DRAFT BIOLOGICAL EVALUATION FOR PLANTS

Grant Lake Hydroelectric Project
FERC No. 13212

Seward Ranger District
Chugach National Forest

May 2015

SIGNATURES

Prepared by: Kathryn Beck, Botanist Date:_____
Beck Botanical Services

Reviewed by: _____ Date:_____

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INTRODUCTION

The United States Forest Service (USFS) policy requires that a review of programs and activities, through an effects analysis, be conducted to determine their potential effect on threatened and endangered species, species proposed for listing and Regional Forester designated sensitive species. The purpose of this document is to present the analysis and determination of effects of the alternatives on federally listed species (endangered, threatened, and proposed) and USFS sensitive species (FSM 2670.31-2670.32).

For threatened and endangered species and species proposed for listing, the analysis and document are referred to as a Biological Assessment, or BA. No plants federally listed or proposed by the U.S. Fish and Wildlife Service are known or suspected to occur in the Alaska Region, therefore there will be no further discussion of federally listed or proposed plants in this document.

For sensitive species the analysis and document are referred to as a Biological Evaluation or BE (FSM 2670.3). Preparation of a BE as part of the National Environmental Policy Act (NEPA) process ensures that sensitive species receive full consideration in the decision-making process.

PROJECT DESCRIPTION

The proposed Project consists of constructing a new 5-megawatt (MW) hydroelectic facility on Grant Lake and Grant Creek near Moose Pass, Alaska (Figure 1)[1]. The Project would be located just east of the Seward Highway, near the community of Moose Lake, Alaska approximately 25 miles north of Seward, Alaska. The Alaska Railroad (ARRC) parallels the route of the Seward Highway, and is also adjacent to the Project area. The Project would divert water from Grant Lake and deliver the flow to a powerhouse located near the outlet of the existing Grant Creek natural, incised rock canyon. It would be owned and operated Kenai Hydro, LLC (KHL).

[1] The Project boundary alignment, in the vicinity of Grant Lake, follows the 703-foot contour line derived from USGS developed topographic data. Due to imprecision in the USGS topography, the Project boundary around Grant Lake does not currently align with the USFS-developed aerial imagery presented in some of the maps that depict the Project boundary as proposed by KHL in the Draft License Application (DLA; KHL 2015a). The Project boundary alignment will be refined as additional survey data of the Grant Lake shoreline becomes available. The updated Project boundary is anticipated to align more precisely with USFS imagery.

All Project infrastructure, including those situated at the natural lake outlet, would be located on Alaska Department of Natural Resources (ADNR) lands and would include the following major components:

- An intake structure in Grant Lake.
- A tunnel extending from the lake intake to just east of the powerhouse.
- A powerhouse with two Francis turbines providing an anticipated combined 5-MW output. The maximum design flow will be approximately 385 cubic feet per second (cfs).
- Tailrace detention pond.
- Switchyard with disconnect switch and step-up transformer.
- An overhead transmission line.
- A pole mounted disconnect switch where the transmission line intersects the main power distribution line.

Legend

- Project Boundary
- Seward Highway
- Alaska Railroad

Property Ownership

- Borough
- Federal
- Private
- State

Lake
Trail
Upper
Moose Pass
Grant Lake
Grant Lake
Grant Creek
Lower Trail Lake
Vagt Lake
Solars Mountain
4500
4000
3500
3000
2500
2000
1500
1000
500

Alaska
Project Vicinity

MAP NOTES:
1. THIS MAP WAS DEVELOPED FOR KENAI HYDRO, LLC AS PART OF THE GRANT LAKE HYDROELECTRIC PROJECT (FERC NO. 13212), BIOLOGICAL EVALUATION. THE LOCATIONS OF PROJECT FEATURES ARE SUBJECT TO CHANGE AND ARE SHOWN FOR PLANNING PURPOSES ONLY.
2. THIS MAP WAS DEVELOPED FROM THE FOLLOWING RESOURCES:
   A. AERIAL IMAGERY DEVELOPED BY USFS.
   B. PROJECT FEATURE LOCATIONS PROVIDED BY MCMILLEN.
   C. LAND OWNERSHIP BOUNDARIES PROVIDED BY THE KENAI PENINSULA BOROUGH'S GIS DEPARTMENT.
3. THIS MAP PRESENTS DATA IN THE FOLLOWING GEOGRAHIC SYSTEMS:
   - HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 (NAD 83)
   - VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88)
   - PROJECTION: ALASKA 4 FIPS 5004 FEET STATE PLANE

REV	DATE	BY	DESCRIPTION

Drawing Scale: 0 0.25 0.5 1 Miles

N

McMILLEN, LLC
THE SONNA BUILDING
910 MAIN ST. SUITE 258
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

Developed For:
Homer Electric Association, Inc.
A Touchstone Energy® Cooperative

GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

BIOLOGICAL EVALUATION

Figure 1
Location Map of Project Vicinity

DESIGNED Jake Woodbury
DRAWN Jake Woodbury
CHECKED C. Warnock
ISSUED DATE 4/29/2015

DRAWING

SCALE: 1:35,000

Legend

- Alaska Railroad
- Seward Highway
- Project Boundary

Property Ownership

- Borough
- Federal
- Private
- State

Upper Trail Lake

Grant Lake

Intake

Intake Bypass Tunnel

Intake Tunnel

Intake Access Road

Transmission Line

Tailrace

Powerhouse

Penstock

Parking Area

Detention Pond

Surge Chamber

Grant Creek

Lower Trail Lake

Powerhouse Access Road

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REV	DATE	BY	DESCRIPTION

Drawing Scale:

N

0 250 500 1,000 Feet

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GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

BIOLOGICAL EVALUATION

Figure 2
General Project Features And Facilities

DESIGNED	Jake Woodbury
DRAWN	Jake Woodbury
CHECKED	C. Warnock
ISSUED DATE	4/29/2015

DRAWING

SCALE: 1:5,000

Grant Creek Diversion

The proposed Project consists of a reinforced concrete intake structure located on the south side of the natural lake outlet. No structural modifications would be made to the existing lake natural outlet. The Project will divert water up to a maximum of 385 cfs into the intake structure. When the lake level exceeds the natural outlet of 703 feet North American Vertical Datum of 1988 (NAVD 88), a maximum of 385 cfs will be diverted into the intake structure and routed to the powerhouse. Flow in excess of 385 cfs would pass over the natural outlet to Grant Creek.

Grant Lake Intake

The Project water intake would be a concrete structure located approximately 500 feet east of the natural outlet of Grant Lake and adjacent to the shore. The intake structure consists of a reinforced concrete structure extending from approximately elevation 675 NAVD 88 feet up to a top deck elevation of 703 feet NAVD 88. The structure has an internal dimension of 38 feet by 15 feet. The structure includes intake trashracks, a selective withdrawal intake gates with wire rope hoist, and a roller gate located on the water conveyance intake. The intake is divided into three bays, each fitted with an intake gate to provide flexibility for delivering the full flow range of 58 cfs to 385 cfs. The gate position within the water column will be set to deliver the required water temperature to Grant Creek below the powerhouse. The roller gate would be 11 feet tall by 11 feet wide and fitted with a wire rope hoist lift mechanism. Electrical power will be extended from the powerhouse to the intake to operate the intake and isolation gates. Pressure transducers will be installed to monitor the water level at the lake as well as within the intake tower. An access bridge 16 feet wide would be installed from the lake shore out to the intake structure.

The intake would allow for drawdown of Grant Lake to elevation 690 feet NAVD 88 thereby creating approximately 18,790 acre-feet of active storage for the Project between elevations 703 feet NAVD 88 and 690 feet NAVD 88. The intake can be designed to allow the Project to draw water near the surface at various levels of storage, if deemed necessary. The invert of the intake would be at elevation 675 feet NAVD 88 to provide for adequate submergence to the tunnel.

A bypass pipe would extend from the intake structure to the base of the existing water fall in Grant Creek. The installed pipe would be 900 feet long and approximately 18 inches in diameter allowing the minimum flow ranging from 5 to 10 cfs to be released. A control gate would be located within the intake structure to regulate and monitor the bypass flow releases.

Tunnel and Surge Chamber

The intake structure would connect to a tunnel extending to the Project powerhouse. The tunnel would be approximately 3,300 feet long with a 10-foot-horseshoe shape. Drill and shoot techniques would be used to construct the tunnel using an entrance portal at the powerhouse for access. The lower 900 feet of tunnel would be constructed at a 15 percent slope. This section of the tunnel will be concrete lined. The upper 2,400 feet of tunnel would be constructed at a 1 percent slope and would be unlined. This proposed arrangement provides a low pressure hydraulic conduit in the upper tunnel reaches suitable for an unlined tunnel. A surge chamber is located at the transition between the two tunnel slopes. This chamber is approximately 10 feet in

diameter and would extend from the tunnel invert elevation of 650 feet NAVD 88 to the ground surface at approximately elevation 790 feet NAVD 88. The surge chamber provides a non-mechanical relief for hydraulic transients that could occur if a load rejection occurs at the powerhouse. Rock anchors and shotcrete stabilization techniques would be used to stabilize the tunnel where required. A rock trap would be located at the surge chamber location to collect dislodged rocks from the unlined tunnel section.

The tunnel would transition to a 6-foot diameter steel penstock approximately 150 feet from the powerhouse. The transition section would consist of a welded steel concentric structure which transitions from the 10-foot tunnel section to the 72-inch diameter penstock. A steel liner would extend from the downstream tunnel portal approximately 300 feet into the tunnel. The liner would be installed within the exposed rock surface with grout pumped behind the liner to provide an impermeable and structurally sound tunnel section. A similar steel tunnel liner section would be installed at the connection to the intake structure for a total distance of approximately 150 feet.

Penstock and Surge Tank

A 72-inch diameter steel penstock extends 150 feet from the downstream tunnel portal to the powerhouse. The welded steel penstock would be supported on concrete pipe saddles along the penstock route. The penstock would bifurcate into two 48 inch diameter pipes feeding each of the powerhouse turbines. The penstock fitted with welded steel thrust rings would be encased in concrete thrust blocks at the tunnel portal as well as the powerhouse. These thrust blocks would be designed to resist the full hydraulic load associated with the Project operation. An interior and exterior coating system would be applied to the penstock providing full corrosion protection. An access manway would be provided on the exposed penstock section allowing access for future inspection and maintenance.

Tailrace

The powerhouse draft tubes would connect to a tailrace channel located on the north side of the powerhouse structure. The draft tubes would extend from a low point elevation of approximately 509 feet NAVD 88 up to the tailrace channel invert elevation of 515 feet NAVD 88. The channel would continue to the east bank of Grant Creek. Each of the draft tubes will be gated allowing the flow to be routed to the detention pond for spinning reserve. Isolation bulkheads would be provided allowing dewatering of the draft tubes for inspection and maintenance of the turbine. The tailrace channel would be trapezoidal in shape with a bottom width of 43 feet, side slopes of 2H:1V and a channel depth ranging from 13 feet at the powerhouse to 7 feet at the creek. A concrete structure would be constructed at the confluence of the channel and Grant Creek. A picket-style fish barrier would be placed on this concrete structure as well as provision for installation of stoplogs allowing the tailrace channel to be dewatered for inspection and maintenance. The channel would be excavated from native material and lined with riprap to provide a long term stable section. A staff gage and pressure transducer will be placed in the channel to monitor the water level in the channel.

Tailrace Detention Pond

An off-stream detention pond would be created to provide a storage reservoir for flows generated during the rare instance when the units being used for emergency spinning reserve are needed to provide full load into the electrical transmission grid. In this situation, the additional powerhouse flows would be diverted into the detention pond and then released slowly back into Grant Creek. It is anticipated that the discharge associated with a spinning reserve event would be dispersed via the tailrace channel which flows into Grant Creek. The detention pond would be located immediately south of the powerhouse and would have a capacity of approximately 15 acre-feet and a surface area of approximately 5 acres.

Powerhouse

The powerhouse would be located on the south bank of Grant Creek immediately west of the downstream tunnel portal and adjacent to the detention pond. The powerhouse would consist of a concrete foundation and a pre-engineered metal building superstructure. The building would be approximately 100 feet long (east to west) and 50 feet wide (north to south). The penstock would tie into the powerhouse on the south side and the tailrace channel on the north side of the building. The building floor would be set at approximately elevation 523 feet NAVD 88 and the centerline of the turbine runner at elevation 526 feet NAVD 88. The draft tube floor would be set at elevation 509 feet NAVD 88 with an operating tailwater inside the draft tubes ranging from 518.0 feet to 519.3 feet NAVD 88.

Two horizontal Francis type turbine/generator units with a rated total capacity of 5,000 kilowatt (kW) would be housed in the powerhouse structure. The powerhouse flow would range from a maximum of 385 cfs to a minimum of 58 cfs with each turbine operating flow ranging from 192.5 cfs to 58 cfs. Associated mechanical and electrical equipment would include hydraulic power units, turbine isolation valves, penstock drain, utility water system, lube oil system, oil water separator, battery system, and heating, ventilating, and air conditioning (HVAC) system. A control room housing the motor control center, communication rack, fiber optic panels, computers, and related equipment would also be provided. The Project switchgear would be located within the powerhouse. A standby generator, transformer, and fused pad mounted switch assembly would be mounted on an enclosed switchyard located on the south side of the powerhouse. Dewatering pumps would be provided to support dewatering of the turbine draft tubes. A 30-ton bridge crane would be provided for equipment maintenance. The crane would travel on rails mounted on the steel building support columns. An energy dissipation valve would extend off the penstock and provide bypass flows into the Project tailrace.

Transmission Line/Switchyard

An overhead 115-kilovolt (kV) transmission line will extend from the powerhouse to the existing 115-kV transmission line located on the east side of the Seward Highway. In addition to any overhead transmission structures, the facilities would include a switchyard at the powerhouse consisting of a 115-kV fused pad-mounted disconnect switch and a pad-mounted 115-kV GSU transformer. The transmission line would run from the powerhouse parallel to the access road where it would intersect Chugach Electric's transmission line. The interconnection would have a pole mounted disconnect switch.

Wooden poles would be designed as tangent line structures on about 250-foot centers. Design of the line would also incorporate the latest raptor protection guidelines. Collision avoidance devices would be installed on the line at appropriate locations to protect migratory birds.

Appurtenant Facilities

The following pertinent mechanical and electrical equipment will be applicable to the Project:

- Intake selective withdrawal intake gate
- Intake trashrack system
- Intake roller gate used to isolate the tunnel and downstream generation facilities
- Control gate located on the bypass pipeline pipe
- A 30-ton bridge crane in the powerhouse
- Pumps located in the powerhouse used to dewater the draft tubes
- Pressure tranducers located throughout the Project used to monitor the water level in the reservoir, tunnel and tailrace, as well as pressures in the tunnel and penstock
- Security cameras at the intake and powerhouse
- Sanitary waste holding tank at the powerhouse
- A power line extending from the powerhouse to the intake to supply electrical power to the gates and trashrack
- Temperature instrumentation at the intake structure and at various stream locations to monitor water temperature

This equipment along with other identified miscellaneous mechanical and electrical equipment will be developed during the final design and included in the construction documents.

Access Roads

The Project would require an access road to both the powerhouse located near the base of the Grant Creek canyon and to the intake at Grant Lake. The access road would be used to construct the Project and afterwards, to maintain the facilities. It is anticipated that the powerhouse would be visited approximately once a week and the intake visited approximately once a month beginning just after the ice melts and continuing until just before freeze up. The powerhouse access road would be maintained year around. The intake access road would not be maintained in winter.

The 24-foot wide access road would tie into the Seward Highway at approximately MP 26.9. The route would travel eastward to cross Trail Lakes at the downstream end of the narrows between Upper and Lower Trail lakes and then continue eastward to the powerhouse. This route would be approximately one mile long. It would cross the ARRC tracks near an existing railroad crossing for a private driveway. The road would cross the narrow channel connecting Upper and Lower Trail lakes with an approximately a 110-foot-long single lane bridge. This bridge is proposed as a clear span with the west abutment located on bedrock and the east abutment on fill. The proposed route would avoid cuts and travel along the base of some small hills on the south side of Grant Creek to the powerhouse. This proposed access road would have one 90-degree

crossing of the Iditarod National Historic Trail (INHT).

The intake access road would be approximately one mile long, beginning at the powerhouse. The road would ascend a 230-foot bluff to get to the top of the southern lip of the Grant Creek canyon. A series of road switchbacks would be required to maintain a road grade of less than 8 percent. The road would then generally follow the southern edge of the canyon until it descends to Grant Lake. A small parking area and turn-a-round area would be provided at the intake structure. A 16 foot wide bridge will extend from the bank out to the intake structure.

The road would be gravel with a 16-foot top width. Maximum grade would be 8 percent. Periodic turnouts would be provided to allow construction traffic to pass. Fifty-foot radius curves would be used to more closely contour around the small steep hills of bedrock to limit the extent of the excavation and the height of the embankments.

Project Operations

Once constructed, the Project will operate to generate power throughout the calendar year based on inflow, available storage, lake elevation, and minimum flow requirements with Grant Creek. The lake will operate from the natural Grant Lake outlet elevation of 703 feet NAVD 88 down to a minimum lake elevation of 690 feet NAVD 88. The lake will be drawn down in the winter months utilizing a combination of Grant Creek inflows and stored water to meet the instream flows in the bypass reach (Reach 5) while also maintaining power production. Water flow predictions will be used to estimate snowpack and the corresponding runoff volume (Figure 3). The Project operation will then be tailored to maximize winter power production while also ensuring the lake refills to elevation 703 feet NAVD 88.

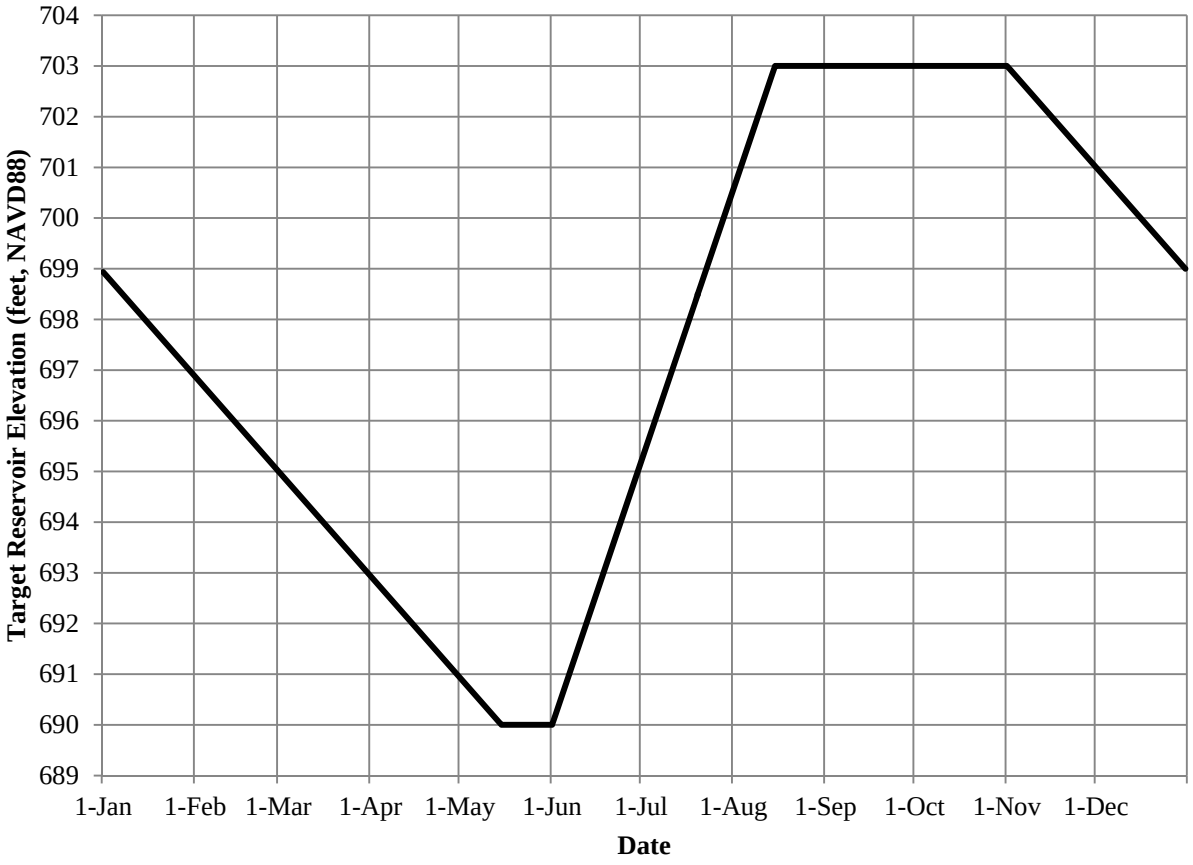

Figure 3. Grant Lake rule curve.

Schedule for Project Construction and Operation

Construction of the Project will commence after the final issuance of a license from FERC, currently anticipated to occur in December 2016. The pre-construction activities such as equipment procurement and shop drawing preparation will begin at that time. Mobilization for field construction activities will begin in April 2018. Construction work for the Project will continue for 18 months followed by a two month startup and commissioning period. Commercial operation of the Project would begin in January 2020.

PROJECT AREA

The Project area extends from east of the Seward Highway and ARRC adjacent to Moose Pass, to just past the eastern shoreline of Grant Lake. From south to north, the Project area extends south along the highway to just south of Grant Creek and north to just beyond the north shoreline of Grant Lake (Figure 1). The proposed Project boundary includes 1,758.1 acres. The USFS manages a total of 1,642.8 acres (94 percent) of this total. USFS lands are part of the Chugach National Forest, which surrounds most of Grant Lake. The Sensitive plant study area (study area) was limited to USFS lands within the Project area, and included 5 vertical feet above the

Grant Lake normal maximum elevation of 703 feet NAVD 88 (Figure 4).

Much of the forest in the Project area is old growth. Evidence of past logging of some larger trees within the Project area was observed in the vicinity of the ARRC and the Seward Highway. Spruce snags are common throughout this forest, most likely killed by the massive spruce beetle outbreak on the Kenai Peninsula during the 1990s (Berg et al. 2006). Within the Project vicinity, few populations of invasive plants have been documented very far from highways, railroad right-of-ways (ROW), and other developments (USFS NRIS 2013). There are no existing hydroelectric projects in the Project vicinity.

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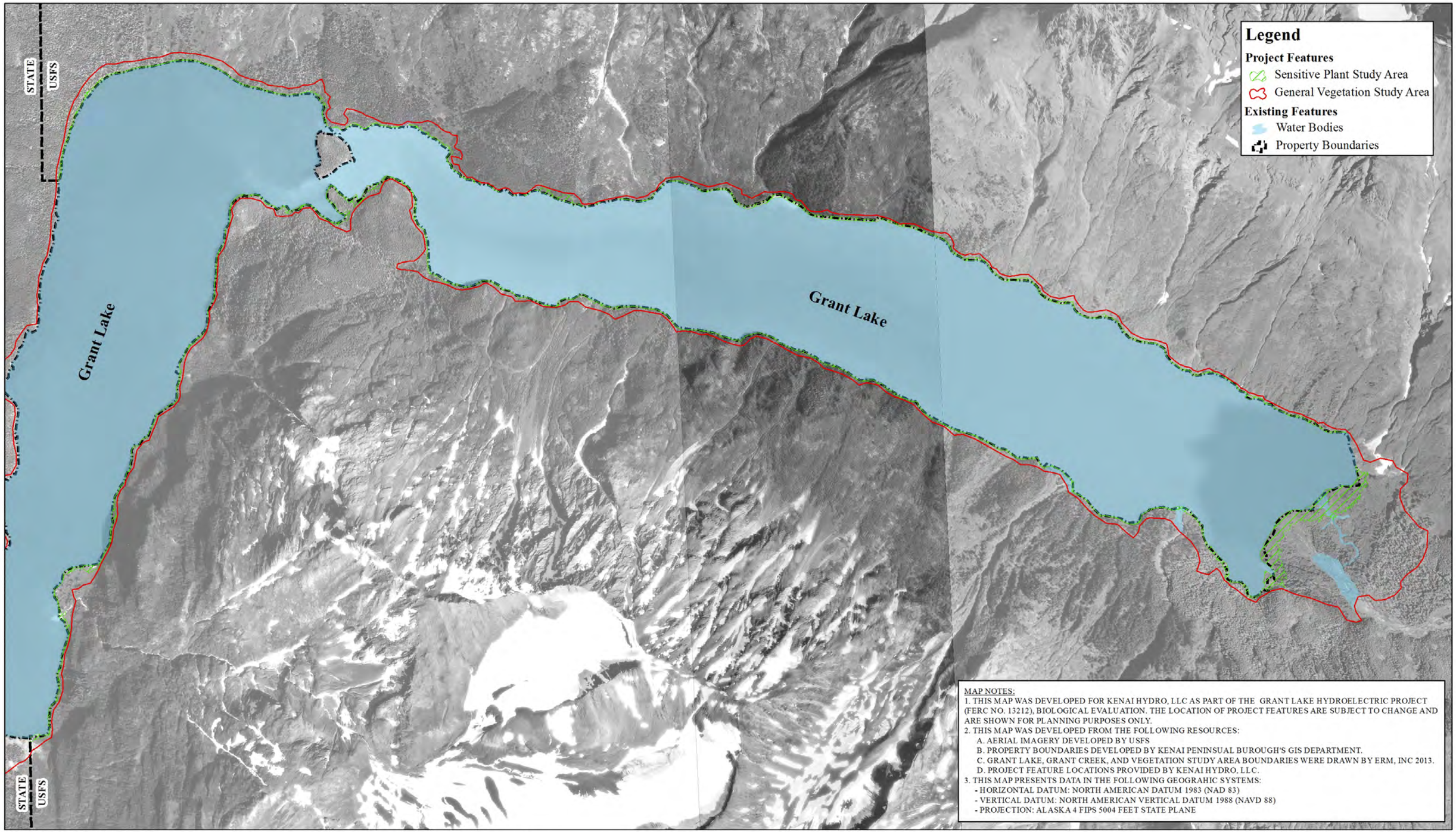

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   C. GRANT LAKE, GRANT CREEK, AND VEGETATION STUDY AREA BOUNDARIES WERE DRAWN BY ERM, INC 2013.
   D. PROJECT FEATURE LOCATIONS PROVIDED BY KENAI HYDRO, LLC.
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REV	DATE	BY	DESCRIPTION

N

Drawing Scale:

0 0.125 0.25 0.5 Miles

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GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

BIOLOGICAL EVALUATION

Figure 4
Sensitive Plant Study Area, 2013

DESIGNED	Jake Woodbury
DRAWN	Jake Woodbury
CHECKED	C. Warnock
ISSUED DATE	4/29/2015

DRAWING

SCALE: 1:19,000

NO ACTION ALTERNATIVE

For an original License, as is the case with the proposed Grant Lake Hydroelectric Project, the No Action alternative would be denial of the license. Under the No Action alternative, the Project would not be constructed and environmental and human resources in the Project area would not be affected.

SENSITIVE PLANTS

Seventeen vascular plants and one lichen are designated as sensitive in the Alaska Region (Appendix A). The following eight sensitive plants are known or suspected to occur on the Seward Ranger District of the Chugach National Forest:

Eschscholtz's little nightmare (*Aphragmus eschscholtzianus*) grows in alpine and subalpine heath meadows and wet, rocky, or mossy seeps (Goldstein et al. 2009). It is known to occur in the Seward Ranger District, but was not observed during field surveys conducted for the Project. The study area does not have alpine or subalpine habitats and is well below the alpine and subalpine zone, thus potential habitat is not present in the study area.

Moosewort fern (*Botrychium tunux*) grows in well-drained sandy beaches and alpine sites (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest, but was not observed during field surveys conducted for the Project. The study area does not have well-drained sandy beaches and is well below the alpine zone, thus potential habitat is not present within the study area.

Moonwort fern (*Botrychium yaaxudakeit*) grows in well drained open meadows, upper beach meadows, and coastal dunes (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest, but was not observed during field surveys conducted for the Project. The study area does not have well drained open meadows, upper beach meadows, or coastal dunes, thus potential habitat is not present within the study area.

Spotted lady's slipper orchid (*Cypripedium guttatum*) grows in open forests, tall shrublands, and wet meadows (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the Project. The study area does have open forests, tall shrublands, and wet meadows, thus potential habitat is present within the study area.

Calder lovage (*Ligusticum calderi*) typically grows on forest edges and dry and wet meadows in the subalpine and alpine zones (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the Project. The study area does not have calcareous substrates and is well below the alpine and subalpine zones, thus potential habitat is not present within the study area.

Pale poppy (*Papaver alboroseum*) grows in open areas, areas with sandy, gravelly, well-drained soils; mesic to dry alpine; and recently deglaciated areas (Goldstein et al. 2009). A small population of 20 plants was located on USFS land during field surveys conducted for the Project.

Other habitat with similar sandy, gravelly well-drained soils was surveyed in the study area and no other populations were found.

Alaska rein orchid (*Piperia unalascensis*) grows in dry open sites, tall shrubs in riparian zones, mesic meadows, and dry forests at low elevation to subalpine elevations (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the Project. The study area does have dry open sites, tall shrubs in riparian zones, mesic meadows, and dry forests, thus potential habitat is present within the study area.

Unalaska mist-maid (*Romanzoffia unalaschcensis*) typically grows on gravelly stream sides, rock outcrop ledges, rock crevices, and beach terraces (Goldstein et al. 2009). It is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the proposed Project. The study area does have gravelly streamsides, rock outcrop ledges and crevices, thus potential habitat is present within the study area.

PRE-FIELD REVIEW OF EXISTING INFORMATION

A pre-field review of existing information concerning the plants listed above was conducted for the study area. This review included: the Regional Forester's Sensitive Species List, Alaska Natural Heritage Program (AKNHP) data base records, Conservation Assessment for the Pale Poppy (*Papaver alboroseum*) (Charnon 2007), and consultation with the Chugach National Forest Botanist. The Project proposal, details, maps, and air photos were reviewed.

PLANTS KNOWN Previously documented sightings of sensitive plants in or near the Project area include:

Species:	Location:
Pale poppy *(Papaver alboroseum)*	Ptarmigan Lake area
Eschscholtz's little nightmare *(Aphragmus eschscholtzianus)*	[unspecificed]
Spotted lady's slipper orchid *(Cypripedium guttatum)* (historic)	Portage Valley

(Date of records search 4/2/2013 by Linda Kelley)

PLANTS SUSPECTED The following general habitats (or plant communities) occur in the study area: coniferous forest, mixed coniferous/deciduous forest, forest edge, tall shrublands, low shrublands, rocky areas, rock outcrops, cliffs, gravel, talus, seeps, wet areas, riparian areas, streambanks, waterfalls, lake margins, ponds, marshes, sphagnum bogs, fens, heath, dry meadows, moist-wet meadows, and human disturbance areas.

The sensitive plants listed below are suspected to occur in the study area since the area contains appropriate habitat and is within the known or suspected range of the plants.

Spotted lady's slipper orchid
Pale poppy
Alaska rein orchid
Unalaska mist-maid

FIELD SURVEY FOR SENSITIVE PLANTS

An intuitive controlled type rare plant survey was conducted in the study area (Appendix B). A detailed map showing the exact route that the botanist travelled on the ground is included in Appendix C. Plant Survey Field Forms and R10 TES Plant Element Occurrence field forms completed according to protocol for the Alaska Region, are in the planning file for this Project and are available in Appendix 1b of the Grant Lake Hydroelectric Project Terrestrial Resources Study Report (KHL 2014). The survey took place at the appropriate time of year to identify all sensitive plant species.

The following sensitive plants were located within areas likely to be affected by Project activities:
Papaver alboroseum
Dates of survey: July 18 – July 23, 2013
Study area surveyed by: Kathryn Beck, botanist, of Beck Botanical Services for McMillen, LLC.

Photographs of *Papaver alboroseum* in the Study area were taken and are included in Appendix D, Appendix 1b of the Grant Lake Hydroelectric Project Terrestrial Resources Study Report (KHL 2014), and are on file with: Kathryn Beck, Beck Botanical Services at: **calypso@openaccess.org**.

DETERMINATION OF EFFECTS

The Project has the potential to have direct, indirect, and cumulative effects on Sensitive plant species. These types of effects are summarized in the following sections.

1. Direct Effects
Direct effects are those that would occur immediately or soon after the implementation of the action.
Direct effects of the Project may include the following:

- Seasonal drawdown of 13 feet below the maximum lake elevation (the lake level naturally drops 11 feet below its maximum elevation)
- Water level fluctuations

2. Indirect Effects
Indirect effects are caused by the action and are later in time or farther removed in distance, but still reasonably foreseeable (50 CFR 1508.8). Indirect effects of the Project may include the following:

- Introduction and spread of invasive plants
- Increased recreation levels may lead to additional trampling in the vicinity of the Sensitive plant location
- Light and moisture level changes may occur in pale poppy habitat

3. Cumulative Impacts
Under NEPA, "Cumulative impact" is defined as an impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably

foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (50 CFR 1508.7).

4. Risk Assessment and Determination

Determination of risks to populations of sensitive plants takes into account: size, density, vigor, habitat requirements, location of the population, and consequence of adverse effect on the species as a whole within its range and within the National Forest. A risk assessment considers two factors: Factor 1) the consequence of adverse (or beneficial) effects on the population, and Factor 2) the likelihood or probability that these effects will occur. Ratings for risk assessment, levels of consequence and levels of likelihood are described in the Appendix E. The direct, indirect and cumulative effects of the proposed Project are used to determine the level of consequence and level of likelihood.

The following 4 sensitive plants are known or suspected to occur on the Seward Ranger District of the Chugach National Forest and have potential habitat present in the study area. For all of the assessed species, the No Action alternative would have no effect on sensitive species as a result of the proposed Project.

Spotted lady's slipper orchid (*Cypripedium guttatum*) is suspected to occur on the Chugach National Forest but has not been documented. This plant was not observed during field surveys conducted for the Project, although potential habitat is present within the study area.

Direct and Indirect Effects

The Project would have no effects to known populations of spotted lady's slipper orchid. Although potential habitat is present, this species has not been found on the Chugach National Forest or the study area and was not located during field surveys conducted for this Project. Potential impacts in the study area resulting from Project implementation could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects would not occur as a result of Grant Lake Reservoir water level fluctuations and drawdown because these would occur in the zone below the natural maximum lake elevation. Indirect effects are possible, including the introduction and spread of invasive plant species in the drawdown zone and an increase in recreation related impacts. Because this species may grow in a variety of habitats, some of the potential impacts that would result from Project implementation have the potential to disturb potential spotted lady's slipper orchid habitat and undetected individuals.

Cumulative Effects

Cumulative effects to this species due to past, present, and reasonably foreseeable projects are possible. Past actions may have impacted undetected individuals or habitat in the study area. Similarly, current or future projects that involve habitat disturbance could affect undetected individuals or habitat. There are no past or current projects (e.g., timber harvest activities, hydroelectric projects, road contruction, etc.) in the Grant Lake area. In addition, there are no planned projects in the area, thus no cumulative impacts are expected as a result of implementing the proposed action. The overall risk to this plant on the Chugach National Forest as a result of this Project viewed in conjunction with other past, present, and reasonably foreseeable projects is **low** due to possible adverse effects to habitat or unknown populations.

Risk Assessment and Determination
The consequence of adverse effects from the Project is **low** to **moderate**, because the Project would result in impacts to habitat, primarily as a result of potential invasive plant introduction and increases in the recreational use of the area. The likelihood of adverse effects of this Project are **low** because the species was not detected during surveys, is not known to occur in the study area, and a Vegetation Management Plan will be implemented during the license term to minimize, monitor and control the impacts of invasive plants to the study area. The overall risk to this plant is **low**; therefore, this Project may adversely impact undetected individuals, but it not likely to result in a loss of viability in the study area, nor cause a trend toward federal listing.

Alaska rein orchid (*Piperia unalascensis*) is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the Project. Potential habitat is present within the study area.

Direct and Indirect Effects
The Project would have no effects on known populations of Alaska rein orchid. Although potential habitat is present, this species is not known to occur in Chugach National Forest or the study area and was not located during field surveys conducted for this Project. Potential impacts to the study area resulting from Project implementation could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects would not occur as a result of Grant Lake water level fluctuations and drawdown because these would occur in the zone below the natural maximum lake elevation. Indirect effects are possible, including the introduction and spread of invasive plant species and an increase in recreation related impacts. Because this species may grow in a variety of habitats, some of the potential impacts that would result from Project implementation have the potential to disturb potential Alaska rein orchid habitat and undetected individuals.

Cumulative Effects
Cumulative effects to this species due to past, present, and reasonably foreseeable projects are possible. Past actions may have impacted undetected individuals or habitat in the study area. Similarly, current or future projects that involve habitat disturbance could affect undetected individuals or habitat. There are no past or current projects (e.g., timber harvest activities, hydroelectric projects, road contruction, etc.) in the Grant Lake area. In addition, there are no planned projects in the area, thus no cumulative impacts are expected as a result of implementing the proposed action. The overall risk to this plant on the Chugach National Forest as a result of this Project viewed in conjunction with other past, present, and reasonably foreseeable projects is **low** due to possible adverse effects to habitat or unknown populations.

Risk Assessment and Determination
The consequence of adverse effects from the Project is **low** to **moderate**, because the Project would result in impacts to habitat, primarily as a result of potential invasive plant introduction and increases in the recreational use of the area. The likelihood of adverse effects of this Project are **low** because the species was not detected during surveys, is not known to occur in the study area, and a Vegetation Management Plan will be implemented during the license term to

minimize, monitor and control the impacts of invasive plants to the study area. The overall risk to this plant is **low**; therefore, this Project may adversely impact undetected individuals, but it not likely to result in a loss of viability in the study area, nor cause a trend toward federal listing.

Unalaska mist-maid (*Romanzoffia unalaschcensis*) is suspected to occur on the Chugach National Forest but was not observed during field surveys conducted for the proposed Project. Potential habitat is present within the study area.

Direct and Indirect Effects
The Project would have no effects to known populations of Unalaska mist-maid. Although potential habitat is present, this species is not known to occur in Chugach National Forest or the study area, and was not located during field surveys conducted for this Project. Potential impacts to the study area resulting from Project implementation could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects would not occur as a result of Grant Lake water level fluctuations and drawdown because these would occur in the zone below the natural maximum lake elevation. Indirect effects are possible, including the introduction and spread of invasive plant species in the drawdown zone and an increase in recreation related impacts. Because this species may grow in a variety of habitats, some of the potential impacts that would result from Project implementation have the potential to disturb potential Unalaska mist-maid habitat and undetected individuals.

Cumulative Effects
Cumulative effects to this species due to past, present, and reasonably foreseeable projects are possible. Past actions may have impacted undetected individuals or habitat in the Study area. Similarly, current or future projects that involve habitat disturbance could affect undetected individuals or habitat. There are no past or current projects (e.g., timber harvest activities, hydroelectric projects, road contruction, etc.) in the Grant Lake area. In addition, there are no planned projects in the area, thus no cumulative impacts are expected as a result of implementing the proposed action. The overall risk to this plant on the Chugach National Forest as a result of this Project viewed in conjunction with other past, present, and reasonably foreseeable projects is **low** due to possible adverse effects to habitat or unknown populations.

Risk Assessment and Determination
The consequence of adverse effects from the Project is **low** to **moderate**, because the Project could potentially result in impacts to habitat, primarily as a result of potential invasive plant introduction and increases in the recreational use of the area. The likelihood of adverse effects of this Project are **low** because the species was not detected during surveys, is not known to occur in the Study area, and and a Vegetation Management Plan will be implemented (during the license term) to minimize, monitor and control the impacts of invasive plants to the study area. The overall risk to this plant is **low**; therefore, this Project may adversely impact undetected individuals, but it not likely to result in a loss of viability in the study area, nor cause a trend toward federal listing.

Pale Poppy (*Papaver alboroseum*) grows in open areas, areas with sandy, gravelly, well-drained soils; mesic to dry alpine areas; and recently deglaciated areas (Goldstein et al. 2009). A small

pale poppy population was located on USFS land during field surveys conducted for the Project. Other habitat with similar sandy, gravelly well-drained soils was surveyed in the study area, and no other populations were found. In the Grant Lake sensitive plant study area, 20 pale poppy plants were growing on a semi-stabilized, sparsely vegetated, south-facing creek outwash area near the Grant Lake shore, on a cobble, sand, and gravel substrate (Appendix D). The population measured approximately 10 feet by 45 feet in size. The plants are a minumum of 8 feet away from and between 1 and 3 feet higher (704 – 707 feet in elevation) than the natural maximum lake elevation level of 703 feet.

The Grant Lake pale poppy population is located in the Floodplain Forest and Scrub vegetation type. Vegetation present at the site was an early successional community with shrubs, forbs, and graminoids. The population and habitat appear to be increasingly shaded due to natural vegetative succession. Dense Sitka alder and willow shrubs and seedlings dominate the site. Approximately half of the pale poppy plants in the population were growing in the shade of Sitka alder branches. The more densely shaded pale poppy plants were smaller and had fewer capsules than plants that were in less shade. If natural vegetation succession in the vicinity of the Grant Lake pale poppy site continues without natural disturbance (e.g., an avalanche or flood event), it is likely that the already small population will decline naturally in numbers and eventually disappear due to the species' requirement for open, well-drained habitat.

There is a historic cabin, a campsite and two campfire rings with evidence of recent use on the small gravel bar where the pale poppy population was located. There was no visible evidence of trampling of plants, although plants were as close as 5 feet away from one of the campfire rings. The only invasive plant species present in the vicinity of the pale poppy population was common dandelion (*Taraxacum officinale*). Horned dandelion (*Taraxacum ceratophorum*), a native plant species, was observed in similar habitat on the lakeshore and may be mixed with the common dandelion at the site.

Direct and Indirect Effects

A small population of pale poppy, a USFS designated sensitive plant, was located on the shore of the USFS-owned portion of Grant Lake. No proposed Project infrastructure are located on USFS land on Grant Lake; thus there would be no direct loss from the following proposed activities: vegetation clearing for Project componants, damage by machinery, soil disturbance, altered natural grading, or fill material placement. The pale poppy population will not be directly affected by the construction or maintenance of Project facilities. The Grant Lake seasonal water level drawdown (between 690 and 703 feet in elevation) will not directly affect areas above the normal high water elevation (703 feet in elevation), and thus will not have direct impacts to pale poppy plants (elevation between 704 and 707 feet) due to inundation. Water level fluctuations are not likely to affect plants because fluctuations will be below the normal high water elevation level.

Indirect effects to sensitive plants are possible due to a seasonal 13-foot drawdown of Grant Lake (the lake level naturally drops 11 feet below is maximum elevation level). Potential indirect effects to plants from the drawdown of Grant Lake include: introduction and spread of invasive plant species, light level changes, and moisture level changes. Indirect effects may also

occur as a result of an increase in reacreation in the area as a result of easier access to Grant Lake.

An indirect impact of Grant Lake level drawdown and fluctuations is that invasive plant species may spread into the drawdown zone between 690 and 703 feet in elevation, and subsequently onto adjacent upland areas, including pale poppy habitat. Currently the only invasive plant species present in the vicinity of the pale poppy population is common dandelion.

Changes to light levels in the vicinity of the pale poppy population as a result of the Project are unlikely because plants establishing in the 13-foot drawdown zone would likely be low in stature and thus would not shade the pale poppy population. Its seems unlikely that the drawdown would change the rate of natural vegetation succession of the upland plant community in the habitat of the population.

While Grant Lake water level drop to 690 feet in elevation during the early part of the growing season may create an overall drying effect to the pale poppy substrate, pale poppy should not be negatively affected as it is an upland species which is able to grow in very dry habitats.

A historic cabin, a campsite and two campfire rings with evidence of recent use are currently located in close proximity to the pale poppy population. There was no visible evidence of trampling of plants when the population was surveyed in 2013, although plants were located as close as 5 feet away from one of the campfire rings. An indirect impact of potential increased recreational use of Grant Lake may be an increased potential for trampling and possible scorching of some pale poppy plants. In addition, easier recreational access and increased use of Grant Lake may spread invasive species into pale poppy habitat.

Because pale poppy habitat is discontinuously present around the perimeter of Grant Lake, potential indirect impacts resulting from Project implementation, as described above, could have the potential to disturb pale poppy habitat and undetected individuals.

A Vegetation Management Plan to be implemented during the license term, describes measures to assess whether the Project is having negative impacts on the pale poppy population on USFS land and establishes a framework for adaptive management to modify Project infrastructure and/or operations for sensitive plant management. It also has measures to help minimize the establishment and spread of invasive plants in the Project area generally, as well as in the vicinity of the pale poppy population.

Cumulative Effects

Cumulative effects to this species due to past, present, and reasonably foreseeable projects are possible. Past actions may have impacted undetected individuals or habitat in the study area. Similarly, current or future projects that involve habitat disturbance could affect undetected individuals or habitat. There are no past or current projects (e.g., timber harvest activities, other hydroelectric projects, road construction, etc.) in the Grant Lake area. In addition, there are no planned projects in the area, thus no cumulative impacts are expected as a result of implementing the proposed action. The overall risk to this plant on the Chugach National Forest as a result of

this Project viewed in conjunction with other past, present, and reasonably foreseeable projects is **low** due to possible adverse effects to habitat or unknown populations.

Risk Assessment and Determination
The consequence of adverse impacts from the Project on pale poppy is **high**, due to the potential indirect effects on individuals and habitat, small population size, and the potential for effects to unidentified individuals.

The likelihood of adverse effects of this Project on pale poppy are **moderate**, because a Vegetation Management Plan will be implemented during the license term with the goal of preventing adverse effects on the sensitive plant population. The Plan will monitor the effects of increased recreation, and monitor, minimize and control the impacts of invasive plants in the Project area and in the vicinity of the pale poppy population.

The overall risk to this plant as a result of the Project is **moderate to high** since effects may occur to this plant's habitat, individuals may be indirectly affected, and additional undetected individuals may be present in the study area.

Based on the rationale described above, the course of action will likely result in the following impact on the sensitive plants. In summary, because the Project might result in a significant increased risk of loss of viability to the pale poppy population due to indirect effects, it is concluded that the Project is **likely to result in a loss of viability in the Planning Area, or in a trend toward federal listing.**

ADDITIONAL MANAGEMENT RECOMMEDATIONS

The most likely negative impacts to the pale poppy population in the study area are non-Project effects resulting from natural vegetation succession and small population size. If natural vegetation succession in the vicinity of the Grant Lake pale poppy habitat continues without some sort of natural disturbance (e.g., an avalanche or flood event), it is likely that the currently small population will decline in numbers and eventually be extirpated. It is possible that the pale poppy population will not persist regardless of whether the Project is built.

KHL has developed a Draft Vegetation Management Plan (VMP; KHL 2015b). It includes best management practices (BMPs) for construction and operation of the Project, revegetation, and measures for invasive plant monitoring, minimization and control. In addition there are measures specifically designed to protect and mitigate potential negative impacts of the Project on the sensitive plant population. These measures will help minimize impacts from recreational use, and invasive plant introduction and spread in the Project area generally, as well as in the pale poppy population specifically. Collectively, the protective measures implemented in the VMP lower the overall risk level to the pale poppy as a result of the Project to **low to moderate** and would change the determination to **may adversely impact individuals, but not likely to result in a loss of viability in the Planning Area, nor cause a trend toward federal listing**. If the pale poppy population does decline in numbers, it is just as likely that the decrease is as a result of natural vegetation succession making its habitat less suitable.

If any previously undiscovered sensitive plants are encountered at any time prior to or during implementation of this Project, the population will be protected and any disturbance in the area containing the population (and similar habitats in that vicinity) will be avoided. The district or forest botanist/ecologist will be notified immediately to evaluate the population and recommend avoidance or mitigation measures.

MONITORING

Guidelines for monitoring the pale poppy population are included in the VMP.

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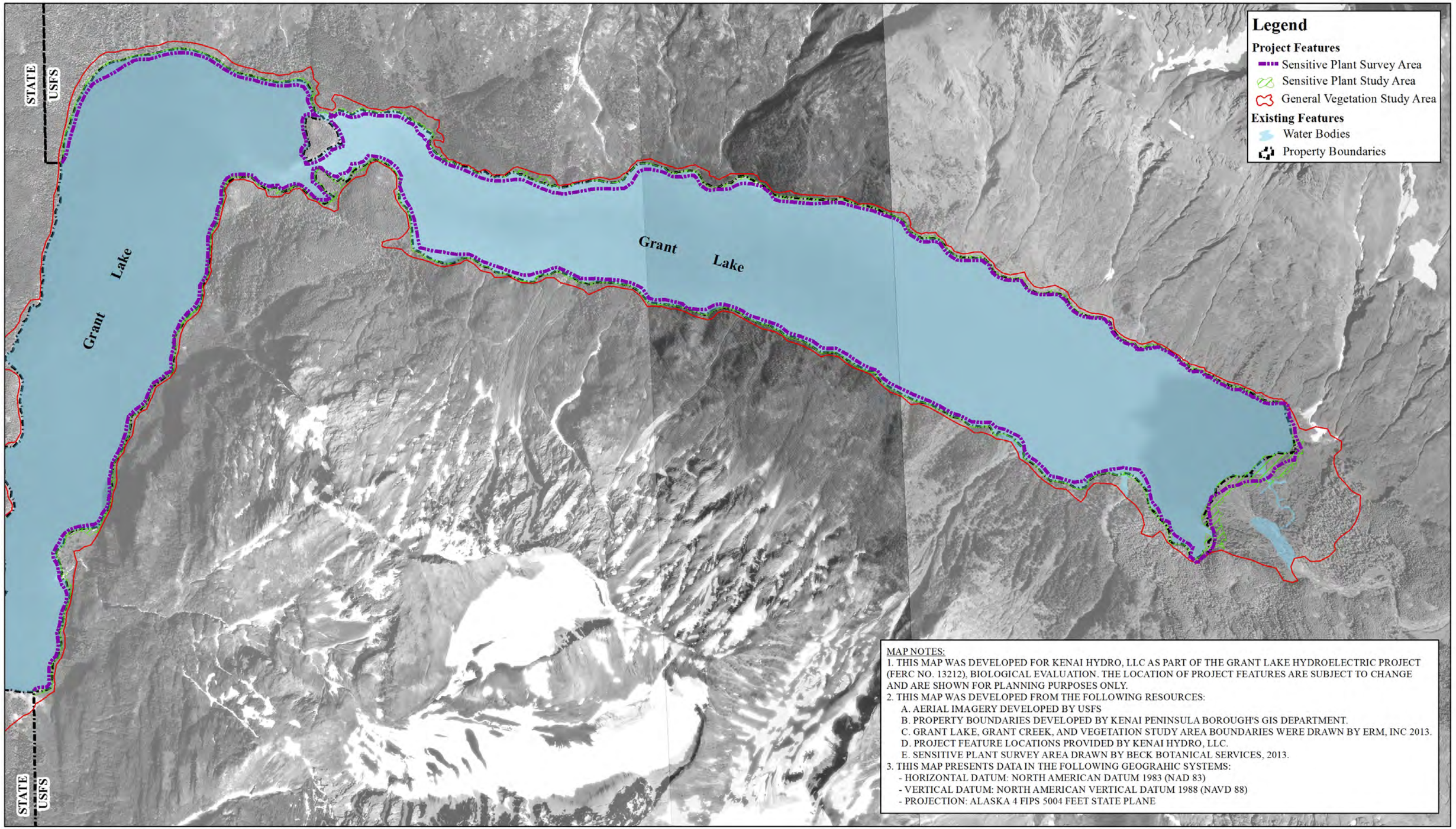
Appendix A. Alaska Region Sensitive Plants, February 2009.

Common Name	Scientific Name	Occurrence	
		CNF	**TNF**
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. Survey Types.

Survey type	Description
Field Check	The survey area is given a quick "once over" but the surveyor does not walk completely throug 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. Sensitive Plant Survey Area, Grant Lake Project, 2013.



MAP NOTES:

1. THIS MAP WAS DEVELOPED FOR KENAI HYDRO, LLC AS PART OF THE GRANT LAKE HYDROELECTRIC PROJECT (FERC NO. 13212), BIOLOGICAL EVALUATION. THE LOCATION OF PROJECT FEATURES ARE SUBJECT TO CHANGE AND ARE SHOWN FOR PLANNING PURPOSES ONLY.
2. THIS MAP WAS DEVELOPED FROM THE FOLLOWING RESOURCES:
   A. AERIAL IMAGERY DEVELOPED BY USFS
   B. PROPERTY BOUNDARIES DEVELOPED BY KENAI PENINSULA BOROUGH'S GIS DEPARTMENT.
   C. GRANT LAKE, GRANT CREEK, AND VEGETATION STUDY AREA BOUNDARIES WERE DRAWN BY ERM, INC 2013.
   D. PROJECT FEATURE LOCATIONS PROVIDED BY KENAI HYDRO, LLC.
   E. SENSITIVE PLANT SURVEY AREA DRAWN BY BECK BOTANICAL SERVICES, 2013.
3. THIS MAP PRESENTS DATA IN THE FOLLOWING GEOGRAHIC SYSTEMS:
   - HORIZONTAL DATUM: NORTH AMERICAN DATUM 1983 (NAD 83)
   - VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988 (NAVD 88)
   - PROJECTION: ALASKA 4 FIPS 5004 FEET STATE PLANE

REV	DATE	BY	DESCRIPTION

N

Drawing Scale:
0 0.1 0.2 0.4 0.6 Miles

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Developed For:
Homer Electric Association, Inc.
A Touchstone Energy® Cooperative

GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO. 13212

BIOLOGICAL EVALUATION

Sensitive Plant Survey Area, Grant Lake Project 2013.

DESIGNED J. Woodbury
DRAWN J. Woodbury
CHECKED K. Beck
ISSUED DATE 4/29/2015

DRAWING

SCALE: 1:20,000

Appendix D. Photos of the Grant Lake Pale Poppy Population.

Photo 1. Blooming pale poppy plant.

Photo 2. Pale poppy habitat, Grant Lake.

Photo 3. Pale poppy plants in the shade of Sitka alder branches, Grant Lake.

Photo 4. Pale poppy plants (adjacent measuring tape) near exisiting fire ring, Grant Lake.

Appendix E. Criteria for Risk Assessment.

Factor 1. Consequence of Adverse Effect From a Particular Activity

LOW: None, or questionable adverse effect on habitat or population. No cumulative effects expected.

MODERATE: Possible adverse effects to habitat or to population. Cumulative effects possible.

HIGH: Obvious adverse effects on habitat or population. Cumulative effects probable.

Factor 2. Likelihood of Adverse Effect From a Particular Activity

NONE: Activity will not affect habitat or population (no further risk assessment needed).

LOW: Activity controllable by seasonal or spatial restrictions and not likely to affect habitat or populations.

MODERATE: Activity not completely controllable or intense administration of project needed to prevent adverse effects on habitat or population. Adverse effects may occur.

HIGH: Activity not controllable and adverse effects on habitat or populations likely to occur.