Grant Lake Hydroelectric Project (FERC No. 13212)

Vegetation Management Plan

Draft

Kenai Hydro, LLC

May 2015

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Acronyms and Abbreviations

ADNR	Alaska Department of Natural Resources
AKEPIC	Alaska Exotic Plant Information Clearinghouse
ARRC	Alaska Railroad Corporation
BMP	Best Management Practices
cfs	cubic feet per second
DLA	Draft License Application
ECM	Environmental Compliance Monitor
FERC	Federal Energy Regulatory Commission
GIS	geographic information system
GPS	global positioning system
HVAC heating,	ventilating, and air conditioning
IEEE	Institute of Electrical and Electronics Engineers
INHT Iditarod	National Historic Trail
KHL	Kenai Hydro, LLC
kV kilovolt	
kW kilowatt	
MW m	egawatt
NAVD 88	North American Vertical Datum of 1988
NRIS	National Register Information System
Project or Grant Lake Project	Grant Lake Hydroelectric Project
ROW right-of-way	
RUS	Rural Utilities Service
USFS	United States Department of Agriculture Forest Service
VMP or Plan	Vegetation Management Plan

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Vegetation Management Plan
Draft
Grant Lake Hydroelectric Project (FERC No. 13212)

1 INTRODUCTION

This document provides a draft of Kenai Hydro, LLC's (KHL) proposed Vegetation Management Plan (VMP or Plan) for the Grant Lake Hydroelectric Project (Project or Grant Lake Project), Federal Energy Regulatory Commission (FERC) No. 13212. Activities associated with the proposed construction and operation of the Project include the construction of an intake structure in Grant Lake, a tunnel, a surge shaft, a penstock, a powerhouse, tailrace channel with fish exclusion barrier, access roads, a step-up transformer, a breaker, a transmission line, and a switchyard. The activities and structures associated with this Project have the potential to impact sensitive plant species and to introduce invasive plants. The VMP covers all lands within the FERC Project boundary, and those lands adjacent to the FERC Project boundary that are either affected by Project operations or have the potential to be affected by Project operations. KHL is responsible for implementing the VMP. The specific actions that KHL shall implement in this VMP were identified and developed based on the results of the Terrestrial Resource Study conducted by KHL for the licensing of the Project. KHL documented the results of this study in the *Terrestrial Resources Study – Grant Lake Terrestrial Resources Study, Final Report* (KHL 2014).

1.1. Location

The proposed Grant Lake Project will be located near the community of Moose Pass, Alaska (population 219) in the Kenai Peninsula Borough, approximately 25 miles north of Seward, Alaska (population 2,693, and just east of the Seward Highway (State Route 9); this highway connects Anchorage (population 291,826) to Seward. The Alaska Railroad (ARRC) parallels the route of the Seward Highway, and is also adjacent to the Project area. Grant Lake is located in the mountainous terrain of the Kenai Mountain Range and has a normal water surface elevation of 703 feet North American Vertical Datum of 1988 (NAVD 88) and surface area of approximately 1,703 acres. A map showing the location of the Project is provided in Figure 1.[1]

1.2. Project Description

The Grant Lake Project will consist of the Grant Lake/Grant Creek development, an intake structure in Grant Lake, a tunnel, a surge shaft, a penstock, a powerhouse, tailrace channel with fish exclusion barrier, access roads, a step-up transformer, a breaker, a switchyard, and an overhead transmission line. The powerhouse will contain two Francis turbine generating units with a

[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 the maps that depict the Project boundary as proposed by KHL in the Draft License Application (DLA; KHL 2015). 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.

combined rated capacity of 5 megawatts (MW) with a maximum design flow of 385 cubic feet per second (cfs). The general proposed layout of the Project is shown in Figure 2.

1.2.1. 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 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.

1.2.2. 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 715 feet NAVD 88. The structure has an outside dimension of 38 feet by 20 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 to meet downstream temperature requirements. 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.

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), VEGETATION MANAGEMENT PLAN. 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

VEGETATION MANAGEMENT PLAN

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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VEGETATION MANAGEMENT PLAN

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

1.2.3. 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 670 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 exposed rock surface 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.

1.2.4. 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.

1.2.5. 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 operation. 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.

1.2.6. 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 spinning reserve are needed for 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.

1.2.7. 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.

1.2.8. 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.

1.2.9. 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 transducers 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.

1.2.10. 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 reach the top of the southern rim 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.

1.2.11. 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 while also maintaining power production. Water flow predictions will be used to estimate snowpack and the corresponding runoff volume. The Project operation will then be tailored to maximize winter power production while also ensuring the lake refills to elevation 703 feet NAVD 88.

1.3. Purpose

Project construction will create both temporary and permanent changes to upland vegetation communities in the Project area (KHL 2014). The VMP was developed to help minimize the negative impacts Project construction and operation activities would have on natural vegetation, wetlands, and downstream aquatic resources. It includes provisions for invasive plant prevention and control, U.S. Forest Service (USFS) sensitive species protection, guidelines for the revegetation of disturbed areas, vegetation monitoring guidelines, and contingency measures.

The VMP applies to lands affected by the Project, including:

- Lands within the Project boundary;

- Lands influenced by ground-disturbing activities conducted as part of Project construction, operations, or license compliance;
- Lands influenced by Project-related erosion or invasive plant infestations;
- Lands influenced by habitat improvements conducted as part of Project operations or license compliance activities (including invasive plant prevention and control).

2 BACKGROUND AND OBJECTIVES

The VMP has been prepared to conform to recommended Best Management Practices (BMPs), and Alaska Department of Natural Resources (ADNR) and Chugach National Forest guidelines for preventing the introduction and spread of invasive plant species (USFS 2002; USFS 2005a), and to protect sensitive plant species in accordance with USFS Region 10 guidelines (USFS 2002). The VMP thus, includes the provisions for invasive plant prevention and control, sensitive plant species protection, revegetation of disturbed areas, vegetation monitoring, and contingency measures. The VMP was created using baseline vegetation data (KHL 2014) and Project design specifications as described in the Draft License Application (DLA; KHL 2015). The VMP provides KHL with appropriate actions to minimize negative impacts to vegetation in the Project area, negative impacts to sensitive plants, and the introduction and spread of invasive plant species. It will promote revegetation of disturbed areas by native plant species and include methods for controlling invasive plants that may become established in disturbed areas associated with the Project.

2.1. Objectives

The objectives of the VMP are to provide guidelines for the:

- Prevention, containment, and control of invasive plants on lands disturbed by Project construction and operations.
- Revegetation of lands affected by Project construction and operations.
- Protection of USFS sensitive plant species and their habitat on Project-affected USFS lands.

2.2. Existing Conditions

This section summarizes the findings of the invasive plant survey and the sensitive plant survey that were conducted in the Project area in 2013 (KLH 2014).

2.2.1. Invasive Plant Species

A survey of invasive plants occurred in areas potentially affected by the Project in 2013 (KHL 2014). Areas of particular focus included: roadsides, motorized vehicle travel routes, existing trails, lake and stream access points, developed and social recreation sites, and other human use areas. Four invasive plant species were found in the invasive plant study area during the 2013 survey (Table 1). In addition, a small population of timothy (*Phleum pratense*) was observed in the study area in the Seward Highway right-of-way (ROW) in 2014 (KHL 2015). Alaska Exotic

Plants Information Clearinghouse (AKEPIC) field data sheets documenting invasive plants in the study area are located in Appendix 1. Overall, relatively few infestations of invasive species were documented in the invasive plant study area. A number of other invasive species are known to exist near the Project area (USFS NRIS 2013).

Once the Project begins operating, it is possible that invasive plants could invade the expanse of bare ground exposed by the seasonal 13-foot drawdown of Grant Lake. The vegetation of reservoir drawdown zones often differs substantially from that of areas that are not periodically inundated. Invasive plants often dominate reservoir drawdown zones. Invasive plants in the drawdown zone would likely spread to adjacent upland areas. It is anticipated that concerted efforts to prevent invasive plant establishment and spread in the Grant Lake drawdown zone will be necessary.

Table 1. Invasive plant populations in the Grant Lake Project area (KHL 2014).

Scientific Name	Common Name	General Location in the Project area
Taraxacum officinale	common dandelion	Small scattered populations in the ARRC ROW, Seward Highway ROW, the Grant Lake Trail near Grant Lake and around Grant Lake.
Trifolium repens	white clover	Small population in the Seward Highway ROW
Poa pratensis	Kentucky bluegrass	Along the Grant Lake Trail near Grant Lake
Poa annua	annual bluegrass	Along the Grant Lake Trail near Grant Lake
Phleum pratense	timothy	Small population in the Seward Highway ROW

2.2.2. Sensitive Plant Species

Although there are no planned Project components on USFS land, field surveys for sensitive plants occurred on USFS-owned portions of the Grant Lake shoreline, as this area will be affected by Project operations (KHL 2014). Sensitive plants are plant species formally identified by Region 10 of the USFS (Goldstein et al. 2009). A primary goal of the VMP is to avoid negative Project-related impacts to USFS sensitive plant populations within the Project area.

In the Grant Lake Project area, a small population of the USFS sensitive species pale poppy (*Papaver alboroseum*) was documented on a semi-stabilized, sparsely vegetated, south-facing creek outwash area near the Grant Lake shore, on a cobble, sand, and gravel substrate. A USFS sighting form for the population is presented in Appendix 2. A map of the population is presented in Appendix 3. The population measured approximately 10 feet by 45 feet in size and had 20 plants. The plants are a minimum of 8 feet away from and between 1 and 3 feet higher (704 – 707 feet NAVD 88) than the natural maximum lake elevation level of 703 feet NAVD 88. Pale poppy typically grows in open areas, areas with sandy, gravelly, well-drained soils; mesic to dry alpine areas; and recently deglaciated areas (Goldstein et al. 2009). Additional information about the pale poppy may be found in "Conservation Assessment for the Pale Poppy (*Papaver alboroseum*)" (Charnon 2007).

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 fruiting 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 naturally decline in numbers and eventually disappear due to the species' requirement for open, well-drained habitat.

There is an 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 damage to plants when surveyed in 2013, 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.

While no direct effects to the pale poppy population as a result of Project construction are anticipated, indirect effects to plants and their habitat are possible due to a seasonal 13-foot drawdown of Grant Lake. Potential indirect effects to plants from the drawdown of the lake include: introduction and spread of invasive plant species in both upland areas in the vicinity of the population and below the natural high water level in the drawdown zone between 690 and703 feet NAVD 88. The lake level naturally fluctuates 11 feet below its maximum elevation level of 703 feet NAVD 88 to approximately 692 feet NAVD 88. Indirect effects to the population may also occur as a result of an increase in recreation in the area due to potentially easier access to Grant Lake.

3 PLAN IMPLEMENTATION

This section describes vegetation management measures to be implemented in the Grant Lake Project area with regard to:

- Invasive Plant Management and Control
- Revegetation and Vegetation Maintenance
- Sensitive Plant Species Protection and Monitoring

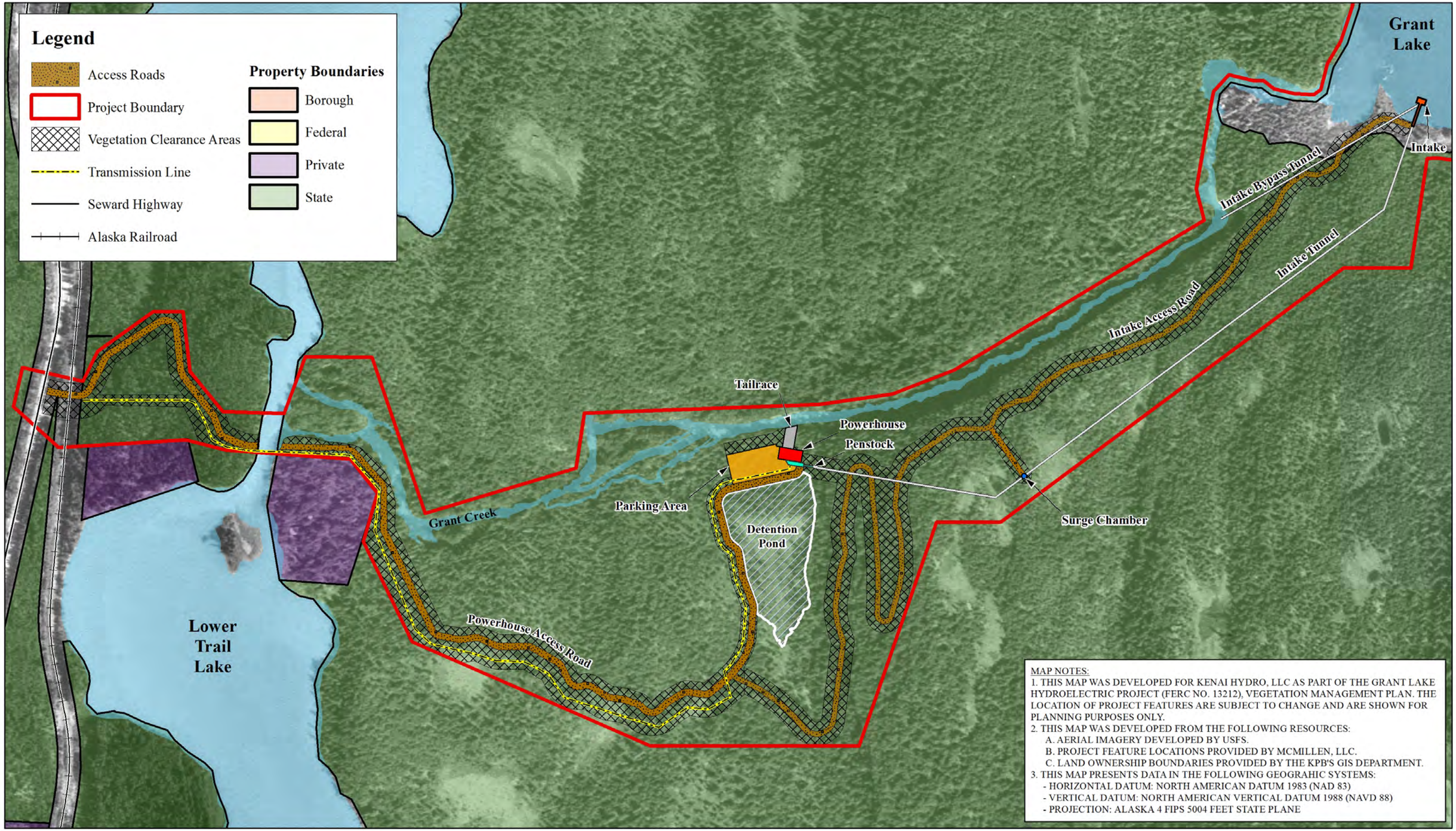
These measures will be implemented before, during, and after the construction phase of the Project, or during Project operations.

Vegetation management measures applied during Project construction and operation will be managed by KHL's on-site Environmental Compliance Monitor (ECM). The ECM will be responsible for assuring that all procedural aspects of the natural resource and construction management plans, as well as general Best Management Practices (BMP) for construction efforts are being adhered to.

3.1. Invasive Plant Management and Control

The following general measures and BMPs regarding invasive plant management and control will be employed during construction and operation of the Project to prevent the establishment and spread of invasive plant species.

- Prior to construction, provide training and information to Project personnel (employees and contractors) about the goals and methods of invasive plant prevention and management. Training will include identification of common invasive plant species.
- Prior to construction, vegetation clearing limits will be clearly marked in the field along access roads, the transmission line, and adjacent Project structures. Vegetation clearing limits are shown in Figure 3.
- Require the use of weed-free construction materials (rock, gravel, fill material, mulch, straw, etc.).
- Prior to construction, treat known invasive plant infestations in and near the Project area to minimize seed source in construction areas. AKEPIC Field Data Sheets documenting known invasive species infestations are included in Appendix 1.
- During construction, restrict ground-disturbing activities and fill footprint to as small an area as possible within the Project boundary and designated roads.
- Limit the amount and length of time that bare ground is exposed by mulching bare areas and minimizing ground disturbance. Bare ground provides a favorable substrate for invasive plants to become established. Invasive plant seeds are most numerous in late summer and can remain viable in the soil for many years.
- Clean construction equipment prior to use in order to avoid the introduction of new invasive plants into the Project area. Clean especially vehicle tires, vehicle undercarriage areas, shovels, and buckets.
- Employ measures to limit erosion during construction in the Project area (consistent with an Erosion and Sediment Control Plan to be developed post-licensing).



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A Touchstone Energy® Cooperative

GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

VEGETATION MANAGMENT PLAN

Figure 3
General Project Features, Facilities, Adjacent Cleared Areas, and Right of Ways

DESIGNED	Jake Woodbury
DRAWN	Jake Woodbury
CHECKED	K. Beck
ISSUED DATE	4/29/2015
DRAWING	
SCALE:	1:4,700

Surveys for and treatment of invasive plant infestations will be conducted during the first growing season after construction completion and year 5 post-construction. The survey will include areas in the vicinity of Project- related disturbance (including construction areas, access roads, ROWs, facilities, and the Grant Lake shoreline). The survey will document invasive plants included on the current AKEPIC invasive plant list (available on the AKEPIC website). The AKEPIC website has comprehensive information about invasive plant species in Alaska.

- Invasive plant surveys will be done by a qualified botanist or someone trained in invasive plant identification.
- In addition to documenting invasive plant infestations, bare areas in need of revegetation will be documented during surveys.
- Any invasive plant infestations will be documented with AKEPIC Field Data Sheets and global positioning system (GPS). Forms will be submitted to AKEPIC for inclusion in their state-wide database. The AKEPIC User's Manual, including a blank AKEPIC Field Data Sheet, is available to download from the AKEPIC website (http://aknhp.uaa.alaska.edu/wp-content/uploads/2012/03/AKEPIC_User_Manual_022312.pdf).
- General information to be recorded includes: species, location, size of infestation, size of bare area, habitat information of adjacent area (vegetation type, dominant native species), etc.
- Surveys will occur during the growing season (June – August), to optimize plant identification.
- Invasive plant locations, bare area locations in need of revegetation, and associated information will be maintained in a geographic information system (GIS) database.
- Subsequent general surveys for invasive plant species will be conducted every ten years for the term of the license.
- The time period between invasive plant surveys may be adjusted depending on the rate at which invasive plants become established and spread in the Project area. Any proposed modifications to the invasive plant survey schedule will be reviewed and ultimately approved by the USFS, and other stakeholders prior to implementation.

Once invasive plant infestations are documented, appropriate invasive plant treatments will be conducted to reduce or eliminate their negative impacts.

- Treat and monitor treated invasive plant infestations associated with Project construction and operations in consultation with the ADNR, the USFS, and their respective invasive plant management plans.
- Invasive plant control will be achieved with a combination of manual, mechanical, cultural, biological and chemical treatments. Damage to non-target species will be avoided to the extent possible.
- For mechanical treatments, the entire plant, including roots, will be removed.
- Control of invasive plants will occur at different times of the year depending on the methods used and the species being controlled.
- If possible, infestations will be treated early in the growing season before invasive plants produce that season's seed.
- After invasive plants are removed, bare areas will be seeded.

- The more aggressive invasive plants should be prioritized for control. Invasiveness Ranks are defined and given for many common invasive plants here: http://aknhp.uaa.alaska.edu/botany/akepic/non-native-plant-species-list/#content
- Horned dandelion (*Taraxacum ceratophorum*), a native plant species, is very similar in appearance to common dandelion (*T. officinale*). The two species may grow together on the Grant Lake shore. Care should be taken that horned dandelion not be controlled.

Standards for invasive plant control success will be determined in consultation with the ADNR and the USFS.

- Treated areas will be monitored to evaluate the effectiveness of control.
- It may take several treatments to eliminate larger invasive plant infestations.
- Monitoring of these sites will continue for 2 years after construction is completed to ensure treatments are effective.

Reporting related to invasive plants will be incorporated into the Annual Compliance Report. Based upon the surveys conducted and associated results, if detrimental populations of invasive species are documented and their spread into the Project area is deemed to be as a result of Project construction or operations, KHL will modify the VMP for the minimization and eradication of invasive plant species from priority Project areas. In this eventuality, the proposed modifications will be reviewed and ultimately approved by the ADNR, the USFS, and other stakeholders prior to filing with FERC. These discussions will take place as part of the annual compliance reporting/meeting process further detailed in Section 4.

3.2. Revegetation and Vegetation Maintenance

3.2.1. Revegetation

KHL proposes to revegetate areas disturbed by Project construction and operations. These areas include areas adjacent Project features, laydown areas for equipment and construction materials, as well as temporary vehicle use and parking areas. Revegetation efforts will restore areas to their previous upland vegetation type. Upland vegetation types in the Project area were surveyed and mapped as a part of vegetation studies of the Grant Lake Project area (KHL 2014). Project construction activities are planned in the following three vegetation types:

- Coniferous Forest
- Coniferous-Deciduous Forest
- Floodplain Forest and Scrub

A survey for areas in need of revegetation will occur during the next growing season after construction completion. These areas will be documented in a manner similar to invasive plant infestations, described in Section 3.1. The following measures and BMPs regarding revegetation will be employed during the construction and operation of the Project:

- Only weed-free materials (rock, mulch, straw, plant materials, native seed mixes) will be used for revegetation.

- During construction, salvage native shrubs, forbs, soils and vegetation mats from areas where plants will be destroyed, for later use in revegetation. As much soil as reasonably possible will be kept with salvaged plant roots.
- Promote natural revegetation when local seed source and site conditions are favorable for achieving revegetation objectives.
- When conditions are not favorable for natural revegetation, use native plant sources for revegetation stock.
- Preference will be given to using plant materials for revegetation from the local region to maximize adaption to the Project area, and to maintain local genetic composition.
- KHL will comply with the state and/or federal land manager's methods for assessing the success of revegetation efforts.

3.2.2. Vegetation Maintenance

While vegetation communities in some areas will eventually be restored to their pre-construction structure, vegetation along access road ROWs, the transmission line corridor and in cleared areas around Project features will be regularly maintained to manage the height of trees and tall shrubs. This regular maintenance will follow applicable guidelines established in the Invasive Plant and Revegetation sections of this document. Measures and guidelines for managed vegetation areas include:

- During the license period, vegetation adjacent to buildings and in ROWs along access roads and the transmission line will be cleared periodically to maintain clearances specified by Rural Utilities Service (RUS) and Institute of Electrical and Electronics Engineers (IEEE) standards. The frequency of maintenance may need to be adjusted depending on how rapidly or slowly trees and other tall vegetation grows. It is anticipated that this will occur every 8 to 10 years.
- Invasive plant infestations will be mapped and controlled in managed vegetation areas. Refer to invasive plant control guidelines in Section 3.1.
- Bare ground areas in managed vegetation areas will be mapped and revegetated. Refer to revegetation guidelines in Section 3.2.1.

Reporting related to revegetation efforts and associated confirmation surveys will be incorporated into the relevant year's Annual Compliance Report. As detailed above, if initial re-vegetation efforts are unsuccessful in certain areas, KHL will assess the reasons and modify the revegetation approach for successful revegetation of those areas. Any modifications to the VMP will be reviewed and ultimately approved by the ADNR, USFS, and other stakeholders prior to filing with FERC. These discussions will take place as part of the annual compliance reporting/meeting process further detailed in Section 4.

3.3. Sensitive Plant Species Protection and Monitoring

3.3.1. General Measures

The following measures apply to sensitive plant occurrences on USFS lands in the Project area.

- If any previously undiscovered sensitive plants are encountered on USFS land at any time prior to or during implementation of the Project, the USFS will be notified and an appropriate course of action determined to avoid or mitigate disturbance.
- During the Project license period, a site-specific sensitive plant survey will be done prior to any new Project-related ground-disturbing activities occurring on USFS land. The survey will be done in consultation with the USFS and will be consistent with current USFS sensitive plant survey protocols (Stensvold 2002; USFS 2005b). USFS 2008 details how to document sensitive plant populations. A blank USFS sighting form (R10 TES Plant Element Occurrence Field Form) is included in Appendix 4.
- The target R10 sensitive species list will be reviewed and updated prior to sensitive plant surveys. The list was last updated in February 2009.
- A GIS database with records of sensitive plant occurrences and invasive plant infestations will be queried as part of the evaluation process for any new ground-disturbing activities.

3.3.2. Pale Poppy Population Management

Monitoring of the pale poppy population located on the north shore of Grant Lake will be conducted during years 1 and 5 after license issuance to assess operational activities impact (if any) on the population or its habitat. The pale poppy sighting form is presented in Appendix 2. General USFS guidelines for (re)surveying sensitive plant occurrences will be followed (USFS 2008):

- Information collected will include: number of plants, population dimensions, elevation of plants relative to the natural maximum lake elevation (703 feet NAVD 88), presence and abundance of invasive plant species; and the presence of any other disturbances or threats.
- Location and boundaries will be documented with a GPS unit.
- Representative photographs will be taken.
- Monitoring information will be updated and maintained in a GIS database.
- Surveys will be conducted by a qualified botanist.

Given that the operational regime for the Project involves no increase in the natural, maximum lake elevation (703 feet NAVD 88), it is possible that Project operations will have no negative impacts on the natural condition of the population. It is more likely that natural succession of other plant species will negatively impact the pale poppy over time. Given proposed operational parameters this impact would not be deemed to be associated with the Project. If this is the case, or if Project operations are documented to increase the number of plants associated with that particular community, no further surveys will be conducted. If however, Project operations are documented to negatively impact the population or its habitat, mitigation efforts will be implemented, including:

- Invasive plants found in the vicinity of the pale poppy population will require timely control. They can be controlled at the same time as invasive plants in other areas around Grant Lake. Control efforts would be determined in consultation with the USFS.

- If increased recreational access to Grant Lake results in increased impacts to the pale poppy population (damage to plants or habitat degradation), campfires and overnight camping could be restricted at the campsite and gravel bar where the population is located.

Reporting related to sensitive species monitoring will be incorporated into the Annual Compliance Report. If the pale poppy population is decreasing in numbers or if its habitat is being degraded as a result of Project operations or invasive plant infestation, KHL will develop a site-specific plan to address either avoiding future degradation of the population or identify mitigation actions that limit the overall impact of the potential loss of that population. In this eventuality, the proposed modifications will be reviewed and ultimately approved by the USFS, and other stakeholders prior to filing with FERC. These discussions will take place as part of the annual compliance reporting/meeting process further detailed in Section 4.

4 COORDINATION AND REPORTING

Provisions in the VMP will be formally adopted and implemented by KHL upon FERC approval of the VMP and after issuance of the FERC license. The USFS will be consulted regarding USFS-listed sensitive plant management, and regarding invasive plant prevention and control measures on USFS lands. The ADNR will be consulted regarding invasive plant prevention and control measures on ADNR lands.

A GIS database will be maintained and updated after each survey, and will include records of all known sensitive species occurrences and all known invasive plant infestations in the Project area. In addition to records of occurrences documented during survey efforts, any relevant data supplied by the ADNR or USFS will be included. As more sensitive plants or invasive plants are identified in the Project area, these will be added to the database. The database will be queried as part of the evaluation process for new ground-disturbing or other activities.

All Plan-related activities in a given year will be documented as part of an annual compliance reporting/meeting process. Every winter, KHL will convene a global meeting with all stakeholders and FERC to review all management plans and related monitoring efforts associated with construction and subsequent operation of the Project. During these annual proceedings, results will be documented, identified issues will be discussed and modifications to plans and/or additional measures will be adopted to ensure that minimal impact to the natural environment occurs as a result of Project construction and operations. With respect to the VMP, primary topics discussed during the annual compliance reporting/meeting process will include:

- A summary of the actions that KHL implemented during the previous calendar year related to:
  - Invasive species
  - Revegetation efforts
  - Sensitive species
- A discussion of any substantial differences between the actions provided in the VMP and the actions that KHL implemented, including explanations for any substantial differences.

- Results of any surveying and monitoring that occurred during the previous calendar year, conclusions that KHL draws from the results, and any change to the VMP that KHL proposes based on the results.
- Stakeholder input with respect to any proposed modifications to the existing VMP.

Ultimately, the draft Annual Compliance Report will be revised to incorporate stakeholder comments and update modified plans for the following year's natural resource implementation and compliance efforts. The Annual Compliance Report will be filed with FERC by April 1 of each year and copies will be made available to the stakeholders and FERC via the internet.

Additionally, all monitoring efforts during construction activities will be managed by KHL's on-site ECM. This person will be responsible for assuring that all procedural aspects of the natural resource and construction management plans as well as general BMPs for construction efforts are being adhered to. This person will be the lead in confirming that all methods and associated data collection activities are occurring as scheduled and all associated data is being entered and reported on appropriately. The ECM will be the primary, on-site contact for both confirmation of appropriate activities with respect to monitoring during construction and the conduit for communicating any issues that may be occurring to insure timely resolution.

5 REFERENCES

AKEPIC (Alaska Exotic Plant Information Clearinghouse). 2014. Alaska Exotic Plants Information Clearinghouse (http://aknhp.uaa.alaska.edu/botany/akepic/) Alaska Natural Heritage Program, University of Alaska, Anchorage. Accessed (October 2014).

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USFS. 2005b. Threatened, Endangered and Sensitive Plants Survey, Field Guide. USDA Forest Service, Rangeland Management Staff, Washington D.C. March 2005.

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Appendix 1: AKEPIC Field Data Sheets, 2013

AKEPIC Field Data Sheet (2010)

**Survey Date: 07/22/2013 (mm / dd / yyyy) **Observers: Beck, Kathryn A. (Last Name, First Name Initial. (e.g.: Smith, J.; Williams, R.)) **Required Field

Observers Affiliation *(circle one)*:
AACD_IPC AKNHP ARS BLM CES CWMA DOD DOWL HDR NPS PMC SCS TECI UAF USFS USFWS USGS (Other)

A. Site Information

** Site Code: AK State Land, Grant Lake Project
Visit Type *(circle one)*: (Reconnaissance) Monitoring (Research) Control
Is this a Revisit *(circle one)*: Yes (No)
** Study Type *(circle one)*: (Exhaustive species Inventory) Highest priority species Single species study
** Area Surveyed: ± 200 (acres)
(Note: 1/10 acre = 37 ft radius, 1/2 acre = 83 ft radius, 1 acre = 118 ft radius)
Site Vegetation Community Description (level IV Viereck et al. 1992): III. G.
Disturbance Type (see instructions below): Fill Importation (Road) Railroad) River Action

B. Location Information

** Latitude: 60.458631 (Decimal Degrees, NAD83)
** Longitude: -149.368377 (Decimal Degrees, NAD83)
Elevation: ± 440 (ft)
** Collection Method *(circle one)*: (GPS) Topographic Map Aerial Photo
** GPS precision: 0-30 (ft; 0-5, 0-30, 0-100, 0-1000, 1000+)
Topographic Map Source: _____ Scale: _____ Date: _____
Quad name: _____ Quad number: _____ (i.e. A-1, B-2, C-3, D-4)

Notes (location): TAOF + TRRE3 located on Seward Hwy ROW + AK RR ROW, within Grant Lake Study Area.

C. Survey Information

** Plant Species Code *(see below)*	**Infested Area (acres) *(see below)*	**Canopy Cover (% cover) *(see below)*	Disturbance Age (yrs.)	Stem Count *(see below)*	**Herbarium *(see below)*	Control Action *(see below)*	Aggressiveness *(see below)*
TAOF	0.1	< 1%	ongoing	51-150	—	Multiple	Medium
TRRE3	0.01	< 1%	ongoing	1-5*	—	Multiple	Medium

D. Notes (species): The TAOF + TRRE3 plants along Seward Hwy + Alaska RR ROW are likely known meta-populations. There were also several TAOF plants at the mouth of Grant Creek where it enters Trail Lake Narrows.
* 1-5 rhizomatous patches.

AKEPIC Field Data Sheet (2010)

**Survey Date: 07/19/2013 (mm / dd / yyyy) **Observers: Beck, Kathryn A. (Last Name, First Name Initial. (e.g.: Smith, J.; Williams, R.))

**Required Field

Observers Affiliation *(circle one)*:
AACD_IPC AKNHP ARS BLM CES CWMA DOD DOWL HDR NPS PMC SCS TECI UAF USFS USFWS USGS (Other)

A. Site Information

** Site Code: CHNF 2013
Visit Type *(circle one)*: (Reconnaissance) Monitoring (Research) Control
Is this a Revisit *(circle one)*: Yes (No)
** Study Type *(circle one)*: (Exhaustive species inventory) Highest priority species Single species study
** Area Surveyed: ≠200 (acres)
(Note: 1/10 acre = 37 ft radius, 1/2 acre = 83 ft radius, 1 acre = 118 ft radius)
Site Vegetation Community Description (level IV Viereck et al. 1992): III.G.1
Disturbance Type (see instructions below): Lake Action / Trail / Landslide / Avalanche

B. Location Information

** Latitude: 60.492915 (Decimal Degrees, NAD83)
** Longitude: -149.3139534 (Decimal Degrees, NAD83)
Elevation: 700' to 705 (ft)
** Collection Method *(circle one)*: (GPS) Topographic Map Aerial Photo
** GPS precision: 0-30 (ft; 0-5, 0-30, 0-100, 0-1000, 1000+)
Topographic Map Source: _____ Scale: _____ Date: _____
Quad name: _____ Quad number: _____ (i.e. A-1, B-2, C-3, D-4)

Notes (location): The Poa annua, Poa pratensis and Taraxacum were found at this point. Taraxacum officinale was located at other scattered locations around lakeshore. This point is where the Grant Lake Trail enters the study area on the west end of the north shore of Grant Lake on USFS land.

C. Survey Information

** Plant Species Code *(see below)*	**Infested Area (acres) *(see below)*	**Canopy Cover (% cover) *(see below)*	Disturbance Age (yrs.)	Stem Count *(see below)*	**Herbarium *(see below)*	Control Action *(see below)*	Aggressiveness *(see below)*
TAOF	0.1 entire lakeshore	1%		151-500	Not Collected	Multiple	Low to Med
POAN	0.01	5%		50-150	Not Collected	Multiple	Low
POPR	0.01	1%		26-50	Not Collected	Multiple	Low

D. **Notes** (species): I located Taraxacum ceratophorum, a native species similar in appearance to Taraxacum officinale mixed in with T. officinale on the Grant Lake shore. The locations of Taraxacum along the Grant Lake shore are likely mixed populations. Wave action and ice scouring create natural disturbance effect along the shore.

Appendix 2: USFS Sensitive Plants Field Form for Grant Lake Pale Poppy, 2013

NOTE: Because of the potentially sensitive nature of information regarding sensitive plant species, the information contained in Appendix 2 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation. It may be obtained by request to Kenai Hydro, LLC or FERC, subject to confidentiality provisions.

Appendix 3: Sensitive Plant Population Map, 2013

NOTE: Because of the potentially sensitive nature of information regarding sensitive plant species, the information contained in Appendix 3 is not being distributed to the general public. This information has been filed with FERC with a Privileged designation. It may be obtained by request to Kenai Hydro, LLC or FERC, subject to confidentiality provisions.

Appendix 4: USFS Sensitive Plants Field Form

Enclosure 1

USDA FOREST SERVICE 2008

PLANT SURVEY FIELD FORM

(⊛ = Required Fields ⊛ = Alaska Required)

DECEMBER 2008

General Information

1) SURVEY ID: ⊛		2) SURVEY NAME:		
3) SURVEY STATUS: ⊛	4) TARGET: ⊛ *TESP; INPA; BOTH*		5) SOURCE OF WORK:	
6) Survey Type: ⊛				
7) Survey Focus: ⊛				
8) Estimate of Survey Area Size (acres):		9) No. of Traverses:		
10) Elevation: Min:	Max:	Average:	11) Elevation UOM:	
12) State: ⊛	13) County: ⊛	14) Region: ⊛	15) Forest: ⊛	16) District: ⊛

17) **Parameters of Survey** (*Describe any ecological parameters, survey criteria or combinations of these used to focus the survey. (I.e., north slopes, specific habitat types, certain soils within certain forest conditions, survey timing, etc.):*

18) **Survey Comments** (*Directions, area description, specific comments by visit date, etc.):*

Survey Visits

Required. Enter a Date (MM/DD/YYYY) and Examiners for each visit made.

19) VISIT DATE ⊛	20) LAST NAME ⊛ AND FIRST NAME ⊛ OF EXAMINERS FOR EACH VISIT

Enclosure 2

R10 TES PLANT ELEMENT OCCURRENCE - FIELD FORM - USDA FOREST SERVICE 12/08

⊗ = required field, ⊗* = conditionally required field, ⊗ = required field Alaska Region

General Information

1) SITE ID: ⊗	2) DATE: ⊗	3) SITE NAME:
4) NRCS PLANT CODE: ⊗		
5) SCIENTIFIC NAME: ⊗		
6) RECORD SOURCE: ⊗	7) SURVEY ID: ⊗*	8) Survey Name:
9) EXAMINER(S)- LAST: ⊗	FIRST: ⊗	MIDDLE INITIAL:
LAST:	FIRST:	MIDDLE INITIAL:
10) OWNERSHIP: ⊗	11) Loc. Uncert: ⊗	12) Uncert. Dist: ⊗*
13) E.O. #	14) STATE: ⊗*	15) COUNTY: ⊗*
16) REGION: ⊗*	17) FOREST: ⊗*	18) DISTRICT: ⊗*
19) Area (Est):		20) Area UOM: ⊗*
21) Canopy Cover Method ⊗* (circle one): COVER PERCENT; DAUBEN; NRMCOV		

Element Occurrence Data

22) EO Canopy Cover: ⊗%Cov: *or* Cover Class Code:		23) Lifeform:
24) Number of subpopulations:	25) Plant Found (Revisit): Yes or No	
26)Plant Count:⊗	27)Count Type: ⊗*Genets/Ramets/Undetermined*	28)Count: ⊗*Actual* or *Estimate*
29) Revisit needed - Yes *or* No	30) Revisit Date:	
31) Revisit Justification:		

32)Phenology by %⊗ *(Sum to 100%)*: Vegetative . . . . . ___ Flower/Bud . . . ___ Fruit/Dispersed . ___ Seedlings/ Juvenile . . . . . ___	33) Population Comments: (e.g., distribution, vigor, density, phenology, dispersal) 34) Evidence of disease, competition, predation, collection, trampling, or herbivory: Yes___ *or* No ___ 35) Evidence Comments:

36) Pollinator observed – Yes *or* No	37) Pollinator type(s):
38) Pollinator comments:	

Site Morphometry

39) Percent Slope: ⊗		40) Slope position: ⊗
41) Aspect: ⊗ azimuth:	*or* cardinal:	
42) Elev.: Ave:	Min: Max:	43) Elev UOM: ⊗*

Soil Characteristics and Light Conditions

44) Substrate on which EO occurs:		
45) Parent Material:	46) Soil Moisture:	47) Soil Texture:
48) Soil Type:		49) Light Exposure: ⊗