Final Grant Lake Project 2013 Natural Resource Study Reports (Continued)

Grant Lake Hydroelectric Project (FERC No. 13212)

Terrestrial Resources Study Final Report

Prepared for Kenai Hydro, LLC

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ACRONYMS AND ABBREVIATIONS

ac	acre
ac-ft	acre-feet
ADEC	.Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
AEPIC	Alaska Exotic Plant Information Clearinghouse
AKNHP	Alaska Natural Heritage Program
ALMS	Alaska Landbird Monitoring System
BE	Biological Evaluation
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practices
CFR	Code of Federal Regulations
cfs	cubic feet per second
Corps Manual	1987 Corps of Engineers Wetland Delineation Manual
CWA	Clean Water Act
DLA	Draft License Application
DP	Wetland determination point
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Administration
ft	feet
GIS	Geographic Information System
GPS	Global Positioning System
in	inch
KHL	Kenai Hydro, LLC
kW	kilowatt
MBTA	Migratory Bird Treaty Act
MW	megawatt
NOI	Notice of Intent
NWI	National Wetland Inventory
NAVD 88	North American Vertical Datum of 1988
NGVD 29	National Geodetic Vertical Datum of 1929
OP	Wetland observation point
PAD	Pre-Application Document
Project	Grant Lake Hydroelectric Project (FERC No. 13212)

Regional SupplementAlaska Regional Supplement to the Corps of Engineers Wetland		
	Delineation Manual	
RGL	Regulatory Guidance Letter	
RNA	Research Natural Area	
ROW	right-of-way	
Section 404	Section 404 of the Clean Water Act	
Study Plan	March 2013 Grant Lake Terrestrial Resources Study Plan	
SWE	surface water elevation	
TLP	Traditional Licensing Process	
USACE	U.S. Army Corps of Engineers	
USFS	U.S. Forest Service	
USGS	U.S. Geological Survey	
USFWS	U.S. Fish & Wildlife Service	

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1 INTRODUCTION

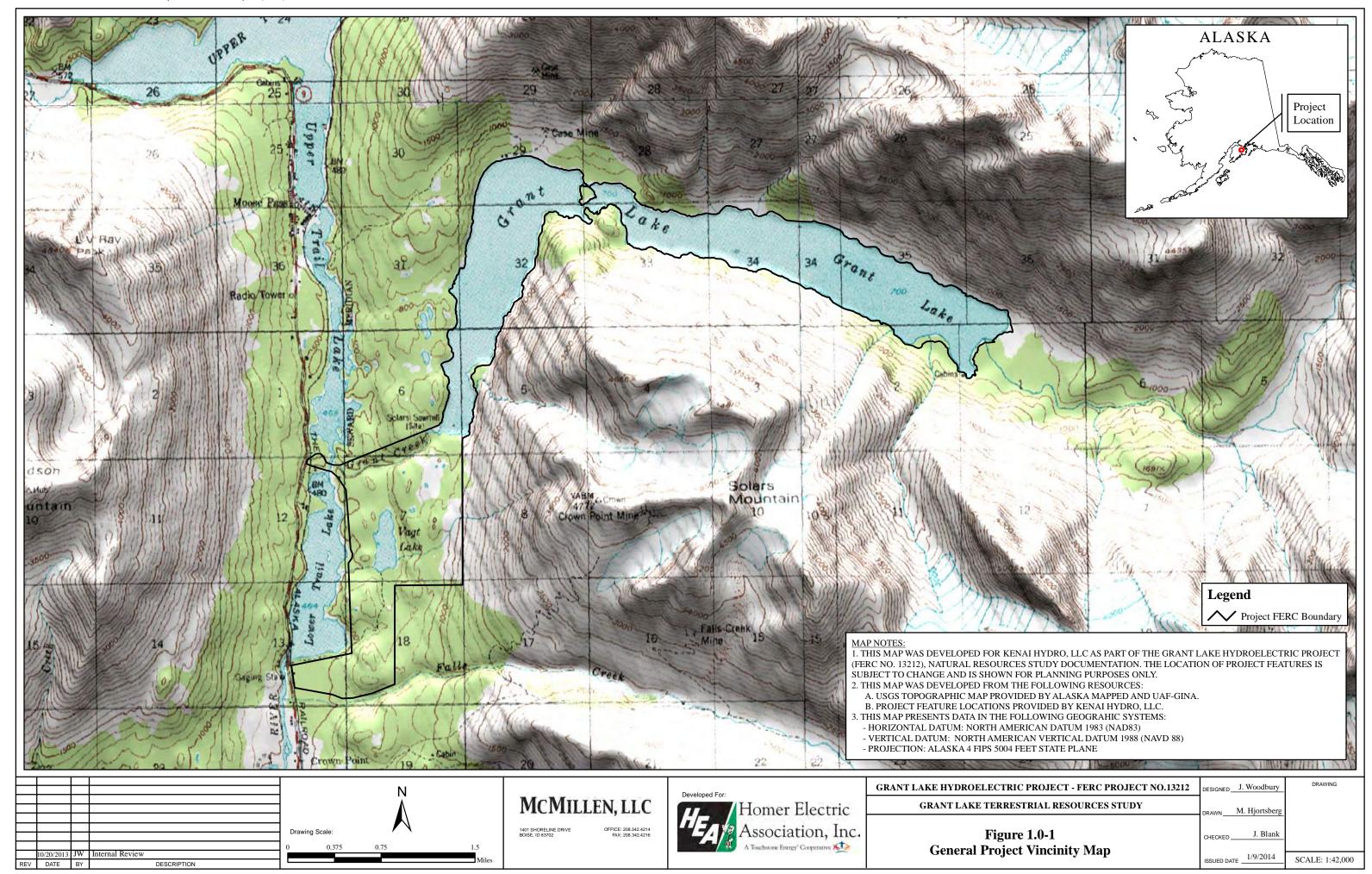
On August 6, 2009, Kenai Hydro, LLC (KHL) filed a Pre-Application Document (PAD; KHL 2009), along with a Notice of Intent (NOI) to file an application for original license, for a combined Grant Lake/Falls Creek Project (Federal Energy Regulatory Commission [FERC] No. 13211/13212 ["Project" or "Grant Lake Project"]) under Part I of the Federal Power Act (FPA). On September 15, 2009, FERC approved the use of the Traditional Licensing Process (TLP) for development of the License Application and supporting materials. As described in more detail below, the Project has been modified to eliminate the diversion of water from Falls Creek to Grant Lake.

The Project will be located near the community of Moose Pass, Alaska, in the Kenai Peninsula Borough, approximately 25 miles north of Seward, Alaska, and just east of the Seward Highway (State Route 9). Figure 1.0-1 provides a general vicinity map for the Project.

The Terrestrial Resources Study Report presents the results of the 2013 Project analysis conducted in accordance with the approved March 2013 Grant Lake Terrestrial Resources Study Plan (Study Plan; KHL 2013). This report builds upon previous Project-related reports (Ebasco 1984, HDR 2011, and KHL 2011) and presents a summary of existing information relative to the scope and context of potential effects of the Project. Specifically, this report describes the 2013 study results of the five primary terrestrial study components outlined in the Study Plan: 1) General Vegetation Type Mapping; 2) Sensitive Plant Survey; 3) Invasive Plant Survey; 4) Wetland and Waters Mapping; and 5) Wildlife Resources. The Study Plan also included provisions for Timber Resources assessment; however, given the probability that project design and operation could eliminate any impact to the timber resource and that an existing timber assessment currently exists, this assessment was not conducted at this time and is therefore not included in this report.

The Terrestrial Resources Study Report is organized in the following manner: Section 1 provides an introduction to the Terrestrial Resource Study component of the Project and a general description of the proposed Project; Section 2 reviews the overarching goals of the Terrestrial Resources Studies; Section 3 is a focused review of the objectives, methods, results, conclusions, and variances of the 2013 Botanical Resources, Invasive Species, and Sensitive Plant Species Study; Section 4 is a focused review of the objectives, methods, results, conclusions, and variances of the 2013 Wetland and Waters Study; and Section 5 is a focused review of the objectives, methods, results, conclusions, and variances of the 2013 Wildlife Resources Study.

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1.1. Proposed Project Description

The Project is located near the community of Moose Pass, (population of 206), approximately 25 miles north of Seward and just east of the Seward Highway. This highway connects Anchorage to Seward. The Alaska Railroad parallels the route of the Seward Highway, and is also adjacent to the Project area. The town of Cooper Landing is located 24 miles to the northwest and is accessible via the Sterling Highway (State Route 1), which connects to the Seward Highway approximately 10 miles northwest of Moose Pass.

The Project lies within Section 13 of Township 4 North, Range 1 West; Sections 1, 2, 5, 6, 7, and 18 of Township 4 North, Range 1 East; and Sections 27, 28, 29, 31, 32, 33, 34, 35, and 36 of Township 5 North, Range 1 East, Seward Meridian (U.S. Geological Survey [USGS] Seward B-6 and B-7 Quadrangles).

The Project would be composed of an intake structure at the outlet to Grant Lake, a tunnel, a surge tank, a penstock, and a powerhouse. It would also include a tailrace detention pond, a switchyard with disconnect switch and step-up transformer, and an overhead or underground transmission line. The preferred alternative would use approximately 15,900 acre-feet of water storage during operations between pool elevations of approximately 692 and up to 705 feet North American Vertical Datum of 1988 (NAVD 88)¹. Note that the previous PAD (KHL 2009) included diverting water from Falls Creek into Grant Lake to provide additional flows and power generation at the Grant Creek powerhouse. The Falls Creek diversion has been removed from the Project proposal.

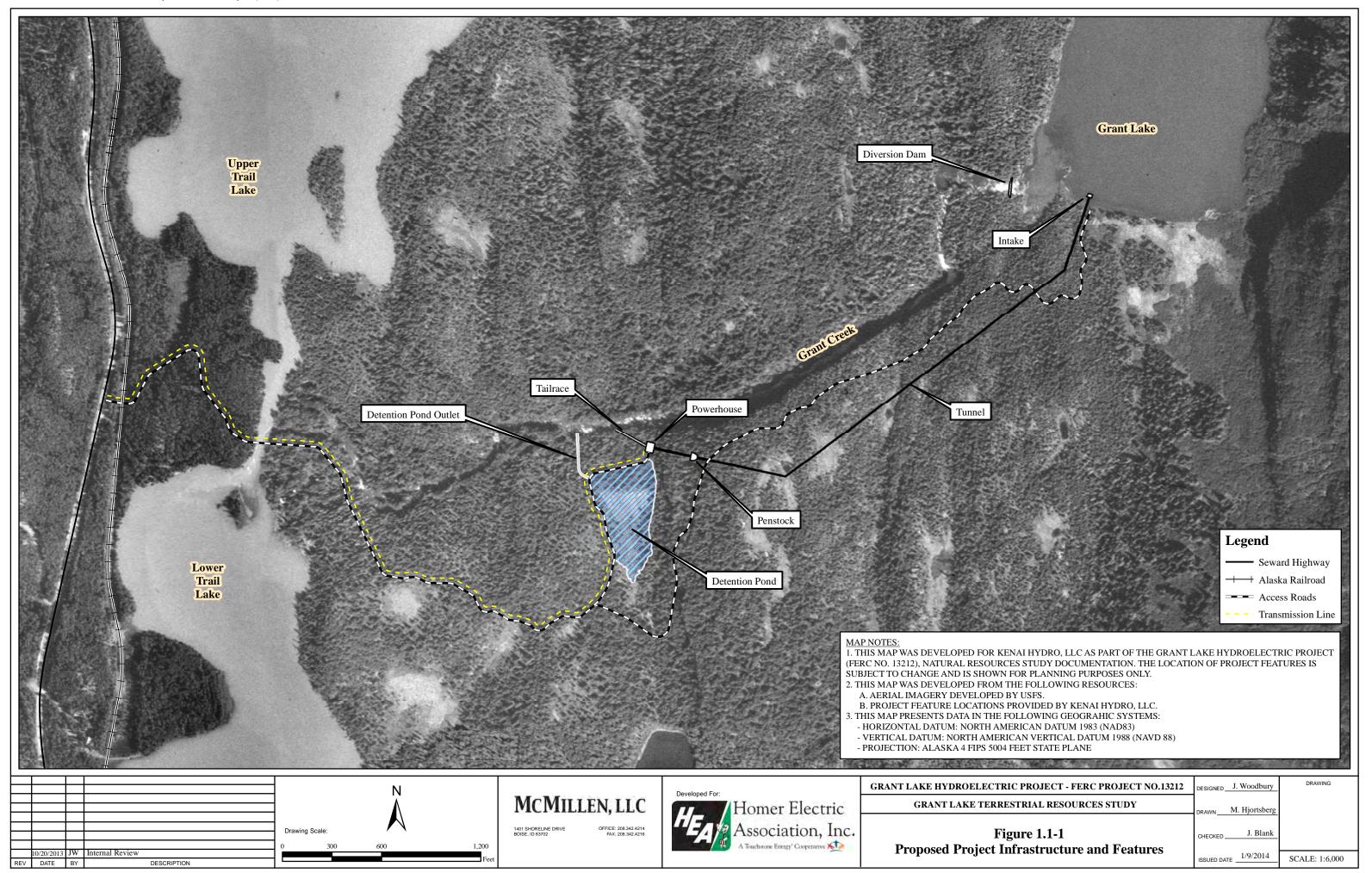
An intake structure would be constructed approximately 500 feet east of the natural outlet of Grant Lake. An approximate 3,200-foot-long, 10-foot diameter horseshoe tunnel would convey water from the intake to directly above the powerhouse at about elevation 628 feet NAVD 88. At the outlet to the tunnel, a 360-foot-long section of penstock will convey water to the powerhouse located at about elevation 531 feet NAVD 88. An off-stream detention pond will 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 at maximum ramping rates. The tailrace would be located in order to minimize impacts to fish habitat by returning flows to Grant Creek upstream of the most productive fish habitat.

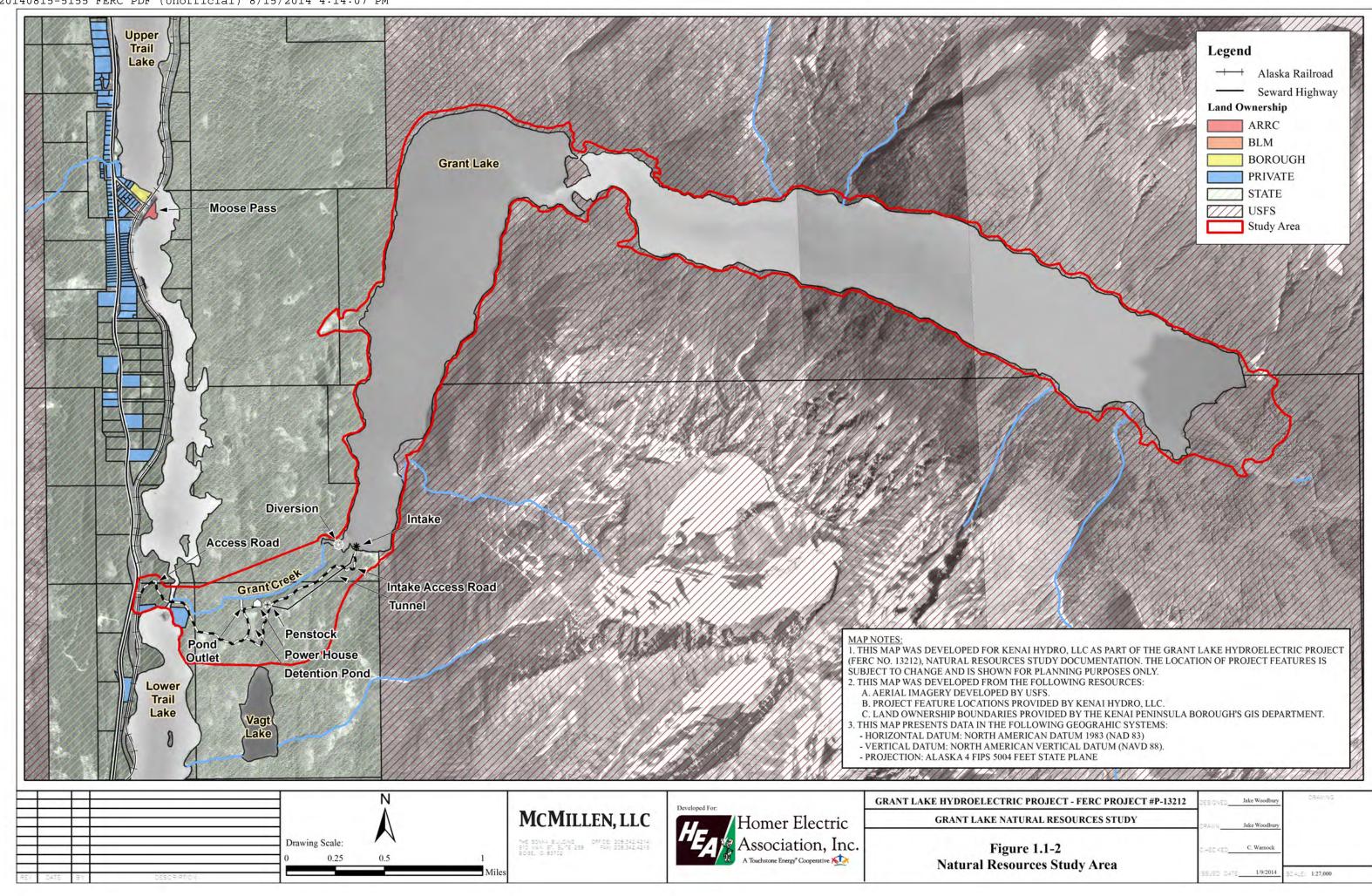
Two concepts are currently being evaluated for water control at the outlet of Grant Lake. The first option would consist of a natural lake outlet that would provide control of flows out of Grant Lake. A new low-level outlet would be constructed on the south side of the natural outlet to release any required environmental flows when the lake is drawdown below the natural outlet level. The outlet works would consist of a 48-inch diameter pipe extending back into Grant Lake, a gate house, regulating gate, controls and associated monitoring equipment. The outlet would discharge into Grant Creek immediately below the natural lake outlet.

¹ The elevations provided in previous licensing and source documents are referenced to feet mean sea level in NGVD 29 [National Geodetic Vertical Datum of 1929] datum, a historical survey datum. The elevations presented in the Grant Lake natural resources study reports are referenced to feet NAVD 88 datum, which results in an approximate +5-foot conversion to the NGVD 29 elevation values.

In the second option, a concrete gravity diversion structure would be constructed near the outlet of Grant Lake. The gravity diversion structure would raise the pool level by a maximum height of approximately 2 feet (from 703 to 705 feet NAVD 88), and the structure would have an overall width of approximately 120 feet. The center 60 feet of the structure would have an uncontrolled spillway section with a crest elevation at approximately 705 feet NAVD 88. Similar to the first option, a low-level outlet would be constructed on the south side of the natural outlet to release any required environmental flows when the lake is drawn down below the natural outlet level. The outlet works would consist of a 48-inch diameter pipe extending back into Grant Lake, a gate house, a regulating gate, controls, and associated monitoring equipment. The outlet would discharge into Grant Creek immediately below the diversion structure. Figure 1.1-1 illustrates the Project infrastructure and features.

Figure 1.1-2 displays the global natural resources study area for the efforts undertaken in 2013 and 2014. Further discussions related to specifics of the aforementioned Project infrastructure along with the need and/or feasibility of the diversion dam will take place with stakeholders in 2014 concurrent with the engineering feasibility work for the Project. Refined Project design information will be detailed in both the Draft License Application (DLA) and any other ancillary engineering documents related to Project development. The current design includes two Francis turbine generators with a combined rated capacity of approximately 5.0 megawatts (MW) with a total design flow of 385 cubic feet per second. Additional information about the Project can be found on the Project website: http://www.kenaihydro.com/index.php.





1.2. Terrestrial Resources Study Area

In general, from west to east, the Terrestrial Resources Study area extends from east of the Seward Highway and Alaska Railroad adjacent to Moose Pass, to just past the eastern shoreline of Grant Lake. From south to north, the study area extends south along the highway to just south of Grant Creek and north to just beyond the north shoreline of Grant Lake (see Figure 1.0-1).

Grant Lake is located approximately 1.5 miles southeast from Moose Pass in the steep mountainous terrain that rises above the community. It has a maximum depth of nearly 300 feet and surface area of 2.6 square miles (Ebasco 1984). Grant Lake's total drainage area is approximately 44 square miles. Tributaries include Inlet Creek at the headwaters and numerous glacial-fed streams and drainages that run down the steep mountain slopes to Grant Lake. The slopes are heavily vegetated with deciduous and coniferous forest communities that end abruptly at the lakeshore (approximately 700 feet NAVD 88). The lake is ringed by mountains of the Kenai Mountain Range to the east, north, and south, with elevations ranging from 4,500 to 5,500 feet NAVD 88.

Grant Lake's only outlet, Grant Creek, runs west approximately 1 mile from the south end of Grant Lake to drain into the narrows between Upper Trail and Lower Trail lakes. Trail River drains Lower Trail Lake, which subsequently flows into Kenai Lake. Kenai Lake drains to the Kenai River at its west end near Cooper Landing (Ebasco 1984). Grant Creek has a mean annual flow of 193 cfs and is 5,180 feet long with an average gradient of 207 feet/mile; its substrate includes cobble and boulder alluvial deposits and gravel shoals (Ebasco 1984). The stream is 25 feet wide on average. In its upper half, the stream passes through a rocky gorge with three substantial waterfalls; in its lower half, the stream becomes less turbulent as it passes over gravel shoals and diminishing boulder substrate (Ebasco 1984). A thick coniferous and deciduous mixed forest flanks the north and south side of Grant Creek. Depressional wetlands and several ponds are interspersed throughout the forest on the south side of the Project area. Several intermittent/ephemeral drainages run down the steep slopes above the upper portion of Grant Creek and contribute to seasonal flow volumes.

The terrestrial resources were evaluated with respects to each resource's potential nexus to the Project features described above and the Project's potential influence on Grant Lake and Grant Creek. Figure 1.1-2 illustrates the Terrestrial Resources Study area which captures all of the Project features described in Section 1.1 above, including Grant Lake. The Terrestrial Resources Study area includes the area determined to conservatively capture the spatial limits of potential direct and indirect impacts to the five resource disciplines evaluated in this report. Within this collective Terrestrial Resources Study area, each resource discipline has its own focused assessment area which are presented in Section 3, Terrestrial Vegetation; Section 4, Wetlands and Waters; and Section 5, Wildlife Resources.

In addition to Figure 1.1-2, Photos 1 through 6 show Project area features and locations.



Photo 1. Inlet Creek entering Grant Lake. Photo taken at east end of lake, looking west.



Photo 2. Inlet Creek entering Grant Lake. Photo taken at southeast corner of Grant Lake, looking northeast.



Photo 3. Grant Lake outlet and the uppermost portion of Grant Creek, looking downstream towards the west.



Photo 4. Representative photo of the canyon reach of upper Grant Creek. Photo taken on the south side of Grant Creek looking upstream.



Photo 5. Representative photo of lower Grant Creek near Trail Lake confluence. Photo taken on the north side of Grant Creek looking upstream.



Photo 6. Representative photo of a depressional wetland located on the south side of Grant Creek.

2 STUDY OBJECTIVES

The Terrestrial Resources Study was developed with the goal of providing supporting information for assessment of potential resource impacts of the Project. Impacts were identified during compilation of the PAD (KHL 2009), public comment, FERC scoping for the License Application, and consideration of subsequent changes to Project design to address stakeholder concerns. Study goals were then developed based on the potential impacts identified and the need for additional information gathering.

The following study goals were identified in the Study Plan:

- Assess the impact of Project construction and operation on wildlife distribution and abundance.
- Assess the impact of Project construction and operation on wildlife during critical life stages.
- Assess the impact of Project construction and operation (lake level fluctuations) on Grant Lake shoreline vegetation and/or habitats used by wildlife species.
- Assess the impact of Project construction and operation (lake level fluctuations and Project roads and facilities) on distribution and abundance of invasive plant species.
- Assess the impact of Project construction and operation (lake level fluctuations and Project facilities) on distribution and abundance of rare plant species.
- Assess the impact of Project construction and operation on breeding and rearing habitat and nesting success of waterbirds on Grant Lake and Inlet Creek.
- Assess the impact of Project construction and operation (road/transmission corridor, facilities, and lake level fluctuations at the lake inlet) on wetlands and waters.
- Assess the impact of Project construction and operation on wildlife use of wetland, riparian, and littoral habitats.
- Assess the impact of Project construction and operation on wildlife movement across the bench between Grant, Upper Trail, and Lower Trail lakes.
- Assess the impact of Project transmission lines (if not buried in the road grade) on bird populations (potential collision deaths).

In order to achieve these overall objectives, the Study Plan outlined a more refined set of objectives for the individual study components of the botanical resources and wildlife resources. The refined objectives for the botanical resources are listed below, and organized by the four botanical study components: Vegetation Type Mapping, Sensitive Plant Survey, Invasive Plant Survey, and Wetland and Waters Mapping.

- The objective of the *Vegetation Type Mapping* was to refine the existing vegetation type map of the Project vicinity using existing GIS layers, existing aerial photography, and available satellite imagery.
- The objective of the *Sensitive Plant Survey* was to satisfy U.S. Department of Agriculture, Forest Service (USFS) requirements for a Biological Evaluation (BE) of plants on lands under its jurisdiction.
- The objective of the *Invasive Plant Survey* was to locate and document populations of invasive plants in areas potentially affected by Project construction and operation.

• The objective of the *Wetlands and Waters Mapping* was to identify and describe the wetlands and other waters of the U.S. that will be potentially impacted by the Project. This objective was further refined after the Study Plan was finalized to include an assessment of potential secondary impacts to wetlands and waters that may be affected by fluctuating lake levels and an altered Grant Creek flow regime.

The refined objectives for the wildlife resources were as follows, organized by the four Wildlife Study components: Raptor Nesting, Breeding Landbirds and Shorebirds, Winter Waterbirds, and Terrestrial Mammal surveys.

- The primary objective of the *Raptor Survey* was to determine the distribution, abundance, and nesting status of large diurnal raptors near the Project area. The survey effort focused on protected, sensitive, or high-profile species such as bald and golden eagles, northern goshawks, and ospreys. Tree and cliff-nesting raptor nest locations will be identified and mapped; a list of raptor species nesting in the Project vicinity will be compiled; and the potential Project effects and potential impact minimization strategies will be assessed. Raptor Survey data was collected in 2010 and 2013. Note, however, that the 2013 Raptor Survey focused on northern goshawks only. An additional Goshawk Survey is planned for 2014.
- The objective of the *Breeding Landbird and Shorebird Study* was to collect baseline data on breeding landbirds and shorebirds near the Project area. More specifically, the objectives of this study were to assess landbird and shorebird species use of the study area during the breeding season, qualitatively determine the occurrence and estimate the numbers of landbird and shorebird species of conservation concern that occur in the study area, estimate the relative abundance and distribution of breeding landbirds and shorebirds in the study area, and describe the habitat use in the study area by breeding landbirds and shorebirds. Breeding landbird and shorebird survey data was collected in 2010 and 2013. The 2013 study focused on collecting additional data for landbirds only.
- The purpose of the *Waterbird Study* was to allow determination of the effects of fluctuation and flow changes on waterbird nesting habitat on Grant Lake and Grant Creek and to determine if winter waterbird habitat is present on Grant Lake. The specific objectives for this study component were to describe species composition of waterbirds using Grant Lake and Grant Creek during breeding season, determine locations of nesting areas for waterbirds to allow determination of effects of potential water level fluctuations on nesting habitat, determine the occurrence and numbers of waterbird species of conservation concern that occur in the study area, and determine winter use by waterbirds in open water habitat of Grant Lake. Waterbird survey data was collected in 2010 and 2013. The 2013 study focused on the collecting additional data for winter waterbird habitat on Grant Lake only. An additional winter Waterbird Survey is planned for 2014.
- The *Terrestrial Mammal Survey* includes an assessment of potential Project effects on the distribution and population of black and brown bears, moose, mountain goats, Dall sheep, and bats. Note that the 2013 study effort focused on winter surveys of moose distribution only. An additional winter Moose Survey is planned for 2014. The remaining terrestrial mammal data relies on information gathered during previous field studies conducted in 2010.

3 BOTANTICAL RESOURCES: TERRESTRIAL VEGETATION, INVASIVE PLANTS, AND SENSITIVE PLANTS

This section provides a description of general upland vegetation types, their distribution within the Project area, and descriptions of the occurrence of sensitive and invasive plant species in the Project area.

3.1. Study Area

The study areas for the general upland vegetation survey, invasive plant survey, and sensitive plant survey are different from each other and are described below.

3.1.1. General Vegetation Type Survey

The study area for the general vegetation mapping survey was based on the nexus to Project effects, and includes the Project boundary and all Project facilities, as well as the outer extent of the assessment areas for the wildlife, wetland, sensitive plants, and invasive plants surveys (see Figure 3.1-1). Around Grant Lake, the general vegetation mapping survey area includes all areas up to an elevation of 733 feet NAVD 88. The description of upland vegetation types is found in this section, as opposed to the description of wetland vegetation types, which is found in Section 4, Wetlands and Other Waters of the U.S.

3.1.2. Invasive Plant Survey

The study area for the invasive plant survey (see Figure 3.1-2) includes:

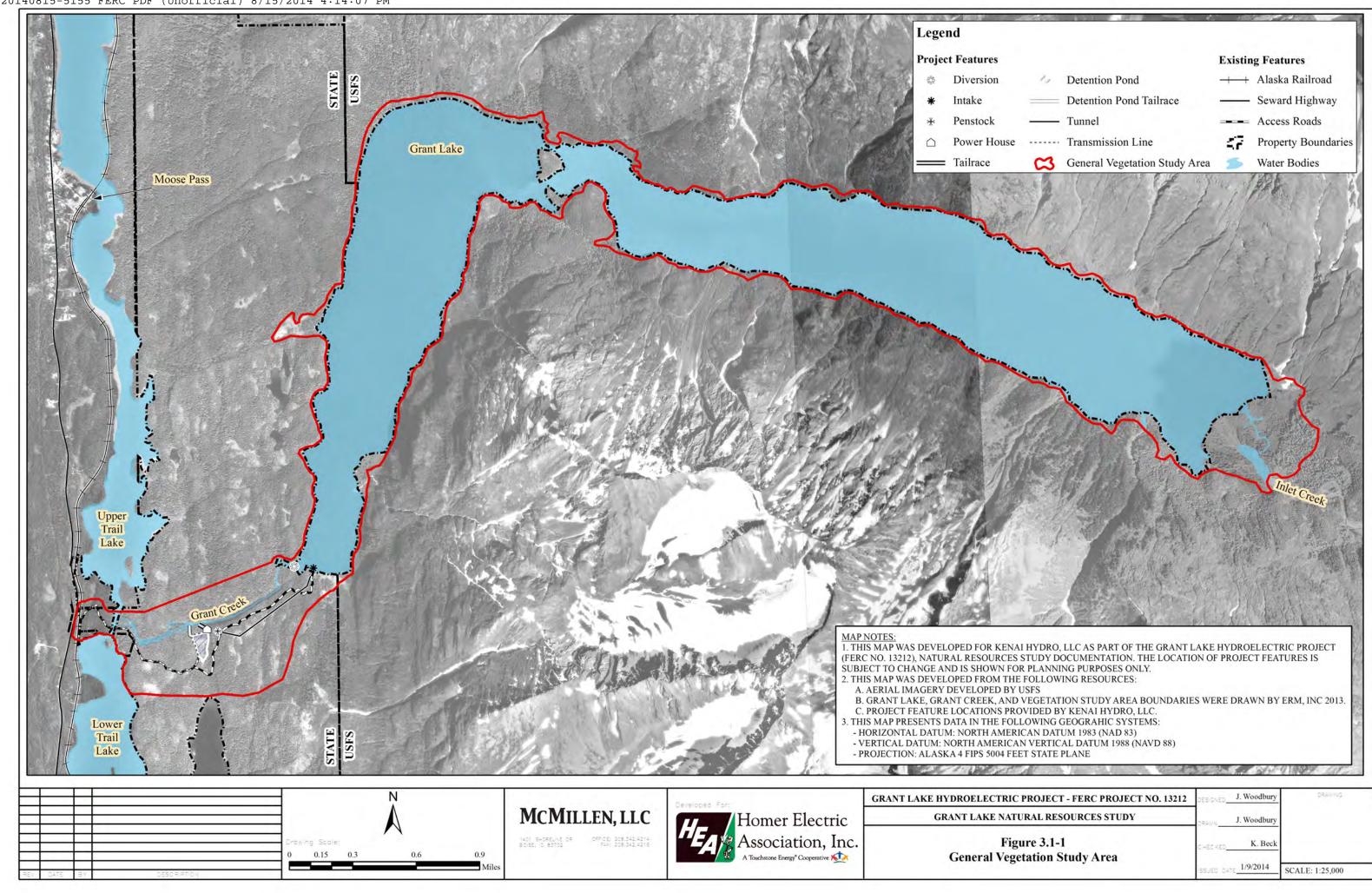
- USFS, private, and State lands in the Project area;
- 5 vertical feet above Grant Lake normal maximum elevation of 703 feet NAVD 88,
- A 50-foot buffer along the road and transmission line,
- A 100-foot buffer around all other Project features.

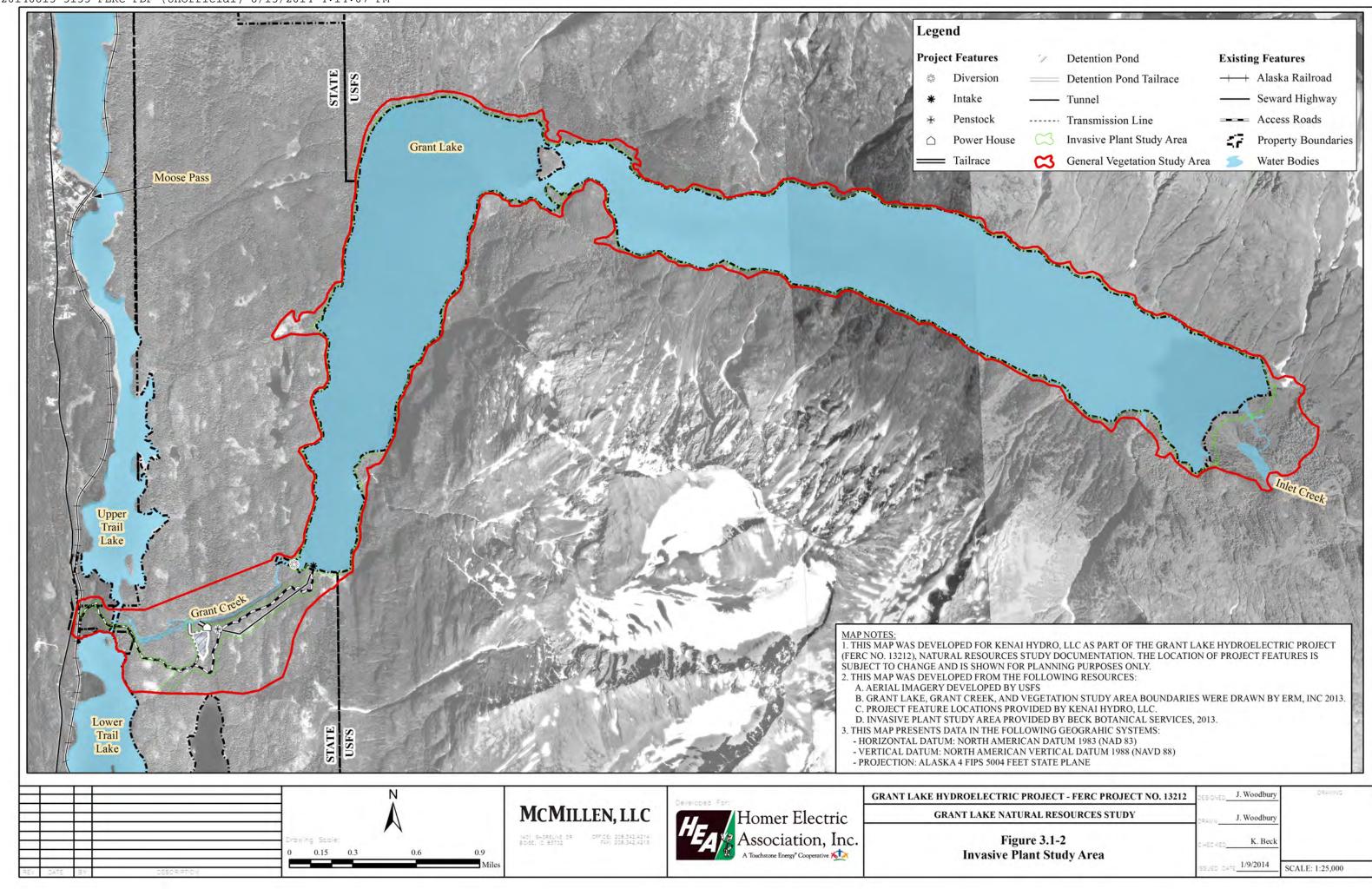
3.1.3. Sensitive Plant Survey

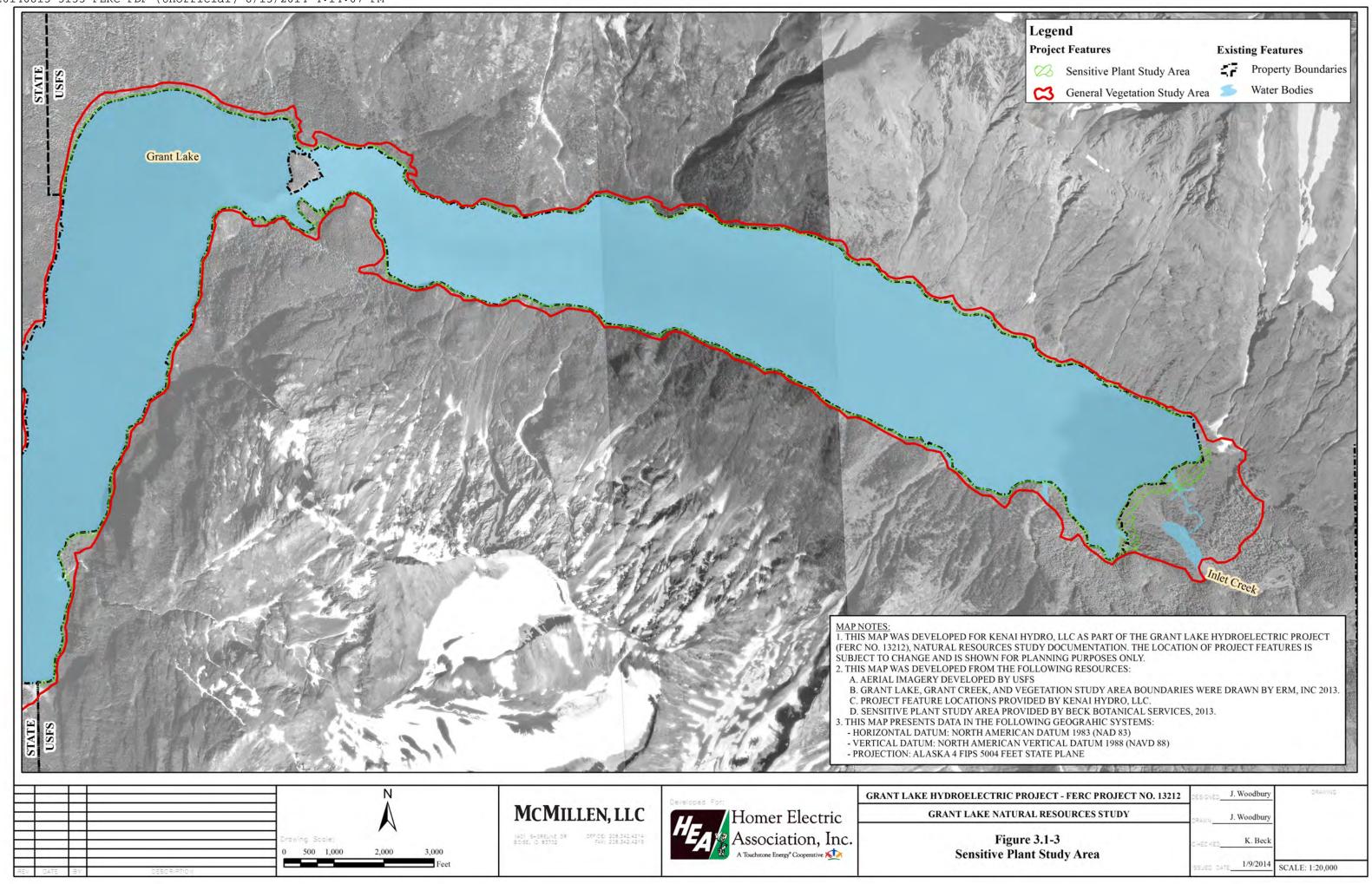
The study area for the sensitive plant survey was limited to USFS lands within the study area (see Figure 3.1-3), and includes:

- 5 vertical feet above Grant Lake normal maximum elevation of 703 feet NAVD 88,
- A 50-foot buffer along the road and transmission line,
- A 100-foot buffer around all other Project features.

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3.2. Methods

The methods used to conduct the general vegetation mapping study, the sensitive plant survey, and the invasive plant survey are described in the Study Plan. Methods for each survey are summarized below.

3.2.1. General Vegetation

The methods used to map and describe upland vegetation types in the study area involved a combination of field observation, ground truthing the existing vegetation cover type maps, and aerial photo interpretation. The following vegetation classification systems were used to update vegetation types: NatureServe 2008, DeVelice et al. 1999, and Viereck et al. 1992. Existing Geographic Information System (GIS) vegetation cover type layers and existing aerial photographs were acquired from available sources. Vegetation boundaries in aerial photos or other imagery were used to update vegetation polygon boundaries in the study area. A final vegetation type map that displays vegetation type polygon boundaries, the study area, and specific Project components and impact areas was produced. The vegetation type map was used to produce a table of vegetation types and to calculate the total acres and percentages of each vegetation type present in the study area.

3.2.2. Invasive Plant Survey

The following methods and activities were performed to document the presence of invasive plants in the study area. For the purposes of this study, invasive plants are those not considered native to Alaska. Existing information on nearby known locations of invasive vascular plants was compiled and reviewed. Previous data collection points in GIS databases from prior studies were identified. When invasive species were identified in the field, the location was recorded with a Global Positioning System (GPS) unit. When large populations of a particular species were found, only one data point was recorded to represent the general area of infestation. If a particular species was found at many sites close to one another, only one data point was recorded. At least one data point for each unique invasive plant species that was encountered was recorded.

The Alaska Exotic Plants Information Clearinghouse (AKEPIC) field form is recommended for use by AKEPIC and the USFS for invasive plant surveys on USFS land. When invasive plant species were located, GPS location information, data, observers, observer affiliation, detailed site information, detailed location information and specific species information were recorded. In addition, completed field form copies were submitted to AKEPIC for the statewide database record.

3.2.3. Sensitive Plant Survey

The study methods for the sensitive plant survey are based on the Procedures for Sensitive Plant Biological Evaluations (Stensvold 2002). As referenced throughout the Study Plan, sensitive plants are plant species formally identified by Region 10 of the USFS (Goldstein et al. 2009). Prior to field surveys, a pre-field review of the study area was prepared (Beck 2013). A total of 17 plant species and 1 lichen species have been designated as Sensitive on the Alaska Regional

Forester's list (see Appendix 1a, Table A.1a-1, Alaska Region sensitive plants, February 2011); 13 of these are known or suspected to occur on the Chugach National Forest. No species on the Alaska Region Sensitive Plant list have been documented previously in or near the study area, although two species have been documented previously in the Seward Ranger District. The potential presence of federally listed threatened or endangered plant species in the study area was reviewed.

Habitat information in the study area was assessed based on information obtained from GIS, reviews of aerial photographs and discussion with resource specialists. Habitat types potentially occurring in the study area include: coniferous forest, deciduous forest, mixed conifer/deciduous forest, forest edge, tall shrublands, rocky areas, rock outcrops, cliffs, gravel, scree, talus, seeps, wet areas, riparian areas, streambanks, waterfalls, lake margins, shallow freshwater marshes, sphagnum bogs, fens, and heaths. Based on the variety of habitats present, it was determined that eight of the sensitive species on the Alaska Region Sensitive Plant List have a reasonable potential to occur in the analysis area.

Of the species with habitats similar to those present within the Project area, only one of these species, pale poppy, had been documented previously on the Seward Ranger District. The Seward Ranger District is also within the potential range of an additional six species that are suspected to occur on the District. Table 3.2-1 summarizes the general habitat requirements of the plant species that have habitats potentially present within the study area that are either known to occur or suspected to occur on the Seward Ranger District.

Table 3.2-1. Known or sus	pected sensitive plan	nts in the Seward Ranger District.

Scientific Name	Common Name	Presence ¹	Habitat ²	
Aphragmus eschscholtzianus	Eschscholtz's little nightmare	Known	Alpine and subalpine heath meadows; wet rocky or mossy seeps	
Botrychium tunux	Moosewort fern	Suspected	Well-drained sandy beaches and alpine sites	
Botrychium yaaxudakeit	Moonwort fern	Suspected	Well drained open meadows, upper beach meadows, coastal dunes	
Cypripedium guttatum	Spotted lady's slipper	Suspected	Open forest, tall shrublands, wet meadows	
Ligusticum calderi	Calder's lovage	Suspected	Limestone, wet to moist sites in the subalpine and alpine, rock habitats, meadows, forest edges	
Papaver alboroseum	Pale poppy	Known	Open areas, areas with sandy, gravelly, well-drained soils, mesic to dry alpine, recently deglaciated areas.	
Piperia unalascensis	Alaska rein orchid	Suspected	Dry open sites, tall shrub in riparian zones mesic meadows, dry forests, low elevation to subalpine	
Romanzoffia unalaschensis	Unalaska mist-maid	Suspected	Rock outcrop ledges and crevices, gravelly stream sides, beach terraces	

Notes:

- Known = known to occur in the Seward Ranger District;
 Suspected = suspected to occur in the Seward Ranger District.
- 2. Habitat descriptions are taken from Goldstein et al. 2009.

Field surveys for sensitive plants included the USFS-owned portions of the Grant Lake shoreline. There are no Project components on USFS land. A variety of habitat types and aspects were surveyed. Surveys on the lake were primarily done with a boat traveling close to the shore because steep terrain and dense vegetation restricted the ability for much of the shoreline to be surveyed on foot. Sections of the shoreline were walked where slope and vegetation density allowed.

Level 5 intuitive controlled surveys for sensitive plants were conducted in the study area. Refer to USFS Survey Intensity Levels for Plants, found in Appendix 1b, for a general description of survey intensity levels for plants. This survey type involves identifying suitable habitat for targeted species and then focusing the survey effort within those identified habitats. Field surveys were conducted at an appropriate time of year to identify targeted species.

A Biological Evaluation (BE) will be prepared for plants in the study area (lands under USFS jurisdiction) with the baseline information collected during the sensitive plant survey.

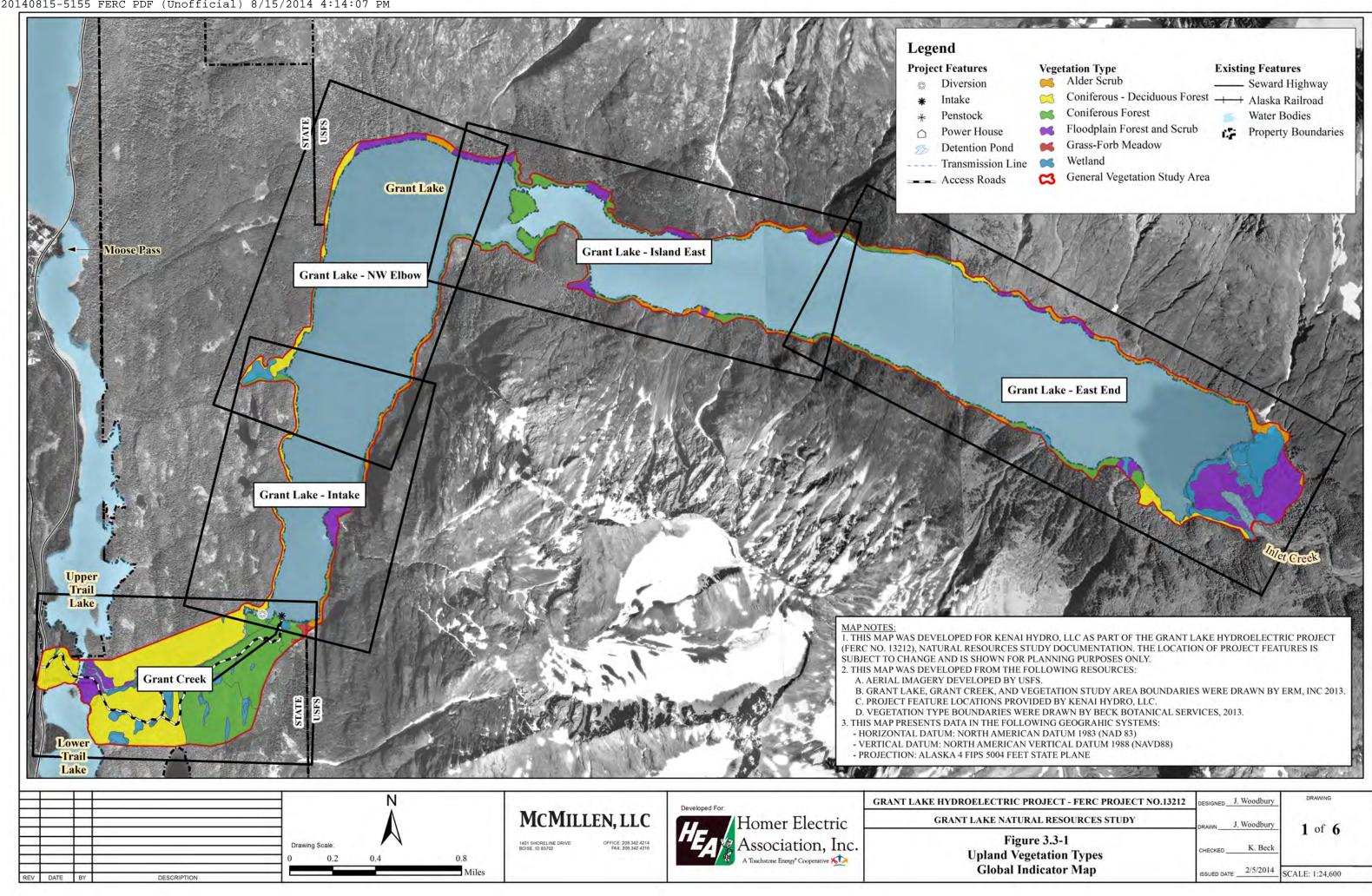
3.3. Results

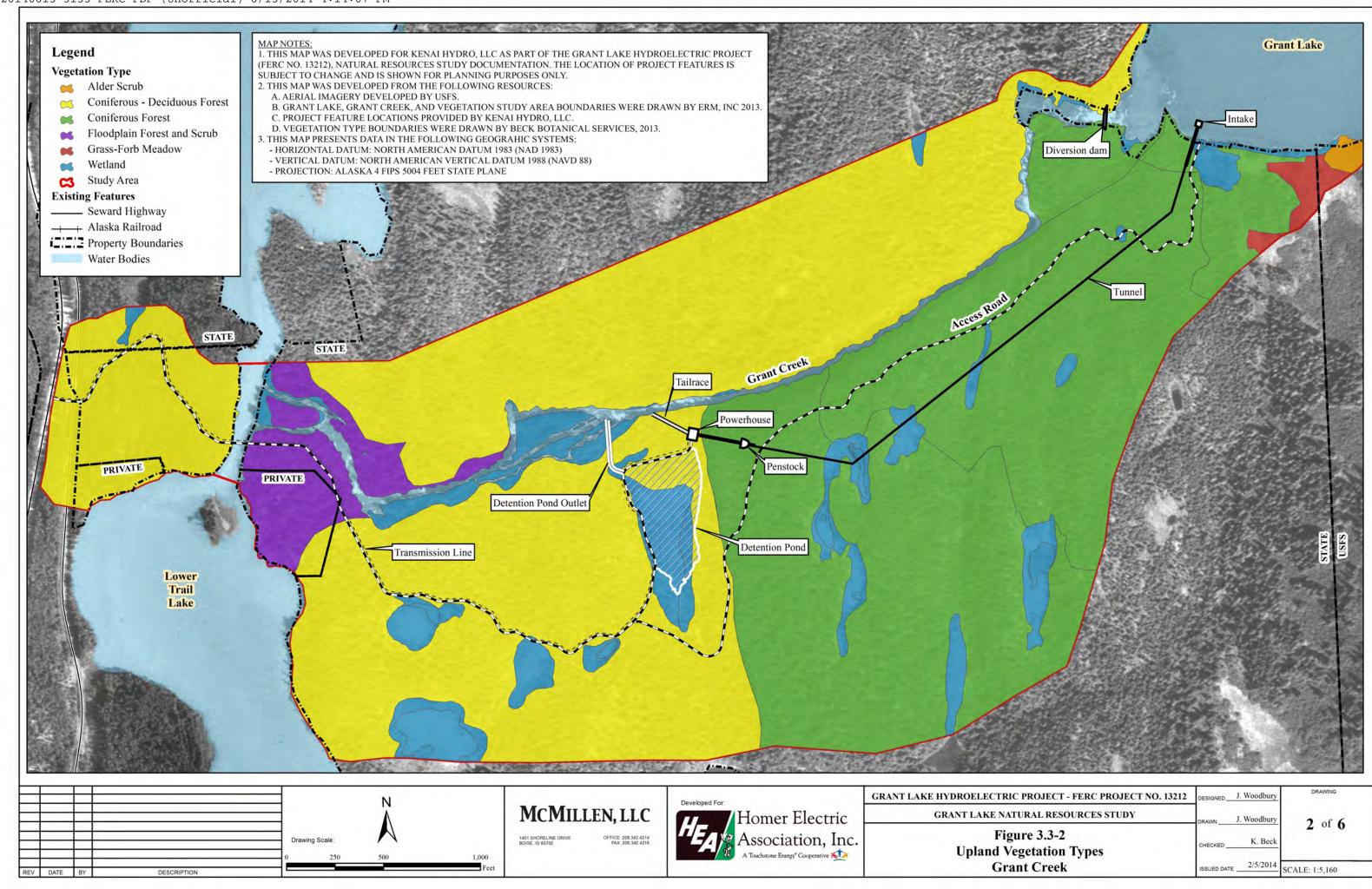
Field surveys were conducted in the general upland vegetation mapping, invasive plant, and sensitive plant study areas from July 18 to July 24, 2013. The Grant Lake water level elevation was estimated to be between 698 and 699 feet NAVD 88 at the time of the survey. Results of the General Vegetation, Invasive Plant, and Sensitive Plant surveys are provided below.

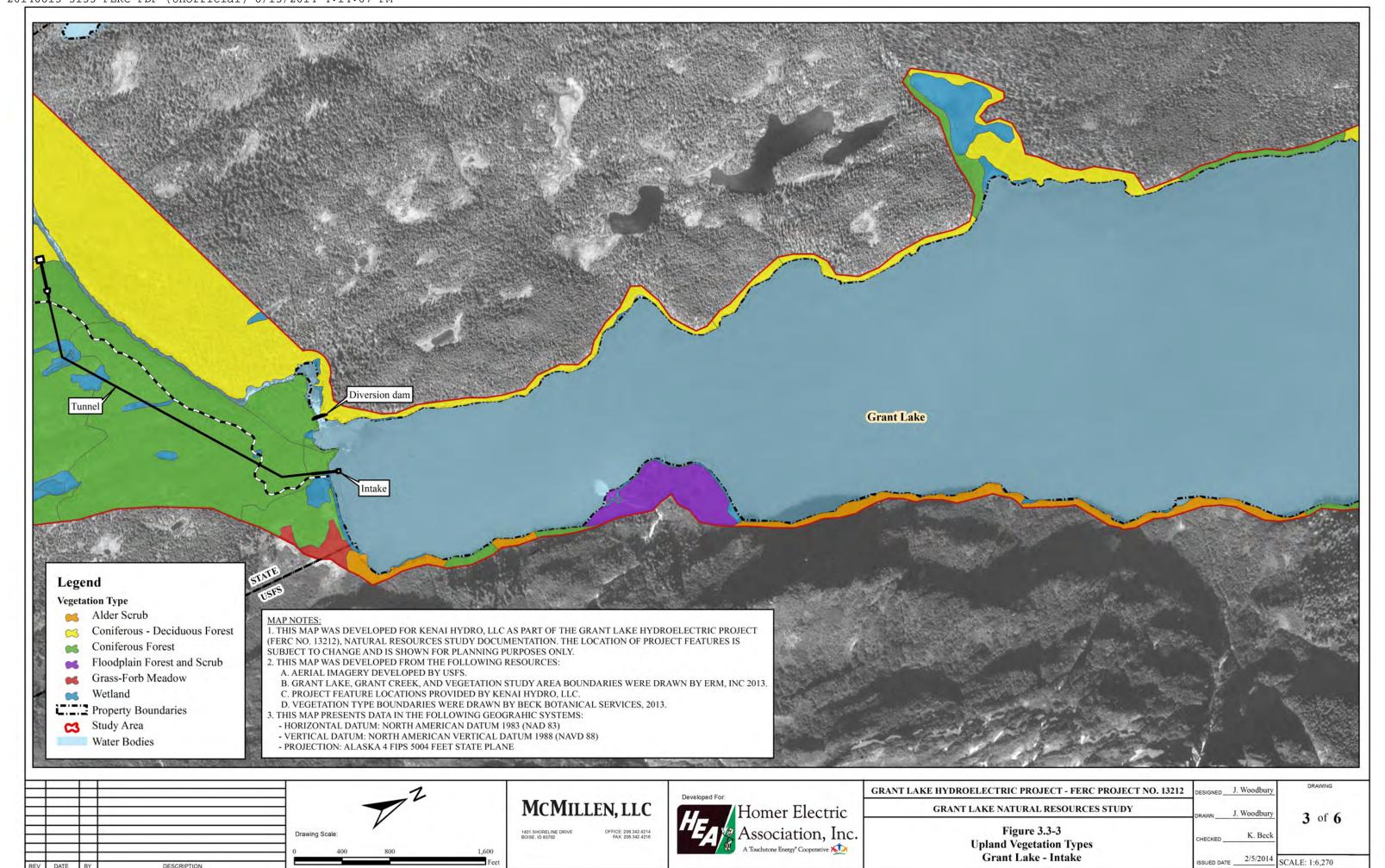
3.3.1. General Vegetation

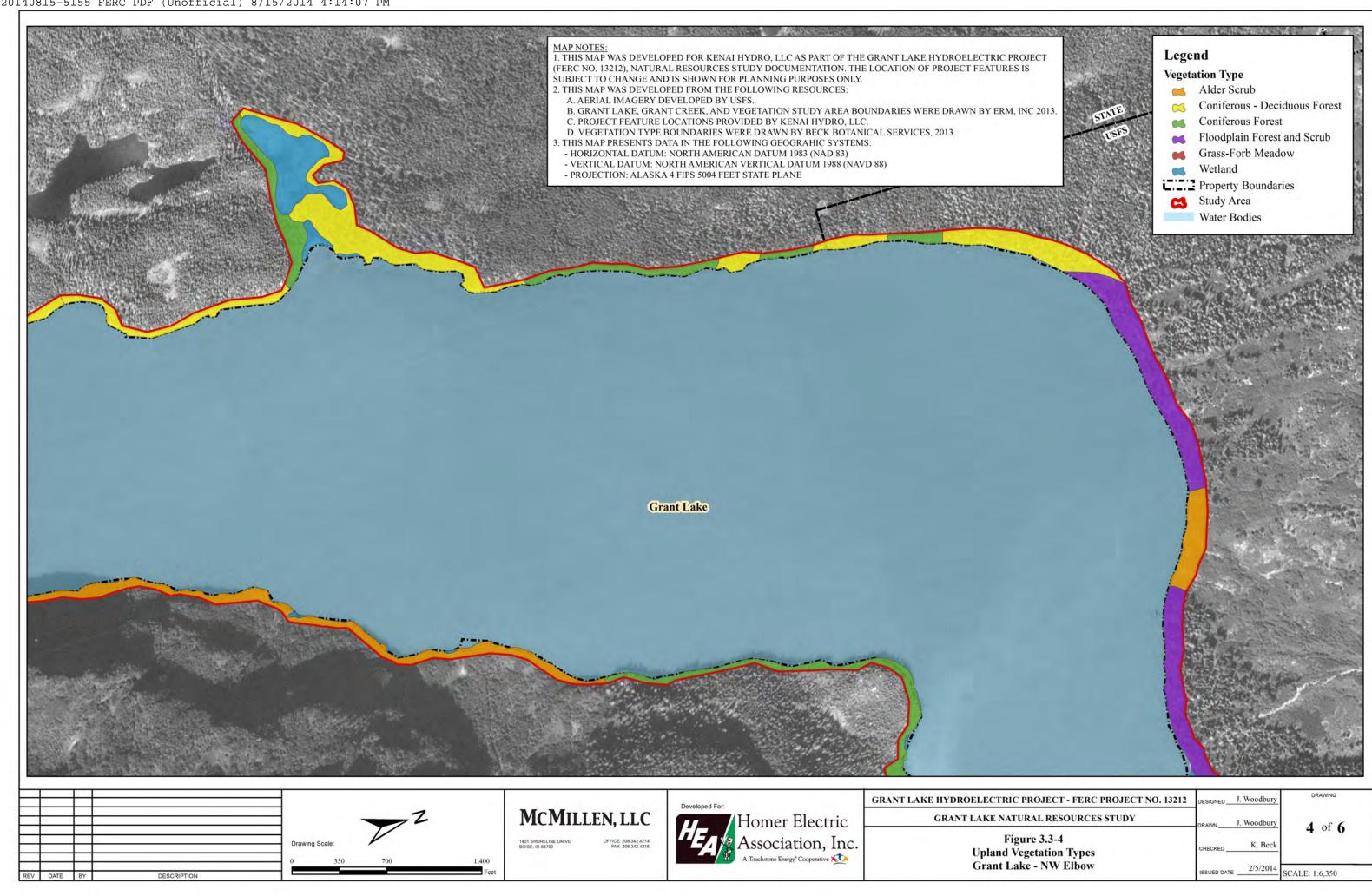
Upland vegetation types within the general vegetation study area were delineated and refined using aerial photograph imagery obtained from the Chugach National Forest dating from between 1996 and 2004 (see Figure 3.3-1). In addition, upland vegetation types were ground truthed in the field. Figure 3.3-2 through Figure 3.3-6 are more detailed maps of the upland vegetation in the study area. Wetland vegetation types are discussed in detail in Section 4, Wetlands and Other Waters of the U.S. The 570.5-acre study area contains a total of 5 upland vegetation types, including Coniferous Forest, Coniferous-Deciduous Forest, Alder Scrub, Grass-Forb Meadow, and Floodplain Forest and Scrub. The 2013 upland vegetation types, total acres, percentages of the total study area, and their corresponding NatureServe ecological systems (NatureServe 2008) are presented in Table 3.3-1. Each of the 2013 vegetation types is widespread in the region. The characteristics and general distribution of the 2013 upland vegetation types are described below.

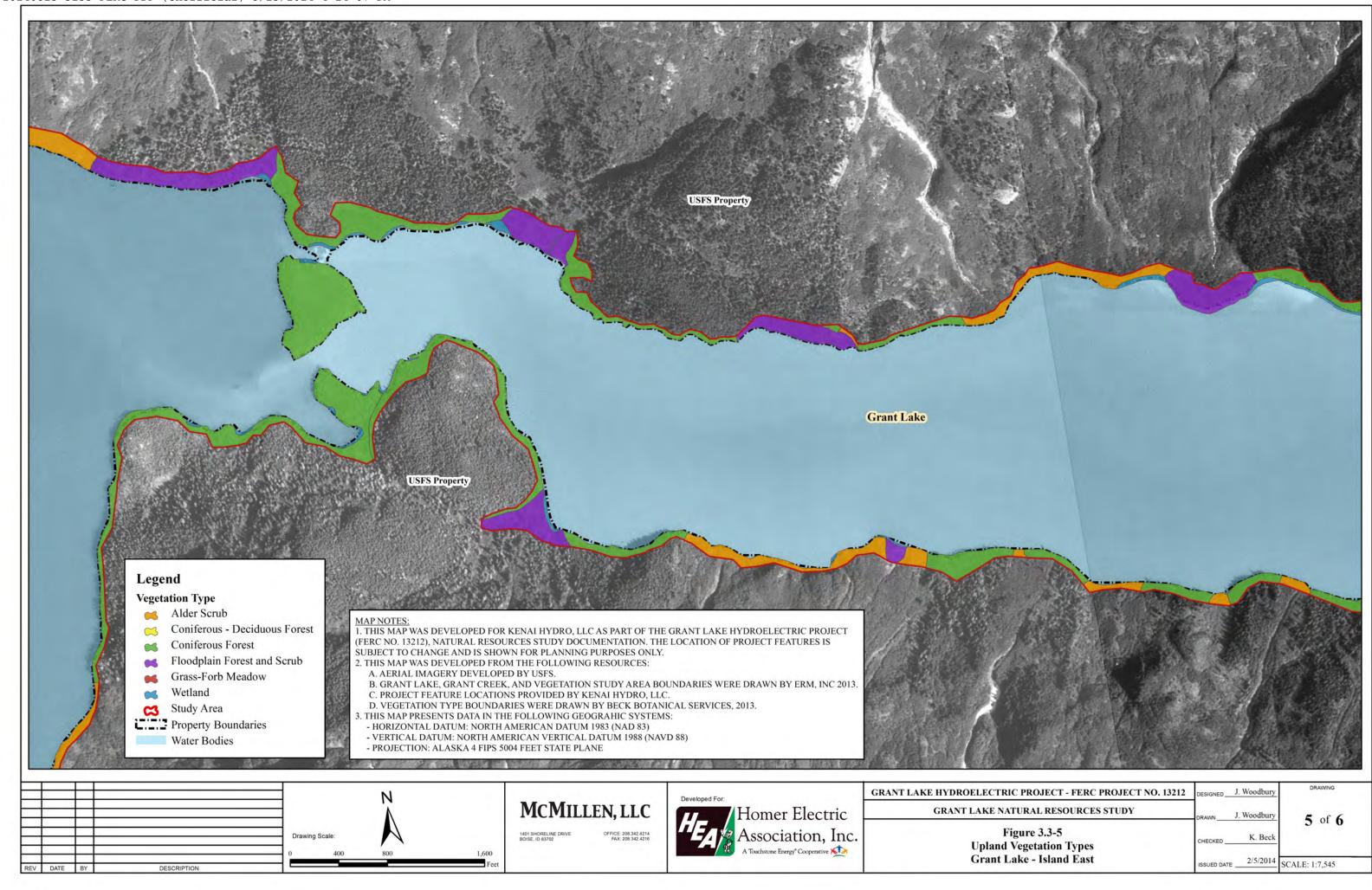
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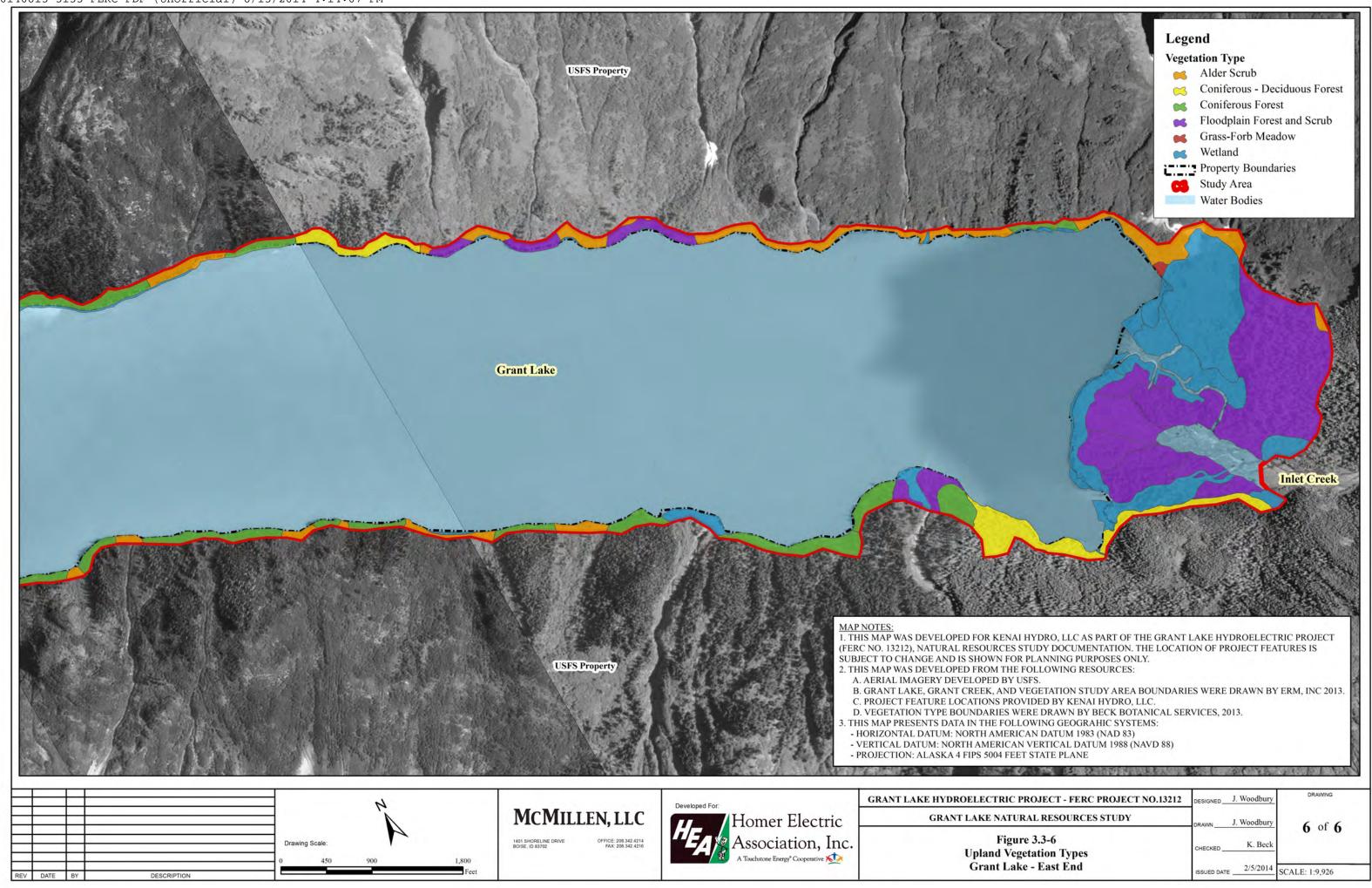


Table 3.3-1. 2013 upland vegetation types, acres, percentages, and NatureServe Ecological Systems.

2013 Vegetation					
Type	Acres ¹	Percent	NatureServe Ecological System		
			Alaska Sub-boreal White-Lutz Spruce Forest and Woodland -		
			CES 105.102, Alaskan Pacific Maritime Mountain Hemlock		
			Forest - CES 204.142, Alaska Sub-boreal Mountain Hemlock-		
Coniferous Forest	173.7	30.5%	White Spruce Forest - CES 204.103		
Coniferous-			Alaska Sub-boreal White Spruce-Hardwood Forest - CES		
Deciduous Forest	177.1	31.0%	105.136		
Alder Scrub	34.5	6.0%	Alaska Sub-boreal Avalanche Slope Shrubland - CES 105.111		
			Western North American Sub-boreal Mesic Bluejoint Meadow -		
Grass-Forb Meadow	2.2	0.4%	CES 105.114		
Floodplain Forest			Western North American Boreal Montane Floodplain Forest and		
and Scrub	106.0	18.6%	Shrubland - CES 105.141		
			WNAB Montane Floodplain Forest and Shrubland – CES		
			105.141, WNAB Riparian Stringer Forest and Shrubland – CES		
			104.144, WNAB Deciduous Shrub Swamp – CES.122, WNAB		
			Low Shrub Peatland – CES 105.140, WNAB Freshwater Aquatic		
			Bed – CES 105.125, WNAB Freshwater Emergent Marsh – CES		
Wetlands	77.1	13.5%	105.123, WNAB Wet Meadow – CES 105.124		
Total	570.5	100.0%			

Notes:

3.3.1.1. Coniferous Forest

Coniferous Forest is a common vegetation type in the study area, occurring on 173.7 acres, and comprising 30.5 percent of the vegetated area. In the study area, this vegetation type is represented by stands of Lutz spruce (*Picea x lutzii*), mountain hemlock (*Tsuga mertensiana*), and mixed Lutz spruce and mountain hemlock. Lutz spruce is a hybrid between Sitka spruce (*Picea sitchensis*) and white spruce (*Picea glauca*). Much of the forest in the study area is old growth. Evidence of past logging of some larger trees within the study area was observed in the vicinity of the Alaska Railroad and the Seward Highway. Lutz spruce and mountain hemlock trees average 50 feet in height in some forested stands. Spruce snags are common throughout this forest type, most likely killed by the massive spruce beetle outbreak on the Kenai Peninsula during the 1990s (Berg et al. 2006).

Large continuous stands of open to closed canopied coniferous forest occur along the upper reaches of Grant Creek and the Project feature corridor, the Grant Lake elbow area, and the southeast end of Grant Lake. Smaller patches of coniferous forest also occur along the Grant Lake shoreline. The understory layer tends to be dense with tall shrub species. Common shrubs include rusty menziesia (*Menziesia ferruginea*), early blueberry (*Vaccinium ovalifolium*), and Alaska huckleberry (*Vaccinium alaskaense*). Common low-shrubs and forbs include: five-leaf bramble (*Rubus pedatus*), twinflower (*Linnaea borealis*), lingonberry (*Vaccinium vitis-idaea*), bunchberry (*Cornus canadensis*), crowberry (*Empetrum nigrum*), Labrador tea (*Ledum groenlandicum*), oakfern (*Gymnocarpium dryopteris*), and northern comandra (*Geocaulon lividum*). In many areas, moss and lichen species form a continuous cover on the forest floor.

^{1.} Differences in wetland acreages presented in Table 3.3-1 and Tables 4.3-1 and 4.3-2 are due to rounding errors

Forest openings often support stands of Sitka alder (*Alnus viridis* ssp. *sinuata*), Sitka mountainash (*Sorbus sitchensis*), trailing black currant (*Ribes laxiflorum*), fireweed (*Chamerion angustifolium*) and bluejoint reedgrass (*Calamagrostis canadensis*).

3.3.1.2. Coniferous-Deciduous Forest

The Coniferous-Deciduous Forest is the most common vegetation type in the study area, occurring on 177.1 acres, and comprising 31.0 percent of the vegetated area. It is characterized by codominant stands of paper birch (*Betula papyrifera*) and Lutz spruce on typically well-drained, upland terrain. Mountain hemlock, poplar (*Populus balsamifera*), and quaking aspen (*Populus tremuloides*) may be present in the overstory canopy. Common understory shrubs include rusty menziesia, trailing black currant, prickly rose (*Rosa acicularis*), Beauvard spiraea (*Spiraea stevenii*) and highbush cranberry (*Viburnum edule*). Common low shrubs and forbs include bunchberry, twinflower, crowberry, fireweed, oak fern, and bluejoint reedgrass. Open sites often support stands of Sitka alder. In the study area, Coniferous-Deciduous forest occurs intermittently along the northwest shore of Grant Lake, along the southeast shore of Grant Lake; and in large stands along Grant Creek and the lower portion of the Project corridor in the vicinity of Lower Trail and Upper Trail lakes.

3.3.1.3. Alder Scrub

The Alder Scrub vegetation type is represented by stands of often closed canopy Sitka alder on the steep, avalanche-prone slopes around Grant Lake. It occurs on 34.5 acres and comprises 6.0 percent of the vegetated area. High snowfall and frequent avalanche activity determine the distribution of Alder Scrub and other plant communities on these slopes. These often dense stands of Sitka alder frequently have a sparse understory or an understory that is dominated by shorter shrubs, including goatsbeard, willow species, and devil's club, as well as forbs such as tall fireweed, cow parsnip, and lady fern. Smaller patches of herbaceous vegetation (Grass-Forb Meadow, discussed below) are common within Alder Scrub, and form a matrix with it. Coniferous tree seedlings and saplings were also observed in this vegetation type.

3.3.1.4. Grass-Forb Meadow

In the study area, the Grass-Forb Meadow vegetation type forms a mosaic with the Alder Scrub vegetation type, as described above, and is mostly included as small, unmapped patches on the steep slopes above Grant Lake. Several larger Grass-Forb Meadows are mapped in the study area; one at the east end of Grant Lake and a larger one at the west end of the lake, south of the Grant Creek outlet. The Grass-Forb Meadow vegetation type is the least common type in the study area, occurring on 2.2 acres, and comprising 0.4 percent of the vegetated area. The dominant plant species in this vegetation type is the tall, rhizomatous grass species bluejoint reedgrass, which often forms extensive swards. Forb associates are often diverse and commonly include tall fireweed, oak fern, northern geranium (*Geranium erianthum*), arctic starflower (*Trientalis europaea*), cow parsnip (*Heracleum maximum*), larkspur (*Delphinium glaucum*), Sitka burnet (*Sanguisorba canadensis*), tall Jacob's-ladder (*Polemonium acutiflorum*), wood fern (*Dryopteris expansa*), common horsetail (*Equisetum arvense*) and monkshood (*Aconitum delphinifolium*). Shrub species include goatsbeard, red raspberry (*Rubus idaeus*), and highbush cranberry. The relative abundance of grass and forbs from site to site is variable.

3.3.1.5. Floodplain Forest and Scrub

The Floodplain Forest and Scrub vegetation type covers 106.0 acres of the study area, constituting 18.6 percent of the vegetated area. This vegetation type occurs on floodplain gravel bars that are successively colonized by herbaceous, shrub, and tree species; and this type is often comprised of a mosaic of upland and wetland areas. Vegetation succession on gravel bars can be represented by the following seral stages: barren or herbaceous, willow or willow-alder, alder, poplar or spruce-poplar, and then spruce (NatureServe 2008), all of which occur in the study area on the wide floodplain associated with Inlet Creek, on outwash fans and floodplains associated with the small drainages around Grant Lake, and on the floodplain where Grant Creek enters the Trail Lake Narrows. The substrate of this vegetation type is typically well-drained sand, silt, gravel, and cobble; it includes a diversity of habitats including bare areas, shrublands, forests, oxbows, wet depressions and herbaceous wetlands. Wetlands included in this vegetation type are described in the Wetlands section (Section 4). Upland portions within this type include: forests comprised of Lutz spruce, balsam poplar, and sometimes paper birch; stands of large poplar, stands of Sitka alder, and Sitka alder stands with willow species such as feltleaf willow, Barclay willow, and Sitka willow (Salix alaxensis, S. barclayi, and S. sitchensis). In the earliest seral areas, herbaceous meadows are dominated by sedge species (Carex species), river beauty (Chamerion latifolium) bluegrass species (Poa species), bluejoint reedgrass, and horsetail species (Equisetum species). Stands of mature poplar can be found on the extensive alluvial area adjacent Inlet Creek.

3.3.1.6. Barren/Sparsely Vegetated

Barren and sparsely vegetated areas include talus slopes, cliffs, and avalanche chutes having less than 10 percent vegetation cover. In the study area, barren and sparsely vegetated areas form a mosaic with the Alder Scrub vegetation type on steep, avalanche prone, often dry, sometimes seepy slopes around Grant Lake. These polygons are generally not large enough to be individually mapped.

3.3.1.7. Wetland Communities

Refer to Section 4, Wetlands and Waters of the U.S. for a detailed discussion about the distribution, types, and functions of the wetland and water resources throughout the Project area.

3.3.2. Invasive Plant Survey

Data about invasive plants were extracted from the USFS's Natural Resource Information System Threatened, Endangered, and Sensitive Plants and Invasive Species Application (USFS NRIS 2013). This application supports national data collection standards from combined Threatened, Endangered, and Sensitive plants and invasive species surveys and inventories. Populations of the following invasive plant species have been documented previously within 0.25 mile of the study area: timothy (*Phleum pratense*), common plantain (*Plantago major*), annual bluegrass (*Poa annua*), Kentucky bluegrass (*Poa pratensis*), common dandelion (*Taraxacum officinale*), white clover (*Trifolium repens*) and alsike clover (*T. hybridum*). Most of these invasive plants were located along the Seward Highway and Alaska Railroad in the area between Upper Trail and Lower Trail lakes. 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). A list of invasive plants considered most likely to be located in the study area is presented in Appendix 1a, Table A.1a-2, Invasive plant populations in the vicinity of Grant Lake, June 2013.

The invasive plant survey was conducted concurrently with the sensitive plant survey and took place within areas potentially affected by the Project. Areas of particular focus included: roadsides, motorized vehicle travel routes, boat traffic routes, existing trails, lake and stream access points, developed and social recreation sites, and other human use areas.

Overall, very few populations of invasive plants were located in the invasive plant study area. Populations of the following four invasive plants were documented: annual bluegrass, Kentucky bluegrass, common dandelion, and white clover. Populations of each of these invasive species have previously been mapped in the vicinity of the Project area on State of Alaska lands (USFS NRIS 2013). AKEPIC Field Data Sheets for these invasive plant populations are included in Appendix 1b.

In the study area, common dandelion and white clover were located along the Seward Highway ROW. Common dandelion was located along the Alaska Railroad ROW. Annual bluegrass, Kentucky bluegrass and common dandelion were located on the Grant Lake Trail where it enters the study area on the west end of the north shore of Grant Lake (USFS land). Ten scattered small- to medium-sized populations of common dandelion were scattered around Grant Lake in areas with exposed soil or gravel on State of Alaska and USFS lands. Wave action and ice scouring on exposed substrates along the Grant Lake shore constitute a natural disturbance regime which favors the establishment of common dandelion. The Grant Lake dandelion populations are comprised of a combination of common dandelion and horned dandelion (*Taraxacum ceratophorum*). Horned dandelion is a native, noninvasive plant whose appearance is similar to common dandelion and is distinguished with a combination of technical characters.

In the study area, invasive plants were most likely to be located in areas where the substrate has been disturbed or where bare soil has been exposed. Except for the Grant Lake shoreline, invasive plants were not observed in areas that do not experience appreciable human disturbance.

3.3.3. Sensitive Plant Survey

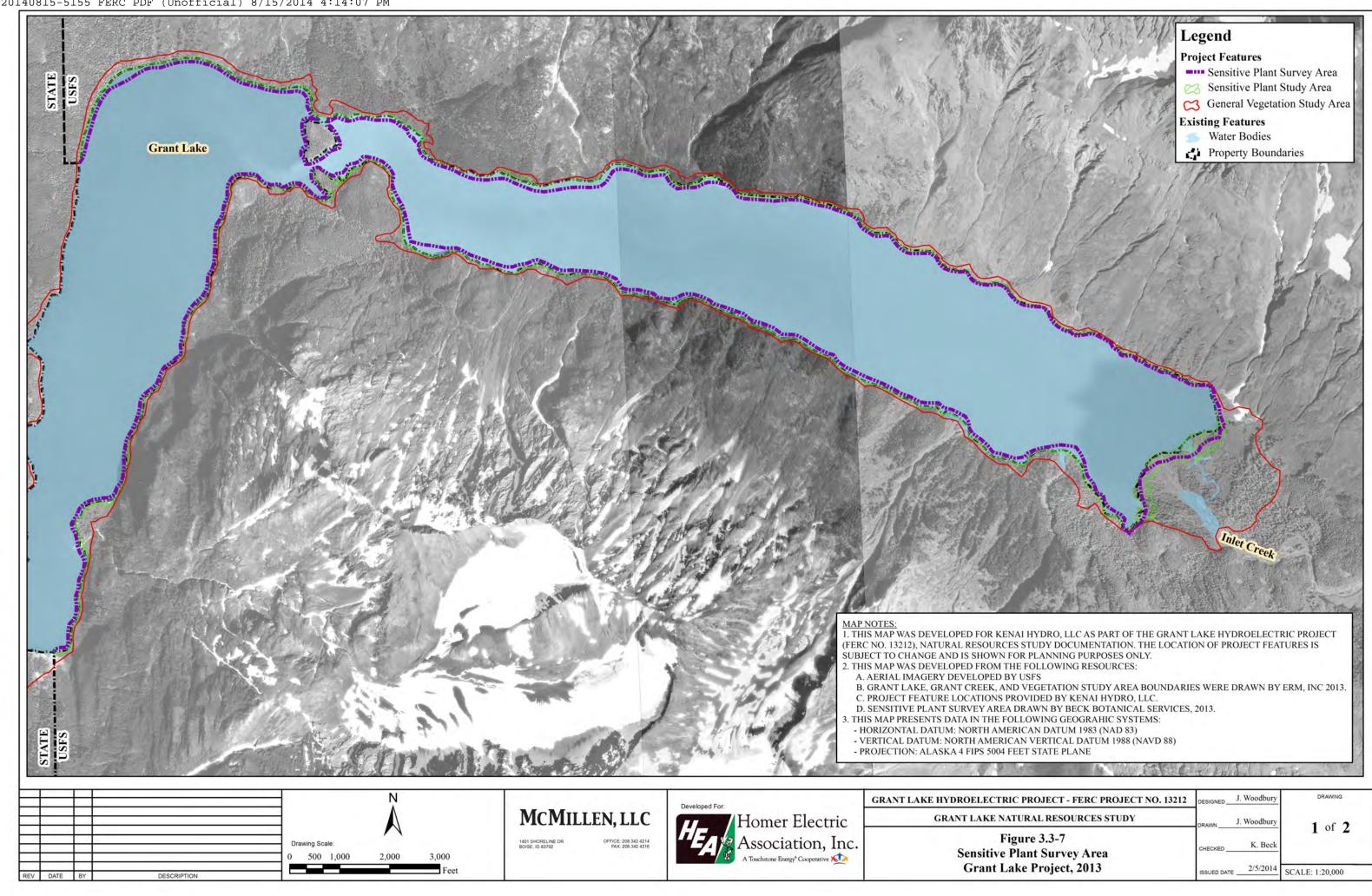
A map of areas surveyed for sensitive plants is included on Figure 3.3-7 and Figure 3.3-8. A list of all plant species observed in the combined sensitive plant and invasive plant study areas is included in Appendix 1a as Table A.1a-3. A USFS Plant Survey Field Form describing the sensitive plant survey is included in Appendix 1b. The species list is divided into three areas: the Project Corridor, which is located on State of Alaska land; the State of Alaska owned portion of Grant Lake; and the USFS owned portion of Grant Lake. Aleutian shield fern (*Polystichum aleuticum*) is the only federally listed or proposed plant species within the range of the Project area (USFWS 2013). Because no habitat for it is present within the Project vicinity, it was not expected to occur, and was not observed during fieldwork.

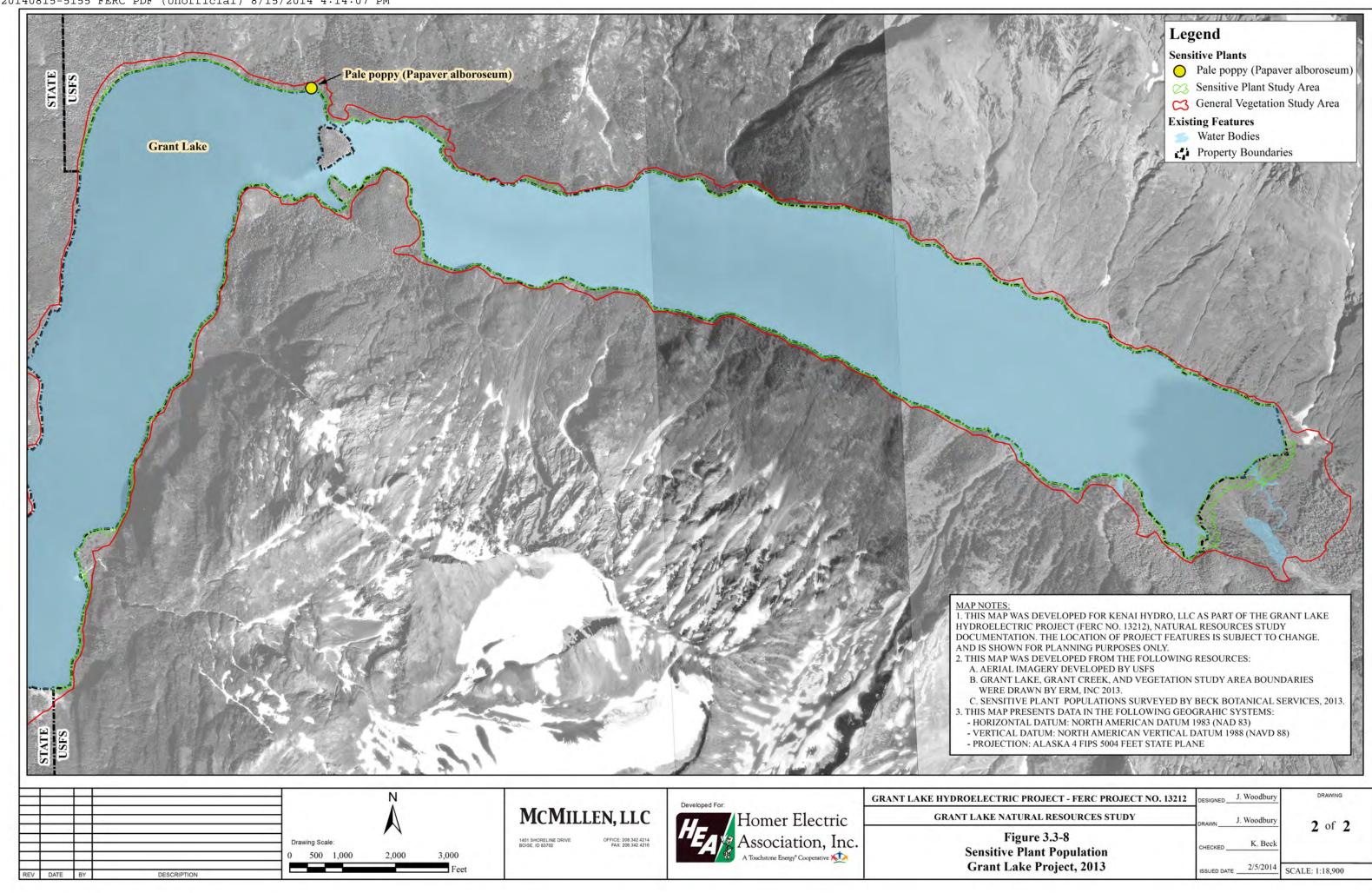
A BE for sensitive plants in the Project area on lands under USFS jurisdiction will be prepared for the Draft License Application. A small population of the USFS sensitive plant pale poppy

TERRESTRIAL RESOURCES STUDY

(*Papaver alboroseum*) was located in the sensitive plant study area and is discussed below. In addition, two plant species tracked by the Alaska Natural Heritage Program as rare plants were located in the combined sensitive plant and invasive plant study areas and are discussed below.

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3.3.3.1. Pale Poppy (Papaver alboroseum)

A small population of pale poppy was located on the north shore of Grant Lake, northwest of the island (see Figure 3.3-8). Figure 3.3-8, above, presents a map of the pale poppy populations. A USFS sighting form for the pale poppy is presented in Appendix 1b (R10 TES Plant Element Occurrence Field Form), along with photographs of pale poppy plants and its habitat in the study area (Appendix 1b, Photos A.1b-1 –A.1b-3). Fifteen 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. The 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 plants nearest in proximity to the lake were located approximately 12 feet away. Plants were between 2 and 5 feet higher than the surface water level elevation (SWE) at the time of the survey (SWE estimated to be between 698 and 699 feet NAVD 88).

Pale poppy is distributed from the Kuril Islands to south central Alaska and is disjunct to north central British Columbia (Goldstein et al. 2009). Pale poppy requires an open, well-drained habitat, and occasional disturbance either creates or maintains this habitat. One-time (as opposed to recurring) disturbances by humans can create habitat for the poppy. Examples include stabilized road sides, railroad trackbeds, and disturbed gravelly areas such as old gravel pits. While some human disturbance may help maintain suitable open habitat, repeated disturbance may have affect the plant's ability to reproduce (Charnon 2007). Pale poppy plants observed on nearby Cooper Lake are able to tolerate some inundation during the growing season (HDR 2005).

3.3.3.2. Additional Findings

A small population of Yellowstone draba (*Draba incerta*) was located on USFS land, on the north shore of Grant Lake, southeast of the island. While it is not listed by the USFS as a sensitive species, this yellow-flowered species in the mustard family is listed by the Alaska Natural Heritage Program as an S3 species (AKNHP 2013). An S3 designation means that the species is "Rare within the state; at moderate risk of extirpation because of restricted range, narrow habitat specificity, recent population decline, small population sizes, and a moderate number of occurrences" (AKNHP 2013). There are nearly 20 occurrences of this species in Alaska, of which 2 are on the Kenai Peninsula (AKNHP 2013).

A small population of western fescue (*Festuca occidentalis*) was located within the 50-foot study area buffer on State of Alaska land along the proposed access route west of the detention pond. This grass species is listed by the Alaska Natural Heritage Program as an S1 species (AKNHP 2013). An S1 designation means that the species is "Critically imperiled within the state; at very high risk of extirpation because of extremely few occurrences, declining populations, or extremely limited range and/or habitat" (AKNHP 2013). There are a total of 4 occurrences of this species in Alaska, of which 2 are on the Kenai Peninsula (AKNHP 2013). In the study area, several western fescue plants were located in an opening in white spruce forest on a well-drained, southwest-facing hummock.

3.4. Conclusions

This section summarizes the findings of the general upland vegetation study and the invasive plant and sensitive plant surveys. In addition, potential qualitative direct and indirect impacts of the construction and operation of the Project on general upland vegetation and sensitive plants are discussed. In general, construction-related impacts are considered short-term, while impacts associated with Project infrastructure and operations would likely be longer-term or permanent. Direct impacts are those that would occur immediately or soon after the implementation of the action (Dillman et al. 2009). Indirect impacts are those impacts that are reasonably likely to occur at a later point in time after the Project has been implemented.

In general, potential direct impacts of the construction of the Project on upland vegetation or sensitive plants involve physical damage to or inundation of individual plants, entire populations, or vegetation habitat. Indirect impacts of the construction and operation of the Project may include the following:

- Changes in Grant Lake hydrology: increased water levels might result in the death or decline in vigor of plants not adapted to higher sustained water levels; or, conversely, a sustained decrease in water levels might result in the death or decline of plants adapted to wetland conditions.
- Changes in Grant Creek hydrology: changes to in-stream flow regime of Grant Creek may result in the death or decline in vigor of plants, or a shift in riparian vegetation community composition in response to the new flow regime.
- Changes in light levels: partial or complete removal of tree canopy in forested areas or shrub cover in dense scrub areas can result in increased light levels in the understory, potentially resulting in light levels beyond the tolerance of shade dependent species.
- Shifts to earlier successional vegetation types in disturbed areas.
- Introduction and spread of invasive plants: ground disturbing activities and increased light levels can create conditions conducive to the establishment of invasive plant populations. Invasive plants compete with native plants for preferred habitat.

3.4.1. General Vegetation

Five general upland vegetation types were mapped within the study area, including Coniferous Forest, Coniferous-Deciduous Forest, Alder Scrub, Grass-Forb Meadow, and Floodplain Forest and Scrub.

Potential direct impacts of the construction of the Project on general upland vegetation may include: clearing of vegetation, the smothering of vegetation by the placement of fill material, damage to vegetation by machinery, soil disturbance, altering of the natural grade, and inundation. Potential indirect impacts of the construction of the Project on upland vegetation may include: the introduction and spread of invasive plant species, soil erosion, poor native vegetation reestablishment, vegetation type changes due to changes in light or moisture levels, and shifts to earlier successional vegetation types in disturbed areas.

The primary potential direct impact of the operation of the Project with regard to upland vegetation is the loss of natural vegetation. Potential indirect impacts of the operation of the

Project on upland vegetation may include: the introduction and spread of invasive plant species, the alteration or loss of some vegetation types, and the maintenance of earlier successional vegetation types. While these direct and indirect impacts have the potential to occur to some degree, Best Management Practices (BMPs) will be collaboratively developed with the agencies prior to the initiation of construction to minimize impacts to general vegetation. These potential impacts to general upland vegetation are summarized by Project component in Table 3.4-1. Refer to Section 4.4, Wetlands Conclusions, for a summary of potential impacts to wetland and water communities. Engineering feasibility work is being conducted in parallel with the natural resource investigations for the Project. The "Potential Qualitative Construction and Operational Impacts" listed in Table 3.4-1 below will be further refined once the operational scenario(s) is selected. This scenario will be developed collaboratively with the input of stakeholders. These refinements will be detailed in the DLA.

3.4.2. Invasive Plant Survey

Few populations of invasive plants were documented in the study area. Invasive plant species observed in the study area included common dandelion, white clover, Kentucky bluegrass, and annual bluegrass. Except for the common dandelion populations around Grant Lake, all of the invasive plant populations in the study area are associated with human disturbance areas. Potential impacts of Project construction and operations on invasive plant populations include:

- invasive plant populations in the Project area could become larger,
- invasive plant populations could spread to new areas within the Project area,
- new species of invasive plants could spread to areas affected by the Project, and
- invasive plant populations could spread out of the Project area into adjacent areas.

Potential direct and indirect impacts of the construction and operation of the Project on upland vegetation and sensitive plants with regard to invasive plants are summarized in Tables 3.4-1 and 3.4-2, respectively. While direct and indirect impacts have the potential to occur to some degree, BMPs will be collaboratively developed with the agencies and incorporated into an Invasive Plant Management Plan prior to the initiation of construction, in order to minimize potential invasive plant impacts associated with the Project.

Table 3.4-1. General upland vegetation potential qualitative impact table, Grant Lake Project.

Project Component	Potential Qualita Impa	tive Construction	Potential Qualitative Operational Impacts ^{1,2}		
· · · · · · · · · · · · · · · · · · ·	Direct	Direct Indirect Direc		Indirect	
GRANT CREEK DIVERSION					
Natural Outlet Option	Vegetation clearing, soil disturbance, altered natural grade, fill material placement, damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation; inundation, Grant Lake water level fluctuations, drawdowns, Grant Creek flow regime changes	Weed infestation; effects of the new lake level fluctuation regime and the new creek flow regime on upland vegetation; alteration and/or loss of upland vegetation types	
Concrete Dam Option	Vegetation clearing, soil disturbance, altered natural grade, fill material placement, damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation; inundation, Grant Lake water level fluctuations, drawdowns, Grant Creek flow regime changes	Weed infestation; effects of new lake level fluctuation regime and the new creek flow regime on upland vegetation; alteration and/or loss of upland vegetation types	
WATER CONVEYANCE					
Intake Structure	Vegetation clearing, soil disturbance, altered natural grade, fill material placement, damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation; inundation, Grant Lake water level fluctuations, drawdowns, Grant Creek flow regime changes	Weed infestation; effects of new lake level fluctuation regime and the new creek flow regime on upland vegetation; alteration and/or loss of upland vegetation types	
Tunnel	At surficial entrance and exit of tunnel: vegetation clearing; soil disturbance; altered natural grade; fill material placement; damage by machinery	At surficial entrance and exit of tunnel: weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels, shift to earlier successional vegetation types	At surficial entrance and exit of tunnel: loss of natural vegetation	At surficial entrance and exit of tunnel: weed infestation; soil erosion; poor native veg re- establishment; alteration or loss of upland vegetation types	

Table 3.4-1, continued...

Project Component	Potential Qualitative Construction Impacts ^{1,2}		Potential Qualitative Operational Impacts ^{1,2}	
	Direct	Indirect	Direct	Indirect
Penstock	Vegetation clearing, soil disturbance, altered natural grade, fill material placement, damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation	Weed infestation; soil erosion, poor native veg re- establishment; alteration or loss of upland vegetation types
Tailrace	Vegetation clearing, soil disturbance, altered natural grade, fill material placement, damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation	Weed infestation; soil erosion, poor native veg re- establishment; alteration or loss of upland vegetation types
Tailrace Detention Pond Pond POWERHOUSE	Vegetation clearing; soil disturbance; altered natural grade, damage by machinery, fill material placement	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Periodic inundation of wetland and adjacent upland areas	Weed infestation; possible expansion of wetland fringe around water edge into upland vegetation; soil erosion, sedimentation/burial of upland vegetation; poor native veg reestablishment. The amount and nature of upland vegetation impacts will be dependent on the frequency, timing, duration of inundation
Powerhouse Structure	Vegetation clearing; soil disturbance; altered natural grade; fill material placement; damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation	Weed infestation; soil erosion, poor native veg re- establishment; alteration or loss of upland vegetation types

Table 3.4-1, continued...

Project Component	Potential Qualitative Construction Impacts ^{1,2}		Potential Qualitative Operational Impacts ^{1,2}	
	Direct	Indirect	Direct	Indirect
TRANSMISSION LINE/ SWITCHYARD				
Above Ground Option	Vegetation clearing; soil disturbance; altered natural grade; fill material placement; damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types Weed infestation; soil erosion; poor	Loss of natural vegetation	Weed infestation; soil erosion, poor native veg reestablishment. Shift to earlier successional vegetation community if ROW is maintained clear of woody vegetation as many utility corridors are
Below Ground Option	Vegetation clearing; soil disturbance; altered natural grade; fill material placement; damage by machinery	native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation	Weed infestation; soil erosion; poor native veg re- establishment; alteration or loss of upland vegetation types
ACCESS ROADS & BRIDGE				
Access Roads & Bridge	Vegetation clearing; soil disturbance; altered natural grade; fill material placement; damage by machinery	Weed infestation; soil erosion; poor native veg re- establishment; change of light or moisture levels; shift to earlier successional vegetation types	Loss of natural vegetation	Weed infestation; soil erosion; poor native veg re- establishment; alteration or loss of upland vegetation types

Notes:

- The potential impacts discussed in this table are preliminary and based primarily on the terrestrial natural
 resource studies and the limited amount of engineering feasibility work conducted prior to this report being
 developed. This table and the associated impacts will be fully refined and vetted once the licensing associated
 engineering work is completed. A full discussion of refined environmental impacts will be included in the
 DLA.
- 2. Project would be constructed over a 30-36 month time period.

3.4.3. Sensitive Plant Survey

The sensitive plant survey occurred on USFS lands in areas potentially affected by the Project. The survey was conducted at the proper time of year to identify sensitive plants recognized as

having the potential to occur in the study area. A small population of pale poppy was located in the study area.

Potential direct and indirect impacts to sensitive plants include potential impacts to known populations and potential impacts to undetected populations on suitable habitat. Potential impacts to USFS lands would primarily be Grant Lake level changes related to the implementation of the Project. No components associated with the Project (Grant Lake Diversion dam and Grant Lake Powerhouse, water conveyance, transmission line, or access roads and bridge) are located on USFS lands, thus USFS lands would not be directly impacted by their construction or operation. While direct and indirect impacts have the potential to occur to some degree, BMPs will be collaboratively developed with the agencies and incorporated into a Sensitive Plant Management Plan prior to the implementation of construction, in order to minimize impacts to sensitive plant populations. Potential direct and indirect impacts of the Project on sensitive plants are discussed below and are summarized in Table 3.4-2. Engineering feasibility work is being conducted in parallel with the natural resource investigations for the Project. The potential qualitative impacts listed in Table 3.4-2 below will be further refined once the operational scenario(s) is selected. This scenario will be developed collaboratively with the input of stakeholders. These refinements will be detailed in the DLA.

3.4.3.1. Eschscholtz's Little Nightmare

Eschscholtz's little nightmare 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. The Project would have no direct or indirect effects to known populations or habitat of Eschscholtz's little nightmare.

3.4.3.2. Moosewort Fern

Moosewort fern 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. The Project would have no direct or indirect effects to known populations or habitat of moosewort fern.

3.4.3.3. Moonwort Fern

Moonwort fern 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. The Project would have no direct or indirect effects on known populations or habitat of moonwort fern.

Table 3.4-2. Sensitive plant potential qualitative impact table, Grant Lake Project.

Species	Potential Habitats	Habitat Present in Study Area?	Project Effects ^{1,2}	Direct Impacts	Indirect Impacts
Eschscholz's little nightmare (Aphragmus eschscholtzianus)	Alpine and subalpine heath meadows; wet rocky or mossy seeps	No	None	none	None
Moosewort fern (Botrychium tunux)	Well-drained sandy beaches and alpine sites	No	None	none	None
Moonwort fern (Botrychium yaaxudakeit)	Well drained open meadows, upper beach meadows, coastal dunes	No	None	None	None
Spotted lady's slipper (Cypripedium guttatum)	Open forest, tall shrublands, wet meadows	Yes	Shoreline inundation, lake water level fluctuations, drawdowns	Inundation of potential habitat or undetected plants	Spread of invasive plants; light or moisture changes
Calder's lovage (Ligusticum calderi)	Limestone, wet, moist sites in subalpine and alpine, rock habitats, meadows, forest edges	No	None	None	None
Pale poppy (Papaver alboroseum)	Open areas, sand, gravelly, well-drained substrates	Yes, a small population was located	Shoreline inundation, lake water level fluctuations, drawdowns	Partial or complete inundation of some or all documented plants, potential habitat, or undetected plants; loss of suitable habitat	Spread of invasive plants, light or moisture changes
Alaska rein orchid (Piperia unalascensis)	Dry, open sites, forests; tall shrub in riparian zones, mesic meadows	Yes	Shoreline inundation, lake water level fluctuations, drawdowns	Inundation of potential habitat or undetected plants	Spread of invasive plants; light or moisture changes
Unalaska mist- maid (Romanzoffia unalaschcensis)	Rocky outcrop areas around Grant Lake	Yes	Shoreline inundation, lake water level fluctuations, drawdowns	Inundation of potential habitat or undetected plants	Spread of invasive plants; light or moisture changes

Notes:

- 1. The potential impacts discussed in this table are preliminary based primarily on the terrestrial natural resources studies and the limited amount of engineering feasibility work conducted prior to this report being fully developed. This table and the associated impacts will be fully refined and vetted once the licensing engineering work is completed. A full discussion of refined environmental impacts will be included in the Draft License Application.
- 2. Project would be constructed over a 30-36 month time period.

3.4.3.4. Spotted Lady's Slipper

Spotted lady's slipper orchid 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.

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 (Grant Lake level change, inundation, water level fluctuations, lake drawdown) could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects could occur through inundation, fluctuations, and drawdown. Indirect effects are also possible, including the introduction and spread of invasive plant species, soil erosion, vegetation type changes due to changes in light or moisture levels, and shifts to earlier successional vegetation types. 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 habitat and undetected individuals.

3.4.3.5. Calder's Lovage

Calder's lovage 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. The Project would have no direct or indirect effects to known populations or habitat of Calder's lovage.

3.4.3.6. Pale Poppy

Pale poppy 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 15 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.

The Project could potentially have direct effects on the pale poppy population in the study area because some or all of the plants might be partially or completely inundated by proposed changes to the lake's surface water elevation, although the duration and frequency of these lake level fluctuations are unknown at this time. Indirect effects to plants not inundated are also possible, potentially occurring as a result of light or water level changes resulting from inundation or the introduction of invasive plants. The presence of additional undetected populations in the study area is possible. Potential impacts to the study area resulting from Project implementation (lake elevation changes, water level fluctuations, and drawdowns) could affect potential habitat for this species and thus potentially affect undetected populations. Indirect effects are also possible, including the introduction and spread of invasive plant species,

soil erosion, vegetation type changes due to changes in light or moisture levels, and shifts to earlier successional vegetation types. Because this species' habitat is discontinuously present around the perimeter of Grant Lake, some of the potential impacts that would result from Project implementation would have the potential to disturb pale poppy habitat and undetected individuals.

3.4.3.7. Alaska Rein Orchid

Alaska rein orchid 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.

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 (Grant Lake level change, inundation, water level fluctuations, drawdown) could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects could occur through inundation, fluctuations and drawdown. Indirect effects are also possible, including the introduction and spread of invasive plant species, soil erosion, vegetation type changes due to changes in light or moisture levels, and shifts to earlier successional vegetation types. 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.

3.4.3.8. Unalaska Mist-Maid

Unalaska mist-maid 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.

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 (Grant Lake level change, inundation, water level fluctuations, lake drawdown) could affect potential habitat for this species and thus potentially affect undetected populations. Direct effects could occur through inundation, fluctuations, and drawdown. Indirect effects are also possible, including the introduction and spread of invasive plant species, soil erosion, vegetation type changes due to changes in light or moisture levels, and shifts to earlier successional vegetation types. 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.

3.4.3.9. Additional Findings – Yellowstone Draba and Western Fescue

A very small population of Yellowstone draba was located in the invasive plant study area on USFS lands on the north shore of Grant Lake, northwest of the island. This yellow-flowered mustard species is listed by the Alaska Natural Heritage Program as an S3 species. Implementation of the Project could cause potential impacts to the population, including light or moisture level changes and the introduction of invasive species.

A small population of western fescue was located in the study area on State of Alaska land along the access route west of the detention pond. This grass species is listed by the Alaska Natural Heritage Program as an S1 species. Construction and operation of the Project access road and transmission line could cause possible impacts to this population, including light or moisture level changes and the introduction of invasive species.

3.5. Variances from FERC-Approved Study Plan and Proposed Modifications

3.5.1. General Vegetation

There were no variances to the FERC-approved general vegetation study plan.

3.5.2. Invasive Plant Survey

There were no variances to the FERC-approved invasive plants study plan.

3.5.3. Sensitive Plant Survey

There were no variances to the FERC-approved sensitive plants study plan.

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4 BOTANTICAL RESOURCES: WETLANDS & OTHER WATERS OF THE U.S.

This section describes the existing wetlands and other "Waters of the U.S." that are associated with the Project based on the 2013 study effort and relevant data from previous Project studies (Ebasco 1984 and HDR 2011). Under Section 404 of the Clean Water Act (CWA [Section 404]), activities that adversely affect wetlands and aquatic resources must be authorized through a Section 404 permit issued by the U.S. Army Corps of Engineers (USACE), and adverse impacts must be mitigated to the extent practicable. Wetlands are defined for regulatory purposes under the CWA as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Waters are defined as any non-vegetated area with a bed and bank, including intermittent, ephemeral, or perennial streams, rivers, or standing water (lakes and ponds).

Various wetland communities are located throughout the Project area and include herbaceous dominated, scrub-shrub dominated, and forested dominated wetlands associated with Grant Lake, Upper Trail Lake, Lower Trail Lake, Grant Creek, Inlet Creek, various tributaries and drainages, and steep slopes. As noted in Table 3.3-1, wetlands comprise a relatively small portion of the overall Terrestrial Resources Study area, but remain important to identify for the purpose of future Project planning and permitting.

In addition to mapping and describing wetland communities, wetland functional assessments are required as per general policies associated with USACE Section 404 permits (33 Code of Federal Regulations [CFR] 320), and the U.S. Environmental Protection Agency's (EPA) 404(b)(1) guidelines for specification of disposal sites for dredged or fill material (40 CFR 230). Further, the USACE Alaska District Regulatory Guidance Letter (RGL) 09-01 states that a wetland functional assessment is important to the wetland evaluation process because the "Alaska District will determine what level of mitigation is appropriate based upon the functions lost or adversely affected by permitted activities" (USACE 2009).

Wetlands provide numerous functions, which are defined as the natural chemical, physical, and biological processes occurring within a wetland and between a wetland and adjacent non-wetland areas that support overall ecosystem processes. Commonly-assessed wetland functions include the ability to moderate or convey floods or provide habitat for sensitive wildlife or plant species. Due to variables such as geomorphology, water source, and plant and animal communities, not all wetlands perform these functions equally.

The 2013 Wetland and Waters Study was conducted in accordance with the approved Study Plan (KHL 2013). The objectives of this study were to 1) delineate Project area wetlands and other potential "Waters of the U.S." in areas not previously mapped in 2010 that could potentially be impacted by the Project and 2) to assess the functions of the wetlands within the Project area and assign each wetland habitat to a USACE-defined functional category. The purpose of the wetlands and waters mapping and functional assessment component is to provide information to prepare a wetland report sufficient to apply for a Section 404 permit. The wetlands and waters report will describe locations near the Project that are potentially subject to the authority of Section 404 of the CWA and/or Executive Order 11990 (42 FR 26961, 3 CFR, 121).

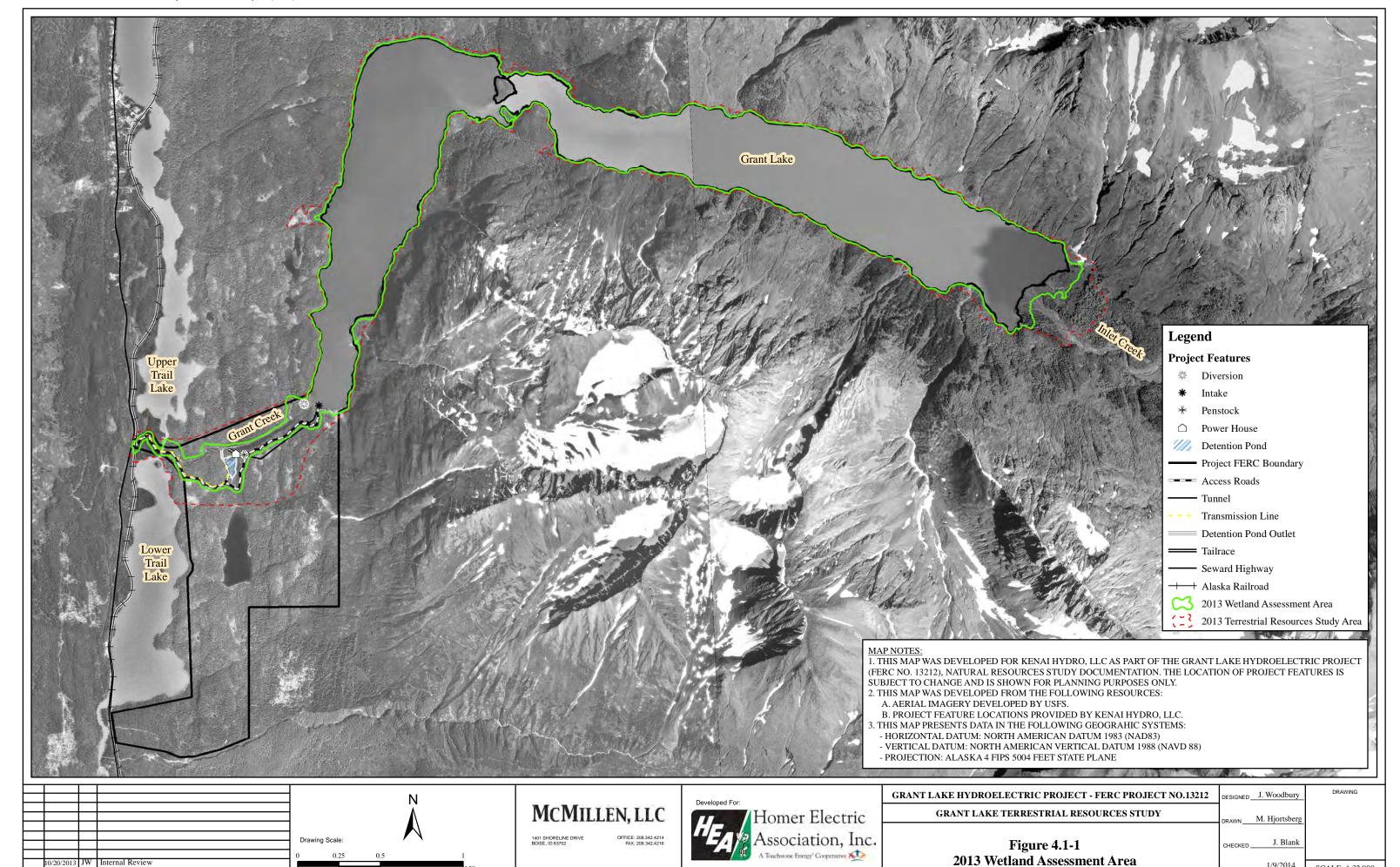
The subsections that follow provide a summary of the 2013 wetland delineation and functional assessment methods, results, and conclusions, as well as a summary of any variances from the 2013 Study Plan.

4.1. Study Area

The wetland and waters assessment area (referred to as the wetlands assessment area) mapped in 2013 is nested within the broader terrestrial resource assessment area that includes wetland and waters mapping conducted in 2010. Figure 4.1-1 provides an illustration of the wetland assessment area in relation to the collective terrestrial resource assessment area and the Project boundary.

The 2013 wetland assessment area focused on those areas where the Project has potential to have direct or indirect primary and/or secondary impacts on wetlands or waters, including surface water features such as lakes, ponds, creeks, and drainages. More specifically, the 2013 wetland assessment area includes the wetlands and waters that have the potential to be influenced by the following:

- The estimated operational minimum and maximum lake level fluctuations (692 feet NAVD 88 to 705 feet NAVD 88) around Grant Lake. Wetlands and waters were delineated in the field to the estimated 705 feet NAVD 88 contour line to capture possible hydrological influences from the operational maximum lake level.
- Project infrastructure (i.e. powerhouse, detention pond, access road, etc.). A 100-foot buffer was applied to all Project features to capture wetlands and waters that could be potentially affected by the construction and operation of these features.
- Secondary hydrological impacts associated with an altered flow regime in Grant Creek.
 A 100-foot buffer was applied to the north and south side of Grant Creek to capture any wetlands or waters that may be affected by a future operational flow regime in Grant Creek.



SCALE: 1:32,000

4.2. Methods

In order to achieve the Wetland Study objectives noted in Section 4 above, the following tasks were conducted in 2013:

- Prepared a preliminary wetland delineation map prior to field work using existing U.S.
 Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping (NWI
 2013) and interpretation of the most current aerial photography or satellite imagery,
 previous Project mapping (HDR 2011), and other available vegetation mapping and
 regional habitat associations (NatureServe 2008).
- Created a wetland assessment area using conservative buffers around Project facilities and potential maximum/minimum surface water fluctuations in Grant Lake and Grant Creek such that wetland and waters with the potential to be influenced by these factors were captured in the field-based and desktop analysis.
- Conducted a field survey of wetlands and waters in the road/transmission corridor, facility locations, at the inlet of Grant Lake, and at the dam site. The field delineation also included an assessment of potential secondary impacts to the wetlands and waters along the Grant Lake shoreline and Grant Creek corridor per recommendations from the USACE following the approval of the Study Plan (McCafferty 2013).
- Collected detailed information on soil conditions, hydrology, and plant community composition in representative upland and wetland sites using guidelines from the 1987 wetland delineation manual (USACE 1987) and 2007 Alaska Regional Supplement (USACE 2007), using standard 2007 Alaska Regional Supplement data sheets.
- Conducted a wetland functional assessment for all wetland and waters areas that have the potential to be directly or indirectly affected by the Project using a functional assessment methodology that was approved by the USACE on May 29, 2013 (McCafferty 2013).
- Collected coordinates of wetland data points and boundary points with a GPS unit in the field.
- Prepared a final wetlands and waters map for areas potentially disturbed by Project activities using field delineation and previous Project study results. Prepared corresponding tables summarizing wetland and waters types and acreages within the assessment area.
- Prepared a summary report (provided here) that includes a detailed map of the areas potentially disturbed by Project activities, a general map of the entire study area, methods and findings, a wetland functional assessment, and copies of the field data forms.

The methodologies discussed below were followed to conduct the 2013 wetland and waters delineation and functional assessment.

4.2.1. Wetland Delineation Methods

Wetlands and waters within the entire assessment area were mapped by experienced wetland scientists using a combination of desktop and field techniques. Wetland determinations were performed according to the 1987 Corps of Engineers Wetland Delineation Manual (Corps Manual) (USACE 1987) and the Alaska Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Regional Supplement; USACE 2007). Waters

were mapped using GPS points in the field, with subsequent editing in GIS using aerial photography and data collected by the Project aquatic habitat mapping study team (KHL 2014a) for Grant Creek side channel areas. The primary tasks for wetlands and waters mapping included the development of a preliminary wetland and waters map based on a review of existing maps and ecological information; a field-based wetland delineation and waters mapping to determine the presence or absence of wetlands and waters including characterization and delineation of the boundaries separating non-wetlands and wetlands by habitat type; and a post-field data analysis to refine and complete the wetlands and waters map within the wetland assessment area and the broader terrestrial resource assessment area.

The 2013 field effort focused on the wetland assessment area illustrated in Figure 4.1-1. Wetlands located outside of the 2013 wetland assessment area that are captured within the broader Terrestrial Resources Study area were mapped using 2010 wetland delineation data, NWI data, and aerial photo interpretation.

Wetlands and waters throughout the wetland assessment area and the broader terrestrial resource assessment area were mapped to the NWI (Cowardin et al 1979) subclass level and Brinson (1993) hydrogeomorphic position level, which describes communities based on site moisture regime, dominant plant growth form, and physiognomic descriptor. This level of mapping relies on aerial photo interpretation with extensive ground reference data. Prior to conducting the field-based delineation effort, a preliminary wetland map was developed in ArcGIS using the following data sources:

- 2010 Project area wetland delineation maps and data (HDR 2011)
- Aerial photography
- Elevation contours (4-foot vertical resolution)
- USFWS NWI mapping (NWI 2013)
- Field Indicators of Hydric Soils in Alaska (USDA-NRCS 2005)
- Alaska 2013 Regional Wetland Plant List (Lichvar 2013)
- Other supporting literature, reference materials, and data are listed in the References Section.

The preliminary map was then groundtruthed during the 2013 field-based delineation effort, which focused on collecting data within the wetland assessment area identified in Figure 4.1-1. Data was collected in accordance with the currently accepted methods for wetland determination in Alaska, described in the Regional Supplement. This "three parameter approach" employed in wetland determination requires the three essential characteristics of wetlands (hydrophytic vegetation, hydric soils, and wetland hydrology) be present to have a positive wetland determination. A total of 41 field determination points (DP) (24 wetland DPs and 17 upland DPs) and 82 observation points (OP) were collected within the wetland assessment area in 2013. At each field determination point, wetland scientists completed a USACE wetland determination form, took representative site photographs, documented the hydrogeomorphic position of the wetland location, and documented general field observations. In addition, the location of wetland DPs representative wetland/upland boundary points, and other notable features were recorded with a Trimble GeoXH 2005 series GPS unit. Similar information was collected at OPs; however, formal delineation datasheets were not filled out for these locations.

Following the field-based wetland delineation, a desktop analysis was then used to refine and complete the vegetation mapping effort. This evaluation included an analysis of DP data, OPs, existing vegetation mapping, NWI mapping, aerial photographs, and surface hydrology data. Wetland boundaries were refined using GPS boundary points and corresponding vegetation cover signatures in aerial photographs. NWI class codes (Cowardin et al. 1979), hydrologic modifiers, and hydrogeomorphic classes were assigned to each wetland polygon through this process.

For the purposes of mapping within the terrestrial resource assessment, wetland or vegetation types were based on the predominant ecosystem and vegetation of the wetland as a whole and not necessarily on narrow bands or inclusions of other wetland/vegetation types or uplands. Many habitats in the Project area consisted of mosaics of wetland/vegetation types. Dominant vegetation types were typically used to characterize habitats, but sometimes a combination of vegetation types was used to describe habitat within the Project area, with multiple vegetation communities comprising a single wetland type.

4.2.2. Functional Assessment Methods

This portion of the report presents the process of assessing wetland and waters functions, and categorizing vegetated wetlands into USACE functional classification categories, per the USACE Alaska District RGL 09-01 (USACE 2009). A preliminary version of the functional assessment method for vegetated wetlands was presented to and approved by USACE representative Katie McCafferty in May 2013 to ensure that all of the USACE-required elements would be included. The functional assessment of the non-vegetated wetlands (waters) was specifically discussed with Katie McCafferty as part of the March 18, 2014 agency meeting in Anchorage, Alaska as well as in subsequent discussions.

4.2.2.1. Waters Functional Assessment Methods

Waters (non-vegetated wetlands) were divided into the following four functional classes for the purpose of the functional assessment: small streams (tributary streams), rivers (Grant Creek and Inlet Creek), the Trail Lake Narrows, and Grant Lake. The moving water functional classes (small streams, Grant and Inlet creeks, and Trail Lake Narrows) were assessed using the guidance provided in the streams functional assessment framework presented in the USACE's Functional Objectives for Stream Restoration (Fischenich 2006), which was further expanded upon in the U.S. EPA's A Function-Based Framework for Stream Assessment and Restoration Projects (Harman et al. 2012). Fifteen functions were assessed, within five areas, as presented in Table 4.2-1. A detailed description and indicators of each function are provided in Fischenich (2006). Grant Lake was assessed using a similar framework and functions as presented in Fischenich (2006) and Table 4.2-1, with adaptations made to better assess lake functions (e.g., an assessment of natural lake level fluctuations and natural shoreline erosion, as part of the hydrodynamics function).

For each moving water functional class, functions were assessed as being present or absent using a tabular format, based on the presence of certain hydrogeomorphic (i.e., water source or landscape position) or hydrologic characteristics, using field observations and data available in a GIS. For all of the functional classes (including Grant Lake), a description and rational for the

presence/absence determination were presented in the narrative text, including discussion of whether a functional class might function at the lower or higher end for that function. While intermittent and perennial small streams were assessed collectively as a single functional class, a description of how these streams might function differently is also provided. No data form was completed for the waters assessment, and waters functional classes were not categorized for compensatory mitigation purposes.

System Dynamics	Stream evolution processes					
	Energy management					
	Riparian succession					
II-dealers	Surface water storage processes					
Hydrologic Balance	Surface/ subsurface water exchange					
Darance	Hydrodynamic character					
Sediment	Sediment continuity					
Processes and	Substrate and structural processes					
Character	Quality and quantity of sediments					
D: -1:1	Biological communities and processes					
Biological	Necessary aquatic and riparian habitats					
Support	Trophic structures and processes					
Chemical	Water and soil quality					

Chemical processes and nutrient cycles

Landscape pathways

Table 4.2-1. Functions assessed for moving waters, from Fischenich (2006).

4.2.2.2. Wetlands Functional Assessment Methods

Processes and

Pathways

Vegetated wetlands were grouped into functional classes based on vegetation and hydrogeomorphic characteristics; each functional class was then evaluated for its ability to perform 11 pre-defined functions. The following 11 hydrologic, biogeochemical, ecological, and social functions were assessed using the recommendations provided in RGL 09-01 (USACE 2009) (these functions are defined later in this section):

- 1. Flood flow alteration
- 2. Sediment removal
- 3. Nutrient and toxicant removal
- 4. Erosion control and stabilization
- 5. Production and export of organic matter
- 6. General wildlife habitat suitability
- 7. Fish habitat
- 8. Native plant richness
- 9. Educational, scientific, recreational, or subsistence use
- 10. Groundwater interchange
- 11. Uniqueness and heritage

Based on their functional rating (low, moderate, high) for each of the above functions, the wetland functional classes were assigned to one of the USACE Categories I-IV presented in RGL 09-01 (USACE 2009), which are intended to describe the ecological service provided by wetlands to the overall landscape or ecosystem. The categorization system used by USACE contains four categories, I-IV, with Category I being the highest functioning wetlands and Category IV being degraded and low functioning wetlands (USACE 2009).

Because wetland functions are difficult and time-consuming to measure directly, ecosystem characteristics (e.g., vegetation, hydrologic regime, soil, and landscape variables) are used as a surrogate to determine wetland function. Therefore, during the 2013 wetland delineation, the characteristics of the wetlands associated with the 24 wetland DPs were assessed using the *Wetland Functions Data Form- Alaska Regulatory Best Professional Judgment Characterization* (USACE 2009) (referred to as the functional assessment data form). Wetlands were rated as having a low, moderate, or high capacity to perform each function, based on the presence of certain hydrogeomorphic (i.e. water source or landscape position) or vegetation characteristics. The characteristics that were assessed at each DP are presented on the functional assessment data forms, located in Appendix 2a. In addition to the data collected on the functional assessment data form, information gathered by the Project's fisheries (KHL 2014b), wildlife (Section 5 of the Terrestrial Resources Report), cultural (KHL 2014c), recreation (KHL 2014d), water quality (KHL 2014e) and geomorphology (KHL 2014f) teams was also used to evaluate wetland functions.

The 24 wetland DPs were grouped into representative wetland functional classes based on an integration of the vegetation, hydrogeomorphology, and the sub-set of the Project area where the functional class was located, resulting in 15 wetland functional classes which are presented in Section 4.3, Results section below. The 124 wetland polygons mapped within the 2013 wetland assessment area were then assigned to one of the wetland functional classes, which provided the framework within which each wetland function was evaluated. The 24 polygons where DPs were located were assigned to the functional class associated with their DP; the remaining 100 polygons that were not directly assessed using a wetland DP were assigned to the most applicable wetland functional class. Many of the remaining 100 mapped polygons were assessed in the field using the OPs described in the wetland delineation section above; although functional assessment data forms were not completed at OPs, the detailed OP descriptions were used to assign these polygons to a functional class. Polygons with neither a DP nor an OP were assigned to functional classes using the data gathered during the desktop portion of the wetlands assessment described in the wetland delineation section above (e.g., with 2010 delineation data, NWI mapping, elevation contours, and aerial imagery).

The 15 wetland functional classes were stratified across three sub-areas within the wetland assessment area, referred to as functional assessment areas: 1) the transmission corridor / facilities area which includes the road/transmission line corridor, as well as associated Project facilities; 2) the Grant Creek corridor which includes the area along Grant Creek, including floodplain areas, between Grant Lake and Trail Lake; and 3) the Grant Lake area which includes the area along the edge of Grant Lake. The Grant Lake area was further divided into three sub-areas, the lake inlet (the flat area surrounding the lake inlet at the eastern end of Grant Lake including along Inlet Creek), lake shore (the lake fringe where the steep shoreline meets the lake,

outside of the inlet and outlet areas), and lake outlet (where Grant Creek exits Grant Lake). Wetland functions were assessed collectively by wetland functional class (e.g., for all of the herbaceous depressional wetlands within the assessment area) rather than for each individually mapped wetland.

The RGL 09-01 (USACE 2009) lists the functions that the Alaska District of the USACE recommends evaluating for Alaska wetlands, the characteristics associated with wetlands that perform each function (on their wetlands assessment data form, see Appendix 2a), as well as the number of characteristics required for a wetland to perform at a low, moderate, or high capacity for a given function. Based on the RGL 09-01 method if a function is evaluated for a given wetland, unless the evaluator is certain that the wetland did not perform the function, the wetland is at a minimum rated as "low" for that function, even if it does not provide any of the listed characteristics. Further, the provision of (i.e. answering "yes" to) a single characteristic automatically ranks the wetland as "moderate" rather than "low". For example, a wetland might only have one of the characteristics listed (e.g. dense woody vegetation, for the "flood flow alteration" function), yet the RGL 09-01 method would still rank this wetland as having a moderate capacity to perform that function. Therefore, wetlands were only ranked as "low" for a function if they did not provide any of the listed characteristics.

Wetlands that were not evaluated for a function because they did not meet certain criteria (e.g. adjacency to a fish-bearing stream for the "fish habitat" function) were listed as "not applicable" (NA). Note that wetlands were assessed based on their current condition, and not on their potential future condition if the proposed Project were constructed.

While the RGL 09-01 provides characteristics associated with each wetland function, it does not provide a specific definition for each function. Therefore, based on the characteristics listed in the RGL 09-01 data form (see Appendix 2a), as well as best professional judgment by wetland scientists, the 11 functions are defined as follows:

- 1. Flood Flow Alteration. This function is defined as a wetland's capacity to reduce flood flows (e.g. channelized or sheet flow) through storage and desynchronization in any area of a watershed, including streams or floodplains, by temporarily storing or slowing water passage. Most wetlands have topographic, soil, and vegetation attributes that contribute to their ability to retain and detain storm flows and snowmelt runoff. Precipitation and flood water is stored or used in wetlands via percolation into the soil, transpiration by plants, evaporation from surface waters, and detention in depressions, micro-topography, or low-lying landforms. Wetlands with no outlets, or constricted outlets, perform this function best.
- 2. Sediment Removal. Sediment removal refers to a wetland's capacity to remove suspended sediment from surface water and stabilize it within the wetland. This can occur, for example, when the energy associated with moving water is dissipated by dense wetland vegetation or allowed to spread out and pool in wetland micro-topography or depressions. None of the wetlands within the Project area are subject to an anthropogenic sediment source; however, the Grant Lake inlet wetlands receive suspended glacial till from Inlet Creek.
- 3. *Nutrient and Toxicant Removal*. This function is defined as the capacity of a wetland to remove suspended or dissolved nutrients and/or toxicants from groundwater and/or

surface water through the conversion to other forms (e.g. detention in vegetation or transformation to a gas). Wetland soils, plants, and organisms provide complex physical, chemical, and biological mechanisms for improving water quality. Nutrients, metals, and contaminants are retained by vegetation and the physical structure of the wetland; nutrients are incorporated into the vegetation biomass, absorbed by soils, or transformed by chemical and microbial pathways. Wetlands that have restricted outlets, ponding, a low slope angle, pronounced micro-topography, or are located in depressions provide a high level of this function because they can detain or retain water for longer periods of time.

- 4. *Erosion Control and Shoreline Stabilization*. This function is defined as the capacity of a wetland to dissipate the erosive forces of waves and streamflow, due to the ability of wetland vegetation to bind and stabilize soil within the root zone. This function was only evaluated for wetlands that are associated with shorelines of ponds, lakes, or stream banks.
- 5. Production and Export of Organic Matter. This function is defined as the capacity of a wetland to produce organic matter (e.g. dissolved or particulate carbon or detritus), and to export this organic matter to downstream or downflow environments. The exported organic matter is important for the support of primary and secondary productivity. Wetlands with dense deciduous vegetation, with a surface water (or inundated) connection to downstream environments perform this function best.
- 6. General Wildlife Habitat Suitability. This function is defined as the capacity of a wetland to provide general wildlife habitat support to birds and terrestrial mammals, including denning, forage, or breeding/nesting habitat. This includes habitat support for species that spend part or all of their life cycle in wetlands individually, or as part of a mosaic of wetlands in a local landscape. Sensitive plant or animal species (e.g., threatened or endangered species) were not evaluated as part of this function; they were instead evaluated as part of the "uniqueness and heritage" function. In addition to the data collected as part of the wetland delineation, this function was also evaluated using data collected for the Wildlife Study associated with the Project.
- 7. Fish Habitat. Fish habitat includes those biological, physical, and chemical attributes that support all life stages of fish. This function is defined as the capacity of a wetland to directly provide habitat to anadromous or resident salmonids. This function was only evaluated for wetlands that are associated with fish-bearing streams or lakes, such as riparian fringe wetlands that might be inundated during periods of high water and provide slower water refuge for salmonids. It was not assessed for wetlands providing indirect fish habitat (e.g., hydrologic or water quality related functions); these indirect fish habitat support functions were assessed as part of separate functions listed here. The fish habitat function was not assessed for Grant Lake or tributaries because no salmonids are present in the Grant Lake system upstream of Grant Creek. In addition to the data collected as part of the wetland delineation, this function was also evaluated using data collected for the Fish and Geomorphology Study associated with the Project.
- 8. *Native Plant Richness*. This function evaluates the capacity of a wetland to produce an abundance and diversity of hydrophytic plant species. Wetland plant communities contribute to many of the other functions (e.g., wildlife habitat). The production and support of abundant wetland vegetation is vital to the maintenance of energy and nutrient

- cycling as well as other fundamental processes that are unique to wetlands and are a significant part of overall ecosystem functioning at the landscape level.
- 9. *Educational or Scientific Value*. This function is defined as the capacity of a wetland to provide educational or scientific opportunities to the public. These opportunities are limited to those that are water dependent and are directly related to wetlands. This function does not include general recreational activities. The entire Project area is located on State or USFS public lands.
- 10. *Uniqueness and Heritage*. The Uniqueness and Heritage function is defined as the capacity of a wetland to provide unique habitat due to biological, geological, cultural, or other features that are considered to be rare. Regarding rare biological characteristics, this function is provided by the following wetlands: 1) wetlands that are USFWS-designated critical habitat for threatened or endangered species; 2) wetlands with documented presence of threatened, endangered, or "priority" species designated by the USFWS, with "priority" species defined as those listed as candidates for Endangered Species Act (ESA) listing by the USFWS. This function is also provided by wetland types that are considered highly valuable and/or vulnerable by the State, as discussed in the Alaska Department of Fish & Game (ADF&G) Wildlife Action Plan (ADF&G 2006). In addition to the data collected as part of the wetland delineation, this function was also evaluated using data collected by the vegetation and wildlife teams associated with the Project (Sections 3 and 5 of this Terrestrial Resources Report respectively).
- 11. *Groundwater Interchange*. Groundwater interchange is defined as the capacity of a wetland to recharge and/or discharge to groundwater. Groundwater recharge is the infiltration of groundwater from a wetland into the underlying aquifer. Recharge replenishes the local or regional groundwater supply. Groundwater discharge is the net upward movement of water from an aquifer source to the wetland. Discharge creates and maintains wetlands and stream flows, supports plant and animal populations, and provides water for other uses. In addition to the data collected as part of the wetland delineation, this function was also evaluated using input by the water resources teams associated with the Project (KHL 2014e, KHL 2014f).

4.2.2.3. Categorization

The functional assessment method for the vegetated wetlands described above ultimately describes the capacity (low, moderate, high) of a functional class to perform a particular function. The results of the functional assessment were then converted into the functional Categories I, II, III, or IV as defined by RGL 09-01 (USACE 2009), with Category I being the highest functioning wetlands and Category IV being degraded and low functioning wetlands. These categories are used during the Section 404 permitting process to determine mitigation ratios for unavoidable impacts to jurisdictional wetlands, as part of compensatory mitigation planning and sequencing (avoidance, minimization, etc.). For example, unavoidable impacts to Category I wetlands may require a mitigation ratio of 2:1 to 3:1, meaning for every 1 acre of Project-related Category I wetland impacts the applicant would be required to restore, enhance and/or preserve 2 to 3 acres of similar wetland habitat or function to offset the loss (USACE 2009). Waters (non-vegetated wetlands) were not categorized as part of this report.

USACE (2009) RGL 09-01 defines the four categories as follows:

- Category I High Functioning Wetlands. These wetlands are the "cream of the crop." Generally, these wetlands are less common. These are wetlands that 1) provide a life support function for threatened or endangered species that has been documented; 2) represent a high-quality example of a rare wetland type; 3) are rare within a given region; or 4) are undisturbed and contain ecological attributes that are impossible or difficult to replace within a human lifetime, if at all.
- Category II High to Moderate Functioning Wetlands. These wetlands are those that 1) provide habitat for very sensitive or important wildlife or plants; 2) are difficult to replace; or 3) provide very high functions, particularly to fish or wildlife habitat.
- Category III Moderate to Low Functioning Wetlands. These wetlands can provide important functions and values. They can be important for a variety of wildlife species and can provide watershed protection functions depending on where they are located. Generally, these wetlands will be smaller and/or less diverse on the landscape than Category II wetlands. [Note that, for this assessment, Category III wetlands were functioning at a moderate level, as none of the Category III wetlands assessed were low functioning.]
- Category IV Degraded and Low Functioning Wetlands. These wetlands are typically the smallest, often isolated with very little vegetation diversity, and generally already degraded by human activities. Regional differences allow for a more narrow definition of this category.

Categories were assigned to functional classes using the Category definitions provided above (USACE 2009), as well as being based on the percent functional capacity at which each functional class was performing. Percent functional capacity was calculated as follows: Functional ratings were assigned a value—1, 2, or 3—for a low, moderate or high rating, respectively. The rating values were then summed for each functional class and divided by the highest possible rating value for a given functional class if the class were performing at 100 percent capacity. For example, if a functional class were evaluated for 10 of the 11 functions (e.g., for all functions except "fish habitat"), then the sum of the rating values would be divided by 30, the total rating if the functional class were performing at its highest capacity. Wetlands were then ranked as Category I, II, III, or IV based on their percent function capacity score. In addition, due to the importance of threatened, endangered, or priority species habitat, as well as salmonid habitat, if a functional class was rated as high for either the "uniqueness and heritage" or "fish habitat" function it was automatically categorized at a minimum as Category I or II, respectively.

4.3. Results

The following subsections present the results of the field-based and desktop wetland delineation and functional assessment. Data from the 2010 and 2013 field efforts provided a total of 41 field-based DPs and 82 OPs that were used to refine the wetland determination and functional assessment results presented in this report. In addition, this section provides a brief synopsis of the potential regulatory status of Project area wetlands with respect to USACE jurisdiction (USACE 2010) and Executive Order 11990 (42 FR 26961, 3 CFR, 121).

4.3.1. Wetlands Delineation and Waters Mapping

The field-based wetland delineation and waters mapping was conducted by qualified wetland scientists between July 16 and July 26, 2013, within the wetland assessment area defined in Figure 4.1-1. Weather conditions during the delineation were warm and dry; therefore, when appropriate, the delineators erred on the conservative side and assumed wetland hydrology could be present during cooler/wetter conditions.

A description of the wetland and waters types delineated within the wetland assessment area and terrestrial resource assessment area is provided below. Figure 4.3-1 through Figure 4.3-6 is an illustrative map set of the wetlands and waters. Table 4.3-1, Wetland and Waters – detailed, summarizes the various wetland and waters types by dominant vegetative cover (for vegetated wetlands), hydrogeomorphic positions (Brinson 1993), and NWI classification (vegetation and water regime, Cowardin et al. 1979), as well as cumulative areas within the terrestrial resource assessment area and 2013 wetland assessment area. Table 4.3-2, Wetland and Waters – summary, provides a summary of acreage and percent cover for each primary vegetation and surface water community within the terrestrial resource assessment area and the 2013 wetland assessment area; tributary streams that were too narrow to map as polygons are reported in linear feet.

Vegetated wetland communities mapped within the Grant Lake wetland assessment area include herbaceous dominated, scrub-shrub dominated, forested dominated wetlands associated with lacustrine, slope, and riparian areas. Waters mapped within the wetland assessment area include small tributary streams, Grant Creek, Inlet Creek, Grant Lake, and the Trail Lake Narrows. Ponds were also identified within the broader terrestrial resources assessment area, but not within the wetlands assessment area.

4.3.1.1. Herbaceous Wetland Communities

Herbaceous dominated wetlands within the terrestrial resources assessment area are associated with *depressional*, *lacustrine*, and *riverine* areas.

Depressional wetlands are those wetlands occurring within discrete topographic depressions primarily located on the south side of Grant Creek in the vicinity of the access road and transmission corridor. The largest individual wetland within the Project area is a depressional wetland located in the proposed tailrace detention pond area. Vegetation composition and hydrological conditions vary from strongly herbaceous to mixed herbaceous and scrub-shrub communities with saturated to seasonally flooded hydrologic conditions.

Lacustrine wetlands include persistent and non-persistent emergent wetlands, aquatic beds, and vegetated shoreline communities that are directly attached to or border Grant Lake or Upper Trail and Lower Trail lakes. The majority of these lakeshore communities are purely herbaceous, although some are mixed herbaceous and scrub-shrub types. Hydrological conditions range from saturated, seasonally flooded, semi-permanently flooded, to permanently flooded or inundated.

Riverine wetlands are those wetlands that are adjacent to and hydrologically influenced by Inlet Creek, Grant Creek, and their tributaries, as well as drainages associated with Grant Lake. These wetlands include both herbaceous only and herbaceous / scrub-shrub communities with hydrological conditions ranging from saturated to seasonally flooded. Riverine wetlands also include those wetlands found within an intricate wetland-upland mosaic associated with the Grant Creek side-channel complex immediately downstream of the proposed powerhouse location and along the Grant Creek side channel at its confluence with Upper Trail and Lower Trail lakes. Wetlands within the riparian mosaic are found in small topographic depressions or as intermittent wetland fringe along the side channels, typically occurring as saturated and seasonally flooded herbaceous stands and/or herbaceous and scrub-shrub mixed communities.

Table 4.3-1 and Table 4.3-2 include details and a summary of the acreages, data points, and dominant species associated for each herbaceous wetland type. Wetland datasheets, field notes, and representative photos of herbaceous dominated wetlands are included in Appendix 2a.

4.3.1.2. Scrub-Shrub Wetland Communities

Scrub-shrub dominated wetlands within the terrestrial resource assessment area are associated with *depressional*, *lacustrine*, and *riverine* areas.

Depressional scrub-shrub wetlands occur throughout or within portions of topographic depressions (usually as concentric rings) primarily on the south side of Grant Creek in the vicinity of the proposed access road and transmission corridor. Vegetation composition and hydrological conditions vary from predominantly broadleaf and/or needle leaf scrub-shrub to mixed scrub-shrub and herbaceous communities with saturated to seasonally flooded hydrologic conditions.

Lacustrine scrub-shrub wetlands include persistent shoreline communities that are directly attached to or border Grant Lake or Upper Trail and Lower Trail lakes. The majority of these lakeshore communities are broadleaf shrub-shrub with some mixed scrub-shrub and herbaceous types. Hydrological conditions range from saturated to seasonally flooded.

Scrub-shrub dominated *riverine wetlands* are broadleaf scrub-shrub and broadleaf scrub-shrub / herbaceous mixed wetlands that are adjacent to and hydrologically influenced by Inlet Creek, Grant Creek, and their tributaries, as well as drainages associated with Grant Lake. Seasonally flooded hydrologic conditions are typical of the riverine scrub-shrub wetlands within the Project area. Riverine wetlands also include scrub-shrub dominated wetlands found within an intricate wetland-upland mosaic associated with the Grant Creek side-channel complex approximately 300 feet downstream of the proposed powerhouse location. There are also two small riverine wetland-upland mosaics located on the north bank of Grant Creek immediately below the falls. Scrub-shrub wetlands within the riparian wetland/upland mosaic are found in small topographic lows or as intermittent wetland fringe along the side channels, typically occurring as temporarily flooded, saturated to seasonally flooded scrub-shrub stands and/or scrub-shrub and herbaceous mixed communities.

Table 4.3-1 and Table 4.3-2 include details and a summary of the acreages, data points, and dominant species associated for each scrub-shrub wetland type. Wetland datasheets, field notes, and representative photos of scrub-shrub dominated wetlands are included in Appendix 2a.

4.3.1.3. Forested Wetland Communities

There are two forest-dominated wetlands present within the Project area, occurring along a seasonal drainage on a north-facing slope and as a narrow fringe on the east side of the proposed tailrace detention pond area. In both cases, the wetland hydrology is more strongly influenced by the surrounding sloped topography that presumably contributes to the saturated hydrologic conditions found in both locations.

Tables 4.3-1 and 4.3-2 include details and a summary of the acreages, data points, and dominant species associated with the forested wetland type. The wetland datasheets, field notes, and representative photos of this wetland are included in Appendix 2a.

4.3.1.4. Waters

Waters within the Project area include the non-vegetated portions of Grant Lake (deep and shallow lake margins) and Trail Lake Narrows, Grant Creek, Inlet Creek, Project area tributaries and drainages (collectively referred to as small streams), and ponds. Waters assessed totaled 1,659.9 acres, with 1,650.1 assessed within Grant Lake and Trail Lake Narrows (99 percent), and 9.8 acres (9.8 percent) assessed within Grant and Inlet Creek channels. Small streams that were too narrow to map as polygons (e.g. less than 20 feet wide) were mapped as lines and reported in linear feet. A total of 13,582 linear feet of small streams were mapped within Project area (Table 4.3-2). All waters documented as part of the study had an ordinary high water mark, determined by a distinct vegetation line (e.g. a transition from unvegetated to vegetated, or from wetland to mesic or non-wetland vegetation), and/or geomorphic indicators (e.g., erosion line from wave action or stream flow).

Surface water is persistent and perennial for the lakes, ponds, and main channels of Grant Creek and Inlet Creek as well as for some of the primary tributary stream segments to these waterbodies. In addition, there are intermittent non-vegetated floodplains and outwash fans associated with Inlet Creek that were dry during the time of the delineation but are very likely inundated during higher flow events. Table 4.3-1 and Table 4.3-2 include details and a summary of the acreages for lakes, ponds, and rivers, and acreage or linear feet of small streams (depending on width), as well as data points associated with each open water type. Field notes and representative photos of open water features are included in Appendix 2a.

4.3.1.4.1. Small streams

The small streams included all of the tributary streams to Grant Creek, Grant Lake, and Trail Lake, identified within the Project area. Perennial small streams were classified as Cowardin R3UB, perennial unconsolidated bottom; intermittent streams were classified as R4SB, intermittent stream bottom (Appendix 2a). All of the small streams were moderate to high gradient, single channel streams.

Stream type and water regime are denoted by NWI type and water regime modifier in tables and figures (i.e., R3UBH or R4SBC). All of these streams were moderate to high gradient, single channel streams. Of the 17 streams within the transmission corridor and Grant Creek corridor, only four were perennial (Figure 4.3-2). In contrast, most small streams at the Grant Lake inlet were perennial. Tributaries to Grant Lake were both perennial and intermittent.

4.3.1.4.2. Grant and Inlet Creeks

Grant and Inlet creeks are the two primary large perennial streams within the Project area, with Inlet Creek entering at the mouth of Grant Lake, and Grant Creek flowing out of Grant Lake, and into the Trail Lake Narrows (Figure 4.3-1). Grant Creek is classified as Cowardin R2UB, perennial unconsolidated bottom (Appendix 2a), with the entire length located within the wetlands assessment area (approximately 1 mile long). Inlet creek while only the confluence area (~200-300 feet) of Inlet Creek was located within the wetlands assessment area. Grant Creek has a mean annual flow of 200 cfs. Grant Creek geomorphology, water quality, and aquatic habitats and resources are described extensively in the resource reports completed for the Project (KHL 2014f, KHL 2014e, KHL 2014a, KHL 2014b, respectively). Studies of Inlet creek were limited to geomorphology studies associated with Grant Lake (KHL 2014f), and the wetlands and waters study described in this report.

The Project divided Grant Creek into six reaches for study purposes; reaches are described in detail in the geomorphology (KHL 2014f) report, but are summarized here. Reach 1 is the lower gradient, alluvial fan section at the confluence with Trail Lake; Reaches 2 and 3 are also low to moderate gradient, with extensive riparian side channel areas on the south side of the creek; Reach 4 is slightly higher gradient with no side channel habitat; Reach 5 is a high gradient (>6 percent), high velocity bedrock channel, referred to as the canyon section; Reach 6 is the high gradient section just below the outlet of Grant Lake.

4.3.1.4.3. Trail Lake Narrows

The Trail Lake Narrows area is located between Upper Trail and Lower Trail lakes (Figure 4.3-1 It is considered Cowardin lacustrine habitat (L1UB, lacustrine unconsolidated bottom) for the purposes of the wetland and waters mapping.

4.3.1.4.4. Grant Lake

Grant Lake is an approximately 6-mile long, 1,649 acre¹ oligotrophic lake classified primarily as Cowardin lacustrine limnetic (deepwater) unconsolidated bottom, L1UB; a very small area was lacustrine littoral (L2UB or L2US) at the lake outlet. Inlet Creek is the primary inlet stream entering at the far eastern end; Grant Creek is the only surface water outlet flowing out of the western end of the lake. It is separated into two portions by a shallow submerged bedrock ridge, with the lower half trending north-south and 262 feet at its deepest point, and the upper half trending east-west and 283 feet at its deepest point. Most of the lake shore is characterized by steep slopes, with flatter shoreline areas limited to the inlet and outlet areas, and small areas of wetland fringe. The shoreline is primarily bedrock, with more erodible areas where small

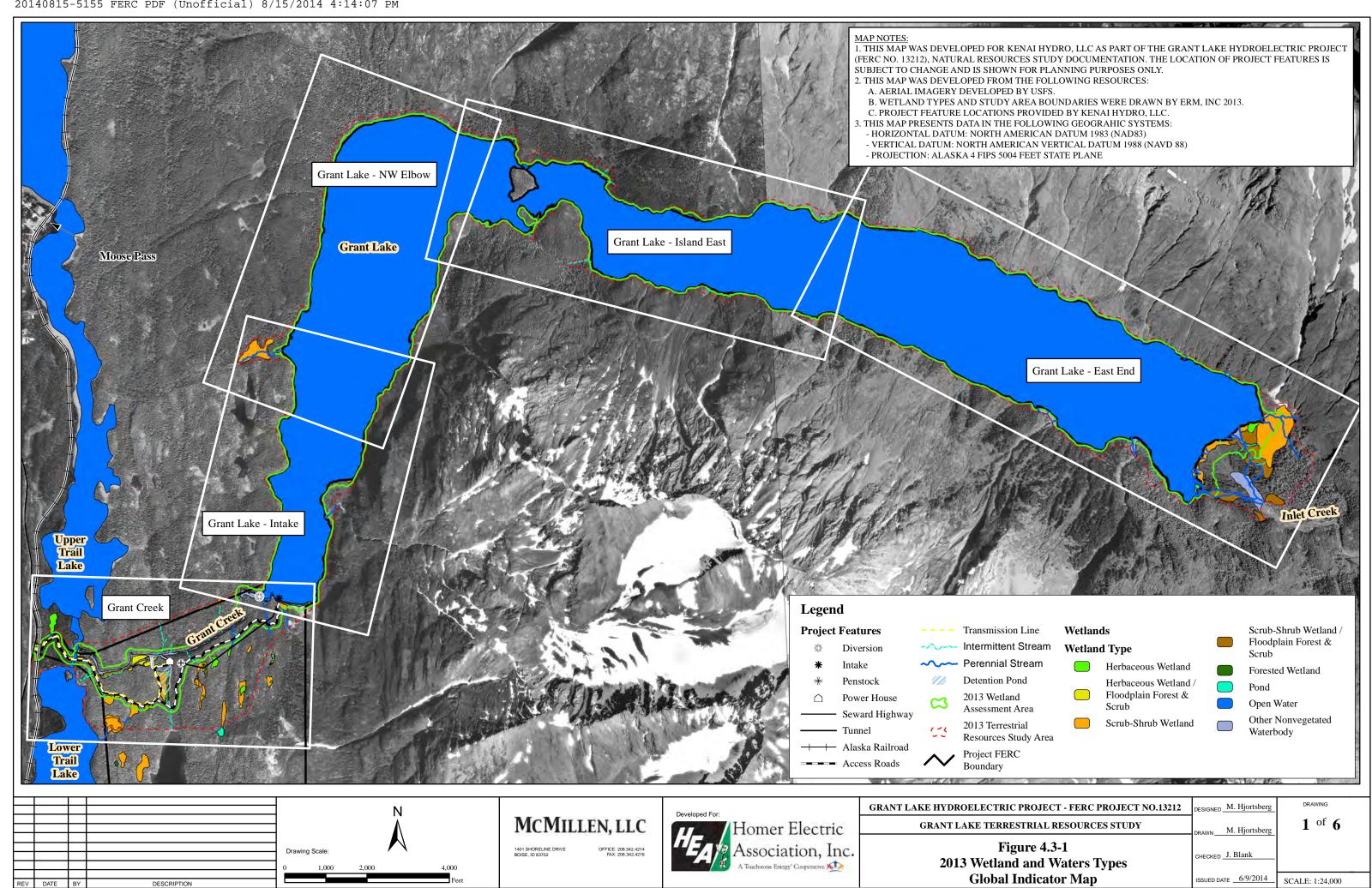
¹ As calculated based on 2013 study data.

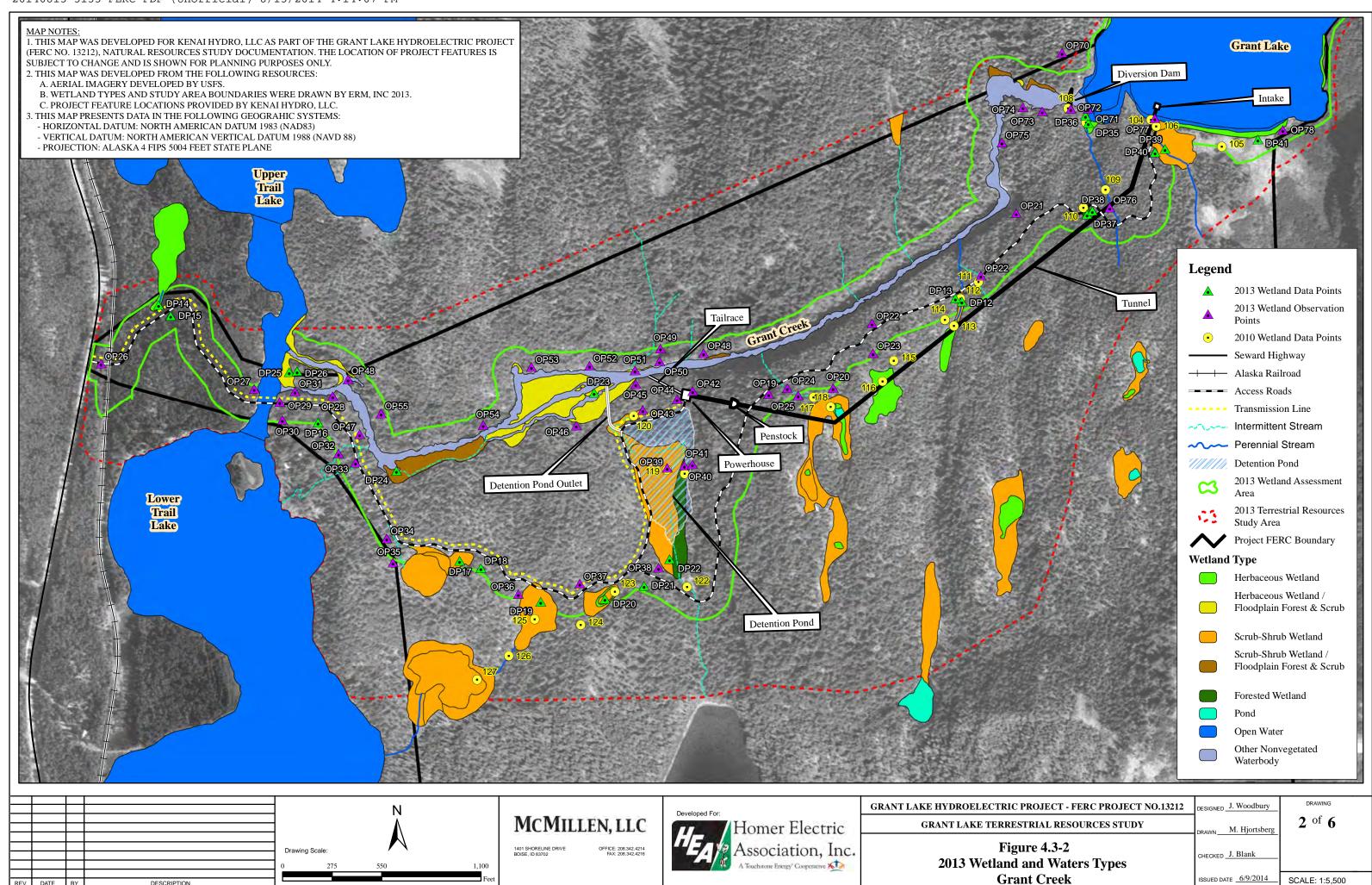
tributary drainages enter the lake forming alluvial fans. Grant Lake geomorphology and water quality are described extensively by the respective Project teams (KHL 2014f, KHL 2014e, respectively).

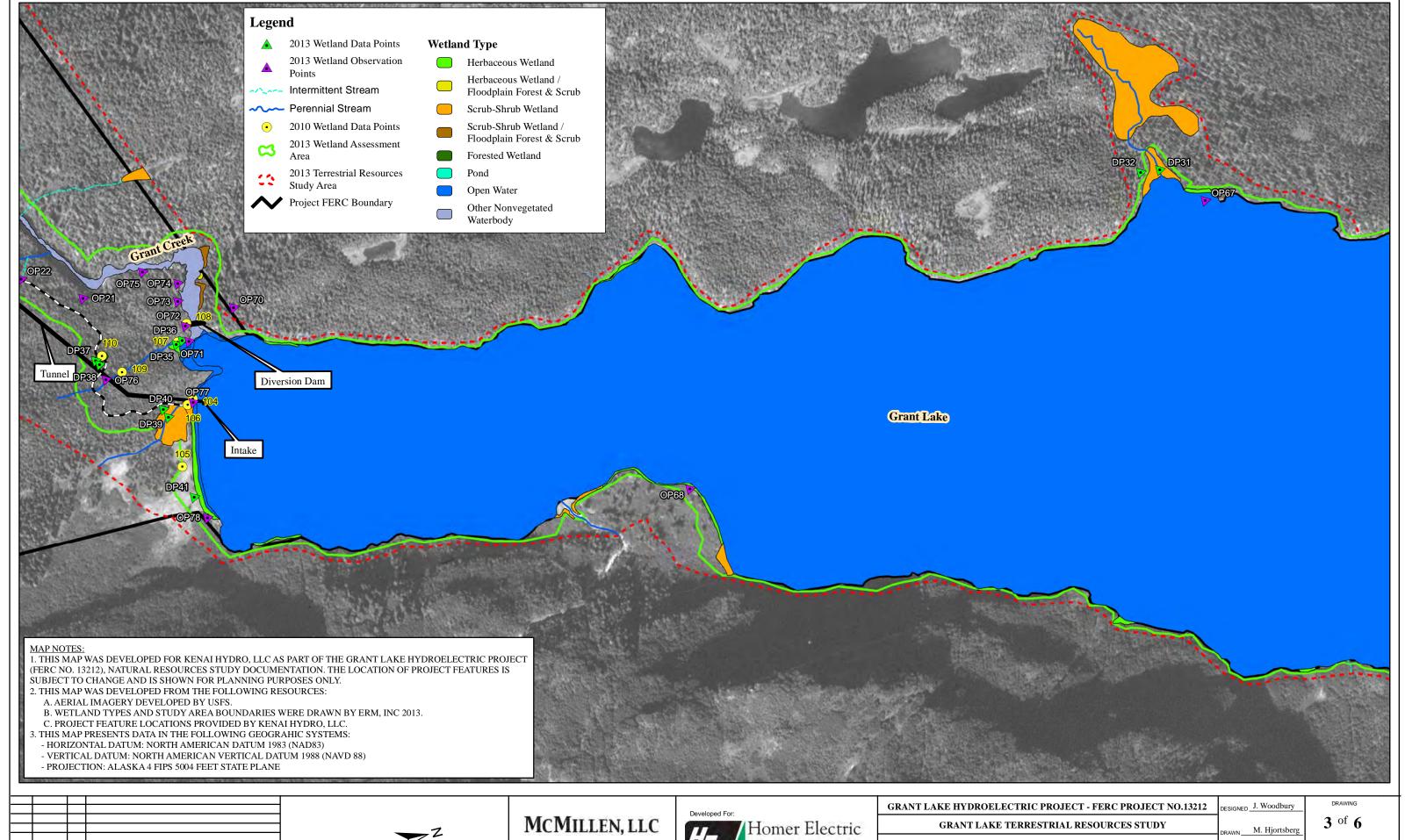
4.3.1.5. Regulatory Status of Project Area Wetlands

Regarding the potential jurisdictional status of Project area wetlands and waters, it is expected that Grant Lake, Upper Trail and Lower Trail lakes, Inlet Creek, Grant Creek, and all of the drainages and tributaries associated with those waterbodies will fall under the jurisdiction of the USACE under Section 404 of the CWA (USACE 2010). In addition, all of the wetlands associated with these waterbodies will also likely fall under the auspice of Section 404 (riverine, lacustrine, and depressional wetlands with a hydrologic connection to a water body). The jurisdictional status of the wetlands affected by the Project and how the Project would be required to compensate for unavoidable losses (if any) will ultimately be determined by the USACE during the Section 404 permitting process.

Federal agencies involved in the Project's FERC application review and approval process are required to consider impacts to wetlands under the directives of Executive Order 11990 (42 FR 26961, 3 CFR, 121). The purpose of Executive Order 11990 is "to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." Presumably, many of the potential wetland impacts described in Section 4.4, Conclusions, will be avoided or minimized through the development of site-specific, engineered controls and best management practices (BMP) during the Project's upcoming detailed engineering design phase.





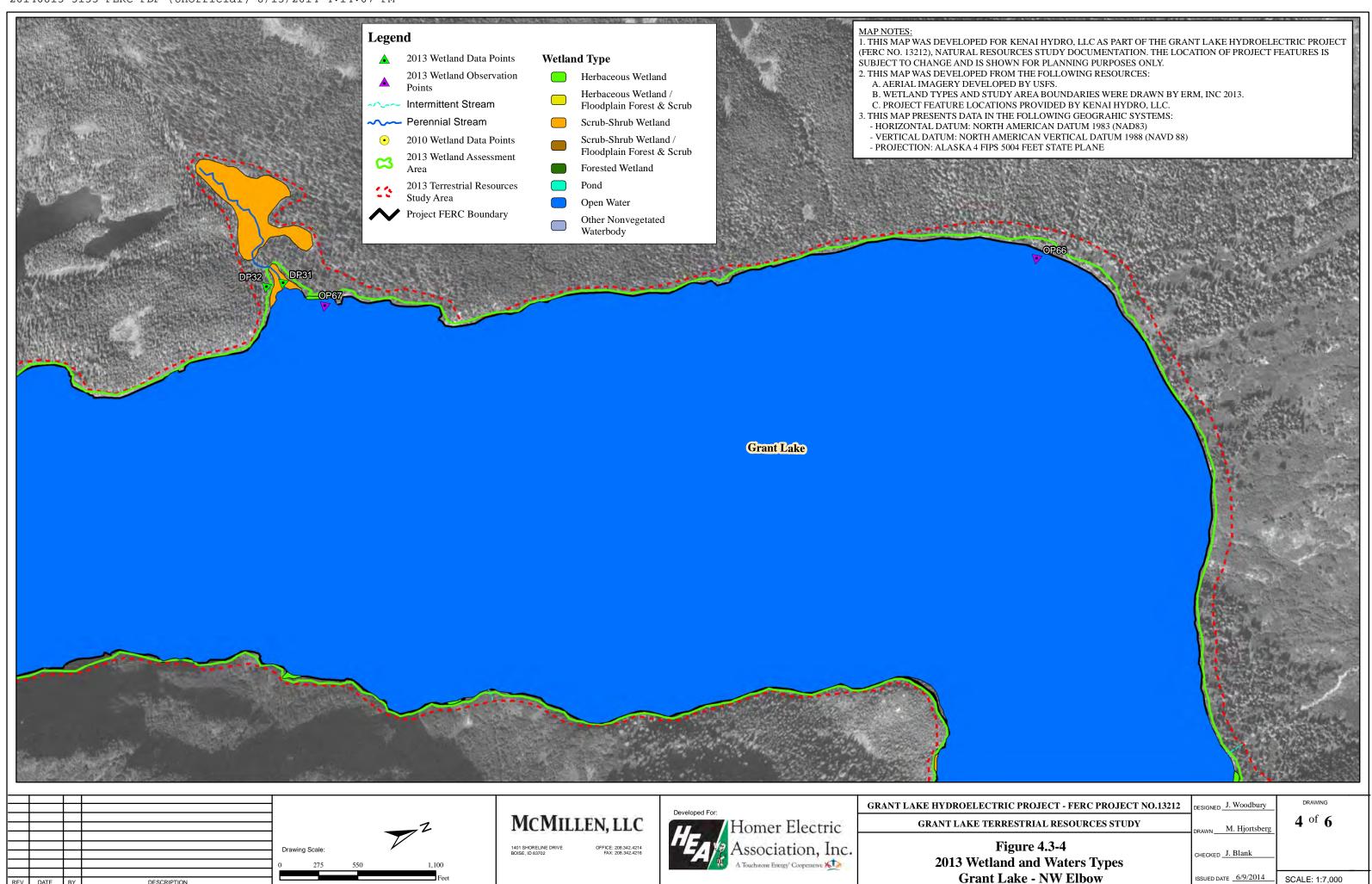


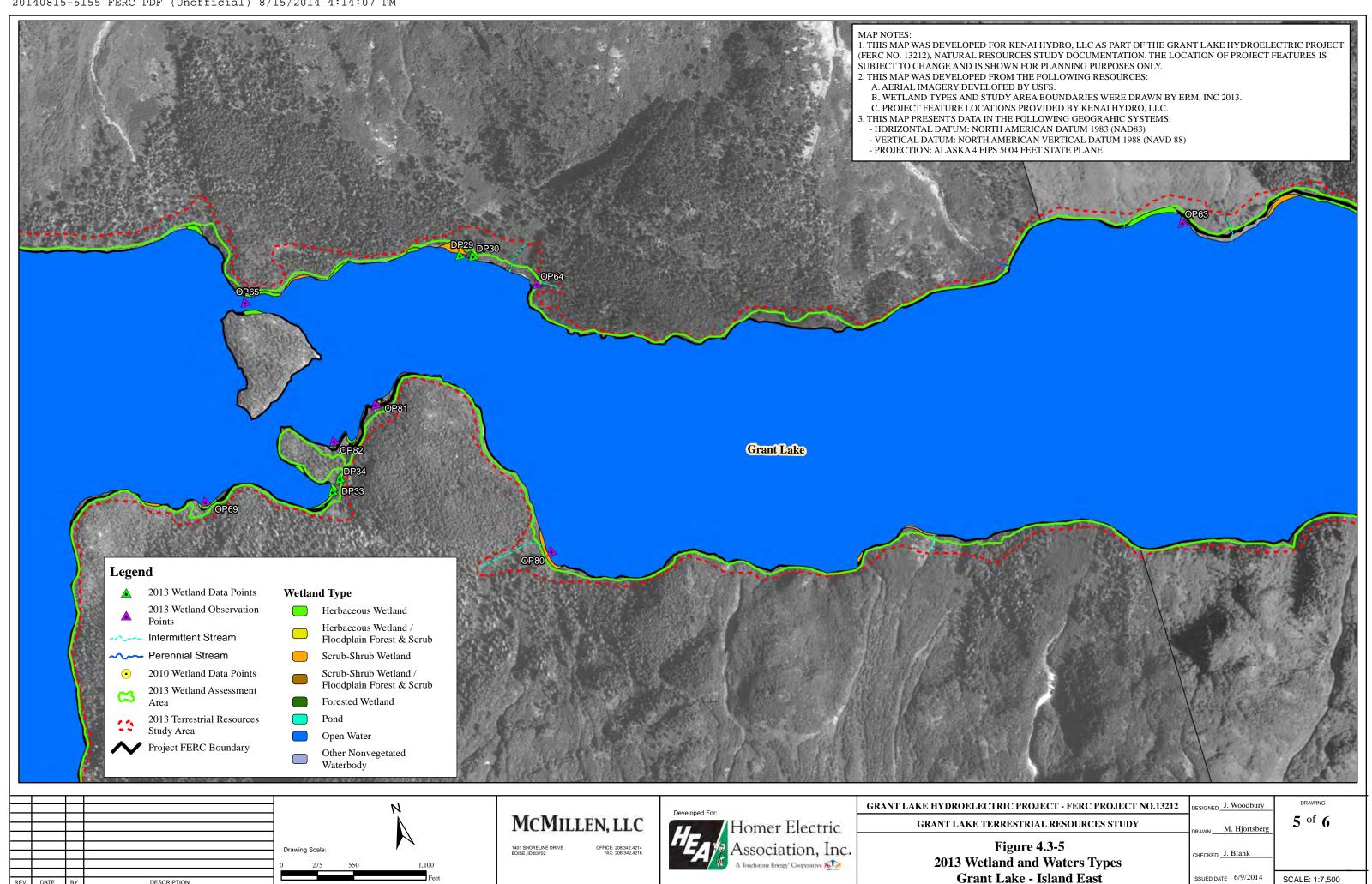
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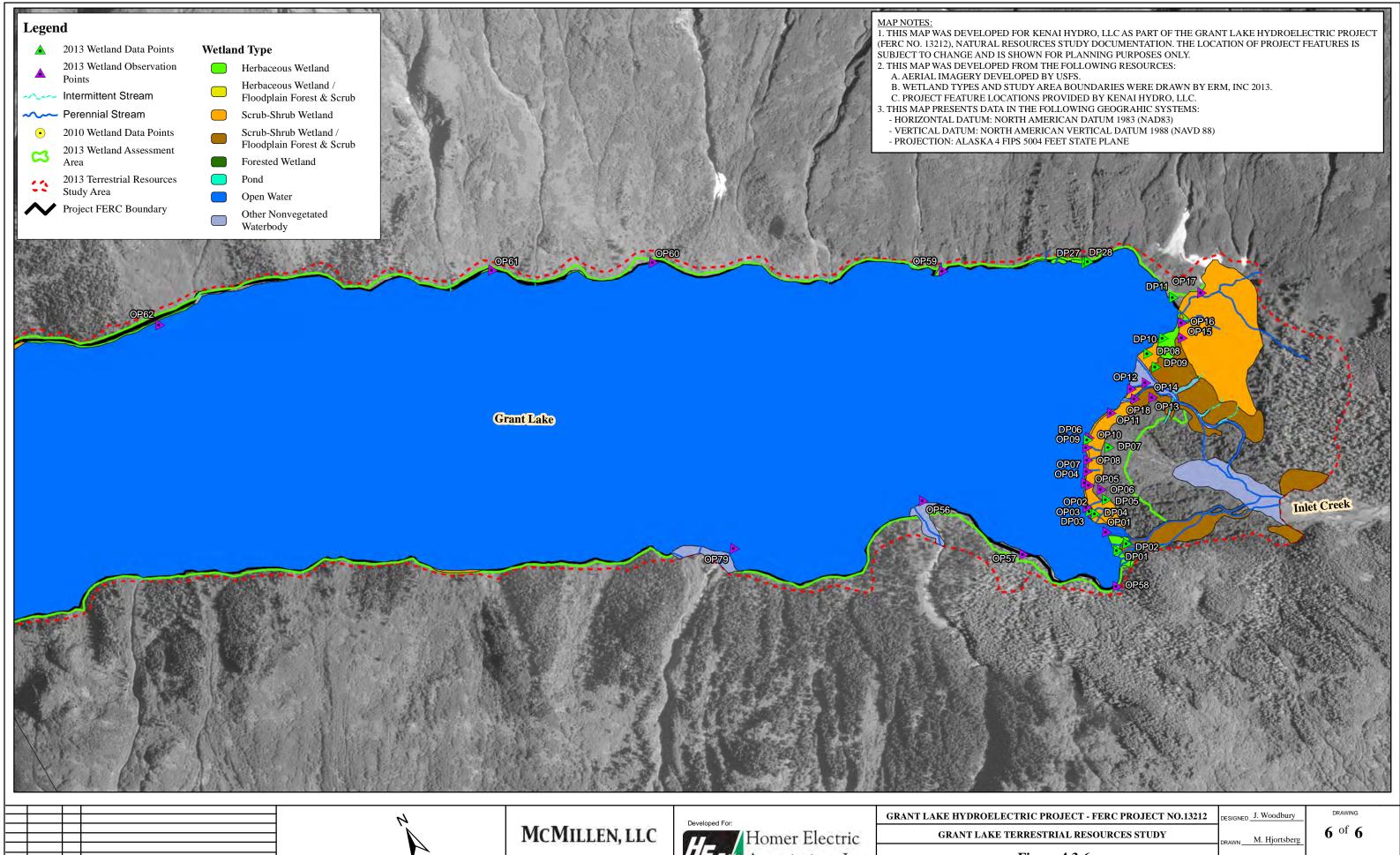
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GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212	DESIGNED J. Woodbury	DRAWING
GRANT LAKE TERRESTRIAL RESOURCES STUDY	DRAWN M. Hjortsberg	3 of 6
Figure 4.3-3 2013 Wetland and Waters Types	CHECKED J. Blank	
Grant Lake - Intake	ISSUED DATE <u>6/9/2014</u>	SCALE: 1:6,200







Association, Inc.

Figure 4.3-6 2013 Wetland and Waters Types

Grant Lake - East End

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ISSUED DATE <u>6/9/2014</u> SCALE: 1:9,900

 Table 4.3-1. Wetlands and waters—detailed.

					Area Mapped (Acres)			
	Wetland Cover Type	Hydrogeomorphic Position	NWI Class/ Subclass ¹	NWI Hydro Modifier ¹	Terrestrial Resource Assessment Area Acres	Wetland Assessment Area	Vegetation Description ²	
	Herbaceous Wetland -5155 FERC PDF (Unofficial) 8/15		PEM1	B, E, F, H	1.83	0.05	Palustrine emergent wetlands with saturated hydrologic conditions occurring throughout or within portions of Project area depressional features. Dominated by Drosera rotundifolia, Carex pauciflora, Rubus chamaemorus, Calamagrostis canadensis, Equisetum arvense. Wetland Points: OP55, (HDR 113, 116, 118,123); similar to DP14 but fewer scrub shrub.	
		Depressional	PEM1/SS1	E	0.24	0.08	Palustrine emergent and deciduous scrub-shrub mixed wetlands with saturated and seasonally flooded conditions occurring in a single depressional area within the transmission corridor west of Trail Lk. Dominated by Equisetum fluviatile, Comarum palustre, Sanguisorba canadensis, Calamagrostis canadensis, Salix barclayi, Betula glandulosa, Picea glauca. Wetland Points: DP14	
20140815-		PEM1 /2014 4:14:	B, E, F, H 07 PM	4.28	4.26	Palustrine emergent wetlands with hydrologic conditions ranging from saturated, seasonally flooded, semipermanently flooded, to permanently flooded typically occurring as a narrow fringe along portions of the Grant Lake shoreline. Dominated by Podagrostis aequivalvis, Poa palustris, Carex lenticularis, Carex utriculata, Calamagrostis canadensis, Equisetum arvense, Equisetum fluviatile, Carex aquatilis, Deschampsia caespitosa, Sanguisorba canadensis. Wetland Points: DP10, DP27, DP33, OP59, OP61, OP62, OP65, OP67, OP82		
		PEM1/SS1	B, C, E	1.21	1.20	Palustrine emergent and deciduous scrub-shrub mixed wetlands with hydrologic conditions ranging from saturated to seasonally flooded occurring typically as a narrow fringe along portions of the Grant Lake and Trail Lake shoreline. Dominated by Chamerion latifolium, Calamagrostis canadensis, Comarum palustre, Equisetum arvense, Sanguisorba canadensis, Alnus viridis, Betula glandulosa, Populus balsamifera, Salix alaxensis, Salix barclayi, Salix sitchensis. Wetland Points: DP01, DP35 (HDR107), OP60, OP68, OP69		
		H	Ierbaceous Wetla	and Subtotal:	7.56	5.60		
]	Herbaceous Wetland / Floodplain Forest & Scrub		PEM1	В, С, Е	0.61	0.61	Palustrine emergent wetlands with hydrologic conditions ranging from saturated to seasonally flooded occurring as narrow fringe along stream channels or as part of a complex wetland-upland mosaic complex associated with Grant Creek side channels. Dominated by Calamagrostis canadensis, Carex sitchensis, Equisetum arvense, Sanguisorba canadensis. Wetland Points: DP25, OP43, OP51, OP74	
		PEM1/SS1	С	2.50	2.50	Palustrine emergent and deciduous scrub-shrub mixed wetlands with seasonally flooded hydrologic conditions occurring in micro-topo lows within the complex riparian wetland-upland mosaic associated with the Grant Creek side channels. Dominated by Calamagrostis canadensis, Equisetum arvense, Athyrium felix-femina, Alnus viridis, Salix commutata. NOTE: Wetlands account for only 20% of the acreage associated with this mosaic community, the remaining 80% is upland. Wetland Points: DP23.		
	Не	lain Forest & Sc	rub Subtotal:	3.12	3.11			

Table 4.3-1, continued...

	er Hydrogeomorphic Position			Area Mapped (Acres)		4
Wetland Cover Type		NWI Class/ Subclass ¹	NWI Hydro Modifier ¹	Terrestrial Resource Assessment Area	Wetland Assessment Area	Vegetation Description ²
				Acres	Acres	
140815-5155 FERC PDF (Und		PSS1	B, E	5.97	0.21	Palustrine deciduous scrub-shrub wetlands wit saturated to seasonally flooded hydrologic conditions occurring throughout or within portions of Project area depressional features Dominated by Ledum decumbens, Betula glandulosa, Vaccinium uliginosum. Wetland Points: (HDR 129); similar to DP22
		PSS1/3	В, Е	3.35	0.14	Palustrine deciduous and broadleaved evergrescrub-shrub wetlands with saturated condition occurring throughout or within portions of Project area depressional features. Typically dominated by Rubus chamaemorus, Cronus canadensis, Emporium unigram, Betula glandulosa, Andromeda polifolia, Ledum decumbens. Wetland Points: None, similar vegetation to DP17
	Depressional (Unofficial) 8/15/	PSS1/EM1	B, E	5.64	2.95	Palustrine deciduous scrub-shrub and emerger mixed wetlands with saturated to seasonally flooded hydrologic conditions occurring throughout or within portions of Project area depressional features, including the proposed detention pond area south of Grant Creek. Dominated by Picea glauca, Salix barclayi, Equisetum fluviatile, and Calamagrostis canadensis. Wetland Points: DP22
		/2014 4:14: PSS3/EM1	07 PM B	3.56	0.60	Palustrine broadleaved evergreen scrub-shrub and emergent mixed wetlands with saturated hydrologic conditions typically occurring with portions of Project area depressional features. Dominated by Andromeda polifolia, Betula glandulosa, Emporium unigram, Carex pauciflora, Rubus chamaemorus, Equisetum arvense. Wetland Points: DP17, DP20; (HDR 127)
Scrub-Shrub Wetland		PSS4	В	0.11	0.00	Palustrine needle leaved evergreen scrub-shruwetland with saturated hydrologic conditions occurring in a single depressional feature sour of the transmission corridor on the west side of Trail Lake. Outside of 2013 wetland assessmarea, plant species not documented. Wetland Points: None, located outside of 2013 wetland assessment area
		PSS4/3/EM1	В	1.25	0.40	Palustrine needle leaved and broadleaved evergreen scrub-shrub and emergent mixed wetland with saturated hydrologic conditions occurring in a depressional feature within the transmission corridor. Dominated by Picea glauca, Rubus chamaemorus, Andromeda polifolia, Betula glandulosa, and Ledum decumbens. Wetland Points: DP19 (HDR 125)
		PSS1	C, E	19.36	8.21	Palustrine deciduous scrub-shrub wetlands wis saturated or seasonally flooded hydrologic conditions occurring as a narrow fringe along portions of the Grant Lake shoreline. Domina by Salix alaxensis, Salix pulchra, Salix barcla Alnus viridis. Wetland Points: OP12, OP15, OP80; (HDR106)
	Lacustrine	PSS1/EM1	В, С, Е	7.25	7.24	Palustrine deciduous scrub-shrub and emerger mixed wetlands with saturated and seasonally flooded hydrologic conditions occurring typic as a narrow fringe along portions of the Grant Lake shoreline, or as larger wetlands at the Gr Lake inlet or outlet. Dominant plant species include Salix sitchensis, Salix alaxensis, Salix barclayi, Alnus viridis, Betula glandulosa, Carhyemale, Carex canescens, Carex lenticularis, Equisetum arvense, Equisetum fluviatile, Calamagrostis canadensis, Chamerion latifolis Sanguisorba canadensis. Wetland Points: DPO DPO4, DPO6, DPO8, DP29, DP31, OP81

Table 4.3-1, continued...

[1 abie 4.5-1, conur				Area Mapped (Acres)			
	Wetland Cover Type	Hydrogeomorphic Position	NWI Class/ Subclass ¹	NWI Hydro Modifier ¹	Terrestrial Resource Assessment Area Acres	Wetland Assessment Area	Vegetation Description ²	
					Acres	Acres	Palustrine deciduous scrub-shrub wetlands with	
			PSS1	С	0.07	0.03	seasonally flooded hydrologic conditions associated with small drainages within the Project area. Dominated by Salix sitchensis, Salix alaxensis, Alnus viridis, Sanguisorba canadensis, Rubus chamaemorus, Calamagrostis canadensis, Cronus canadensis. <i>Wetland Points: OP58</i>	
		Riverine	PSS1/EM1	C, E	1.35	0.97	Palustrine deciduous scrub-shrub and emergent mixed wetlands with saturated to seasonally flooded hydrologic conditions associated with small drainages within the Project area. Dominated by Salix pulchra, Salix barclayi, Alnus viridis, Tsuga mertensiana, Equisetum arvense, Equisetum fluviatile, Calamagrostis canadensis, Agrostis mertensii. Wetland Points: DP12, DP39	
			Scrub-Shrub W	etland Subtotal:	47.91	20.75		
20140815-	5155 FERC PDF	(Unofficial) 8/15/	PSS1 (2014 4:14:	A, B, C, E 07 PM	15.36	5.67	Palustrine deciduous scrub-shrub wetlands with hydrologic conditions ranging from temporarily flooded, saturated, to seasonally flooded associated with Project area active floodplain and outwash fan features. Dominated by Salix sitchensis, Salix alaxensis, Alnus viridis, Populus balsamifera, Calamagrostis canadensis, Equisetum hyemale. Wetland Points: DP02, DP09	
	Scrub-Shrub Wetland / Floodplain Forest and Scrub	Riverine	PSS1/EM1	C, E	2.22	2.22	Palustrine deciduous scrub-shrub and emergent mixed wetlands with saturated to seasonally flooded hydrologic conditions occurring in micro-topo lows within the complex riparian wetland-upland mosaic associated with the Grant Creek side channels. Dominated by Alnus viridis, Salix commutata, Calamagrostis canadensis. NOTE: Wetlands account for only 10% of the acreage associated with this mosaic community, the remaining 90% is upland. Wetland Points: DP24, OP73, OP74	
			PSS1/FO1	С	0.04	0.04	Palustrine deciduous scrub-shrub and deciduous forested mixed wetlands with seasonally flooded hydrologic conditions associated riparian fringe along Grant Creek. Dominated by Salix sitchensis, Salix alaxensis, Alnus viridis, Betula papyrifera. Wetland Points: Documented on field map only; similar to DP24 but with more mature deciduous trees	
	S	Scrub-Shrub / Floodplain Fo	orest & Scrub W	etland Subtotal:	17.62	7.94		
	Forested Wetland	Slope	PFO4	В	0.81	0.81	Palustrine needle leaved evergreen forested wetland with saturated hydrologic conditions; within the Project area this includes one wetland which is associated with the west-facing slope adjacent to the detention pond. Dominated by Picea glauca, Salix barclayi, Betula papyrifera, and Agrostis stolonifera. Wetland Points: OP40 (HDR121)	
		-	PFO4/EM1	В	0.08	0.08	Palustrine needle leaved evergreen forested and emergent mixed wetland with saturated hydrologic conditions associated with a seasonal drainage on a north-facing slope. Dominated by Salix sitchensis, Salix alaxensis, Alnus viridis, Tsuga mertensiana, Rubus chamaemorus, Cronus canadensis. Wetland Points: DP37, (HDR 110)	
-			Forested Wo	etland Subtotal:	0.89	0.89	Unvegetated deep water (greater than 6.6 ft deep)	
			(Grant Lk.)	Н	1648.20	1648.20	of Grant Lake. Wetland Points: None Unvegetated shallow water (less than 6.6 ft deep)	
	Omon Water	Lacustrine	(Grant Lk.)	Н	0.82	0.82	associated with the outlet of Grant Lake. Wetland Points: None Unvegetated shallow water (less than 6.6 ft deep)	
	Open Water	Lacustrine	(Grant Lk.)	C Total Count I b	0.09	0.09	associated with the outlet of Grant Lake. Wetland Points: None	
			L1UB (Trail Lk. Narrows)	Total Grant Lk.	1.54	1.02	Unvegetated deep water (greater than 6.6 ft deep) of Trail Lake Narrows. Wetland Points: None	
ŀ				Water Subtotal:	1650.65	1650.12		

Table 4.3-1, continued...

					Area Map	ped (Acres)		
	Wetland Cover Type	Hydrogeomorphic Position	NWI Class/ Subclass ¹	NWI Hydro Modifier ¹	Terrestrial Resource Assessment Area	Wetland Assessment Area	Vegetation Description ²	
					Acres	Acres		
	Pond	Depressional	PUB	Н	0.06	0.00	Shallow ponds (less than 20 acres in size) associated with depressional features within the Project area. All were outside the 2013 wetland assessment area. Wetland Points: None, located outside 2013 wetland assessment area	
				Pond Subtotal:	0.06	0.00		
			R2UB (Grant Cr.)	Н	6.74	6.74	Active channel and unvegetated portion of the Grant Creek main channel and side channels. <i>Wetland Points: OP28, OP45, OP48, OP51</i>	
			R3UB (Outwash fans and Inlet Cr.)	С	12.03	3.07	Unvegetated channel beds and outwash fan located at the inlet of Grant Lake, including areas of Inlet Creek channel that are flooded during high flow and likely during high precipitation events, but dry during low flows. Wetland Points: OP14, OP56, OP79	
	Non-Vegetated	Riverine	R3UB (Small streams, perennial)	Н	17,772 ft	8,303 ft	Unvegetated perennial permanently flooded (flowing) active stream channels mapped as stream lines throughout Project area. Includes small stream tributaries to Grant Creek, Grant Lake, and active channels of Inlet Creek. No acreages associated with these stream lines. Wetland Points: DP12,(HDR112), DP14, DP31, DP39, OP01, OP02, OP03, OP07, OP08, OP09, OP16, OP18, OP56, OP58, OP59, OP68, OP76 (HDR109), OP79; (HDR126)	
20140815-	5155 FERC PDF	(Unofficial) 8/15,	R4SB (Small streams, intermittent)	07 PM C	10,818 ft	5,279 ft	Unvegetated intermittent seasonally flooded (not flowing during survey) stream channels mapped as stream lines throughout Project area. Includes small stream tributaries to Grant Creek and Grant Lake. No acreages associated with these stream lines. Wetland Points: DP17, OP11, OP25, (HDR117) OP32, OP33, OP43, OP64, OP80; (HDR111)	
		N	on-Vegetated Ri	verine Subtotal:	18.77	9.82		
				TOTALS	1745.04	1697.22		

Notes:

^{1.} NWI and hydro modifier codes are the Wetlands and Deepwater Habitats Classification table (Cowardin et al 1979) in Appendix 2b.

^{2.} DP =wetland delineation point, ERM 2013 field; OP = observation point, ERM 2013 field; (HDR ##) = HDR data point, HDR 2010 field; Wetland types w/o specific data points were assessed as part of the ERM 2013 field study, the HDR 2010 field study, or through a desktop analysis. Community associations were determined based on field knowledge of the wetland communities.

Table 4.3-2. Wetlands and waters—summary.

		strial Resources sessment Area		13 Wetland essment Area
Vegetated Wetland Communities	Acres	% Coverage	Acres	% Coverage
Herbaceous Wetlands	7.6	10%	5.6	15%
Herbaceous Wetland / Floodplain Forest & Scrub	3.1	4%	3.1	8%
Scrub-Shrub Wetlands	47.9	62%	20.8	54%
Scrub-Shrub Wetland / Floodplain Forest & Scrub	17.6	23%	7.9	21%
Forested Wetlands	0.9	1%	0.9	2%
Vegetated Wetland Subtotals	77.1		38.3	
Non-Vegetated Waters- Lakes, Ponds, Rivers	Acres	% Coverage	Acres	% Coverage
Open Water - Grant Lake	1,649.1	99%	1,649.1	99%
Open Water - Trail Lake Narrows	1.5	0%	1.0	0%
Open Water - Ponds	0.1	0%	0	0%
Riverine- Grant Creek main and side channels	18.8	1%	9.8	1%
Riverine- Outwash fans and areas of Inlet Creek channel	12.0	1%	3.1	0%
Non-Vegetated Water Acres Subtotals	1,669.5		1,659.9	
ACREAGE TOTAL	1,746.6		1,698.2	
Non-Vegetated Waters¹- Streams	Feet		Feet	
Streams (perennial)	17,772	62%	8,303	61%
Streams (intermittent)	10,818	38%	5,279	39%
FEET TOTAL	28,590		13,583	

Notes:

4.3.2. Functional Assessment Results

Due to the undisturbed nature of the Project area, most of the wetlands and waters within the wetland assessment area were functioning at their highest potential, thus this functional assessment is considered a rough measure of their undisturbed, "baseline" functional condition. However, this does not mean that all of the evaluated functions were present or performing equally for each of the functional classes, nor is the highest functional potential equal between functional classes (i.e., for many functions, maximum functional potential is inherently greater for certain functional classes as compared to others), due to differences in hydrology, geomorphology, and vegetation (for the vegetated wetlands). Potential existing disturbance sources within the Project area are limited to residences along the Trail Lake Narrows that could cause shoreline erosion and water quality degradation, and walk-in fishing on Grant Creek. Results of the functional assessment are presented for non-vegetated wetlands (referred to as waters) and vegetated wetlands below. Note that this section is a summary of potential functions, the characteristics of several of the functional classes are discussed in greater detail in their respective resource reports (wildlife, vegetation, geomorphology, water quality, and fisheries).

^{1.} Streams that were mapped as lines rather than polygons due to width.

4.3.2.1. Waters Functional Assessment

Four functional classes were assessed as part of the waters functional assessment: small streams, Grant and Inlet Creeks, the Trail Lake Narrows, and Grant Lake. Table 4.3-3 presents the functional assessment ratings (present, absent, or not assessed) for each of the three moving water functional assessment classes. The small streams functional class included all of the tributary streams to Grant Creek, Grant Lake, and Trail Lake, identified within the wetland assessment area. Grant Creek included both the main and side channels.

Eight functions were present for small streams, all 15 functions were present for Grant Creek and Inlet Creek, and for the Trail Lake Narrows. As a deepwater habitat, Grant Lake was not evaluated as part of Table 4.3-3, but its assessment is presented in the narrative below.

Table 4.3-3. Results of waters functional assessment for moving waters functional classes.

			Functional Class	
	Waters Function	Small Streams	Grant and Inlet Creeks	Trail Lake Narrows
	Stream evolution processes	X	X	X
System Dynamics	Energy management	X	X	X
	Riparian succession	0	X	X
	Surface water storage processes	0	X	X
Hydrologic Balance	Surface/ subsurface water exchange	0	X	X
	Hydrodynamic character	X	X	X
G P A D	Sediment continuity	X	X	X
Sediment Processes and Character	Substrate and structural processes	X^1	X	X
and Character	Quality and quantity of sediments	X	X	X
	Biological communities and processes	X^1	X	X
Biological Support	Necessary aquatic and riparian habitats	X^1	X	X
	Trophic structures and processes	X	X	X
	Water and soil quality	\circ	X	X
Chemical Processes and Pathways	Chemical processes and nutrient cycles	0	X	X
	Landscape pathways	X	X	X

Notes:

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1/1111111170110	THE HIGH	lerate gradient	DETERMINA	i sinan	SHEATHS

4.3.2.1.1. Small Streams

A total of 13,582 linear feet of small streams were mapped within the wetlands assessment area (Table 4.3-2). Twenty-three of the small stream segments were perennial (8,303 feet); 36 stream segments (5,279 feet) were intermittent with no water flowing in the channel during the 2013 assessment. Small streams were evaluated as having eight of the 15 functions present (Table4.3-3). While perennial and intermittent streams were evaluated equally for this presence/absence assessment, overall, perennial streams would be expected to perform all of the functions at a

higher level than intermittent streams. The following is a summary of the results of the waters functional assessment presented in Table 4.3-3. Two of the System Dynamics functions were present; stream evolution was considered present but limited for this class due to their very young nature and moderate to high gradient. These streams do dissipate energy, as many of them had considerable alluvial fans at their mouths. Riparian succession was considered absent (or very limited) due to their moderate to high gradient, high velocity channels, which lacked significant movement required for riparian succession. Most of the vegetation succession along these channels was due to natural slope vegetation succession (e.g., along Grant Lake associated with alder monocultures in avalanche paths), or forest succession (e.g., along all other channels) and not due to the stream channel. Stream banks were naturally stable for the small streams, with minimal erosion.

Only one of the Hydrologic Balance functions was present for the small streams, maintenance of hydrodynamic character, as the small streams do exhibit a natural flow regime. Due to their steeper gradient, they do not contribute to surface water storage, and contribute only negligibly to surface/subsurface water exchange. Small streams provide varying degrees of Sediment Process and Character functions. These moderate to high gradient small streams maintain sediment continuity, as they provide for natural erosion, transport, and deposition processes, as well as maintenance of substrate sorting and armoring within their channel and downstream receiving waters. They also maintain the quality and quantity of sediments, contributing to the natural sediment regime within their channel and downstream waters. Although they have limited habitat complexity, the more moderate gradient perennial (and possibly intermittent) small streams entering Grant Creek likely contribute to the maintenance of the quality of substrate and structural processes by providing rearing habitat for young fish. However, it is unlikely that the steeper high gradient perennial or intermittent small streams provide this habitat.

All the Biological Support functions were present for small streams (although minor), with significantly greater support provided by the perennial streams as opposed to the intermittent streams. The moderate perennial (and potentially intermittent) small streams likely provide necessary aquatic habitats within their channel; however, with less habitat complexity and flow they were not considered as productive as Grant Creek and Inlet Creek. They also maintain trophic structure and processes at a minimal level by acting as pathways for riparian-derived detrital inputs (e.g., leaf and needle litter) to the adjacent and downstream channels, contributing nutrients to the system. Although minimal, the moderate gradient perennial tributaries to Grant Creek likely provided some direct support for biological communities, e.g. rearing habitat for young fish, although these small streams were not surveyed as part of the 2013 fisheries study. The Project fisheries report (KHL 2014b) noted that during the 1981-1982 fish surveys, sculpin and three-spine stickleback were the only fish observed in Grant Lake, and no fish were observed in Grant Lake tributaries.

One Chemical Processes and Pathways function was present in the small streams class. Small streams, particularly perennial streams, act as landscape pathways, maintaining both longitudinal and lateral (detrital inputs) connectivity. With their limited water retention time, steeper gradient, and limited hydric riparian soils, the small streams do not likely function to improve water and soil quality, nor maintain chemical processes and nutrient cycles.

4.3.2.1.2. Grant and Inlet Creeks

Salmonid species are present and spawn in reaches 1-4 of Grant Creek; the upstream end of Reach 5 provides a barrier to upstream salmonid migration, and no salmonids are found in Grant Lake (KHL 2014b). Where lower gradient side slopes allow riparian communities to exist along Grant Creek they are primarily mid to later successional scrub shrub and non-wetland forested areas, with limited herbaceous and scrub shrub wetland fringes and side channel areas (as described in the vegetated wetland section above). The portion of Inlet Creek within the wetland assessment area is a low gradient, dynamic, braided system with extensive sediment and bedload deposition, forming an alluvial fan where it flows into Grant Lake. Due to a more active disturbance regime, riparian areas along Inlet Creek are primarily early to mid-successional herbaceous and scrub shrub communities, with some floodplain forest and scrub riparian areas and backwater areas associated with beaver damming.

All of the functions were present for Grant and Inlet creeks (Table 4.3-3) with most of the functions performing at a high level compared to small streams. Grant and Inlet creeks have significant System Dynamic functions, with active stream evolution processes, energy management, and riparian succession. The Grant Creek riparian area is in a later successional state than the Inlet Creek riparian area, with less armoring, greater channel movement and disturbance occurring along Inlet Creek. Both creeks have extensive side channel systems with associated vegetated riparian wetlands (evaluated in the vegetated wetlands section below). The exception to the extensive riparian is within the Grant Creek upper Canyon Reach. Hydrologic Balance functions are also present, although surface water storage processes are more limited than the lotic habitats (e.g., Grant Lake). Primary water storage areas include the side channel areas and microtopographic features on both creeks, and the beaver ponds along Inlet Creek. Surface/subsurface water exchange occurs within the hyporheic zones along both creeks, likely to a greater degree than small streams. The rivers maintain their hydrodynamic character with natural flow regimes, including the characteristic spring and fall peak flows resulting from snowmelt and fall rains respectively, as well as additional flashy storm events spring through fall (KHL 2014e). Banks are relatively stable for Grant Creek, which is well armored; Inlet Creek banks are naturally eroding to the extent typical of a braided gravel bed channel.

Sediment Process and Character functions are performing at a high level in Grant and Inlet creeks. They provide for sediment continuity (e.g., erosion, transport, and deposition processes), as well as maintain the natural quality and quantity of sediments. Inlet creek is a dynamic system, characterized by glacial sediment deposits, gravel, and cobble, which form a highly erodible alluvial fan as it enters Grant Lake, providing a source of suspended sediment to Grant Lake. Grant Creek is a steep bedrock canyon in the upper reach; the geomorphology report for the Project (KHL 2014f) identified the Canyon Reach as the sole source of bedload material for the downstream reaches. This material is thought to be carried downstream during episodic events (e.g., a landslide into Grant Lake that pushes a surge of water into Grant Creek) providing for the continued development of the alluvial fan at the confluence of Grant Creek with the Trail Lake Narrows (KHL 2014f). With the exception of the Canyon Reach of Grant Creek, Grant Creek and Inlet Creek have a high degree of structural complexity for maintenance of substrates and structural processes. Both creeks have large woody debris, side channel habitat, diversity of substrates, healthy overhanging riparian vegetation, and frequent disturbance events which are important for maintaining this structural diversity (KHL 2014 a). Grant Creek also has habitat

within undercut bank areas, and large boulders which create low velocity habitat. With the presence of salmonids, Grant Creek provides habitat for a greater diversity of species than Inlet Creek (KHL 2014b).

Grant Creek and Inlet Creek provide high quality Biological Support functions. Both streams provide for maintenance of biological communities and processes with diverse assemblages of native species and age classes, including fish and benthic macroinvertebrates (KHL 2014b, KHL 2014g, respectively), with Grant Creek providing greater aquatic species diversity than Inlet Creek due to the presence of salmonids in Grant Creek (KHL 2014b). These creeks also provide necessary aquatic and riparian habitats, with excellent in-channel and riparian habitat diversity, as described above related to the substrate and structural process function described in the paragraph above (e.g., large woody debris, side channel habitat, diversity of substrates, and healthy overhanging riparian vegetation) (KHL 2014a). The exception to this habitat diversity is the canyon section of Grant Creek (Reach 5), which provides minimal low velocity habitat within a steep bedrock channeled reach (KHL 2014a). Reaches 2 and 3 of Grant Creek are considered the most ecologically productive, due to the complex side channel habitat, and increased habitat complexity in the main channel. Both creeks provide for trophic structure and processes, with several trophic levels represented, including periphyton, benthic macroinvertebrates, small resident fish (e.g., sticklebacks), as well as salmonids in Grant Creek. Both creeks also provide habitat for stream-associated waterfowl, and a food source (fish) for raptor species. These creeks also provide nutrient levels capable of sustaining the native species.

Chemical Process and Pathways functions are provided by Grant and Inlet creeks through the maintenance of water and soil quality, chemical processes and nutrient cycles, and landscape pathways. With the exception of the Canyon Reach on Grant Creek (Reach 5) Grant and Inlet creeks likely provide moderate water and soil quality improvement, and chemical process and nutrient cycling functions. Most of the potential water quality and nutrient processing likely occurs in the lower velocity side channels, and in the hyporheic zones of the main and side channels (e.g. dissolved nutrient processing), and within riparian wetlands (nutrient processing and adsorption, and sediment and particulate retention). In-channel functions are expected to be limited to nutrient cycling via the breakdown of detrital material, and sediment deposition in Inlet Creek (Grant Creek appears to flush most of its suspended sediment through the channel resulting in the alluvial fan at the confluence). It is important to recognize that although nutrient processing functions are occurring, they are likely limited due to the low productivity of the creeks which limits nutrient inputs (KHL 2014e). Grant and Inlets creeks do however have significant natural suspended sediment inputs associated with upstream glaciers (KHL 2014f). Both creeks maintain natural thermal regimes, with Grant Creek's temperatures driven primarily by the thermal regime of Grant Lake due to minimal groundwater or surface water inputs to the creek (KHL 2014e).

Both creeks act as landscape pathways, maintaining both longitudinal and lateral (detrital inputs) connectivity with downstream and riparian environments, as well as acting as habitat corridors for fish and birds. The high gradient, high velocity sections of the Grant Creek Canyon Reach also act as a barrier of longitudinal pathways for upstream salmonid passage (KHL 2014b), as there are no salmonids in Grant Lake.

4.3.2.1.3. Trail Lake Narrows

Because the Narrows area between the lakes functions more like a riverine system than a lacustrine habitat, it was assessed using the streams functional assessment method. All of the functions were present for the Trail Lakes Narrows (Table 4.3-3). The System Dynamics functions were present but were more limited than Grant and Inlet creeks. Due to its position between two large lakes, Trail Lakes Narrows exhibits a more stable hydrologic regime than the small streams, on Grant or Inlet creeks (KHL 2014e). As such, stream evolution processes, energy management, and the resulting riparian succession are more limited for the Narrows. Hydrologic Balance functions are also present, although as a larger "river" with limited side channels, surface water storage processes are limited, with greater water conveyance functions rather than storage functions (KHL 2014e). Surface/subsurface water exchange occurs within the hyporheic zone. The Narrows area maintains its hydrodynamic character with a natural flow regime, including the characteristic spring and fall peak flows resulting from snowmelt and fall rains respectively, with these peak events buffered by the storage capacity of Upper Trail Lake.

Sediment Process and Character functions are performing at a high level in the Trail Lake Narrows. It provides for sediment continuity (e.g., erosion, transport, and deposition processes), as well as maintaining the natural quality and quantity of sediments. The Narrows area is not as dynamic as Grant or Inlet creeks, but does carry suspended sediment from Upper to Lower Trail Lakes. The water quality report for the Project (KHL 2014e) found that the Trail Lake Narrows consistently had higher turbidity values than found in Grant Lake or Grant Creek, yet well below the Alaska Department of Environmental Conservation (ADEC) water quality standards. Trail Lakes Narrows has a low to moderate degree of structural complexity for maintenance of substrates and structural processes, with minimal large woody debris, and no off-channel habitat areas. It does have a diversity of substrates, and healthy overhanging riparian vegetation. Trail Lakes provides important salmonid habitat within the Kenai River watershed.

The Trail Lakes Narrows provides high quality Biological Support functions. The area provides for maintenance of biological communities and processes with diverse assemblages of native species and age classes, including fish and benthic macroinvertebrates (KHL 2014b, KHL 2014g, respectively). It also provides necessary aquatic and riparian habitats, with in-channel and riparian habitat diversity, as described above, related to the substrate and structural process function described in the paragraph above (e.g., large woody debris, and healthy overhanging riparian vegetation) (KHL 2014a). The Narrows also provides for trophic structure and processes, with several trophic levels represented, including periphyton, benthic macroinvertebrates, juvenile and adult fish, as well as habitat for stream-associated waterfowl, and a food source (fish) for raptor species. Trumpeter swans, a USFS Species of Special Concern, were observed just downstream of the Trail Lake Narrows during the spring 2013 wildlife studies associated with the Project. The Narrows also provides nutrient levels capable of sustaining the native species.

Chemical Process and Pathways functions are provided by the Trail Lake Narrows through the maintenance of water and soil quality, chemical processes and nutrient cycles, and landscape pathways. The Narrows likely provides moderate water and soil quality improvement, and chemical process and nutrient cycling functions. Most of the potential water quality and nutrient processing likely occurs in the hyporheic zone (e.g., dissolved nutrient processing); however, this

is expected to be more limited than in Grant and Inlet creeks due to the lack of extensive side channels and riparian wetlands where nutrient processing and adsorption, and sediment and particulate retention would typically occur. In-channel functions (nutrient cycling via the breakdown of detrital material, and sediment deposition) are expected to be rather limited, as most of the suspended sediment and materials would be expected to be flushed through the channel. The water quality report for the Project (KHL 2014e) found that levels of gas and diesel range organic chemicals were below detectible limits within the Narrows. It is important to recognize that although nutrient processing functions are occurring, they are likely limited due to the low productivity of the Narrows water, which limits nutrient inputs. Trail Lake Narrows also acts as a landscape pathway, maintaining both longitudinal and lateral (detrital inputs) connectivity with downstream and riparian environments, as well as acting as habitat corridors for fish and birds.

4.3.2.1.4. Grant Lake

The following is a summary of the functions potentially performed by Grant Lake. Although the Fischenich (2006) stream functions assessment was not formally used to assess Grant Lake, the applicable functions are described where applicable for consistency with the moving waters assessment described above.

Grant Lake performs several hydrologic, biogeochemical, and ecological functions. Hydrologic and hydraulic functions are functioning at a high level within the lake. The watershed is subject to a natural hydrologic regime, with natural vertical lake fluctuations estimated at 7 feet, fluctuating between approximately 696 and 703 feet in elevation (NAVD 88) due to snow melt, glacial melt, and precipitation, with the ordinary high water surface elevation estimated at 700 feet elevation. The highest water surface elevations typically occur during the summer months, the lowest occur during the winter months. Due to its steep shoreline, minimal riparian areas are present, with all lacustrine fringe wetlands described in the vegetated wetland assessment below. Grant Lake is important for surface water storage within the watershed.

Sediment functions are very important within the Grant Lake watershed. Grant Lake is subject to natural wind-generated erosive forces that erode shoreline areas, deposit, and transport sediments along the shoreline. However, the geomorphology report for the Project (KHL 2014f) indicated that erosion due to wind-generated waves was minimal, even in the highly erodible alluvial fan areas. They also reported that sediment loads in Grant Lake remain trapped in the lake, with very little suspended sediment or bedload being transported into Grant Creek. Overall substrate and structural habitat complexity is limited due to the steep bedrock shoreline in most areas, with habitat complexity limited to the less steep shoreline areas, where some large woody debris, and littoral zone vegetation is present.

Grant Lake provides high quality Biological Support Functions, providing for maintenance of biological communities and processes with diverse assemblages of native species and age classes, including fish (non-salmonids) and benthic macroinvertebrates. Grant Lake provides relatively moderate quality aquatic and riparian habitat, with limited littoral and riparian habitat diversity (e.g., large woody debris and diversity of substrates) due to the steep shoreline. Grant Lake provides for trophic structure and processes, with several trophic levels represented, including periphyton, benthic macroinvertebrates, small resident fish (sticklebacks and sculpins).

The Project fisheries report (KHL 2014b) noted that during the 1981-1982 fish surveys, sculpin and three-spine stickleback were the only fish observed in Grant Lake; based on additional studies prior to 2013, no salmonids have been observed in Grant Lake. The littoral areas, as well as open water areas during winter, also provide waterfowl habitat; the 2013 Project wildlife study observed trumpeter swans, a USFS Species of Special Concern, in an open area within the ice on Grant Lake.

Chemical Process and Pathways functions are provided by the natural limnology of Grant Lake through the maintenance of natural water quality, chemical processes and nutrient cycles, and landscape pathways. Grant Lake itself acts as a sediment sink, trapping sediment in its deep basin, with almost no transport downstream into Grant Creek, thereby functioning to maintain the water quality of downstream receiving waters (KHL 2014f). Grant Lake is naturally a highly oligotrophic lake, with cold water and low nutrient inputs (KHL 2014e). Natural nutrient inputs include detritus entering from shore and the littoral zone, and from biological sources (e.g., fish and wildlife). Grant Lake also maintains a natural thermal regime, contributing to the natural thermal regime of Grant Creek (KHL 2014e). The 2013 Project water quality study (KHL 2014e) found that temperatures in Grant Creek best matched Grant Lake outlet water temperatures at a depth of 1.5 meters (during ice-free periods), rather than the lake surface temperature. The water quality studies also indicate that Grant Lake is only minimally thermally stratified, but does exhibit spring and fall turnover events where the lake mixes, important for redistribution of nutrients and the removal of temperature gradients within the water column. Although there are limited riparian areas where nutrient processing and adsorption, and sediment and particulate retention would typically occur, natural nutrient cycling occurs within the lake water column. Grant Lake also acts as a landscape pathway, maintaining both longitudinal and lateral (detrital inputs) connectivity with downstream and upstream environments, as well as acting as habitat corridors for fish and birds.

4.3.2.2. Wetlands Functional Assessment

A total of 38.29 acres of vegetated wetlands were assessed within the wetlands assessment area, with 6.34 acres (16.5 percent) assessed within the transmission corridor / facilities functional assessment area, 4.39 acres (11.5 percent) in the Grant Creek functional assessment area, and 27.57 acres (72 percent) in the Grant Lake functional assessment area (Table 4.3-4). Fifteen wetland functional classes were identified across the three functional assessment areas (Table 4.3-4). Table 4.3-3 also presents the DP (and functional assessment data form(s)) with which each functional class is associated, as well as the associated vegetation types (NWI Class/Subclass), as described in Table 4.3-1 and Table 4.3-2 in the wetland delineation results section, Section 4.3.1 above.

Table 4.3-5 presents the functional assessment ratings (low, moderate, or high) for each of the functional assessment classes. Each functional class was assessed for a minimum of nine functions; and up to ten or eleven functions for some of the functional classes, depending on whether the "erosion control and shoreline stabilization" or "fish habitat" functions were assessed for a given functional class. Most of the functional classes rated as moderate or high for the evaluated functions, with a few exceptions.

Several functional classes were not evaluated for the "erosion control and shoreline stabilization" function because the wetlands associated with these functional classes were not located adjacent to streams, ponds, or lakes. Similarly, only the two functional classes located within the Grant Creek corridor were evaluated for the "fish habitat" function, as none of the other functional classes were associated with fish-bearing (salmonid) waters. All of the functional classes were rated as moderate for the "educational or scientific" function, as all of the functional classes were located on public land, but none were noted for scientific/educational use and were not used for wetland-focused recreation. All but two of the functional classes (forested slope wetland and Grant Lake Inlet scrub shrub) were rated as high for the "nutrient and toxicant" removal function.

All of the functional classes were rated equally as low for the "uniqueness and heritage" function. Project area wetlands are not habitat for any USFWS-designated threatened or endangered plant or animal species, or State-listed endangered plant or animal species, and as such none were expected nor documented within the Project area wetlands. "Priority" species were those listed as candidates for ESA listing by the USFWS. Two USFWS-designated ESA candidate bird species were potentially present in the Project area, Kittlitz's murrelet and the yellow-billed loon, but neither was documented in the Project area during the 2010 or 2013 Wildlife surveys, nor during the 1981-1982 field surveys (see Section 5, Wildlife, for additional details on Wildlife surveys within the Project area). While USFS Sensitive Species or Species of Special Interest plant and bird species were detected by the Project sensitive plant and wildlife teams during the 2013 surveys (as reported in Sections 3 and 5 respectively of the Terrestrial Resources Report), the RGL 09-01 (USACE 2009) is focused exclusively on the documented occurrence of "priority" species designated by the USFWS, and, as noted above, no priority species were documented in wetlands (see the wetland functional assessment data forms presented in Appendix 2a).

Lastly, according to the Project cultural resources team (KHL 2014c), none of the wetlands were considered "culturally significant" (e.g., habitat for a culturally significant plant species). Note that the proposed Iditarod National Historic Trail (INHT), as currently planned, bisects the northwest corner of the wetland associated with the proposed tailrace detention pond, and continues across Grant Creek immediately downstream of the powerhouse location. While the proposed INHT is considered socially significant, it was not considered significant from a wetlands perspective because wetlands do not inherently contribute to the social or historical significance of the trail.

Characteristics and general rating of each functional class are discussed below by functional area, with greater discussion focused on the functions that showed more variation between functional classes (e.g., "erosion control and shoreline stabilization" and "fish habitat").

4.3.2.2.1. Transmission Corridor / Facilities Area

Six functional classes were identified within the transmission corridor / facilities area: four of the functional classes within this area were associated with depressional wetlands, grouped by dominant vegetation type: herbaceous depressional, deciduous scrub shrub depressional, broadleaved evergreen scrub shrub depressional, and needle leaved evergreen scrub shrub depressional. One riverine wetland functional class, small stream scrub shrub riparian riverine

wetland, and one slope wetland functional class, forested slope wetland, were also associated with the transmission corridor / facilities area. These functional classes were rated as having a moderate or high capacity to perform most of the functions. The exception was that the three depressional scrub shrub functional classes were not evaluated for the "erosion control and shoreline stabilization" function because they were not associated with a stream bank or shoreline, and none of the functional classes in this area were evaluated for the fish habitat function because they did not provide any direct fish habitat.

4.3.2.2.2. Grant Creek Corridor Area

The Grant Creek corridor includes only vegetated wetlands along Grant Creek; the Grant Creek main and side channels are discussed in the waters functional assessment above. Within the Grant Creek corridor, two riverine functional classes were identified: herbaceous riparian wetlands and scrub shrub riparian wetlands. Both of these riparian functional classes were associated with floodplain and wetland fringe areas along Grant Creek, with one small area located along Upper Trail Lake. These functional classes were also rated as having a moderate or high capacity to perform most functions. Because these were riparian fringe or floodplain wetlands with dense vegetation, they ranked high for the "erosion control and shoreline stabilization" function. These functional classes rated high for the "fish habitat" function because they provide potential salmonid habitat within a narrow fringe along Grant Creek and its side channels during high water events.

4.3.2.2.3. Grant Lake Area

The Grant Lake area includes only vegetated wetlands along Grant Lake; Grant Lake itself is discussed in the waters functional assessment above. The bulk of the wetland acreage in the wetlands assessment area was associated with the Grant Lake functional area. Four of the lake functional classes were identified at the lake inlet area. Three were lacustrine classes: inlet herbaceous wetlands, inlet herbaceous inundated wetland, and inlet scrub shrub wetland. One was a riverine functional class, inlet scrub shrub riparian, located along the alluvial fan outwash channels adjacent to Inlet Creek. Two functional classes were identified along the lake shore outside of the inlet or outlet area; both were lacustrine fringe wetlands: herbaceous lake fringe wetland and scrub shrub lake fringe wetland. Lastly, one functional class was identified at the lake outlet area, outlet herbaceous wetland. These functional classes were also rated as having a moderate or high capacity to perform most functions. Due to their adjacency to Grant Lake or Inlet Creek, all of the lake wetlands were evaluated for the "erosion control and shoreline stabilization" function; all of the functional classes scored high for this function, except the inlet herbaceous wetland, and inlet herbaceous inundated wetland functional classes scored low due to their lack of dense vegetation. No salmonids are present in Grant Lake or its tributaries (KHL 2014b); therefore, the lake functional classes were not evaluated for the "fish habitat" function.

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 Table 4.3-4.
 Functional classes, acreages, and associated characteristics.

Function	al Area ¹	Functional Class ²	Wetland Cover Type	Hydrogeomorphic Position	Acres	FER Percent Wetland Assessment Area	Representative Data Point(s) ³	NWI Codes	Hydro
		Herbaceous depressional wetland	Herbaceous Wetland	Depressional	0.14	G 0.36	DP14	PEM1, PEM1/SS1	B, E, F, H
		Deciduous scrub shrub depressional wetland			3.16	ο Η Η Ω 8.25	DP22	PSS1, PSS1/3, PSS1/EM1	B, E
Transmission Facil		Broadleaved evergreen scrub shrub depressional wetland	Scrub Shrub Wetland	Depressional	0.74) 1.93	DP17, DP20	PSS3/EM1	В
		Needle leaved evergreen scrub shrub depressional wetland			0.40	∞ 1.05	DP19	PSS4, PSS4/1, PSS4/3/EM1	В
		Small stream scrub shrub riparian		Riverine	1.01	0 1 2.63	DP12, DP39	PSS1, PSS1/EM1	E, C
		Forested slope wetland	Forested Wetland	Slope	0.89	2.32	DP37	PFO4/EM1	В
			Total Tra	nsmission Corridor / Facilities	6.34	16.5			
Crant Craal	rant Creek Corridor Grant	Grant Creek herbaceous riparian	Herbaceous Wetland / Floodplain Forest & Scrub	Riverine -	3.11	8.12	DP23, DP25	PEM1, PEM1/SS1	B, C, E
Grant Creek	K Corridor	Grant Creek scrub shrub riparian	Scrub-Shrub Wetland / Floodplain Forest & Scrub	Rivernic	1.28	3.34	DP24	PSS1/EM1, PSS1/FO1	С
				Total Grant Creek Corridor	4.39	11.5			
		Grant Lake inlet herbaceous wetland	Herbaceous Wetland		0.70	1.84	DP01	PEM1/SS1	С
	Lake Inlet	Grant Lake inlet herbaceous inundated wetland	110101100000	Lacustrine	1.23	3.22	DP10	PEM1	F
	Lake Inice	Grant Lake inlet scrub shrub wetland	Scrub Shrub Wetland		13.99	36.54	DP03, DP04, DP06, DP08	PSS1, PSS1/EM1	B, C, E
Grant Lake		Grant Lake inlet scrub shrub riparian	Scrub-Shrub Wetland / Floodplain Forest & Scrub	Riverine	6.66	17.39	DP02, DP09	PSS1	B, E
	Lake	Grant Lake herbaceous lake fringe wetland	Herbaceous Wetland		3.03	7.91	DP27, DP33	PEM1, PEM/SS1	В, Е, Н
	Shore	Grant Lake scrub shrub lake fringe wetland	Scrub Shrub Wetland	Lacustrine	1.45	3.79	DP29, DP31	PSS1, PSS1/EM1	Е
	Lake Outlet	Grant Lake outlet herbaceous wetland	Herbaceous Wetland		0.50	1.29	DP35	PEM1/SS1	Е
				Total Grant Lake	27.56	72.0			
Notes:	TOTAL WETLAND ASSESSMENT AREA 38.29								

- 1. Functional area where the functional class was found; some areas overlap, e.g. transmission corridor at Grant Lake shoreline. Transmission Corridor includes corridor and Project facilities.
- Functional class: developed based on integration of dominant vegetation type, hydrogeomorphic position, and primary area within Project.
 Wetland DP functional assessment data form with which the functional class is associated.

Table 4.3-5. Functional assessment ratings for each functional class.

	1		ı	T	T		<u> </u>	<u> </u>		ı		Ī	1
Functional Area ¹	Functional Class ²	Representative Data Point(s) ³	Flood Flow Alteration	Sediment Removal	Nutrient, & Toxicant Removal	Erosion Control and Shoreline Stabilization	Production and Export of Organic Matter	General Wildlife Habitat Suitabi u ty	Fish Habitat	Native Plant Richness	Educational or Scientific	Groundwater Interchange	Uniqueness and Heritage
	Herbaceous depressional wetland	DP14	Moderate	High	High	High	High	High	NA	Moderate	Moderate	High	Low
	Deciduous scrub shrub depressional wetland	DP22	Moderate	Moderate	High	NA	High	High	NA	High	Moderate	High	Low
Transmission Corridor /	Broadleaved evergreen scrub shrub depressional wetland	DP17, DP20	Moderate	Moderate	High	NA	Moderate-High	High W	NA	Moderate	Moderate	Moderate-High	Low
Facilities	Needle leaved evergreen scrub shrub depressional wetland	DP19	Moderate	Moderate	High	NA	High	15 High201	NA	Moderate	Moderate	High	Low
	Small stream scrub shrub riparian	DP12, DP39	Moderate	Moderate- High	High	High	High	4- 4dgiH ∵	NA	Moderate- High	Moderate	Moderate-High	Low
	Forested slope wetland	DP37	Moderate	Moderate	Moderate	NA	Moderate	High.	NA	High	Moderate	High	Low
Grant Creek	Grant Creek herbaceous riparian	DP23, DP25	Moderate	High	High	High	High	High _D ≾	High	Moderate- High	Moderate	Moderate-High	Low
Corridor	Grant Creek scrub shrub riparian	DP24	Moderate	High	High	High	High	High	High	High	Moderate	High	Low
	Grant Lake inlet herbaceous wetland	DP01	Moderate	Moderate	High	Low	High	High	NA	Moderate	Moderate	Moderate	Low
I also Iulo4	Grant Lake inlet herbaceous inundated wetland	DP10	Moderate	High	High	Low	Moderate	Moderate	NA	Moderate	Moderate	Moderate	Low
Lake Inlet	Grant Lake inlet scrub shrub wetland	DP03, DP04, DP06, DP08	Moderate- High	Moderate- High	High	High	High	High	NA	Moderate	Moderate	Moderate	Low
	Grant Lake inlet scrub shrub riparian	DP02, DP09	Moderate	Moderate- High	Moderate-High	High	Moderate-High	Moderate	NA	Moderate	Moderate	Moderate	Low
Lake Shore	Grant Lake herbaceous lake fringe wetland	DP27, DP33	Moderate	High	High	High	High	Moderate- High	NA	Moderate	Moderate	Moderate-High	Low
Lake Shore	Grant Lake scrub shrub lake fringe wetland	DP29, DP31	Moderate	Moderate- High	High	High	High	High	NA	Moderate	Moderate	Moderate-High	Low
Lake Outlet	Grant Lake outlet herbaceous wetland	DP35	Moderate	High	High	High	High	High	NA	Moderate	Moderate	High	Low

^{1.} Functional area where the functional class was found; some areas overlap, e.g. transmission corridor at Grant Lake shoreline. Transmission Corridor includes corridor and Project facilities.

Functional class: developed based on integration of dominant vegetation type, hydrogeomorphic position, and primary area within Project.
 Wetland DP functional assessment data form with which the functional class is associated.

4.3.2.3. Wetlands Categorization

Table 4.3-6 presents the results of the categorization of the 15 wetland functional classes into USACE categories (per USACE 2009) within the wetlands assessment area. A separate categorization was not performed for the waters within the Project area. The wetlands within each functional class were either moderate functioning Category III wetlands, or moderate to high functioning Category II wetlands, based on the category definitions presented in RGL 09-01 (USACE 2009), as well as on the percent functional capacity at which each functional class was performing. The two lowest-ranking functional classes were performing at 67 percent of their functional capacity, while the highest-ranking functional class was performing at 88 percent of its functional capacity. With this range of functional capacity ratings, a threshold between Category III and Category III wetlands was established at 75 percent functional capacity. Five of the functional classes were performing at less than 75 percent of their functional capacity and were thus categorized as Category III wetlands (10.22 acres, or 27 percent of the wetlands within the wetland assessment area). The remaining functional classes were functioning at greater than 75 percent of their functional capacity and were categorized as Category II wetlands (28.07 acres, or 73 percent of the wetlands within the wetland assessment area).

Table 4.3-6. Wetland acres per category by functional class.

				A	cres per	Catego	ry
Functional Fu		Percent Functional Capacity	I	П	III	IV	
		Herbaceous depressional wetland	83	/	0.14	/	/
		Deciduous scrub shrub depressional wetland	81	/	3.16	/	/
	mission	Broadleaved evergreen scrub shrub depressional wetland	74	/	/	0.74	/
Corridor / Facilities		Needle leaved evergreen scrub shrub depressional wetland	78	/	0.40	/	/
		Small stream scrub shrub riparian	82	/	1.01	/	/
		Forested slope wetland	74	/	/	0.89	/
		or / Facilities	0.00	4.71	1.63	0.00	
Grant Creek		Grant Creek herbaceous riparian	85	/	3.11	/	/
Cor	ridor	Grant Creek scrub shrub riparian	88	/	1.28	/	/
		Total Grant Cre	ek Corridor	0.00	4.39	0.00	0.00
		Grant Lake inlet herbaceous wetland	67	/	/	0.70	/
	Lake Inlet	Grant Lake inlet herbaceous inundated wetland	67	/	/	1.23	/
	met	Grant Lake inlet scrub shrub wetland	80	/	13.99	/	/
0 - 111-11	Grant Lake inlet scrub shrub riparian		72	/	/	6.66	/
Lake Crant Lake herbaceous lake fringe wetla		Grant Lake herbaceous lake fringe wetland	80	/	3.03	/	/
	Shore Grant Lake scrub shrub lake fringe wetland		80	/	1.45	/	/
Lake Outlet Grant Lake outlet herbaceous wetland		83	/	0.50	/	/	
	·	Total	Grant Lake	0.00	18.97	8.59	0.00

None of the wetland functional classes were considered rare and had no documented occurrence of a threatened, endangered, or priority species; therefore, none were categorized as high functioning Category I wetlands. Due to the undisturbed nature of the wetlands, none of the functional classes were categorized as low functioning Category IV wetlands.

4.4. Potential Impacts to Wetlands and Waters

Potential Project-related impacts to wetlands and waters have been qualitatively evaluated for direct and indirect impacts. The functional assessment described in Section 4.2, Methods and Section 4.3, Results, illustrates the various direct and indirect interdisciplinary linkages between wetlands and waters with other study disciplines evaluated for this Project. For example, direct or indirect effects to Project area soils, vegetation, groundwater hydrology, or surface water hydrology could result in localized impacts to wetland and water communities within the Project area. Likewise, impacts to wetlands could have localized effects on the integrity and function of Project area soils, vegetation, and water resources. Similarly, impacts or changes to wetland and water resources could have direct or indirect effects to the level of use or benefits gained by fish, wildlife, or humans that use wetlands and waters for habitat, food, protection, or recreation.

The following sections discuss the potential impacts to specific wetland or waters types (depressional, lacustrine, or riverine); impacts by Project infrastructure type are presented in Table 4.4-1. It is important to note that the potential impacts discussed in these sections are preliminary and based primarily on the Terrestrial Resources studies and the current amount of engineering feasibility work conducted prior to this report being developed. Many of the potential wetland impacts described below will be avoided or minimized through the development of site-specific engineered controls and best management practices (BMPs) during the Project's upcoming detailed engineering design phase. A full discussion of wetland impacts will be included in the DLA.

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 Table 4.4-1. Potential wetland impacts by Project infrastructure type.

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Project Component		Short Term Impacts ^{1,2}	Potential Qualitative Long Term/Permanent Impacts			
	Direct	Indirect	Direct	Indirect		
Natural Outlet Option	Vegetation clearing/grubbing; soil disturbance; shoreline/bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term redacted capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; altered bank, shoreline and lakebed; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Effects of new max lake level elevation on wetland vegetation (i.e. inundation); change in lakeshore erosion/deposition; effect of new Grant Creek in-stream flow regime on hydrologically connected riparian wetlands; change in capacity to perform certain wetland functions (i.e. shoreline stabilization, wildlife habitat)		
Concrete Dam Option 5155 FERC PDF (Unoffici	Vegetation clearing/grubbing; soil disturbance; shoreline/bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity a1) 8/15/2014 4:14:07	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; altered bank, shoreline and lakebed; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Effects of new max lake level elevation on wetland vegetation (i.e. inundation); change in lakeshore erosion/deposition; effect of new Grant Creek in-stream flow regime on hydrologically connected riparian wetlands; change in capacity to perform certain wetland functions (i.e. shoreline stabilization, wildlife habitat)		
WATER CONVEYANCE						
Intake Structure	Vegetation clearing/grubbing; soil disturbance; shoreline/bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; altered bank, shoreline and lakebed; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Effects of new max lake level drop on wetland vegetation (i.e. wetland to upland conversion); down cutting in creeks may drain wetlands and add suspended sediments to water column; change in lakeshore erosion/deposition; effect of new in-stream flow regime on hydrologically connected riparian wetlands; change in capacity to perform certain wetland functions (i.e. shoreline stabilization, wildlife habitat)		
Tunnel	At surficial entrance and exit of tunnel: vegetation clearing/grubbing; soil disturbance; shoreline/bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	At surficial entrance and exit of tunnel: weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	At surficial entrance and exit of tunnel: weed infestation; soil erosion, sediment input to water column; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)		
Penstock	Vegetation clearing/grubbing; soil disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Weed infestation; soil erosion; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Weed infestation; soil erosion; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat).		
Tailrace	Vegetation clearing/grubbing; soil disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Wetland excavation and fills; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Drainage of adjacent wetlands; weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)		
Tailrace Detention Pond	Vegetation clearing/grubbing; soil disturbance; bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structures associated with detention pond and conveyance pipeline; inundation of wetland areas; sedimentation; loss of certain wetland functions and gain of others (i.e. loss of wildlife habitat functions tied to existing vegetation, and gain of open water habitat resulting from inundation)	Possible expansion of wetland fringe around water edge; weed infestation; soil erosion; sedimentation/burial of existing wetland vegetation; sediment input to water column (if pipeline conveys sediment laden water); poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)		

FINAL REPORT TERRESTRIAL RESOURCES STUDY

Table 4.4-1, continued...

T.	Project Component Potential Qualitative Short Term Impacts ^{1,2}		Short Term Impacts ^{1,2}	Potential Qualitative Long Term/Permanent Impac			
P	Project Component	Direct	Indirect	Direct	Indirect		
POWEI	RHOUSE						
		Vegetation clearing/grubbing; soil disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Weed infestation; soil erosion; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)		
	SMISSION SWITCHYARD						
Above 6	Ground Option	Vegetation clearing/grubbing; soil disturbance; bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills where poles are installed in wetlands or surface water bodies; loss of certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Weed infestation; soil erosion; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat). Change in wetland vegetation community if ROW is maintained clear of woody vegetation.		
:15 - 5155 Below (FERC PDF (Unoffici Ground Option	Vegetation clearing/grubbing; soil disturbance; bank disturbance; short-term reduced to perform 7 certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native etation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Wetland excavation and fills for buried utility line; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Drainage of adjacent wetlands; weed infestation; soil erosion; sediment input to water column from erosion; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat). Change in wetland vegetation community if ROW is maintained clear of woody vegetation.		
ACCES	SS ROADS						
Access	Roads	Vegetation clearing/grubbing; soil disturbance; bank disturbance; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat); temporary surface water turbidity	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; short-term reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)	Fills due to structure; permanently reduced capacity to perform certain wetland functions (i.e. water quality, wildlife habitat, stormwater attenuation)	Weed infestation; soil erosion; sediment input to water column; poor native vegetation re-establishment; change in capacity to perform certain wetland functions (i.e. water quality, wildlife habitat)		

^{1.} The potential impacts discussed in this table are qualitative based primarily on the terrestrial studies and the limited amount of engineering design work conducted prior to this report being developed. This table and the associated impacts will be refined as engineered designs are finalized for the Project. A discussion of wetland impacts will be included in the DLA.

2. Short term impacts would occur primarily during construction; Project would be constructed over a 30-36 month time period.

4.4.1. Depressional Wetlands

Depressional wetlands within the Project area include those wetlands occurring within discrete topographic depressions primarily located on the south side of Grant Creek in the vicinity of the access road and transmission corridor (Figure 4.3-2). Due to their geographic position, these wetlands experience little to no hydrologic influence from Grant Lake or Grant Creek. Therefore, there are no anticipated impacts to depressional wetlands associated with changes to lake level elevations and fluctuations, nor are there any anticipated impacts to depressional wetlands associated with the proposed changes to Grant Creek Project flows.

Potential indirect and direct impacts to depressional wetlands will primarily result from the construction, operation, and maintenance of the following Project features noted in Table 4.4-1: detention pond and small segments of the access road and transmission line corridor. While the water conveyance tunnel would pass under several depressional wetlands, it is assumed the underground tunnel would be constructed in a manner that would not alter wetland hydrology and, therefore, would not result in any impacts to depressional wetlands.

4.4.2. Lacustrine Wetlands and Waters

Vegetated Lacustrine Wetlands – Lacustrine wetlands include persistent and non-persistent emergent wetlands, aquatic beds, and vegetated shoreline communities that are directly attached to or border Grant Lake (Figure 4.3-1). Note that there were no vegetated lacustrine fringe wetlands associated with Upper Trail and Lower Trail lakes; therefore, this section refers to potential impacts to Grant lake lacustrine wetlands only (Figure 4.3-4 through Figure 4.3-6).

Grant Lake lacustrine wetlands could be affected by proposed changes to the lake's surface water elevations and fluctuations, as well as impacts associated with the construction and operation of Project features on the lake. As noted in Section 1.1, there are two concepts currently being considered for water control at the outlet of Grant Lake: the natural outlet option and the concrete diversion dam option. The new outlet control structure and low level intake structure will result in a new minimum pool elevation of approximately 692 feet NAVD 88, which is 4 feet lower than the current estimated minimum pool elevation of 696 feet NAVD 88. The maximum pool elevation, if the diversion structure option is implemented, is estimated to increase to 705 feet NAVD 88, up 2 vertical feet from the current estimated maximum pool elevation of 703 feet NAVD 88. Lake level and associated fluctuations will be further assessed with engineering studies. If it is determined that lake level changes would constitute a measurable gain or loss of jurisdictional wetlands it will be discussed with stakeholders and documented in the draft license application along with potential options for mitigation. In general, if minimum pool elevations occur during the growing season for prolonged periods of time (e.g., weeks), lacustrine wetlands, particularly herbaceous wetlands, may dry out and convert to uplands. Alternatively, if maximum pool elevations occur during the growing season for prolonged periods of time (e.g., weeks), lacustrine wetlands, especially herbaceous wetlands along the current wetted shoreline may drown. There is also the potential for areas of new wetland fringe to become established along the wetted shoreline if a new consistent pool elevation is maintained during the Project's normal operational conditions.

Other potential impacts associated with Grant Lake lacustrine wetlands include those resulting from the construction, operation, and maintenance of the following Project features noted in Table 4.4-1: outlet control structure, low level intake structure, surficial entrance to the tunnel, and a small portion of the access road that approaches the low level intake structure.

Non-Vegetated Lacustrine Waters – Lacustrine waters, also referred to as 'open water' in this report, includes the non-vegetated portions of Grant Lake and Upper Trail and Lower Trail lakes (deep and shallow lake margins). Depending on the timing, frequency, and duration of the new Grant Lake level fluctuations, the open water component of the lake may increase or decrease. Lake level and associated fluctuations will be further assessed with engineering studies. If it is determined that lake level changes would constitute a measurable gain or loss of jurisdictional waters it will be discussed with stakeholders and documented in the draft license application along with potential options for mitigation. Lake level fluctuations are not expected to change significantly for Upper Trail and Lower Trail lakes as a result of the Project; therefore, there are no anticipated gains or losses to the open water component of the Trail Lake system.

Potential impacts to the open water portion of Grant Lake and the Upper Trail and Lower Trail lakes include those resulting from the construction, operation, and maintenance of the following Project features noted in Table 4.4-1 that could potentially affect the bed, bank and surface water of the lakes: outlet control structure (Grant Lake), low level intake structure (Grant Lake), the initial segment of the conveyance tunnel (Grant Lake), and the access road, bridge, and transmission line that crosses the Trail Lake Narrows.

4.4.3. Riverine Wetlands and Waters

Vegetated Riverine Wetlands - Riverine wetlands are those wetlands that are adjacent to and hydrologically influenced by Inlet Creek, Grant Creek, and their tributaries, as well as drainages associated with Grant Lake.

Riverine wetlands associated with Inlet Creek and Grant Lake drainages have the potential to be affected by the new lake level elevations that would result from the outlet control structure and low level intake structure on Grant Lake. The Project is not expected to alter the current instream flows for Inlet Creek or surrounding lake tributaries/drainages. HEA's current operation plan is to draw the lake down no further than 4 ft below the current natural low and, under the concrete dam option, raise the lake level no further than 2 ft above its current natural maximum. However, the new minimum and maximum lake levels could cause erosion or depositional changes to stream channels and their associated floodplains and outwash fans at the Grant Lake interface. Changes to channel bed and form could, in turn, affect the hydrology of adjacent wetlands. Depending on the timing, duration and frequency, a drop in the lake level elevation commissariat with operations could cause the Inlet Creek and lake drainage channels to downcut or become incised, and possibly drain the adjacent riverine wetlands at the Grant Lake shoreline. Fortunately, the majority of the Grant Lake shoreline is well-armored with angular rocks which would likely minimize the potential for channels to become incised. Alternatively, an increase in the lake level elevation could create a backwater effect at the stream channel/Grant Lake interface, which could cause some low lying riverine wetlands to drown from excessive inundation, or be buried by increased sedimentation or deposition, while other wetland areas may expand and/or become enhanced by the additional hydrology.

There are no additional anticipated impacts associated with Project construction, operational, or maintenance for Inlet Creek or the tributaries/drainages that terminate at Grant Lake.

Instream flows associated with the various steep drainages and tributaries to Grant Creek are not expected to be affected by the changes in surface water elevations in Grant Lake or by the changes to instream flows in Grant Creek. Several seasonal drainages could be affected, however, by the construction, operations, and maintenance of several Project features described in Table 4.4-1, including: tailrace detention pond and outlet, access road, and transmission line. The water conveyance tunnel would pass under several seasonal drainages; however, it is assumed the underground tunnel would be constructed in a manner that would not alter stream hydrology and, therefore, would not result in any impacts to those drainages or their associated wetlands.

One of the most significant changes associated with the Project will be changes to instream flows in the main channel and primary side channels of Grant Creek (refer to Section 5.2 and Section 6.2 of the Water Resources Report for a detailed description). Instream flows will be reduced in the upper portion of Grant Creek, also referred to as the 'Canyon Reach,' between the Grant Lake outlet and the powerhouse tailrace (Reach 4/5 break). The majority of the water that naturally flows down this reach would be diverted to the powerhouse via the low elevation intake structure and tunnel to produce power. A limited amount of water would continue to flow down Grant Creek's Canyon Reach to provide a consistent baseflow throughout the year. This drop in flow would expose more channel bed and bank, reduce sediment transport, and most likely cause the four small wetland fringe communities mapped within the Canyon Reach to be drained and convert to uplands (a total wetland loss of approximately 0.2 acres) (Figure 4.3-2). Steep seasonal drainages that contribute to instream flows are not expected to be affected.

Annual average instream base flows from the powerhouse tailrace downstream to the Grant Creek outlet are expected to increase with Project operations; however, peak flows will be reduced, allowing for quality main stem habitats to be maintained for longer periods. Note that during annual periods of high water when lake inflows exceed the Project's maximum capacity of 350 cfs, the excess water will bypass the diversion structure and flow naturally through the Grant Creek channel, and continue to access the adjacent floodplain. It is fully anticipated that Grant Creek will continue to see peak flows well above what the Project can accommodate. The new instream flow pattern is expected to keep side channels wetted spring through fall. As noted in Section 4.3.1, wetlands located along the lower portion of Grant Creek are predominantly associated with complex wetland/upland floodplain mosaics that are supported by flood and baseflow hydrology. The anticipated instream flow changes to lower Grant Creek could affect associated riverine wetlands in a variety of ways. Wetland areas located in the distal fringes of the existing Grant Creek floodplain that are supported by current natural peak flows may be negatively affected by reduced peak flow hydrology (although it is unknown at this time what proportion of the wetland hydrology is supported by groundwater baseflows vs. surface water contributions). Alternatively, wetland areas supported by an increase in baseflows would experience a longer hydroperiod that could have beneficial results like expanded and enhanced wetland areas.

Non-Vegetated Riverine Waters - The riverine waters include the nonvegetated bed and bank of Inlet Creek channel, Grant Lake tributaries/drainages, Grant Creek tributaries/drainages, the Grant Creek channel, and numerous unvegetated floodplain and outwash fans that are likely inundated with surface water during spring breakup and flood events. Potential impacts to riverine waterbodies associated with Grant Lake and Grant Creek tributaries are noted in riverine wetland discussion above. Refer to Section 5.2 and Section 6.2 of the Water Resources Report for further discussion of anticipated impacts or changes to Grant Creek channel geomorphology resulting from changes to instream flow.

In addition, there are several construction, operational, and maintenance-related impacts noted in Table 4.4-1 that could affect the riparian wetlands associated with Grant Creek and the Grant Creek bed and bank including: the outlet control structure, the tailrace outlet, the detention pond outlet, the bridge, and small segments of the access road and transmission line corridor that cross small seasonal side channels and drainages. All other Project features have been intentionally configured to avoid unnecessary impacts to Grant Creek and other Project area stream channels.

4.4.4. Potential Impacts by Project Infrastructure Type

Table 4.4-1 summarizes the types of potential direct and indirect impacts associated with Project construction and operations, summarized by short term versus long term/permanent impacts. This table and the associated impacts will be fully refined, vetted, and incorporated into the DLA once the engineering designs are finalized. Table 4.4-1 combined with wetland maps will help guide Project engineering designs for Project infrastructure components as well as for the development of mitigation plans for the construction and operation phases.

4.5. Conclusions

This report provides the technical summary of the assessment methods, results, and conclusions of the 2013 Wetlands and Waters Study. The objective of the 2013 Wetlands and Waters Study was to delineate and describe wetlands and other potential "waters of the U.S." potentially impacted by the Project. The 2013 field effort delineated wetlands and other potential waters in the Project study area. Specifically, preliminary wetland maps were prepared; a field survey of wetlands and waters was conducted throughout the areas needing further study described in the Study Plan; a wetland functional assessment was conducted; and final wetland and waters maps were prepared using wetland data collect for the Project in 2010 and 2013. In addition, the potential impacts associated with Project construction and operational activities were evaluated.

As Project designs are further refined, the data provided in this report will be applied to conduct a quantitative analysis of potential impacts to wetlands and waters. This analysis will be included in the DLA. Additionally, all of the wetland and waters information associated with this report (including appendices and GIS data) can be used in support of future Section 404 application packages and other Project-related technical environmental reports.

4.6. Variances from FERC-Approved Study Plan and Proposed Modifications

The 2013 Wetland and Waters Mapping effort followed the March 2013 Study Plan objectives and methodologies. There were no variances to report.

5 WILDLIFE RESOURCES

This section describes the existing wildlife resources associated within the Grant Lake Hydroelectric Project based on the 2013 study effort and relevant data from previous Project studies. Under 18 CFR Ch. 1§5.6 (4-1-12 Edition), wildlife studies are required to obtain information requested by resource agencies as part of the informed decision process regarding the merits of the application. The ESA of 1973 (16 U.S.C. 1531 et seq.); the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703 et seq.) and the Bald and Golden Eagle Protection Act (BGEPA) of 1940 (16 U.S.C. 668 et seq.) are also regulatory drivers for the permitting process.

The 2013 Terrestrial Resources Study incorporates field work on wildlife resources associated with three distinct study efforts: 1) wildlife studies completed in the 1980s as part of a hydro licensing effort referred to as Ebasco (1984); 2) wildlife studies conducted in 2010, referred to as the 2010 wildlife studies (HDR 2011); and 3) the 2013 wildlife studies. The Ebasco 1984 report and the 2010 wildlife studies as well as other readily available sources of information have been assimilated for a better understanding of Grant Lake wildlife resources. Data sources used in the wildlife resources results section are referenced.

The 1984 Ebasco wildlife investigation conducted for the Project included various literature reviews and field investigations on amphibians, birds (waterfowl, loons, grebes, gulls, terns, shorebirds, raptors, grouse and ptarmigan), and mammals (rodents, bats, hares, marmots, squirrels, beaver [Castor canadensis], porcupine [Erethizon dorsatum], wolf [Canis lupus], coyote [Canis latrans], red fox [Vulpes vulpes], black bear [Ursus americanus], brown bear [Ursus arctos], mink [Neovison vison], wolverine [Gulo gulo], lynx [Lynx lynx], moose [Alces alces], mountain goat [Oreannos americanus], and Dall sheep [Ovis dalli]). The Ebasco (1984) report served as the initial comprehensive assessment of wildlife resources within the Project area. The wildlife studies conducted in 2010 and 2013 build upon this study and serve to provide additional data for wildlife resources that required more research.

The 2010 wildlife studies collected information on breeding landbirds and shorebirds, Northern goshawks (*Accipiter gentilis*), waterbirds, and little brown bats (*Myotis lucifugus*), as well as various incidental mammal observations that included moose, bear, and goats. In addition, USFS 2010 observations of bear and wolverine dens and raptor nests within the wildlife study area were provided to KHL and are referred to in this report.

The 2013 wildlife studies conducted by the Project encompassed breeding landbird and shorebird studies, Northern Goshawk surveys, Winter Moose surveys, and Winter Waterbird surveys on Grant Lake. The Breeding Landbird, Shorebird, and Northern Goshawk surveys were conducted in the spring and summer of 2013. The 2013 Winter Moose and Winter Waterbird surveys were performed in December 2013. Field studies to be undertaken in 2014 include a second Winter Moose and Winter Waterbird survey to be conducted in February/March 2014 and two additional Northern Goshawk surveys to be completed in the summer of 2014. These data, once collected and analyzed, will be provided to stakeholders for review and collaboration and incorporated into the DLA.

The 2013 Wildlife Study was conducted in accordance with the approved Study Plan (KHL 2013). The objectives of this wildlife study were to:

- Document presence and distribution information to allow the Project to minimize or avoid impacts to protected species, including bald eagles and other raptors, shorebirds, waterbirds, and landbirds of special interest;
- Quantify the distribution and abundance of target wildlife species during key seasons of activity in the study area;
- Document the species composition of avian communities, particularly landbirds, shorebirds, and waterbirds; and
- Classify and map wildlife habitat in the study area in conjunction with the Botanical Resources Study.

The subsections that follow provide a summary of the primary components of the 2013 wildlife studies: Raptor Nesting survey, Breeding Landbirds and Shorebirds, Waterbirds, and Terrestrial Mammals. The methods, results, and conclusions, as well as a summary of any variances from the 2013 Study Plan are provided for each study component. Relevant data from the previous Project wildlife studies are also incorporated within the relevant section.

5.1. Study Area

The Grant Lake area is a characteristic component of the diverse vegetation mosaic found in the mountainous interior of the Kenai Peninsula. The plant communities in the study area are described in Section 3 and Section 4 and include coniferous forests, mixed conifer/deciduous forest, forested shrub communities, grass communities, riparian areas, stream banks, lake margins, and small meadows.

The variety of habitats in this region of Alaska sustains an array of large game as well as other non-game wildlife species. Early seral stands found in conifer and / or mixed conifer / deciduous forests (Oliver 1996), provide feeding habitat for moose, wolves, snowshoe hare, and lynx, and nesting habitat for birds. Old growth forests provide potential nesting habitat for Northern goshawks, neotropical migrants, and other raptors, while also providing thermal cover, concealment from predators, denning and bedding areas for large mammals, travel corridors for moose, bear, wolverine, and wolves, and winter foraging areas for mountain goats. Canopy gaps and steep slope areas with blueberry provide good foraging areas for bears. Paper birch snags, found in successional stages between mixed and conifer forest types provide good habitat for cavity nesting birds (songbirds, raptors, and waterfowl).

Wildlife habitat within the Project area has been, and continues to be, influenced by tree mortality due to spruce bark beetle (*Dendroctonus rufipennis*) and windthrow events. Spruce trees in Southcentral Alaska have experienced extensive mortality in response to the spruce bark beetle in the last 20 years, resulting in significant vegetation compositional and structural changes (Holsten et al. 1995). Some of the impacts to wildlife species associated with spruce beetle infestations outlined in USFS (2006) include long term stand conversion. For example, on some sites in Southcentral Alaska, blue-joint grass (*Calamagrostis canadensis*) and other competing vegetation quickly invade stands where spruce beetles have "opened up" the canopy, delaying reestablishment of tree species. Wildlife species dependent on live, mature spruce

stands may decline due to long term stand conversion (e.g., red squirrels [Sciurus vulgaris], spruce grouse [Falcipennis canadensis], Townsend's warblers [Dendroica townsendi], and ruby-crowned kinglets [Regulus calendula]). Species that benefit from early successional vegetation (willow and aspen) like moose may increase in number as stand composition changes. Increases in large mammals may also result in an increase in predators including wolf and bear.

This area of the Kenai Peninsula is subject to windthrow; a cataclysmic abiotic factor that can generate an entire new chain of seral plant succession in a given area. Trees already stressed by infestation may be more susceptible to windthrow events. This was evident during the 2013 field season along the proposed Project access route. Many areas were difficult to traverse due to high concentrations of downed trees.

The 2013 Wildlife Study area represents the combined area that was assessed for each wildlife study component. It is also the same area previously defined as the collective terrestrial resources assessment area in Figure 1.2-1 and the general vegetation study area shown in Figure 3.1-1. Changes in the access route, Project design, and field efforts necessitated a revision of both the Breeding Bird and Northern Goshawk surveys; resulting in a revised definition of the 2013 'Wildlife Study area.' Figure 5.1-1 illustrates the revised 2013 Wildlife Study area in relation to the proposed FERC Project boundary. The delineated study areas specific to each component of the Study Plan are defined by their geographic nexus to the Project and are described below for the four 2013 field studies.

5.1.1. Raptor Nesting Survey

The Raptor Survey area is defined by the 2013 Study Plan as follows:

- The proposed development footprint of the Project (access roads, transmission line, Grant Creek, Grant Lake, powerhouse, and tunnel) and a buffer of 660 feet around Project development features. The 2013 field efforts occurred within the 2013 wildlife assessment area (see Figure 5.1-1) and focused exclusively on Northern Goshawk Broadcast Surveys along the newly defined Project route, as all other Raptor surveys were deemed complete.
- The 2010 study area encompassed the entire shore area of Grant Lake, including several rocky cliff faces and outcroppings above Grant Lake and potential nesting habitat for raptors, Grant Creek, and the access route (as defined at the time).

5.1.2. Breeding Landbirds and Shorebirds

The 2013 study area for breeding landbirds and shorebirds is defined by the Study Plan as follows:

- Grant Lake outlet delta area near the proposed tower intake (includes 500 feet on either side of Tower Intake);
- Trail Lake narrows access road alignment (100 feet on either side of the centerline of new road), as access allows;
- Powerhouse, detention pond, tailrace, and penstock (100 feet on either side of the centerline); and

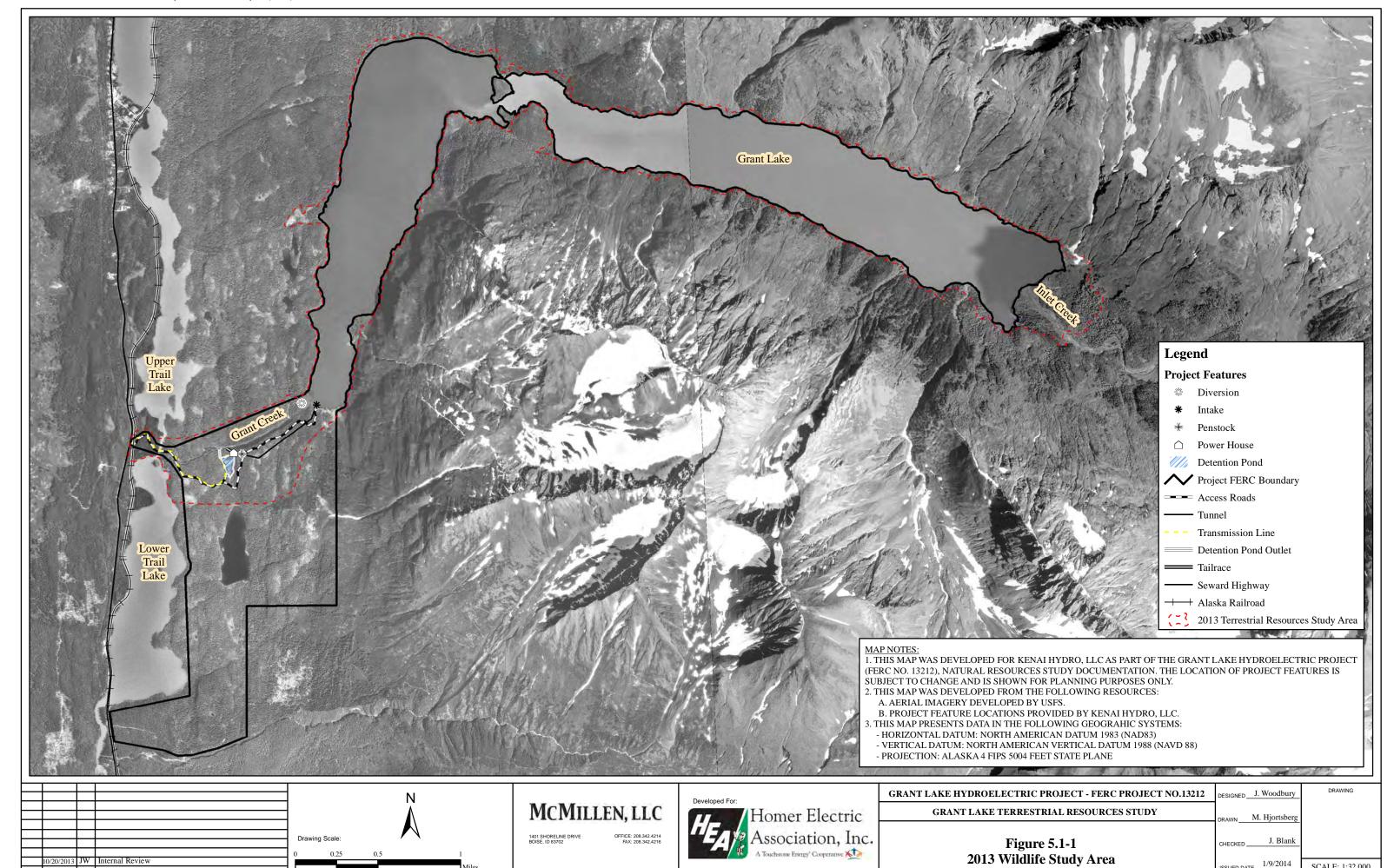
• Transmission line corridor (includes up to 100 feet on both sides of centerline of transmission line), as access allows.

The 2010 study area for breeding landbirds and shorebirds incorporated the above; however, the access route (as defined at the time) paralleled Falls Creek extending from the highway south of Lower Trail Lake, north to Grant Creek, and then to Grant Lake. Appendix 3a contains further information on breeding landbirds and shorebirds.

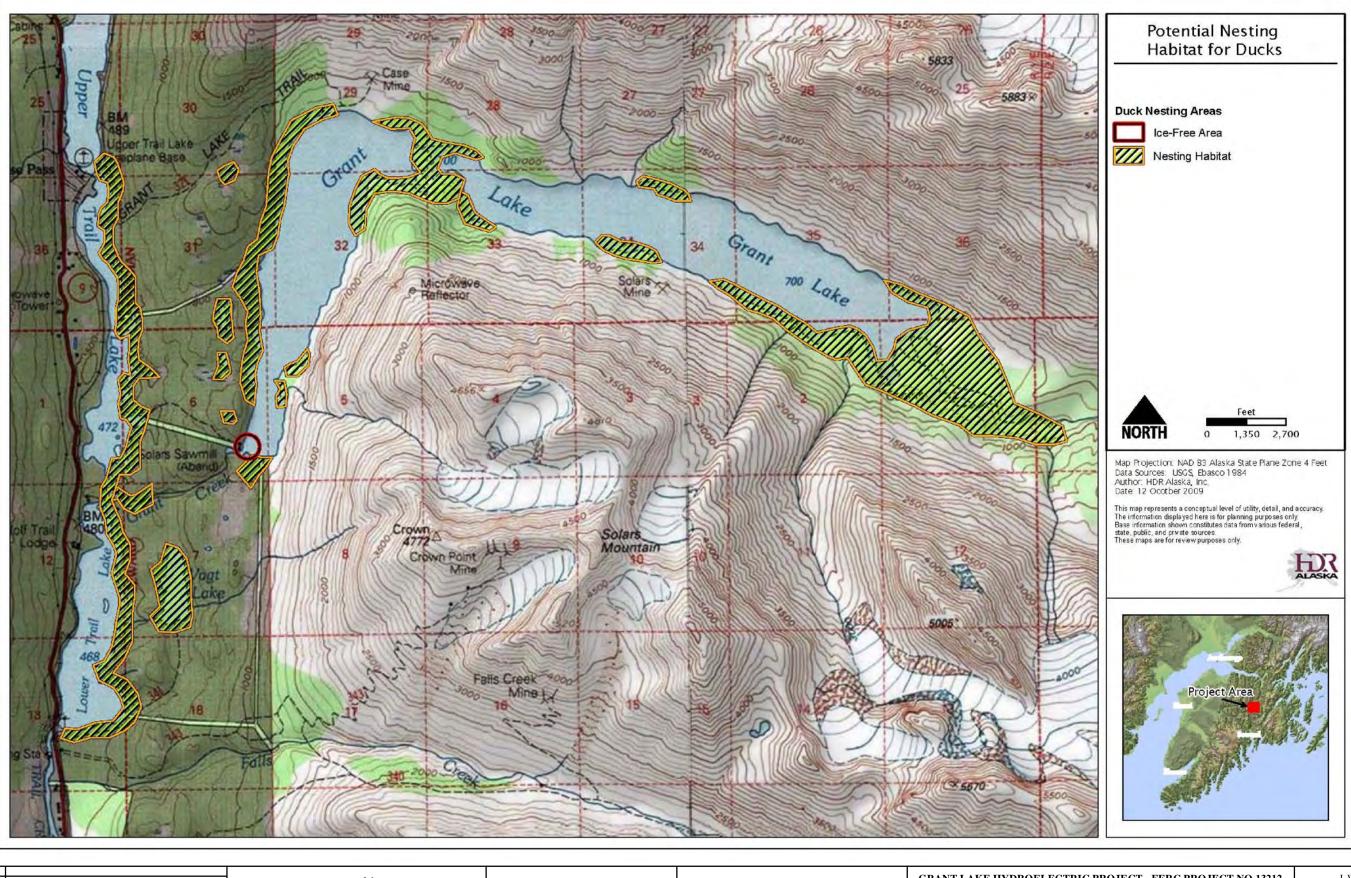
5.1.3. Waterbirds

The study area for nesting and wintering waterbirds is defined by the 2013 Study Plan as follows:

- The survey area for wintering waterbirds is located within the 2013 wildlife assessment area (see Figure 5.1-1) at the southern-most portion of Grant Lake at the source of Grant Creek. Two surveys are planned for the winter of 2013 and 2014, one of which was performed in December 2013 and the other is slated for February/March 2014.
- The 2010 field effort included surveys of Grant Lake and the lower reaches of Grant Creek below the Canyon Reach for nesting harlequin ducks (*Histrionicus histrionicus*) (see Figure 5.1-2). Waterbird surveys to determine the distribution and abundance of waterbirds nesting in the study area were considered complete at the conclusion of the 2010 summer field season.



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GRANT LAKE TERRESTRIAL RESOURCES STUDY

Figure 5.1-2 Potential Nesting Habitat for Ducks (2010 Effort)

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5.1.4. Terrestrial Mammals

A study area was not defined specifically for mammals in the 2013 Study Plan. Two winter surveys of the study area will be conducted to determine the presence and travel paths of moose during the winter 2013 and 2014, one of which was performed in December 2013 and the other to be conducted in February/March 2014. Incidental records of 2013 and 2014 wildlife observations will continue to be collected as other studies are performed.

The 2013 Moose Study area will occur within the 2013 wildlife assessment area (see Figure 5.1-1) and includes the area east of the Seward Highway and Alaska Railroad adjacent to the community of Moose Pass, extending past the eastern shoreline of Grant Lake. The Moose Study area extends south between the highway and Grant Lake to Grant Creek, and includes all Project facilities along Grant Lake, Grant Creek, and access road and transmission line routes (see Figure 5.1-1).

Mammal Survey tasks for the 2010 studies focused on brown and black bears, moose, mountain goats, Dall sheep, and bats. Incidental observations of other species were also recorded during all 2010 surveys. All components of the Mammal Study plan were considered complete in 2010, except winter moose presence and use of the Project area.

5.2. Methods

Field investigations for the Terrestrial Wildlife studies were undertaken in 2010. Field data collection methods during the 2010 field season were specific to breeding birds, Northern goshawks, waterbirds, and little brown bats. Data were also collected from other sources to fulfill Raptor and Large Mammal Survey requirements as stipulated by the Study Plan. As noted, a number of the Terrestrial Wildlife studies were considered complete at the conclusion of the 2010 field season.

Changes in the access route, Project design, and field efforts necessitated a reiteration of both the Breeding Bird and Northern Goshawk surveys. The Moose surveys and Winter Waterbird surveys not completed in 2010 were incorporated into the 2013 Study Plan. The study method specific to each component of the 2010 and 2013 Terrestrial Study plans, respectively, are described below.

5.2.1. Raptor Nesting Survey

2010 Raptor Nesting Surveys - Based on discussions with Mary Ann Benoit, USFS Seward Ranger District Wildlife Biologist (May 2009), the Study Plan methods were modified to include ground-based surveys for Northern goshawk nests and territories instead of an aerial survey for raptor nests. The survey methods are based on the Broadcast Acoustical Survey Method as detailed in the USFS Survey Methodology for Northern Goshawks in the Pacific Southwest Region (2000) and in Woodbridge and Hargis (2006). The USFS conducted an aerial survey for bald eagle nests that included the Grant Lake study area on May 7, 2010. Therefore, the USFS did not feel it was necessary for the 2010 biologists to conduct an aerial Raptor Nest Survey as indicated in the Study Plan.

2013 Northern Goshawk Broadcast Surveys - A ground-based survey for Northern goshawk territories was conducted along all linear Project facilities (access road, transmission line, powerhouse, detention pond, tailrace, intake, and penstock). The 2013 survey methods utilize the same methods used for the 2010 study effort; the USFS Survey Methodology for Northern Goshawks in the Pacific Southwest Region (2000) and Woodbridge et al. (2006). Appendix 3b contains further information about the Northern Goshawk Survey.

ArcMap was used to identify 15 sample points for calling stations prior to going in the field. The calling stations were positioned roughly 200 meters (~219 yards) apart along the revised Project access route and facilities. Pre-selected calling stations were located in the field using a GPS receiver; each point was physically marked with flagging for ease of relocation. At each calling station, the surveyors utilized a broadcast speaker amplifier to broadcast 10 second recordings of an adult Northern goshawk wail call (3-call sequence) and a fledgling goshawk begging call (separate 3-call sequence). After each broadcast, the surveyors watched and listened for 30 seconds before continuing with the next broadcast. At each calling station, the calls were broadcast at 60 degrees, 120 degrees, and 300 degrees (the 3-call sequence). This 3-call sequence was completed twice at each call station. After the last sequence, the surveyors progressed to the next station, listening and watching carefully for Northern goshawk signs and presence along the way. The food-delivery call was not used as indicated in the USFS methodology for Northern goshawks.

At each survey calling station, the following information was recorded on the data form:

- Dates, start and stop times
- Station number
- Description (type) of the detection, if any
- Age of birds detected, if any
- Location of detection, if any, relative to survey station and transect, including details about habitat, and
- Incidental birds

5.2.2. Breeding Landbirds and Shorebirds

2010 Breeding Landbird and Shorebird Surveys – The 2010 Breeding Landbirds and Shorebirds Survey used a modified point count approach based on the Alaska Landbird Monitoring System (ALMS) protocol. Point count locations were selected along the route corridor based on representative habitat types from aerial photography. The survey area included the Grant Lake outlet area, the Project access road and transmission line alignment, and the powerhouse and penstock. Sample points were mapped in the office and when possible were located at least 400 meters (~437 yards) apart. Point counts were conducted between 0500 (5:00am) and 1000 (10:00am). Point-count locations were accessed on foot using a GPS receiver to locate preselected point-count locations. Some of the office-based point count locations were modified in the field due to rough terrain or inaccessibility. If the location was modified, a new GPS point was taken.

The point-counts were conducted in standard 10-minute intervals at each point-count location. All species observed visually or aurally were recorded during each count. Observations were

categorized into distance-estimated categories of <50 meters (~55 yards) or >50 meters (~55 yards) as measured horizontally from the observers. In addition, species were documented based on the time interval at which they were detected (0-3 minutes; 3-5 minutes; and 5-10 minutes). Birds that were flying over during the count were also recorded. General vegetation types were recorded for eight points. ALMS-associated habitat information was not collected at any point. Data were recorded on a modified point count data sheet, and photos of the general vegetation at 19 point locations were taken. Incidental sightings of shorebirds, birds of conservation concern, or nest sites that were observed in transit between survey points were also documented.

2013 Breeding Landbird and Shorebird Surveys—ArcMap was used to identify 14 sample points for survey points prior to going in the field. The sample points were positioned roughly 250 meters (~273 yards) apart along the revised Project access route and facilities. Pre-selected survey points were located in the field using a GPS receiver; each point was physically marked with flagging for ease of relocation and then removed after the last survey.

Resident breeding birds begin nesting earlier than migrants on the Kenai. The different breeding timelines between residents and migrants manifests in distinct peak singing periods in May and June. To capture the peak singing periods for both groups of breeders, the 14 points were surveyed twice in 2013. The first time period (May 21st and 22nd) was surveyed for early nesting resident birds; the second time period (June 15th and 16th) was surveyed to capture later breeding migrants. Vegetation and habitat documentation were conducted within a 50 meter (~55 yards) radius for each point. Photo documentation at each cardinal direction (4 pictures per point), as specified by ALMS protocol, was also obtained. Habitat types were categorized in the field to at least Level III of the Alaska Vegetation Classification, and further classified to Level IV when possible (Viereck et al. 1992). All data were recorded on standard ALMS datasheets.

Surveys were initiated one half hour after sunrise and were completed by 0900 (9:00am). Each point was sampled for 10-minutes; all species observed visually or aurally were recorded during each count. Observations were categorized into standard ALMS distance-estimated categories in the field as measured horizontally from the observers; distances were later grouped as either <50 meters (~55 yards) or >50 meters (~55 yards) for analysis and compilation with 2010 data. Birds that were detected while flying over the point during the count were also recorded as well as their estimated horizontal distance from the observer. All point count data were recorded on standard ALMS datasheets.

Incidental observations of wildlife encountered while in transit between surveys points or while conducting surveys for other wildlife were also documented. Only the birds recorded within the 50 meter (55 yard) radius during each count were qualitatively analyzed for habitat association.

2013 Vegetation Classification and Correlation – In order to place the 2010 and 2013 breeding landbird and shorebird data in context with the vegetation community types located throughout the Project area, a vegetation community correlation was developed for this report. The correlation described below provides a linkage between the various habitat and vegetation cover types described for breeding landbirds and shorebirds from previous Project reports and literature sources, with the 2013 vegetation community classification types presented in Section 3 and Section 4 of this report.

The USFS (2007) cover types provided for this study originated from much older timber type coverages that were developed by the Alaska Regional Office in 1978 using 1:15,840 aerial photography flown in the 1950s-1970s. Part of the 2013 effort was to update and re-classify the cover types within the delineated study area, as described in Section 3 and Section 4. The breeding bird survey points (14), originally categorized by USFS (2007) vegetation types, were given new designations after the 2013 classification and then correlated to Ebasco (1984) for understory species comparisons and loose habitat associations (see Table 5.2-1). The only exceptions are the southern-most portion surrounding the Lower Trail Lake classified as birch, and the area immediately to the east classified as white spruce. These areas were outside of the designated 2013 study area. The 2010 breeding bird data were utilized for the overall qualitative assessment and all birds detected in the vegetation classifications either retained the old USFS (2007) designation of birch, or were re-named and incorporated into the 2013 Coniferous Forest classification. The bird species detected during the 2010 and 2013 field efforts were collectively summarized by the 2013 vegetation type classification.

Table 5.2-1. 2013 Breeding birds survey point vegetation classifications and correlation.

	Vegetation Type						
2013 Mapped Point	USFS Cover Code (2007)	2013 Vegetation Types	EBASCO 1984 Crosswalk Classification	EBASCO 1984 Common Associated Understory Plants	Additional Associated Understory Plants		
1	Other-Non Forested	Coniferous Deciduous Forest	Mixed Broadleaf / Needleleaf Forest	MENFER, VIBEDU, VACOVA, RIBTRI, ROSACI, OPLHOR, ALNVIR, CORCAN, VACVIT, MOSS	LINBOR, SPIBEA, CHAANG, EMPNIG, GYMDRY, CALCAN.		
2	Mixed Hardwood- softwood	Coniferous Deciduous Forest	Mixed Broadleaf / Needleleaf Forest	MENFER, VIBEDU, VACOVA, RIBTRI, ROSACI, OPLHOR, ALNVIR, CORCAN, VACVIT, MOSS	LINBOR, SPIBEA, CHAANG, EMPNIG, GYMDRY, CALCAN.		
3	Cottonwood	Coniferous Forest	Conifer Forest	MENFER, VACOVA, SPIBEA, OPLHOR, ALNVIR, RIBTRI, VACVIT, LEDSPP, RUBPED, MOSS	VACALA, CORCAN, CHAANG, EMPNIG, LINBOR, CALCAN, EQUARV, DRYEXP, GYMDRY		
4	White Spruce	Coniferous Deciduous Forest	Mixed Broadleaf / Needleleaf Forest	MENFER, VIBEDU, VACOVA, RIBTRI, ROSACI, OPLHOR, ALNVIR, CORCAN, VACVIT, MOSS	LINBOR, SPIBEA, CHAANG, EMPNIG, GYMDRY, CALCAN.		
5	Mixed Hardwood- softwood	Coniferous Deciduous Forest	Mixed Broadleaf / Needleleaf Forest	MENFER, VIBEDU, VACOVA, RIBTRI, ROSACI, OPLHOR, ALNVIR, CORCAN, VACVIT, MOSS	LINBOR, SPIBEA, CHAANG, EMPNIG, GYMDRY, CALCAN.		

Table 5.2-1, Continued...

2012	Vegetation Type					
2013 Mapped Point	USFS Cover Code (2007)	2013 Vegetation Types	EBASCO 1984 Crosswalk Classification	EBASCO 1984 Common Associated Understory Plants	Additional Associated Understory Plants	
6	Mixed Hardwood- Softwood	Scrub Shrub Wetland	Bog (Wet Meadow)	LEDSPP, VACVIT, EMPNIG, RUBCHA	BETNAN, VACOVA	
7	White Spruce	Herbaceous Wetland / Floodplain Forest & Scrub	Riparian Scrub	SALSPP, CHALAT, CHAANG, EQUSPP, CALCAN	EQIARV,ALNVIR	
8 & 9	Birch	Coniferous Deciduous Forest	Mixed Broadleaf / Needleleaf Forest	MENFER, VIBEDU, VACOVA, RIBTRI, ROSACI, OPLHOR, ALNVIR, CORCAN, VACVIT, MOSS	LINBOR, SPIBEA, CHAANG, EMPNIG, GYMDRY, CALCAN.	
10, 11, 12 & 14	Hemlock- Spruce	Coniferous Forest	Conifer Forest	MENFER, VACOVA, SPIBEA, OPLHOR, ALNVIR, RIBTRI, VACVIT, LEDSPP, RUBPED, MOSS	VACALA, CORCAN, CHAANG, EMPNIG, LINBOR, CALCAN, EQUARV, DRYEXP, GYMDRY	
13	Hemlock- Spruce	Scrub Shrub Wetland	Riparian Scrub	SALSPP, CHALAT, CHAANG, EQUSPP, CALCAN	SALALA, ALNVIR	

5.2.3. Waterbirds

2010 Waterbird Breeding and Brood-Rearing Surveys —Boat-based, intense area surveys were conducted along the entire nearshore habitat of Grant Lake in late June and mid-July 2010 to search for waterbird nests and broods. The survey was conducted by two observers motoring slowly along the lakeshore, documenting waterbirds and other wildlife observed. No effort was made to search for nest sites (except potential loon nesting habitat) since broods were already on the lake during the June 23, 2010 survey (the first 2010 survey). Additionally, the nesting waterbirds documented on Grant Lake were mainly cavity-nesting species that utilize standing dead trees. Therefore, nest searches along the entire shoreline were not conducted. However, areas with potential for loon nesting habitat (marshy habitat, emergent vegetation, and islands), which was limited to a few isolated areas on Grant Lake, were searched. Potential waterbird nesting habitat and broods were documented along the shoreline. The following information was recorded for each brood observed: species, descriptive location (no coordinates), number of ducklings and adults, approximate age of brood, behavior, and distance from shoreline.

2010 Harlequin Duck Survey –A foot survey of Grant Creek (below the falls to the outlet) was conducted on July 12, 2010, to identify harlequin duck broods and other waterbirds using Grant Creek. For each harlequin duck observation, the following data were recorded: GPS location, total number of birds in the group; numbers of pairs, males, and females; number of young; physical description of location (i.e., in the water, creek banks, flying); and a brief description of the creek habitat where the bird or birds were documented. Other notable species such as common merganser (Mergus merganser) and red-breasted merganser (Mergus serrator) were counted, but locations were not recorded.

2013 Winter Waterbird Surveys—In order to determine if this area is still being utilized by waterbirds in the winter, wildlife biologists conducted a survey of the Grant Lake outlet area in December 2013 and will conduct a second survey of the same area in February/March 2014 to document waterbird use and the amount of open water habitat available. Biologists will document species, number of individuals, and percent open water during a daylight survey period of 4-6 hours. The biologists will also document any wildlife species or tracks observed in the study area while en route to and from Grant Lake. These data, once collected and analyzed, will be provided to stakeholders for review and collaboration and incorporated into the DLA.

5.2.4. Terrestrial Mammals

2010 Terrestrial Mammal Surveys —A Bat Survey was conducted to document roosting of little brown bats (*Myotis lucifugus*) in an abandoned historic cabin on the west side of Grant Lake. While no other specific surveys were conducted, all wildlife observed during other field studies in 2010 were documented and reported as incidental information.

Bear - The Study Plan stated that a bear den emergence aerial survey would be conducted in early to mid-May 2010 to capture bear activities as they were leaving their dens in the spring. Based on discussions with Mary Ann Benoit, USFS Seward Ranger District Wildlife Biologist, the USFS assumed responsibility for Bear Denning surveys in concert with their annual survey for bald eagle nests and trumpeter swans on May 6, 2010. Ms. Benoit provided the ArcGIS shapefiles and findings to use in determining Project effects on bears. The survey effort included habitat along Grant Creek (covering the area of Trail Lake narrows access route) and around Grant Lake.

Mountain Goat and Dall Sheep - Observations of suitable habitat around Grant Lake were made in 2010 using binoculars and spotting scopes from a boat during the Waterbird surveys.

Bats - Biologists conducted a bat survey of the historic cabin on July 23, 2010, based on standard USFS Bat Survey protocols for abandoned buildings and mine sites (Reynolds and Leffler 1994). A high powered flashlight was used to search the cracks and crevices of the cabin, and crews searched for bat signs (guano and carcasses). Photos were taken inside and outside of the cabin.

Observations of all species including moose were recorded incidentally during all 2010 Wildlife surveys.

2013-2014 Winter Moose Surveys— Managers suspect that many moose depart the area in the late fall and winter in the Trail river drainage as well as the northeast portion of Grant lake through

the low pass into Moose Creek (Selinger 2013.). Two winter surveys of the study area will be conducted to determine the presence and travel paths of moose during the winter 2013- 2014. The first of the two Winter Moose surveys was conducted in December 2013, the second is planned for February/March 2014. Surveys will use methods for full coverage of the study area as described in detail in Gasaway et al. (1986). USFS flight regulations and requirements will be followed during the surveys. These data, once collected and analyzed, will be provided to stakeholders for review and collaboration and incorporated into the DLA.

5.3. Results

The following subsections present the results of the 2013 Wildlife Study as well as relevant data from the Ebasco (1984) and the 2010 Wildlife studies.

Field investigations for the Terrestrial Wildlife studies were undertaken in 2010 and then again in 2013. Figure 5.3-1 illustrates the Wildlife Survey locations from both of these field efforts. The 2010 field data are included in this results section for Waterbird Breeding and Brood Rearing, Harlequin Duck, and Little Brown Bat surveys as well as incidental observations. Data were also collected from the USFS to fulfill Raptor and Large Mammal Survey requirements as stipulated by the Study Plan. Changes in the access route, project design, and field efforts necessitated a reiteration of both the Breeding Bird and Northern Goshawk surveys included in the 2013 results section.

The terrestrial wildlife results section reports on studies that are complete as well as several studies that are in progress. These latter studies require either two years of data collection and/or seasonally-specific sampling methods. As a result of the ongoing field efforts, results are not yet complete for this report. The Breeding Land Bird surveys were completed in 2013. The first year of the two-year Northern Goshawk Survey was also completed along the new Project route. In addition, the first of the two Winter Moose and Winter Waterbird surveys were completed in December 2013. The 2014 Northern Goshawk (second year) Survey, Winter Waterbird, and Winter Moose surveys are not complete as of the drafting of this report. However, all other components as stipulated in the Study Plan are deemed complete. The results are organized by the four primary components of the Terrestrial Wildlife Study Plan.

5.3.1. Raptor Nesting Survey

Tree-nesting raptor habitats in the Project vicinity include mixed broadleaf/coniferous forests, broadleaf forest, and coniferous forests (see Table 5.3-1). Suitable habitats for cliff-nesting raptors are not abundant near the Project but include several rocky cliff faces and outcroppings above Grant Lake. Potential nesting habitat for raptors, at that time, was delineated during the AEIDC field studies conducted in the Project vicinity in 1981-1982 (Ebasco 1984).

Hawks and other owls commonly use woodlands, forests, and forested wetland areas for nesting and hunting. Prime foraging areas for many raptors include wetlands containing waterfowl, seabirds, shorebirds, and shallow or clear waterbodies that carry appropriate fish prey.

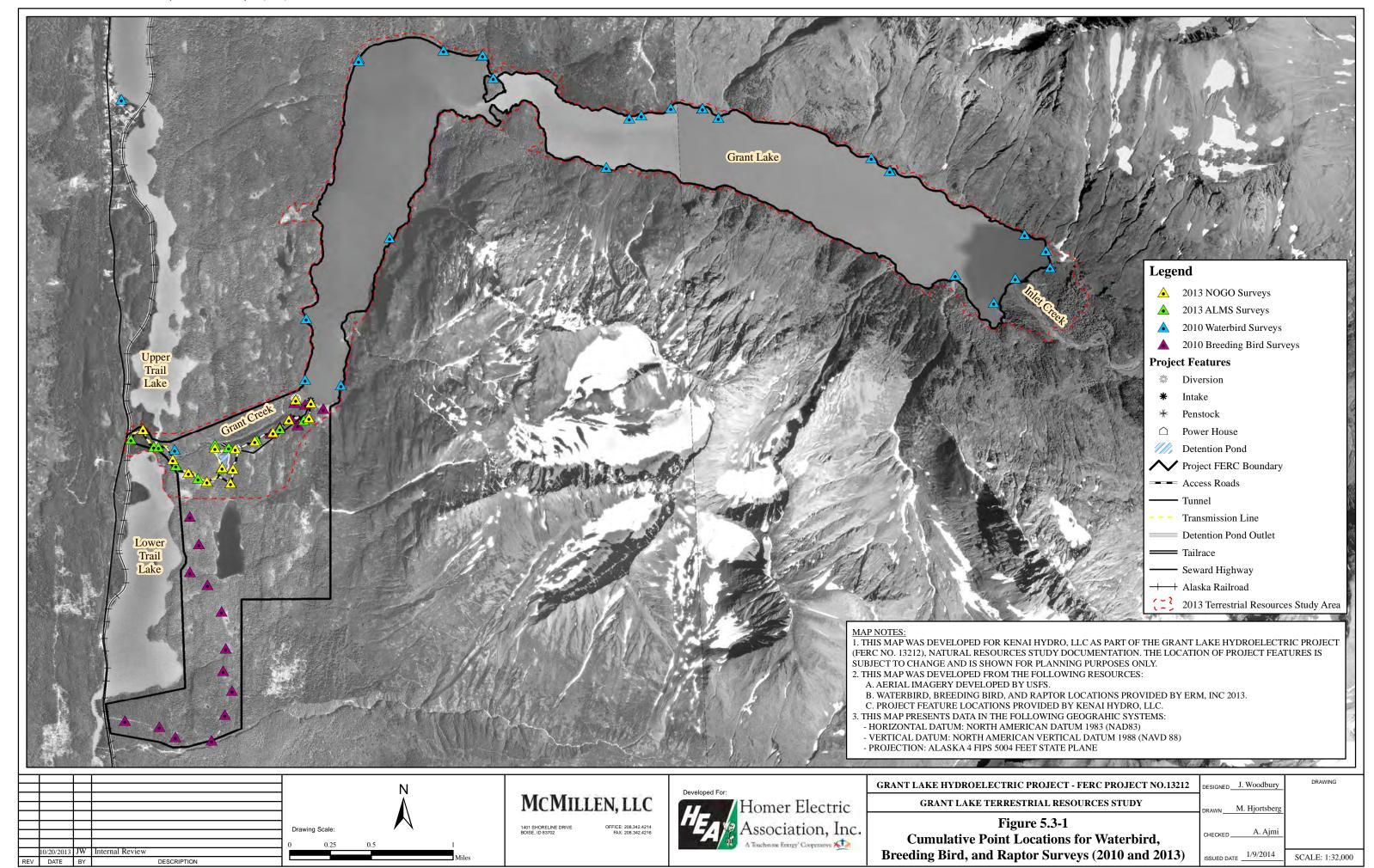
Table 5.3-1. Raptor breeding habitats.

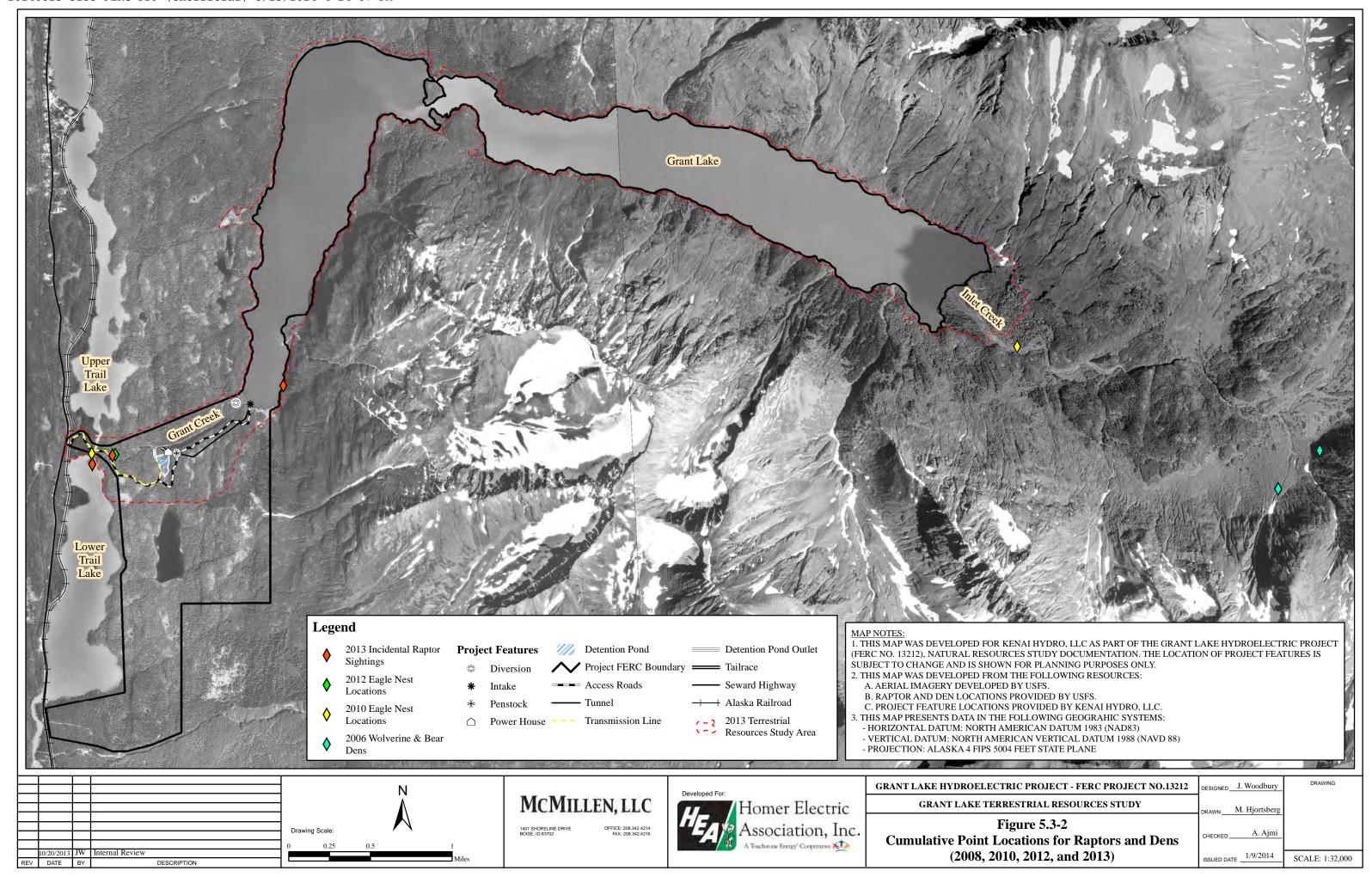
Raptor	Breeding Habitat		
Golden Eagle (Aquila chrysaetos)			
Peregrine Falcon (Falco peregrinus)	Coastal or inland cliffs, bluffs, or other steep terrain		
Rough-legged Hawk (Buteo lagopus)			
Osprey (Pandion haliaetus)			
Bald Eagle (Haliaeetus leucocephalus)	Large trees for stick nest placement		
Red-tailed Hawk (Buteo jamaicensis)			
Sharp-shinned Hawk (Accipiter striatus)			
Northern Goshawks (Accipiter gentilis)			
Great Horned Owl (Bubo virginianus)	Forest		
Northern Hawk Owl (Surnia ulula)	Potest		
Boreal Owl (Aegolius funereus)			
Northern Saw-whet Owl (Aegolius acadicus)			
Northern Harrier (Circus cyaneus)	Open meadows, marshes or tundra		
Short-eared Owl (Asio flammeus)			
Great Gray Owl (Strix nebulosa)	Semi-open country including open coniferous woodland		
Merlin (Falco columbarius)	Semi-open country including open conferous woodiand		
	Rivers and coastal areas, and possibly near alpine		
Black Merlin (Falco columbarius suckleyi)	meadows; edges of forest habitat adjoining open areas,		
	such as muskegs, ponds, and lakes		
	Cavity nesters, utilizing natural holes in trees,		
	abandoned woodpecker holes, holes in buildings or		
American Kestrel (Falco sparverius)	cliffs, abandoned magpie nests, and similar sites. This		
American Resuct (Face sparvertus)	species is also found in alpine and tundra areas not far		
	from treeline and in open spruce and mixed		
	spruce/aspen forests (Alexander et al. 2003)		

2010 Raptor Nesting Surveys - Bald Eagle Nest surveys were conducted by the USFS in 2010. The surveys provided two nest locations (see Figure 5.3-2). Three sightings of bald eagles were noted as incidental during the 2010 season. There were no indications that these individuals were near or in nests.

2010 Northern Goshawk Broadcast Surveys –One survey was completed in 2010. No Northern goshawk responses (vocal or non-vocal) were detected and no Northern goshawk nests or territories were identified. There were no confirmed sightings of Northern goshawks in the study area during the 2010 effort.

2013 Northern Goshawk Broadcast Surveys - Two separate survey events were conducted in 2013: the first on June 16th and 17th and the second on July 8th and 9th. One adult female Northern goshawk response was detected both audibly and visually during the first survey on June 16, 2013 (see Figure 5.3-2). The individual responded to an adult wail call during the first 3-call sequence. The female was detected in a coniferous hardwood forest with False Azalea (Menziesia ferruginea), Dwarf Dogwood (Cornus canadensis), Devil's Club (Oplopanax horridus) and Nagoonberry (Rubus arcticus) dominant woody plant understory. Other non woody species included Pink Wintergreen (Pyrola asarifolia), Fireweed (Chamerion angustifolium), Oak Fern (Gymnocarpium dryopteris), Wood Fern (Dryopteris expansa), and moss species. No other individuals were detected during the surveys.





2013 Incidental Raptor Sightings – A bald eagle nest in a large cottonwood along Grant Creek was recorded with a pair of adults in attendance; they appeared to be incubating eggs as assessed by behavior on May 22, 2013 (see Figure 5.3-2). This nest sight has been documented in previous years (2010 and 2012). The pair was re-sighted on June 14th -17th and again appeared to be incubating eggs. During the last field visit (July 8th -9th), the pair was once again sighted in the nest and appeared to have at least one hatched young as assessed from observed feeding behavior. An immature bald eagle was observed on July 19, 2013, attempting to capture a duckling (see Figure 5.3-2).

A pair of merlin was detected on May 21, 2013, during the first field visit on the small island just south of the Trail Lake narrows (see Figure 5.3-2). The Trail Lake Narrows area is defined as the section of water between the Upper Trail and Lower Trail lakes. The merlin did not appear to be incubating at that time; however, they did appear to have established a breeding territory based on assessed behavior. The pair was detected again during the second and final field visits at the same location; however, no effort was made to locate a nest due to high water near the suspected location of the nest.

An adult male osprey (based on plumage) was detected flying over the Trail Lake Narrows during the June $14^{th} - 17^{th}$ field visit.

Compilation of 2010 and 2013 Results - There are eleven diurnal raptor species that potentially occur in the delineated Project area: osprey, Northern harrier, golden eagle, bald eagle, sharpshinned hawk, Northern goshawk, red-tailed hawk, rough-legged hawk, American kestrel, merlin, and peregrine falcon. There are also and six owls species that potentially occur in the delineated Project area: short-eared, great horned, great gray, Northern saw-whet, Northern hawk, and boreal. Occurrence includes migration and/or residence. All species listed are protected by the MBTA 1972 (16 U.S.C. 1361 et seq.). The bald eagle is protected under the BGEPA (16 U.S.C. 668 et seq.) and is considered a species of special interest for the USFS (2008). Northern goshawks are also considered a species of special interest for the USFS (2008).

Table 5.3-2 provides a summary of the various raptors that have been detected during site-specific studies in the Grant Lake Project area:

Raptor Species Detected in Project Area	Study Year
Bald Eagle	Ebasco 1984, 2010 and 2013
Northern Goshawk	2013
Sharp-shinned Hawk	Ebasco 1984
Osprey	2013
American Kestrel	Ebasco 1984
Golden Eagle	Ebasco 1984
Merlin	2013

Table 5.3-2. Raptors detected during site specific studies and year of study.

Based on vegetation classification, nesting habitat is available for all the listed diurnal raptors in the area. No owls were detected during any field studies; however, based on vegetation classification, suitable habitat exists throughout the Grant Lake area.

5.3.2. USFS Sensitive Species and Species of Special Interest

Osprey: The osprey is a Region 10 sensitive species. Ospreys were not documented using the Grant Lake area during the Trail River Watershed landscape assessment (USFS 2008), but potential nesting and foraging habitat was observed in the study area during the 2013 field efforts. An adult male Osprey was documented in 2013; however, its breeding status was unknown. Ospreys are very individualistic and type specific with regards to tolerance to human activities (Poole 1981).

Bald Eagle: Approximately 80 percent of all detected bald eagle nests on the Seward Ranger District are located in mature cottonwood trees with an average diameter of 31 inches and within 0.25 mile of an anadromous fish-bearing stream (USFS 2008). The breeding pair documented on Grant Creek in 2013 did not appear to be impacted by human activity and presence.

Northern Goshawks: This species is a year-round resident of the Chugach National Forest (USFS 1984). The majority of Northern goshawk nests discovered on the Seward Ranger District have been documented in old growth hemlock-spruce stands characterized by a closed canopy, large average diameter, gap regeneration, and an open understory (USFS 2008). A small stand of old growth hemlock and spruce at the east end of Grant Lake may provide additional nesting habitat (USFS 2008). The spruce bark beetle has affected approximately 95 percent of large conifer trees on the Kenai; a portion of these stands may yet provide nesting or foraging habitat, but the bark beetle is likely reducing the value of these stands for Northern goshawk nesting habitat as the canopy becomes more open (USFS 2008).

5.3.3. Breeding Landbirds and Shorebirds

Bird species are diverse in their forms and lifestyles; therefore, their habitat also needs to vary. However, regardless of location, a habitat must fulfill basic needs of: 1) cover (shelter) from weather and predators; 2) food and water for nourishment; and 3) space to obtain food, water, and to attract a mate. A bird's need for cover may depend on the age and breeding status of the individual. Birds, nestlings in particular, need shelter from predators and the elements. Cover, including trees, grasses, and rocks, also harbors foods for birds and provides space or materials for nesting. The requirements for cover can be quite specific. Species often show a marked preference for nesting and foraging at certain heights and in certain structures of vegetation. Cavity nesters, such as woodpeckers, require trees of the age and size to support suitable holes. The type of food that a bird selects depends on availability, and during periods of abundance (for example, during a spring fish spawning or fall fruiting) its diet may become very repetitive. A bird's diet also depends on its nutritional requirements, which change with season and age. Breeding adults and developing chicks need additional protein, for example. Birds that eat plant matter much of the year will turn to insects to fulfill that need. Birds undertaking strenuous migrations will increase and alter their diets prior to their journeys in order to accumulate large amounts of energy in the form of fat. Water is also an essential as a medium for feeding and other activities. Most species of birds will space themselves out during breeding, with males or breeding pairs defending their territory. In contrast, some bird species nest in colonies. Space or territory needs also depend on food sources and availability.

2010 Breeding Landbird and Shorebird Surveys - Point-count surveys for breeding landbirds and shorebirds were conducted in the study area in June 19th and 20th, 2010. A total of 20 point-counts were conducted in the study area. A total of 232 birds (27 species) were detected during the surveys at 19 points (see Table 5.3-3). The 2010 efforts did not include the 50 meter (~55 yards) radius vegetation survey for habitat delineation at each survey point; therefore, these species can only be compiled and assessed for presence in the Project area and a very loose forest type association.

Table 5.3-3. 2010 breeding bird and shorebird surveys.

20	010 Species	Total Detected
Wilson's Snipe	Gallinago delicata	1
Hairy Woodpecker	Picoides villosus	1
Alder Flycatcher	Empidonax alnorum	1
Gray Jay	Perisoreus canadensis	2
Black-billed Magpie	Pica hudsonia	3
Black-capped Chickadee	Poecile atricapilla	1
Boreal Chickadee	Poecile hudsonicus	9
Brown Creeper	Certhia americana	3
Golden-crowned Kinglet	Regulus satrapa	3
Ruby-crowned Kinglet	Regulus calendula	16
Swainson's Thrush	Catharus ustulatus	7
Hermit Thrush	Catharus guttatus	32
American Robin	Turdus migratorius	9
Varied Thrush	Ixoreus naevius	33
Orange-crowned Warbler	Oreothlypis celata	17
Yellow Warbler	Setophaga petechia	4
Yellow-rumped Warbler	Setophaga coronata	23
Townsend's Warbler	Setophaga towsendi	12
Wilson's Warbler	Cardellina pusilla	13
Northern Waterthrush	Parkesia noveboracensis	3
American Tree Sparrow	Spizella arborea	2
Fox Sparrow	Passerella iliaca	3
Lincoln's Sparrow	Melospiza lincolnii	3
Dark-eyed Junco	Junco hyemalis	12
Pine Grosbeak	Pinicola enucleator	2
Pine Siskin	Spinus pinus	4
Redpoll Species	Acanthis sp.	13
	Total Detections	232
	Total Species	27

Additional 2010 Incidentals – The following species were recorded as incidental observations during the 2010 field effort: American dipper (*Cinclus mexicanus*), American three-toed woodpecker (*Picoides tridactylus*), violet-green swallow (*Tachycineta thalassina*), common raven (*Corvus corax*), Steller's jay (*Cyanocitta stelleri*), alder flycatcher (*Empidonax alnorum*), spotted sandpiper (*Actitis macularia*), gray-cheeked thrush (*Catharus minimus*), goldencrowned sparrow (*Zonotrichia atricapilla*), herring gull (*Larus argentatus*), Western woodpewee (*Contopus sordidulus*), olive-sided flycatcher (*Contopus cooperi*), solitary sandpiper (*Tringa solitaria*), and belted kingfisher (*Ceryle alcyon*).

2013 Breeding Landbird and Shorebird Surveys - Point-count surveys for breeding landbirds and shorebirds were conducted in the study area in May 21st – 22nd and June 15th – 16th, 2013. A total of 279 birds (31 species) were detected during the surveys at 14 points (see Table 5.3-4). The 2013 effort did include vegetation and habitat delineation at each point (see Table 5.3-5); however, due to the small sample size, only a qualitative assessment may be compiled for loose bird habitat associations in the Project area as a whole.

Table 5.3-4. 2013 breeding bird and shorebird surveys.

201	3 Species	Total Detected	< 50 m
Common Loon	Gavia immer	1	1
Barrow's Goldeneye	Bucephala islandica	2	
Red-breasted Merganser	Mergus serrator	2	
Merganser Species	Mergus sp.	1	
Bald Eagle	Haliaeetus leucocephalus	1	
Merlin	Falco columbarius	1	1
Sandhill Crane	Grus canadensis	5	
Greater Yellowlegs	Tringa melanoleuca	1	1
Wilson's Snipe	Gallinago delicata	4	2
Mew Gull	Larus canus	1	
Glaucous-winged Gull	Larus glaucescens	1	
Chestnut-backed Chickadee	Poecile rufescens	6	3
Pacific Wren	Troglodytes pacificus	1	
American Dipper	Cinclus mexicanus	5	1
Ruby-crowned Kinglet	Regulus calendula	34	12
Swainson's Thrush	Catharus ustulatus	8	3
Hermit Thrush	Catharus guttatus	15	4
American Robin	Turdus migratorius	6	4
Varied Thrush	Ixoreus naevius	53	18
Orange-crowned Warbler	Oreothlypis celata	20	12
Yellow Warbler	Setophaga petechia	1	
Yellow-rumped Warbler	Setophaga coronata	13	2
Townsend's Warbler	Setophaga townsendi	7	

Table 5.3-4, Continued...

2013 Spo	ecies	Total Detected	< 50 m
Wilson's Warbler	Cardellina pusilla	12	3
Fox Sparrow	Passerella iliaca	3	
Golden-crowned Sparrow	Zonotrichia atricapilla	2	2
Dark-eyed Junco	Junco hyemalis	6	3
White-winged Crossbill	Loxia leucoptera	6	6
Pine Grosbeak	Pinicola enucleator	3	3
Pine Siskin	Spinus pinus	47	41
Redpoll Species	Acanthis sp.	11	10
	Total Detections	279	132
	Total Species	31	20

Table 5.3-5. 2013 Breeding birds survey point vegetation survey.

		Poin	t Vegetation Type	
Point	% of 50m radius and Type of Upper Story Tree Species	Upper Story Trees (% Canopy Cover, % Coniferous)	Mid-story Shrub Species	Non-woody Plant Cover Species
1	[85%] * BETPAP, POPTRE, PICGLA (PICSIT / PICLUT) [15%] * Developed Railroad	75%, 10%	VACOVA, VIBEDU, VACVIT,EMPNIG, SPIBEA	Graminoids, GEOLIV,CHAANG, VIOLAN, GYMDRY, DRYEXP and Moss species
2	[55%] * PICGLA (PICSIT / PICLUT), BETPAP [45%] * Grant Creek	90%, 85%	SALSPP, EMPNIG, VACOVA, LINBOR, ALNSPP	Graminoids, GEOLIV,CHAANG, GERERI, GYMDRY, DRYEXP and Moss species
3	[60%] * BETPAP, PICGLA (PICSIT / PICLUT) [40%] * Grant Creek	85%, 50%	VIBEDU, ROSACI, OPLHOR, CORCAN	Graminoids, PYRASA,STRAMP, GERERI, GALTRI, GYMDRY, DRYEXP and Moss species
4	[100%] * PICGLA (PICSIT / PICLUT), BETPAP	10%, 90%	MENFER, LEDGRO, RIBTRI, OPLHOR, ALNSPP	Graminoids, TRIARC,CHAANG, GYMDRY, DRYEXP and Moss species
5	[70%] * PICGLA (PICSIT / PICLUT), BETPAP [30%] * PICGLA (PICSIT / PICLUT)	85%, 60% 7%, 100%	MENFER, LINBOR, VIBEDU, ROSACI, EMPNIG SALSPP, BETGLA, VIBEDU, ANDPOL	Graminoids, PYRASA, GERERI,CHAANG, GYMDRY and Moss species Graminoids, PYRASA, COMPAL, ANERIC, VIOLAN and Moss species
6	[60%] * PICMAR, BETPAP	10%, 100%	SALSPP, BETGLA, LEDDEC, VACOVA	Graminoids and Moss species

Table 5.3-5, Continued...

		Poin	t Vegetation Type	
Point	% of 50m radius and Type of Upper Story Tree Species	Upper Story Trees (% Canopy Cover, % Coniferous)	Mid-story Shrub Species	Non-woody Plant Cover Species
	[40%] * PICMAR, BETPAP	85%, 30%	MENFER, EMPNIG, VACVIT, RUBCHA	GEOLIV, CHAANG and Moss species
7	[50%] * BETPAP, PICGLA (PICSIT / PICLUT), POPBAL [50%] * Grant Creek	65%, 20%	VIBEDU, RIBTRI, OPLHOR, ROSACI	Graminoids, HERLAN, CHAANG, STRAMP, PYRASA, GERERI, GYMDRY, DRYEXP and Moss species
8	[55%] * TSUMER, PICMAR, BETPAP	90%, 90%	MENFER, SALSPP, RIBTRI, OPLHOR	Graminoids, CHAANG, STRAMP, GYMDRY, DRYEXP CLASPP and Moss species
	[45%] * PICMAR, BETPAP	65%, 70%	MENFER, RIBTRI, RUBARC, VACOVA	Graminoids, CHAANG, GYMDRY and Moss species
9	[100%] * BETPAP, PICGLA (PICSIT/PICLUT)	85%, 45%	MENFER, CORCAN, OPLHOR, RUBARC	Graminoids, PYRASA, CHAANG, GYMDRY, DRYEXP and Moss species
10	[100%] * TSUMER, PICGLA (PICSIT / PICLUT)	92%, 99%	MENFER, VACOVA, VACVIT, EMPNIG	GEOLIV, GYMDRY, PELBRI and Moss species
11	[100%] * TSUMER, PICGLA (PICSIT / PICLUT), BETPAP	92%, 99%	MENFER, OPLHOR, VACOVA, RUBARC, ALNSPP	GEOLIV, GYMDRY, PELBRI and Moss species
12	[100%] * TSUMER, PICGLA (PICSIT / PICLUT)	87%, 99%	MENFER, CORCAN, VACVIT, EMPNIG, ALNSPP	Graminoids and Moss species
13	[30%] * PICGLA (PICSIT / PICLUT)	50%, 5%	ROSACI, VACOVA, RIBTRI, VACVIT, ALNSPP	Graminoids, VIOLAN, GYMDRY and Moss species
	[20%] * PICGLA (PICSIT / PICLUT)	15%, 5%	VIBEDU, ROSACI, SALSPP, VACOVA, ALNSPP	Graminoids, VIOSPP, COMPAL and GYMDRY
14	[50%] * Grant Lake [50%] * TSUMER, PICGLA (PICSIT / PICLUT) [50%] * Grant Creek	85%, 100%	BETNAN, LEDDEC, EMPNIG, VACOVA	Graminoids and Moss species

Additional 2013 Incidentals – Species that were observed incidentally during the 2013 field season include: Black-capped chickadee, boreal chickadee, brown creeper, belted kingfisher, spruce grouse, spotted sandpiper, violet-green swallow, common raven, alder flycatcher, tree swallow (*Tachycineta bicolor*), gray jay, and Arctic tern (*Sterna paradisaea*).

Compilation of Results - Compilation of site specific data (Ebasco 1984, 2010 field work, and 2013 field work) and the documented species list from the Kenai Lake-Black Mountain Research Natural Area (RNA) (2007) (4 miles to the southwest of the Project area) provided sufficient

information for an assessment of presence / absence of breeding birds in the immediate surrounding area. Observed species in the Kenai Lake-Black Mountain RNA include all species detected during the site specific Grant Lake studies, except for the Northern harrier, ptarmigan (*Lagopus* sp.), green sandpiper (*Tringa ochropus*), Northern shrike (*Lanius excubitor*), and savannah sparrow (*Passerculus sandwichensis*) (USFWS 2008).

Breeding bird presence in the Project area is contingent on many variables including habitat. Habitat includes vegetation as well as landform characteristics important to specific species. Bird species utilize forested and non-forested vegetation communities differently depending on nesting, cover, and foraging requirements. Landform characteristics important to species include elevation, slope, aspect, and rock ledges. Avifauna habitat types were developed by Kessel (1979) and utilized by Ebasco (1984). Ebasco (1984) correlated the avian breeding habitat types developed by Kessel (1979) to the general vegetation classifications developed for their study (see Table 5.3-6).

Table 5.3-6. Comparison of avifauna breeding habitat types (Kessel 1979) to vegetation classifications (Ebasco 1984).

					A	vifaur	a Ha	bitat '	Types	;			
EBASCO (1984) Vegetation Classifications	Lacustrine Waters and Shorelines	Riverine Waters and Shorelines	Cliffs, Cutbanks, and Block Fields	Wet Meadow	Dwarf Shrub Meadow	Dwarf Shrub Mat	Low Shrub Thicket	Medium Shrub Thicket	Tall Shrub Thicket	Deciduous Forest	Coniferous Forest	Mixed Deciduous-Coniferous Forest	Scattered Woodland and Dwarf Forest
Conifer Forest	X	X		X	X						X	X	X
Broadleaf Forest	X	X							X	X			
Mixed Broadleaf / Needleleaf Forest	X	X						X	X			X	X
Riparian Scrub	X	X					X	X	X				
Upland Scrub		X						X	X				
Grass / Forbe Meadow		X		X									
Bog (Wet meadow)	X	X		X	X						X		X
Alpine Tundra		X		X		X	X						
Barren			X										

For this report, all site-specific bird data has been incorporated into the Ebasco (1984) table format to include species detected during each site-specific study and their primary breeding habitats as described by Kessel (1979) (see Table 5.3-7).

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Table 5.3-7. Bird species and breeding habitats in the 2013 wildlife study area¹.

	Species Potentially Project Red-throated Loon*	Area	Observed or Reported During 2013 Field Season	Observed During 2010 Field Season	Observed During 1981-82 AEIDC Field Season ²	Known Breeders	Inferred Breeders	Abundance ³	XX Lacustrine Waters and Shorelines	X Riverine Waters and Shorelines	Cliffs, Cutbanks, and Block Fields	Wet Meadow	Dwarf Shrub Meadow	Dwarf Shrub Mat	Low Shrub Thicket	Medium Shrub Thicket	Tall Shrub Thicket	Deciduous Forest	Coniferous Forest	Mixed Deciduous-Coniferous Forest	Scattered Woodland and Dwarf Forest	Migratory Only
	Pacific Loon	Gavia stellata Gavia pacifica		X	X	X		U	XX	X												
	Common Loon	Gavia pacifica Gavia immer	X	1	X	X		FC	XX	X												
	Yellow-billed	Gavia immer Gavia adamsii	Λ		Λ	Λ		R	AA	Λ												
	Loon*	Gavia aaamsii						IX														X
	Horned Grebe	Podiceps						U	XX	X												
	Red-necked Grebe	auritus Podiceps						R	XX	X												
20140815		grisegena Unofficial) 8 Cygnus	/15 ,	/201	4 4	:14	107															
20140013-	5155 FERC PDF (Tundra Swan		15	201	- T	• 1 4	0 /	PM R														X
	Trumpeter Swan***	columbianus Cygnus	X					U	X			XX	X									
	_	buccinator																				
	Greater White-	Anser albifrons						U														X
	fronted Goose* Canada Goose	Branta	X					U	X			X	XX									
		canadensis																				
	Mallard	Anas platyrhynchos		X	X		X	С	XX	X		X	X									
	Gadwall	Anas strepera						R														X
	Green-winged Teal	Anas crecca			X		X	U					XX									
	American Widgeon	Anas americana			X	X	Λ	U	X				X									
	Northern Pintail	Anas acuta						FC	XX	X		XX	X									
	Northern Shoveler	Anas clypeata						С														X
	Blue-wing Teal	Anas discors						R	X				X									71
	Canvasback	Aythya						R				XX	11									X
	Canvasback	valisineria																				
	Greater Scaup	Aythya marila						R	XX													
	Lesser Scaup	Aythya affinis			X			U	X			XX										
	Harlequin Duck	Histrionicus	X	X	X		X	R		XX								XX			XX	
	Common	histrionicus Bucephala		X	X	X		FC	X	X											XX	
	Goldeneye	clangula		1	1	71		10	71	71											7171	
	Barrows Goldeneye	Bucephala	X	X	X			FC	X	X											XX	
	Bufflehead	islandica Bucephala						U	X	X											XX	
	Burnenead	albeola																				
	Common	Mergus	X	X	X			С	X	X											XX	
	Merganser Red-breasted	merganser Mergus serrator	X	X	X			FC	X	X		X	X									
	Merganser																					
	Osprey***	Pandion haliaetus	X					R										XX	X	X		
	Northern Harrier	Circus cyaneus						R				XX	X									
	Golden Eagle	Aquila			X		X	С			XX									X		
		chrysaetos																				
	Bald Eagle***	Haliaeetus leucocephalus	X	X	X			FC										XX	X	X		
	Sharp-shinned	Accipiter			X			С										X	XX	X		
	Hawk	striatus																				
	Northern Goshawk***	Accipiter gentilis	X	X				U										X	X	XX		
	Red-tailed Hawk	Buteo						U			X						X	X	X	X		
		jamaicensis																				
	Rough-legged Hawk	Buteo lagopus						U			XX											
	American Kestrel	Falco sparverius			X			R										X	X	XX		
	Merlin	Falco	X					R			X							X	X	XX		
		columbarius																				
	Peregrine Falcon	Falco .						R			XX											
	Spruce Grouse	peregrinus Falcipennis	X		X	X		FC											X	XX		
	Sprace Grouse	canadensis																				

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Table 5.3-7, continued...

			eason		son ²																	
	Species Potentially (Observed or Reported During 2013 Field Season	Observed During 2010 Field Season	Observed During 1981-82 AEIDC Field Season	Known Breeders	Inferred Breeders	Abundance ³	Lacustrine Waters and Shorelines	Riverine Waters and Shorelines	Cliffs, Cutbanks, and Block Fields	Wet Meadow	Dwarf Shrub Meadow	Dwarf Shrub Mat	Low Shrub Thicket	Medium Shrub Thicket	Tall Shrub Thicket	Deciduous Forest	Coniferous Forest	Mixed Deciduous-Coniferous Forest	Scattered Woodland and Dwarf Forest	Migratory Only
	Willow Ptarmigan	Lagopus lagopus			X		X	С							X	XX	X					
	Rock Ptarmigan	Lagopus muta			X		X	С						XX	X							
	White-tailed Ptarmigan	Lagopus leucura						U						XX	X							
	Sandhill Crane	Grus canadensis	X					R				XX	X									
	Black-bellied	Pluvialis						U					X	XX								
_	Plover Semipalmated	squatarola Charadrius						U	XX	XX												
20140815-	Ployer FFRC PDF (1	semipalmatus 8	/15,	/ ₂₀₁		:14	07	PM C	71.71	7171												
	Greater Yellowlegs	Tringa melanoleuca	X		X		X	С				X	XX									
	Lesser Yellowlegs*	Tringa flavipes			X		X	С					XX									
	Wandering Tattler*	Tringa incana			X			U	X	XX												
	Solitary Sandpiper*	Tringa solitaria		X			X	U				X	XX									
	Spotted Sandpiper	Actitis macularius	X	X	X		X	FC	XX	XX			X	X								
	Whimbrel	Numenius						R				XX	X	X								
-	Western Sandpiper	phaeopus Calidris mauri						U														X
	Least Sandpiper	Calidris						U				XX	X									
	Short-billed	minutilla						U				XX	X									
	Dowitcher	Limnodromus griseus										ΛΛ									X	
	Wilson's Snipe	Gallinago delicata	X	X	X		X	FC				X	XX									
	Red-necked	Phalaropus						U				XX	X									
	Phalarope Bonaparte's Gull	lobatus Chroicocephalu						R	X												X	
	-	s philadelphia						K	71												71	
	Mew Gull	Larus canus	X		X			U			X	XX										
	Herring Gull	Larus argentatus		X				R	X		XX	X										
	Glaucous-winged	Larus	X					U			XX											
	Gull Arctic Tern	glaucescens Sterna			X			FC				XX	X									
		paradisaea																				
	Kittlitz's Murrelet*	Brachyramphus brevirostris						R			X											
-	Short-eared Owl	Asio flammeus						R				XX	X	X								
	Great Horned Owl	Bubo virginianus						U		_	X				_			X	X	X	_	
	Great Gray Owl	Strix nebulosa						U										X	XX	X		
	Northern Saw-whet	Aegolius						U										X	XX	X		
_	Owl Northern Hawk Owl	acadicus Surnia ulula						U										X	X	XX		
	Boreal Owl	Aegolius						U											XX	X		
		funereus															T 7					
	Rufous Hummingbird	Selasphorus rufus						U									X		XX			
	Belted Kingfisher	Megaceryle	X	X	X		X	С			XX											
-	Northern Flicker	alcyon Colaptes			X			U										XX	X	X		
	Downy Woodpecker	auratus Picoides						R										XX	X	X		
	•	pubescens																				
	Hairy Woodpecker	Picoides villosus		X	X		X	U							_			XX	X	X		
	American Three-	Picoides		X	X		X	FC											XX	X		
	toed Woodpecker	dorsalis																				
	Olive-sided	Contopus		X				U											XX	X	X	
	Flycatcher* Western Wood-	cooperi Contopus		X				U											XX	X	X	
	pewee	sordidulus	37	X			v	EC							v	VV	v				X	
	Alder Flycatcher	Empidonax alnorum	X	^			X	FC							X	XX	X				Λ	

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Table 5.3-7, continued...

201408

			Season		Season ²																	
	Species Potentially (Observed or Reported During 2013 Field Season	Observed During 2010 Field Season	Observed During 1981-82 AEIDC Field S	Known Breeders	Inferred Breeders	Abundance ³	Lacustrine Waters and Shorelines	Riverine Waters and Shorelines	Cliffs, Cutbanks, and Block Fields	Wet Meadow	Dwarf Shrub Meadow	Dwarf Shrub Mat	Low Shrub Thicket	Medium Shrub Thicket	Tall Shrub Thicket	Deciduous Forest	Coniferous Forest	Mixed Deciduous-Coniferous Forest	Scattered Woodland and Dwarf Forest	Migratory Only
	Willow Flycatcher	Empidonax			X		X	FC				<u> </u>			X	XX	X				X	
	Say's phoebe	traillii Sayornis saya						R													X	
	Northern Shrike	Lanius			X			U							X	X	X	X	X	X	X	
		excubitor		77			***	**									X			***		
	Steller's Jay	Cyanocitta stelleri		X			X	U											XX	X		
	Gray Jay	Perisoreus		X	X		X	С										X	XX	X	X	
-	Black-billed Magpie	canadensis Pica hudsonia	-	X	X	-		С									X	XX		X	X	
	1155 FERC PDF (1 Northwestern Crow		/15			:14	07	PM									X			_	_	17
		Corvus corar	X	X	X	<u> </u>		C			X							X	X	X		X
	Common Raven Tree Swallow	Corvus corax Tachycineta	A	A	X		X	A			Λ							X	X	X	X	
		bicolor						Α.										Λ				
	Violet-green Swallow	Tachycineta thalassina	X	X	X		X	A			X							X	X	X	X	
	Swanow Bank Swallow	Riparia riparia			X		X	С			XX											
-	Cliff Swallow	Petrochelidon						U			XX											
	D 0 11	pyrrhonota						D	37	N/		V	37								WW	
	Barn Swallow	Hirundo rustica	X	V	V	X		R	X	X		X	X				v	VV	X	X	XX	
	Black-capped Chickadee	Poecile atricapillus	Λ	X	X	Λ		A									X	XX	A	Λ		
	Chestnut-backed	Poecile	X				X	FC										X	XX	X		
	Chickadee Boreal Chickadee	rufescens Poecile	X	X				FC									X	X	XX	X		\vdash
		hudsonicus																				
	Red-breasted Nuthatch	Sitta canadensis						R										X	XX	X		
_	Brown Creeper	Certhia	X	X				U										X	XX	X		
	Pacific Wren	americana Troglodytes pacificus	X					U										X	X	X		
	American Dipper	Cinclus	X	X	X	X		A		XX												
	Golden-crowned Kinglet	mexicanus Regulus satrapa		X				U											XX	X		
	Ruby-crowned	Regulus	X	X	X		X	A											XX	X		
	Kinglet Gray-cheeked	calendula Catharus		X	X		X	R								XX	X				X	<u> </u>
	Thrush	minimus																	_			<u> </u>
	Swainson's Thrush	Catharus ustulatus	X	X	X		X	FC									X X		XX	X	X	
-	Hermit Thrush	Catharus guttatus	X	X	X	X		С									X	X	XX	X	X	
	Varied Thrush*	Ixoreus naevius	X	X	X		X	С									X		XX	X	X	
	American Robin	Turdus	X	X	X		X	С									X	XX		X	X	
-	American Pipit	migratorius Anthus			X		X	С					X	XX								-
		rubescens				-													****	*7	***	<u> </u>
	Bohemian Waxwing	Bombycilla garrulus			X	X		U											XX	X	X	
	Orange-crowned	Oreothlypis	X	X	X		X	С							X	XX		X				
_	Warbler Yellow-rumped	celata Setophaga	X	X	X		X	A											XX	X		
	Warbler	coronata																				
	Townsend's Warbler***	Setophaga townsendi	X	X	X	X		A		_							X		XX	X		_
	Blackpoll Warbler*	Setophaga						U											XX	X		
	Yellow Warbler	striata Setophaga	X	X	X	-	X	С							X	X	X					
	1 enow wardler	Setophaga petechia	^	^	^		^								Λ	Λ	X X					
	Wilson's Warbler	Cardellina	X	X	X	X		A							X	XX	X					
ŀ	Northern	pusilla Parkesia	X	X				FC	X	X		XX	X									
	Waterthrush	noveboracensis		v	X			EC								X	X				VV	
	American Tree Sparrow	Spizella arborea		X	X			FC								Λ	A				XX	
		Passerella	X	X	X	1	1	U	i e	1				i - 1		XX	X		i		X	

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Table 5.3-7, continued...

	Species Potentially o		Observed or Reported During 2013 Field Season	Observed During 2010 Field Season	Observed During 1981-82 AEIDC Field Season ²	Known Breeders	Inferred Breeders	Abundance ³	Lacustrine Waters and Shorelines	Riverine Waters and Shorelines	Cliffs, Cutbanks, and Block Fields	Wet Meadow	Dwarf Shrub Meadow	Dwarf Shrub Mat	Low Shrub Thicket	Medium Shrub Thicket	Tall Shrub Thicket	Deciduous Forest	Coniferous Forest	Mixed Deciduous-Coniferous Forest	Scattered Woodland and Dwarf Forest	Migratory Only
		iliaca																				
	Savannah Sparrow	Passerculus sandwichensis			X		X	С					XX	X	X	X						
	Lincoln's Sparrow	Melospiza lincolnii		X	X			U					X		XX	X						
	Song Sparrow	Melospiza melodia			X			U				XX	X									
	White-crowned	Zonotrichia		X	X		X	С							XX	X	X				X	
	Sparrow Golden-crowned	leucophrys Zonotrichia	X	X	X		X	A						X	XX	X	X					
140815-	Sparrow PDF (*Dark-eyed Junco	atricapilla Jnofficial) 8 Junco hyemalis	/ <u>15</u> , X	201 X	4 <u>4</u>	:14:	0.7 X	PM FC												XX	X	
	Lapland Longspur	Calcarius						U					X	XX								
	Caran Dantina	lapponicus						U														X
	Snow Bunting	Plectrophenax nivalis																				
	Gray-crowned Rosy Finch	Leucosticte tephrocotis			X			FC						XX								
	White-winged	Loxia	X					U											XX	X		
	Crossbill Pine Grosbeak	leucoptera Pinicola enucleator	X	X	X		X	С											XX	X		
	Pine Siskin	Spinus pinus	X	X				U											XX	X		
	Hoary Redpoll	Acanthis hornemanni						U						XX	X	X						
	Common Redpoll	Acanthis flammea		X				С						XX	X	X	X		X		X	
	Redpoll Species	Acanthis sp.	X					С						XX	X	X	X		X		X	

Notes:

- A Abundant
- C Common
- FC Fairly common
- U Uncommon
- R Rare
- $XX-Primary\ breeding\ habitat$
- X Secondary breeding habitat
- (I) Habitat types follow Kessel 1979
- (2) As reported in Ebasco 1984
- (3) Abundance categories follow U.S. Forest Service unpublished. Applies to study area only
- * Alaska Audubon's Red-listed Species (2010)
- *** USFS Sensitive Species or Species of Special Interest (USFS 2008)

Sources:

Ebasco 1984 Kessel 1979

Ehrlich et al. 1988

Gabrielson and Lincoln 1959

U.S. Forest Service unpublished.

Tarres 1980

Bellrose 1980

Kortright 1967

The Project area previously described by the USFS cover class was updated in 2013. All reclassified vegetation is defined and discussed in Section 3 and Section 4 and summarized in Table 5.2-1. The assessment of the 2013 breeding bird point vegetation data indicates the following: Five breeding bird points sampled in 2013 matched closely to the 2013 vegetation classifications; three points did not, and the final six sites shared attributes with the 2013 vegetation classifications. Also, distinct differences existed between the reported shrub and understory communities. Reasons for differences are attributed to the sampling methods for ALMS points.

Table 5.3-8 provides the 2013 vegetation types, the number of points that fell into each class, and the bird species detected in each class. The reader should keep in mind that the birch category is retained from the USFS (2007) cover class and was not located within the 2013 study area. Utilizing the species and the general point vegetation information collated from the 33 points (2010 and 2013), qualitative extrapolation may suggest that the non-sampled identical vegetation classes in the study area will have similar species. Appendix 3c contains further information on vegetation classes.

Table 5.3-8. Qualitative assessment of avian species presence in sampled 2013 wildlife study area by vegetation type.

2013 Vegetation Types	Grass- Forb Meadow	Coniferous Forest	Birch (Original USFS Classification)	Coniferous Deciduous Forest	Scrub Shrub Wetland	Herbaceous Wetland / Floodplain Forest & Scrub
Number of points in Vegetation Class	1	16	1	12	2	1
Species Detected						
Alder Flycatcher	X					
American Dipper		X		X	X	
American Robin		X		X		
American Tree Sparrow	X					
Bald Eagle				X		
Barrow's Goldeneye		X			X	
Black-billed Magpie				X		
Black-capped Chickadee		X				
Boreal Chickadee		X		X		
Brown Creeper		X		X		
Chestnut-backed Chickadee				X	X	
Common Loon		X				
Dark-eyed Junco		X	X	X	X	
Fox Sparrow	X	X			X	
Glaucous-winged Gull				X		
Golden-crowned Kinglet		X				
Golden-crowned Sparrow		X				

Table 5.3-8, continued...

2013 Vegetation Types	Grass- Forb Meadow	Coniferous Forest	Birch (Original USFS Classification)	Coniferous Deciduous Forest	Scrub Shrub Wetland	Herbaceous Wetland / Floodplain Forest & Scrub
Number of points in Vegetation Class	1	16	1	12	2	1
Species Detected						
Gray Jay				X		
Greater Yellowlegs					X	
Hairy Woodpecker		X				
Hermit Thrush	X	X	X	X	X	
Lincoln's Sparrow				X		
Merganser Species		X				
Merlin				X		
Mew Gull				X		
Northern Waterthrush				X		
Orange-crowned Warbler	X	X	X	X	X	
Pacific Wren		X				
Pine Grosbeak			X	X		
Pine Siskin		X		X	X	
Red-breasted Merganser		X			X	
Redpoll Species		X		X	X	
Ruby-crowned Kinglet		X	X	X	X	X
Sandhill Crane				X		
Swainson's Thrush		X	X	X	X	
Townsend's Warbler		X		X	X	
Varied Thrush	X	X	X	X	X	X
White-winged Crossbill		X		X	X	
Wilson's Snipe				X		
Wilson's Warbler	X	X		X	X	
Yellow Warbler	X	X		X	X	
Yellow-rumped Warbler		X	X	X	X	
			ecies that may be 3 Vegetation Cla		- 1	
Alder Flycatcher		X	X	X	X	X
American Dipper			X		X	X
American Pipit		X			X	
American Robin			X		X	X
American Three-toed Woodpecker		X		X	X	
American Tree Sparrow		X	X	X	X	X

Table 5.3-8, continued...

2013 Vegetation Types	Grass- Forb Meadow	Coniferous Forest	Birch (Original USFS Classification)	Coniferous Deciduous Forest	Scrub Shrub Wetland	Herbaceous Wetland / Floodplain Forest & Scrub
Number of points in Vegetation Class	1	16	1	12	2	1
Species Detected						
Arctic Tern		X			X	
Black-billed Magpie		X	X		X	X
Black-capped Chickadee			X	X	X	X
Bohemian Waxwing		X		X	X	
Boreal Chickadee			X		X	X
Brown Creeper			X		X	
Chestnut-backed Chickadee		X	X			
Common Raven		X	X	X	X	
Common Redpoll			X	X	X	X
Fox Sparrow			X	X		X
Golden-crowned Kinglet				X	X	
Golden-crowned Sparrow			X	X	X	X
Gray-cheeked Thrush		X	X	X	X	X
Gray Jay		X	X		X	
Greater Yellowlegs		X				
Hairy Woodpecker			X	X	X	
Hermit Thrush						X
Herring Gull		X	X	X	X	X
Lesser Yellowlegs		X			X	
Lincoln's Sparrow		X			X	X
Mew Gull		X			X	
Northern Flicker		X	X	X	X	
Northern Shrike		X	X	X	X	X
Northern Waterthrush		X	X		X	X
Olive-sided Flycatcher		X		X	X	
Orange-crowned Warbler						X
Pacific Wren			X	X	X	
Pine Grosbeak		X			X	
Redpoll Species			X			X
Rock Ptarmigan					X	X
Sandhill Crane		X			X	
Savannah Sparrow		X		X	X	X

Table 5.3-8, continued...

2013 Vegetation Types	Grass- Forb Meadow	Coniferous Forest	Birch (Original USFS Classification)	Coniferous Deciduous Forest	Scrub Shrub Wetland	Herbaceous Wetland / Floodplain Forest & Scrub
Number of points in Vegetation Class	1	16	1	12	2	1
Species Detected						
Solitary Sandpiper		X			X	
Song Sparrow		X			X	
Spotted Sandpiper		X	X	X	X	X
Spruce Grouse		X		X	X	
Steller's Jay		X		X	X	
Swainson's Thrush						X
Townsend's Warbler			X			X
Tree Swallow		X	X	X	X	
Violet-green Swallow		X	X	X	X	
Wandering Tattler		X	X	X	X	X
Western Wood-pewee		X		X	X	
White-crowned Sparrow		X	X	X	X	X
White-winged Crossbill					X	
Willow Flycatcher		X	X	X	X	X
Willow Ptarmigan			X	X	X	X
Wilson's Snipe		X		X		
Wilson's Warbler			X			X
Yellow Warbler			X		X	X
Yellow-rumped Warbler		X				

Vegetation classes not sampled include: Alder Scrub, Forested Wetland, and Herbaceous Wetland. Table 5.3-9 qualitatively evaluates the species most likely found in these habitats based on Kessel (1979) and the descriptions for these habitats provided in Section 3 and Section 4.

Table 5.3-9. Qualitative assessment of avian species presence in non-sampled Project area by vegetation type.

Species that may be Present in 2013 Vegetation Types	Alder Scrub	Forested Wetland	Herbaceous Wetland
Alder Flycatcher	X	X	X
American Dipper		X	
American Pipit	X	X	
American Robin		X	
American Three-toed Woodpecker	X	X	
American Tree Sparrow		X	X
Arctic Tern	X	X	
Black-billed Magpie	X	X	
Black-capped Chickadee		X	
Bohemian Waxwing	X	X	
Boreal Chickadee		X	
Brown Creeper		X	
Chestnut-backed Chickadee		X	
Common Raven	X	X	
Common Redpoll		X	
Dark-eyed Junco	X	X	
Fox Sparrow		X	
Golden-crowned Kinglet	X		
Golden-crowned Sparrow		X	
Gray Jay	X	X	
Gray-cheeked Thrush		X	X
Greater Yellowlegs		X	
Hairy Woodpecker	X	X	
Hermit Thrush		X	X
Herring Gull		X	
Lesser Yellowlegs	X	X	
Lincoln's Sparrow		X	X
Mew Gull		X	
Northern Flicker	X	X	X
Northern Shrike	X	X	
Northern Waterthrush		X	
Olive-sided Flycatcher	X		
Orange-crowned Warbler		X	
Pacific Wren		X	
Pine Grosbeak		X	
Pine Siskin	X	X	

Table 5.3-9, continued...

Species that may be Present in 2013 Vegetation Types	Alder Scrub	Forested Wetland	Herbaceous Wetland
Redpoll Species		X	
Ruby-crowned Kinglet		X	X
Sandhill Crane	X	X	
Savannah Sparrow		X	X
Solitary Sandpiper		X	X
Song Sparrow	X	X	X
Spotted Sandpiper		X	
Spruce Grouse		X	
Steller's Jay	X	X	
Swainson's Thrush	X	X	
Townsend's Warbler		X	
Tree Swallow	X	X	
Varied Thrush		X	
Violet-green Swallow	X	X	X
Wandering Tattler		X	
Western Wood-pewee	X	X	
White-crowned Sparrow		X	
White-winged Crossbill	X	X	
Willow Flycatcher	X		
Willow Ptarmigan		X	X
Wilson's Snipe	X		
Wilson's Warbler	X		
Yellow Warbler		X	
Yellow-rumped Warbler			

5.3.4. USFS Sensitive Species and Species of Special Interest

Marbled Murrelet (*Brachyramphus marmoratus*): A USFS species of special interest, this medium sized seabird is documented to inhabit inland freshwater lakes and nest in inland areas of old-growth conifer forest or on the ground (Carter and Sealy 1986; Marshall 1988). Marbled murrelets have not been observed in the Grant Lake area. Murrelets are known to select mature or old growth conifers for nesting, and this habitat is found within the area in mature hemlock and spruce-hemlock forests.

Townsend's Warbler: A USFS species of special interest, this species is found throughout forested locations on the Kenai and Seward Ranger District (USFS 2008). They are associated with older, mature spruce and hemlock forests and are not found as often in young coniferous or hardwood forests. Seward Ranger District Breeding Bird surveys indicate that Townsend's warblers are found in higher numbers in older spruce and hemlock forests, and that they have declined in numbers between 1994 and 2000 (Prosser 2002). Townsend's warblers were detected during the Ebasco (1984), 2010, and 2013 Grant Lake surveys and their habitat occurs throughout forested sections of this area, in mature hemlock and spruce-hemlock forests.

Audubon's Red-Listed Species - The Alaska WatchList is Audubon Alaska's science-based, early warning system to identify bird species at risk. It is a tool to focus attention and resources on vulnerable and declining bird populations across the state. Species and subspecies on the WatchList face some combination of population decline, small population size, or limited geographic range. The Red List has the highest level of concern: species are vulnerable and currently declining, or depressed from a prior decline. The species listed below are identified on the Alaska WatchList.

Varied Thrush: This species is found in spruce forests, deciduous (balsam poplar and dense alder stands), and mixed forests (Kessel 1989; Kessel 1998; George 2000). Shrub understory appears important to breeding; shady, mossy forests, deciduous shrub, dense alder thickets, and isolated cottonwood patches are all apparently preferred habitat (Kessel 1998). Varied thrushes were detected during the Ebasco (1984), 2010, and 2013 Grant Lake surveys and their habitat occurs throughout forested sections of this area.

Lesser Yellowlegs: Breeds in muskegs and freshwater marshes in open boreal forests and forest / tundra transition habitats. Nesting habitat is typically a combination of shallow wetlands, trees, shrubs, and open water. The species will forage in boreal forest wetlands (Tibbitts and Moskoff 1999). Lesser yellowlegs were only detected during the Ebasco (1984) surveys and their habitat occurs throughout sections of this area.

Wandering Tattler: Mostly restricted to the alpine zone, this species usually breeds along rocky or scrubby vegetated edges of mountain streams and lakes; frequents rapidly-flowing streams and tundra habitats, wet meadows, moraine deposits, scree slopes, braided rivers, and is sometimes found in forest clearings away from water. These birds often nest on the ground in a rocky or gravelly site (Weeden 1965; Johnsgard 1981; Weeden 1959). Nests have also been observed in dwarf shrub tundra near streams or lakes (Spindler et al. 1980; Gill et al. 2002). Wandering tattlers were detected during the Ebasco (1984) surveys; however, their habitat does not likely occur in the study area.

Solitary Sandpiper: This species nests in wooded wetlands in muskeg bogs, spruce forests, and deciduous riparian woodlands (Moskoff 1995) and, occasionally, riparian tall shrub thickets (Spindler and Kessel 1980; McCaffery and Harwood 2004). More specifically, on the Kenai Peninsula, this sandpiper is closely associated with wet forest gaps 10 to 20 meters (~11 to 22 yards) wide (Collins et al. 1999). Solitary sandpipers were only detected during the 2010 surveys and their habitat likely occurs in the study area.

Kittlitz's Murrelet: A ground nesting species with nests constructed on barren scree slopes, a short distance below a peak or ridge (Day et al. 1983; Day 1995; Piatt et al. 1999). Breeding generally occurs in high elevation alpine areas, with little or no vegetative cover. When present, vegetation is primarily comprised of lichens and mosses (Day et al. 1983). Kittlitz's murrelets have not been observed in the Grant Lake area and their habitat does not likely occur in the study area.

Olive-sided Flycatcher: The species shows a preference for forest edges, including harvested areas and open canopied forested habitats where forests are naturally open or semi-open. This species, although considered an indicator for coniferous forests, is also found in mixed deciduous / coniferous forests. Further, this species is associated with openings and water (e.g., bogs, wetlands) and dead standing trees, and is closely associated with recently burned areas (Wright 1997). Olive-sided flycatchers were detected during the 2010 surveys and their habitat likely occurs in the study area.

Blackpoll warbler: This species is found predominantly along rivers, streams, or bogs in mixed or coniferous forests and tall shrub thickets (especially *Salix alaxensis* and *Alnus incana*) with mixed spruce-paper birch overstory ([*Betula papyrifera*] Gabrielson and Lincoln 1959; Kessel 1989; McCaffery 1996; Kessel 1998; Cotter and Andres 2000). These species will also inhabit riparian areas and ecotones between treeline alpine tundra (Kessel 1998; Kessel and Gibson 1978). Blackpoll warblers have not been observed in the Grant Lake area; however, their habitat does occur in the study area.

5.3.5. Waterbirds

Ducks can be categorized as either "puddle ducks" or "diving ducks." Puddle ducks frequent shallow water areas such as marshes, ponds, and creeks and nest on adjacent dry uplands. Puddle ducks generally feed in shallow water on the seeds and tubers of aquatic plants, grass, and insects. Mallards, pintails, American widgeons, Northern shovelers, and green—winged teals are common Alaskan puddle ducks. Diving ducks, mergansers, and loons are primarily observed on the larger and deeper ponds, lakes, and rivers. Some species nest in tree cavities while others nest over water among aquatic emergent plants or along the shore lines. Goldeneyes, buffleheads, common loons, and red-breasted mergansers are common in Alaska and feed by diving for a variety of aquatic animals and plants.

2010 Waterbird Surveys - A total of four boat-based, intense area searches for waterbird broods and nesting habitat were conducted on Grant Lake (6/23/2010, 7/9/2010, 7/16/2010, and 7/23/2010). In addition, a foot survey of Grant Creek was conducted on 7/12/2010 to search for harlequin duck broods and other waterbirds.

2010 Waterbird Breeding and Brood-Rearing Surveys – Four Waterbird surveys were conducted in 2010. Identified species as well as brooding status is provided in Table 5.3-10. Incidental bird species identified during the surveys included herring gull, solitary sandpiper, and spotted sandpiper.

2010 Harlequin Duck Survey - No harlequin ducks were detected during the survey on Grant Creek. Three individual adult American dippers were documented during this survey

Table 5.3-10. 2010 breeding waterbird surveys.

Date	Wa	terfowl	Adults	Pairs	Adult Females	Adult Females + Young	
23-Jun-10	Barrow's Goldeneye	Bucephala islandica	3	0	4	(3+5)	
	Common Goldeneye	Bucephala clangula	1	0	2	(1+7); $(1+7)$	
	Goldeneye Species	Bucephala sp.	2				
	Common Loon	Gavia immer	2				
	Common Merganser	Mergus merganser	2				
	Red-breasted Merganser	Mergus serrator		1	5		
	Merganser Species	Mergus sp.	3				
	Harlequin Duck	Histrionicus histrionicus			1		
9-Jul-10	Common Goldeneye	Bucephala clangula	1	1	2	(1 + 8)	
<i>y-3u</i> 1-10	Goldeneye Species	Bucephala sp.	1			(-)	
	Common Loon	Gavia immer	1	1			
	Common Merganser	Mergus merganser	2				
	1					(1 + 3);	
16-Jul-10	Common Goldeneye	Bucephala clangula	4		9	(1+6); $(2+3)$	
	Common Loon	Gavia immer	1				
	Red-breasted Merganser	Mergus serrator	3			(1+1); (1+1); (1+8); (1+9)	
	Harlequin Duck	Histrionicus histrionicus	1				
23-Jul-10	Barrow's Goldeneye	Bucephala islandica				(1+6)	
25 861 10	Common Goldeneye	Bucephala clangula	1			(1+3); (1+5)	
	Goldeneye Species	Bucephala sp.	7			(210)	
	Common Loon	Gavia immer	4				

Table 5.3-10, continued...

Date	Wate	rfowl	Adults	Pairs	Adult Females	Adult Females + Young
	Pacific Loon	Gavia pacifica	1			
	Red-breasted Merganser	Mergus serrator	1			
	Merganser Species	Mergus sp.	6			
	Harlequin Duck	Histrionicus histrionicus	1			
	Mallard	Anas platyrhynchos		· · · · · · · · · · · · · · · · · · ·	1	

2013 Winter Waterbird Surveys - Winter Waterbird surveys are scheduled for December 2013 (completed) and February/March 2014 and will verify whether the outlet of Grant Lake, purportedly ice-free throughout the winter, affords winter habitat and is utilized by waterbirds. This area was documented as a winter feeding area for a flock of mallards during the 1981-1982 field studies (Ebasco 1984). Open water habitat that supports waterbirds in the Seward Ranger District is limited during the winter (Benoit 2009).

Additional 2013 Incidentals – A pair of common loons were observed daily by the wetland crew during field work in various locations on Grant Lake in July 2013. A female merganser and brood were also seen during this time on Grant Lake. A female red-breasted merganser and a brood of nine chicks were documented in June 2013 along the shoreline above the Trail Lake narrows (defined as the section of water between the Upper Trail and Lower Trail lakes). A harlequin duck female was also recorded in June on Grant Creek just above the Trail Lake narrows.

Trumpeter swans were detected on March 3, 2013, on the east side of Lower Trail Lake. It is purported that these birds over winter in this area. Apparently the location remains ice-free due to the high pressure of water flow through the Trail Lake narrows.

Compilation of Results - The 2010 data provided information on seven species of waterfowl on Grant Lake (see Table 5.3-10). Ebasco (1984) reported two additional species of waterfowl, American widgeon and green-winged teal. Barrow's and common goldeneye species as well as red-breasted mergansers were also observed with broods. All three species are considered diving ducks and feed primarily on aquatic invertebrates (goldeneyes) and crustaceans and fish (merganser). Ebasco (1984) documented the availability of the following aquatic food resources for diving ducks: Diptera, Plecoptera, Tricoptera, Bivalvia, Gastropoda and Gammaridae. Prey concentrations and availability appear to sustain reproduction and brood rearing on Grant Lake.

Both goldeneye species are cavity nesters. Presence and availability of nest sites are a natural limiting factor. Females will often return to the same nest if reproduction is successful in previous years. The red-breasted merganser is a ground nester, and habitat for nest selection may not be as limited for this waterbird species in the Grant Lake area.

There is suitable habitat available for ground-nesting ducks including the for-mentioned puddle ducks in certain areas of Grant Lake. Winter Waterbird surveys will delineate any use of the area by non-migratory waterfowl.

5.3.6. USFS Sensitive Species and Species of Special Interest

Trumpeter Swan: A USFS sensitive species prefers large ponds, lakes, and marshes; constructing massive nest mounds in areas of reeds, sedges, or similar emergent vegetation, primarily on stationary fresh waterbodies (Mitchell 1994). Swans are considered shy waterfowl easily disturbed during nesting; however, once cygnets are mobile, adults become very protective. Trumpeter swans were observed north of the Grant Lake study area during USFS surveys (2008); however, no nests or cygnets were observed during these USFS (2008) surveys. Trumpeters were also sighted during spring 2013 below the Trail Lake narrows; however, they were not resighted during summer field work. Suitable habitat likely occurs in the wildlife study area.

5.3.6.1. Audubon's Red-Listed Species

Red-throated Loon: This species will typically select marshy islands for nest sites or on dry shores. They will nest on small oligotrophic lakes in diverse habitats, such as forests or tundra up to 1,070 meters (~3,510 feet) in elevation. The availability of freshwater fish limits this species' distribution (Soper 1946; Palmer 1962; Davis 1972; Bundy 1976; Bergman and Derksen 1977; Cramp and Simmons 1977; Merrie 1978; Derksen et al. 1981; Furness 1983; Reimchen and Douglas 1984; Johnsgard 1987; Douglas and Reimchen 1988; Eberl and Picman 1993; Barr et al. 2000). Red-throated loons have not been observed in the Grant Lake area however their nesting habitat does occur in the study area.

Yellow-billed Loon and Greater White-fronted Goose: Both species are considered non-breeders in this area and warrant no further discussion as their primary breeding habitats also do not occur in this area.

5.3.7. Terrestrial Mammals

Terrestrial mammals in the Project area have specific habitat requirements including: 1) cover (shelter) from weather and predators; 2) food and water for nourishment; and 3) space to obtain food, water, and to attract a mate. Moose use cover for shelter against weather and predators. Thermal cover is used to help moose control their body temperature, especially during extreme weather and temperatures in the summer and winter. Wildlife diet selection is driven by the quantity and quality of available food in concert with the nutritional needs of the animal. Food availability to a predator equates to prey availability. Carnivores may expend a large amount of energy in searching for, chasing, capturing, and killing their food. Herbivores or plant eaters may become nutritionally stressed by a lack or shortage of food (quantity) or by a lack of highly nutritious food (quality). Although woods and meadows may look green and be covered with lush plants, this does not mean moose and other herbivores have adequate food.

Each wildlife species requires a certain amount of space to avoid or escape potential predators, locate a mate, obtain sufficient food and water for survival, and rest. Space requirements protect behavioral and social responses that ensure an animal's well-being. Wildlife space requirements

vary by species, but, generally, the amount of space required is determined by the quantity and quality of food, cover, and water (habitat) found in an area. Other factors affecting space needs of wildlife include how large the animal is (larger animals require more space); the animal's dietary preferences (carnivores generally require more space than herbivores); and how well the animal can withstand crowded conditions. Space requirements (as a function of habitat quantity and quality) essentially determine the carrying capacity of the site for wildlife.

2010 Terrestrial Mammal Surveys - The following species were included in the 2010 Terrestrial Mammal surveys:

Bear: The USFS provided one brown bear den location collected in 2008 (see Figure 5.3-2). Three sightings of black bears and one sighting of a brown bear were noted as incidentals during the 2010 field season. The coordinates were not provided. No other field work was conducted in 2010 to document bear den locations. Denning surveys are considered complete, as stipulated in the Study Plan.

Mountain Goat and Dall Sheep: Six mountain goats (5 adults, 1 kid) were noted during the Waterbird Nesting Survey on July 23, 2010. The coordinates were not provided. This survey is considered complete, as stipulated in the Study Plan.

Bats: The survey was conducted on July 23, 2010, at an abandoned historic cabin near the inlet of Grant Lake. No bats or any evidence of bats were detected. Bat surveys are considered complete, as stipulated in the Study Plan.

Additional 2010 Incidentals – A moose, three beaver, a coyote, and a porcupine were all recorded during the various survey activities in 2010. The coordinates were not provided.

Additional Information – The USFS provided one wolverine den location collected in 2008 and again in 2010 (see Figure 5.3-2).

2013 – 2014 Terrestrial Mammal Surveys – The following species are included in the 2013 and 2014 Terrestrial Mammal surveys:

Moose: Two Moose surveys are scheduled for the winter 2013-2014, the first was conducted in December 2013 and the second to be conducted in February/March 2014. Results from these surveys will be amended to this study report when completed.

Additional 2013 Incidentals – A moose / calf pair were sighted at the Trail Lake narrows area in June 2013. Various crews from other resource studies reported individual moose sightings along Grant Creek and Grant Lake. Beaver activity, an active dam, and at least two active lodges, were reported by crews doing surveys around Grant Lake. Two black bears were sighted in the study area, one on Grant Creek and the other on Grant Lake. A lynx was observed in the study area on July 21, 2013. The coordinates were not provided.

5.3.7.1. Compilation of Results

Bear: Ebasco (1984) surveyed for the presence of black bears in their defined study area and reported detecting nine bears during three field surveys. They did not discover activity in the upper Grant Lake valley.

Important black bear habitat in the study area includes the lower alpine zone near the shrubline, which is important in July and August for the young, succulent forbs and sedges it produces. During August and September, salmon present in Grant Creek are sought by black bears. Because salmon are unavailable in great numbers, bears intermittently forage in the subalpine zone and on lowland berries at this time. Elderberries, blueberries, rosehips, salmon berries and low and highbush cranberries are probably utilized heavily.

Likely denning habitat for those black bears residing locally year-round in the Grant Lake area includes the bench between Grant Lake and Upper Trail and Lower Trail lakes.

On the Kenai Peninsula, the primary limiting factor for brown bear is spring and summer feeding habitat. Spring and summer habitat includes south-facing hillsides and avalanche chutes, big game winter ranges, and salmon streams that provide the high quality foods that bears need to develop fat reserves before denning and to replenish fat stores depleted after denning. Carrion, berries, and fish sources in the watershed provide a diversity of food sources for bears (USFS 2008). Ebasco (1984) delineated denning habitat for brown bear based on sightings of individual bears and their sign at the time of den emergence, and on the basis of certain geomorphic and vegetation characteristics. Three units of potential denning habitat were delineated in this manner (see Figure 5.3-3).

The USFS (2008) also delineated high value brown bear denning habitat in the more general Trail River Landscape Assessment (2008) (see Figure 5.3-4). The model predicted the probability of denning across the landscape. Potential denning habitat is abundant and well distributed on steep slopes. The identified habitat is most likely to be used by females with cubs after den emergence, which is also important for foraging (USFS 2008).

Mountain Goat: The 2010 wildlife study field efforts reported sighting six mountain goats during Waterbird surveys. Ebasco (1984) delineated goat habitat based on assessment of ADF&G information (see Figure 5.3-5).

The principal area of goat use in the Grant Lake basin is the north side of the lake. These south-facing slopes are utilized in fall, winter, spring, and into early summer. Occupied areas reach from alpine benches downslope into stringers of mountain hemlock. This plant was present in 70 percent of all fecal samples collected from alpine winter ranges at Grant Lake (Hansen and Archer 1981). The primary area of interchange between Grant Lake and other subpopulations is into the Moose Creek drainage to the northeast and across the glacier to the east to the Kings River-Kings Bay area.

Based on Chugach National Forest GIS data, mountain goat winter range primarily occurs on south-facing alpine slopes within the Trail River Watershed (USFS 2008). Predictive modeling

delineated mountain goat winter habitat well outside the 2013 wildlife study area (see Figure 5.3-6).

Dall Sheep: The Grant Lake area is purportedly considered the outer boundary of sheep range on the Kenai Peninsula covering the entire Grant Lake drainage in several small bands. During the Ebasco (1984) field studies, sheep were only noted on the northern half of the Grant Lake drainage, which may be the most favored range (see Figure 5.3-7). Dall sheep habitat does not likely occur in the study area.

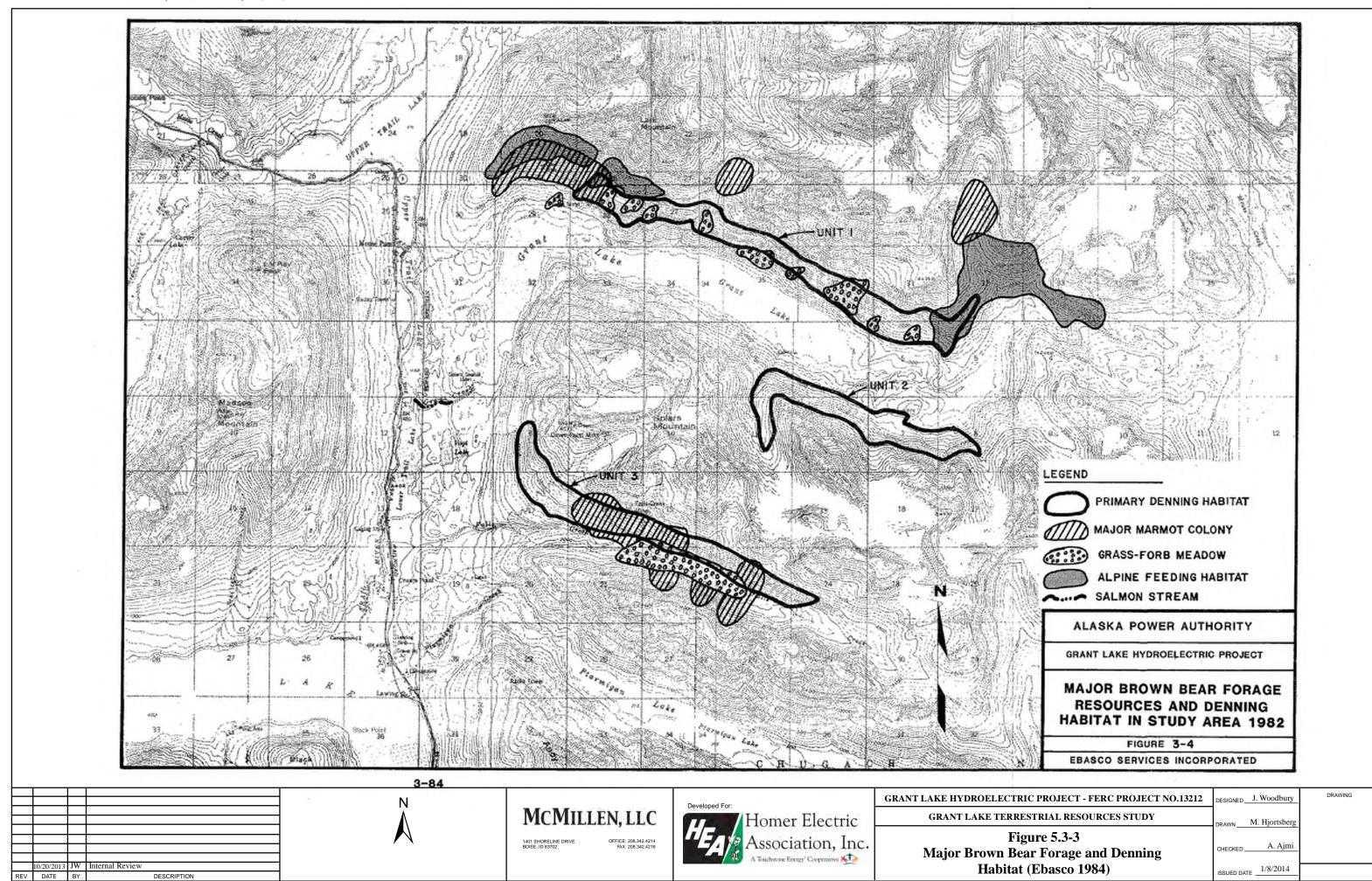
Bat: The little brown Myotis is the only bat found in Interior and South Central Alaska, and has only been documented in forested regions of Alaska (Parker 1996, Parker et al. 1997). This species favors old-growth forests and riparian habitats (Parker et al. 1996), and will roost in building, trees, under rocks and wood, and caves (MacDonald and Cook 1996). Currently, there is not enough information for this species in Alaska to assess the presence or absence of habitat in the Project area.

Moose: This species is primarily associated with early to mid-succession habitat and riparian areas and are dependent on early seral vegetation types including young hardwoods (willow, birch, aspen, and, to a smaller extent, cottonwoods). Ebasco (1984) delineated moose habitat based on assessment of ADF&G information (see Figure 5.3-8).

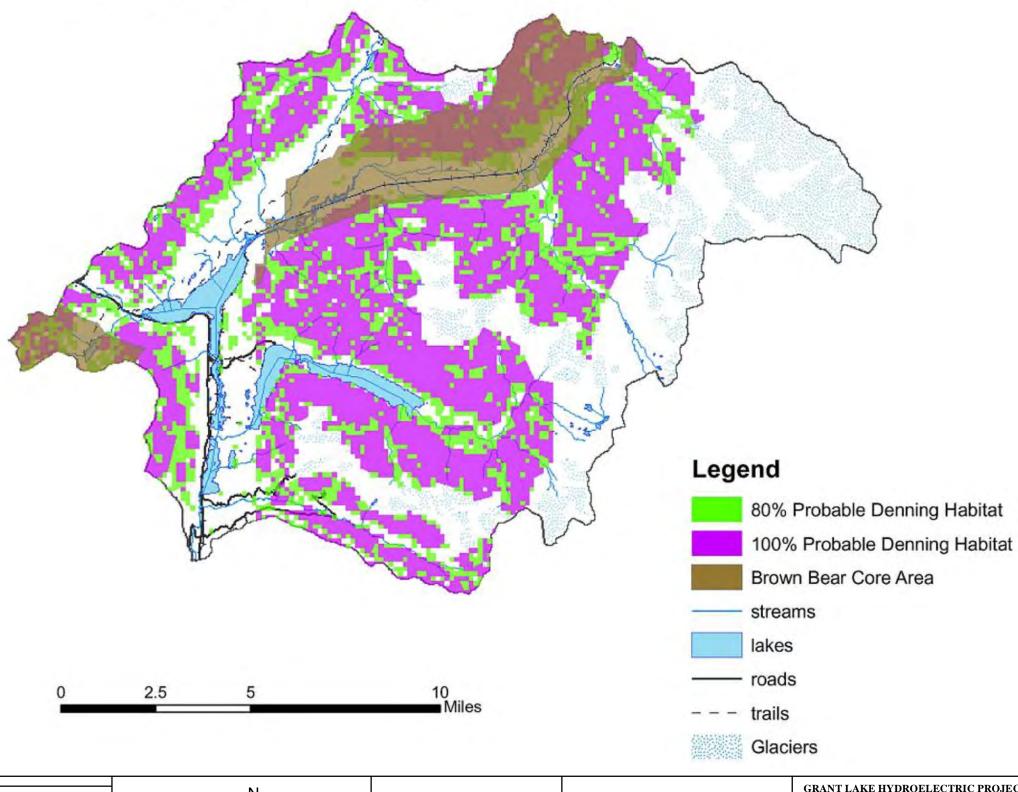
Primary limiting factors for moose in Alaska and the Kenai Peninsula are the availability of winter range, predation, collision mortality from vehicles and trains (Lottsfeldt-Frost 2000), and distance between feeding and hiding/thermal cover (Renecker and Schwartz 1998).

Chugach National Forest GIS data indicated that high-quality habitat is primarily in riparian areas along the river valleys, but is distributed throughout the Trail River Watershed on all but the highest elevations (USFS 2008). The ADF&G considers the overall habitat on the Seward Ranger District to be of low quality and capable of supporting only 2 to 5 moose per square mile. Predictive modeling of moose winter range is displayed in Figure 5.3-6 (USFS 2008).

Results from the 2013 / 2014 Winter Moose surveys once collected and analyzed, will be provided to stakeholders for review and collaboration and incorporated into the DLA.



80 - 100% Probable Denning Habitat and Brown Bear Core Prescription in the Trial River Landscape Assessment Area



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	10/20/2013	JW	Internal Review	
REV	DATE	BY	DESCRIPTION	



MCMILLEN, LLC

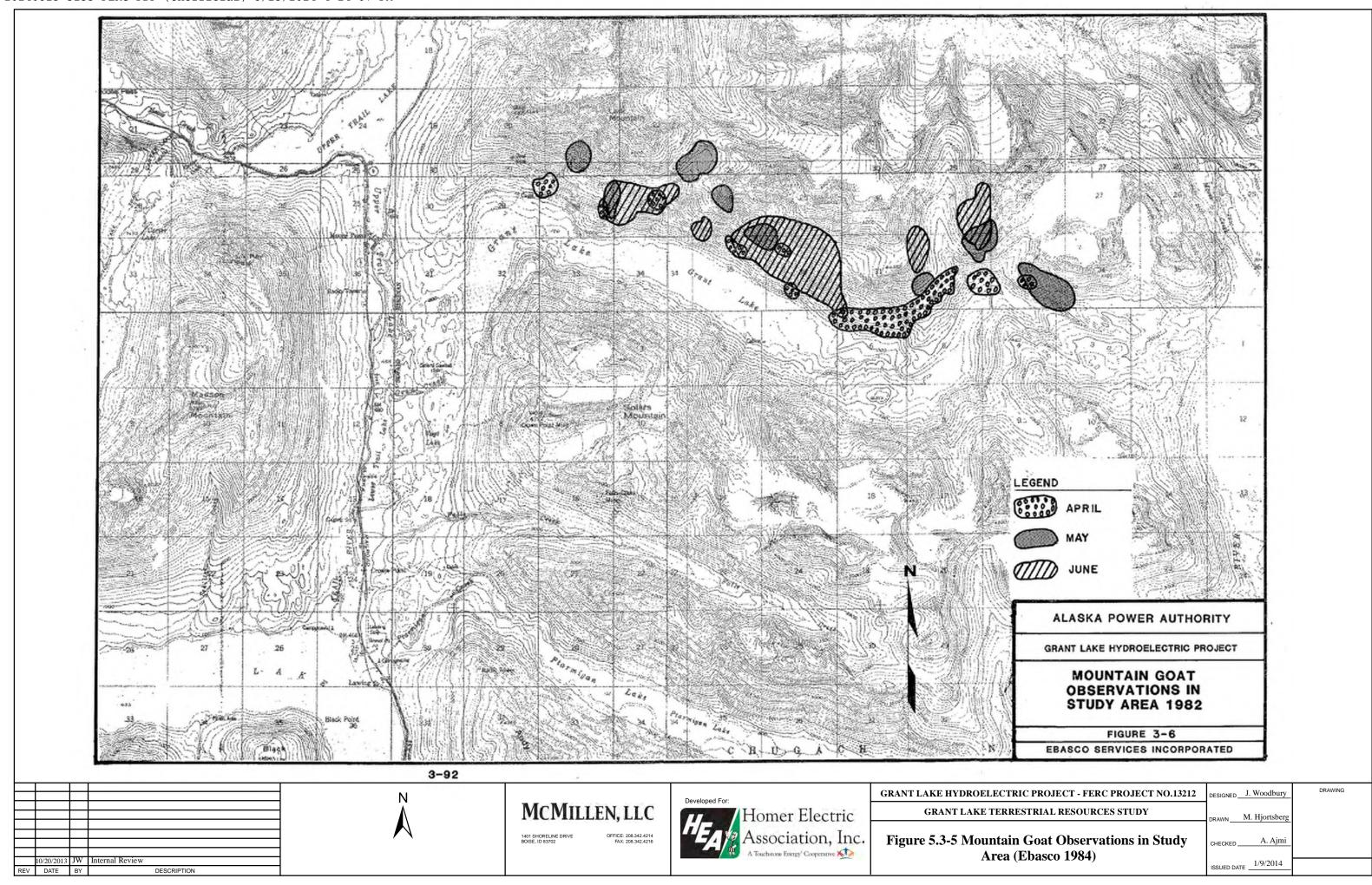
1401 SHORELINE DRIVE BOISE, ID 83702

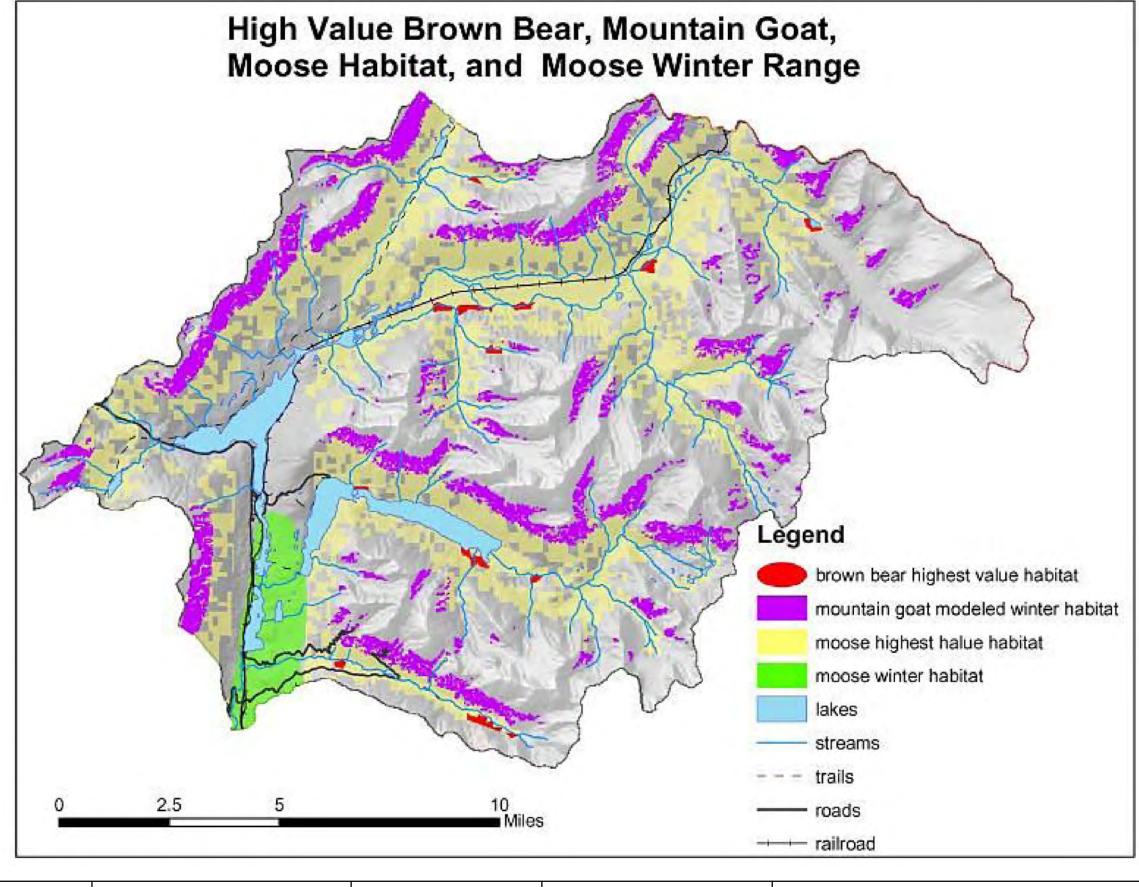
OFFICE: 208.342.4214

FAX: 208.342.4216



RANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212	DESIGNED J. Woodbury	DRAWING
GRANT LAKE TERRESTRIAL RESOURCES STUDY	DRAWN M. Hjortsberg	
Figure 5.3-4	CHECKED A. Ajmi	
Major Brown Bear Forage and Denning	CHECKED	
Habitat (USFS 2008).	ISSUED DATE	





	10/20/2013	JW	Internal Review
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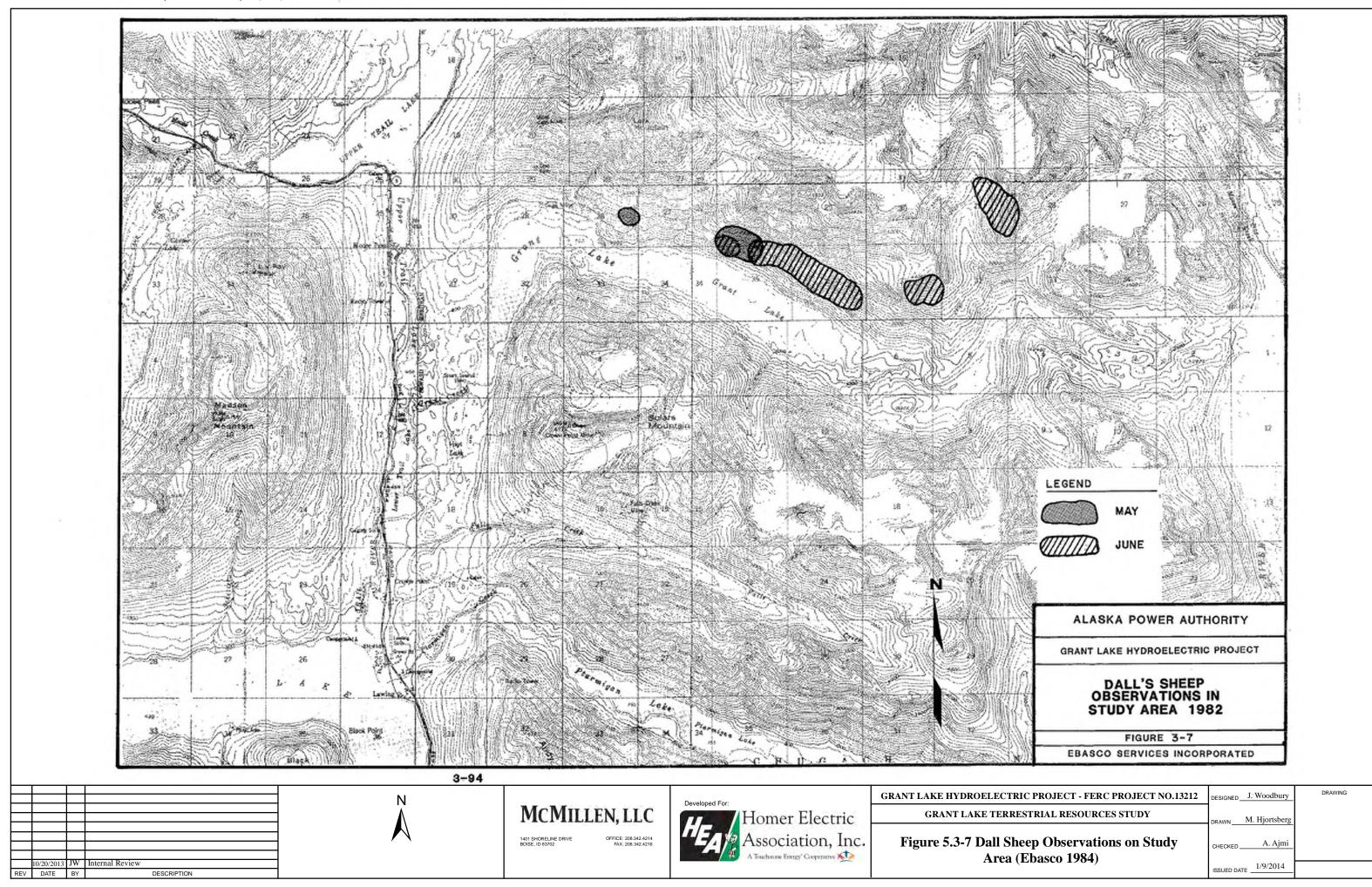
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POLISE ID 83702 FBX: 208.342.4214

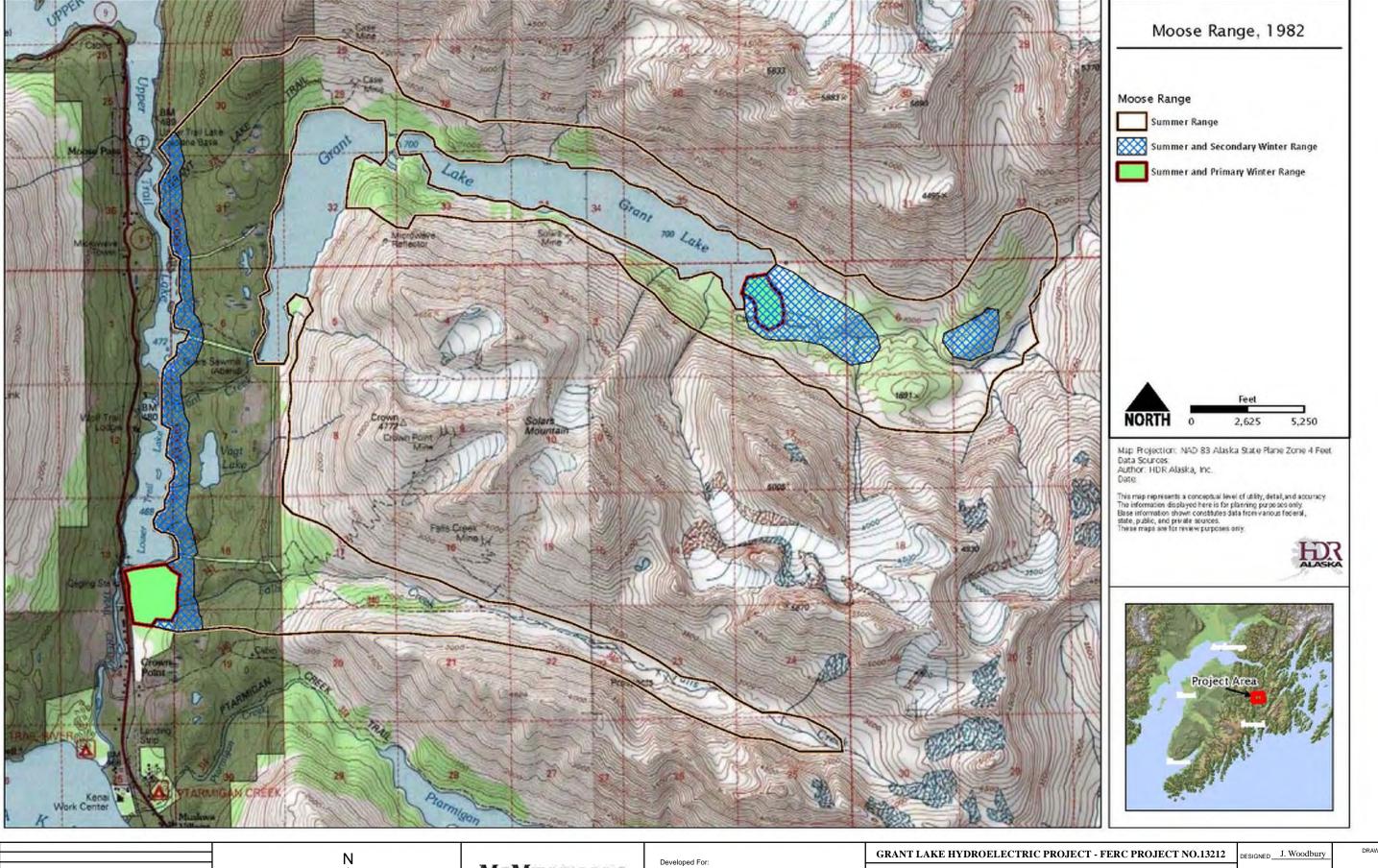


GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212					
GRANT LAKE TERRESTRIAL RESOURCES STUDY					

Figure 5.3-6 High Value Brown Bear, Mountain Goat, Moose Habitat, and Moose Winter Range (USFS 2008)

DESIGNED J. Woodbury	DRAWING
DRAWN M. Hjortsberg	
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GRANT LAKE TERRESTRIAL RESOURCES STUDY

Figure 5.3-8 Moose Range on Study Area (Ebasco 1984)

M. Hjortsberg

5.4. Conclusions

This report provides the technical summary of the assessment methods, results, and conclusions of the 2010 and 2013 wildlife studies. The objectives of the 2010 and 2013 wildlife studies were to:

- Document presence and distribution information to allow the Project to minimize or avoid impacts to protected species, including bald eagles and other raptors, shorebirds, waterbirds, and landbirds of special interest;
- Quantify the distribution and abundance of target wildlife species during key seasons of activity in the study area;
- Document the species composition of avian communities, particularly landbirds, shorebirds, and waterbirds; and
- Classify and map wildlife habitat in the study area in conjunction with the Botanical Resources Study.

The 2010 field effort documented presence of breeding birds and shorebirds, breeding waterbirds, bear, beaver, moose, coyote, porcupine, and mountain goats in the 2010 wildlife study area. The 2013 field effort documented presence of breeding birds and shorebirds, breeding waterbirds, breeding raptors, bear, beaver, moose, and lynx in the 2013 wildlife study area. The Ebasco (1984) site-specific study is referred to extensively to provide additional species information. The Ebasco (1984) document supplements information regarding Dall sheep, mountain goats, moose, and bear. The 2013 non-field effort combined all the site-specific information regarding wildlife resources in the Project area. In addition, the potential impacts associated with Project construction and operational activities are qualitatively evaluated for direct and indirect impacts in the subsections to follow. As Project designs are further refined, the data provided in this report will be applied to conduct a quantitative analysis of potential impacts to wildlife species and their habitat.

Wildlife presence in the Project area is contingent on many variables including habitat. Habitat is comprised of resources (water, food, and shelter) and environmental requirements (temperature, predators, and competitors) that determine the presence, survival, and reproduction of a species. Wildlife exhibits a propensity to occupy those habitats that provide the resources to fulfill the requirements necessary for the continuance of that species. This section utilizes the factor of vegetation (food and cover) to qualitatively assess species presence and use of the 2013 wildlife study area.

Vegetation characteristics utilized for this qualitative assessment have been obtained from various sources, including the site-specific Ebasco (1984) report, the USFS (2007) cover-type ArcGIS layer, and 2013 field work reported in Section 3 and Section 4 of this report. The level of vegetation classification varies for each source; therefore, an amalgamation of all these resources was necessary to discern habitat specific to the components of the wildlife study. General vegetation characteristics (cover type), as defined or mapped by each source, were compared. More specific habitat characteristics (understory species) were then delineated by correlating all available sources (see Table 5.2-1). A qualitative assessment of species presence and use of the 2013 wildlife study area is presented in the following section components. Each section includes a qualitative evaluation of Project impacts.

Impacts are categorized as construction-related or operations-related, each having direct and indirect effects. In general, construction-related impacts are considered temporary or short-term whereas operational impacts are considered longer-term or permanent. Table 5.4-1 summarizes potential Project impacts on wildlife as related to habitat, disturbance of biological activities, and possible direct mortality. It is important to note that the potential impacts discussed in Table 5.4-1 are preliminary and based primarily on the terrestrial natural resource studies and the limited amount of engineering feasibility work conducted prior to this report being developed. This table and the associated impacts will be fully refined and vetted once the engineering designs are finalized. A full discussion of wildlife impacts will be included in the DLA. Best Management Practices (BMP's) associated with construction and development activities will be collaboratively developed with stakeholders and implemented during those activities.

Table 5.4-1. Grant Lake terrestrial resources - wildlife study impacts.

Project Component		ntive Construction pacts	Potential Qualitative Operations Impacts	
1 Toject Component	Direct	Indirect	Direct	Indirect
GRANT CREEK DIVERSION				
Natural Outlet Option	Vegetation clearing and disturbance; shoreline/bank disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands, and altered banks /shoreline/bed.	Changes to natural lake level elevation on wildlife habitat include permanent changes to nesting, foraging and cover, and changes to species dynamics including predatorprey interactions.
Concrete Dam Option	Vegetation clearing and disturbance; shoreline/bank disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands, and altered banks /shoreline/bed.	Changes to natural lake level elevation on wildlife habitat include permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.

Table 5.4-1, continued...

Project Component	_	ntive Construction pacts	Potential Qualitative Operational Impacts	
	Direct	Indirect	Direct	Indirect
WATER CONVEYANCE				
Intake Structure	Vegetation clearing and disturbance; shoreline/bank disturbance; short-term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands, and altered banks /shoreline/bed.	Changes to natural lake level elevation on wildlife habitat include permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
Tunnel	At surficial entrance and exit of tunnel: Vegetation clearing and disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	At surficial entrance and exit of tunnel: Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg reestablishment; short-term changes in prey availability.	At surficial entrance and exit of tunnel: Permanent changes in habitat due vegetation clearing and altered succession stage.	At surficial entrance and exit of tunnel: Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
Penstock	Vegetation clearing and disturbance; shoreline/bank disturbance; short-term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing and altered banks /shoreline/bed.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.

Table 5.4-1, continued...

Project Component	_	itative Construction Potential Qualitative Operation Impacts		_
110jeet 00mponen	Direct	Indirect	Direct	Indirect
Tailrace	Vegetation clearing and disturbance; shoreline/bank disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing and altered banks /shoreline/bed.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
Tailrace Detention Pond	Vegetation inundation and disturbance; changes in wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Changes in species and dynamics; soil erosion, sediment input to water column and reduced clarity; poor native veg re- establishment; changes in prey availability.	Permanent changes in habitat due vegetation clearing and filled wetlands.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
POWERHOUSE				
Powerhouse Structure	Vegetation clearing and disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing and altered succession stage. Auditory disturbance to wildlife and associated biological activities.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions. Auditory disturbance to wildlife and associated biological activities.

Table 5.4-1, continued...

Project Component	Potential Qualitative Construction Impacts		Potential Qualitative Operational Impacts	
	Direct	Indirect	Direct	Indirect
TRANSMISSION LINE/SWITCHYARD				
Above Ground Option	Vegetation clearing and disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands and altered succession stage. Possible direct mortality to avifauna not accustomed to power lines.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
Below Ground Option	Vegetation clearing and disturbance; short-term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands and altered succession stage.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions.
ACCESS ROADS & BRIDGE				
Access Roads & Bridge	Vegetation clearing and disturbance; short- term reduction of wildlife habitat (nesting, foraging, and cover). Auditory disturbance to wildlife and associated biological activities.	Species introduction and competition; soil erosion; poor native veg re- establishment; short-term changes in prey availability.	Permanent changes in habitat due vegetation clearing, filled wetlands and altered succession stage. Possible direct mortality to wildlife not accustomed to access vehicles. Permanent periodic auditory disturbance to wildlife and associated biological activities.	Permanent changes to nesting, foraging and cover, and changes to species dynamics including predator-prey interactions from road and bridge infrastructure, and backwater effects from bridge. Permanent periodic auditory disturbance to wildlife and associated biological activities.

The following sections discuss the potential species-specific impacts that are not covered in Table 5.4-1 and are based solely on the 2013 Terrestrial Resources Study investigations. Impact assessments will be refined based upon engineering feasibility work that will document infrastructural locations in relation to habitat for the species mentioned below, and will be included in the DLA.

5.4.1. Raptor Nesting Survey

Potential Impacts to Raptors - Removal or loss of vegetation affects raptors in several ways that include loss of old growth trees for nesting platforms (bald eagles, osprey, and red-tailed hawks) and perches. Project-related tree removal may be direct or indirect. Indirect removal includes tree species influenced by changes in creek levels, causing tree mortality and eventual structure loss. Tree platforms utilized for large raptor nests and perches are lost naturally every year. Raptors often construct multiple nests in a season (osprey) or build new structures every year. The loss of the tree or the nest from the previous season is not a detriment to successful breeding, and is not predicted to impact the overall raptor population on the Kenai Peninsula. The direct removal of any nest structure utilized by bald eagles, regardless of activity state, without a permit is prohibited; the USFWS (2007) has published recommendations to avoid disturbance to occupied bald eagle nests during development activities. The USFWS (2007) recommend the following:

- (1) Keep a distance between the activity and the nest (distance buffers),
- (2) Maintain preferably forested (or natural) areas between the activity and around nest trees (landscape buffers), and
- (3) Avoid certain activities during the breeding season.

The buffer areas serve to minimize visual and auditory impacts associated with human activities near nest sites. Ideally, buffers would be large enough to protect existing nest trees and provide for alternative or replacement nest trees. The size and shape of effective buffers vary depending on the topography and other ecological characteristics surrounding the nest site.

The height of the nest above the ground may also ameliorate effects of human activities; eagles at higher nests may be less prone to disturbance.

In addition to the physical features of the landscape and nest site, the appropriate size for the distance buffer may vary according to the historical tolerances of eagles to human activities in particular localities, and may also depend on the location of the nest in relation to feeding and roosting areas used by the eagles. Increased competition for nest sites may lead bald eagles to nest closer to human activity (and other eagles).

Seasonal restrictions can prevent the potential impacts of many shorter-term, obtrusive activities that do not entail landscape alterations (e.g. fireworks, outdoor concerts). In proximity to the nest, these kinds of activities should be conducted only outside the breeding season. For activities that entail both short-term, obtrusive characteristics and more permanent impacts (e.g., building construction), we [USFWS] recommend a combination of both approaches: retaining a landscape buffer and observing seasonal restrictions.

USFWS (2007) provides information regarding specific buffer distances (660 feet – ½ mile) depending on activities (Categories A - H) (Table 5.4-2). Category A (construction of roads, trails, canals, power lines, and other linear utilities) have the following buffer recommendations:

Table 5.4-2. Recommended d	distances for Category A	A activities as defin	ed by USFWS (2007	()

	If there is no similar activity within 1 mile of the nest	If there is similar activity closer than 1 mile from the nest		
If the activity	660 feet. Landscape buffers are	660 feet, or as close as existing tolerated activity		
will be visible	recommended.	of similar scope.		
from the nest	recommended.	Landscape buffers are recommended.		
If the activity	330 feet. Clearing, external	330 feet, or as close as existing tolerated activity		
will not be	construction, and landscaping	of similar scope.		
visible from the	between 330 feet and 660 feet should	Clearing, external construction and landscaping		
nest be done outside breeding season		within 660 feet should be done outside breeding		
	(~March – August).	season (~March – August).		

The Federal eagle nest take permit (OMB Control No. 1018-0022) authorizes a 'take' (removal and/or relocation) of a bald or golden eagle nest to protect human safety or eagles, and under other limited circumstances. Title 50 Parts 10, 13, and 22.27 of the Code of Federal Regulations (CFR) will provide addition regulatory information. This permit may be used to authorize the removal of a bald or golden eagle nest where the removal is: (a) necessary to alleviate a safety emergency to people or eagles; (b) necessary to ensure public health and safety; (c) the nest prevents the use of a pre-existing human-engineered structure; or (d) the activity or mitigation for the activity will provide a net benefit to eagles. Only inactive nests may be taken, except in the case of safety emergencies. Inactive nests are defined by the continuous absence of any adult, egg, or dependent young at the nest for at least 10 consecutive days leading up to the time of take. Permittees may be required to monitor the area and report whether eagles attempt to build or occupy another nest at another site in the vicinity for the duration specified in the permit. Permittees must submit a report to the Regional Migratory Bird Permit Office within 30 days after the permitted nest removal (except for programmatic permittees who must report each nest removal within 10 days after the take and submit an annual report by January 31 of the calendar year). The report must include all the information required by Service Form 3-202-16. All permittees will be required to avoid and minimize the potential for take to the degree practicable, and for programmatic permits, to the point where take is unavoidable. Where feasible, if suitable conditions are present, the permittee may be required to relocate the nest, construct an alternate nest, or improve conditions at alternate nest sites in the territory. Compensatory mitigation may be appropriate depending on the biological value of the nest and the type of circumstances necessitating its removal. In general, little or no compensatory mitigation will be required for emergency nest-take if the permittee could not foresee or prevent the eagles from nesting. The time needed by the Service to process a permit application depends on the complexity and scope of the activity and associated take, whether tribal consultation is warranted, what additional environmental analyses may be required, and other factors.

In general, applicants may expect the following approximate permit processing times from the time we receive a complete application:

- Emergency nest-take permit: (2 to 5 days)
- Standard permit: (90 days)
- Standard or programmatic permit requiring an environmental assessment: (4 to 6 months)
- Standard or programmatic permit with EIS: (18 to 24 months)

Removal of vegetation will also impact forest nesting and foraging raptor species including Northern goshawks and sharp-shinned hawks. Impacts include loss of nesting and foraging habitat. Both species are considered shy and may be sensitive to disturbance. Activities related to forest removal and anthropogenic access may cause these two species to move to other less disturbed areas; however, the movement of these accipiters is not predicted to impact the overall population of the Kenai Peninsula. The USFWS (2005) has published recommendations for time periods to avoid vegetation clearing. These recommendations are provided to help avoid vegetation removal during the breeding season.

Direct mortality to forest raptors may increase with the placement of power lines along the access route. Birds, especially resident species, unaccustomed to these lines may be impacted by flying into the line or injury by electrocution. Collision and nesting deterrent methods will be considered during the Project design phase to avoid or minimize impacts if the overhead power line alternative is selected.

Disturbance associated with construction and operational phases of the Project may impact raptor presence and distributions in the area; however, the movement of these species is not predicted to impact the overall population of the Kenai Peninsula.

5.4.2. Breeding Landbirds and Shorebirds

Potential Impacts to Breeding Birds and Shorebirds - Removal or loss of vegetation affects breeding birds and shorebirds in several ways that include loss of old growth trees for nesting, foraging, and cover habitat. Project-related tree and vegetation removal may be direct or indirect. Indirect removal includes understory changes to plant species influenced by direct tree removal; causing mortality and eventual structure loss or alteration. Breeding birds and shorebirds often construct a new nest every season and habitat is often lost to natural events like flooding and fire. The loss of nesting habitat from the previous season is not a detriment to successful breeding and is not predicted to impact the overall breeding birds and shorebirds population on the Kenai Peninsula. The direct removal of any active nest structure is prohibited. The USFWS (2005) has published recommendations for time periods to avoid vegetation clearing. These recommendations are provided to help avoid vegetation removal during the breeding season.

Removal or loss of vegetation will impact songbirds by decreasing the availability of habitat for cover from predators and for foraging. Loss of cover may increase predation on both breeding adults as well as nests. Activities related to forest removal and anthropogenic access may also cause more shy or sensitive species to move to other less acoustically disturbed areas; however, these movements are not predicted to impact the overall songbird population of the Kenai Peninsula. The USFWS (2005) has published recommendations for time periods to avoid

vegetation clearing. These recommendations are provided to help avoid vegetation removal and disturbance during the breeding season.

Direct mortality to breeding birds and shorebirds may increase with the placement of power lines along the access route. Birds, especially resident species, unaccustomed to these lines may be impacted by flying into the line or injury by electrocution. Collision deterrent methods will be considered during the Project design phase to avoid or minimize impacts if the overhead power line alternative is selected.

5.4.3. Waterbirds

Potential Impacts to Waterfowl - Removal or loss of vegetation affects waterfowl directly by loss of old growth trees for nesting habitat. Nest and trees are lost naturally every year to natural events that include flooding and fire. Cavity-nesting ducks make efficient use of hard to find tree-cavity nest sites, and are capable of identifying new cavities as trees age. The loss of the tree from the previous season can be a limiting factor in successful breeding, but this is not predicted to impact the overall waterbird population on the Kenai. The direct removal of any active nest structure is prohibited; the USFWS (2005) has published recommendations for time periods to avoid vegetation clearing. These recommendations are provided to help avoid vegetation removal during the breeding season.

Changes in lake and creek levels may indirectly impact waterfowl and waterbirds like American dippers by decreasing or altering prey availability. Lake level changes will also directly impact shorebirds by limiting available nesting and foraging habitat. Spotted sandpipers are known breeders along the shoreline of Grant Lake (2010 field data) and will place nests along the perimeter of lakes and rivers. Typical breeding habitat includes the edge of an open or semi-open area adjacent to water, with low ground cover, such as shrub-dotted or lightly treed meadows or grassland. This species prefers shores with rocks, wood, or debris (NatureServe 2007). Changes in the predator-prey dynamics and nesting surface availability may be temporary or permanent depending on the species and extent of lake level change.

Construction and operational activities may cause more shy or sensitive species to move to other less acoustically disturbed areas; however, these movements are not predicted to impact the overall waterfowl population of the Kenai Peninsula.

Direct mortality to waterfowl may increase with the placement of power lines along the access route. Waterfowl unaccustomed to these lines may be impacted by flying into the line or injury by electrocution. Collision deterrent methods will be considered during the Project design phase to avoid or minimize impacts if the overhead power line alternative is selected.

5.4.4. Terrestrial Mammals

Potential Impacts to Terrestrial Mammals – Removal or loss of vegetation may impact mammals (moose, bear, mountain goats, lynx, and other small mammals) by decreasing the availability of forest cover from predators and foraging. Loss of cover may increase predation on both breeding adults as well as young. Activities related to forest removal and anthropogenic access may also cause more shy or sensitive species to move to other less acoustically disturbed areas; however,

these movements are not predicted to impact the overall mammal population of the Kenai Peninsula. Black bear are very adaptable to human disturbance. This is not necessarily the case with brown bear, as impacts of roads and trails resulting from new development in the watershed may reduce the quality of available habitat and increase the number of negative bear-human encounters. On the Kenai Peninsula, habitat modification and human activities have resulted in an increase in the number of brown bears killed in defense of life or property (Suring and Del Frate 2002). During the summer, bears concentrate along salmon streams in areas that are heavily used by people; several encounters have occurred at salmon streams resulting in injury to humans and injury or death to brown bears (USFS 2008).

5.5. Variances from FERC-Approved Study Plan and Proposed Modifications

The 2013 wildlife resources effort followed the March 2013 Study Plan objectives and methodologies. There are no variances to report.

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Appendix 1: Terrestrial Vegetation

Appendix 1a: Terrestrial Vegetation Tables

Appendix 1b: Terrestrial Vegetation Related Materials

Appendix 1a. Terrestrial Vegetation Tables

Table A.1a-1. Alaska Region sensitive plants, February 2011

Table A.1a-2. Invasive plant populations in the vicinity of Grant Lake, June 2013.

Table A.1a-3. Plants observed during vegetation surveys of the Grant Lake Project, 2013

Table A.1a-1. Alaska Region sensitive plants, February 2011

Scientific Name	Common Name	Known/Suspected on the Seward RD	
Aphragmus eschscholtianus	Eschscholtz's little nightmare	Known	
Botrychium spathulatum	Spatulate moonwort		
Botrychium tunux	Moosewort fern	Sensitive	
Botyrychium yaaxudakeit	Moonwort fern	Sensitive	
Cirsium edule var. macounii	Edible thistle	Sensitive	
Cochlearia sessilifolia	Sessileleaf scurveygrass		
Cypripedium guttatum	Spotted lady's slipper	Sensitive	
Cypripedium montanum	Mountain lady's slipper		
Cypripedium parviflorum var. pubescens	Large yellow lady's slipper		
Ligusticum calderi	Calder's lovage	Sensitive	
Lobaria amplissima	Lichen, no common name		
Papaver alboroseum	Pale poppy	Known	
Piperia unalascensis	Alaska rein orchid	Sensitive	
Platanthera orbiculata	Lesser round-leaved orchid		
Polystichum kruckebergii	Kruckeberg's swordfern		
Romanzoffia unalaschcensis	Unalaska mist-maid	Sensitive	
Sidalcea hendersonii	Henderson's checkermallow		
Tanacetum bipinnatum ssp. huronense	Dune tansy	Sensitive	

Table A.1a-2. Invasive plant populations in the vicinity of Grant Lake, June 2013.

USDA Plant Code	Common Name	Comments
ACMIM2	common yarrow	
ALGE2	water foxtail	
ALPR3	meadow foxtail	
ARGL	tower rockcress	
BRRA	field mustard	
CABU2	shepherd's purse	
CEFO2	common mouse-ear	
CEGL2	sticky chickweed	
CHALA	lambsquarters	
CIAR	common thistle	Not present in vicinity. High invasive potential.
CRTE3	annual hawksbeard	
DAGL	orchardgrass	
ELRE4	quackgrass	
GABI3	splitlip hempnettle	
HIAU	orange hawkweed	Not present in vicinity. High invasive potential.
HIUM	narrowleaf hawkweed	
HOJU	foxtail barley	
LEDE	common peppergrass	
LEVU	oxeye daisy	
LIVU2	butter and eggs	High potential invasiveness.
LOPEP	perennial ryegrass	
LOCO	bird's foot trefoil	Not present in vicinity. High invasive potential.
LUPOP4	bigleaf lupine	
MADI6	disc mayweed	
MEAL12	yellow sweetclover	High potential invasiveness.
PANU3	Icelandic poppy	
PHAR3	reed canarygrass	Not present in vicinity. High invasive potential.
PHPR3	timothy	
PLMA2	common plantain	
POAN	annual bluegrass	
POAV	prostrate knotweed	
POPR	Kentucky bluegrass	
RUAC3	common sheep	
RUCR	curly dock	
SOAR2	field sowthistle	Not present in vicinity. High invasive potential.
SPRU	red sandspurry	
STME2	common chickweed	
TAOF	common dandelion	
TRHY	alsike clover	

USDA Plant Code	Common Name	Comments
TRPE21	scentless false	
TRPR2	red clover	
TRRE3	white clover	
VESES	thymeleaf speedwell	
VICRC	bird vetch	High potential invasiveness.

Table A.1a-3. Plants observed during Vegetation surveys of the Grant Lake Project, 2013.

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
TREES				
Betula papyrifera var. kenaica	X	X	X	
Picea glauca	X	X	X	
Picea mariana			X	
Picea x lutzii	X	Х	X	
Populus balsamifera		Х	X	
Populus tremuloides		Х	X	
Salix scouleriana		Х	X	
Tsuga mertensiana	X	X	X	
SHRUBS				
Alnus incana ssp. tenuifolia			X	
Alnus viridis ssp. sinuata	X	X	X	
Amelanchier alnifolia		X		
Andromeda polifolia	X		X	
Arctostaphylos uva–ursi		X		
Betula glandulosa/nana	X	X	X	
Dasiphora fruticosa	X	X	X	
Empetrum nigrum	X	X	X	
Juniperus communis		X	X	
Ledum groenlandicum		X	X	
Ledum palustre ssp. decumbens	X	X	X	
Linnaea borealis	X	X	X	
Menziesia ferruginea	X	X	X	
Oplopanax horridus	X	X	X	
Oxycoccus microcarpus	X	X	X	
Ribes laxiflorum	X	X	X	
Ribes triste		Х	X	
Rosa acicularis		X	X	
Rosa nutkana	X	X	X	
Rubus idaeus	X	X	X	
Salix alaxensis		X		
Salix barclayi	X	X	X	
Salix communtata		X	X	
Salix sitchensis		X		
Salix sp.	X	X	X	
Sambucus racemosa	X	X	X	

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Sibbaldia procumbens		X		
Sorbus sitchensis		X	X	
Spiraea stevenii	X	X	X	
Vaccinium alaskaense	X	X	X	
Vaccinium caespitosum	X	X	X	
Vaccinium ovalifolium	X	X	X	
Vaccinium uliginosum		X	X	
Vaccinium vitis–idaea	X	X	X	
Viburnum edule	X	X	Х	
FORBS				
Achillea millefolium var. borealis	X	X	Х	
Aconitum delphiniifolium	X	X	Х	
Actaea rubra		X	Х	
Allium schoenoprasm		X		
Anemone narcissiflora		X		
Anemone parviflora		X		
Anemone richardsonii		X		
Angelica genuflexa	X	X		
Antennaria monocephala	X	X		
Aquilegia formosa	X	X	X	
Arabis lyrata	X	X		
Arabis sp.		X		
Arnica latifolia	X	X		
Artemisia arctica	X	X		
Artemisia tilesii	X	X		
Aruncus dioicus	X	Х	Х	
Aster sibiricus		Х		
Astragalus alpinus		X		
Barbarea orthoceras	X	X		
Boschniakia rossica		X	Х	
Caltha sp.		X		
Campanula rotundifolia	X	X	X	
Cardamine pratensis		X		
Cardamine sp.		X		
Cardamine umbellata	X	X	X	
Castilleja unalaschcensis		X		

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Cerastium arvense		X		
Chamerion angustifolium	X	X	X	
Chamerion latifolium	X	X		
Chrysosplenium tetandrum	X	X		
Circaea alpina	X	X	X	
Comarum palustre	X	X	X	
Cornus canadensis	X	X	X	
Delphinium glaucum	X	X	X	
Draba incerta		X		
Draba palanderiana		X		
Drosera anglica			X	
Drosera rotundifolia	Х		X	
Epilobium anagallidifolium	X	X		
Epilobium glandulosum	X	X		
Epilobium leptocarpum		X		
Epilobium leptophyllum			Х	
Erigeron peregrinus	X		X	
Galium boreale		X		
Galium trifidum	X	X		
Galium triflorum	X	X	X	
Geocaulon lividum	X	X	X	
Geranium erianthum	X	X	X	
Geum macrophyllum	X	X	X	
Heracleum maximum	X	X	X	
Heuchera glabra	X	X	X	
Impatiens noli-tangeri			X	
Iris setosa			X	
Leptarrhena pyrolifolia			X	
Listera cordata			X	
Lloydia serotina		X		
Lupinus nootkatensis		X	X	
Menyanthes trifoliata			X	
Mimulus guttatus		X	X	
Moehringia lateriflora		Х		
Moneses uniflora		X	X	
Orthilia secunda	Х	X	X	
Oxytropis campestris		X		

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Packera pauciflora			X	
Papaver alboroseum		Х		
Parnassia kotzebuei		X		
Parnassia palustris	X	х	X	
Pedicularis labradorica			X	
Pedicularis verticillata		X		
Petasites hyperboreus		X		
Platanthera dilatata	X		X	
Polemonium acutiflorum	X	X	X	
Polemonium pulcherrimum		X	X	
Polygonum bistortum		X		
Polygonum viviparum	X	X	X	
Potentilla norvegica	X	х		
Potentilla villosa		X		
Potentilla virgulata		X		
Prenanthes alata		X	X	
Prunella vulgaris ssp. lanceolata		x		
Pyrola asarifolia	X	X	X	
Ranunculus abortivus		X		
Ranunculus eschscholtzii		X		
Ranunculus lapponicus			X	
Ranunculus uncinatus		X		
Rhinanthus minor		X	X	
Rhodiola integrifolia	X	X	X	
Romanzoffia sitchensis		X		
Rubus arcticus	X	X		
Rubus chamaemorus	X	X	X	
Rubus pedatus	X	X	Х	
Rumex sp.			X	
Sagina saginoides		X		
Sanguisorba canadensis	X	X	Х	
Saxifraga ferruginea		X		
Saxifraga lyallii ssp hultenii			Х	
Saxifraga punctata	X	х	Х	
Saxifraga rivularis	X			
Saxifraga sp.		X		
Saxifraga tricuspidata	X	X	X	

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Senecio triangularis	X			
Solidago multiradiata	X	Х	X	
Stellaria spp.	X	Х		
Streptopus amplexifolius	X	х	X	
Swertia perennis	X	Х	X	
Taraxacum ceratophorum		X		
Taraxacum officinale	X	X	Х	X
Tellima grandiflora	X	Х		
Thalictrum sparsiflorum	X	Х	X	
Tiarella trifoliata	X	х		
Trientalis europaea	X	Х	X	
Trifolium repens			X	X
Triglochin palustre			X	
Urtica dioica	X	Х	X	
Valeriana sitchensis		Х	X	
Veronica americana		Х		
Veronica wormskjoldii		Х	X	
Viola langsdorffii		Х	X	
Viola sp.	X	х	X	
Zigadenus elegans		Х		
V V				
GRAMINOIDS				
Agrostis aequivalvis			X	
Agrostis mertensii	X	X	X	
Agrostis scabra	X	X	X	
Alopecurus aequalis	X	X		
Anthoxanthum monticola subsp. alpinum		X		
Arctagrostis latifolia		X		
Calamagrostis canadensis	X	X	X	
Carex aquatilis var. aquatilis		X	X	
Carex atrosquama		X		
Carex brunnescens		x		
Carex canescens	X	x	X	
Carex crawfordii		X		
Carex disperma		X		
Carex echinata	X			

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Carex lenticularis	X	X		
Carex leptalea	Х		X	
Carex limosa			X	
Carex livida			Х	
Carex loliacea		Х		
Carex macrochaeta	X	Х		
Carex magellanica			Х	
Carex media		Х	X	
Carex mertensii	X	X	X	
Carex pachystachya		Х		
Carex pauciflora	X		X	
Carex saxatilis	X	X	X	
Carex scirpoides		X		
Carex sitchensis var. dives			X	
Carex sp.			X	
Carex utriculata		X	X	
Cinna latifolia			X	
Deschampsia caespitosa	X	X	X	
Elymus trachycaulus		X		
Elymus violaceus	X	X	X	
Eriophorum angustifolium	X			
Eriophorum russeolum	X		X	
Eriophorum scheuchzeri			X	
Festuca brachyphylla		X		
Festuca occidentalis			X	
Festuca saximontana		X		
Festuca sp.		X		
Hordeum brachyantherum		X	X	
Juncus castaneus		X		
Juncus mertensianus	X	X		
Juncus sp.			X	
Luzula multiflora	X	X		
Luzula parviflora	X	x		
Luzula spicata		X		
Phleum alpinum	X	X	X	
Poa alpina	X	x		
Poa annua		X		X

Table A.1a-3, continued...

Species	Grant Lake/State Lands	Grant Lake/ USFS Lands	Project Features / State Lands	Invasive Species
Poa arctica x stenantha	X			
Poa interior	X	X	X	
Poa palustris		X		
Poa pratensis		X		X
Poa spp.	X	X	X	
Trichophorum alpinum			X	
Trichophorum caespitosum			X	
Trisetum spicatum	X	X	X	
Vahlodea atropurpurea		X	X	
FERNS AND FERN ALLIES				
Athyrium americanum		X		
Athyrium filix–femina	X	X	X	
Botrychium lunaria	X			
Botrychium minganense	X			
Cryptogramma acrostichoides		х		
Cystopteris fragilis	X	Х	X	
Dryopteris expansa	X	Х	X	
Equisetum arvense	X	Х	X	
Equisetum fluviatile	X	Х	X	
Equisetum hyemale	X	Х	X	
Equisetum scirpoides		Х		
Equisetum sylvaticum	X	Х	X	
Equisetum variegatum	X	Х	X	
Gymnocarpium dryopteris	X	х	X	
Lycopodium annotinum	X	X	X	
Lycopodium clavatum	X	х		
Lycopodium complanatum			X	
Lycopodium selago	X			
Matteucia struthiopteris		X	X	
Thelypteris phegopteris	X	X	X	
Woodsia ilvensis		X	X	

Appendix 1b. Terrestrial Vegetation Related Materials

R10 TES Plant Element Occurrence Field Form, Grant Lake Project, 2013.

AKEPIC Field Data Sheet, Grant Lake Project

USFS Plant Survey Field Form, Grant Lake Project, 2013

USFS Survey Intensity Levels for Plants

Photo A.1b-1. Blooming pale poppy plant

Photo A.1b-2. Pale poppy habitat.

Photo A.1b-3. Pale poppy habitat from Grant Lake

R10 TES PLANT ELEMENT OCCURRENCE FIELD FORM -

USDA FOREST SERVICE 12/08

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

		G	eneral Informati	on		
1) SITE ID: ®			2) DATE: ® 07/19/20)13	3) SITE NAME:	GRANT LAKE 1
4) NRCS PLANT CODE	: ® PAAL5					
5) SCIENTIFIC NAME: ®	PAPAVER A	LBOROSEUM				
6) RECORD SOURCE: ®	FS	7) SURVEY	ID: ®*		8) Survey Nam	e: Grant Lake
9) EXAMINER(S)- LAST:	® Beck			FIRST: ®	Kathryn	MIDDLE INITIAL: A
Last:				FIRST:		MIDDLE INITIAL:
10) OWNERSHIP: ® US	SFS	11) Loc.	Uncert: ®		12) Uncert. Dis	st: ®*
13) E.O.#		14) STATE	:: ®* AK		15) COUNTY: ®*	KENAI
16) REGION: ®* 10	17) Fores	T: ®* CHUG	ACH 1	8) DISTRI	CT: ®* SEWARD	
19) Area (Est): 10' x :	25'		2	0) Area	UOM: ®* FEET	
21) Canopy Cover M	ethod ®* (c	ircle one):	COVER PERCENT; D.	AUBEN; N	IRMCOV DAUBEN	

Element Occurrence Data 22) EO Canopy Cover: ®%Cov: or Cover Class Code: T 23) Lifeform: FB 25) Plant Found (Revisit): Yes or No 24) Number of subpopulations: 0 27)Count Type: ®Genets/Ramets/Undetermined 28)Count: ®Actual or Estimate 26)Plant Count:® 15 **29) Revisit needed -** Yes X or No 30) Revisit Date: 31) Revisit Justification: 32)Phenology by %® **33) Population Comments:** (e.g., distribution, vigor, density, phenology, dispersal) Moderately vigorous, small population. Flowering adults and juveniles present. (Sum to 100%): Vegetative 20_ Flower/Bud . . . 50 34) Evidence of disease, competition, predation, collection, trampling, or Fruit/Dispersed . ____ herbivory: Yes___ or No _X__ Seedlings/ 35) Evidence Comments: Juvenile _30 **36) Pollinator observed –** Yes or No 37) Pollinator type(s):

Site Morphometry 39) Percent Slope: ® 2% 40) Slope position: ® TS 41) Aspect: ® azimuth: 160° or cardinal: 42) Elev.: Ave: 703 Min: 702 Max: 705 43) Elev UOM: ®* FEET

38) Pollinator comments:

Soil (Characteristics and Light Conc	litions
44) Substrate on which EO occurs: F	₹	
45) Parent Material: ALLU	46) Soil Moisture: M	47) Soil Texture: S
48) Soil Type:		49) Light Exposure: ® PSH

		Site Classifications SITE ID:	
Record taxonomic unit	s of the given ty	ype(s) if published classifications exist for the area	
CLASSIFICATION TYPE	CLASS CODE	CLASSIFICATION SHORT NAME	CLASSIFICATION SET
50) Existing Veg®			
51) Potential Veg			
52) Ecotype			

Habitat Quality and Management Comments

- **53) Habitat Description:** Plants growing on semi-stabilized, sparsely vegetated, south-facing creek outwash area near shore of Grant Lake, on cobble, sand, gravel substrate, in open early successional shrub-forb-graminoid community. Plants 12 feet from lake edge. Plants from 2 to 6 feet higher than the estimated water level of 700 feet.
- 54) Dominant Process: 50, 70
- **55) Process Comment:** At base of steep avalanche slopes, with creek nearby. Area is likely prone to flood and avalanches which could affect the population.
- 56) Community Quality (L, M, H): H

57) Landscape Integrity (L, M, H): H

- 58) Disturbance/Threats (present or imminent): EX, RC, SU
- **59) Disturbance/Threats Comment:** There is an historic cabin on same gravel bar. There are also at least 2 fire rings, and an obvious campsite in the vicinity. It is possible that the trees and shrubs growing near the population might eventually shade it out. The population is small to begin with.
- **60) Non-Native Comment:** There were estimated to be > 100 Taraxacum plants in and around the poppy population. It is possible that some of them were the native dandelion species Taraxacum ceratophorum, which was collected elsewhere on the lake in similar habitats.
- 61) Current Land Use Comment:

Canopy Cover

Record % canopy cover by actual	percent, or by cover class	(as indicated in General	Information Block).
Lifeform Canopy Cover	62) % Cov <i>or</i> Code	Ground Cover	63) % Cov <i>or</i> Code
Tree		Bare	

Shrub	Gravel
Forb	Rock
Graminoid	Bedrock
Non-vascular	Moss
Lichen	Litter/Duff
Algae	Basal Veg
	Water
	Road surface
	Lichen

Associated Species SITE ID:

List species directly associated with the EO species on this site. Record the NRCS Plant Code, scientific name or both. If desired, indicate lifeform, dominant species, % cover for each species and flag non-native species.

- 64) Completeness of Species List: ®* C, R, OR S®
- 65) Species List Comment: Complete

66) ® NRCS Plant Code	67) ® Scientific Name	68) Life Form	69) Dom. (Y/N)	70) % Cov or Class	71) Non- native
	Picea x lutzii	T		2	
	Alnus viridis sinuata	s		2	
	Populus balsamifera	S		Т	
	Taraxacum officinale/ceratophorum	F		2	?
	Aquilegia formosa	F		1	
	Cerastium arvense	F		1	
	Heracleum maximum	F		t	
	Astragalus alpinus	F		t	
	Chamerion latifolium	F		1	
	Oxytropis splendans	F		t	
	Artemisia arctica	F		t	
	Carex pachystachya	G		t	
	Festuca brachyphylla	G		1	
	Elymus violaceus	G		t	
	Trisetum spicatum	G		1	
	Poa alpina	G		1	
	Sibbaldia procumbens	F		1	
	Arabis lyrata	F		t	

FINAL REPORT			TERRESTRIAL RESOURCES STUDY
			
	EO Specin	nen Documentation	
70) D ((
72) Reference for			
	ector – ®Last Name: Beck		athryn M.I. A
Other Collec	ctors - ®Last Name:	First Name:	M.I.
74) Collection #	®* 201334	75) ID Confirmed: ®* Y: X	or N: or Questionable:
76) Verification:	® K. Beck		
77) Specimen Re	epository: ®* WTU (UNIVERSITY	OF WASHINGTON)	
	lmaga Inform	nation @ (IE IMAGES TAKEN)	SITE ID:
	illiage illioiti	nation ® (IF IMAGES TAKEN)	011 E 1D.
78) Image ID	79) Image Description		
-, .			
	<u> </u>		
	_		
	Locati	ion Information	
(State, Co	ounty, Region, Forest, District will be auto-po		the spatial feature is entered)
80) USGS Quad	Number:	81) USGS Quad Name:	
82) Forest Quad	Number:	83) Forest Quad Name	:
84) Legal Des	cription: Required where publi	ic land survey is available.	
Meridian:	Township and Ran	ge: T05N R01E	
Section: 29	Q Sec:_SW QQ	Sec:NE QQQ Sec:	QQQQ Sec:
	nd Longitude ®FOR TONGASS (e	ither in degrees, minutes, se	conds or in decimal
degrees)			
Geodetic Dati		North Co. 1	_
	· J · · · · — —		s
	Degrees W N	linutes Second	s
GPS Lat Dog	Degrees, 60 404 4005 N I-4	CDC Lange Data Date	2001 440 2042CE2 W Iam
GPS Lat. Dec.	. Degrees: 60.4914885 N lat	Gra Long. Dec. Degre	ees: -149.3043653 W lon
86) UTM® FOR	CHUGACH		
UTM Datum:	OHOGACH	UTM Zone:	
OTIVI Datuin:		OTIVI ZUITE.	

Easting:	Northing:
87) GPS Equipment Used (Manu	ıfacturer and Model):
Garmin Trek	
88) Metes and Bounds	
	89) Directions to Site SITE ID:
	lation located on the north shore of lake, at the base of large the island on cobble shore visible from water. It is just west of
#	
	90) Sketch of Site or Area
	91) General FO Comments

315-5155 FE	RC PDF (Unofi	ficial) 8/15/	2014 4:14:0)7 PM			
	FI.				AKE	PIC Field D	ata Sheet (2010
*Survey Date:	7/22/203**0	bservers: Bec	K, Kath	yu A.			**Required Field
m	nm / dd / yyyy	Last No	ame, First Name	Initial. (e.g.	.: Smith, J.; Willio	ims, R.)	
Observers Affiliat AACD_IPC A	tion (circle one): AKNHP ARS BLM	CES CWMA DOD	DOWL HDR N	PS PMC S	SCS TECI UAF	USFS USFW	S USGS Other
A. Site Informati	ion						
Visit Type (Is this a Re ** Study Type ** Area Surve Site Vegeta Disturbanc B. Location Info ** Latitude:	(circle one): Reconnivisit (circle one): Ye (circle one): Exhause (circle one): Exhause (circle one): Exhause (Note: 1/10 acception Community December (see instruction) Trimation 1.0.4581831 3.440	stive species Invento (acres) re = 37 ft radius, 1/2 escription (level IV V tions below):	Highest prior acre = 83 ft radiiereck et al. 199	ntrol rity species us, 1 acre = 2):	118 ft radius)	ver Actie	у и
		(ft; 0-5, 0-30, 0-1			Date:		
	e:		Quad number:			, C-3, D-4)	-
Notes (location within &	on): TAOF + Bant Lake St	TRDE3 low	cated on!	Sewand t	lwy ROW+	AKRRI	ROW,
C. Survey Inform	nation						
** 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)
TADE	0.1	11%	ongoing	51-150	_	Multiple	Medison
TRRE3	0.01	(1040	ongoing	· 1-5*	_	Multiple.	Medirn

	H. TAR	ODE 3	de de	de la	and they	- Alaska I	De emil
Notes (species):		motornon			LOUS ALAB	conound	ADFORME
at the more	the A Gra	nt Creek	share it		rail Lake N	anows.	7.01
* 1-5 Thi	omatous	patches.					

AKEPIC Field Data Sheet (2010)

m		servers:	Kathryn A				**Required Field
	m / dd / yyyy	Last No	ame, First Name	Initial. (e.g.	: Smith, J.; Willian	ms, R.)	
servers Affiliati AACD_IPC A	ion (circle one): KNHP ARS BLM	CES CWMA DOD	DOWL HDR N	PS PMC S	CS TECI UAF L	JSFS USFWS	S USGS Other
Site Information	on						
Visit Type (Is this a Rev ** Study Type ** Area Surve	visit (circle one): Ye (circle one): Exhaus yed: #200 (Note: 1/10 acr	stive species Invento	acre = 83 ft radi	rity species us, 1 acre =	118 ft radius)		
Disturbance	e Type (see instruct	ions below).	1	100.72	210-10-11	0.00-10-10-	
Location Infor	mation						
Topograph	ic Map Source:	(ft; 0-5, 0-30, 0-1	Scale:		Date:	C3 D4)	
Quad name	avaxacum of lateshore. the west end	this post is was to	nois and I located at there the Con	arayaran other s ant Lal rant L	m were for cattered !	and at the	Stude
Quad name Notes (location print Survey Inform Plant Species Code	avaxacum of lateshore. the west end	ma, Pou piate	nois and I located at there the con	arayanas others ant Lal	m were for cattered !	and at the	Stude
Quad name Notes (location Pornal Avenue on Survey Inform Plant Species Code	avaxaum of lates have. the west end sation **Infested Area (acres)	**Canopy Cover (% cover) (see below)	nois and I located at there the Con share of C	Stem Count (see below)	catteres 1 ce Trail en alce on US	control Action (see below)	Aggressivenes (see below)
Quad name Notes (location print area on Survey Inform ** Plant Species Code (see below)	average of the west end **Infested Area (acres) (see below)	**Canopy Cover (% cover) (see below)	nois and I located at there the Con share of C	Stem Count (see below)	catteres of atteres of atteres of the atteres of th	control Action (see below)	Aggressivenes (see below)
Quad name Notes (location AND TOTAL AND TOTAL Survey Inform ** Plant Species Code (see below) TAOF POAN	avaxauum phateshare. the west end **Infested Area (acres) (see below) 0. lareshare	**Canopy Cover (% cover) (see below)	nois and I located at there the Con share of C	Stem Count (see below) 151-500	m were for cattered I cattered I cattered I cattered I cate on us alce on us **Herbarium (see below) Not Collected Not Collected	Control Action (see below) Multiple Multiple	Aggressivenes (see below)
Quad name Notes (location production Survey Inform ** Plant Species Code (see below) TAOF	averyacium of lates have. the west end **Infested Area (acres) (see below)	**Canopy Cover (% cover) (see below)	nois and I located at there the Con share of C	Stem Count (see below) 151-500	m were for cattered of ce Trail en alce on US "Herbarium (see below)	Control Action (see below) Multiple Multiple	Aggressivenes (see below) Low to Med
Quad name Notes (location paint The paint Survey Inform ** Plant Species Code (see below) TAOF PDAN	avaxauum phateshare. the west end **Infested Area (acres) (see below) 0. lareshare	**Canopy Cover (% cover) (see below)	nois and I located at there the Con share of C	Stem Count (see below) 151-500	m were for cattered I cattered I cattered I cattered I cate on us alce on us **Herbarium (see below) Not Collected Not Collected	Control Action (see below) Multiple Multiple	Aggressivenes (see below) Low to Med

USDA FOREST SERVICE 2008 PLANT SURVEY FIELD FORM

(® = Required Fields ® = Alaska Required)
DECEMBER 2008

		General In	form	ation			
1) SURVEY ID	D: ®	2) SURVEY	NAME	: GRANT LA	AKE PROJECT	Γ	
3) SURVEY STATUS: ® COMPLETED 4) TARGET: ® TEST				ESP; INPA; 5) SOURCE OF WORK: CONTRAC			
6) Survey T	ype: ® Focused Intuit	IVE CONTROLLED					
7) Survey F	ocus: ® Features						
8) Estimate	of Survey Area Size (acres):	9) No	. of Traver	ses:		
10) Elevatio	on: Min: 700 M	/lax: 710	Α	verage: 70)5 11) El e	evation UOM: Feet	
12) State: ®	13) County: ®	14) Region:	®	15) Fo	orest: ®	16) District: ®	
AK	Kenai	10		Chugach	NF	Seward	
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.): Survey was done around USFS owned portions of Grant Lake between lake level (700 feet) and five feet above normal high lake level (est. 705 feet). Habitats similar to those of targeted Sensitive plant species were focused on. Survey was done by boat in steep areas and walking surveys were done where walking was possible. Intuitive controlled survey was performed at proper time of year to identify all targeted species.							
18) Survey	Comments (Directions	, area description	, spec	ific comme	nts by visit a	late, 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
7/18-7/23/2013	BECK, KATHRYN / BECK BOTANICAL SERVICES
	LOHR, ROB / MCMILLEN LLC

Target Species

Required. List all targeted plant species (TES, INPA, special forest products, or other species of concern) that are the focus of the survey. It may be helpful to separate TES from INPA species by page or block if survey is for both purposes. Enter all the species individually using the NRCS *PLANTS* code and/or scientific name. All columns are required.

21) ® NRCS Plant Code	22) ® Scientific name	23) ® Suitable habitat found	24) ® Plant found	25) ® FS Site ID(s) for EOs (If EO forms completed)
APES	Aphragmus eschscholtzianus	no	No	
BOTU3	Botrychium tunux	no	No	
BOYA	Botrychium yaaxudakeit	no	No	
CYGU	Cypripedium guttatum	yes	No	
LICA15	Ligusticum calderi	no	No	
PAAL5	Papaver alboroseum	yes	Yes	Grant Lake 1
PIUN3	Piperia unalascensis	yes	No	
ROUN	Romanzoffia unalaschensis	yes	No	

Species List of Surveyed Area

Optional. List other species found during the survey. Record the NRCS *PLANTS* Code, scientific name or both. Indicate habitat (locally defined), lifeform and cover abundance (all optional). Indicate nonnative plants with "X"

26) Completeness of species list:	27) Cover Method (if cover recorded): Dauben
® COMPLETE	

28) Comments (e.g. details about species list approach, habitat focus, vegetation types or structure, etc.): ®

An attempt was made to compile a complete species list.

29) NRCS Plant Code	30) Scientific Name	31) Life Form	32) Habitat	33) % Cover or Class	34) Non- native
	See Appendix A.8-1 of Grant Lake Project Terrestrial Resources Report for complete species list				

Optional Location Information

Location information to represent the survey area may be recorded, in addition to entering the spatial feature in the application

		1 -					
35) USGS Quad Number			36) USGS Quad Name:				
37) Forest Quad Numbe	r:	3	8) Forest Quad Name:				
39) Legal Description: R	Required where	re public land	survey is available.				
Meridian:	Township a	nd Range:					
Section:	Q Sec:	QQ Sec: _	QQQ Sec:	QQQQ Sec:			
40) Latitude and Longitu	ude (either in	degrees, min	utes, seconds or in de	cimal degrees) ® FOR			
Geodetic Datum:							
Latitude: Degrees	N	Minutes	Seconds				
Longitude: Degrees	w	Minutes	Seconds				
GPS Datum:							
GPS Lat. Dec. Degrees:			GPS Long. Dec. Degre	es:			
41) UTM® FOR CHUGACH							
UTM Datum:		LITI	M Zone:				
Easting:			thing:				
		110.		_			
42) GPS Equipment: M	anufacturer:		Model:				
43) Metes and Bounds							
,							
	44) D	irections to	Survey Area				
Hike or fly into Grant Lake	near Moose F	Pass, Alaska.					
	45)	Sketch of	Survey Area				
			•				
				Λ.			
				~			

USFS Survey Intensity Levels for Plants

The surveyor gives the area a quick "once-over" but does not walk completely through the project area. The entire project area has not been examined.

Level 2 – "Cursory"

The surveyor gives the area an "once-over" by walking through the project area. The entire project has not been examined.

Level 3 – "Limited Focus"

The surveyor closely examines one or more habitat-specific locations within the project area, but does not look at the rest of the area.

Level 4 – "General"

The surveyor gives the area a closer look by walking through the project area and walking around the perimeter of the area or by walking more than once through the area. Most of the project area is examined.

Level 5 – "Intuitive Controlled"

The surveyor has a closer look by conducting a complete examination of specific areas of the project after walking through the project area an perimeter or by walking more than once through the area.

Level 6 – "Complete"

The surveyor has walked throughout the area being examined until nearly all of the area has been examined.



Photo A.1b-1. Blooming pale poppy plant



Photo A.1b-2. Pale poppy habitat.



Photo A.1b-3. Pale poppy habitat from Grant Lake

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 $TERRESTRIAL\ RESOURCES\ STUDY$

Appendix 2: Wetlands

Appendix 2a: Wetlands Related Materials

Appendix 2a. Wetlands Related Materials

Wetlands and Deepwater Habitat Classification Chart

Wetland Determination Datasheets

Wetland Functional Assessment Datasheets

Fieldnotes

Photo A.2a-1. Representative photo of an herbaceous dominated depressional wetland.

Photo A.2a-2. Representative photo of an herbaceous dominated lacustrine fringe wetland.

Photo A.2a-3. Representative photo of an herbaceous floodplain forest & scrub dominated riverine wetland on Grant Creek.

Photo A.2a-4. Representative photo of an herbaceous floodplain forest & scrub dominated riverine wetland in the complex wetland/upland mosaic associated with the Grant Creek side channels.

Photo A.2a-5. Representative photo of scrub-shrub dominated depressional wetland.

Photo A.2a-6. Representative photo of scrub-shrub dominated lacustrine wetland

Photo A.2a-7. Representative photo of scrub-shrub dominated riverine wetland.

Photo A.2a-8. Representative photo of a scrub-shrub floodplain forest & scrub dominated riverine wetland.

Photo A.2a-9. Representative photo of a scrub-shrub floodplain forest & scrub dominated riverine wetland in the complex wetland/upland mosaic associated with the Grant Creek side channels.

Photo A.2a-10. Representative photo of a forest dominated slope wetland

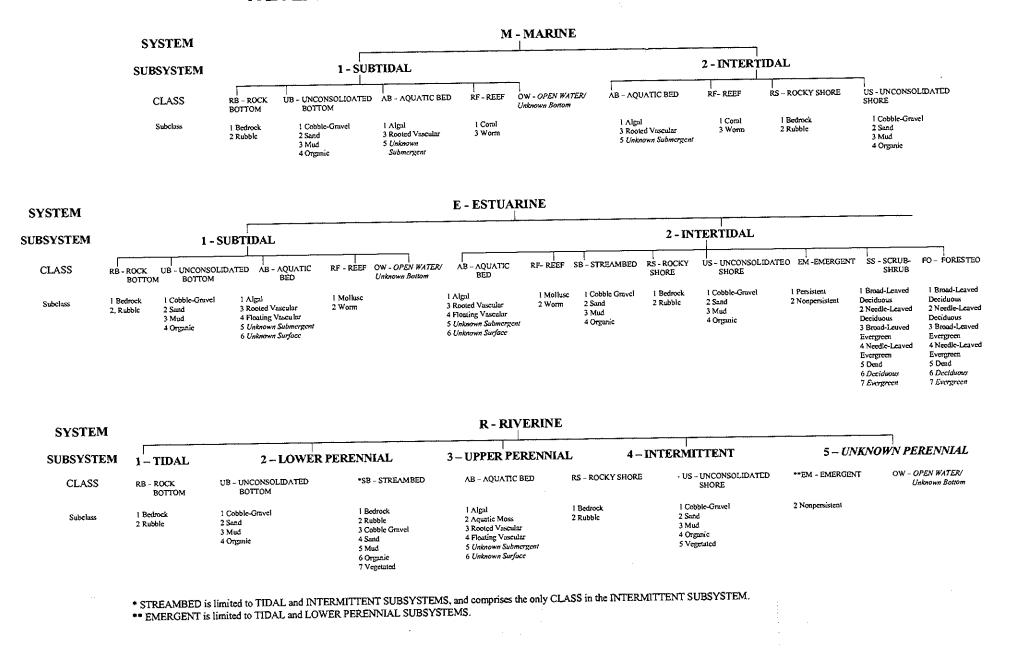
Photo A.2a-11. Representative photo of an open water lacustrine water body. Aerial photo of Grant Lake looking west towards narrows.

Photo A.2a-12. Representative photo of an active riverine water body.

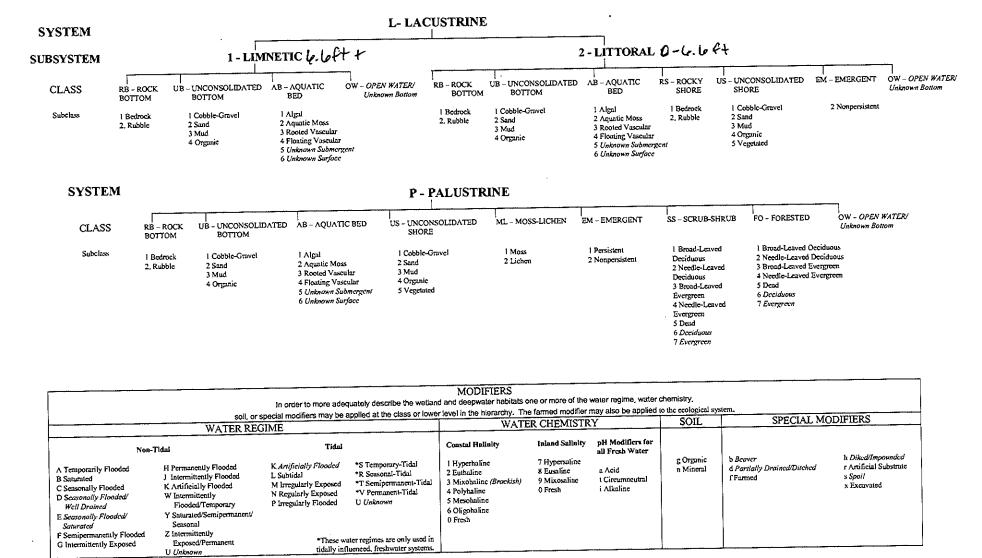
Photo A.2a-13. Representative photo of non-vegetated and intermittent/ephemeral (dry) channel areas associated with Inlet Creek on west end of Grant Lake.

Photo A.2a-14. Representative photo of an intermittent/ephemeral (inactive) riverine water body.

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



NOTE: Italicized terms were added for mapping by the National Wetlands Inventory program.

Source: Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D. C. FWS/OBS-79/31.

WETLAND DETERMINATION DATA FORM - Alaska Region

WETLAND DETE				- · · · · ·
Project/Site: Grant Lake	Borou	igh/City: <u>Moose</u>	? Pass	Sampling Date: 7-16-13
1400 11 10 100				Sempling Point: <u></u>
Applicant/Owner: <u>Vertect Floavo</u> Investigator(s): <u>C. Schidel</u> <u>S. Blank</u>	Land	form (hiliside, terrac	æ,' hummocks, etc.): _	lake edge
	Sione	· (%): //		
late.	- I. J. U I. 11.	いっとう Long	-149. 21713E	Datum:
Subregion:			NWI classif	fication: PFMI/SSIC.
	time of vear? \	∕es X No	(It no, explain in	L/Gillalivo')
Are climatic / hydrologic conditions on the site typical for this Are Vegetation, Soil, or Hydrology si	anificantly distu	rbed? No Are "N	lormal Circumstances'	present? Yes No
Are Vegetation, Soil, or Hydrology si Are Vegetation, Soil, or Hydrology n	aturally problem	atic? No. (if nee	ded, explain any ansv	vers In Remarks.)
Are Vegetation, Soii, of Hydrology for SUMMARY OF FINDINGS – Attach site map sh	owing samni	ing point locatio	ons, transects, imr	portant features, etc.
		ling point to see		
Hydrophytic Vegetation Present? Yes X		is the Sampled	Area	V
Hydric Soil Present? Yes X No.		within a Wetlan	d? Ye	es <u>X</u> No
Wetland Hydrology Present? Yes X No		<u> </u>		
Remarks: Representative samp	u p1. 0)	PEM SS	communi	ty on lake shore
VEGETATION – Use scientific names of plants.	List all spec	cies in the plot.		
	Absolute Do	ominant Indicator pecies? Status	Dominance Test wo	, 800
Tree Stratum 1 Nove		1	Number of Dominant That Are OBL, FACV	t Species 7 3 (A)
1. Nove 2.			Total Number of Dor	minant 3 4
3.			Species Across Ali S	Strata: (B)
4Total Cove			Percent of Dominant That Are OBL, FAC	t Species W, or FAC: 66 75 (A/B)
50% of total cover:		tal cover:	Prevalence Index v	
Santing/Shruh Stratum			Total % Cover of	
To a lie loal camitera.	_ <u>_10</u>	X FACU		O = x1 = D
1- Allies mondis	15	Y FAC	FACW species	6 x2= 12
13. Salix SHEHRISIS		FAC	FAC species	58 x3= 174
4. Picca mariana		FACW	FACU species	10 ×4 = <u>40</u>
5				0 x5= 0
6.			Column Totals:	74 (A) 226 (B)
Total Cove	er		Prevalence In	2 0 5
50% of total cover: 14,5	20% of to	tal cover:	Hydrophytic Vege	
Herb Stratum 1 Chamerion latifolium	30	Y FAC	Hydrophytic vege 人 人 Dominance Tes	
1. Ehamerion [attrollum]		FACW	Prevalence ind	
3. Potemonium acutiflorum	_ <u> </u>	FAC	Morphological	Adentations ¹ (Provide supporting
4 Hansing arang tea	5	TAC	data in Rem	narks or on a separate sheet)
" V V I a a Ca ca		FAG	Problematic H	ydrophytic Vegetation¹ (Expiain)
6. Carex lenticularis				
7. Calamagrostis canadensi	<u> 5_10_</u> _	Y FAC	Indicators of hydri	ic soil and wetland hydrology must disturbed or problematic.
8.			. Be process assets	
9.		·		
10			-	
Total Cov	rer: <u>45</u>	a		
50% of total cover: <u>27</u>	. 5 20% of to	otal cover:	Hydrophytic	
Plot size (radlus, or length x width) 50' radius	% Bare Gr	ound <u>'Akb</u>	Vegetation Present?	Yes × No
% Cover of Wetland Bryophytes Total (Cover of Bryoph	ytes	Liesquit	
(Where applicable)				
shotos: C'S 619-623				

Profile Descriptions (D			Sampling Point: <u>DP 0</u>
Depth Matrix	o the depth needed to document the Indicator of	r confirm the abser	ice of Indicators.)
(Inches) Matrix Color (moist)	Redox Features		
0-10" 2.5 1 2.5	5/1 100%		Sandy silt
			w/gravely
			cobble
		**************************************	<u></u>
Type: C=Concentration, D=Deplet	tion, RM=Reduced Matrix, CS=Covered or Coated 5	Sand Graine 2	
riyane son maleators:	Indicators for Problematic Hydric Sc	olls ³ :	ocation: PL=Pore Lining, M=Matrix.
Histosol or Histel (A1)	Alaska Color Change (TA4) ⁴		ka Gleyed Without Hue 5Y or Redder
Histic Epipedon (A2) Hydrogen Sulfide (A4)	Alaska Alpine Swales (TA5)	Un	derlying Layer
Hydrogen Sulfide (A4) Thick Dark Surface (A12)	Ataska Redox With 2.5Y Hue		r (Explain in Remarks)
Alaska Gleyed (A13)	³ One Indicator of hydrophytic varietate		
Alaska Redox (A14)	³ One Indicator of hydrophytic vegetatlo and an appropriate landscape position	n, one primary indic	ator of wetland hydrology,
Alaska Gleyed Pores (A15)	and an appropriate landscape position dive details of color change in Remark	ou wast ne bieseur i	Inless disturbed or problematic.
Restrictive Layer (If present):			
Times Mark D 1		1	
Type: None found	The state of the s	Ì	
Depth (Inches):		Hydric So	II Present? Yes X No
Depth (Inches): Remarks:			Il Present? Yes X No
Depth (Inches): Remarks:	: (+ sand sediment no o		Il Present? Yes X No
Depth (Inches):		rganics	
Depth (Inches):	a in an ontwasa tha	rganics	
Depth (Inches):	a in an ontwasa tha	rganics	
Depth (Inches):	a in an ontwasa tha	rganics	
Depth (Inches):	a in an ontwash the upstram.	rganics It is regn	early flooded from
Depth (Inches):	a in an ontwash the up stram. Is sufficient)	rganics + is regu Secondary In	early Flooded from
Depth (Inches):	a in an ontwash that up stram. Is sufficient) Inundation Visible on Aerial Imagery (B7	Secondary Ir X Water-sl X Drainage	larly Flooded from adicators (2 or more required) ained Leaves (B9)
Depth (Inches):	a in an ontwash tha My Stram. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B	rganics T is regn Secondary in X Water-st Drainage	edicators (2 or more regulred) ained Leaves (89) Patterns (B10)
Depth (Inches):	a in an ontwash that M Strain. Is sufficient) Inundation Visible on Aerial Imagery (B7) Sparsely Vegetated Concave Surface (B) Mari Deposits (B15)	Secondary Ir Secondary Ir Water-si Drainage Oxldized Presence	larly Flowded from Idicators (2 or more required) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4)
Depth (Inches):	a (n an ontwash the NP Shram. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1)	Secondary Ir Secondary Ir Water-si Drainage Oxidized Presence Salt Dep	e Patterns (B10) I Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5)
Depth (Inches):	a in an ontwash the Strain. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2)	Secondary Ir Secondary Ir Water-st Drainage Presence Salt Dep Stunted	edicators (2 or more required) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1)
Depth (Inches):	a (n an ontwash the NP Shram. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1)	Secondary Ir Secondary Ir Water-sl Drainage Presence Salt Dep Stunted K Geomore	edicators (2 or more required) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1)
Depth (Inches):	a in an ontwash the Strain. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2)	Secondary Ir Secondary Ir Water-si Drainage Presence Salt Dep Stunted of Shellow	edicators (2 or more regulred) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) Aquitard (D3)
Depth (Inches):	a in an ontwash the Strain. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2)	Secondary in Secondary in Water-si Drainage Presence Salt Dep Stunted of Microtope	e Patterns (B10) I Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Relief (D4)
Depth (Inches):	a in an ontwash that Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks)	Secondary in Secondary in Water-si Drainage Presence Salt Dep Stunted of Microtope	edicators (2 or more regulred) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) Aquitard (D3)
Depth (Inches): Remarks: a C edge, grave. W thurs a reagle of a cial melt of a cial m	a in an entwash that Strain. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks)	Secondary in Secondary in Water-si Drainage Presence Salt Dep Stunted of Microtope	edicators (2 or more regulred) ained Leaves (B9) e Patterns (B10) I Rhizospheres along Living Roots (C3) e of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Relief (D4)
Depth (Inches): Remarks: a Cl edgl grave. W thand a rea g a c a le g a c a a le g a c a a le g a c a a a le YDROLOGY Vetland Hydrology Indicators: Primary Indicators (any one Indicator Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sediment Deposits (B2) Drift Deposits (B3) Algal Mat or Crust (B4) Iron Deposits (B5) Surface Soil Cracks (B6) eld Observations: urface Water Present? Yes ater Table Present? Yes	a in an entwash that sufficient) Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks)	Secondary Ir Secondary Ir Water-sl Drainage Presence Salt Dep Stunted Geomory Microtope FAC-Neu	edicators (2 or more required) ained Leaves (89) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Rellef (D4) tral Test (D5)
Depth (Inches): Remarks: a C edge grave. Without a ready and a read	a in an entwash that sufficient) Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks)	Secondary Ir Secondary Ir Water-sl Drainage Presence Salt Dep Stunted Geomory Microtope FAC-Neu	edicators (2 or more required) ained Leaves (89) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Rellef (D4) tral Test (D5)
Depth (Inches): Remarks: AKL edgl, grave Without a rea glacial melt v YDROLOGY Vetland Hydrology Indicators: rimary Indicators (any one Indicator Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sediment Deposits (B2) Drift Deposits (B3) Algal Mat or Crust (B4) Iron Deposits (B5) Surface Soil Cracks (B6) eld Observations: urface Water Present? ater Table Present? yes aturation Present? yes cludes capillary fringe)	a in an entwach that MS Syzam. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks) No X Depth (Inches): No X Depth (inches):	Secondary in Secondary in Water-si Drainage Presence Salt Dep Stunted of Microtope FAC-Neu	e Patterns (B10) I Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Relief (D4)
Depth (Inches): Remarks: AKL edgl, grave Without a rea glacial melt v YDROLOGY Vetland Hydrology Indicators: rimary Indicators (any one Indicator Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sediment Deposits (B2) Drift Deposits (B3) Algal Mat or Crust (B4) Iron Deposits (B5) Surface Soil Cracks (B6) eld Observations: urface Water Present? ater Table Present? yes aturation Present? yes cludes capillary fringe)	a in an entwash that sufficient) Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks)	Secondary in Secondary in Water-si Drainage Presence Salt Dep Stunted of Microtope FAC-Neu	edicators (2 or more required) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Rellef (D4) tral Test (D5)
Depth (Inches): Remarks: a C edge grave. W C a c G a c a YDROLOGY Vetland Hydrology Indicators: Crimary Indicators (any one Indicator Surface Water (A1) High Water Table (A2) Saturation (A3) Water Marks (B1) Sediment Deposits (B2) Drift Deposits (B3) Algal Mat or Crust (B4) Iron Deposits (B5) Surface Soil Cracks (B6) eld Observations: Order Water Present? Yes Saturation Present? Yes	a in an entwach that MS Syzam. Is sufficient) Inundation Visible on Aerial Imagery (B7 Sparsely Vegetated Concave Surface (B Mari Deposits (B15) Hydrogen Sulfide Odor (C1) Dry-Season Water Table (C2) Other (Explain in Remarks) No X Depth (Inches): No X Depth (inches):	Secondary Ir Secondary Ir Water-st Drainage Presence Salt Dep Stunted Shellow Microtope FAC-Neu Wetland Hydrology ons), if available:	edicators (2 or more required) ained Leaves (B9) Patterns (B10) Rhizospheres along Living Roots (C3) of Reduced Iron (C4) osits (C5) or Stressed Plants (D1) ohlo Position (D2) Aquitard (D3) ographic Rellef (D4) tral Test (D5)

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Sile: Grant Lake	Borough/City: _Mabse	Pass Sampling Date: 7-16-13
Applicant/Owner: Youar Hydro	_	Sampling Point: DP とて
Investigator(s): C. Schudel J. Blank	Landform (hillside, terrace	hummocks etc.): \alta edac w/
Local relief (concave, convex, none):		Streams
		~ (49 . 211038 Dalum:
Soil Map Unit Name: Alluvial Deltaic Deposits		NWI classification: PSSIE
The state of the s		
Are climatic / hydrologic conditions on the site typical for this time o		
Are Vegetation, Soil, or Hydrology significa		
Are Vegetation, Soil, or Hydrology naturally		
SUMMARY OF FINDINGS – Attach site map showing	sampling point location	ns, transects, important features, etc.
Hydrophytic Vegetation Present? Yes No	Is the Sampled A	
Hydric Soil Present? Yes Y No		
Wetland Hydrology Present? YesX No		, les _/
Remarks: Performative according the	on sis commu	mity between 2 outflow
channels in portions of unch		
VEGETATION - Use scientific names of plants. List a	all species in the plot.	
Abso	lule Dominant Indicator	Dominance Test worksheet:
	over Species? Slatus	Number of Dominant Species
1. <u>Salix alaxensis</u> <u>5</u>	FAC	That Are OBL, FACW, or FAC:
2		Total Number of Dominant
3	———— ⁵	Species Across All Sirata:(B)
4		Percent of Dominant Species
Total Cover: 5	A	That Are OBL, FACW, or FAC: 20 (A/B)
50% of total cover: 2.5 20 Sapling/Shrub Stratum		Prevalence Index worksheet:
1. Alhus vindus 38)	Total % Cover of: Multiply by:
2Salix		OBL species O x1 = O
3. Picea glauca 5		FACW species x 2 =
4. Salix alaxensis 15		FAC species $\frac{75}{25}$ $\times 3 = \frac{725}{100}$ FACU species $\frac{25}{25}$ $\times 4 = \frac{100}{100}$
5. Salix sitchensis 20		
6. Populus balsamifera 20	/ 1 17/1-7 1/ 1	•
Total Cover: 9	0	Column Totals: 101 (A) 327 (B)
50% of total cover: <u>45</u> 20	% of Iolal cover:	Prevalence Index = B/A = 3,24
Herb Stralum		Hydrophytic Vegetation indicators:
1. Agrostis greantea 5		∠ Dominance Test is >50%
& Equiserm (Kyemale 1	FACW [Prevalence Index is ≤3.0
3. Calamagnostis Unadensis 5	<u>_</u> _ <u></u> <u></u> <u></u> <u></u> <u></u> <u></u>	Morphological Adaptations ¹ (Provide supporting
4	— — —	data in Remarks or on a separale sheet)
5		Problematic Hydrophytic Vegetation ¹ (Explain)
6		Indicators of hydric soil and wetland hydrology must
7	— — — I I	pe present unless disturbed or problematic.
9		
10.		
Total Cover:		
50% of total cover: 3 20'	% of total cover: 1.2	
		Hydrophytic Vegetation
% Cover of Wetland Bryophytes Total Cover of E	· ·	Present? Yes X No
(Where applicable)		
Remarks: pro to 5 627- 630		

SOIL								Sampling Point: DV 62
Profile Des	cription: (Describe	e to the dep	oth needed to docu	ment the i	ndicator c	r confirm	the absence of	Indicators.)
Depth (inches)	Matrix Color (moist)	%	Color (moist)	x Feature 	Type ¹	_Loc²_	<u>Texture</u> _	Remarks
	· — (1) — (1)	<u></u>	**************************************	-	LET THE A			
	100 h	→ ————————————————————————————————————						
	bu	<u>bt0s</u>	627-630					
				·				
			-					
Hydric Solt		pletion, RM	Reduced Matrix, CS				ains. *Locati	on: PL=Pore Lining, M=Matrix.
-	or Histel (A1)		Alaska Colo		-		Alaska Gi	eyed Without Hue 5Y or Redder
	pipedon (A2)		Alaska Alpi	-				ing Layer
	en Sulfide (A4)		Alaska Red					plain in Remarks)
Thick Da	ark Surface (A12)		_					,
Alaska (Gleyed (A13)		³ One indicator of	f hydrophy	tic vegeta	tion, one p	orimary indicator of	of wettand hydrology,
	Redox (A14)							s disturbed or problematic.
	Gleyed Pores (A15)		⁴Give details of	color chan	ge in Rem	arks.		
	Layer (if present):							
	None found							4
Depth (in	ches):		·				Hydric Soil Pr	esent? Yes 🔀 No
Remarks:				1			Cladad	£
We-l	Hand area	z IN O	in outweish	that	is re	gvkir (y Mounted	JAOSAI
ماه	acial melt	upstre	am					
J.		,	•				•	
HYDROLO	GY							
Wetland Hyd	drology Indicators:		MANA.				Secondary Indica	ators (2 or more required)
Primary India	cators (any one indic	ator Is suffi	clent)					ed Leaves (B9)
✓ Surface	Water (A1)	_	Inundation Visibl	e on Aeria	l imagery ((B7)	Drainage Pa	, ,
X High Wa	iter Table (A2)	_	Sparsely Vegeta					izospheres along Living Roots (C3)
Saturatio	on (A3)	-	Mart Deposits (B	15)				Reduced Iron (C4)
Water M	arks (B1)	-	Hydrogen Sulfide	Odor (C1)		Salt Deposit	s (C5)
	ıt Deposits (B2)	-	Dry-Season Wat	•	-		Stunted or S	tressed Plants (D1)
	osits (B3)	_	Other (Explain In	Remarks	1		· · · · · · · · · · · · · · · · · · ·	Position (D2)
	it or Crust (B4)						Shallow Aqu	
	osits (B5)						Microtopogra	
-	Soil Cracks (B6)						FAC-Neutral	Test (D5)
Field Observ		. v .			0			
Surface Water		4	No Depth (inc		<u>/</u> /1	-		
Water Table			No Depth (Inc		<u> </u>	-		· · · · · · · · · · · · · · · · · · ·
Saturation Pr (includes cap		'es <u>X</u> I	No Depth (inc	thes):C	<i>)</i>	. Wetta	ind Hydrology Pi	resent? Yes X No
		gauge, mo	nitoring well, aerial p	hotos, pre	vious insp	ections), i	f available:	
Remarks:								
							anoto	15: C15
							()	15: CIS 627-630

WETLAND DETERMINATION DATA FORM - Alaska Region

	Borough/C	in MAN	Se Pass sometime Date: 7-16	a ~1.3
	oorougis o	ny. <u>1400</u>		
	Londform	(billoido tor	Sampling Point; Di	
-1. (a/2 al.	210he (%):		-	
at: <u> </u>	10 or to	Lo	ng:	
				12.
				,
_ significantly	disturbed?	No Are	"Normal Circumstances" present? Yes X	,
naturally pro	blematic?	No (If no	eeded, explain any answers in Remarks.)	
showing sa	mpling p	oint locat	tions, transects, important features, etc.	
No	1-4	0 1		-
No				
No				
e herb	ncio	ns 5/	15 without adjacent to	
s. List all s	pecies in	the plot.		
Absolute	Dominant	Indicator	Dominance Test worksheet:	
			Number of Dominant Species	
_ —			That Are OBL, FACW, of FAC:	(A)
			Total Number of Dominant	
			Species Across All Strata:	(B)
er:			Percent of Dominant Species That Are OBL FACING or FAC: 100	(A (D)
		r:		(A/B)
1.	.,		1 11 11 11 11 11 11 11 11 11 11 11 11 1	
- 10	<u></u>			_
			· · · · · · · · · · · · · · · · · · ·	-
		FAL		-
				_
	L KWG		UPL species	-
- -			Column Totals: 100 (A) 205	_ (B)
		. 3-		,
20% QI	total cover	·		-
15	_У	FACW	_	
10		OBL	I — .	
_ 10		FACW	<u> </u>	
5		OBL.	Morphological Adaptations' (Provide supporti	ng
_ <u>20</u>	Y	OBL		ı)
		FAC		•
<u> </u>		FAC	Indicators of hydric soil and wetland hydrology m	ıust
	<u>, </u>		be present unless disturbed or problematic.	
			-	
· - -				
		_		
			Hydrophytic	
			Vegetation	
over of Bryopl	nytes $\underline{\mathcal{F}}$	<u>5</u>	Present? Yes No No	
	_			
	at: 40.4 bis: time of year significantly inaturally pro showing sa No No No No List all s Absolute % Cover 20% of 10 5 200 er: 25 20% of 15 10 5 200 er: 45 20% of 15 20% of 15 20% of 15 20% of 15 30% of 15 40 55 20% of 15 40 55 40 56 40 57 58 59 50 50 50 60 60 60 60 60 60 60 60 60 60 60 60 60	Landform Slope (%): at: \(\begin{align*} \cdot	Landform (hillside, ter Slope (%): at: 40.46 8940 Lo 25.45 this time of year? Yes X No significantly disturbed? No Are naturally problematic? No (If n showing sampling point local No Is the Sample within a Wetlan No Dominant Indicator % Cover Species? Status Set: 20% of total cover: 10 Y FAC 5 FAL 20 Y FAC 10 OBL 10 FACW 10 OBL 10 FACW 5 OBL 5 FACC 6 FACC 6 FACC 6 FACC 7 FACW 10 OBL 10 FACW 10 FACW	Landform (hillside, terrace, hummocks, etc.): 4 Re edge Slope (%): 1 at: 40 46 640 Long: 140, 2/1940 Datum: Doshts NWI classification: 2544 5545 his time of year? Yes X No (If no, explain in Remarks.) Post anturally problematic? No (If needed, explain any answers in Remarks.) showing sampling point locations, transects, important features, etc. No Is the Sampled Area within a Wetland? Yes X No (Is the Sampled Area within a Wetland? Yes X No (Is the Sampled Area within a Wetland? Yes X No (Is tall species in the plot.) Absolute Dominant Indicator % Cover Species? Slatus That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: No (Is take Species Across All Strata: 4) Percent of Dominant Species That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: Number of Dominant Species Across All Strata: 4 Percent of Dominant Species That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: Number of Dominant Species Across All Strata: 4 Percent of Dominant Species That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: Number of Dominant Species Across All Strata: 4 Percent of Dominant Species That Are OBL, FACW, or FAC: 100 Prevalence Index worksheet: 100 FAC species 35 x 2 = 50 FAC species 35 x 2 = 50 FAC species 0 x 4 = 0 UPL species 0 x 4 = 0 Obl. Applications of Northological Adaptations (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetation (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetation (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetation (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetation (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetation (Provide support data in Remarks or on a separate sheet) Problematic Hydrophytic Vegetati

	2003
Sampling Point:	DP 03

SOIL						Sampling Point: DP 0.3
Profile Desc	ription: (Describe	to the depth need	led to document the ind	lcator or confirm t	he absence	of Indicators.)
Depth (inches)	Matrix Color (molst)	% Cole	Redox Features or (moist) %	Type ¹ Loc ²	Texture	Remarks
3-0	Marc day V		- Sand + gravel			live voot layer
50	AGA CHINE	Jied Louces	- March	<u> </u>		w/ sandy silt
0-11	very dark	grey I black	Sandy grave	<u> </u>		Sand + gravel
						- All
	TOTAL					
				·		
						·
		pletion, RM=Reduc	ed Matrix, CS=Covered o	r Coated Sand Gra	Ins. ² Loc	catton: PL=Pore Lining, M=Matrix.
Hydric Soll			ficators for Problematic	_	Alaaka	Gleyed Without Hue 5Y or Redder
	or Histel (A1)		_ Alaska Color Change (1 _ Alaska Alpine Swales (1			erlying Layer
	pipedon (A2) en Sulfide (A4)		Alaska Redox With 2.5)		,	(Explain in Remarks)
	ark Surface (A12)				 ,	` '
	Gleyed (A13)		ne indicator of hydrophyti			
Alaska I	Redox (A14)				be present ur	less disturbed or problematic.
	Gleyed Pores (A15)		lve details of color change	e in Remarks.		
	Layer (if present):					
	nove forn				Hudric Soil	Present? Yes X No
ļ	ches):			•	Tiyuno 30n	Theseliti Lea 77 110
Remarks:	1 1dae 501	asmally.	Flooded			
IMIC	e eage see	1 105	11000000			
	glacial o	asmally .				
						•
HYDROLO)GY					1.00
	drology Indicator	s:			Secondary In	dicators (2 or more required)
1	cators (any one Inc				Water-st	alned Leaves (B9)
✓ Surface	Water (A1)		ındation Visible on Aerial			Patterns (B10)
	ater Table (A2)		arsely Vegetated Concav	e Surface (B8)		Rhizospheres along Living Roots (C3)
★ Saturati			rl Deposits (B15)		—	e of Reduced Iron (C4)
I	Marks (B1)		drogen Sulfide Odor (C1) y-Season Water Table (C			osits (C5) or Stressed Plants (D1)
1	nt Deposits (B2) posits (B3)		her (Explain in Remarks)	2)		phic Position (D2)
I —	at or Crust (B4)		(C)			Aquitard (D3)
1	posits (B5)					ographic Relief (D4)
1	Soil Cracks (B6)				K FAC-Ne	utral Test (D5)
Field Obser	rvations:	~/	ກ່	(mar put)		
Surface Wa	ter Present?	Yes No	Depth (inches): 0	Chest (1)		
Water Table		Yes No	Depth (inches):	<u></u> !	1 11 - 11	jy Present? Yes <u> </u>
Saturation F	nillary fringe)	•	Depth (Inches):			ly Present? Tes No
Describe Re	corded Data (strea	ım gauge, monitorin	ig well, aerial photos, pre	vlous inspections), i	f available:	
						,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
Remarks:						
Į.						

WETLAND DETERMINATION DATA FORM -- Alaska Region

C 1.7				m Alaska Region		_
Project/Site: Grant Lake	Bo	orough/C	ity: <u>Moo</u>	ડલ મેવકડ	_ Sampling Date: _	7-16-13
Applicant/Owner: <u>Kernen</u> Hydro				•	Sampling Point:	DP04
Investigator(s): C. Schudel J. Blank	La	andform ((hillside, ter	race, hummocks, etc.):	lake edge	
Local relief (concave, convex, none):	SI	lope (%):		_	v	
Subregion: La	t: <u>60,46</u>	08824	Lo	ng: <u>-149,211793</u>	Datum:	
Soil Map Unit Name: Alluvial Deltace Depos	its			NWI classific	cation: _ PS516	8 /EM
Are climatic / hydrologic conditions on the site typical for th	ls time of year	7 Yes _	No _	(If no, explain In F	Remarks.)	
Are Vegetation, Soil, or Hydrology	slgnificantly_di	sturbed?	Are	"Normal Circumstances"	present? Yes _X,	No
Are Vegetation, Soil, or Hydrology	naturally probl	iematic?		eeded, explain any answe		, Aut
SUMMARY OF FINDINGS – Attach site map s	howing sam	a prilar	oint locat	ions transects impo	ortant features	etc
				, transcore, impe		
	ło	ls ti	he Sample	d Area		
1	ło	with	hin a Wetla	nd? Yes	X No	
	10					
Remarks: Representative of th	re will	owl a	lder	community		
VEGETATION – Use scientific names of plants	Liet all en	ooloo ir	the plat			
- 2 2 3 Solonina Hames of plants	Absolute [-			
Tree Stratum	% Cover	Species?	Status	Dominance Test work Number of Dominant S		
1. None				That Are OBL, FACW,	or FAC:	(A)
2				Total Number of Domin		,
3				Species Across Ali Stra		(B)
4		****	***	Percent of Dominant Sp	pecies	
Total Cove				That Are OBL, FACW,	or FAC: 100	(A/B)
50% of total cover: Sapling/Shrub Stratum	20% of to	otal cove	r:	Prevalence Index work		
1. Alnus viridus	70	4	FAC .	Total % Cover of:		
2. Salix sitchensis	<u> 40 _</u>	У	FAC	OBL species 22		
3. Salix alexensis	<u> 5 </u>		FAC	FACW species 25		
4. Picea glavca			FACU	FAC species		
5				1	x4= <u>4</u> x5= D	
6				Column Totals: 119		
Total Cover			101.4	Column Totals. 111		1
50% of total cover: 33	20% of to	tal cover	: 13.2	Prevalence Index	= B/A =2.4	3
1. Equiperm hyemale	15	4	FACW	Hydrophytic Vegetatlo		-
2. Equiption fluviative	2		OBL	_X Dominance Test is		
3. Carex canescens	U	Υ	FACW.	Yevalence Index Is		
4. <u>Carex lenticularis</u>		<u></u>	_08L_	Morphological Adap data in Remarks	otations' (Provide su sor on a separate sh	ipporting
5. Carex lynghyel	10.	<u> Y</u>	OBL.	Problematic Hydrop		
6. Chamerion latifolia			FAC		•	' /
7 Agrostis giganka			FAC	¹ Indicators of hydric soil be present unless distur	and wetland hydrol	logy must
8. Calamagrostis ranadensis.	_5		<u>FAC</u>	De present unless distai	bed of problematic.	
10.	· · · ·			1		ļ
. Total Cover:	53					Ì
50% of total cover: 26.5		al coupri	10.4			
Plot size (radius, or length x width) 20 rad.	20 % Gr (or _ % Bare Gro		9	Hydrophytic		
	er of Bryophyl		20	Vegetation Present? Yes	<u>X</u> No	_
Remarks:			<u> </u>	pt 50		
				photos 642-6	alla	
				7	ノブゼ	

Soil Sampling Point: DP 0

Depth	Matrix		Redox Fe		· · · · · · · · · · · · · · · · · · ·	- ·	
(inches)	Color (moist)	%	Color (molst)	<u>%Туре'</u>	Loc²	Texture Re	marks
3-0	•					live layer	
0-2	10 310 211	0601	7,54R 416	5% 0	0.5-	sut	
0-2	10 46 311	_ 13/6	-713 11 - 110 _	<u> </u>	- ts	· ·	1
2-11	dark grey	11 black	sandy gravel			Sandy gr	avel
•	<i>y 1</i>	•	O			V	· · · · · · · · · · · · · · · · · · ·
	•						
						·	
		Jakina DM	-Dadwood Motory CS-C	avered or Cor	Had Sand G	rains. ² Location: PL=Pore I	Ining, M=Matrix.
'Type: C=C Hydric Soii	indicators:	pletion, Rivi	Reduced Matrix, CS=C Indicators for Prot	overed or Coa	ric Solls ³ :	Parillo. Ecoation, 12 1 ord 1	
-	l or Histel (A1)		Alaska Color Ci			Alaska Gleyed Without I	lue 5Y or Redder
	pipedon (A2)		Alaska Alpine S		٠	Underlying Layer	
	en Sulfide (A4)		Alaska Redox \			X Other (Explain in Rema	ks)
	Park Surface (A12)		<u> </u>				
	Gleyed (A13)		³ One Indicator of hy	drophytic veg	etatlon, one	primary indicator of wetland hyd	rology,
	Redox (A14)		and an appropria	te landscape	position mus	it be present unless disturbed or	problematic.
	Gleyed Pores (A15)		⁴Give details of colo	r change in R	emarks.		
Restrictive	Layer (If present):						
Туре:	none for	<u>ncl</u>					\-
Depth (ir	nches):					Hydric Soil Present? Yes	No
Remarks:							
lak	a edge	SEUSONE	uly flooded				
,	danal	NATINASIV	,				
	Shoreties .	30.0					
LIVEROLO)CV		****				
HYDROLO						Secondary Indicators (2 or mo	re required)
1 -	ydrology indicator		(initial)			Water-stained Leaves (B9	
	licators (any one ind	icator is sur		n Ansial Imaa	op. (87)	Drainage Patterns (B10)	,
	e Water (A1)		Inundation Visible of Sparsely Vegetated			Oxidized Rhizospheres al	ana Livina Roots (C3)
	Vater Table (A2)		Sparsely Vegetated Mari Deposits (B15)		lace (DO)	Presence of Reduced Iron	-
-	tion (A3)		Hydrogen Sulfide O			Salt Deposits (C5)	
	Marks (B1)		Dry-Season Water				
	ant Deposite (D2)			Table (G2)			s (D1)
ı —	ent Deposits (B2)					Stunted or Stressed Plant	
Drift De	eposits (B3)		Other (Explain in R			Stunted or Stressed Plant 此。Geomorphic Position (D2)	
Drift De	eposits (B3) Mat or Crust (B4)					Stunted or Stressed Plant Geomorphic Position (D2) Shallow Aquitard (D3)	i
Drift De	eposits (B3) Mat or Crust (B4) eposits (B5)					Stunted or Stressed Plant 此。Geomorphic Position (D2)	i
Drift Do Algal M iron Do Surface	eposits (B3) fat or Crust (B4) eposits (B5) e Soil Cracks (B6)	<u>:</u>				Stunted or Stressed Plant _X_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I	i
Drift Do Algal M iron Do Surface Field Obse	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations:	· Yes	Other (Explain In R	emarks)		Stunted or Stressed Plant _X_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I	i
Drift Do Algal M iron Do Surface Field Obse Surface Wa	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present?		Other (Explain in R	emarks)		Stunted or Stressed Plant _X_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I	i
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present?	Yes X	Other (Explain in R	emarks) es):	We	Stunted or Stressed Plant Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	Other (Explain in R	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation (Includes co	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation (Includes co	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)
Drift Do Algal M iron Do Surface Field Obse Surface Wa Water Tabl Saturation (Includes co	eposits (B3) Mat or Crust (B4) eposits (B5) e Soil Cracks (B6) ervations: ater Present? Present? Present?	Yes X Yes X	No Depth (inche	es):		Stunted or Stressed Plant _K_ Geomorphic Position (D2) Shallow Aquitard (D3) Microtopographic Rellef (I _K_ FAC-Neutral Test (D5)	D4)

WETLAND DETERMINATION DATA FORM - Alaska Region

	DATA FORM - Miaska Region
Project/Site: brunt lake Boroug	ph/City: Mouse Pass Sampling Date: 7-110-13
Applicant/Owner: Ichas Hydro	Sampling Point: NPA 5
Investigator(s): Co Shudl J Blesque Landfo	orm (hillside, terrace, hummocks, etc.): 31 ichteracen
Local relief (concave, convex, none): Slope	(%);
Subregion: Lat: <u>Le 0. 4690</u>	00 Long: <u>-149.210881</u> Datum:
Soil Map Unit Name: Alwaral Deltair Deposits	NWI classification: WL
Are climatic / hydrologic conditions on the site typical for this time of year? Ye	esX No (If no, explain In Remarks.)
Are Vegetation, Soil, or Hydrology significantly disturb	
Are Vegetetion, Soil, or Hydrology naturally problema	iic? (If needed, explain any answers in Remarks.)
SUMMARY OF FINDINGS – Attach site map showing sampling	g point locations, transects, important features, etc.
	o providence of oto.
Hydrophytic Vegetation Present? Yes No No	Is the Sampled Area
Hydric Soil Present? Wetland Hydrology Present? Yes No	within a Wetland? Yes No _X
	rginal reg, annihydrie a no hydro.
VEGETATION - Use scientific names of plants. List all specie	es in the plot.
Absolute Domi	nant Indicator Dominance Test worksheet:
Tree Stratum 1. populus halsamilera 20 FARUS Y	I Mumber of Dollingtif Opecies 17
2. Salix alexensis 30 Y	
3	- I total Number of Dominant
4	
Total Cover: 50	Percent of Dominant Species That Are OBL, FACW, or FAC: (A/B)
50% of total cover. 25 20% of total c	Prevalence Index worksheet:
Sapling/Shrub Stratum 1. Almus Viss 40 4	Total 9/ Cover of Bautin L. L.
2. Salix sitchensis 20 y	OBL species 0 x1 = 0
3. Speix alexensis 5 N	FACW species 0 x2 = 0
4	FAC species 120 x3 = 360
5	FACU species 25 x 4 = 100
6	UPL species x 5 =
Total Cover: 125	Column Totals: 145 (A) 460 (B)
50% of total cover: <u>32.5</u> 20% of total co	over: 13 Prevalence Index = B/A = 3, 17
1. Corthilla Secunda, 6	Hydrophytic Vegetation Indicators:
2, Agrosts aganten 20	FAC: X Dominance Test is >50%
P. Erginisetum arvense 5	CAL Prevalence Index is ≤3.0
4. Calamagnostis canadensis 20 4	FAC Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
5,	Problematic Hydrophytic Vegetation ¹ (Explain)
6	
7	Indicators of hydric soil and wetland hydrology must
8,	be present unless disturbed or problematic.
9	
10	
Total Cover: 20 50% of total cover: 15 20% of total co	1.
50% of total cover: 15 20% of total cover: 15 20% of total cover: 20% of total cover: 15 20% of total cover: 20% of total cove	7.0 Hydrophytic
% Cover of Wetland Bryophytes Total Cover of Bryophytes (Where applicable)	Vegetation
	. '
Remarks: protos 647-650 Represent	tative of upland-marginal
veg community	
IS Army Corps of Engineers	

SOIL	Sampling Point: 1) 03
Profile Description: (Describe to the depth needed to document the indica	lor or confirm the absence of indicators.)
Depth Matrix Redox Feetures Color (molet) % Type	pe ¹ Loc ² Texture Remarks
(inches) Color (moist) % Color (moist) % Typ	
1-0	live layer
0-3 7.54 2.5/1 160	
3-14 gravely sand vory dark grey 161	ack sand+gravel
100000000000000000000000000000000000000	
Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or C	toated Sand Grains. ² Location: PL=Pore Lining, M=Matrix.
Histosol or Histel (A1) Alaska Color Change (1A4 Histic Epipedon (A2) Alaska Aiplne Swales (TA5	•
Hydrogen Sulfide (A4) Alaska Redox With 2.5Y H	
Thick Dark Surface (A12)	
	egetation, one primary indicator of wetland hydrology,
	e position must be present unless disturbed or problematic.
Alaska Gleyed Pores (A15)	Remarks.
Restrictive Layer (if present):	
Type: Nave final	Hydric Soil Present? Yes No
Depth (inches):Remarks:	Trydric don't rosalt.
IYDROLOGY	
Wetland Hydrology Indicators:	Secondary Indicators (2 or more required)
Primary Indicators (any one Indicator is sufficient)	Water-stained Leaves (B9)
Surface Water (A1) Inundation Visible on Aerial Ima High Water Table (A2) Sparsely Vegetated Concave S	
High Water Table (A2) Sparsely Vegetated Concave S Saturation (A3) Marl Deposits (B15)	Presence of Reduced Iron (C4)
Water Marks (B1) Hydrogen Sulfide Odor (C1)	Salt Deposits (C5)
Sediment Deposits (B2) Dry-Season Water Table (C2)	Stunted or Stressed Plants (D1) .
Orift Deposits (B3) Other (Explain in Remarks)	Geomorphic Position (D2)
Algal Mal or Crust (B4)	Shallow Aquitard (D3)
tron Deposits (B5)	Microtopographic Relief (D4) FAC-Neutral Test (D5)
Surface Soil Cracks (B6)	
Field Observations: Surface Water Present? Yes No Depth (inches):	
Water Table Present? Yes No Depth (inches):	l .
Saturation Present? Yes No Depth (inches):	· · · · · · · · · · · · · · · · · · ·
(Includes capillary fringe)	
Describe Recorded Dala (stream gauge, monitoring well, aerial photos, previous	us mspections, ii availavie.
Remarks:	

WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Grant Lake	D.	rough/Citu	Marca	dasc	O	7-11-13
Applicant/Owner: Kenau Hydro	D()	iough/City	1,100%	1 0133		
Investigator(s): C. Schudel J. Bhrk		M (1911)			_ Sampling Point:	DF 00
				литтоскя, etc.):	Take eage	WARDENGED.
Local relief (concave, convex, none): \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\					•	
Subregion: L	at: <u>(60,470</u>	0636	Long:	149.21025	1 Datum:	1
Soll Map Unit Name: Aleuvial Dettai						/EMIC
Are climatic / hydrologic conditions on the site typical for ti					•	•
Are Vegelation, Soil, or Hydrology						No
Are Vegetation, Soll, or Hydrology	naturally proble	matic? No	(If needed	i, explain any answ	ers in Remarks.)	
SUMMARY OF FINDINGS - Attach site map	showing sam	pling point	locations,	, transects, imp	ortant features,	etc.
Hudrophytic Vocatetion December 1						www.
	No No	Is the Sa	am <mark>pled Ar</mark> ea		V	
	No	within a	Wetland?	Yes	s <u> </u>	
Remarks: Representative of 5/5 adjacent to lune shore	wold ow	r waren	itan.	16		
VEGETATION - Use scientific names of plants	s. List all spe	ecies in the	e plot.			
Tree Stratum		ominant Indi		minance Test work	ksheet:	*****
1. Nore	<u>% Cover</u> S	species? St	i jaul	mber of Dominant S	Species y 4	·
***************************************			—— Ппа	at Are OBL, FACW,	or FAC: 7 ~	, (A)
2				at Number of Domir		ا ر
3. 4. ·			Spe	ecies Across All Stra	ata: <u>// /</u>	2 (B)
Total Cove	er:			cent of Dominant S		(4.75)
50% of total cover:		tal cover:		it Are OBL, FACW, valence Index wor		(A/B)
Sapling/Shrub Stratum				Total % Cover of:		hu
1. <u>Salix alaxensis</u> .	<u> 30</u> –	¥ £	10	L species (O	x1=19	<u>DY.</u>
2. Salix sitchensis				CW species 40	· ·	TIAS
3. Alnus viridis	_ <u>ro</u> _	7	$\alpha \cup 1$		90 x3=	I
4				CU species	x4= 0	
5			_{UPL}	L species /U	x5= 9	
6			I	umn Totals:) 120 (A) (S8)	9330 (B)
Total Cove 50% of total cover: <u>35</u>		14		782		Ž. //
Herb Stratum	20% of tot	ai cover		Prevalence Index	. —	1)2415
1. Equischm hyemale	<u># 30</u>	Y FA	FT 1AV I '-	Irophytic Vegetatio		
2. Carex media		FA	H. IVI	Dominance Test Is		
3. Chamerian latitolia		Y FAC	L 1—	Prevalence Index is		
& Agrostis gisantea	10 _	FA	<u>e</u> -		ptalions ¹ (Provide s s or on a separale s	
5. Calamagnosts canadens	<u> 10 _</u>	4_ FA	tc _		phytic Vegetation ¹ (, i
6		<u> </u>			•	
7			\ \land	licators of hydric so	il and wetland hydro rbed or problematio	ology must
8,			. ve p	ilesent uniess dista	ibed of problematic	•
9.						
10.						
Total Cove		1.4				
50% of total cover: 35	20% of tota		_{Hvd}	rophytic		
Plot size (radius, or length x width) 70 rad			Vege	etation	V	ĺ
% Cover of Wetland Bryophytes Total Co (Where applicable)	over of Bryophyl	es	Pres	sent? Yes	s No	
Remarks:	· <u></u>					
			photos	678 -68	71	

		All Heeded to door	nent the i	iluicator (or commi	m the absence o	n muicators	··I
Depth Matrix (inches) Color (molst)	%	Redo Color (molst)	x Feature:	S Tyne ¹	L oc²	Teyture		Remarks
		COIDI (IIIOISI)	. 70	1100				
1-0		- W.					yer_	
Ø-3						Sandy	silt	MANUAL MA
3-10				B		sand t	gravel	, small cob
MATERIAL MAIN PROFIT					**************************************			
			·		•••			
Type: C=Concentration, D=D	epletion, RM	=Reduced Matrix, CS	S=Covered	d or Coate	d Sand G	Brains. ² Loc	ation: PL=Pc	ore Lining, M=Matrix.
ydrlc Soll Indicators:		Indicators for F	Problema	tic Hydric	Solls ³ :			
Histosol or Histel (A1)		Aiaska Coid						out Hue 5Y or Redde
_ Histle Epipedon (A2)		Alaska Alpi					rlying Layer	
_ Hydrogen Sulfide (A4)		Alaska Red	lox With 2.	.5Y Hue		_X Other (Explain in Re	emarks)
_ Thick Dark Surface (A12)		30			-1:		a structional	Ludralagu
_ Alaska Gleyed (A13)						primary indicate		
_ Alaska Redox (A14)	•	and an appro Give details of				st be present uni	ess disturbet	or problematic.
			coidi chai	iye ili Keli	Hairs.			
Alaska Gleyed Pores (A15		Give details of						
estrictive Layer (If present)	: ,	Give details of						
estrictive Layer (if present) Type:	: ind	Give details of		•		Hudric Soil	Drocont?	Vas X No
estrictive Layer (if present) Type:	ind			•		Hydric Soil	Present?	Yes <u> </u>
estrictive Layer (if present) Type:	ind			•	•	Hydric Soil	Present?	Yes <u>X</u> No
estrictive Layer (if present) Type:	ind			•		Hydric Soil	Present?	Yes <u>X</u> No
estrictive Layer (if present) Type:	ind			·		Hydric Soil	Present?	Yes X No
lestrictive Layer (if present) Type: <u>York んし</u> Depth (inches):	ind				·	Hydric Soil	Present?	Yes <u>X</u> No
estrictive Layer (if present) Type: None for Depth (inches): temarks: lake edge Seasonally Slacial or	ind				•	Hydric Soil	Present?	Yes X No
estrictive Layer (if present) Type: None for Depth (inches): temarks: Ake edge Seasonally Slacial or YDROLOGY	flocde wash				•			
restrictive Layer (if present) Type: None for Depth (inches): emarks: Ake edge Seasonally Slacial or YDROLOGY Vetland Hydrology Indicator	flocale trash	d sand t q				Secondary Inc	dicators (2 or	more required)
rimary Indicators (any one Interest in Type:	flocale trash	d sand t q	graved			Secondary Inc.	dicators (2 or lined Leaves	more required) (B9)
rimary Indicators (any one Inc. Surface Water (A1)	flocale trash	Sand + 9 Scient) Inundation Visib	gravel le on Aeri	al imagery		Secondary Inc — Water-sta X Drainage	dicators (2 or lined Leaves Patterns (B1	more required) (B9) 0)
rimary Indicators (any one Inc. Supple (any one Inc.) Supple (any one Inc.) Supple (any one Inc.) High Water Table (A2)	flocale trash	Sand + q	gravel le on Aeri ated Conc	al imagery		Secondary Inc Water-sta Drainage Oxidized	dicators (2 or lined Leaves Patterns (B1 Rhizosphere:	more required) (B9) 0) s along Living Roots
rimary Indicators (any one Inc. Surface Water (A1) High Water Table (A2) Strippe: Your Property (A2) Type: Your Property (A2)	flocale trash	Sand + q Sand + q ficient) Inundation Visib Sparsely Vegete Marl Deposits (F	le on Aeri ated Conc	al imagery ave Surfac		Secondary Inc. Water-sta Drainage Oxidized Presence	dicators (2 or lined Leaves Patterns (B1 Rhizosphere of Reduced	more required) (B9) 0) s along Living Roots
rimary Indicators (any one Inc. Surface Water (A1) High Water Marks (B1)	flocale trash	Sand + q Sand + q ficient) Inundation Visib Sparsely Vegeta Marl Deposits (I Hydrogen Sulfid	le on Aeri ated Conc 315) e Odor (C	al imagery ave Surfac		Secondary Inc. Water-sta Drainage Oxidized Presence Salt Depo	dicators (2 or nined Leaves Patterns (B1 Rhizospheres of Reduced osits (C5)	more required) (B9) 0) s along Living Roots (Iron (C4)
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