

FINAL VEGETATION INVESTIGATIONS REPORT FOR 2008

Blue Lake Hydroelectric Project FERC No. 2230 Expansion

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Executive Summary

The objectives of this study were to determine the botanical resources of the proposed inundation zone. Botanical resources were considered in two categories: 1) Tongass National Forest sensitive plant species, AKNHP vascular plant tracking list and species of concern 2) a baseline general vegetation survey of existing plants and vegetation. Methods included a literature review and field surveys. All work was conducted in the summer and fall of 2008. No plant species currently included on the Region 10 Sensitive plant list were found within the project area. One species considered a rare plant on the Tongass National Forest, *Papaver radicum* or *radicum ssp. alaskanum*, and two species on the AKNHP list, *Mimulus lewisii* and *Polystichum setigerum*, were found within the project area. General vegetation within the Blue Lake Project area was categorized as the following broad types: Hemlock-Spruce dominated forest; Forested muskeg; Alder dominated recurrent slides; Deciduous tree and shrub dominated or species rich herb dominated riparian areas.

INTRODUCTION

This report documents the results of plant surveys conducted from June 2008 to August 2008, as part of the Biological evaluation of terrestrial resources for expansion of the Blue Lake Hydroelectric facilities by the City and Borough of Sitka's Blue Lake hydroelectric project (FERC No. 2230). Expansion of the hydroelectric facilities requires an environmental data base sufficient to allow FERC, as lead agency under the National Environmental Policy Act to evaluate existing environments, potential impacts, and mitigation measures associated with reauthorization of the project. The focal objective of this study was to inventory and document plant species present in the project area. This report includes descriptions of the study area, methods and results of surveys to date.

BACKGROUND

The City and Borough of Sitka Electric Department (City) recently received a new license for the Blue Lake hydroelectric Project (FERC No. 2230, "Project") from the

Federal Energy Regulatory Commission (FERC). During the relicensing process, the City's ongoing energy forecasts indicated that, in order to assure continued delivery of low cost electrical power in the face of rising energy needs and fuel costs in Sitka, it must expand its hydroelectric generating base.

Among other alternatives, the City is examining 1) installing a third generating turbine near the existing Blue Lake Project powerhouse; and 2) raising the height of Project dam. Raising the Blue lake dam will inundate area around Blue Lake up to 80ft above the current high water mark and significant area in the Blue Lake creek drainage.

STUDY AREA

Plant surveys during the summer of 2008 were conducted in the projected flood zone around Blue Lake and eastward up the Blue Lake Creek valley (Figure 1). The projected flood zone is approximately 80ft above the current high water mark around Blue Lake reservoir. The flood zone includes up to 430 acres of National Forest lands.

METHODS

Pre-field review for Sensitive plants

Prior to field work in the Blue Lake watershed, the Region 10 USDA Forest Service Sensitive plant list was obtained from the Regional Botanist. Additionally USDA Forest Service surveys for Sensitive plants and species of concern from the Blue Lake Watershed and immediate area were obtained and reviewed. Sensitive plant surveys from areas of similar habitat on Baranof Island were also obtained from the USDA Forest Service. Not all species included on the Region 10 list that occur on the Tongass are likely to occur within the Blue Lake project area, the plant reports were used to prepare a list of the most likely Sensitive species to occur within the project area. The surveys consulted are listed in Table 3.

The Alaska Natural Heritage Program, Environmental and Natural Resources Institute affiliated with the college of Arts and Sciences of the University of Alaska, Anchorage. The institute serves as a clearinghouse for information about species of conservation concern in Alaska. The Alaska Natural Heritage Program maintains a statewide Vascular Plant Tracking List (last updated April 2008) which is available online http://aknhp.uaa.alaska.edu/botany/Botany_tracking_page.htm. The AKNHP tracking list includes vascular plants that the Alaska Natural Heritage Program considers rare within Alaska. The list of plants included on the list occurring in Southeast Alaska is included in Appendix 1.

Although many of the plants tracked by the Alaska Natural Heritage Program do not meet the criteria for the Region 10 Sensitive Species list, the rarity of the plant species and the intensity of the project disturbance warrant survey for their presence within the project area. Ranking for these species include: S1) Critically imperiled in state because of extreme rarity or some factor(s) making it especially vulnerable to extirpation from the state; S2) Imperiled in state because of rarity or because of some factor(s) making it very

vulnerable to extirpation from the state; S3) Rare or uncommon in the state; and S4): Apparently secure in state, with many occurrences.

Several species on the Alaska Natural Heritage Program tracking list are known or suspected to occur in the Sitka Ranger District and occur in habitat likely to be found within the Blue Lake project area.

Pre-field review for Vegetation Resources

Vegetation resources have been mapped by the USFS using aerial photos to delineate polygons of similar broad vegetation categories. Tree species, canopy density, volume classification and crown size were used to further classify forested vegetation. This mapping information was digitized and transferred to computerized Geographical Information System (GIS) data base which is available from the Southeast Alaska GIS Library (Spatial Data @ UAS <http://gina.uas.alaska.edu/joomla/>). The vegetation information layer (Veg Code) includes attributes describing the existing vegetation of the Tongass National Forest. Attributes used to evaluate the vegetation for this project include; canopy type for forested stands, type of vegetation cover for non-forested ecosystems, the volume class of timber, and acreage.

A modified Veg Code layer (see Table 1) designed by John Caouette (Caouette and DeGayner ,2005) was used to prepare a map of the existing vegetation. This layer uses mean tree size and stand density (combined with slope and soils to more accurately predict vegetation characteristics. This mapping system uses the relationship of tree size (diameter at breast height) to tree density (trees per acre). Tree size and density were extrapolated from the photo interpreted volume class. This correlation was successfully tested with the timber inventory database. Productive upland western hemlock and spruce stands may be mapped as SD4 through SD67 depending on tree size, density, aspect and soil characteristics.

Table 1. Vegetation codes and descriptions of mapped area in the Blue Lake Project area.

Vegetation Code	Description
SD4H	Hydric soils, volume class 4
SD4N	Non hydric soils, North aspect, volume class 4
SD4S	Non hydric soils, South aspect, volume class 4
SD5H	Hydric soils, Volume class 5
SD5N	Non hydric soils, North aspect, volume class 5
SD5S	Non hydric soils, south aspect volume class 5

SD67	Non hydric soils, volume class 6 or 7
UF	Non-forested
NF	Non-forested
S1	Recurrent slide
S3	Recurrent slide
FM	Forested Muskeg (usually Shore pine in a muskeg setting)

Volume classes are as follows: 3= < 8 Mbf/acre; 4= 8-20 Mbf/acre; 5= 20-30 Mbf/acre; 6=30-50 Mbf/acre; and 7= >50 Mbf/acre.

Polygons mapped as hydric (H) include 50% or more hydric soils and slope ranging from 0-55% . (Caouette and DeGayner, 2005)

Each mapped polygon is a composite of soils and topography that produce similar canopy characteristics which are not mapped on aerial photos. Although useful for planning at the landscape level, the mapped vegetation types are useful at the landscape level, but are not designed to adequately describe the variation in vegetation that occurs in a given site. Field surveys are necessary to verify which plant species are present.

The vegetation resource maps were used primarily to ensure survey coverage of all vegetation types occurring in the Blue Lake Project area and to ensure maximum species capture.

Accessible areas of the project area were surveyed for the purpose of documenting plant resources. No attempt was made to verify the mapping within the forest polygons.

Another contractor, K. Bovee is verifying the extent of the mapped vegetation types for the purpose of evaluating wildlife habitat.

Field Survey for Sensitive Plants

The field survey methodology followed the procedures outlined in the Tongass National Forest- Guidance for Biological Evaluations: Sensitive Plants, November 2007 (Dillman et al, 2007) describes a methodology for plant biological evaluations. Field methodology was discussed with the Regional Botanist, Mary Stensvold.

The purposes of a Biological Evaluation are to 1) ensure that actions do not contribute to the loss of viability of any native or desired non-native plant species; 2) to incorporate concerns for sensitive species throughout the planning process; 3) to ensure that activities will not cause a species to move toward federal listing. TLRMP directs that management will maintain habitat to support well distributed viable populations of sensitive species throughout the recent range of the species by avoiding or minimizing impacts to those species.”(Dillman et al, 2007)

The guidelines for Biological evaluations prescribe that the survey intensity should be related to the possible risks associated with the project and the potential habitat. The

intensity and scope of inventories should be commensurate with the potential risk of a proposed project on sensitive plants.

As the impact of the hydroelectric project is loss of the vegetation within the flood zone, the survey intensity would be appropriately thorough. The level of survey intensity deemed appropriate was Level 5 or Intuitive Controlled. In this type of survey, the botanist walks through most of the affected area, but gives closer scrutiny to habitats associated with sensitive plants. (2001). Intensive searches are conducted in those portions of the project area with the highest potential for finding sensitive or monitored plants. An intensive search includes multiple visits and a longer period of time in a given area.

Habitat associated with each plant species included on either the USDA Forest Service Sensitive plant list or the Alaska Natural Heritage Vascular Plant Tracking list was targeted for more intensive surveys. Aerial photos were used to target areas with habitat associated with sensitive plant species included on Tongass Sensitive plant or the ANHP tracking list

The project area size precludes completing the most intensive survey level; 6 in a single field season. The level 6 survey requires that the surveyor walk throughout the entire project area.

Vegetation surveys were distributed through the growing season in order to detect and identify the maximum number of species (Table 2)

Table 2 Dates and Areas of 2008 Blue Lake Project Relicensing Plant Surveys

Survey Date	Areas Surveyed	Survey Type
June 25, 2008	Blue Lake	Foot survey
July 16, 2008	Blue Lake	Foot survey
July 17, 2008	Blue Lake	Foot survey
July 22, 2008	Blue Lake	Foot survey
August 1, 2008	Blue Lake	Foot survey
August 4, 2008	Blue Lake	Foot survey
August 11, 2008	Blue Lake	Foot survey
August 21, 2008	Blue Lake	Foot survey

Field Survey for Vegetation Inventory

The project area survey was conducted in such a manner to traverse representative areas of each of the mapped vegetation types. Within each vegetation type, transect meanders attempted to include microsite variation when possible. In a transect meander survey, species are listed as encountered, the course is chosen when feasible that appears mostly likely to yield new species populations. Areas of high probability of encountering species were revisited when possible. The vegetation and sensitive plant surveys were done on the same field days. The level 5 survey (Intuitive Controlled) methodology was useful for both sensitive plant and total vegetation surveys of the area impacted by the project.

GPS tracks of the areas surveyed were recorded.

Surveys were distributed through the growing season in order to capture and identify the maximum number of species.

Herbarium specimens of taxa of interest or species of difficult taxonomy were collected.

The specimens will be stored at the UAF Museum herbarium; selected specimens will be reviewed by Museum staff.

A photographic record of taxa of interest was kept.

RESULTS:

Preview Review Sensitive Plant Surveys:

There are no federally listed rare or endangered plant species on the Tongass National forest. (Dillman and Krosse, 2007). The Regional Botanist, Mary Stensvold, maintains a list of sensitive plants whose populations are monitored in project areas as regulated by the NEPA (National Environmental Policy Act) process. There are 19 vascular plant species included on the Region 10 Sensitive species list (see Appendix). The Sensitive plant list is currently under review by the regional botanist and district ecologists and substantial revision of included species is expected.

Fifteen species of vascular plants included on the Alaska Natural Heritage Program tracking list are likely to occur in the Sitka Ranger District (see Appendix II). Two of the fifteen species are included on the Region 10 Sensitive species list.

Fifteen botanical surveys have been completed by the USFS in the Blue Lake, Heart Lake and Thimbleberry Lake area in the last 25 years. Three species formerly included on sensitive plant list or deemed species of interest were located; *Papaver radicum* or *radicum ssp. alaskanum*, *Romanozoffia unaslacensis*, and *Botrychium mutifidum*.

Table 3. Surveys conducted in the Blue Lake Watershed or in similar habitat on Baranof Island by USDA Forest Service.

Survey Number	Date	Surveyor	Rare Plant	Sensitive plants
MAST00142	7/11/1979	M. Stensvold	None	None
MAST00144	1979	M. Stensvold	None	None

MAST00606	6/27/1982	M. Stensvold	None	Romanozoffia unalascensis
BRKR0148	5/29/2003	B. Kriekhaus	None	None
BRKR00149	6/05/2003	B.Kriekhaus	Botrychium mutifidum	None
BRKR00150	6/6/2003	B. Kriekhaus	None	None
BRKR00152	6/11/2003	B. Kriekhaus	None	None
BRKR00186	8/9/2003	B. Kriekhaus	None	None
BRKR00212	7/13/2004	B. Kriekhaus	Papaver kluanensis	None
BRKR00217	8/10/2003	B. Kriekhaus	None	None
BRK00170		B. Krickhaus	Polystichum kruhebergii	
BRKR00171		B. Kriekhaus	Asplenium trichomanes	
BRKR00201		B. Kriekhaus	Mimulus lewisii	
BRKR00202		B. Kriekhaus	Mimulus lewisii	
KECA00105			Saussurea americana	
KECA001001			Galium kamtschaticum	

The most recent sensitive and rare plant surveys were conducted for the Blue Lake power line corridor in 2003 by Tongass National forest biologist, B. Kriekhaus. Kriekhaus surveyed the Beaver Lake trail and the Bear Mountain area in 2003 and 2004. Field surveys completed in 2003 and 2004 were conducted following the Region 10 protocol for surveying sensitive and rare plants (USDA 2001). Earlier surveys used similar methods and were conducted by Mary Stensvold, Regional Botanist for the Forest Service. Surveys for the Blue Lake area occurred at various intensity levels that were dependent on the habitat. Forest Service surveys focused primarily on unique and unusual habitats within the project area but also traversed the edges and interior areas of proposed harvest units and proposed road lines. A vascular plant checklist was generated during all the recent botanical surveys of the Blue Lake area. All of the botanical surveys for the Blue Lake project were completed during the growing season, June-September.

The first documented report of *Papaver radicum* or *radicum ssp. alaskanum* in southeastern Alaska was in 2004 by Kriekhaus (Kriekhaus 2004). A small population of this plant was found on a ridge top at 4000 feet on Bear Mountain. Two additional populations of *Papaver* were found during 2004 on Chichagof Island. These populations were found on gravel bars along rivers between 850 and 1200 feet elevation. This suggests a possibility that this plant may occur along the river flowing from Glacier Lake to Blue Lake. (Kriekhaus, 2004)

Two other locally rare plants were found in alpine habitat on Bear Mountain in 2004. Small populations of *Parnassia kotzebuei* and *Saxifraga rivularis* (BRKR00212) were found above 3000 feet in fractured bedrock or rocky scree habitat. It is possible that either of these plants could occur on open exposed rock outcrop in the Blue Lake area. (Kriekhaus, 2004)

Another plant found near Beaver Lake is considered locally rare. *Botrychium multifidum* has only been documented from 3 locations on Baranof Island. However, it has been documented from numerous locations on Chichagof Island and other areas in SE Alaska.

Sensitive plant surveys conducted in the South Baranof Wilderness in 2003 and 2004 found five rare species of vascular plants. Surveys were limited to a few selected lakes (eg. Diana, Rezanoff, Ekaterina, and bays (Gut and Red Bluff Bay) in the South Baranof Wilderness. Two species of ferns, *Asplenium trichomanes* and *Polystichum kruckebergii* are less likely to occur within the project area due to the lack of preferred habitat. *Asplenium trichomanes* occurs in sheltered rock crevices on limestone cliffs or large boulders. *Polystichum kruckebergii* is usually found on ultramafic outcrops. Both species have been reported from Red Bluff Bay. The three remaining species are more likely to be found in the Blue Lake Project area. *Galium kamtschaticum* and *Mimulus lewisii* occur in brush fields and along streambanks both of which are found within the project area. Although the preferred habitat of *Saussurea americana* may not be abundant in the project area, this plant is found in the Sitka area on Harbor mountain.

Table 4. Description of range and habitat for plant species listed as sensitive by the Region 10 that are most likely to occur in the Blue Lake project area.

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
<i>Arnica lessingii ssp. Norbergii</i> (Norberg arnica)	Occurs in alpine and subalpine meadows, arctic and alpine tundra, heath and open woods.	Known	Suspected	S1
<i>Carex lenticularis var. dolia</i> (Goose-	This sedge is an alpine/subalpine plant that is emergent or lies at the edge of wet meadows and ponds. Known to occur in	Known	Suspected	S3

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
grass Sedge)	the coastal mountains of Alaska.			
<i>Galium kamtschaticum</i>	Occurs in open forest, along forest edges and in meadows	Known		
<i>Glyceria leptoctachya</i> (Davy Manna grass)	Grows in wet lowland habitats including swamps and stream and lake margins.	Known	Known	S1, S2
<i>Hymenophyllum wrightii</i>	Prefers humid shaded boulders, cliffs and damp woods and occurs at the base of trees and rock outcrops or in crevices of tree trunks.	Known	Known	S1
<i>Isoetes truncata</i> (Truncate Quillwort)	Grows immersed in shallow water of lakes and ponds and is known to occur on Kodiak and Vancouver Islands.	Suspected	Suspected	S1
<i>Ligusticum calderi</i> (Calder lovage)	Occurs in subalpine boggy meadows, meadows and forest edges. Occurs on Kodiak Island, Dall Island (just west of Prince of Wales Island), and Bokan Mountain on Prince of Wales Island.	Known	Suspected	S1
<i>Mimulus lewisii</i>	Occurs in avalanche tracks, disturbed floodplains and gravel bars, open streambanks	Known	Known	S2
<i>Poa laxiflora</i> (Loose-flowered Bluegrass)	Occurs in upper beach meadows and open forests. Several sightings have been documented in Southeast Alaska at Sandborn Canal, Port Houghton and Admiralty Island and Red Bluff Bay estuary.	Known	Known	S2
<i>Polystichum setigerum</i>	Occurs in open, well drained forests	Known	Known	S23
<i>Romanzoffia unalaschcensis</i> (Unalaska mist- maid)	Occurs on beach terraces or wet rock outcrops and rock crevices. IRanges from eastern Aleutians, Alaska Peninsula, Kodiak to southeastern Alaska.	Known	Known	S2

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
<i>Senecio moresbiensis</i> (Queen Charlotte Butterweed)	Occurs in montane to alpine habitats in shady wet areas and bogs on open or rocky slopes and in open, rocky heath or grass communities.	Known	Suspected	S2
<i>Saussurea americana</i>	Occurs in subalpine meadows and brushfields	Known	Known	S3
<i>Stellaria ruscifolia ssp. aleutica</i> (Circumpolar starwort)	Occurs in moist gravelly sites along creeks in alpine or subalpine areas. Range is limited to coastal southeastern and south-central Alaska and the Aleutian islands.	Known	Suspected	S2

Preferred habitat for listed plants was obtained from prior survey reports, regional floras and personal communication with Forest Service personnel (Kriekhaus and Stensvold).

Based on past surveys and habitat requirements, the most likely sensitive or tracked plants likely to be found in the Blue Lake project area are: *Mimulus lewisii*; *Saussurea americana*; *Galium kamtschaticum*; *Hymenophyllum wrightii*; and *Polystichum setigerm*.

Field Survey Sensitive Plants:

No plants currently included on the Region 10 Sensitive plant list were found in the project area. One species considered rare on the Tongass National Forest, *Papaver radicum* or *radicum ssp. alaskanum*, was found in the areas surveyed.

Hymenophyllum wrightii is highly likely to occur in the area despite not being detected in these surveys. This fern is similar in size to small mosses and can be difficult to distinguish from other bryophytes. No impacts

Table 5. Effects determination for Vascular plants included on the Region 10 sensitive plant list most likely to occur in the Blue Lake project area. No sensitive species were found within the project area.

Common Name	Scientific Name	Effects Determination
	<i>Cypripedium montanum</i>	No impact
	<i>Cypripedium parviflorum</i> <i>var. pubescens</i>	No Impact
Calder's Lovage	<i>Ligusticum calderi</i>	No Impact
	<i>Piperia unalaschcensis</i>	No impact
Unalaska Mist Maid	<i>Romanzoffia</i> <i>unalaschcensis</i>	No impact

Two species listed on the Alaska Natural Heritage tracking list was observed. *Polystichum setigerum* was found in several forest stands. *Mimulus lewisii* was found within the survey area in two locations on vegetated gravel bars on Blue Lake creek. Several locally unusual or rare plant species were found within the project area. *Papaver radicum* or *radicum ssp. alaskanum* a species of interest on the Tongass was located on one gravel bar within the flood zone. This habitat is similar to that where *Papaver* populations were found on Chichagof Island.

One species; *Romanzoffia unaslacensis* included on the Region 10 list was found in the Herring Cove area in 1982 (Table 5, MAST00606). This population is believed to have been extirpated as attempts to relocate the plants have failed (Kriekhaus 2004).

Because direct or indirect effects to sensitive plant species on the Region 10 list are not anticipated, there will be no cumulative effects to populations of sensitive plants.

There are two species of plants included on the Alaska Natural Heritage Vascular plant tracking list within the Blue Lake Project area. These populations are at risk due to inundation of their habitat. Both populations include few individuals and come feasibly be removed for replanting in suitable locations within the forest or included in botanical gardens in Sitka.

Table 6. Effects determination for Vascular Plants included on the Alaska Natural Heritage Vascular Plant Tracking List found in Blue Lake project area.

Common Name	Scientific Name	Effects Determination
Pink Monkey Flower	<i>Mimulus lewisii</i>	Local population impacted
Alaska Holly Fern	<i>Polystichum setigerum</i>	Local population impacted

Field Survey Vegetation Resources:

Although the plant communities occurring in Blue Lake watershed are typical of those found in other areas of northern southeastern Alaska, several locally uncommon or previously undocumented species were found. A list of the vascular plants found in the Blue Lake project area is included in Appendix 3.

The Project area includes vegetation mapped as SD4 through SD5. None of the highest productivity class stands (SD67) occurred in the watershed. Classification SD4 through SD5 are generally considered productive, upland Western Hemlock-Sitka spruce old growth forest stands. The Tongass National forest has also classified forest stands by dominant species and productivity. The plant associations of an area can not be mapped from aerial photos, but must be determined on the ground. Plant associations encountered in surveys within this upland forest include Western Hemlock/Blueberry/Shield Fern, Western Hemlock/Blueberry, Western Hemlock/Blueberry/Skunk Cabbage, and Western Hemlock/Blueberry /Devils Club, and small areas with Western Hemlock/Alaska Cedar/Blueberry. Extent of these plant associations is being assessed for winter deer habitat by another contractor (K. Bovee).

Plant species found within these old growth and mature forested stands were typical of stands found on Baranof Island. Western Hemlock (*Tsuga heterophylla*) was the most abundant conifer in mature stands. Sitka spruce was more abundant in younger stands, but remained a significant component of most forest stands. Alaska cedar (*Chamaecyparis nootkatensis*) was most abundant on slopes of the knoll with forested muskeg (SD4H). Another small inclusion of an Alaska cedar (*Chamaecyparis nootkatensis*) stand was found on a small knoll adjacent to a large recurrent slide. This was also mapped SD4H (see Map). Isolated large Alaska cedars (*Chamaecyparis nootkatensis*) were found in the productive old growth units (SD5S) adjacent to Blue Lake Creek.

Microsite conditions determined the mixture and abundance of vascular plant species found in a given area. Site history also seems to play a role in species distribution within the landscape. For example, plant species similar to those found on stable vegetated gravel bars along Blue Lake Creek were found on small inclusions of relict gravel bars in forested zones.

Habitat diversity was highest in alluvial areas. Differences in disturbance regime, small scale changes in topography and substratum texture produced visible changes in plant communities. Vegetation varied from mature forest to gravel bars with few pioneering plants.

The project area lacks streamside or alluvial stands dominated by large Sitka spruce. Most of the forested areas adjacent to the river seem to be on stable land that has allowed Western Hemlock to be the dominant species.

Sitka Willow was the dominant shrub in some alluvial communities. Young Sitka spruce (*Picea sitchensis*) were found in the understory in willow stands. Presumably these stands could in time be dominated by Sitka Spruce (*Picea sitchensis*) if flooding frequency and channel movement favor this successional change.

Cottonwood (*Populus balsamifera*) grew as isolated individuals and in a small stand in alluvial areas. The largest stand of Cottonwood (*Populus balsamifera*) was on the south

side of Blue lake creek. The understory in the Cottonwood (*Populus balsamifera*) stand was primarily species of ferns; *Polystichum andersonii*, *P. braunii* with a limited number of herb species. One locally rare orchid, *Corallorhiza trifida* was found under a stand of sapling spruce adjacent to the Cottonwood stand. . A lichen, *Leptogium cyanescens*, was found on the trunk of a Cottonwood (*Populus balsamifera*). This is a significant range extension for this lichen; it has not previously been found on the islands of southeastern Alaska. Prior collections of this lichen in the region were from from the mainland along the Unuk and the Stikene river valleys (Geiser, 1994).

The sand and gravel bars of intermediate stability had the highest vascular plant species richness (55 species) recorded in the project area. The more active side channels and bars had isolated individual plants, including both small shrubs (*Salix* spp.) and a variety of herbs (*Chamerion* spp, *Carex* spp, and *Montia parvifolia*).

Pyrola minor, not previously documented on Baranof island, was found in a sapling stand of Sitka spruce on a slightly elevated area adjacent to a gravel bar. *Pyrola minor* has been collected from Rust Lake on Chichagof Island, Heceta Island, Yakutat and the Skagway area.

There is one area mapped as Forested Muskeg adjacent to the inundation zone. There is an additional small forested muskeg on the south side of Blue Lake creek which wasn't mapped separately from the surrounding forest. The forested muskeg areas include acidic bogs located on the upper slopes and top of a rolling ridges or knolls and transitional areas which resembled forested fens. Vegetation in the acid bogs was dominated by small ericaceous shrubs, *Sphagnum* spp and short sedges; *Trichophorum casepitosum*, *Carex pauciflora* and *C. pluriflora*. The side slopes had somewhat similar species composition, with the addition of *Platanthera stricta*, *Erigeron peregrinus* and *Dodecatheon jeffreyii*. The transition zones graded into to stands dominated by Alaska Cedar. The stand closest to Blue Lake creek was large enough to be mapped as a distinct polygon (SD4H).

The eastern shore of Blue Lake north of the mouth of Blue lake creek is locally unusual habitat. There is a meadow or mudflat dominated by *Carex lenticularis* and *Calamagrostis canadensis*. A locally uncommon moss, *Climacium dendroides*, which favors lakeshore habitat was abundant as an understory of the graminoids.

Recurrent slides are found in several locations in the inundation zone. A dense mixture of *Alnus viridis* var. *sinuata*, *Oplopanax horridum*, *Sambucus racemosa*, and *Urtica dioica*, as well as *Athyrium filix-femina*, and a variety of other ferns, grow in the slides. Branches and trunks of larger shrubs were host to a variety of lichens, including *Nephroma* spp and *Pseudocyphellaria croaca* . *Lobaria retigera* was found on *Alnus viridis* var. *sinuata* in a large slide on the north side of Blue Lake creek. This is a significant range extension for this species (Geiser, 1994). This lichen has rarely been documented in southeast Alaska (Stikine, Unuk rivers and Skagway area).

In the project area below the dam, vegetation along the road was impacted by original hydro project, recurrent slides and recreational use. Project area

(roadside) vegetation is dominated by a mixture of woody shrubs, Salmonberry, Sitka alder, Elderberry and young conifers. Roadside herbs include both weedy invasive species and native herbs tolerant of disturbance.

Discussion

One species on the Tongass National Forest Sensitive plant list was found in the Blue Lake Project area. Two species on the Alaska Natural Heritage Tracking list were found within the project area. Although not common in southeastern Alaska, *Mimulus lewisii* has been found in several locations on Baranof island. (Table 8). *Papaver radicum* or *radicum ssp. alaskanum* has been found in a limited number of locations on Baranof and Chichagof Islands, but is not considered threatened.

Notable features of the Blue Lake project area were the abundance of alpine species at low elevation gravel bars, the presence of lichens previously reported from mainland river valleys of southeastern Alaska, and two species of plants not previously found in the Sitka area (*Pyrola minor* and *Corallorhiza trifida*). Other species present in project area which are not generally common the Sitka area were *Urtica dioica* , and *Populus balsamifera* (isolated small populations). Both *Urtica dioica* (Nettles) and *Actaea rubra* (baneberry) were more abundant than is typical for the Sitka area. Both species were found in the transitional area between the lake shore meadow and forest. *Actaea rubra* (baneberry) was also present in the transitions from forest to alluvial areas

Several species more typically found in alpine habitats were growing on sand and gravel bars, especially the most stable ones along Blue Lake Creek. The low elevation occurrence of these species is most likely a function of topography, localized climate/weather conditions and proximity to alpine which may function as a seed source. Gravel bar conditions may provide the good drainage and open conditions similar to those found in rocky alpine habitats.

An attempt was made to survey the Blue lake watershed for habitat and vegetation similar to that in the inundation zone. Two areas adjacent to the inundation zone were surveyed. The first drainage (proximal to the winch house at the lake access road) had similar species rich gravel bars, but was smaller in total area. The species list is included in the appendix. The second area assessed was the Blue Lake Creek above the barrier falls at stream mile 2. This area did not find have the broad gravel bar habitat similar to that found lower on Blue Lake Creek stream mile 0-2. This survey was somewhat limited by logistics (high water) and travel time required to reach the upper parts of the valley. See map.

Beyond Blue Lake watershed, it is difficult to assess the rarity of some of the vegetation features of the Blue Lake Project area on Baranof Island due to the lack of systematic field studies. The vegetation of the inner valleys of Baranof Island has not been systematically surveyed. Surveys have been largely limited to areas potentially affected by projects (outfitter-guides, stream gauges, timber sales, hydroelectric projects). The 319,568 acres of public lands in Wilderness status on Baranof Island have not been systematically surveyed because of lack of potential impacts due to human activities. The topography and qualities of vegetation visible with aerial photos has been mapped by the USFS for all of Baranof Island. However the existing GIS data layer is a predictive

model for forest productivity and cannot assess the finer features of the vegetation in a given area. The species present in a given area and their abundance cannot be inferred from the GIS database, but must be assessed on the ground. However, similar topography and channel type maps available on the GIS database could possibly be used as screening tools to select areas that may be similar to the Blue Lake project area. General patterns of vegetation can be predicted by the topography, aspect, geology and history of the watershed. The topography and glacial history of the Blue Lake watershed seems likely to be typical of that described as typical for the West and East Baranof Provinces in the Southeast Alaska Conservation Assessment (Schoen and Dovichin, 2007). Given that the topography of Blue Lake project area is probably typical of Baranof Island, it is likely that similar vegetation patterns will occur in other watersheds on Baranof Island. The direct effect of the expansion of the Blue Lake hydroelectric project will be the destruction of the vegetation within the inundation zone. Resolving the questions of rarity of the vegetation resource in the flood zone could be assessed by limited surveys in similar valleys on Baranof Island.

In the powerhouse area, construction-related effects would be slight because the area is currently industrialized and often visited by Blue Lake Project workers, hunters, fishers and other recreationists. Blasting and excavation work would result in permanent removal of vegetation in construction areas. Construction impacts from the dam and powerhouse cannot be precisely assessed until the final design of the project is complete. Precise location of the Powerhouse is not known. Once the area is delineated there will be a site specific survey completed.

Cumulative Effects

Because there are no plant species on the Region 10 sensitive plant species list found within the Blue Lake project zone, there are no cumulative effects to sensitive plant species caused by the Blue Lake hydro project. Implementation of the hydro project expansion is not anticipated to move any sensitive plant species within the project area toward federal listing.

With few exceptions, plant species within the project zone are widely distributed throughout the Tongass National Forest. The one species (*Papaver radicum*) currently thought to be relatively limited in distribution in the Tongass is not currently on either the Region 10 or the Alaska Heritage plant list. Other species, eg. Balsam cottonwood, *Pyrola minor*, and *Corallorhiza trifida* all with limited distribution on Baranof Island are more common on other parts of the Tongass and furthermore are not included on the Region 10 sensitive plant or the Alaska Natural Heritage Vascular Plant tracking lists.

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Appendix 1

Table. USDA Forest Service Region 10 Sensitive plant list. Region 10 includes the Chugach and Tongass National Forests. Alaska Natural Heritage Program (ANHP) Rank is included.

Scientific Name	Common Name	Occurrence on Tongass	ANHP rank
<i>Aphragmus eschscholtzianus</i>	Eschscholtz's little nightmare	Suspected	G3S3
<i>Arnica lessingii</i> ssp. <i>norbergii</i>	Norberg Arnica	Known	G5T2QS2
<i>Botrychium tunux</i>	Moosewort fern	Known	G1S1
<i>Botrychium yaaxudakeit</i>	Moonwort fern	Known	G2S2
<i>Carex lenticularis</i> var. <i>dolia</i>	Goose-grass Sedge	Known	G5T3QS3
<i>Cirsium edule</i>	Edible Thistle	Known	G3S1
<i>Draba kanaanaskis</i>	Tundra whitlow-grass	No (Chugach)	G1QS1
<i>Glyceria leptostachya</i>	Davy Manna Grass	Known	G3S1S2
<i>Hymenophyllum wrightii</i>	Wright Filmy Fern	Known	G34S1
<i>Isoetes truncata</i>	Truncate Quillwort	Suspected	G1G2QS1
<i>Ligusticum calderi</i>	Calder's Lovage	Known	G3S1
<i>Papaver alboroseum</i>	Pale Poppy	Suspected	G3S3
<i>Platanthera gracilis</i>	Slender Bog Orchid	Known	G2QS2
<i>Poa laxiflora</i>	Loose flowered Blue grass	Known	G3S2
<i>Puccinellia glabra</i>	Smooth alkali grass	No (Chugach)	G3S2
<i>Puccinellia kamtschatica</i>	Kamchatka alkali grass	Known	G2QS2
<i>Romanzoffia</i>	Unalaska Mist Maid	Known	G3S3

<i>unalaschcensis</i>			
<i>Senecio moresbiensis</i>	Queen Charlotte Butterweed	Known	G3S2
<i>Stellaria ruscifolia</i> ssp. <i>aleutica</i>	Circumpolar Starwort	Known	G4T2T3S2S3

Appendix II

Vascular plant species likely to occur in Sitka Ranger District included on the Alaska Natural Heritage Program tracking list. Modified from Kriekhaus (2004).

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
<i>Arnica lessingii</i> ssp. <i>Norbergii</i> (Norberg arnica)	Occurs in alpine and subalpine meadows, arctic and alpine tundra, heath and open woods.	Known	Known	S2
<i>Galium kamschaticum</i> (Boreal bedstraw)	Occurs in open forest, along forest edges and in meadows.	Known	Known	
<i>Glyceria leptoctachya</i> (Davy Manna grass)	Grows in wet lowland habitats including swamps and stream and lake margins. Also colonizes disturbed areas such as ditches and roadsides.	Known	Known	S2
<i>Hymenophyllum wrightii</i> (Wright Filmy Fern)	Prefers humid shaded boulders, cliffs and damp woods and occurs at the base of trees and rock outcrops or in crevices of tree trunks. Occurs in coastal areas of Southeast Alaska and has been documented on Biorka and Mitkof Islands.	Known	Known	S1
<i>Isoetes truncata</i> (Truncate Quillwort)	Grows immersed in shallow water of lakes and ponds and is known to occur on Kodiak and Vancouver Islands.	Suspected	Suspected	S1
<i>Ligusticum calderi</i> (Calder lovage)	Occurs in subalpine boggy meadows, meadows and forest edges. Occurs on Kodiak Island, Dall Island (just west of Prince of Wales Island), and Bokan Mtn. on Prince of	Known	Suspected	S1

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
	Wales Island.			
<i>Listera convallarioides</i> (Broadlipped twayblade)	Occurs in open forest and along forest edges.	Known	Known	S2
<i>Mimulus lewisii</i> (Pink monkey-flower)	Occurs in avalanche tracks, disturbed floodplains and gravel bars, open streambanks	Known	Known	S2
<i>Poa laxiflora</i> (Loose-flowered Bluegrass)	Occurs in upper beach meadows and open forests. Several sightings have been documented in Southeast Alaska at Sandborn Canal at Port Houghton, and Admiralty Island.	Known	Known	S2S3
<i>Polystichum kruckebergii</i> (Kruckeberg's Holly fern)	Occurs on rock outcrops, cliffs in alpine habitats	Known	Known	S1
<i>Polystichum setigerum</i> (Alaska Holly Fern)	Occurs in open, well drained forests	Known	Known	S2S3
<i>Romanzoffia unalascensis</i> (Unalaska mist-maid)	Occurs on beach terraces or wet rock outcrops and rock crevices. Ranges from eastern Aleutians, Alaska Peninsula, Kodiak to southeastern Alaska.	Known	Known	S2
<i>Sausurrea americana</i> (American sawwort)	Occurs in subalpine meadows and brushfields	Known	Known	S3
<i>Senecio moresbiensis</i> (Queen Charlotte Butterweed)	Occurs in montane to alpine habitats in shady wet areas and bogs on open or rocky slopes and in open, rocky heath or grass communities.	Known	Suspected	S2
<i>Stellaria ruscifolia</i> ssp. <i>aleutica</i> (Circumpolar starwort)	Occurs in moist gravelly sites along creeks in alpine or subalpine areas. Range is limited to coastal southeastern and south-central Alaska and the Aleutian	Known	Suspected	S3

Species	Habitat and Location Description	Occurrence on the Tongass NF	Occurrence on the Sitka RD	State Ranking
	islands.			

Consultation

Reviewer Comments on Draft Vegetation Report were addressed in the final report in **bold**. Comments on this report were received from the USDA Forest Service (USFS) in October 2009. Comments are listed in this table with notation of how they were addressed in the preparation of the final report.

Comment Number	Comment Summary	Response and Report Location
USFS 1	Lack of Indirect and Cumulative Effects	A table and discussion of indirect and cumulative effects added to the report on page 11, 15
USFS 2	Lack of risk assessment and determinations	A table and discussion of risk assessment and determinations included on page 11
USFS 3	Project area below lake not discussed	Discussion of prior work in area by USFS on page 11 Discussion of vegetation resources on page 13 Discussion of potential impacts included on page 13, 15