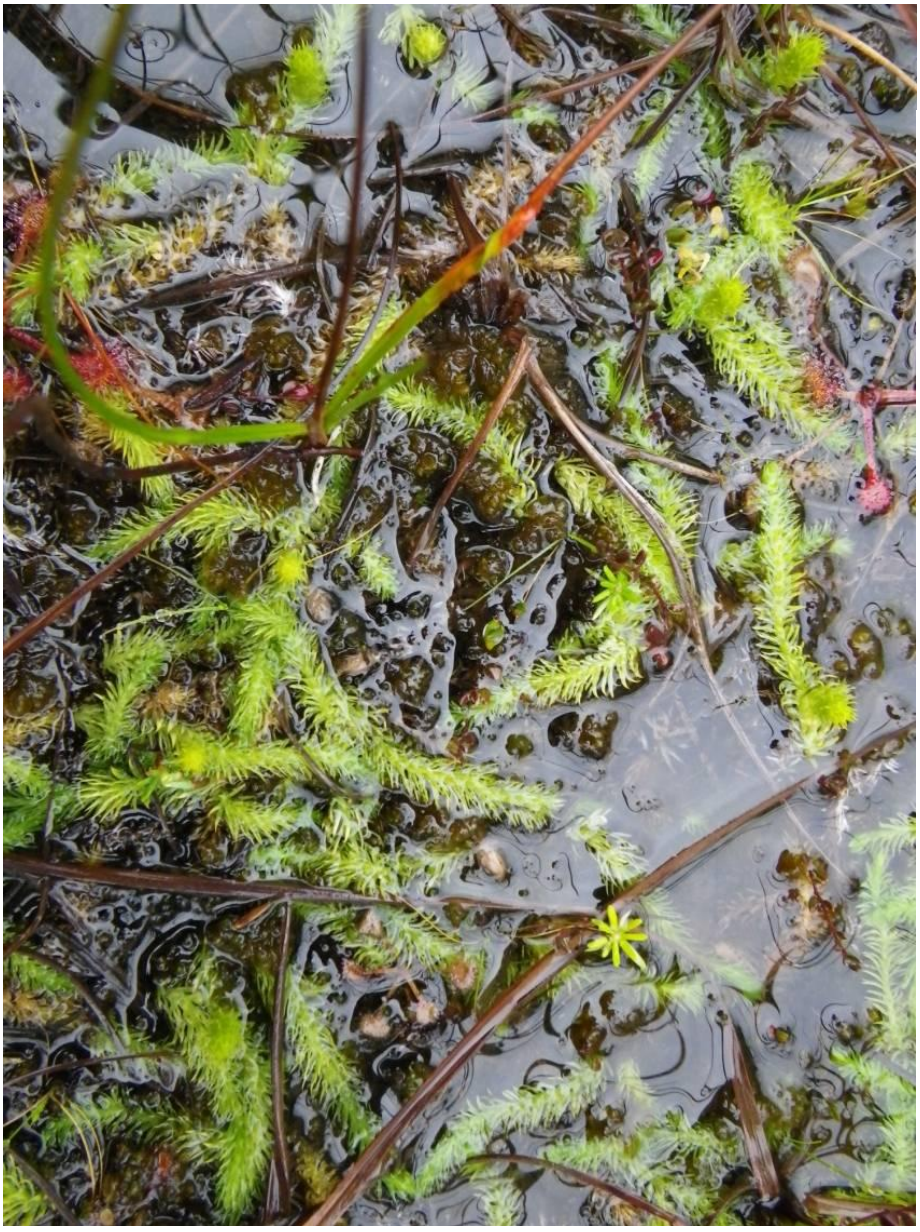
Takatz Lake Hydroelectric Project

Federal Energy Regulatory Commission Project No. 13234

Botanical Resources Studies

Final Report



Inundated club moss *(Lycopodiella inundata)*

Prepared for:

City and Borough of Sitka
Electric Department
105 Jarvis Street
Sitka, Alaska 99835

Prepared by:

HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, AK 99503

In association with
Lazy Mountain
Biological Consulting

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EXECUTIVE SUMMARY

The City and Borough of Sitka (City) contracted with HDR Alaska, Inc. to conduct Botanical Resources Studies to support evaluation of the proposed Takatz Lake Hydroelectric Project. The objectives of the botanical resources studies are three-fold:

- Describe the vegetation types in the study area based on existing information and field reconnaissance.
- Determine whether suitable habitats for rare plant species exist in potentially-affected areas, and survey representative suitable habitats.
- Determine whether non-native plant infestations exist in the study area and document representative occurrences.

The studies provide information needed for the City, Federal Energy Regulatory Commission, and other management agencies to analyze the potential effects of project alternatives and to develop appropriate measures to protect botanical resources.

Each of these studies included a review of existing information, then a field survey. The locations of many project components were not defined at the time of the studies so the investigators conducted the field surveys within the approximate corridors that might be affected.

Most of the study-area land is not forested; rather, more than half consists of cliffs and other exposed rock, alpine habitats, landslide and avalanche tracks, wet meadows, and sparsely treed muskegs. Approximately one-quarter of the land in the general project vicinity supports conifer forests with a wide range of productivity.

The study team located non-native plant infestations in the community of Baranof Warm Springs and at two sites subject to foot traffic between that community and Baranof Lake. They did not find non-native plants elsewhere in the Baranof or Takatz drainages.

During field surveys, botanists found no species that are identified as Sensitive by the U.S. Forest Service. However, they found three notable plant species that the USFS informally considers rare:

> A population of *Lycopodiella inundata* (inundated club moss) exists near Takatz Creek. That species is nearits northern range limit in the Sitka Ranger District. It is considered vulnerable to extirpation in Alaska by the Alaska Natural Heritage Program.
>
> A population of *Lycopodium dendroideum* (tree groundpine) was relocated north of the east end of Baranof Lake. The species is common in the Interior of Alaska but its Baranof Island populations are quite distant from other known populations—more than 150 miles away to the north and more than 100 miles away to the south.
>
> *Oenanthe sarmentosa* (water parsely) plants were found along Takatz Creek. The species is known in Alaska principally from sites near Ketchikan and Petersburg, though also from some sites on the south end of Baranof Island, near Juneau, and on Douglas Island.

Additional field surveys for rare plant species may be needed when exact locations of project components have been identified. If rare species are found, appropriate mitigation measures can then be developed. No conclusions can yet be made regarding the proposed project's potential effects on rare plant species.

1 Introduction and Scope of the Studies

The City and Borough of Sitka (City) Electric Department is studying the feasibility of constructing and operating the Takatz Lake Hydroelectric Project ("project"). The City is seeking a license for the project from the Federal Energy Regulatory Commission (FERC) through FERC's Alternative Licensing Process. In accordance with that process, the City prepared a Botanical Resources Study Plan, which was finalized in May 2011. The studies will document the botanical resources that might be affected by construction and long-term operation of the project. The specific objectives of the botanical resources studies are to document vegetation types and extents, and document locations of rare plants and non-native plants within the area potentially affected by the project. This will provide the botanical information needed for the City, FERC, and other agencies to analyze the potential effects of project alternatives and to develop appropriate measures to protect these resources. This report presents the methods and results of the botanical resources studies performed in 2011 and 2013. It incorporates the information presented in the Interim Report issued in February 2012 (HDR Alaska 2012) and adds the results of field work completed at Takatz Lake in 2013. The format of this report generally follows that of a U.S. Forest Service (USFS) Biological Evaluation for Plants so the information can be drawn directly into that assessment if needed later in project development.

The botanical resources studies accomplish three objectives:

- Identify the vegetation types in the study area. Map vegetation types by manipulating existing digital datasets. Describe the vegetation types based on reconnaissance-level field surveys.
- Determine whether suitable habitats for USFS Sensitive, Biotics-listed plants, and other rare plant species exist in potentially-affected areas, and survey representative suitable habitats. Except for the one lichen considered Sensitive by the USFS, the scope of this effort is limited to vascular plant species.
- Document representative non-native plant infestations in the study area.

Project botanical resources studies were conducted by two contractors. This report documents the studies performed by a team from HDR Alaska, Inc. (HDR) in the Takatz Bay drainage and north and east of the outlet end of Baranof Lake. Another contractor performed botanical resources work in the Baranof and Medvejie valleys west of the outlet end of Baranof Lake (Bethel 2012).

2 Study Area

The water for power generation would come from Takatz Lake, which is about 20 miles by air from Sitka, on the opposite (east) side of Baranof Island. Scientists performed the botanical resources studies based on the project described in the project's Scoping Document 2, issued in June 2010. The project components, shown on Figures 1 through 7, include:

- Two dams to raise the Takatz Lake water surface elevation approximately 135 ft;
- An access road from the head of Takatz Bay to the lower end of Takatz Lake;
- A tunnel to divert outflow from the lake to the power house;
- A power house on land at the head of Takatz Bay;

- A dock at deep water in outer Takatz Bay;
- An access road from the dock to the power house area;
- An overhead electrical transmission from the power house to the vicinity of the dock;
- Two alternative transmission line routes from the vicinity of the dock: (1) continuing overland along the south side of Takatz Bay as an overhead line, then as a submerged cable in Chatham Strait to Baranof Warm Springs, and onward overhead or underground to the outlet end of Baranof Lake (the "Marine Alternative Segment"); or (2) an overhead line extending southward over the pass to the Sadie Lake valley and continuing toward the outlet end of Baranof Lake (the "Overland Alternative Segment");
- Either an overland or submerged transmission line from the lower to upper end of Baranof Lake, and from there as an overhead line up the Baranof valley, a two-mile-long tunnel through the pass, and overhead down the Medvejie valley to connect with the existing electrical grid.

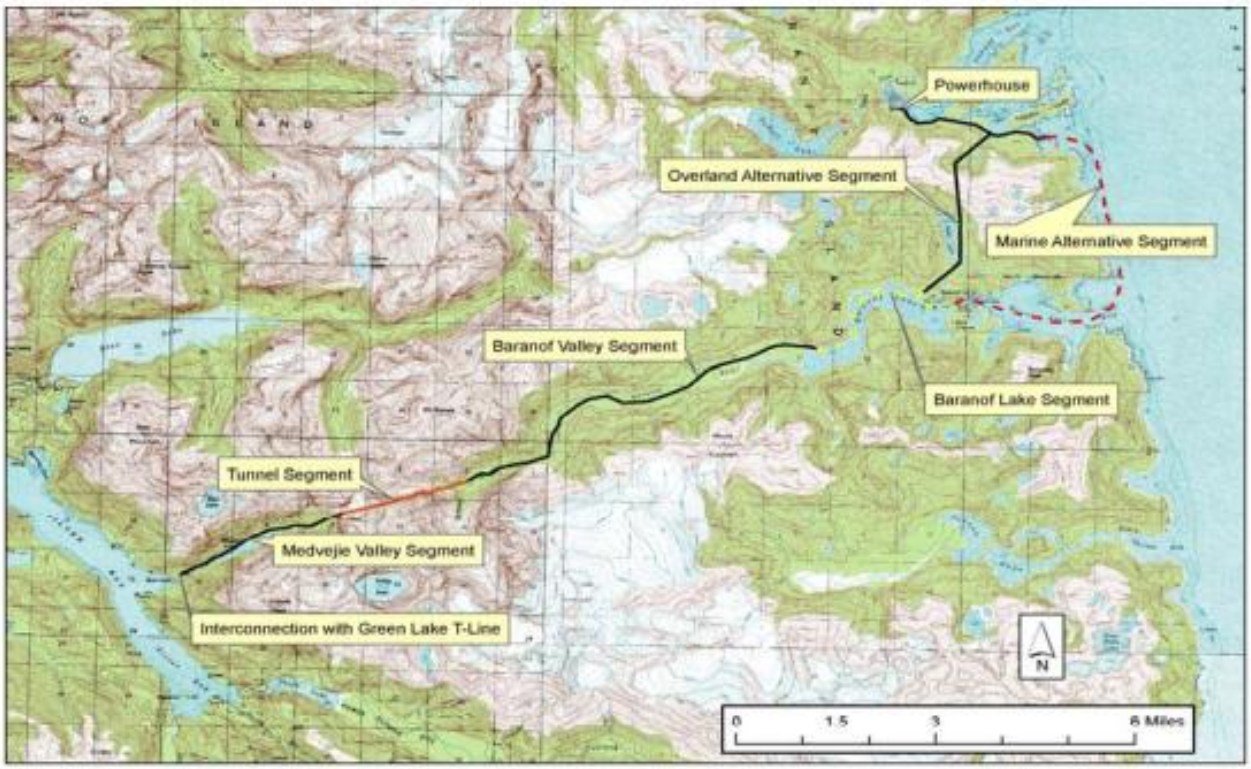


Figure 1. General Takatz Lake Hydroelectric Project location and electrical transmission line alternative locations (Source: Federal Energy Regulatory Commission 2010; from City and Borough of Sitka, Electric Department)

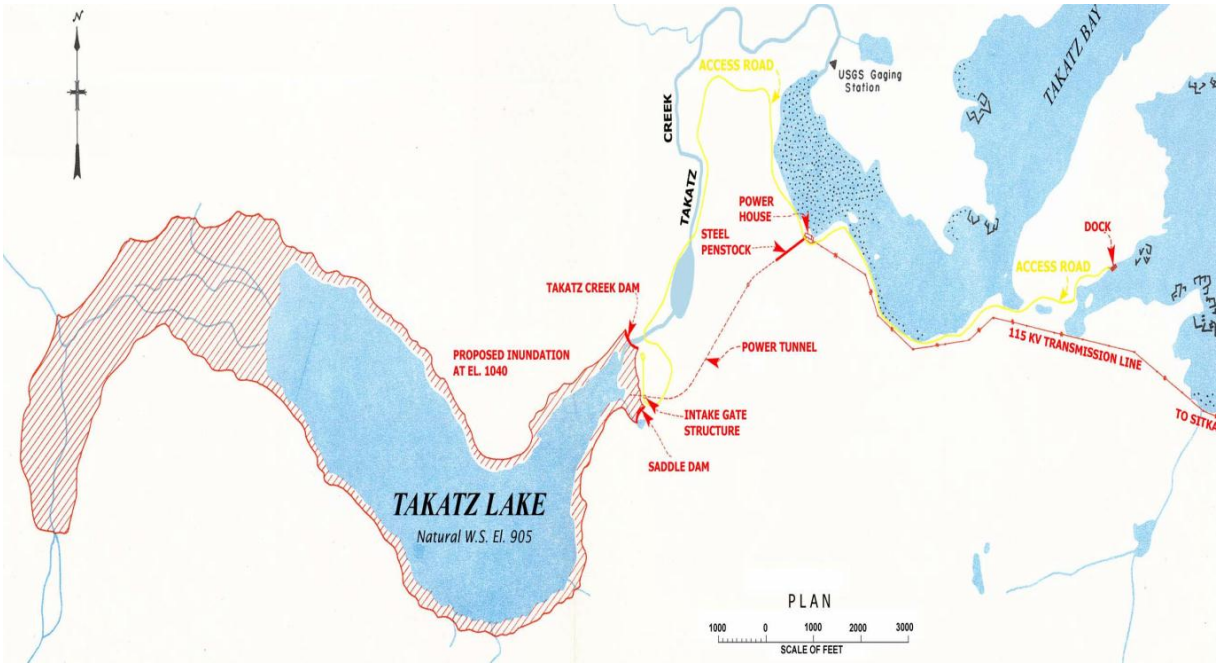


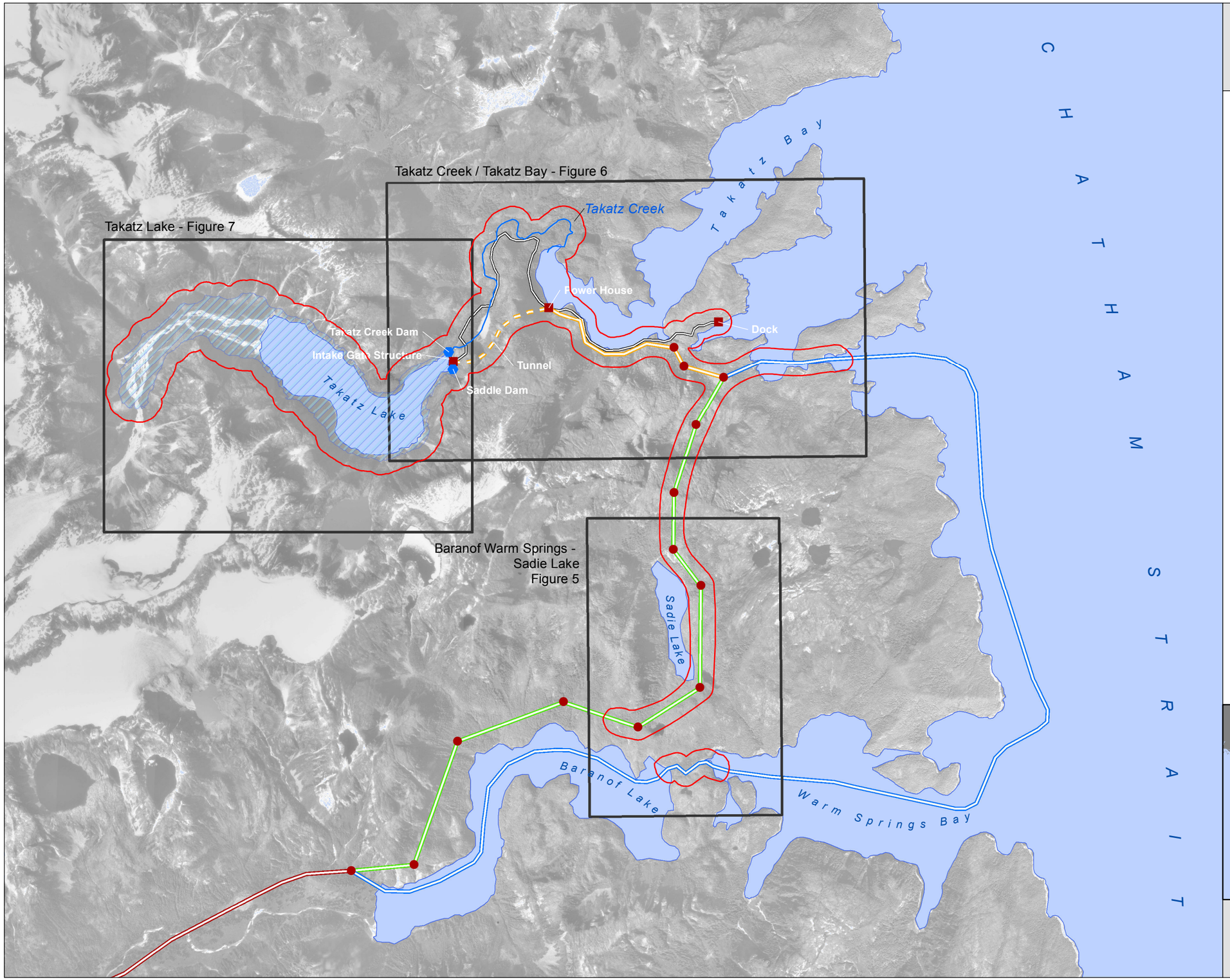
Figure 2. Project components of the Takatz Lake Hydroelectric Project
(Source: Federal Energy Regulatory Commission 2010; from City and Borough of Sitka Electric Department Preliminary Application Document, 2009)

While Scoping Document 2 shows conceptual locations of project components, specific locations and alternatives are still being developed. Locations of the access road to Takatz Lake and the electrical transmission line were particularly in flux. Consequently, the City opted to conduct a reconnaissance-level study. Information gathered from this study would then be used to inform alternative development. Figure 3 shows the specific study area of the field surveys as the "botanical survey corridor." (The office-based vegetation mapping covers a larger area.) The ground surface above the proposed tunnel between Takatz Lake and the power house would not be disturbed; accordingly, a survey would not be required for that portion of the project.

The study area extends from sea level to approximately 2,100 ft above sea level. It supports conifer forests, forested and scrub muskegs, and deciduous shrub thickets; cliffs and other rock outcrops; and a flat river valley at the head of Takatz Lake. Its waterbodies include Takatz Lake, Sadie Lake, and Baranof Lake; Takatz Bay and Warm Springs Bay extending off Chatham Strait; the creek flowing into Takatz Lake, Takatz Creek, and Baranof Creek.

The study area's human developments include the community of Baranof Warm Springs at the head of Warm Springs Bay, a trail from Baranof Warm Springs to Baranof Lake, and an informal trail from Baranof Lake to Sadie Lake. Remnants of a cabin or shelter exist in the forest at the head of Takatz Bay. Land around Takatz Lake, upper Takatz Bay, and the community of Baranof Warm Springs is owned by the City. The remainder of the study area is managed by the USFS.

Figure 3
Takatz Lake Hydroelectric Project
Botanical Resources Survey Areas



Botanical Survey Corridor

Detail Areas - Figures 5-7

Proposed Features

- **Facility**
- **Pole**
- **Dam**
- **Area of Inundation**
- **Road**
- **Tunnel**

Transmission Line Alternatives

- **Submarine Alternative**
- **Overland Alternative**
- **Baronof-Medveji Segment**
- **Main Overland Segment**

0 0.5 1 Miles

0 0.5 1 2 Kilometers

1:45,000

Projection: NAD83 State Plane Zone 1 (Feet)

In determining where to focus field studies, it is relevant to consider the types and locations of potential project effects. Effects pertinent to planning the botanical resources studies could include clearing and cut and fill for dams, access roads, the power house, and landside at the dock; inundation of areas surrounding Takatz Lake, particularly extensive at the inlet end of the lake, and ongoing lake surface fluctuation; alteration of the volume and timing of flows in Takatz Creek; clearing for the overhead transmission line in some forested areas; and disturbance of the ground surface for transmission line towers.

Project scientists and the City agreed to focus the surveys on more easily accessed locations until project siting is better known. In particular, the overland transmission line segment between Takatz Bay and Sadie Lake traverses extensive cliffs and an alpine ridge; impacts there would likely be limited to pole locations, so no effort would be made to survey that area at this time.

3 Literature and Information Review

3.1 Vegetation Types

Scientists compiled and reviewed several sources of information on vegetation types and on potentially suitable habitats for rare and non-native plant species, including the following.

- The final vegetation investigations report developed for the City's Blue Lake Hydroelectric Project, which summarized the results of several vegetation and botanical investigations. The Blue Lake project is located on the west side of Baranof Island, approximately 10 miles from Takatz Lake (LaBounty 2010).
- A journal article describing the vegetation analysis methods to be used for this project (Caouette and DeGayner 2005) and a graphic depiction of the vegetation types described by that method (USFS no date).
- Digital datasets compiled and reviewed within a Geographic Information System (GIS):
    - Aerial photography – black and white USFS imagery covering the full project area, and true color images covering limited areas around Baranof Warm Springs and upper Takatz Bay.
    - Five-ft topographic contours covering all terrestrial parts of the study area that might be directly affected by the Project; developed for the City from LIDAR data collected and processed by Aerometric, Inc.
    - Digital elevation model from the USGS National Elevation Dataset, with 30-meter resolution.
    - Soil mapping developed by USFS, with each soil unit characterized as hydric or non-hydric.
    - Timber type mapping prepared by the USFS which included timber volume classes and identified non-forested lands.
- Videos and GPS tracks of fixed wing and helicopter surveys of project area taken by the project wildlife biologist and covering all the potentially affected areas (K. Bovee, personal communication, August 20, 2011).

Vegetation and other cover types visible on aerial photographs and videos include conifer forests, sedge and scrub tree wetlands (muskegs), forested muskegs, beaver-dammed wetlands,

deciduous shrub thickets in disturbed areas along streams and in snow and debris avalanche paths, estuarine meadows, unvegetated intertidal flats, cliffs, bedrock slopes, creeks, lakes, and ocean.

3.2 Sensitive and Rare Plant Species

Team botanists conducted a pre-field review of existing information concerning plants considered Sensitive or rare that might be in the project area. This review included:

1. The Regional Forester's Sensitive Species List (Appendix A);
2. Communication with the USFS Alaska Region Botanist (M. Stensvold, pers. comm., Aug. 16, 19, 25, 2011) and Sitka Ranger District Botanist (B. Krieckhaus, pers. comm., Aug. 16, 2011) for details on any previous investigations of the area and likely species and habitats.
3. A matrix provided by the Regional Botanist (M. Stensvold Aug.19, 2011; Feb. 24, 2012) identifying plant species thought to be rare in the Sitka Ranger District (Appendix C);
4. A database query by USFS staff of known locations of Sensitive and rare plant species near the study area (USFS 2011);
5. Alaska Natural Heritage Program (AKNHP) BIOTICS data base records regarding occurrence of plants tracked by the AKNHP as potentially rare that are known to occur near the study area (AKNHP 2011b, c);
6. The Arctos database of the herbarium of the University of Alaska Museum of the North for records of plant collections near the study area (accessed at http://arctos.database.museum/home.cfm);
7. Aerial photography to determine potential habitat types; and
8. Consultation with project scientists regarding potentially unique habitats (K. Bovee, K. Wolfe, pers. comm., Aug. 20, 2011).

3.2.1 Threatened and Endangered Species

The only Alaskan plant that is federally listed (or proposed) as Threatened or Endangered is the Aleutian shield fern: *Polystichum aleuticum* C. Christensen. This narrow endemic of the Aleutian Islands is almost certainly not to be found in the project area.

3.2.2 USFS-Designated Sensitive Species

Seventeen vascular plants and one lichen are designated by the USFS as Sensitive in the Alaska Region (Appendix A). The ten Sensitive plant species listed in Table 1 are known or suspected to occur on the Sitka Ranger District of the Tongass National Forest.

Table 1. USFS-Designated Sensitive Plant Species Known or Suspected to Occur on the Sitka Ranger District of the Tongass National Forest

Sensitive Plant Species		
Scientific Name	**Common Name**	**Occurrence on the Sitka Ranger District**
Botrychium spathulatum	Spatulate moonwort fern	known
Botrychium tunux	Moosewort fern	known
Botrychium yaaxudakeit	Moonwort, no common name	suspected
Ligusticum caldera	Calder's loveage	suspected
Lobaria amplissima	Lichen, no common name	known
Piperia unalascensis	Alaska rein orchid	known
Polystichum kruckebergii	Kruckeberg's swordfern	known
Romanzoffia unalaschcensis	Unalaska mist-maid	known
Sidalcea hendersonii	Henderson's checkermallow	suspected
Tanacetum bipinnatum subsp. *huronense*	Dune tansy	known

PLANTS KNOWN. There were no previously documented sightings of Sensitive plants in or near the project area.

PLANTS SUSPECTED. Based on a review of existing information, maps, and aerial photography, the following general habitats (or plant communities) occur in the project area: coniferous forest, forest edge, beach/forest ecotone, tall shrublands, low shrublands, rock outcrops, ridgetops, cliffs, gravel, boulder fields, seeps, wet areas, riparian areas, streambanks, waterfalls, lake margins, ponds, shallow freshwater, marshes, fens, heath, subalpine meadows, alpine tundra, snowbeds, moist-wet meadows, upper beach meadows, rocky intertidal and headlands, maritime beaches, intertidal mudflats, estuarine and beach meadows, and marine aquatic.

The Sensitive plants listed below were suspected to occur in the project area since the area contains appropriate habitat and is within the known or suspected range of the plants.

> *Botrychium spathulatum* W. H. Wagner. In Southeast Alaska, this moonwort is known only from upper beach meadows at one site on Kruzof Island and from an alpine site on Chichagof Island. It is also known from several disturbed sites in the Wrangell-St. Elias Mountains of Alaska and the Yukon, and scattered sites to the south and east to Quebec.
>
> *Botrychium tunux* Stensvold & Farrar. This moonwort is known in Southeast Alaska principally from sandy beaches, but it has also been found in open, disturbed areas of the Wrangell-St. Elias Mountains, and in alpine habitats on Dall and West Chichagof Islands.
>
> *Botrychium yaaxudakeit* Stensvold & Farrar. Until recently, this moonwort was known only from sandy beaches of the Yakutat Forelands in Southeast Alaska. It is now also known from forb meadows and open, disturbed roadside areas and rights-of-way in the Wrangell-St. Elias Mountains of Alaska, Yukon Territory, and British Columbia. Its total range includes scattered sites in Alberta, Montana, and northern California, as well as on the Pribilof Islands.

Lobaria amplissima (Scop.) Forss. This large and showy lichen is found on the trunks and branches of old-growth Sitka spruce and western hemlock, in old-growth stands at the edge of exposed ocean beaches. In Alaska, it is endemic to Southeast, where it is known from approximately twenty locations, including one on Baranof Island. Outside of eaAlaska it is known from one site in California and is considered very rare in Europe.

Piperia unalascensis (Spreng.) Rydb. is known from several sites in Southeast Alaska, including Baranof and Willoughby Islands, and is found in mesic meadows and open areas in forests and shrubland, from low elevation to the subalpine.

Romanzoffia unalaschcensis Cham. is found on wet rocky outcrops and along streams, often near the coast. This plant is common in the Aleutians, but is only known from a few locations in Southeast Alaska including one on Baranof Island, near Sitka.

Tanacetum bipinnatum (L.) Sch. Bip. ssp. *huronense* (Nutt.) Breitung. Dune tansy is common globally, but rare on the Tongass National Forest where it is only known from one upper beach meadow on Kruzof Island. Its general habitat is sand dunes and well drained sandy soil.

Three other Sensitive plants, listed below, are identified by the USFS as suspected to occur in the Sitka Ranger District but the investigators did not think any of the three was likely to occur in the project area.

Ligusticum calderi Mathias & Constance has its main range in British Colombia, from northern Vancouver Island to the Queen Charlotte Islands. In Alaska, it is known from a few widely separated sites on Dall Island, southern Prince of Wales Island, and Kodiak Island. It is found in wet to moist alpine or subalpine habitats, usually on limestone.

Polystichum kruckebergii W.H. Wagner. Although known from sites on Baranof Island, it is only found on ultramafic outcrops, a habitat that does not occur in the project area.

Sidalcea hendersonii S. Watson is endemic to Oregon, Washington, and southern Vancouver Island, and is disjunct to Southeast Alaska, where it is only known from one site – Howard Bay – about 25 miles west of Juneau. It is found in upper estuarine areas near the forest edge.

3.2.3 Other Rare Plant Taxa

Although the USFS Sensitive plant list is the only rare plant list formally recognized by the USFS, the Regional Botanist provided a working list of additional taxa that are rare within the Alaska Region or within particular Ranger Districts of the Region. HDR team members consulted with the USFS Regional Botanist (Mary Stensvold) and the Sitka Ranger District Botanist (Brad Krieckhaus) to determine which of these additional taxa were likely to be in the project area. Investigators also queried the AKNHP database for plant taxa that were known from the immediate vicinity of the project area and which also had a Subnational Rank[1] (SRank)

[1] S1 = CRITICALLY IMPERILED = Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extinction.
S2 = IMPERILED = Imperiled in the state because of rarity or because of some factor(s) making it especially vulnerable to extinction.
S3 = VULNERABLE = Vulnerable in the state either because rare and uncommon, found only in a restricted range, or because of other factors making it vulnerable to extinction.

of S3 or rarer. This review found the following taxa are known or suspected to occur in the vicinity of the study area. Two plants had records of occurrence in the general study area.

Hymenophyllum wrightii Bosch (Wright's filmy fern). The easily overlooked, minute gametophyte of this fern is now known from over 60 locations on the Tongass National Forest, including the Sitka Ranger District. The larger sporophyte of this filmy fern has not been found in Alaska. The only known location in North America is in the Queen Charlotte Islands of British Colombia. It is ranked as S2S3 by the AKNHP.

Lycopodiella inundata (L.) Holub (inundated club moss). This club moss is found on flooded pond margins and muddy lake shores and is near its northern range limit in the Sitka Ranger District. It is more common in southern Southeast Alaska where it is known from sites near Ketchikan and Wrangell; it is ranked S3 by the AKNHP.

Lycopodium dendroideum Michx. (tree groundpine) is known from three sites on Baranof Island, but is disjunct from other locations to the north by more than 150 miles, and to the south by over 100 miles. It is more common in the Interior of Alaska and is not on the AKNHP tracking list. It is known from a rocky site near Baranof Lake.

Mimulus lewisii Pursh (purple monkeyflower) reaches its northern range limit on Baranof Island. Although more common in British Colombia, the only other locations in Alaska are near Hyder and one site on southern Admiralty Island; it is ranked S2 by the AKNHP. It has been found on rocky sites near lake shores and streams and in avalanche chutes above lakes.

Oenanthe sarmentosa K. Presl ex DC. (water parsley) is known in Alaska principally from sites clustered near Ketchikan and Petersburg. It is known from several sites on the south end of Baranof Island and from the vicinity of Juneau and Douglas Island, and disjunctly over 400 miles north to the Bering Glacier and to Kayak Island. It is not tracked by the AKNHP.

Papaver spp. (unidentified poppy). An as-yet-unidentified species of poppy was collected in the alpine areas near Blue Lake and Bear Mt. on Baranof Island. These populations are the first records for a species of poppy in Southeast Alaska.

Phyllospadix serrulatus Rupr. ex Asch. (toothed surfgrass). In Alaska, this surf grass is known from widely scattered rocky, tidal, and subtidal sites along the coast, between Ketchikan and the Alaska Peninsula. It has been collected on Baranof Island and is ranked S2S3 by the AKNHP.

Sedum oreganum Nutt. (Oregon stonecrop) is found near the coast on cliffs, bluffs, and rocky sites from Alaska to California. In Alaska it is only known from a few sites, all in the Southeast, including Hyder, Juneau, and the south end of Admiralty Island. It was

S4 = APPARENTLY SECURE = Uncommon but not rare, and usually widespread in the state; possible cause of long-term concern.
S5 = SECURE = Common, widespread, and abundant in the state.

collected near Baranof Lake in 1963, but has not been found there since then. It is ranked S1 by the AKNHP.

Botanists used the existing information on rare plants and their habitats to identify habitats most likely to support rare plants, which would be targeted during the field surveys.

3.3 Non-Native Plant Species

Team members searched two databases to determine whether non-native plant species had been reported in the study area:

1. A database query by USFS staff of known locations of non-native plant species near the study area (USFS 2011); and
2. An on-line query of the Alaska Exotic Plant Information Clearinghouse (AKEPIC) database (AKNHP 2011a, c).

Database queries showed no reports of non-native plants in the study area; the nearest are approximately 12 miles west at Blue Lake and along the Sitka road system, and approximately 14 miles east across Chatham Strait near Tyee and in Whitewater Bay on Admiralty Island.

Review of aerial photographs of the study area and conversation with other Project staff identified areas disturbed by humans that would be likely to support non-native plants: developed areas in the community of Baranof Warm Springs, the trail from the developed area to Baranof Lake, the trail from Baranof Lake to Sadie Lake, and an old shelter site at the head of Takatz Bay.

4 Methods

4.1 Vegetation Mapping

The project scope called for using existing datasets to map vegetation in the study area in a format emphasizing tree size and density. The method described by Caouette and DeGayner (2005) uses existing information developed by the USFS to classify vegetation types in a way that they propose predicts tree size and density of forest stands. Caoutte and DeGayner propose that those stand characteristics may be more useful to address current management issues (for example, forest structure, wildlife habitat, ecosystem diversity) than the timber volume information more traditionally used for forest management. Caoutte and DeGayner's method uses three datasets as input to a GIS-based model: (1) timber type mapping produced by stereoscopic interpretation of aerial photographs, which delineated and classified homogeneous polygons with attributes including timber volume classes: (2) "common land unit" mapping that includes soil characteristics; and (3) a digital elevation model (DEM) useful for classifying slopes and aspects. The model uses three timber volume classes (actually, four classes combined into three), hydric versus non-hydric soils, and south-facing (considered wind-exposed) versus all other aspects to delineate size-density (SD) mapping groups, plus unproductive forests and non-forested lands.

For this study, HDR used equivalent methods and datasets to develop maps representing study-area vegetation types. The datasets HDR used are the timber type and soil layers provided by the USFS and the USGS DEM. HDR queried those datasets to identify unique combinations of

timber volume (or non-forested unit), hydric versus non-hydric soil, and south-facing versus all other aspects. Each unique combination of those three features constitutes one of the mapping units and those represent vegetation types. The study scope did not call for modifying the mapping after application of the model, so it was not adjusted based on field observations.

4.2 Field Study

Two botanists (Robert Lipkin, Lazy Mountain Biological Consulting; Anne Leggett, HDR) surveyed the project area for Sensitive and non-native plant species, and vegetation types, from 20 – 24 August 2011 and 6 – 8 August 2013. The team surveyed the Baranof Warm Springs and Sadie Lake areas on 20 – 21 August 2011; the Takatz Bay and Takatz Creek areas on 22 – 24 August 2011; and the Takatz Lake vicinity on 6 – 8 August 2013. Approximate survey routes are shown on Figures 5, 6, and 7. The Lorna Dee (a chartered fishing vessel) provided transport to Baranof Warm Springs and Takatz Bay and a small inflatable boat was used to access sites along Takatz Bay. The scientists accessed the Baranof Lake, Sadie Lake, and Takatz Creek areas on foot from Baranof Warm Springs and Takatz Bay. They surveyed areas surrounding Takatz Lake by traveling to and from the lake by floatplane from Sitka, then surveying lands on foot with skiff transport. Scientists identified survey routes within the potentially affected area to balance multiple objectives:

1. surveying unique habitats most likely to harbor rare plants;
2. visiting representative vegetation types;
3. examining human-disturbed areas to determine whether non-native plant species have become established;
4. determining whether additional rare-plant-supporting habitats might be present that merit further investigation if potentially affected; and
5. conducting work safely and efficiently.

They developed general survey plans before the field work but chose actual routes while in the field, adjusting and optimizing them continually in response to their observations and field travel logistics. Survey areas are described in section 4.2.2 because the investigators selected the routes with the primary focus on seeking rare plants and their habitats. Vegetation types were described in the course of rare plant surveys, and non-native species were sought as rare plant surveys took the scientists through disturbed areas.

4.2.1 Vegetation Types Survey

Field data would be used to describe the vegetation types shown on the maps produced from existing datasets. As scientists walked accessible parts of the project area (see section 4.2.2), they collected vegetation data (plant species and areal cover) at representative locations on a simple data form and as notes in a field book and on paper maps. They noted the mapping unit in which each sampling site was located so they could relate the field-observed vegetation type to the size-density-focused map units. Scientists took photographs at each data collection site and recorded their locations with both a GPS receiver and on paper maps.

4.2.2 Sensitive and Rare Plant Species Survey

The survey method for rare plants followed suggestions in Dillman et al. (2009) and USFS sampling protocols (various dates). Various survey intensity levels used by the USFS are described in Appendix B. The survey team conducted an Intuitive Controlled survey for selected parts of the project area, which included representatives of most suitable habitat types except for those in alpine, cliff, and steep creek-side areas. The team was unable to complete an Intuitive Controlled survey for the full project area because of access and time limitations. The team had not intended to perform a full survey of the transmission line alternatives because it would not have been cost-effective until the final alignment and proposed tower and clearing locations are identified, largely because of steep terrain and the relatively small footprint of ground disturbance required for pole footings. In addition, because the access road location was not yet specified, the team did not make a special effort to survey the conceptual road route at the expense of visiting other interesting and more accessible areas.

At Baranof Warm Springs the team surveyed selected areas of suitable habitat along the north side of Baranof Creek and Lake, from Baranof Lake to Sadie Lake, and halfway up Sadie Lake along its east side within the likely corridor for the transmission line (see survey route on Figure 5). Selected areas received Intuitive-Controlled-level survey; the remainder of the route received a General level survey. (See survey intensity definitions in Appendix B.)

At Takatz Creek the team surveyed the lower section of the creek, focusing on areas likely to be affected by modified water levels (riparian wetlands, ponds, and waterfalls). The general areas of the power house and proposed routes for the access road and transmission line (Figure 6) were given a General level survey with some areas receiving a more complete Intuitive Controlled survey.

At Takatz Lake the team surveyed the valley floor and representative toes of mountain slopes in the proposed inundation area at the lake inlet. They examined accessible representative areas at the proposed outlet dam and saddle dam sites, and representative suitable habitats on the lower mountain slopes on the north and south sides of Takatz Lake within the proposed inundation limits (survey routes and points on Figure 7).

The investigators recorded waypoints along each survey route; data collection sites were recorded with a hand-held GPS receiver and on aerial-photo-based field maps. Within each general survey area, scientists concentrated on areas with likely habitat for Sensitive or rare species, and on areas most likely to be affected by the project, either from direct, construction-related disturbance or from lowered or raised water levels. At each site where rare taxa were found, the survey team took digital photos and compiled detailed notes on abundance, distribution, habitat, and associated species. The botanists could identify most plants in the field. The scientists collected unknown or critical taxa in the field where practical, taking voucher specimens of rare taxa only if the population was large enough to support collections. They identified the collected plants in camp, or pressed and dried them for later identification in the office. Not all plants collected in the field were identified to species in the office, but each was identified sufficiently to know whether it was a rare taxon. The lead botanist retained voucher specimens of the rarer taxa, and discarded collections of more common plants. The voucher specimens have not been provided to a herbarium.

The names used to refer to individual plant taxa largely follow the PLANTS database (USDA NRCS 2012) and Flora of North America (Flora of North America Editorial Committee, eds. 1993+).

4.2.3 Non-Native Plant Species Survey

Botanists performed a reconnaissance-level survey for non-native plants in the same areas as the rare plant survey, plus recorded incidental observations in the community of Baranof Warm Springs. The work in Baranof Warm Springs did not extend throughout the developed area but included the heavily traveled land area near the dock. The team recorded observations on the forms used by the AKEPIC program and recorded locations by GPS receiver and on field maps.

5 Results

5.1 Vegetation Mapping and Vegetation Types

GIS analysts mapped the vegetation according to the tree size-density (SD) model developed by Caouette and DeGayner (2005). The resulting map is shown in Figure 4 and the acreage extent of each SD type is listed in Table 2. This mapping is based on existing digital datasets developed from gross-scale mapping and has not been adjusted based on this study's field surveys. Informal site observations indicate it is generally accurate, but some mapped polygons may differ from actual site conditions by one timber volume class (for example, a unit mapped as SD5N may actually be SD4N); field investigators did not measure timber volume so this observation is based entirely on comparison among similarly mapped polygons. Additionally, the mapping presented on Figure 4 has not been adjusted to better match the vegetation boundaries visible on aerial imagery, and units of homogeneous vegetation that are smaller than the minimum polygon size of the timber type and soil mapping are not identified on this mapping (for example, riparian shrub vegetation). Because the USFS timber type and soil maps were created independently, many boundaries that are similar between the two datasets do not match exactly, which results in many very small, scattered edge polygons; these have not been removed from the vegetation mapping depicted on Figure 4 nor from the acreage calculations because they are not detectable at the scale of the full vegetation mapping area.

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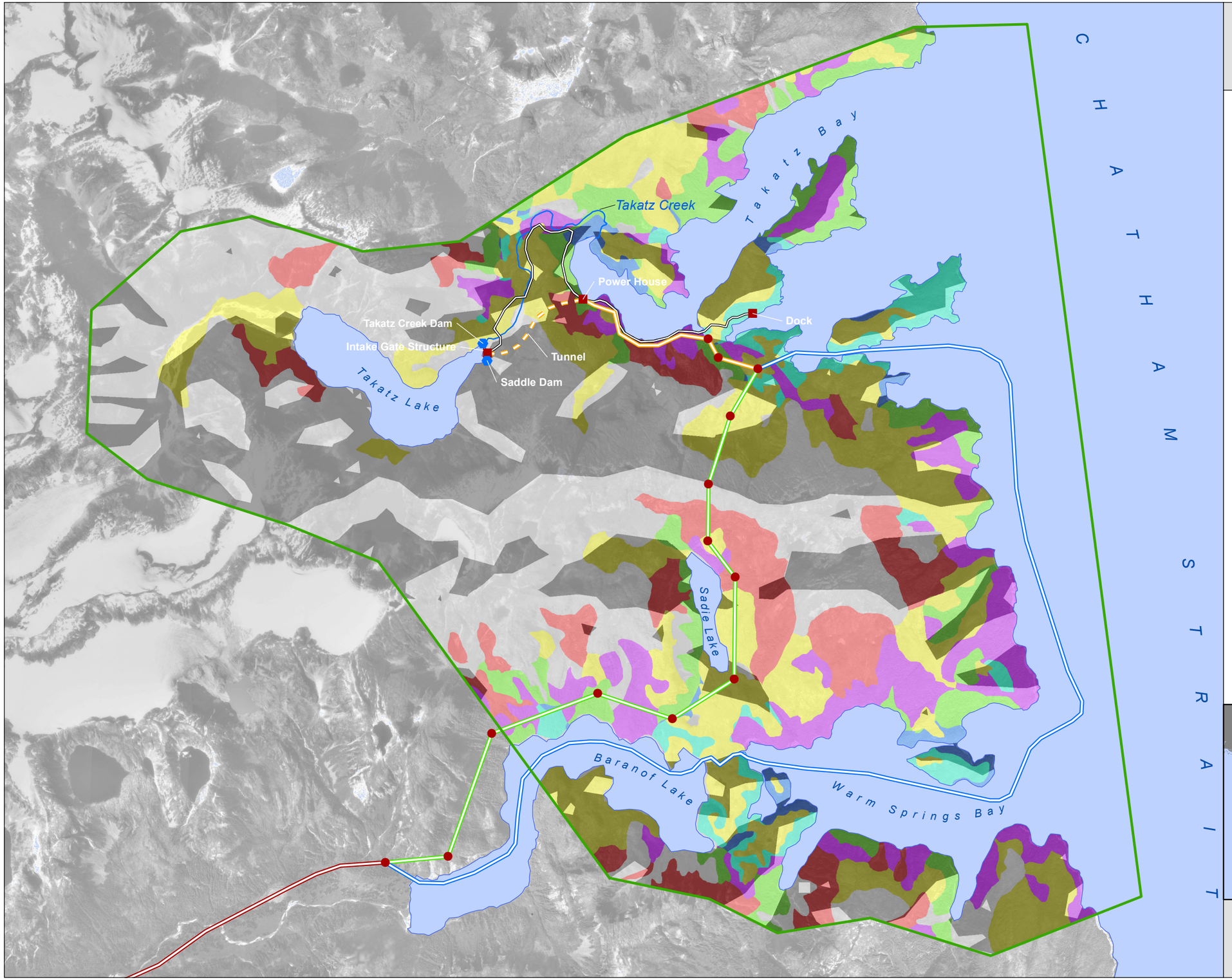
Figure 4
Takatz Lake Hydroelectric Project
Botanical Resources Studies
Tree Size - Density Mapping



Transmission Line Alternatives
- Submarine Alternative
- Overland Alternative
- Baronof-Medveji Segment
- Main Overland Segment

Proposed Structures
- Facility
- Pole
- Dam
- Proposed Road
- Tunnel
- Area of Interest

Tree Size - Density Class by Aspect

SOUTH	NORTH	
		Non-Forested
		Slide
		Unproductive Forest
		Size-Density Class 4
		Size-Density Class 4 - Hydric Soil
		Size-Density Class 5
		Size-Density Class 5 - Hydric Soil

Timber volume classes are: 4 = 8-20 Mbf/acre;
5 = 20-30 Mbf/acre; 6 = 30-50 Mbf/acre.
7 > 50 Mbf/acre.

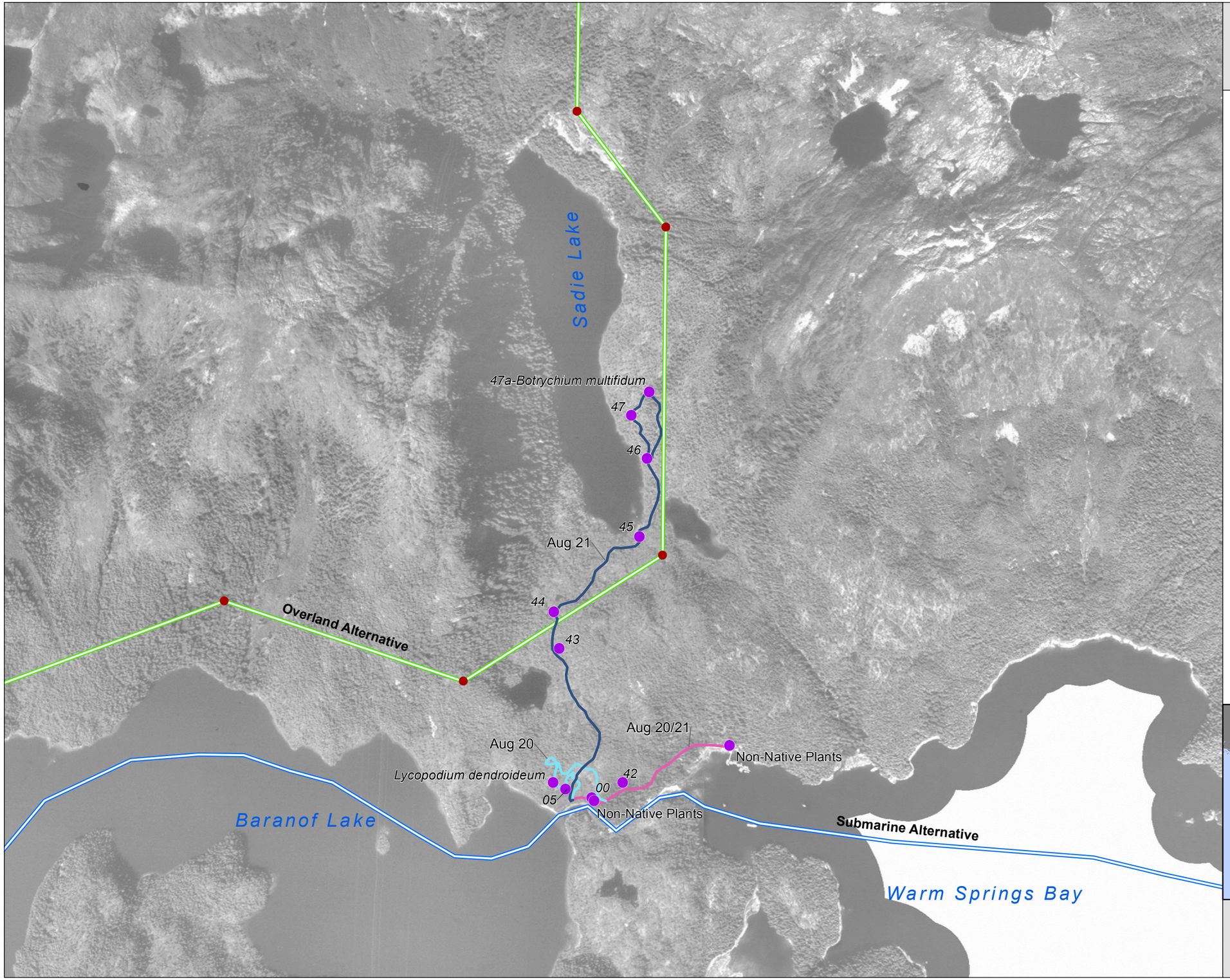
0 0.5 1 Miles

0 0.5 1 2 Kilometers

1:45,000

Projection: NAD83 State Plane Zone 1 (Feet)

Figure 5
Takatz Lake Hydroelectric Project
Baranof Warm Springs-Sadie Lake
Botanical Resources Survey Areas



Field Study Sites

2011 Survey Routes

Aug 20

Aug 20/21

Aug 21

Proposed Features

Pole

Transmission Line Alternatives

Submarine Alternative

Overland Alternative

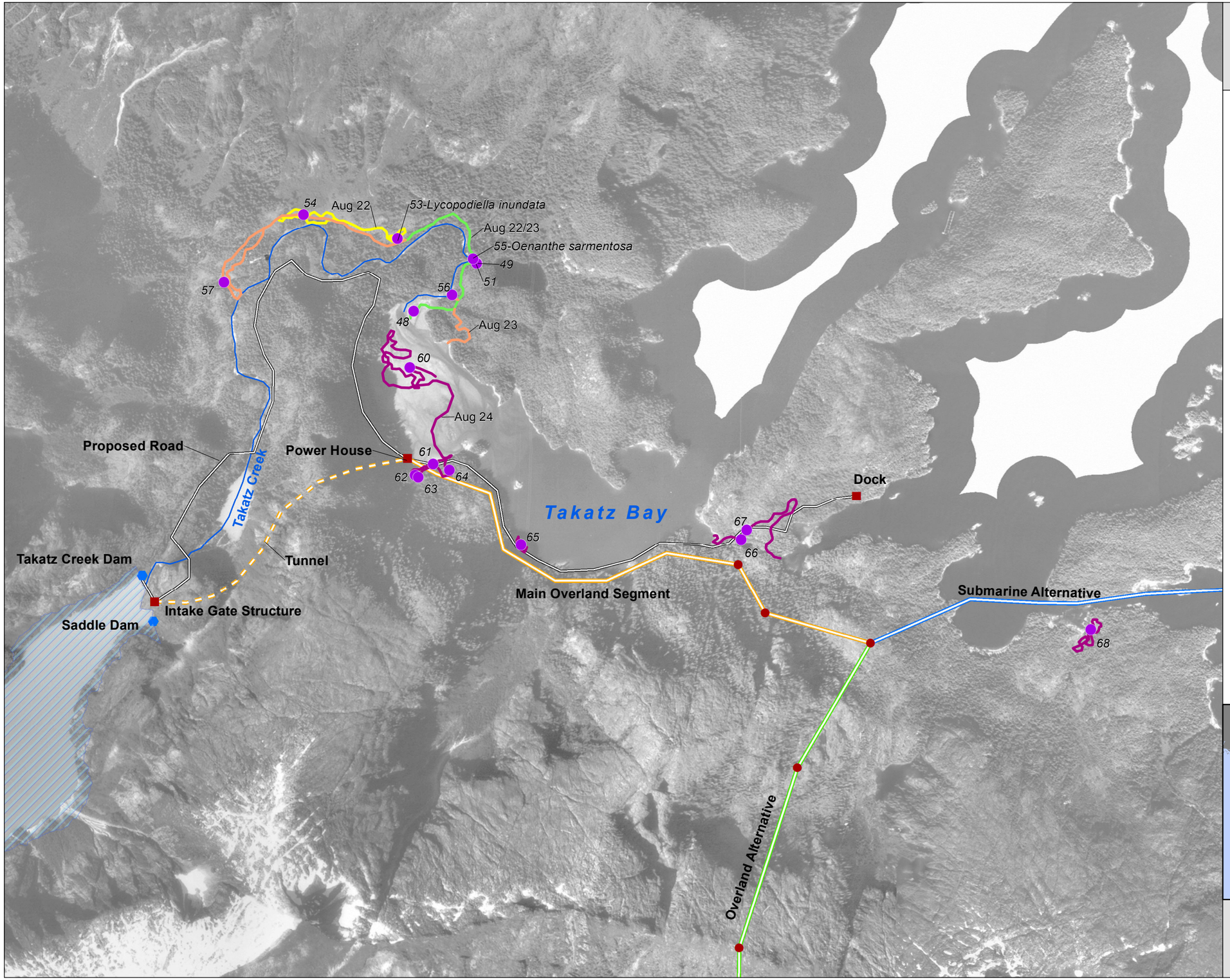
0 500 1,000 2,000 Feet

0 100 200 400 600 Meters

1:14,000

Projection: NAD83 State Plane Zone 1 (Feet)

Figure 6
Takatz Lake Hydroelectric Project
Takatz Creek-Takatz Bay
Botanical Resources Survey Areas



Field Study Sites

2011 Survey Routes

- Aug 22
- Aug 22/23
- Aug 23
- Aug 24

Proposed Features

- Facility
- Pole
- Dam
- Area of Inundation
- Road
- Tunnel

Transmission Line Alternatives

- Submarine Alternative
- Overland Alternative
- Main Overland Segment

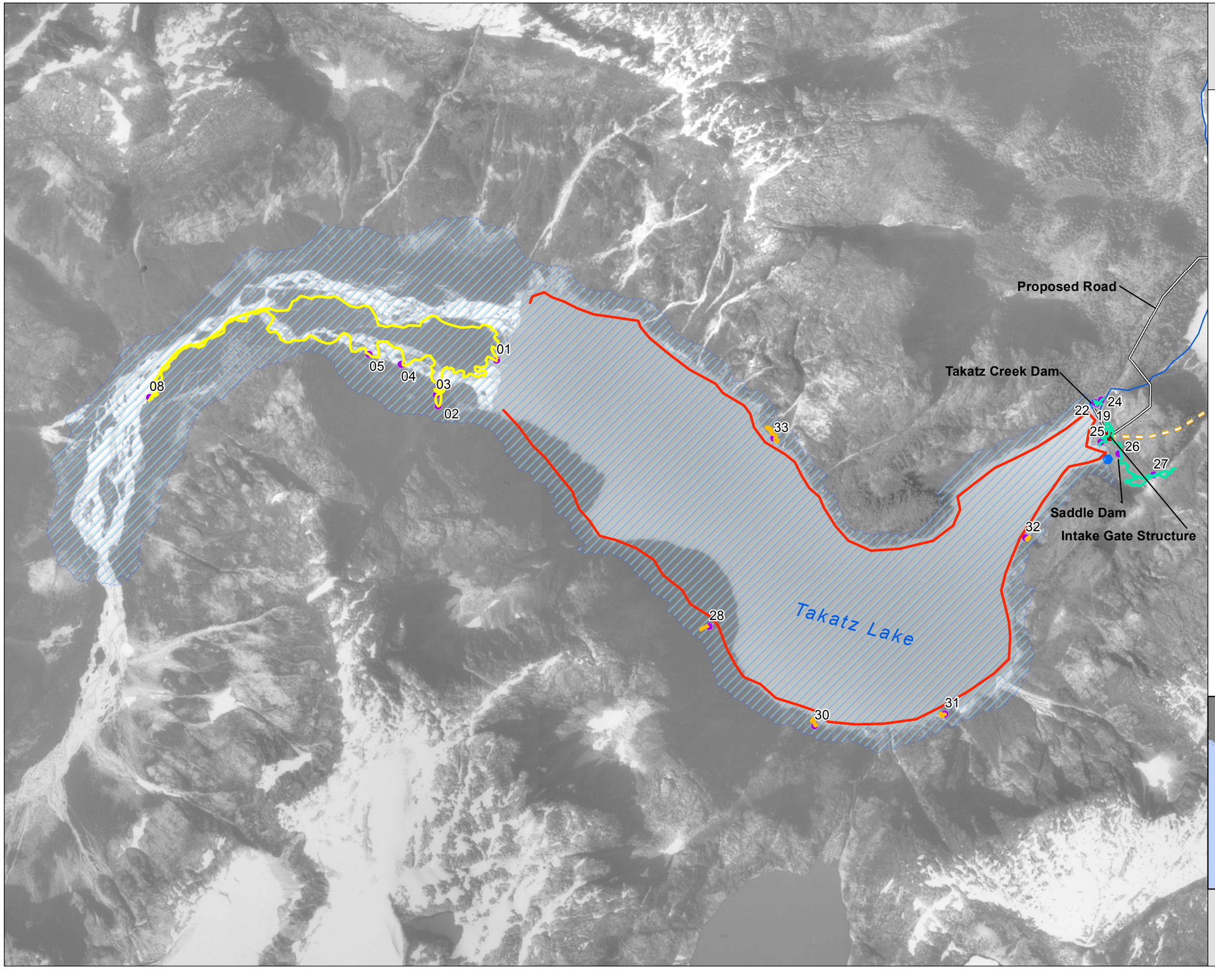
0 500 1,000 Feet

0 100 200 400 Meters

1:17,000

Projection: NAD83 State Plane Zone 1 (Feet)

Figure 7
Takatz Lake Hydroelectric Project
Takatz Lake
Botanical Resources Survey Areas



Field Study Sites

2013 Survey Routes

- Aug 6
- Aug 7
- Aug 7/8
- Aug 8

Proposed Features

- Facility
- Pole
- Dam
- Area of Inundation
- Road
- Tunnel

N

0 500 1,000 Feet

0 100 200 400 Meters

1:14,000

Projection: NAD83 State Plane Zone 1 (Feet)

Table 2. Vegetation Type Acreages of the Study Area Based on the Results of a Tree Size-Density Model[1]

Vegetation Type and Symbol[1] (Tree Size-Density Class)		Brief Description[2]	Acreage in Study Area	Percentage of Study Area
Timber volume class 6 or 7, any aspect, any soil type	SD67	Highly productive forests	0	0
Timber volume class 5, south aspect, non-hydric soil	SD5S	Highly productive forests; canopy closure moderate to high and texture uniform	741	5
Timber volume class 5, north aspect or flat, non-hydric soil	SD5N	Moderately productive forests. Canopy closure is moderate and texture coarse	338	2
Timber volume class 5, any aspect, hydric soil	SD5H	Moderately productive forests on poorly-drained sites; patchy canopy closure and texture variable and patchy	203	1
Timber volume class 4, south aspect, non-hydric soil	SD4S	Highly productive forests; closed canopy, uniform canopy texture	815	6
Timber volume class 4, north aspect, non-hydric soil	SD4N	Low- or moderate-productivity forests; moderate canopy closure, coarse canopy texture	560	4
Timber volume class 4, any aspect, hydric soil	SD4H	Low-productivity older forests on poorly-drained sites (muskegs, rolling terrain); trees small, canopy closure variable	526	4
Unproductive forests with timber volume class ≤ 3	UF	Low timber volume due to rock cover, alder, willow, and/or high elevation	3,099	21
Unproductive forests or shrub thickets resulting from recurrent slides	S	Recurrent slide areas	1,417	10
Non-forested	NF	Rock, alpine, muskeg meadow, natural grassland, brush, mass wasting, recurrent slide	6,105	42
Lake		Lakes	844	6
TOTAL			**14,648**	**100**

[1] Described by Caouette and DeGayner (2005); Non-forested and Unproductive forest types are not described in that article. Those descriptions are based on attribute descriptions in the USFS timber type shapefile.

[2] From USFS (no date) table describing SD types.

Prominent plant species in each vegetation type are described below based on limited data collected during field surveys, and the plant associations are named according to the USFS Chatham Area Forest Plant Association Management Guide (Martin et al. 1995). Figures 5, 6, and 7 display the site numbers where data were collected, and those are listed with the respective vegetation descriptions below, as are the names of typical plant associations (Martin et al. 1995).

SD67 – The field team did not visit any sites of this type; it is not a common type in the study area. From aerial imagery, it appears that these mapped units support larger and a higher proportion of Sitka spruce (*Picea sitchensis*) trees than do the SD5S and SD5N units described below. SD67 sites would be in the western hemlock (*Tsuga heterophylla*) and Sitka spruce plant association series.

SD5N and SD5S – (sites 46, 49, 62) These units support large Sitka spruce and western hemlock. Common vascular understory species are blueberry (*Vaccinium ovalifolium*), rusty menziesia (*Menziesia ferruginea*), salmonberry (*Rubus spectabilis*), deer fern (*Blechnum spicant*), five-leaved bramble (*Rubus pedatus*), fernleaf goldthread (*Coptis aspleniifolia*), mountain woodfern (*Dryopteris expansa*), foamflower (*Tiarella trifoliata*), and dwarf dogwood (*Cornus canadensis).* Investigators did not visit enough sites to distinguish differences between north- and south-facing forests.

A typical plant association for this vegetation type is western hemlock-Sitka spruce/blueberry.

SD5H and SD4H – (site 64) Field investigators did not visit any SD5H sites. Species are likely similar between these two vegetation types. Common vascular species include western hemlock, yellow cedar (*Callitropsis nootkatensis*), tall blueberry, fernleaf goldthread, skunk cabbage (*Lysichiton americanus*), dwarf dogwood, and false lily of the valley (*Maianthemum dilitatum*).

SD5H is not common in the study area; much of the mapped SD5H may be the result of timber volume and soil mapping boundaries not matching exactly, so locations where hydric soils extend slightly into SD5 areas become coded as SD5H even though the SD5 sites may actually be well drained. It also appears that SD5H polygons may have resulted where the timber volume mapping delineated vegetation units at a finer scale than the scale at which soil mapping delineated hydric soils.

A typical plant association of this vegetation type would be western hemlock-yellow cedar/tall blueberry/skunk cabbage association.

SD4N and SD4S – (site 42) These vegetation types support most of the same species as do the SD5 sites, but the trees tend to be smaller and with a lower proportion of Sitka spruce and a higher proportion of yellow cedar. Some units mapped as these types appear to be sparser forests in a matrix of alder shrubs. Dominant vascular species are western hemlock, Sitka spruce, and yellow cedar, tall blueberry, rusty menziesia, five-leaved bramble, bunchberry, false lily of the valley, fernleaf goldthread, deer fern, and twisted stalk (*Streptopus amplexifolius*).

The one site of this type where data were collected would be classified in the western hemlock-yellow cedar/blueberry association.

Unproductive Forest (UF) – (sites 00, 05 (2011; at Baranof Lake), 24, 43, 44, 45, 47, 67) In the lower elevation parts of the study area, these were scrub forests or scrubby muskegs and fens. They support small trees and stunted shrubs of mountain hemlock (*Tsuga mertensiana*), yellow cedar, and shore pine (*Pinus contorta*). Common shrubs include crowberry (*Empetrum nigrum*), bog blueberry (*Vaccinium uliginosum*), bog rosemary (*Andromeda polifolia*), Aleutian mountainheath (*Phyllodoce aleutica*), and tall blueberry. Dominant herbs are deer cabbage (*Nephrophyllidium crista-galli*), dwarf dogwood, tufted clubrush (*Trichophorum cespitosum),* few-flowered sedge (*Carex pauciflora*), and tall cottongrass (*Eriophorum angustifolium* ssp. *angustifolum*). These sites would be classified in the following plant associations: mixed

conifer/blueberry/deer cabbage, mountain hemlock/blueberry/deer cabbage, and shore pine/crowberry.

Around Takatz Lake, areas mapped as unproductive forest include the valley floor at the west (inlet) end of the lake and limited areas of steep slope adjacent to the lake. However, the valley floor actually supports few trees. The unproductive forests on the mountain slopes occupy sites not subject to avalanches or rock slides; these are on rock knobs; on and below cliffs; and on sites with little slope above them. These were generally inaccessible along the lake. Dominant species observed from a distance and at the single site visited at Takatz Lake include mountain and western hemlock, yellow cedar, Sitka spruce, blueberry, rusty menziesia, Sitka alder (*Alnus viridis* ssp. s*inuata*), deer fern, partridgefoot (*Luetkea pectinata*), and five-leaved bramble.

Slides (S) – (site 063) A single site mapped as this type was visited while in the field, at low elevation in Takatz Bay; the site supported a dense thicket of salmonberry, with a small amount of Sitka alder (*Alnus viridis* ssp. s*inuata*) and Devil's club (*Oplopanax horridus*), and with a sparse understory dominated by foamflower and five-leaved bramble.

Non-forested (NF)

Terrestrial. This mapped land cover type includes unvegetated areas and areas that are vegetated but do not support trees. Much of the area immediately surrounding Takatz Lake and all the upper slopes and ridges throughout the study area are mapped as non-forested and have extensive areas of cliffs and exposed bedrock. In many areas, the exposed rock is partially vegetated with small groups of trees, alders and salmonberries, and, in depressions and flat areas, wet meadows.

Non-forested sites visited at lower elevations included three fens or wet meadows: sites 52, 53, and 54. Two of these were sedge fens characterized by tall cottongrass, Sitka sedge (*Carex aquatilis* var. *dives*), deer cabbage, dwarf dogwood, sundew (*Drosera rotundifolia*), and a dense moss cover. They were water-saturated to the surface or shallowly inundated. The sites had a sparse cover of small or scrub-form tree species including yellow cedar, mountain hemlock, and shore pine. Common shrubs included Labrador tea (*Ledum groenlandicum*), crowberry, bog laurel (*Kalmia microphylla*), bog rosemary, bog cranberry (*Vaccinium oxycoccus*), copperbush (*Elliottia pyroliflorus*), and bog blueberry.

A wet meadow that other project biologists had cited as unique within the study area was located north of Takatz Creek (site 54). It was sloping and appeared to be wetted by groundwater discharge or a diffuse flow from the alder slope above. Dominants herbs included Sitka sedge, bluejoint reedgrass (*Calamagrostis canadensis*), and deer cabbage, Bering hairgrass (*Deschampsia beringensis*), and Douglas aster (*Symphyotrichum subspicatum* var. *subspicatum*).

The slopes surrounding Takatz Lake are mostly mapped as non-forested. They are composed of cliffs, steep bedrock slopes, bare talus slopes, and talus or mineral soil slopes supporting herb meadow, heath, or shrub thickets. Sites visited on these slopes (sites 02, 28, 30, 31, 32, 33) are variously dominated by salmonberry, Sitka alder, stink currant (*Ribes bracteosum*), copperbush, elderberry (*Sambucus racemosa*),and a diverse herbaceous understory including partridgefoot, Sitka valerian (*Valeriana sitchensis*), American false hellebore (*Veratrum viride*), alpine heuchera (*Heuchera glabra*), Canadian burnet (*Sanguisorba stipulata*), saxifrages (*Micranthes ferruginea, M. lyallii*), alpine mountainsorrel (*Oxyria digyna*), curled starwort (*Stellaria crispa*), and mountain hairgrass (*Vahlodea atropurpurea*).

The valley floor at the inlet of Takatz Lake is mapped as unproductive forest but it actually supports few trees. It is a mosaic of active river channels and bars, inactive bars and channels being recolonized with herbaceous plants, dense thickets of tall alder and willow, and low and open alder and willow stands. The shrub thickets (sites 03, 05 [2013; at Takatz Lake]) are dominated by Sitka alder, undergreen willow (*Salix commutata*), partridgefoot, mountain hairgrass, fireleaf leptarrhena (*Leptarrhena pyrolifolia*), and arctic sweet coltsfoot (*Petasites frigidus*). Common plants on the gravel bars (sites 01, 04, 08) include Sitka alder, undergreen willow, bluegrass (*Poa pratensis* ssp. *alpigena*), river beauty (*Chamerion latifolium*), saxifrages (*Micranthes ferruginea*, *M. lyallii*), arctic sweet coltsfoot, and mountain hairgrass.

Lakes. Also mapped as non-forested, these include Takatz Lake, the lake downstream of Takatz Lake along Takatz Creek, Sadie Lake, Baranof Lake, and small lakes or ponds between Sadie Lake and Baranof Lake.

Intertidal areas. (sites 48, 60, 61, 65, 68) Investigators visited vegetated intertidal sites at the head of Takatz Bay and along its south shore. A description is presented in the rare plant section below, under the Takatz Bay discussion.

Riparian areas. (sites 49, 55) These areas are too narrow to have been mapped within the existing USFS timber type or soil mapping but, along Takatz Creek, could be affected by diversion of water for the Project. They include rocky areas exposed to spray from falls and rapids; sun-exposed moist banks and bars; shrub thickets formed by flooding, shifting channels, and intermittent beaver use; backwaters; and forests (as described above) extending all the way to the bank.

5.2 Sensitive and Rare Plant Species

The investigators did not find any plant species designated as Sensitive by the USFS. The following describes the types of habitats searched, species identified in each, and any rare plants that were found. The approximate survey routes or points are marked on Figures 5, 6, and 7.

5.2.1 Baranof Warm Springs

The team surveyed the trail from Baranof Warm Springs to Baranof Lake on 20 – 21 August 2011. The plant species listed in this section comprise all the vascular plant species observed in the Baranof Warm Springs area. The trail led through a mixed forest of Sitka spruce and western hemlock with an understory of blueberry, rusty menziesia, Sitka alder, and dwarf dogwood. Observed species included:

Alnus viridis ssp. *sinuata* (Regel) A. & D. Love
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) Roth
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Carex echinata ssp. *phyllomanica* (W. Boott) Reznicek
Carex laeviculmis Meinsh.
Carex lenticularis var. *limnophila* (Holm) Cronq.
Carex mertensii Prescott ex Bong.
Menziesia ferruginea Sm.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Picea sitchensis (Bong.) Carr.
Pinus contorta Dougl. ex Loud.
Poa annua L.
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Polystichum munitum (Kaulfuss) K. Presl
Rubus pedatus Sm.
Rubus spectabilis Pursh
Sanguisorba stipulata Raf.
Sorbus sitchensis M. Roemer

Carex pluriflora Hulten
Cassiope mertensiana (Bong.) D. Don
Coptis aspleniifolia Salisb.
Cornus canadensis L.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Geocaulon lividum (Richards.) Fern.
Juncus supiniformis Engelm.
Ledum groenlandicum Oeder
Lysichiton americanus Hulten & St. John
Maianthemum dilatatum (Wood) A. Nels. & J.F. Macbr.
Streptopus Michx.
Tiarella trifoliata L.
Tiarella trifoliata var. *trifoliata* L.
Torreyochloa pallida var. *pauciflora* (J. Presl) J.I. Davis
Trisetum cernuum Trin.
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L.

Investigators did not encounter any USFS Sensitive plant species in the survey area. A few individuals of Chamisso's orchid (*Platanthera chorisiana*) were seen growing in the wet, lakeshore meadow near the trail at the lower end of Baranof Lake. This orchid was previously listed as a USFS Sensitive species but has been found at an increasing number of wet sites in south coastal Alaska, especially in fens and bogs.

Oregon stonecrop (*Sedum oreganum*) is known from a 1963 collection made by Luella Smith who only noted the location as "Baranof Lake, Warm Springs Bay" with no additional notes on site or habitat. The team searched a number of rocky outcrops on slopes and muskegs near the lake but did not find this rare stonecrop. No other collections or observations are known from this site.

The field team found a small population of tree groundpine (*Lycopodium dendroideum*) at the base of a large outcrop above the lake (Photographs 1 and 2; Figure 5). The population consisted of approximately 20 ramets (which may possibly represent only two to four genetically distinct individuals) growing in thin soil and rock crevices adjacent to an unofficial trail. Associated species included yellow cedar, dwarf blueberry (*Vaccinium cespitosum*), tall blueberry, bog blueberry, lowbush cranberry (*Vaccinium vitis-idaea*), and dwarf dogwood.

Photograph 1. **Tree groundpine (*Lycopodium dendroideum*) habitat**

Photograph 2. **Tree groundpine (*Lycopodium dendroideum*)**

The population was largely vegetative, with only five ramets bearing strobili. The individuals seemed reasonably healthy, but are growing immediately adjacent to a trail that has moderate use. Continued trail erosion could extirpate this population.

This is possibly the same population collected by Stensvold in 1982 (Muller 4747) which consisted of approximately ten plants.

Species seen on this and nearby outcrops included:

Andromeda polifolia L.
Blechnum spicant (L.) Roth
Coptis trifolia (L.) Salisb.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Gentiana douglasiana Bong.
Geocaulon lividum (Richards.) Fern.
Ledum groenlandicum Oeder
Lycopodium dendroideum Michx.
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Phegopteris connectilis (Michx.) Watt
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Rubus chamaemorus L.
Trichophorum cespitosum (L.) Hartm.
Tsuga heterophylla (Raf.) Sarg.

Botanists surveyed the trail (and adjacent areas) from Baranof Lake to and part way around Sadie Lake on 20 – 21 August 2011. This area includes portions of the proposed transmission line route. The trail ascended through shore pine/tufted clubrush fens and muskegs through forested slopes, ericaceous shrub openings, wet meadows, streams, and ponds to Sadie Lake. Species seen along the survey route and meanders include:

Alnus viridis ssp. *sinuata (Regel)* A.& D. Love
Andromeda polifolia L.
Arnica amplexicaulis Nutt.
Blechnum spicant (L.) Roth
Botrychium multifidum (Gmel.) Trev.
Callitropsis nootkatensis (D. Don) Oerst. ex D.P.
Luetkea pectinata (Pursh) Kuntze
Lycopodium dendroideum Michx.
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Lysichiton americanus Hulten & St. John
Nephrophyllidium crista-galli (Menzies ex

Little
Carex anthoxanthea J.& K. Presl
Carex echinata ssp. *phyllomanica* (W. Boott) Reznicek
Carex laeviculmis Meinsh.
Carex pluriflora Hulten
Carex saxatilis L.
Carex stylosa C.A. Mey.
Cassiope mertensiana (Bong.) D. Don
Coptis aspleniifolia Salisb.
Coptis trifolia (L.) Salisb.
Cornus canadensis L.
Dodecatheon jeffreyi Van Houtte
Drosera anglica Huds.
Drosera rotundifolia L.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Erigeron peregrinus (Banks ex Pursh) Greene
Eriophorum angustifolium Honckeny ssp. *angustifolium*
Gentiana douglasiana Bong.
Gentiana platypetala Griseb.
Geocaulon lividum (Richards.) Fern.
Geum macrophyllum Willd.
Harrimanella stelleriana (Pallas) Coville
Huperzia haleakalae (Brack.) Holub
Juncus ensifolius Wikstr.
Juncus supiniformis Engelm.
Kalmia microphylla (Hook.) Heller
Ledum groenlandicum Oeder
Loiseleuria procumbens (L.) Desv.
Hook.) Gilg
Nuphar lutea ssp. polysepala (Engelm.) E.O. Beal
Parnassia fimbriata Koenig
Pedicularis parviflora Sm. ex Rees
Phegopteris connectilis (Michx.) Watt
Phyllodoce aleutica ssp. *glanduliflora* (Hook.) Hulten
Pinguicula vulgaris L.
Pinus contorta Dougl. ex Loud.
Platanthera chorisiana (Cham.) Reichenb.
Platanthera stricta Lindl.
Poa annua L.
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Rhynchospora alba (L.) Vahl
Rubus chamaemorus L.
Sanguisorba stipulata Raf.
Trichophorum cespitosum (L.) Hartm.
Selaginella selaginoides (L.) Beauv. ex Mart. & Schrank
Sparganium angustifolium Michx.
Stuckenia filiformis (Pers.) Borner
Tofieldia glutinosa (Michx.) Pers.
Triantha glutinosa (Michx.) Baker
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium cespitosum Michx.
Vaccinium ovalifolium Sm.
Vaccinium oxycoccos L.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L.
Veratrum viride Ait.
Viola langsdorfii Fisch. ex Gingins

No USFS Sensitive plant species were seen; but one individual of leathery grapefern (*Botrychium multifidum*) was located in a muskeg above Sadie Lake. This moonwort is sparsely distributed in south coastal Alaska, but is known from other collections on Baranof Island. It is not tracked by the AKNHP or by the USFS.

5.2.2 Takatz Creek

On 22 – 23 August 2011, the team surveyed Takatz Creek from tide water up to the lower falls (Figure 6). The team did not search creekside areas above the falls in 2011 or 2013. The creek is bordered by western hemlock-Sitka spruce forest interspersed with open wet graminoid and herbaceous meadows on low banks and terraces, sloughs and pools, and wet rock faces as well as sedge-dominated muskegs and fens. Scientists concentrated on open creekside sites and other areas likely to be affected by diminished water levels. An Intuitive Controlled survey was completed just at representative sites along the creek, not at every suitable habitat.

A list of vascular plants observed along the Takatz Creek survey routes is shown in Appendix D. No USFS Sensitive plant species were seen, although two new populations of plants that the USFS considers rare within the Tongass Forest were discovered – inundated club moss (*Lycopodiella inundata* (L.) Holub) and water parsely (*Oenanthe sarmentosa* K. Presl ex DC).

Photograph 3. **Inundated club moss (*Lycopodiella inundata*)**

The inundated club moss population was in a muskeg near the creek (Photographs 3, 4, and 5; Figure 6; data form on file). This club moss is ranked as S3 (rare or uncommon in Alaska) by the AKNHP and reaches its northern range limit on Baranof Island. The population consisted of four to five subpopulations in a wet sedge (tufted clubrush-tall cottongrass) fen with ericaceous shrubs and scattered small pools. All of the subpopulations were restricted to the low, flooded or saturated areas at the margins of the pools where they formed mats growing on live moss and exposed moss peat (Photographs 4 and 5). Associated species included:

Eriophorum angustifolium Honckeny ssp. *angustifolium*
Drosera rotundifolia L.
Trichophorum cespitosum (L.) Hartm.
Andromeda polifolia L.
Ledum groenlandicum Oeder
Carex aquatilis var. *dives* (Holm) Kukenth.
Coptis trifolia (L.) Salisb.

Photograph 4. **Inundated club moss (*Lycopodiella inundata*) habitat**

Photograph 5. **Inundated club moss (*Lycopodiella inundata*) habitat**

The population of inundated club moss seemed healthy and vigorous with numerous fertile stems. The growth habit of this club moss produces a dense mat of tangled stems rooting in the muddy substrate making it difficult to estimate population size or even to identify individual plants and ramets. The various subpopulations cover approximately 45 m^2 of suitable habitat with an average of 40% cover of inundated club moss stems. A conservative estimate of 200 ramets/m^2 would yield an estimated population of over 9,000 ramets. It would be difficult to estimate the number of genetically distinct individuals this represents.

Other common species within the surrounding muskeg include:

Andromeda polifolia L.
Carex aquatilis var. *dives* (Holm) Kukenth.
Carex pauciflora Lightf.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Nuphar lutea ssp. *polysepala* (Engelm.) E.O.

Coptis trifolia (L.) Salisb.
Cornus canadensis L.
Drosera rotundifolia L.
Empetrum nigrum L.
Eriophorum angustifolium Honckeny ssp. *angustifolium*
Gentiana douglasiana Bong.
Ledum groenlandicum Oeder
Lysichiton americanus Hulten & St. John
Menyanthes trifoliata L.
Beal
Pinus contorta Dougl. ex Loud.
Platanthera dilatata (Pursh) Lindl. ex Beck
Rhynchospora alba (L.) Vahl
Trichophorum cespitosum (L.) Hartm.
Sparganium angustifolium Michx.
Stuckenia filiformis (Pers.) Borner
Triantha glutinosa (Michx.) Baker
Tsuga mertensiana (Bong.) Carr.
Vaccinium oxycoccos L.
Vaccinium uliginosum L.

The water parsley (*Oenanthe sarmentosa*) population was located on a low bank of Takatz Creek within a wet tufted hairgrass - swordleaf rush - cow parsnip - kneeling angelica *(Deschampsia cespitosa - Juncus ensifolius - Heracleum lanatum - Angelica genuflexa)* graminoid-forb meadow (site 055, Figure 6). This species is not tracked by the AKNHP but is considered rare by the USFS within the Sitka Ranger District because of its sparse distribution. The population consisted of several individuals, in fruit, growing within one small cluster. The site also supported a small population of Enander's sedge (*Carex lenticularis* var. *dolia*), a sedge that was formerly listed as a USFS Sensitive species within the Alaska Region, and had been ranked S3 by the AKNHP, but which has now been found on many additional sites. It is no longer tracked by either the USFS or the AKNHP.

Associated species included:

Angelica genuflexa Nutt.
Arnica amplexicaulis Nutt.
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Carex lenticularis var. *dolia* (M.E. Jones) L.A. Standley
Carex macrochaeta C.A. Mey.
Deschampsia cespitosa ssp. *beringensis* (Hulten) W.E. Lawrence
Epilobium anagallidifolium Lam.
Epilobium hornemannii Reichenb.
Heracleum lanatum Michx.
Juncus ensifolius Wikstr.
Juncus filiformis L.
Oenanthe sarmentosa K. Presl ex DC.
Petasites frigidus (L.) Fries
Salix sitchensis Sanson ex Bong.
Symphyotrichum subspicatum (Nees) Nesom
Veratrum viride Ait.
Viola langsdorfii Fisch. ex Gingins

5.2.3 Takatz Bay

On 24 August 2011, the team surveyed selected intertidal, shoreline, forested, and muskeg sites in Takatz Bay along the proposed Access Road and Transmission Line. Survey routes and sites are shown on Figure 6 and include the proposed site of the power house. Much of the slope along the south side of the bay is inaccessible because of steep slopes or cliffs. The full road and transmission line routes were not explored for potentially suitable habitat.

The survey team found no USFS Sensitive plant species or any species on the USFS working list of rare species or the AKNHP tracking list of rare plants. A list of all species observed along the Takatz Bay survey routes can be found in Appendix D.

Intertidal, shallow gradient, mudflats near the mouth of Takatz Creek were sparsely vegetated with a wet halophytic graminoid herbaceous meadow dominated by Nootka alkaligrass

(*Puccinellia nutkaensis*), and western sandspurry (*Spergularia canadensis* var. *occidentalis*) with scattered patches of saltmarsh starwort (*Stellaria humifusa*) and popweed (*Fucus*) species. Sessileleaf scurvygrass (*Cochlearia sessilifolia*), a USFS Sensitive plant species, is known from these sorts of sites in Prince William Sound, Kenai Fjords, and Kodiak Island. A recent report of this species from Prince of Wales Island appears to be based on a misidentification of Danish scurvygrass (*Cochlearia groenlandica*), but the team still surveyed the mudflats around Takatz Bay for *C. sessilifolia.* A single specimen of Danish scurvygrass was found growing in the intertidal zone with Nootka alkaligrass, but no sessileleaf scurvygrass.

Above the intertidal mudflats was a dense stand of Lyngbye's sedge (*Carex lyngbyei*) with smaller amounts of meadow barley (*Hordeum brachyantherum*) and Pacific silverweed (*Potentilla anserina* ssp. *pacifica*) grading into a graminoid herbaceous meadow along the rocky shoreline in front of the proposed power house site (Figure 6). The rocky shoreline was backed by a dense forest of Sitka spruce and western hemlock. The team surveyed several other sites along the south side of Takatz Bay adjacent to the proposed road and transmission line, all of which had similar plant communities. Common species of these intertidal and shoreline communities included:

Achillea millefolium ssp. *borealis* (Bong.) Breitung
Alnus rubra Bong.
Angelica genuflexa Nutt.
Bistorta plumosa (Small) Greene
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Carex lyngbyei Hornem.
Carex macrochaeta C.A. Mey.
Carex pluriflora Hulten
Cochlearia groenlandica L.
Conioselinum pacificum (S. Wats.) Coult. & Rose
Cornus canadensis L.
Deschampsia cespitosa (L.) Beauv.
Epilobium hornemannii Reichenb.
Erigeron peregrinus (Banks ex Pursh) Greene
Festuca rubra L.
Fritillaria camschatcensis (L.) Ker-Gawl.
Galium trifidum ssp. *columbianum* (Rydb.) Hulten
Glaux maritima L.
Hordeum brachyantherum Nevski
Juncus haenkei E. Mey.
Leymus mollis ssp. *mollis* (Trin.) Hara
Ligusticum scoticum ssp. *hultenii* (Fern.) Calder & Taylor
Maianthemum dilatatum (Wood) A. Nels. & J.F. Macbr.
Picea sitchensis (Bong.) Carr.
Plantago macrocarpa Cham. & Schlecht.
Potentilla anserina ssp. *pacifica* (T.J. Howell) Rousi
Prenanthes alata (Hook.) D. Dietr.
Puccinellia nutkaensis (J. Presl) Fern. & Weatherby
Rubus spectabilis Pursh
Sanguisorba stipulata Raf.
Spergularia canadensis var. *occidentalis* R.P. Rossb.
Stellaria borealis ssp. *sitchana* (Steud.) Piper
Stellaria humifusa Rottb.
Triglochin maritimum L.
Tsuga heterophylla (Raf.) Sarg.
Vaccinium ovalifolium Sm.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman

Scientists also surveyed forested areas near the proposed power house site for Sensitive and rare plants. The area was dominated by a dense canopy of western hemlock, yellow cedar, and Sitka spruce, with an understory of tall blueberry, rusty menziesia, and oak fern (*Gymnocarpium dryopteris*). Common species included:

Blechnum spicant (L.) Roth
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Maianthemum dilatatum (Wood) A. Nels. & J.F. Macbr.
Menziesia ferruginea Sm.

Carex anthoxanthea J.& K. Presl
Clintonia uniflora (Menzies ex J.A. & J.H. Schultes) Kunth
Coptis aspleniifolia Salisb.
Cornus canadensis L.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Geum macrophyllum Willd.
Gymnocarpium dryopteris (L.) Newman
Lysichiton americanus Hulten & St. John
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Picea sitchensis (Bong.) Carr.
Platanthera stricta Lindl.
Rubus pedatus Sm.
Rubus spectabilis Pursh
Streptopus Michx.
Tsuga heterophylla (Raf.) Sarg.
Vaccinium ovalifolium Sm.

The proposed road and transmission line cross over the base of a peninsula to reach the south arm of Takatz Bay. The team surveyed this segment of the route with particular focus on the steep sloping fens and muskegs found near the hill crest. Tufted clubrush was the dominant species with tall cottongrass, dwarf dogwood, and swamp gentian (*Gentiana douglasiana*) as common associates along with ericaceous shrubs. The team found no populations of inundated club moss or other rare species. Common species in the muskeg and associated ponds included:

Andromeda polifolia L.
Blechnum spicant (L.) Roth
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Carex aquatilis var. *dives* (Holm) Kukenth.
Carex pauciflora Lightf.
Carex pluriflora Hulten
Cornus canadensis L.
Cornus suecica L.
Drosera rotundifolia L.
Empetrum nigrum L.
Erigeron peregrinus (Banks ex Pursh) Greene
Eriophorum angustifolium Honckeny ssp. *angustifolium*
Gentiana douglasiana Bong.
Huperzia haleakalae (Brack.) Holub
Kalmia microphylla (Hook.) Heller
Ledum groenlandicum Oeder
Luetkea pectinata (Pursh) Kuntze
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Lysichiton americanus Hulten & St. John
Menziesia ferruginea Sm.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Nuphar lutea ssp. *polysepala* (Engelm.) E.O. Beal
Pedicularis parviflora Sm. ex Rees
Pinguicula vulgaris L.
Pinus contorta Dougl. ex Loud.
Rubus arcticus L.
Rubus chamaemorus L.
Trichophorum cespitosum (L.) Hartm.
Sparganium angustifolium Michx.
Tsuga mertensiana (Bong.) Carr.
Vaccinium ovalifolium Sm.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L.

5.2.4 Takatz Lake

On 6 – 8 August 2013, the team surveyed selected habitat types around Takatz Lake in the potential inundation area and at proposed sites of the primary dam and a saddle dam. The tunnel portal site could not be safely accessed on foot during the survey; on overflight, it appeared to be a steep talus slope. Survey routes and sites are shown on Figure 7; survey routes at the points along the lake were short. The survey team found no USFS Sensitive plant species, any species on the USFS working list of rare species, or plant species tracked by the AKNHP. A list of all species identified during the Takatz Lake survey is presented in Appendix D.

On 6 August 2013, the team surveyed the valley floor at the inlet of Takatz Lake as well as a mountainside avalanche chute. The team was unable to survey the valley floor north of the inlet creek, and visited only one site on the lower mountainside.Habitat types on the valley floor included creek channels, unvegetated river bars, bars in various stages of being recolonized by plants, open shrub thickets of alder and willow, and closed tall alder-willow thickets. These areas were generally moist, with wetter spots at the toe of the mountain slope and in active and inactive channels within exposed gravel areas and within shrub thickets.

Species noted on the sparsely vegetated bars included:

Agrostis sp.
Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Arnica amplexicaulis Nutt.
Artemisia arctica Less.
Athyrium filix-femina (L.) Roth
Carex lenticularis var. *dolia* (M.E. Jones) L.A. Standley
Castilleja parviflora Bong.
Chamerion latifolium (L.) Holub
Dodecatheon jeffreyi Van Houtte
Epilobium anagallidifolium Lam.
Epilobium ciliatum ssp. *glandulosum* (Lehm.) Hoch & Raven
Epilobium lactiflorum Hausskn.
Geum macrophyllum Willd.
Hieracium triste Willd. ex Spreng.
Juncus drummondii E. Mey.
Juncus mertensianus Bong.
Leptarrhena pyrolifolia (D. Don) R. Br. ex Ser.
Micranthes ferruginea (Graham) Brouillet & Gornall
Micranthes lyallii (Engl.) Small
Mimulus guttatus DC.
Petasites frigidus (L.) Fries
Poa alpina ssp. *vivipara* (L.) Arcang.
Poa pratensis ssp. *alpigena* (Fries ex Blytt) Hiitonen
Salix barclayi Anderss.
Salix commutata Bebb
Salix sitchensis Sanson ex Bong.
Sanguisorba stipulata Raf.
Stellaria crispa Cham. & Schlecht.
Tsuga mertensiana (Bong.) Carr.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Veronica wormskjoldii ssp. *wormskjoldii* Roem. & Schult.

Species observed in the shrub thickets included:

Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Aruncus dioicus (Walt.) Fern.
Athyrium filix-femina (L.) Roth
Carex anthoxanthea J.& K. Presl
Carex lenticularis var. *dolia* (M.E. Jones) L.A. Standley
Carex macrochaeta C.A. Mey.
Carex nigricans C.A. Mey.
Cassiope mertensiana (Bong.) D. Don
Castilleja parviflora Bong.
Conioselinum pacificum (S. Wats.) Coult. & Rose
Dodecatheon jeffreyi Van Houtte
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Epilobium anagallidifolium Lam.
Epilobium ciliatum ssp. *glandulosum* (Lehm.) Hoch & Raven
Epilobium sp. L.
Heuchera glabra Willd. ex Roemer & J.A. Schultes
Juncus mertensianus Bong.
Mitella pentandra Hook.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Petasites frigidus (L.) Fries
Poa alpina ssp. *vivipara* (L.) Arcang.
Ribes bracteosum Dougl. ex Hook.
Rubus spectabilis Pursh
Salix commutata Bebb
Salix barclayi Anderss.
Sambucus racemosa L.
Sanguisorba stipulata Raf.
Stellaria crispa Cham. & Schlecht.
Streptopus amplexifolius (L.) DC.
Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz
Tiarella trifoliata var. *trifoliata* L.
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium ovalifolium Sm.
Vahlodea atropurpurea (Wahlenb.) Fries ex

Leptarrhena pyrolifolia (D. Don) R. Br. ex Ser.
Luetkea pectinata (Pursh) Kuntze
Luzula parviflora (Ehrh.) Desv.
Micranthes lyallii (Engl.) Small
Hartman
Valeriana sitchensis Bong.
Veratrum viride Ait.
Viola sp.

Species in the avalanche chute are included in a later list.

On 7 August 2013, the team surveyed selected areas at the east end of the lake in the vicinity of the two proposed dams. On the north side of Takatz Creek, they examined a lakeshore salmonberry thicket and a heath area that lie between the toe of the mountain slope and the creek. They walked a short way down the creek through forest along its north side before choosing to spend limited time instead in more accessible areas south of the creek.

On the south side of Takatz Creek, the team examined the approximate locations of the proposed intake gate structure and saddle dam. The latter areas included a sloping granite outcrop/heath/mountain hemlock scrub complex and open scrub forest of mountain hemlock and yellow cedar with a deer cabbage and copperbush understory – both broadly described as 'heath'.

Species observed in the salmonberry thicket included:

Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Athyrium alpestre var. *americanum* Butters
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) Roth
Cassiope mertensiana (Bong.) D. Don
Dryopteris expansa (K. Presl) Fraser-Jenkins & Jermy
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Epilobium hornemannii ssp. *behringianum* (Hausskn.) Hoch & Raven
Erigeron peregrinus (Banks ex Pursh) Greene
Hippuris montana Ledeb.
Luetkea pectinata (Pursh) Kuntze
Micranthes ferruginea (Graham) Brouillet & Gornall
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Petasites frigidus (L.) Fries
Prenanthes alata (Hook.) D. Dietr.
Rubus spectabilis Pursh
Sanguisorba stipulata Raf.
Senecio triangularis Hook.
Stellaria crispa Cham. & Schlecht.
Streptopus amplexifolius (L.) DC.
Tiarella trifoliata var. *trifoliata* L.
Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz
Tsuga mertensiana (Bong.) Carr.
Vaccinium ovalifolium Sm.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Valeriana sitchensis Bong.
Veratrum viride Ait.
Viola sp.

Species noted in the heath habitats included:

Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Blechnum spicant (L.) Roth
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Carex anthoxanthea J.& K. Presl
Carex circinata C.A. Mey.
Carex micropoda C.A. Mey.
Carex nigricans C.A. Mey.
Carex stylosa C.A. Mey.
Cassiope mertensiana (Bong.) D. Don
Diphasiastrum sitchense (Rupr.) Holub
Luetkea pectinata (Pursh) Kuntze
Lycopodium clavatum L.
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Menziesia ferruginea Sm.
Micranthes ferruginea (Graham) Brouillet & Gornall
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Pedicularis ornithorhyncha Benth.
Phyllodoce aleutica ssp. *glanduliflora* (Hook.)

Dodecatheon jeffreyi Van Houtte
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Erigeron peregrinus (Banks ex Pursh) Greene
Geum macrophyllum Willd.
Harrimanella stelleriana (Pallas) Coville
Hippuris montana Ledeb.
Huperzia haleakalae (Brack.) Holub
Juncus mertensianus Bong.
Kalmia microphylla (Hook.) Heller
Hulten
Pinguicula vulgaris L.
Pinus contorta Dougl. ex Loud.Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Tsuga mertensiana (Bong.) Carr.
Vaccinium cespitosum Michx.
Vaccinium ovalifolium Sm.
Vaccinium uliginosum L.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Veratrum viride Ait.

Forest species included:

Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Aruncus dioicus (Walt.) Fern.
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) Roth
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Erigeron peregrinus (Banks ex Pursh) Greene
Geum macrophyllum Willd.
Heuchera glabra Willd. ex Roemer & J.A. Schultes
Luetkea pectinata (Pursh) Kuntze
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Phegopteris connectilis (Michx.) Watt
Prenanthes alata (Hook.) D. Dietr.
Ribes bracteosum Dougl. ex Hook.
Rubus pedatus Sm.
Rubus spectabilis Pursh
Streptopus amplexifolius (L.) DC.
Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz
Tsuga mertensiana (Bong.) Carr.
Vaccinium ovalifolium Sm.
Veratrum viride Ait.

On 7 August 2013, en route between the west and east ends of the lake, the team motored slowly along the south and north lakeshores to identify habitats most suitable for supporting rare plant species suspected to be in the area. The most suitable habitats were scree and talus slopes, avalanche chute meadows, and stream margins. Safe places to land the boat and explore on foot were limited by the cliffs, steep slopes of talus, and potentially unstable substrates.

On 8 August, the team visited representative sites on both lakeshores. All of the sites visited are subject to recurring disturbance of snow avalanches, rock slides, or unstable soils, and some were adjacent to late-lying snow. Substrates included talus with little soil, broken rock, cliffs, and mineral soil. Vegetation types included open alder with a heath understory, heath, dense mixed shrub thicket, and forb meadows. Two of the sites included streams. Dominant species included Sitka alder, salmonberry, copperbush, stink currant, elderberry, alpine heuchera, partridgefoot, saxifrages, alpine mountainsorrel, valerian, and false hellebore. The avalanche chute examined on 6 August was similar to these.

Species noted in these mountainside habitats included:

Agrostis sp.
Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Aquilegia formosa Fisch. ex DC.
Aruncus dioicus (Walt.) Fern.
Athyrium alpestre var. *americanum* Butters
Athyrium filix-femina (L.) Roth
Heuchera glabra Willd. ex Roemer & J.A. Schultes
Hippuris montana Ledeb.
Huperzia haleakalae (Brack.) Holub
Juncus mertensianus Bong.
Luetkea pectinata (Pursh) Kuntze
Luzula parviflora (Ehrh.) Desv.

Blechnum spicant (L.) Roth
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Cardamine umbellata Greene
Carex macrochaeta C.A. Mey.
Cassiope mertensiana (Bong.) D. Don
Chamerion angustifolium (L.) Holub
Chamerion latifolium (L.) Holub
Conioselinum pacificum (S. Wats.) Coult. & Rose
Cryptogramma sitchensis (Rupr.) T. Moore
Cystopteris fragilis (L.) Bernh.
Deschampsia cespitosa ssp. *beringensis* (Hulten) W.E. Lawrence
Dodecatheon jeffreyi Van Houtte
Dryopteris expansa (K. Presl) Fraser-Jenkins & Jermy
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Epilobium ciliatum ssp. *glandulosum* (Lehm.) Hoch & Raven
Epilobium hornemannii ssp. *behringianum* (Hausskn.) Hoch & Raven
Epilobium palustre L.
Erigeron peregrinus (Banks ex Pursh) Greene
Geum calthifolium Menzies ex Sm.
Geum macrophyllum Willd.
Gymnocarpium dryopteris
Harrimanella stelleriana (Pallas) Coville
Heracleum lanatum Michx.
Menziesia ferruginea Sm.
Micranthes ferruginea (Graham) Brouillet & Gornall
Micranthes lyallii (Engl.) Small
Mimulus guttatus DC.
Mitella pentandra Hook.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Oxyria digyna (L.) Hill
Pedicularis ornithorhyncha Benth.
Petasites frigidus (L.) Fries
Phegopteris connectilis (Michx.) Watt
Ribes bracteosum Dougl. ex Hook.
Rubus spectabilis Pursh
Salix commutata Bebb
Sambucus racemosa L.
Sanguisorba stipulata Raf.
Stellaria crispa Cham. & Schlecht.
Streptopus amplexifolius (L.) DC.
Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz
Tsuga mertensiana (Bong.) Carr.
Vaccinium cespitosum Michx.
Vaccinium ovalifolium Sm.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Valeriana sitchensis Bong.
Veratrum viride Ait.
Viola glabella Nutt.
Viola sp.

5.3 Non-Native Plant Species

The investigators located non-native plant species in the Baranof Warm Springs and Baranof Creek areas. These were in areas potentially affected by the marine transmission line route, depending on where the line would come ashore, construction areas, and trenches or tower locations. Investigators collected detailed data on one infestation found in the community of Baranof Warm Springs.

An infestation was found in the trail from the community to Baranof Lake (site TAKA 11-01); it supported approximately 5% cover of annual bluegrass (*Poa annua*) in an area measuring approximately 15 m^2. The plant may have been recently carried to the site in gravel brought in to fill a muddy spot in the trail. A small infestation of the same species was also found at the constructed pools at the warm springs along Baranof Creek. Investigators did not find infestations away from these foot-traffic areas.

A substantial infestation exists around a picnic shelter near the dock in the Baranof Warm Springs community (site TAKA 11-02). This infestation—approximately 140 m^2 in size—supported foxtail barley (*Hordeum jubatum*), creeping buttercup (*Ranunculus repens*), alsike

clover and white clover (*Trifolium hybridum* and *T. repens*), and common plantain (*Plantago major*). Additional infestations exist in the community, including on the public dock.

No non-native plant species were observed at Takatz Bay, along Takatz Creek, or at Takatz Lake.

6 Discussion

6.1 Vegetation Mapping and Types

The tree size-density mapping based on existing digital datasets shows project-area vegetation types at a coarse scale, both in terms of polygon size and number of vegetation types identified. The Caouette and DeGayner (2005) model used to develop the vegetation map relies on timber type mapping that lumps cover types that are not important to tree production. It does not distinguish among various shrub- and herb-dominated vegetation types or unvegetated areas such as river bars, cliffs, and waterbodies.

This study developed brief descriptions of study-area land cover types based on limited field survey, including the various types encompassed by broader, non-forested mapping units. Unless there is concern about project effects on a particular vegetation type, the tree size-density mapping and vegetation type descriptions should suffice for analyzing project effects on vegetation.

While vegetation is one component of wildlife habitat, some important habitat features are not typically captured by vegetation mapping. The model used to develop the tree size-density mapping for this project encompasses some of those features such as tree size and aspect, from which wind and sun exposure and other habitat features may be discerned. The project wildlife biologist has traversed the project area more thoroughly and could identify unique wildlife habitats and those that are particularly important to wildlife species of interest.

6.2 Sensitive and Rare Plant Species

Scientists were able to survey selected sites in the general area of the proposed transmission line between Baranof and Sadie Lakes. Although the team found no USFS Sensitive plant species, they could not cover all of the areas of suitable habitat that are likely to be affected; at the time of this survey, the final alignment of the transmission line had not been selected and the survey was done at planning level, without specific locations identified for some project components.

Scientists were also able to survey areas along Takatz Creek up to the lower falls, concentrating on sites likely to be affected by lowered water levels but not surveying all such sites. Additional surveys along the creek may be warranted, depending on the expected changes to the creek's flow regime. No USFS Sensitive plant species were found in the areas surveyed. Essentially no areas along Takatz Creek upstream of the lower falls were surveyed because of limited time and unsafe access. Botanists could further evaluate the existence of habitat suitable for rare plants along Takatz Creek (and possibly elsewhere in the project area) using existing video imagery captured during low-elevation helicopter flights.

Scientists were able to complete a more focused and complete survey of the proposed site in Takatz Bay where water from the tailrace would be discharged and of the shoreline area where the proposed access road would be located. They did not conduct surveys of the proposed dock

area or potential transmission line tower locations located upslope from the shoreline. They did not observe any particularly unique habitats.

At Takatz Lake, scientists were able to examine representative areas of each habitat type suitable for supporting rare plant species but did not visit all suitable habitats. Sites visited included habitats in the proposed inundation zone at the inlet end of the lake, sites along the north and south shores that would also be inundated, and areas at the east end of the lake where project structures would be built. No USFS Sensitive plants were observed, nor were other rare plants found. *Mimulus lewisii* and the unidentified poppy (*Papaver* sp.) collected near Blue Lake and Bear Mountain on Baranof Island are the two rare plants most likely to be found at Takatz Lake, on the inlet river bars or slopes above the lake. With more time, botanists could search more thoroughly for these plants. More thorough searches could also be done in the vicinity of the proposed saddle dam.

Additional surveys for Sensitive and other rare plants should be completed when proposed project components are better known, or even after licensing for the transmission line towers so locations can be adjusted if particularly rare species are found. Video imagery captured during other project evaluation work could be very useful for planning remaining field studies. No conclusions can yet be made regarding the proposed project's potential effects on Sensitive or rare plant species because the locations of all project components have not yet been surveyed.

6.3 Non-Native Plant Species

The study area is unlikely to support non-native species away from the Baranof Warm Springs community and developed trail to Baranof Lake because there has been little ground disturbance. The rare plant survey route included the informal trail to Sadie Lake and non-native species did not exist along the route. No survey occurred at the old shelter site located in upper Takatz Bay; it is a possible location where non-native species could be found. No non-native plant species were observed at Takatz Lake, including at a disturbed camp site in the heath near the lake's outlet.

The City should implement measures to prevent introduction of non-native species during any ground-disturbing investigations needed to design the Project, and thereafter during construction and operation.

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Appendix A
USFS Alaska Region Sensitive Plants, February 2009

Common Name	Scientific Name	Occurrence	
		Chugach National Forest	Tongass National Forest
Vascular Plant			
Eschscholtz's little nightmare	*Aphragmus eschscholtzianus*	Y	S
Moosewort fern	*Botrychium tunux*	S	Y
Spatulate moonwort fern	*Botrychium spathulatum*	S	Y
Moonwort, no common name	*Botrychium yaaxudakeit*	S	Y
Edible thistle	*Cirsium edule* var. *macounii*		Y
Sessileleaf scurvygrass	*Cochlearia sessilifolia*	S	
Spotted lady's slipper	*Cypripedium guttatum*	Y	
Mountain lady's slipper	*Cypripedium montanum*	S	Y
Large yellow lady's slipper	*Cypripedium parviflorum* var. *pubescens*	S	Y
Calder's loveage	*Ligusticum calderi*	S	Y
Pale poppy	*Papaver alboroseum*	Y	S
Alaska rein orchid	*Piperia unalascensis*	S	Y
Lesser round-leaved orchid	*Platanthera orbiculata*		Y
Kruckeberg's swordfern	*Polystichum kruckebergii*		Y
Unalaska mist-maid	*Romanzoffia unalaschcensis*	Y	Y
Henderson's checkermallow	*Sidalcea hendersonii*		Y
Dune tansy	*Tanacetum bipinnatum* subsp. *huronense*	S	Y
Lichen			
Lichen, no common name	*Lobaria amplissima*	S	Y

Appendix B
USFS Sensitive Plant Survey Types

Survey Type	Description
Field Check	The survey area is given a quick "once over" but the surveyor does not walk completely through the project area. The entire area is not examined.
Cursory	A Cursory survey is appropriately used to confirm the presence of species of interest identified in previous surveys or in the pre-field analysis. By its nature, the cursory survey is rapid, and does not provide in-depth environmental information. The entire area is traversed at least once. For example, stand condition as seen in aerial photography can be verified by a cursory survey. Also, a cursory survey can be used to determine if a plant population that had been previously documented at a site remains present or intact.
General	The survey area is given a closer review by walking through the area and its perimeter or by walking more than once through the area. Most of the area is examined
Focused (Intuitive Controlled)	The Focused, or Intuitive Controlled, survey is the most commonly used and most efficient method of surveying for TES plants. During pre-field analysis, potential suitable habitat is identified for each species of interest and the survey effort is focused in those areas. This method requires adequate knowledge of suitable habitat in order to accurately select the areas of focused searching. When conducting intuitive controlled surveys, an area somewhat larger than the identified suitable habitat should be searched to validate current suitable habitat definitions.
Random	Random surveys employ an undirected, typically non-linear, traverse through a project area. They are employed either when there is inadequate natural history information about a species to discern its suitable habitat and the surveyor is simply searching for occurrences, or when a target species is very abundant within a search area and the surveyor is attempting to make estimates of population parameters such as intra-patch variations in density or the occurrence of predation or herbivory. However, a stratified random survey may be more effective in these latter cases.
Stratified Random	This survey is most often used within known population areas of target species, or when an area to be surveyed is of unknown habitat suitability and is relatively large. Stratified random surveys employ a series of randomly selected plots of equal size within a project area that are each thoroughly searched for target species. When conducting a stratified random survey, it is important to sample an adequate number of plots that are of sufficient size if statistical inference regarding the survey area is desired (discussion of sample designs, see Elzinga, C., *et al.* 1998)**.**
Systematic	Typically used in limited areas where the likelihood of occurrence of a target species may be evenly distributed throughout the survey area. Systematic surveys are often employed either within focused search areas (e.g., stratified random and intuitive controlled methods), or when a proposed project is likely to produce significant habitat alterations for species that are especially sensitive to the proposed activities.

Appendix C
Plants Considered Rare on Sitka Ranger District[1]

Plant Name	Rangewide Distribution	Distribution in USFS Region 10	Habitat	Current Status on Sitka Ranger District*
Acomastylis rossii (R.Br.) Greene var. *rossii*	Kam, Chukotka, E to Brooks Range, AK Range, E to YT, disj. to Telegraph Creek, insular SE	W. Chichagof; Turnagain Pass area	Rocky alpine ridges, calcareous sites,	KR
Adiantum aleuticum	Coast from Unalaska to N Mex.; disj in Rockies & NE	Kenai, Elrington I, Evans I., Cordova Crater Lk.; SE from Hoonah S.	Damp rock faces, forest edge, streamsides	K
Ambrosia chamisonis (Less.) Greene	Pacific coast Yakutat S to Baja Cal.	Yakutat, Kruzof I, Ketchikan Area	Sandy beaches	KR
Asplenium trichomanes L. subsp. *quadrivalens* D. E. Meyer	Worldwide,scattered	N to Juneau area and islands	Calcareous rocks, cracks in rock faces	KR
Asplenium trichomanes-ramosum (A.viride)	Circumpolar temperate, widely disjunct	Eyak Lk. Trail, widely scattered in Tongass	Often limestone, cracks in rock faces	KR
Botrychium ascendens W. H. Wagner	Widely scattered across boreal & temperate NA	Yakutat, Lynn Canal, Icy Straits, outer Kruzof I.	Sandy beaches Upper beach meadows.	KR
Botrychium lanceolatum (S.G. Gmelin) Angström subsp. *lanceolatum*	Disjunctly circumtemperate, in NA, W AK S down Rockies to AZ, few scattered pops in boreal E NA	Entire Region	Upper beach meadows, meadows, alpine meadows	S
Botrychium lunaria (L.) Swartz	Circumboreal and north temperate	SE, unknown on KRD, less rare to the north	Upper beach meadows, meadows, alpine meadows	KR
Botrychium minganense Victorin	Boreal NA, S along Rockies, Iceland,	Across R10, more frequent N and W	Upper beach meadows, meadows	S
Botrychium pinnatum H. St. John	AK S down coast and Rockies to CO, NV	R10, possibly more abundant N and W	Upper beach meadows, meadows, alpine meadows	S
Bromus pacificus Trin.	Central SE S along coast to coastal OR. Possible disjunct at head of Cook Inlet.	Sitka, S Admiralty. Kuiu I., Coronation I, south	Upper beach meadow, beach forest ecotone	K

Calamagrostis deschampsioides Trin.	Disjunctly circumpolar near saltwater. In NA Hudson Bay, Labrador, coastal AK	Chugach, E to Stikine mouth	Brackish marshes, meadows along seashore	S
Calamagrostis sesquiflora	kamchatka, Kuril, E Aleutians, disj to QCI VI & mainland	suspected	Maritime rocky cliffs, open forest, heath	S
Cardamine pensylvanica				KR
Crassula aquatica (L.) Schonl.	Disjunctly circumpolar	SE Kenai on NPS land, Chief Shakes Springs		S
Cryptogramma stelleri	Disjunctly circumpolar	Tongass	Calcareous substrate, cracks in rock, shaded areas	S
Cystopteris montana	Circumpolar boreal and temperate, widely disjunct.	Ptarmigan L, Kenai; Chichagof, POW Adm I, N of Skagway	Rocky subalpine to alpine, often Calcareous areas,	KR
Danthonia intermedia	Kam, disj to S Central & SE AK, & Disj across NA	Scattered across Region	Meadows, muskeg, subalpine, alpine	KR
Danthonia spicata (L.) Beauv. ex Roem. & Schult.	Across N temperate NA, scattered in W, abundant in E.	S SE, S POW, Baranof I, Red Bluff Bay	dry meadows, dry subalpine meadows	KR
Draba lonchocarpa				KR
Elymus glaucus Buckl.	W coast. Rockies, widely disj across NA	SE	Sandy, gravelly soils, uper beach meadow, beach/forest ecotone, open forest	K
Elymus hirsutus Presl	Attu, disjunct to PWS, S to Cal coast.	Copper R. flats, E & S across panhandle	Upper beach meadow, beach forest ecotone	K
Festuca subulata Trin.	E Asia, in NA from Juneau S to CA, E to ID, MT	Juneau & S	Open forest	KR
Glyceria leptostachya	Central SE disjunctly (QCI, S Van, Col R area) along coast to N CA.	Sitka to Wrangell	Shallow water, ditches	KR
Hymenophyllum wrightii gametophyte	Japan, Korea disj to SE AK, S to Oly.	W and S SE	Dark wet forest, rotting tree bases, logs	K
Hymenophyllum wrightii sporophyte	Japan, Korea disj to QCI	Suspected	Dark wet forest, rotting tree bases, logs	S

Isoetes occidentalis Henderson	Scattered disj. from Pribilofs along coast, Kodiak, W of Icy bay, southeast to N cal, and northern rockies	Scattered disjuncts, SRD Baranof I. Big Port Walter, Still Harbor	Lakes and ponds near shore, often muddy substrate	KR
Lonicera involucrata		Kayak I/Cape Suckling, disj S to POW & Southern KRD		S
Lycopodiella inundata (L.) Presl	Europe, Japan, SE AK S to N WA, disj. to NE US & SE Canada	S SE	Bog edge, freshwater meadows, muddy substrate	KR
Lycopodium dendroideum	Bristol Bay across AK, across boreal NA, NE Asia	Scattered W PWS to S SE	Open areas, boggy areas, open forest, forest edge	KR
Melica subulata (Griseb.) Scribn.	Unalaska, disj to Kruzof, POW S to N CA, E from WA to MT	POW, Coronation I, Kruzof I	Meadows, open bogs, slides dominated by Alnus	KR
Myriophyllum farwellii Morong				KR
Pinus contorta Douglas ex Loudon var. *contorta*	Coast fromYakutat to CA	All of SE	Bogs, shores	K
Poa laxiflora Buckl.	Cape Suckling along coast to OR.	Tongass, possibly Cordova RD	Upper beach meadow, beach forest ecotone	KR
Poa macrantha Vasey	Coastal, PWS to N coastal CA,	Copper Sands I, Softuk Bar; Yakutat, Kruzof I.	Sandy maritime beaches and meadows on sandy soil.	KR
Poa macrocalyx Trautv. & C. A. Mey.	Far E Asia along Aleutians to N SE	N SE Taylor Bay, Hawk Inlet	Generally sandy Shores in Leymus belt	S
Polystichum andersonii M. Hopkins	Northern panhandle S along coast to Oregon. Disj to N Idaho area.	Tongass	Well drained forest, forest edge.	K
Polystichum lonchitis (L.) Roth	Circumpolar, widely disjunct temperate boreal	Known across Region ex GRD YRD but tbe	Cracks in rocks, soil with rocks.	K
Polystichum munitum (Kaulf.) C. Presl	Central SE along coast to CA.	Extreme N edge on E Baranof, W Kuiu	Well drained forest, forest edge.	KR
Polystichum segiterum (C. Presl) C. Presl.	Attu, disjunct to Skagway, SE and BC.	All SE excluding Yakutat	Well drained forest, forest edge.	K

Pteridium aquilinum (L.) Kuhn var. *pubescens*	Skagway/GB S along coast and Rockies to Mexico	Tongass	Muskeg edges, open mixed conifer	K
Scheuchzeria palustris L.	Circumpolar, rare in Alaska	Panhandle	Muskegs, peatlands	KR
Schoenoplectus subterminalis (Torrey) Sojak	Across temperate NA	SE AK, SRD Big Port Walter Lk, KRD Ella Lk, Princess Bay Lk. Duke I	Lakes and ponds near shore	KR
Sedum oreganum var. *oreganum*		Widely scattered in SE,		KR
Zannichellia palustris	Circumpolar temperate to boreal	Widely scattered in and adjacent to Chugach. S half of BC	Brackish water	S

K = Known

KR = Known Rare

S = Suspected

[1]Stensvold, pers.comm., 2012. Working List of Plants Considered Rare on Sitka Ranger District of Tongass National Forest, Not Including Designated Sensitive Species, February 2012

Appendix D
Plant Species Observed in Each Survey Sub-Area

BARANOF WARM SPRINGS-SADIE LAKE AREA

All species observed in this area are listed in the report text.

TAKATZ CREEK SPECIES LIST

Note: this list consists of vascular plant species observed or collected along the survey routes shown in Figure 6; it is not intended to be a complete list of species found along Takatz Creek.

Achillea millefolium ssp. *borealis* (Bong.) Breitung
Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Andromeda polifolia L.
Angelica genuflexa Nutt.
Arnica amplexicaulis Nutt.
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) Roth
Boschniakia rossica (Cham. & Schlecht.) Fedtsch.
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Caltha leptosepala DC.
Carex aquatilis var. *dives* (Holm) Kukenth.
Carex lenticularis var. *dolia* (M.E. Jones) L.A. Standley
Carex macrochaeta C.A. Mey.
Carex pauciflora Lightf.
Carex utriculata Boott
Cassiope lycopodioides (Pallas) D. Don
Chamerion angustifolium (L.) Holub
Coptis aspleniifolia Salisb.
Coptis trifolia (L.) Salisb.
Cornus canadensis L.
Deschampsia cespitosa (L.) Beauv.
Deschampsia cespitosa ssp. *beringensis* (Hulten) W.E. Lawrence
Dodecatheon jeffreyi Van Houtte
Drosera rotundifolia L.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Epilobium anagallidifolium Lam.
Epilobium hornemannii Reichenb.
Epilobium L.
Equisetum arvense L.
Erigeron peregrinus (Banks ex Pursh) Greene

Eriophorum angustifolium Honckeny ssp. *angustifolium*
Gentiana douglasiana Bong.
Gymnocarpium dryopteris (L.) Newman
Harrimanella stelleriana (Pallas) Coville
Heracleum lanatum Michx.
Heuchera glabra Willd. ex Roemer & J.A. Schultes
Hippuris tetraphylla L. f.
Hordeum brachyantherum Nevski
Juncus ensifolius Wikstr.
Juncus filiformis L.
Kalmia microphylla (Hook.) Heller
Ledum groenlandicum Oeder
Listera caurina Piper
Luetkea pectinata (Pursh) Kuntze
Luzula parviflora (Ehrh.) Desv.
Lycopodiella inundata (L.) Holub
Lysichiton americanus Hulten & St. John
Menyanthes trifoliata L.
Menziesia ferruginea Sm.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Nuphar lutea ssp. *polysepala* (Engelm.) E.O. Beal
Oenanthe sarmentosa K. Presl ex DC.
Oplopanax horridus Miq.
Pedicularis parviflora Sm. ex Rees
Petasites frigidus (L.) Fries
Phegopteris connectilis (Michx.) Watt
Picea sitchensis (Bong.) Carr.
Pinus contorta Dougl. ex Loud.
Platanthera dilatata (Pursh) Lindl. ex Beck
Platanthera stricta Lindl.
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Polypodium glycyrrhiza D.C. Eat.
Polystichum munitum (Kaulfuss) K. Presl
Prenanthes alata (Hook.) D. Dietr.
Ranunculus eschscholtzii Schlecht.
Ranunculus uncinatus D. Don ex G. Don
Rhynchospora alba (L.) Vahl
Ribes bracteosum Dougl. ex Hook.
Romanzoffia sitchensis Bong.
Rubus arcticus L.
Rubus chamaemorus L.
Rubus pedatus Sm.
Rubus spectabilis Pursh
Salix sitchensis Sanson ex Bong.
Sanguisorba stipulata Raf.
Saxifraga ferruginea Graham

Trichophorum cespitosum (L.) Hartm.
Senecio triangularis Hook.
Solidago multiradiata Ait.
Sparganium angustifolium Michx.
Spiranthes romanzoffiana Cham.
Streptopus sp. Michx.
Stuckenia filiformis (Pers.) Borner
Symphyotrichum subspicatum (Nees) Nesom
Tiarella trifoliata L.
Torreyochloa pallida var. *pauciflora* (J. Presl) J.I. Davis
Triantha glutinosa (Michx.) Baker
Trientalis europaea L.
Trisetum cernuum Trin.
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium ovalifolium Sm.
Vaccinium oxycoccos L.
Vaccinium uliginosum L.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Valeriana sitchensis Bong.
Veratrum viride Ait.
Viburnum edule (Michx.) Raf.
Viola epipsila ssp. *repens* Becker
Viola glabella Nutt.
Viola langsdorfii Fisch. ex Gingins

TAKATZ BAY SPECIES LIST

Note: this list consists of vascular plant species observed or collected along the survey routes shown in Figure 6; it is not intended to be a complete list of species found at Takatz Bay.

Achillea millefolium ssp. *borealis* (Bong.) Breitung
Alnus rubra Bong.
Andromeda polifolia L.
Angelica genuflexa Nutt.
Bistorta plumosa (Small) Greene
Blechnum spicant (L.) Roth
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Carex anthoxanthea J.& K. Presl
Carex aquatilis var. *dives* (Holm) Kukenth.
Carex lyngbyei Hornem.
Carex macrochaeta C.A. Mey.
Carex pauciflora Lightf.
Carex pluriflora Hulten
Clintonia uniflora (Menzies ex J.A. & J.H. Schultes) Kunth

Cochlearia groenlandica L.
Conioselinum pacificum (S. Wats.) Coult. & Rose
Coptis aspleniifolia Salisb.
Cornus canadensis L.
Cornus suecica L.
Deschampsia cespitosa (L.) Beauv.
Drosera rotundifolia L.
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Epilobium hornemannii Reichenb.
Erigeron peregrinus (Banks ex Pursh) Greene
Eriophorum angustifolium Honckeny ssp. *angustifolium*
Festuca rubra L.
Fritillaria camschatcensis (L.) Ker-Gawl.
Galium trifidum ssp. *columbianum* (Rydb.) Hulten
Gentiana douglasiana Bong.
Geum macrophyllum Willd.
Glaux maritima L.
Gymnocarpium dryopteris (L.) Newman
Hordeum brachyantherum Nevski
Huperzia haleakalae (Brack.) Holub
Juncus haenkei E. Mey.
Kalmia microphylla (Hook.) Heller
Ledum groenlandicum Oeder
Leymus mollis ssp. *mollis* (Trin.) Hara
Ligusticum scoticum ssp. *hultenii* (Fern.) Calder & Taylor
Luetkea pectinata (Pursh) Kuntze
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Lysichiton americanus Hulten & St. John
Maianthemum dilatatum (Wood) A. Nels. & J.F. Macbr.
Menziesia ferruginea Sm.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Nuphar lutea ssp. *polysepala* (Engelm.) E.O. Beal
Oplopanax horridus Miq.
Pedicularis parviflora Sm. ex Rees
Phyllodoce aleutica ssp. *glanduliflora* (Hook.) Hulten
Picea sitchensis (Bong.) Carr.
Pinguicula vulgaris L.
Pinus contorta Dougl. ex Loud.
Plantago macrocarpa Cham. & Schlecht.
Platanthera dilatata (Pursh) Lindl. ex Beck
Platanthera L.C. Rich.
Platanthera stricta Lindl.
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Potentilla anserina ssp. *pacifica* (T.J. Howell) Rousi
Prenanthes alata (Hook.) D. Dietr.

Puccinellia nutkaensis (J. Presl) Fern. & Weatherby
Rubus arcticus L.
Rubus chamaemorus L.
Rubus pedatus Sm.
Rubus spectabilis Pursh
Sanguisorba stipulata Raf.
Trichophorum cespitosum (L.) Hartm.
Sparganium angustifolium Michx.
Spergularia canadensis var. *occidentalis* R.P. Rossb.
Stellaria borealis ssp. *sitchana* (Steud.) Piper
Stellaria humifusa Rottb.
Triglochin maritimum L.
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium cespitosum Michx.
Vaccinium ovalifolium Sm.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman

TAKATZ LAKE SPECIES LIST

This list consists of vascular plant species observed at the survey sites shown in Figure 7; it is not intended to be a complete list of species found at Takatz Lake.

Agrostis sp.
Alnus viridis ssp. *sinuata* (Regel) A.& D. Love
Aquilegia formosa Fisch. ex DC.
Arnica amplexicaulis Nutt.
Artemisia arctica Less.
Aruncus dioicus (Walt.) Fern.
Athyrium alpestre var. *americanum* Butters
Athyrium filix-femina (L.) Roth
Blechnum spicant (L.) Roth
Calamagrostis canadensis var. *langsdorfii* (Link) Inman
Callitropsis nootkatensis (D. Don) Oerst. ex D.P. Little
Cardamine umbellata Greene
Carex anthoxanthea J.& K. Presl
Carex circinata C.A. Mey.
Carex lenticularis var. *dolia* (M.E. Jones) L.A. Standley
Carex macrochaeta C.A. Mey.
Carex mertensii Prescott ex Bong.
Carex micropoda C.A. Mey.
Carex nigricans C.A. Mey.
Carex stylosa C.A. Mey.
Cassiope mertensiana (Bong.) D. Don
Castilleja parviflora Bong.
Chamerion angustifolium (L.) Holub

Chamerion latifolium (L.) Holub
Conioselinum pacificum (S. Wats.) Coult. & Rose
Cryptogramma sitchensis (Rupr.) T. Moore
Cystopteris fragilis (L.) Bernh.
Deschampsia cespitosa ssp. *beringensis* (Hulten) W.E. Lawrence
Diphasiastrum sitchense (Rupr.) Holub
Dodecatheon jeffreyi Van Houtte
Dryopteris expansa (K. Presl) Fraser-Jenkins & Jermy
Elliottia pyroliflorus (Bong.) S.W. Brim & P.F. Stevens
Empetrum nigrum L.
Epilobium anagallidifolium Lam.
Epilobium ciliatum ssp. *glandulosum* (Lehm.) Hoch & Raven
Epilobium hornemannii ssp. *behringianum* (Hausskn.) Hoch & Raven
Epilobium lactiflorum Hausskn.
Epilobium palustre L.
Epilobium sp. L.
Erigeron peregrinus (Banks ex Pursh) Greene
Geum calthifolium Menzies ex Sm.
Geum macrophyllum Willd.
Harrimanella stelleriana (Pallas) Coville
Heracleum lanatum Michx.
Heuchera glabra Willd. ex Roemer & J.A. Schultes
Hieracium triste Willd. ex Spreng.
Hippuris montana Ledeb.
Huperzia haleakalae (Brack.) Holub
Juncus drummondii E. Mey.
Juncus mertensianus Bong.
Kalmia microphylla (Hook.) Heller
Leptarrhena pyrolifolia (D. Don) R. Br. ex Ser.
Luetkea pectinata (Pursh) Kuntze
Lupinus nootkatensis Donn ex Sims
Luzula parviflora (Ehrh.) Desv.
Lycopodium annotinum L. (unconfirmed)
Lycopodium clavatum L.
Lycopodium lagopus (Laestad. ex Hartm.) Zinserl. ex Kuzen
Menziesia ferruginea Sm.
Micranthes ferruginea (Graham) Brouillet & Gornall
Micranthes lyallii (Engl.) Small
Mimulus guttatus DC.
Mitella pentandra Hook.
Nephrophyllidium crista-galli (Menzies ex Hook.) Gilg
Oplopanax horridus Miq.
Oxyria digyna (L.) Hill
Pedicularis ornithorhyncha Benth.
Petasites frigidus (L.) Fries
Phegopteris connectilis (Michx.) Watt

Phyllodoce aleutica ssp. *glanduliflora* (Hook.) Hulten
Pinguicula vulgaris L.
Pinus contorta Dougl. ex Loud.
Poa alpina ssp. *vivipara* (L.) Arcang.
Poa pratensis ssp. *alpigena* (Fries ex Blytt) Hiitonen
Podagrostis aequivalvis (Trin.) Scribn. & Merr.
Prenanthes alata (Hook.) D. Dietr.
Ribes bracteosum Dougl. ex Hook.
Rubus pedatus Sm.
Rubus spectabilis Pursh
Salix barclayi Anderss.
Salix commutata Bebb
Salix sitchensis Sanson ex Bong.
Sambucus racemosa L.
Sanguisorba stipulata Raf.
Senecio triangularis Hook.
Sorbus sitchensis M. Roemer
Stellaria crispa Cham. & Schlecht.
Streptopus amplexifolius (L.) DC.
Tiarella trifoliata var. *trifoliata* L.
Tiarella trifoliata var. *unifoliata* (Hook.) Kurtz
Tsuga heterophylla (Raf.) Sarg.
Tsuga mertensiana (Bong.) Carr.
Vaccinium cespitosum Michx.
Vaccinium ovalifolium Sm.
Vaccinium uliginosum L.
Vahlodea atropurpurea (Wahlenb.) Fries ex Hartman
Valeriana sitchensis Bong.
Veratrum viride Ait.
Veronica wormskjoldii ssp. *wormskjoldii* Roem. & Schult.
Viola glabella Nutt.