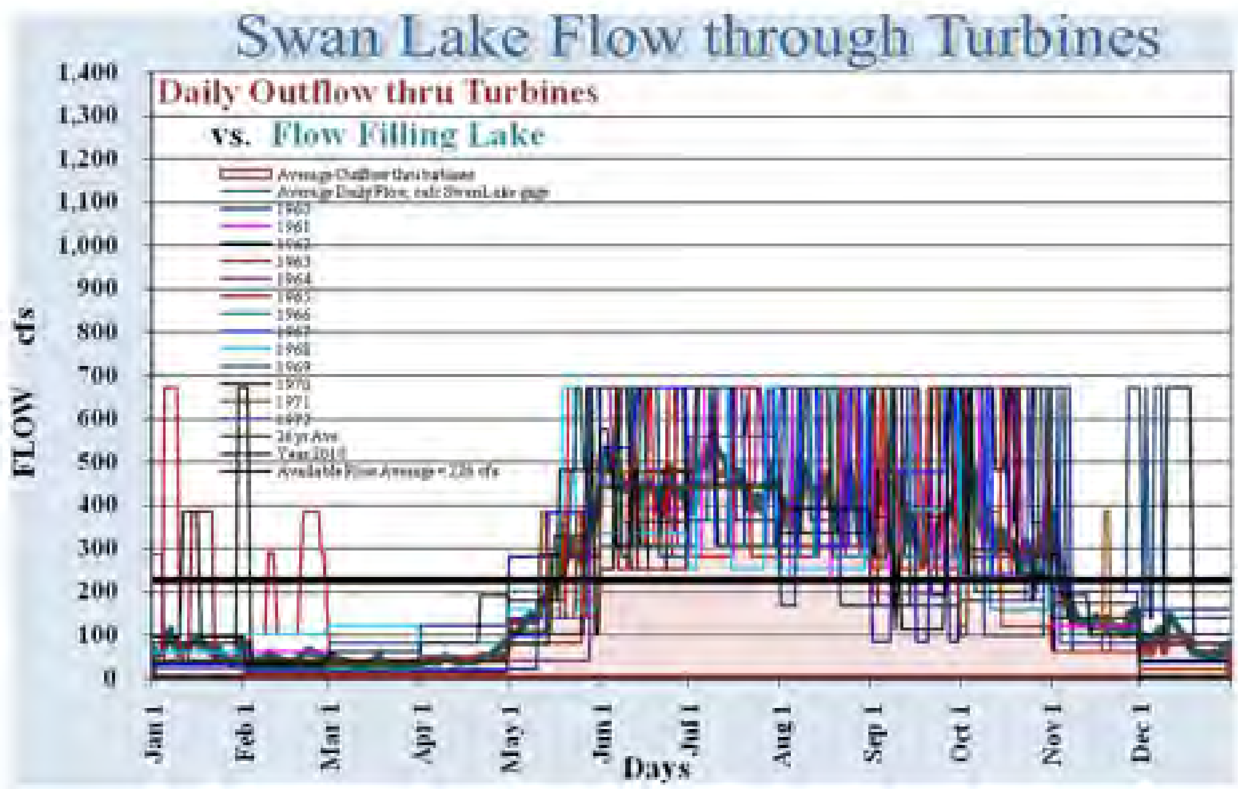
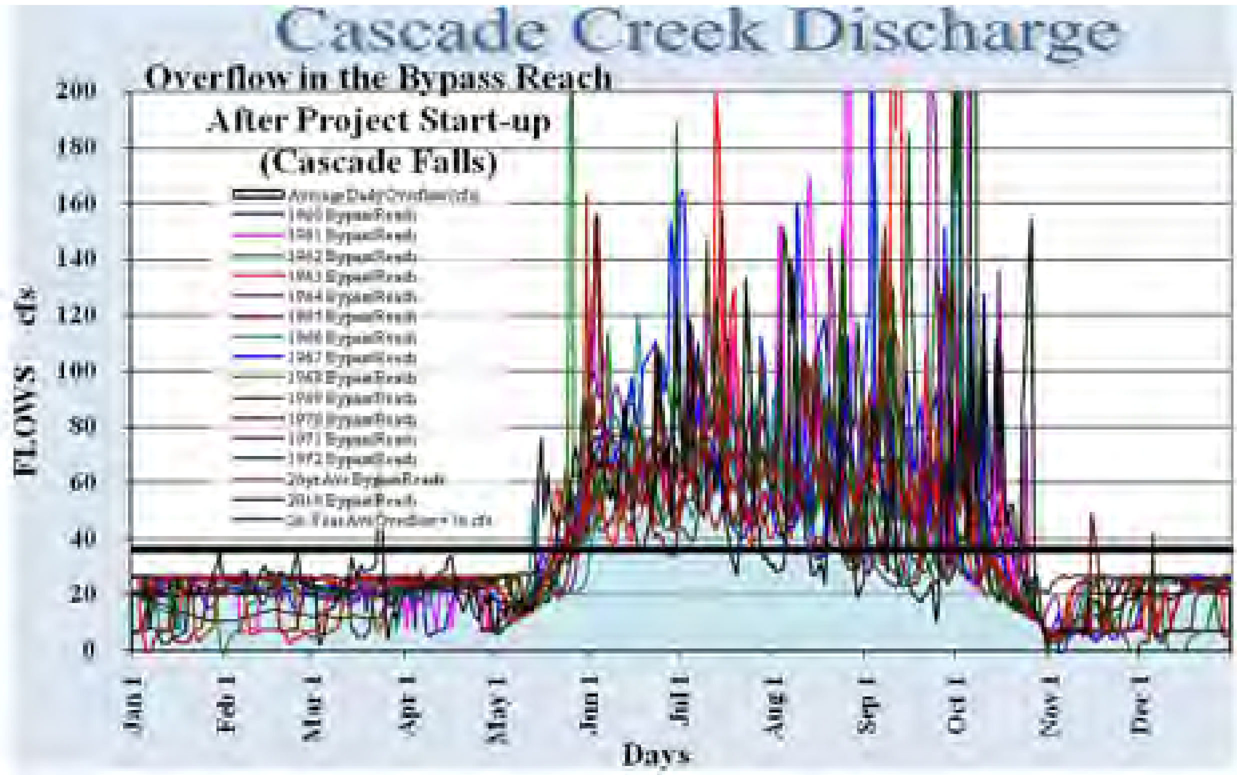


Figure 3-26. **Cascade Creek Discharge After Project Start-up**



Potential Effects of Project Operation within Thomas Bay

The effects of the proposed Project on Thomas Bay were assessed within the Aquatic Resources Study utilizing the calculations and associated concerns summarized in the 1985 Hosey & Associates (HA) Report (referenced in above discussion) and from field data collected during 2009 and 2010. It should be noted that the Hosey calculations are based on a constant water intake for hydropower. As Cascade Creek is one of the four main sources of freshwater influence in south Thomas Bay, calculations show that the most freshwater influence originates from the Patterson River, located in the southern end of the southern Thomas Bay arm. Table 3-5shows the contribution of freshwater discharge into south Thomas Bay from Cascade Creek and the proposed Project relative to other freshwater sources during pre- and post-development phases. The data is summarized for summer and winter period, representing the four months with the highest and lowest discharge, respectively.

Within the Aquatic Resources Study Report, it is assumed that the minimum flows within Cascade Creek will be 20 cfs. Using this assumption, discharge from Cascade Creek post-development will be about 1% during summer and 9% during winter. The remaining 14% and 19% will be discharged through the tailrace from the hydropower plant. The contribution of combined Cascade Creek and Power Plant discharge in Thomas Bay will remain similar to pre-development values under the assumption that operations will be conducted under a run-of-the-river flow scenario. Changes in ice formation due to increased freshwater discharge during winter will therefore not occur under the proposed operations.

Table 3-5. Analysis of discharge inputs to Thomas Bay

FRESHWATER DISCHARGE (cfs)	Pre-development		Post-development	
	SUMMER (Jun-Sep)	WINTER (Jan-Apr)	SUMMER (Jun-Sep)	WINTER (Jan-Apr)
Lower Cascade Creek [1]	474	61	20	20
Patterson River [2]	2084	80	2084	80
Delta Creek [3]	142	18	142	18
Scenery Creek [4]	474	61	474	61
Hydropower plant	0	0	454	41
TOTAL discharge on south Thomas Bay	3174.2	220.3	3174.2	220.3
% contribution Cascade Creek	15%	28%	1%	9%
% contribution hydropower plant	0%	0%	14%	19%
% contribution combined	15%	28%	15%	28%

[1] Average cfs 1918-28 and 1947-73 (HA 1985). Minimum post-development discharge values based on 90-day cfs minimum of 1918-28 and 1947-73 (HA 1985, page IV-4).

[2] Table V-A, page V-9 (HA 1985)
[3] cfs 30% of Cascade Creek, page V-7 (Ha 1985)
[4] cfs similar to Cascade Creek, page IV-7 (HA 1985).

Table 3-6. Discharge from hydropower plant verses tributaries to Thomas Bay.

	SUMMER (Jun-Sep)	WINTER (Jan-Apr)
Freshwater discharge in cubic meters per day		
from hydropower plant	1,098,317	99,187
from all main freshwater sources	7,679,025	532,950
% discharge relative to south Thomas Bay volume		
from hydropower plant	0.50%	0.05%
from all main freshwater sources	3.49%	0.24%

Temperature changes in the south arm of Thomas Bay due to a shift in discharge source from Cascade Creek to the hydropower plant are expected to be negligible. Hosey & Associates (1985) report temperature data profiles from Swan Lake taken in summer of 1961 and 1962 and winter of 1984. Measurements were taken of the depth profile temperature data of Swan Lake in August and September of 2010 (Figure 3-16). The available data show that summer temperature in Swan Lake varied from 10.0 to 14.5°C at the surface and from 6.1 to 10.2°C at the intake level (12 m or 40 feet). On average, the difference in temperature between the intake location at Swan Lake and Lower Cascade Creek water surface during summer is about 3°C. During winter months, the temperature of the water intake at Swan Lake might be somewhat warmer than Cascade Creek surface water. No apparent temperature changes are expected during the three-mile tunnel transport. The contribution of hydropower plant discharge relative to Thomas Bay water volume and other freshwater sources is relatively small, especially in winter when hydropower operations are limited. No appreciable influence on Thomas Bay water temperature is therefore expected to occur from a shift in water discharge from Cascade Creek to the hydropower plant.

Differences in water salinity, pH and dissolved oxygen between the intake location at Swan Lake and surface water are generally very small, especially in winter when biological productivity is low. Any differences that might exist will not change during the passage through the three-mile rock tunnel system. Once the water exits the powerhouse to the tailrace, consisting of a 450-foot-long open-stream channel, it will be exposed to natural atmospheric conditions before entering Thomas Bay. This open channel will not substantially change any water characteristics, but mitigates for the potential of gas supersaturation of discharge water. Most importantly, the discharge volume of the hydropower plant will not exceed natural values and as such will have no measurable effect on the water quality of Thomas Bay.

Measures Proposed by the Applicant

As construction activities may result in a temporary increase in turbidity levels within the project area, the Applicant will prepare an erosion and sediment control plan incorporating related preventative measures to mitigate for this potential effect. The Applicant will also develop and implement post-construction water quality monitoring and evaluation Program to monitor project operational effects on water quality and maintain established gaging stations post-construction. Furthermore, the Applicant proposes to develop a Water Management/Operation Program that minimizes the effect of project operations on lake levels and establishes operational parameters for drought and high-flow events.

No Action Alternative

Under the no action alternative, no additional water gaging would be accomplished. Subsequently, the agencies currently managing resources within the project boundary would not benefit from the Applicant's proposed maintenance and long-term monitoring of gaging stations. There would be no further expansion of the hydrologic data and regime within Cascade Creek and Swan Lake.

3.3.2.3 Unavoidable Adverse Effects

Under the proposed action, minor amounts of sediment would likely enter Swan Lake and Thomas Bay as a result of Project construction, even with the implementation of erosion control measures, resulting in the potential for short-term impacts to aquatic species. There will also likely be seasonal changes to inflow delivery from Swan Lake to Lower Cascade Creek and, subsequently, to Falls Lake. However, aquatic field studies (See Section 3.3.3) indicate there is limited habitat in the river reach directly below Swan Lake. Hydrologic studies indicate that accretion, seepage, and tributary flows will provide a sufficient habitat flow within Lower Cascade Creek to support environmental resources. The Applicant proposes to maintain gaging stations post-licensing to provide long-term flow information for maintaining lake level elevations, as well as providing ongoing data to interested resource agencies.

3.3.3 Fish and Aquatic Resources

3.3.3.1 Affected Environment

The proposed Project will encompass Swan Lake and lower Cascade Creek, which is hydrologically connected to Thomas Bay via Cascade Creek. The non-native rainbow trout (*Oncorhyncus mykiss*) was stocked into Swan Lake approximately 60 years ago. Records from ADFG and USFS do not indicate any other fish species in the Lake (Oasis, 2010b). Since the initial stocking period in the late 1950's, rainbow trout have expanded downstream into Lower Cascade Creek including Falls Lake. Fish appear to be limited to downstream movement only for the most part due to multiple cascades and waterfalls along the length of

Lower Cascade Creek. A single Dolly Varden (*Salvelinus malmo*) was observed in the lowest most reach of Lower Cascade Creek a short distance upstream from the initial barrier falls. Rainbow trout and Dolly Varden distribution was confirmed by field studies conducted by the Applicant.

During the 2010 field season, the Applicant undertook a series of fish and aquatic resource studies of waters potentially affected by the proposed Project to help describe the affected environment and inform the discussion of potential effects of project construction and operation on habitats and species. The Aquatic Resources Study area encompassed Cascade Creek from its mouth at Thomas Bay to Swan Lake. This included a habitat survey of Upper Cascade Creek (the portion of Cascade Creek that flows from a natural fish barrier approximately 1.5 miles upstream of Swan Lake); Spring Creek (a tributary to Upper Cascade Creek); Swan Lake; Lower Cascade Creek (upper and lower section); Falls Lake; and the Pond (a small waterbody that is hydrologically connected to the upper section of Lower Cascade Creek). The following Fish and Aquatic Resources section is comprised of available existing data supplemented with information from the following individual studies, which comprise the Aquatic Resources Study Report (Oasis, 2010b) (Appendix C):

- Stock Assessment and Seasonal Fisheries Inventory;
- Fish Habitat Survey;
- Fish Passage Survey;
- Geomorphic Study of Swan Lake Inlet;
- Bathymetry Study;
- Limnology Study of Swan Lake at the Power Conduit Intake; and
- Aquatic Macroinvertebrate Study on Falls Lake and Lower Cascade Creek.

Overview of Fisheries Resources

Freshwater Fish and Habitats

Swan Lake

Swan Lake has a surface area of about 579 acres and a drainage area of approximately 18.95 square miles above the intake. A hydroacoustic survey undertaken by the Applicant indicates that generally the southeastern portion of the lake exhibits the most gradual bathymetry, in relation to other areas which reach depths of over 300 feet, within 175 feet of the shoreline (BioSonics, 2008). Bathymetric mapping indicates that the lake has a maximum depth exceeding 500 feet in a large, uniform basin in the western section of the lake (see Swan Lake Hydro-acoustic Study, included within Appendix C). The shoreline surrounding Swan Lake is mostly precipitous and unvegetated. In areas that are not sheer cliffs, the Swan Lake shoreline is nearly vertical. Swan Lake lacks a developed littoral zone and does not support submerged aquatic vegetation. The Swan Lake inlet, characterized by a shallow delta, is the only portion of the lake where lower-slope areas exist (Oasis, 2010b).

Water quality measurements conducted during licensing efforts ranged from 5.4° C to 14.5°C, 10.1 mg/l to 11.9 mg/l, and 5.1 to 6.5 respectively for temperature, dissolved oxygen, and pH during sampling events conducted during August and September 2010 and were within state water quality standards (see Section 3.3.2, *Water Quantity and Water Quality*) (Oasis, 2010b).

In general, rainbow trout prefer cold water streams and lakes with the optimal temperatures ranging between 12.8 and 15.6 ^{o} C. Trout move into tributaries and shallow areas of lakes and rivers consisting of gravel and cobble to spawn in early spring. As with other salmonids, 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. Upon emergence, the fingerling trout assemble in groups and seek shelter along the stream margins or protected lake shore, feeding on crustaceans, plant material, and aquatic insects and their larvae (ADFG, 2010a). There is usually a shift with increase in size from plankton to insects and crustaceans and then to fishes.

The stocked Cascade Creek rainbow trout population exists in several fragmented populations. The Spring Creek adjacent to Upper Cascade Creek appears to provide the vast majority of spawning and rearing habitat in the Swan Lake/Upper Cascade Creek drainage. The fishery resource from Falls Lake upstream and including Swan Lake is believed to be a monoculture (Oasis, 2010b).

Although capable of reproduction, the population size of these non-native trout, within the system, including Swan Lake appears relatively small. The Southeast Alaska Recreation Cabin Survey conducted in 2006 indicates approximately 354 fish were caught over a 69-day usage period (Oasis, 2010b). Field surveys conducted by the Applicant in 2008 resulted in 104 observed fish within Swan Lake. The majority of fish were located in the eastern portion of the lake (BioSonics, 2008).

Given the trout's spawning needs, there are limited to no spawning areas within Swan Lake. The cool, deep waters provide suitable habitat for adults but are limited as rearing habitat for young-of-year and juvenile fish largely due to the lack of cover and refuge from cannibalistic adult RBT.

Consequently, the lack of sufficient spawning and rearing habitat coupled with adult RBT propensity for piscivory likely limits population size Furthermore, rainbow trout that migrate downstream and leave the lake system are unable to return to the lake due to multiple impassable natural barriers that exist downstream of the Swan Lake outlet.

Cascade Creek

Upper and Lower Cascade Creek contain very different habitats and are described individually below.

Upper Cascade Creek

As previously discussed, Upper Cascade Creek's gradient is securely anchored by surface bedrock nickpoint at the head of the study reach and at several exposed bedrock shelves farther downstream, and by the natural low pool elevation of Swan Lake . The bathymetric hydrologic study undertaken by the Applicant indicates that the channel morphology and gradient at the Swan Lake inlet are in equilibrium with the natural low pool elevation of Swan Lake. Under natural low pool elevations, RBT are able to move freely between the riverine and lacustrine habitats. This allows for continuous upstream migration of stocked trout at all existing and proposed/observed lake levels on record.

The Upper Cascade Creek channel has an ample supply of loose and well-graded sand and gravel. The channel shape and sinuosity is well defined by dense floodplain vegetation. No evidence of vertical incision was observed or suggested by the channel data during studies conducted by the Applicant in 2010 (Oasis, 2010b).

The Spring Creek adjacent to Upper Cascade Creek contains suitable spawning habitat, and is discussed in greater detail below. Upper Cascade Creek itself also appears to contain suitable spawning habitat consisting of pools and riffles with appropriate size gravels. Although geomorphologic and fish habitat survey data conducted by the Applicant confirms that spawning habitat and adult feeding habitat exist in Upper Cascade Creek, the survey determined that rearing habitat is not very abundant in this section due to lack of cover and food resources. Furthermore, no fish or redds were observed in Upper Cascade Creek during geomorphic and habitat surveys (Oasis, 2010b).

The Applicant conducted a rainbow trout spawning survey in May 2010 in Upper Cascade Creek and Cabin Creek. Additional observations of spawning activity in Swan Lake tributaries and other areas of the Cascade Creek drainage were made during the Stock Assessment and Seasonal Fish Inventory field trips (Oasis, 2010b). During these study efforts, and despite exceptional water clarity during the survey, no rainbow trout spawners were observed in Upper Cascade Creek, Swan Lake inlet delta or Cabin Creek, which feeds into Swan Lake south of the Upper Cascade Creek confluence (Oasis, 2010b).

Spring Creek

Spawning surveys were not conducted in Spring Creek; however, up to 49 potential redds were observed in the first 200 meters of Spring Creek directly upstream from Swan Lake during habitat mapping surveys in August 2010. Newly emerged young-of-year fish were observed in the gravel depressions of these redds at the time (Oasis, 2010b). Spring Creek appears to have the best available spawning and rearing habitat for rainbow trout inhabiting Swan Lake.

Falls Lake

Falls Lake is a 17-acre lake located approximately ¾ mile downstream of Swan Lake and approximately 360 vertical354 feet lower below the outletat an approximate elevation of 1,160 feet. The lower Cascade Creek both feeds and drains Falls Lake. Falls Lake empties into the lower portion of Lower Cascade Creek which flows into Thomas Bay (Oasis, 2010b). The lake is a relatively narrow impoundment of Cascade Creek. A natural bedrock constriction divides the lake into two segments. The upper section of the lake is most recognizable for the 20 – 30 feet high cliff at the inlet of Falls Lake that creates a cascade for which the lake is named. The lake is typified by steep cliffs and large, angular substrate. Near-shore depths range from 10 to 12 feet. The deepest areas of the lake occur at the center of the river channel and range from 35 to 40 feet. The lake outlet leaks at all lake levels and it is only at higher stages, i.e., gage heights of approximately 34 feet and greater, that surface waters flow from the lake. At lower stages, flow exits the lake through the boulder-sized colluvium material which forms a natural dam at the lake outlet. Substantial amounts of flow, on the order of 50-100 cfs (and possibly more), are believed to be able to flow through this material based on measured lake levels and visual observations of outlet flow patterns that were made from above via helicopter and from the lake outlet itself via boat during low Fall flows. On both these observations, a significant amount of flow was observed to be exiting the lake by running under and through the colluvium while a lesser amount was observed exiting through the narrow surface water passage at the outlet (Civil Science, 2011).

A fisheries investigation undertaken in Falls Lake focused on a mark and recapture and seasonal distribution study to determine the abundance of rainbow trout and inventory other species that might occur in the lake (Oasis, 2010b). As described in more detail in the Aquatic Resource Report (Appendix C), mark and recapture efforts included a combination of hoop netting and minnow traps. During the August through October 2010 fish investigations, 5 rainbow trout were caught in August and 36 were caught in September, with sizes ranging from 48 to

361 mm. No young-of-year rainbow trout were observed or captured in Falls Lake. No other fish species were reported for Falls Lake (Oasis, 2010b).

Lower Cascade Creek

Lower Cascade Creek is a high energy, low sediment supply stream system that is mostly bedrock or structurally controlled by boulders/colluvial deposition with numerous waterfalls and plunge pools and habitat and substrate consisting of steep cliffs, large boulders, and bedrock (Oasis, 2010b). Visual and aerial investigations conducted during the Aquatic Resource Study (Oasis, 2010b) concluded that these areas are not conducive for spawning. Spawning size substrate was virtually non-existent in Lower Cascade Creek including the reach between the last downstream barrier falls and Thomas Bay. Furthermore, no young-of-year rainbow trout were observed or captured in Lower Cascade Creek or tributaries below Swan Lake. Fisheries staff also performed spawning survey reconnaissance on tributaries to the Pond on May 23, 2010 but did not observe any spawning rainbow trout or redds (Oasis, 2010b).

Fish that wash downstream into sections of Lower Cascade Creek are unable to migrate back upstream because of natural impassable barriers throughout the tributary. In fact, a total of ten barriers to upstream fish passage were observed and mapped within Lower Cascade Creek between Swan Lake outlet and Thomas Bay (Oasis, 2010b). All observed barriers were photo documented and included within the Aquatic Resources Study Report (Appendix C).

Fish investigations were undertaken in August, September, October, and December 2010 in four distinct reaches of Lower Cascade Creek plus the Pond and Falls Lake. Sixty rainbow trout were captured and marked during two sampling events in Falls Lake, the Pond and reaches of Lower Cascade Creek. No other fish species was captured or observed. Only 9 fish were captured in August and none of these fin-clipped trout were recaptured in September.

The seasonal fisheries inventory was conducted in October and December 2010 downstream of Falls Lake in Lower Cascade Creek. Collection efforts targeted two distinct and separate stream reaches in Lower Cascade: Reach 1A from the confluence with Thomas Bay to the impassable barrier falls approximately 250 meters upstream and reach 1B starting upstream of the barrier falls to Falls Lake outlet. During the October sampling event a total of six fish were trapped in reach 1A downstream of the barrier falls; two rainbow trout; three Dolly Varden and one coast range sculpin (*Cottus aleuticus*) (Oasis, 2010b). In reach 1B upstream of the barrier falls, a total of two fish were; one rainbow trout and one Dolly Varden. December 2010 inventory efforts collected a total of ten fish in reach 1A downstream of the barrier falls; five Dolly Varden, one rainbow trout, one coho salmon, and three coast range sculpin. No fish were collected in reach 1B during the December 2010 sampling event.

<u>Anadromous Fish</u>

A 2010 anadromous waters atlas produced by ADFG indicated that no anadromous fish occur in Cascade Creek (ADFG, 2010c). The impassable natural falls of Cascade Creek limit upstream access to suitable spawning and rearing habitat for completion of anadromous fish life cycles. The Applicant determined that a small population of Dolly Varden may exist within the lower reaches of Lower Cascade Creek. Dolly Varden populations may be anadromous or non-anadromous and are found throughout Western North America (Oasis, 2010b). The resident form is commonly found upstream of natural barriers (e.g. falls, dams) that prevent the upstream migration of the anadromous form (Ihlenfeldt, 2005).

Some of the characteristics of some forms of resident populations are small body size, reduced fecundity and early maturation. Those found in lower Cascade Creek are resident, rather than anadromous in nature, due to their land-locked state.

The single coho salmon observed in reach 1A during the December 2010 sampling effort, was estimated to be a two-year-old fish based on its total length (104 mm). Coho salmon are known to be capable of rearing in brackish, estuarine environments and of traveling between brackish and freshwater habitat (Crone and Bond, 1976; Bramblett et al., 2002; Miller and Sadro, 2003). It is unlikely that Coho spawn in lower Cascade Creek, based upon the nearly complete absence of spawning gravels and lack of additional captures during the October and December sampling events (Oasis, 2010b).

Coast range sculpin is a marine-derived species which spends most of its life in fresh water but spawns in salt water or brackish water estuaries (a life history strategy known as catadromy). This fish is widely distributed from southern California to Bristol Bay, Alaska, where it commonly occurs in small coastal streams (Oasis, 2010b).

<u>Marine Fish and Habitats</u>

In addition to the freshwater portion of Cascade Creek, a relatively small tidal area occurs as Cascade Creek enters Thomas Bay. Red, Dungeness, and Tanner crab populations, as well as pandalid shrimp populations are present in Thomas Bay. Pandalid shrimp can be found throughout the water column but feed mostly on benthic organisms whereas the crab species tend to spend most of the time on or near the ocean floor and feed primarily on other crustaceans and benthic organisms. Razor clams, blue mussels, and littleneck clams are also known to exist in Thomas Bay outside the project boundary (NSGL, 2010; AFSC, 2010; ADFG, 2010l).

<u>Essential Fish Habitat As Defined Under Magnuson-Stevens Fishery Act</u>

Pursuant to the amended Magnuson-Stevens Fishery Conservation and Management Act (Act), essential fish habitat (EFH) for federally managed fish species are defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is only applicable to federally managed commercial fish species that live out at least one component of their lifecycle in marine waters.

EFH is designated for the following species of juvenile, immature, and maturing adult salmon within Thomas Bay and Frederick Sound: Chinook, sockeye, chum, coho, and pink. There are no fishing restrictions within this EFH. There is no EFH within the Cascade Creek drainage (Swan Lake, Falls Lake, or Cascade Creek). Habitat within these waterbodies does not support diadromous fish or marine species (NMFS, 2010b).

Overview of Benthic Macroinvertebrates

As discussed within the Aquatic Resource Study Report (Appendix C), benthic macroinvertebrates 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). Benthic macroinvertebrate indices (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).

The Aquatic Resources Study included an assessment of the BMI community composition and BMI density longitudinally in Lower Cascade Creek. Riffle habitats are the preferred stream habitat for comparative studies of benthic macroinvertebrates, as they typically have the highest densities and diversity of benthic macroinvertebrates. As such, three appropriate locations for macroinvertebrate sampling were located within Lower Cascade Creek and one location was requested by resource agencies for Falls Lake (Oasis, 2010b).

The 2010 BMI sampling effort yielded 35 taxa collected from the three sites in Lower Cascade Creek (RM 1.25 site; Pond site; and Swan Lake outlet site). The taxa were distributed among eight orders: EPT - *Ephemeroptera* (5); *Plecoptera* (7); and *Trichoptera* (4); flies - *Diptera* (14); freshwater molluscs - *Bivalvia* (1); crustacean - *Crustacea* (2); spiders - *Arachnidea* (1); and worms - *Annelida* (1). *Diptera* comprised nearly half of the total taxa list. Within the *Diptera* order the family *Chironomidae* dominated the taxa list with a total of twelve taxa. The list of taxa was relatively consistent spatially throughout the elevation gradient on Lower Cascade Creek (Oasis, 2010b).

Swan Lake outlet had the highest BMI density of the three sites sampled in Lower Cascade Creek. The BMI community likely capitalizes on the food resources available in the surface water outflows from Swan Lake. Other researchers have found higher BMI densities at lake outlets. Surface water lake outlets tend to contain higher quality food resources in the form of phytoplankton, zooplankton and seasonal nutrient fluxes relative to adjacent lotic environments. Phytoplankton and zooplankton, entrained in the waters at the lake outlet, are transported downstream. The concentration of this higher quality food decreases progressively with distance from the lake outlet. Accordingly, BMI densities decrease progressively downstream as food quality declines. The BMI density at the two downstream sites was less than half the density observed at Swan Lake outlet (Oasis, 2010b).

Sampling efforts indicated the number of taxa collected at the three sites on Lower Cascade Creek is low relative to taxa lists for studies elsewhere in Alaska and specifically in the Alexander Archipelago in southeast Alaska. The lack of BMI diversity may be due to the high gradient nature of Lower Cascade Creek resulting in coarse substrate (mostly boulders with little fine grained material) and return interval of scouring flows. The high gradient character of Lower Cascade Creek results in intense scour of the streambed on a regular basis. Scouring flows were observed in 2010 on a nearly monthly basis triggered by snowmelt in the spring, above normal air temperatures in August resulting in increased glacial melt, and during normal precipitation events in August, September, and October. It is noted that the *Diptera* taxa more common to Alaska streams tend to burrow into finer grained materials (Oasis, 2010b).

As discussed in greater detail in the Aquatic Resources Report (Appendix C), three replicate samples taken within Falls Lake did not contain any BMI organisms. Though Falls Lake was not conducive to bottom sampling using an Ekman or Ponar grab type device due to the angular boulder substrate, field staff did collect numerous BMI (*Plecoptera* and *Trichoptera*) in the minnow traps and hoop nets deployed in upper Falls Lake near the inlet falls (Oasis, 2010b). These specimens most likely drifted from upstream sites over the falls and into Falls Lake. This same location also had the highest catch during the September fish trapping likely due to the higher concentration of benthic food resources drifting over the falls.

ADFG determined that BMI sampling was not necessary in Upper Cascade Creek or the adjacent Spring Creek based on the proposed natural lake level operation regime. However, distinct differences in the BMI and algal communities between Upper Cascade Creek and Lower Cascade Creek were observed by field staff. BMI were conspicuously absent (particularly *Ephemeroptera, Plecoptera and Trichoptera*) within Upper Cascade Creek requiring turning over numerous rocks before a single organism could be observed. BMI density in Upper Cascade Creek appeared to be a fraction of that observed in Lower Cascade Creek. The adjacent Spring Creek appears to have a higher BMI density relative to Upper Cascade Creek based on field observations. Nutrients associated with hyporheic upwellings coupled with biological productivity in the wetlands and stable substrate likely contribute to the increase in BMI density. Young-of-year and juvenile rainbow trout likely rely on the BMI and zooplankton food resources in the Spring Creek (Oasis, 2010b).

Overview of Amphibians and Marine Reptiles

Most of Alaska is inhospitable to reptiles and amphibians, although three species of salamanders, one newt, five species of frogs and toads, four species of sea turtles, and one snake species are reported to occur in the state (MacDonald, 2003). In comparison to the rest of the state, Southeast Alaska has a richer diversity of amphibians, including eight of the state's nine species of amphibians (ADFG, 2006).

As part of the Wildlife Resources Study, conducted for the Project, the Applicant conducted an Amphibian Presence/Absence Literature Review in order to provide baseline data on amphibians potentially occurring in the project area. The area of review included Upper Cascade

Creek, Swan Lake, the Lower Cascade Creek Corridor, the proposed powerhouse and tunnel locations, and the proposed transmission line corridor. Based on the results of the amphibian literature review, there are six species of amphibians that may use the project area (Table 3-7). These species include a number of common amphibians such as wood frog (*Rana sylvatica*) and western toad (*Bufo boreas*). On occasion, sea turtles may be observed in southeast Alaska as they travel through to the Gulf Coast, North Pacific or Japan (ADFG, 2010b; Oasis, 2010a).

Amphibians and Aquatic Reptile Species and Habitats

Although phenology of aquatic habitat use by amphibians within the 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 (*Taricha granulosa*) 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 (ADFG, 2006; MacDonald, 2003).

Except for the Columbia spotted frog (*Rana luteiventris*), which is an aquatic obligate, migrations toward breeding grounds begin in early spring. Oviposition occurs from April to July, depending on the species, weather and elevation. Exact timing of breeding for Alaskan amphibians is relatively unknown as compared to other amphibians in the United States; however, it is likely that breeding occurs 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).

As a part of the licensing effort, habitat use, quality and availability project area are described below.

Long-toed Salamander (*Ambystoma macrodactylum*) - The long-toed salamander has a broad range extending from Southeast Alaska southward to Tuolumne County, California and eastward to the Rockies. Occurrences within southeast Alaska include the mouth of the Stikine River at Figure Eight Lake, Mallard Slough, Cheliped Bay, Andrew Slough, Farm Island and Sokolof Island. One specimen was collected in 2003 in the Taku River Valley of the Coast Range, approximately 110 miles north of the Project site (Carstensen et. al., 2003).

In the project area, long-toed salamanders would most likely occur in permanent and temporary ponds with abundant aquatic vegetation associated with Swan Lake, the Pond, Falls Lake, and along the proposed transmission line corridor. Additionally, Spring Creek above the Swan Lake inlet may also provide breeding habitat for the long-toed salamander due to the slow-moving water and abundance of submerged vegetation and woody debris suitable for attaching egg clusters. The long-toed salamander is relatively common throughout its range, but is considered less common in Alaska (MacDonald and Cook, 2007).

Northwestern Salamander (*Ambystomata macrodactylum*) - The northwestern salamander (*Ambystomata macrodactylum*) is found along the Pacific coast from California to Southeast Alaska. The northwestern salamander is considered rare in Alaska and only two specimens have been documented and verified in the state. The specimens were collected in coastal forests at Mary Island southeast of Ketchikan and northwest of Chichagof Island near Pelican approximately 150 miles southeast and 150 miles northwest of the project site, respectively (MacDonald and Cook, 2007).

Although northwestern salamanders are rare in Alaska, this species has the potential to occur in the project area based on its distribution and range. The project area contains a variety of breeding and juvenile habitat potentially suitable to northwestern salamander. Suitable breeding habitat such as muskeg ponds, freshwater lakes, slow moving streams, and still waters occur throughout the project area with abundant vegetation for egg mass attachment. These areas include the Swan Lake inlet, Spring Creek, the pond above Falls Lake, Falls Lake, and some ponds within the vicinity of the proposed transmission line corridor. Upland habitat for post-metamorphosed adults occurs throughout the project area on mainland Alaska and Mitkof Island (Oasis, 2010a).

Roughskin Newt (*Taricha granulose*) - The rough-skinned newt is the most common tailed amphibian in the state of Alaska and has been observed in numerous locations throughout the state from the mainland of Southeast Alaska to as far north as Juneau. There have been approximately five documented occurrences of rough-skinned newts at various locations on Mitkof Island, approximately twenty miles from the project area – the nearest documented occurrences (MacDonald and Cook 2007).

Rough-skinned newts have been observed within the project area, and are expected to occur throughout the proposed transmission line corridor due to the availability of suitable breeding, foraging, and overwintering habitat (Oasis, 2010a).

Western Toad (Bufo boreas) - In Alaska the western toad is considered very common but residents in Southeast Alaska have reported sharp declines in recent years (ADFG 2006). Occurrences have been documented in nearly all areas within Southeast Alaska from the mainland to the east, to remote islands in the westernmost portion of the state (MacDonald and Cook 2007). Numerous occurrences have been documented at various locations on Mitkof Island approximately twenty miles away (MacDonald and Cook 2007). Field study staff observed numerous western toads near the inlet on the eastern edge of Swan Lake and along Cabin Creek near the Forest Service cabin, in August of 2010. Two western toads were also observed in the pond between Swan Lake and Falls Lake during the same period and also along the trail between Falls Lake and Swan Lake. Two separate occurrences of the western toad have been reported in the Thomas Bay area (MacDonald and Cook, 2007).

The project area contains suitable foraging, breeding, and overwintering habitat for western toad. Muskegs and ponds located within the vicinity of the proposed transmission line corridor, Falls Lake, the pond above Falls Lake, Swan Lake, the delta at the Swan Lake inlet, and along Spring Creek may also provide suitable breeding habitat for western toad. Additionally, the upland area located within the proposed powerhouse site may be suitable for foraging adult western toads (Oasis, 2010a).

Wood Frog (Rana sylvatica) - The wood frog is widely distributed throughout Alaska and is the only amphibian found north of the Arctic Circle. In Southeast Alaska this species has been documented on the mainland on the Taku River, Chilkat River, Yakutat area, and at numerous locations along the Stikine River. The Stikine River occurrences are the nearest documented specimens to the Cascade Creek project area, approximately 30 miles to the south (MacDonald 2003).

The project area contains suitable forested habitat for foraging adult wood frog. In addition, suitable breeding habitat occurs within shallow waters in the project area, including Spring Creek, the Pond, muskegs and small ponds near Swan Lake, and along the proposed transmission line corridor on the Agassiz Peninsula (Oasis, 2010a).

Columbia Spotted Frog (Rana luteiventris) - In Alaska the Columbia spotted frog has been documented along numerous mainland rivers in southeast Alaska including the Salmon, Unuk, Stikine and Taku Rivers. Other occurrences include several delta islands near the Stikine River, Pt. Agassiz and on Mitkof Island. MacDonald and Cook (2007) reported that one specimen has been collected in Thomas Bay, within the project area.

The Columbia spotted frog is expected to occur within the project area. The permanent freshwater ponds and muskeg ponds that occur along the proposed transmission line corridor on Point Agassiz Peninsula and Mitkof Island would provide suitable habitat for the Columbia spotted frog. In addition, Lower Cascade Creek, Spring Creek, and Upper Cascade Creek at the inlet would provide suitable habitat for the Columbia spotted frog (Oasis, 2010a).

Table 3-7. List of Reptiles and Amphibians that may use the Project Area for Habitat.

Common Name	Scientific Name	Federal Status [3]	ANHP Status [4]
Marine Reptiles			
Green turtle	*Chelonia mydas*	LT	SNA
Leatherback sea turtle	*Dermochelys coriacea*	LE	S2
Loggerhead	*Caretta caretta*	LT	SA
Pacific Ridley	*Lepidochelys olivacea*		SA
Amphibians			
Columbia Spotted Frog	*Rana luteiventris*		S2
Wood Frog	*Rana sylvatica*		S5
Western Toad	*Bufo boreas*		S3S4
Long-toed Salamander	*Ambystoma macrodactylum*		S3
Northwestern Salamander	*Ambystomata macrodactylum*		S3
Roughskin Newt	*Taricha granulosa*		S4

SOURCE: (Mac Donald, 2003; ANHP, 2007).

[3] Federal Status (US Fish and Wildlife Service (USFWS) and US Marine Fisheries Service (USMFS)): LE, Endangered: A species which is in danger of extinction throughout all or a significant portion of its range; LT, Threatened: A species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

[4] ANHP Status: S2, Imperiled in state; S3, Vulnerable in state 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 state; SA, Accidental; SNA, Accidental Non-breeding status; SR, Reported from the State, but not yet verified.

3.3.3.2 Environmental Effects

Effects of Project Construction and Operation on Fish and Aquatic Resources

The temporary effects of project construction on fish and aquatic resources of project-related waters include potential near shore upland, shoreline littoral and riparian, and aquatic rearing habitat disturbance from the installation of the intake and outlet structure at Swan Lake. In addition, a localized effect to benthic habitat in the immediate vicinity of the intake siphon may result from initial operations that disturb the lake bottom. The installation of the submarine transmission cable in the marine habitat of Thomas Bay and Frederick Sound also has the potential to affect fish habitat and benthic macroinvertebrate organisms.

Temporary effects to water quality from erosion and sedimentation may result from associated ground disturbing construction activities. Long-term effects include localized permanent habitat alteration in the footprint of the outlet structure.

Ground disturbance from submarine transmission cable installation may have a temporary effect on marine habitat and benthic macroinvertebrate communities.

Proposed Action

The proposed action involves construction and ground disturbance in an upland area, immediately adjacent to the Swan Lake shoreline, for the installation of the project intake structure. In addition, an outlet control structure will be placed at the outlet of Swan Lake into Cascade Creek, which will cause temporary ground disturbance and permanently reduce overall flows from Swan Lake into the downstream reach, which feeds Falls Lake before discharging into Thomas Bay. The powerhouse for the proposed Project will be constructed approximately 200 feet set back from the tidewater at Thomas Bay with a naturalized channel and constructed falls which will be designed to deter entry into the tailrace by anadromous fish.

In addition, ground disturbance from the installation of the submarine transmission cable may impact fish habitat and benthic macroinvertebrates. The proposed activities would directly impact existing fish spawning habitat and benthic macroinvertebrates occurring in the proposed submarine transmission cable location in Thomas Bay and Frederick Sound.

Swan Lake

Fish Resources

Bathymetric and topographic analyses indicate that access to upstream spawning areas is not impeded at current lake fluctuation levels. Project operations will be within the natural hydrologic footprint of Cascade Creek and associated water bodies. As a result, Swan Lake level fluctuation will generally remain the same as existing conditions therefore, the proposed action would continue to allow rainbow trout to spawn in Upper Cascade Creek and the adjacent Spring Creek. Previously utilized habitat within Swan Lake for spawning will remain unchanged as will lake water quality parameters such as temperature and DO, see Section 3.3.2, *Water Quantity and Water Quality*.

Field studies conclude that Swan Lake provides limited if any spawning habitat for rainbow trout and limited rearing habitat for young-of-the-year and juveniles due to the lack of cover to avoid predation from adults. Swan Lake does provide suitable habitat for adult rainbow trout. Construction activities have the potential to temporarily disrupt adult feeding activities through equipment operation, drilling, and construction of the project siphon. These activities will occur within a distinct and limited area of Swan Lake, thus avoiding a majority of available rearing habitat. Most of the construction effort on the project siphon is underground which would avoid adult feeding areas. As work progresses contractors will employ BMPs such as the use of sediment curtains and other erosion control measures to limit potential effects to adult trout, as part of the proposed Soil Erosion Control Plan for the Project. The Applicant will remain in ongoing consultation with ADFG regarding construction timing and methodology.

Once constructed, the project facilities will occupy a limited area of lakebed and have no effect on adult habitat. As discussed below, project facilities will be designed to limit entrainment and impingement of resident trout.

To minimize the temporary effects to habitat and water quality from construction activities, the Applicant proposes to develop a Soil Erosion Control Plan and conduct post-construction erosion and sediment control monitoring with remediation for such impacts, as necessary. Water quality for fish and aquatic species will be further protected by the Applicant's proposed post-construction water quality monitoring efforts, which are discussed above in Section 3.3.2, *Water Quantity and Water Quality*. The Applicant will also develop a Hazardous Substances Spill Prevention and Cleanup Program during all pre-and post-construction activities making the likelihood of direct spills into the salt and freshwater environments or surrounding landscape highly unlikely.

Effects of the Proposed Project on Fish Entrainment/Impingement and Fish Mortality

Fish that are entrained into the project intakes and turbines may be killed or injured. Fish that are impinged on the project intake can also be injured or killed. Fish protection devices designed to prevent fish from entering the project intake are routinely used to reduce entrainment and impingement (EPRI, 1994).

The number of fish entrained at a hydroelectric development may be related to a variety of physical factors near the intake structure, such as flow, intake configuration, intake depth, intake approach velocities, trash rack spacing, plant operating mode, and proximity to fish feeding and rearing habitats (EPRI, 1992; FERC, 1995). Biotic factors also affect entrainment, including diurnal and/or seasonal patterns of fish migration and dispersal, fish size and swimming speed, fish behavior, life history requirements, and density-dependent influences (e.g., resource availability) on fish populations in upstream habitats (EPRI, 1992; FERC, 1995; Cada et al., 1997).

In addition, fish mortality depends on fish size relative to the intake structure screening system. Fish screens may reduce or eliminate entrainment, but few studies exist on their benefits and these studies have evaluated effects on anadromous populations only (Gale S.B. et al., 2008).

Proposed Action

The Aquatic Resources Study Report (Oasis, 2010b) documents the lack of thermal stratification observed during the study period. This is likely a result of the flow-through dynamics of Swan Lake, which is fed by glacial streams. Nowak *et al.* (2002) suggest that rainbow trout tend to exhibit a more pronounced diurnal activity pattern and occupy warmer surface waters in the littoral zone more often when a lake is not stratified. The rainbow trout diet tends to consists mainly of benthic organisms. The location of the intake structure is located at a depth of approximately 40 feet, below the littoral zone and at depths where food is scarce to non-existent. The potential for entrainment should be minimal. The Applicant, however, proposes to equip the lake siphon with an intake screen developed in accordance with specifications consistent with ADFG requirements for similar southeast Alaska hydroelectric projects.

No Action Alternative

In the no action alternative, the hydrologic regime of Cascade Creek would remain unchanged. Lower Cascade Creek would continue to be subject to extreme, unregulated flow events. Non-native rainbow trout washed out of Swan Lake would continue to be exposed to extreme and unregulated events. The opportunity for potential accumulation of suitable spawning substrates below Swan Lake would not occur. Aquatic resources do not receive the potential benefits of additional habitat enhancement measures, nor would the interested agencies benefit from information provided through the development and implementation of the Applicant's proposed Fisheries Management Program.

3.3.3.3 Unavoidable Adverse Effects

Significant permanent effects resulting from project construction and operation are not anticipated for aquatic resources. Unavoidable adverse effects of potential entrainment mortality and aquatic habitat alteration are anticipated to be minimal. Although the intake will be located at a depth and be screened such that entrainment and impingement is minimized, some fish may be able to pass through this barrier. Fish that pass through the power conduit would likely have a high mortality rate due to the change in pressure between the entrance of the power conduit and the discharge structure. Any trout that passed through the Project and survived would likely be unable to survive in the marine environment which exists at the discharge of the Project. Aquatic habitats that were present in areas that will be occupied by project structures will likely result in redistribution of species to adjacent, available habitat.

Aquatic Resources

Construction activities associated with the proposed intake at Swan Lake would temporarily displace amphibians that use the proposed construction laydown area, siphon intake, and outlet structure areas for habitat. The proposed equipment laydown area may provide suitable foraging and resting habitat to amphibians at higher lake elevations.

Temporary effects to water quality from erosion and sedimentation may result from associated ground disturbing construction activities. To minimize the temporary effects to amphibian habitat and water quality from construction activities, the Applicant proposes to develop a Soil Erosion Control Plan and conduct post-construction erosion and sediment control monitoring with remediation for such impacts, as necessary. Water quality for amphibian species will be further protected by the Applicant's proposed post-construction water quality monitoring efforts, which are discussed above in Section 3.3.2, *Water Quantity and Water Quality*. The Applicant will also develop a Hazardous Substances Spill Prevention and Cleanup Program during all pre- and post-construction activities making the likelihood of direct spills into the salt and freshwater environments or surrounding landscape highly unlikely.

Long-term effects to amphibian resources include localized permanent habitat alteration in the footprint of the intake siphon and outlet structure. Amphibians that use the terrestrial habitat in the immediate vicinity of the proposed intake siphon would become displaced to suitable habitat available nearby. The proposed intake siphon would be located approximately 40 feet below the surface of Swan Lake, thus avoiding amphibians and egg masses that occupy the shoreline areas in the future, although there would be temporary disturbance installing the siphon pipeline during construction should egg masses or amphibians occur there. Long-term permanent effects associated with the proposed outlet tunnel, include approximately 0.88 acres of forested wetland habitat that may be occupied by amphibians. These individuals would be permanently displaced to suitable habitat available outside of the outlet tunnel footprint.

Since water level fluctuations in Swan Lake will remain within the historic lake-level fluctuation, amphibians that may use Swan Lake and the surrounding shoreline for habitat would not be affected.

Lower Cascade Creek and Falls Lake

As indicated in studies undertaken by the Applicant, due to Lower Cascade Creek's geomorphology and extreme flow regime there is limited to no spawning or rearing habitat for the resident, non-native rainbow trout. The proposed project operations will divert a portion of Swan Lake's discharge, decreasing its overall hydrologic contributions to Upper Cascade Creek and thus reducing the overall hydrologic input to Falls Lake and Lower Cascade Creek. While the proposed project operations may reduce the overall energy of downstream flows, it will not affect the periodicity of extreme high hydraulic inputs below Swan Lake. The proposed outlet structure gate will continue to pass high seasonal or storm event flows. In addition to the flows from creeks and waterfalls in the Lower Cascade Creek drainage areas, some subsurface and accretion flows below the outlet will maintain downstream flow patterns. Decreased discharge in Lower Cascade Creek will help reduce scouring effects characteristic for much of the water year resulting in more pools and reduced velocity habitats more suitable for juvenile fish rearing.

Fish Resources

As previously discussed, Lower Cascade Creek provides limited habitat given its steep cascades, high energy flows, and general morphology. The Lower Cascade Creek habitat consists of vertical shorelines, large boulders, and plunge pools with little to no spawning substrate and very little suitable habitat for trout. This reach is subject to periodic extreme flows related to rain events and seasonal snow/glacial melt. Fish inhabiting this reach are likely individuals who have washed out of Swan Lake and the upstream tributaries.

Project operations within the natural hydrologic regime of Cascade Creek will result in a reduction of extreme flows that currently occur below Swan Lake. This will likely reduce the number of transient fish "washed out" of Swan Lake and provide less extreme conditions in downstream reaches for fish that do move downstream. Additionally, the reduction in flow energy may provide a net benefit by allowing fines and small gravel deposition in locations where current high flows remove all but the largest, least mobile streambed material. Little to no vegetative cover exists in the channel on this section of the stream. As with the deposition of smaller gravel, a change in flow regime may allow for additional near shore re-vegetation. This would provide additional habitat not only for trout but for macroinvertebrates as well. There would be no effect to aquatic vegetation along the rocky outcroppings and cliffs. As such, effects to fish species from project operations are limited. Furthermore, due to the upstream passage barriers, fish located in Lower Cascade Creek do not contribute to sustaining the Swan Lake rainbow trout population.

Observations made during 2010 field study efforts coupled with hydrologic field sampling and analysis, indicate that currently, at low flow conditions (below 135 cfs) at Cascade Creek directly below the Swan Lake outlet ceases to flow above ground. As this reach is currently unavailable to trout periodically, post-construction effects – following the lake and creek's hydrologic regime – pose no additional effects to habitat at this location.

Project operation will result in a lower average lake level at Falls Lake. Fisheries investigations identified a population of trout within Falls Lake. As the lake is isolated by impassable falls upstream and intermittent surface outflow and impassable cascade barriers downstream, this population is likely the result of fish washing downstream from Swan Lake (or human introduced). Habitat assessments identified no appropriate spawning or rearing habitat within the lake or associated with tributaries. As Falls Lake currently undergoes significant fluctuation and will continue to receive inflow from seepage, high flow events passed by the outlet structure, and accretion flows, water quality will remain consistent. Increased cannibalism among adult and juvenile non-native rainbow trout may occur as a result of lowered lake elevations.

The project area is federally reserved for hydropower development and the primary use of project land and waters is reserved for this purpose. Additionally, the existing population of rainbow trout is not a naturally occurring species. The Applicant, however, seeks to maintain this resource in a manner that continues to provide recreational opportunities for anglers. Accordingly, the Applicant proposes to develop a Fisheries Management Plan for project waters in consultation with state and federal agencies. The Plan will identify post licensing study activities to assess project operations effects on resident species. It will identify consultation procedures related to agency review of the project's final design and proposed operations plans. The Plan will also provide a mechanism through which state and federal agencies may supplement their understanding of the system and inform future management activities. It will help to identify necessary PME measures for the protection of resident species and habitats should future studies identify specific impacts to the fishery directly associated with project operation.

The Applicant intends to seek construction permit approval from state and federal regulatory agencies. The Applicant anticipates working collaboratively with these agencies prior to construction to identify any necessary construction timing and mitigation.

Aquatic Resources

It is anticipated that project operations will modify the hydrology of wetlands which are hydrological associated with Falls Lake or Cascade Creek down gradient of Swans Lake. These hydrologic modifications will likely resemble current winter conditions throughout the year, outside of high water events. Long-term permanent effects to localized amphibian habitat include potential wetland habitat disturbance from reduced hydrologic input into Falls Lake and nearby hydrologically connected wetlands from the proposed project operations. A localized effect to shallow wetlands that receive input from Falls Lake and/or Lower Cascade Creek may include water-level fluctuations and dewatering. Water-level fluctuations that dewater amphibian breeding pools may result in desiccation of egg masses and larvae or increased predation rates. In contrast, reduced discharge will decrease velocities and scour leading to increased pool habitat more favorable for amphibian reproduction.

Thomas Bay and Frederick Sound

The Project will also encompass a small area of the intertidal, marine environment. This tidal area would likely experience some short-term effects during the construction phase of the Project; however, long term effects to fish and aquatic species are not expected.

The discharge from the Project will be through a 450 foot long tailrace will enter Lower Cascade Creek 1/4 mile south of the creek's confluence with Thomas Bay. Water discharged from the Project will be similar to the natural creek discharge in volume, temperature, and seasonal output. Potential increase to ice cover, decreases in salinity, and changes to the water column stratification during the winter months on Thomas Bay is not anticipated because the Project will operate within the natural flow regimes of Cascade Creek. As project outflow will be consistent with pre-construction discharges of Lower Cascade Creek, there will be no effect on the oceanographic conditions. Accordingly, there will be no effect to any habitat or breeding grounds used by marine fish or benthic macroinvertebrate species from the proposed discharge.

Construction activities associated with the installation of the proposed buried cable may result in temporary, increased turbidity within Thomas Bay and Frederick Sound. These areas are currently subject to significant sediment inputs from adjacent streams and creeks during periods of high run off and storm events. Due to the high-energy marine environment, it is anticipated that localized construction related turbidity will rapidly disperse and have pose no additional effects to marine species in these areas.

Ocean floor and intertidal area disturbance will incur a minimal footprint to accommodate anchoring, trenching, and burying to secure submarine cables. This will result in temporary dislocation of benthic macroinvertebrates and ground fish during installation. Once installed the cable will settle on and, over time, be incorporated into the marine environment. Mobile species will return to the construction area. Benthic macroinvertebrates will also repopulate on and around the cable footprint.

The Applicant anticipates working with the appropriate agencies during construction planning set appropriate installation windows to avoid disturbing relevant marine fish and benthic macroinvertebrate species during critical life stages.

Transmission Line Corridor, Buried Penstock Alignment and Powerhouse

Amphibians that may use temporary or permanent pools associated with the proposed transmission line corridor, buried penstock alignment, and powerhouse site would be displaced to nearby, available habitat. However, much of the transmission line will be installed within an existing transmission line corridor. As such, the transmission line installation effects to amphibian habitats will be primarily associated with the need for new clearing on the Point Agassiz peninsula. Specifically, the anticipated disturbance to permanent freshwater and muskeg ponds associated with the terrestrial transmission line corridor along Point Agassiz Peninsula and near Petersburg on Mitkof Island will pose temporary impacts to Columbia Spotted frog and western toad habitat.

The Applicant intends to seek construction permit approval from state and federal regulatory agencies. The Applicant anticipates working collaboratively with these agencies prior to construction to identify any necessary construction timing and mitigation. The Applicant will continue to work with agencies to develop a post-construction monitoring and evaluation plan for wildlife, as discussed in Section 3.3.4, *Terrestrial Resources*.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

The EPA identifies 20 distinct Level III Ecoregions in Alaska (EPA, 2007). The project area and most of southeastern Alaska are located within the Coastal Western Hemlock-Sitka Spruce Forest Ecoregion of the Alexander Archipelago, which encompasses approximately 7 percent of Alaska's total land area (USFS, 2008a). Deep, narrow bays and steep valley walls as a result of glaciations characterize this ecoregion's terrain. The region has the mildest winter temperatures in Alaska, accompanied by large amounts of precipitation. Forests of western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*) are widespread (EPA, 2007).

At a finer scale, the lands that comprise and surround the project area belong to the Stikine Province (TNC, 2007). The USFS manages approximately 25 percent of the Province as the Stikine-LeConte Wilderness under the Wilderness Protection Act, 55 percent of which is managed as national forest land, including those lands of the project area and 20 percent is managed for development. While project lands are located within the TNF, the project area is reserved for hydroelectric generation through its Power Site classification and it not within any nationally recognized wilderness areas. The wilderness areas located within the project vicinity are described below in *Section 3.3.6 Recreation*. The physical and biological processes of the Province are largely influenced by the Stikine River corridor that connects Southeast Alaska with the Interior (USFS, 2007).

Botanical and Wetland Resources

Upland Habitats

Upland Hemlock/Spruce Forest

Upland Hemlock/Spruce Forest dominates upland areas within the project area. These stands include Sitka spruce, red cedar (*Thuja plicata*) and yellow cedar (*Cupressus nootkatensis*) (Table 3-6). The stands have abundant standing and down dead wood in all stages of decay, which provide soft wood for cavity excavators and secondary hole-dwellers. Understory shrubs form a patchwork in response to variable light penetration. The dominant shrubs include huckleberries of the genus *Vaccinium*, along with rusty menziesia (*Menziesia ferruginea*). In less shaded areas, species such as salmonberry (*Rubus spectabilis*), devil's club (*Oplopanax horridum*), and red elderberry (*Sambucus racemosa*) persist. Herbs covering the forest floor include bunchberry (*Cornus canadensis*), strawberryleaf raspberry (*Rubus pedatus*), and fern-leaved goldenrod (*Coptis grandifolia*). These evergreen herbs provide important winter forage for deer (ATSI, 2010).

Table 3-5. Common Botanical Species Present within the Project Area.

Common Name	Scientific Name
Arctic starflower	*Trientalis europaea*
Black crowberry	*Empetrum nigrum*
Bog blueberry	*Vaccinium uliginosum*
Bog cranberry	*Vaccinium oxycoccos*
Bog Labrador tea	*Ledum groenlandicum*
Bog laurel	*Kalmia polifolia*
Bog rosemary	*Andromeda polifolia*
Buckbean	*Menyanthes trifoliata*
Bunchberry dogwood	*Cornus canadensis*
Clasping twisted stalk	*Streptopus amplexifolius*
Cloudberry	*Rubus chamaemorus*
Common butterwort	*Pinguicula vulgaris*
Common horsetail	*Equisetum arvense*
Common juniper	*Juniperus communis*
Common lady fern	*Athyrium filix-femina*
Common yarrow	*Achillea millefolium*
Deer cabbage	*Fauria crista-galli*
Deer fern	*Blechnum spicant*
Devil's club	*Oplopanax horridus*
Dunegrass	*Elymus arenarius*
False lily of the valley	*Maianthemum dilatatum*
Fern-leaf goldthread	*Coptis aspleniifolia*
Grass sp.	
Leatherleaf leptarrhena	*Leptarrhena pyrolifolia*
Lyngbye's sedge	*Carex lyngbyei*
Marsh marigold	*Caltha leptosepala*
Marsh violet	*Viola palustris*
Meadow barley	*Hordeum brachyantherum*
Northern mountain cranberry	*Vaccinium vitis-idaea*
Oval-leaf blueberry	*Vaccinium ovalifolium*
Red alder	*Alnus rubra*

Common Name	Scientific Name
Red cedar	*Thuja plicata*
Red elderberry	*Sambucus racemosa*
Roundleaf sundew	*Drosera rotundifolia*
Running clubmoss	*Lycopodium clavatum*
Rusty menziesia	*Menziesia ferruginea*
Salmonberry	*Rubus spectabilis*
Scottish licorice-root	*Ligusticum scoticum*
Seashore plantain	*Plantago macrocarpa*
Shore pine	*Pinus contorta*
Silverweed cinquefoil	*Potentilla anserina*
Sitka sedge	*Carex aquatilis*
Sitka spruce	*Picea sitchensis*
Slender bog orchid	*Platanthera stricta*
Sticky tofieldia	*Tofieldia glutinosa*
Strawberryleaf raspberry	*Rubus pedatus*
Swamp gentian	*Gentiana douglasiana*
Threeleaf foamflower	*Tiarella trifoliata*
Tufted hair grass	*Deschampsia cespitosa*
Western hemlock	*Tsuga heterophylla*
Western oak fern	*Gymnocarpium dryopteris*
Western pearly everlasting	*Anaphalis margaritacea*
Western skunk cabbage	*Lysichiton americanus*
Wild carrot	*Daucus carota*
Yellow cedar	*Cupressus nootkatensis*
Yellow dock	*Rumex occidentalis*
Yellow pond lily	*Nuphar luteum*
	Vaccinium sp.

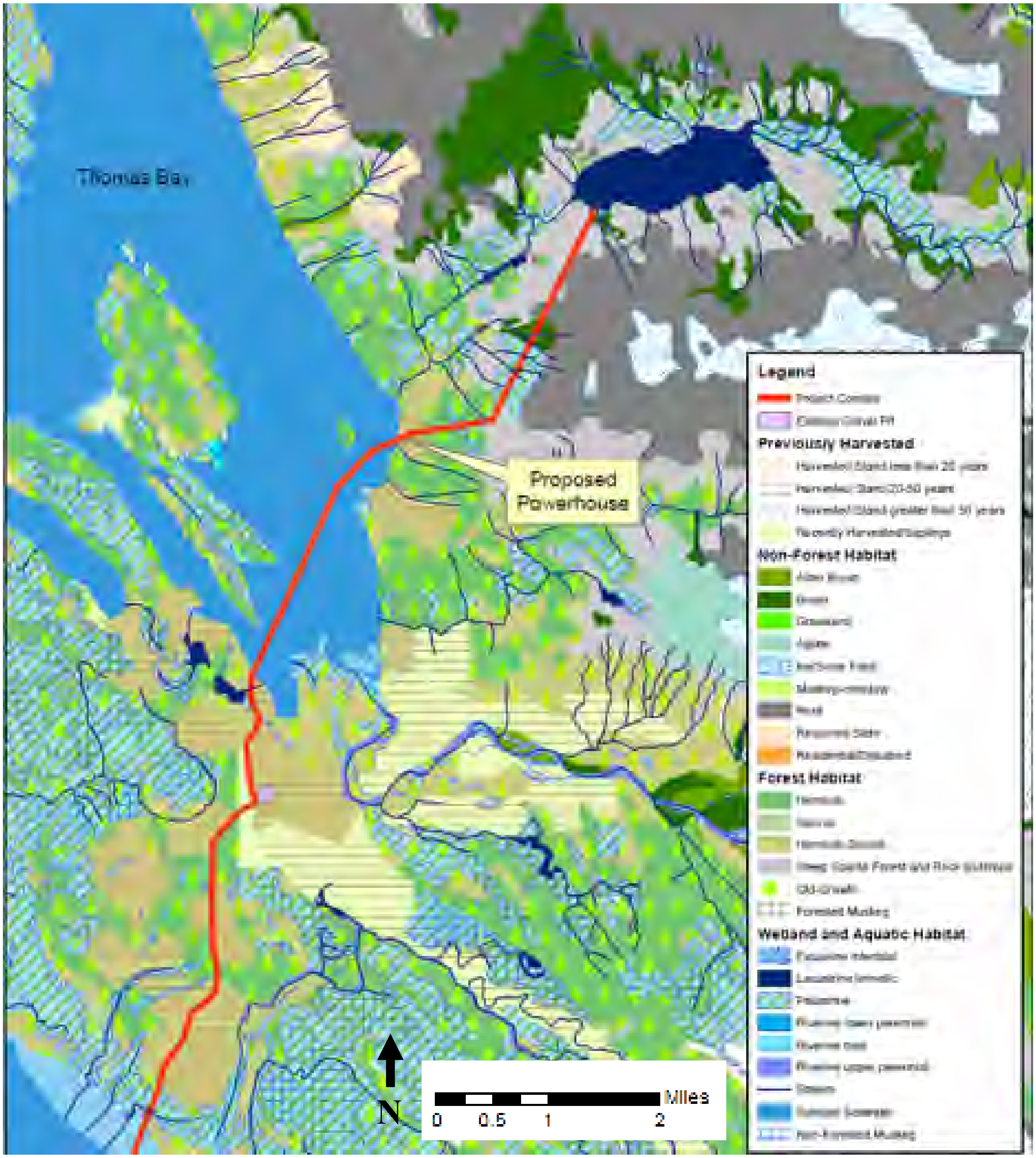
Source: ATSI, 2010

Wetlands, Riparian, and Littoral Habitat

Wetland Habitat

National Wetlands Inventory (NWI) mapping is available for lands within the project area (USFWS, 2010). However, land cover mapping conducted for the Wildlife Resources Study Report (Oasis, 2010a) shows palustrine wetlands which are hydrologically linked to Upper Cascade Creek, Cabin Creek and Spring Creek and other feeder streams to Swan Lake. The land cover map also shows several wetlands associated with Lower Cascade Creek and Falls Lake (Figure 3-27).

Figure 3-27. Habitat Mapping of the Project Area and Immediate Vicinity



Source: Oasis, 2010a

The Applicant undertook a wetland survey in Fall 2010 (August 29 through 31 and September 1 through 4, 2010) to assess direct effects to wetlands from project construction activities (ATSI, 2010). The survey focused on lands within the proposed intake and powerhouse sites and along portions of the existing Thomas Bay and Petersburg transmission lines. The results of this effort are summarized below.

Swan Lake Intake

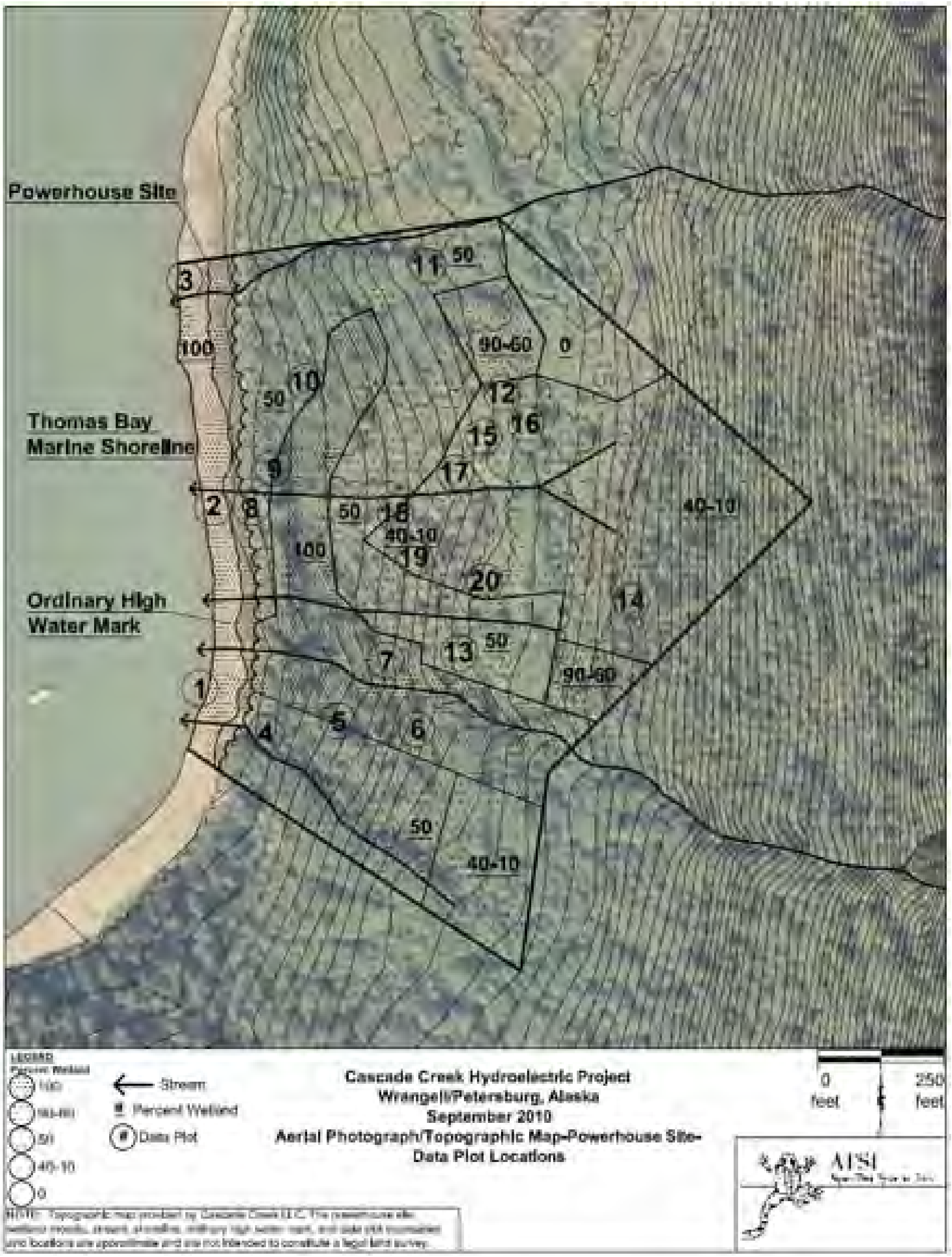
Wetlands were confirmed near the intake site and appear to be primarily influenced by snow water melt streams (Photo 3-5). It is assumed that wetland hydrology is present and wetland dominant plant species typical to the region occur (ATSI, 2010).

Photo 3-5. Aerial Photograph of Meltwater Streams Draining into Swan Lake

Powerhouse

The southeast end of Thomas Bay is primarily marine shoreline although a wetland mosaic occurs further inland near the proposed powerhouse location (Figure 3-28) (ATSI, 2010). The wetland mosaic portion of the site is comprised of several hummocky topographic "benches" that generally slope steeply to moderately to the west. The wetland portions of the proposed powerhouse site are characterized by relict stumps with "springboard" notches, decayed logs and shallow soils (Photo 3-6). Five small streams were observed on this portion of the site. Portions of the streams are located within well defined channels while others are best described as "flow through wetlands" with no defined channel. The marine shoreline portion of the site is a tidally influenced beach comprised of boulders, cobbles, and gravel (ATSI, 2010).

Figure 3-28. Wetlands in the Area of the Proposed Powerhouse



Source: ATSI, 2010

Photo 3-6. Typical Wetland Mosaic near Proposed Powerhouse Site with Herb, Shrub, and Tree Stratum

The vegetation of the wetland mosaic has a tree stratum dominated by red alder (*Alnus rubra*); a sapling/shrub stratum of Sitka spruce, blueberry (*Vaccinium* spp.) and oval-leaf blueberry (*Vaccinium ovalifolium*), and western hemlock (*Tsuga heterophylla*); and an herb stratum of Sitka sedge (*Carex aquatilis*), skunk cabbage (*Lysichiton americanus*), and a grass species. Bare ground and bryophytes are also dominant in the herb stratum. The subdominants in the tree stratum include western hemlock and Sitka spruce; in the sapling/shrub stratum, rusty menziesia (*Menziesia ferruginea*), devil's club (*Oplopanax horridus*), red alder, salmonberry (*Rubus spectabilis*), and red elderberry (*Sambucus racemosa*); and in the herb stratum, fernleaf goldthread (*Coptis aspleniifolia*), lady fern (*Athyrium filix-femina*), bunchberry dogwood (*Cornus canadensis*), common horsetail (*Equisetum arvense*), strawberryleaf raspberry, threeleaf foamflower (*Tiarella trifoliata*), deer fern (*Blechnum spicant*), western oakfern (*Gymnocarpium dryopteris*), clasping twisted stalk (*Streptopus amplexifolius*), marsh violet (*Viola palustris*), false lily of the valley (*Maianthemum dilatatum*), running clubmoss (*Lycopodium clavatum*), and fireleaf leptarrhena (*Leptarrhena pyrolifolia*) (ATSI, 2010).

Thomas Bay Transmission Route

The existing Thomas Bay transmission line corridor is located near the southwest end of Thomas Bay (Photo 3-7). The corridor serves as the proposed location for the Project's transmission line, thus this area was also surveyed for wetlands (ATSI, 2010). Wetlands in the Thomas Bay transmission route accounted for approximately less than 5 percent of the land cover and consisted primarily of ponded remnant river meanders, and emergent and estuarine wetlands (ATSI, 2010).

The vegetative species observed adjacent to the road corridor include Sitka spruce, western hemlock, blueberry, bunchberry dogwood, common horsetail, common yarrow, devil's club, fireleaf leptarrhena, lady fern, lupine sp. (*Lupinus* sp.), red elderberry, red huckleberry, running clubmoss, salmonberry, Sitka alder, and western pearly everlasting (*Anaphalis margaritacea*) (ATSI, 2010).

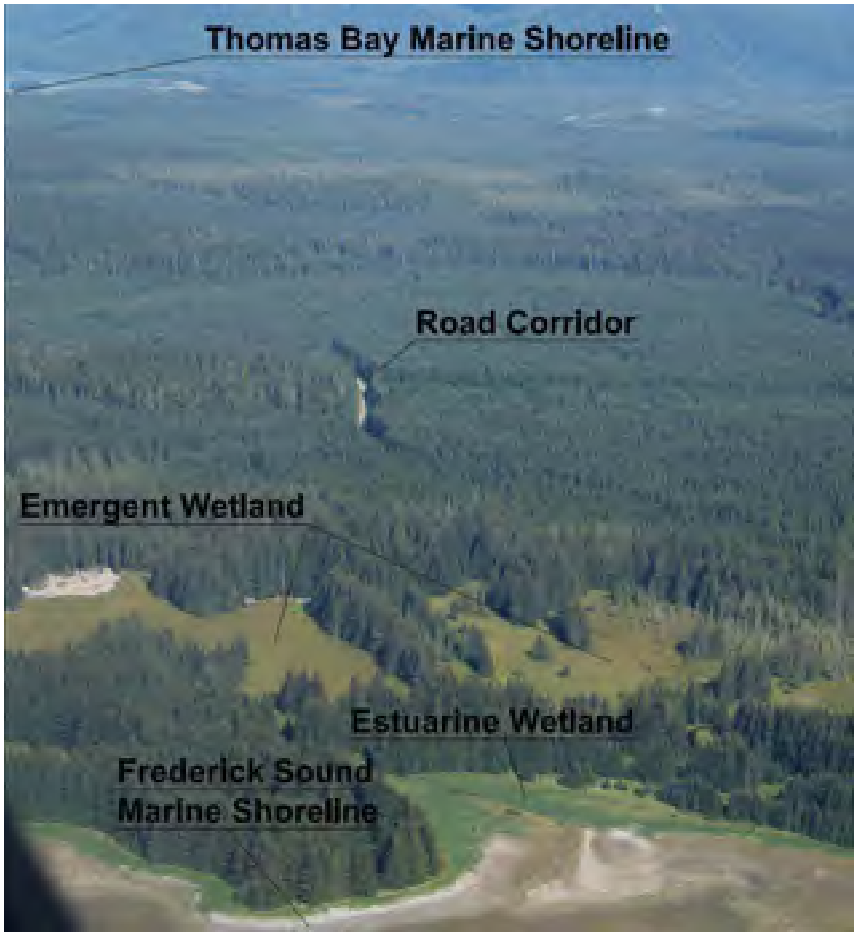


Photo 3-7. Aerial Photograph of the Thomas Bay Road Corridor and Nearby Wetlands.

Petersburg Transmission Route

The Petersburg transmission line corridor is located in Petersburg, Alaska on Mitkof Island. The corridor serves as the proposed location for the second phase of the Project's overland transmission line and was also surveyed for wetlands (ATSI, 2010). Wetlands in the Petersburg transmission route include the Frederick Sound and Wrangell Narrows marine shorelines, forested wetland, and muskeg (ATSI, 2010). Adjacent to the Frederick Sound marine shoreline is a forested wetland adjacent to a muskeg which accounts for the majority of the site.

The species observed and assumed to be present in the muskeg include Arctic starflower (*Trientalis europaea*), black crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), bog Labrador tea (*Ledum groenlandicum*), bog laurel (*Kalmia polifolia*), bog rosemary (*Andromeda polifolia*), buckbean (*Menyanthes trifoliata*), cloudberry (*Rubus chamaemorus*), common butterwort (*Pinguicula vulgaris*), common juniper (*Juniperus communis*), deer cabbage (*Fauria crista-galli*), fernleaf goldthread, northern mountain cranberry (*Vaccinium vitis-idaea*), marsh marigold (*Caltha leptosepala*), marsh violet, roundleaf sundew (*Drosera rotundifolia*), shore pine (*Pinus contorta*), slender bog orchid (*Platanthera stricta*), bog cranberry (*Vaccinium oxycoccos*), sticky tofieldia (*Tofieldia glutinosa*), swamp gentian (*Gentiana douglasiana*), and yellow pond lily (*Nuphar luteum*) (ATSI, 2010).

Riparian Habitat

Cascade Creek in the project area is a high gradient perennial waterbody. There is little to no floodplain development surrounding Cascade Creek, and, as such, riparian habitat is limited.

A number of meltwater and intermittent streams flow into and out of Swan Lake and near the Thomas Bay and Petersburg transmission line corridors.

Littoral Habitat

As discussed in Section 3.3.3, *Fish and Aquatic Resources*, the shoreline surrounding Swan Lake is mostly steep and unvegetated cliff walls and steep shoreline with a general lack of littoral zone. The Swan Lake inlet, at the confluence of Upper Cascade Creek, is the only area of any size where lower-slope areas exist (Oasis, 2010b). Likewise, Falls Lake lacks a developed littoral zone due to the steep granite walls forming the shoreline in much of the perimeter and enormous angular boulders in other portions.

The marine shoreline of Thomas Bay near the proposed powerhouse location is a tidally influenced beach comprised of boulders, cobbles, and gravel (Photo 3-8). The vegetation sampled in the marine shoreline portion of the site has a sapling/shrub stratum dominated by red alder and an herb stratum dominated by tufted hairgrass (*Deschampsia cespitosa*) and Lyngbye's sedge (*Carex lyngbyei*). The subdominants in the herb stratum include silverweed cinquefoil (*Potentilla anserina*), Scottish licorice-root (*Ligusticum scoticum*), dunegrass (*Elymus arenarius*), common yarrow (*Achillea millefolium*), wild carrot (*Daucus carota*), meadow barley (*Hordeum brachyantherum*), false lily of the valley, seashore plantain (*Plantago macrocarpa*), and western dock (*Rumex occidentalis*). Bare ground and bryophytes are subdominants in the herb stratum (ATSI, 2010).

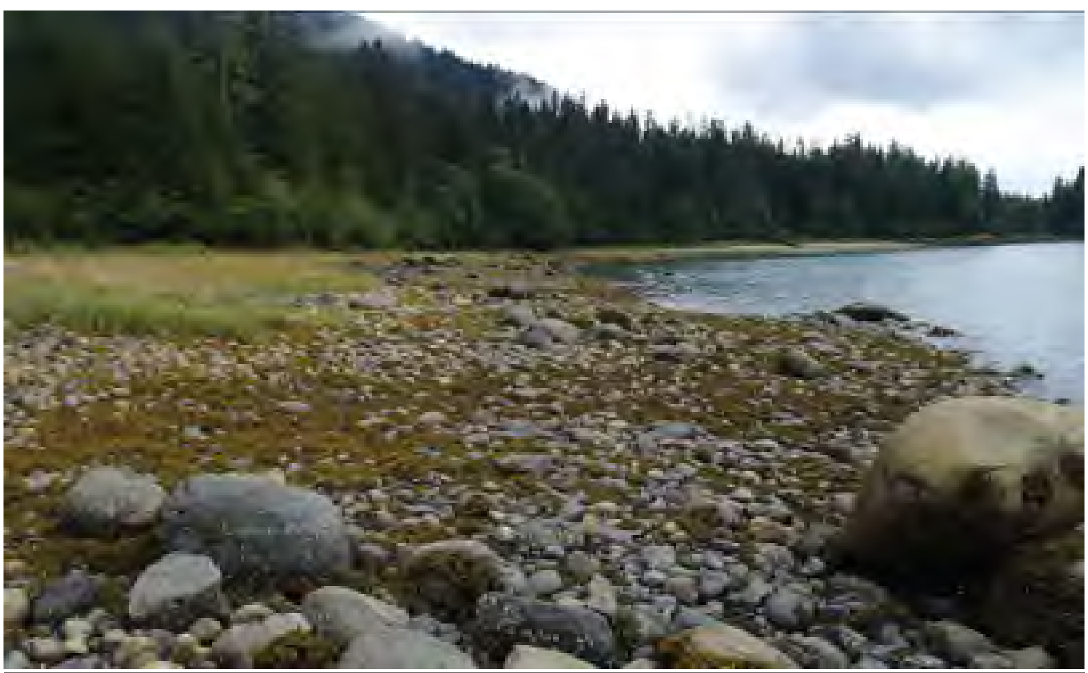


Photo 3-8. Marine Shoreline of Thomas Bay near the Proposed Powerhouse Site.

Exotic and Invasive Plants

The TLRMP defines an invasive species as a "species that is non-native (or alien) to the habitat under consideration and who's purposeful or accidental introduction causes, or is likely to cause, economic or environmental harm or harm to human health. Invasive plant species that are currently being treated (mowing, pesticide, or hand-pulling) at the TNF are listed in Table 3-8. In 2009, a total of 181.2 acres of invasive plant treatments were completed at the TNF (USFS, 2009a). The prevalence of invasive species in the project area is most likely limited to previously disturbed areas, such as existing transmission line corridors. See also Appendix C for Vegetation Resources Overview developed by Oasis in January 2011.

Table 3-8. Invasive Botanical Species Potentially Present within the Project Area.

Common Name	**Scientific Name**
Bohemian knotweed	*Polygonum bohemicum*
Bull thistle	*Cirsium vulgare*
Canada thistle	*Cirsium arvense*
Common brassbuttons	*Cotula coronopifolia L.*
Common Dandelion	*Taraxacum officinale*
Common tansy	*Tanacetum vulgare*
Garlic mustard	*Alliaria petiolata*
Japanese knotweed	*Polygonum cuspidatum*
Orange hawkweed	*Hieracium aurantiacum*
Perennial sowthistle	*Sonchus arvensis*
Ragwort	*Senecio jacobaea*
Reed canarygrass	*Phalaris arundinacea*
Split-lip hemp-nettle	*Galeopsis tetrahit*
Spotted knapweed	*Centaurea stoebe*
St. John's wort	*Hypericum perforatum L.*
White sweet clover	*Melilotus alba*

Source: (Oasis, 2011; USFS 2009a).

Wildlife Resources

Many of the species that have the potential to occur within the project area are seasonally migratory and inhabit different areas in the project vicinity throughout the year. Some avian species, for example, are present during the spring and summer periods during the breeding season, then move on to wintering grounds. Large mammals such as Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), black bear (*Ursus americanus*), and moose (*Alces alces*), also inhabit the project vicinity, utilizing different habitats of the project area throughout the year. Mountain goats (*Oreamnos americanus*), on the other hand, are a highly mobile species, but only occur at higher elevations at the upper reaches of the project area (personal communication, Rich Lowell, ADFG, September, 2010).

Mammals

Several large mammalian species may occur in the project area including brown bear (*Ursus arctos)* and black bear, moose and coyote (*Canis latrans*). Various small mammals may be present as well, and are listed in Table 3-9.

Table 3-9. Common Mammalian Species Potentially Present within the Project Vicinity.

Common Name	**Scientific Name**
American Beaver	*Castor canadensis*
American Black Bear	*Ursus americanus*
American Mink	*Mustela vison*
Arctic Fox	*Alopex lagopus*
Brown Bear	*Ursus arctos*
Canada Lynx	*Lynx canadensis*
Cinereus Shrew	*Sorex cinereus*
Coyote	*Canis latrans*
Gray Wolf	*Canis lupus*

Common Name	**Scientific Name**
Least Weasel	*Mustela nivalis*
Little Brown Bat	*Myotis lucifugus*
Meadow Jumping Mouse	*Zapus hundsonius*
Meadow Vole	*Microtus pennsylvanicus*
Moose	*Alces alces*
Mountain goat	*Oreamnos americanus*
Muskrat	*Ondatra zibethicus*
North American Porcupine	*Erethizon dorsatum*
Northern Bog Lemming	*Synaptomys borealis*
Northern Red-backed Vole	*Clethrionomys rutilus*
Red Fox	*Vulpes vulpes*
Red Squirrel	*Tamiasciurus hudsonicus*
Sitka Black-tailed Deer	*Odocoileus hemionus sitkensis*
Snowshoe Hare	*Lepus americanus*
Wolverine	*Gulo gulo*

Source: USFS 2010a; SMONH 2010; ADFG 2010d

Bear - The brown and black bear are resident species that inhabit forested habitats (soft, hard, and mixed woodlands) that are interspersed with openings, clearings, and wetlands. These species may exhibit seasonal habitat-use depending on food supplies. In general, bears will inhabit lower elevations more often in spring and summer, and higher elevations in the fall according to the seasonal abundance of herbaceous vegetation, insects, various berries and nuts (ADFG, 2010d).

Sitka black-tailed deer - The Sitka black-tailed deer is also a resident species in the area surrounding the Project and is endemic to Alaska (ADFG, 2010). Sitka black-tails use a variety of habitats throughout the year from coastal beaches to alpine areas. During the winter Sitka black-tails tend to favor old-growth forests due to the cover they provide from snowfall. Sitka black-tail generally use habitat at elevations below 800 feet msl during winter months due to deep snow cover at higher elevations which buries food supplies and makes travel difficult. 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 El. 1,500 feet msl. 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 El. 3,000 feet msl that contain abundant herbaceous forage. 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 El. 1,500 feet msl during this time and occupy old-growth, forest openings and muskeg.

The results of a Sitka blacktailed deer winter range assessment, conducted in September 2010, found that productive old growth habitat near the proposed transmission corridor on Point Agassiz Peninsula and the proposed powerhouse location may provide suitable winter habitat for Sitka black-tailed deer (Oasis, 2010a).

Moose - Moose are widely distributed in Alaska and are popular among residents for subsistence and sport hunting (ADFG, 2007). The Project is located in ADFG Game Management Unit (GMU) 1B which is approximately 3,000 square miles, including the Southeast Alaska mainland, and from Cape Fanshaw to Lemesurier Point (ADFG, 2009). Isolated populations of moose occurring in GMU 1B are believed to be the *andersonii* subspecies, which migrated from interior British Columbia through the Coast Range and the Stikine River valley during the 20th century (ADFG, 2009). Moose occur in several areas of GMU 1B, with concentrations near Thomas Bay and along the Stikine River (ADFG, 2004).

Moose populations in Thomas Bay have responded favorably to the initial increase in available browse from the historic logging. Since that time, natural forest succession has occurred and these clear cut areas have transitioned to dense, closed-canopy forests, reducing available understory browse vegetation for moose (ADFG, 2009). The average annual harvest of bulls per decade from Thomas Bay from the 1950s to the 1990s was 5, 8, 10, 18, and 21 respectively. In the late 1970s, the Thomas Bay moose population was estimated at 180 individuals (ADFG, 2009). The 1982 and 1983 moose hunting seasons were closed due to low calf numbers (ADGF, 2009). From 2000 to 2004, the moose harvest at Thomas Bay has declined; averaging 12 moose annually (ADFG, 2009).

In March 1997, ADFG implemented a plan to enhance moose habitat on state land at Thomas Bay. The plan included treating 380 acres of dense second growth stands, primarily by pre-commercial thinning and partial strip clearing (ADFG, 2009). Anecdotal reports from hunters and observations by ADFG staff indicate that moose have recently increased utilization of these thinned areas in response to the browse production increase.

Mountain goat - In Southeast Alaska, mountain goats occur on most mainland ridge complexes. As part of ongoing mountain goat population monitoring and management, ADFG conducted aerial surveys during September 2010 over the project area. The aerial surveys found that mountain goat primarily occurred along the high-elevation ridges outside the project area. Mountain goats primarily use alpine, subalpine, and heavily forested habitats in proximity to steep escape terrain. The greatest number of mountain goat observations occurred approximately 5 miles south of the project area along the Patterson Peaks. No mountain goats were observed in the project area (Richard E. Lowell, ADFG, personal communication on January 3, 2011; ADFG, 2008).

Of the 3,000 square miles in GMU 1B, approximately 850 square miles is forested, some of which serves as important goat winter habitat (ADFG, 2008). The USFS and ADFG estimate that GMU 1B could support approximately 1,219 mountain goats based on the availability of suitable winter habitat; however, more precise population estimates are not available (ADFG, 2008).

Mountain goats exhibit seasonal movements in elevation, which are largely influenced by the availability of food resources. During the spring, mountain goats typically occur in lower elevations, including south-facing rock cliffs, brush and forest habitats (ADFG, 2008). Female mountain goats typically give birth in May and begin to form large nursery bands with other females. In the summer, mountain goats disperse to a variety of habitats with an increase in elevation and greater use of northerly exposures to feed on sedges and forbs (ADFG, 2008). During the winter, mountain goats may descend to low elevation forested areas during heavy snowfalls or occupy windblown or steep slopes with little snow cover (ADFG, 2008).

In GMU IB, the mountain goat hunting season extends from August 1 to December 31. The project area occurs in subunit RG004, north of the North Fork Bradfield River where hunters are limited to the taking of one goat each per year (ADFG, 2008). From 1973 to 2000, the annual harvest of mountain goats in GMU 1B averaged 30 goats (ADFG, 2008). Since 2006, the harvest has remained relatively stable, averaging 23 goats per year. Historically, residents of Petersburg and Wrangell represented the largest group of mountain goat hunters, harvesting the majority of mountain goats taken in the subunit (ADFG, 2008). However, in 2001, 2002, and 2004 the harvest of mountain goats by non-residents exceeded that of local residents.

Since 1985, Le Conte Bay, Stikine River, and Thomas Bay have received the greatest percentage rates of mountain goat harvests in GMU 1B (ADFG, 2008). Generally, mountain goats occur in remote, rugged terrain throughout GMU 1B making it difficult for hunters to access. However, mountain goats occurring near Le Conte Bay, Stikine River, and Thomas Bay are more easily accessed by hunters due to the proximity of high elevation lakes. Hunters access mountain goat habitat by hiking up from saltwater, river drainages, logging roads, or by using floatplanes to fly into subalpine and alpine lakes in the subunit (ADFG, 2008).

Activities that alter forested habitat, resulting in large clear cuts, can make mountain goats vulnerable to exploitation by increased human access or impact mountain goat winter habitat (ADFG, 2008).

Swan Lake and Cascade Creek are surrounded by high cliffs and ridges including the Cosmos Range to the south and Foote Peak, Fighting John Peak, Porter Peak, and Waterfall Peak to the north. The topography of these peaks ranges from el. 3,343 feet to 5,030 feet (Figure 3-29). ADFG routinely monitors these areas, documenting mountain goat presence and movement and to establish hunting limits in the area.

Figure 3-29. Topography of mainland Alaska near the project area.

(Source: MSR, 2011)

As part of ongoing mountain goat population monitoring and management, ADFG conducted aerial surveys during September 2010 over the project area. The aerial surveys found that mountain goat primarily occurred along the high-elevation ridges outside the project area (Figure 3-30). The greatest number of mountain goat observations occurred approximately 5 miles south of the project area along the Patterson Peaks. No mountain goats were observed in the project area.

Figure 3-30. September 2010 Mountain goat survey

(Source: ADFG, January 3, 2011.)

Wolverine – Wolverine (*Gulo gulo*) are a wide-ranging species occurring throughout mainland Alaska and on some islands of Southeast Alaska (ADFG, 2011). Wolverines naturally occur at low densities throughout their range based on home range requirements which are influenced by the availability of denning sites and food supply (ADFG, 2011). The species prefers large wilderness areas, including arctic tundra, boreal, and primarily coniferous mountain forests (NatureServe, 2011). Studies suggest that wolverines may exhibit seasonal migrations from higher elevations in the summer to lower elevations in the winter (Hornocker and Hash, 1981; Whitman et al., 1986). In general wolverines are opportunistic feeders and will travel great distances in short periods of time to take advantage of food items such as carrion (ADFG, 2011).

In Alaska, the home ranges of male wolverines average approximately 200 to 260 square miles. The home ranges of resident female wolverines can be up to 115 square miles (ADFG, 2011). It is unclear what females use for den sites in Southeast Alaska, although they have been known to use hollow logs, dense vegetation, tree roots or rocky areas in other parts of their range (NatureServe, 2011).

In 2008, the Wolverine Foundation, Inc. conducted a study to determine the associations and movement patterns of reproductive female wolverines on the Southeast Alaska mainland (Magoun et al., 2008). The Applicant provided support for this study through transportation funding. The goal of the research was to “provide wildlife managers with the information needed to ensure that wolverine populations are managed sustainably and the functional habitat for reproductive female wolverines is maintained in the face of increasing human development and access to remote areas in Southeast Alaska” (Magoun et al., 2008).

The study area comprised approximately 2,140 square kilometers of Tongass National Forest on the mainland of Southeast Alaska, including the project area (Magoun et al., 2008). The researchers documented 21 wolverines in the study area, estimating the density of wolverines in the study area at about 9.7/1,000 square kilometers (Magoun et al., 2008). Of the 21 wolverines documented in the study area, at least seven of the reproductive female wolverines are expected to be residents (Magoun et al., 2008).

A single natal den site was documented during the study, which occurred in a stand of trees upstream of Scenery Lake at an elevation of approximately 350 meters (Magoun et al., 2008). Scenery Lake is approximately 9 miles northeast of the project area, and is separated by a ridgeline of five peaks ranging in elevation from 3,343 to 5,040 feet.

The estimated home ranges of two wolverines extended into the project area, however there were no wolverines that were documented in the project area exclusively (Magoun et al., 2008). In addition, the concentration of Very High Frequency (VHF) positions for these individuals was predominantly on the southern shoreline of Point Agassiz approximately 14 miles southwest of the project area.

Small Mammals

Southeast Alaska is home to a large number of small mammal species that fall into three categories of taxa including: shrews (*Insectivora*), rodents (*Rodentia*) and pikas, and hares (*Lagomorpha*). 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. During previous trapping efforts within the project area, Oasis biologists documented northern red-backed vole *(Myodes rutilus*), deer mouse (*Peromyscus keeni*), cinereus shrew *(Sorex cinereus*), and red squirrel *(Tamiasciurus hudsonicus*) (Oasis, 2010a; Macdonald and Cook, 2007).

The project area contains suitable habitat to support a variety of small mammals and furbearers (Table 3-9). These species include but are not limited to red squirrel, American beaver *(Castor canadensis*), meadow jumping mouse *(Zapus hudsonius)*, meadow vole *(Microtus pennsylvanicus)*, northern red-backed vole, common muskrat *(Ondatra zibethicus)*, cinereus shrew, and the American mink *(Neovision vision)* (MacDonald and Cook, 2007).

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 (Manley 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, 2008a).

Birds

Bird species potentially occurring in the project area reflect those typical of Southeast Alaska. The project area includes a variety of habitats including a diversity of forested uplands, freshwater wetlands, mountainous areas, and marine estuaries (Oasis, 2010a). The close proximity of all of these various habitat types lends to a diverse set of avian species that may potentially occupy the project area at various times of the year. The avian species that may use the project area for habitat include a variety of freshwater and saltwater ducks, grouse, loons, grebes, seabirds, herons, gulls, and woodland warblers.

The avian species that potentially occur within the project area may only occupy the project area during the breeding season or winter, while other species may reside year round (resident). For instance, Canada geese (*Branta canadensis*), mallard (*Anas platyrhynchos*), and black capped chickadee (*Parus atricapillus*) are considered residents in Southeast Alaska and could occupy project lands year-round.Songbirds occurring throughout the project area are diverse and may include resident birds throughout the year, birds in migratory transition, birds using the corridor as breeding and nesting grounds, and/or overwintering birds. Songbird species that may be found using the project area during the summer months or breeding season to nest and raise their young include the yellow-rumped warbler (*Dendroica coronata*), winter wren (*Troglodytes troglodytes*), and common yellowthroat (*Geothlypis trichas*), among others. Belted kingfisher (*Megaceryle alcyon*), common loon (*Gavia immer*), and common merganser (*Mergus merganser*) would most likely occur in the aquatic environments based on their habitat preferences. As with the forested environments, a diverse array of smaller songbird and other passerine species would also be expected to occur in shoreline, marine and wetland habitats (Oasis, 2010a).

Habitat requirements vary by species. Songbirds in the project area forage on numerous food resources depending upon the species, including insects, aquatic and land invertebrates, seeds, and plant material among others. For songbirds that breed and nest in the project area, nests may either be located in trees, tree/snag cavities, shrubs, on the ground, within cliffs, or within manmade structures such as bridges, culverts, or buildings.

Special Status Wildlife Habitats

The state lands in the project vicinity are owned and managed by the Alaska Mental Health Trust Authority (AMHTA) Land Office. The Trust Land Office (TLO) is a small unit in the ADNR that manages approximately one million acres of land in Alaska on behalf of the beneficiaries of the AMHTA (TLO 2010). In the project vicinity, outside of the project area, the TLO has identified approximately 4,446 acres in Thomas Bay for its wildlife, community use, and commercial harvest use values (ADNR, 2000). The ADNR maintains that Thomas Bay supports a concentration of marbled murrelets (*Brachyramphus marmoratus*), foraging habitat for osprey (*Pandion haliaetus*), and provides local communities with the commercial harvest of king salmon (*Oncorhynchus tshawytscha*), waterfowl, pot and trawl shrimp, Dungeness (*Cancer magister*), red king (*Paralithodes camtschaticus*) and tanner crab (*Chionoecetes bairdi*), and halibut (*Hippoglossus Stenolepsis*).

3.3.4.2 Environmental Effects

Effects of Project Construction and Operation on Terrestrial Resources

Project construction can result in short term effects to wetland and wildlife habitats resulting from ground disturbing activities in construction laydown areas. Construction activities can also result in temporary increases in noise and human presence, which can have an effect on wildlife and migratory patterns. Project construction and the presence of project structures will potentially result in long-term effects of habitat loss and alteration in the footprint of the Swan Lake intake and outlet structure; portions of the power conduit; the powerhouse, switchyard access roads, and appurtenant facilities. Construction benefits to terrestrial resources include providing canopy openings for birds, and a limited amount of clearing along transmission routes providing low shrub browse for ungulates.

Proposed Action

The proposed action involves construction and ground disturbance in an upland area, immediately adjacent to the Swan Lake shoreline, for the installation of the project intake structure. The powerhouse and support facilities will cover approximately 22 acres and will be constructed at least 200 feet set back from the shoreline at Thomas Bay. There will be approximately 15.66 acres of wetland and 14.7 acres of upland that will be altered for the installation of the project facilities, including the powerhouse, buried penstock, and transmission line within the project area.

Swan Lake Intake and Outlet

The proposed intake includes a 58-foot-long by 49-foot-wide and 25-foot-high concrete intake control structure and equipment lay down area measuring approximately 9,750 square feet. The construction activities and proposed facilities at the intake site are expected to affect approximately 1.20 acres of upland habitat and 0.88 acres of wetland habitat. The upland habitat located near the proposed lay down area and siphon intake is primarily steep, sparsely forested, with some rock outcrop areas and brush. As the topography becomes less dramatic and the power conduit nears the surface adjacent to the proposed powerhouse, a mixture of palustrine wetland, old growth, and recently harvested hemlock (20-50 years) occurs.

Power Conduit

A 12-foot-diameter proposed tunnel complex will begin at the intake control structure and extend approximately 3 miles southeast to connect with the proposed powerhouse. Permanent effects related to tunnel construction will include blasting and removal of bedrock; however, the majority of this work will occur underground. As such, there will be no effect to wetlands and wildlife habitats with the exception of re-purposing the rock spoil material for burying the penstock, as discussed below.

Powerhouse and Support Facilities

The proposed powerhouse site is approximately 22 acres, including the powerhouse, a tunnel access route, housing structures, and tailrace. There are two streams that occur along the northern and southern portions of the powerhouse site. In addition to these two streams with well-defined channels, there are three other small streams without defined channels. A wetland mosaic of both wetland and upland areas occur within the powerhouse footprint (Figure 3-27). The northeastern portion of the site contains the greatest concentration of wetland and the southwestern portion transitions to a more upland dominated area with less than five percent wetland. Overall, the Applicant anticipates that the proposed powerhouse and tailrace will permanently affect approximately 5.63 acres of wetland.

The marine shoreline of Thomas Bay is adjacent to the proposed powerhouse site. The Applicant is proposing to install a marine access facility on Thomas Bay, adjacent to the powerhouse site. The new dock would be approximately 12 feet wide by 290 feet long on a fixed pier with an approximately 8 foot by 60 foot ramp down to a 60-foot by 30-foot float stationed to pilings. In addition a barge landing ramp (30 feet by 228 feet) will be constructed to access the powerhouse and lower tunnel portal. The installation of the barge landing ramp and fixed pier will affect approximately 0.29 acres of Estuarine Subtidal Unconsolidated Bottom

(E1UBL) wetland. Permanent impacts to the wetland are from the barge landing ramp (0.16 acres) and a small area immediately surrounding and including the footings for the pilings used to secure the pier and dock. Additional impacts include shading and other non-fill related impacts, from the presence of the pier (0.08 acres), floating dock (0.04 acres), and dock ramp (0.01 acres).

Behavioral Disturbance during Project Construction and Operation

The limited project footprint and associated construction and operation may result in effects to wildlife behavior for those species that may use the upland and riparian habitats in the project area; however, such effects will likely be of low intensity. The Applicant will work with agencies to plan this construction around a time that will result in minimal effects to these habitats. The region provides abundant similar habitat within immediate proximity to the Project. Disturbance to the behavioral patterns of terrestrial species that occur in the project area may occur temporarily during project construction and operation. Potential activities that may be a source of disturbance to terrestrial species that use the project area for habitat include construction vehicles, helicopters, and humans on foot.

Disturbance effects would be of concern mainly for terrestrial species that are sensitive to disturbance such as mountain goats, moose, and birds. There is a potential for temporary disturbances to marine mammals, in particular seal and sea lion haulouts, as the result of the installation of the submerged cable during construction; however, the Applicant is proposing a 200-foot buffer zone between generation facilities and the shoreline. Additionally, the Applicant proposes re-vegetation/naturalization of shoreline areas used for access, staging, and the proposed tailrace post-construction. Permanent, water dependent structures include the proposed dock and ramp are ubiquitous to the region and are documented to be sites that these species favor for haulouts.

In order to evaluate the potential disturbance impact to mountain goats and moose in the project area created by increased human activity and noise, the Applicant is proposing to support ADFG in its efforts to undertake two separate studies for these species. This would include habitat use surveys and population monitoring. The Applicant proposes to undertake a suite of avian studies as discussed in Section 3.3.5.2. The Applicant also anticipates that further coordination with state and federal permitting agencies prior to construction, as well as application for a USFS Special Use permit will result in timing construction requirements to avoid temporary disturbance of species.

Habitat Loss or Fragmentation

Habitat loss for terrestrial species occurring in the project area will occur during the construction period and may be either permanent or temporary dependent on the proposed activity. This habitat loss has the potential to affect amphibians, small mammals, and larger mammals that may move through the project area; however, a majority of the habitat that would be affected by the Project is abundant in the project vicinity and the wildlife species would likely use other available habitat. Localized effects to wetlands and wildlife habitats from the construction of project facilities are discussed below.

Effects of Transmission Line Corridor on Terrestrial Resources

Transmission line corridor effects to wildlife are associated with the disturbance to wetlands and wildlife habitats in areas where new clearing and tower installation is required. The new transmission line has the potential to increase raptor and passerine electrocutions and collisions.

<u>Proposed Action</u>

The proposed transmission line will be installed as a series of overland and undersea cables that cross Thomas Bay, the Point Agassiz peninsula, Frederick Sound and Petersburg. The majority of the transmission line installation will utilize existing transmission line and road corridors. The Applicant is proposing to prepare an avian protection plan that would provide site-specific practices to reduce the potential for adverse effects to raptors in accordance with the following raptor protection guidelines: Avian Protection Plan Guidelines: A Joint Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service, and APLIC's Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 and Mitigating Bird Collisions with Power Lines: The State of the Art in 1994, or the most current editions of these documents. Effects of the installation of transmission lines in new corridors are discussed in greater detail below, as is the effect on raptors of new transmission facilities.

Transmission Line Installation

Generally, the proposed transmission line corridors will follow existing roads, minimizing disturbance to wildlife and existing habitat. The northern portion of the proposed overhead transmission line would largely follow existing roads (approximately 6.17 acres of upland) on Point Agassiz and create a new corridor (approximately 9.24 acres of mixed habitat) near the southern portion of Point Agassiz (Photo 3-9).

The habitat located along the northern portions of the existing and proposed corridors is dominated by recently harvested (20-50 years) hemlock. Along the southwestern shoreline of Point Agassiz, there are approximately 1.23 acres of palustrine and emergent wetland and 0.92 acres of estuarine intertidal wetland located within the proposed corridor.

The proposed overhead transmission line corridor near Petersburg would be located adjacent to existing residential and disturbed areas, including the Petersburg airport. The proposed transmission line would create a new corridor traversing approximately 6.78 acres of wetland habitat. The wetlands located within this portion of the proposed corridor include a mixture of freshwater emergent and forested scrub-shrub.

Much of the transmission line will be installed within an existing transmission line corridor. The USFWS also originally identified a variety of songbirds, and owls, which are dependent on old growth forest. In response to the Applicant's proposal to use existing transmission corridors within secondary forests, the USFWS indicated that the Project was unlikely to affect these species and removed them from consideration (personal communication, Richard Enriquez, USFWS, September 8, 2010).

As such, the transmission line installation effects to wildlife habitats will be primarily associated with the need for new clearing on the Point Agassiz peninsula. The transmission line corridor would be maintained as an herbaceous and scrub/shrub habitat, which would create browse habitat for moose. As an active right of way, the corridor provides limited habitat that is routinely used for other purposes. Species that prefer more forested areas such as Canada lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), and Sitka black-tailed deer may temporarily avoid lands associated with the clearing activities for the proposed transmission line corridor and seek adjacent forested areas.

Overall, the most significant effect to terrestrial species would be the increase in edge habitat. The increase in edge habitat would benefit some common species that would utilize the corridor for travel such as coyote (*Canis latrans*), and red fox (*Vulpes vulpes*), although at the expense of edge-sensitive species.

The Applicant will, where possible, avoid or minimize effects to wetlands during transmission line construction. Additionally, as part of the USACOE 401/404 permitting process, the Applicant anticipates mitigation requirements for unavoidable effects. Pending final design, the Applicant will perform a site specific wetland survey to determine the exact amount of wetland that would be impacted.

Increased Mortality due to Collision

The proposed Project poses some risk of avian collisions with project facilities, primarily the proposed transmission lines. The Applicant is proposing to use underwater cables where feasible, minimizing the risk of avian collision. Additionally, the Applicant is committed to working closely with the state and federal agencies to develop and implement studies providing appropriate and relevant information related to potential transmission line effects.

As an initial design consideration, the Applicant is proposing 60-inch separation between energized conductors or energized hardware and grounded conductors/hardware, as well as, appropriate covers will be used to prevent simultaneous contact between energized and/or grounded facilities. Nest platforms will be installed to encourage raptor nesting in areas containing suitable habitat. Nest platforms will be species specific and designed to ensure raptor safety and to prevent outages.

The Applicant will prepare an avian protection plan, after consultation with the USFWS, USFS, and ADF&G, that would provide site-specific practices to reduce the potential for adverse effects to raptors in accordance with the following raptor protection guidelines: Avian

Protection Plan Guidelines: A Joint Power Line Interaction Committee (APLIC) and U.S. Fish and Wildlife Service, and APLIC's Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 and Mitigating Bird Collisions with Power Lines: The State of the Art in 1994, or the most current editions of these documents. As necessary, the Applicant will develop additional appropriate mitigation and monitoring programs in consultation with state and federal agencies.

Spread of Noxious Plants during Project Construction and Operation

The Applicant has identified a number of noxious plant species with potential to occur in the project area (Table 3-8). The Applicant will augment this list with qualitative field observations associated with other field activities. Should noxious weeds be identified, the Applicant will work with the USFS to develop a noxious weed management program to address potential construction related effects that may result in distribution or exacerbation of noxious weeds as a post-licensing compliance measure.

No Action Alternative

Under the non-action alternative, terrestrial resources within the project area would remain as they currently exist. No further Applicant funded resource assessments would occur, nor would any proposed or potential mitigation efforts be realized. Accordingly, management agencies would not benefit from additional data and understanding of existing resources or Applicant support of additional habitat enhancement.

3.3.4.3 Unavoidable Adverse Effects

There will be approximately 15.66 acres of wetland and 14.7 acres of upland that will be altered for the installation of the project facilities, including the powerhouse, penstock, and transmission line within the project area. Approximately 6.17 acres of the total upland and wetland habitat that will be altered, occurs within existing road corridors. There will be some temporary effect to existing wetlands and vegetation in these areas for construction access, although it is anticipated these areas would return to existing conditions over time. The Applicant anticipates undertaking mitigation to counter these effects through creation or protection of similar resources within the watershed.

3.3.5 Rare, Threatened, and Endangered (RTE) Species

3.3.5.1 Affected Environment

Federally Listed Wildlife Species

Terrestrial TE Species

On November 17, 2010, the USFWS responded to a request for information on potential impacts to terrestrial federally threatened, endangered and candidate species in the project area (Appendix E). The USFWS response indicated that there are no federally TEspecies within the jurisdiction of the USFWS in Southeast Alaska (personal communication, Richard Enriquez, USFWS, November 17, 2010). The USFWS had previously identified two candidate species for ESA listing: the Kittlitz's murrelet (*Brachyramphus brevirostris*) and the yellow billed loon (*Gavia adamsii*), that may use habitat in the project vicinity (personal communication, Bill Hansen, USFWS, July 17, 2009).

The November 17, 2010 communication with the USFWS confirmed that the proposed Project is outside of the known nesting range of the Kittlitz's murrelet. The USFWS does not expect project effects to these referenced species (personal communication, Richard Enriquez, USFWS, November 17, 2010) and did not request studies for them.

Aquatic Threatened and Endangered Species

NMFS has federal statutory responsibility for the protection of marine life, including anadromous fish resources that occur in US waters. By letter dated December 6, 2010, NMFS identified two federally listed marine mammals, one federally listed marine herptile, and ten federally listed Evolutionarily Significant Units (ESU) of anadromous fish that may use Thomas Bay and Frederick Sound for habitat. Specifically, five ESU of Chinook salmon and five ESU of steelhead salmon that may occur within Alaska waters on a constant or seasonal basis. The species with the potential to occur within the area are discussed further below.

Steller Sea Lions - Steller sea lions (*Eumetopias jubatus*) are the largest of the otarids and the fourth largest of the pinnipeds. The average lifespan of this species is approximately 20 years, although females may live significantly longer (Alaska Sea Otter and Steller Sea Lion Commission, 2010). Steller sea lions were listed as threatened species under the ESA in 1990. Populations are separated into two populations divided by the 144°W longitude. Stocks are differentiated by DNA strain and population trends. Mating and birthing takes place at more than 40 rookeries from May to July and over 200 haul-out sites have been identified. Haul-out sites are used for resting and no mating takes place here. Ruth rock and Horn Cliffs are local haul-outs for Steller sea lions in Frederick Sound, although, NOAA fisheries did not list this location as a major haul-out for the purposes of designating critical habitat (NOAA, 2010). Horn Cliffs is located approximately 3.3 miles southeast of the subsea cable transmission line crossing in Frederick Sound. Frederick Sound, including the project area of Frederick Sound, has been formally surveyed by ADFG and NOAA discontinuously since 1971, of which Horn Cliffs has been surveyed seven times since 1991. In 1991 the survey effort yielded one sea lion. In 1993, the survey yielded 64 sea lions. Since then surveys have detected no sea lions. However, these surveys may not be entirely representative of this haul-out use since often the survey may have consisted of only one pass that year, and sea lions may have been missed (Fritz, personal communication, 2011). Also, climatic changes such as El Nino and La Nina affect patterns of use based on prey species dynamics (Stenseth et al., 2002). Since late 2010, NOAA has been conducting radio telemetry studies on two adult sea lions in the project vicinity. Preliminary data exhibits use of the Horn Cliff haul-out and presumed foraging activity throughout the project area in Frederick Sound (Fritz 2011, Personal Communication). Critical habitat does not occur in the project area.

Humpback Whale - In June 1970, humpback whales (*Megaptera novaengliae*) were designated as endangered under the Endangered Species Conservation Act (ESCA). In 1973, the ESA replaced the ESCA, and continued to list humpbacks as endangered. In 1972, humpbacks were provided additional protection under the Marine Mammal Protection Act, and were considered "depleted" in 1973. Humpback whales live in all major oceans from the equator to the sub-polar latitudes (NOAA, 2010). North Pacific humpbacks are broken down into three specific populations. The one occurring in the Southeast Alaska region is the Central North Pacific stock.

Leatherback Turtle - Leatherbacks are commonly known as pelagic animals, but also forage in coastal waters. The leatherback is the largest, deepest diving, and most migratory and wide ranging of all sea turtles. The adult leatherback can reach 4 to 8 feet in length and 500 to 2000 pounds in weight. Leatherbacks mate in the waters adjacent to nesting beaches and along migratory corridors, which include the waters of the northern Pacific Ocean. Female leatherbacks typically nest at 8-12 day intervals, several times during a nesting season and lay clutches of eggs on sandy, tropical beaches (NOAA, 2010). The December 6, 2010 letter from the NMFS indicates that the leatherback turtle is uncommon but recorded in the Gulf of Alaska.

Forest Service Sensitive Species

Sensitive species are defined as plant or animal species that are susceptible or vulnerable to habitat alterations or management activities resulting in a viability concern for the species long-term persistence. Sensitive species may be those species under consideration for official listing as endangered or threatened species, are on an official state list, or are recognized by the Regional Forester as needing special consideration to ensure viable populations and to prevent their being listed for federal or state protection (USFS 2008a). Queen Charlotte northern goshawk (*Accipiter gentilis laingi*) and Kittlitz's murrelet (*Brachyramphus brevirostris*) have been identified by the USFS as sensitive species potentially inhabiting the project vicinity.

State Listed Wildlife Species

The ADFG[5] only identifies species of special concern (above) and beyond those species that are already federally listed as endangered or threatened. In addition to USFS sensitive species above, the state-listed species specifically identified as potentially using the project area for habitat include the olive-sided flycatcher (*Contopus cooperi*), American peregrine falcon (*Falco peregrines anatum*), harbor seal (*Phoca vitulina*), and the sea otter (*Enhydra lutris*) (ADFG, 2010e).

[5] Article 3, Title 16, Chapter 20, Section 170

Queen Charlotte Northern Goshawk

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 preferring mature and old-growth stands with an open understory for foraging and nesting. The USFWS proposes the British Columbia distinct population segment of this subspecies for threatened status. The state rates the species as a Species of Special Concern (SOSC). The USFS identifies the species as a Sensitive Species. The Queen Charlotte northern goshawk potentially uses the Thomas Bay area on a year-round basis (ADFG, 2010f). During the spring 2010 field season, one of the three recommended sets of northern goshawk broadcast surveys was conducted in the project area. The surveys resulted in no detections in the project area (Oasis, 2010).

Kittlitz's Murrelet

Kittlitz's murrelet is a small diving bird that feeds on fish, invertebrates, and microplankton. Within Southeast Alaska the species is uncommon but is known to be present throughout the entire year. Kittlitz's murrelet typically nest just above the treeline near glaciers, usually a short distance below peaks on coastal cliffs, barren ground, rock ledges, and talus slopes (Day et al. 1983). The proposed Project is outside of the known nesting range of the Kittlitz's murrelet. The USFWS does not expect project effects to these referenced species (personal communication, Richard Enriquez, USFWS, November 17, 2010).

ANHP characterizes the waters of Frederick Sound and Thomas Bay as potential foraging habitat, and Swan Lake and surrounding areas as potential nesting habitat (ANHP, 2011).

Olive-sided Flycatcher

The olive-sided flycatcher is considered a SOSC by the state. In Alaska, this species breeds in the western, southern, and central regions. The olive-sided flycatcher is only present in the project vicinity during its breeding season from the middle of May to early September. The flycatcher breeds in open coniferous forests, typically in stands of open canopy spruce associated with meadows, muskegs, burns, streams, beaver ponds, bogs, lakes and logged areas (ANHP, 2006). Suitable habitat occurs within the project area.

Peregrine Falcon

The peregrine falcon was formerly listed as federally endangered; de-listing occurred in August 1999 based on successful recovery. The species is now considered a SOSC by the state. Peregrine falcons are uncommon breeders and rare wintering birds in Southeast Alaska (Isleib et al., 1993). Suitable habitat occurs in rocky cliffs along Thomas Bay. Peregrine falcons may be present in the project vicinity during their breeding season (early spring to late summer).

Other Protected Species

Bald eagle - The bald eagle (*Haliaeetus leucocephalus*) was delisted as a federally threatened species under the ESA on June 28, 2007 but remains protected under the Bald and Golden Eagle Protection Act. Southeast Alaska supports the largest population of breeding bald eagles in North America. Bald eagles typically nest within 0.25 to one mile of large bodies of open water, with a clear view of the surrounding area (ADFG, 2010h). USFWS conducted surveys of bald eagles in the project area in the spring of 2009. The survey determined Bald eagles use Thomas Bay year-round for nesting and foraging and there are many active nests located in and around the project vicinity. There are no known nesting sites within the project footprint.

Osprey - Osprey are uncommon in Southeast Alaska and are considered a sensitive species by the USFS (USFS 2008a). According to ADFG, osprey are known to seasonally occur in Thomas Bay, and are known to nest in the project area. Additionally, osprey were observed in June 2010 during field reconnaissance along Swan Lake and Cascade Creek. Populations remain stable in Alaska, but numbers are relatively low (USFS, 2008a).

The TNF has adopted policies designed to offer protection for osprey nest locations. In addition to buffers around existing nests, it recommends a 1,000-foot shoreline buffer that provides suitable dominant or co-dominant trees along beaches protects a large amount of nesting, perching, and foraging habitat (USFS, 2008a).

Botanical Species

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." In the project vicinity, there are potentially 38 rare, threatened, or endangered (RTE) botanical species that may occur based on species distribution and habitat preferences. These include Eschsholtz's little nightmare (*Aphragmus eschscholtzianus*) moosewort fern (*Botrychium tunux*) (*Botrychium yaaxudakeit*), Unalaska mist-maid (*Romanzoffia unalaschcensis*), and Queen Charlotte butterweed (*Senecio moresbiensis*). There are no plant species protected by the ESA expected to occur in the project area. See also Appendix C for Vegetation Resources Overview that was developed by Oasis in January 2011 (USFS, 2008a).

Table 3-10. Rare and Sensitive Botanical Species that may Occur in the Project Area (Partial List)

Common Name	Scientific Name	USFS Status	ANHP Status	Habitat
Eschscholtz's Little Nightmare	*Aphragmus eschscholtzianus*	Sensitive Species	G3, S3	Moist mossy areas, seeps, heaths, and scree slopes in the subalpine and alpine.
Spatulate Moonwart	*Botrychium spathulatum*	Sensitive Species	G3, S1	Open to partially open habitats, mostly in montane and lakeshore areas. Habitats are often associated with moderate disturbance and/or have sparse or grassy vegetation.
Moosewort Fern	*Botrychium tunux*	Sensitive Species	G1, S2	Well-drained open areas on maritime beaches or upper beach meadows. Mountain habitats are sparsely vegetated alpine scree slopes.
Moonwort Fern, no unique common name	*Botrychium yaaxudakeit*	Sensitive Species	G2, S2	Well-drained open areas on maritime beaches or upper beach meadows.
Edible Thistle	*Cirsium edule var. macounii*	Sensitive Species	G4, S1	Wet meadows and woods.
Mountain Lady's Slipper	*Cypripedium montanum*	Sensitive Species	G4, S1	Mesic to dry (rarely wet) coniferous, deciduous forests, openings, and thickets, around shrubs and open slopes. 0-2400m.
Large Yellow Lady's Slipper	*Cypripedium parviflorum var. pubescens*	Sensitive Species	G5, S2S3	Boggy areas, swampy areas, damp woods (often with a rich layer of humus and decaying leaf litter), near rivers or canal banks and in wet meadows.
Wright's Filmy Fern	*Hymenophyllum wrightii*		S2	Humid, shaded boulders, cliffs, tree trunks; damp woods.
Lichen	*Lobaria amplissima*	Sensitive Species		Nutrient-rich bark and branches, rarely on rocks.

Common Name	Scientific Name	USFS Status	ANHP Status	Habitat
Alaska Rein Orchid	*Piperia unalascensis*	Sensitive Species	G5, S2	Meadows and woods.
Lesser Round-leaved Orchid	*Platanthera orbiculata*	Sensitive Species	G5, S2	Mesic to wet coniferous and deciduous forest, fen forest; 0--1500 m.
Loose-flowered Bluegrass	*Poa laxiflora*		G3G4, S2S3	Moist areas near or in riparian zones, seeps, springs, boggy areas, in partial to full shade, within western hemlock forest associations.
Unalaska Mist-maid	*Romanzoffia unalaschcensis*	Sensitive Species	G3, S3	Cracks in rock outcrops, along stream banks, beach terraces, open rocky areas, and on grassy, mossy rock cliffs along shores.
Queen Charlotte Butterweed	*Senecio moresbiensis*	Sensitive Species	G3, S2	Montane to alpine habitat in shady wet areas and bogs, on open, rocky or boggy slopes, and in open, rocky heath or grass communities.

Species State Rankings: S1 critically imperiled in state; S2 Imperiled in state; S3 Rare or Uncommon in State.

*Based upon county distribution

Source: AKNHP, 2010; USFWS, 2010, USFS, 2008a

3.3.5.2 Environmental Effects

Effects of Project Construction and Operation on TE and Sensitive Terrestrial and Botanical Species and Habitats

As there are no known terrestrial ESA-listed wildlife species in the project area, the Project is not expected to affect ESA-listed terrestrial wildlife species. With respect to aquatic TE species, there is a potential for temporary disturbances to marine mammals during construction.

Construction can result in short-term effects to state-listed or USFS-sensitive wildlife habitats resulting from ground disturbing activities in construction laydown areas and permanent effects within the project facilities footprints, including the transmission line. Construction activities can also result in temporary increases in noise and human presence, which can have an effect on state-listed or USFS-sensitive wildlife populations and migratory patterns.

Proposed Action

The project powerhouse and appurtenant facilities will occur within a wetland. The Project will also encompass a small area of the intertidal, marine environment. This tidal area would likely experience some short-term effects during the construction phase of the Project; however, longer-term effects to NMFS identified TE species are not expected.

Consultation with the USFWS has indicated the absence of federally threatened and endangered terrestrial species within the project area. Therefore, no impacts to federally listed, threatened or endangered terrestrial species from the proposed project construction or operation are anticipated (personal communication, Richard Enriquez, USFWS, November 17, 2010). The Applicant will prepare a Biological Assessment for determination of effects to ESA-listed species.

Construction activities may have a temporary effect on special status marine mammals, marine reptiles, and terrestrial species, which may require additional site surveys. The Applicant anticipates undertaking additional consultation with NMFS to develop construction mitigation efforts in support of anticipated USACOE Section 10/404 and USFS Special Use permitting. This may include construction timing requirements, noise abatement strategies, and site specific mitigation efforts to avoid potential effects to these species. This will occur as the Applicant finalizes project design, approximately one to two years prior to project construction. Given the transitory nature of the species identified by the agencies and the temporary nature of potential effects, timing this effort to more closely precede project construction will provide the most accurate analysis of effects and subsequently more specific and effective mitigation measures if required.

Additionally, the Applicant is proposing at least a 200-foot buffer zone between generation facilities and the shoreline and re-vegetation/naturalization of shoreline areas used for access, staging, and the proposed tailrace post-construction. These actions are expected to mitigate disruptions to marine habitats. Permanent, water dependent structures, including the proposed dock and ramp, are ubiquitous to the region.

Effects to water quality from construction activities in the immediate vicinity of the new tailrace discharge area are expected to be temporary and localized and will be addressed by the Soil Erosion Control Plan proposed for the Project.

Additional Pre-Construction Study Efforts

With respect to sensitive terrestrial and aquatic wildlife and botanical resources, the Applicant proposes to conduct several species and habitat surveys as part of the USFS Special Use permit application and in an effort to provide additional data that may be useful for managing agencies. These will include:

- Kitlitz's Murrelet Survey
- Bald Eagle Survey
- Osprey Survey
- Oystercatcher Survey
- Amphibian Survey
- Vegetation Survey

In conjunction with other wildlife and botanical studies, the Applicant will identify the presence of any other stated-listed or USFS-sensitive species in the project area. Given the transitory nature of many of the terrestrial species, specifically birds, the Applicant proposes to undertake an initial survey for these species during the 2011 field survey and a secondary follow up for identified species one year prior to project construction, if requested by state and federal agencies. Should any of these species be identified as occurring within the project boundary or affected by project operations, the Applicant will develop pre-construction mitigation, avoidance, or minimization strategies in consultation with the USFS and ADFG.

No Action Alternative

There are no anticipated permanent effects to any potential state listed or USFS sensitive species within the project area and minimal, temporary effects to a small area of the intertidal, marine environment and transmission line corridor. The Applicant, however, proposes to undertake a variety of post-licensing surveys to support project construction and provide additional information regarding species of agency interest. These survey efforts will not take place under the no action alternative and the managing agencies will not benefit from an expanded understanding and knowledge base of these resources.

3.3.5.3 Unavoidable Adverse Effects

The habitat modification caused by the proposed transmission line corridor could have an adverse, temporary effect to wildlife. Additionally, there is a potential for temporary disturbance of marine mammals during project construction. All proposed activities will be planned to minimize impacts to these resources to the greatest extent possible and, where these effects are unavoidable, species specific protection plans will be implemented. Furthermore, the Applicant anticipates undertaking additional consultation with USFWS and NMFS to develop construction mitigation programs in support of anticipated USACOE Section 10/404 and USFS Special Use permitting. These efforts will be further developed and refined through information gathered during the various species surveys planned for 2011.

3.3.6 Recreation

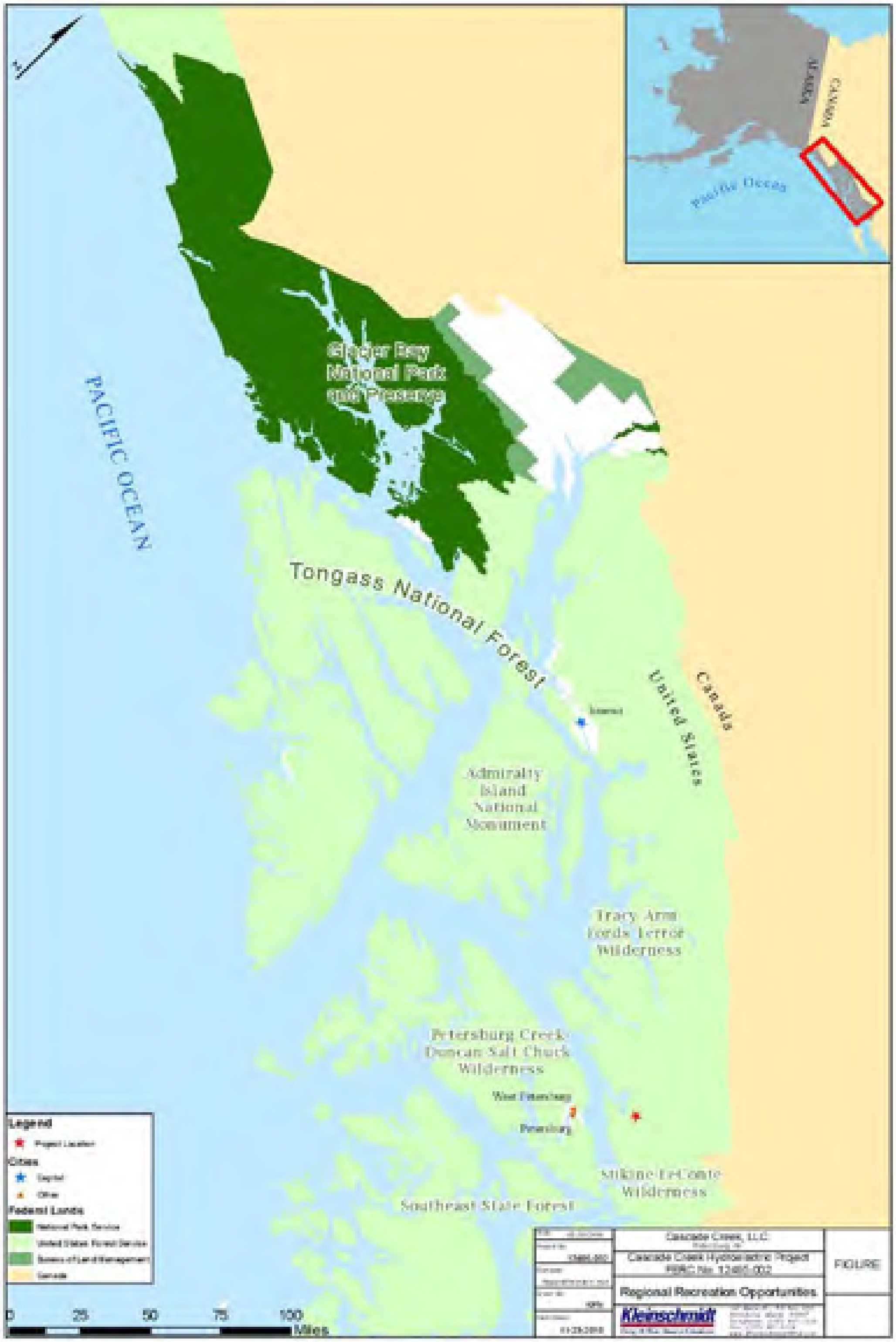
3.3.6.1 Affected Environment

Southeast Alaska has approximately 10 million acres of forestland, over 1,000 islands, and about 10,000 miles of shoreline (Miller, 2008). Most of this area is available to recreationists. The project structures would be located within the TNF on Swan Lake and Cascade Creek, which empties into Thomas Bay of Southeast Alaska. The Project would be located approximately 100 miles south of Juneau and 100 miles north of Ketchikan, Alaska (City of Petersburg, 2000). The closest population center to the Project is the city of Petersburg which is located off the mainland across Frederick Sound on Mitkof Island. The affected environment for the Project includes lands and waters within the project boundary or directly affected by the Project including Swan Lake, Falls Lake, Cascade Creek, and the shoreline immediate to the project generation facilities on Thomas Bay (east of Ruth Island).

Regional Recreation Opportunities

Recreation opportunities of the southeast Alaska region are largely provided by Glacier Bay National Park and Preserve, Admiralty Island National Monument, Misty Fiords National Monument, and the Tongass National Forest (Figure 3-31).

Figure 3-31. Regional Recreation Opportunities.



Glacier Bay National Park and Preserve

Glacier Bay National Park (GBNP) and Glacier Bay National Preserve (GBP) lie west of Juneau, Alaska approximately 145 miles northwest of the project area. They can be reached only by plane or boat (NPS, 2010c). The Park was established by Congress in 1925 and has since been expanded twice in 1939 and 1980 (NPS, 2000). The combined lands of GBNP and GBP include 3.3 million acres and receive approximately 450,000 visitors annually (NPS, 2000).

Many visitors to the GBNP and GBP arrive as passengers on board cruise ships, tour boats, charter boats, or their own private vessels (NPS, 2010a). Visitors may also stay overnight in the GBNP at Glacier Bay Lodge at Bartlett Cove or outside of the Park in the nearby town of Gustavus. Camping is available at the Bartlett Cove campground. Sport hunting and trapping are permitted in GBP, but not in GBNP. There are approximately 57, 800 acres of land open to hunting grounds in the GBP, accessible through Dry Bay, Alaska located at the northwest end of the Park (NPS, 1989). In addition, there are thirty privately operated, commercial fishing camps in the Preserve offering boats, vehicles, and fishing equipment (NPS, 2010c). Camping is available in the GBP at several private commercial cabins and at a USFS public use cabin.

Visitors to the GBNP and GBP also participate in sea kayaking, white water rafting, guided boat and land tours, mountaineering, trail and back-country hiking, and wildlife viewing. There are four maintained hiking trails in GBP, although backcountry and off-trail hiking opportunities occur throughout the GBNP.

Tongass National Forest

Stretching the entire length of the Southeast Alaskan coastline and comprising approximately 77 percent of the region's land, the TNF is the largest national forest in the United States (Readicker-Henderson, 2006). The TNF provides users a variety of recreational opportunities and wilderness experiences. These activities are accommodated by the 150 rustic cabins and 15 campgrounds located throughout the TNF (USFS, 2008a; USFS, 2010a). Generally, these recreational facilities are only accessible via boat or plane. Specifically, the Alaska Marine Highway provides access through the Inside Passage and serves the TNF; however, due to historic and current timber management in the TNF, there are also a number of roads throughout the forest. The two major roads into the TNF are the Klondike Highway (Route 2) which leads into Skagway and the Haines Highway (Route 7) which leads into Haines, Alaska. The majority of lands within the TNF are open to hunting, fishing, and other mostly non-motorized recreation activities; although some areas are off limits such as wildlife sanctuaries or residential areas. There are nineteen wilderness areas (including those contained within Admiralty Island National Monument and Misty Fiords National Monument, discussed below), multiple roadless lands, and over 100 hiking trails within the TNF. The TNF is further discussed below in *Project Vicinity Recreational Opportunities.*

Misty Fiords National Monument

Misty Fiords National Monument encompasses 2,294,343 acres, on the southern tip of the Alaska Panhandle approximately 130 miles southeast of the Project. It is the largest wilderness in the TNF. Misty Fiords provides visitors with a variety of recreational opportunities including freshwater and saltwater fishing, hunting, hiking, boating, sea kayaking, camping, beach combing and wildlife viewing with 13 USFS cabins and 5 USFS shelters, accessible by boat or floatplane (USFS, 2011a).

The fishing opportunities at Misty Fiords include both freshwater lakes, which provide opportunities for cutthroat trout, Dolly Varden, sockeye salmon, and land-locked salmon and coastal areas and bays, on which public mooring buoys available. Game species include Sitka black-tail deer, mountain goat, brown and black bear, beaver, mink, and marten. Sea kayaking is also a popular recreational activity in the numerous coves and inlets as well as a 150 mile sea kayak route along the shoreline of Revillagigedo Island. There are approximately 11 formal hiking trails scattered throughout Misty Fiords, although most are associated with existing USFS cabins and shelters that follow lakes and coves (USFS, 2011a).

Admiralty Island National Monument

The eastern coast of Admiralty Island National Monument is located approximately 50 miles northwest of the project area. The island encompasses nearly a million acres of old growth rain forest, alpine tundra, and rugged coastline and a portion of the National Monument is designated as the Kootznoowood Wilderness (KW). In addition to hiking, fishing and camping, the Island is also known for its Stan Price Bear Sanctuary (Pack Creek Brown Bear Viewing Area). Admiralty Island is home to an estimated 1,500 brown bears; more than all the lower 48 states combined. At the viewing area, visitors can observe brown bears living in their natural habitat (USFS, 2010c). There are 14 USFS cabins located on Admiralty Island for overnight visitors (USFS, 2010d). Admiralty Island is accessible by boat, plane or the Oliver Inlet Tram. The Tram is capable of hauling gear such as kayaks and canoes.

The Cross Admiralty Canoe Route is also a popular recreational activity on the Island. The trailhead begins in Mole Harbor, the east end of Mitchell Bay and is approximately 32 miles long (USFS, 2010d). The Canoe Route links seven of the eleven mountain lakes of Admiralty Island. Fishing opportunities on the Island include both freshwater and saltwater. Most hiking trails on the Island are in the lakes region and are used for portaging. There are no maintained trails for long-distance hikes.

Project Vicinity Recreation Opportunities

Outdoor recreation opportunities in the project vicinity occur primarily on national forest lands in the TNF. The project vicinity, which includes the surrounding TNF lands, Thomas Bay and the communities of Petersburg, Wrangell, and Kake, provides a wide array of recreation opportunities including fishing, hunting, boating, kayaking/canoeing, hiking, cross-country skiing, snowshoeing, wildlife watching, sightseeing, and camping including camping at USFS cabins and shelters, and a private campground. Recreational opportunities within the TNF and the project vicinity include camping at USFS cabins and shelters, and a private campground, freshwater and saltwater fishing, hunting, boating, cruises, wildlife viewing, and hiking. Each type of recreational activity available in the project vicinity is described in greater detail below.

Figure 3-32. Recreation Facilities in the Project Vicinity

Angling

There are at least twelve documented freshwater fishing sites and five saltwater sites within the project vicinity (Table 3-11). It is likely that there are lesser known fishing opportunities undocumented by USFS or ADFG. Like Swan Lake, the majority of the project vicinities' fishing sites are remote and are only accessible by boat (via hiking trail) or float plane. Specifically, Colp and Scenery Lakes are only accessible by hiking wilderness trails that follow the associated Colp Lake Trail, and Scenery Creek with trailheads accessible by boat and/or float plane (USFS, 2009). DeBoer Lake is located within the project vicinity, is accessible only by float plane.

Table 3-11. Project Vicinity Freshwater and Saltwater Fishing Opportunities

Name of river, lake, or creek	Location in relation to the project area	Access	Fish
Freshwater Fishing Sites			
Petersburg Creek	17 miles west to the mouth of Petersburg Creek.	Boat and float plane access only.	Salmon: Chum, Coho, Pink, Sockeye, Dolly Varden Trout: Cutthroat, Rainbow, Steelhead.
Petersburg Lake	19 miles west; in Petersburg.	Boat and cabin on site. Access by float plane (ice out) or helicopter (frozen.) Access by boat or floatplane to trailhead, then 4.5 miles by trail up Petersburg Creek (Petersburg Lake Trail).	Salmon: Chum, Coho, Pink, Sockeye, Dolly Varden Trout: Cutthroat, Rainbow, Steelhead.
Twelvemile Creek	12.5 miles northwest; on northern tip of Lindenberg Peninsula.	Boat access only.	No publically available information.
Colp Lake	14.7 miles west; on western coast of Lindenberg Peninsula.	Access to trailhead by boat or float plane, then 2.4 miles by trail up Five Mile Creek (Colp Lake Trail).	No publically available information.
Fivemile Creek	13 miles west to mouth of Fivemile Creek; on western coast of Lindenberg Peninsula.	Boat access only.	No publically available information.
Scenery Creek	4 miles north to mouth of Scenery Creek; near Thomas Bay.	Boat and float plane access only.	No publically available information.
Scenery Lake	4 miles northeast; near Thomas Bay.	Boat and float plane (ice out) or helicopter (frozen) access only.	No publically available information.
Muddy River	9 miles southwest to the mouth of the Muddy River; near Frederick Sound.	Boat access only.	No publically available information.

Name of river, lake, or creek	**Location in relation to the project area**	**Access**	**Fish**
Patterson River	5 miles southwest to the mouth of the Patterson River; near Frederick Sound.	Boat access only.	No publically available information.
Farragut River	18 miles northwest to the mouth of the Farragut River; near Farragut Bay.	Boat access only.	King Salmon
Spurt Lake	5 miles northwest	Access by boat or float plane to trailhead then 1.5 miles up the Spurt Lake Trail	Cutthroat Trout
De Boer Lake	8 miles northwest; mainland Alaska.	Boat and cabin on site. Float plane (ice out) or helicopter (frozen) access only.	Rainbow Trout
Saltwater Coastal Sites			
Petersburg Harbor	17 miles southwest.	Boat or float plane access only.	Salmon: King. Coho, Dolly Varden Other: Halibut
Cape Strait	12.5 miles northwest; on northern tip of Lindenberg Peninsula.	Boat or float plane access only.	Salmon: King, Coho Other: Halibut
Beacon Point	15 miles west; on western coast of Lindenberg Peninsula.	Boat or float plane access only.	King Salmon
Frederick Point/Sound	Frederick Point is approximately 17 miles southwest on Kupreanof Island.	Boat or float plane access only.	Salmon: Chum, Coho, King, Pink, Dolly Varden Other: Halibut, Rockfish
Thomas Bay	At mouth of Cascade Creek.	Cabins on site (Spurt Cove and Cascade Creek). Boat or float plane access only.	King Salmon and Halibut.

*Distances based on air miles.

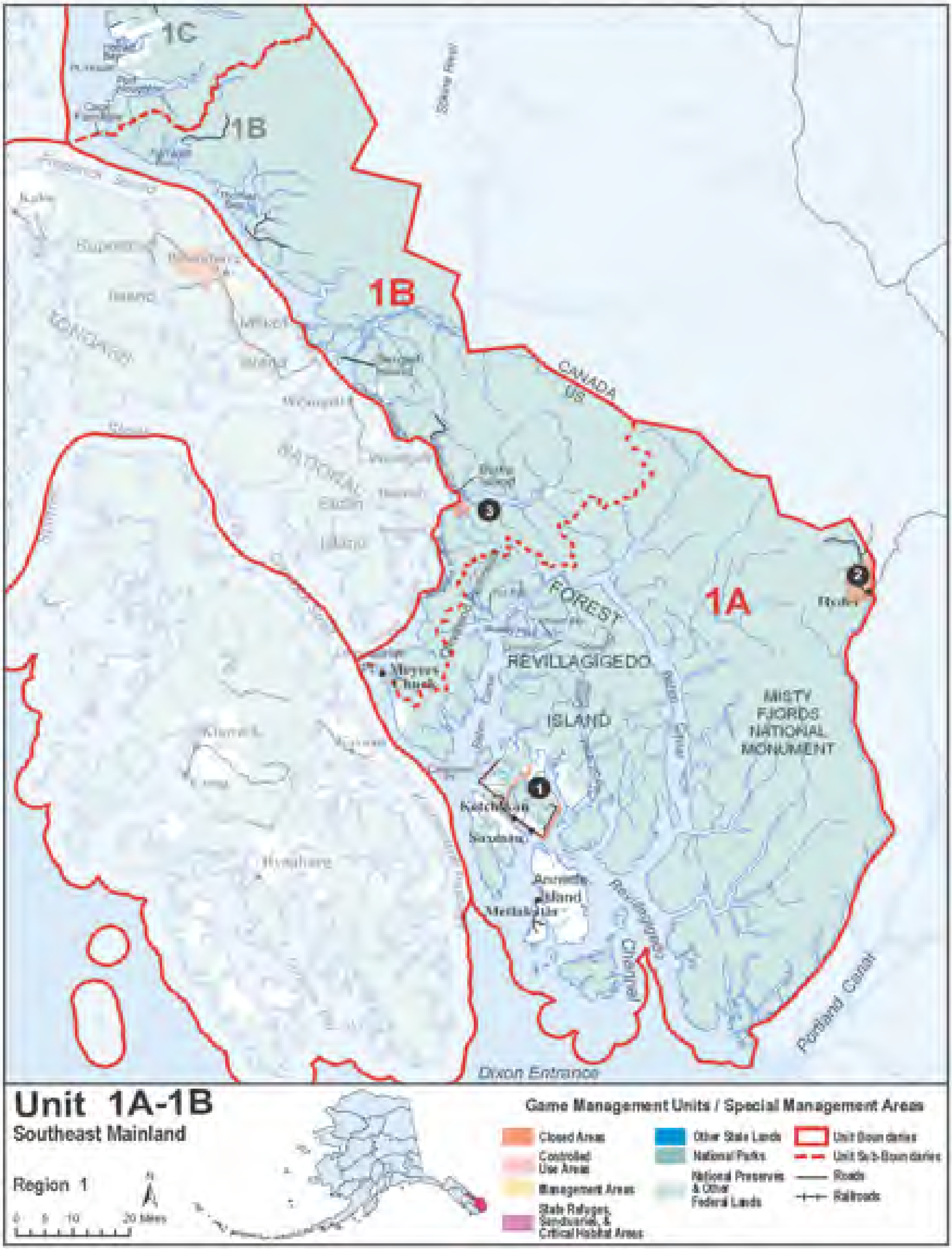
Source: DeLorme, 2010; ADFG, 2010i; USFS, 2009b

<u>Hunting</u>

The project vicinity includes lands the ADFG manages for hunting, including game management units (GMU) 3, 1B, and 1C. The Petersburg-Wrangell GMU 3 extends from the Coronation Islands and Ernest Sound in the south to the community of Kake in the north. The GMU 3 also includes the communities of Petersburg and Wrangell and portions of Frederick Sound. The game species available for hunting in GMU 3 include brown bear, elk, moose deer, and black bear. Hunting for these species involves specific restrictions such as season, allowable hunting methods, and non-resident restrictions. Additionally, a portion of GMU 3 is restricted to specific hunting methods. The Petersburg Management Area within GMU 3 is only open to hunting by bow and arrow and includes the Petersburg city boundary. Also within GMU 3, the Mitkof Highway closed area includes a strip one-fourth mile wide on each side of the Mitkof Highway from the Petersburg city limits to the Crystal Lake Campground. This area is closed to the taking of big game, except wolves (ADFG, 2010j).

The Southeast Mainland GMU 1 includes the sub-unit GMU 1B, in which the proposed Project is located, which extends across the mainland from Frederick Sound in the west to the Canadian border and from Farragut Bay in the north to Ernest Sound in the south (Figure 3-33). Game species occurring in GMU 1B include, brown bear, grizzly bear, mountain goat, moose, elk, deer, and black bear. The Anan Creek Closed Area is the only restricted area within GMU 1B. This area is closed to the taking of black and brown bears (ADFG, 2010j).

Figure 3-33. ADFG Game Management Unit 1B



GMU 1C is also part of the Southeast Mainland GMU 1 and is located to the north of the Project. This sub-unit extends from the ocean to the Canadian border and from Cape Fanshaw in the south to Glacier Bay National Park in the north. Species available for hunting in this GMU include brown, black and grizzly bear; mountain goat; moose; elk; and deer, although the GMU 1C has a fair amount of restricted areas compared with other sub-units within GMU 1. The Douglas Island Management Area also has various restrictions in certain locations such as limitations on the hunting and trapping of wolves and deer conservation provisions (ADFG, 2010j).

Hiking

Public use hiking trails are available throughout the TNF and are key to providing access to additional remote recreation opportunities including backcountry camping, sightseeing and wildlife viewing, shoreline angling at remote lakes, and hunting. There are five USFS maintained hiking trails located within approximately 20 miles of the project area in the TNF (USFS, 2010e; USFS, 2010o).

- **Spurt Lake Trail** - The Spurt Lake Trail trailhead can be reached by boat or floatplane, beginning on the shore of Thomas Bay, approximately 5 miles northwest of the project area. The trailhead is also accessible by a 0.25 mile spur trail from the USFS Spurt Cove Cabin. The Spurt Lake Trail is approximately 1.5 miles in length, follows the base of a vertical rock wall and traverses through mature forest and through semi-open muskeg. The trail ends at Spurt Lake where visitors can fish for cutthroat trout from a small boat provided by the USFS. This Trail is rated as “more difficult” (USFS, 2010e).
- **Raven Trail** - This trail is located in Petersburg, approximately 18.5 miles southwest from the project area, and extends 4 miles from the Petersburg water tower to the Ravens Roost Cabin. The trail is open year-round and is a part of a larger complex of cross-country ski trails. The Raven Trail traverses through forested areas, open, subalpine, meadow, and muskeg and is rated “more

difficult". An overlook approximately one mile into the trail offers views of Frederick Sound, Wrangell Narrows and the mainland (USFS, 2010e).

- **Petersburg Lake Trail** - The Petersburg Lake Trail is mostly located in the Petersburg Creek – Duncan Salt Chuck Wilderness (PCW) on Kupreanof Island, approximately 17.5 miles southwest from the project area. Two trailheads are available: one is only accessible by boat or float plane under favorable tide conditions and continues 6.5 miles to Petersburg Lake; the other begins at the Kupreanof Island State Boat Dock and follows Petersburg Creek to end after 10.5 miles at the Petersburg Lake Cabin. The beginning of the trail at the dock follows an old road bed for 800 feet, continues uphill 4 miles along Petersburg Creek, where it is intercepted by the high tide trailhead, and continues through forested areas and muskeg for 6.5 miles to Petersburg Lake and Cabin (USFS, 2010o).
- **Colp Lake Trail** - The Colp Lake Trail provides access to Colp Lake from the mouth of Fivemile Creek in Frederick Sound. The Trail begins 200 feet north of Fivemile Creek and initially passes through a small stand of timber before climbing the creek valley, primarily through muskeg. The trail crosses the creek at approximately the midpoint to Colp Lake, which offers fishing for cutthroat trout and camping opportunities. This trail is rated "more difficult" (USFS, 2010o).
- **Petersburg Mountain Trail** - The Petersburg Mountain Trail begins at the same location as the Petersburg Lake Trail (Kupreanof State Boat Dock) and follows an old road bed which parallels the shore. Approximately 1.5 miles from the trailhead, the Trail leaves the road bed and begins climbing steadily up the mountain, with few switchbacks, through mature forest. This stretch extends for approximately 1.5 miles to the saddle where the trail becomes indiscernible (hikers must follow the blue trail markers to the peak). An anchored cable near the summit assists the climb and this trail is rated as the "most difficult" (USFS, 2010o).
- **Portage Mountain Loop Trail** - The Portage Mountain Loop trail connects Petersburg Lake with the Salt Chuck East Cabin, approximately 20 miles southwest of the proposed Project. The Trail may be difficult to follow as it is not frequently cleared because of low use. The trailhead starts at Petersburg Lake Cabin and continues to the north end of the lake. It continues to, the tidal flat of Goose Cove at the southeast end of Portage Bay, west

across the tide flat and heads southwest through muskeg and timber, to the Salt Chuck East Cabin.

There is one USFS maintained and operated TNF hiking trail located immediately adjacent to the project area, the Cascade Creek Trail, which is described below in *Project Area Recreation Opportunities.*

Sea Kayaking

The 60-mile Thomas Bay sea kayak route is located in the project vicinity and traverses Frederick Sound and Thomas Bay (Figure 3-34). The trip is broken up into four distinct segments based on the location of the USFS campsites along the route. From Petersburg, kayakers travel approximately 6.7 miles north along the Kupreanof Island coast to the Sukoi Islets. From the Sukoi Islets, kayakers travel across Frederick Sound approximately 7 miles to the Agassiz Peninsula. After reaching the Agassiz Peninsula, the route hugs the coast of Thomas Bay and the Baird Glacier approximately 19 miles to the Mainland 4 Campsite near Spurt Cove. The last campsite is approximately 15 miles southeast of Spurt Cove and is located on the Lindenberg Peninsula. The route ends approximately 6 miles further southeast in Petersburg. There are three other USFS sea kayaking routes that originate from Petersburg and traverse waters in the project vicinity but are generally located beyond a 20 mile radius of the Project in Frederick Sound (North Shore Kupreanof Island Route, South Shore Kupreanof Island Route and LeConte Bay Loop) (USFS, 2010f).

Figure 3-34. Thomas Bay Sea Kayaking Route

Source: USFS, 2010f

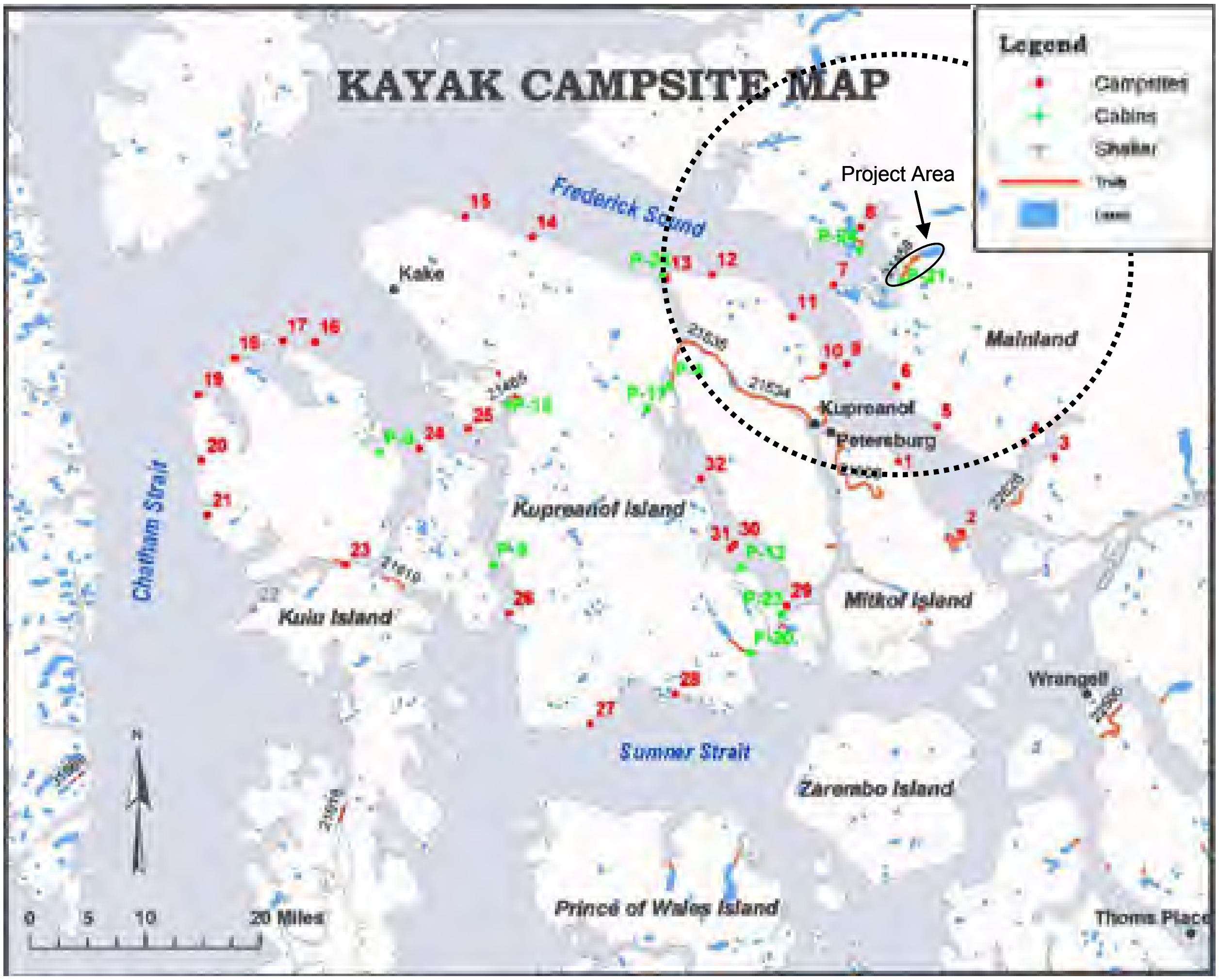
Overnight Use (Camping and Cabins)

In addition to TNF lands in the project vicinity available for backcountry camping, the USFS identifies 11 formal campsites within the project vicinity that can accommodate overnight use (Figure 3-35) (USFS, 2010f).

- **Frederick 19 Campsite (#1) –** This beach site can accommodate three tents and is located on the south side of Cabin Creek on Mitkof Island.

- **Mainland 6 Campsite (#4)** – This wooded campsite is located in LeConte Bay on the northside of the Bussy Creek drainage and is only one of two sites in LeConte Bay. This site, located in the Stikine-LeConte Wilderness offers a wildflower meadow.
- **Mainland 1 Campsite (#5) –** This beach and woodland campsite is located on the Agassiz Peninsula south of Moonshine Creek along Horn Cliffs on Frederick Sound. The site offers good views of the Sound and has one beach-front tent site and 6+ wooded campsites.
- **Mainland 2 Campsite (#6)** - This beach front campsite can accommodate eight tents and is located in Ice Cove off of Frederick Sound on the Point Agassiz Peninsula.
- **Mainland 3 Campsite (#7) –** This beach campsite is located on the Agassiz Peninsula just east of Wood Point. The site can accommodate twelve tents and is considered a good campsite to explore Thomas Bay..
- **Mainland 4 Campsite (#8) –** This beach campsite is located on the mainland near Spurt Cove. The site can accommodate two tents and also provides great views of Baird Glacier, which is approximately 3 miles north.
- **Sukoi 1 Islet Campsite (#9) –** This island beach campsite is located on the northern end of East Sukoi Islet. The site can accommodate three tents and provides a great view of the northern lights.
- **Frederick Sound 2 Campsite (#10) –** This beach campsite is located on the southeastern shore of Lindenberg Peninsula. The site can accommodate three tents and also provides access to the Colp Lake Trail. The Sukoi Islets Lighthouse is visible from this campsite.
- **Frederick Sound 3 Campsite (#11) –** This is a beach campsite located on the eastern shore of the Lindenberg Peninsula. The site can accommodate three tents.
- **Frederick Sound 8 Campsite (#12)** – This site is located at the northern shore of Kupreanof Island and is a beach site. The site can accommodate six tents.
- **Frederick Sound 11 Campsite (#13)** – This beach site is located in Portage Bay on the northern end of Kupreanof Island. This site is a beach site accommodating 1 tent. There is a dock and road terminal located 0.5 miles south of the site and the USFS West Point Cabin is located approximately 0.5 miles across the Bay.

Figure 3-35. Campsites in the Project Vicinity



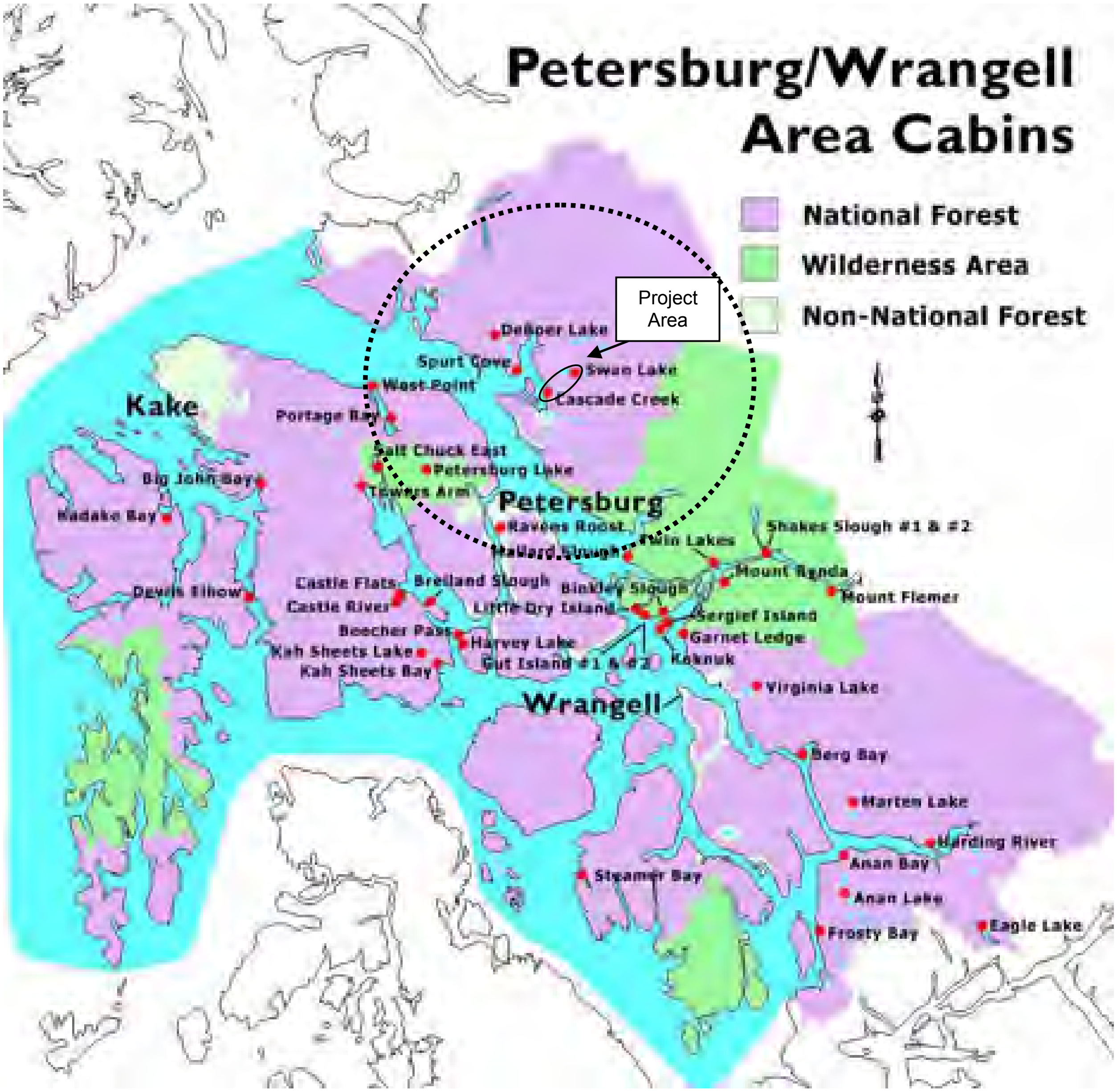
Note: Project vicinity (20 mile radius) denoted by dotted line.

Source: USFS, 2010f, modified

There are two commercial campgrounds in the project vicinity. The Trees RV Park is located on Mitkof Island adjacent to Wrangell Narrows and offers 13 RV sites, laundry facilities, restrooms and shower house, and general store (Trees RV, 2010). Le Conte RV Park is located in downtown Petersburg and provides RV sites (PCC, 2010).

Public use cabins are available throughout the TNF providing remote recreation opportunities (Figure 3-36). Many of the cabins within the project vicinity are accessible by floatplane/helicopter, depending on lake conditions, or via boat or float plane, some of which are then accessible by foot from waterfront trailheads. Areas of the TNF used for hunting, sightseeing, and hiking are accessible from these cabins. In addition, many of these cabins are located on waterbodies and provide rowboats for non-motorized boating and angling opportunities.

Figure 3-36. USFS Cabins in the Project Vicinity



Note: Project vicinity (20 mile radius) denoted by dotted line.
Source: USFS, 2010f, modified

There are six USFS maintained and operated cabins located within approximately 20 miles of the project area within the TNF (USFS, 2010f Recreation.gov, 2010):

- **DeBoer Lake Cabin -** This cabin is located on the western end of DeBoer Lake on the mainland, approximately 10 miles northwest of the project area and is only accessible via floatplane during ice-out or helicopter. The cabin is available year-round and offers basic facilities including a rowboat for access to DeBoer Lake for rainbow trout angling.
- **West Point Cabin** – This cabin is located at the mouth of Portage Bay on Kupreanof Island, approximately 20 miles west of the project area and is only accessible via boat or plane. The cabin is available year-round and offers basic facilities including an ADA accessible boat ramp. The cabin also provides access to beach hiking, wildlife viewing and fishing in Frederick Sound.
- **Portage Bay Cabin** - This cabin is located on the eastern shore of the interior of Portage Bay on Kupreanof Island, approximately 20 miles west of the project area and is only accessible via boat or plane. The cabin is available year-round and offers basic facilities. The cabin provides access to fishing in Portage Bay, the Portage Mountain Trail, Petersburg Lake Cabin, and the Salt Chuck East Cabin.
- **Petersburg Lake Cabin -** This Cabin is located on the southeast end of Petersburg Lake on Kupreanof Island within the PCW approximately 15 miles southwest of the project area. The cabin is available year-round but accessible by floatplane or boat only when Petersburg Lake is ice-free. Boat access is from Petersburg Creek, at high tide only, then via the Petersburg Creek Trail (6.5 miles) or from Wrangel Narrows to the Kupreanof State Boat Dock then via the Petersburg Creek Trail (10.5 miles). The cabin provides basic accommodations and a rowboat for fishing for cutthroat trout and sockeye salmon in Petersburg Lake. Fishing for steelhead, coho, and sockeye salmon is available in nearby Petersburg Creek. Hunting, hiking, and sightseeing opportunities are also available via the Petersburg Lake Trail and the Portage Mountain Trail.
- **Ravens Roost Cabin –** This Cabin is accessible year-round by helicopter or by foot from the Raven Trail and is approximately 17 miles southwest of the project area on Mitkof Island south of Petersburg, Alaska. The cabin offers basic accommodations and provides access to such recreational opportunities as hiking, cross-country skiing, snowshoeing and sightseeing.

- **Spurt Cove Cabin** - The Spurt Cove Cabin is located approximately 5 miles northeast of the project area along the north shore of Thomas Bay on the mainland and providing views of the Bay for sightseeing and wildlife watching. The cabin is accessible year-round by float plane and by boat. The Spurt Cove Cabin offers basic accommodations while Thomas Bay provides opportunities for halibut, king salmon and trout fishing. The Spurt Lake trail is around the point just north of Spurt Cove but the trailhead is only accessible by boat or float plane.

In addition, there are three USFS maintained and operated cabins or shelters located within close proximity of the project area, which are described in *Project Area Recreation Opportunities.*

Wilderness and Wildlife Areas

There are three congressionally designated wilderness areas within approximately 20 miles of the project area within the TNF: the Tracy Arm-Fords Terror Wilderness, Stikine-LeConte Wilderness, and the Petersburg Creek-Duncan Salt Chuck Wilderness, described below.

<u>Tracy Arm-Fords Terror Wilderness</u>

The southern boundary of the Tracy Arm-Fords Terror Wilderness (TAW) is located approximately 23 miles from the project area on the mainland bounded by Canada on the east (USFWS, 2010a). The TAW encompasses approximately 653,179 acres and is bordered by the Chuck River Wilderness to the southeast. (*See the Cascade Creek Recreation Report for details on additional wilderness areas in the region.)* The TAW terrain is characterized by rugged mountains with deep valleys and high waterfalls. In addition, the TAW is flanked by the Tracy Arm and Endicott Arm fjords, which measure over 30 miles long. The most common access to the TAW is by boat or floatplane. Recreation opportunities at the TAW include sea kayaking, wildlife viewing, fishing, hunting, and primitive camping.

Stikine-Leconte Wilderness

The Stikine-Leconte Wilderness (SLW) is located less than 10 miles southeast of the project area on the mainland between towns of Wrangel and Petersburg (USFWS 2010b). The SLW is comprised of 448,926 acres and its main features include the Stikine River, the fastest free-flowing navigable river in the US, and the LeConte Glacier, the southernmost tidewater glacier on the Pacific Coast. The SLW provides opportunities for camping, hunting, fishing, sightseeing, boating, and hiking. There are 12 USFS recreation cabins, two trails, and two hot spring bathing structures at Chief Shakes Hot Springs within the SLW. There are no formal campgrounds within the SLW, although back-country camping is common in forested upland areas. Wildlife-dependent recreation such as fishing, hunting and wildlife viewing are dominant in the SLW. The Stikine River drainage is recognized as an important fish and wildlife area (USFS, 2007) and the 29,180-acre Stikine River Delta is the largest estuary in southeast Alaska, providing salt marsh habitat during avian migrations (USFWS 2010b). In April, the eulachon smelt run occurs in the SLW which attracts more than 15,000 bald eagles, the second largest known concentration of bald eagles in the world (Miller 2008). Moose, mountain goats, brown and black bear, deer, and wolves also inhabit the area. A variety of fish including king and other species of salmon are found in the waters of the SLW.

Petersburg Creek-Duncan Salt Chuck Wilderness

The 46,849-acre PCW is located on northeastern Kupreanof Island, near the small village of Kupreanof, approximately 15 miles southwest of the project area (USFWS, 2010c). The PCW is accessible by either boat or floatplane and provides opportunities for camping, hunting, fishing, sightseeing, photography, canoeing, and hiking. The PCW contains two public recreation cabins (the Petersburg Lake Cabin, discussed above, and

Salt Chuck East Cabin) and three hiking trails (Petersburg Lake Trail, discussed above, the Mountain Loop Trail and an unnamed primitive trail) (USFWS, 2010c). The PCW provides habitat for such game species as black bear, Sitka black-tailed deer, moose, and gray wolves, as well as trumpeter swan, bald eagle, and osprey, providing opportunities for hunting and wildlife viewing. The waters of PCW support a variety of game species including salmon, Dolly Varden, and cutthroat trout (USFWS, 2010c).

State Parks and Forests

There are no state parks or forests within the project vicinity. The closest state park to the Project is the Petroglyph State Historic site in Wrangell, which covers 7 acres and features an ADA compliant boardwalk, trails, interpretive facilities and a beach (APOR, 2010a).

Other ADNR administered, state designated “Undeveloped Public Recreation and Tourism” and “Developed Public Recreation and Tourism” lands in the project vicinity are mostly concentrated in Farragut Bay and in and around Petersburg. Near the project area at the terminus of Thomas Bay to the north, a tideland parcel has been designated as a major seabird nesting colony providing opportunities for wildlife viewing, exploring the North Baird Glacier and climbing nearby peaks. The southern portion of Thomas Bay, to the west and east of Ruth Island, has been designated as undeveloped recreation, noting the significance of access to the USFS Cascade Creek Cabin and Trail. The “Thomas Bay Parcel”, located at the southern terminus of Thomas Bay, to the south of the proposed Project, is managed for habitat protection, timber harvest and continued dispersed recreation (ADNR, 2000).

County and Municipal Recreation Areas

Several county and municipal recreation areas are located within 20 miles of the project area, primarily in the city of Petersburg. In addition, the city of Wrangell is home to several parks and recreation areas including Wrangell City Park, the Mount Dewey Trail, Wrangell Volunteer Park, and Shoemaker Bay Recreational Area. These areas provide opportunities for picnicking, hiking and walking, fishing, and camping, as well as such facilities as tennis courts, running tracks, and sports fields.

- **Petersburg Visitors Information Center -** The Petersburg Visitors Information Center is a joint effort of the Chamber of Commerce and the USFS. It is located at First and Farm Streets and provides visitors with maps, brochures, and local knowledge of the region (Miller, 2008).
- **Eagle's Roost Park -** The Eagle's Roost Park is located in Petersburg on North Nordic Drive. It is operated by the City of Petersburg and includes picnic tables, a viewing platform and benches (Miller, 2008). The park is a popular spot for observing the Wrangell Narrows and to watch bald eagles perched near prime fishing grounds.
- **Overlook Park -** Overlook Park is located in Petersburg near Eagle's Roost Park. The Overlook Park provides a viewing spot for visitors to see humpback whales and other wildlife using Frederick Sound. The Overlook also includes a telescope for viewing wildlife, mountains, glaciers, and Devil's Thumb, a dominant landmark peak, which rises from the Stikine Ice Field (Miller, 2008).
- **Sandy Beach Recreation Area -** The Sandy Beach Recreation Area is located 2 miles outside of Petersburg. At low tide, petroglyophs can be observed along rocks on the north end of the beach (Miller, 2008). From the beach, visitors can walk the Cabin Creek Road which leads to the city's reservoir. The city Creek Walking Bridge is located approximately 1 mile down this road and depending on the season, salmon may be viewed in waters below.
- **Falls Creek Fish Ladder -** The Falls Creek Fish Ladder is located approximately nine miles outside of Petersburg off the Mitkof Highway on the Three Lakes Loop Road. A small bridge from a

parking area provides visitors with a view of migrating coho and pink salmon during the late summer and fall (Miller 2008).

- **Papke's Landing** - Papke's Landing is located near the Fall Creek Fish Ladder off the Papke's Landing Road. The landing overlooks the Wrangell Narrows and includes a state maintained float and boat launch ramp.

Specially Designated Recreation Areas

National Wild and Scenic Rivers

There are 31 rivers or river segments that have been proposed for Wild, Scenic, or Recreational designation under the National Wild and Scenic Rivers System in the TNF (USFS, 2008a). Approximately seven miles of Petersburg Creek in the project vicinity has been proposed for the Wild designation. The USFS describes Petersburg Creek as an outstanding fishery for salmon and steelhead with good access from the community of Petersburg.

There are no rivers or river segments in the project area (including Cascade Creek) that have been or are currently proposed for Wild, Scenic, or Recreational designation.

National Trails System

The National Trail System was established in 1968 to promote the development of trails in both urban and rural settings (NPS, 2010a). No trails in proximity of the proposed Project have been designated as a National Trail (NPS, 2010b).

National Wilderness Areas

In the project vicinity there are three Wilderness Areas designated under the Alaska National Interest Lands Conservation Act (ANILCA).

The TAW, SLW, and the PCW are discussed in further detail above in the *Project Vicinity Recreation Opportunities* section.

Project Area Recreation Opportunities

Recreation facilities within or immediately adjacent to the project boundary include the Cascade Creek Cabin, Cascade Creek Trail, Falls Lake Shelter, and the Swan Lake Cabin (Figure 3-37).

Figure 3-37. Overview map of Recreation Facilities within the Project Area and Immediate Vicinity

Source: USFS 2010d, modified

Public Recreation Opportunities

Cascade Creek Cabin - Cascade Creek Cabin is located approximately 0.25 miles south of the mouth of Cascade Creek in Thomas Bay on the mainland. The cabin is accessible by floatplane or boat and is approximately 14 miles from Petersburg (USFS, 2010d). The cabin (Photo 3-9) is available year-round and offers basic facilities including sleeping bunks, wooden table and benches, oil heater, wood stove, and a pit-type outhouse. Nearby recreational opportunities include fishing at the mouth of Cascade Creek, boating and kayaking, hunting, sightseeing and hiking.

Photo 3-9. Cascade Creek Cabin

Cascade Creek Trail - The Cascade Creek Trail is a challenging, primitive, unimproved trail that extends from the Thomas Bay shoreline to Swan Lake, passing by Falls Lake and following the Cascade Creek for much of its length. Cascade Creek Trail is accessible from three trailheads: one at the Cascade Creek Cabin; one near the mouth of Cascade Creek (accessible by floatplane or boat); and one at the west end of Swan Lake (accessible by float plane or boat or by skiff from Swan

Lake Cabin). The trail is largely inaccessible due to limited maintenance. Outside of the peak recreation season, snow and ice cover make sections of the trail impassable.

The Cascade Creek trail follows Cascade Creek and traverses through a variety of habitats including spruce and hemlock forests, muskeg and tidewater beach. The trail is approximately 4 miles in length from the tidewater at Thomas Bay to Swan Lake (USFS 2010e). The Trail follows Lower Cascade Creek for the first 0.25 mile; crossing a boardwalk and bridge where views of the Cascade Creek lower falls are most visible. The first 0.5 mile of the trail is rated as “easiest” with the remainder of the trail rated “more difficult” to “most difficult”. The Cascade Creek Trail gives hikers the option to hike around Falls Lake to a high bog providing views of Petersburg and Frederick Sound (this section of the trail is “minimally developed and very challenging”), or to follow a spur trail to Falls Lake where they will find a boat that can be used to access the Falls Lake Shelter or to cross the lake and continue north on the Trail to Swan Lake (USFS 2010e).

Falls Lake Shelter - Falls Lake Shelter is located above Falls Lake near the upper section of the Cascade Creek Trail. The shelter is a rustic 3-sided Adirondack-style shelter (Photo 3-10) and is available year-round. Nearby recreational opportunities include fishing and hiking the Cascade Creek Trail (USFS, 2010d).

Photo 3-10. Falls Lake Shelter

Swan Lake Cabin - Swan Lake Cabin is located on the shores of Swan Lake and is accessible by rowboat from the Cascade Creek Trail or by floatplane or helicopter depending on the season. The Swan Lake Cabin is a typical A-frame cabin that can accommodate up to five people (Photo 3-11). The cabin is available year-round and offers basic facilities including sleeping bunks and loft, wooden tables and benches, oil heater, pit-type outhouse and two rowboats. Nearby recreational opportunities include fishing for rainbow trout in Swan Lake, hunting, sightseeing and hiking (USFS, 2010d).

Photo 3-11. Swan Lake Cabin

Commercial Recreation Opportunities

In the project vicinity, there are a variety of commercial recreation opportunities including plane, helicopter and boat charters, hunting and fishing outfitters and guides and international cruise ships. Recreation opportunities offered in the project vicinity are mostly remote wilderness activities that may involve camping, fishing, hunting, hiking or sightseeing with recreation guide services or transportation to the area provided by commercial operators. In more inaccessible areas such as the Baird Glacier, located at the northern end of Thomas Bay, and Patterson Glacier, located at the southern end of Thomas Bay, flight tours and guided hunting opportunities are the primary commercial uses (USFS, 2009b). Recreation outfitters that use the project vicinity are discussed in further detail below.

Existing Recreation Use

The USFS Petersburg Ranger District (PRD) conducted an analysis to determine the recreation carrying capacity for the district in 2009 (USFS, 2009). The area of study focused on public and commercial recreation use of lands within the District, extending from Tebenkof Bay in the west to Baird and Patterson Glaciers in the east and bounded by Frederick Sound to the north and Sumner Strait to the south. The District study areas included TNF lands within a 20 mile radius of the project area: a portion of the mainland within the project vicinity (Muddy River Area, Thomas Bay/Point Vandeput, Farragut Bay/Cape Fanshaw, and Baird/Patterson Glaciers), Mitkof Island, the PCW, and the North Lindenberg Peninsula. The USFS reported that together, these Study Areas accommodated an estimated, annual average of 1,405 total recreation visitor days from 2004 – 2008 (USFS, 2009b) (Table 3-12).

Table 3-12. Reported Recreation Use at PRD Study Areas within the Project Vicinity (2004-2008) (in Recreation Visitor Days (RVD)[a]).

Study Area	Primary Commercial Recreation Uses	Total Acres	2004	2005	2006	2007	2008	Annual Average Reported Use	Percentage of Total Use for All Study Areas
1 Mitkof Island	Sightseeing, hiking swimming, picnicking, fishing, camping, black bear hunting	16,009	378	610	487	334	336	429	10.0%
7 Petersburg Creek/Duncan Salt Chuck	Fishing, hiking , sightseeing, black bear hunting	4,786	309	339	179	150	164	228	5.4%
8 North Lindenberg Peninsula	Fishing, camping, hiking, sightseeing, black bear and deer hunting	6,791	167	178	355	167	170	207	4.9%
21 Muddy River Area	Camping, hunting (deer, mountain goat, wolf, black bear), guided trapping, outfitting kayaks, sightseeing	3,398	124	197	348	324	70	212	5.0%
22 Thomas Bay/Point Vandeput	Camping, hunting (deer, mountain goat, wolf, black bear), guided trapping, outfitting kayaks, sightseeing, fishing	4,284	246	339	319	222	266	282	6.6%
23 Farragut Bay/Cape Fanshaw	Camping, hunting (mountain goat, wolf, black bear), outfitting kayaks, sightseeing, fishing.	2,753	14	12	62	56	17	32	0.8%
24 Baird/Patterson Glaciers	Helicopter landing tours, mountain goat hunting	2,732	23	22	7	14	6	15	0.4%

[a] Recreation Visitor Days (RVDs) – One RVD is equal to 12 hours of recreation use on National Forest System lands or water by an outfitted or guided client(s). One RVD may be one client for 12 hours, 12 clients for one hour, or any combination that equals 12 hours of use on National Forest System lands.
Source: USFS, 2009b

The proposed Project is contained within the Thomas Bay/Point Vandeput Study Area. The Thomas Bay/Point Vandeput Study Area includes the USFS Cascade Creek and Swan Lake Cabins, the Cascade Creek Trail, Falls Lake and Swan Lake. The USFS Spurt Cove Cabin is also included in the Study Area (USFS, 2009b). Overnight occupancy of the Cascade Creek, Swan Lake and Spurt Cove cabins reported by the USFS, is presented in Table 3-13.

The Thomas Bay/Point Vandeput Study Area received the second highest amount of use when compared with the seven study areas within the project vicinity; however, this use represents only approximately 7 percent of the total use for all 21 of the District study areas. Residents of Petersburg and non-residents with transportation used the study area for camping, moose, black bear, deer, mountain goat hunting, sightseeing, fishing, trapping, and kayaking (USFS, 2009b).

Table 3-13. Project Area Recreation Facilities Overnight Use from 2007-2010 by Number of Days Occupied

		January	February	March	April	May	June	July	August	September	October	November	December	Annual Totals
Cascade Creek Cabin	2010	0	0	0	2	16	10	22	18	7	10	NA	NA	85
	2009	0	0	1	0	13	17	14	7	11	2	0	2	67
	2008	0	6	0	2	10	23	24	19	2	1	2	0	89
	2007	NA	NA	NA	NA	NA	NA	NA	0	3	4	0	0	7
Spurt Cove Cabin	2010	0	0	0	1	18	3	8	6	0	0	0	0	36
	2009	0	0	0	7	15	4	11	13	4	2	0	0	56
	2008	0	0	0	0	2	5	8	8	6	0	3	0	32
	2007	0	0	0	0	0	0	0	0	0	5	0	0	5
Swan Lake Cabin	2010	0	0	0	0	0	9	27	20	19	9	NA	NA	84
	2009	0	0	0	0	0	2	28	24	21	3	0	0	78
	2008	0	0	0	0	0	6	19	27	11	18	0	0	81
	2007	NA	NA	NA	NA	NA	NA	NA	0	3	8	0	0	11
Monthly Totals		0	6	1	12	74	79	161	142	87	62	5	2	

SOURCE: personal correspondence, Brad Hunter, USFS, November 4, 2010

In fall 2010, the Applicant conducted a study of commercial and private recreation use of the project area. The Applicant distributed a survey, soliciting information on commercial recreation and transportation services and use of Thomas Bay, Swan and Falls Lakes, and Cascade Creek, preferences and opinions of recreation in the area, and opinions regarding potential project effects to 99 outfitters and guides that were identified as potentially operating in the Petersburg, Wrangell, and Kake areas. Of these, 34 self-identified as not operating in the Thomas Bay, Swan Lake, Falls Lake, and/or Cascade Creek area and 2 surveys were returned as undeliverable and were removed from the mailing list. The Applicant received 25 completed surveys from commercial outfitters and guides for a response rate of approximately 40 percent. In addition, 8 surveys were received from boaters/pilots indicating that they provided commercial recreation opportunities in the project area and immediate vicinity, which were subsequently added to the commercial outfitter/guide survey database. The Applicant distributed a similar survey to capture private recreation use to a list of 1,232 registered boaters and pilots in the Petersburg (59 percent), Wrangell (37 percent) and Kake (4 percent) areas. A total of 284 surveys were completed for a response rate of 23 percent (Kleinschmidt, 2010).

Commercial outfitter/guide respondents indicated charter boat/water taxi was the service most often provided (76 percent). Approximately 67 percent of respondents provide scenic boat tours with wildlife watching also indicated by 67 percent of respondents, whale watching indicated by 55 percent of respondents and nature study/photography indicated by approximately 46 percent of respondents. In addition to these activities, 60 percent offered recreational fishing, 52 percent provided sea kayaking, and just over 50 percent of respondents offered cruises (Kleinschmidt, 2010). Respondents reported “on-water” activities as the most popular of the services provided.

Total reported use in RVDs from October, 2009 through September, 2010 by commercial and outfitter respondents is provided in Table 3-14. The summer months of June, July, and August account for the greatest reported use by commercial outfitters and guides, totaling approximately 60 percent of total use. Thomas Bay received the highest use, accounting for approximately 63 percent of total use. The project area and immediate vicinity overall receives very little commercial recreation use from October through April, comparatively speaking, with these months comprising approximately 14 percent of total use (Kleinschmidt, 2010).

Table 3-14. Commercial Recreation Use (RVD) Estimated from 2010 Outfitter/Guide Survey Effort (October, 2009 through September, 2010)

	Thomas Bay		Swan Lake		Falls Lake/Cascade Creek		Total All Areas	
	Total Reported Trip Days	Calculated RVDs	Total Reported Trip Days	Calculated RVDs	Total Reported Trip Days	Calculated RVDs	Total Reported Trip Days	Calculated RVDs
September	109	810	20	130	48	280	177	1,220
October	48	280	2	10	27	110	77	400
November	37	150	0	0	12	50	49	200
December	17	70	0	0	2	20	19	90
January	2	10	0	0	5	10	7	20
February	0	0	0	0	0	0	0	0
March	9	70	0	0	0	0	9	70
April	49	330	9	100	27	170	85	600
May	151	820	29	200	75	370	255	1,390
June	181	1,040	41	240	90	440	312	1,720
July	204	1,210	51	270	86	410	341	1,890
August	188	1,140	54	310	92	460	334	1,910
TOTAL	**995**	**5,930**	**206**	**1,260**	**464**	**2,320**	**1,665**	**9,510**
Number of Outfitters Providing Services (N=)	32		12		23			

Note: Recreation Visitor Days (RVD) as defined by the USFS is 12 hours of recreational use (for example, one individual recreating for 12 hrs or 12 individuals recreating for 1 hr) (USFS, 2009b). It is a calculation of total recreation pressure, not a quantification of the number of individuals recreating.

Source: Kleinschmidt, 2010.

Estimated RVDs from the 2010 Cascade Creek Recreation Study was much higher than RVDs reported by the USFS for the project vicinity (Table 3-12). This is likely attributable to several factors. First, the USFS RVDs are calculated from reported use by guides and outfitters holding Special Use Permits needed for commercial recreation activities on USFS lands. The Applicant's 2010 survey effort returns included 11 operators holding Special Use Permits and 22 operators that do not. The 2010 Cascade Creek Recreation Study likely captured additional non-USFS land dependent uses (such as boating and fishing use in Thomas Bay), as well as commercial charter/transportation services providing access for recreational purposes that do not require a Special Use Permit. Second, the use of an average reported group size in RVD calculation may result in overestimation. There is likely seasonal group size variation that may not be fully captured by the reported average group size per trip. This is supported by the fact that calculated RVDs for outfitter and guide respondents holding Special Use Permits only was also higher than that reported by the USFS for the project area and immediate vicinity.

It is important to note, however, that the estimated use reported is only for that of the responding outfitters and guides and may be underestimated overall. Several attempts were made to contact non-responding outfitters and guides to determine whether they provide services in the area and use levels. As no response was received, it is unclear how much, if any, additional commercial use could be attributed to these operators.

Public recreational use of Thomas Bay, Swan Lake, Falls Lake and Cascade Creek was also estimated for the 2010 Cascade Creek Recreation Study. Of the 284 total survey respondents, approximately 54 percent indicated that they participate in recreation activities in Thomas Bay, Swan Lake, and/or Falls Lake/Cascade Creek and immediate vicinity. Of these participating respondents, 47 percent indicated that they visit other recreation destinations more often with Duncan Canal, Frederick Sound, Portage Bay, and Stikine River identified as the most popular alternative destinations for recreation purposes (Kleinschmidt, 2010).

Total estimated public recreation use (in RVDs) for Thomas Bay, Swan Lake, Falls Lake and Cascade Creek is provided in Table 3-15. From November through April, monthly public recreation use drops to between 2 and 6 percent of total use with this 6 month time frame supporting approximately 20 percent of the total annual estimated use. With exception to the winter and early spring months, use is fairly evenly spread out from May through October. As with commercial recreation use, Thomas Bay received the highest amount of public recreation use, accounting for almost 70 percent of total use (Kleinschmidt, 2010).

Table 3-15. Public Recreation Use (RVD) Estimated from 2010 Boater/Pilot Survey Effort (October, 2009 through September, 2010)

	Thomas Bay		Swan Lake		Falls Lake/Cascade Creek		Total All Areas	
	Total Reported Trip Days	**Calculated RVDs**	**Total Reported Trip Days**	**Calculated RVDs**	**Total Reported Trip Days**	**Calculated RVDs**	**Total Reported Trip Days**	**Calculated RVDs**
September	361.5	2,380	53	340	110	730	525	3,450
October	295.5	2,020	22	160	115	700	433	2,880
November	131.0	870	0	0	60	400	191	1,270
December	73.5	510	0	0	20	120	93	630
January	46.5	310	3	20	13	70	62	400
February	63.5	450	0	0	16	90	79	540
March	76.5	470	0	0	20	120	96	590
April	176.0	1,150	9	50	50	280	235	1,480
May	394.5	2,360	20	100	133	770	547	3,230
June	380.0	2,150	41	240	136	850	557	3,240
July	355.0	1,990	50	280	147	740	552	3,010
August	362.0	2,170	60	350	125	940	547	3,460
TOTAL	**2,716**	**16,820**	**258**	**1,530**	**942**	**5,810**	**3,915**	**24,180**
Number of Outfitters Providing Services (N=)	130		52		80			

Note: Recreation Visitor Days (RVD) as defined by the USFS is 12 hours of recreational use (for example, one individual recreating for 12 hrs or 12 individuals recreating for 1 hr) (USFS, 2009b). It is a calculation of total recreation pressure, not a quantification of the number of individuals recreating.
Source: Kleinschmidt, 2010.

Respondents were asked to indicate the recreation activities in which they participated in by season. For spring recreation (March, April and May), respondents indicated recreational and subsistence fishing (71 percent and 24 percent, respectively), pleasure boating (41 percent), and hiking/mountaineering (31 percent) as the most popular activities. The most popular activities for summer (June, July and August) recreationists were recreational and subsistence fishing (77 percent and 24 percent, respectively), pleasure boating (52 percent), sightseeing and photography (44 percent), and camping (40 percent). Fall (September, October and November) activities reported to be the most popular were large game hunting (73 percent), recreational and subsistence fishing (54 percent and 25 percent, respectively), and camping (30 percent), followed by hiking/mountaineering (29 percent). Winter (December, January, and February) recreation activities reported by respondents were predominantly fishing and hunting with recreational fishing (51 percent), subsistence fishing (22 percent), large game hunting (33 percent), small game hunting (18 percent) and trapping (18 percent) reported to be the most popular winter activities. Pleasure boating was also reported to be a winter activity by 20 percent of respondents (Kleinschmidt, 2010).

Regional Needs Identified in Management Plans

The recreation, municipal, wilderness, state and national forest management plans identified below are discussed relative to their applicability to the Cascade Creek Project. This includes recreation facilities provided within and adjacent to the project area and general recreation needs identified for the project vicinity that may bear relevance to the recreation opportunities of Thomas Bay, Swan Lake, Falls Lake and the Cascade Creek Trail.

A summary of the applicable federal, state, county, and regional comprehensive plans on FERC's List of Comprehensive Plans are provided in Section 5.2, *Consistency with Comprehensive Plans*. We also note that as part of the Comprehensive planning for the region, several areas including the Cascade Creek Drainage were specifically reserved for the development of hydroelectric power. The proposed development is consistent with the reservation and as such is an important component of any regional planning.

Alaska Statewide Comprehensive Outdoor Recreation Plan

The 2009-2014 Alaska Statewide Comprehensive Outdoor Recreation Plan (SCORP) provides and evaluation of existing outdoor recreation opportunities, identifies the outdoor recreation and conservation issues facing the state, and provides state and local government, outdoor recreation providers and the general public guidance with respect to the actions necessary to address these issues. Among the recreation priorities for the Southeast Region, which includes the towns of Petersburg, Wrangell and Kake, are improving existing facilities, more picnic areas, better access to outdoor recreation opportunities, and an expanded cabin system (ADNR, 2010). The SCORP does not identify any recreation planning issues or related recommendations that would impact project lands, though the Applicant is working with the USFS on recreation enhancements in the project vicinity such as trail improvements and a new USFS cabin.

Tongass National Forest Land and Resource Management Plan

The 2008 Tongass National Forest Land and Resource Management Plan (TLMP) guides all natural resource management activities and establishes management standards and guidelines for the TNF. The TLMP describes resource management practices, levels of resource production and management, and the availability of lands for different kinds of resource management, including recreation (USFS, 2008a). While the USFS assigns LUDs to the project area, the sites Power

Site classification remains the primary use objective. Accordingly, the USFS indicates that the project area has been removed from other management considerations. The Applicant intends to operate and manage the Project in a manner as consistent as possible with existing LUDs; however, pursuant to the Power Site classification, these management objectives should not inhibit hydroelectric development and generation.

The TLMP designates a majority of lands surrounding the project, and all lands within the project boundary and immediate vicinity, for Semi-Remote Recreation. The TLMP goals for these lands are to provide predominantly natural or natural-appearing settings for semi-primitive types of recreation and tourism, and occasional enclaves of concentrated recreation and tourism facilities (USFS, 2008a).

The Semi-Remote Recreation LUD outlines objectives to meet the goals for recreation opportunities and access and dictates the appropriate management prescriptions to achieve the defined "desired condition". For Semi-Remote Recreation lands the "desired condition" is characterized as generally unmodified natural environments, moderate levels of remoteness and seclusion with some areas offering support facilities, development and motorized access and opportunities. The USFS generally manages these areas for the Semi-Primitive Recreation Opportunity Spectrum (ROS) classifications; however, new or existing development and other factors may result in different ROS classifications (USFS, 2008a).

The TLMP does not expressly restrict facilities and development. It does, however, indicate that non-recreation facilities and development should be designed and located to reduce adverse effects on recreation and tourism opportunities. Development may be "minimal or occasionally may be larger in scale, but will be rustic in appearance, or in harmony with the natural setting" (USFS, 2008a).

Central/Southern Southeast Area Plan

The 2000 Central/Southern Southeast Area Plan (CSAP) directs how the ADNR will manage state uplands, tidelands, and submerged lands within the planning boundary. The Plan determines management intent, land-used designations, and management guidelines that apply to all state lands in the planning area. The project is located entirely within the USFS lands, although state lands do occupy portions of the surrounding project vicinity (ADNR, 2000).

City of Petersburg Comprehensive Plan

The purpose of the 2000 City of Petersburg Comprehensive Plan (CPCP) provides guidance to citizens and decision-makers concerning land use, growth and development, and the enhancement of the quality of life for residents and visitors to the community. Available recreation opportunities within the project vicinity are discussed in the Parks and Recreation Plan, which is designed to enhance, expand, and create cultural and recreational opportunities for the citizens of Petersburg, as well as preserve the aesthetic beauty of the community (COP, 2000). There are no specific recreation needs identified for the project area.

Draft Wrangell Comprehensive Plan

The purpose of the 2010 Draft Wrangell Comprehensive Plan (DWCP) is to guide the future growth of Wrangell. The Plan describes current conditions, reviews outstanding issues and needs, and identifies an orderly path to help achieve the desired future. While the Plan identified several recreational needs in the community, it does not identify any needs within the project area (TOW, 2010b).

3.3.6.2 Environmental Effects

Effects of Project Construction and Operation on Recreational Use

Potential project construction and operation effects on the recreational use of Swan and Falls Lake, the USFS Cabins, the Cascade Creek Trail and Thomas Bay; including associated recreational uses of sightseeing, hiking, boating, fishing, hunting, camping, and related activities, are primarily associated with the potential for temporary disruption of uses related to construction activities. Additionally, project structures and operation effects on the landscape within the project boundary may have an effect on recreation use of the area; however, the Project's Power Site classification anticipates and accommodates these effects.

Proposed Action

The proposed Project would consist of an intake structure at Swan Lake, an outlet control structure at Swan Lake at the headwaters of Cascade Creek, a power conduit consisting of a 12-foot-diameter tunnel and steel penstock, and a powerhouse located at least 200 feet back from tidewater at Thomas Bay, adjacent to the existing outfall of Cascade Creek and within a Power Site classification.

Construction activities will include ground clearing and the installation of project structures, which will have short-term effects to the visual and aural resources in the project vicinity. Construction activities such as blasting, barge traffic, vegetation clearing, and the use of heavy equipment for the installation of project facilities will change the landscape dynamic, convey increased human presence on the environment, and result in increased noise that may temporarily disrupt or degrade the recreational quality of Swan Lake, Falls Lake, Cascade Creek and Thomas Bay. These effects would be temporary.

The permanent effect of project structures on the recreation experience are predominantly associated with the changes to the visual landscape resulting from the presence of the intake structure on Swan Lake, the outlet control structure at Cascade Creek, and the powerhouse complex and tailrace near the shore of Thomas Bay. The intake and outlet control structures at Swan Lake will only be visible from particular vantage points and will generally blend in with the surrounding environment or be otherwise shielded from view by vegetation, intervening topography, or the naturalization of the structure footprint. The Project will be operated within Swan Lake's normal, seasonal lake fluctuations to avoid effects to the lake and shoreline and project structures have no overt operational aspects (no movement or sound). These structures, therefore, will have no significant effect overall on recreational uses such as boating, fishing, and hunting, which comprise the majority of recreation activity at the lake. Project operations will result in reduced flows into and lower annual average lake elevations at Falls Lake and reduced average annual flows into Cascade Creek. These effects to the hydrology of the basin may have implications to recreational use of the Cascade Creek Trail and/or Falls Lake.

Other project facilities, such as the powerhouse and power conduit and the transmission line, will likewise be relatively obscured by vegetation, topography or distance and will likely not have a significant effect on the availability of recreation opportunities in the project area and immediate vicinity, particularly given that the primary activities are consumptive activities, fishing and hunting, though some aesthetics-dependent activities popular in the area such as sightseeing and photography may experience some impact from project structures.

As discussed above, the USFS manages the lands adjacent to the project area and the immediate vicinity for Semi-Remote Recreation; the Power Site classification is the underlying land management reservation for most of the project area. The goals for Semi-Remote Recreation include natural-appearing settings, solitude, and limited development (USFS, 2008a). The primary objective for this land use area is to provide recreation and tourism use and activities to meet the levels of social encounters, on-site developments, methods of access, and visitor impacts indicated for the Semi-Primitive ROS classes (USFS, 2008a). The lands of the project area and immediately surrounding are classified as "primitive" (Swan Lake, upper Cascade Creek, northern half of Falls Lake), "semi-primitive non-motorized" (southern half of Falls Lake, lower Cascade Creek), and "roaded modified" (outfall of Cascade Creek and Thomas Bay shoreline) ROS classifications (USFS, 2009).

Swan Lake

Primitive ROS standard calls for high scenic integrity, very limited indication of human presence, and limited motorized access (USFS, 2008a). Construction activities will certainly have implications to the scenic integrity and indication of human presence, however, these effects will be temporary and timed to occur outside of the peak recreation season (May through October). They are also within the allowable activities associated with the project areas designation as a Power Site.

The Swan Lake intake will be constructed at the southwest corner of Swan Lake, just east of the existing outlet into the upper section of Lower Cascade Creek. The construction laydown area, covering less than 1 acre (Photo 3-12) will be cleared temporarily during the construction season but returned to a natural condition post-construction. While effects to aesthetics, noise, and increased human activity from construction activities associated with the intake structure and construction laydown area are expected, these effects will be temporary and limited to the construction season only. Much of the construction activity for the intake is underground, which has little effect on Swan Lake recreation. The balance of construction should be performed during one construction season.

The intake structure, once completed, will be largely encased within the mountainside, where it will serve as the beginning of the excavated power conduit. Though the structure footprint measures 260 feet long by 49 feet wide, the siphon structure will be under water and the intake works will be subterranean. As such, only the intake facility entrance, measuring approximately 49 feet wide by 25 feet high, will be visible (Photo 3-12). Consistent with the management objectives of the USFS, the intake structure entrance will be constructed to blend with the natural surroundings, to the extent possible. The intake structure entrance will be largely obscured from view from vantage points on the southern shore of the lake by vegetation and intervening topography, including the location of the USFS Swan Lake Cabin, by intervening topography. Views of the structure from other vantage points on the lake will obscure and attenuate with distance from the site.

Photo 3-12. Rendition of Swan Lake Intake Structure.

Once completed and naturalized, the intake structure will make no noise and will have no effect on water levels. Because the proposed project will not affect lake levels and will mirror the seasonal fluctuations that currently exist in Swan Lake, the intake will have no physical effect on the primary recreational pursuits of fishing and hunting. Project operation effects on recreational pursuits are discussed in further detail below.

Commercial outfitters and guides and public recreational users (boaters and pilots) who participate in recreation activities in the area were asked to evaluate the effect of the proposed intake on their use of Swan Lake. Commercial outfitter and guide respondents indicated that the shoreline of Swan Lake in the location of the proposed intake in the pre-construction condition was of “Good” to “High” visual quality (average rating of 4.6 on a scale from 1 to 5 with 1 being “Low Quality”, 3 being “Neutral” and 5 being “High Quality”), with approximately 72 percent of the commercial respondents rating the proposed intake location as “High” quality. Commercial outfitters and guides were presented with a rendition of the post-construction condition of the Swan Lake shoreline, depicting the intake structure entrance as viewed from within 100 feet of the structure. The average rating for the visual quality reported by commercial operators was 1.9 (”Fair” to “Low” quality) with approximately 58 percent of the commercial outfitters and guides rating the visual quality of the view of the intake structure entrance as “Low”, generally attributed to the preference for a more natural shoreline without man-made structures.

Respondents to the Boater/Pilot Survey likewise rated the Swan Lake shoreline as “Good” to “High” visual quality (average quality rating of 4.3) with approximately 60 percent rating the proposed intake location as “High” quality. In response to a question regarding the rating of the visual aspects of the location of the proposed intake in the post-construction rendition (see Photo 3-12), the average response was "Fair" quality (average quality rating of 2.0), with approximately 42 percent of the respondents rating it as "Low" Quality. Preferences for an undeveloped shoreline and maintaining the wilderness character were cited most often.

Approximately 58 percent of commercial outfitter and guide respondents indicated that the presence of the intake would affect their recreational use of the lake with 44 percent indicating that they would expect a decrease in patrons or that they would specifically use Swan Lake less often as a result of the presence of the intake. Among the boater/pilot respondents who indicated that they recreate in the area, approximately 38 percent indicated that they would use Swan Lake less often as a result of the presence of the intake.

As discussed in Section3.3.2*,* the Project will use lake water for power generation in a manner that maintains the natural pre-development lake level fluctuation based on historical discharge records correlated to lake elevation stage. Project operations, therefore, are not expected to affect the visual quality of Swan Lake with respect to changes in the hydrologic regime nor affect the availability of Swan Lake for on-water activities. As the Applicant will maintain lake levels within existing, seasonal fluctuations, project operations are not expected to alter participation in water-based activities at Swan Lake.

Cascade Creek

Also located within the Primitive ROS but still within the Power Site classification, the outlet structure will be constructed at the headwaters of Cascade Creek, where Swan Lake discharges into the Creek, and will control flows into Cascade Creek. The visibility of the outlet structure will be limited to a small section of the northern reach of the Cascade Creek Trail; it will not be visible from Swan Lake. In addition, the outlet structure will be relatively small and buried in native rock to blend with the surrounding environment. As with the intake structure, the outlet structure will make no mechanical noise, will have no effect on Swan Lake water levels, and will have no physical effect on the suitability of Swan Lake for fishing and hunting. As such, the overall effects to recreational use are expected to be more associated with the controlled flows into Cascade Creek than with the presence of the structure itself. The effects of controlled flows into Cascade Creek and the potential effects to recreation at the Cascade Creek Trail, Falls Lake, and to certain activities in Thomas Bay are discussed in greater detail below.

Construction of the outlet control structure at the headwaters of the lower section of the upper reach of Lower Cascade Creek would amount to a disturbance of approximately one construction season in duration. The resulting structure would be mostly buried beneath natural rock, the surrounding area would be restored and naturalized and would weather and appear mostly natural in the post-construction condition. Recreational use of Falls Lake and Cascade Creek during the construction season comprises approximately 3 percent of total annual commercial use and approximately 4 percent of total annual public use. As such, construction activities effects on the recreation setting will be minimized by timing and will be temporary.

Commercial outfitter/guide survey respondents rated the visual aspects of Cascade Creek at the outlet of Swan Lake under existing conditions as “Good” to “High” quality (average quality rating of 4.4), with approximately 63 percent rating it as “High” quality. When asked to rate the visual aspects of the Swan Lake outlet structure, based on a post construction rendition (Photo 3-13), the average response rating was 1.8 (“Fair” quality), with approximately 56 percent rating it as “Low” quality.

Preferences for a natural flow and objections to the aesthetics of a man-made structure in the natural environment were cited most often.

Photo 3-13. Rendition of Cascade Creek Outlet (After).

Respondents to the Resident Boater/Pilot survey likewise rated the visual aspects of the pre-construction condition of the outlet of Swan Lake into Cascade Creek as “Good” to “High” quality (average quality rating of 4.4), with approximately 65 percent rating the headwaters of Cascade Creek as “High” quality. The visual aspects of the Swan Lake outlet structure, based on a post construction rendition, were rated as “Fair” quality (2.0 average rating), with approximately 49 percent of boater/pilot respondents rating it as “Low” Quality. Approximately 29 percent of boater/pilot respondents rated had a neutral opinion of the visual quality of the Swan Lake outlet structure. The aesthetics of a fuller creek and maintaining the creek in its natural state were the preferences cited most often.

Approximately 69 percent of commercial outfitter and guide respondents indicated that the presence of the outlet structure would impact their recreational use of Cascade Creek. Approximately 22 percent of commercial outfitter and guide respondents indicated that they expected a decrease in patrons as a result of the structure, while approximately 9 percent indicated that they would use Cascade Creek less often as a result of the presence of the outlet structure. It should be noted that the outlet structure has undergone minor design modification since distribution of the recreation use survey. These modifications have resulted in the addition of an overflow crest gate and gate house. As negative reactions to the outlet structure were based on a preference for a natural flow, the Applicant does not anticipate that the design modification will affect survey results.

Lower Cascade Creek, which includes Falls Lake, is visible for much of its length from vantage points along the Cascade Creek Trail and from Thomas Bay, which serves as the outfall of the Creek. Currently, the flows into Cascade Creek vary and average 226 cfs annually, as measured at the Swan Lake gage and 250 cfs annually, as measured at the Thomas Bay gage. As indicated Section 3.3.2, the system is subject to extreme variations in flow overall, with a minimal recorded flow of 13 cfs during winter flows to a high of 2,460 cfs. Additionally, at lake elevations below 1511 ft, the colluvial sill at the outlet of Swan Lake results in subsurface flow passing out of sight, rather than observable surface flow. Hydrologic inputs from accretion, tributary flows, and seepage that contribute to flows released into Lower Cascade Creek from the outlet at Swan Lake may range from 75 cfs in the winter to 129 in the summer. As now designed, the outlet structure at Swan Lake will pass high flows above plant capacity and outside the ordinary high water elevation of the lake.

Project operations will result in the alteration of flow into Cascade Creek. The proposed operation will, however, closely match the seasonal timing of flows and mirror the existing hydrograph albeit at a lower level of flow. Project operations will not eliminate the cascade aesthetic along the creek with the exception of the Swan Lake outlet; a condition that occurs periodically now.

Project operations will generally reduce the elevation of Falls Lake from an average of between 37 feet and 50 feet during the peak recreation season (May through September) to between 20 feet and 37 feet. Much of the change will occur from October to January, outside of the peak recreation season, when the average elevation of Falls Lake will be reduced from the existing range of between 15 feet and 50 feet to a new range of between 15 feet and 37 feet. Winter and early spring elevations will not change dramatically over existing conditions. As existing lake access from the spur trail off of the Cascade Creek Trail may be impeded due to lower annual lake levels, the Applicant proposes existing trail upgrades including modifications of the trail to accommodate lake access at anticipated, post construction levels. Given the steep, boulder/cliff topography at Falls Lake, there will be minimal effect to overall aesthetics and none which do not occur naturally now.

Hydrologic inputs from Falls Lake are sufficient to maintain flows in the lower section of Lower Cascade Creek, though flows will be reduced on an average annual basis. At full plant operation, which is anticipated to occur approximately 33% of the year, average flows at Cascade Creek falls will range from 20 cfs in the winter months to 70 cfs in the summer months. High flow events, outside the Project's operation parameters will continue to occur, passing downstream, and providing higher flows at the falls, principally in the summer months. Accordingly the falls will still provide an aesthetic resource with seasonal differences as presently occurs. Given recreator opinions of the aesthetic quality of Cascade Cree flows discussed below, recreational use of the Cascade Creek Trail, with respect to the influence of the aesthetics of Cascade

Creek from Thomas Bay to Falls Lake, is expected to be unchanged. Attenuated flows also have the potential to provide additional creek access and viewing opportunities.

Respondents to the commercial outfitter and guide survey were asked to evaluate the potential project effect of lower flows on their use of Falls Lake and Cascade Creek. Approximately 68 percent of commercial outfitters and guides indicated that the visual quality of Cascade Creek under lower average fall flow conditions (Photo 3-15), which presents similar hydrologic conditions as expected under the proposed action, was “Good” to “High” quality (average rating of 3.9 with 42 percent indicating “High” quality). The majority of commercial outfitter/guide respondents (67 percent) indicated “No Change” when asked if they would prefer a lower or higher flow. Under average spring flow conditions (Photo 3-14), with higher water levels, similar preferences were reported. Approximately 87 percent of outfitter/guide respondents indicated higher Cascade Creek flows were of “Good” to “High” visual quality (4.6 average rating) with 77 percent indicating “No Change”.

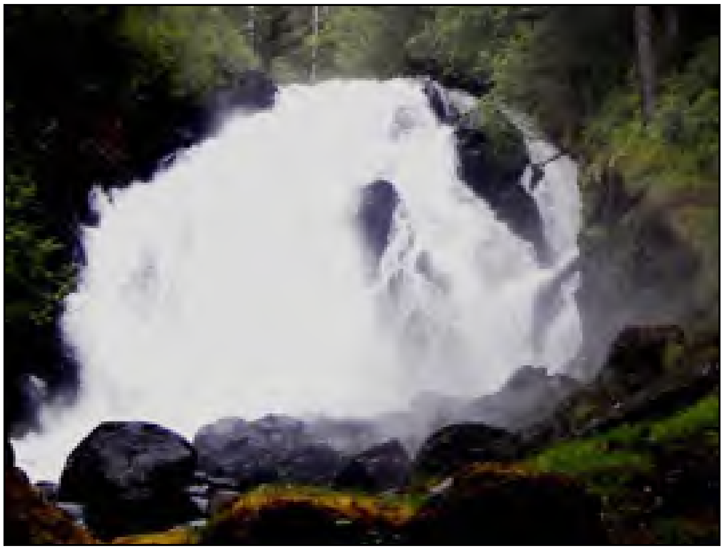


Photo 3-14. Cascade Creek Spring Flow Conditions

Photo 3-15. Cascade Creek Fall Flow Conditions

Registered boaters and pilots were asked to rate the visual aspects of the existing Cascade Creek under average spring flow conditions. Approximately 70 percent of boater/pilot respondents provided a rating of "High" quality (average rating of 4.5). When respondents were asked if they preferred flows that were higher, lower, or about the same for the existing Cascade Creek falls under average spring flow conditions, approximately 88 percent of respondents indicated that they would prefer no change. When respondents were asked to rate the visual aspects of the existing Cascade Creek under average fall conditions, the average response was "Good" quality (3.9 visual quality rating), with approximately 41 percent rating it as "High" quality and approximately 32 percent of respondents having a neutral opinion. Approximately 80 percent of respondents indicated that they preferred no change to the average fall flow condition (Kleinschmidt, 2010).

Thomas Bay

Construction of the powerhouse and appurtenant facilities and excavation of the power conduit would also take place, to the extent possible as prevailing environmental and climate conditions allow. The installation of access facilities would be constructed first. Vegetation clearing in the vicinity of the immediate shoreline will be kept to a minimum to maintain an existing vegetative buffer between the project facilities and the Thomas Bay shoreline. As much of the construction will be shielded from direct view by this vegetative buffer, direct effects of construction activities to the recreation environment through visual and auditory impacts will be somewhat lessened. Increased human activity and traffic in the vicinity of the Thomas Bay shoreline will directly affect the recreational experience for the lower portion of the Cascade Creek Trail and use of the Cascade Creek Cabin.

The new powerhouse will be set back at least 200 feet from tideline at Thomas Bay, will be fully screened from view by coniferous vegetation year-round from Thomas Bay, and will be located within the Power Site classification as well as the Roaded Modified ROS. The Power Site classification reserves the Cascade Creek drainage for power development. The ROS, as discussed above, has a very low scenic integrity objective, allows for all forms of access and motorized travel and has some development. The powerhouse design will include facility construction standards detailed in the TNF plan to ensure that its size and architecture are consistent with existing developed recreational facilities in the area. The powerhouse complex will also include staff housing and outbuildings. The powerhouse structures and landscape modifications will also include a boat dock (fixed pier/floating structure) and barge ramp, access road, and rock fill that will be used to bury the penstock. As discussed in Section 3.3.8, *Aesthetic Resources*, the dock and barge, a portion of the access road and the rock fill outfall will be visible from Thomas Bay. Because the area is mountainous, and the powerhouse will be constructed in a manner in which it will be concealed with rock and vegetation within the 200 foot setback, the powerhouse will be largely invisible from most vantage points, including from Thomas Bay. .

The tailrace will be a naturalized channel that will exit at a 90 degree angle into Thomas Bay, further screening the powerhouse from view. A fish barrier will be constructed in the tailrace approximately 100 feet from tideline in Thomas Bay. As such, only the bottom outlet of the tailrace will be visible from the Bay. A footbridge will be constructed that will traverse the tailrace just below the constructed falls providing continuity of the Cascade Creek Trail from Cascade Creek Cabin to the trailhead and providing a scenic vantage point from which to view the barrier falls and Thomas Bay.

Among the structures visible from Thomas Bay will be the dock and barge, a portion of the access road and the rock fill outfall, as well as the new tailrace discharge into Thomas Bay (Photo 3-16).

Photo 3-16. Photo-rendition of Thomas Bay Shoreline Containing Powerhouse

Photo 3-17 Photo rendition of Thomas Bay Shoreline Facing North

Photo 3-18. **Photo Rendition of Thomas Bay Shoreline Facing South**

Respondents to both surveys indicating that the recreate in the area were asked to evaluate the effects of the proposed powerhouse on their recreation experience. Approximately 75 percent of outfitter/guide respondents indicated that the proposed powerhouse was of “Fair” to “Low” visual quality, compared with 6 percent who indicated the shoreline was of “Fair” visual quality as it exists today. Approximately 72 percent of outfitter/guide respondents indicated that the presence of the powerhouse would affect their use of the area, with 30 percent indicating that they would use the area less as a result and 26 percent anticipating a decrease in patrons. Likewise, approximately 56 percent of boater/pilot respondents indicated unfavorable visual quality of the powerhouse structures with approximately 43 percent indicating they would visit less often as a result.

It is important to note that while both commercial and public recreationists would be expected to hold a negative view of development in Thomas Bay, the actual effect of the development to the overall recreational setting is nominal. The powerhouse complex will be largely screened from view from Thomas Bay by 200 feet of vegetative buffer zone. The visible structures, including the dock and ramp, will actually be smaller in footprint and less visible than USFS facilities and dock that support gravel and timber harvesting. The potential for increased use as a result of access opportunities provided by the project dock and ramp will likely offset this affect.

The proposed powerhouse design incorporates several options to mitigate for powerhouse noise resulting from operations. Operation noise will be limited to the rushing waters of the tailrace, which are likely to be auditorily appealing and in line with the sounds currently experienced at the outlet of Cascade Creek. Construction design and earth berming will limit noise off-site. Any lighting at project facilities will generally not be visible offsite due to orientation and cut-off shielding.

As the Project will take advantage of natural inflow variations, discharges into Thomas Bay from the powerhouse will generally follow the same hydrologic regime as exists currently at the existing outlet of Cascade Creek.

Other Project Facilities

The Semi-Primitive Non-motorized ROS standards have a similar aesthetic characteristic as the primitive ROS, and limited human activity, structures and motorized access facilities (USFS, 2008a), while the Roaded Modified ROS has a very low scenic integrity objective, allows for all forms of access and motorized travel and has some development (USFS, 2008a).

The approximately 3-mile-long, 12-foot-diameter tunnel complex extending from the intake at Swan Lake to the powerhouse at Thomas Bay will be subterranean until the lower tunnel portal near the powerhouse. From the lower tunnel portal, the conduit turns into a buried penstock that is concealed with rock and native vegetation so as not to disrupt the natural scenic qualities of the area. While the power conduit will traverse lands within all three ROS classifications, it will consist of an excavated tunnel and buried penstock and have no effect on recreational use of the project vicinity. Additionally, this use is acceptable under the Power Site classification.

Transmission will consist of a combination of overland and undersea cable to a point of connection at Petersburg, Alaska, approximately 20 miles to the southwest of the project site. The overland line may have the potential to be visible from some vantage points from the coastline at Thomas Bay or Frederick Sound, or from areas on the Point Agassiz Peninsula or Petersburg, but it will likely not be significant as the line installation will largely utilize existing transmission and road corridors, therefore mitigating effects to the scenic quality of the area. From Thomas Bay, the undersea cable will connect at the proposed dock and barge facility and at the location of the USFS Dock facility. In Frederick Sound, the undersea cable will connect at the Frederick Sound shoreline, just east of the Sukoi Islets, and at an existing fiber optic cable site in Petersburg. As the transmission lines will be buried sea cable or traverse existing transmission line corridors and require only limited additional clearing, the effects to recreation for landscape changes, aesthetics changes and other modifications is minimal.

Other Effects to Recreation

As discussed in Section 3.3.6, both locals and non-residents may hunt or trap brown and black bear, elk, moose, deer, mountain goat wolverine and wolf on lands within the project area and immediate vicinity. In general, these species are wide-ranging and would most likely only occur in the project area during travel or seasonal migrations. Due to the limited footprint of the proposed project facilities, there are no impacts anticipated to hunting or trapping opportunities in the project area. In addition, the Applicant is proposing to design the facilities to ensure that size and architecture are consistent with USFS land use standards and that facilities are, where possible, screened from view. These environmental measures will reduce any visual disturbance to game species that may use the project area for habitat. The Applicant will also work with the ADFG to develop construction timing and methods protocols to minimize disturbance to terrestrial species, including resident game species.

The Applicant is also proposing to develop a Recreational Use Monitoring Plan to provide periodic assessment of public and commercial use of the project area. The combination of the Recreational Use Monitoring Plan and the proposed moose and mountain goat studies, discussed in Section 3.3.6.1, will ensure that existing hunting resources in the project area are not impacted by the proposed project facilities or operation.

Irrespective of the magnitude of effects to recreational use of the localized project area, the effects to recreation activity in the project area and immediate vicinity is expected to be offset by the vast availability of other comparable recreation opportunities in the project vicinity. Should changes to the landscape within the project area and immediate vicinity from the presence of the project structures result in a decrease in recreational use at Swan Lake, Falls Lake, Cascade Creek and/or Thomas Bay (in the vicinity of the Project) or at the USFS recreation facilities provided therein, these recreators are expected to be displaced to other recreation areas and facilities generally within the project vicinity, which provides a dozen freshwater fishing sites, six trails, and six USFS cabins for public use. The surveys of commercial outfitters/guides and resident boater/pilots indicate that the project area and immediate vicinity are not among the primary destinations for recreators and commercial patrons, in comparison with other locations within the TNF. For example, over 75 percent of boater/pilot respondents indicated that they visit other recreation destinations more often or instead of project area and immediate vicinity. The most popular alternative destinations for recreation purposes were reported to be Duncan Canal, Frederick Sound, Portage Bay, Stikine River, Farragut Bay, LeConte Bay, and Wrangell Narrows; all within the same general proximity from Petersburg as the project area

As such, decreased use of the project area and immediate vicinity would likely result in increased use of in-kind facilities and other lands and waterbodies in the project vicinity. There are a number of similar high alpine lakes, USFS cabins, hunting areas, hiking trails, campsites and backcountry camping and other recreation opportunities within a 20 mile radius of the project area. Within a 20 mile radius of Petersburg, equivalent to the distance currently traveled by individuals from the community recreating in the project area, the number of recreation facilities increases substantially over that which is available within the project vicinity. Commercial operators would likely seek alternative recreation areas in similar proximity of Petersburg as the project area, rather than choose to no longer provide outfitter or guide services. Commercial recreators, therefore, would continue to solicit the services of local outfitter and guide operations for recreation activities in the project vicinity or at TNF, wilderness areas, and other recreation environments within proximity of Petersburg. Private recreators originating from Petersburg would likewise likely seek other sites within proximity rather than choose to no longer participate in recreation activities within the TNF altogether. The Applicant's proposal for an additional USFS in the project vicinity will consider potential alternative recreation destinations, providing in-kind opportunities as the project area and immediate vicinity.

Furthermore, changes to the landscape within the project area that could result in a decrease in recreational use at Swan Lake, Falls Lake, Cascade Creek and the USFS recreation facilities would likely be offset by improvements proposed by the Applicant. For example, providing a new dock facility and expanding the availability of the Cascade Creek Trail over a greater time period and a more accessible trail may increase use of this site, regardless of the presence of the proposed Project.

Given that the community of Petersburg is likely the largest economic benefactor from this use in terms of overnight accommodations, food, fuel, transportation and other expenditures. Displacing recreation use to other areas within proximity of the community of Petersburg will not change the economic impact of such use. There may be a negligible shift in economic activity from Petersburg to Wrangell should commercial and private recreators visit other areas of the TNF to the south of the project area. However, this is considered to be unlikely as Petersburg provides a variety of services not available in Wrangell.

Adequacy of Existing Recreation Facilities and the Need for Additional Facilities

This section investigates the need for any new recreation facilities and/or public access in the vicinity of the proposed Project to meet current and future (over the term of any new license) recreation demand.

<u>Proposed Action</u>

As discussed in Section 3.3.7, *Land Use*, the proposed Project is a Power Site classification overlain by the Spires Roadless Area, with no available vehicular access to recreation facilities or lands available for remote recreation in the project area and immediate vicinity. The project area and surrounding lands are accessed by private and commercial charter boat via Thomas Bay with anchorages and accessible shorelines suitable for landing small craft but no direct ferry service. There are no sites suitable for landing wheeled aircraft; however, there are helicopter landing sites available in addition to frozen lake landings, and floatplane access on Thomas Bay and several freshwater lakes, including Swan Lake (USFS, 2008b). Recreation and support facilities in the project area and immediate vicinity are primarily USFS cabins and shelter and the Cascade Creek Trail.

The USFS' Recreation Carrying Capacity Study (2009) of the PRD estimated the number of net RVDs within the "managed season of use", defined as 150 days from May through November that could be accommodated by the various recreation facilities of the project area and immediate vicinity.

Recreation estimates calculated for the 2010 Cascade Creek Recreation Study indicate that use of Swan Lake and Falls Lake and certain use of the Cascade Creek Trail currently exceed the net RVD carrying capacity for these areas (USFS, 2009b). However, USFS reported occupied days for the Cascade Creek Cabin (Table 3-12) is within approximately 10 percent of the USFS reported capacity of the cabin, while average annual occupied days of the Swan Lake Cabin is within approximately 5 percent of capacity. As such, the recreation facilities within the project area and immediate vicinity are anticipated to be used well within the design carrying capacity and are expected to accommodate additional use.

In support of recreational use of the project area, the Applicant would provide additional access/landing at Thomas Bay via the new boat dock. This dock would provide direct access to the Cascade Creek Trail and is within proximity of the Cascade Creek Cabin. In addition, the Applicant will coordinate with the USFS to determine the need for establishing a new cabin or other mitigative measures to address additional access and facilities over the term of the new license. The Applicant is also proposing improvements to the Cascade Creek Trail which would allow this trail to accommodate a greater number of individuals for longer period within the recreation season.

No Action Alternative

Under the non-action alternative, the Project would not be constructed. There would be no changes to the recreational resources of the area. Additional cabin, trail and dock facilities would not be constructed by the Applicant. Access to the project area will remain unchanged and unimproved.

3.3.6.3 Unavoidable Adverse Effects

Construction of the Project may temporarily influence recreation within the Cascade Creek/Swan Lake basin and near-shore areas of Thomas Bay, which are contained within the USFS TNF but are reserved for hydroelectric development. 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 degrade the recreational quality and aesthetic and auditory character of Thomas Bay and Patterson Delta.

In addition, project structures and operation have the potential to permanently affect recreational use of Swan Lake, Falls Lake, the Cascade Creek Trail and the southeastern reach of Thomas Bay, including USFS recreation facilities. While the previously discussed temporary effects may negatively affect use for a period of time, the project structures (e.g. dock and ramp) may provide additional mooring and shoreline access which could facilitate additional use of the trail and cabins once constructed.

3.3.7 Land Use

3.3.7.1 Affected Environment

Land Use within Project Vicinity

The Project is proposed in southeast Alaska, which consists of more than a 500-mile-long band of mainland and islands on the western edge of the North American continent. The region's southern boundary runs down the Portland Canal and westward across Dixon Entrance; the northern end of the region's boundary contains Mount St. Elias and Icy Bay. Deep channels, straits, sounds, fjords and narrows separate the main islands of the Alexander Archipelago, which are collectively known as the Inside Passage (USDC, 2006).

The southeast region is distinguished from other regions of the state by the dominant maritime rainforest, steep mountains rising 1,500 to 1,800 feet in height from the ocean, and an abundance of tidewater glaciers. The archipelago measures approximately 120 miles east to west at its widest point and has over 11,000 miles of coastline. The Island of Prince of Wales is the third largest in the United States, with only Kodiak and Hawaii being larger in size. Treeline elevations are approximately 3,000 feet in southern Southeast and 1,800 feet in the region's northern extreme (USDC, 2006).

Federal lands comprise about 95 percent of all of southeast Alaska, with about 80 percent belonging to the TNF and a predominant portion of the rest of the land belonging to GBNP and GBP. Of the lands that are part of the TNF, much of them are wild and undeveloped (USFS, 2008a). The remaining land is held in state, Native, and local community private ownerships, including the lands contained within ADNR Planning Region 1 (Petersburg) and Planning Region 3 (Sumdum-Stevens Passage), in which the lands of the project vicinity are contained (ADNR, 2000).

Approximately 20-25 Power Site classifications remain in effect on the TNF (pers. communication, Barbara Stanley, USFS, December 20, 2010). The Cascade Creek drainage is within one such classification (Figure 3-38).

Figure 3-38. Power Site Classification Lands of the Project Area

The TNF includes a narrow mainland strip of steep, rugged mountains and icefields, and over 1,000 offshore islands. As a whole, the islands and mainland comprise nearly 11,000 miles of winding shoreline, which include numerous bays and coves. A system of seaways separates the numerous islands and includes a protected waterway called the Inside Passage (USFS, 2008a).

The land surrounding the proposed Project is predominantly remote and rural, with little residential or commercial development. The area provides recreational opportunities due to its proximity to the TNF and a federal designated Wilderness Area southeast of the proposed Project (see Section 3.3.6, *Recreation.*)

The closest city to the proposed Project is Petersburg, Alaska, which had a population of 3,224 in 2000 and is located on Mitkoff Island approximately 15 miles southwest of the proposed Project (US Census, 2010). Known as the Petersburg Census Area, Petersburg and the area directly surrounding it are part of the Unorganized Borough, which the state legislature deems a governing body that oversees services such services as education, planning, and zoning (AK DCRA, 2003).

There are existing industrial operations in Thomas Bay on lands within the TNF, most notably timber extracting operations in the Muddy and lower Patterson River valleys and an active gravel transfer facility at the terminal of Thomas Bay from which barges transport gravel. Development of the gravel transfer facility was believed to have begun in 1991 and the barges transferring gravel utilize the docking facilities owned by the USFS. A Special Use Permit was issued by the USFS for the maintenance and use of the gravel transfer facility at the north end of the Thomas Bay Log Transfer Facility, which is a dual-purpose site. A Road Use Permit was also issued by the USFS for the use of Forest Development Road 6256 for the purpose of hauling mineral material as part of the gravel transfer facility (USFS, 2006 and 2007). Figure 3-39 identifies the specific location of the gravel transfer facility (ADNR 2010, USFS 2006 and 2007).

Figure 3-39. Gravel and Mining Operations in the Project Vicinity

Figure 3-40. Stand Harvest Map

Note: Harvest areas are denoted in yellow. Source: USFS, 2010g.

Land Management within the Project Vicinity

While the TNF is managed as one Administrative Area, there are nine USFS Ranger Districts, with offices in Yakutat, Juneau, Hoonah, Sitka, Petersburg, Wrangell, Thorne Bay, Craig and Ketchikan. Petersburg is the Ranger District in which the proposed Project would be located (USFS, 2008a).

As proposed and consistent with USFS directives, the Project is located within an area of the TNF identified as "reserved for hydropower" according to the USFS (USFS, 2008c). The proposed Project will be situated in Power Site Classification 9/192. The USFS acknowledges this designation and indicates the drainage is "withdrawn from other management considerations" (USFS, 2003). The Applicant proposes to work collaboratively with the USFS to develop the Project to meet operational standards and requirements but also within management objectives and TNF guidelines where feasible. Accordingly, the USFS' management of lands immediately adjacent to the project area is discussed below.

The proposed Project is also within the Spires Roadless Area 202, which is located on the mainland, from the Port Houghton drainage and Tracy Arm-Fords Terror Wilderness on the north to the Stikine-LeConte Wilderness on the south. The Roadless Area is approximately 10 air miles northeast of Petersburg, which is on the Alaska Marine Highway and has air service. The area is accessed by boat on saltwater and by floatplane on saltwater and several freshwater lakes, with anchorages available in Farragut and Thomas Bays. In addition, accessible shorelines suitable for landing small craft and floatplanes are found in both bays. While there are no sites suitable for landing wheeled aircraft, there are commercial helicopter landings for tourism activities in the ice fields of the area. There is no direct ferry service or road access to the area from outside, but there is road access from the south end of Thomas Bay at Point Agassiz to the Muddy and Patterson Rivers. Vehicles are typically transported via landing craft from Petersburg. Interior access is by foot or helicopter (USFS, 2008c).

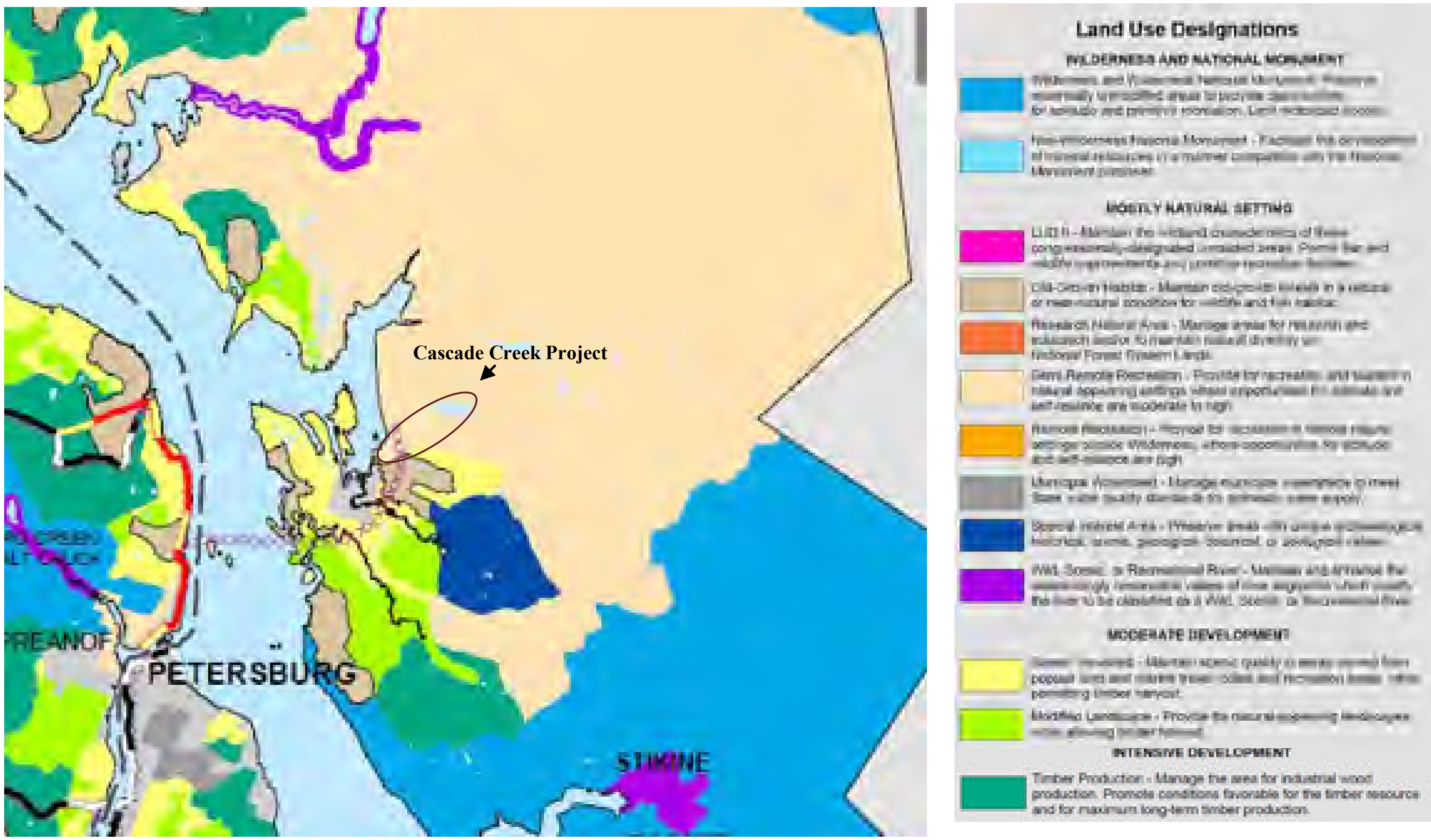
The lands of the TNF are managed under USFS' TLRMP, which outlines land allocations to LUDs for different uses as part of the TNF planning process. However, as discussed above, allocations that were congressionally designated, such as Federal Power Site Classification for Cascade Creek Project area, must be managed in accordance to the direction provided through their enabling legislation. The TLRMP provides management prescriptions for what is allowable within the area allocated to the corresponding LUD, the standards for accomplishing each activity, and the guidelines on how to implement the standards such that all activities are integrated to meet land allocation objectives (USFS, 2008a). The project vicinity, within approximately 20 miles of the project area, encompasses lands with the following USFS LUDs (Figure 3-41):

- Semi-Remote Recreation, the objective of which is to provide for recreation and tourism in natural-appearing settings where opportunities for solitude and self-reliance are moderate to high;
- Old-Growth Habitat, the objective of which is to maintain old-growth forests in a natural or near-natural condition for wildlife and fish habitat;
- Scenic Viewshed, the objective of which is to maintain scenic quality in the areas viewed from popular travel and marine travel routes and recreation areas, while permitting timber harvest;
- Modified Landscape, the objective of which is to provide for natural-appearing landscapes while allowing timber harvest.
- Timber Production – the objective of which is to maintain wood production and supply while providing recreation opportunities; and
- Wilderness – specifically the Sitkine LeConte Wilderness, Petersburg Creek/Duncan Salt Chuck Wilderness, and the Tracy Arm-Fords Terror Wilderness, which are managed to protect and perpetuate the ecological conditions of the environment and

prohibit development or alteration while allowing primitive recreation activities.

Lands on which the proposed project structures will be located are entirely within the Power Site classification with the exception of the transmission corridor on the Agassiz Peninsula. The Power Site classification precedes the current Semi-Remote Recreation LUD, which is still applicable to lands immediately adjacent to the project boundary. Lands of the proposed transmission line corridor traverse Scenic Viewshed, Old Growth Habitat, and Modified Landscape LUDs, as well as non-federal lands (USFS, 2008a).

Figure 3-41. USFS Land Use Designations in the Project Vicinity



Source: USFS, 2008c, modified

Swan Lake and Thomas Bay are both situated in the Dispersed Recreation Area, while Thomas Bay is also located in a Saltwater Use Area. The Dispersed Recreation Area is defined by the type of recreation use that requires few, if any, improvements and may occur over a large area. Such recreation includes activities related to roads, trails, and undeveloped waterways and beaches. The activities may not necessarily take place on or adjacent to a road, trail, or waterway, but would likely occur in conjunction with it. Activities are typically day-use oriented and include hunting, fishing, boating, off-highway vehicle use, and hiking. While there is no defined objective for Saltwater Use Areas, such areas are located in saltwater areas and are permitted for motorized boat and floatplane access (USFS, 2008a; USFS, 2008b).

The TLRMP also requires that all new construction be conducted in accordance with an approved site development plan in order to provide safe, functional, aesthetically pleasing, energy-efficient, and cost-effective facilities. Planning must encompass complete site development plans for all facility needs as identified in the TLRMP implementation schedule or the Forest Facility Master Plan (USFS, 2008a).

Shoreline Management

The shoreline around Swan Lake is mostly precipitous and un-vegetated, to the extent that there is no access from the Lake's west end (at the terminus of the Cascade Creek trail) to the Swan Lake cabin at the lake's east end. In areas that are not sheer cliffs, the Swan Lake shoreline is nearly vertical, except near the Upper Cascade Creek inlet. Only at the Upper Cascade Creek inlet area are there limited lower-slope areas. The stream banks of both Upper and Lower Cascade Creek are similarly steep and rocky, limiting access and movement. Lower Cascade Creek is bordered by either cliffs or near-vertical forested topography for essentially its entire route from Swan Lake to tidewater at Thomas Bay.

The primary objective of the USFS's Riparian Standards and Guidelines is to maintain riparian areas in "mostly natural conditions for fish, other aquatic life, old-growth and riparian-associated plant and wildlife species, water-related recreation, and to provide for ecosystem processes, including important aquatic and land interactions". These standards and guidelines emphasize the protection and maintenance of the ecological integrity of shoreline and shoreline forest habitats for shorebirds, other marine-associated species, and the many upland species that utilize these habitats. For lands of the project area, within the Semi-Remote LUD, the following standards and guidelines apply with respect to shoreline buffers (USFS, 2008a); however, these must be considered in the context of the Power Site classification and hydroelectric facility operational requirements.

- Maintain an approximate 1,000-foot buffer inland from mean high tide of mostly unmodified forest around all marine coastline for habitat protection and connectivity;
- Maintain an approximate 300-foot buffer of permitted in-water access development (such as docks and boat ramps) from Class 1 anadromous fish streams, or tidal or subtidal beds of aquatic vegetation;
- Designate Riparian Management Areas (RMAs) for each project where ground disturbance will occur; and
- Permit activities that do not significantly affect fish or wildlife habitat or water quality within the RMA.

The proposed project boundary will encircle Swan Lake, the intake, the power tunnel complex, transmission line, and the powerhouse and tailrace. Any related post-construction disturbances will be limited to operation and maintenance of the powerhouse and associated facilities and routine vegetation maintenance of the transmission line corridor.

3.3.7.2 Environmental Effects

Effects of Project Construction and Operation on Land Use and Management

The proposed Project will be located within the Spires Roadless Area on lands of the Semi-Remote LUD of the TNF. Because the lands within the project area are contained within the Power Site classification, it is not anticipated that the proposed Project will require any changes to the TLRMP or that the standards and guidelines of the TLRMP will necessitate significant project alternatives. Nevertheless, the effects of the proposed Project on the Semi-Remote LUD standards are discussed below.

Construction of the Project will have effects to local infrastructure and roadways. Support facilities will provide additional services, such as shoreline access. In addition, property owners adjacent to the transmission line corridor may be affected in the short-term by construction activities (i.e. noise, aesthetic alterations, waste, hazardous materials and construction debris) and in the long-term by infrastructure improvements.

Proposed Action

While it is anticipated that long-term impacts to land use will be limited, the Applicant will take measures to minimize construction effects and mitigate for unavoidable impacts of project operation. This will be accomplished through the implementation of a Soil Erosion Control Plan and monitoring; coordinating with the USFS on designing project facilities such that they are consistent with the TLRMP LUD standards (in keeping with the Power Site classification); minimizing shoreline disturbance; and re-vegetating disturbed areas not occupied by project facilities.

The lake intake siphon will be screened with earth materials and re-vegetation while the outlet structure will be buried in natural rock and cobble to minimize effects to the existing landscape of Swan Lake. Most of the power conduit will be underground through a tunnel. The penstock exiting the tunnel will be buried in rock spoils from the power conduit excavation to likewise minimize the effect of the presence of man-made facilities on the surrounding landscape. The Soil Erosion Control Plan will provide further benefits to existing land use conditions by protection shoreline erosion and effects of ground disturbing activities in the footprint of project structures and adjacent construction laydown areas.

The powerhouse will consist of a concrete and metal building embanked by rock fill on the north and east sides at least 200 feet from the marine shoreline to provide an aesthetic vegetative buffer and avoid effects to the coastal zone. Workers would construct the powerhouse, and maintain it from two proposed housing units located south of the powerhouse. These houses will be constructed in a manner consistent with the TLRMP, adhering to the natural aesthetic of the surroundings. The houses will remain after construction of the Project for use by plant operators. Water, wastewater, and waste management will be compliant with Alaska State Department of Health standards. Systems will be closed tank/containers, if onsite development is not feasible. No significant light, noise, or intrusion is anticipated for other residents due to the proposed housing's separation from other dwellings, proposed and existing vegetative screening, and earth berming of the powerhouse.

Transmission will include an undersea cable to a point of connection at Petersburg, Alaska, approximately 18 miles southwest of the project site. Overland transmission will primarily follow existing transmission line corridors with some additional clearing and improvement for connectivity. The undersea transmission line reaches will be settled in the intertidal and shallow sub-tidal zone upon installation and is anticipated to otherwise settle in and slowly become covered with sediment. Cascade anticipates working with the USCG prior to construction to determine if it is necessary to provide additional location detail to update navigation hazard mapping.

As the result of Cascade's proposal to install a submarine and overhead transmission lines, there will likely be some temporary disruption to land use during construction and installation of the transmission lines; however, these will be only negligible effects, if any, to land use in the long-term since the submarine transmission will be submerged beneath the water and the overhead transmission line will primarily utilize existing transmission line corridors. It is likely that a portion of the Thomas Bay Subdivision (Alaska State Land Survey No. 81-235), located on the Point Agassiz Peninsula, will abut the proposed transmission corridor. This will potentially serve an added benefit of providing power service to future inhabitants of the subdivisions if provided by a future utility.

Access to the project site for construction purposes will take place through the use of boat and helicopter, as the project site is not accessible by roadways. Therefore, the disruption of traffic in the project vicinity due to construction activities is not anticipated. Transportation to the project facilities by project staff (including the powerhouse and staff housing units) would be by use of construction equipment or temporarily staged vehicles on the constructed project access road which will extend from the dock/ramp facility approximately 0.6 miles to its terminus at the power conduit portal. Transportation between Wrangell and Petersburg to the project site will be by float plane, landing in Thomas Bay, or by boat.

In addition to obtaining the necessary local, state and federal permits for construction activities at the Project, a Soil Erosion Control Plan will be developed, as discussed above, which will contain plans for standard silt-fencing and rip-rap to minimize erosion and sedimentation during the interim of the construction. The Applicant is also proposing to implement and develop a Hazardous Substances Spill Prevention and Cleanup Program to prevent, reduce, and contain the release of any contaminants and monitor water quality parameters during construction.

No Action Alternative

Land uses and management would be unchanged under the no action alternative. Communities adjacent to the transmission line corridor would not realize the benefits of the availability and distribution of reliable, green power under this alternative.

3.3.7.3 Unavoidable Adverse Effects

Permanent alteration of the existing landscape will result within the footprint of the project structures. Some alteration to land uses in the shoreline area closest to the project facilities will result from staging areas that will be maintained post-construction; however, all of the changes to land-use are anticipated in the Power Site classification and all uses are consistent with this designation. There is the potential for limited erosion during construction activities. The Applicant proposes implementing previously described re-vegetation measures and BMPs outlined in the Soil Erosion Control Plan.

3.3.8 Aesthetic Resources

3.3.8.1 Affected Environment

Visual Character of the Project Vicinity

The TNF consists of a narrow mainland strip of steep, rugged mountains and icefields, and over 1,000 offshore islands. Together, the islands and mainland equal nearly 11,000 miles of winding shoreline, with numerous bays and coves. A system of seaways separate the many islands and provides a protected waterway known as the Inside Passage. With the exception of steep slopes, the area is covered with a dense growth of timber consisting of western hemlock, Sitka spruce, western red cedar, and Alaska cedar. The entire area is extremely mountainous, with numerous peaks on the Canadian border rising to more than 8,000 feet above sea level (City of Petersburg, 1985; USFS, 2008a). The landscape in the project vicinity is dominated by a maritime rainforest, with steep mountains rising 1,500 to 1,800 feet in height from the ocean, and an abundance of tidewater glaciers (USDC, 2006).

The proposed Project will be centrally located in the Power Site classification for Cascade Creek drainage which occurs adjacent to the Spires Roadless Area, just north of the Stikine-LeConte Wilderness Area (Figure 3-42). The project vicinity contains some scenic attractions of local and regional importance, most of them attributable to the TNF. In particular, Thomas Bay provides such attractions as outwash plains, buried forests, and timber management areas, as well as Baird, Patterson, and LeConte Glaciers. In addition, wildlife viewing of whales, mountain goats, moose, birds, seals, and other wildlife is a popular attraction in the area (USFS, 2002).

Figure 3-42. Tongass National Forest

Source: USFS, 2010h, modified.

There are existing, industrial operations in Thomas Bay, most notably timber extracting operations in the Muddy and lower Patterson River valleys and an active gravel pit in the southwest corner of Thomas Bay. The operations use the docking facilities owned by the USFS (USFS, 2010g) to moor and load barges that transport gravel from the pit to other locations in SE Alaska.

Management of Scenic Resources in the Project Vicinity

In its TLRMP (2008a), and as discussed above in Section 3.3.7, *Land Use*, the USFS has assigned LUDs for specific areas in the TNF in the project vicinity. The scenic integrity objectives (SIO) of the LUDs of the project vicinity provide guidance for instituting landscape architecture in projects and ensuring consistency with the scenery management objectives for that LUD. While all LUDs in the project vicinity have management goals and objectives and/or identified desired conditions relative to the scenic qualities of that particular LUD, the Scenic Viewshed LUD, in which a portion of the proposed transmission line is located, is specifically designated to:

- minimize the visibility of developments as seen from Visual Priority Routes and Use Areas (VPRUA) (discussed in further detail below),
- recognize the scenic values of lands viewed from certain roads, trails, water travel routes, recreation sites, bays, and anchorages, and
- implement forest management practices, recreation opportunities, and access consistent with a natural appearing landscape.

Lands designated as Scenic Viewshed in the project vicinity are located to the south of Swan Lake and Cascade Creek and to the west of the project area at Ruth Island, portions of the Agassiz Peninsula and the Frederick Sound shoreline north of Petersburg (see Figure 3-41 in *Land Use*) (USFS, 2008a; USFS, 2008c).

The project structures are wholly contained within the Semi-Remote Recreation LUD, discussed in Section 3.3.6, *Recreation Resources* and within *Land Use*, Section 3.3.7 and Figure 3-32. The goals of this LUD are to provide a natural or natural-appearing setting with generally minimal and rustic support facilities, and to manage use in accordance with the Semi-Primitive Recreation Opportunity Spectrum (ROS) class, which likewise supports minimal development and a generally unmodified landscape (USFS, 2008a; USFS, 2008c). The SIOs for the Semi-Remote Recreation LUD include, but are not limited to:

- design activities to be subordinate to the landscape character of the area;
- minimize amount and breadth of vegetation clearing;
- enhance views from recreational facilities;
- select materials and colors that blend with those found in the natural surroundings; and
- minimize potential scenic impacts through scheduling or timing of activities, subject to considerations given to other resources, such as wildlife.

In addition to LUDs, which have management implications to the visual characteristics of the TNF, as discussed above, the USFS's TLRMP identifies Visual Priority Routes and Use Areas (VRPUA) for the Forest. VRPUA are routes and use areas from which scenery will be emphasized from a LUD management perspective, whereby VRPUA are used to institute design guidelines and visual quality objectives for proposed projects (USFS, 2008a; USFS, 2008b; USFS, 2008c).

Visual Priority Routes are separated into several categories: Alaska Marine Highway; Tour Ship Routes; Roads; and Hiking Trails. Visual Priority Use Areas are categorized into: State Marine Parks; Recommended Wild, Scenic, and Recreational Rivers; Saltwater Use

Areas; Dispersed Recreation Areas; Communities; Forest Service Cabins; Developed Recreation Sites; and Boat Anchorages. In concert, the LUD SIOs and VRPUA list convey how scenery will be considered in project design for any given area, identifies distance zones within the LUD as visible from the VRPUAs and implements development and management standards for each of these zones to maintain the scenic integrity of the landscape from these various priority viewpoints (USFS, 2008a).

VPRUA that are within the project vicinity include Frederick Sound, Farragut River and Farragut Bay, and various Dispersed Recreation Sites, Hiking Trails, Developed Recreation Sites, USFS Cabins, as well as the communities of Petersburg, Kake and Wrangell. VPRUA adjacent to or within the project area include (USFS, 2008a):

- Thomas Bay, identified as a Saltwater Use Area, Dispersed Recreation Area, and Boat Anchorage;
- Swan Lake, identified as a Dispersed Recreation Area, and having a USFS Cabin;
- Cascade Creek, identified as having a USGS Cabin and as a Hiking Trail, and
- Falls Lake, which is identified as a Developed Recreation Site (Falls Lake Shelter).

The Recreation Areas (dispersed or developed and facilities such as trails and cabins) are defined by the type of recreation use and can require few, if any, improvements to modifications that enhance recreation opportunities and accommodate intensive recreation activities in a defined area. Because the recreation experience has a direct correlation to aesthetics, these area types have an impact on the visual quality management objectives of classified LUDs. There are no defined visual objectives for Saltwater Use Areas or Boat Anchorages but because these occur exclusively near waterbodies, these areas also typically provide visual significance (USFS, 2008a).

Visual Character of the Project Area

Thomas Bay, an arm of Frederick Sound into which several drainage basins on the mainland discharge, offers such recreation opportunities as fishing, boating, and sea kayaking, as well as scenic opportunities such as glacier watching, wildlife viewing, and birding. In addition, cruise ships utilize the Thomas Bay as a destination for vacationers, mostly from outside the southeast Alaska region (City of Petersburg, 1985). The Thomas Bay shoreline, where the powerhouse outfall will discharge, is visible from some vantage points in the project vicinity, including Thomas Bay itself as well as the Aggasiz Peninsula and Ruth Island (Photo 3-19). The Thomas Bay shoreline consists predominantly of rocky/pebbly beaches with heavy vegetation occurring in some areas and ledge (including quartz formations) occurring in other areas. While the Bay is predominantly undeveloped, there are boat anchorages used by small pleasure boats and commercial fishing boats, as well as four recreation cabins that are owned and managed by the TNF (USFS, 2008a). In addition, timber harvesting and gravel extraction sites are present in the Bay.

Below Swan Lake, Cascade Creek flows approximately 2.5 miles from the outlet of Swan Lake to tidewater. For the first three-quarter mile downstream of Swan Lake, Cascade Creek descends a series of cascades, which collectively take on the appearance of multiple waterfalls with a significant waterfall at Falls Lake. These cascades continue below Falls Lake to the lower barrier falls, approximately 400 feet upstream from the confluence of Cascade Creek and Thomas Bay.

Photo 3-19. Thomas Bay Shoreline in the Area of the Proposed Powerhouse.

Lower Cascade Creek extends from the outlet of Swan Lake to tidewater at Thomas Bay (Photo 3-20). The Lower Cascade Creek area, which is particularly steep and heavily vegetated, is inaccessible during much of the year. A 4-mile hike that encompasses Cascade Creek and leads to Falls Lake and to Swan Lake, the Cascade Creek Trail affords multiple scenic views of Cascade Creek at various sections, including clear views of the lower falls of Cascade Creek and the Creek through the canyon, as well as views of the Cosmos Range and of Petersburg and Frederick Sound at Falls Lake (GORP, 2010; USFS, 2010b; NYT, 2009; USFS, 2008a).

From the Thomas Bay shoreline, the Cascade Creek Trail begins either at the tidewater trailhead or from the USFS Cascade Creek Cabin and parallels Lower Cascade Creek for 0.25 mile to the lower falls with views of the lower falls. A bridge spans the Lower Cascade Creek approximately 0.25 mile north of the lower falls, providing panoramic views of the Creek and the Trail then continues along the opposite side of the Creek (USFS, 2010c).

Photo 3-20. View of Cascade Creek from Cascade Creek Trail (~100 yards from the beach).

The Trail continues around Falls Lake to a high bog providing views of Petersburg and Frederick Sound. This section of the trail is rugged, not well defined, and very steep. A spur trail from the Cascade Creek Trail provides access to the western shoreline of Falls Lake

(Photo 3-21). A row boat provides transportation across Falls Lake to another spur trail on the eastern shoreline that reconnects with the Cascade Creek Trail. While the landscape near Falls Lake is predominantly undeveloped and rural in nature, the TNF maintains a three-sided Adirondack shelter at Falls Lake that can be reserved and utilized by the public for overnight use for no fee. Scenery at Falls Lake consists of steep slopes containing young-growth conifers, particularly in the vicinity of the public shelter. Ledge is a predominant land form leading up to the Lake in some areas, with the primary vegetation leading to other parts of the Lake consisting predominantly of grass, moss, and brush (USFS, 2010c).

Photo 3-21. **Falls Lake (Cascade Creek Outfall)**

After passing Falls Lake, the Trail crosses another small lake providing views of cliffs and waterfalls, then follows Cascade Creek for approximately 1 mile to the trailhead at Swan Lake (USFS, 2010c). The shoreline around Swan Lake is mostly precipitous and un-vegetated, to the extent that there is no access from the Lake's west end (at the terminus of the Cascade Creek Trail) to the Swan Lake cabin at the lake's east end. Again, row boats at Swan Lake provide access across the lake to the Swan Lake Cabin.

Photo 3-22. Swan Lake Shoreline in the Location of the Proposed Intake Structure

Photo 3-23. Swan Lake Cabin and View of Swan Lake

There are no public roadways that provide direct access to the project area. The roadway closest to the project area is an existing logging road located about one mile south of a gravel pit on the Patterson Delta. Accordingly, access to the project area is primarily by boat floatplane or by foot on the Cascade Creek Trail. This trail is largely impassable from Falls Lake and above, and is therefore infrequently used (USFS, 2010c; R. Lowell, personal communication, September 29, 2010).

3.3.8.2 Environmental Effects

Effects of Project Structures on the Aesthetic Value of the Project Vicinity

Project construction activities and project structures have the potential to affect the landscape dynamic and sightseeing activities at Swan Lake, the Cascade Creek Trail, and Thomas Bay, including near shore USFS cabins from which project structures can be seen. Additional temporary effects of project construction include noise from blasting, tunneling, hauling, and construction vehicle idling, which will generally be limited to nearby areas.

The project features (intake and outlet structure at Swan Lake and powerhouse and tailrace at Thomas Bay) will permanently change the landscape and viewshed in the vicinity of the proposed structures; however, these affects are expected to attenuate with distance as the project features will be largely constructed on natural materials and/or screened from view by berming, re-vegetation, and other landscape architecture. As the transmission line corridor will largely be undersea or will follow existing overland corridors, aesthetic effects are expected to be limited to the areas of new clearing. All of these effects, both temporary and permanent are anticipated in the development of the resource under the Power Site classification.

Proposed Action

The proposed action has the potential to affect aesthetic resources within Thomas Bay, Swan Lake, Cascade Creek, Falls Lake, and vantage points surrounding the project area; however, these are within the known effects resulting from the development of the resource under the Power Site classification.

Construction activities will include ground clearing and the installation of project structures, which will have short-term effects to visual resources in the project vicinity. Once constructed, the visual effects of the Project will be limited to vantage points from which the project features can be seen, operations and maintenance of the powerhouse and associated facilities, and routine vegetation maintenance of the transmission line corridor.

Construction activities such as blasting, barge traffic, vegetation clearing, and the use of heavy equipment for the installation of project facilities will also likely create some noise that may temporarily disrupt or degrade the recreational quality and aesthetic character of Swan Lake, , Cascade Creek and Thomas Bay. These effects would be temporary and limited to the construction window.

According to the TLRMP, the project structures will be located in a LUD area dedicated to Semi-Remote Recreation, the goal of which is to provide recreation and tourism in natural-appearing settings with objectives indicated for the Semi-Primitive ROS, as discussed in greater detail in Section 3.3.6, *Recreation*, and Section 3.3.7, *Land Use*. As discussed previously, these USFS designations overlay the underlying Power Site classification. Forest-wide Standards and Guidelines include providing opportunities and programs that are appropriate to the Forest environment and dependent upon natural settings; consider the scenic condition of adjacent non-USFS lands during the planning of development activities on the TNF; and manage areas not seen from VPRUA as “non-priority” with allowable activities including recreation facilities, roads, resource extraction, and, under Special Use Permits, hydroelectric projects (USFS, 2008a, 2008c). As discussed previously, these USFS designations overlay the underlying Power Site classification. Accordingly, in instances related to project design, operation, or safety accommodation should be made for this primary designation.

The Applicant surveyed registered boaters and pilots in Petersburg, Kake, and Wrangell, in Southeast Alaska in the fall of 2010. Boaters and pilots were asked to rate visual aspects of the project area and immediate vicinity: Thomas Bay, Swan Lake, Falls Lake, and Cascade Creek (Kleinschmidt, 2010). The average response was a visual quality rating of “Good” to “High”, with 76 percent of the respondents rating the area as

"High" Quality. Respondents were also asked what they considered to be scenic attributes or detriments of Thomas Bay, Swan Lake, and Cascade Creek. Approximately 72 percent stated that the entire area was considered to be a scenic attribute, while 63 percent of respondents stated that Cascade Creek was a predominant scenic attribute of the area. Regarding the particular scenic features of the project area and vicinity, approximately 26 percent of respondents reported that mountains were a scenic feature of the area, while nearly 20 percent reported waterfalls and approximately 18 percent reported wilderness as scenic features of the area. Approximately 58 percent of respondents indicated that the visual quality of Thomas Bay, Swan Lake, Falls Lake, and Cascade Creek was "Essential" to their recreational experience.

Swan Lake Intake and Outlet Structure

The Swan Lake intake will be constructed at the southwest corner of Swan Lake, just east of the existing outlet into the upper section of Lower Cascade Creek. The construction laydown area, covering just under 1 acre, will be cleared temporarily during the construction season but returned to a natural condition post-construction. While effects to aesthetics from construction activities associated with the intake structure and construction laydown area are expected, these effects will be temporary, limited to the construction season only..

The intake structure will be largely encased within the mountainside, where it will serve as the beginning of the excavated power conduit. A 58-foot-long, 49-foot-wide, and 25-foot-high underground gatehouse will be constructed near the shore of Swan Lake and would house the intake works; the siphon structure will be underwater at a depth of 40 feet. As such, only the intake facility entrance will be visible (Photo 3-24) and will be constructed to blend with the natural surroundings, to the extent possible, and will be shielded from view from vantage points on the southern shore of Swan Lake, including the location of the USFS Swan Lake Cabin, by intervening topography. The conspicuousness of the intake structure entrance will be attenuated with distance from the structure.

Photo 3-24. Rendition of Swan Lake Intake Structure.

Respondents to the 2010 Recreation Study boater/pilot survey indicated that the location of the proposed intake as it currently exists was of "Good" to "High" visual quality, with approximately 57 percent of the respondents rating the proposed intake location as "High" quality. In response to a question regarding the rating of the visual aspects of the location of the proposed intake in the post-construction rendition (see Photo 3-24), the average response was "Fair" to "Low" quality, with approximately 40 percent of the respondents rating it as "Low" Quality. When respondents were asked why they rated the visual aspects of the post-rendition rendering the way they did, 39 percent stated that they preferred the visual aspects of the shoreline without man-made structures. As previously noted, at the time of the survey the outlet control structure did not include the current crest gate and gate house structures. As the primary objection to the structure was an expressed preference for a more natural setting, it is not expected that these modifications would greatly affect this response. The ability of the structure to now pass higher flows, may, in fact attenuate the negative responses.

Construction of the outlet control structure at the headwaters of the lower section of the upper reach of Lower Cascade Creek would amount to a disturbance of approximately two months in duration. The resulting structure would be mostly buried beneath natural rock, the surrounding area would be restored and naturalized and would weather and appear mostly natural in the post-construction condition. Because of the shoreline's steep, rocky nature and lack of vegetation at the outlet of the lake, where the flood control device will be appended, the area is generally not easily viewable from a close distance and is completely obscured at greater distances on Swan Lake. As such, there would be very little long-term visual impact or effect on the aesthetic quality of Swan Lake from the outlet structure. Though the structure will be covered with natural materials to blend with the natural surroundings, it will be visible from a vantage point off of the Cascade Creek Trail.

Photo 3-25. Rendition of Cascade Creek Outlet (After).

Respondents to the boater/pilot survey rated the visual aspects of Cascade Creek at the outlet of Swan Lake as "Good" to "High" quality, with approximately 64 percent of respondents rating it as "High" quality. In addition, respondents were asked to rate the visual aspects of the Swan Lake outlet structure (Photo 3-21). The average response was "Fair" quality, with approximately 46 percent of respondents rating it as "Low" Quality. Approximately 30 percent of respondents rated had a neutral opinion of the visual quality of the Swan Lake outlet control structure. Approximately 35 percent of respondents stated that they preferred the aesthetics of a fuller creek and 26 percent stated that they viewed the visual aspects as lessened because the creek would no longer be in its natural state.

<u>Power Conduit and Powerhouse</u>

The approximately 3-mile-long, 12-foot-diameter tunnel complex extending from the intake at Swan Lake to the powerhouse at Thomas Bay will be subterranean for much of the route or otherwise concealed with rock and native vegetation so as not to disrupt the natural scenic qualities of the area. According to the TLRMP, the power conduit, as with the intake, will be located in a LUD area dedicated to Semi-Remote Recreation (USFS, 2008a, 2008c) and will be located in the Dispersed Recreation Area VRPUA (USFS, 2008a). As discussed previously, these USFS designations overlay the underlying Power Site classification. Accordingly, in instances related to project design, operation, or safety accommodation should be made for this primary designation.

Because the area is mountainous, and the powerhouse will be constructed in a manner in which it will be concealed with rock and vegetation, the powerhouse will consequently be invisible from most vantage points, including from Thomas Bay (Photo 3-26). The powerhouse will be set back approximately 200 feet from the shoreline of Thomas Bay and will be fully screened from view by coniferous vegetation year-round from Thomas Bay. Like the Swan Lake structures, the powerhouse and outfall will be located in the Semi-Remote LUD and the Saltwater Use Area, which have no defined scenic objectives (USFS, 2008a, 2008c). While much of the shoreline of Thomas Bay is undeveloped, the proposed Project will be located in proximity of the transmission line corridor, which will encompass the USFS dock facility, which serves a gravel extraction and timber harvesting operations (Photo 3-29).

Photo 3-26. Photo-rendition of Thomas Bay Shoreline Containing Powerhouse

Photo 3-27. **Photo rendition of Thomas Bay Shoreline Facing North**

Photo 3-28. Photo Rendition of Thomas Bay Shoreline Facing South

Photo 3-29. Thomas Bay in the Vicinity of the Proposed Project

When respondents to the boater/pilot survey were asked how they would rate the visual aspects of the Thomas Bay shoreline in the vicinity of the proposed powerhouse as it exists today, the average response was generally "Good" visual quality, with approximately 56 percent of respondents rating the shoreline as "Good" to "High" quality and 36 percent of respondents having a neutral opinion of the visual quality of Thomas Bay. The average rating of the post-construction rendition of the project powerhouse (Photo 3-26) was generally "Fair". While approximately 51 percent of respondents rated the visual aspects of the location of the proposed powerhouse in the post-construction rendition as "Low" to "Fair" quality, 35 percent had a neutral opinion. When respondents were asked why they rated the visual aspects of the post-construction photograph the way that they did, 30 percent stated that they preferred an undeveloped shoreline, approximately 13 percent of respondents stated that it was due to vegetation removal, and approximately 13 percent stated that the shoreline would no longer be wilderness.

Transmission Line Corridor

Transmission will consist of a combination of overland and undersea cable to a point of connection at Petersburg, Alaska, approximately 18 miles to the southwest of the project site. The overland line may have the potential to be visible from some vantage points from the coastline at Thomas Bay or Frederick Sound, or from areas on the Point Agassiz Peninsula or Petersburg, but it will likely not be significant as the line installation will largely utilize existing transmission and road corridors, therefore mitigating effects to the scenic quality of the area. From Thomas Bay, the undersea cable will connect at the proposed dock and barge landing facility (Photo 3-29) and at the location of the USFS Dock facility (Photo 3-30). In Frederick Sound, the undersea cable will connect at the Frederick Sound shoreline, just east of the Sukoi Islets (Photo 3-31), and at an existing fiber optic cable landing site in Petersburg.

According to the TLRMP, the transmission line will be located in LUD areas dedicated to Old-Growth Habitat, Scenic Viewshed, and Modified Landscape (USFS, 2008a, 2008c).

Of particular note to aesthetic resources are those areas of the transmission line corridor that traverse the Scenic Viewshed area, which is managed according to a high foreground SIO and a moderate middle and background SIO, as seen from VPRUA; and a very low SIO in all other areas. The Scenic Viewshed area is classified for a portion of the transmission line corridor that traverses the Point Agassiz Peninsula. However, the transmission line will follow an existing corridor within this LUD and so will not affect the existing scenic integrity or the USFS SIOs of the LUD.

Photo 3-30. Transmission Line Landing at Existing USFS Dock in Thomas Bay.

Photo 3-31. Frederick Sound Shoreline Cable Connection

Effects of Project Operations on the Aesthetics Values of the Project Vicinity

As the Project will utilize flows from Swan Lake that would discharge into Cascade Creek under existing conditions, lower average flows are expected into the upper section of Lower Cascade Creek; however, these flows will still be within the range of the existing natural hydrologic regime of the creek. Visual effects of modified water flow over Cascade Creek waterfalls will be largely confined to the upper section of Lower Cascade Creek, as hydrologic inputs to Falls Lake are expected to maintain the hydrodynamics of the lower section of Lower Cascade Creek in the post-construction condition. Other effects that have sensory impacts within the project area are noise from construction and operations.

Proposed Action

The Project will withdraw lake water for power generation in a manner that maintains the natural pre-development lake level fluctuation based on historical discharge records correlated to lake elevation stage. While the project powerhouse has been designed to accommodate approximately 95 percent of the typical water year flow regime, high flows that exceed the plant capacity of 670 cfs (plus any in-stream flow requirement) would be subject to delayed release from Swan lake if capacity below the normal high water was available, and/or released via the outlet structure, if storage capacity was not available. Project operations, therefore, are not expected to affect the visual quality of Swan Lake with respect to changes in the hydrologic regime.

Project operations will result in the alteration of flow into Cascade Creek, as water that previously cascaded over the falls during high flow would be attenuated due to plant operation. The Applicant surveyed registered boaters and pilots in Petersburg, Kake, and Wrangell, in Southeast Alaska in the fall of 2010 regarding opinions of changes in average flow conditions at the Cascade Creek Falls (Kleinschmidt, 2010). Respondents were asked to rate the visual aspects of the existing Cascade Creek under average spring flow conditions. Approximately 67 percent of respondents provided a rating of “High” quality. When respondents were asked if they preferred flows that were higher, lower, or about the same for the existing Cascade Falls under average spring flow conditions, approximately 86 percent of respondents indicated that they would prefer no change. When respondents were asked to rate the visual aspects of the existing Cascade Creek under average fall conditions, the average response was ”Good” quality, with approximately 60 percent rating it as “Good” to “High” quality and approximately 35 percent of respondents having a neutral opinion. Approximately 79 percent of respondents indicated that they preferred no change to the average fall flow condition.

The Applicant's proposed powerhouse design incorporates several options to mitigate for powerhouse noise. The Applicant intends to continue to work with state and federal agencies to refine the design with these objectives during final design post-licensing. Operation noise will be limited to the rushing waters of the tailrace, which are likely to be auditorily appealing and in line with the sounds currently experienced at the outlet of Cascade Creek. Construction design and earth berming will limit noise off-site. Any lighting at project facilities will generally not be visible offsite due to orientation and cut-off shielding.

No Action Alternative

As stated above, the no action alternative would consist of the status quo and the proposed Project would not be constructed. As such, the visual qualities of the project area and views of the project area from various vantage points in the project vicinity would be unchanged.

3.3.8.3 Unavoidable Adverse Effects

Construction and operation of the Project may temporarily influence aesthetics-based recreation within the Cascade Creek/Swan Lake basin and near-shore areas of Thomas Bay. Construction activities will likely create some noise and landscape disturbance that may temporarily disrupt or degrade the recreational quality and aesthetic character of the project area and immediate vicinity.

While the project structures and operations will permanently modify the landscape of the project area, the design of the structures will be in keeping with the Power Site classification but understated and in keeping with the visual context of the surrounding environment. Once the

Project is operational, there will likely be no more or less noise than what currently exists, other than some potential faint humming from the turbines that will likely not be heard from more than 200 feet from the powerhouse. The powerhouse will be surrounded by sound-blocking vegetation. Other project-related sounds are in keeping what is currently audible now, such as rushing water from the discharge, which will not be any more or less loud or audibly pleasant or unpleasant than the Cascade Creek outflow.

3.3.9 Cultural Resources

3.3.9.1 Affected Environment

History of the Cascade Creek Project Region

Before Russian and European settlers first explored southeast Alaska, the area was inhabited by the peoples of the Tlingit and Haida tribes. The Tlingit tribe, who initially came to the region by the Nass and Stikine Rivers, established their territory along the coastline of southeast Alaska. Though their territory only reached as far as 120 miles inland, trade routes were established throughout the region by Tlingit tribal groups (AHCS, 2010). Tribal groups of the Tlingit, specifically the Talquedi Clan, once inhabited the project vicinity, utilizing Thomas Bay for the hunting and trapping of furbearers (Grover, 2010). Waterways aided the southeastern Alaska natives in the gathering of food and resource trade (USFS, 2008b). Meanwhile, the Haida Indians traveled to the area from the Queen Charlotte Islands and displaced the Tlingit in some coastal areas. Trade was established between Tlingit and Haida, with some Tlingit sailing as far as 900 miles to trade goods. Native fishes such as halibut, black cod, smelt, and salmon proved a valuable resource for these tribes. However, these resources, among others, attracted the attention of non-native traders and Euro-American explorers during the 17th and 18th centuries (AHCS, 2010).

Russian explorers were the first to actively colonize Alaska, with interests driven by the fur trade. In the late 1700's, negotiations between Russian settlers and Yakutat Bay natives took place and resulted in the establishment of Russian colonies (AHCS, 2010). Timber was harvested by Russians for the construction of ships and structures (USFS, 2008b). Furthermore, fishing gear crafted by the Tlingit and Haida tribes was prized by early explorers and traders. By 1821, Russia had claimed all of Alaska and began prohibiting non-Russian ships from coming within 100 miles of the coast. Treaties were reached with the British to allow access to southeast Alaska through Canada for the fur trade. Over time, through the declining fur trade, and clashes with natives, Russia's interest in Alaska diminished and Alaska was sold to the United States in 1867 (USFS, 2008b).

As the US began to colonize Alaska, new industries developed. In the 1800's, commercial fishing and canning became an important industry in southeast Alaska. Norwegian pioneer Peter Buschmann can be credited with the establishment of Petersburg, near the Cascade Creek Project. Along with a sawmill and a dock, the Icy Strait Packing Company was founded by Buschmann for the harvesting of halibut (PCC, 2004). The nearby Le Conte Glacier provided the ice which was used in packing the Company's product (AHCS, 2010). By 1920, 600 people lived in Petersburg year-round. Today, that number has grown to nearly 3100, and the Norwegian culture, brought to the area by Buschmann, is still evident (PCC, 2004).

Another important industry in southeast Alaska was mining. Gold mining occurred through the 1800's, up until the Great Depression and

WWII brought about mine closures. Following WWI, fox farming also became profitable for southeast Alaska. Islands were utilized for the raising of fox, typically blue fox, until the fur trade was also devastated in the 1930's with the drop in fur prices (AHCS, 2010).

While some industries in southeast Alaska waivered in the 1900s, the timber industry remained strong. In 1907, the TNF was created and combined with the Alexander Archipelago Forest Reserve in 1908. Headquartered in Ketchikan, the TNF's establishment meant federal timber sales were available to loggers. However, this also meant restrictions on the Indians, miners, fishers and cannery owners located in the newly formed National Forest. Timber production was augmented with a diversified economy when Alaska became a state in 1959 and more government employment options became available (AHCS, 2010). Just as they once did, natural resource-based industries still play an important role in the region's economy today (USFS, 2008b).

Prior Cultural Resource Investigations

Prior cultural resource investigations have been performed by the USFS, as well as several other entities. The USFS has developed a database to inventory historic resources in the TNF referred to as the INFRA, identifying sites that have been listed in the National Register of Historic Places (NRHP) and many more are deemed eligible for listing. Sacred site protection is also performed by the USFS to protect those sites that have traditional spiritual value to native Alaskan peoples (USFS, 2008b). In total, research performed as a part of the licensing has identified 18 heritage resource inventory projects that have been conducted in or near the project vicinity. Further research and consultation determined that 14 historic and prehistoric sites have been documented in or near the project area of potential effect (APE), defined as below (Greiser, 2010).

National Register of Historic Places

The Alaska SHPO was consulted extensively during cultural resources research for the Project. By email dated November 2, 2010 SHPO notes that they have no comment at this time with regards to the distributed study reports. Further, they have not yet identified NRHP sites of concern.

Area of Potential Effect

The APE for the proposed Project has been defined in accordance with the National Historic Preservation Act of 1966 (as amended) to include all lands that the proposed project construction and/or operation may affect. Accordingly, the APE includes only those lands within the project boundary. This includes Swan Lake, the intake, power conduit, powerhouse, tailrace, and transmission line with associated 50-foot buffer. For research and transmission line placement purposes, PRD Archaeologists suggested that the APE for the cultural resource inventory be extended from the mouth of Muddy River north along the intertidal area, the shore, and forest edge toward Point Agassiz. Furthermore, the APE for research purposes was expanded up to a mile-and-a-half from the Project and related features.

Cultural Resource Surveys Performed for Licensing Purposes

Heritage resources research and ethnographic research was conducted during licensing efforts. The focus of the heritage research study was to conduct a review of the Forest Service and OHA records for previously recorded heritage resources, attempt to document native use of the area through research and interviews, and review historic documents and maps for potential historic sites in the APE. The goal of the ethnographic research and interviews was to determine if known, reported, or suspected Traditional Cultural Properties or Areas may have traditional or spiritual significance for people currently living in communities such as Petersburg, Wrangell, or Kake (Greiser, 2010).

The heritage resources research was conducted in compliance with the National Historic Preservation Act of 1966, as amended, and in accordance with guidelines present in the Second Amended Programmatic Agreement among the Alaska Region of the Forest Services, the Advisory Council on Historic Preservation, and the Alaska SHPO. Research resulted in locating forms for 14 previously recorded sites in or near the project APE, from Swan Lake across Thomas Bay and the Agassiz Peninsula, both sides of Frederick Sound, and from south of Sandy Beach to the Scow Bay substation. Six of these previously recorded sites are eligible for the NRHP, with concurrence between the Forest Service and Alaska SHPO. During research proceedings and report review, data did not indicate that any shipwrecks occurred specifically in or near the project area. However, the Vessel Schcold was reported as having wrecked in an unknown location within Frederick Sound in January of 1914 (Greiser, 2010).

During ethnographic research, it was found that three sites recorded in or near the project APE and two locations considered site leads may have cultural significance to the native Tlingit peoples. Several individuals were contacted regarding potential Native use of or concerns about traditional areas of cultural practices or use in or near the Project APE. A narrative of these discussions is included within the Research Report. However, this report is considered as containing sensitive information and is only being provided to the appropriate federal agencies, state agencies, and Tribes (Greiser, 2010).

Future Cultural Resource Surveys

As stated in the cultural resource study plan prepared for the Project (Appendix C), the goal of future cultural resource studies related to the Project will be to conduct fieldwork to determine the locations of sites within or near the APE and develop ways to avoid significant sites. The inventory will relocate previously recorded sites and intensively inventory areas of high probability for previously undocumented sites. All located sites will be either updated if previously recorded or new forms will be prepared according to Forest Service and Alaska SHPO.

Tribal Consultation

The FERC sent consultation letters about the Project to the Wrangell Cooperative Association, the Organized Village of Kake, the Sealaska Heritage Institute, the Sealaska Corporation, and the Central Council Tlingit and Haida Tribes of Alaska, in Government-to-Government consultation. In addition to those points of contact, letters were also sent to the Kake Tribal Corporation, and the Petersburg Indian Association during cultural resource studies. To date, neither the FERC nor the Applicant has received any responses to their letters. In addition, Petersburg Ranger District Archaeologists supplied the Applicant's cultural resource consultants with names of local tribal members or contacts who might have knowledge of use of the area. At this time, contact has been made with several of these individuals.

3.3.9.2 Environmental Effects

Effects of the Proposed Project on Cultural Resources

Project construction and operation may have an effect on potential historic and/or archaeological properties or sites of record within the defined project APE. Likewise, construction and operations may have an effect on Native American traditional cultural properties identified within the project APE.

Proposed Action

Initial project renderings and Exhibit G maps indicate that known cultural resource sites are located outside of the project boundary; however, file reviews resulted in locating information about 14 previously recorded sites between a half-mile and a mile-and-a-half of the Project and related features. Four NRHP eligible heritage resource sites, though appearing to be located outside of the project boundary, may be located within the APE specified through the Cultural Resource Research Studies. In areas where the APE crosses private land, there is the potential for original homestead structures or foundations of those structures to exist. However, much of the area to be utilized for project construction and operation will occur on previously disturbed sites, as well as along previously disturbed road corridors, in the case of the transmission line. Quarrying and timber harvesting are also actively occurring within the project vicinity; therefore cultural resources are likely already being affected. As noted within the Research Report for historic resources, the project area has likely lost heritage resources due to past logging and land-based activities related to fishing, hunting, or homesteading, although the extent of those activities may be less than in many other areas (Greiser, 2010).

As discussed above, in order to specifically identify cultural resources that may be affected; the Applicant proposes to conduct an onsite comprehensive cultural resources assessment survey to be completed by a local, qualified consulting archaeologist. Furthermore the Applicant proposes to develop a Historic Properties Management Plan

(HPMP) and a Memorandum of Agreement (MOA) or Programmatic Agreement (PA) in consultation with state and federal agencies.

The appropriate cultural and historic resource entities, such as SHPO and affected tribes will be consulted if archeological sites or related human remains are additionally discovered during project construction or operation.

No Action Alternative

Under the no action alternative, comprehensive cultural resource studies anticipated under the proposed action would not take place. This would result in previously unidentified sites remaining undocumented unless future studies are performed by an outside party. Additionally, protections afforded through the development and implementation of a Cultural Resource Management Plan would not be realized.

3.3.9.3 Unavoidable Adverse Effects

No unavoidable adverse effects are anticipated as future inventories will serve to verify previously recorded sites with the APE and intensively inventory areas of high probability for previously undocumented sites within the APE.

3.3.10 Socioeconomic Resources

3.3.10.1 Affected Environment

The proposed Project is located on the mainland of Southeast Alaska, approximately 18 miles northeast of Petersburg, Alaska and 60 miles due north of Wrangell, Alaska in the 16.8-million-acre TNF (City of Petersburg, 1985; USFS, 2008a). Federal lands comprise about 95 percent of all of Southeast Alaska, with about 80 percent belonging to the TNF, and a predominant portion of the rest of the land belonging to GBNP and GBP. The remaining land is held in state, Native, and local community private ownerships. Of the lands that are part of the TNF, much of them are wild and undeveloped (USFS, 2008a), including those lands on which a portion of the Project is proposed.

While located within the TNF, the Project is close to the municipalities of Petersburg, Wrangell, and Kake. However, the project area is remote as there are no public roads, with the proposed Project only accessible by boat or float plane. The Marine Highway System is Southeast Alaska's predominant transportation system, which consists of a ferry system operated by the State of Alaska and which links Wrangell, Kake, and Petersburg but does not provide access to the project area (ADOT, 2010).

Socioeconomic resources associated with the proposed Project include the population centers of Petersburg, Kake, and Wrangell, with the primary contributing factors of the socioeconomic environment being population, income, tourism, development and employment. Table 3-16 provides a summary of the major socioeconomic characteristics of the affected communities.

Table 3-16. Population Statistics for the Affected Environment

	People (2000)	Percent Change Since 1990	Per Capita Income (2000)($)	Poverty Rate (1999) (%)	Labor Force (2000)	Unemployment Rate (2000) (%)
Wrangell	2,308	-6.9%	21,851	9.0	1,181	5.80%
Petersburg	3,224	+0.53%	25,827	5.0	1,703	7.30%
Kake	710	+1.4%	17,411	14.6	330	16.70%
Total	6,242	-4.97%	65,089	28.6	3,214	29.8%
Average	2,080.67	-1.66%	21,696	9.53	1,071.33	9.93%

Source: Census, 2000a; Census, 2000b; Census, 2000c; Census, 2009a; Census 2009b; Census 2009c.

Demographics and Population

The Wrangell-Petersburg Census Area, includes the three communities of the project affected environment –Wrangell, Kake and Petersburg, as well as Kupreanof, Port Alexander, Meyers Chuck, and Thomas Place – and had a population of 6,684 in 2000 (US Census, 2010). The population of the City of Petersburg, which was 3,224 in 2000, has remained stable in recent years with only 0.53 percent growth between 1990 and 2000 (Census, 2009a). Petersburg has a population density of 73.5 people/square mile with a total area of 43.86 square miles. Over 52 percent of the population of Petersburg is male (Census, 2000f). With a median age of 36.2 years, more than 29.0 percent of the population is under the age of 18. An estimated 30.6 percent of the population of Petersburg is between 25 and 44 years, 24.7 percent is between 45 and 64 years, and 8.8 percent is over the age of 64 (Census, 2000a).

The town of Wrangell, Alaska had a total population of 2,308 in 2000. The population of Wrangell decreased by 6.9 percent from 1990 to 2000 (Census, 2009b). With a total area of 24.1 square miles, the town has a population density of 51 people/square mile. Over 51 percent of the population of the town is male. The population of Wrangell is fairly evenly distributed age-wise with 29.4 percent under the age of 18, 27.2 percent between the ages of 25 and 44, 26.4 percent between 45 and 64, and less than 12 percent over the age of 64. The median age of Wrangell is 39.1 years (US Census, 2000b).

The community of Kake is a comparatively small town, with a population of 710 people in 2000, just over 53 percent of which are male. Kake grew by 1.4 percent from 1990 to 2000 (Census, 2009c). Approximately 33.8 percent of the population is under the age of 18, while 7 percent is age 65 and over. Kake covers a total area of 8.16 square miles, with a resulting population density of 87 people/square mile (Census, 2000c; Census 2000f).

The regional racial composition is predominately Caucasian, consisting of about 73 percent of the Census Area population in 2000, with American Indian and Alaska Natives comprising 16.1 percent of the Census Area population (Census, 2000d). Over 34 percent of residents of Wrangell, 36.6 percent of residents of Petersburg, and 44.4 percent of residents of Kake have a high school diploma, compared with nearly 90 percent of residents of the state of Alaska, as a whole. Nearly 10 percent of Wrangell residents, 12.5 percent of Petersburg residents, and 7.5 percent of Kake residents have a college degree. The degree attainment of Alaska residents is approximately 25 percent (Census, 2000a; Census, 2000b; Census, 2000c; Census, 2000d).

The Wrangell-Petersburg Census Area has a high rate of homeownership, compared to the state overall average, with 70.4 percent and 62.5 percent, respectively. The median home value for Kake is $92,500, 77 percent of the state median home value. Petersburg has a median home value of $175,000 and Wrangell has a median home value of $132,200, 146 percent and 111 percent of the state median home value, respectively (Census, 2000a; Census, 2000b; Census, 2000c; Census, 2000d).

In 1997, housing construction peaked in Petersburg with 45 units having been built; meanwhile, only five homes were constructed in 2000. Historically, housing construction averages at about 15 to 25 new homes being built per year. Assessed property values have remained stable, keeping pace with inflation with an increase of 2.4 percent between 1999 and 2000. As of 1999, there were approximately 1,350 dwelling units in the City of Petersburg, with another100 to 150 dwelling units existing outside city limits. From 1990 to 2000, the number of housing units has increased by 18 percent while the population has increased by only less than 1 percent. Single-family dwellings account for three quarters of Petersburg's housing (McDowell Group, 2001). In 2000, there were an estimated 408 single-family, owned-occupied houses in Wrangell; that same year, there were approximately 108 single-family, owner-occupied houses in Kake (Census, 2000b; Census, 2000c).

Table 3-17. Selected Socioeconomic Characteristics for the Affected Environment (2000)

Population	**Wrangell-Petersburg Census Area**	**Wrangell**	**Petersburg**	**Kake**	**Alaska**
Population	6,684	2,308	3,224	710	626,932
Population Density (people/sq mi)	n/a	51	73.5	87	1.1
Persons under 5 years old	6.7%	6.1%	6.6%	8.9%	7.6%
Persons 18 years and over	70.3%	70.6%	70.2%	66.2%	69.6%
Persons 65 years old and over	9.5%	11.7%	8.8%	7.0%	5.7%
Gender					
Male persons	3,477	128	1,679	377	354,893
Male, percent	52%	51.5%	52.1%	53.1%	52.1%
Race					
White persons (a)	73.0%	73.5%	81.6%	24.1%	69.3%
Black persons (a)	0.2%	0.1%	0.3%	0.3%	3.5%
American Indian and Alaska Native person (a)	16.1%	15.5%	7.2%	66.8%	15.6%
Asian persons (a)	1.6%	0.6%	2.8%	0.3%	4.0%
Persons reporting two or more races	7.8%	9.7%	6.0%	8.0%	5.4%
Persons of Hispanic or Latino origin (b)	2.0%	1.0%	2.9%	1.5%	4.1%
Education					
High school graduates, percent of persons age 25+	85.8%	34.9%	36.6%	44.4%	88.8%
Bachelor's degree or higher, pct of persons age 25+	16.3%	9.9%	12.5%	7.5%	24.7%
Households					
Single-family owner-occupied homes	1,820	626	888	151	105,620
Owner-occupied housing units, percent	70.4%	67.9%	71.6%	61.4%	62.5%
Renter-occupied housing units, percent	29.6%	32.1%	28.4%	38.6%	37.5%
Median value of owner-occupied housing units	$156,100	$132,100	$175,000	$92,500	$119,600
Persons per household	2.56	2.52	2.56	2.88	2.74

Source: Census, 2000a; Census, 2000b; Census, 2000c; Census, 2000d; Census 2000e

(a) Includes persons reporting only one race.

(b) Hispanics may be of any race, so also are included in applicable race categories.

General Economic Patterns

Historically, Alaska's economy has been predominantly resource-based, with oil development being the predominant industry in the past three decades. In addition, Alaska has also relied on federal funding for multiple purposes, which include military activities, services for Alaska Natives, and protection of federal conservation lands. While the North Slope oil that transformed Alaska's economy is declining, other industries are growing, including tourism, mining and air cargo, with fishing and timber industries in a more vulnerable position due to in part because of globalization (ISER, n.d.).

Resource-based economic sectors experienced growth in the 1970s and 1980s but slowed and began to decline in the 1990s. In the first half of the 1970s, economic growth was rapid as the result of the pipeline construction boom, as well as during the first half of the 1980s when state spending of oil revenues occurred. Consequently, job growth in this sector slowed in the 1990s when oil production and state oil revenues halted and several other industries lost jobs. During the 1970s and 1980s, the seafood industry experienced growth as the result of recovery of salmon runs, development of crab fisheries, and American boats and processors taking over foreign boats. In the 1990s, economic factors and foreign competition resulted in management changes, consolidation and the overall decline of the Alaskan seafood industry. While the timber industry experienced growth through the 1980s, by the late 1990s reduced harvest and the closing of pulp mills reduced employment by half (ISER, 2001). With the number of visitors to Alaska increasing from 39,000 in 1961 to 1.1 million in 1998, the tourism industry has increased more than any other basic industry since 1990. In addition, the mining industry in the 1990s increased when mineral production (consisting primarily of zinc) experienced a sharp increase (ISER, 2001). Southeast Alaska region experienced a similar decline in the timber and seafood industries as the result of reduced timber harvests and globalization; however, like the rest of Alaska, it has experienced an increase in tourism (ISER, 2001).

Employment and Income

In 1999, the annual per capita personal income in the Wrangell-Petersburg Census Area was $23,494, which is nearly $1,000 more than the per capita income for the state of Alaska (Table 3-18). At 7.9 percent, the Census Area has a lower than average persons-below-poverty rate with the overall state and national average (Census, 2000d).

In 1999, the per capita personal income in Petersburg was $25,827; $21,851 for Wrangell, and $17,411 for Kake. The 1999 figures for the affected environment were 114 percent, 96.4 percent and 76.8 percent of the state per capita income, respectively, which was $22,660. Wrangell and Petersburg have a lower poverty rate than the overall state average of 9.4 percent (Census, 2000a; Census, 2000b; Census, 2000c).

Table 3-18. Selected Economic Characteristics for the Affected Environment (2000)

	Wrangell-Petersburg Census Area	Wrangell	Petersburg	Kake	Alaska
Employment					
In labor force, persons 16+ years	3,406	1,711	1,703	330	361,306
Unemployment Rate	7.6%	5.8%	7.3%	16.7%	6.0%
Income					
Median household income, 1999	$46,434	$43,250	$54,934	$42,857	$51,574
Per capita money income, 1999	$23,494	$21,851	$25,827	$17,411	$22,660
Persons below poverty, percent	7.9%	9.0%	5.0%	14.6%	9.4%
Families below poverty, percent	6.1%	7.3%	3.3%	35.5%	6.7%
Industry					
Agriculture, forestry, fishing and hunting, and mining	17.9%	16.3%	19.7%	13.7%	4.9%
Construction	7.3%	9.1%	4.9%	13.7%	8.7%
Manufacturing	7.7%	7.2%	8.9%	4.0%	4.1%
Wholesale trade	0.6%	0.6%	0.4%	0.0%	2.3%
Retail trade	9.4%	8.2%	10.8%	8.9%	11.3%
Transportation and warehousing, and utilities	7.2%	7.1%	7.3%	7.7%	8.0%
Information	2.9%	2.5%	3.9%	0.0%	2.1%
Finance, insurance, real estate, and rental and leasing	1.8%	2.1%	1.6%	1.2%	4.9%
Professional, scientific, management, administrative, and waste management services	3.2%	5.7%	2.6%	0.0%	8.4%
Educational, health and social services	19.7%	22.1%	17.5%	23.2%	21.6%
Arts, entertainment, recreation, accommodation and food services	7.4%	6.4%	8.4%	6.9%	8.3%
Other services (except public administration)	5.3%	3.5%	6.3%	8.1%	4.9%
Public administration	9.5%	10.0%	7.7%	12.9%	10.6%

(Source: Census, 2000a; Census, 2000b; Census, 2000c; Census, 2000f)

During the 1990s, the City of Petersburg experienced some economic fluctuation resulting primarily from changes in the seafood and forest products industries. Between 1997 and 2000, school enrollment declined, as evidenced by a 12 percent decrease which equated to a loss of about 90 students – in part because of home schooling and because of out-migration. These population indicators show some aging of the population and out-migration of families with children. Wage and salary employment as tracked by the Alaska Department of Labor and Workforce Development has declined moderately in recent years from 1,560 in 1995 to 1,436 average annual jobs in 1999, exhibiting a loss primarily in private sector jobs (McDowell Group, 2001).

Table 3-18 provides 1999 Census data on employment sources in the affected environment and the state of Alaska. At 19.7 percent, the education, health and social services sector provides the greatest number of jobs in the Wrangell-Petersburg Census Area. The agriculture, forestry, fishing and hunting, and mining sector is also important, accounting for approximately 17.9 percent of the workforce. Arts, entertainment, recreation, accommodation and food service industries employ the sixth highest number of people. In Petersburg, the agriculture, forestry, fishing and hunting, and mining sector is the largest employment sector, employing nearly 20 percent of individuals in 1999. The education, health and social services sector provides the greatest number of jobs in Wrangell with 22.1 percent of individuals in 2000. In Kake, the education, health, and social services is the largest sector employing 23.2 percent of individuals in 1999 (Census, 2000a; Census, 2000b; Census, 2000c; Census, 2000d).

According to the City of Petersburg Economic Development Steering Committee, Icicle Seafoods, Inc. was the largest employer in the City of Petersburg in 1999, employing approximately 162 people.

Petersburg consistently ranks among the top 20 seafood ports in the country with salmon as the mainstay. Other major employers, ranked from highest to lowers according to number of employees include: the USFS, Norquest Seafoods, Inc., Petersburg School District, the City of Petersburg, Petersburg Medical Center, Ocean Beauty Seafoods, Inc., The Trading Union, Inc., Hammer & Wikan, Inc., and the ADFG. Local companies in the area provide tours and experiences for visitors including sightseeing, charter fishing, and adventure experiences.

According to the Alaska Department of Labor, the top employer in Wrangell is the City of Wrangell. Other employers, ranked from highest to lowest according to number of employees, are: Alaska Island Community Services; Wrangell Public Schools; Wrangell Medical Center; the State of Alaska (which excludes University of Alaska); City Market Inc.; Sea Level Seafoods LLC; Southeast Properties LLC, Benjamin's Store Inc.; and Trident Seafoods Corporation. The top employer in Kake is the Kake City School District. Other employers in Kake, ranked from highest to lowest according to number of employees, are: the City of Kake and the Organized Village of Kake, Kake Tribal Corporation, Southeast Alaska Regional Health Consortium, Sos Value-Mart Inc., Csc Tree Service, Kake Tribal Fuel Corporation, Rural AK Community Action Program, Tlingit Haida Regulatory Housing Authority, Gunnuk Creek Hatchery, and Icicle Seafoods Inc. (ADOL, 2010a; 2010b).

3.3.10.2 Environmental Effects

Effects of the Proposed Project on the Local Economy

Construction of the proposed Project has the potential to provide temporary job opportunities in the construction and support sectors during the construction window. Permanent job opportunities would be created by the need for on-site staff to actively run and manage the facility.

Proposed Action

The proposed action and associated PME measures will contribute to the local tax base, and construction of the facility will result in construction-related labor drawing from Southeastern Alaska.

The proposed Project will also generate electrical energy for approximately 31,000 homes without burning fossil fuels, creating solid wastes, discharging wastewater, or air emissions. There will also be benefits associated with the distributed generation of electricity in the event of major power failures because the electricity generated by this facility could provide emergency power for the local community in such an event. Petersburg would be able to discontinue use of its diesel generating plant as back-up power, and save an estimated $20 million in planned relocation of the diesel powerplant. This Project would provide the backup generation in the event the Southeast Intertie to the south of Petersburg were to fail. The Project will help reduce the dependence on foreign fossil fuels.

The Project would bring certain economic benefits to the region, both from construction and operation-related employment, and from generation revenue sharing among the project participants. The Project would result in a workforce estimated to be as great as 200 workers, which would be employed over a three-year timeframe to complete initial construction of the generation facilities and the transmission segment.

The total workforce income could be as high as $80 million for the construction part of the Project. A smaller workforce would remain onsite for approximately two years during Project startup and validation. Subsequently, a workforce of approximately four would be necessary for routine operations, and an additional workforce of ten would be seasonally employed in routine operations and maintenance.

It is not expected that construction or operation of the Project would result in any significant long-term increase in the populations of Petersburg or other nearby settlements. Socioeconomic benefits to southeast Alaska participants include overall reduction in greenhouse gases; contribution to national energy independence; stable energy rates; increased employment in an economically depressed region; and potential benefits to communities currently not currently connected to the SE Intertie grid.

Effects of the Proposed Project Operations on Recreation and Tourism-Based Business

The socioeconomic resources in the project vicinity are affected by the recreation and tourism industry that exists within the TNF Thomas Bay. Any proposed action that modifies recreational use of the project area or affects regional tourism in the immediate vicinity of the proposed Project has the potential to affect the socioeconomic resources of the local community of Petersburg and, to a lesser degree, the communities of Wrangell and Kake. Decreased visitation by commercial operators and private recreationists could result from the effects of construction and the presence of project facilities. Likewise, new access facilities and recreation amenities could have socioeconomic benefits if they contribute to recreational use of the project area and immediate vicinity.

<u>Proposed Action</u>

Construction and operation of the Project may temporarily influence recreation within the Cascade Creek/Swan Lake basin and near-shore areas of Thomas Bay. Construction activities such as blasting, barge traffic, vegetation clearing, and the use of heavy equipment for the installation of project facilities will likely create noise and landscape disturbance that may temporarily disrupt or degrade the recreational quality and aesthetic character of Thomas Bay and the project area. However, these effects will be limited to the construction season.

Project operation has the potential to affect recreational use of Swan Lake, Falls Lake, the Cascade Creek Trail, and Thomas Bay, including USFS recreation facilities. Development of additional or improved facilities as part of the Proposed Project could enhance visitor use of the area. This could have subsequent, secondary socioeconomics benefits for local communities.

For Swan Lake, the proposed action would result in a lake level regime that corresponds to existing lake levels. As such, project operations would not be expected to alter participation in water-based activities. Project structures at Swan Lake will only be visible from particular vantage points and will blend in with the surrounding environment or be shielded from view by vegetation, intervening topography, or the naturalization of the structure footprint. As such, project features at Swan Lake are not expected to have an effect on recreational uses such as boating, fishing, and hunting, which comprise the majority of recreation activity at the lake. Other project facilities, such as the powerhouse and t transmission line, will likewise be obscured by vegetation, topography or distance and will likely not have an effect on recreational use of the area.

Any effects to socioeconomic resources of Petersburg and the surrounding communities likely would be positive in both the short and long-term due to construction, operation and the provision of power. Changes to the landscape within the project area that could result in a decrease in recreational use at Swan Lake, Falls Lake, Cascade Creek and the USFS recreation facilities would be offset by improvements proposed by the Applicant.

Additionally, as discussed in Section 3.36, there are a number of similar high alpine lakes, USFS cabins, hunting area, hiking trails, backcountry camping and other recreation opportunities within a 20 mile radius of the project area. Within a 20 mile radius of Petersburg, which is equivalent to the distance currently traveled by individuals from the community recreating on or directly adjacent to the project area, the number of recreation facilities increases substantially. Commercial and private recreationists would likely seek alternative recreation areas in proximity to Petersburg. They would continue to solicit local outfitter or guide services.

Petersburg is likely the largest economic benefactor from recreational use of the area in terms of overnight accommodations, food, fuel, transportation and other expenditures. Any displacement of recreational use to other areas within proximity of Petersburg will not change the economic impact of such use. Should commercial and private recreationists visit other areas of the TNF to the south of the project area as a result of project development there may be a negligible shift in economic activity from Petersburg to Wrangell. This is considered unlikely given that Petersburg provides a variety of services not available in Wrangell.

No Action Alternative

Under the no action alternative, the socioeconomics of this area will continue to depend on fossil fuels for energy. The area would not receive the benefits of temporary construction, long-term operation of the facility and improvements proposed by the Applicant.

3.3.10.3 Unavoidable Adverse Effects

None identified.

4.0 DEVELOPMENTAL ANALYSIS

4.1 Power and Economic Benefits

The proposed Project would have an installed capacity of 70 MW. The Applicant expects that the average annual generation of the Project would be around 204,600 MWh. The purpose of this Project is to generate energy for sale to meet the regional energy needs to offset the need to generate energy using diesel-fueled generation. The proposed Project would operate within the natural fluctuations of Swan Lake, with some minor flexibility. The Project will withdraw lake water for power generation in a manner that maintains the natural pre-development lake level fluctuation based on historical discharge records correlated to lake elevation stage.

For the proposed Project to be economically beneficial, the estimated current cost of the project would have to be less than the current cost of alternative energy from any other sources available that can supply the regional energy needs.

An economic analysis comparing the proposed project and the diesel alternative has been prepared. The cost to construct the project is estimated at $147.9 million. Total capital requirements, including financing charges, are estimated at $188.4 million. Annual Operation and Maintenance costs are estimated to be $2.9 million.

For the diesel alternative, the Applicant assumed additional diesel units would be installed to satisfy the projected deficit in regional energy needs. The total cost of energy from a diesel fueled powerplant was estimated to be $350/MWh.

The expected 30-year levalized energy cost (LEC) of building and operating the proposed project, based on an 8 percent discount rate, would be $102.9/MWh. The expected 30-year LEC of generating an equivalent amount of diesel fueled electricity, based on an 8 percent discount rate, would be about $350/MWh. The diesel analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the Project's power benefits.

A summary of the overall economics of the proposed action and the no action alternative are described below in Table 4-1.

4.1.1 Proposed Action

Under the proposed action, the Project would be constructed and would subsequently generate an average of 204,600 MWh of electricity annually. The annual power value of the project, based on producing an equivalent amount of diesel-fueled power, would be $71.6 million ($350/MWh). The annual cost of power generated by the project, based on the 30-year LEC, would be $21.1 million ($102.9/MWh). Therefore, the average annual net benefit of the project is $50.5 million ($247.1/MWh).

Table 4-1. Summary of the annual cost, power benefits, and annual net benefits for the Cascade Creek Project.

	Proposed Action	No Action
Installed Capacity (MW)	70	0
Annual Generation (MWh)	204,600	0
Annual Power Value	$71.6 million	$0
($/MWh and mills/kWh)	($350)	$0
Annual Cost	$21.1 million	$0
($/MWh and mills/kWh)	($102.9)	$0
Annual Net Benefit	$50.5 million	$0
($/MWh and mills/kWh)	($247.1)	$0

4.1.2 No-Action Alternative

Under the no action alternative, the Project would not be constructed and would produce no electricity. There would be neither an LEC value of the Project nor annual costs, resulting in no average annual net benefit.

4.1.3 Cost of Environmental Measures

Table 4-2 gives the cost of the environmental measures proposed for the Project. All costs have been converted to equal annual (levelized) values over a 50-year license period to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4-2. Estimated capital, annual, and levelized costs for proposed PM&E measures.

Proposed Mitigation Measures	Capital Cost $k	Annual Cost $k	Levelized Annual Cost $k
Visual			
Undersea cable in Thomas Bay vs. overhead construction	$ 2,200	$ -	$ 44
200-ft powerhouse setback from Thomas Bay vs. at tidewate	$ 200	$ -	$ 4
Marine access at powerhouse vs. access road	$ -	$ -	$ -
Underground tunnel vs. buried penstock	$ 10,000	$ -	$ 200
Underground siphon house vs. building structure	$ 100	$ -	$ 2
Recreation			
Construct new cabin	$ 90	$ -	$ 2
Provide trail upgrades at Falls Lake	$ 75	$ -	$ 2
Marine dock access to Public	$ -	$ -	$ -
Recreational Use Monitoring Program	$ -	$ 5	$ 5
Wildlife			
Wildlife Avoidance Program	$ 15	$ 1	$ 1
Avian Protection Program	$ 35	$ 5	$ 6
Bear Safety Program	$ 10	$ 1	$ 1
Fisheries			
Water Management and Operation Plan	$ 1,100	$ 10	$ 32
Post-Construction Fisheries Monitoring Plan	$ 15	$ 10	$ 10
Anadramous fish tailrace barrier falls	$ 15	$ -	$ 0
Historic Properties			
Historic Properties Management Plan	$ 35	$ 3	$ 4
Mitigation during Construction			
Erosion and Sediment Control Plan	$ 200	$ 8	$ 12
Revegatation Plan	$ 80	$ 5	$ 7
Hazardous Substances Spill Prevention and Cleanup Program	$ 15	$ -	$ 0
Noxious Weed Control Program	$ 15	$ -	$ 0
Construction Timing Protocals	$ 15	$ -	$ 0
Environmental Compliance Monitor	$ 250	$ -	$ 5
Total Proposed Mitigation Measures	**$14,465**	**$ 48**	**$ 337**

5.0 CONCLUSIONS AND RECOMMENDATIONS

Sections 4(e) and 10(a)(1) of the FPA require FERC to give equal consideration to all uses of the waterway on which a project is located, including recreation, fish, wildlife and other non-developmental values as well as generation. In deciding whether, and under what conditions, a hydropower license should be issued, FERC must weigh the various economic and environmental tradeoffs involved in that decision. This section compares the developmental and non-developmental effects of the proposed action and the no-action alternative.

5.1 Comparison of Effects of the Proposed Action and Alternatives

As discussed extensively throughout this document, the proposed action includes construction and operation of the proposed Cascade Creek hydroelectric facility, as well as a number of PME measures to protect and enhance the human and natural environment. The no action alternative continues the status quo, whereby the proposed Project would not be constructed and the benefits of Project development are not received.

Table 5-1 provides a comparison of the developmental and non-developmental effects of the proposed action and the no action alternative.

Table 5-1. Comparison of alternatives

Issue	**No action Alternative**	**Proposed Action**
Generation	0 MWh	204,600 MWh
Geology and Soils	No resources would be affected because the Project would not be constructed	Temporary impacts to soils will be primarily the result of construction activities and movement of equipment. Impacts related to soil erosion and sedimentation would be limited by implementing proper sediment and erosion control techniques through the Soil Erosion Control Plan.
Water Quantity and Quality	Flows and temperatures within Swan Lake and Cascade Creek would remain at their current levels because the Project would not be constructed.	The Project would be operated essentially with lake withdraws maintaining natural lake-level fluctuations. Reduced average annual flows would be limited to Lower Cascade Creek and would be within the natural hydrologic range. Temporary, construction related impacts may temporarily increase turbidity and sedimentation. A Soil Erosion Control Plan would be implemented to minimize effects to water quality. The Hazardous Substances Spill Prevention and Cleanup Program will likewise reduce effects to water quality. Streaming gage sites are installed and will be maintained for a period of time sufficient to collect water quantity data to determine natural resource management stream flow and hydropower operational parameters.

Issue	**No action Alternative**	**Proposed Action**
Aquatic Resources	No resources would be affected because the Project would not be constructed	A temporary drawdown of Swan Lake will be required for construction of the intake system with no effect on Rainbow Trout spawning because the drawdown would be outside of spawning months. Normal project operations are not anticipated to affect spawning habitat as lake drawdown will follow natural patterns. Cascade Creek and Falls Creek may experience temporary flow reductions during construction and during seasonal fluctuation patterns. No long-term effects on aquatic resources are anticipated. A natural barrier falls will be constructed at the outlet of the tailrace into Thomas Bay to prevent entrance by anadromous fish. The Fisheries Management Plan will outline post-licensing studies and enhancement measures for the benefit of fisheries resources.

Issue	No action Alternative	Proposed Action
Terrestrial Resources	No resources would be affected because the Project would not be constructed.	Temporary construction related effects on upland and riparian habitats. Permanent alteration of upland habitat in the footprint of project structures and within the limited extension of the existing transmission line corridor. Re-vegetation of disturbed areas and a 200 foot shoreline buffer will mitigate for effects to habitats. Species specific protection measures will be put in place to mitigate any permanent impacts on wildlife found in the Project vicinity that may be adversely affected by transmission lines and project facilities, including raptor safety protection measures, nesting platforms, and noxious weed control programs.

Issue	No action Alternative	Proposed Action
Recreation/Aesthetics	No resources would be affected because the Project would not be constructed.	New access facilities created for construction, such as a dock, will be left in place to provide for additional public access for recreational use. New recreation facilities (USFS cabin) and trail upgrades will be constructed to mitigate for effects to recreational use of the project area. Construction related activities could have a temporary effect on recreation and aesthetics in the project vicinity. Permanent effects to visual aesthetics and recreation will be mitigated with re-vegetation plans around project facilities. Vegetation screens will be used around the powerhouse and power tunnel structures.
Cultural Resources	No resources would be affected because the Project would not be constructed	Potential cultural resources may be affected within the project area. An HPMP will be developed for any identified sensitive cultural sites.

5.1.1 Comprehensive Development and Recommended Alternative

[To be completed following agency review]

5.1.2 Unavoidable Adverse Impacts

Unavoidable adverse effects related to project construction, project facilities and project operations, as proposed, include:

- Temporary increase in sedimentation and erosion related to earth moving activities in the project facility footprints, construction laydown areas, and transmission line corridor (including the footprint of the submerged cable), resulting in the potential for short-term impacts to water quality and aquatic species.
- Permanent effects to the underlying bedrock features within the footprint of the power conduit and power house and permanent alteration of terrestrial and aquatic habitats in the footprint of project structures and new clearing necessary for the transmission line extension, including areas used by RTE species or species of special concern or sensitive species.
- Seasonal changes to inflow delivery from Swan Lake to Lower Cascade Creek and, subsequently, to Falls Lake.
- Entrainment of non-native trout inhabiting Swan Lake may occur as a result of the construction of the Project.
- Temporary effects to recreation from construction activities including noise, landscape disturbance, and viewshed changes and the potential for project structures, alterations, and operations to permanently influence aesthetics-based recreation within the Cascade Creek/Swan Lake basin and near-shore areas of Thomas Bay.

5.1.3 Recommendations of Fish and Wildlife Agencies

[To be completed following agency review]

5.2 Consistency with Comprehensive Plans

Section 10(a)(2) of the FPA, 16 USC., § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. FERC has identified several plans relevant to the Cascade Creek Project that meet the criteria established under the Federal Power Act (FPA) for a comprehensive plan to improve, develop, or conserve a waterway. These plans include plans prepared by federal resource agencies and the State of Alaska, which collectively provide a general assessment of a variety of environmental conditions in the state, including water quality, water pollution control, wetlands, recreation, instream flows, and land management, and lists the comprehensive plans identified by FERC.

Table 5-2. List of qualifying Federal and state or tribal comprehensive waterway plans potentially relevant to the Cascade Creek Project (FERC Revised List of Comprehensive Plans, July, 2010).

RESOURCE	COMPREHENSIVE PLAN
Land Use	US Department of Interior. 1920. Cascade Creek and Thomas Bay Powersite Classification. August 1920. Anchorage, Alaska.
Fisheries	Alaska Department of Fish and Game. 1998. Catalog of waters important for spawning, rearing or migration of anadromous fishes. November 1998. Juneau, Alaska. Six volumes.
Fisheries	Alaska Department of Fish and Game. 1998. Atlas to the catalog of waters important for spawning, rearing or migration of anadromous fishes. November 1998. Juneau, Alaska. Six volumes.
Recreation	Alaska Department of Natural Resources. 2004. Alaska's Outdoor Legacy: Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2004-2009. Juneau, Alaska. July 2004.
Land Use	Alaska Department of Natural Resources. 2000. Central/Southern Southeast Area Plan. Adopted November 2000.
Land Use, Recreation, Aesthetics, Fish and Aquatic Resources, Terrestrial Resources	Forest Service. 2008. Tongass National Forest land and resource management plan. Department of Agriculture, Ketchikan, Alaska. January 2008.
Recreation, Fish Resources	US Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S.US Fish and Wildlife Service. Washington, DC.

Cascade Creek reviewed the following comprehensive plans that are applicable to the proposed Project, located in Alaska.

US Department of Interior. 1920. Cascade Creek and Thomas Bay Powersite Classification. August 1920. Anchorage, Alaska.

Under and pursuant to the provisions of the Act of Congress approved March 3, 1875 (20 Stat. 394), the DOI classified certain lands of Thomas Bay and Cascade Creek as powersites. The powersite classification designates those lands as suitable for future hydropower development. The location of the proposed Project is included in TNF's

Powersite Classification No. 9. The lands included in the No. 9 site are those below the 1,650 foot contour above sea level which drain into Swan Lake, located in the Cascade Creek Basin about 2.5 miles inland from the east shore of Thomas Bay. In addition, all lands south of Cascade Creek within 1 mile of the middle of Cascade Creek, and all lands north of Cascade Creek within 1/8 of a mile of the middle of Cascade Creek, extending from Swan Lake to the shore of Thomas Bay.

Alaska Department of Fish and Game. 1998. Catalog of waters important for spawning, rearing or migration of anadromous fishes. November 1998. Juneau, Alaska. Six volumes.

Established in 1982 by the Joint Boards of Fisheries and Game, the Anadromous Waters Catalog is divided into six volumes corresponding to Alaska's six fish and game resource management regions (Arctic, Interior, Western, Southwestern, Southcentral, Southeastern). The Catalog consists of a numerically ordered list of the water bodies documented as used by anadromous fish. It also lists the quad map, latitude, longitude and legal description of the mouth and upper known extent of anadromous fish use for each specified water body. The Catalog, as with the Atlas, specifies which streams, rivers and lakes are important to anadromous fish species and therefore afforded protection under AS 16.05.871. Water bodies that are not specified within the Catalog and Atlas are accordingly not afforded protection under AS 16.05.871.

According to the Catalog, the following species have been recorded in the following water bodies associated with the proposed Project. The catalog is not consistent with species present in respective waterbodies.

<u>Cascade Creek</u>

Sitka Map A-5: Chum Salmon, present (CHp); Coho Salmon, present (COp); Pink Salmon, present (Pp).

Ketchikan Map A-5: Chum Salmon, rearing (CHp); Pink Salmon, present (Pp).

Swan Lake

Skagway Map B-3: Coho Salmon, rearing (COr); Steelhead Trout, rearing (SHr).

Falls Lake

Petersburg Map A-2: Chum Salmon, present (CHp); Coho Salmon (COp); Pink Salmon, present (Pp); Dolly Varden, present (DVp).

The proposed Project is in compliance with the goals and objectives of the Catalog. Fishery resources are discussed in greater detail within Section 3.3.3, *Fish and Aquatic Resources*.

Alaska Department of Fish and Game. 1998. Atlas to the catalog of waters important for spawning, rearing or migration of anadromous fishes. November 1998. Juneau, Alaska. Six volumes.

The Atlas to the Catalog consist of a compilation of topographic maps that cartographically shows the location, name, and number of specified anadromous fish-bearing water bodies, the anadromous fish species using these water bodies, and the fish life history phases for which the water bodies are used, to the extent that they are known. The pertinent data files for the Atlas associated with the proposed Project have been reviewed, and the proposed Project is in compliance with the Atlas.

Alaska Department of Natural Resources. 2004. Alaska's Outdoor Legacy: Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2004-2009. Juneau, Alaska. July 2004.

A plan that was developed with cooperation between the Alaska State Parks, and local, state, and federal outdoor recreation professionals, interest groups, and the public, the Alaska SCORP provides an overview of outdoor recreation that is considered an essential part of the Alaska lifestyle. The primary objectives that are identified in the plan include developing a secure funding base for outdoor recreation and maintenance, expanding recreation opportunities on public lands, improving access to recreation resources, and accommodating close-to-home recreation needs. The plan has been reviewed, and the proposed Project is in compliance with objectives and goals of the SCORP.

Alaska Department of Natural Resources. 2000. Central/Southern Southeast Area Plan. Adopted November 2000.

The Central/Southern Southeast Area Plan (CSAP) directs how the Alaska Division of Natural Resources (ADNR) will manage state uplands, tidelands, and submerged lands within the planning boundary. The plan determines management intent, land-use designations, and management guidelines that apply to all state lands in the planning area. The Project is located entirely within the USFS lands, although state lands do occupy portions of the surrounding area.

Forest Service. 2008. Tongass National Forest land and resource management plan. Department of Agriculture, Ketchikan, Alaska. January 2008.

This plan provides guidelines and standards for all natural resource management activities at TNF. It specifically describes resource management practices, levels of resource production and management, and the availability and suitability of lands for different kinds of resource management. The plan has been reviewed, and the proposed Project is consistent with the goals of the Plan.

US Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the US Fish and Wildlife Service. Washington, DC.

This policy, endorsed by the USFWS, promotes the enhancement of fishery resources in the United States through PME measures, among others. This comprehensive plan outlines broad and generic goals for the entire nation (i.e. improvement of recreational fisheries opportunities nationwide). Swan Lake and Thomas Bay provide recreational fisheries opportunities. The USFS and ADFG manage this recreational fisheries resource. The Applicant has assessed recreational activities including fishing at the waters of the proposed Project. Public access to Swan Lake and

Thomas Bay and recreational fisheries opportunities will continue to be provided over the term of any license issued for the Project. As such, the proposed Project is in compliance with this policy.

6.0 FINDING OF NO SIGNIFICANT IMPACT

This is a FERC staff finding, and not applicable to this PDEA.

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APPENDIX A

FEDERAL POWER RESERVE DOCUMENTATION

APPENDIX B

STUDY PLANS

APPENDIX C

STUDY REPORTS

APPENDIX D

COMMUNICATIONS PROTOCOL

APPENDIX E

CONSULTATION RECORD