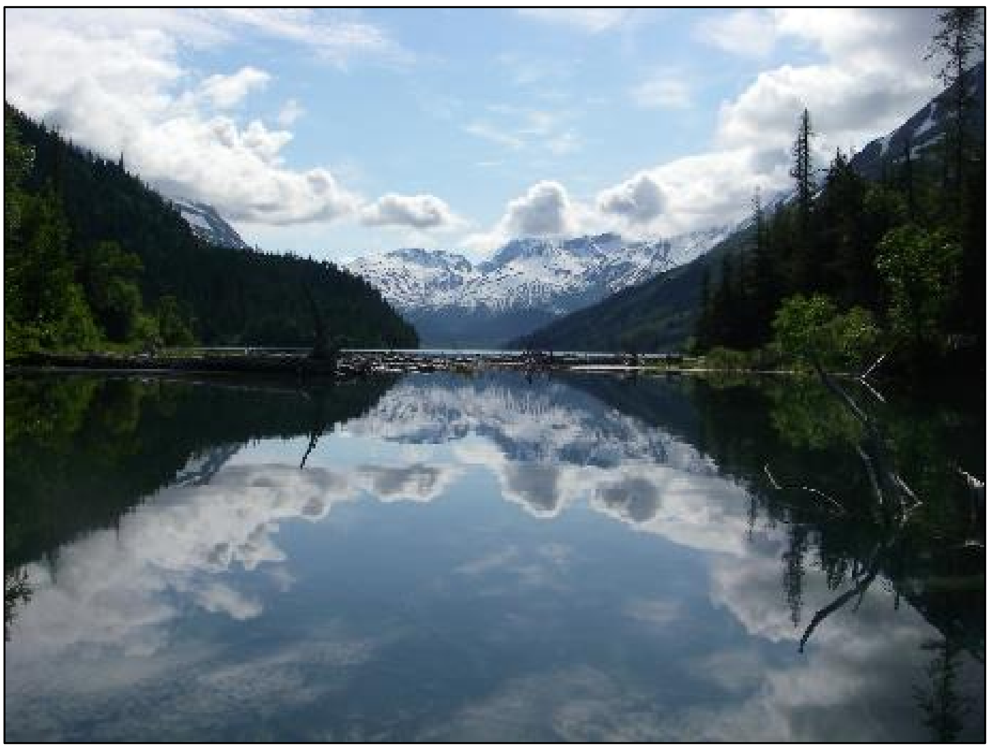
Federal Energy Regulatory Commission

Office of Energy Projects
May 2019

FERC/FEIS–0283F

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

Grant Lake Hydroelectric Project—FERC Project No. 13212-005
Alaska



Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE, Washington, DC 20426

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FOR HYDROPOWER LICENSE

Grant Lake Hydroelectric Project—FERC Project No. 13212-005

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FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (final EIS) for the Grant Lake Hydroelectric Project (FERC Project No. 13212), which would be located on Grant Creek near the community of Moose Pass within the Kenai Peninsula Borough of Alaska.

This final EIS documents the view of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicant's proposal and alternatives for licensing the Grant Lake Hydroelectric Project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about May 1, 2019.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington D.C. 20426. The draft EIS also may be viewed on the Internet at www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Final EIS

COVER SHEET

a. Title:	Environmental Impact Statement for Hydropower License, Grant Lake Hydroelectric Project—FERC Project No. 13212
b. Subject:	Final Environmental Impact Statement
c. Lead Agency:	Federal Energy Regulatory Commission
d. Abstract:	The Grant Lake Hydroelectric Project would be located on Grant Creek near the community of Moose Pass, Kenai Peninsula Borough, Alaska. Kenai Hydro, LLC, proposes to construct an intake structure in Grant Lake, pumped bypass flow system, tunnel, surge chamber, penstock, powerhouse, tailrace channel with fish exclusion barrier, tailrace detention pond, access roads, step-up transformer, breaker, switchyard, and overhead transmission line. The powerhouse would contain two Francis turbine generating units with a combined rated capacity of 5 megawatts with a maximum design flow of 385 cubic feet per second and proposed average annual generation of 18,600 megawatt-hours. The staff's recommendation is to license the project as proposed by Kenai Hydro, LLC, with certain modifications and additional measures recommended by the agencies.
e. Contact:	Kenneth Hogan Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, D.C. 20426 (202) 502-8434
f. Transmittal:	This final environmental impact statement on an application to construct and operate the Grant Lake Hydroelectric Project is being made available for public comment on or about May 1, 2019, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 Code of Federal Regulations, Part 380).

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321–4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, §4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric development subject to its jurisdiction, on the necessary conditions:

"That the project adopted…shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e)…"[4]

The Commission may require such other conditions consistent with the FPA and as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Pub. L. 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a).

[5] 16 U.S.C. § 803(g).

[6] 18 C.F.R. § 385.206 (2018).

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
Advisory Council	Advisory Council on Historic Preservation
AHRS	Alaska Heritage Resources Survey
Alaska DEC	Alaska Department of Environmental Conservation
Alaska DFG	Alaska Department of Fish and Game
Alaska DNR	Alaska Department of Natural Resources
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
Applicant	Kenai Hydro, LLC
ARRC	Alaska Railroad Corporation
BMP	best management practices
ºC	degrees Celsius
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
ECM	environmental compliance monitor
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESCP	erosion and sediment control plan
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Department of the Interior, Fish and Wildlife Service
HPMP	Historic Properties Management Plan
INHT	Iditarod National Historic Trail
INHT Plan	comprehensive management plan for the INHT
Interior	U.S. Department of the Interior
Kenai Hydro	Kenai Hydro, LLC
kV	kilovolt
LWD	large woody debris
mg/kg	milligram per kilogram
mg/L	milligram per liter
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places

NFS lands	National Forest System lands (public land managed by the Forest Service)
NHPA	National Historic Preservation Act of 1966
NMFS	U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service
NTU	nephelometric turbidity unit
O&M	operation and maintenance
Park Service	National Park Service
PHABSIM	physical habitat simulation model
Railbelt	Alaska Railbelt
RHABSIM	riverine habitat simulation model
ROW	right-of-way
SD1	Scoping Document 1
SD2	Scoping Document 2
SD3	Scoping Document 3
SD4	Scoping Document 4
SHPO	State Historic Preservation Officer
SMART	specific, measurable, achievable, realistic, and time-bound (objectives)
TCP	traditional cultural property
TLP	traditional licensing process
U.S.C.	United States Code
USGS	U.S. Geological Survey
WUA	weighted usable area

EXECUTIVE SUMMARY

Proposed Action

On April 18, 2016, Kenai Hydro, LLC (Kenai Hydro or applicant), filed an application for a license with the Federal Energy Regulatory Commission (Commission or FERC) to construct and operate the proposed Grant Lake Hydroelectric Project (Grant Lake Project or project). Kenai Hydro amended the application on January 16, 2018. On May 23, 2018, Kenai Hydro modified its proposed measures by agreeing to some agency recommendations or proposing alternative measures. On August 6, 2018, after further consultation with agencies, Kenai Hydro filed a revised proposal for minimum flows downstream of the proposed tailrace. The proposed 5-megawatt (MW) project would be located on Grant Lake and Grant Creek, near the community of Moose Pass within the Kenai Peninsula Borough of Alaska, and would generate about 18,600 megawatt-hours (MWh) of energy annually. The project would occupy 1,688.7 acres of federal land within the Chugach National Forest, administered by U.S. Department of Agriculture, Forest Service (Forest Service).

Project Description and Proposed Facilities

The project would require the construction of the following new facilities: (1) a reinforced concrete intake with an outside dimension of 38 feet by 20 feet, intake trashracks, and a vertical turbine pump to provide base flows; (2) a 100-foot-long concrete bypass weir at the natural Grant Lake outlet with a crest elevation at 703 feet; (3) a buried, 400-foot-long, 16-inch-diameter bypass flow pipe to carry pumped flows from the intake to just below the bypass weir; (4) a 3,300-foot-long tunnel from the project intake to the powerhouse that transitions to a 6-foot-diameter, steel penstock about 150 feet from the powerhouse; (5) a 100-foot-long by 50-foot-wide powerhouse with two horizontal Francis type turbine/generator units with a total rated capacity of 5 MW; (6) a trapezoidal tailrace channel with a bottom width of 74 feet and a channel depth ranging from 13 feet at the powerhouse to 8 feet at the creek; (7) a 3.6-acre tailrace detention pond with 15 acre-feet of storage capacity; and (8) a 5,567-foot-long, 115-kilovolt transmission line. The project would bypass stream flows around 0.6 mile of Grant Creek (bypassed reach).

Project Operation

The project would use inflow into and storage within Grant Lake to generate power and meet any minimum flow requirements within Grant Creek. Under Kenai Hydro's proposed operation, Grant Lake's elevation would vary from a normal maximum elevation of 703 feet,[7] which is the elevation of the natural Grant Lake outlet, down to a minimum lake elevation of 690 feet. To provide storage for spring flows, Kenai Hydro would draw down the lake during the winter and use these reservoir releases to generate power and meet instream flows requirements in Grant Creek. Kenai Hydro proposes to maximize power benefits by taking advantage of spinning reserve[8] and load-following operations[9] (peaking). The project intake would include variable depth withdrawal locations to control water temperatures in Grant Creek.

The powerhouse would operate with a minimum hydraulic capacity of 58 cubic feet per second (cfs) (one unit) and a maximum hydraulic capacity of 385 cfs (total for two units). Any minimum flow requirements in the bypassed reach would be provided from the penstock intake structure and pumped through a bypass pipe to the downstream side of the bypass weir. Flows provided via the bypass pipe would travel approximately 0.6 mile downstream to where the powerhouse tailrace channel would discharge into Grant Creek, after which the combined flows would travel downstream to Trail Lake Narrows (the narrow channel between Upper Trail Lake and Lower Trail Lake).

An off-stream detention pond would provide a temporary storage reservoir for flows generated during rare instances when the units being used for spinning reserve are needed for the electrical transmission grid. To prevent a sudden increase in the water surface levels of Grant Creek as a result of the increased flows generated, the additional powerhouse flows would be diverted into the detention pond and then released slowly back into Grant Creek. The discharge associated with a spinning reserve event would be dispersed via the tailrace channel that flows into Grant Creek. Once the spinning reserve demand is met, Kenai Hydro would reduce generation at the unit or bring it offline and slowly release flow from the detention pond back into the powerhouse tailrace.

Proposed Environmental Measures

Kenai Hydro proposes the following environmental measures to protect or enhance environmental resources at the project:

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[7] All elevations are in North American Vertical Datum 88.

[8] Spinning reserve is the extra generating capacity that is available by increasing the power output of generators that are already connected to the power system. Non-spinning reserve or supplemental reserve is the extra generating capacity that is not currently connected to the system but can be brought online after a short delay.

[9] Under load-following, or peaking operations, the project would adjust its power output as demand for electricity fluctuates throughout the day.

Project Construction

- Designate a third-party environmental compliance monitor (ECM) to oversee construction activities and ensure compliance with measures to protect natural resources.
- Develop an erosion and sediment control plan (ESCP) that includes best management practices (BMPs) to prevent sediment mobilized during construction from entering Grant Creek or Grant Lake.
- Restore areas disturbed by construction to pre-existing conditions.
- Develop a hazardous materials containment/fuel storage plan that includes measures to contain all hazardous materials used during construction.
- Consult with the Alaska Department of Fish and Game (Alaska DFG), U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, and U.S. Department of the Interior, Fish and Wildlife Service (FWS) to finalize design details for fish exclusion measures in the tailrace.
- Consult with Alaska DFG's habitat biologist to establish timing windows for instream construction and stream-crossing activities.
- Develop a bear safety plan that includes: (1) keeping construction sites and refuse areas clear of substances that attract bears, (2) installing bear-proof garbage receptacles and other measures during construction to prevent bears from obtaining food or garbage, (3) minimizing possible conflict with bears during construction and operation, (4) establishing protocols for dealing with problem bears,[10] and (5) notifying authorities of any bear-human conflict.

Project Operation

- Provide the following minimum flows in the bypassed reach: 5 cfs from January 1 through July 31, 10 cfs from August 1 through September 31, 7 cfs from October 1 through October 31, and 6 cfs from November 1 through December 31 to protect aquatic habitat and support benthic macroinvertebrates.
- Provide the following instantaneous minimum flows downstream of the tailrace: 60 cfs from January 1 through May 15, 80 cfs from May 16

[10] Although Kenai Hydro and the agencies do not specifically define *problem bears*, we understand this term to refer to bears that repeatedly visit a construction area despite implementation of other measures in the plan, including trash management and use of bear-proof containers.

through May 31, 150 cfs from June 1 through June 30, 195 cfs from July 1 through September 1, 150 cfs from September 1 through September 30, 125 cfs from October 1 through October 15, 72 cfs from October 16 through November 15, and 60 cfs from November 16 through December 31 to protect habitat for salmonids and benthic macroinvertebrates.

- Use variable depth withdrawals from the project intake to control water temperature in Grant Creek.
- Provide channel maintenance flows of 800 cfs to the Grant Creek bypassed reach for a continuous 8-hour duration, once per year, in a minimum of 2 years in each moving 10-year period to promote sediment recruitment and transport from the bypassed reach to Grant Creek.
- Limit upramping rates to 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15). Limit downramping rates to 1 inch per hour from November 16 through May 15 and 2.25 inches per hour from May 16 through November 15.
- Implement the Operation Compliance Monitoring Plan (filed on January 16, 2018) that includes: (1) lake level and temperature monitoring in Grant Lake; (2) flow and temperature monitoring in Grant Creek bypassed reach; (3) flow and temperature monitoring in Grant Creek-tailrace; (4) failsafe provisions; (5) a schedule for installing, maintaining, and collecting flow and temperature instrumentation; and (6) reporting.
- Develop a spill prevention, control, and containment plan and a hazardous materials containment/fuel storage plan to prevent hazardous materials from entering Grant Creek or Grant Lake during construction and operations.
- Implement the Biotic Monitoring Plan (filed on January 16, 2018) that includes monitoring juvenile and adult salmonid abundance and habitat use, and monitoring gravel transport in Grant Creek to assess project effects on salmonid spawning habitat.
- Conduct biological monitoring in Grant Creek to determine the need for gravel augmentation as well as the effectiveness of the proposed enhancement/mitigation measures, including minimum flows in the bypassed reach and minimum flows downstream of the tailrace, and to evaluate the need for removal of a log jam to increase flow in a Grant Creek side channel.
- Implement the Vegetation Management Plan (filed on January 16, 2018) that includes: (1) invasive plant management and control, (2) revegetation,

(3) vegetation maintenance, (4) sensitive plant species protection and monitoring, and (5) pale poppy population management.

- Implement the Avian Protection Plan (filed on January 16, 2018) that addresses migratory species and bald eagles and minimizes potential for electrocutions or collisions with the project transmission line.
- Develop an Iditarod National Historic Trail (INHT) re-route plan that includes constructing the southern half of the proposed INHT re-route from the existing route to Grant Creek.
- Restrict public access to the project using signage and gating/fencing of the access road to address local residents' concerns about encouraging motorized use near the project and reduce the potential for unauthorized motorized use and on adjacent National Forest System lands (NFS lands).
- Develop a fire prevention plan.
- Implement the Historic Properties Management Plan (HPMP) (filed on January 16, 2018) to protect historic properties in the project area.

Public Involvement

Before filing its license application, Kenai Hydro conducted pre-filing consultation under the Commission's traditional licensing process (TLP). The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to formal filing of the application with the Commission.

As part of the National Environmental Policy Act scoping process, we distributed a scoping document (SD1) on May 11, 2010.[11] Two scoping meetings were held on June 2 and June 3, 2010, in Moose Pass, Alaska. Based on comments made during the scoping meetings and written comments filed with the Commission, we issued a revised scoping document (SD2) on August 23, 2010. On April 18, 2016, Kenai Hydro filed its final

[11] In response to Kenai Hydro's August 6, 2009, request to use the TLP, the Forest Service and Alaska DFG filed comments on September 4 and 8, 2009, respectively, supporting the use of the TLP and requesting that scoping be held early in the licensing process. Although we do not typically conduct scoping in the TLP until after a license application has been filed, in our September 15, 2009, letter authorizing the use of the TLP, we agreed to conduct scoping earlier to facilitate the identification of issues and development of any needed studies.

license application. Upon review of the final license application, we found that the proposed project differed substantially from Kenai Hydro's original proposal described in the Preliminary Application Document. As a result, we issued a third scoping document (SD3) on July 22, 2016, and held two scoping meetings on September 7 and 8, 2016, in Moose Pass, Alaska. Based on comments made during the scoping meetings and written comments filed with the Commission, we issued a revised scoping document (SD4) on December 7, 2016. Kenai Hydro filed an amended license application on January 16, 2018. On February 8, 2018, we issued a notice that Kenai Hydro's application for an original license for the Grant Lake Project was ready for environmental analysis, and requesting comments, terms and conditions, recommendations, and prescriptions.

Written comments on the draft EIS were due March 1, 2019.[12] In addition, oral testimony on the draft EIS was received during two public meetings held in Moose Pass, Alaska, on November 28, 2018.[13] Appendix A lists the commenters who provided written comments, summarizes the substantive comments that were filed, includes staff responses to those comments, and indicates locations in the final EIS that were revised, as appropriate.

Alternatives Considered

This final environmental impact statement analyzes the effects of the proposed project's construction and operation and recommends conditions for any license that may be issued for the project. In addition to Kenai Hydro's proposal, we consider three alternatives: (1) no-action, whereby the project would not be licensed and constructed; (2) Kenai Hydro's proposal with staff modifications (staff alternative); and (3) the staff alternative with all mandatory conditions.

Staff Alternative

Under the staff alternative, the project would include most of Kenai Hydro's proposed measures, with the following exceptions. We do not recommend the proposed Biotic Monitoring Plan because the proposed fishery monitoring efforts do not provide direct benefits to the fishery, and it is not clear how the proposed fish monitoring would

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[12] The notice established December 10, 2018, as the due date for filing comments on the draft EIS; however, in response to the November 30, 2018, Alaska DFG and the December 6, 2018, NMFS requests for an extension of time to file comments on the draft EIS, on December 6, 2018 the Commission extended the comment period to January 9, 2019. Subsequently, due to the funding lapse at certain federal agencies between December 22, 2018 and January 25, 2019, on February 11, 2019, the Commission extended the comment period to March 1, 2019.

[13] The transcripts from the meetings were filed in the administrative record for the project on January 9, 2019.

inform project-related matters given that it is not designed to isolate project effects from other non-project-related variables that could affect fish populations. In addition, the project record contains sufficient information on which to base license conditions such that there is no project-related benefit to requiring additional study. We recognize the proposed Biotic Monitoring Plan also includes a proposal to monitor salmonid spawning gravel and we address gravel monitoring below. We do not recommend the removal of the existing logjam in Reach 1 because it provides habitat for aquatic resources. We do not recommend the INHT re-route plan because the proposed project infrastructure is compatible with the existing INHT route, and no re-routing is necessary.

The staff alternative also includes the following recommended modifications of Kenai Hydro's proposal and some additional measures.

Project Construction

- Include in the proposed measure to designate a third-party ECM a provision for the ECM to have stop work authority.
- Modify the proposed ESCP to include: (1) a description of existing soil, groundwater, and vegetation conditions; (2) site-specific preventive measures; (3) identification of areas for storage or deposition of overburden and implementation of erosion control measures in those areas; (4) measures to sample for lead in Grant Lake sediments that could be disturbed by project construction and operation, and, if lead is present, measures to prevent mobilization; and (5) an implementation schedule.
- A construction plan that includes: (1) a detailed construction schedule; (2) a description of construction methods and BMPs to be employed, and measures to reduce the risk of introduction and spread of invasive plants; (3) delineation of construction areas using fencing and/or flagging; (4) measures for avoiding streams, wetlands, and pond habitats to the extent possible during construction; (5) provisions for the training of construction staff regarding environmental laws, regulations, and BMPs to avoid or reduce effects on all native plant and wildlife species including special-status species and their habitats; and (6) identification of other resource-specific protection plans that should be considered during construction activities.
- A spoils disposal plan that includes: (1) means and methods to dispose of any materials excavated during construction, (2) mapped locations of any proposed temporary and/or permanent spoil pile locations, (3) descriptions of the composition of any materials expected to be excavated on the site, (4) proposed use of excavated materials in the construction process, (5) any plans to dispose of materials off site, (6) methods for preventing spoil materials from leaching from spoil piles into adjacent waterways and

wetlands, and (7) identification of other resource-specific protection plans that should be considered during construction activities.

- Modify the proposed Avian Protection Plan to include nest surveys prior to any construction activities that have the potential to disturb nesting birds, not just before vegetation clearing activities.
- Avoid the use of helicopters or airplanes near the mountainside adjacent to Grant Lake and Grant Creek, maintain a 1,500-foot clearance between aircraft and mountain goat habitat, and follow Forest Service no-fly zones to protect mountain goats.

Project Operation

- Develop a solid waste and wastewater plan to protect water quality in Grant Creek from waste and sewage generated on site.
- Combine the proposed hazardous materials containment/fuel storage plan and spill prevention control and containment plan into a single hazardous materials plan that includes the following measures to be implemented during project construction and operations: (1) designation of specific areas to maintain and refuel vehicles and equipment, (2) measures for containment and cleanup in the event of a spill or accident, (3) provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse, and (4) a reporting schedule.
- Limit downramping rates to a year-round maximum of 1 inch per hour (when operational control exists).
- Develop an operation compliance monitoring and reporting plan that includes: (1) real-time water surface elevation monitoring of Grant Lake and real-time temperature monitoring within Grant Lake near the intake at a depth of 0.5 meter; (2) real-time flow monitoring in the Grant Creek bypassed reach; (3) real-time flow and temperature monitoring in Grant Creek-downstream of the tailrace; (4) provisions to minimize effects of equipment malfunction on Grant Creek water temperature; (5) a schedule for installing, maintaining, and collecting flow and temperature instrumentation; and (6) reporting of Grant Creek water temperatures and Grant Lake elevations.
- Adjust the intake withdrawal depth on a real-time basis based on the real-time Grant Creek and Grant Lake temperature monitoring to ensure Grant Creek temperature below the tailrace meets the following: (1) for the 30-day period when Grant Lake is going through its ice break-up, Grant Creek temperature be maintained at the temperature recorded in Grant Lake at a depth of 0.5 meter + 1.0°C (+/- 0.5°C); (2) once the ice break-up is

complete and Grant Lake is ice-free, Grant Creek temperatures remain within +/-0.5°C of Grant Lake temperature measured at a 0.5 meter depth, and (3) the same +/-0.5°C criterion be maintained when Grant Lake is ice-covered.

- Develop and implement a salmonid spawning gravel monitoring plan, that includes: (1) methods to assess the distribution and abundance of salmonid spawning gravel; (2) spawning gravel assessments in years 1, 10, 15, 20, and 30; and (3) a trend analysis in years 20 and 30 to determine the rate of any spawning gravel reduction and appropriate measures to address any reduction in spawning gravel recruitment; and (4) reporting schedule to include reports after each sampling year.

- Modify the Vegetation Management Plan to also include: (1) locating equipment inspections and/or wash stations well outside of riparian/aquatic zones; (2) treating aquatic invasive plants if any are detected in project waters; (3) monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (4) developing restoration success criteria, based on existing conditions, to determine whether revegetation efforts are successful; (5) developing data collection and analysis methods for monitoring that corresponds with success criteria; (6) monitoring restoration success and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; (7) conducting pre-construction surveys for Forest Service sensitive plants within areas of proposed ground disturbance and consult with the Forest Service if needed to minimize effects on newly identified populations; and (8) obtaining written approval from the Forest Service prior to using herbicides or pesticides on NFS lands.

- Develop a scenery management plan to minimize views of project facilities from the INHT and direct security lighting toward the ground to limit effects of light pollution.

- Install a gate and construct a parking area with a single-unit vault restroom on the project access road, east of the Seward Highway and railroad corridor and west of the access road bridge over Trail Lake Narrows to support non-winter visitor use of the project access road.

- Develop a public access plan to describe locations and identify entities responsible for installing and maintaining infrastructure such as gate(s), parking area, restroom, and signs to manage public access in the vicinity of the project access road between Seward Highway and Grant Lake.

- Revise the HPMP in consultation with the Alaska SHPO, Forest Service, and other consulting parties to include: (1) the identification of the specific Native organizations that will be consulted and how they will be involved;

(2) the addition of Mark Luttrell as a consulting party; (3) a discussion of the methods for conducting the traditional cultural properties study, which Native organizations were consulted, results of such consultation, and conditions under which Native organizations would continue to be consulted in the future; (4) clarification regarding the survey status of the section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line; (5) a schedule for completion of all HPMP measures; (6) a historic properties monitoring plan that specifies the circumstances under which monitoring would occur, who would conduct the monitoring, how frequently regular monitoring would occur, and how monitoring results would be disseminated and used; (7) specific factors that would trigger implementation of more active management/mitigation measures to address project-related effects on historic properties over periodic monitoring; (8) a provision to formally evaluate and assess project effects on submerged cultural resources if they are exposed in the future; and (9) documentation and copies of all section 106 consultation throughout the licensing process, including documentation of Alaska State Historic Preservation Officer concurrence on the project area of potential effects (APE) and concurrence with all measures contained within the HPMP (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.

Staff Alternative with Mandatory Conditions

We recognize that the Commission is required to include valid section 4(e) conditions in any license issued for the project. The staff alternative with mandatory conditions includes the staff-recommended measures noted above along with the development of an aquatic invasive species management plan (preliminary 4(e) condition 19).

Incorporating these mandatory conditions into a license would not cause us to modify or eliminate any of the environmental measures included in the staff alternative.

No-action Alternative

Under the no-action alternative, the project would not be constructed.

Environmental Impacts and Measures of the Staff Alternative

The primary issues associated with constructing and operating the project are effects of project construction, operation, and maintenance on instream flows and water quality; loss of fish, botanical, and wildlife habitat; effects on aesthetics; and protection of cultural resources. The environmental effects of the staff alternative are described in the following section.

Geology and Soils

Construction of the project would require land-disturbing activities associated with building the diversion dam and associated intake and fish screening structure, the pipeline and penstock, the powerhouse, and the transmission line and its substation. These activities would include instream excavation, vegetation removal, and other soil disturbance that would create the potential for erosion and could affect water quality. Kenai Hydro's proposed measures to designate an ECM and develop an ESCP would specify the measures that would be used to limit the adverse effects of erosion on terrestrial and aquatic habitats. Developing a construction plan and a spoils disposal plan and conducting turbidity monitoring would provide additional protection for terrestrial and aquatic habitats by documenting any required measures for protecting birds and sensitive plants and preventing sediment discharge into watercourses. Providing the ECM with the authority to stop work would help to limit adverse conditions resulting from construction activities.

Aquatic Resources

The proposed use of a cofferdam, silt fences, and an in-water construction window during low-flow periods to protect water quality would minimize the effect of increased turbidity on aquatic organisms during project construction because these measures would isolate construction areas from Grant Creek and protect aquatic resources by limiting the spread of disturbed sediment in the creek. Implementing staff's recommended water quality monitoring during project construction would identify whether construction activities are adversely affecting water quality and facilitate corrective action to be taken in a timely fashion. Staff's recommended modifications to the proposed ESCP would determine the potential for project construction to mobilize lead in lake sediments near the proposed project intake. If the staff-recommended pre-construction lead sampling indicates there is potential for lead mobilization in concentrations that would adversely affect aquatic resources, staff's recommended sediment capping measures should prevent mobilization.

Developing a hazardous materials plan that includes measures for the storage of hazardous materials and measures for spill prevention and containment would further protect aquatic habitat by preventing hazardous materials from entering waterways. Combining the two proposed plans into a single plan, as staff recommends, would facilitate agency review and communication between Kenai Hydro and contractors. Staff recommendations to: (1) develop the plan in consultation with Alaska DFG, FWS, and Forest Service; (2) include designation of specific areas for the maintenance and refueling of vehicles and equipment; (3) include appropriate measures for containment and cleanup in the event of a spill or accident; (4) include provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse; and (5) include a reporting schedule would improve the clarity of the plan and ensure measures are in place for timely implementation during hazardous spill emergency situations.

Reduced flows in the bypassed reach would reduce sediment transport into the lower reaches of Grant Creek. The proposed channel maintenance flows would limit the effects of the project on sediment transport and maintain salmonid spawning and rearing habitat in Grant Creek. Staff's recommended salmonid spawning gravel monitoring plan would monitor sediment supply and any depletion rate within the channel and our recommended trend analysis would support the development of appropriate measures (e.g., modifying the intensity or duration of the channel maintenance flows or gravel augmentation) to address any spawning gravel recruitment issues needed to maintain existing spawning habitat.

Implementing the proposed minimum flows in the bypassed reach and downstream of the project tailrace, along with staff's recommended ramping rates, would protect aquatic habitat and limit the potential for egg scour or fish stranding during flow fluctuations associated with project operation. Staff's recommended continuous monitoring of temperature in Grant Lake and Grant Creek, coupled with real-time adjustments in intake depth such that Grant Creek temperatures are within 0.5ºC Grant Lake at 0.5-meter depth (or Grant Lake +1.0ºC during ice break-up), would maintain the existing Grant Creek thermal regime, thereby minimizing project effects on salmonid life history and protecting habitat for salmonids.

Compared to existing conditions, project operation would result in slightly lower flows in Grant Creek in the spring and summer and slightly higher flows in the late fall and winter. Although lower spring and summer flows would result in a 10 to 20 percent reduction in wetted usable area for salmonid spawning and rearing habitat, depending on life stage, species, and water availability, the project flows would provide a net benefit to fish habitat because higher winter flows would provide additional rearing habitat for fish in Grant Creek in side channels that would normally be dry or frozen.

Terrestrial Resources

Project construction would disturb existing vegetation and remove or alter 10.2 acres of vegetated wildlife habitat. Construction activities would also include disturbance and noise produced by machinery and crews that could affect avian communities and other wildlife. Designating an ECM to oversee construction activities, implementing the proposed Vegetation Management Plan with staff-recommended additions for revegetation monitoring and success criteria, implementing measures to reduce the risk of introduction or spread of terrestrial and aquatic invasive plants, and conducting pre-construction surveys for sensitive plants in areas of proposed ground disturbance would limit the effects of construction and operation on vegetation.

Project operation would result in fluctuations in Grant Lake surface elevations that could affect nesting habitat for shore-nesting birds. The project's transmission line would increase the risk of injury and electrocution to birds that could collide with the transmission line. Implementation Kenai Hydro's Avian Protection Plan would limit project effects on nesting birds by avoiding or minimizing vegetation clearing activities during the breeding season, conducting nest surveys prior to vegetation clearing, and establishing protective buffers around active nests. Staff's recommended modification of the plan to include nest surveys prior to any construction activities with potential to disturb nesting birds, not just before vegetation clearing activities, would further limit these effects. The proposed Avian Protection Plan also includes measures to ensure that the transmission line would be designed and constructed with consideration of Avian Power Line Interaction Committee recommendations to reduce potential for bird electrocutions and collisions that would minimize the risk of injury and mortality to birds due to collision, and final engineering plans would be submitted to FWS and Alaska DFG for comment prior to being filed with the Commission for approval.

Increased human presence associated with project construction and operation could disturb bears and increase the risk of adverse interactions between bears and humans. Implementing Kenai Hydro's proposed bear safety plan would minimize effects on bears and limit the potential for bear-human encounters by keeping proposed construction sites and refuse areas clear of food or garbage and installing bear-proof garbage receptacles. The plan would also include provisions for reporting bear-human conflicts and dealing with problem bears.

Noise and disturbance produced by helicopters or other aircraft (if necessary) used during construction of the proposed project could affect mountain goats within and near proposed project lands. If aircraft are used during construction, impacts would be minimized by maintaining a 1,500-foot distance between aircraft and mountain goats at all times, as recommended by FWS and Alaska DFG.

Threatened and Endangered Species

No federally listed species have the potential to occur in the project area; therefore, constructing and operating the project would not affect listed species.

Recreation

Constructing the project would temporarily restrict public access by displacing the few anglers who use the stream near the construction site. Constructing the staff-recommended parking lot and single-unit vault restroom in the staging area on the west side of the access road bridge over Grant Creek would support non-motorized use of the project road for visitors to access Grant Lake, address public safety concerns about pedestrians crossing or walking along the highway and railroad tracks, and reduce congestion caused by visitors parking cars along the highway. Developing a public access plan to describe locations and identify entities responsible for installing and maintaining infrastructure such as gate(s), parking area, restroom, and signs to manage public access in the vicinity of the project access road between Seward Highway and Grant Lake would ensure the staff-recommended improvements are properly located and managed to provide public access and protect environmental resources.

Land Use and Aesthetics

An analysis of existing land use management goals for the project area indicates that the proposed project facilities would not conflict with the current level of development and motorized vehicle use in the area and would be consistent with allowable land uses on NFS lands adjacent to the proposed project.

The staff-recommended scenery management plan would mitigate project effects on aesthetic resources by screening project facilities from recreation users and directing project lighting, so it would be less visible.

Cultural Resources

Project-related effects on cultural resources within the APE could occur from project construction, operation and maintenance of project facilities and roads, and the mitigation measures associated with other environmental resources. To meet its section 106 responsibilities, staff intends to execute a Programmatic Agreement with the Alaska State Historic Preservation Officer for the proposed project for the protection of historic properties that would be affected by project construction and operation. The terms of the Programmatic Agreement would require Kenai Hydro to address all historic properties identified within the project APE through revision of the January 2018 HPMP.

No-action Alternative

Under the no-action alternative, the project would not be constructed.

Conclusions

Based on the analysis, we recommend licensing the project as proposed by Kenai Hydro with some staff modifications and additional measures.

In section 4.2 of the environmental impact statement, we estimate the likely cost of alternative power for each of the three alternatives identified above. The analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,616,890, or $86.93 per MWh more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,589,380, or $85.45/MWh more than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $1,608,810, or $86.50MWh more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (18,600 MWh annually); (2) the 5 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by Kenai Hydro, as modified by staff, would adequately protect and enhance environmental resources affected by the project.

The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

FINAL ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Grant Lake Hydroelectric Project
FERC Project No. 13212-005—Alaska

1.0 INTRODUCTION

1.1 APPLICATION

On April 18, 2016, Kenai Hydro, LLC (Kenai Hydro or applicant), filed its final application for an original license with the Federal Energy Regulatory Commission (Commission or FERC) for the proposed Grant Lake Hydroelectric Project (Grant Lake Project or project). Kenai Hydro amended the application on January 16, 2018.[14] On May 23, 2018, Kenai Hydro filed its response to agency terms and conditions, modifying its proposed measures by agreeing to some agency recommendations or proposing alternative measures. On August 6, 2018, after further consultation with agencies, Kenai Hydro filed a revised schedule for minimum flows downstream of the proposed tailrace. The proposed 5-megawatt (MW) project would be located on Grant Lake and Grant Creek, near the community of Moose Pass, Kenai Peninsula Borough, Alaska (figure 1-1) and would generate about 18,600 megawatt-hours (MWh) of energy annually. The project would occupy 1,688.7 acres of federal land within the Chugach National Forest, administered by U.S. Department of Agriculture, Forest Service (Forest Service).

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Grant Lake Project is to provide a new source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to Kenai Hydro for the proposed Grant Lake Project and what conditions should be placed on any license issued. In

[14] Kenai Hydro amended its final license application to address requests from the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) to relocate the proposed minimum bypass flow discharge to facilitate downstream ecological processes.

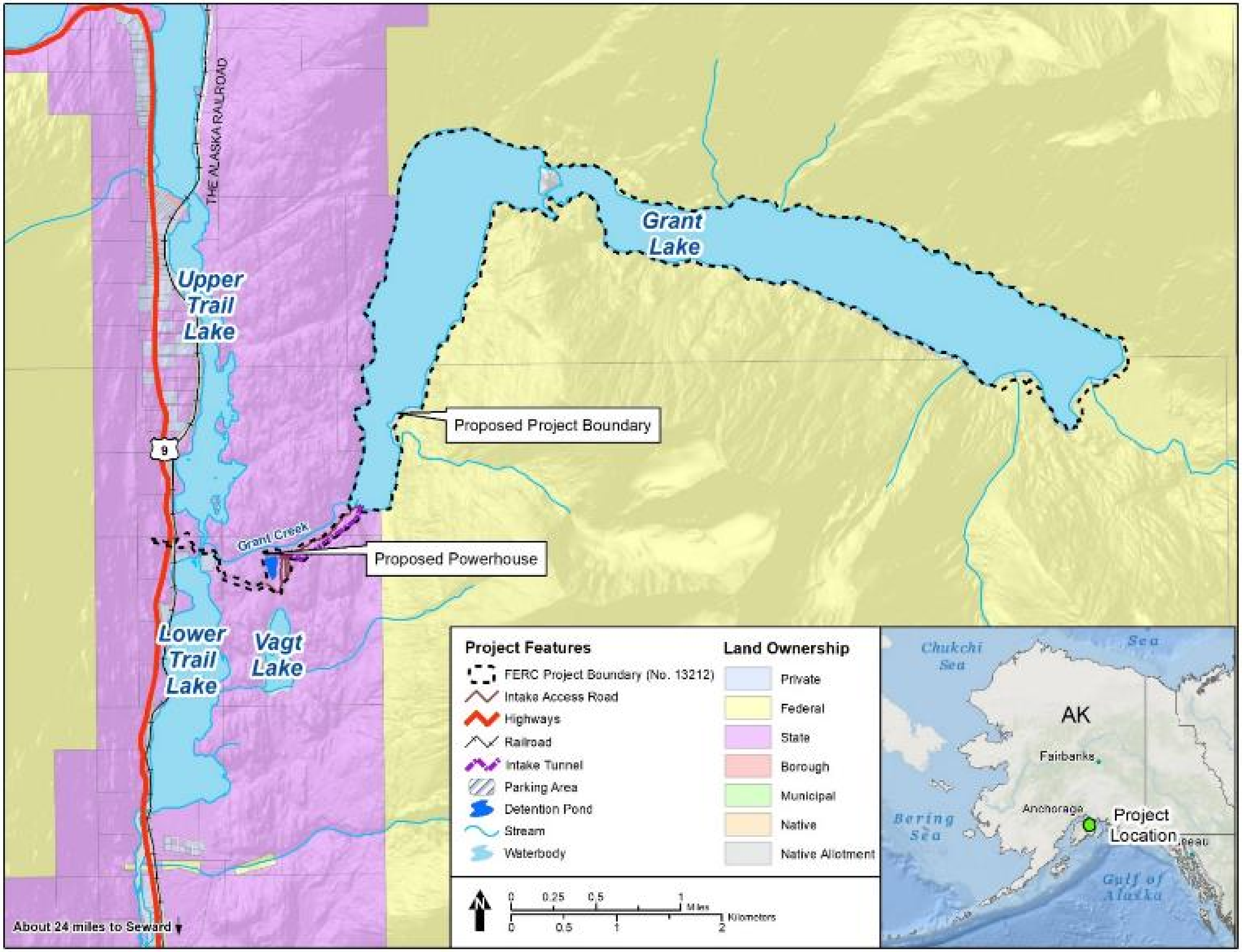

Figure 1-1. Proposed location of the Grant Lake Project (Source: Kenai Hydro, 2018a, as modified by staff).

deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing an original license for the Grant Lake Project would allow Kenai Hydro to generate electricity at the project for the term of the license, making electrical power from a renewable resource available to its customers.

This final environmental impact statement (EIS) assesses the effects associated with operation of the project and alternatives to the proposed project. It also includes recommendations to the Commission on whether to issue a license and, if so, includes the recommended terms and conditions to become a part of any license issued.

In this final EIS, we assess the environmental and economic effects of constructing and operating the project: (1) as proposed by the applicant, and (2) with our recommended measures. We also consider the effects of the no-action alternative. Important issues that are addressed include the effects of project construction and operation on water quality; aquatic resources, including winter-, spring-, and fall-run Chinook salmon and steelhead; vegetation and wildlife; and cultural resources.

1.2.2 Need for Power

The Grant Lake Project would provide hydroelectric generation to meet part of Alaska's power requirements, resource diversity, and capacity needs. The project would have an installed capacity of 5 MW and generate an average of 18,600 MWh per year.

Kenai Hydro is a subsidiary of the Homer Electric Association, which currently provides power to the Alaska Railbelt (Railbelt) region[15] from other generating facilities. The Railbelt electrical grid is defined as the service areas of six regulated public utilities, extending from Fairbanks to Anchorage and the Kenai Peninsula—Golden Valley Electric Association; Chugach Electric Association; Matanuska Electric Association, Homer Electric Association; Anchorage Municipal Light and Power; and the City of Seward Electric System. Power also comes from Aurora Energy, LLC, an independent, power-producing utility. Sixty-five percent of the Alaskan population lives within the Railbelt region (Alaska Energy Wiki, 2018).

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[15] The Railbelt region includes developments along the Alaska Railroad between the Kenai Peninsula and Fairbanks. The region includes the Mat-Su Valley, Anchorage, the Kenai Peninsula, Talkeetna, and Fairbanks.

The southern portion of the Railbelt region—Mat-Su Valley, Anchorage, and the Kenai Peninsula—is highly dependent on natural gas as a source of electricity and heat. The northern portion of the Railbelt region—Fairbanks and other communities in the interior—relies on petroleum fuels in addition to natural gas, coal, and hydroelectric power imported from the south.

Nearly all the thermal generating capacity in the Railbelt region is almost 25 years old, and much of it is more than 35 years old. The majority of the generation is combustion turbine generation.

We conclude that power from the Grant Lake Project would help meet a need for power in the Railbelt region in both the short- and long-term. As a renewable resource, the project may provide power that displaces generation from non-renewable sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Grant Lake Project would be subject to numerous requirements under the FPA and other applicable statutes, as summarized below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the U.S. Department of the Interior (Interior). The U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), by letter dated April 9, 2018, requests that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation will be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The Forest Service filed final conditions on March 1, 2019 (appendix B), pursuant to section 4(e) of the FPA. These conditions are described under section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

The Alaska Department of Fish and Game (Alaska DFG) and NMFS timely filed, on January 8, 2019, and March 1, 2019, respectively, final recommendations under section 10(j). These recommendations are summarized in table 5-1. In section 5.3.1, *Fish and Wildlife Agency Recommendations*, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Clean Water Act. By letter dated February 22, 2016, the Alaska Department of Environmental Conservation (Alaska DEC) waived its right to issue a water quality certification for licensing the Grant Lake Project, in accordance with section 401 of the Clean Water Act. Kenai Hydro filed a copy of the letter with the Commission on September 5, 2017.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. No federally listed threatened, endangered, proposed, or candidate species and no proposed or designated critical habitats are known to occur in the vicinity of the project (letter from U.S. Department of the Interior, Fish and Wildlife Service (FWS), Anchorage Fish and Wildlife Field office, filed February 8, 2019). No federally listed species under NMFS management occur in the project area (NOAA, 2019a). Therefore, licensing the project would not affect listed species, and no further consultation under section 7 is required.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

On July 7, 2011, by operation of state law, the federally approved Alaska Coastal Zone Management Plan expired, resulting in a withdrawal from participation in the CZMA's National Coastal Management Program. The CZMA federal consistency provision, section 307, no longer applies in Alaska.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties (TCPs), and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement for the protection of historic properties from the effects of the operation of the Grant Lake Project. The terms of the Programmatic Agreement ensure that Kenai Hydro addresses and treats all historic properties identified within the project's area of potential effects (APE) through revision of the Historic Properties Management Plan (HPMP) filed on January 16, 2018.

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect Essential Fish Habitat (EFH). Grant Lake Project is identified as EFH for Chinook, coho, pink, and sockeye salmon.

The analysis of project effects on these species' EFH is presented in section 3.3.2.3, *Essential Fish Habitat*. We conclude that licensing the project as proposed with staff-recommended measures and mandatory conditions would have minor, adverse effects on Chinook, coho, pink, and sockeye salmon habitat and on migrating adult and juvenile salmonids due to temporary increases in turbidity and suspended sediment during in-water construction activities and reduced spring and summer flows. However, the mitigation measures, including providing minimum flows to increase access to side channels in winter, providing channel maintenance flows at least twice during every 10-year period, limiting downramping rates to between 1 and 2.25 inches per hour, depending on season, and maintaining existing water temperature fluctuations would not affect EFH in project waters. We are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations.

1.3.7 National Trails System Act

The National Trails System is the network of scenic, historic, and recreational trails created by the National Trails System Act of 1968 (16 U.S.C. §§ 1241-1251).

These trails provide outdoor recreation; promote the enjoyment, appreciation, and preservation of open-air, outdoor areas and historic resources; and encourage public access and citizen involvement.

The Forest Service plans to construct a segment of the Iditarod National Historic Trail (INHT) near the project. Based on the analysis presented in section 3.3.4.2, in the *Iditarod National Historic Trail* subsection*,* we conclude that the proposed project would not be inconsistent with the planned trail and the National Trails System Act.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on May 11, 2010. It was noticed in the *Federal Register* on May 18, 2010. Commission staff conducted an environmental site review of the project area on June 2, 2010. Two scoping meetings, both advertised in in the local newspapers, were held on June 2 and June 3, 2010, in Moose Pass, Alaska, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Seward Iditarod Trail Blazers	June 5, 2010
John Polonowski	June 15, 2010
William Brennan	June 23, 2010
Kenai River Watershed Foundation	June 25, 2010; July 6, 2010; July 19, 2010
Becky Long	June 25, 2010
Michael Cooney	July 6, 2010
Alaska Center for the Environment	July 6, 2010
Shawn Lynch	July 6, 2010

Commenting Entity	Date Filed
Resurrection Bay Conservation Alliance	July 6, 2010, July 7, 2010[16]
NMFS	July 6, 2010
Alaska Department of Natural Resources (Alaska DNR), Division of Mining, Land & Water	July 6, 2010
FWS	July 6, 2010
National Park Service (Park Service)	July 6, 2010
Alaska DFG	July 6, 2010
Kenai Hydro	July 7, 2010
Forest Service	July 9, 2010
U.S. Army Corps of Engineers	August 3, 2010

A revised scoping document (SD2), addressing these comments, was issued on August 23, 2010. On April 18, 2016, Kenai Hydro filed its final license application for the proposed Grant Lake Project. Upon review of the final license application, Commission staff found that the proposed project differed substantially from Kenia Hydro's original proposal described in the Preliminary Application Document. As a result, the Commission re-initiated its National Environmental Policy Act scoping process with the issuance of Scoping Document 3 (SD3) on July 22, 2016. SD3 was noticed in the *Federal Register* on July 28, 2016. Two scoping meetings, both advertised in local newspapers, were held on September 7 and 8, 2016, in Moose Pass, Alaska, to request oral comments on the project. A court reporter recorded all comments and statements made at the scoping meetings, and this information is part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments on SD3:

Commenting Entity	Date Filed
Alaska DFG	October 7, 2016
Kenai River Watershed Foundation	October 11, 2016
Mark Luttrell	October 11, 2016

[16] Public comments in response to a resolution regarding the development of the Grant Lake/Falls Creek Hydropower Project and considered by the Kenai Peninsula Borough Assembly, during its June 21, 2010, council meeting, were submitted as part of the public record for this proceeding.

Commenting Entity	Date Filed
Park Service	October 11, 2016
NMFS	October 11, 2016
FWS	October 17, 2016

The Commission issued a revised scoping document (SD4), addressing these comments on December 7, 2016.

1.4.2 Interventions

On July 19, 2016, the Commission issued a notice that Kenai Hydro had filed an application for an original license for the Grant Lake Project. This notice set September 17, 2016, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervenor	Date Filed
Mark Luttrell	September 12, 2016
Forest Service	September 15, 2016
Kenai River Watershed Foundation[a]	September 16, 2016
Friends of Copper Landing[a]	September 16, 2016
Bureau of Land Management	September 16, 2016
Bruce Jaffa	September 16, 2016
Iditarod Historic Trail Alliance[a]	September 16, 2016
Seward Iditarod Trail Blazers	September 16, 2016
Irene Lindquist[b]	October 6, 2016
Herrick Sullivan[b]	April 3, 2018
Interior[b]	April 6, 2018
NMFS[b]	April 9, 2018

[a] Intervention in opposition

[b] Late intervention approved by Commission notice issued on April 27, 2018.

1.4.3 Comments on the Application

A notice requesting comments, preliminary terms and conditions, and recommendations was issued on February 8, 2018. The following entities commented:

Commenting Agency and Other Entity	Date Filed
Herrick Sullivan	April 3, 2018
Alaska DFG	April 6, 2018
Homer Electric Association, Board of Directors	April 9, 2018
David Lisi	April 9, 2018
Forest Service	April 9, 2018
Cook Inletkeeper	April 9, 2018
Interior	April 9, 2018
NMFS	April 9, 2018
Jonathan Sewall (Iditarod Historic Trail Alliance)	April 9, 2018
Interior (errata for 10(j) recommendation 2)	May 2, 2018
Alaska DFG (modification to 10(j) recommendation 2)	August 24, 2018
Forest Service (modification to preliminary 4(e) condition 21)	August 27, 2018

The applicant filed reply comments on May 23, 2018.

1.4.4 Comments on the Draft Environmental Impact Statement

The draft EIS was sent to the U.S. Environmental Protection Agency (EPA) and made available to the public on October 19, 2018. Written comments on the draft EIS were due March 1, 2019.[17] In addition, oral testimony on the draft EIS was received during two public meetings held in Moose Pass, Alaska, on November 28, 2018.[18] Appendix A lists the commenters who provided written comments, summarizes the substantive comments that were filed, includes staff responses to those comments, and indicates locations in the final EIS that were revised, as appropriate. Kenai Hydro filed a response to comments on the draft EIS on March 11, 2019.

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[17] The notice established December 10, 2018, as the due date for filing comments on the draft EIS; however, in response to the November 30, 2018, Alaska DFG and the December 6, 2018, NMFS requests for an extension of time to file comments on the draft EIS, on December 6, 2018, the Commission extended the comment period to January 9, 2019. Subsequently, due to the funding lapse at certain federal agencies between December 22, 2018, and January 25, 2019, on February 11, 2019, the Commission extended the comment period to March 1, 2019

[18] The transcripts from the meetings were filed in the administrative record for the project on January 9, 2019.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the project would not be built, and the environmental resources in the project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

Grant Lake Intake

The proposed Grant Creek Project intake would consist of a reinforced concrete structure located about 500 feet east of the natural outlet of Grant Lake and adjacent to the south shore (figures 2-1 and 2-2). The intake structure would consist of a reinforced concrete structure and extend from elevation 668 feet[19] to a top deck elevation of 715 feet. The structure, which would have an outside dimension of 38 feet by 20 feet, would have intake trashracks, selective withdrawal intake gates with a wire rope hoist, and an 11-foot-high by 11-foot-wide roller gate. The intake would be divided into three bays, and pressure transducers would be installed to monitor the Grant Lake water level and within the intake tower. A 16-foot-wide access bridge would provide access to the intake structure from the lake's shoreline.

The intake structure would also house a pump to supply minimum flows to the bypassed reach as discussed below.

Grant Lake Bypass

The proposed bypass system would consist of a concrete weir with a crest elevation of 703 feet and an automated slide gate and a pump at the intake to provide up to 10 cubic feet per second (cfs) of flow to the bypassed reaches of Grant Creek (Reaches 5 and 6, as shown on figure 2-1). The concrete weir would be about 100 feet long, spanning from the north shore to the south shore and connecting in the middle at an existing island (see figure 2-2). A 16-inch-diameter, 400-foot-long bypass flow pipe would extend from the intake to the upper end of Reach 6, just downstream of the weir.

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[19] All elevations in this EIS are in North American Vertical Datum 88.

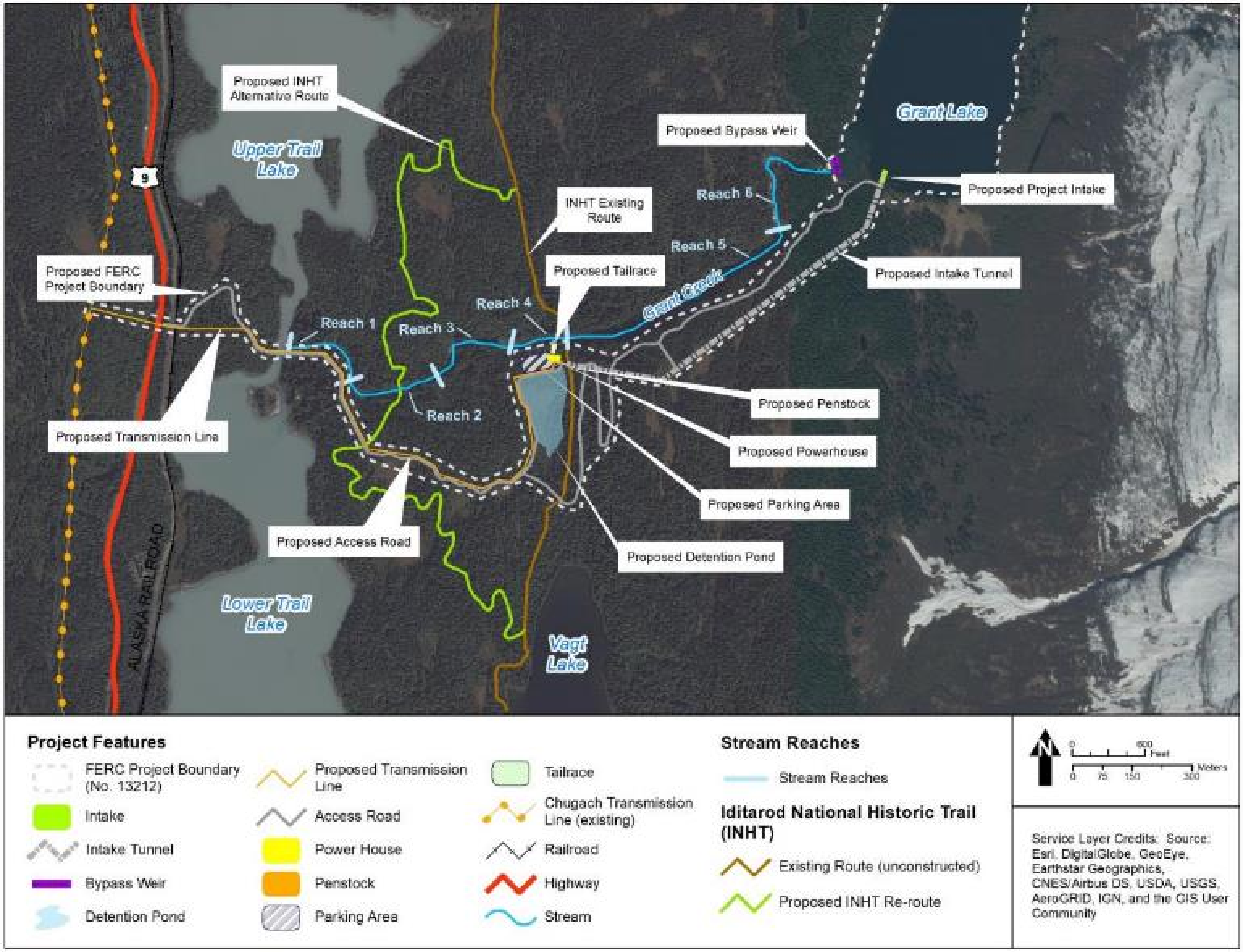

Figure 2-1. Proposed Grant Lake Project facilities (Source: Kenai Hydro, 2018a, as modified by staff).

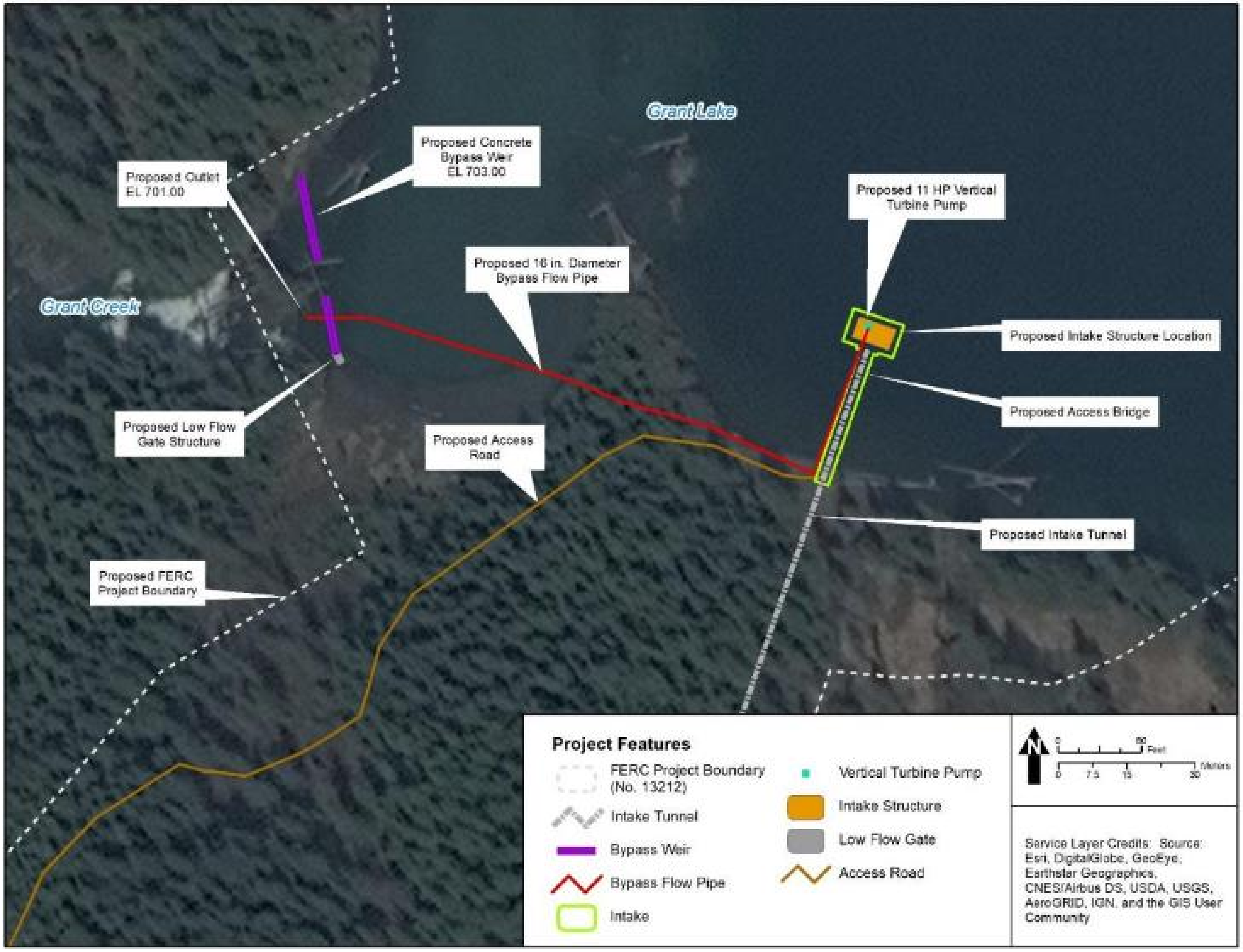

Figure 2-2. Enlargement of proposed Grant Lake Project intake, bypass pipe, and weir (Source: Kenai Hydro, 2018a, as modified by staff).

Tunnel and Surge Chamber

A 3,300-foot-long, 10-foot-diameter, horseshoe-shape tunnel would connect the project's intake structure in the lake to a 6-foot-diameter, steel penstock about 150 feet from the powerhouse. The upper 2,400 feet of the tunnel would be constructed at a 1 percent slope and would be unlined. The lower 900 feet of tunnel would be constructed at a 15 percent slope and would be concrete lined. A surge chamber would be located at the transition between the two tunnel slopes. This chamber would be about 10 feet in diameter and would extend from the tunnel invert elevation of 675 feet to the ground surface at about elevation 790 feet. The surge chamber outlet would be fully screened to exclude wildlife and the public from accessing the chamber.

Penstock

A 72-inch-diameter steel penstock would extend 150 feet from the downstream tunnel portal to the powerhouse. The welded steel penstock would be supported on concrete pipe saddles along the penstock route. The first 100 feet of the 72-inch-diameter penstock would be buried with earth to a minimum depth of 2 feet on the top and sloping outward from the penstock to the existing grade. The penstock would bifurcate into two 48-inch-diameter penstocks outside the powerhouse to provide water flow to each of the powerhouse turbines. The last 50 feet of the 72-inch-diameter penstock and the 48-inch-diameter penstock would be encased in concrete. The penstock would tie into a powerhouse located on the south bank of Grant Creek near the mouth of the Grant Creek Canyon (Reach 5). The penstock would enter the south side, and the tailrace channel would exit on the north side of the powerhouse.

Powerhouse

The 100-foot-long by 50-foot-wide powerhouse would contain two horizontal Francis type turbine/generator units with a turbine runner at elevation 526 feet and a total rated capacity of 5,000-kilowatt. The powerhouse flow would range from a maximum of 385 cfs to a minimum of 58 cfs, and the flow from each turbine would range from 192.5 cfs to 58 cfs and discharge to the project's tailrace. An energy dissipation valve would extend off the penstock and to bypass flow around the turbines and discharge directly to the project tailrace in the event of an emergency project shutdown.

Tailrace

The trapezoidal tailrace channel would be 105 feet wide and have a bottom width of 74 feet and a channel depth ranging from 13 feet at the powerhouse to 8 feet at the edge of Grant Creek. It would be located between the north side of the powerhouse and the south bank of Grant Creek. The channel in Grant Creek at the outflow of the tailrace would be excavated and lined with riprap. At the entrance of the tailrace, a flume structure with discharge gates would be constructed to allow water to flow from the turbines to the tailrace when the gates are open, but when the gates are closed, it would allow flow to pass from the turbines to a detention pond through a 240-foot-long concrete conduit. The detention pond is discussed in detail below. The tailrace channel would be equipped with a fish barrier at the mouth of Grant Creek, and an 8-foot-tall wildlife exclusion fence would be located at the top of the bank on both sides of the channel and across the top of the fish barrier to exclude wildlife from the tailrace channel.

Detention Pond

Kenai Hydro proposes to construct a 3.6-acre detention pond with a storage capacity of 15 acre-feet and would locate it near the powerhouse. Kenai Hydro anticipates that, at times, generation would be required instantaneously for very short periods (15 to 20 minutes) and discharge to Grant Creek would adversely affect water levels in the creek.

Transmission Line and Switchyard

An overhead 1.1-mile-long, 115-kilovolt (kV) transmission line would extend from the powerhouse and run parallel to the proposed access road to Chugach Electric's existing 115-kV transmission line located on the west side of the Seward Highway (see figure 2-1). The transmission line would be constructed using wooden poles set at about 250-foot intervals.

Access Roads

The project would include a 1-mile-long, 24-foot-wide powerhouse access road from the Seward Highway as milepost 26.9 to the powerhouse located near the base of the Grant Creek Canyon and a 16-foot-wide, 1.1-mile-long intake access road from the powerhouse to the intake at Grant Lake. The proposed access roads would be used during project construction and after construction is completed for facility maintenance.

The powerhouse access road, which would be surfaced with crushed stone, would travel eastward from the Seward Highway across the Alaska Railroad Corporation (ARRC) tracks and across the downstream end of Trail Lake Narrows.[20] The road would then continue eastward to the powerhouse (see figure 2-1). The crossing of Trail Lake Narrows would be via a 110-foot-long, single-lane bridge.

The 1.1 mile-long intake access road would begin at the powerhouse and ascend a 230-foot bluff to the top of the southern rim of the Grant Creek Canyon. A series of road switchbacks would be required to maintain a road grade of less than 8 percent and periodic turnouts would be constructed to allow traffic to pass. The road would be surfaced with crushed stone. The road would then generally follow the southern edge of the canyon until it descends to the edge of Grant Lake. A 16-foot-wide, 60-foot-long access bridge would extend from the edge of the lake to the intake structure. A small

[20] Trail Lake Narrows is the narrow channel between Upper Trail Lake and Lower Trail Lake.

parking area and turn-around area would be constructed upstream of the intake structure access bridge.

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on Kenai Hydro's adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the facilities, identification of unauthorized modifications, efficiency and safety of operation, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.3 Project Operation

The project would use inflow to and storage in Grant Lake to generate power and meet minimum flow requirements within Grant Creek. Under the applicant's proposed operation, Grant Lake's elevation would vary from the current normal maximum elevation of 703 feet, which is the elevation of the natural Grant Lake outlet, down to a minimum lake elevation of 690 feet (see figure 3-6 in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*). To provide storage for spring flows, Kenai Hydro would draw down the lake during the winter months and use these reservoir releases to generate power and meet instream flows requirements in Grant Creek. Kenai Hydro also proposes to increase power benefits by taking advantage of spinning reserve and load-following operations (peaking).

The powerhouse would operate with a minimum hydraulic capacity of 58 cfs (one unit) and a maximum hydraulic capacity of 385 cfs (total for two units). When the lake is at a sufficient elevation, Kenai Hydro would provide minimum flows into the bypassed reach through a slide gate in the bypass weir. When the lake elevation is too low to provide a sufficient flow volume to meet the minimum bypass flows through the slide gate, Kenai Hydro would close the slide gate. A vertical turbine pump station would then pump water from the penstock intake structure through a bypass pipe to the downstream side of the bypass weir at the head of the Grant Creek bypassed reach.[21] When the lake level exceeds 703 feet, and inflow is greater than 385 cfs the excess flow would pass over

[21] The weir would prevent flows pumped from the intake from flowing back into Grant Lake.

the top of the bypass weir and into Grant Creek's natural outlet.[22] The pump-and-weir combination would allow the minimum flows ranging from 5 to 10 cfs to be released at the top of Reach 6. Under this proposed operation, no reach of the creek would be dewatered. Water would be provided to maintain anadromous and resident passage in Reach 5 and provide persistent wetted habitat for any macroinvertebrate populations in Reach 6. The minimum flows would flow down through Reaches 6 and 5 (the bypassed reach) to Reach 4, where the powerhouse tailrace channel would discharge into Grant Creek. The combined flows would travel downstream through Reaches 3, 2, and 1 to Trail Lake Narrows.

Kenai Hydro proposes to use the project for spinning reserve. Spinning reserve is the ability to provide immediate power to the electric grid in the event of a sudden loss of power somewhere on the grid, such as when a generating unit trips off-line. Hydroelectric facilities, such as Grant Creek, would have this capability, because of the storage capacity in Grant Lake. A generating unit would be brought online at whatever capacity is required, up to its full hydraulic and generating capacity—in the case of Grant Creek, 192.5 cfs and 2.5 MW.

Kenai Hydro would construct an off-stream detention pond near the powerhouse. The detention pond would provide a temporary storage reservoir for flows generated during the spinning reserve operations to prevent a sudden increase in the water surface levels of Grant Creek as a result of the increased flows generated.

Spinning reserve capacity for the Grant Lake Project would be primarily available during the winter and "shoulder months" when the lake inflows were low and the corresponding powerhouse output would not be at full capacity. If the transmission grid required an immediate power input from spinning reserve, the powerhouse would ramp up to full output with the increased flow routed to the detention pond to capture the increased discharge. The flow diversion would be accomplished with a gated diversion structure in the powerhouse tailrace.

If a turbine were to be brought online for spinning reserve, the turbine would operate for a period of minutes or hours to meet the instantaneous demand. Typically, it would be for a short period until the system demand was met by other generating facilities on the electric grid. The rate of flow through the unit would dictate how long the unit could operate in this mode. For example, at a discharge of 20 cfs, it would take approximately 12 hours to completely fill the detention pond from empty, but at a flow of

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[22] Kenai Hydro's amended final license application states that under project operations, Grant Lake would fluctuate between elevations 703 feet and 690 feet. However, Kenai Hydro also states that when the lake is full, inflow greater than 385 cfs would spill over the crest of the weir. Subsequently, it is not clear how the proposed weir, with crest elevation of 703 feet, would affect lake elevation during rare periods when the lake is full and inflow is above 385 cfs.

192.5 cfs, it would only take 1.2 hours. It is not clear whether both units could provide spinning reserve, either separately or combined, but it is our interpretation of the project drawings and discussions in the license application, that perhaps only one unit would be used for this purpose. It is also not clear whether one unit could discharge to the detention pond providing spinning reserve while the other unit was discharging to the tailrace, although our review of the project drawings seems to indicate this would be possible.

Once the spinning reserve demand is met, Kenai hydro would shut down the unit and slowly release the detention pond flow back into the powerhouse tailrace. Kenai Hydro would release the captured flow slowly or at a regulated, adjustable rate into the tailrace to minimize effects on tailwater elevations. The release rate could be adjusted up and down by a weir gate to match the given project conditions at that time. Depending on the release rate selected, the detention pond would simply take longer to drain, limiting spinning reserve during that period. Kenai Hydro would moderate detention pond releases in the tailrace and flows through the powerhouse to ensure that combined releases from the powerhouse and the detention pond adhere to, and do not exceed, the ramping rates established for project operation.

Kenai Hydro also proposes to occasionally use the project for peaking generation, resulting in the project providing generation during the peak demand period of the day. Our understanding of the proposed peaking operation is that Kenai Hydro would typically undergo peak generation during the winter if demand warrants. In the spring, Kenai Hydro would operate the project in essentially a run-of-river mode up to the hydraulic capacity of the project (385 cfs) and store all inflows above 385 cfs until the reservoir is full.

2.2.4 Environmental Measures

Kenai Hydro proposes the following environmental measures:

Project Construction

- Designate a third-party environmental compliance monitor (ECM) to oversee construction activities and ensure compliance with measures to protect natural resources.
- Develop an ESCP that includes best management practices (BMPs) to prevent sediment mobilized during construction from entering Grant Creek or Grant Lake.
- Restore areas disturbed by construction to pre-existing conditions.
- Develop a hazardous materials containment/fuel storage plan that includes measures to contain all hazardous materials used during construction.

- Consult with Alaska DFG, NMFS, and FWS to finalize design details for fish exclusion measures in the tailrace.
- Consult with Alaska DFG's habitat biologist to establish timing windows for instream construction and stream-crossing activities.
- Develop a bear safety plan that includes: (1) keeping construction sites and refuse areas clear of substances that attract bears, (2) installing bear-proof garbage receptacles and other measures during construction to prevent bears from obtaining food or garbage, (3) minimizing possible conflict with bears during construction and operation, (4) establishing protocols for dealing with problem bears,[23] and (5) notifying authorities of any bear-human conflict.

Project Operation

- Provide the following minimum flows in the bypassed reach: 5 cfs from January 1 through July 31, 10 cfs from August 1 through September 31, 7 cfs from October 1 through October 31, and 6 cfs from November 1 through December 31 to protect aquatic habitat and support benthic macroinvertebrates.
- Provide the following instantaneous minimum flows downstream of the tailrace: 60 cfs from January 1 through May 15, 80 cfs from May 16 through May 31, 150 cfs from June 1 through June 30, 195 cfs from July 1 through September 1, 150 cfs from September 1 through September 30, 125 cfs from October 1 through October 15, 72 cfs from October 16 through November 15, and 60 cfs from November 16 through December 31 to protect habitat for salmonids and benthic macroinvertebrates.
- Use variable depth withdrawals from the project intake to control water temperature in Grant Creek.
- Provide channel maintenance flows of 800 cfs to the Grant Creek bypassed reach for a continuous 8-hour duration, once per year, in a minimum of 2 years in each moving 10-year period to promote sediment recruitment and transport from the bypassed reach to Grant Creek.
- Limit upramping rates to 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15). Limit downramping rates to 1 inch per hour from

[23] Although Kenai Hydro and the agencies do not specifically define *problem bears*, we understand this term to refer to bears that repeatedly visit a construction area despite implementation of other measures in the plan, including trash management and use of bear-proof containers.

November 16 through May 15 and 2.25 inches per hour from May 16 through November 15.

- Implement the Operation Compliance Monitoring Plan (filed on January 16, 2018) that includes: (1) lake level and temperature monitoring in Grant Lake; (2) flow and temperature monitoring in Grant Creek bypassed reach; (3) flow and temperature monitoring in Grant Creek-tailrace; (4) failsafe provisions; (5) a schedule for installing, maintaining, and collecting flow and temperature instrumentation; and (6) reporting.
- Develop a spill prevention, control, and containment plan and a hazardous materials containment/fuel storage plan to prevent hazardous materials from entering Grant Creek or Grant Lake during construction and operations.
- Implement the Biotic Monitoring Plan (filed on January 16, 2018) that includes monitoring juvenile and adult salmonid abundance and habitat use, and monitoring gravel transport in Grant Creek to assess project effects on salmonid spawning habitat.
- Conduct biological monitoring in Grant Creek to determine the need for gravel augmentation as well as the effectiveness of the proposed enhancement/mitigation measures that includes flows in the bypassed reach and flows downstream of the tailrace, and to evaluate the need for removal of a log jam to increase flow in a Grant Creek side channel, and an assessment of the need for gravel augmentation.
- Implement the Vegetation Management Plan (filed on January 16, 2018) that includes: (1) invasive plant management and control, (2) revegetation, (3) vegetation maintenance, (4) sensitive plant species protection and monitoring, and (5) pale poppy population management.
- Implement the Avian Protection Plan (filed on January 16, 2018) that addresses migratory species and bald eagles and minimizes potential for electrocutions or collisions with the project transmission line.
- Develop an INHT re-route plan that includes constructing the southern half of the proposed INHT re-route from the existing route to Grant Creek.
- Restrict public access to the project using signage and gating/fencing of the access road to address local residents' concerns about encouraging motorized use near the project and reduce the potential for unauthorized motorized use and on adjacent National Forest System lands (NFS lands).
- Develop a fire prevention plan.
- Implement the HPMP (filed on January 16, 2018) to protect historic properties in the project area.

2.2.5 Modifications to Applicant's Proposal—Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of the applicant's proposal.

Section 4(e) Land Management Conditions

The following final mandatory conditions have been provided by the Forest Service under section 4(e) and are included in appendix A. We consider final conditions 1 through 3, 5 through 13, and 15 through 18 and 22 to be either administrative, unrelated to the proposed action, or speculative and uncertain as to whether or not the condition would ever be implemented; therefore, they are not analyzed in detail in this EIS.[24] The following conditions are resource-specific and are analyzed in this EIS.

- Condition 4: Hold an annual consultation meeting to discuss measures needed for the protection and use of NFS lands and resources affected by the project.
- Condition 14: Restrict the use of pesticides[25] on public lands managed by the Forest Service for NFS lands without the prior written approval of the Forest Service.

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[24] For example, Forest Service final 4(e) condition 22 describes measures to be implemented if, at any point during design, construction, and operation of the hydroelectric facility it becomes necessary to reroute any portion of the Iditarod National Historic Trail to accommodate the facility. We consider this measure to be speculative, because it depends upon an uncertain and unspecified future event that results in the need for a reroute of the trail. Forest Service Final 4(e) condition 19 includes development of a reservoir management and inundation plan to identify seasonal reservoir fluctuations and NFS lands potentially inundated because of anticipated fluctuations. We consider this plan to be unrelated to the proposed action, because under the proposed project operations alternatives assessed in this EIS Grant Lake's maximum water surface elevation will mirror historic conditions and therefore the project would not cause the inundation of any additional NSF lands. Forest Service final 4(e) condition 1 requires the applicant to conduct the administrative action of obtaining a special use authorization for the use of NFS lands.

[25] Pesticides are any substance or mixture of substances intended to prevent, destroy, repel, or mitigate for any pest or used as a plant regulator, defoliant, or desiccant. The term pesticide includes many types, broadly classified by the type of pest they control for (e.g., herbicides are intended to kill plants) (Forest Service, 2013a).

- Condition 19: Develop the following plans addressing specific resource issues covered by the Chugach National Forest Land and Resource Management Plan: construction plan, ESCP, fire prevention plan, hazardous materials plan, heritage resource protection plan, reservoir management and inundation plan, scenery management plan, solid waste and wastewater plan, spoil disposal plan, aquatic invasive species management plan, and vegetation management plan.[26]
- Condition 20: Provide an ECM to oversee the project during major construction activities and ensure that the ECM has stop work or change order authority.
- Condition 21: Consult with Forest Service during the design and construction of project facilities crossing the INHT to minimize adverse effects on the INHT 100-foot wide easement.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include most of Kenai Hydro's proposed measures, with the following exceptions. We do not recommend the proposed Biotic Monitoring Plan because the proposed fishery monitoring efforts do not provide direct benefits to the fishery, and it is not clear how the proposed fish monitoring would inform project-related matters given that it is not designed to isolate project effects from other non-project-related variables that could affect fish populations. In addition, the project record contains sufficient information on which to base license conditions such that there is no project-related benefit to requiring additional study. We recognize the proposed Biotic Monitoring Plan also includes a proposal to monitor salmonid spawning gravel and we address gravel monitoring below. We do not recommend the removal of the existing logjam in Reach 1 because it provides habitat for aquatic resources. We do not recommend the INHT re-route plan because the proposed project infrastructure is compatible with the existing INHT route, and no re-routing is necessary.

The staff alternative also includes the following recommended modifications of Kenai Hydro's proposal and additional measures.

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[26] Forest Service final 4(e) condition 19 includes filing of 11 management plans. In some cases, the Forest Service plans relate to proposed plans or recommendations from other agencies. However, the Forest Service does not provide any details about these plans. Therefore, we do not analyze these plans as specific Forest Service recommendations; however, we analyze the need for such plans based on our understanding of what these types of plans would typically include.

Project Construction

- Modify the proposed measure to designate a third-party ECM to include a provision for the ECM to have stop work authority.
- Modify the proposed ESCP to include: (1) a description of existing soil, groundwater, and vegetation conditions; (2) site-specific preventive measures; (3) identification of areas for storage or deposition of overburden and implementation of erosion control measures in those areas; (4) measures to sample for lead in Grant Lake sediments that could be disturbed by project construction and operation, and if lead is present, measures to prevent mobilization; and (5) an implementation schedule.
- Develop a construction plan that includes: (1) a detailed construction schedule; (2) a description of construction methods and BMPs to be employed and measures to reduce the risk of introduction or spread of invasive plants; (3) the delineation of construction areas using fencing and flagging; (4) measures to avoid streams, wetlands, and pond habitats to the extent possible during construction; (5) provisions for environmental training of construction staff regarding laws, regulations, and BMPs to avoid or reduce effects on all native plant and wildlife species including special-status species and their habitats; and (6) identification of other resource-specific protection plans that should be considered during construction activities.
- Develop a spoils disposal plan that includes: (1) means and methods to dispose of any materials excavated during construction, (2) mapped locations of any proposed temporary and/or permanent spoil pile locations, (3) descriptions of the composition of any materials expected to be excavated on the site, (4) proposed use of excavated materials in the construction process, (5) any plans to dispose of materials off site, (6) methods to prevent spoil materials from leaching from spoil piles into adjacent waterways and wetlands, and (7) identification of other resource-specific protection plans that should be considered during construction activities.
- Modify the proposed Avian Protection Plan to include nest surveys prior to any construction activities that have the potential to disturb nesting birds, not just before vegetation clearing activities.
- Avoid the use of helicopters or airplanes near the mountainside adjacent to Grant Lake and Grant Creek, maintain a 1,500-foot clearance between aircraft and mountain goat habitat, and follow Forest Service no-fly zones to protect mountain goats.

Project Operation

- Develop a solid waste and wastewater plan to protect water quality in Grant Lake and Grant Creek from waste and sewage generated on site.
- Combine the proposed hazardous materials containment/fuel storage plan and spill prevention control and containment plan into a single hazardous materials plan that includes the following measures to be implemented during construction and operation: (1) designation of specific areas to maintain and refuel vehicles and equipment, (2) measures for containment and cleanup in the event of a spill or accident, (3) provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse, and (4) a reporting schedule.
- Limit downramping rates to a year-round maximum of 1 inch per hour (when operational control exists).
- Develop an operation compliance monitoring and reporting plan that includes: (1) real-time water surface elevation monitoring of Grant Lake and real-time temperature monitoring within Grant Lake near the intake at a depth of 0.5 meter; (2) real-time flow monitoring in the Grant Creek bypassed reach; (3) real-time flow and temperature monitoring in Grant Creek-downstream of the tailrace; (4) provisions to minimize effects of equipment malfunction on Grant Creek water temperature; (5) a schedule for installing, maintaining, and collecting flow and temperature instrumentation; and (6) reporting of Grant Lake and Grant Creek water temperatures and Grant Lake elevations.
- Adjust intake withdrawal depth on a real-time basis based on the real-time Grant Creek and Grant Lake temperature monitoring to ensure Grant Creek temperature below the tailrace meets the following: (1) for the 30-day period when Grant Lake is going through its ice break-up, Grant Creek temperature be maintained at the temperature recorded in Grant Lake at a depth pof 0.5 meter + 1.0°C (+/- 0.5°C); (2) once the spring turnover is complete and Grant Lake is ice-free, Grant Creek temperatures remain within +/- 0.5°C of Grant Lake temperature measured at a 0.5 meter depth, and (3) the same +/- 0.5°C criterion be maintained when Grant Lake is ice-covered.
- Develop and implement a salmonid spawning gravel monitoring plan, that includes: (1) methods to assess the distribution and abundance of salmonid spawning gravel; (2) spawning gravel assessments in years 1, 10, 15, 20, and 30; and (3) a trend analysis in years 20 and 30 to determine the rate of any spawning gravel reduction and appropriate measures to address any reduction in spawning gravel recruitment; and (4) reporting schedule to include reports after each sampling year.

- Modify the Vegetation Management Plan to also include: (1) locating equipment inspections and/or wash stations well outside of riparian/aquatic zones; (2) treating aquatic invasive plants if any are detected in project waters; (3) monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (4) developing restoration success criteria, based on existing conditions, to determine whether revegetation efforts are successful; (5) developing data collection and analysis methods for monitoring that corresponds with success criteria; (6) monitoring restoration success and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; (7) conducting pre-construction surveys for Forest Service sensitive plants within areas of proposed ground disturbance and consult with the Forest Service if needed to minimize effects on newly identified populations; and (8) obtaining written approval from the Forest Service prior to using herbicides or pesticides on NFS lands.
- Develop a scenery management plan to minimize views of project facilities from the INHT and direct security lighting toward the ground to limit effects of light pollution.
- Install a gate and construct a parking area with a single-unit vault restroom on the project access road, east of the Seward Highway and railroad corridor and west of the access road bridge over Trail Lake Narrows to support non-winter visitor use of the project access road.
- Develop a public access plan to describe locations and identify entities responsible for installing and maintaining infrastructure such as gate(s), parking area, restroom, and signs to manage public access in the vicinity of the project access road between Seward Highway and Grant Lake.
- Revise the HPMP in consultation with the Alaska State Historic Preservation Officer (Alaska SHPO), Forest Service, and other consulting parties to include: (1) the identification of the specific Native organizations that will be consulted and how they will be involved; (2) the addition of Mark Luttrell as a consulting party; (3) a discussion of the methods for conducting the TCP study, which Native organizations were consulted, results of such consultation, and conditions under which Native organizations would continue to be consulted in the future; (4) clarification regarding the survey status of the section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line; (5) a schedule for completion of all HPMP measures; (6) a historic properties monitoring plan that specifies the circumstances under which monitoring would occur, who would conduct the monitoring, how frequently regular monitoring would occur, and how monitoring results would be disseminated and used; (7)

specific factors that would trigger implementation of more active management/mitigation measures to address project-related effects on historic properties over periodic monitoring; (8) a provision to formally evaluate and assess project effects on submerged cultural resources if they are exposed in the future; and (9) documentation and copies of all section 106 consultation throughout the licensing process, including documentation of Alaska SHPO concurrence on the project APE and concurrence with all measures contained within the HPMP (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include valid section 4(e) conditions in any license issued for the project. Thus, the staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) develop an aquatic habitat restoration and monitoring plan; (2) develop a fish migration and monitoring plan; (3) develop a terrestrial and aquatic invasive species management plan; (4) develop a threatened, endangered, proposed for listing, and sensitive species plan; (5) develop a wildlife mitigation and monitoring plan; (6) develop a plan for the INHT access and re-route; and (7) develop a maintenance and operation plan for the re-routed INHT segment and INHT bridge over Grant Creek.

Incorporation of these mandatory conditions into a license would not cause us to modify or eliminate any of the environmental measures that we include in the staff alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity, (2) an explanation of the scope of the cumulative effects analysis, and (3) the analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historical and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[27]

3.1 DESCRIPTION OF THE RIVER BASIN

The proposed project would be located on Grant Creek and Grant Lake, near the community of Moose Pass, Alaska, in the Kenai Peninsula Borough, about 25 miles north of Seward, Alaska. The Kenai Mountain Range with elevations ranging from 4,500 to 5,500 feet surrounds Grant Lake to the east, north, and south. Inlet Creek—the predominant stream in the upper portion of the watershed—drains melting alpine glaciers and snow from the nearby mountains into Grant Lake on its eastern banks. In addition, several intermittent, snowmelt-fed streams drain the steep terrain adjacent to Grant Lake. Grant Creek runs west about 1 mile from the south end of Grant Lake draining into Trail Lake Narrows between Upper and Lower Trail Lakes. Trail River drains Lower Trail Lake, and then flows into Kenai Lake. Kenai Lake drains into the Kenai River at its west end near Cooper Landing. The Grant Lake and Grant Creek Watershed has a total drainage area of about 44 square miles. Grant Lake is located at an elevation of about 703 feet and has a maximum depth of nearly 300 feet, average depth of 91 feet, and surface area of 2.6 square miles. Lands surrounding Grant Lake are primarily NFS lands managed by the Forest Service, Chugach National Forest, with state ownership west of Grant Lake to the Seward Highway and along Grant Creek. Alaska Department of Natural Resources (Alaska DNR) manages the state lands. Limited private ownership of lands (mainly rural residential) occurs in the lower portions of the Grant Creek drainage.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 CFR, section 1508.7), a cumulative effect is the impact on the environment that results from the incremental

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[27] Unless otherwise indicated, our information is taken from the amended final application for license for this project (Kenai Hydro, 2018a) and additional information filed by Kenai Hydro (Kenai Hydro, 2017a,b,c).

impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the amended final license application and agency and public comments, we identified water quantity, water quality, fishery resources, and recreation resources as having potential to be cumulatively affected by the proposed project in combination with other past, present, and reasonably foreseeable future activities.

The following existing actions or activities in the Kenai River Basin may contribute to cumulative effects:

- Mining activities in the Grant Creek Watershed;
- Chugach Electric Association's operation of the Cooper Lake Hydroelectric Project (FERC No. 2170) on Cooper Creek, a tributary to the Kenai River;
- The Forest Service's proposed construction of the INHT, which would cross Grant Creek near the proposed Grant Creek powerhouse.

3.2.1 Geographic Scope

The geographic scope of analysis defines the physical limits or boundaries of the proposed action's effects on the resources. Because the proposed action would affect resources differently, the geographic scope for each resource may vary. We have identified the Kenai River Basin as our geographic scope of analysis for water quantity, water quality, fishery resources, and recreation resources.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and reasonably foreseeable future actions and their effects on water quantity, water quality, fishery resources, and recreation resources. Based on the term of a license, we will look 30 to 50 years into the future, concentrating on the effects on water quality and fisheries from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information. We identified the present resource conditions based on the amended final license application, agency comments, and comprehensive plans.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific cumulative and site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EIS. Based on this, we have determined that water quality and quantity, aquatic, terrestrial, threatened and endangered species, recreation, cultural, aesthetic and socioeconomic resources may be affected by the proposed action and action alternatives. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

Geology

The Grant Lake Watershed is located on the Kenai Peninsula within the Kenai Mountain Range. Metasedimentary[28] and metavolcanic[29] rocks from the Valdez Group (Mesozoic Era) dominate the bedrock geology of the Grant Lake Watershed and the project area. The Valdez Group comprises primarily greywacke, slate, and sandy slates. Grant Creek, the outlet from Grant Lake, flows west about 1 mile from the south end of Grant Lake and into the Trail River between Upper and Lower Trail Lakes. The Trail Lakes Valley is a long, north-trending valley that extends from the town of Seward northward to Upper Trail Lake, and the valley has been called the Kenai Lineament.[30] The Kenai Lineament may represent one of the fault zones that was extensively eroded during the glacial period. The lineament is unlikely to be a major active fault but, rather, a glacial valley whose orientation and location followed the north-northwest trend of the minor fault set observed in other areas. Minor faults and fracture zones are present in the area. Two fracture directions are dominant—one set trends northeast and the other north-

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[28] Metamorphic rock that was first formed through the formation and solidification of sediment.

[29] Metamorphic rock that was first produced by a volcano, either as lava or tephra, and was then was buried underneath subsequent rock and subjected to high pressures and temperatures, causing the rock to recrystallize.

[30] A lineament is a linear geologic feature on the earth's surface, such as a fault.

northwest. Grant Creek follows the most obvious northeast feature, identified as the Grant Creek Fault.

Unconsolidated surficial deposits are relatively rare in the proposed project area. Alluvium[31] is found at the head of Grant Lake in the area between Lower Trail Lake and Kenai Lake within a few of the coves around Upper and Lower Trail Lakes and the small bogs found in the low, bedrock ridges flanking the Trail Lakes Valley. These deposits are typically mixtures of silt, sand, and gravel. Minor sand and gravel deposits are also found at the mouth of Grant Creek and Falls Creek.

Avalanche debris, transported by snow avalanches during the winter and spring, consists of poorly sorted mixtures of cobbles, gravel, sand, and silt found at the base of the major avalanche chutes. Avalanche debris is found on the north shore of Grant Lake where the lake bends to the east. Talus deposits are rare in the proposed project area, despite the steep slopes.

Historically, portions of the project area have been mined for gold. Four mining claims are located on NFS lands on the north side of Grant Lake's lower basin—one along the shoreline and three located uphill from the shoreline claim.

Soils

The soils on the Kenai Peninsula, including in the proposed project area, are derived from glacial and other deposits associated with heavily glaciated alpine mountains. Extensive glacial till deposits are absent in the project area. Minor glacial till deposits may exist at the base of some of the bogs and lakes and within some of the coves along Upper and Lower Trail Lakes. Two exploratory borings in an area of alluvial deposits in the valley on the east side of Upper Trail Lake penetrated 28 feet and 18 feet of soils ranging from sand and silt near the surface to poorly sorted mixtures of cobbles, gravel, sand, and silt at depth. The lower material may represent glacial till or outwash, while the upper material is likely younger stream or lake bed sediment. None of the material is consolidated.

Recent geotechnical investigations show that soils at the site are generally shallow, mantling the glacially scoured bedrock. Along the proposed tunnel alignment, soils are primarily limited to a thin (less than 5 feet) organic silt to sandy silt overlying bedrock. In low-lying areas along the alignment, these soils may be in excess of 20 feet.

Recent alluvial deposits are present near the location of the proposed powerhouse and downstream end of the penstock. Based on proximity to the creek and surface exposures, these soils are likely to consist primarily of gravels and sandy gravels. Organic-rich, fine-grained interbeds, which may also occur in this area, may be in excess of 20 feet thick.

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[31] Alluvium is sand and mud, formed by flowing water and deposited in a river.

Soft, organic-rich, fine-grained deposits are present in low-lying areas south of the proposed powerhouse. These areas have formed peat bogs and may be in excess of 20 feet thick. The currently proposed access road alignments contour around this area.

Mass movements or slope failures, including landslides, rockfalls, avalanches, and slab failure, are possibly the result of seismic activity. The rock cliffs along Upper Trail Lake from the east could be a source of small rockfalls, triggered either by seismic activity or seasonal freeze-thaw. Examination of the many cliffs in the area, however, suggests a high degree of stability.

Seismic Hazards

Potential seismic hazards at the proposed project area include vibratory ground motion, ground rupture, seismically induced slope failure, and seiche. The megathrust zone beneath southern Alaska and a random crustal event caused vibratory ground motion. Random crustal events potentially could occur anywhere. Based on all known sources of earthquakes that were close enough to the proposed project area to have significant effects, the estimated maximum credible earthquake for a random crustal event was assigned a magnitude of 6.0, a conservative upgrade from the maximum recorded magnitude of 5.5. The maximum calculated acceleration at the site is 0.40 gravity from the random crustal event and 0.37 gravity from the 1964-type Aleutian Arc megathrust.

Return periods for these maximum earthquake events were established using historical and instrumental earthquake data. With a return period of more than 160 years, the likelihood of another 1964-type event on the megathrust is considered low for the life of the project, and with a recurrence interval of 50 to 100 years and a low probability of such an event occurring in the proposed project area, the likelihood of a large, random crustal event is moderate to high.

No known active faults cross the proposed project site, no evidence of seismic events is present at the site, and no geologic data have been found to suggest the presence of active faulting. Ground rupture is not considered to be a hazard for the site.

One of the most common features associated with moderate-to-large magnitude earthquakes is slope failure. Triggered by ground motion, unstable slopes can fail. Slope failure can be broadly classified into landslides, rockfalls, avalanches, and slab or tumbling failures of rock faces. Little material in the project area would be susceptible to landslides during seismic events. No evidence was found for the occurrence of major landslides or of their deposits.

Rockfalls from the steep cliffs could occur during seismic shaking. Some evidence of minor rockfalls has been found in the area, but the triggering mechanism is unknown. The rock cliffs along the Upper Trail Lake Valley on the west slope below Grant Lake are a potential source of rockfalls. A second rockfall area has been identified on the steep slopes south of the proposed powerhouse location. The hazard is located near the proposed access road to the intake structure.

Seismically induced avalanches could occur in the mountains above the project; however, the topography around the proposed project facilities does not appear to be subject to a hazard from avalanche.

Slab or tumbling failure of rock faces during seismic events is common in areas of unstable rock slopes. The western shore of Grant Lake is particularly susceptible to rock slope failures because the slopes are steeply dipping slopes of bedrock. Data from the early 1980s suggest that bedding-plane slides have already occurred in this location.

Seiches are lake waves formed by water sloshing back and forth resulting from the ground shaking during seismic events or the catastrophic inflow of material by slope failures around the lake's rim. Several areas surrounding Grant Lake could be sources of earth or avalanche material for mass movements into Grant Lake, potentially generating seiche waves. Fieldwork conducted in 1984 did not reveal any areas along the shoreline of Grant Lake where wave damage above normal high water levels was noted. This observation suggests that significant wave run-up did not occur during the 1964 earthquake. Further, the volumes of material that could enter Grant Lake are probably not sufficient to generate very large seiche waves.

Shoreline Erosion Potential

Element Solutions (2014) conducted a geomorphic study of Grant Lake and Grant Creek that included an inventory and evaluation of shoreline conditions that affect erosion potential around Grant Lake. For this analysis, several geomorphic units—alluvial deltaic deposits, alluvial fan deposits, beach/littoral[32] deposits, colluvial[33] deposits, landslide deposits, and bedrock—were established.

The study found that, currently, wind-generated waves are likely the predominant erosional process acting on the Grant Lake shoreline. An overlay of relative wind fetch[34] potential was applied to a map of the reservoir with the rationale that larger waves had more energy and were more effective at eroding the shoreline area than smaller waves. Field observations of wave run-up potential were made during the boat-based survey and documented with photographs. The geomorphic units were integrated with the fetch parameters to determine relative erodibility (table 3-1).

[32] Related to or situated on the shore of the sea or a lake.

[33] Material that accumulates at the foot of a steep slope.

[34] The length of water over which a given wind has blown.

Table 3-1. Relative erodibility integrating erosion susceptibility with wave energy potential (Source: Element Solutions, 2014).

Relative Fetch Distance	Geomorphic Unit					
	Alluvial Deltaic	**Alluvial Fan**	**Beach**	**Colluvium**	**Landslide (bedrock)**	**Bedrock**
Short	Moderate	Moderate	Moderate	Low	Low	Low
Medium	Moderate–high	Moderate–high	Moderate–High	Moderate–low	Moderate–low	Low
Long	High	High	High	Moderate	Moderate	Low

The Grant Lake shoreline geomorphology is influenced by climate and seasonal variability. The lake remains ice-free for about half of the year. During the ice-free period, the water surface elevation fluctuates in response to snowmelt, glacial melt, and precipitation. Wind-generated wave processes erode, rework, deposit, and transport sediment in the littoral zone during the ice-free periods. The narrow confined valleys flanking the lake control wind direction and intensity. Wind direction from east or west has the greatest effect on the upper lake basin, but this wind direction has little effect on the lower lake basin. Conversely, wind directions from north or south have the greatest effect on the lower lake basin and only negligible effect on the upper lake basin. Because the lake orientation is divided by a 90-degree "bend" about mid-point, the effective maximum fetch is only about 3 miles. The largest wind-generated waves are at the shorelines at the end of the fetch runs. The near-shore bathymetric conditions also affect wave height and run-up potential.

The highest water surface elevations typically occur in the summer when snowmelt and precipitation probability are highest or episodically in the fall when transient snow and precipitation occur. Grant Lake's outlet elevation (703 feet) and high rainfall events and snowmelt from the watershed affect the lake's water surface elevation. The maximum water surface elevation of Grant Lake is about 703 feet. The ordinary high water mark has apparent elevation increases where wind-generated wave run-up occurs, including at the outlet at Grant Lake.

Grant Lake's water surface elevation is lowest in the winter when the watershed is frozen, virtually halting hydrologic input. When the lake is frozen, the effect of wind-generated waves is likely negligible, except when the ice breaks up.

Grant Creek Spawning Substrate and Sediment Transport

Element Solutions (2014) also conducted a spawning substrate recruitment study of Grant Creek as part of the geomorphic study to provide a basis for predicting and assessing potential changes to material movement, sedimentation, and gravel recruitment that may occur in with proposed operational management, especially the long-term maintenance of fish spawning substrate. The spawning substrate study combined quantitative and qualitative elements.

The geomorphic study focused on the potential effects on the spawning-size range of sediment. Species of concern documented to use Grant Creek for spawning include Chinook salmon, sockeye salmon, coho salmon, rainbow trout, and Dolly Varden. The preferred spawning sediment size classes for these species typically range from 5 to 50 centimeters with rainbow trout preferring the smaller substrate range and Chinook the larger.

For the spawning substrate recruitment study, Element Solutions (2014) divided Grant Creek into six reaches from the Trail Bridge to Grant Lake and then further divided the creek into three generalized geomorphic channel form reaches—Reaches 5 and 6 (Canyon Reach), Reaches 2 through 4 (Anastomosing[35] Reach), and Reach 1 (Alluvial Fan Distributary[36] Reach).

Reaches 5 and 6 consist of a confined bedrock channel and the primary source of sediment recruitment for Grant Creek. The channel in this reach is steep and bedrock-lined with limited sediment storage, both in volume and temporal duration. Most sediment is stored in sediment wedges formed behind boulder obstructions. Extremely high flows are capable of mobilizing these wedges and typically the channel cuts deeper (incision) into the bedrock.

Reaches 2 through 4 are within the partially confined alluvial plain and typically result in deposition in the channel with periods of channel cutting occurring during low sediment input rates. Loss in hydraulic confinement and a change in gradient allow for sediment deposition within these reaches when sediment input rates are high and transport capacity is low. The channels and bedforms[37] in Reaches 2 through 4 are sensitive to changes in flow regime and sediment load. Loss of side channel connectivity results in a single thread channel, decreasing hydraulic complexity, concentrating stream power, and often resulting in increased channel incision.

Reach 1 experiences horizontal and vertical channel movement and sediment deposition. Distributary channel networks that disperse flow to Lower Trail Lake and Trail Lake Narrows are accessed at a wide range of flows. Reach 1 is likely the most

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[35] The Anastomosing Reach consists of branching channels.

[36] A distributary is a stream or channel that branches off and flows away from a main stream channel and does not return to the main channel.

[37] A bedform is a morphological relief feature formed by the interaction between flow and small obstacles on the bottom of a stream bed consisting of movable (alluvial) sediment materials.

dynamic reach in Grant Creek with respect to horizontal and vertical channel movements and avulsions.[38] The reach is very sensitive to disturbances, particularly sediment supply and flow regime changes. Hydraulic complexity in Reach 1 is less complex than in Reaches 2 through 4, and it is probable that there is a slight hydrologic loss experienced in this reach.

Reaches 2 through 4 likely provide the greatest overall ecological function and salmonid productivity relative to the other reaches. The rationale for this hypothesis is that these reaches have: (1) the greatest hydraulic complexity, (2) the greatest wetted channel length at moderate flows, (3) a more balanced wetted perimeter to depth at moderate flows, (4) a higher probability of maintaining low and hyporheic[39] zone connectivity in the winter, (5) more stability than Reach 1, and (6) lower velocity and stream power than Reaches 5 and 6.

A small amount of suspended and dissolved sediment load from the upper watershed reaches Grant Creek; however, Grant Lake arrests all bedload sediment transport from the upper watershed area. Therefore, the sediment supply for Grant Creek, excluding the throughput suspended sediment load, comes from Reaches 5 and 6. With the majority of the sediment source for Grant Creek being derived from the canyon walls, the geological formations present along this length of stream channel play a critical role in generating bedload sediment. The primary process for generating new bedload sediment in Grant Creek is the erosional forces that incise the canyon, causing wall undermining and mass wasting (rockfall) from the canyon walls, and exposing the geology to freeze-thaw and other surface erosion processes. As presented below in section 3.3.2.1, table 3-4, recorded flows in Grant Creek have ranged from 6 to 2,140 cfs. Analysis by Alaska DFG and Kenai Hydro resulted in the Kenai Hydro's determination that a flow of 800 cfs or greater would provide flows capable of mobilizing sediment in Reaches 5 and 6.

Although Grant Creek within the alluvial plain exhibits net deposition over time, under "normal" hydrologic conditions, it is a supply limited stream, meaning that the sediment transport capacity of the stream is greater than the sediment supply to the stream. A supply limited stream tends to migrate less laterally and vertically than a transport limited stream, and channel form is more "stable." Supply limited streams also tend to be armored, incised, and exhibit a straight versus meandering channel form.

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[38] Avulsion is the rapid abandonment of a river channel and the formation of a new river channel. Avulsions occur as a result of channel slopes that are much less steep than the slope that the river could travel if it took a new course.

[39] The hyporheic zone is the saturated interstitial areas beneath the streambed and into the banks that contain some channel water.

Of the three geological formations present along the creek channel, the greywacke is the most resistant rock type, whereas the sandy slate and slate are more friable and tend to supply the majority of sediment to the streambed.

The sediment being recruited to Grant Creek is angular with the slate having a "platy" particle morphology and the greywacke having long "blocky or brick-like" particle morphology. Angular sediment also transports across the channel bed (rolling and bouncing) and entrains differently than does rounded sediment. The particle morphology of Grant Creek likely increases the armoring qualities of the bed and thus adds to the overall stability of the channel form.

The cycle of melting snow and precipitation in the summer and frozen watershed conditions in the winter are the predominant drivers of hydrology in Grant Creek. The bankfull and peak flows dominate the fluvial geomorphic processes of Grant Creek. The streambed comprises large sediment particles and the bed is armored, so only the larger flows are able to mobilize the bed armoring, transport sediment en masse, and reorganize bedforms. Snowmelt conditions offer the sustained flows, allowing for a longer duration of time in which to organize the substrate, construct and arrange the geomorphic channel bed structures, and allow channel form development.

3.3.1.2 Environmental Effects

Construction Effects on Geology and Soils

Project construction has the potential to cause erosion and overland sedimentation that could affect water quality in Grant Lake, Grant Creek, and Trail Lake Narrows between Upper and Lower Trail Lakes. Kenai Hydro would construct the project intake structure in Grant Lake near the natural outlet of the lake that allows flow into Grant Creek. Kenai Hydro proposes to construct the following project elements:

- bypassed reach weir at the outlet of the lake;
- powerhouse and powerhouse parking area;
- powerhouse tailrace and fish exclusion weir adjacent to Grant Creek;
- powerhouse access road;
- powerhouse access road and a road bridge to cross Trail Lake Narrows; and
- intake access road, which would extend from the powerhouse access road near the powerhouse to the intake structure at Grant Lake.

In addition, Kenai Hydro proposes to re-route the INHT to move it away from the location of the powerhouse and associated structures, which Kenai Hydro proposes to locate just outside the 100-foot easement of the currently planned route for the INHT. The path of the re-routed INHT would deviate from the current route about 1,250 feet north of Grant Creek, proceed along a 4,102-foot-long path to Grant Creek about 1,000 feet west of the proposed powerhouse, across a new footbridge over Grant Creek, and proceed along a 4,277-foot-long path from Grant Creek to Vagt Lake at the point where the current planned INHT path would reach Vagt Lake. The proposed re-route of the trail would require an additional 6,870 square feet (0.15 acre) of permanently disturbed ground area.[40]

Kenai Hydro proposes to develop and implement an ESCP that would include measures to minimize erosion and sediment deposition during construction, but does not describe any specific measures for inclusion in the plan. Kenai Hydro proposes a global adherence to unspecified BMPs used in conjunction with all project construction and operation activities. Kenai Hydro proposes to develop a series of monitoring and management plans after a license is issued to ensure that construction and operation of the project do not change or adversely affect existing processes associated with erosion and sediment deposition.

Kenai Hydro also proposes to construct a cofferdam around the intake structure site so that construction could take place in the dry to reduce the potential for sediment transport into the lake.

Following completion of construction of project structures, Kenai Hydro proposes to revegetate remaining open areas disturbed by construction as outlined in the proposed draft Vegetation Management Plan. The plan includes specifications for revegetation, monitoring of revegetated plants, and maintenance of revegetated areas to ensure successful revegetation, which would also reduce or eliminate the potential for erosion in those areas. Section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* presents a detailed discussion of the Vegetation Management Plan. Finally, Kenai Hydro states it would restore all temporarily impacted areas associated with project construction back to "natural" conditions. Although it is not anticipated that these areas would be numerous or cover a large area, examples of areas to be restored may include temporary laydown areas for infrastructural materials or parking/pull-out areas for construction equipment. Kenai Hydro would refine the list of restoration areas as construction neared conclusion and review plans with stakeholders prior to conducting restoration activities.

Alaska DFG 10(j) recommendation 13 and FWS 10(j) recommendation 14 recommend Kenai Hydro develop an ESCP that would include the following: (1) soil, groundwater and vegetation conditions; (2) preventive measures based on site-specific conditions; (3) location of areas for storage or deposition of removed overburden including erosion control to be used in those areas; and (4) prescriptions for revegetation of all disturbed areas, including location of treatment areas, plant species and methods to be used; and (5) implementation schedule.

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[40] This corresponds to an 18-inch-wide trail surface for a Forest Service Trail Class 3 but does not include the clearing of high vegetation to provide the desired trail corridor width and height clearances for the proposed trail uses (pedestrian/hiking, bicycling, and pack and saddle/equestrian).

The recommendations also suggest that Kenai Hydro pay particular attention to about 500 feet of access road east of Trail Lake Narrows, where private property necessitates construction of the road and transmission line corridor within 100 feet of Grant Creek. Because this section of road would also be constructed adjacent to Trail Lake Narrows, it is assumed that the agencies' concern also applies to Trail Lake Narrows. The plan would be required to include provisions for bank stabilization and ongoing monitoring along this section of the road and transmission line corridor.

The agencies also recommend that Kenai Hydro prepare the plan after consultation with Alaska DFG (Alaska DFG recommendation), FWS (Interior recommendation), and other requesting agencies.

Forest Service final 4(e) condition 19 specifies that Kenai Hydro add the development of an ESCP to its list of plans, but provides no details. However, in its comments in response to the Ready for Environmental Analysis notice filed with the 4(e) conditions, the Forest Service provides details of what the plan would entail.[41] The Forest Service would require that within 1 year following the date of license issuance and at least 90-days prior to any land-disturbing activity, Kenai Hydro file a plan that is approved by the Forest Service to control erosion, stream sedimentation, dust, and soil mass movement consistent with the standards and guidelines of the Chugach National Forest Land Management Plan (USDA, 2002), *Soil and Water Conservation Handbook* (USDA, 2006), and the *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA, 2012). Upon Commission approval, Kenai Hydro would implement the plan, which would be based on actual site geological, soil, surface water and groundwater conditions and include: (1) a description of the actual site conditions, including any existing erosion or sedimentation problems from roads, stream crossings, trails, or other facilities; (2) detailed descriptions, design drawings, and specific topographic locations of all control measures; (3) measures to divert runoff over disturbed land surfaces, including sediment ponds at the diversion and powerhouse sites; (4) revegetation of areas outside the roadbed; (5) measures to dissipate energy and prevent erosion at the tailrace; (6) a monitoring and maintenance schedule; and (7) any other measures the Forest Service, and Kenai Hydro mutually identify as needing care to ensure resource protection. The plan and erosion control measures would comply with the *Soil and Water Conservation Handbook* (USDA, 2006), and *National Best Management Practices for Water Quality Management on National Forest System Lands* (USDA, 2012). Erosion control measures would be designed to retain the appearance of the surrounding area where practicable.

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[41] We anticipate any final 4(e) conditions from Forest Service would include the detailed description of an ESCP included in the comments section of the Forest Service's Ready for Environmental Analysis letter. Therefore, we analyze the detailed plan as a 10(a) recommendation.

Forest Service final 4(e) condition 19 specifies that Kenai Hydro add the development of a spoils disposal plan to its list of plans but provides no details. Forest Service final 4(e) condition 19 also specifies that Kenai Hydro add the development of a construction plan to its list of plans, but it did not provide any details.

Our Analysis

Construction of the intake structure access road and adjacent project components would require permanent ground disturbance of about 3.44 acres of land. Construction of the powerhouse, work area, penstock, detention pond, tailrace, and the buffers surrounding these structures would require the permanent ground disturbance of about 0.92 acre of land. Construction of the powerhouse access road and transmission line corridor would require the permanent ground disturbance of 4.06 acres of land between Seward Highway and the powerhouse.

In addition, Kenai Hydro would use about 1.46 acres for stockpile storage, laydown areas, and temporary parking areas for construction and vehicles. Table 3-2 provides the size of these areas.

Table 3-2. Areas temporarily disturbed by project construction (Source: Kenai Hydro, 2018a).

Area	Location Description	Approximate Size
Bridge crossing	Located on the north side of the powerhouse access road (Station 13+00) and on the west bank of the bridge crossing.	9,000 square feet/ 0.20 acre
Powerhouse access road	Located on the south side of the powerhouse access road at about Station 35+50.	17,500 square feet/ 0.40 acre
Powerhouse	Located on the west side of the powerhouse and bordered by the powerhouse access road (Station 51+00), this area would remain outside the streambank protection zone. At the conclusion of construction, this area would become the powerhouse parking lot.	27,000 square feet/ 0.62 acre
Intake access road	Located at the second switchback of the intake access road (Station 17+00). Sufficient space for the stockpile storage and parking area on both the north and south sides of the access road.	5,600 square feet/ 0.13 acre
Intake access road	Located on the north side of the intake access road at Station 42+00.	1,500 square feet / 0.03 acre
Intake	Located on the north side of the intake access road at Station 58+50.	3,600 square feet / 0.08 acre

Kenai Hydro does not provide any detail about what measures it would include in its proposed ESCP. Therefore, we cannot determine whether the proposed plan would reduce the potential for erosion and sediment transport to adjacent waterways in conjunction with the construction of the project structures and roadways. However, the Forest Service recommends provisions for the plan, which would define areas to be remediated and provide more detail about the methods to be used to remediate the areas. The additional provisions listed in the Forest Service's comments on the amended final license application would dovetail with the details provided by Alaska DFG and FWS and provide further detail for the plan. The Forest Service lists guidance documents to be considered in the development of the plan and requires design drawings for soil erosion and control measures and location maps to identify where those measures would be employed.

Kenai Hydro proposes to re-use excavated materials as part of the construction, including re-using excavated rock that is then crushed and applied to road surfaces and top soil applied to disturbed areas for revegetation.

We expect the spoil disposal plan for the project: (1) means and methods used to dispose of any materials excavated during construction, (2) mapped locations of any proposed temporary and/or permanent spoil pile locations, (3) descriptions of the material composition of any materials expected to be excavated on the site and appropriate uses of such materials for construction, (4) proposed use of excavated materials in the construction process, (5) any plans to dispose of materials offsite, (6) methods to be employed to prevent spoil materials from leaching from spoil piles into adjacent waterways and wetlands, and (7) identification of other resource-specific protection plans that should be considered during construction activities.

The following components should adequately protect aquatic and terrestrial resources if included in a construction plan for the project: (1) a detailed construction schedule; (2) a description of construction methods and BMPs to be employed including measures to reduce the risk of introduction or spread of invasive plants; (3) requirements to delineate construction areas using fencing and/or flagging; (4) identification of measures to avoid streams, wetlands, and pond habitats to the extent possible during construction; (5) provisions for environmental training of construction staff regarding laws, regulations, and BMPs to avoid or reduce effects on native plant and wildlife and their habitats; and (6) identification of other resource-specific protection plans that should be considered during construction activities. Developing a construction plan, as Forest Service final 4(e) condition 19 specifies, would ensure, for example, that measures to prevent erosion are not planned within protective buffers and during limited operating periods devised to protect nesting birds. Because soil disturbance would not occur within the protection buffers during the limited operation period, it would be appropriate to limit construction of erosion protection measures in these areas to periods outside of the nesting season. Such a plan would also facilitate agency review of proposed measures and aid communication with contractors and construction staff.

Kenai Hydro's proposed water quality monitoring during construction that includes turbidity monitoring and monitoring of erosion and sediment control measures in place during construction should address any concerns related to effects of project construction. Therefore, we do not see the need for additional monitoring and management plans related to project construction.

Operation Effects on Geology and Soils

Project operation effects on geology and soils would occur from lake level fluctuations on Grant Lake, flow fluctuations in Grant Creek, use and maintenance of the project access roads, and maintenance of the transmission line right-of-way (ROW).

Lake Level Fluctuations

Kenai Hydro proposes to maintain the level in Grant Lake between elevation 690 and 703 feet. As discussed above in section 3.3.1.1, Geologic and Soil Resources, Affected Environment, the shoreline around Grant Lake is currently subject to rockslides, rockfalls, and wind-driven erosion. Under existing conditions, Kenai Hydro estimates that lake levels are at their maximum (estimated elevation 703) during June through September.

Grant Lake's water surface elevation typically fluctuates 6 to 8 feet over the course of a year and may fluctuate as much as 11 feet (692–703 feet). The lake is generally at its maximum elevation from June through September. Under proposed operation, the lake level fluctuation could be up to 13 feet (690–703 feet). Project operations would draw down the lake during the fall and winter and allow it to refill in the spring and summer, returning to normal maximum elevation by mid-August.

Kenai Hydro proposes no measures related to shoreline erosion, and none of the resource agencies recommend measures.

Our Analysis

Proposed operation would reduce lake levels in the winter when ice may be in place and when wave and stream erosion processes are less active. The shoreline at and below elevation 703 feet predominantly consists of bedrock or coarse, angular boulders with a low susceptibility to erosion. Proposed operation would reduce the period that the lake level is at one elevation, especially peak lake levels, which would decrease the frequency of wave events occurring at any one elevation and reduce the effects of wave erosion at any one elevation along the shoreline. Therefore, no additional measures are warranted.

Flow Effects on Sediment Transport

Flows in the bypassed reach would vary over the course of the year, and the flows in the upper reaches (Reaches 5 and 6) of Grant Creek would be lower than flows in the lower reaches (Reaches 1 through 4) of Grant Creek (downstream of the powerhouse tailrace) in accordance with minimum flow requirements for the project. Reduced flows in Reaches 5 and 6 are expected to reduce the amount of gravel recruitment in Grant Creek and, therefore, are likely to diminish the quantity and quality of spawning habitat over time.

Our Analysis

Reduced flows in the bypassed reach resulting from project operation would likely degrade substrate quantity and quality as a result of: (1) an increased coarsening of surface bedload sediment as sediment supply decreases from Reach 5 and as smaller surface sediment is transported out of the reach by operational flows; (2) increased armoring and pavement depth as subsurface fines are mobilized and washed out; (3) decreased geomorphic channel form complexity (loss of side-channel and floodplain connectivity, and development of a single-thread channel) resulting from decreased sediment supply that would increase primary channel incision and stream velocity; and (4) decreased quantity of channel bedforms resulting from decreased sediment supply and decreased sediment transport with the reduce flow regime in Reaches 5 and 6. Because these geomorphic changes primarily affect aquatic habitat, these changes are discussed and analyzed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*. Kenai Hydro's proposed 800-cfs channel maintenance flow releases are also discussed and analyzed in that section.

Use and Maintenance of Project Roadways and the Transmission Line Right-of-Way

Kenai Hydro would use the powerhouse and intake structure access roads periodically, but infrequently, to monitor project operation and to maintain project structures, including the project roads and transmission lines. Kenai Hydro proposes to maintain these roads, including plowing during the winter. Plowing could result in related erosion along the roadway shoulders, runoff, siltation, and turbidity in adjacent or nearby wetlands and streams.

To address potential effects of road and transmission line maintenance, Kenai Hydro proposes to develop an ESCP for construction and operation of the project. Alaska DFG and FWS recommend and the Forest Service (final 4(e) condition 19) specifies that Kenai Hydro develop an ESCP.

Our Analysis

Implementation of the ESCP for the project discussed in section 3.3.1.2, in the *Construction Effects* subsection, coupled with maintenance of the project roadways during project operation, should ensure that the project roadways do not cause erosion and sediment transport to Grant Lake, Grant Creek, wetlands, or streams. Maintenance of the transmission line would likely involve vegetation cutting or clearing to allow access and ensure adequate electrical clearance below and around the lines. Much of the line corridor parallels proposed roadways, so access for line maintenance could be accomplished by vehicles on the roads in most places; therefore, we expect effects on geology and soils during these maintenance activities would be minimal.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

Grant Lake is a 1,741-acre waterbody created by glacial activity. It encompasses two almost separate bathymetric lake basins, which are separated by a shallow submerged ridge near the lake's midpoint. Grant Lake has a gross storage volume of 260,120 acre-feet at the normal mean water surface elevation of 703 feet, a mean depth of about 91 feet, and a maximum depth of 283 feet in the upper basin and 262 feet in the lower basin. The lake is primarily fed by snowmelt and additional runoff from the Kenai Mountain Range. Inlet Creek, the predominant feeder stream in the upper portion of the watershed, drains melting alpine glaciers and snow from the nearby mountains into Grant Lake. At its natural outlet, Grant Lake drains an area of about 43 square miles.

Alaska Power Authority, now Alaska Energy Authority, studied seasonal water level fluctuations from January 1982 through December 1983. The maximum difference in water surface elevation observed during the 2-year study period was a 5.3-foot decrease from the normal mean water surface elevation of 703 feet. The greatest inter-monthly changes occurred during ice breakup and snowmelt from late March through late June, with an average lake elevation increase of 0.8 foot per month. Maximum lake elevations were observed in July, with decreasing water levels averaging 0.33 foot per month in the fall and winter (Ebasco, 1984).

From Grant Lake, Grant Creek flows west for 1 mile, draining into Upper and Lower Trail Lakes. Just above its confluence with Upper Trail Lake and Lower Trail Lake, Grant Creek has a mean annual flow of 206 cfs, and average monthly flows range from a low of 33 cfs in March to a high of 503 cfs in July. Table 3-3 presents a summary of gage[42] information used to develop the synthetic streamflow record for Grant Creek. Table 3-4 provides composite mean monthly and annual discharge data for Grant Creek that represents 66 years of daily streamflow data from 1948 through 2013.

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[42] The final license application, proposed mitigation plans, and agency recommendations use several naming conventions for gages that were used during licensing studies and proposed gages for monitoring. It is our understanding that proposed gage GC100 would be in the same location as GC100 and GC200 would be in the same location as GC200. For consistency, we use the GC naming convention for all gages in Grant Creek.

Table 3-3. Streamflow gage information for gages used in developing the synthesized flow record for Grant Creek.

Gage Name (Number)	Drainage Area	Dates Operational	Flow (cfs) Mean	Max.	Min.
U.S. Geological Survey (USGS) Grant Creek near Moose Pass (15246000)[a]	43.8	September 1, 1947, to September 30, 1958	192	2,140	11
Ebasco GC200 (GC200)[b]	43.8	January 1, 1981, to December 31, 1983	268	602	18
Kenai Hydro GC200 (GC200)[c]	43.8	April 3, 2013, to present[d]	279	1,005	16

[a] USGS (2018)

[b] GC200 data were taken from the amended final license application.

[c] USGS (2018)

[d] Data only available through 2013.

Table 3-4. Minimum, maximum, and mean monthly and annual synthesized flow values for Grant Creek 1948–2013 (Source: Kenai Hydro, 2018a).

Month	Minimum Flow (cfs)	Mean Flow (cfs)	Maximum Flow (cfs)
January	12	52	326
February	11	43	227
March	6	33	116
April	13	36	160
May	17	146	566
June	102	409	2,140
July	210	503	1,210
August	173	444	1,383
September	65	367	1,731
October	45	233	1,295
November	28	123	851
December	18	73	570
Annual	6	206	2,140

Water levels can fluctuate in Grant Lake between the normal mean water surface elevation of 703 feet and the minimum water surface elevation of 690 feet; however, water surface elevations more typically fluctuate between 698 feet and 703 feet. Grant Lake's highest water surface elevations occur during the summer when snowmelt and precipitation are highest, and its water surface elevation is lowest during the winter when the watershed is frozen.

Water Quality

Water Quality Standards

Designated uses of a waterbody and criteria to protect those designated uses are defined by Alaska DEC's water quality standards provided in 18 Alaska Administrative Code 70 (Alaska DEC, 2018). Alaska's list of impaired or 303(d) listed waterbodies lists any waterbodies within Alaska that do not meet applicable water quality standards. The most recent EPA-approved 303(d) list does not include any waterbodies in the project area (Alaska DEC, 2010). Water quality standards applicable to surface waters in the project area are summarized below (table 3-5).

Table 3-5. Alaska DEC water quality standards applicable to the project area (Source: Alaska DEC, 2018).

Constituent	Water Quality Standards
Color	Color or apparent color may not reduce the depth of the compensation point for photosynthetic activity by more than 10% from the seasonally established norm for aquatic life. For all waters without a seasonally established norm for aquatic life, color or apparent color may not exceed 50 color units or the natural condition, whichever is greater.
Temperature	May not exceed 20 °C at any time. The following maximum temperatures may not be exceeded, where applicable: • Migration routes—15°C • Spawning areas—13°C • Rearing areas—15°C • Egg and fry incubation—13°C For all other waters, the weekly average temperature may not exceed site-specific requirements needed to preserve normal species diversity or to prevent appearance of nuisance organisms.
Dissolved gas	Dissolved oxygen (DO) must be greater than 7 milligrams per liter (mg/L) in waters used by anadromous or resident fish. In no case may DO be less than 5 mg/L to a depth of 20 centimeters in the interstitial waters of gravel used by anadromous or resident fish for

Constituent	Water Quality Standards
	spawning (see note 2). For waters not used by anadromous or resident fish, DO must be greater than or equal to 5 mg/L. In no case may DO be greater than 17 mg/L. The concentration of total dissolved gas may not exceed 110% of saturation at any point of sample collection.
pH	May not be less than 6.5 or greater than 8.5. May not vary more than 0.5 pH unit from natural conditions.
Turbidity	May not exceed 25 nephelometric turbidity units (NTU) above natural conditions. For all lake waters, may not exceed 5 NTU above natural conditions.
Fecal coliform	In a 30-day period, the geometric mean of samples may not exceed 126 *Escherichia coli* (*E. coli*) colony forming units/100 milliliters, and not more than 10% of the samples may exceed a statistical threshold value of 410 *E. coli* colony forming units/100 milliliters.

Note: Applicable standards are based on those for fresh water Class C—growth and propagation of fish, shellfish, other aquatic life, and wildlife.

In addition to the above, standards for mercury and lead are relevant to the water quality sampling conducted by Kenai Hydro. Freshwater acute and chronic standards for mercury are 1.4 micrograms per liter (µg/L) and 0.77 µg/L, respectively (Alaska DEC, 2008).[43] Acute and chronic standards for lead are a function of hardness, either measured directly or calculated from calcium and magnesium concentrations (Alaska DEC, 2008). Lower hardness leads to greater susceptibility of fish and aquatic organisms to a given lead concentration, and thus lower acute and chronic criteria.

Based on an average hardness of 37 milligrams per liter (mg/L) (range of 33 mg/L to 41 mg/L) throughout all sampling events (including Grant Creek, Grant Lake, and Trail Lake Narrows), we calculated freshwater acute and chronic standards for lead applicable to Kenai Hydro's sampling data: 21.6 µg/L and 0.84 µg/L, respectively. The latter are based on 20 hardness values, including 13 reported laboratory measurements and 7 calculated based on calcium and magnesium concentrations. We note this differs

[43] Per Alaska ADEC (2008), acute criteria are based on the average concentration of chemical pollutants during a 1-hour period, while chronic criteria are based on the average concentration of chemical pollutants during a 4-day period. Chronic criteria are typically stricter than the acute criteria and are therefore used to protect ambient waters. Acute and chronic criteria are used together to develop water quality-based effluent limits.

slightly from lead standards reported by Kenai Hydro: 16.4 μg/L (acute); 0.64 μg/L (chronic) (Kenai Hydro, 2016).

The Alaska DEC 2014/2016 Integrated Water Quality Monitoring and Assessment Report (known as the 303(d) report), includes Grant Creek as a Category 3 Waterbody, for which "there are insufficient or no data or information to determine if the WQS are attained" (Alaska DEC, 2017). We summarize existing water quality and temperature data for Grant Creek and Grant Lake below, including a comparison to state standards where possible.

Water Quality Sampling

Kenai Hydro collected grab samples for laboratory analysis and *in situ* water quality measurements at two sites in Grant Lake, one near the proposed intake (GLTS), and the other near the lake outflow (GLOUT). Three sites were sampled in Grant Creek (GC100, GC200, GC300), and one site near Trail Lake Narrows. Grant Creek sites were all located downstream of the Canyon Reach and the proposed powerhouse location. Table 3-6 depicts the timing and frequency with which Kenai Hydro performed water quality sampling, and figure 3-1 shows locations of the sampling sites in the project area. We summarize results of Kenai Hydro's water quality sampling of Grant Lake, Grant Creek, and Trail Lake Narrows below. Water temperature monitoring results are discussed separately later in this section.

Table 3-6. Water quality sampling events at Grant Creek and Grant Lake sites, 2009–2013 (Source: staff).

Site	June 2009	August 2009	June 2010	June 2013	August 2013	September 2013
GLTS	✓	✓	✓		✓	
GLOUT	✓	✓	✓		✓	
GC300	✓	✓	✓		✓	
GC200	✓	✓	✓		✓	
GC100	✓	✓	✓		✓	
TLN				✓	✓	✓

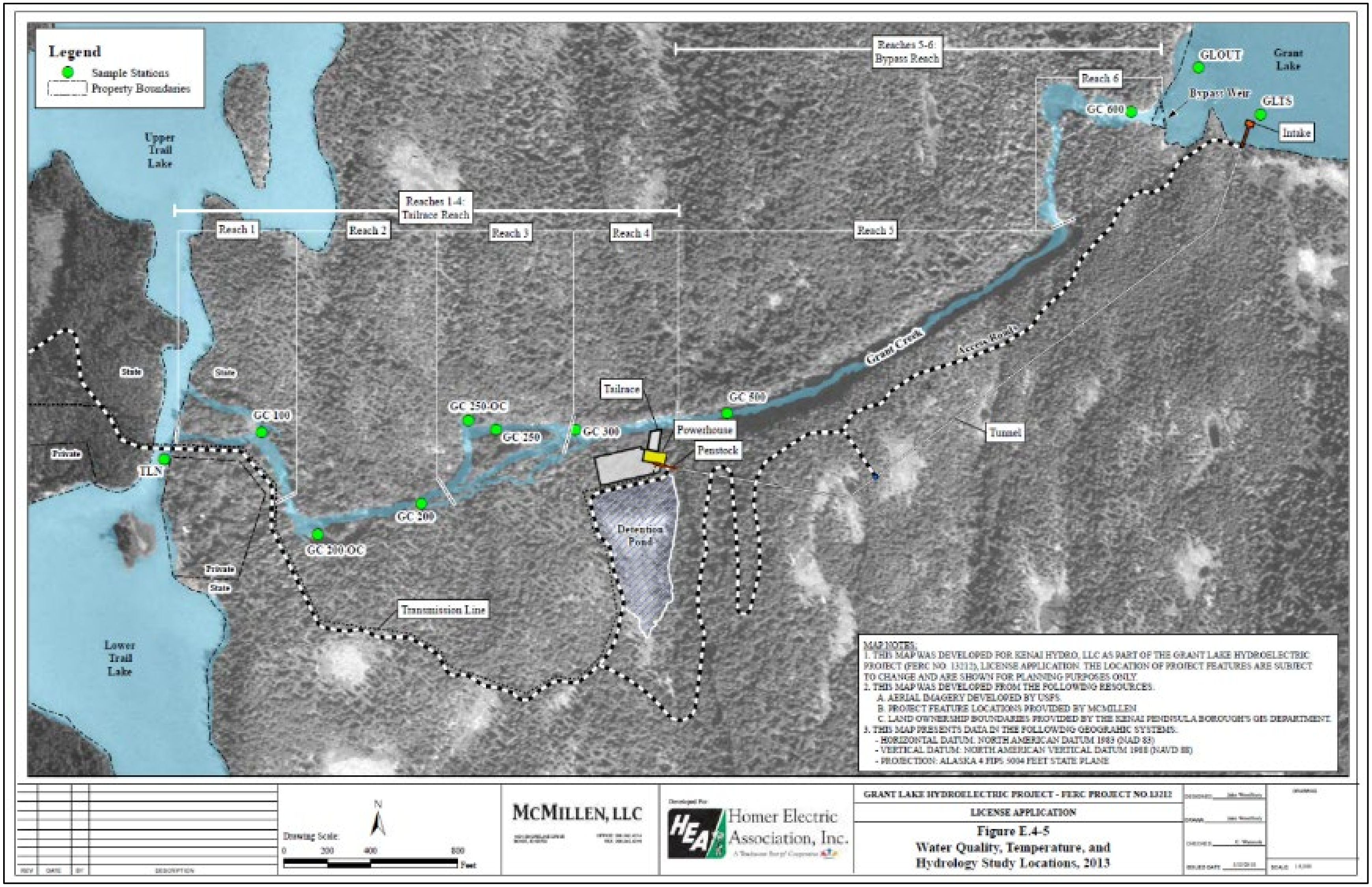

Figure 3-1. Water quality/water temperature study locations (Source: Kenai Hydro, 2018a, as modified by staff).

Grant Lake—Kenai Hydro sampled Grant Lake at site GLTS, representing conditions of the lower basin; and Site GLOUT, representing outflow conditions into Grant Creek. The GLTS site was located in the immediate vicinity of the proposed intake structure. Both sites were sampled in August 2013 at selected depths for grab analyses and at 1-meter depth intervals for *in situ* parameters. No parameter sampled exceeded water quality standards during the August 2013 sampling event.

Grant Lake nutrient concentrations were low throughout Kenai Hydro's monitoring program. Total and ortho-phosphorus values were typically not detectable with the only measurable value for either a concentration of 0.1 mg/L ortho-phosphorus in August 2013. Nitrate values ranged from 0.175 to 0.651 mg/L over the course of all sampling events. Turbidity was low; generally less than 5 nephelometric turbidity unites (NTUs), and DO was high throughout the water column at both stations. Total and suspended solids were also low during all sampling events.

In situ sampling during 2013 at the GLTS site was conducted from the surface down to a bottom depth of 17 meters. DO ranged from 103.6 percent saturation at the surface to 94.5 percent saturation at the bottom. At mid-depth (8.0 meters), DO was 100.9 percent saturation. DO concentrations for these same depths ranged from a surface reading of 11.15 mg/L, increasing to 11.76 mg/L at the bottom. Mid-depth DO was 11.18 mg/L; pH levels at the GLTS site ranged from 7.26 standard units at the surface to 7.42 standard units at the bottom. Neither Secchi disk nor chlorophyll *a* were measured; however, *in situ* results, conductivity, alkalinity, measured cation/anion, and nutrients were low and reflect dilute, oligotrophic conditions.

Mercury concentrations were less than the Alaska DEC chronic standard of 0.77 µg/L in all Grant Lake samples. A lead concentration of 1.1 µg/L at the GLTS site (10-meter depth) in June 2009 exceeded the calculated chronic freshwater standard of 0.84 µg/L.

Review of Grant Lake water quality data summarized by Ebasco (1984) indicates that the 2013 data are consistent with historical results. However, measurements of DO (saturation and concentration) at Grant Lake sites GLOUT and GLTS were both low—50 to 60 percent saturation in 2009 and 75 percent in 2010. Kenai Hydro attributed these prior measurements of low DO concentrations and percent saturation to faulty calibration and/or instrumentation.[44] We agree these values are likely erroneous.

Grant Creek—In 2009, Kenai Hydro established three water quality sampling stations in Grant Creek (GC100, GC200, and GC300, see figure 3-1). Kenai Hydro

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[44] Kenai Hydro attributed the low DO concentrations and percent saturation to either poor calibration or faulty instrumentation, leading to the use of two Hydrolabs for *in situ* measurements in 2013.

collected samples at these stations in June 2010 and August 2013. Kenai Hydro noted that little longitudinal variation occurred between the water quality sampling locations and therefore deemed the mid-station site of GC200 representative. Turbidity values at GC200 ranged from 4.0 to 4.6 NTUs, DO ranged from 10.95 to 11.02 mg/L, and pH values ranged from 7.00 to 7.18 standard units.

In general, water quality at the Grant Creek sites was similar but more dilute compared to other waterbodies in the area, with low dissolved solids and total phosphorus, and low alkalinity (Orejuela, 2014; Brabets et al., 1999). Ebasco (1984) notes that glaciers have retreated to the upper limits of the watershed and only a few small alpine glaciers and snow fields are currently present in the area near Solars Mountain. The likely reasons for comparatively low alkalinity, low dissolved solids, and low nutrient concentrations in samples collected from Grant Creek are watershed geochemistry, the lack of glacial runoff, and Grant Lake serving as a sediment trap.

Kenai Hydro sampled lead and mercury in Grant Creek during the 2009, 2010, and 2013 field seasons and Trail Lake Narrows during 2013 only. Mercury concentrations were less than the Alaska DEC chronic standard of 0.77 µg/L during all sampling events. A lead value of 3.09 µg/L at GC200 in June 2009 exceeded the calculated chronic standard of 0.84 µg/L. Lead values were also near the chronic standard in Grant Creek in June 2009 and June 2010 at the GC100 site (0.597 µg/L during each event).

Trail Lake Narrows—Kenai Hydro conducted three sampling events at the Trail Lake Narrows site (June, August, and September 2013). Sampled parameters included those measured at Grant Creek sites, plus gas and diesel compounds. No parameter sampled exceeded water quality standards during any sampling event, although Trail Lake Narrows routinely had the highest turbidity readings of all sites in 2013 (about 9 NTUs).

Grant Creek/Grant Lake Temperatures—All temperature data collected in Grant Creek met the 20°C criterion set by Alaska DEC. With the exception of 2013, standards for rearing and migration (15°C) and spawning and egg/fry incubation (13°C) were also met. Mean daily temperatures mid-July through early August 2013 at site GC200 exceeded both the 13°C spawning criteria, as well as the 15°C rearing criteria (figure 3-2). Daily mean temperatures at sites GC100 and GC600, the upper-most and lower-most sites monitored, were virtually identical, showing longitudinal changes in temperature within Grant Creek were minimal (figure 3-3).

Continuous temperature profiles for Grant Lake at the GLTS site are shown below for 2013 (figure 3-4). Relatively strong stratification was seen in June through August, with maximum surface temperatures approaching 16°C by July 30. Drops in temperature of about 1°C per meter from the surface to about 8 meters occurred at the end of July. Kenai Hydro noted that isothermal conditions were observed by mid- to late September, consistent with historical temperature profiles from earlier studies.

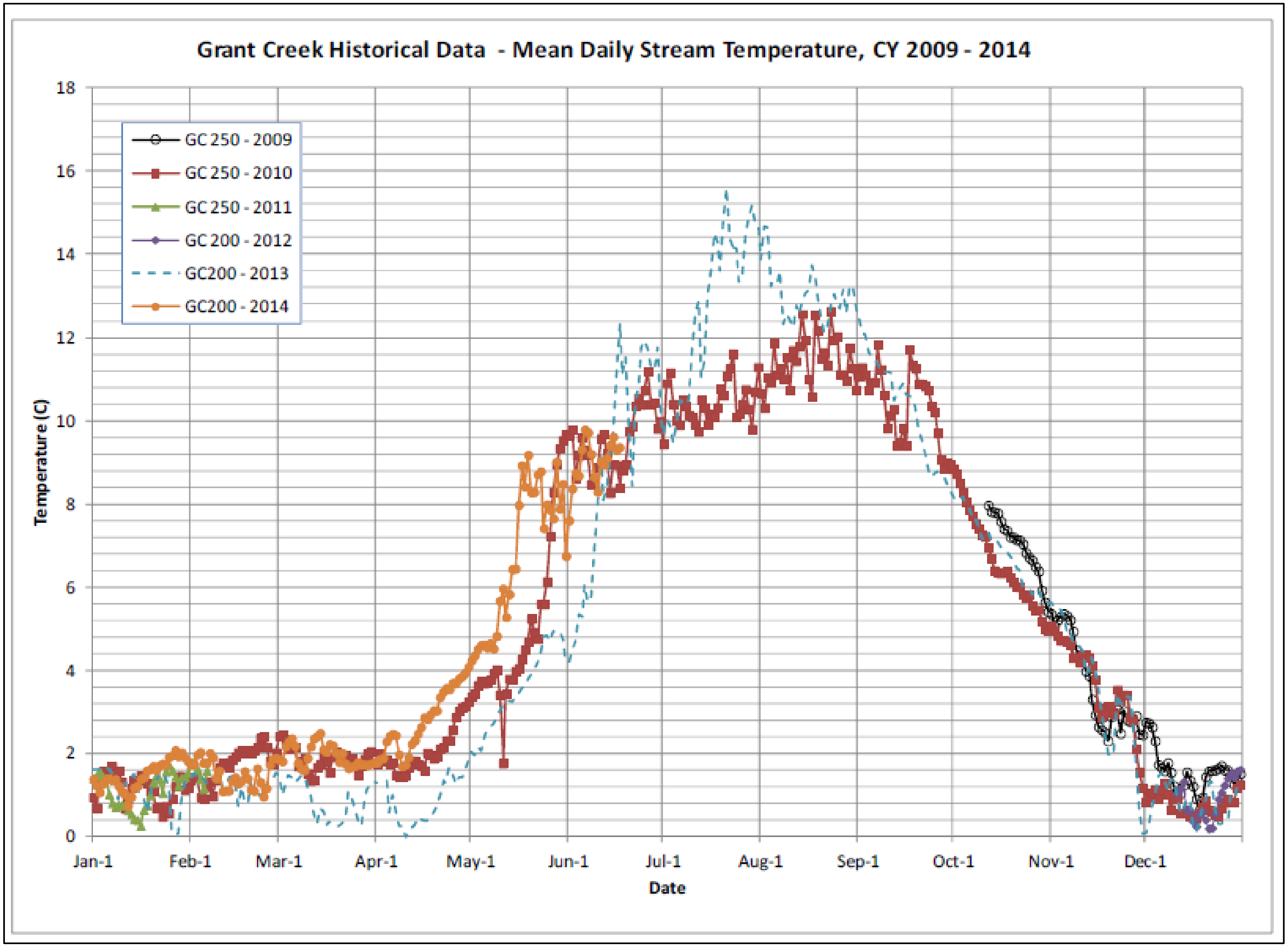


Figure 3-2. Grant Creek water temperatures, 2009−2013 (Source: Kenai Hydro, 2018a, as modified by staff).

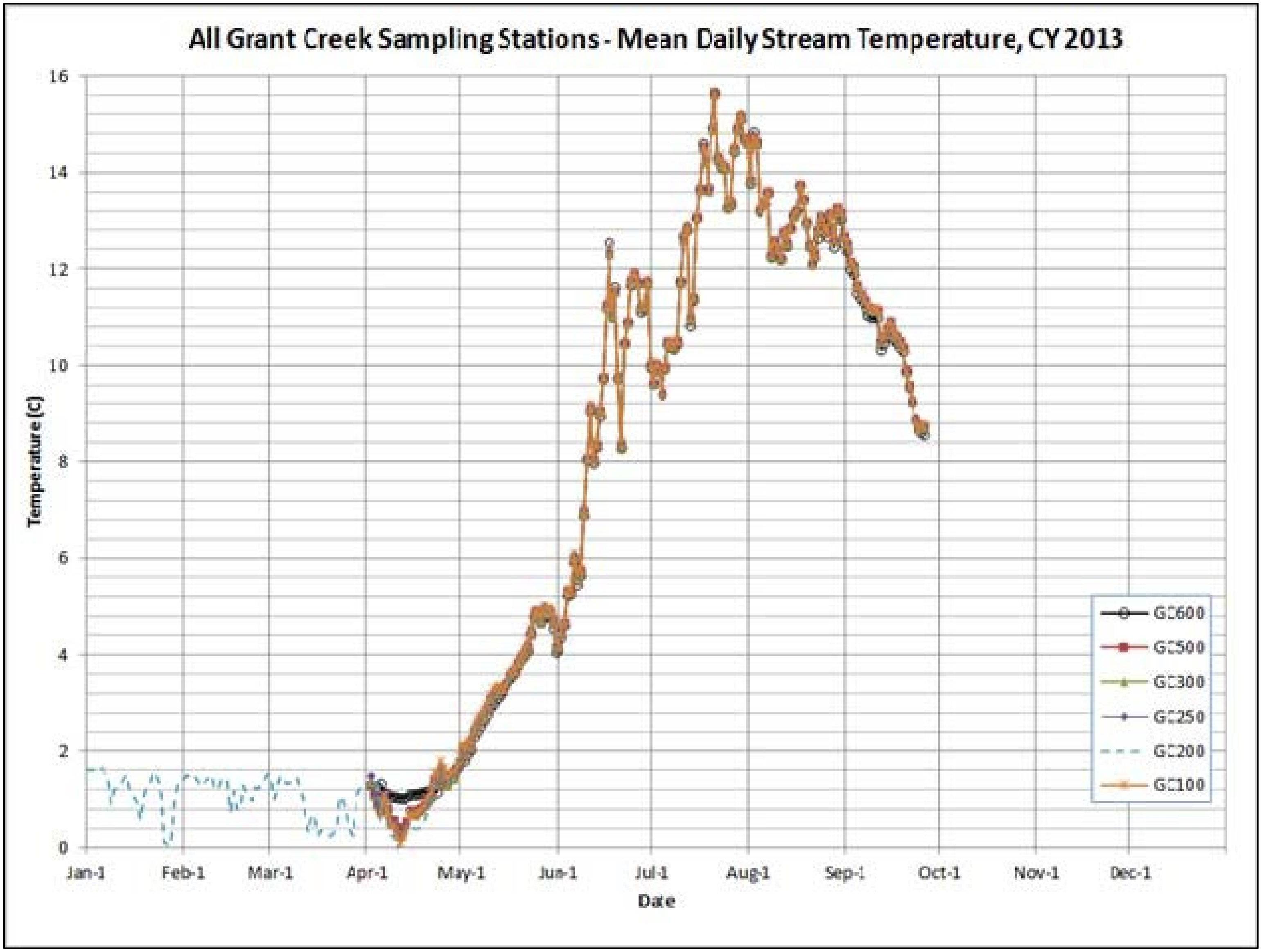


Figure 3-3. Mean daily temperatures at all Grant Creek sites, 2013 (Source: Kenai Hydro, 2018a).

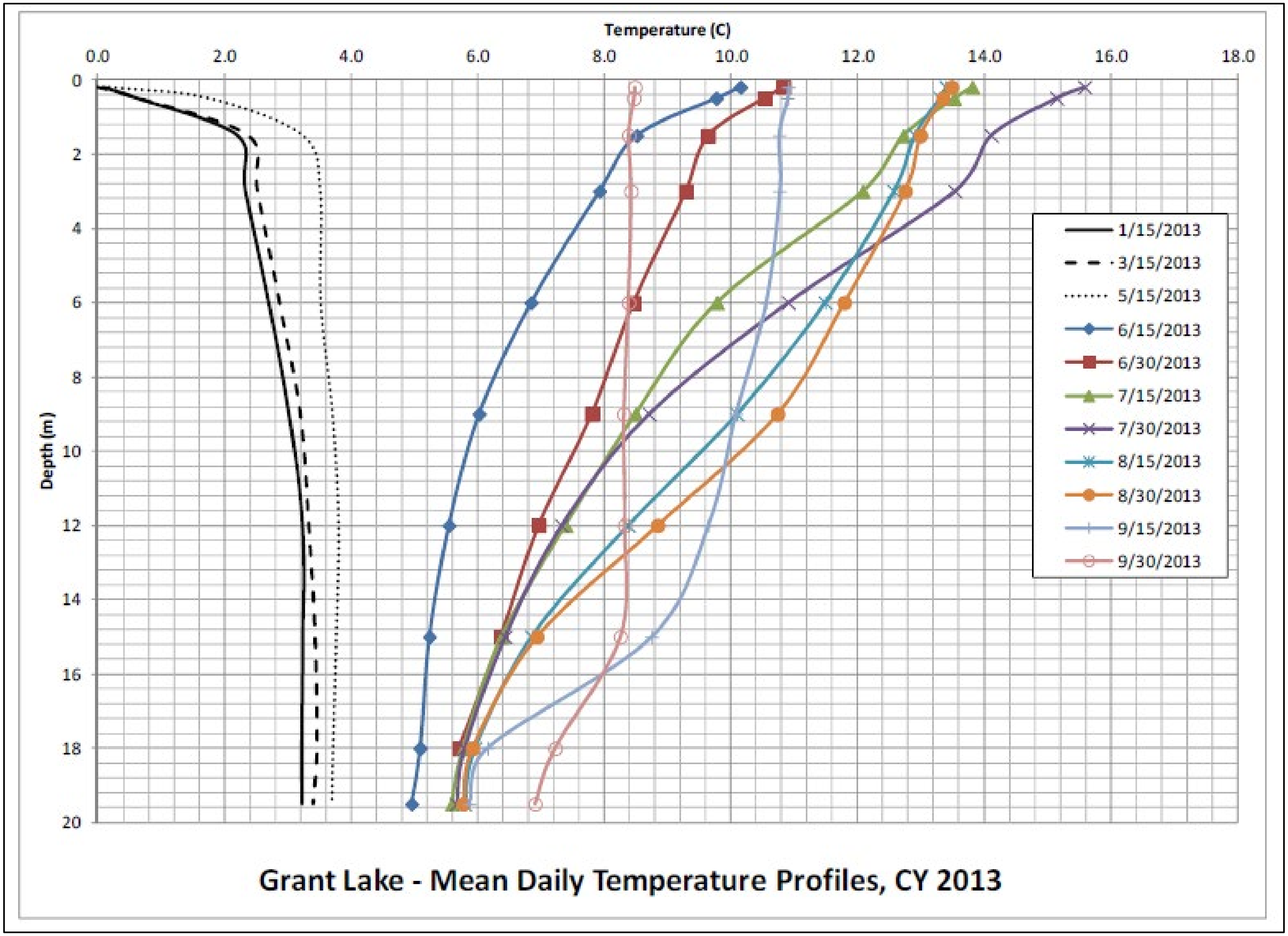


Figure 3-4. Grant Lake temperature profiles, 2013 (Source: Kenai Hydro, 2018a, as modified by staff).

Fishery Resources

Fish Populations

Grant Lake—No anadromous fish species are found in Grant Lake or its tributaries because of the presence of an impassable falls in Reach 6 of Grant Creek (FWS, 1961; AEIDC, 1983; Ebasco, 1984), and Grant Lake is not included in Alaska DFG's anadromous waters catalog (Johnson and Daigneault, 2008). Grant Lake appears to support only resident populations of slimy sculpin, Coast Range sculpin, and threespine stickleback (AEIDC, 1983, FWS, 1961, Johnson and Klein, 2009). Alaska DFG stocked coho salmon fry in Grant Lake from 1983 to 1986 with limited success. However, these stocking efforts may have enhanced returns to Grant Creek (Marcuson, 1989). No fish are present in the tributaries to Grant Lake (AEIDC, 1983).

Grant Creek—Chinook and coho salmon, rainbow trout, and Dolly Varden are known to spawn and rear in the lower reaches of Grant Creek (Ebasco, 1984; Johnson and Klein, 2009). Angling surveys also documented round whitefish and arctic grayling in the creek; however, it is unlikely that these species spawn in Grant Creek (Ebasco, 1984).

In 2013, Kenai Hydro conducted a series of fisheries investigations to characterize spawning distribution, run timing, and relative abundance of fish in Grant Creek (BioAnalysts, Inc., 2014). Juvenile fish were captured using incline plane traps, minnow traps, and beach seining, or observed during snorkeling surveys. Adult fish were captured by using a picket-style weir, or observed during weekly radio telemetry tracking, redd surveys, visual surveys, and carcass surveys. Based on weir counts and visual counts of salmon above and below the weir in 2013, Kenai Hydro estimates that escapement to Grant Creek was 90 Chinook, 1,169 sockeye, and 252 coho salmon (table 3-7). Run timing for adult salmon extended over a 13-week period beginning at the end of July and concluded near the end of October (table 3-7).

Ebasco (1984) estimated that Grant Creek supported 250 Chinook and 1,650 sockeye spawners; maximum counts from intermittent stream surveys by Alaska DFG were 76 Chinook salmon in 1963 and 324 sockeye salmon in 1952 (Johnson and Klein, 2009). Kenai Hydro conducted surveys in 2010 and estimated escapement in Grant Creek to be 231 Chinook salmon, and 6,293 sockeye salmon, but these estimates were developed using the area-under-the-curve methodology and may have been biased by critical components of the calculation being based on professional judgement, rather than empirical data.

Table 3-7. Run timing by week of year for pink, Chinook, sockeye, and coho salmon assessed at weir on Grant Creek, 2013 (Source: BioAnalysts, Inc., 2014).

Week of Year	Dates	Pink	Chinook	Sockeye	Coho
31	Jul 28–Aug 03	0	0	5	0
32	Aug 4–Aug 10	6	0	3	0
33	Aug 11–Aug 17	2	11	16	0
34	Aug 18–Aug 24	1	3	220	0
35	Aug 25–Aug 31	1	7	601	0
36	Sep 1–Sep 7	0	2	201	0
37	Sep 8–Sep 14	0	0	65	16
38	Sep 15–Sep 21	0	0	4	17
39	Sep 22–Sep 28	0	0	0	40
40	Sep 29–Oct 5	0	0	1	96
41	Oct 6–Oct 12	0	0	1	42
42	Oct 13–Oct 19	0	0	0	21
43	Oct 20–Oct 26	0	0	0	1
Total		**10**	**23**	**1,117**	**237**

Salmon started building redds in Grant Creek during the first week of August and ended their spawning activity around the end of October (table 3-8). Pink salmon began spawning in early August; Chinook salmon began spawning in mid-August; and sockeye salmon began spawning at the end of August. Sockeye salmon spawning activity (active digging) was observed until the last week of September. Coho began spawning the first week of October and were complete at the end of the month.

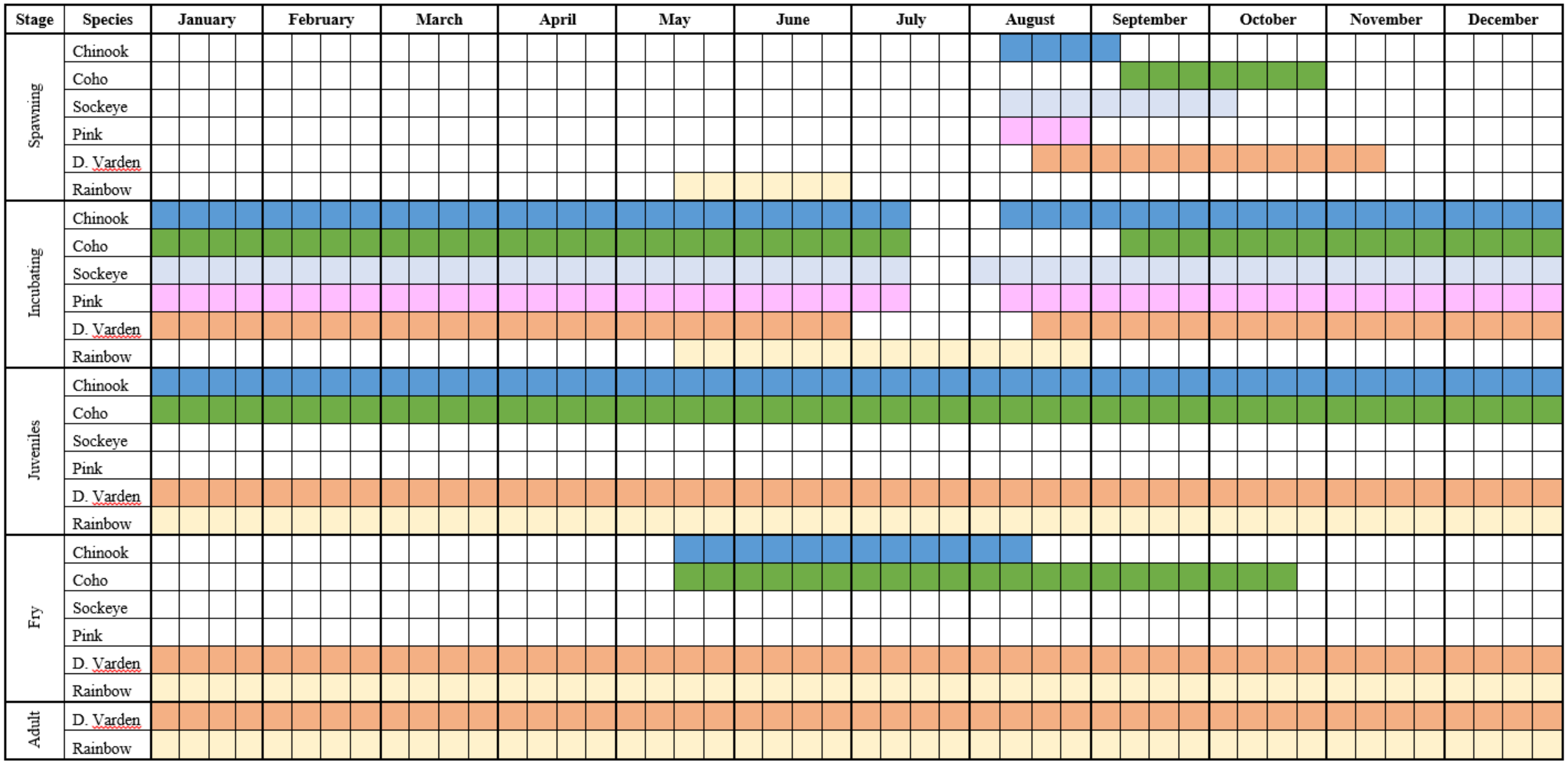
Table 3-8. New redds constructed in Grant Creek by week of the year for pink, Chinook, sockeye and coho salmon in 2013 (Source: Kenai Hydro, 2018a).

Week	Dates	Pink	Chinook	Sockeye	Coho	Total
31	Jul 28–Aug 3	0	0	0	0	**0**
32	Aug 4–Aug 10	2	0	0	0	**2**
33	Aug 11–Aug 17	0	0	0	0	**0**
34	Aug 18–Aug 24	0	1	0	0	**1**
35	Aug 25–Aug 31	0	3	200	0	**203**
36	Sep 1–Sep 7	0	2	108	0	**110**
37	Sep 8–Sep 14	0	0	MS	0	**0**
38	Sep 15–Sep 21	0	0	MS	0	**0**
39	Sep 22–Sep 28	0	0	MS	0	**0**
40	Sep 29–Oct 5	0	0	0	5	**5**
41	Oct 6–Oct 12	0	0	0	47	**47**
42	Oct 13–Oct 19	0	0	0	13	**13**
43	Oct 20–Oct 26	0	0	0	6	**6**
44	Oct 27–Nov 2	0	0	0	1	**1**
45	Nov 3–Nov 9	0	0	0	0	**0**
Total		**2**	**6**	**308**	**72**	**388**

Note: A designation of “MS” (mass spawning) means that new redds and old redds could not be distinguished in the mass spawning aggregates.

Kenai Hydro developed a life stage periodicity for each of the salmonid species and life history stages (table 3-9). The periodicity for each species were reviewed and approved by the Instream Flow Subgroup of the Natural Resource Work Group, consisting of state and federal resource agency staff, Kenai Hydro staff, and interested members of the local community.

Table3-9. Grant Creek salmonid periodicity (Source: Kenai Hydro, 2018a, as modified by staff).



Note: Table is color-coded by species.

Kenai Hydro found that 95 percent of salmon redds were concentrated within Reaches 1 through 3 of Grant Creek (table 3-10). Sockeye and coho salmon spawned in every accessible reach of Grant Creek, while Chinook only spawned in Reaches 1, 3, and 4. The spawning locations of sockeye and coho salmon often overlapped in several locations in Reaches 1 and 3. Pink salmon only spawned in Reach 1. There was less spawning in Reach 2 (15 percent), Reach 4 (4 percent), and Reach 5 (1 percent). Spawning only occurred in a few locations in Reaches 4 and 5. The distribution of redds closely followed the distribution of visual detections and was similar to the results from mobile telemetry surveys.

Table 3-10. Number and proportion of redds counted in 2013 in each reach of Grant Creek for pink, Chinook, sockeye, and coho salmon (Source: BioAnalysts, Inc., 2014).

Reach	Pink	Chinook	Sockeye	Coho	Total	Proportion
1	2	4	144	18	**168**	**0.433**
2	0	0	52	7	**59**	**0.152**
3	0	1	102	38	**141**	**0.363**
4	0	1	7	7	**15**	**0.039**
5	0	0	3	2	**5**	**0.013**
Total	**2**	**6**	**308**	**72**	**388**	**1.000**

The majority of redds observed in Grant Creek in 2013 were located in riffle (71 percent) and pool (19 percent) habitat. The majority of redds were located in the main channel along the stream margins or in areas protected from the main current. Chinook were the exception, building redds mid-channel within the stronger current. Redds were also observed in side channels and in backwater areas near the main channel where suitable stream velocities and substrates were present.

In 2013, the resident rainbow trout migration period extended from May 24 to June 29 and resulted in the capture of 13 adult rainbow trout, although this count may be somewhat low because of deficiencies in the weir (undercut bank on the right bank and high flows overtopping the weir). The migration period for Dolly Varden extended from August 18 to September 14, 2013, with the capture of 14 Dolly Varden.

Kenai Hydro biologists used snorkeling and minnow traps to assess juvenile species diversity, relative abundance, and distribution in Grant Creek. Dolly Varden and rainbow trout were the most numerous fish captured in minnow traps, followed by Chinook, sculpin species, and coho.

Also, Kenai Hydro used radio telemetry to assess habitat use in Grant Creek. The majority of the 198 detections were in riffles and pools in the main channel (table 3-11).

Table 3-11. Habitat use by location based on mobile telemetry surveys for radio tagged rainbow trout in Grant Creek, 2014 (Source: Kenai Hydro, 2018a).

Reach—Area	Riffle	Pool	Back-Water	Step Pool	Glide	Pocket-Water	Total
1—Main stem	101	23					124
2—Main stem	13	19	8				40
3—Main stem	11	9					20
3—Predominant side channel	5	3					8
3—Secondary side channel		3					3
4—Main stem	1	1				1	3
Total	131	58	8	0	0	1	198

Trail Lake Narrows—Adult salmon, rainbow trout, and Dolly Varden occur in the Trail Lakes Narrows area, which is also an upstream migration corridor for fish that spawn in Grant Creek and all other tributaries of Upper Trail Lake. Likewise, this area is also a downstream migration corridor for salmonid production upstream. Dolly Varden and rainbow trout probably reside in the area to prey on juvenile salmon that migrate through or rear in this area.

Kenai Hydro conducted fish sampling in 2013 at Trail Lake Narrows (BioAnalysts, Inc., 2014). Juvenile Chinook and threespine sticklebacks were the most numerous fish captured using minnow traps and beach seines, followed by coho, Dolly Varden, sculpins, rainbow trout, and sockeye (table 3-12). The size of juvenile Chinook and coho captured in minnow traps suggests that both age-0 and age-1+ fish were present in Trail Lake Narrows. Dolly Varden varied in size from 57 to 184 millimeters with several age classes represented. Salmon may spawn in Trail Lake Narrows because Kenai Hydro biologists observed sockeye carcasses and depressions (likely redds) in suitable spawning gravels in this area.

Table 3-12. Number, proportion, and catch-per-unit-effort of fish caught in Trail Lake Narrows with minnow traps, July 2013 (Source: BioAnalysts, Inc., 2014).

Species	Number	Proportion	CPUE (fish per hour)
Chinook	108	0.283	0.095
Dolly Varden	52	0.136	0.046
Coho	62	0.163	0.055
Rainbow trout	4	0.010	0.004

Species	Number	Proportion	CPUE (fish per hour)
Sockeye	1	0.003	0.001
Sculpin sp.	38	0.100	0.034
Threespine stickleback	116	0.304	0.102
Grand Total	**381**	**1.000**	**0.336**

Note: CPUE – catch-per-unit-effort

Macroinvertebrates

The Arctic Environmental Information Data Center evaluated benthic macroinvertebrates from Grant Lake in 1981 and 1982 (AEIDC, 1983). Samples collected contained relatively few insects and showed little diversity. The most common groups where midges, worms, and clams, which is typical for cold-water, glacier-fed systems with narrow littoral zones.

In addition to the data collected in the early 1980s, Kenai Hydro conducted a baseline study of macroinvertebrates and periphyton in Grant Creek in August 2013 (BioAnalysts, Inc., 2014). Biologists used a Serber sampler to collect benthic macroinvertebrate and periphyton samples upstream of the Reach 1 distributary and at the proposed detention pond outlet. Thirty-five macroinvertebrate taxa were identified in Grant Creek, the most abundant of which were midges, followed by mayflies, stoneflies, and clams.

Aquatic Habitat

Grant Lake—Grant Lake has a total surface area of 2.5 square miles and consists of two basins connected by an isthmus and small island (see figure 1-1). The 3.5-mile-long, 0.5-mile-wide upper basin has a maximum depth of 283 feet. The 1.5-mile-long, 0.5-mile-wide lower basin has a maximum depth of 262 feet. Ebasco (1984) studied water surface elevations in Grant Lake and found the maximum lake elevation was 703 feet with a seasonal -5.3 foot elevation decrease. The Grant Lake shoreline littoral area is predominantly bedrock or coarse, angular boulders. Six small glacial streams flow into Grant Lake. Inlet Creek is the largest and is the lake's only perennial tributary. Fish habitat in these streams is extremely limited because of their steep gradient and intermittent nature, but detailed fish habitat data have not been collected.

Grant Creek—Grant Creek, Grant Lake's only outlet, is about 5,180 feet long and flows west from Grant Lake to Trail Lake Narrows. It has a mean annual flow of 193 cfs, with an average gradient of 207 feet per mile (3.6 percent slope). Cobble and boulder alluvial deposits and gravel shoals are the dominate substrates (Ebasco, 1984). In its upper half, Grant Creek passes through a rocky gorge with three substantial waterfalls all of which are natural barriers to upstream fish migration (figure 3-5). In its lower half, Grant Creek becomes a lower gradient stream, is less turbulent, and passes over gravel shoals and diminishing boulder substrate.

Kenai Hydro delineated aquatic habitat and completed an instream flow study in Grant Creek during summer 2014 (McMillen, 2014). Surveyors divided the creek into six study reaches (see figure 2-1); however, mapping focused on Reaches 1 through 5 because Reach 6 is inaccessible to anadromous fish due to the presence of a natural migration barrier (a 50-foot-high waterfall) at about river mile 0.8.

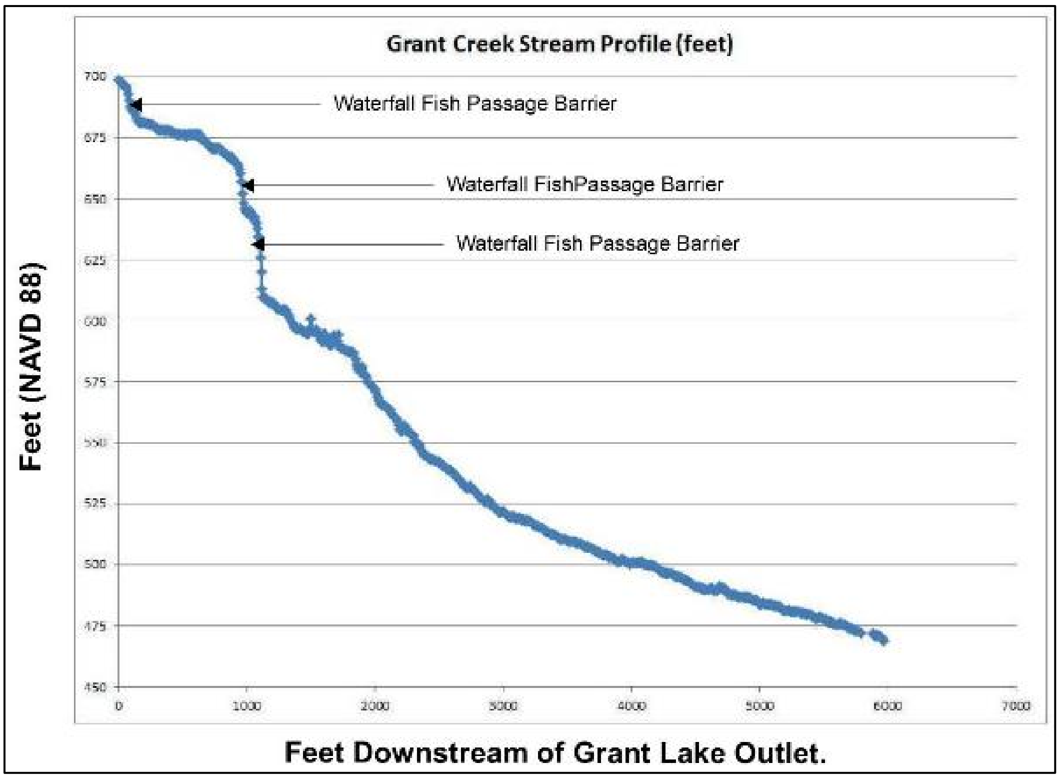


Figure 3-5. Grant Creek stream profile generated from light detection and ranging (Source: Kenai Hydro, 2018a, as modified by staff).

Riffle habitats are predominant throughout all five reaches (50 percent), followed by pools (19.3 percent) and cascades (15.3 percent) (tables 3-13 and 3-14). All of the cascades are located in Reach 5. Pools are rare in the main stem of Grant Creek but are occasionally found in its side channels and distributaries. Undercut banks provide cover for fish in Reaches 1 and 4.

Large woody debris (LWD) is sparse in the main stem of Grant Creek but relatively abundant in its side channels and distributaries (table 3-14). McMillen (2014) concludes that high flows and velocities limit the amount of LWD in the system because LWD collects in only a few places in the main channel. Most wood is found in the distributary and the Reach 2/3 side channels, where flows are greatly reduced and protected from the main discharges in Grant Creek, and is associated with the pool mesohabitat.

Table 3-13. Mesohabitats found in Grant Creek (Source: McMillen, 2014).

Habitat Type	Total Area (Sq. Ft)	Reach 1 Distrib-utary	Reach 1 Mainstem	Reach 2 Backwater Habitat	Reach 2 Mainstem	Reach 2 Secondary Channel	Reach 3 Backwater Habitat	Reach 3 Mainstem	Reach 3 Primary Side Channel	Reach 3 Secondary Channel	Reach 4 Mainstem	Reach 5 Mainstem
Backwater	8,534	0	0	4,837	0	0	3,697	0	0	0	0	0
Cascade	33,707	0	0	0	0	114	0	0	0	0	0	33,593
Glide	3,202	0	0	0	1,613	0	0	0	0	1,588	0	0
Pocket water	3,709	0	0	0	0	0	0	0	0	0	3,709	0
Pool	42,568	7,495	3,143	0	3,834	398	0	3,997	5,018	9,510	1,195	7,977
Rapid	511	0	0	0	0	0	0	0	511	0	0	0
Riffle	110,429	6,004	23,168	0	23,669	1,189	0	25,585	11,672	1,493	17,649	0
Run	576	0	0	0	0	0	0	0	0	576	0	0
Step Pool	16,858	0	0	0	0	0	0	0	0	0	0	16,858

Table 3-14. Aquatic habitats found in Grant Creek (Source: McMillen, 2014).

Habitat Type	Total Area (Sq. Ft)	Reach 1 Distrib-utary	Reach 1 Mainstem	Reach 2 Backwater Habitat	Reach 2 Mainstem	Reach 2 Secondary Channel	Reach 3 Backwater Habitat	Reach 3 Mainstem	Reach 3 Primary Side Channel	Reach 3 Secondary Channel	Reach 4 Mainstem	Reach 5 Mainstem
Margin	7,214	0	3,343	0	3,871	0	0	0	0	0	0	0
Overhead Vegetation	10,096	302	0	0	0	0	0	0	2,455	7,339	0	0
UCB	12,187	1,513	3,372	0	2,193	0	0	278	110	1,214	3,216	0
LWD	17,750	3,556	1,894	0	187	0	0	1,142	1,611	6,218	3,040	0

As described in the amended final license application, salmonid spawning habitat is relatively limited in Grant Creek and influences salmon productivity because of a lack of suitable substrate (i.e., gravel and small cobble). The substrate that is present in the creek is recruited from Reaches 5 and 6 and tends to be either broad and flat or angular (Element Solutions, 2014). As a result, salmon spawning activity appears to be opportunistic and driven by the presence of adequate spawning substrates, rather than by water depths and velocities. Kenai Hydro observed that much of spawning in Grant Creek occurs along its margins, where velocities and depths are lower, and spawning substrates are perched on relatively flatter benches. However, redds that were constructed along the stream margins at higher discharges were left dry and exposed on these flat benches as flows decreased throughout the summer. This was particularly noted for sockeye that were observed spawning at much higher flows than coho.

Significant side channel habitat exists in Grant Creek, notably in Reaches 2 and 3, and Kenai Hydro observed coho and sockeye spawning activity in these side channels. Reach 2 and 3 side channels are wetted at all flows, although low winter flows may result in dry creek beds or freezing in the smaller side channels. The distributary in Reach 1 becomes wetted at a flow of about 190 cfs, while the overflow channel near the break between Reaches 1 and 2 becomes wetted at a flow of about 450 cfs. There is most likely a substantial, yet unquantified loss of production in these side channels because of desiccation and freezing.

Trail Lake Narrows—As described above, Grant Creek enters Trail Lake Narrows, which connects Upper Trail Lake to Lower Trail Lake. Riffles are the dominant habitat type in the Trail Lake Narrows area from the confluence of Grant Creek to the downstream end of a 0.5-acre island (figure 3-5). This area contains about 2,000 square feet of juvenile rearing habitat, spawning habitat, and adult salmon staging habitat.

Essential Fish Habitat

EFH refers to those waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity and covers a species' full life cycle (50 CFR 600.10). Per the *Catalog of Water Important for Spawning, Rearing or Migration of Anadromous Fishes—Southcentral Region* (Johnson and Blossom, 2017), Alaska DFG designated EFH for 27 species of anadromous fish in Alaska. Freshwater EFH includes all those streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to anadromous fish in Alaska, except areas upstream of certain impassable man-made barriers, and longstanding, impassable barriers (i.e., waterfalls in existence for several hundred years).

Within the proposed project area, a series of waterfalls in Reach 6 of Grant Creek block the upstream migration of anadromous fish. Consequently, no designated EFH occurs in Grant Lake. Grant Creek below the waterfalls is designated as EFH for Chinook, coho, pink, and sockeye salmon because it contains suitable spawning and rearing habitat accessible to these species.

3.3.2.2 Environmental Effects

Water Quantity

Effects of Project Construction on Water Quantity

During construction of the proposed project, Kenai Hydro does not expect adverse effects on the streamflows and water levels of existing surface water resources (i.e., Grant Lake and Grant Creek). Kenai Hydro notes that construction of the proposed penstock may require some near-shore cofferdams, but any localized dewatering would be returned to Grant Lake.

To minimize potential for dewatering during construction activities, Kenai Hydro would install the proposed streamflow and water level monitoring equipment during project construction and would monitor water levels and streamflows for the duration of construction. To monitor effects on Grant Lake water levels, Kenai Hydro would install station IT-1 at the proposed project intake. Kenai Hydro's proposed ISF-1 monitoring location would record outflow from Grant Lake into Grant Creek at the bypass weir, and station ST-2 (GC200)[45] would monitor flows in Grant Creek downstream of the project tailrace. In addition, Kenai Hydro proposes to employ a third-party ECM to remain on site for the duration of construction. As proposed, the ECM would document Kenai Hydro's compliance with conditions of the license and prepare annual compliance reports that would be filed with the Commission and other requesting agencies.

Kenai Hydro's proposal to hire an ECM to oversee streamflow and water level monitoring during project construction is consistent with Forest Service final 4(e) condition 20. However, this condition specifies that the ECM have the authority to stop work or issue change orders in the field if conditions warrant.

Our Analysis

Grant Lake—Construction related to the applicant's proposal could temporarily change local hydrology and water quantity levels near the proposed intake structure, concrete weir (i.e., outlet to Grant Creek), and penstock. Construction of the penstock could require construction of near shore cofferdams. However, Kenai Hydro would pump water from inside the coffer dams back into Grant Lake and conveyed downstream. Construction of the bypass weir is discussed below under Grant Creek. Kenai Hydro's proposal to monitor water levels near construction areas, and limit construction to appropriate timing for in-water activities are appropriate to ensure construction of the project is completed as required.

Given the remote nature of the project, having an ECM on site to monitor project construction activities and ensure Kenai Hydro's proposed measures effectively protect environmental resources is appropriate. Requirements of the proposed ECM (e.g.,

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[45] ST-2 is the same location as Kenai Hydro's station GC200.

ensuring construction activities are in compliance with license requirements) would adequately address water quantity-related issues related to the construction of the proposed project features. Kenai Hydro's proposal to install and operate water level monitoring equipment prior to any construction activities would provide the ECM with baseline water levels in Grant Lake to compare to any changes that result from project construction. Both monitoring mechanisms (i.e., onsite ECM and water level monitoring equipment) would minimize project construction effects on the portions of Grant Lake affected during the proposed construction period. Therefore, we expect limited and short-duration effects on water quantity and water levels in the portions of Grant Lake affected by project construction.

Grant Creek—Construction related to the applicant's proposal could change local hydrology and water quantity levels in Grant Creek downstream of the proposed bypass weir. Kenai Hydro's final construction plans would detail the timing of weir construction and Kenai Hydro would consult with Alaska DFG to schedule any in-water work. Therefore, construction of the bypass weir would have minimal effect on water quantity in Grant Creek.

Requirements of the ECM as proposed by Kenai Hydro would address water quantity-related issues related to the construction of the proposed project features. Kenai Hydro's proposal to install and operate streamflow monitoring equipment prior to any construction activities would provide the ECM with baseline streamflows in Grant Creek to compare to any changes that result from project construction. Both measures would minimize project construction effects on Grant Creek. We expect limited and short-term effects on water quantity and streamflows in the portions of Grant Creek affected by project construction.

Effects of Project Operation on Water Quantity

Kenai Hydro does not expect operation of the proposed project to adversely affect streamflows and water levels of existing surface water resources. Kenai Hydro proposes to annually vary Grant Lake water levels by up to 13 feet and operate the project from the natural Grant Lake outlet elevation of 703 feet down to a minimum lake elevation of 690 feet. The lake would be drawn down in the winter months using a combination of Grant Creek inflows and stored water to provide for project generation and meet the minimum instream flows in the bypassed reach. Figure 3-6 compares current water surface elevations with the anticipated lake elevation fluctuation. Kenai Hydro does not expect operation of the project to affect the natural ice processes (e.g., freeze up and breakup) of Grant Lake.

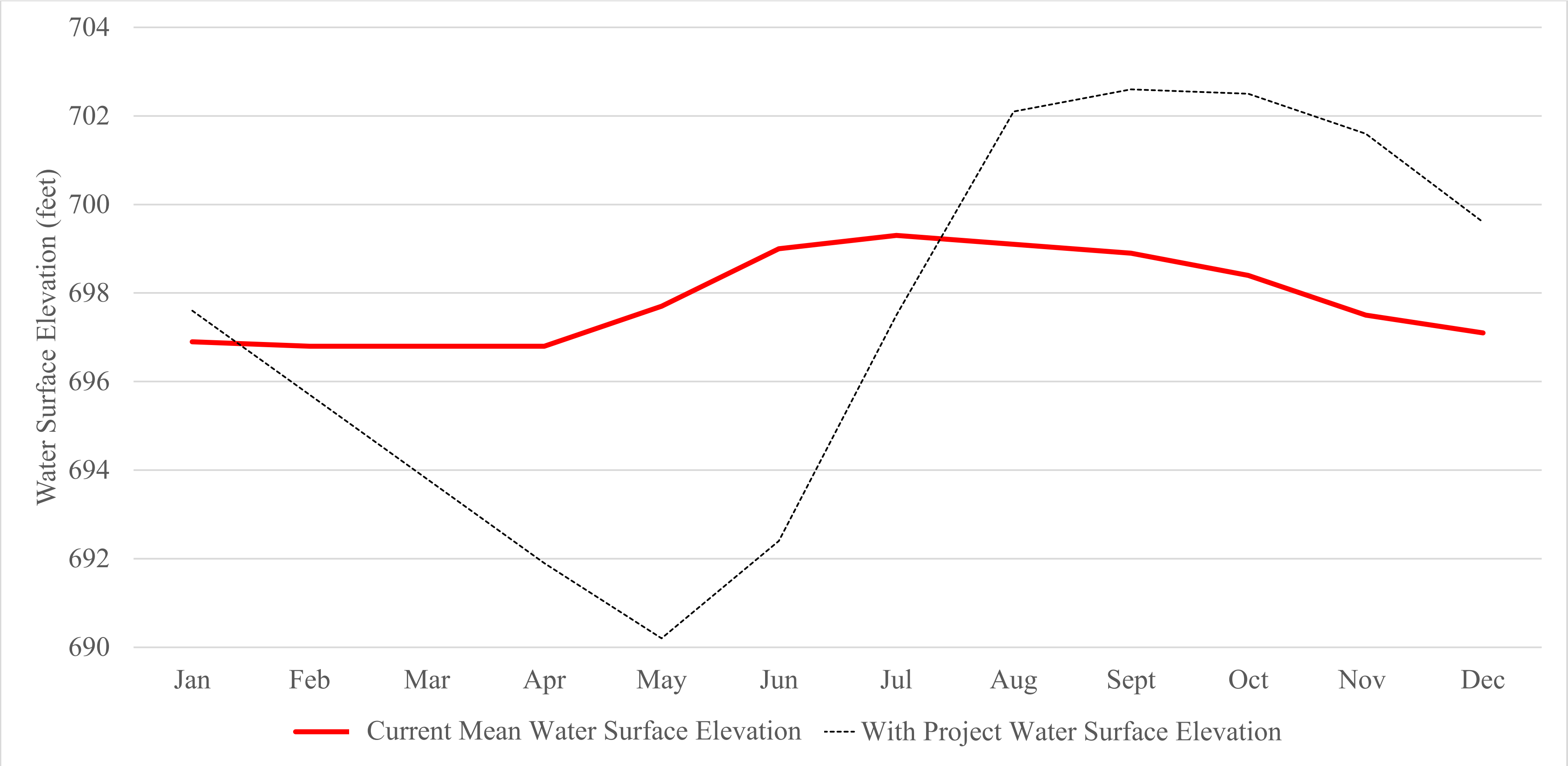

Figure 3-6. Current and with project average Grant Lake water surface elevation (Source: Kenai Hydro, 2018a, as modified by staff).

Kenai Hydro notes that water diverted or spilled from Grant Lake would follow one of three outflow route options:

1. Waters to be used for typical power production would be conveyed to the powerhouse via an intake, tunnel, and penstock along the southeastern bank of Grant Creek. The powerhouse would return all water to the reach of Grant Creek below the powerhouse. Flow used for power production could also be routed to Kenai Hydro's proposed detention pond, a storage reservoir for flows generated when the proposed unit's spinning reserve capacity would be used. Spinning reserve capacity for the proposed project would be primarily available in the winter when Grant Lake inflows are low. If the transmission grid were to require an immediate power input from spinning reserve, the powerhouse would ramp up to full output with the increased flow routed to the detention pond to capture the increased discharge. The flow diversion would be accomplished with a gated diversion structure in the powerhouse tailrace. All additional flow captured in the detention pond would then be released over time back to the tailrace (i.e., reach of Grant Creek immediately below the powerhouse). Kenai Hydro notes that the controlled release would ensure that downstream flow and stage conditions were maintained.
2. The second flow route would divert Grant Lake water via a bypass pipe to a weir located at the outlet of Grant Lake that would serve as the source for bypass flow volumes in the bypassed reach. Bypass flows (i.e., Kenai Hydro's proposed minimum flows) would progress down the bypassed reach before converging with the waters released below the project powerhouse.
3. The third routing option would occur when lake storage is full and inflows to Grant Lake exceed the powerhouse capacity of 385 cfs. Under these conditions, any flow above the capacity of the project would be spilled over the bypass weir and be conveyed the entire length of Grant Creek.

In addition to the routing options above, Kenai Hydro would provide failsafe provisions (i.e., bypass weir pump system) during project operation to ensure that flows were provided continuously to Grant Creek during maintenance periods and any emergency project shutdowns or unexpected outages.

Kenai Hydro proposes to address effects (i.e., reduced streamflows in the Grant Creek bypassed reach and greater water level fluctuations within Grant Lake) associated with project operation through implementation of measures (e.g., water level and flow monitoring) described in its Operation Compliance Monitoring Plan.

To ensure water surface elevations remain between Kenai Hydro's proposed operating range (703 feet to 690 feet), Kenai Hydro proposes to install water level monitoring equipment (RL-1) at the proposed intake structure. In addition to monitoring Grant Lake water levels, Kenai Hydro would monitor flows exiting Grant Lake at two locations—at the proposed intake structure (ISF-1) and at the proposed bypass weir

(ISF-3). The intake structure monitoring equipment would be used to monitor the quantity of water diverted for power production and the bypass weir monitoring equipment would ensure compliance with any required bypassed reach minimum flows. To monitor project outflows and determine compliance with the proposed minimum flows downstream of the powerhouse, Kenai Hydro would continue to monitor flow at their existing streamflow gage (ISF-2) in Grant Creek, located at the same location as U.S. Geological Survey (USGS) gage 15246000 (Grant Creek near Moose Pass, Alaska), which was operational from 1947 through 1958.[46] Kenai Hydro proposes to operate and maintain these monitoring devices for the duration of the license term.

Alaska DFG (10(j) recommendation 5), NMFS (10(j) recommendation 5), and FWS (10(j) recommendation 5) recommend that 1 month before the start of any land-disturbing or land-clearing activities, Kenai Hydro develop and implement a stream monitoring plan to monitor flows in the bypassed reach and flows in Grant Creek below the project tailrace. The plan would include: (1) methods of measuring and recording bypass flows, instream minimum flows downstream of the project tailrace, channel maintenance flows, and project ramping rates; (2) a schedule for establishing the gage downstream of the tailrace and operating the gage for the remainder of the license; (3) provisions to disseminate flow data to the Commission, resource agencies, and public; and (4) specify that the installed stream gages conform to USGS stream gage standards. Specifically, the commenting agencies recommend that Kenai Hydro monitor flows in the following locations: (1) in the bypassed reach through the bypass system or a stream gage within the bypassed reach, (2) downstream of the project tailrace at the location that was used by USGS for stream gage no. 15246000, (3) ramping rates at the existing downstream gage location, and (4) channel maintenance flows in the bypassed reach or at the existing downstream gage location. In its response to agency terms and conditions, Kenai Hydro agreed to develop a stream monitoring plan as recommended by Alaska DFG, NMFS, and FWS. NMFS 10(j) recommendation 5 also includes installation of a stilling well at the downstream gage to accurately measure changes in stage and recommends Kenai Hydro provide flow information on a website accessible to NMFS and project stakeholders. Kenai Hydro agrees with the commenting agencies to monitor flows in the following locations: (1) in the bypassed reach via the bypass system, (2) instream flows downstream of the project tailrace at Kenai Hydro's existing streamflow gage located at the location that was used by USGS for stream gage no. 15246000, and (3) channel maintenance flows at the existing gage downstream of the project tailrace. However, while committed to measuring project ramping rates, Kenai Hydro would measure and confirm ramping rates at the project powerhouse/tailrace interface as opposed to the existing Grant Creek stream gage.

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[46] Kenai Hydro maintains a USGS-approved stage recorder at this location, previously installed during the 2013 licensing studies.

Alaska DFG 10(j) recommendation 6 and FWS 10(j) recommendation 6 recommend the operations and compliance plan include provisions to ensure flow releases are provided continuously to the bypassed reach and downstream of the tailrace at all times including during any routine maintenance, emergency project shutdowns, or unanticipated interruptions to power generation.

FWS 10(j) recommendation 21 recommends the operations plan include process provisions for how any determined need for operational changes would be incorporated into the project operation.

Our Analysis

Grant Lake—The project as proposed would result in changes to the current timing, magnitude, and duration of water surface elevation fluctuations in Grant Lake. Currently, water levels fluctuate within Grant Lake between 703 feet and 690 feet, with water surface elevations typically fluctuating between 703 feet and 698 feet. The greatest inter-monthly changes occur during ice breakup and snowmelt from late March through late June, with an average lake elevation increase of 0.8 feet per month. Maximum lake elevations were observed in July, with decreasing water levels averaging 0.33 feet per month in the fall and winter (Ebasco, 1984). While project operation would not result in Grant Lake water surface elevation fluctuations outside the existing range (i.e., 703 feet to 690 feet), based on figure 3-6, Kenai Hydro's proposed project operation would result in greater inter-monthly water surface elevation changes. Table 3-15 shows the average change in Grant Lake water surface elevations per month for a typical operation cycle.

Table 3-15. Average inter-monthly Grant Lake water surface elevation change (Source: Kenai Hydro, 2018a; Ebasco, 1984; as modified by staff).

	Water Surface Elevation Change (+/-) per Month	
Period	**Existing Conditions (feet)**	**With Project in Place (feet)**
January–May	+ 0.8	–1.6
June–August		+ 4.2
September–October	–0.33	0
November–December		–2

Changes to the current water surface elevation fluctuations could also affect the natural ice processes of Grant Lake. Because proposed operation would likely result in a gradual drawdown of Grant Lake during the winter, we do not expect the operation of the proposed project to change the current timing of ice cover on Grant Lake (i.e., ice formation in winter and ice breakup in the spring), but the expected lower than current water surface elevations during the winter could influence the structure of near-shore ice cover. As ice on the lake subsides, near shore ice would fracture and refreeze. Kenai

Hydro's proposal to operate the project for spinning reserve could result in localized ice cover modification. Because the spinning reserve capacity for the proposed project would be primarily available in the winter when Grant Lake inflows were low and ice cover was high, the quick withdraw of water from Grant Lake (one turbine would divert the full 192.5 cfs of flow into the detention pond with a total volume of 173,250 cubic feet (about 4 acre-feet) discharged during a 15-minute period) could result in minor localized ice cover subsidence in the area immediately around the project intake.

Kenai Hydro's proposed modes of project operation (i.e., block loading and level control) require accurate water level monitoring in Grant Lake for Kenai Hydro to adequately balance the competing water needs (e.g., power production, minimum instream flows, and surface water recreation) of the project. Kenai Hydro's water surface elevation monitoring equipment (RL-1) proposed in its Operation Compliance Monitoring Plan would appropriately serve as a mechanism to monitor the effects of project operation on Grant Lake an ensure compliance with potential license conditions (e.g., reservoir maximum and minimum water surface levels). The proposed plan would also include provisions to ensure flow releases are provided continuously to the bypassed reach and downstream of the tailrace at all times, consistent with Alaska DFG and FWS 10(j) recommendations.

Grant Creek—Project operation would alter the existing timing, magnitude, and duration of streamflows along the entire length of Grant Creek. Operation of the proposed project would reduce the amount of glacial melt water released from Grant Lake into Grant Creek. Under Kenai Hydro's proposal, flows in the bypassed reach (i.e., Reaches 5 and 6) would be reduced from current conditions to the agreed upon minimum instream flows plus accretion flows from groundwater, surface runoff, and minor tributary contributions. Downstream of the project tailrace (i.e., Reaches 1 through 4), winter base flows in Grant Creek during November through May would be higher than current conditions under with-project conditions. When Grant Lake is either at its minimum water surface level (i.e., May to early June) or full water level (i.e., late July through October), project outflows would approximate inflows and we expect no effect on the flow and water levels of Grant Creek. When Kenai Hydro is allowing Grant Lake to refill, flows in Grant Creek would be lower than current conditions under with-project conditions from early June until late July. High flow magnitudes (i.e., flood flows) during storm events would also be reduced throughout Grant Creek. Figure 3-7 presents flow hydrographs from 2013 for the reaches of Grant Creek below the project tailrace for current conditions and with-project conditions for flow.

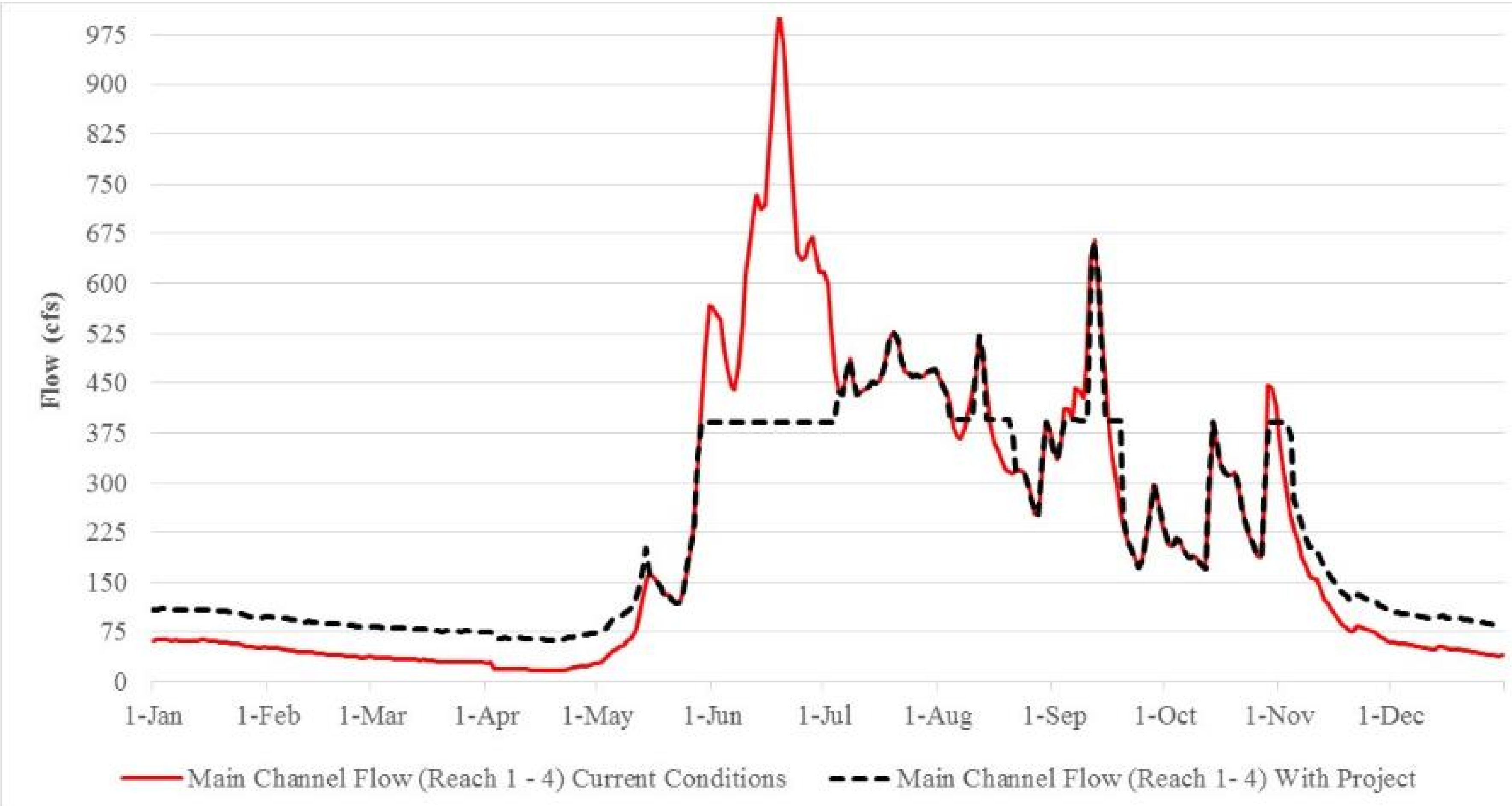

Figure 3-7. Grant Creek flows downstream of the proposed powerhouse for current conditions and conditions with the project in place (2013) (Source: Kenai Hydro, 2017d, as modified by staff).

Kenai Hydro's proposal to use the project for spinning reserve could also affect the timing, magnitude, and duration of flows in the portion of Grant Creek below the powerhouse. During typical operation, the detention pond would be kept dry and used only in rare instances when the spinning reserve capacity of the project was needed. Kenai Hydro notes that when a turbine is brought online for spinning reserve, the turbine would operate for an average period of 15 to 20 minutes to meet the instantaneous demand. Assuming one turbine was allocated to spinning reserve, the turbine would divert the full 192.5 cfs of flow into the detention pond with a total volume of 173,250 cubic feet (about 4 acre-feet) discharged during a 15-minute period.

Because Kenai Hydro's proposed project would alter streamflows in Grant Creek, project operation would require accurate streamflow monitoring for Kenai Hydro to adequately balance the competing water needs of the project. Kenai Hydro's streamflow monitoring equipment (e.g., ISF-1, ISF-2, and ISF-3) proposed in its Operation Compliance Monitoring Plan and its commitment to develop a stream monitoring plan, as recommended by Alaska DFG, FWS, and NMFS, would appropriately serve as mechanisms to monitor the effects of project operation on Grant Creek and ensure compliance with potential license conditions (e.g., minimum flows and channel maintenance flows).

Specifically, flow monitoring equipment placed at the proposed project intake (ISF-1) would allow Kenai Hydro to operate the project in a level control operating mode where outflow is balanced to inflow. Kenai Hydro's proposed ISF-3 streamflow recording location would consist of flow recording equipment through the bypass system within the bypass weir. This system, developed in consultation with the appropriate resource agencies, would allow Kenai Hydro to record flows entering the bypassed reach of Grant Creek and ensure adopted minimum flows were being met. Kenai Hydro's existing ISF-2 streamflow gage is appropriately located to record streamflows in the portion of Grant Creek below project influence. This location allows Kenai Hydro to ensure the adopted minimum flows of lower Grant Creek were being met. Adding a stilling well at this gage, as NMFS recommends, would reduce splashing and increase accuracy of stage readings. Kenai Hydro's agreement to consult with Alaska DFG, NMFS, and FWS on the proposed streamflow monitoring plan would provide a reasonable balance of input regarding appropriate measuring and recording methods.

Regarding FWS's recommendation that the plan include process provisions for how any determined need for operational changes would be incorporated into the project operation, Kenai Hydro would consult with agencies during preparation of the annual operations report, and issues concerning potential need for changes in operations would occur through the Commission's report approval and standard license modification processes.

A web-based, real-time monitoring of flow levels, as NMFS recommends, would allow the Commission and the agencies to determine project flows in the bypass reach and below the tailrace at any time, but this data is not needed to ensure the compliance with license requirements because the OCMP discussed earlier would ensure oversight of the project operations. Moreover, the OCMP would clarify definitions of all operations and conditions during which deviations from normal operations would be allowed and these clarifications would reduce confusion and ensure compliance with license requirements.

Modifying Kenai Hydro's Operation Compliance Monitoring Plan to include the measures presented in the commenting agencies stream monitoring plan with specific measures for flow monitoring in the bypassed reach and downstream of the project tailrace, would minimize operational effects on flows and water levels in Grant Creek. Modifying Kenai Hydro's Operation Compliance Monitoring Plan to include the agency proposed stream monitoring plan would consolidate all project operation requirements and provide the appropriate reporting procedures to efficiently document compliance of project operation with flow requirements.

Water Quality

Effects of Project Construction on Water Quality

Project construction could result in a number of direct and indirect effects on water quality within Grant Lake and in the affected reaches of Grant Creek. Use of heavy equipment for excavation and ingress/egress access during construction would disturb areas near proposed project facilities, potentially adding sediment to and increasing turbidity in Grant Lake. Construction of a cofferdam and subsequent removal may also lead to short-term increases in turbidity. In addition to ground-disturbing activities, heavy equipment would require use and storage of hazardous materials (e.g., fuel, oil, hydraulic fluids), which could degrade water quality if they came in contact with the aquatic environment.

Following issuance of a license, Kenai Hydro proposes to develop a series of monitoring and management plans to ensure that construction and operation of the project do not change or adversely affect water quality in Grant Lake or Grant Creek. These plans include an erosion sediment control plan, and, consistent with NMFS 10(j) recommendation 11, a hazardous materials containment/fuel storage plan, and a spill prevention control and containment plan. Kenai Hydro proposes to develop these plans in advance of construction activities and provide stakeholders with an agreed upon review and comment period prior to finalizing and filing with the Commission.

Kenai Hydro proposes, consistent with Forest Service final 4(e) condition 20, to provide a third-party ECM to oversee the project during major construction activities (e.g., vegetative- or land-disturbing, spoil producing, blasting activities). In addition, Forest Service final 4(e) condition 20 specifies that the ECM must have the authority to stop work or issue change orders in the field if conditions warrant and provide a liaison between the Forest Service and Kenai Hydro. The ECM would manage regulatory monitoring and compliance activities throughout construction. In its reply comments, Kenai Hydro states its ECM would meet with all requisite qualifications and expertise needed to monitor all major construction activities.

FWS (10(j) recommendation 16) and Alaska DFG (10(j) recommendation 15) recommend Kenai Hydro combine measures to address hazardous materials; fuel storage; and spill prevention, control and containment into a single plan. FWS and Alaska DFG recommend the plan include the following protective measures, applicable to both construction and project operation:

- designation of specific areas for maintenance and refueling of vehicles and equipment;
- contingencies with appropriate measures for containment and cleanup in the event of a spill or accident; and
- provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse.

In response to Agency recommendations, Kenai Hydro states it would combine the hazardous materials containment/fuel storage plan, and spill prevention control and containment plans. Kenai Hydro states it is committed to the collaborative development of a plan (or set of plans) that describes methods it would implement to minimize any impacts associated with the handling and/or use of hazardous substances, but does not specifically adopt the agency recommended measures.

Kenai Hydro proposes to conduct construction work per measures to be described in the ESCP. However, Kenai Hydro does not describe specific measures it would include in the plan. As discussed in section 3.3.1.2, *Construction Effects on Geology and Soils,* Forest Service provided specific measures it recommends Kenai Hydro include in its ESCP. Kenai Hydro also proposes to develop a construction stormwater pollution prevention plan to prevent stormwater runoff in construction areas from entering Grant Creek and Grant Lake.

Alaska DFG (10(j) recommendation 14) and FWS (10(j) recommendation 15) recommend the ECM monitor turbidity during construction both upstream of and 100 feet downstream of all construction activities and/or discharge points for overland flows that cross construction areas and discharge into Grant Creek. Both agencies recommend that, if turbidity 100 feet downstream of the construction area exceeds Alaska water quality standards, Kenai Hydro would stop related construction activities immediately, locate sediment sources, and implement appropriate sediment control measures. Additionally, FWS 10(j) comment 15 recommends Kenai Hydro conduct turbidity monitoring at 15-minute intervals at the stream gage downstream of the tailrace. Kenai Hydro states its intent to adhere to these requirements if they are conditions of a license.

Section 3.3.2.1 notes that Kenai Hydro measured lead concentrations in excess of the calculated freshwater chronic standard of 0.84 µg/l on two occasions in June 2009—one at Grant Creek at Site GC200 and the other at Grant Lake at Site GLTS at a depth of

10 meters. These values suggest that disturbing Grant Lake sediments during construction could mobilize lead, if present, and result in downstream transport in Grant Creek.

Our Analysis

Implementing an ESCP, as Forest Service specifies and as further discussed above in section 3.3.1.2, *Construction Effects on Geology and Soils*, would reduce potential effects of sediment erosion during construction on water quality in Grant Lake, Grant Creek, and Trail Lake Narrows.

Developing a hazardous material plan, as Alaska DFG and FWS recommends, to include specific areas for the maintenance and refueling of vehicles and equipment; contingencies with appropriate measures for containment and cleanup in the event of a spill or accident; and provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse would provide additional detail to better describe proposed measures and strengthen the plan. In addition, reporting observations of oily sheens and turbidity plumes on surface waters would also document potential fuel and oil spills and major erosion events, e.g., cofferdam construction and removal. Such reporting observations would identify the potential any need for additional containment measures.

Combining measures for hazardous material storage, spill containment, and spill prevention into a single plan, as Kenai Hydro proposes, and consistent with FWS and Alaska DFG recommendations would provide a single guidance and reference document for the construction contractor, ECM, and state permitting agencies as needed. A hazardous materials plan that includes: (1) specific areas for the maintenance and refueling of vehicles and equipment, (2) contingencies with appropriate measures for containment and cleanup in the event of a spill or accident, (3) provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse, and (4) reporting requirements to minimize project construction effects on water quality. Combining fuel storage, spill prevention/control, and containment plans into a single document would simplify agency consultation, the Commission's plan approval process, and compliance reporting.

Because of the remote nature of the proposed project, providing onsite monitoring by a third-party ECM with authority to stop work would assist in the detection of spills or erosion and allow for corrective measures to be quickly identified and implemented.

Regarding turbidity monitoring during construction, requiring Kenai Hydro through the ECM to monitor turbidity both upstream and 100 foot downstream of all activities and/or discharge points for overland flows that cross construction areas and discharge into Grant Creek would provide a means for detecting any erosion or sedimentation caused by the project. If turbidity measurements indicate a construction-related effect, the ECM could issue a stop work order to the construction contractor and work with the contractor to implement corrective measures. Therefore, additional monitoring at the stream gaging site on Grant Creek, per FWS 10(j) recommendation 15, would be unnecessary.

Adding pre-construction lead sampling to the ESCP would complement existing BMPs focused on turbidity. Sampling and analysis of lead prior to construction would: (1) characterize sediment lead concentrations from the standpoint of a threat to aquatic resources; (2) inform an assessment of the likelihood of release to the Grant Lake water column and downstream to Grant Creek, during construction; and (3) support a plan to avoid release of lead from disturbed sediments, if present.

Measuring sediment lead concentrations in areas where construction would disturb lake sediments, e.g., in the area of the proposed cofferdam, would be an appropriate means of assessing potential risks of mobilizing sediment bound lead. The U.S. Army Corps of Engineers developed screening values for characterizing levels of concern for lead to benthic communities: SL1, below which adverse effects would not be expected, is 360 milligrams per kilogram (mg/kg), and SL2, above which more than minor adverse effects may be observed, is >1300 mg/kg (Northwest Regional Sediment Evaluation Team 2018). Use of these screening levels would provide valuable comparisons and help assess risk of construction-related increases in lead concentrations.

If measured values exceed established screening level thresholds, capping sediments that may be disturbed during construction would minimize the potential for lead mobilization. Suitable materials for *in situ* caps include clean sand or a combination of sand and gravel (EPA, 2005). Placement of the cap following construction and prior to the removal of the proposed coffer dam, would be an effective means of preventing interaction between the water sediment interface, reducing the likelihood of release of lead to the water column.

Effects of Project Operation on Water Quality

Below, we identify the potential effects of operation of the proposed project on water quality in Grant Lake and Grant Creek, focusing primarily on changes to Grant Lake water surface elevations. In the *Our Analysis* section that follows, we discuss whether these effects would occur at the project. Due to complexities associated with proposed and recommended water temperature measures, we address temperature issues below other water quality parameters.

Grant Lake—Proposed drafting and refilling of Grant Lake could cause erosion of shoreline sediments, and, if present, leach or mobilize sediment bound metals. Winter drawdown could also reduce DO levels in Grant Lake and expose previously submerged littoral substrates to temperatures below 0°C, freezing the substrate and the associated benthic invertebrate community (Carmignani and Roy, 2017). Additionally, reduced Grant Lake elevations could expose a shallow rock ledge, isolating the two basins. As discussed in Ebasco (1984), the southern of the two channels in the ledge could act as a dam if the level of Grant Lake were lowered sufficiently during operation of the project. Per Ebasco, the controlling ledge of rock occurs at an elevation of about 685 feet.

Kenai Hydro's proposal to operate the project for spinning reserve could result in more rapid, but short-term, changes in lake levels. Such changes would occur during the winter within the descending portion of the operational rule curve.

Shifting the majority of flow volume leaving Grant Lake from the natural outlet to the proposed intake structure could affect stratification patterns, and therefore lake trophic status. In addition, proposed drawdown in the winter and spring and refilling of Grant Lake during the summer could affect the Grant Lake thermal regime. Currents associated with the project intake could also mobilize sediment near the lake bottom, entraining sediment-bound lead, if lead is present in this location.

Our Analysis

Changes to Grant Lake elevations would occur following construction of the project. As shown in figure 3-6, Grant Lake water levels would decline from January through May with surface elevations ranging from about 698 feet to 690 feet. During these months, project operation would expose shoreline areas that are submerged under existing conditions. Lake levels would rise from May through July, leveling out in August at elevation 702 feet. Grant Lake elevations from August through December (702 to 700 feet) would be about 2 feet higher than current elevations. However, project operation would not change the existing maximum lake elevation (703 feet); hence, there would be no potential for newly inundated shoreline areas.

The volume and area of Grant Lake would also be reduced during the winter/spring drawdown. At minimum pool, the Grant Lake volume would decrease by approximately 11,564 acre-feet, a reduction of 4.6 percent to 241,329 acre-feet. The lake area would be reduced by a maximum of 61 acres at minimum pool, or about 4 percent to 1,642 acres. In contrast to existing conditions, the annual average volume and lake area would change less than 0.5 percent. The maximum change in the ratio of lake volume to area would be 1 percent, and the annual average lake volume to area ratio would be unchanged.

Exposure and/or inundation of shoreline sediments based on the proposed rule curve could increase shoreline erosion in contrast to existing conditions. However, the shoreline littoral area is predominantly bedrock or coarse, angular boulders with a low susceptibility to erosion (Kenai Hydro, 2016). In a USGS analysis of trace metals transport in the Sacramento River, including lead and mercury, Taylor et al. (2011) found that nearly 100 percent of measured lead transported between Shasta Dam and Freeport occurred as colloids—bound to extremely small clay sized particles with grain size between about 0.005 and 1.0 micrometer. In addition to small particle size, organic material is also a key factor in determining metal distribution and mobility (Baran and Tarnawski, 2015). As discussed in the *Affected Environment* section, results of low-level mercury analyses were less than the Alaska DEC chronic standard of 0.77 μg/L during all sampling events. A single measurement of lead at Grant Lake, in June 2009, exceeded the calculated chronic standard of 0.84 μg/L:1.1 μg/l at GLTS at a depth of 10 meters.

Because of the nature of the Grant Lake shoreline, the lack of organic materials (wetlands or other vegetation) that would be affected by lake level fluctuation, and the unlikely presence of elevated metals, particularly in an oxidized environment, we find that heavy metal leaching resulting from water level fluctuations would be unlikely in Grant Lake or the surrounding shoreline. However, velocities near the intake could entrain lake sediments, and, if present, project operations could transport sediment-bound lead downstream to Grant Creek. Analysis of sediment lead concentrations, sediment grain size near the proposed intake, anticipated current velocities associated with the intake, and the likelihood of sediment entrainment would determine whether project operations could result in lead mobilization that would affect aquatic resources. If this analysis indicates adverse effects would occur, implementing measures to prevent sediment mobilization would minimize these effects.

Reduction in DO levels during winter drawdowns has been documented in experiments on shield lakes in the Northwest Territories. Drawdown volumes as low as 10 percent of the total lake volumes reduced DO levels to an extent deemed slightly greater than would occur naturally under heavy snow cover (Cott et al., 2008). However, these were small (<70-acre) lakes, in contrast to a much larger, well oxygenated Grant Lake (1,741 acres). Leppi et al. (2016) found low DO regimes in Alaskan lakes were most typical of shallow lakes with large littoral areas and macrophyte development, while lakes that had high DO regimes had limited littoral areas and deeper water.

Minor increases in turbidity associated with the proposed changes in lake levels may occur; however, the large particle size of shoreline substrates and low erodibility reduce the likelihood of increased turbidity during drawdowns or filling, or during short-term spinning reserve/peaking operations that would primarily occur during the winter. Bedrock and coarse angular boulders in the shoreline area would be expected to limit habitat for, and thus impacts on, benthic macroinvertebrates.

Other changes in water quality/water chemistry are not expected as a result of proposed changes in lake levels. In a simulation of lake level fluctuation for power production, Turner et al. (2005) experimentally conducted winter drawdowns and summer refilling in Lake 226 of the Experimental Lakes Area in northwestern Ontario. Drawdowns of 2−3 meters were conducted over three successive winters. Nitrogen and phosphorus concentrations as well as phytoplankton biomass, species assemblages, productivity, and nutrient status were largely unaffected.

Reduced lake levels could expose a rock ledge between upper and lower Grant Lake, isolating the two basins. Because of the proposed operational rule curve, the minimum lake level, reached in May, would be 690 feet, about 5 feet higher than the level of the rock ledge between the two basins. Kenai Hydro's proposed operation would therefore maintain continuity between the two basins.

Shifting the majority of outflow volume from the natural outlet to the proposed intake structure is not expected to alter stratification patterns or change the lake thermal regime because of the proposed surface level withdrawals from the Grant Lake intake structure (0.5 or 1.5 meter depths). In addition, the combination of proposed flows from Grant Lake to the powerhouse and bypassed reach would not change average annual discharge, thus we would expect no change in residence time, lake trophic status, or nutrient availability in contrast to current conditions. Further, in contrast to a hypolimnetic withdrawal that would act to remove cool water and expand the warmer epilimnion, we do not expect the proposed surface withdrawal to affect the existing Grant Lake thermal regime.

Maximum drawdown of Grant Lake (698 to 690 feet) would reduce its elevation by about 1 percent from January to May and its surface area by approximately 4 percent (1,704 acres to 1,642 acres based on figure B.3-5 in Kenai Hydro's amended final license application). Over the same period, operations would reduce lake volume by about 11,564 ac-ft, or 5 percent. Lake volume in June and July would be about 3 percent and 1 percent, respectively, of normal (pre-project) volume, and through the remainder of the ice-free season lake volume would be slightly higher than pre-project conditions.

Because the largest decrease in lake volume would occur during the winter, colder air temperatures at this time could result in cooler than pre-project temperatures in shallow, littoral areas of Grant Lake. However, as noted above, bedrock and coarse angular boulders in the shoreline area would be expected to limit habitat for, and thus impacts on, benthic macroinvertebrates.

Substantial changes in lake water temperature with respect to either night time cooling or day time warming would not be expected during ice-free conditions because of the relatively small changes in lake volume and surface area noted above. A simulated drawdown of Grant Lake from elevation 698 to 690 feet is shown in figure 3-34.

Grant Creek and Trail Lake Narrows—Reduced bypassed reach flows could also alter nutrient transport and biological processes within this reach (see discussion in section 3.3.2.2). Increased powerhouse flows under spinning reserve operations could increase turbidity or alter patterns of macroinvertebrate drift. Depending on local geology and geochemistry, downstream changes to DO, pH, specific conductance, alkalinity, metals, or other water quality constituents are a concern in any project that alters flow to downstream reaches. Solid waste or waste water generated at the project could also enter Grant Creek and affect water quality.

Kenai Hydro proposes to construct a sanitary waste holding tank or septic system to ensure proper treatment of solid waste and wastewater. Forest Service final 4(e) condition 19 specifies Kenai Hydro prepare a solid waste and wastewater plan.

Our Analysis

Spinning reserve operations would be subject to ramping rate restrictions, reducing the likelihood of increased turbidity or velocity that may otherwise effect macroinvertebrate drift. Other water quality changes to Grant Creek, Trail Lake Narrows, or Lower Trail Lake are unlikely because of proposed minimum flows, and the proposed surface level withdrawal from Grant Lake, mimicking the natural outlet.

Changes in elevations of Grant Lake would be would be unlikely to cause downstream changes in DO, pH, nutrients, specific conductance, alkalinity, metals, or other water quality constituents.

Lead concentrations in excess of the chronic standard were found in 2009 at Sites GC200 and GLTS in Grant Lake (10 meters). Sources of lead in Grant Creek and Grant Lake are unknown; anthropogenic contributions typically include gasoline-powered boat engines, agriculture, and mining (Orejuela, 2014). Mining has occurred in the Grant Lake Watershed, including recent approval by the Forest Service (Seward Ranger District) of a mining plan for operating the White Rock Mine on the north side of Grant Lake. The Forest Service's 2015 Environmental Assessment concludes that operation approved under the plan would have no direct, indirect, or cumulative effects on fish or the aquatic environment (Forest Service, 2015).

Proposed project operation would not contribute metals (or other contaminants), and as discussed relative to changing lake levels, elevation of non-project-related lead or other metals, if present, is unlikely in Grant Lake, Grant Creek, Trail Lake Narrows, or Lower Trail Lake.

Kenai Hydro's proposed construction of a holding tank or septic system would likely prevent release of solid waste or wastewater into Grant Creek, but no specific designs or locations were provided in the final license application. Developing a solid waste and wastewater plan, as Forest Service specifies, would allow agencies to review final plans and ensure facilities are appropriately designed for site-specific conditions.

Effects of Project Operation on Water Temperature in Grant Creek

Diversion of water from Grant Lake into the proposed project's powerhouse has the potential to alter the water temperature regime downstream of the lake outlet. If water temperatures in Grant Creek do not remain similar to existing (baseline) conditions, they could influence the amount of available spawning and rearing habitat for resident and anadromous fish and affect egg incubation, timing of emergence, benthic macroinvertebrate production, and other ecological processes in Grant Creek. Comments on the draft EIS also include concern that the project's reduction of flow in the bypassed reach may influence water temperature in this reach.[47]

Alaska DFG 10(j) recommendation 8 provide recommendations on efficacy and operation of the proposed temperature control system (variable intake). NMFS 10(j) recommendation 8, FWS 10(j) recommendation 8, and Alaska DFG 10(j) recommendation 8 also provide recommendations related to the underlying monitoring program that would allow confirmation that temperature targets and goals are being met. The intake system and monitoring are critical to avoiding and minimizing potential

[47] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

effects of the proposed project on water temperature. Because of these distinct but interrelated aspects of Kenai Hydro's proposed temperature management program, the discussion and analysis of the proposed variable intake and related targets/thresholds separately is presented below, followed by the proposed temperature monitoring program.

To minimize adverse effects on the Grant Creek thermal regime, Kenai Hydro proposes and Alaska (10(j) recommendation 8) recommends a variable depth intake structure in Grant Lake that includes adjustable gates to target water from depths that match the current temperature regime in Grant Creek. Kenai Hydro has developed recommended monthly intake depths designed to minimize project effects on Grant Creek temperatures. Alaska DFG notes that temperatures in Grant Creek are very similar to the temperatures at a depth of 0.5 meter in Grant Lake.

Our Analysis

Maintenance of the current Grant Creek thermal regime requires a robust, durable solution capable of long-term protection of critical fisheries and aquatic resources. Because Grant Creek temperatures are driven largely by Grant Lake outlet temperatures, Kenai Hydro's approach is to continuously monitor both lake and creek temperatures, adjusting intake elevations in Grant Lake as needed to maintain the Grant Creek thermal regime. Kenai Hydro has proposed intake depths that, based on continuous monitoring data, would match downstream temperatures to within 1°C.

Kenai Hydro's temperature analysis shows that the strongest correlation between Grant Lake and Grant Creek temperatures was between creek temperatures and surface lake depths of either 0.5 meter or 1.5 meters, depending on ice cover. During the winter, Kenai Hydro's monitoring documented that lake temperatures at a depth of 0.5 meter most closely match water temperatures in Grant Creek, while during the ice-free period (May through October), Grant Creek temperatures are most similar to Grant Lake temperatures at a depth of 1.5 meters (figure 3-8).

In the 2013 winter period (January through April), mean monthly temperatures at GLTS at a depth of 1.5 meters were up to 1.5°C warmer than Grant Creek (GC200) temperatures. Close correlation of the water temperatures at Grant Creek and GLTS (at a depth of 1.5 meters) during the ice-free season was also shown during 2009.

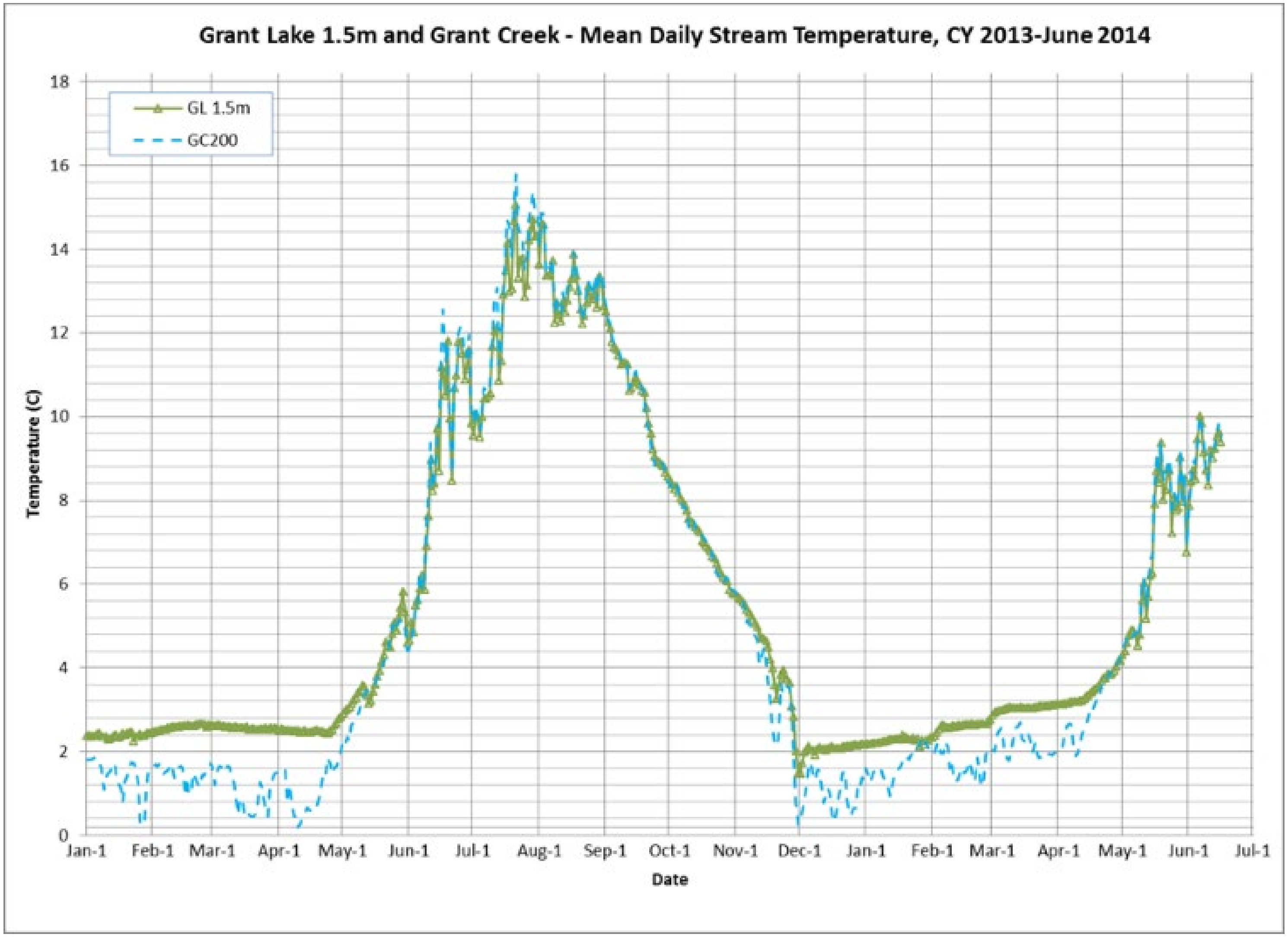

Figure 3-8. Comparison of daily mean water temperatures in Grant Creek and Grant Lake near the proposed intake structure at a depth of 1.5 meters, January 2013–June 2014 (Source: Kenai Hydro, 2018a, as modified by staff).

Kenai Hydro's approach for determining the withdrawal depth from Grant Lake would target the depth where temperatures have been found to be most similar to those at downstream sites under current conditions. Using data collected in 2013 from April through September, we compared Kenai Hydro's average daily temperature data near the proposed intake (site GLT1) at four depths (0.2, 0.5, 1.5, and 3 meters), with Grant Creek sites GC100, GC200, and GC300 to determine the intake depth with least impact on the Grant Creek thermal regime (figure 3-9).

Below, we evaluate Kenai Hydro's proposed intake depths and subsequent effects on Grant Creek water temperatures. As shown in both staff and Kenai Hydro's assessment, water temperature differences between Grant Creek and Grant Lake are most apparent during early spring, when creek sites are warming faster than Grant Lake surface waters. Slightly deeper waters in Grant Lake are colder than creek sites in April and to a lesser extent in May. This pattern reverses in June through August, when creek sites are cooler than Grant Lake surface waters and warmer than Grant Lake at 1.5- and 3-meters depth. September differences are minimal as the lake becomes isothermal.

The depths by month that would most closely approximate Grant Creek water temperatures are summarized below (table 3-16). The depths in April, May, June, and September are the same as those recommended in Kenai Hydro's amended final license application. A withdrawal depth of 0.5 meter in Grant Lake in July and August would result in less of a difference to downstream temperatures than would 1.5 meters, based again on 2013 data from Grant Creek sites GC100, GC200, and GC300.

Table 3-16. Grant Lake withdrawal depths with least effect on downstream temperatures (Source: staff depths based on analysis shown in figure 3-9; Kenai Hydro data from Kenai Hydro, 2018a).

Month	**Staff Analysis**	**Proposed Crest Depth**
April	0.5	0.5
May	1.5	1.5
June	1.5	1.5
July	0.5	1.5
August	0.5	1.5
September	1.5	1.5

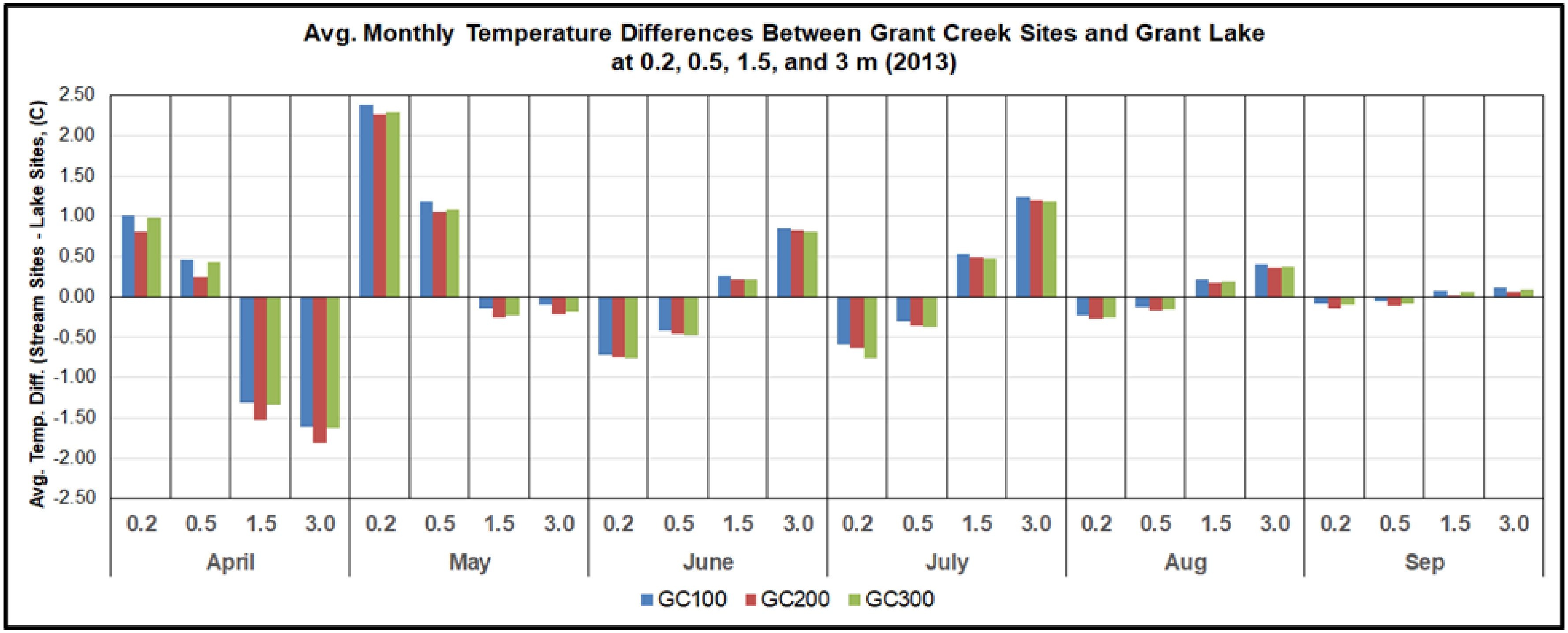

Figure 3-9. Average monthly temperature differences between Grant Creek sites and Grant Lake, 2013 (Source: staff).

We reviewed the proposed rule curve for the project to assess whether it could constrain water temperature management goals during the spring and early summer, when lake elevation may prevent access to deeper water. Kenai Hydro's proposed maximum and minimum pool elevations for Grant Lake are 703 feet and 690 feet, respectively. Exhibit F (preliminary design drawings), sheet F7, shows the sill elevation of the intake facility at 686.5 feet (figure 3-10). Maximum intake depth would therefore be limited to about 1 meter at minimum pool.

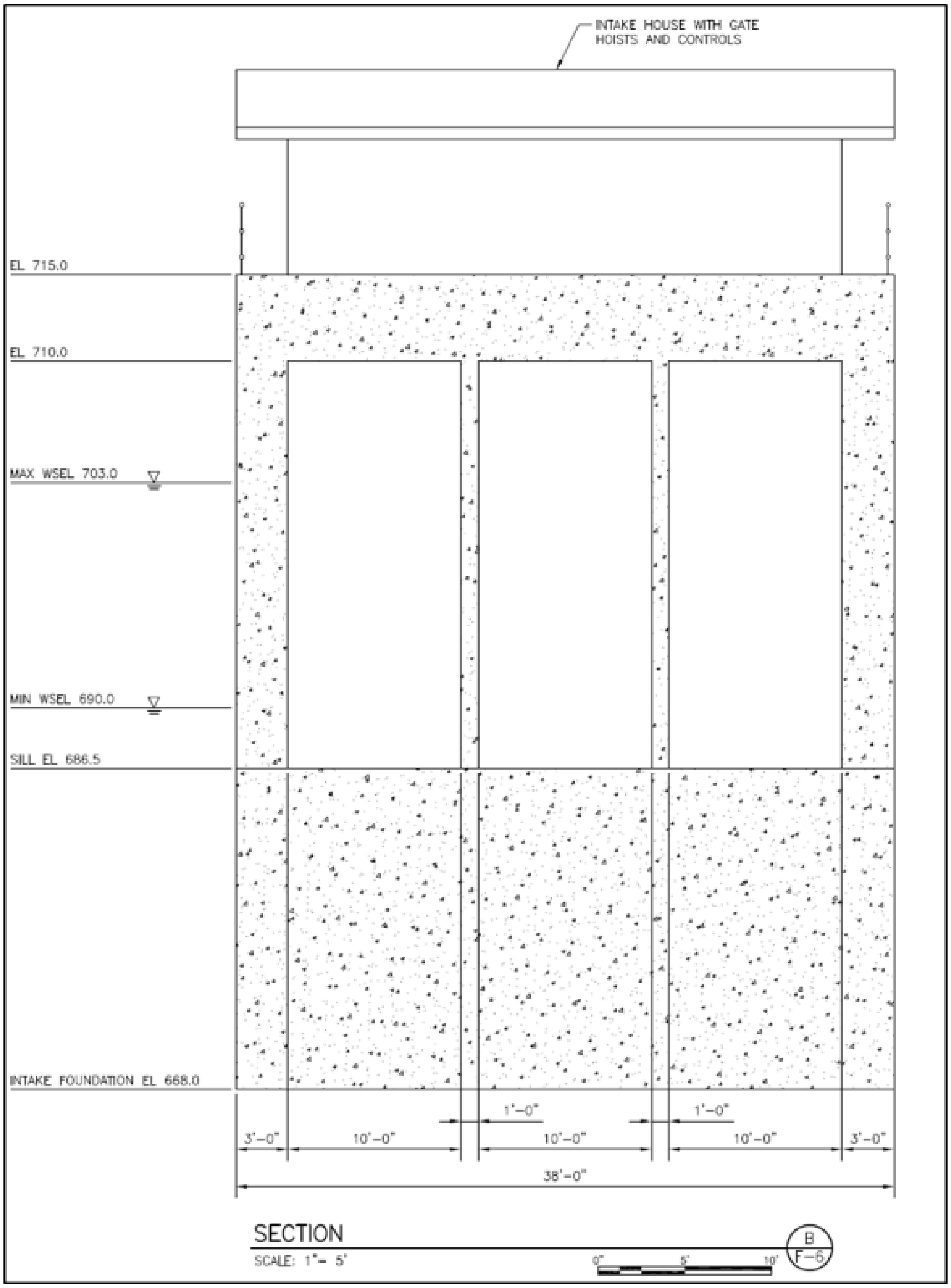

Figure 3-10. Cross section of intake facility (Source: Kenai Hydro, 2016, as modified by staff).

Grant Lake would be at minimal pool for 17 days in May (from 690 to 691 feet). During May, our comparison of differences between Grant Lake and Grant Creek temperatures suggests that an intake depth of 1.5 meters (4.9 feet) best mimics creek temperatures (measured at GC200 downstream of the tailrace). As noted, there would be insufficient depth to achieve more than about a 1-meter intake depth in May. However, review of temperature differences shown in figure 3-9 suggests that Grant Lake and Grant Creek temperatures are not likely to differ by more than 1°C at an intake depth of 1 meter (the maximum depth possible at this time).

Similar to May, Grant Lake during early June would be at an elevation that may prevent reaching 1.5 meters below the surface. Based on the 2013 analysis above, shallower intake depth temperatures are likely to be cooler than Grant Creek temperatures at that time but still likely to be within 1°C of Grant Creek temperatures. A steeply rising lake level would limit this issue to early June.

In view of potential operational constraints on the ability to mitigate temperature impacts of the project, we assessed potential modifications of the project rule curve that would raise the minimum reservoir elevation to 692 feet, allowing withdrawal at 1.5 meters depth. Raising the minimum elevation to 692 feet while maintaining the same total annual storage would increase the duration of minimum pool from 17 to 41 days (May 3 to June 13) under average hydrological conditions (water year 2009). The limited increase in flexibility that this would provide to manage temperature impacts, particularly during the ice break-up period, would not justify effects of the extended drawdown on other resources, including potential for reduced wildlife access, increased shoreline erosion, increased habitat for invasive plants, and reduced recreational/aesthetic value.

Pre-project temperature data document that Grant Creek temperatures mimic those of the Grant Lake outlet, regardless of the location in Grant Creek. Figure 3-3, in Section 3.3.2.1, subsection *Fish Populations,* shows daily mean temperatures at sites monitored at Grant Creek during 2013 (the most complete data set available). All sites, including GC100 and GC600, the lower-most and upper-most sites monitored on Grant Creek, have nearly identical temperatures, showing negligible longitudinal changes in temperature within Grant Creek under existing conditions. Average difference in mean daily temperature between these two sites was 0.1°C over the period May through September. Within the proposed bypassed reach, (Reaches 5 and 6), average difference between Site GC600 and GC500 was also 0.1 °C over the period May through September (2013). These small changes reflect the high gradient and heavily shaded nature of this region of Grant Creek.

In response to a comment on the draft EIS, we expanded our evaluation of effects of project operation on water temperature in Grant Creek to address potential changes (warming and cooling) within the bypassed reach specifically. Using a mass-balance approach, we approximated the effects of the proposed project using daily mean temperature data collected in Grant Lake (Site GLTS), and at upstream and downstream ends of the proposed bypassed reach (Sites GC600 and GC500). For this analysis, we used daily mean flows from Kenai Hydro's operations model for 2013, and the relationship between wetted widths and flow at a cascade transect in the bypassed reach (TR520). Using observed changes in daily mean temperature from GC600 to GC500 from April 5 to September 26, 2013, we computed the required energy (in joules) needed to achieve the observed change at known flows, then prorated this energy based on the change in wetted widths with project flows. The project flows are the proposed minimum flow with the addition of spill-gate flow in August and September, when Grant Lake would reach approximately 702 feet amsl.[48] The temperature of project inflow was set equal to either Grant Lake at a depth of 0.5 or 1.5 meters, thus covering the range of anticipated intake depths.

Comparison of temperature estimates described above to measurements at GC500 in 2013 are shown in figure 3-11. Based on likely intake depths needed to maintain the lower Grant Creek thermal regime as discussed above (see the Staff Analysis column in table 3-15), we expect proposed project operation would result in average water temperatures at the downstream end of the bypassed reach that are about 1°C cooler in April, about 1°C warmer in May, slightly warmer in June (average 0.1°C), and on average 0.5°C to 0.9°C warmer in July through September. Although ranges and quartile differences are greater for the proposed project, bypassed reach temperatures would generally have been within about 2°C of temperatures measured in 2013 (figure 3-12).

Estimates of Grant Creek bypassed reach temperatures discussed above are a function of air temperature and local meteorology from April through September of 2013. For reference, monthly average air temperatures in 2013 at Anchorage were among the coldest on record in April and among the warmest on record in June, July, and August (National Weather Service, 2019). Average June and July air temperatures at the Seward airport in 2013 were also among the warmest on record.[49]

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[48] Spill-gate flow is any positive value for the following equation: total flow - 385 cfs powerhouse capacity - 10 cfs minimum flow.

[49] Anchorage monthly average air temperature in April was the third lowest, June and July were the second warmest, and August was the tenth warmest of the 1917-current period of record. Average monthly air temperatures in June and July were also warmest and second warmest at the Seward airport (2000-2018).

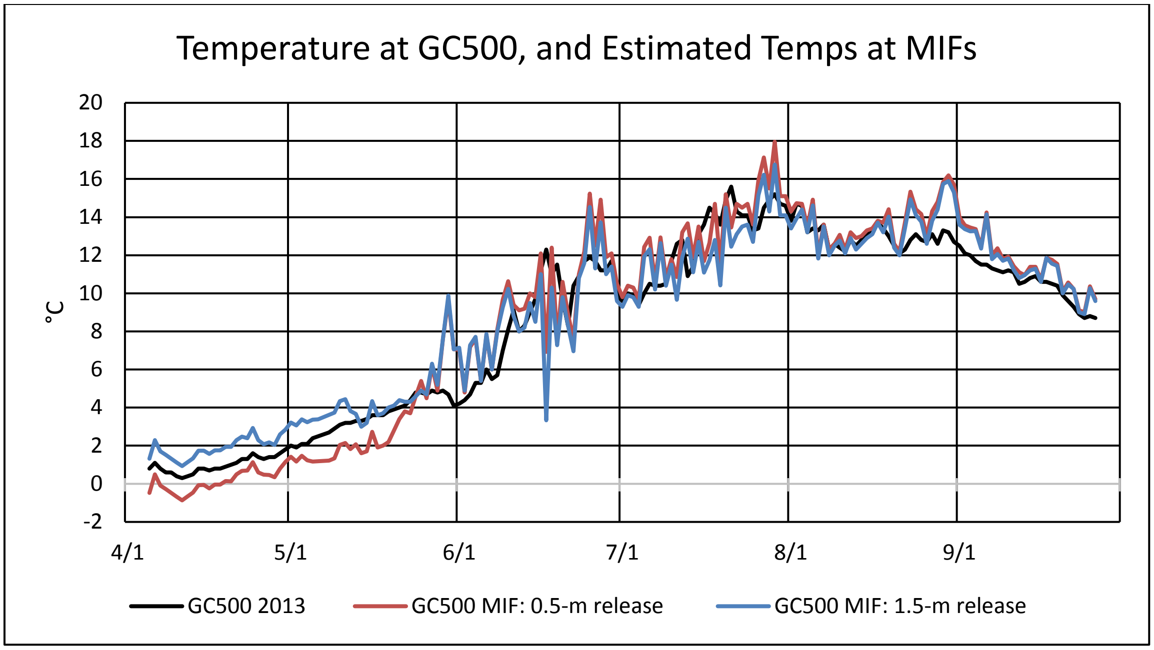
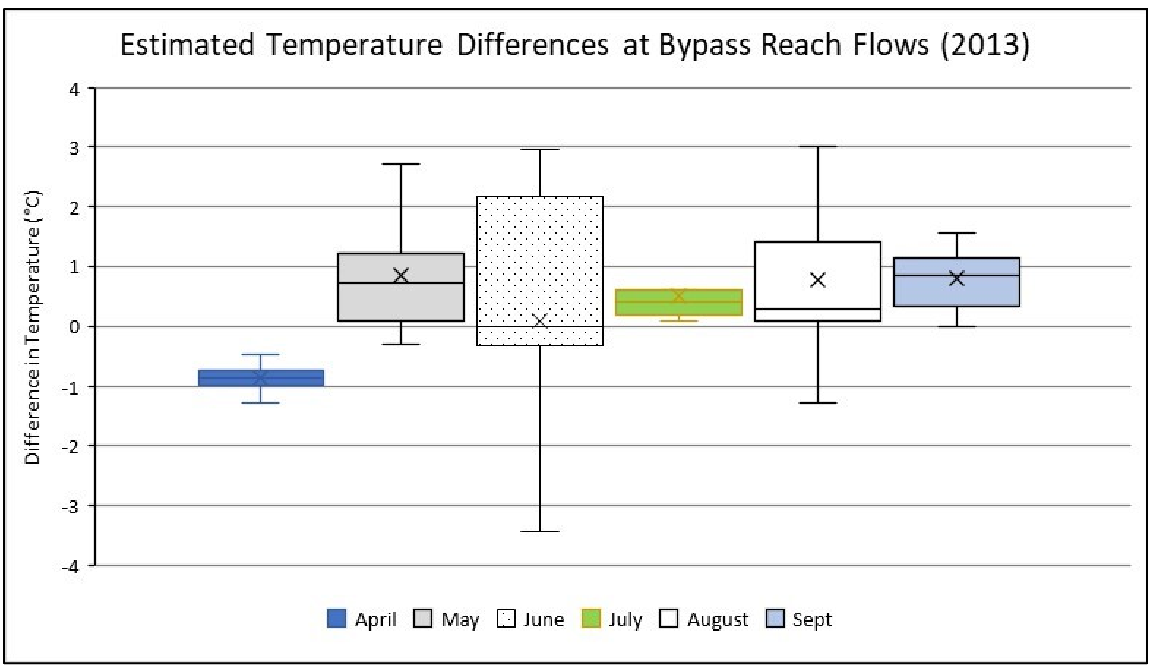


Figure 3-11. Daily mean temperatures measured at Site GC500 in 2013 and estimated under proposed project operation (Source: staff).



Note: Differences are based on releases at lake depths of 0.5 meter in April, July, and August; and 1.5 meters in May, June, and September (see table 3-16).

An X represents mean, horizontal lines represent medians, a box represents 25% to 75% quartiles, and the top and bottom of vertical lines are minimum and maximum.

Figure 3-12. Boxplots of estimated project effect on temperature at the lower end of the bypassed reach at Site GC500 (Source: staff).

Because of the low ratio of proposed bypassed reach flows to proposed powerhouse discharge, bypassed reach temperatures would typically have minimal effect on the Grant Creek thermal regime downstream of the powerhouse. When operating at proposed minimum flows, the bypassed reach would contribute less than 10 percent of the total flow downstream of the powerhouse. An exception to this pattern could occur during spills at the dam that result in much higher flows in the bypassed reach, although the powerhouse discharge would typically be near its capacity of 385 cfs during these periods. During high spill events, the volume and temperature of spill-gate releases would dominate releases into the bypassed reach from the intake and, to a lesser degree, influence temperature downstream of the powerhouse tailrace depending on the ratio of spill-gate releases to powerhouse discharges.

As noted in agency comments referenced earlier in this section, if water temperatures in Grant Creek do not remain similar to existing (baseline) conditions, they could influence the amount of available spawning and rearing habitat for resident and anadromous fish and affect egg incubation and timing of emergence. Increased temperatures could also affect benthic macroinvertebrate production and other ecological processes in Grant Creek.

This analysis indicates that the proposed project operation would increase the bypassed reach temperature in May through September and may cause more frequent exceedances of the 15°C rearing and migration criteria in late summer. However, increases in daily mean temperatures of the bypassed reach would likely remain well under the Alaska 20°C maximum water temperature criterion.

Water Temperature Monitoring

Kenai Hydro's proposed temperature monitoring, described in section 3.1 of its Operation Compliance Monitoring Plan, is generally consistent with agency 10(j) recommendations. Kenai Hydro would collect temperature data continuously (at 15-minute intervals) and monitor differences between Grant Creek and Grant Lake. As discussed in section 3.1 of its Operation Compliance Monitoring Plan, Kenai Hydro would install temperature monitors at the Grant Lake intake structure in Grant Lake near the intake (0.5 meter) and at two downstream locations (ST-1 and ST-2 [GC200]). Kenai Hydro proposes that ST-l, at the downstream end of the bypassed reach, just upstream of the tailrace, would serve as the reference site for comparison to Grant Lake near the intake (0.5 meter); Site ST-2 (GC200) would be located about 1,000 feet farther downstream (figure 3-13). Thermographs would transmit information to the control system located in the powerhouse via a fiber optic link. The powerhouse would be linked to the Kenai Hydro Dispatch Center via a telemetry system (e.g., landline, cellular, satellite) to transmit appropriate supervisory control and data acquisition signals. Kenai Hydro would collect lake level and associated water temperature data for the duration of the license term.

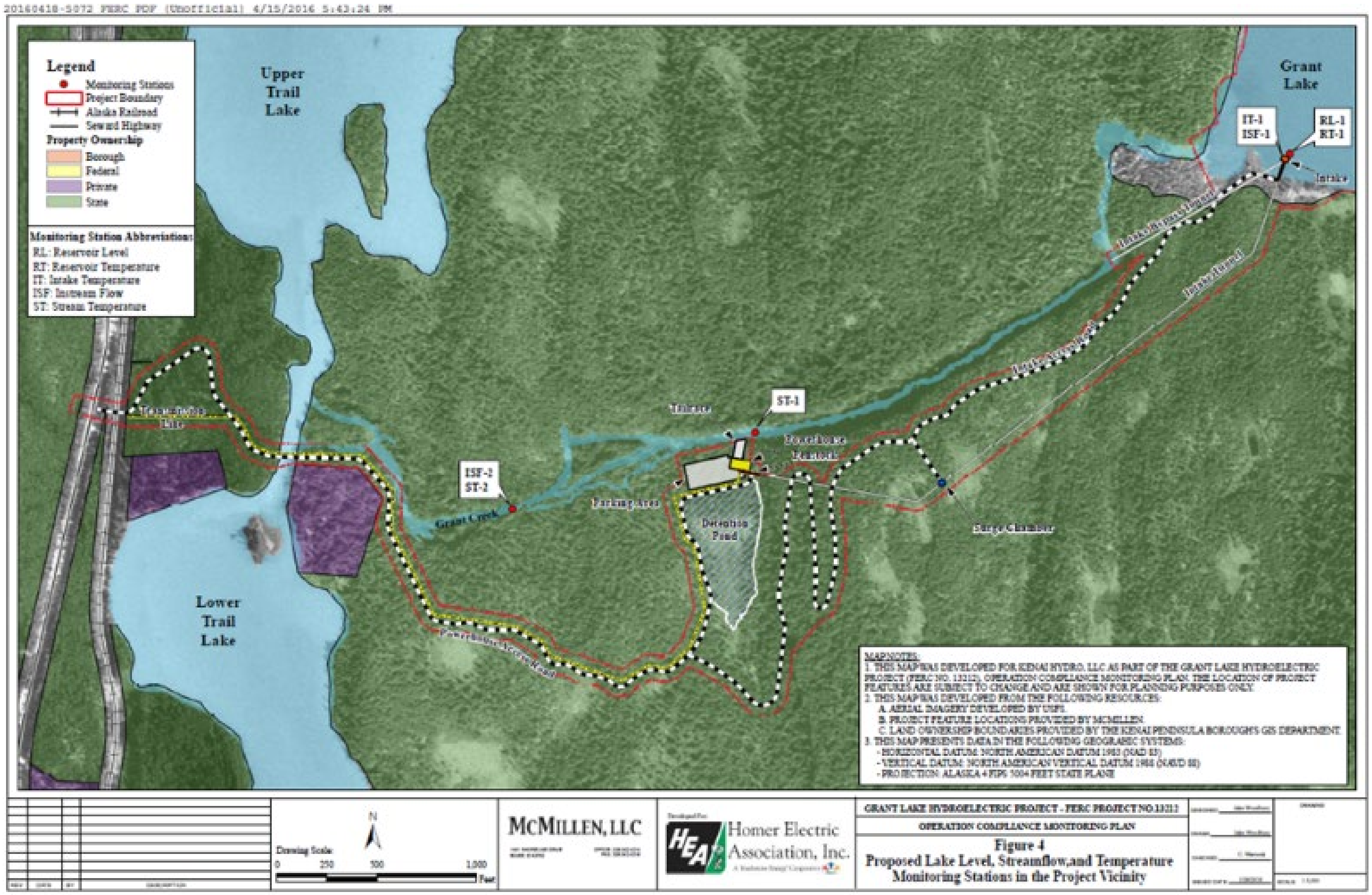


Figure 3-13. Proposed flow and temperature monitoring locations in the Grant Lake Project vicinity (Source: Kenai Hydro, 2018a, as modified by staff).

Alaska DFG 10(j) recommendation 8, NMFS 10(j) recommendation 8, and FWS 10(j) recommendation 8 each recommend Kenai Hydro develop a temperature monitoring plan to be filed with the Commission 6 months before the start of project operation. The agency recommendations differ with respect to location and number of monitoring sites, and threshold differences between temperatures in Grant Lake and Grant Creek; i.e., the difference above which would require corrective action (table 3-17).

Table 3-17. Summary of Kenai Hydro proposed and agency 10(j) monitoring recommendations (Source: staff).

Location	**Kenai Hydro**	**Alaska DFG**	**NMFS**	**Interior**
Gage upstream of intake structure (OCMP Station RT-1); unspecified depth	X			
Gage in Grant Lake at 0.5 meter (away from influence of project intake)				
Gage in Grant Lake at 0–0.5 meter (near intake)				X
Gage in Grant Lake at 0-0.5 meter (away from influence of project intake)		X		
Gage in Grant Lake at 0–1 meter (near the intake)			X	
Thermograph inside of intake structure (OCMP Station IT-1)	X		X	X
Grant Creek lower bypassed reach (ST-1)	X			
Grant Creek downstream of tailrace (ST-2 [GC200]) in the OCMP	X	X	X	X
1ºC	X		X[b]	X
0.5ºC		X[a]		

[a] Inferred from 10(j) comments.

[b] 0.5ºC, not exceeding 1.0ºC during initial years of operation.

Alaska DFG, NMFS, and FWS recommend that the Grant Creek reference location—the site to be compared to Grant Lake—be downstream of the powerhouse tailrace. Kenai Hydro proposes that ST-1, at the downstream end of the bypassed reach, serve as the reference in Grant Creek. Recommended monitoring locations in Grant Lake differ slightly among the agencies; however, each agency recommends monitoring surface waters at depths from 0 to 1.0 meter near the proposed intake structure. In addition, Kenai Hydro proposes, and the agencies recommend, monitoring within the intake structure.

Regarding threshold temperatures, FWS recommends and Kenai Hydro proposes a threshold of 1°C, while NMFS recommends 0.5°C, not greater than 1°C during initial years of operation. Alaska DFG recommends a 0.5°C threshold. We note that these thresholds refer to maximum differences between Grant Lake and Grant Creek temperatures, not to absolute temperatures at these locations.

Our Analysis

Small deviations from the current thermal regime could lead to large differences in the timing of emergence and condition of salmonid fry. In their 10(j) recommendations, Alaska DFG, NMFS, and FWS note that water temperature is a fundamental variable affecting fish development, particularly for over-wintering eggs and alevins, and that a consistent temperature difference of even 0.5°C during the entire winter could alter the timing of emergence by as much as 1 month and could, therefore, seriously affect fry survival. Fuhrman et al. (2017) found that salmonid fry from warmer thermal regimes emerged earlier than those from colder regimes both in terms of calendar date and temperature units and that warmer temperatures caused fry to emerge less developed. McCullough (1999) found that when the base temperature is 2°C, an increase of 1°C results in a shortening of time to emergence for chinook by 60 days; increasing winter incubation temperature from 6°C to 7°C results in a reduction of time to emergence by 22 days. Other effects of flow management on aquatic resources, including fish and benthic macroinvertebrates are discussed in section 3.3.2.2, in the *Effects of Project Operation on Aquatic Habitat in the Bypassed Reach* and the *Effects of Project Operation on Macroinvertebrates* subsections.

As noted above, Kenai Hydro proposes that ST-l, at the downstream end of the bypassed reach, just upstream of the tailrace, would serve as the reference site for comparison to Grant Lake near the intake (0.5 meter). However, in contrast to site ST-1, site ST-2 (GC200) is also the proposed stream gaging location and is within and representative of the reach of Grant Creek that is accessible to anadromous fish. In addition, this location informed staff as well as Kenai Hydro's assessment of existing temperature relationships between Grant Creek and Grant Lake. Finally, site ST-2 (GC200) would integrate any effects of the project on temperatures in the bypassed reach. We see no direct role for site ST-1 in temperature management.

As described in section 3.1 of the Operation Compliance Monitoring Plan, Kenai Hydro's proposal to deploy a stratified set of temperature probes at various depths in Grant Lake would inform and refine the understanding of water temperature responses to changes in intake elevations. However, compliance with temperature targets would be best achieved by comparing temperature differences between site ST-2 (GC200) and Grant Lake at 0.5 meter and adjusting the intake level accordingly to control temperature in Grant Creek. Temperature probes within the intake structure would be redundant and unnecessary to an operational temperature monitoring program.

As stated in its Operation Compliance Monitoring Plan, Kenai Hydro would monitor temperature at locations throughout the project area to ensure that monthly lake and creek temperatures are within 1°C. Below, we compare differences in daily, 7-day average, and the monthly mean temperature difference between Grant Creek at site ST-2 (GC200) and Grant Lake at 0.5 meter during May 2013 (figure 3-14). Using the monthly average difference as a target masks greater variability that occurs more frequently and could therefore negatively affect over-wintering eggs and alevins. However, Kenai Hydro would have access to temperature data on a real-time basis and could make corresponding changes in intake elevation as needed to target appropriate water temperatures in Grant Creek on a real-time basis. Managing Grant Creek water temperatures on a real-time basis would minimize the project's potential to negatively affect water temperatures in Grant Creek and subsequently influence development of eggs, alevin, and fish residing there.

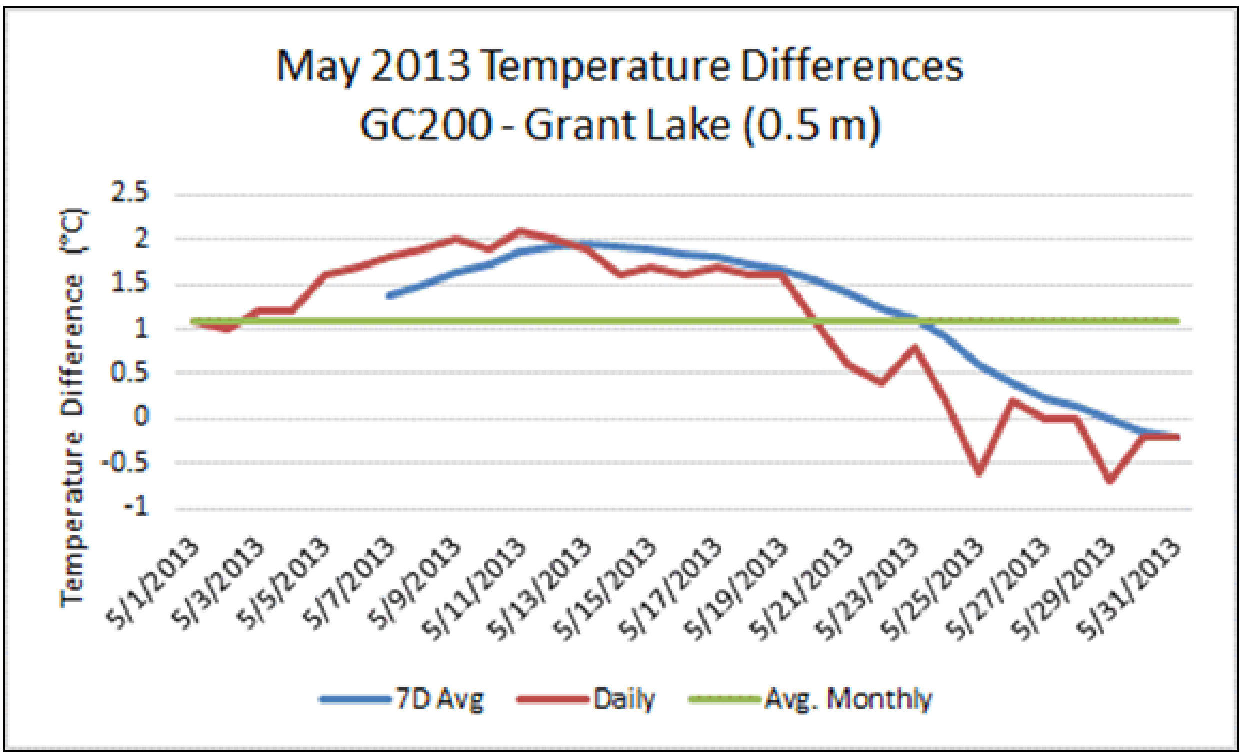


Figure 3-14. Differences in 7-day average and daily temperatures versus average monthly temperature difference in Grant Creek and Grant Lake, May, 2013 (Source: Kenai Hydro, 2018a, as modified by staff).

To determine compliance with any operational temperature requirements, the water temperature monitoring plan could establish well-defined target and threshold differences between Grant Creek and Grant Lake temperatures, as recommended by the agencies. Kenai Hydro's 2013 temperature data indicate that, except for May, water temperatures measured at 0.5-meter depth in Grant Lake are generally within 0.5°C of the water temperature concurrently measured at ST-2 (GC200). Subsequently, using real-time water temperature data from 0.5-meter depth in Grant Lake to establish a real-time water temperature target for Grant Creek would establish a temperature regime for Grant Creek, and operating the project to meet that target would establish a temperature regime in Grant Creek that closely mimics current conditions. However, during May, differences in water temperatures as great as 2.1°C warmer have been observed, likely the result of rapidly changing air temperatures during the spring (figure 3-15). Establishing threshold differences of +/− 0.5°C between Grant Lake (0.5-meter depth) and Grant Creek temperatures at site ST-2 (GC200), as recommended by Alaska DFG, should be attainable and most protective of the aquatic resources in Grant Creek during all months, except during the ice break-up period. Differences in water temperature data collected during May 2013 have an upper quartile value difference of 1.7°C, with a median difference of 1.2°C. Therefore, allowing threshold differences of 0.5°C between Grant Creek and Grant Lake water temperatures at a 0.5-meter depth plus 1°C would result in Grant Creek temperature fluctuations that mimic current conditions during ice breakup.

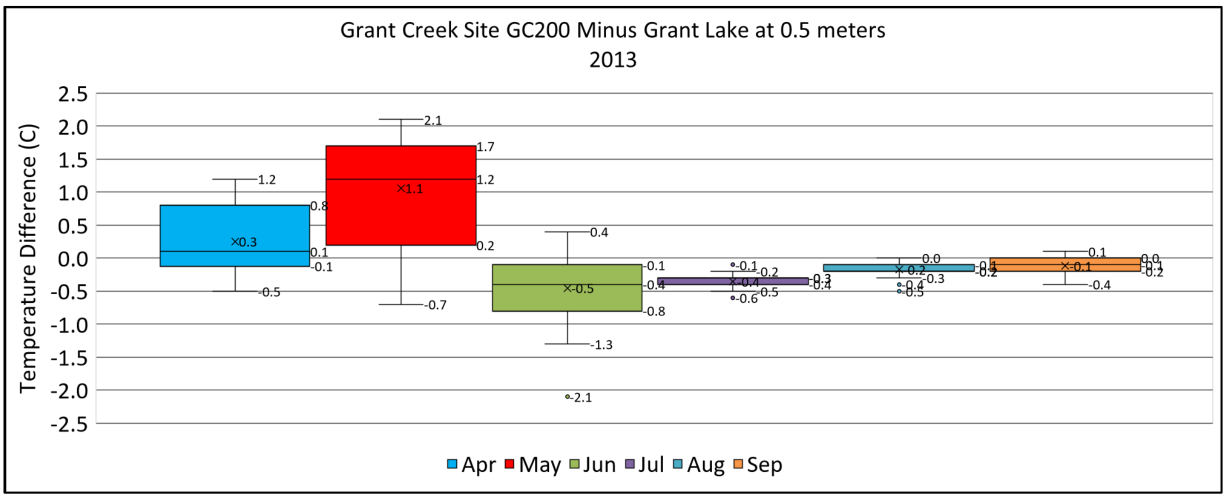


Figure 3-15. Box and whisker plot showing temperature differences between Grant Creek Site ST-2 (GC200) and Grant Lake at 0.5 meter, 2013 (Source: staff).

Kenai Hydro's development of a plan that outlines goals and objectives of Grant Creek temperature management, as recommended by the agencies, would be beneficial in that it would detail the location and operation of temperature gages and improve clarity of project operation and compliance monitoring. While the agencies recommend that Kenai Hydro develop a separate temperature monitoring plan, modifying the Operation Compliance Monitoring Plan to incorporate these criteria as proposed by Kenai Hydro would avoid the need for a new stand-alone plan.

Fishery Resources

Construction Effects on Fisheries and Macroinvertebrate Resources

Grant Lake—Construction of the proposed project's intake has the potential to adversely affect resident fish and macroinvertebrate populations in Grant Lake from temporary displacement and mortality associated with the cofferdam construction and dewatering, excavation of the lakebed to the base of the intake, and erosion and runoff from adjacent disturbed areas.

In its amended final license application, Kenai Hydro proposes to develop several plans—an ESCP, a hazardous material containment/fuel storage plan, a spill prevention, control and containment plan, a construction water quality monitoring plan, and a blasting plan—to protect both water quality and fisheries resources during construction.

Alaska DFG's 10(j) recommendation 9, NMFS 10(j) recommendation 9 and FWS's 10(j) recommendation 10 about timing windows for instream construction also apply to construction of the intake in Grant Lake.

Alaska DFG (10(j) recommendation 10) and FWS (10(j) recommendation 11) for stream buffers include exemptions from the recommended timing windows for appurtenant facilities, which include the weir at the outlet of Grant Lake, intake in Grant Lake, and monitoring equipment in Grant Lake. Alaska DFG states that construction and maintenance of these sections of the project would be addressed in an ESCP.

In response to these recommendations, Kenai Hydro agreed to consult on its proposed resource management plans and implement agency recommendations for instream construction scheduling, which includes construction in Grant Lake.

Grant Creek—Construction activities could adversely affect anadromous and resident fish and macroinvertebrate populations in Grant Creek through temporary displacement and mortality associated with construction and erosion and runoff from adjacent disturbed areas. Increases in suspended sediment could reduce aquatic habitat suitability downstream of the construction area, including Lower Trail Lake and Trail Lake Narrows, bury fish eggs, and clog the gills of macroinvertebrates.

As described above in the *Grant Lake* subsection, Kenai Hydro's proposed ESCP, hazardous material containment/fuel storage plan, spill prevention, control and containment plan, a construction water quality monitoring plan, and a blasting plan would be implemented for all construction activities occurring in Grant Creek.

In Alaska DFG's 10(j) recommendation 9, NMFS 10(j) recommendation 9, and FWS's 10(j) recommendation 10, the respective agencies recommend Kenai Hydro work with Alaska DFG's habitat biologist to establish timing windows for instream construction and stream crossing activities. Alaska DFG states that timing windows are needed to ensure that instream construction activities do not adversely affect aquatic resources.

Alaska DFG's 10(j) recommendation 10 and FWS 10(j) recommendation 11 also recommend that Kenai Hydro maintain stream buffers around clearings, road corridors, and the transmission line corridor. Alaska DFG states that construction activities should be sited at least 100 horizontal feet from the ordinary high water of Grant Creek, except for clearings for the powerhouse, appurtenant facilities, and tailrace. Alaska DFG states that appurtenant facilities include, but are not limited to, the bridge across Trail Lake Narrows, the weir at the outlet of Grant Lake, the intake in Grant Lake, and monitoring equipment in both Grant Lake and Grant Creek. An exception is also recommended for about 500 feet of access road east of Trail Lake Narrows, where private property necessitates construction of the road and transmission line corridor within 100 feet of Grant Creek. Alaska DFG states that construction and maintenance of this section of the project would be addressed in the ESCP.

In response to the agencies' recommendations, Kenai Hydro agreed to consult with the resource agencies regarding the development of its proposed resource management plans and implement agency recommendations for an instream construction scheduling.

Lower Trail Lake and Trail Lake Narrows—Construction of the proposed project's powerhouse access road and transmission line at Trail Lake Narrows, upstream of Lower Trail Lake, also has the potential to adversely affect aquatic resources through temporary displacement and mortality associated with construction and erosion and runoff from adjacent disturbed areas. However, as is the case for Grant Creek and Grant Lake, Kenai Hydro's proposed plans to protect water quality and aquatic resources during construction and the resource agencies' recommended instream construction timing windows would be implemented during construction of the access road and transmission line across Trail Lake Narrows.

Alaska DFG's 10(j) recommendation 9, NMFS 10(j) recommendation 9, and FWS's 10(j) recommendation 10 for timing windows for instream construction would be implemented during construction of the of access road and transmission line in Lower Trail Lake and Trail Lake Narrows.

However, under Alaska DFG (10(j) recommendation 10) and FWS (10(j) recommendation 11) recommendations, 100-foot stream buffers would not be provided for clearings for the powerhouse, appurtenant facilities, and tailrace. Alaska DFG states that appurtenant facilities include, but are not limited to, the bridge across Trail Lake Narrows, the weir at the outlet of Grant Lake, the intake in Grant Lake, and monitoring equipment in both Grant Lake and Grant Creek. The buffers would also not be provided for about 500 feet of access road east of Trail Lake Narrows, where private property necessitates construction of the road and transmission line corridor within 100 feet of Grant Creek. Alaska DFG states that construction and maintenance of this section of the project would be addressed in the ESCP.

Our Analysis

Kenai Hydro's proposed project, including the location of its project facilities, would limit disturbance to aquatic habitat. Kenai Hydro's exhibit drawings show that its facilities would be at least 100 feet from stream crossings (where practicable) as recommended by Alaska DFG; those facilities located closer than 100 feet fall within the exceptions noted by Alaska DFG (tailrace, powerhouse, intake, and appurtenant facilities) and cannot practicably be located farther away. Maintaining this buffer distance from the ordinary high water of Grant Creek and Grant Lake would reduce the potential for bank erosion and prevent the removal of important riparian habitat that supports aquatic resources.

Alaska DFG, NMFS, and FWS's recommendations that timing windows be established for instream construction activities and stream crossings could minimize harm or disturbance either to fish during sensitive life stages such as migration and spawning, or to macroinvertebrate species and life stages intolerant to higher levels of turbidity. Establishing the timing windows for instream activities in consultation with Alaska DFG, as Kenai Hydro proposes, would ensure the windows are adequate to protect aquatic resources while providing some accommodation to project construction requirements.

As discussed above in the *Effects of Construction on Water Quality* subsection, the development and implementation of the above-listed plans would protect water quality and, therefore, fisheries and macroinvertebrate resources, during construction. Given the remote nature of the project, having an ECM on site to monitor project construction activities and ensure measures effectively protect environmental resources is appropriate and would further benefit aquatic resources.

Effects of Grant Lake Fluctuations on Resident Fish

The volume of water in Grant Lake at any given time would affect Kenai Hydro's ability to address storage and power generation needs and its ability to maintain minimum instream flows and channel maintenance flows. Reservoir fluctuations also have the potential to affect aquatic resources in Grant Lake through exposure of resident fish habitat and stranding during reservoir drawdowns.

In its amended final license application, Kenai Hydro proposes to follow a lake level rule curve for drawdowns and subsequent refilling over time (see figure 3-6). Under Kenai Hydro's proposed operation, Grant Lake's elevation would vary from a normal maximum of 703 feet, which is the elevation of the natural Grant Lake outlet, down to a minimum lake elevation of 690 feet. To provide storage for spring flows, Kenai Hydro would draw down the lake during the winter and use these reservoir releases to generate power and meet instream flow requirements in Grant Creek.

Our Analysis

As discussed in the *Effects of Project Operation on Water Quantity* subsection, the proposed project would alter the existing timing, magnitude, and duration of water surface elevation fluctuations in Grant Lake. While it would not inundate any existing out-of-water lakeshore habitat, proposed project operation would lower the lake level by about 2 feet compared to existing conditions. The proposed project's operation would result in greater inter-monthly water surface elevation changes, the greatest of which occur during ice breakup and snowmelt from late March through late June.

Resident fish in Grant Lake (slimy and coastrange sculpin and threespine stickleback) typically spawn in the late spring, usually after ice breakup, in shallower waters among rocks or logs. Because of the steep topography of the shoreline around most of the lake, a 2-foot-drop in minimum elevation of Grant Lake would dewater approximately 15 acres, or about 1 percent of the lakeshore, regardless of habitat quality (table 3-18). The steep lakeshore topography also contributes to very little additional potential for stranding on these 15 acres.

Table 3-18. Grant Lake storage and surface area relative to lake elevation (Source: Kenai Hydro, 2018a, as modified by staff).

Lake Elevation (feet, NAVD 88)	Elevation Description	Gross Storage (acre-feet)	Surface Area (acres)
703	Full pool, elevation of natural lake outlet	260,120	1,741
692	Current low elevation	244,220	1,657
690	Minimum surface elevation	241,329	1,642

Therefore, resultant changes to reservoir fluctuations as caused by operation of the project, as proposed, would have little effect on slimy and coastrange sculpin and threespine stickleback in Grant Lake because of the small percentage of available habitat that would be exposed during drawdown and the very small likelihood of stranding.

Effects of Entrainment of Resident Fish in Grant Lake

Fish entrained into intakes at hydropower projects can be subject to injury or mortality resulting from turbine-blade strike, pressure changes, sheer forces, and water velocity accelerations. Alternatively, entrained fish may survive and interact with fish populations located downstream of the powerhouse. Juvenile fish have the greatest potential for entrainment because they have poor swimming ability, whereas adult fish have a much greater swimming ability and generally can avoid entrainment, unless fish desire to migrate downstream. Although project-specific entrainment studies were not conducted to estimate fish mortality through the proposed project's turbines, mortality rates for fish that pass through Francis turbines can vary from 5 to 90 percent depending on turbine design, head, and fish size.

Kenai Hydro does not propose and no entity recommends measures to prevent or minimize resident fish entrainment at the intake structure aside from a trash rack, which is designed to keep debris from entering the power conduit.

Our Analysis

The proposed intake structure in Grant Lake would selectively withdraw reservoir water from depths that range from about 4 to 18 feet. Resident fish species in Grant Lake include both limnetic-benthic[50] (threespine stickleback), and benthic (slimy and coastrange sculpin) fish. The two species of sculpin in Grant Lake prefer to stay close to the substrate and, therefore, would not typically be found within the intakes' area of influence, thereby avoiding involuntary entrainment. Threespine stickleback, however, occupy both benthic environments and well-lit open waters away from shores. Therefore, any threespine stickleback occupying the limnetic zone would be susceptible to some level of entrainment.

Kenai Hydro proposes to install an intake trashrack sized to keep the maximum approach velocity at the intake below 2.5 feet per second. Threespine stickleback are known to have swimming speeds of up to 2.88 feet per second, suggesting that most reservoir fish that are expected to occur in deeper water near the intake have swimming speeds that meet or exceed the maximum approach velocity of water entering the intake and should be able to avoid involuntary entrainment, but some smaller sticklebacks may be susceptible to entrainment.

Under Kenai Hydro's proposed project design and operation, some losses of threespine stickleback would result from turbine entrainment, but these losses would be minimal because of the varying depth preference and swimming speed of stickleback.

Effects of Loss of Habitat Connectivity and Bi-directional Passage on Resident Fish in Grant Lake and Grant Creek

The series of impassible falls in Grant Creek downstream of Grant Lake's outlet prevent both resident and anadromous salmonids from entering Grant Lake. However, the resident fish species in Grant Lake (slimy and coastrange sculpin and threespine stickleback) are known to inhabit both Grant Lake and Reach 6 of Grant Creek upstream of the impassable falls. Under existing conditions, resident fish residing in Grant Lake have access to the lake's natural outlet (Grant Creek) and may voluntarily migrate downstream when flows allow.

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[50] Limnetic fish are those fish that remain in the well-lit, open surface waters away from shore. Benthic fish are those fish that remain on or near the bottom. Limnetic-benthic fish are those species that are known to be either limnetic or benthic, depending on life stage, or those species that can be either depending on the morphological traits that develop in a particular population.

As designed, the proposed project would divert up to 385 cfs from Grant Lake and return it to Grant Creek about 3,200 feet downstream from the lake's outlet. When the lake level is lower than the natural outlet, minimum flows in the bypassed reach would be provided via a bypass weir and pump, while a concrete weir at the outlet of Grant Lake would provide consistent water level control, and would block voluntary downstream passage of resident fish.

Kenai Hydro does not propose and the resource agencies do not recommend any measures to pass resident or anadromous fish above the anadromous fish barrier at the Reach 5/6 break in Grant Creek.

Our Analysis

The presence of the proposed project's weir at the outlet of Grant Lake is not expected to affect the upstream passage of resident fish into Grant Lake because under existing conditions, a waterfall located less than 100 feet downstream of the outlet prevents the upstream migration of resident fish.

Voluntary downstream migration from Grant Lake would only be available to resident fish when flows in the bypassed reach are provided via overflow from Grant Lake (e.g., when the lake is full and inflow into the lake exceeds the 385 cfs capacity of the project's turbines, approximately from the mid-August to mid-September). Under existing conditions, resident fish in Grant Lake are able to voluntarily migrate downstream throughout the year.

Effects of Project Operation on Aquatic Habitat in the Bypassed Reach

Operation of the proposed project would divert up to 385 cfs from Grant Lake and return it to Grant Creek about 3,200 feet downstream from lake's natural outlet. This reduction in flow in the proposed Grant Creek bypassed reach (Reaches 5 and 6) would directly affect the capacity of Grant Creek to support macroinvertebrate populations; spawning, rearing, and other life stages of resident and anadromous fish; and other physical and biological processes including LWD and sediment transport.

To maintain aquatic habitat connectivity and support resident and anadromous fish spawning in Grant Creek, Kenai Hydro proposes to maintain seasonal minimum instream flows in the bypassed reach ranging from 5 to 10 cfs (table 3-19). Kenai Hydro would use a bypass weir and pump system to provide minimum instream flows to Grant Creek from the project intake, while a concrete weir at the outlet of Grant Lake would provide consistent water level control. The weir and pump combination would allow the minimum flow to be released at the top of Reach 6 near the natural lake outlet (see figure 2-2). Kenai Hydro states that with these measures, project operation would not dewater any section of Grant Creek, and the project would provide flows to maintain anadromous and resident passage in Reach 5 and provide persistent wetted habitat for macroinvertebrate populations in Reach 6. Kenai Hydro would monitor and document its adherence to these minimum flows in its annual compliance report, which it would prepare in consultation with the resource agencies prior to filing with the Commission.

Alaska DFG (10(j) recommendation 1), FWS (10(j) recommendation 1), and NMFS (10(j) recommendation 1) each recommend Kenai Hydro provide seasonal minimum instream flows in the bypassed reach to maintain ecological functions, processes, and habitat connectivity. The agency-recommended flows are identical to those proposed by Kenai Hydro, except the resource agencies recommend extending the 10 cfs release through the end of September, which they state would provide better connectivity for adult sockeye and Chinook salmon upstream of the tailrace.

In its reply comments, Kenai Hydro indicated its agreement with the resources agencies' recommended minimum flow releases for the bypassed reach and modified its proposed minimum flows to be consistent with the resource agencies 10(j) recommendations (table 3-19).[51]

Table 3-19. Kenai Hydro's proposed and the resource agencies recommended minimum instream flows for the Grant Creek bypassed reach (Source: Kenai Hydro, 2018b, as modified by staff).

Month	Kenai Hydro Proposed and Alaska DFG, FWS, and NMFS Recommended Minimum Flow Release in the Bypassed Reach (cfs)[a]
January 1–July 31	5
August 1–September 31	10
October	7
November 1–December 31	5
Mean Annual	6

Our Analysis

The diversion of water out of Grant Creek would influence both aquatic habitat and aquatic biota in the bypassed reach. We discuss the effects on habitat and biota individually, below.

Aquatic Habitat

As a component of its instream flow studies in Grant Creek, Kenai Hydro worked with the resource agencies to assess aquatic habitat availability and connectivity in Reach

[51] Kenai Hydro's original proposed minimum flow releases for the bypassed reach were 5 cfs from January 1–July 31 and November 1–December 31, 10 cfs from August 1–September 7, and 7 cfs from September 8–October 31.

5 of the proposed bypassed reach (McMillen, 2014). Because of the relatively poor habitat conditions in Reach 5 (see section 3.3.2.1, in the *Fishery Resources* subsection), the technical working group[52] and Kenai Hydro agreed to use a riverine habitat simulation model (RHABSIM), a physical habitat simulation model (PHABSIM), and the Oregon Method (Thompson, 1972) to evaluate fish passage success in Reach 5 (i.e., connectivity) at a range of modelled instream flows. Kenai Hydro used RHABSIM and PHABSIM to calculate stage-discharge (depth-discharge) relationships at two transects expected to be sensitive to changes in flow and stage. Using these data, Kenai Hydro then tallied the station depths equal to or exceeding known passage depth criteria for each species at each modeled flow (table 3-20). The total width of the cells in each of these categories at each modeled flow was then divided by the total wetted width at each flow to compute the percent of the transect that was passable. Kenai Hydro then used the Oregon Method to determine overall habitat connectivity. The Oregon Method recommends a minimum depth of 0.6 foot for large trout and 0.8 foot for Chinook salmon to achieve successful passage (table 3-20). The Oregon Method concludes that the passage flow is adequate when the depth criterion is met on at least 25 percent of the transect width and on at least a 10 percent continuous portion.

Table 3-20. Minimum depth criteria required for species found in Grant Creek (Source: McMillen, 2014).

Species	**Minimum Depth Criteria**
Chinook Salmon	0.80 feet
Coho and Sockeye Salmon	0.60 feet
Dolly Varden Char and Rainbow Trout	0.40 feet

Based on the results of this assessment, the passage criteria for Chinook salmon (0.8 feet) in Reach 5 is met at 30 cfs. The passage criterion for coho salmon, sockeye salmon (0.6 feet), Dolly Varden and rainbow trout in Reach 5 is met at 10 cfs.

While Kenai Hydro's proposed and the resource agencies recommended minimum instream flows in the bypassed reach would not meet the Oregon Method's passage criteria for adult Chinook salmon, the mean monthly discharge calculated from the composite record shows that flows in Grant Greek would exceed the project's turbine capacity in June, July, and August. In June and early July, Kenai Hydro would store

[52] The Technical Working Group included Kenai Hydro and its consultants (Long View Associates, HDR, and Northern Ecological Services) and representatives from Alaska DFG, Alaska DNR, the Forest Service, FWS, Friends of Cooper Landing, Cook Inlet Aquaculture Association, Kenai Area Fishermen's Coalition, and Kenai River Sportfishing Association.

flows in excess of the turbine capacity in Grant Lake; after the lake is full in mid-July, these excess flows would enter the bypassed reach by overtopping the project weir at the outlet of Grant Lake. These flows would likely be high enough to facilitate Chinook passage into Reach 5 in August (see section 3.3.2.1, *Aquatic Resources, Affected Environment*). However, anticipated flows for September would not always exceed the project's maximum turbine capacity; consequently, the September minimum flows of 10 cfs proposed by Kenai Hydro and recommended by the resource agencies, would not meet the 30 cfs required for adult Chinook passage. However, because Chinook spawning is limited to August and early September, spawning habitat in Reach 5 is very limited, and Chinook were not observed spawning in this reach, the proposed minimum flows would not negatively affect Chinook spawning.

Kenai Hydro's proposed and the agencies recommended minimum flows would not provide the 10 cfs required for rainbow trout and Dolly Varden passage year-round. Rainbow trout in the Grant Creek system spawn from mid-May through June, when the proposed and recommended minimum flow would be 5 cfs. Although Reach 5 contains approximately 26 percent of all habitat in Grant Creek below Reach 6, about 57 percent of Reach 5 is cascade habitat and is not preferred spawning habitat for resident trout. Therefore, the proposed and recommended minimum flows would preclude rainbow trout access to all of Reach 5, which is about 15 percent of existing spawning habitat in Grant Creek, throughout the spawning period. In contrast, Dolly Varden spawn mid-August through mid-November in the Grant Creek system. While the proposed 10 cfs minimum flows in August and September, would provide adequate flows for passage of spawning Dolly Varden, the proposed 7 cfs minimum flows for October and 5 cfs flow in November would not. Therefore, the proposed minimum flows would limit Dolly Varden spawning in Reach 5 to the first 6 weeks of the spawning season when all of existing Doly Varden habitat would be accessible and would not allow spawning in Reach 5, about 15 percent of existing spawning habitat in Grant Creek, during the second 6 weeks of the spawning season. As discussed in section 3.3.2.2, in the *Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace* subsection, the proposed elevated flows in winter would be expected to increase rearing habitat for resident salmonids by providing consistent flow to the Reach 1 distributary and Reach 2/3 side channels. The proposed minimum flows in the bypassed reach, which would limit access to spawning habitat in Reach 5, combined with the proposed minimum flows downstream of the project tailrace which would increase rearing habitat downstream of the tailrace, are not expected to have a cumulative, negative effect on the resident salmonid species in Grant Creek.

As discussed in section 3.3.2.2, *Effects of Project Operation on Water Temperature*, proposed project operations would have resulted in average water temperatures at the downstream end of the bypassed reach of about 1°C cooler in April, about 1°C warmer in May, slightly warmer in June (average 0.1°C), and on average 0.5 to 0.9°C warmer in July through September (in contrast to temperature data collected in 2013, see figure 3-12). Assuming they are representative of bypassed reach temperatures during operations, these changes have an effect on resident salmonids in the accessible areas of Reach 5; however, as discussed above, rainbow trout spawning is not expected in Reach 5 because of the proposed minimum flows during the spawning season. Minimum flows in August and September would allow for Dolly Varden to access spawning beds in Reach 5; project-induced temperature increases during this time would be small and are not expected to affect Dolly Varden that may be spawning in Reach 5 during this period. As discussed above, access to Reach 5 by Chinook salmon would be restricted to August and parts of September, and the minor project-related temperature increases during this period are not expected to negatively affect Chinook spawning.

Elevated temperatures are not anticipated to affect incubation of anadromous and resident salmonids because salmonid eggs typically hatch by mid-July for all species, except rainbow trout, which incubate from mid-May through the end of August. Project-related temperature changes in the bypassed reach are not anticipated to affect rainbow trout incubation because rainbow trout spawning is not expected in Reach 5.

Therefore, Kenai Hydro's proposed and Alaska DFG, FWS, and NMFS's recommended minimum instream flows for the bypassed reach, would support the ecological functions, processes, and connectivity necessary to sustain aquatic resources in the bypassed reach.

Aquatic Resources

In addition to limiting access to aquatic habitat in the downstream portions of the bypassed reach, as discussed above, proposed and recommended minimum flows would affect both resident fish and macroinvertebrates in the bypassed reach. However, any adverse effects on these organisms are expected to be minor because of poor habitat conditions created by the high to moderate gradient, coarse substrate dominated by boulder and bedrock, and high water velocities. Although the bypassed reach likely provides some rearing and spawning habitat for resident sculpin and threespine stickleback, it is unlikely this habitat would persist year-round because of the predominately confined and high to moderate gradient stream channel and limited holding areas (pools) for fish. Furthermore, the occurrence of high flow events under current conditions and the proposed and recommended channel maintenance flows under proposed project operation make it unlikely that the bypassed reach supports a self-sustaining spawning population of resident fish. Construction of the project would eliminate the potential for fish originating from Grant Lake to access the bypassed reach, except during high flows when the project is in run-of-river mode in the summer, and the number of fish in the reach would likely be reduced. Therefore, the proposed minimum flows should be adequate to maintain habitat connectivity for fish, amphibians, macroinvertebrates, and other aquatic organisms in the bypassed reach.

While research has shown that macroinvertebrate communities respond to the timing of extreme flows, few studies have explored the ecological responses to flow within river systems and specifically regulated environments (White et al., 2017). Comparison of Grant Creek macroinvertebrate metrics with other Kenai Peninsula stream metrics indicates that current conditions in Grant Creek are more stressful for macroinvertebrate populations than other streams in the region, and the populations in Grant Creek are composed of taxa that can thrive where streamflows are variable (BioAnalysts, 2014). The proposed project would modify the magnitude of peak flows observed in the late spring under current conditions, but would retain most of the high flows observed during the summer (see figure 3-7); however, because the macroinvertebrate taxa are adapted to highly variable flows, it is not expected that project operation would have a significant impact on the species assemblage and populations found in the bypassed reach of Grant Creek.

Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace

As is the case for the proposed bypassed reach, operation of the proposed Grant Lake Project would alter the seasonal instream flow pattern in Grant Creek downstream of the proposed project's powerhouse. These altered flow conditions could affect the river's capacity to support spawning, rearing, and other life stages of Chinook, coho, and sockeye salmon, as well as resident rainbow trout and Dolly Varden.

On August 6, 2018, Kenai Hydro filed a revised instantaneous instream flow schedule for the proposed project below the powerhouse, developed collaboratively with the resource agencies (table 3-21). On August 24, 2018, NMFS filed comments supporting Kenai Hydro's revised flow schedule. On August 24, 2018, and August 29, 2018, Alaska DFG and FWS, respectively, filed amendments to their 10(j) recommendation 2 that is consistent with Kenai Hydro's proposed flow schedule.

Table 3-21. Existing mean monthly discharge and proposed minimum flows in Grant Creek below the tailrace (Source: staff).

Period	Existing Mean Monthly Discharge	Kenai Hydro proposed and Alaska DFG, FWS, and NMFS recommended minimum flows
January	52	60
February	43	60
March	33	60
April	36	60
May 1–May 15	87	60
May 16–May 31	199	80
June 1–June 15	353	150
June 16–June 30	465	150
July 1–July 15	504	195

Period	Existing Mean Monthly Discharge	Kenai Hydro proposed and Alaska DFG, FWS, and NMFS recommended minimum flows
July 16–July 31	500	195
August	444	195
September	366	150
October 1–October 15	275	125
October 16–October 31	194	72
November 1–November 15	143	72
November 16–November 30	106	60
December	73	60

Our Analysis

Proposed project operation would have the greatest effect on the annual hydrograph in lower Grant Creek during the spring and early summer (June through mid-July) when snowmelt runoff dominates with effects varying in magnitude depending on the amount of annual snowpack and rainfall (figure 3-16). During this time of the year, water in the Grant Creek System would be managed to fill Grant Lake and flows in lower Grant Creek (Reaches 1 through 4 and the lower portions of Reach 5) would include discharge from the project's powerhouse plus any additional instream flows released into the bypassed reach (figure 3-16).

Under the proposed and recommended operational regime, the minimum instream flows in lower Grant Creek would range from about 60 to 195 cfs. While maintaining these minimum flows would represent a substantial reduction in the volume of water in Grant Creek during the spring and early summer, when Chinook, pink, and sockeye salmon enter Grant Creek to spawn and rainbow trout are spawning, these minimum flows should be considered a worst-case scenario. For example, during normal water years, June through early July flows with the proposed project in place would range from approximately 200 to 400 cfs, and during low water years, flows with the project in place would range from about 90 to 350 cfs (figure 3-16). Once Grant Lake is full (usually by mid-August), flows in lower Grant Creek would include discharge from the project's powerhouse, plus any inflow into Grant Lake in excess of the project's 385 cfs capacity. The project would have little or no effect on flows in lower Grant Creek during the Chinook, coho, pink, and sockeye salmon and Dolly Varden spawning periods.

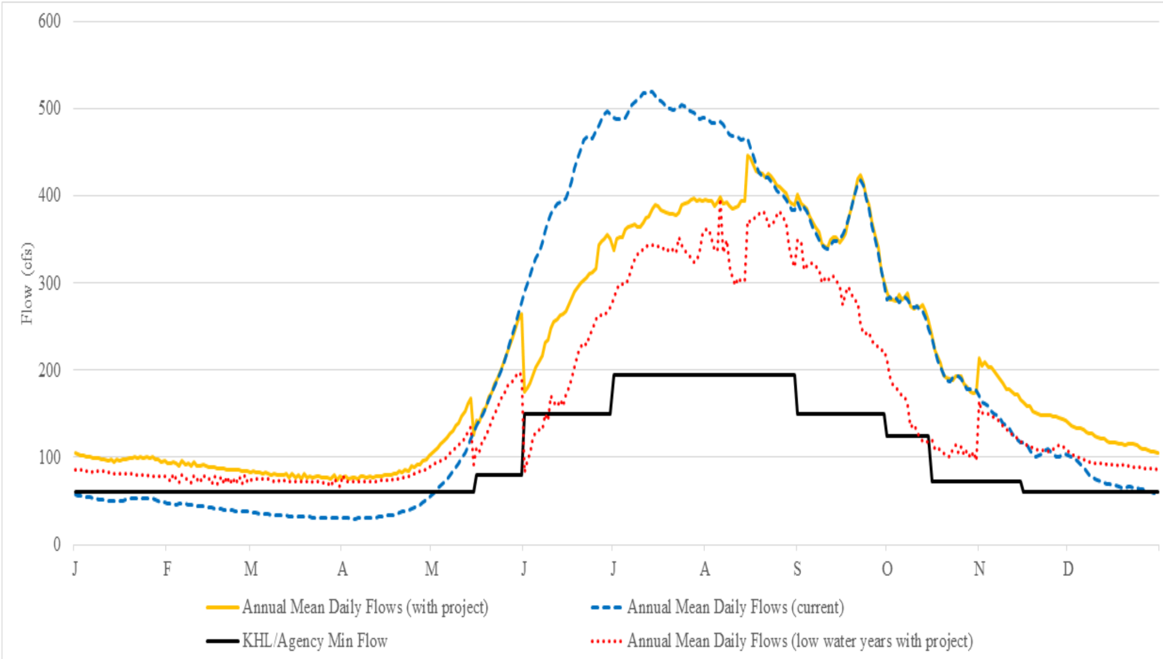

Figure 3-16. Annual mean daily and proposed minimum flows in Grant Creek below the tailrace (Source: staff).

Pink salmon, the first of the salmon species to enter and spawn in Grant Creek, were found to spawn only in Reach 1 in August. Investigations identified only two pink redds in riffles in the mainstem of Reach 1. Because of the low number of pink salmon observed, it is unknown whether pink salmon would also use habitat located in the Reach 1 distributary in years with more returning adult pink salmon. Under current conditions, a logjam at the head of the Reach 1 distributary limits inundation of the distributary to flows in Grant Creek of more than 190 cfs. Under the proposed and recommended operational regime, flows in August are expected to be in excess of 300 cfs with a minimum flow of 190 cfs. These flows would maintain access to all of Reach 1 for pink salmon spawning in Grant Creek.

To evaluate the effects of altering the natural hydrograph on resident and anadromous fish habitat in lower Grant Creek, Kenai Hydro conducted an instream flow study using the Instream Flow Incremental Methodology including PHABSIM (McMillen, 2014). The focus of the analysis was to evaluate the changes in weighted usable area (WUA)[53] for spawning and rearing of Chinook, sockeye, and coho salmon, and rainbow trout and Dolly Varden that would occur under average monthly flow ranging from 10 cfs to 1,000 cfs.

During an average water year, the amount of spawning WUA for Chinook, sockeye, and coho salmon would remain the same as under current conditions. However,

[53] The WUA is an index of habitat suitability.

during low water years, each of the proposed and recommended minimum flow regimes (table 3-21) may constitute the entirety of the flow available below the tailrace because Grant Lake is never filled, the amount of spawning WUA for Chinook, sockeye, and coho salmon would decrease in the anadromous reach of Grant Creek during their respective spawning seasons (August through October) (figure 3-17). Kenai Hydro's proposed and the resource agencies minimum flows for August would provide 87 percent of existing spawning WUA for Chinook and 85 percent of existing spawning WUA for sockeye. In September, Kenai Hydro's proposed and the agencies' recommended minimum flows would provide 79 percent of the existing spawning WUA for Chinook, 88 percent of the existing spawning WUA for coho, and 84 percent of the existing spawning WUA for sockeye. Kenai Hydro's proposed and the agencies' recommended flows for during early October would provide 87 percent of existing spawning WUA for coho and 83 percent of existing spawning WUA for sockeye. Coho are the only salmonid species in Grant Creek that spawns during the second half of October, and the proposed and recommended minimum flows would provide 70 percent of existing coho spawning WUA during this period (table 3-22, below).

Kenai Hydro's proposed and the resource agencies' recommended minimum flows would increase the spawning WUA for Dolly Varden compared to existing conditions, except during early November when the amount of spawning WUA would decrease by 4 percent compared to existing conditions (figure 3-17). Kenai Hydro's proposed and the resource agencies' recommended minimum flows regimes would have very little effect on rainbow trout spawning, with the greatest changes resulting from proposed and recommended minimum flows during late May, decreasing the amount of existing spawning WUA by up to 13 percent (table 3-22).

While Kenai Hydro's proposed and the resource agencies' recommended minimum flows would all decrease the amount of spawning WUA for Chinook, coho, and sockeye (table 3-22), as noted above, inflow during the late summer when the reservoir is full would still typically exceed the project's turbine capacity, resulting in flows below the tailrace that are the same as current conditions. Once the reservoir is full, flows are expected to exceed the 385 cfs turbine capacity beginning in mid-July and remain above this level until September in an average year. These periods when flow in excess of the turbine's capacity are spilled into the bypassed reach would likely maintain habitat connectivity and movement for salmonids to their spawning locations.

Figure 3-17. Estimated weighted usable area for Chinook, coho, and sockeye salmon and Dolly Varden and rainbow trout spawning and incubation under proposed minimum flows and existing average monthly flows in the Grant Creek anadromous reach (Source: staff).

The instream flow study results indicate that reducing existing average monthly flows from the natural hydrograph to Kenai Hydro's proposed flows would decrease the Chinook fry rearing WUA from 73 percent (June 1–July 15), to 89 percent in late May, with an average of 81 percent over the mid-May through August period (figure 3-18, table 3-22). Kenai Hydro's proposed flows would decrease the existing coho fry rearing WUA to 73 percent in June and September, and to 87 percent in July, with an average of 81 percent between May and October. Dolly Varden fry rear in Grant Creek from mid-May through September, and fry rearing WUA would decrease to an average of 85 percent of existing over this period. Rainbow trout rear in Grant Creek year-round, and under Kenai Hydro's proposed minimum flows would experience an increase in fry rearing WUA from November through early May, with a maximum increase in March and April (113 percent) and a decrease in fry rearing WUA from mid-May through October, with a low of 72 percent of existing WUA in June and September.

Juvenile Chinook and coho salmon, Dolly Varden, and rainbow trout rear in Grant Creek year-round. Consequently, these species would experience a decrease in juvenile rearing WUA during low water years in the summer (June through October), when flows would be limited to the proposed minimum instream flows, and would be much less than the existing flows due to spring runoff being retained in the reservoir. Juvenile salmonids would also experience an increase in WUA in the winter in almost all water years, when the project would supply a steady minimum flow, providing flow to side channels that would normally be dry or frozen (figure 3-19, table 3-22). Adult Dolly Varden and rainbow trout rear in Grant Creek in the summer and fall. In normal years, these species would experience a decrease in WUA during late May and June as the reservoir was filling (about 85 percent of WUA under existing flows), and no change from existing conditions about July through October) when the reservoir was full and the proposed project was running at capacity. However, these species would experience a decrease in adult rearing WUA throughout their adult rearing period in low water years (figure 3-20, table 3-22).

Based on the above analysis, Kenai Hydro's proposed and the agency-recommended minimum flows throughout the year would likely maintain existing fisheries resources in Grant Creek because they would provide more than 80 percent of existing WUA for Chinook, coho, sockeye, rainbow trout, and Dolly Varden spawning; Chinook, coho, rainbow trout, and Dolly Varden juvenile and fry rearing; and rainbow trout and Dolly Varden adult rearing, even in low water years, and maintain access to spawning habitat in all of Reach 1 for pink salmon in August. Kenai Hydro's proposed minimum flows would provide an average of 88 percent of existing WUA for all species and life stages present in Grant Creek.

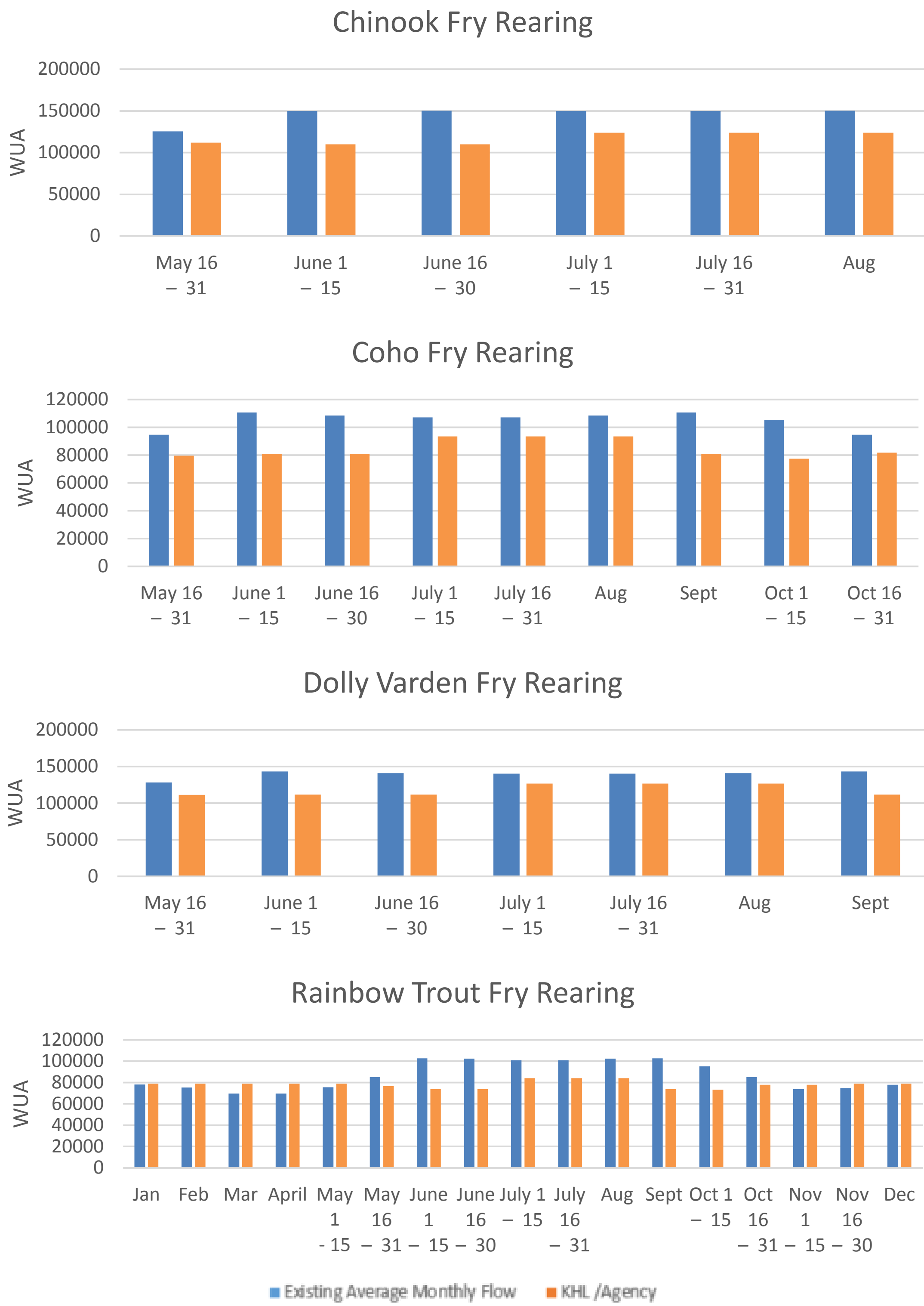

Figure 3-18. Estimated weighted usable area for Chinook and coho salmon and Dolly Varden and rainbow trout fry rearing under proposed minimum flows and existing average monthly flows in the Grant Creek anadromous reach (Source: staff).

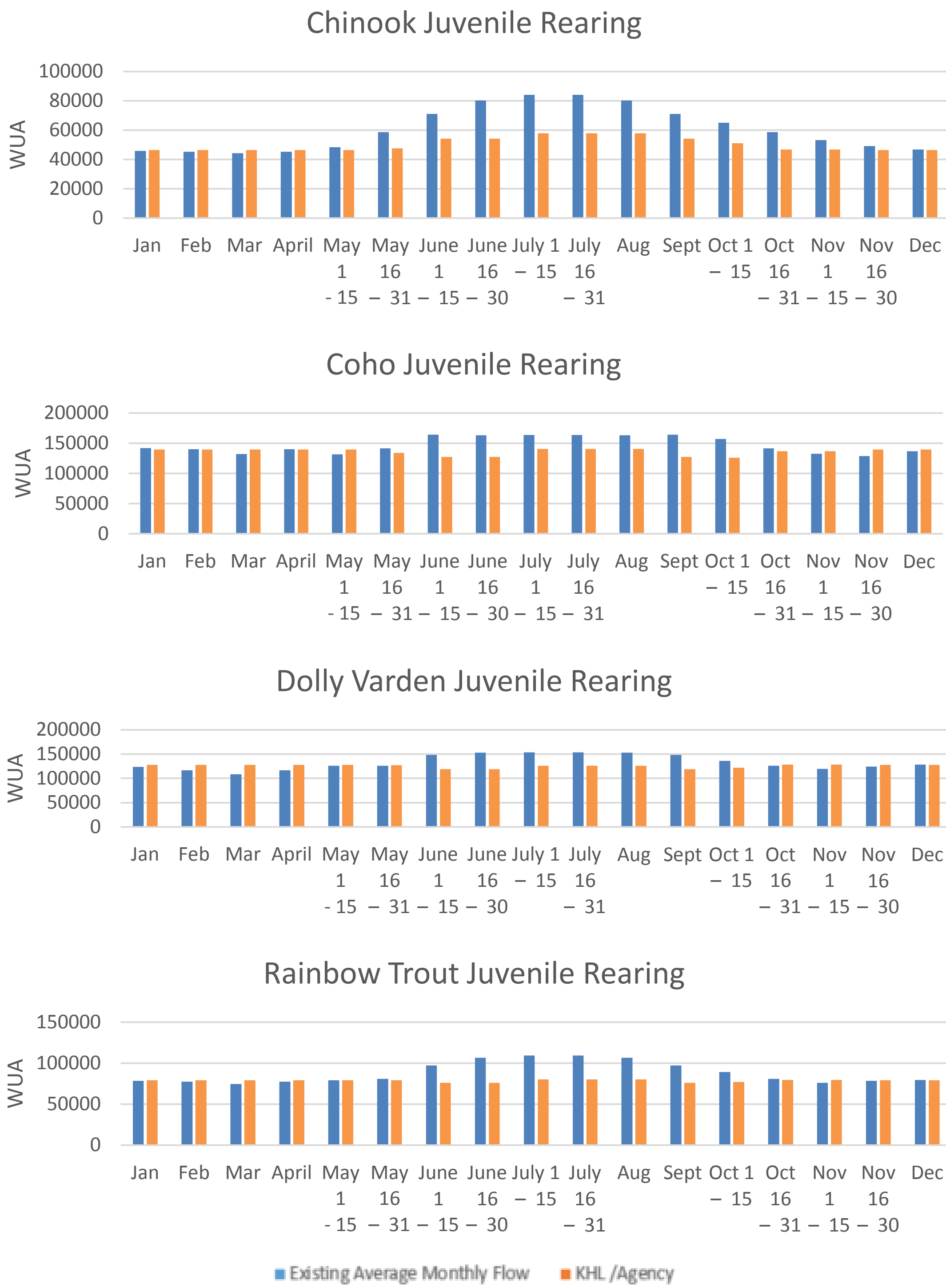

Figure 3-19. Estimated weighted usable area for Chinook and coho salmon and Dolly Varden and rainbow trout juvenile rearing under proposed minimum flows and existing average monthly flows in the Grant Creek anadromous reach (Source: staff).

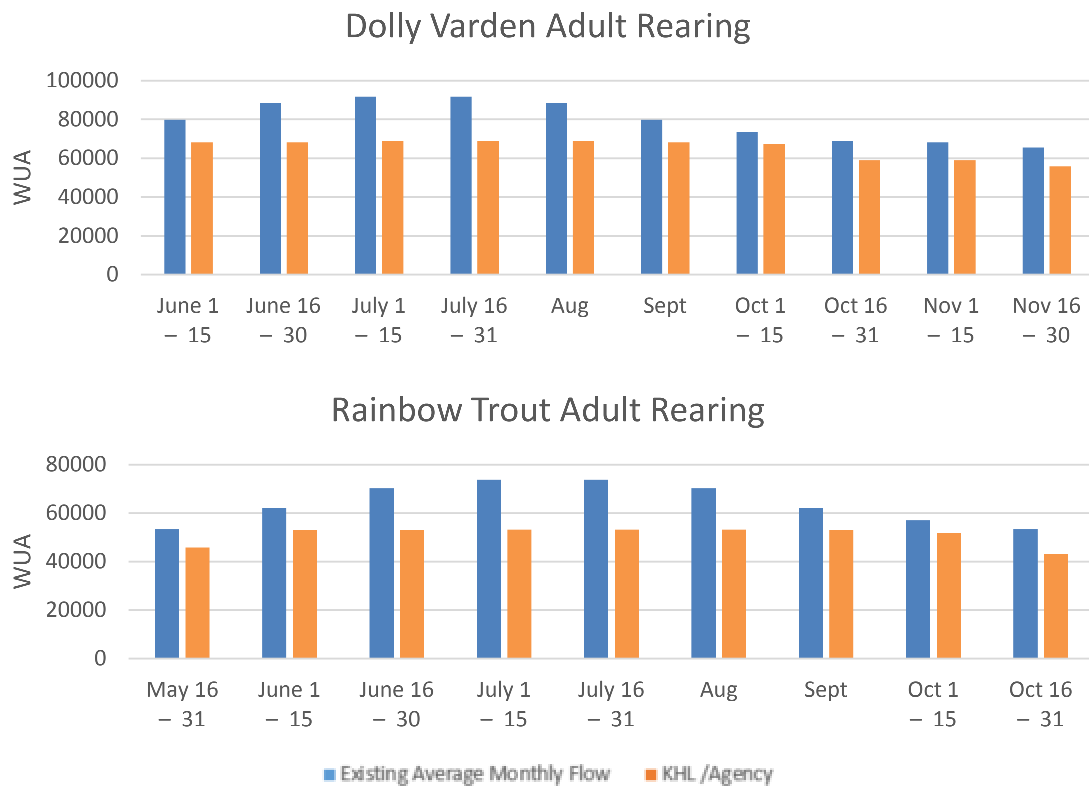

Figure 3-20. Estimated weighted usable area for Dolly Varden and rainbow trout adult rearing under proposed minimum flows and existing average monthly flows in the Grant Creek anadromous reach (Source: staff).

Table 3-22. Estimated weighted usable area for all species and life stages of salmonids under Kenai Hydro-proposed and FWS-, NMFS-, Alaska DFG-recommended minimum flows in the Grant Creek anadromous reach (Source: staff).

Life stage	Period	Average WUA % of Existing Conditions
Chinook		
Spawning	August–September	83
Fry rearing	May 16–August	81
Juvenile rearing	Year-round	86
Coho		
Spawning	September–October	82
Fry rearing	May 16–October	81
Juvenile rearing	Year-round	93
Sockeye		
Spawning	August–Oct 15	84
Rainbow Trout		
Spawning	May 16–June	96
Fry rearing	Year-round	92
Juvenile rearing	Year-round	91
Adult rearing	May 16–October	80
Dolly Varden		
Spawning	August–November 15	101
Fry rearing	May 16–September	85
Juvenile rearing	Year-round	96
Adult rearing	June–November	93
Average all species and life stages		88

Ramping Rates

Rapid changes in streamflows associated with hydroelectric project operation have the potential to adversely affect aquatic resources. If water recedes in a project-affected reach faster than what would occur naturally (e.g., from changes in generation, emergency shutdowns), adverse effects can include stranding of fish in shallow, low-gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and the dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). Rapid changes in streamflows also can affect fish behavior leading to reduced spawning success (Bauersfeld, 1978). Fry and juvenile fish less than 2 inches long are normally the most vulnerable to stranding because of their weak swimming ability; preference for shallow, low-velocity habitat such as edge-water and side channels; and a tendency to burrow into the substrate to hide. Limits governing the rate and timing of project-induced stage changes (ramping rate restrictions when operational control exists) are often established at hydroelectric projects to protect aquatic organisms (Hunter, 1992; Olson, 1990).

Alaska DFG (10(j) recommendation 3), FWS (10(j) recommendation 3), and NMFS (10(j) recommendation 3) each recommend Kenai Hydro operate the proposed project to avoid sudden changes (either increases or decreases) in the flow in Grant Creek. They further recommend that ramping rates vary depending on the time of year. Maximum downramping rates would be limited to a year-round maximum of 1 inch per hour (when operational control exists), and maximum upramping would be limited 1 inch per hour during the winter (November 16 through May 15), and 2 inches per hour during the summer (May 16 through November 15). The agencies state their recommended rates are similar to those suggested in the scientific literature (Hunter, 1992) and are consistent with existing rates of stage change in Grant Creek. Additionally, Alaska DFG (10(j) recommendation 5) recommends Kenai Hydro use a gage downstream of the project tailrace as the compliance point for ramping rates.

In response to these recommendations, Kenai Hydro agreed to implement a set of ramping rate restrictions that are similar with the resource agencies' recommendations; however, Kenai Hydro proposes a maximum downramping rate of 2.25 inches per hour from May 16 through November 15 to better reflect Grant Creek's current characteristics. Kenai Hydro also disagrees with Alaska DFG's recommended ramping rate compliance location and proposes to monitor ramping at a gage in the project tailrace.

Our Analysis

Even though the proposed project would be operated with infrequent ramping events, any rapid changes in streamflows associated with project start-ups or shutdowns could adversely affect aquatic resources in Grant Creek. For example, project start-ups could suddenly decrease the amount of water in the bypassed reach and strand fish and other aquatic biota. A rapid shutdown could also suddenly decrease the amount of flow immediately downstream of the powerhouse and rapidly increase the amount of flow in the bypassed reach.

The resource agencies' upramping rate recommendations are two times greater than the steepest rate of change observed in the 2013 to 2014 discharge record when 15-minute data are available. The recommended upramping rate is more restrictive in the winter when eggs and alevins are at risk of mortality due to being flushed from the gravel by a rapid increase in stage. Maintaining ramping rates in line with current changes in stage would help maintain fish productivity and historical habitat conditions in Grant Creek. The resource agencies state that their recommended ramping rates would support

Kenai Hydro's intent that operation of the Grant Lake Project would have either a neutral or a positive effect on fish and fish habitat.

In an evaluation of the resource agencies' ramping rate recommendation, Kenai Hydro analyzed all significant downramping events that occurred in Grant Creek during the period of record (May 31, 2013, through October 10, 2014) and found 54 separate hourly stage decreases in excess of 1 inch per hour. The maximum stage decreases during the period of record was 2.76 inches per hour (figure 3-21, table 3-23). However, these data were recorded with a gage that was not encased in a stilling basin, and analysis was conducted to minimize outliers.[54] Subsequently, the maximum stage decrease is calculated, not observed, but is expected to be indicative of current conditions. Surveys were not conducted during these downramping events to assess the rate of stranded fish. It is expected that the aquatic resources in Grant Creek are accustomed to the variability that occurs under current conditions, and downramping rates with these magnitudes with this frequency would not cause significant effects on the fish and macroinvertebrate species present.

Kenai Hydro also proposes to use the project occasionally for peaking generation when demand dictates, which is not defined in its amended final license application; however, Kenai Hydro indicates it would occur only during the winter and not in the summer. No overlap occurs between the proposed peaking operations in the "winter," which is presumed to be January through April, and the period of higher rate of downramping proposed by Kenai Hydro.

The resource agencies' downramping and upramping rates would likely eliminate any sudden changes in flow in Grant Creek and therefore would protect aquatic resources. Because the natural hydrograph regularly experiences downramping rates approaching 2.75 inches per hour (and that the local fish populations have adapted these natural fluctuations), Kenai Hydro's proposed rates, which (as noted above) are less restrictive than the agency-recommended rates, would also adequately protect aquatic resources in the project-affected reaches of Grant Creek.

Regarding the Alaska DFG recommended and Kenai Hydro proposed compliance locations for ramping monitoring, stage measurements recorded in Grant Creek downstream from the tailrace, as Alaska DFG recommends, would best reflect project-related effects on aquatic resources. We note that the project would also modify flows in the bypass, which would contribute to stage change below the tailrace. Although the magnitude of these changes relative to flows through the powerhouse would be small and have little contribution to ramping rates downstream of the tailrace, the dimensions of the tailrace do not reflect existing Grant Creek contours and would not provide an accurate assessment of ramping rates observed in reaches downstream of the project.

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[54] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

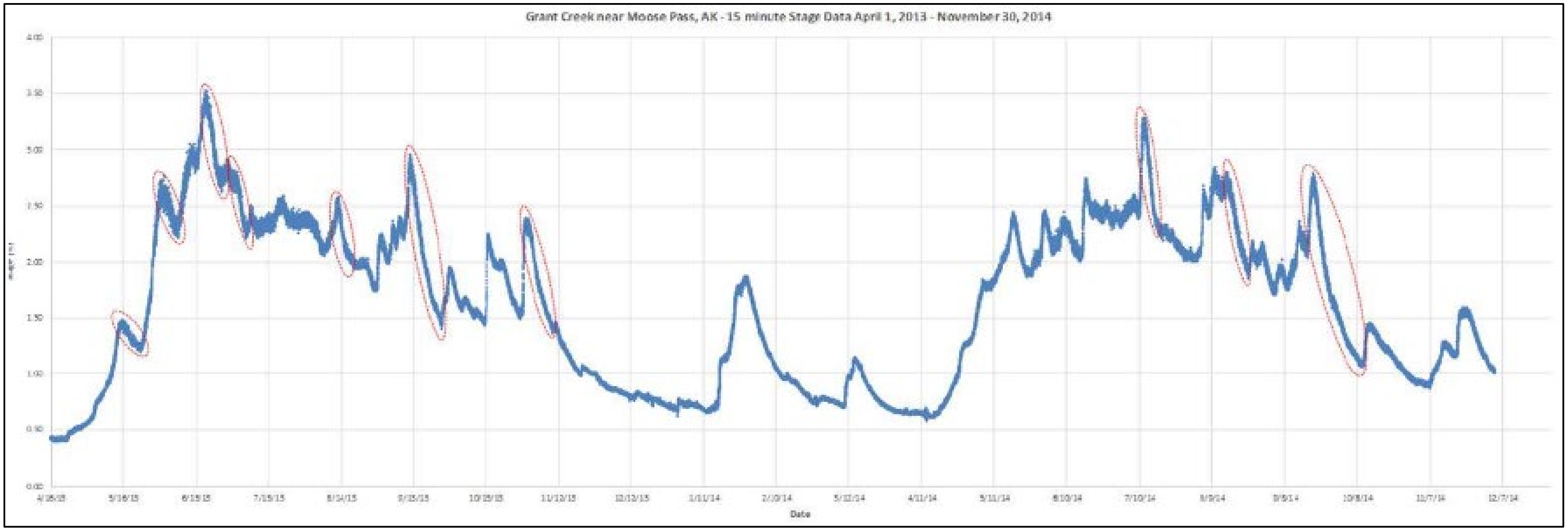

Figure 3-21. Downramping events in Grant Creek that were greater than 1 inch per hour during the period of record, May 31, 2013, through October 10, 2014 (Source: Kenai Hydro, 2018b, as modified by staff).

Table 3-23. Number of stage changes greater than 1 inch per hour and maximum hourly stage difference in inches in Grant Creek, May 31, 2013, through October 10, 2014 (Source: Kenai Hydro, 2018b).

Date	Number of Stage Decreases > 1 Inch/Hour	Max Hourly Stage Difference (inch)
2013		
May 31–June 7	19	-2.76
June 19–June 25	12	-1.56
July 2–July 5	2	-2.04
Aug 12–Aug 19	6	-1.44
September 11–September 24	4	-1.68
October 30–November 8	1	-1.20
2014		
July 12–July 18	3	-1.20
August 15–August 23	4	-1.36
September 20–October 10	3	-1.44

Sediment Management

Operation of the project would result in reduced flows in the proposed bypassed reach and could potentially reduce the rate and volume of sediment recruited and transported into the lower reaches of Grant Creek. This reduction in sediment recruitment and transport could affect the distribution and availability of suitable spawning substrate (gravel) for resident and anadromous salmonids.

Under existing conditions, Grant Creek is a sediment limited fluvial environment. As discussed in section 3.3.1.1, the primary process for generating new bedload sediment in Grant Creek is the erosional force from high flows (flows as high as 2,140 cfs have been recorded) that incise the canyon walls in Reaches 5 and 6, causing wall undermining and mass wasting (rockfall) from the canyon walls and exposing the geology to surface erosion processes. The biologically significant transport of sediment from Reaches 5 and 6 is limited but what does occur likely takes place during seasonal high flow events. As a result of the limited availability of spawning gravel, salmonid spawning in Grant Creek is opportunistic and occurs where suitable substrates are found, with less emphasis on appropriate water depths and velocities.

To minimize effects on spawning habitat from reduced flows in the bypassed reach and the reduction of erosion potential and sediment transported downstream to the anadromous reach, Kenai Hydro proposes to provide channel maintenance flows consistent with Alaska DFG (10(j) recommendation 4), FWS (10(j) recommendation 4), and NMFS (10(j) recommendation 4). Alaska DFG and NMFS recommend Kenai Hydro provide channel maintenance flows in 2 years in the previous 10-year-period, updated annually. FWS recommends Kenai Hydro provide channel-maintaining flows a minimum of two times (separated by at least 24 hours) in the previous 10-year period, updated annually.

Channel maintenance flows, as recommended by the resource agencies, consist of an average discharge of 800 cfs to the bypassed reach for a minimum of 8 hours. NMFS and FWS recommend that a flow event that exceeds 800 cfs for at least 1 hour, but less than 8 hours, may be counted as a channel maintenance flow if the project reduces flows at the powerhouse to zero in an attempt to comply with this provision. Alaska DFG recommends that flows must exceed 800 cfs for at least 2 hours to be counted as a channel maintenance flow. NMFS, FWS, and Alaska DFG recommend Kenai Hydro measure channel maintenance flows by subtracting penstock or powerhouse flows from Grant Creek flows measured at ST-2 (GC200).

In the event that the channel maintenance flows are not delivered as proposed, NMFS, FWS, and Alaska DFG recommend Kenai Hydro operate the project to ensure that Grant Lake is at the maximum reservoir level of 703 feet by September 1 and operate the project to maintain that reservoir level for the month of September.

Our Analysis

As described above, a reduction in peak flows in the proposed bypassed reach has the potential to degrade spawning substrate quantity and quality in lower Grant Creek as a result of: (1) coarsening surface bedload, (2) increased armoring and pavement depth, (3) decreased geomorphic channel form complexity, and (4) decreased quantity of channel bedforms. Kenai Hydro's proposed monitoring would determine whether any degradation occurs from project operation and would provide data to modify project operation in the future, if needed.

Anadromous and resident fish of Grant Creek are adapted to current conditions in Grant Creek, which reflect a limited sediment supply. Channel maintenance flows provided through the bypassed reach would mimic the natural hydrograph and better reflect the existing processes of spawning substrate movement than gravel augmentation.

The major source of sediment in Grant Creek is high flow that erodes the canyon walls in Reaches 5 and 6, causing rockfall from the canyon walls and exposing the underlying geology to surface erosion processes. Mobilization of sediment in Grant Creek results when very high flows flush sediment from Reaches 5 and 6 into the lower reaches of Grant Creek where anadromous fish spawning occurs. Using the effective discharge concept, Alaska DFG and Kenai Hydro determined that 80 percent of bankfull flow (1,000 cfs) would provide flows strong enough to mobilize sediments and promote bedform creations. An analysis of the hydrologic record showed that flow events of this 800 cfs or greater would have occurred 12 times during the 66-year period (Biotic

Monitoring Plan), all of which occurred during the months in which the reservoir would be full under proposed operation (July, August, and September); flows greater than 800 cfs occur approximately 5 percent of the time in September (Kenai Hydro, 2018a). Kenai Hydro should be able to achieve this magnitude and frequency of channel maintenance flows. However, given the discrepancy between the recorded maximum flow in Grant Creek (2,140 cfs), the proposed channel maintenance flows, it is unlikely the channel maintenance flows would be successful at maintaining the current rate of sediment recruitment from Reaches 5 and 6.

Reduced flows in the bypassed reach would reduce sediment recruitment from the bypassed reach and reduce sediment transport to downstream reaches in Grant Creek, which could impair spawning gravels downstream. Channel maintenance flows of 800 cfs, provided on a regular basis and adaptively managed for magnitude, duration, and frequency as recommended by the agencies would limit the effects of the project on sediment recruitment and transport in a manner that may be similar to the existing conditions to retain downstream fish spawning habitat, but the success of these flows is unknown. Measuring flows in Grant Creek at ST-2 (GC200) and subtracting flows from the powerhouse would accurately measure the timing and duration of channel maintenance flows.

Effects of Operation on Transport of Biological Materials

As discussed in section 3.3.2.2, in the *Sediment Management* subsection, operation of the proposed project would result in reduced flows in the bypassed reach and could potentially reduce the rate and volume of biological materials transported into the lower reaches of Grant Creek, including large wood, macroinvertebrates, and nutrients. This reduction in biological material transport could affect the distribution and availability of suitable rearing habitat for resident and anadromous salmonids.

Kenai Hydro does not propose and no entity recommends measures to monitor, mobilize, or retain LWD, macroinvertebrates, or nutrients in Grant Creek.

Our Analysis

Under existing conditions, Grant Creek is a higher gradient, very flashy stream, where high flows and velocities limit the amount of large wood in the system because of limited collection points. Aquatic macroinvertebrates and nutrients, while found throughout Grant Creek, are flushed through the system by high summer flows. Most wood is found in the Reach 2/3 side channels and the Reach 1 distributary, where flows are reduced and protected from the main discharges in Grant Creek. High flows in the main channel of Grant Creek move large wood, macroinvertebrates and nutrients downstream and eventually into the Upper and Lower Trail Lakes.

A reduction in peak flows in the proposed bypassed reach has the potential to degrade fish habitat quantity and quality in lower Grant Creek from reduced wood, macroinvertebrate, and nutrient transport from the bypassed reach to Grant Creek below the tailrace. However, anadromous and resident fish of Grant Creek are adapted to its current conditions, which reflect a limited wood and nutrient supply. Transport of wood in Grant Creek results when very high flows flush wood from Reaches 5 and 6 into the lower reaches of Grant Creek where wood deposition occurs in lower velocity side channels and the Reach 1 distributary. These same high flows move woody debris in the main channel downstream and eventually into the Upper and Lower Trail Lakes.

Transport of wood from the bypassed reach downstream is expected to continue due to the implementation of channel maintenance flows as recommended by the resource agencies (FWS 10(j) recommendation 4, NMFS 10(j) recommendation 4, and Alaska DFG 10(j) recommendation 4) (see section 3.3.2.2, *Sediment Management*). Under these recommendations, channel maintenance flows of 800 cfs would be provided in 2 years of every 10 years, updated annually, to move sediment from Reaches 5 and 6 downstream. These flows would be achievable by the project, and would be adequate to also move pieces of LWD. Therefore, channel maintenance flows provided through the bypassed reach would mimic the natural hydrograph, and contribute to the movement of wood and other resources, such as macroinvertebrates and nutrients.

However, the expected reduction in peak flows in Grant Creek below the tailrace in spring (see figure 3-7) has the potential to lower velocities in the main channel. These reduced velocities may contribute to a higher retention rate of large wood in Grant Creek until channel maintenance flows occur and flush wood through the system. Wood retained in the main channel has the potential to create and maintain new stream habitat by creating pool habitat for fish, maintain connectivity between the main channel and side channels, retain spawning gravel, and provide cover for aquatic species. Existing habitat could be disrupted, and channel-spanning logjams may create fish passage barriers while they are retained in the system. These same impacts can result from natural accumulations of wood under current conditions, and channel maintenance flows of adequate magnitude, duration, and frequency are expected to maintain natural habitat forming processes in Grant Creek.

Channel maintenance flows of 800 cfs provided on a regular basis, and adaptively managed for magnitude, duration, and frequency as recommended by the agencies and proposed by Kenai Hydro, would move large wood, macroinvertebrates, and nutrients from Reaches 5 and 6 to the lower reaches in a manner similar to existing conditions to retain downstream fish rearing habitat, and lower peak flows below the tailrace in spring may contribute to higher retention rates of wood in the main channel and increase fish habitat forming structures until the next channel maintenance flow event.

Effects of Spinning Reserve and Load Following on Aquatic Resources and Habitat in Grant Creek

Potential effects of spinning reserve and load following operations on fish and macroinvertebrates could be the loss of habitat within the width of the stream margin that are periodically exposed during the up-ramp and down-ramp flow cycle; cycles of increased and decreased drift during the up-ramp and down-ramp cycle, potentially reducing macroinvertebrate standing crop in permanently wetted areas; alterations in the macroinvertebrate community structure that favor more mobile rather than sessile (attached or not freely moving) organisms; and stranding and/or trapping of fry and juvenile fish and drifting macroinvertebrates within the stream margin zone during the down-ramp period (Reiser et al., 2006).

Kenai Hydro proposes to increase power benefits by taking advantage of spinning reserve and load-following operations (peaking). To prevent a sudden increase in the water surface levels of Grant Creek as a result of the increased flows generated by these operations, Kenai Hydro would divert the additional powerhouse flows into the detention pond and then slowly release water from the pond back into Grant Creek via the tailrace channel. Kenai Hydro proposes to use spinning reserve and load-following infrequently, and mainly in the winter and shoulder months, when generators are not running at capacity. Kenai Hydro does not propose and no entity recommends a schedule describing how frequently spinning reserve and load-following operations would occur.

Our Analysis

As discussed above, project operation may include spinning reserve and load-following operations. The magnitude of the effects of these operations on fish and macroinvertebrates, if any, would be based on, among other things, the rate of change of flow in downstream reaches.

As discussed in section 3.3.2.2, in the *Ramping Rates* subsection, maintaining ramping rates in line with existing changes in stage would help maintain fish productivity and current habitat conditions in Grant Creek.

The operational aspects of spinning reserve and load following operations are proposed to be primarily in the winter and shoulder months, when generation is not at capacity. During this season, both upramping and downramping would be limited by the proposed and recommended 1 inch per hour. Under the proposed ramping rates, spinning reserve and load-following operations of the proposed project are not expected to have an adverse impact on the project-affected reaches of Grant Creek.

Effects of Project Operation on Macroinvertebrates

Aquatic macroinvertebrates are commonly used as an indicator of the biological health of streams. Their distribution and relative abundance are affected by a variety of naturally occurring and human-induced factors, including the annual hydrologic cycle, the timing and magnitude of spring outflows, streambed substrate composition, channel gradient, bank erosion and sediment deposition, pollution, and riparian habitat degradation. Taxa that are especially sensitive to disturbance are considered intolerant; therefore, their absence in a particular stream or river could indicate poor water quality. Other taxa are tolerant of disturbance, heavy sedimentation, and poor water quality. Many of the tolerant taxa are the first to reestablish an area after a scouring event or habitat disruption.

Kenai Hydro does not propose and the resource agencies do not recommend any measures to monitor macroinvertebrates in Grant Lake, Grant Creek, Upper Trail Lake, or Trail Lake Narrows.

Our Analysis

Macroinvertebrates have several characteristics that make them potentially useful indicators of water quality and overall stream health. They are relatively non-mobile, and thus well suited for assessing site-specific effects. They are also abundant in most streams, and sampling is relatively easy and inexpensive. Finally, the sensitivity of aquatic insects to habitat changes makes them excellent indicators of overall environmental quality. However, macroinvertebrate assemblages often exhibit a high degree of natural variability within or between sample sites, sample seasons, and sample years. In 2013, Northern Ecological Services (2014) found that macroinvertebrates were mostly healthy throughout Grant Creek, and typical of cold, glacial fed streams. In Grant Creek, the macroinvertebrate populations comprise taxa that have a low tolerance for water quality impairment but can also thrive where the growing season is short and streamflows are variable.

As noted above, water quality is similar between Grant Lake and Grant Creek; therefore, project operation would have little effect on the water chemistry of Grant Creek. As discussed in section 3.3.2.2, in the *Effects of Project Operation on Water Quality* subsection, Kenai Hydro would manage water temperature in Grant Creek to limit changes from current annual variations, which would prevent changes to this critical habitat parameter for macroinvertebrates. Project operation would alter the flow regime of Grant Creek and Kenai Hydro would manage and implement proposed mitigation measures, including minimum instream flows in the bypassed reach, minimum instream flows below the tailrace, ramping rates, and channel maintenance flows for sediment, nutrient, and LWD transport through the bypassed reach. With these measures in place, the bypassed reach of Grant Creek would experience significant decreases in flow annually except during the summer when the lake is full, and Grant Creek below the tailrace would experience an elevated base flow in the winter, a reduction in peak flows in June, and similar conditions in the summer.

Kenai Hydro's proposed minimum instream flows would keep the bypassed reach wetted year-round, which would allow the continued persistence of macroinvertebrates in this area, but would decrease the amount of available habitat when flows are limited to minimum releases. As discussed in section 3.3.2.2, in the *Effects of Project Operation on Water Temperature* subsection, in contrast to Kenai Hydro's water temperature data collected in 2013, the bypassed reach may have water temperatures that are about 1°C cooler in April, 1°C warmer in May, slightly warmer in June (average of 0.1°C), and on average 0.5 to 0.9°C warmer in July through September. Elevated temperatures in late summer may approach the thermal optima for some macroinvertebrate taxa and may be warmer than optimal for more sensitive taxa in Grant Creek, such as mayflies *Baetis*, *Brunella*, and *Ephemerella* (EPA, 2006). However, the taxa present in Grant Creek are generally adapted to the temperature variability in cold, glacial streams that experience cold nights and warm days in the summer months. The reduction in peak flows in the bypassed reach in spring would allow for continued growth and development of macroinvertebrates, and could lead to larger populations that would later be transported downstream by the channel maintenance flows prescribed in the summer. Downstream of the tailrace in Grant Creek, elevated flows in the winter would increase wetted perimeter and available habitat for macroinvertebrates. Reduced flows in the spring could create habitat conditions that are favorable for macroinvertebrates, as they would not be subject to higher velocities, and summer flows are expected to be the same. For these reasons, project operation would not have a significant effect on aquatic insects.

Kenai Hydro proposes to increase power benefits by taking advantage of spinning reserve and load-following operations (peaking). To prevent a sudden increase in the water surface levels of Grant Creek as a result of the increased flows generated by these operations, the additional powerhouse flows would be diverted into the detention pond and then released slowly back into Grant Creek via the tailrace channel that flows into Grant Creek. Kenai Hydro proposes to use spinning reserve and load-following infrequently, mainly in the winter. While operating in a spinning reserve or load-following mode, Kenai Hydro would implement certain ramping rates to protect aquatic resources from sudden changes in flows. As discussed above, the proposed ramping rates would protect aquatic resources in Grant Creek.

In summary, Kenai Hydro's proposed mitigation measures, including: minimum instream flows in the bypassed reach; ramping rates; channel maintenance flows for sediment, nutrient, and large wood passage through the bypassed reach; and the ESCP, hazardous material plan, a construction water quality monitoring plan, and a blasting plan during construction, would adequately protect macroinvertebrate resources in Grant Creek during operation and construction of the proposed project.

Grant Creek Tailrace Barrier

The discharge of a hydroelectric facility turbine can create artificial hydraulic conditions that may attract fish. Fish attracted to these discharges could also swim into the project's turbines through the draft tubes where they could be injured or killed from turbine blade strike. Fish exclusion devices installed downstream of a powerhouse discharge can be used to physically block upstream migrating fish from entering the draft tubes and guide fish away from the powerhouse.

Consistent with Alaska DFG (10(j) recommendation 7), FWS (10(j) recommendation 7), and NMFS (10(j) recommendation 7), Kenai Hydro proposes to install a fish exclusion structure in the proposed tailrace channel about 85 feet downstream of the powerhouse to prevent fish from reaching the powerhouse. Kenai Hydro states that its picket-style fish barrier would meet NMFS criteria and would be made of 0.75-inch vertical pickets with 1-inch bar clear spacing. The picket barrier final design would be developed in collaboration with NMFS technical representatives. As part of preparation of final design plans and specifications, Kenai Hydro would refine the design to provide an efficient hydraulic and fish exclusion operation considering barrier orientation, length, and river flow conditions.

In its Tailrace Fish Barrier Design Approach Technical Memorandum (McMillen, 2017), Kenai Hydro provided a conceptual drawing and design specifications, indicating the final design of the fish exclusion structure would be consistent with NMFS's fish passage criteria. Once completed, Kenai Hydro also indicated it would continuously operate the structure during the anadromous fish migration period and remove the picket panels when migrating fish are no longer present in Grant Creek. Kenai Hydro would also continuously monitor the barrier via pressure transducers during operation to determine debris loads and would regularly remove debris at the intake tower trashrack to protect the turbine.

Our Analysis

Installation of a fish exclusion barrier downstream of the proposed powerhouse, as proposed by Kenai Hydro and recommended by Alaska DFG, FWS, and NMFS, would protect upstream migrating fish, including Chinook, coho, and sockeye salmon, from entering the turbine draft tube and potentially suffering injury or mortality. All flows passing through the turbines would be reintroduced to Grant Creek through the tailrace barrier, and during most of the year, flows through the tailrace barrier would be greater than flows through the bypass. This may provide a false attraction to the picket barrier flows. However, as discussed in section 3.3.2.2, *Effects of Project Operation on Aquatic Habitat in the Bypassed Reach*, the amount of habitat for anadromous fish upstream of the barrier is minimal, and false attraction is not expected to be an issue.

Aquatic Habitat Enhancement Measures

As discussed in sections 3.3.1.2, *Geologic and Soil Resources, Environmental Effects,* and 3.3.2.2, *Aquatic Resources, Environmental Effects,* in the *Effects of Project Construction on Water Quality* subsection, construction and operation of the proposed project could affect water quality and alter the amount of available salmonid spawning and rearing habitat in Grant Creek.

In its amended final license application, Kenai Hydro proposes five environmental measures to modify and/or enhance physical habitat in Grant Creek. These measures include implementing its Biotic Monitoring Plan, enhancing the Reach 2/3 side channels by implementing minimum flows downstream of the tailrace throughout the winter, augmenting the amount of flow in the Reach 1 distributary, providing minimum instream flows in the bypassed reach, and monitoring spawning gravel in Grant Creek.

Kenai Hydro's proposed Biotic Monitoring Plan includes goals, objectives, and methodologies for biotic monitoring during project construction and operation and during the evaluation of its proposed enhancement and mitigation measures (see section 3.3.2.2, in the *Biotic Monitoring in Grant Creek* subsection). Kenai Hydro's proposes minimum instream flows below the tailrace to provide consistent flow and wintertime inundation in the Reach 2/3 side channels and to increase the amount of juvenile salmonid rearing habitat in lower Grant Creek. Kenai Hydro's proposed removal of a sill consisting of LWD and substrate that functions to control the amount of flow inundating the Reach 1 distributary is intended to provide greater and more consistent flow in the distributary, increasing both rearing and spawning habitat. Its proposed assessment of the distribution and abundance of gravel in the main stem and Reach 1 distributary relative to existing conditions is designed to evaluate the need for gravel supplementation within the mainstream and distributary and/or the periodic need for channel maintenance flows to mobilize upstream sediment. Kenai Hydro's proposed sediment management plan and the resource agencies' recommendations regarding sediment management are discussed further in section 3.3.2.2, in the *Sediment Management* subsection.

In its section 10(j) recommendation 20, FWS disagrees with Kenai Hydro's proposed logjam removal measure in Reach 1. FWS's preference is to reserve this action as a potential mitigation option once results from biotic monitoring (winter minnow trapping) are made available to better inform the proposal. In lieu of the mitigation measure for gravel augmentation, FWS recommends Kenai Hydro collect genetic tissue samples for species DNA analyses. We discuss FWS's recommended DNA collections below under the *Biotic Monitoring Plan* subsection.

Kenai Hydro's response to FWS's comments proposes to delay removing the logjam, pending a review of initial monitoring data and to use the annual meeting review process as the collaborative mechanism for decision making related to this topic.

Our Analysis

Kenai Hydro developed its proposed aquatic enhancement measures in consultation with Alaska DFG, NMFS, and FWS and included monitoring associated with these measures in its Biotic Monitoring Plan. However, one of the measures proposed by Kenai Hydro and recommended by FWS lacks a clear project nexus.

Under current conditions, the Reach 2/3 side channels experience significant flow fluctuations and inconsistent inundation, which restricts rearing habitat for resident and anadromous species in Grant Creek. Increased flows through these side channels would be achieved by adopting Kenai Hydro's proposed minimum flows below the project's tailrace. These instream flows would provide more consistent and higher minimum flows in the side channels during the winter. As part its instream flow study, Kenai Hydro conducted modeling to evaluate changes in habitat in the Reach 2/3 side channels as a result of project operation. These modeling results indicate that increasing minimum flows to 60 cfs from January through April would increase the WUA for fry rearing for rainbow trout and juvenile rearing for Chinook, coho, Dolly Varden, and rainbow trout (figure 3-22), and would improve ecological functions, processes, and connectivity necessary to sustain aquatic resources in the Reach 2/3 side channel.

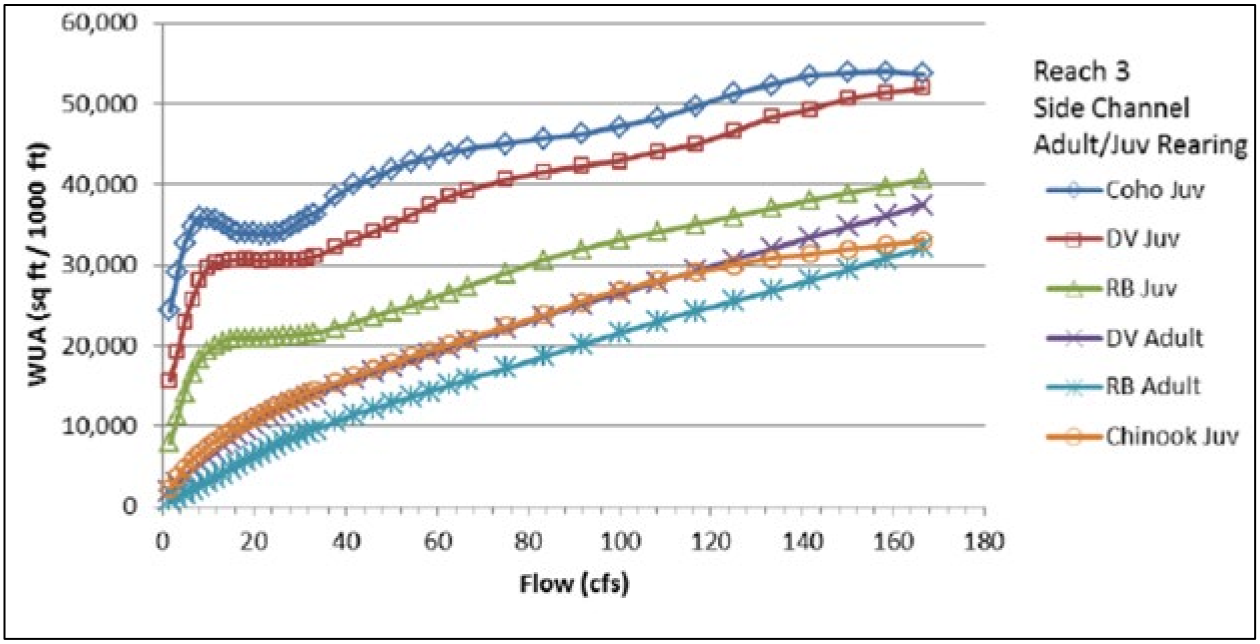

Figure 3-22. Adult and juvenile rearing WUA, Reach 3 side channels (Source: McMillen, 2014).

The rearing WUA in the Reach 2/3 side channels would decrease by about 15 percent from existing conditions in November as flows decrease under the natural hydrograph and would increase about 5 percent from December to February compared to what is present under existing conditions. Kenai Hydro's proposed and the resource agencies' recommended minimum flows in Grant Creek downstream of the tailrace are discussed further in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*.

Under Kenai Hydro's proposed operation, flows downstream of the tailrace are expected to be higher than the proposed 60-cfs minimum flow throughout winter as a result of Kenai Hydro's desire to maximize generation. Observed flow downstream of the tailrace is expected to be closer to 100 cfs in December, steadily decreasing to approximately 75 cfs in April (see figure 3-7). These flows (in excess of 60 cfs) would increase the amount of WUA for fry rearing by approximately 15 percent.

The upstream control (logjam) at the head of the Reach 1 distributary limits inundation of the distributary to flows in Grant Creek of over 190 cfs. At Grant Creek flows of about 200 cfs, flows in the Reach 1 distributary are limited to about 2 cfs. This logjam complex developed after a log became entrenched and gathered additional pieces of wood over time.

Kenai Hydro analyzed the available habitat in the Reach 1 distributary as part of its instream study. The results show significant increases in the spawning, fry rearing, and juvenile and adult rearing WUAs associated with increased flows in the distributary (figure 3-23).

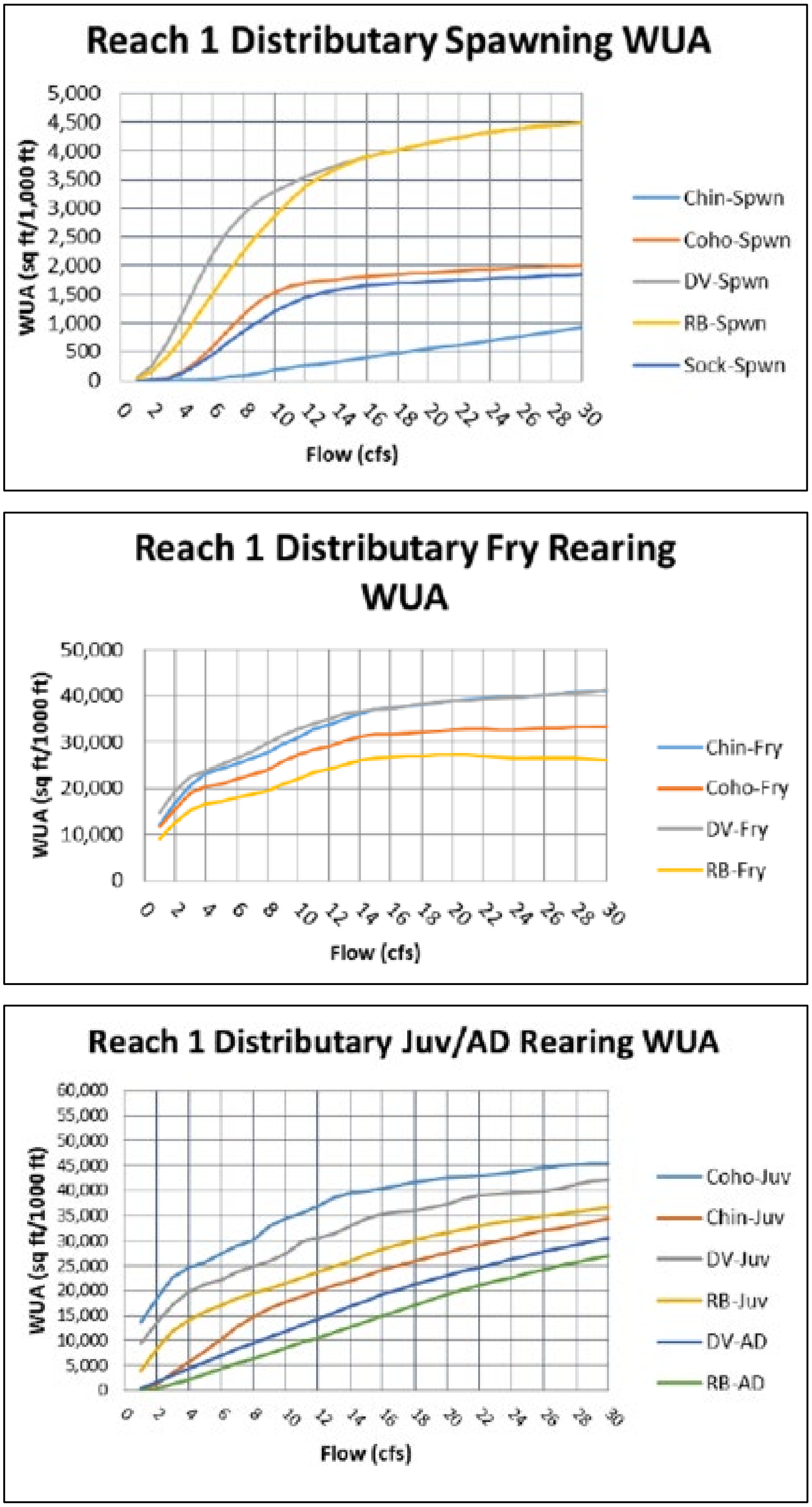

Figure 3-23. Reach 1 distributary spawning, fry rearing, and juvenile/adult rearing WUA (Source: Kenai Hydro, 2018a, as modified by staff).

Under Kenai Hydro's proposed flow regime, flows in Grant Creek would be increased during the winter but would not exceed the 190 cfs required to inundate the Reach 1 distributary. In this scenario, there would be no modification from current conditions, and the distributary would not be wetted until flows exceed 190 cfs in late spring.

Implementation of the logjam removal would increase habitat available to aquatic resources in Grant Creek and improve ecological processes and connectivity in the Reach 1 distributary. However, removal of this logjam would modify an existing natural feature that would not be influenced in any way by the proposed project. Large wood is known to provide important habitat for aquatic organisms, including slowing the flow of water, collecting gravel for spawning, providing refuge for various life stages of fish and habitat for macroinvertebrates, and to contributing to overall habitat complexity. Therefore, this proposed enhancement measure to provide additional aquatic habitat is unnecessary.

FWS's recommendation to collect tissue samples of live adult salmonids in Grant Creek for genetic analysis would improve the existing genetic baselines for these species in the Kenai Basin. However, there is no project-related purpose for requiring a license condition stipulating that Kenai Hydro collect tissue samples for genetic analysis. In addition, we anticipate that Kenai Hydro's proposed and the resource agency's recommended measures including minimum flows in both the bypassed reach and downstream of the tailrace, ramping rates, channel maintenance flows, and implementation of an ESCP, a hazardous material plan, a construction water quality monitoring plan, and a blasting plan during construction would adequately protect aquatic habitat and aquatic resources in Grant Creek. Therefore, we cannot envision a scenario where project construction and operation, with protection and enhancement measures included in any license issued for the project, would result in a significant change in genetic structure of the salmonid populations in Grant Greek. Further, general monitoring of population genetics would not necessarily isolate any project-specific effects on the resource. Consequently, we find that any monitoring data would provide no benefits from a project-related perspective.

Biotic Monitoring in Grant Creek

Any license issued for the proposed project could include a number of measures that would alter aquatic habitat conditions in Grant Creek. These altered habitat conditions have the potential to affect the distribution and abundance of resident and anadromous salmonids and benthic macroinvertebrates in Grant Creek and reduce the rate and volume of sediment (spawning gravel) being transported through the system. Construction of the proposed project facilities (i.e., penstock, powerhouse, tailrace, detention ponds, and roads) could also cause habitat alteration due to sedimentation and erosion, or through the accidental release of contaminants into project area waterbodies. Kenai Hydro's proposed protection, mitigation, and enhancement measures, which include providing additional flow into the Reach 2/3 side channels, augmenting the flows in the Reach 1 distributary, and implementing spawning gravel augmentation and channel maintenance flows could benefit fish and benthic macroinvertebrate production in Grant Creek (see section 3.3.2.2, in the *Sediment Management* subsection).

To monitor project effects on biotic resources and efficacy of protection and mitigation measures, Kenai Hydro proposes to implement its Biotic Monitoring Plan, which documents the monitoring measures that Kenai Hydro proposes to implement during project construction and through the initial phases of operation to evaluate the effects of the project on aquatic resources. As outlined in the Biotic Monitoring Plan, Kenai Hydro would conduct juvenile and adult salmonid investigations during year 1 of construction and during years 2 and 5 of project operation. Kenai Hydro also proposes to monitor the effects of proposed aquatic habitat enhancement measures (discussed above in *Aquatic Habitat Enhancement Measures* subsection), which include juvenile and adult salmonid use of the Reach 1 distributary and Reaches 2/3 side channels, and to conduct gravel monitoring prior to construction and in years 5 and 10 of operation to determine the need for gravel supplementation and channel maintenance flows. These measures are discussed in detail below in the *Salmonid Monitoring* and *Gravel Monitoring and Augmentation* sub-sections.

FWS 10(j) recommendation 9 recommends Kenai Hydro modify its Biotic Monitoring Plan to include adaptive management strategies and provisions for how any determined need for operational changes would be incorporated into the project. In addition, FWS recommends the plan include specific, measurable, achievable, realistic, and time-bound (SMART) objectives, but specific objectives were not provided.

Finally, Alaska DFG and FWS 10(j) recommendations 18 recommend that Kenai Hydro hold annual consultation meetings with the agencies to review study and monitoring reports and compliance with license articles. Forest Service final 4(e) condition 4 specifies that Kenai Hydro conduct annual meetings with agencies to discuss measures needed to ensure protection and use of NFS lands and resources affected by the project.

In response to comments, Kenai Hydro states annual meetings with stakeholders and FERC to review all management plans and related monitoring efforts associated with construction and subsequent operation of the Project are included in each monitoring plan submitted with the project. Kenai Hydro states that they would be amenable to either adhering to the annual compliance meeting proposed in their monitoring plans, or modifying it to allow for an annual meeting to take place by April 15 (as proposed by Alaska DFG) with the later filing of a Final Annual Compliance Report.

Our Analysis

Detailed analysis of the Biotic Monitoring Plan's juvenile and adult salmonid monitoring and gravel monitoring and augmentation area are presented in the following subsections.

Regarding agency recommendations for an annual project review, adaptive management, and consultation meeting, while we have no objection to such meetings, we note that the Commission's review process for study and monitoring reports includes a mechanism for agency review and comment. Therefore, it is not clear what additional benefit the meeting would provide to support aquatic resource management. FWS recommends that Kenai Hydro include SMART objectives in its Biotic Monitoring Plan, but without supplying specific objectives, there is nothing to analyze.

Salmonid Monitoring

During construction of the project, Kenai Hydro proposes to focus its monitoring efforts on maintaining existing priority sites for spawning, incubation, and rearing. Specifically, Kenai Hydro proposes to assess juvenile life stages using minnow traps in early June and early August and evaluate adult life stages using a combination of visual, redd, and carcass surveys. Kenai Hydro would conduct all three adult surveys three times for each species during their peak spawning periods, for a total of 9 visual surveys, 9 redd surveys, and 9 carcass surveys each year of sampling.

Once the project begins to operate, Kenai Hydro proposes to conduct additional juvenile and adult surveys to document the effects of operation on aquatic resources and to determine if its proposed enhancement measures are providing the additional habitat that was predicted during the modeling exercises. Kenai Hydro would employ similar methods to those used during construction monitoring including minnow traps, visual, redd, and carcass surveys, and expand the juvenile monitoring to include snorkeling surveys. Following completion of each monitoring year, Kenai Hydro proposes to provide stakeholders with a summary of its findings in the annual compliance report. If a stakeholder representative believed that the results of monitoring demonstrate that construction activities were imposing deleterious effects on any life stage of Grant Creek salmonids, that representative could call for a meeting to discuss what effects did exist and what, if any, actions were necessary to remedy the effects.

Kenai Hydro's Biotic Monitoring Plan also includes provisions to monitor the effectiveness of its proposed aquatic resources measures. As described in the plan, Kenai Hydro would assess juvenile salmonid abundance in the Reach 2/3 side channels during the winter and evaluate juvenile and adult salmonid utilization in the Reach 1 distributary. This monitoring program would include minnow trapping and snorkel surveys for juvenile salmonids, and visual surveys for adult spawners, redds, and carcasses in the Reach 1 distributary and Reach 2/3 side channels. Kenai Hydro proposes to conduct these surveys concurrently with construction monitoring to provide baseline data prior to the implementation of its measures and would evaluate the effectiveness of these measures in years 2 and 5.

FWS 10(j) recommendation 9 recommends Kenai Hydro add minnow trapping in winter to monitor species occupancy, abundance, and habitat use in Grant Creek during project construction and operation. NMFS believes that sampling in April, as proposed by Kenai Hydro, is not indicative of true winter conditions.

Alaska DFG comments that the schedule for the adult salmon surveys during construction is inadequate and recommends five surveys for each species (for a total of 15 visual surveys, 15 redd surveys, and 15 carcass surveys each year) and that fisheries sampling for both juveniles and adults should be carried out during the first two years of project construction, not just the first year. Alaska DFG comments that the schedule for monitoring activities during operation phase of the project should also be expanded from two sampling days per species to five days per species. Alaska DFG recommends expanding monitoring during operations from only years 2 and 5, to years 2, 5, 8, 11, and 14 to monitor several salmon life cycles.

In response to comments, Kenai Hydro stated that the Biotic Monitoring Plan was developed in collaboration with the resource agencies during its development and proposes that the current Biotic Monitoring Plan schedule represents an acceptable level of effort and analysis.

In comments on the draft EIS, Alaska DFG and FWS note that project effects on fish population dynamics would be isolated, to some extent, by comparing the fish monitoring results for Grant Creek to the results of other fish population assessments in the Kenai River Watershed (e.g., Cooper Creek, Russian River, and Kenai River).

Our Analysis

Fish population monitoring is typically based on the presence or absence of particular species, numbers of particular species, or on community parameters (such as productivity, density, and diversity) and is usually conducted over multiple years. Fish habitat monitoring usually focuses on the long-term assessment of habitat variables that have the greatest influence on aquatic species. According to Kenai Hydro (2018), the objective of its proposed Biotic Monitoring Plan is to monitor the potential effects of project construction and operation (including the proposed protection measures) on fish and fish habitat in Grant Creek.

Kenai Hydro’s proposed erosion and sediment control, spill prevention, control and containment, hazardous materials, and fuel storage plan are intended to limit adverse effects on environmental resources. We anticipate these plans would adequately protect water quality and aquatic habitat in Grant Creek from sedimentation or inadvertent releases of hazardous petroleum products. We also anticipate that Kenai Hydro’s proposed instream flows, ramping rates, channel maintenance flows, and water temperature regime, would adequately mitigate project effects on resident and anadromous salmonids in Grant Creek. Therefore, we have no reason to conclude that construction and operation of the project would in and of itself, cause long-term changes to aquatic resources in Grant Creek or Grant Lake.

Further, while juvenile and adult salmonid monitoring during the initial phases of project operation would provide data on aquatic habitat and juvenile and adult fish population in Grant Creek, a limited amount of information is available on the historical abundance and distribution of both juvenile and adult salmonids in Grant Creek. This lack of data inhibits development of a monitoring program that would provide for comparisons between existing conditions and conditions with the project in place.

The project has no control over external factors that influence anadromous salmonid abundance including commercial and recreational harvest, ocean survival, predation, or degraded habitat located outside the project vicinity, that may lead to significant variability in the abundance of salmonid populations in Grant Creek. Although some project effects can be approximated by comparing fish monitoring results for Grant Creek to other concurrent fish population assessments in the Kenai River Watershed, this analysis is restricted to data gathered on fish populations within a limited distance from the project to minimize other variables, such as habitat quality and land use practices, and there is no way to identify mitigation measures that are specific to project effects.

For all of these reasons, we find no project-related benefit or justification for a license condition requiring monitoring juvenile and adult salmonids before and after project construction and operation commences.

Gravel Monitoring and Augmentation

Kenai Hydro proposes to assess the condition of salmonid spawning gravels within reaches 1 through 4 of Grant Creek to determine a need for gravel augmentation in year one of construction and again in years 5 and 10 of operation. Gravel monitoring would include surface sampling to characterize surface substrate size at various bedforms often utilized for spawning, and subsurface bulk sampling to characterize subsurface substrate size at anticipated spawning areas. If no significant changes were identified within the first 10 years of operation, Kenai Hydro would discuss the frequency and need for additional gravel monitoring with the stakeholders. In the event that the project is having a negative effect on spawning gravel recruitment and transport in Grant Creek, Kenai Hydro would discuss the issue with the stakeholders during the next annual compliance reporting period, and develop an approach for supplementing gravel or using channel maintenance flows to ensure functional recruitment and transport of spawning gravels and sediment.

FWS (10(j) recommendations 4 and 20), NMFS (10(j) recommendations 4), and Alaska DFG (10(j) recommendation 4) do not support gravel augmentation, and instead recommend channel maintenance flows through the bypassed reach, as discussed in section 3.3.2.2, *Sediment Management* subsection.

In lieu of the Kenai Hydro's proposed measures for gravel augmentation, FWS recommends Kenai Hydro collect genetic tissue samples for species DNA analyses. FWS believes that there is an opportunity to obtain live fish DNA samples during the construction of the project access road. FWS recommends tissue be collected from adult salmon from Grant Creek in consecutive sample years until 200 coho, 100 sockeye, and 200 salmon samples have been collected. FWS states that Kenia Hydro needs to collet DNA samples from Grant Creek before the project is constructed to support population baselines used to identify appropriate post-project mitigation measures over the life of the project license. FWS also recommends Kenai Hydro collect tissue samples from about 50 to 100 rainbow trout and Dolly Varden adults for DNA analysis. FWS states that tissue samples from rainbow trout and Dolly Varden from Grant Creek would improve the FWS spatial coverage for these species in the Kenai River Watershed and would improve FWS's estimates of genetic diversity for both species.

NMFS agrees with Kenai Hydro's proposed gravel monitoring but recommends the assessment of the gravels continue on a 5-year interval for the life of the license. NMFS believes that if spawning gravels were to be depleted, the depletion would not likely be detected in the first 5 years of project operation and may take 20 to 30 years or more to manifest.

Alaska DFG believes that Kenai Hydro's proposed sediment monitoring is inadequate, and recommends monitoring sediment conditions using Kenai Hydro's proposed methods during years 5, 10, and 20 of project operation. Alaska DFG also recommends Kenai Hydro prepare a final report to address possible modifications to the project structures and operation for any protection or enhancement purposes.

In response to comments, Kenai Hydro agreed to the agencies' recommended channel maintenance flows, and if channel maintenance flows are required as a condition of the license, it would modify the Biotic Monitoring Plan to eliminate the need for adaptive management measure to assess sediment transport and will eliminate the potential need for gravel supplementation.

In regard to DNA sampling, Kenai Hydro states that the methods to monitor adult salmonids consist of visual, redd, and carcass surveys, none of which include live adult salmonid capture. As such, Kenai Hydro states that it is unable to commit to the collection of genetic samples from live fish. Kenai Hydro states that if FWS determines that samples from carcasses associated with the monitoring presented in the Biotic Monitoring Plan would assist in FWS's desire to expand its global genetic database, Kenai Hydro would be willing to gather samples opportunistically.

Our Analysis

As discussed in section 3.3.2.2, in the *Sediment Management* subsection, the proposed channel maintenance flows of 800 cfs, provided on a regular basis should move sediment from Reaches 5 and 6 to the lower reaches in a manner that is similar to the existing conditions to retain downstream fish spawning habitat. However, it is unknown whether the proposed and recommended channel maintenance flows would be successful at maintaining the current rate of sediment recruitment from Reach 5 and Reach 6. The primary source of gravel in Grant Creek is erosion in Reaches 5 and 6 occurring during high flows. Because the project would change the frequency, duration, and intensity of high flows through these reaches, it is likely erosion potential would be reduced and Reaches 5 and 6 could become gravel limited. While the 800-cfs flows would likely transport gravel if it is present it the channel, they would not have the desired effect if no gravel is available to transport. Gravel monitoring, using Kenai Hydro's proposed methods, would be adequate to evaluate the success of channel maintenance flows at maintaining erosion processes and providing gravel into Reaches 5 and 6.

Because erosion is a long-term process, any potential effect of the project on gravel would occur slowly, and any decrease in gravel abundance as a result of the project may not be observable after the first 5 years of operation. Therefore, monitoring in year 5 of operation, as recommended by Alaska DFG, is not likely to detect a change. By year 10, two channel maintenance flows would have occurred, and evidence of any depletion of spawning gravel in Grant Creek may be identified. Because the time span between channel maintenance flows would depend on water years, monitoring in years 15 and 20 would provide an accurate assessment of the effects of the project on gravel abundance in Grant Creek. An analysis of monitoring results conducted after year 20 would identify whether a change in spawning gravel has occurred and if a decline is observed, actions to improve spawning habitat such as modifications to project operations or gravel augmentation could be implemented. Monitoring in year 30 and a subsequent analysis would evaluate whether the channel maintenance flows and any mitigation measures that were implemented after year 20 were successful at maintaining gravel recruitment and transport processes in Grant Creek. If no mitigation measures were implemented in year 20, monitoring in year 30 would be able to confirm that gravel abundance remained stable under project operations.

As discussed in section 3.3.2.2, in the *Aquatic Habitat Enhancement Measures* subsection, FWS's recommendation to collect tissue samples for genetic analysis would improve the existing genetic baselines for salmonids in Grant Creek. However, there is no project-related purpose for requiring a license condition stipulating that Kenai Hydro collect tissue samples for genetic analysis. We cannot envision a scenario where project construction and operation, with protection and enhancement measures included in any license issued for the project, would result in a significant change in genetic structure of the salmonid populations in Grant Greek. Further, general monitoring of population genetics would not necessarily isolate any project-specific effects on the resource. Consequently, we find that any monitoring data would provide no benefits from a project-related perspective.

Effects of Project Operation on Aquatic Habitat in the Trail Lake Narrows

Operation of the proposed project would alter the seasonal flow pattern in Grant Creek, which would, in turn, modify the amount of flow through the Trail Lake Narrows. These altered flow conditions could affect the capacity of the Trail Lake Narrows to support fisheries resources, including Chinook, coho, sockeye, and pink salmon and resident rainbow trout and Dolly Varden.

Our Analysis

As discussed above in section 3.3.2.2, in the *Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace* subsection, operation of the proposed project would have the greatest effect on the hydrograph in spring and early summer when snowmelt would be retained in Grant Lake to fill the reservoir and would also increase flows through Grant Creek in the winter.

Grant Creek contributes to about 25 percent of the flow through the Trail Lake Narrows throughout the year under existing conditions with slight seasonal variations (see table 3-9). The decrease in flow in the Trail Lake Narrows during June through August comes at a time when the Trail River system experiences highly variable flows because of snowmelt runoff. The decrease in flows in that would be attributable to project operations are expected to be within the range of daily average flows that are observed at the Trail Lake Narrows in a low to average daily flow. The increase in flow from Grant Creek between January and April—from between 33 and 55 cfs average monthly discharge under current conditions to 60 cfs as recommended by the agencies—would result in a minor change in flows from Grant Creek to the Trail Lake Narrows and would not change existing conditions at the Narrows. Winter habitat is expected to remain varied, freezing in colder years and remaining flowing in warmer years.

Riffles dominate the Trail Lake Narrows, and redds have been found in suitable spawning gravels. Because Grant Creek is the closest upstream tributary to the Trail Lake Narrows, project operation could reduce the distribution and availability of suitable spawning gravels for resident and anadromous salmonids in the Trail Lake Narrows, as well as in Grant Creek. As discussed in section 3.3.2.2, in the *Sediment Management* and *Effects of Operation on Transport of Materials* subsection, adequate channel maintenance flows provided through the bypassed reach would mimic the natural hydrograph and would reflect the existing processes of spawning substrate recruitment into Grant Creek and sediment transport from Grant Creek through the Trail Lake Narrows.

As discussed in section 3.3.2.2, in the *Effects of Operation on Transport of Materials* subsection, reduced peak flows in Grant Creek below the tailrace in spring has the potential to retain more large wood in Grant Creek on an annual basis, instead of flushing wood through Grant Creek and into the Trail Lake Narrows. Channel maintenance flows of adequate magnitude, duration, and frequency are expected to maintain natural wood transport processes over a longer period. Also, LWD in the Grant Creek system is limited; consequently, the amount of contribution of LWD from Grant Creek to habitat in the Trail Lake Narrows is expected to also be limited. Grant Creek is 1 of 10 tributaries to Upper and Lower Trail Lakes, and a potential decrease in LWD contribution in 1 of these 10 tributaries is not expected to substantially affect the habitat complexity in the Trail Lake Narrows.

Based on the above analysis, operation of the proposed project would slightly modify flows that are not expected to have a significant impact on habitat in the Trail Lake Narrows. Project operations would also regularly provide channel maintenance flows with a magnitude, duration, and frequency that is adaptively managed to maintain transport of sediment and biological materials in a manner that is similar to existing conditions. Channel maintenance flows are also intended to maintain sediment recruitment from the bypassed reach of Grant Creek; however, the success of these flows is unknown. If the proposed channel maintenance flows are successful at maintaining the erosional processes that recruit sediment into the Grant Creek system, it is expected fish spawning and rearing habitat in the Trail Lake Narrows would be maintained similar to existing conditions.

3.3.2.3 Essential Fish Habitat

As discussed in detail above and in section 3.3.2.2, the proposed project would result in short-term adverse effects on Chinook, coho, pink, and sockeye salmon EFH, predominately during construction of the proposed project. However, proposed and recommended measures, for construction timing, stream buffers, and ESCP, hazardous material containment/fuel storage plan, spill prevention, control and containment plan, construction water quality monitoring plan, and blasting plan would protect water quality, and any short-term adverse effects would be minor.

Over the long term, the recommended measures of minimum flows in the bypassed reach, minimum flows below the tailrace, ramping rates, channel maintenance flows, and installation of a tailrace barrier would maintain and protect habitat for macroinvertebrates in the bypassed reach, maintain sediment, nutrient, macroinvertebrate, and large wood transport from the bypassed reaches to below the tailrace, maintain habitat in Grant Creek during summer, and improve habitat for aquatic resources below the tailrace both by retaining more LWD in the system by reducing peak flows, and by increasing rearing habitat in the winter by increasing minimum flows. Therefore, the proposed project would not adversely affect, and may improve, Chinook, coho, pink, or sockeye salmon EFH in Grant Creek relative to existing conditions.

3.3.2.4 Cumulative Effects

Water Quantity

Given the remote location of Grant Lake and general lack of human activity in area, no consumptive Grant Lake or Grant Creek water uses have been identified. Operation of the project is not likely to have a cumulative effect on streamflows and water levels in Grant Lake and Grant Creek. The project would likely change the timing of flows through Grant Creek and therefore could have an effect on the water levels in Lower Trail Lake and Upper Trail Lake, which receive outflow from Grant Creek. However, because project operation is not expected to change the overall volume of water flowing through Grant Creek, the overall effects (i.e., water level fluctuations) on receiving water bodies should be minimal.

Actions within the geographic scope (i.e., Kenai River Basin) that may affect streamflows and water levels in combination with the project include other hydroelectric project developments. The Cooper Lake Hydroelectric Project (FERC No. 2170) is located on Cooper Lake, Cooper Creek, and Kenai Lake immediately southeast of Grant Lake. The Cooper Lake Project powerhouse releases directly into Kenai Lake, which is the source of the Kenai River. Kenai Lake receives flow from Grant Lake via outflows from Lower Trail Lake. No existing impoundment or diversion structures are located on Kenai Lake. Operation of the Cooper Lake Project has little to no effect on the flows in the Kenai River downstream of Kenai Lake. Operation of the Grant Lake Project would not result in the diversion of water out of the Kenai River Basin; therefore, project operation would not reduce the amount of water that enters Kenai Lake. Additionally, operation of the project would not dramatically alter the timing of flow entering Kenai Lake and would have a limited to no effect on flows in the Kenai River. We conclude that the project would not cause a cumulative effect on streamflows and water levels in the Kenai River Basin.

Water Quality

Operation of the project is not expected to have a cumulative effect on water quality in Grant Lake or Grant Creek. Several mining claims are located on Grant Lake (see figure 3-26 in section 3.3.4.1). The Forest Service (Seward Ranger District) approved a mining plan for operating the White Rock Mine on the north side of Grant Lake, with proposed access via all-terrain vehicle on the Grant Lake Trail. The Forest Service's 2015 environmental assessment concludes that operation approved under the plan of operation would have no direct, indirect, or cumulative effects on fish or the aquatic environment.

Plans for erosion and sediment control, hazardous materials containment/fuel storage, and spill prevention will minimize short-term impacts of project construction on water quality. Once operational, more frequent fluctuations in Grant Lake elevations may result in increased erosion from shoreline areas, with potential minor increases in turbidity in Grant Lake, and to a lesser extent in Grant Creek. However, this is unlikely given the makeup of the Grant Lake shoreline, which is composed of large substrate unlikely to erode. No changes in temperature are anticipated in Grant Lake, and other project effects on water quality, including levels of metals, nutrients, cations/anions, and alkalinity are not anticipated because the substrate composition of the lake shore consists of coarse, angular boulders, with low susceptibility to erosion and there would be no new inundation of vegetated areas.

Minor changes in Grant Creek water temperatures may occur, including within the proposed bypassed reach and downstream of the proposed tailrace. The proposed variable intake structure and plans to match Grant Creek and Grant Lake temperatures are expected to minimize temperature effects of the project. Because of the minor effects on temperature and water quality, the project is not anticipated to have any noticeable cumulative effects on the water quality of Lower Trail Lake or the Kenai River Basin.

Fisheries

Sculpin and threespine stickleback, the only fish species present in Grant Lake, would experience reservoir fluctuations that differ from existing conditions because of project operation. While project operation would not result in Grant Lake water surface elevation fluctuations outside the existing lake level range, Grant Lake would experience greater inter-monthly water surface elevation changes. Because of its steep, rocky shorelines, project operation would not expose or adversely affect important fish habitat during project drawdowns. However, fish residing in Grant Lake could be entrained through the project intake during periods of generation. While some fish entrainment would occur, entrainment rates at the project intake are expected to be minimal and would not contribute to cumulative effects in the Kenai River basin.

Under existing conditions, the proposed project's bypassed reach supports a population of resident fish and macroinvertebrates. The diversion of water associated with the proposed project would affect the natural hydrology, geomorphology, and water quality in the bypassed reach downstream of the dam, which in turn would affect the quality and quantity of aquatic habitat for resident fish in the bypassed reach and the section of Reach 5 that is accessible to anadromous fish. These effects would be localized and would not contribute to cumulative effects in the Kenai River Basin.

It is anticipated that implementation of Kenai Hydro's proposed minimum instream flows in the bypassed reach and downstream of the project tailrace, ramping rate requirements, channel maintenance flows, and construction related measures to protect water quality would maintain aquatic habitat diversity in the proposed bypassed reach and downstream of the tailrace for the duration of any license issued for the project. These measures, coupled with the implementation of our recommended water temperature management would provide minimize project effects aquatic habitat in the project area. Therefore, operation of the project would likely mitigate these cumulative effects on fishery resources in Grant Creek.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

In support of the 2013/2014 Terrestrial Resources Study, Kenai Hydro developed an upland vegetation map of the project area using aerial imagery and ground-truthing (ERM and Beck, 2014). The study area for the general vegetation mapping survey included all lands within the FERC project boundary and the outer extent of the assessment areas for the wildlife, wetland, sensitive plant, and invasive plant surveys. Around Grant Lake, the general vegetation mapping survey area included all areas up to an elevation of 733 feet. Upland vegetation around Grant Lake comprises large stands of coniferous forest and coniferous-deciduous forest on moderate slopes at the southeastern end, the elbow, and the southwestern shore of the project area. Floodplain forest and scrub communities occur mostly in the eastern portion of the project area and are associated with Inlet Creek and along outwash fans and floodplains associated with small drainage areas along the Grant Lake shoreline. A mosaic of smaller areas of alder scrub and grass-forb meadow vegetation types are found on steep, avalanche-prone slopes around Grant Lake. Much of the forest in the study area is old growth. Although upland vegetation in most of the study area is currently largely unaffected by human activities, evidence of past logging of some larger trees was observed during the survey near the ARRC and Seward Highway. Table 3-24 shows the vegetation communities/habitat types and their approximate area estimated during the 2013/2014 field surveys.

Table 3-24. Vegetation communities/habitats within the project study area (Source: ERM and Beck, 2014, as modified by staff).

Vegetation Type	Acres	Dominant Species
Coniferous forest	173.7	Lutz spruce,[a] mountain hemlock, rusty menziesia, early blueberry, twinflower
Coniferous-deciduous forest	177.1	Lutz spruce, paper birch, poplar, quaking aspen, rusty menziesia
Alder scrub	34.5	Sitka alder, goatsbeard, willow species, devil's club
Grass-forb meadow	2.2	Bluejoint wheatgrass, goatsbeard, red raspberry, highbush cranberry
Floodplain forest and scrub	106.0	Lutz spruce, poplar, paper birch, Sitka alder, willow, sedge species, river beauty, bluejoint reedgrass
Wetlands	77.1[b]	Herbaceous wetlands, scrub-shrub wetlands, riparian/forested wetlands, non-vegetated open water
Total	**570.6**	

[a] Lutz spruce (*Picea x lutzii*) is a hybrid of Sitka spruce (*Picea sitchensis*) and white spruce (*Picea glauca*).

[b] Wetland acreages presented in table 3-24 differ from those in table 3-25 because the value in table 3-24 is for the entire Terrestrial Resources Study area, whereas acreages for table 3-25 are for the wetland assessment area only.

Wetlands

Kenai Hydro assessed wetlands and waters using a combination of desktop studies and mapping during the broader terrestrial resources surveys in 2013 (ERM and Beck, 2014). The wetlands assessment area included Grant Lake to about the 705-foot elevation contour along the shoreline, the area within a 100-foot buffer around Grant Creek, and the area within 100 feet of all proposed project infrastructure features. Wetlands were mapped using global positioning system points in the field with subsequent editing in geographic information system software using aerial photography. In December 2014, the wetland assessment area was updated to reflect the addition of the surge chamber, access road, and switchbacks along the intake access road.

Vegetated wetlands included herbaceous, scrub-shrub, forested wetlands associated with depressional, lacustrine, slope, and riparian areas. Depressional wetlands within the wetland assessment 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. Lacustrine wetlands included persistent and non-persistent emergent wetlands, aquatic beds, and vegetated shoreline communities that are directly attached to or border Grant Lake. Slope wetlands include a west-facing forested slope adjacent to the detention pond and a small seasonal drainage on a north-facing slope south of Grant Creek. No vegetated lacustrine fringe or slope wetlands were associated with Upper Trail and Lower Trail Lakes. Riverine wetlands were adjacent to and hydrologically influenced by Inlet Creek, Grant Creek, their tributaries, and drainages associated with Grant Lake. The upper reaches of Grant Creek, which are steep and bedrock-lined, transition from unvegetated bed and bank to limited nonvegetated floodplain and scrub vegetation in the lower reaches and Trail Lake Narrows confluence. Table 3-25 shows the total area of wetlands and waters within the wetland assessment area for the project.

Table 3-25. Wetlands and other waters within the proposed project lands (Source: ERM and Beck, 2014).

Feature Type	Acres	Description
Wetlands		
Herbaceous wetlands	5.68	Palustrine emergent and deciduous scrub-shrub mixed wetlands
Herbaceous wetland/ floodplain forest and scrub	3.11	Palustrine emergent and deciduous scrub-shrub mixed wetlands
Scrub-shrub wetlands	20.92	Palustrine deciduous and broadleaved evergreen scrub-shrub wetlands and emergent mixed wetlands
Scrub-shrub wetland/ floodplain forest and scrub	7.94	Palustrine deciduous scrub-shrub, emergent mixed, and deciduous forested mixed wetlands
Forested wetlands	0.89	Palustrine needle leaved evergreen forested wetland
Total wetlands	38.54	
Other Waters		
Open water	1,650.14	Grant Lake, Trail Lake Narrows, ponds
Riverine	9.81	Grant Creek, Inlet Creek, outwash fans, and streams

Feature Type	Acres	Description
Total other waters[a]	1,660	
Total	**1,698.5**	

[a] Small streams that were too narrow to map as polygons (e.g., less than 15 feet wide) were mapped as lines and reported in linear feet. Twenty-three of the small stream segments were perennial (8,303 feet), and 36 stream segments (5,279 feet) were intermittent with no water flowing in the channel.

Non-native, Invasive Species

Overall, Kenai Hydro observed few populations of invasive plants[55] in the invasive plant study area during the 2013/2014 Terrestrial Resources Study surveys. The study area for the invasive plant survey included NFS, private, and state lands in the project area, 5 feet above Grant Lake normal maximum elevation of 703 feet; a 50-foot buffer along the route for the proposed road and transmission line; and a 100-foot buffer around all other proposed project features along Grant Creek and the Seward Highway. Populations of annual bluegrass, Kentucky bluegrass, common dandelion, and white clover were documented. Each of these species were previously mapped in the vicinity of the invasive plant study area on State of Alaska lands (Forest Service, 2013b) and documented in the Alaska Exotic Plants Information Clearinghouse database (Alaska Center for Conservation Science, 2018). Invasive aquatic species known to occur on the Kenai Peninsula include waterweed and white water lily (Alaska Exotic Plants Information Clearinghouse, 2019).

During the 2013 study, common dandelion and white clover were located along the Seward Highway ROW within the study area. In addition, a small population of timothy grass was observed along Seward Highway in 2014. Common dandelion was located along the ARRC ROW, and annual bluegrass, Kentucky bluegrass, and common dandelion were located on the Grant Lake Trail where it enters the invasive plant study area on the northwestern shore of Grant Lake on Forest Service lands. Small- to medium-sized populations of common dandelion were scattered around Grant Lake in disturbed or bare/exposed soil areas on State of Alaska and Forest Service lands. Invasive plants were otherwise not observed in areas that do not experience appreciable human disturbance.

[55] The National Invasive Species Council (2016) defines invasive species as non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm.

Special-status Plants

Special-status plants include species listed as threatened or endangered at the state level and species designated by the Forest Service as sensitive. Through review of Kenai Hydro's Biological Evaluation for Plants,[56] relevant literature and consultation, maps, and field surveys in July 2013, Kenai Hydro identified two special-status plants with the potential to occur on proposed project lands: pale poppy (*Papaver alboroseum*) and Aleutian shield fern (*Polystichum aleuticum*). The study area for the sensitive plant survey was limited to NFS lands within the study area and included 5 feet above Grant Lake normal maximum elevation of 703 feet, a 50-foot buffer along the route for the proposed road and transmission line, and a 100-foot buffer around all other proposed project features.

The pale poppy requires open, well-drained habitat and occasional disturbance to create or maintain this habitat. During the 2013 sensitive plant surveys, Kenai Hydro observed a small population of pale poppy on NFS lands located in a floodplain forest and scrub community near the north shore of Grant Lake. The population consisted of 20 individual plants growing on a semi-stabilized, sparsely vegetated, south-facing creek outwash area consisting of cobble, sand, and gravel. The nearest plants were 8 feet from the shoreline, 1 to 3 feet higher than the current maximum lake elevation of 703 feet. No other sensitive species or habitats, including that of the Aleutian shield fern, were documented during the survey.

Wildlife

Proposed project lands are within a region containing vast amounts of undisturbed habitat supporting a variety of terrestrial wildlife species. Kenai Hydro conducted wildlife field surveys of the project area in 2010 and 2013/2014 as part of its Terrestrial Resources Study (ERM and Beck, 2014). The results of previous wildlife studies conducted in the 1980s provided baseline data for Kenai Hydro's more recent inventories. Kenai Hydro's inventories, along with data from previous studies, report an abundance of bird species in the project area including seven raptor species, eight waterfowl species, and more than 100 species of resident and migratory landbirds and shorebirds that potentially occur and breed in the project area. Results from Kenai Hydro's 2013/2014 surveys suggest that Grant Lake and Trail Lake Narrows provide overwintering habitat for trumpeter swans and other waterbirds. Also documented, or potentially present, are several terrestrial mammal species, including brown bear, black bear, moose, mountain goat, Dall sheep, gray wolf, river otter, and wolverine. In comments on the final license application, the Forest Service noted that caribou may also occur in the project vicinity. Several of the avian and mammalian species, which are known to occur or may occur within the project, are Forest Service sensitive species, species of special interest, or species of conservation concern (table 3-26).

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[56] Kenai Hydro filed its final biological evaluation for plants as attachment E-4 in exhibit E of the amended final license application.

Table 3-26. Forest Service sensitive species, species of special interest, and species of conservation concern potentially occurring on proposed project lands (Source: Kenai Hydro, 2018a).

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
Raptors			
Bald eagle (*Haliaeetus leucocephalus*)	Forest Service species of special interest	Nesting habitat includes deciduous forest, coniferous forest, and mixed deciduous-coniferous forest. Foraging habitat includes riparian and open-water habitats.	Kenai Hydro observed individuals during 2010 field surveys, and documented a breeding pair on Grant Creek in 2013. The species was previously documented on proposed project lands in 1984. About 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. Bald eagle is considered to be a common species in the area.
Northern goshawk (*Accipiter gentilis*)	Forest Service species of special interest	Nesting and foraging habitat includes deciduous forest, coniferous forest, and mixed deciduous-coniferous forest.	Kenai Hydro documented one individual female goshawk during 2013 field surveys. The individual was documented in coniferous hardwood forest habitat and was not observed to be nesting. The northern goshawk is a year-round resident of the Chugach National Forest. The majority of nests discovered on the

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			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. A small stand of old-growth hemlock and spruce at the east end of Grant Lake may provide additional nesting habitat. However, nesting habitat on the Kenai Peninsula has been degraded by the invasive spruce bark beetle.
Osprey (*Pandion haliaetus*)	Forest Service species of special interest	Nesting habitat includes deciduous forest, coniferous forest, and mixed deciduous-coniferous forest. Foraging habitat includes riparian and open-water habitats.	Although Kenai Hydro documented this species during 2013 field surveys, it is considered to be rare on the proposed project lands.
Breeding Landbirds and Shorebirds			
Marbled murrelet (*Brachyramphus marmoratus*)	Forest Service species of special interest	Nesting habitat consists of old-growth conifer forest on islands and along coasts and inland freshwater lakes.	This species has not been documented in the Grant Lake area. Potential suitable nesting habitat is present in mature hemlock and spruce-hemlock forests and suitable foraging habitat is present on Grant Lake within the proposed project boundary.

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
Townsend's warbler (*Setophaga townsendi*)	Forest Service species of special interest	Nesting and foraging habitat includes tall shrub thickets, coniferous forest, and mixed deciduous-coniferous forest.	Kenai Hydro documented the presence of this species during 2010 and 2013 field surveys. The species was previously documented on the proposed project lands in 1984. This species is abundant throughout forested locations on the Kenai Peninsula and Seward Ranger District and is found in higher numbers in older spruce and hemlock forests.
Waterbirds			
Dusky Canada goose (*Branta canadensis occidentalis*)	Forest Service species of conservation concern for Chugach National Forest	Nesting and foraging habitat includes lacustrine waters and shorelines, wet meadow, and dwarf shrub meadow.	Kenai Hydro documented Canada goose (*Branta canadensis*) during 2013 field surveys. However, it is unclear whether documented individuals were members of the *occidentalis* subspecies. Suitable habitat is present for Canada goose on proposed project lands. The dusky Canada goose is not likely to be present on proposed project lands because its nesting range is limited to the Copper River Delta near Cordova within the Chugach National Forest, well east of the project area. This subspecies' winter range consists

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			primarily of Oregon's Willamette Valley and along the Columbia River, but a few individuals stay farther north in coastal areas of Washington and British Columbia. Therefore, it is not likely that dusky Canada geese would traverse the project area during migration.
Trumpeter swan (*Cygnus buccinator*)	Forest Service sensitive species	Nesting and foraging habitat includes lacustrine waters and shorelines, wet meadow, and dwarf shrub meadow. Massive nest mounds in areas of reeds, sedges, or similar emergent vegetation, primarily on stationary fresh waterbodies.	Kenai Hydro documented this species on the east side of Lower Trail Lake during 2013 field surveys. Trumpeter swans are believed to overwinter in this area because the location remains ice-free because of the high pressure of water flowing through Trail Lake Narrows. However, this species is considered to be uncommon in the area.

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
Terrestrial Mammals			
Brown bear (*Ursus arctos*)	Forest Service management indicator species	Spring and summer habitat includes south-facing hillsides, avalanche chutes, and salmon streams.	Kenai Hydro did not observe brown bears during the 2010 or 2013/2014 field surveys, although suitable spring and summer habitat is present. Modeling results indicated that potential denning habitat is abundant and well distributed on steep slopes on the proposed project lands.
Canada lynx (*Lynx Canadensis*)	Forest Service species of special interest	This species uses a variety of habitats, including spruce and hardwood forest, and both subalpine and successional communities. The best habitats are those with an abundance of early successional growth, which provide the best habitat for snowshoe hares and other prey species.	Kenai Hydro did not observe this species during any of the field surveys. An incidental sighting of a lynx in the project area was reported in 2013, but the coordinates of the sighting were not provided.
Little brown bat (*Myotis lucifugus*)	Forest Service management indicator species	This species favors old-growth forests and riparian habitats but will roost in buildings and trees, under rocks and wood, and in caves.	Kenai Hydro conducted a bat survey in 2010 in an abandoned cabin on the west side of Grant Lake. No bats were documented during the survey. Similarly, this species was not documented during the 2013/2014 field surveys. Currently, insufficient

Species (*Scientific Name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			information exists for this species in Alaska to assess the presence of suitable habitat on the proposed project lands.
Moose (*Alces alces*)	Forest Service management indicator species	This species is primarily associated with early to mid-succession habitat and riparian areas and depends on early seral vegetation types including young hardwoods (willow, birch, aspen, and, to a smaller extent, cottonwoods).	Kenai Hydro observed moose in on proposed project lands during the 2010 field surveys. However, no moose or moose tracks were observed during the 2013/2014 winter moose surveys. Overall moose habitat on the Seward Ranger District is considered to be of low quality and capable of supporting only 2 to 5 moose per square mile.
Mountain goat (*Oreamnos americanus*)	Forest Service management indicator species	Preferred habitat includes alpine slopes supporting mountain hemlock, a major component of their diet.	Kenai Hydro documented six individuals during the 2010 field surveys. The principal area of goat use in the Grant Lake Basin is the north side of the lake. These south-facing slopes are used in fall, winter, spring, and into early summer.
River otter (*Lontra canadensis*)	Forest Service species of special interest	This species occurs in freshwater riparian habitats.	Kenai Hydro did not observe this species during any of its field surveys. However, suitable habitat occurs along Grant Creek and Grant Lake.

Species (*Scientific Name*)	**Status**	**Habitat Requirements**	**Potential to Occur on Proposed Project Lands**
Wolverine (*Gulo gulo*)	Forest Service species of special interest	This wide-ranging predator can be found in various habitats, most commonly in mountain areas. Studies in southcentral Alaska found that wolverines prefer higher elevations during the summer and lower elevations during the winter. This species' range and distribution is driven primarily by prey abundance.	Kenai Hydro did not observe this species during any of its field surveys. Forest Service reported the presence of wolverine dens approximately 2 miles southeast of Grant Lake in 2008 and 2010. However, these den locations are well outside the area where project-related activities would occur.

3.3.3.2 Environmental Effects

Effects of Project Construction on Vegetation Communities

During project construction, Kenai Hydro would clear vegetation and conduct other ground-disturbing activities on proposed project lands, resulting in permanent and temporary disturbances that could alter vegetation community structure through vegetation removal, soil compaction and erosion, or introduction of invasive plants. Disturbance of vegetation communities also has implications for wildlife species associated with these habitats. Effects of project operation could include maintaining vegetation in the project area, including recreational access areas and trails, and maintaining the transmission line corridor.

Kenai Hydro estimates that construction activities would result in a permanent loss of 8.42 acres of vegetation, including forested cover types. Construction access, corridor clearing, and the establishment of temporary staging and work areas would result in an additional 1.46 acres of temporary disturbance.

To minimize effects associated with project construction and operation on vegetation communities, Kenai Hydro proposes a Vegetation Management Plan, consistent with Forest Service final 4(e) condition 19. The proposed plan would cover all lands within, and adjacent to, the FERC project boundary and describes measures proposed (i.e., BMPs) to minimize effects on vegetation communities, including:

- Minimization of the introduction and spread of invasive plant species during construction;
- Invasive plant management and control during the first growing season after construction completion and year 5 post-construction;
- Revegetation of the project area during the next growing season after construction completion;
- Vegetation maintenance prior to construction, including removal of vegetation in construction areas, and every 8 to 10 years during the license term;
- Sensitive plant species protection and monitoring to be conducted prior to ground-disturbing activities on NFS lands associated with project construction; and
- Management of the pale poppy population within the project boundary.

Kenai Hydro also proposes to develop an ESCP that would include BMPs to minimize erosion potential and sediment deposition related to construction and maintenance to protect any sensitive plants and reduce the potential introduction of invasive plants. Section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*, presents a more detailed discussion of the ESCP.

Alaska DFG 10(j) recommendation 10 and FWS 10(j) recommendation 11 recommend that Kenai Hydro provide protective buffers around water resources to reduce construction effects on wildlife habitat and movement corridors by locating proposed clearings, road corridors, and the proposed transmission line corridor a minimum of 100 feet, measured horizontally, away from ordinary high water of Grant Creek. However, the recommendations note that clearings for the powerhouse and appurtenant facilities, and tailrace, are excluded from this requirement; appurtenant facilities include, but are not limited to, the bridge across Trail Lake Narrows, the weir at the outlet of Grant Lake, the intake in Grant Lake, and monitoring equipment in both Grant Lake and Grant Creek. Additionally, the agencies exclude the approximately 500 feet of access road east of Trail Lake Narrows, where private property necessitates construction of the road and transmission line corridor within 100 feet of Grant Creek.

Forest Service final 4(e) condition 19 specifies that Kenai Hydro prepare a project construction plan; however, the Forest Service provides no specific details about the objectives of this plan or what measures should be included.

Our Analysis

Construction of the proposed intake structure, access road, and adjacent project components would require permanent disturbance of about 3.44 acres (0.62 acre of coniferous-deciduous and 2.82 acres of coniferous forest cover types). Construction of the proposed powerhouse, work area, penstock, detention pond, tailrace, and the buffers surrounding these structures would require the permanent disturbance of about 0.92 acre of coniferous-deciduous cover type. Construction of the proposed powerhouse access road and transmission line corridor would require permanent disturbance of 4.06 acres (3.53 acres of coniferous-deciduous forest and 0.53 acre of floodplain forest and scrub cover types) between the Seward Highway and the proposed powerhouse. Clearing of upland vegetation in the transmission line corridor during project construction and operation would result in the permanent conversion of some forested habitats to herbaceous or shrub habitats. A loss or reduction of the wildlife habitat function for 1.9 acres of wetlands would occur through filling and vegetation clearing within the project corridor between Grant Lake and Trail Lake Narrows.

These disturbances would alter vegetation community structure and associated wildlife habitat on project land. Although some permanent removal of vegetation for construction of project facilities would be unavoidable, Kenai Hydro's proposal to minimize ground disturbances and removal of vegetation where possible, and adherence to working within the limits of the recommended buffers, would minimize construction-related effects.

Although Alaska DFG and FWS's 10(j) recommendations 10 and 11 recommend a minimum 100-foot protective buffer around Grant Creek for siting of ground disturbances, clearings for the proposed powerhouse, appurtenant facilities, and tailrace are not included in this requirement. Also not included in their recommendations is about

500 feet of access road east of Trail Lake Narrows, where private property necessitates construction of the road and transmission line corridor within 100 feet of Grant Creek.

The exhibit G drawings filed with Kenai Hydro's amended final license application show the proposed location of project facilities in relationship to Grant Creek is consistent with Alaska DFG and FWS's 10(j) recommendations 10 and 11. Providing a protective 100-foot buffer around Grant Creek for proposed clearings, roads, and transmission line corridors would reduce construction-related effects on terrestrial resources associated with riparian or shoreline habitats. Along the access road east of Trail Lake Narrows, where construction activities would need to occur within 100 feet of Grant Creek, Kenai Hydro would implement measures defined in the ESCP to minimize effects on water quality. The plan would include provisions for bank stabilization and ongoing monitoring along this section of the road and transmission line corridor, as discussed in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effect.*

Clearing of vegetation in the proposed 1.1-mile-long, 100-foot-wide transmission line corridor during project construction would result in the permanent conversion of about 4.06 acres of forested habitats to herbaceous or shrub habitats. These disturbances would alter vegetation community structure and associated wildlife habitat. In addition, about 1.46 acres of herbaceous communities would be temporarily disturbed during construction from clearing of the proposed transmission line corridor, and the establishment of proposed temporary staging and work areas. These plant communities are expected to recover over time with proper restoration and monitoring as proposed in the Vegetation Management Plan.

Table 3-27 summarizes total anticipated permanent and temporary disturbance to vegetation community/habitat types along the existing INHT route and proposed INHT re-route. Trail construction would likely require using heavy machinery to clear trees and grade the trail. These activities would result in vegetation disturbance outside the permanently maintained trail footprint. However, because vegetation would naturally regenerate in these areas, these effects would be temporary. We assume all temporary effects of construction would occur within a 100-foot-wide corridor. Permanent effects would be associated only with trail use and maintenance and would be calculated using a 10-foot corridor. Although Kenai Hydro only proposes to construct the southern portion of the re-routed INHT from Grant Creek to Vagt Lake, we anticipate that any license issued for the project that includes the trail re-route would require Kenai Hydro to construct and maintain the entire re-routed trail. Therefore, we analyze effects of the re-route as a whole and not just the southern portion. Because Kenai Hydro's vegetation study did not include the northern section of the INHT, we conducted this analysis using recent aerial imagery (Google Earth imagery dated April 16, 2011) to extrapolate vegetation communities identified in Kenai Hydro's vegetation study to the remainder of the INHT.

Table 3-27. Permanent and temporary effects on vegetation along the existing and proposed INHT route (Source: Kenai Hydro, 2018a, as modified by staff).

Vegetation Community/ Cover Type	Permanent Disturbance (acres)[a]	Temporary Disturbance (acres)[b]	Total Disturbance (acres)
Existing INHT Route (0.8 mile)			
Coniferous-Deciduous Forest	9.05	0.89	9.94
Riverine Wetland	0.12	0.01	0.13
Freshwater Forested/Shrub Wetland	--	--	--
Total	9.17	0.9	**10.07**
Proposed INHT Re-Route (1.6 miles)			
Coniferous-Deciduous Forest	19.38	1.95	21.33
Riverine Wetland	0.13	0.01	0.14
Freshwater Forested/Shrub Wetland	0.36	0.04	0.4
Total	19.87	2.0	**21.87**

[a] Based on a 100-foot corridor.

[b] Based on a 10-foot corridor.

Kenai Hydro's proposed INHT re-route would be twice the length of the existing route and would double the amount of acreage of similar coniferous-deciduous forested vegetation that would need to be cleared. No additional acreage of riverine wetlands would be disturbed; however, an additional 0.36 acre of existing forested/shrub wetlands encountered along the south section of the re-route would be permanently disturbed.

Kenai Hydro's adherence to BMPs defined in its proposed ESCP (see section 3.3.1.2, *Construction Effects on Geology and Soils* subsection) would minimize the effects of erosion and sediment deposition from ground-disturbing activities on vegetation communities.

As outlined in Kenai Hydro's Vegetation Management Plan, once project facilities and structures have been constructed, areas temporarily disturbed by construction would be revegetated within the next growing season based on existing vegetation conditions. The plan includes specifications for removal of vegetation prior to construction, post-construction restoration with monitoring and maintenance of revegetated areas to ensure successful revegetation, and performing vegetation maintenance every 8 to 10 years during the license term. Performing vegetation maintenance outside the avian breeding season, as proposed in Kenai Hydro's Avian Protection Plan, would help to reduce potential effects on breeding birds and other wildlife species in the project area. Kenai

Hydro would also employ measures to protect any existing populations of sensitive plant species documented during licensing studies.

Kenai Hydro's Vegetation Management Plan would ensure temporarily disturbed areas are revegetated and maintained based on existing conditions found on proposed project lands, invasive species are controlled, and sensitive plant species are protected, including existing pale poppy populations. In its comments in response to the Ready for Environmental Analysis notice filed with its preliminary 4(e) conditions, the Forest Service indicates the Vegetation Management Plan is adequate and provides sufficient detail about what the plan would entail.

Although the Vegetation Management Plan states Kenai Hydro would comply with the state and/or federal land manager's methods for assessing the success of revegetation efforts, the plan provides no details regarding success criteria or monitoring schedule. Revegetated sites would be most susceptible to failure during the initial growing season as seeds germinate and mature and root systems become established. Monitoring during this period can be especially beneficial in identifying poor establishment success and identifying the need for additional measures. Identification of specific success criteria is a critical component of a revegetation plan. Success criteria based on pre-disturbance vegetation structure would provide the greatest potential for re-establishing similar wildlife habitat following disturbance. Including survey methods, survey schedules, and specific guidelines for supplemental plantings would provide the details needed to evaluate whether the plan would effectively guide restoration efforts. Because of annual variability in environmental conditions (e.g., weather), initial success of plantings may not be indicative of further success through subsequent growing seasons. Ensuring revegetated areas meet success criteria for two consecutive growing seasons would provide more certainty that restored communities successfully establish and persist.

The Vegetation Management Plan would provide a guide for restoration success if Kenai Hydro were to modify its proposed plan to also include provisions to: (1) monitor the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (2) develop restoration success criteria, based on existing conditions, to determine whether revegetation efforts are successful; (3) develop data collection and analysis methods for monitoring that corresponds with success criteria; (4) monitor restoration success and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; (5) conduct pre-construction surveys for Forest Service sensitive plant species within areas of proposed ground and vegetation disturbance and consult with the Forest Service if needed to minimize effects on newly identified populations; and (6) obtain written approval from the Forest Service prior to using herbicides or pesticides on NFS lands.

Typically, project construction plans include descriptions of construction methods, a construction schedule, and drawings depicting the design and site-specific locations for measures to protect natural resources. Kenai Hydro proposes to implement a variety of plans, including an ESCP, Vegetation Management Plan, and Avian Protection Plan, to identify sensitive areas and protect terrestrial resources. While each of these plans include agency consultation during preparation, it is unclear how Kenai Hydro would identify potential conflicts between the plans without implementing a construction plan. For example, the ESCP could include placement of a silt fence in an area identified as occupied nesting habitat through implementation of the Avian Protection Plan. Developing a construction plan, as Forest Service specifies, and as discussed in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects,* would consolidate site-specific location and design information for proposed resource protection measures into a set of maps and drawings that would facilitate agency consultation and communication with contractors.

Effects of Project Operation on the Potential Spread of Invasive Plant Species

To minimize the potential introduction and spread of invasive species during project construction and operation, Kenai Hydro would implement measures defined in the proposed ESCP and the Vegetation Management Plan. As part of its Vegetation Management Plan, Kenai Hydro would begin construction activity in uninfested areas before working in infested areas, use weed-free construction materials, clean construction vehicles and equipment prior to use, limit the amount and length of time that bare ground is exposed, and minimize ground disturbance and erosion during construction. Kenai Hydro also proposes to conduct surveys for and to treat invasive plant infestations during the first growing season after construction completion and year 5 post-construction. Kenai Hydro would survey areas in the vicinity of project-related disturbance, including construction areas, access roads, corridors, facilities, and the Grant Lake shoreline, during the growing season (June to August). Subsequent surveys for invasive plant species would be conducted every 10 years for the term of the license. The period between invasive plant surveys may be adjusted depending on the rate at which invasive plants become established and spread in the project area. Invasive plant infestations associated with project construction and operation would be monitored and treated in consultation with Alaska DNR, the Forest Service, and their respective invasive plant management plans.

Forest Service final 4(e) condition 19 specifies Kenai Hydro develop an aquatic invasive species management plan that includes: (1) actions taken to reduce the potential for introduction of aquatic invasive species, such as, locating equipment inspections and/or wash stations well outside of riparian/aquatic zones; requiring all equipment/material potentially entering riparian/aquatic zones be either inspected or washed prior to entering stream, lake or riparian zones; and (2) treatments should aquatic invasive species be detected.

Our Analysis

Construction and operation of the proposed project has the potential to introduce and spread invasive plant species. Invasive plants threaten ecosystems by displacing and degrading native plant communities, outcompeting rare plants, and reducing wildlife habitat values. Removal of vegetation and ground disturbance during construction could create opportunities for invasive plant species to establish and spread. In addition, proposed operation and maintenance (O&M) activities, including the inadvertent transport of invasive plant species by maintenance equipment and workers, and recreational visitors to the project area could cause invasive plant species to spread on the proposed project lands.

As discussed above in section 3.3.3.1, *Terrestrial Resources, Affected Environment*, very few observations of invasive plant populations have been reported in the vicinity of the proposed project. Known invasive species occurring in the vicinity of the project (along the Seward Highway and ARRC ROWs and along the Grant Lake Trail) are mostly associated with upland vegetation communities, with the exception of the small population of common dandelion along the Grant Lake shoreline. These are areas where the substrate has been disturbed or where bare soil has been exposed. However, there is potential for construction vehicles, equipment, and tools to transport invasive species from other work sites to the project area. Kenai Hydro's proposed measures to wash vehicles and equipment before entering the project area would minimize the potential for introduction of invasive species. Following construction, Kenai Hydro's proposed surveys and treatment of any invasive species identified would minimize the potential for invasive plants to have adverse effects on terrestrial or aquatic resources. Spread of these invasive species would be minimal with the implementation of Kenai Hydro's Vegetation Management Plan.

As described in the Final Vegetation Management Plan, Kenai Hydro proposes measures for invasive plant management and control during construction and ground-disturbing activities during the first growing season after completion of construction and year 5 post-construction. These proposed measures, such as washing construction vehicles and equipment prior to instream work would apply to aquatic invasive species as well as terrestrial species. However, modifying the plan, as Forest Service specifies in final 4(e) condition 19 to include (1) locating equipment inspections and/or wash stations well outside of riparian/aquatic zones; and (2) applying treatments if aquatic invasive species are detected, would ensure any weed propagules washed off of equipment do not enter Grant Creek and that any invasive aquatic plant populations are appropriately treated. Subsequent surveys of project lands during the growing season for invasive plant species would be conducted every 10 years for the term of the license. Such action would be appropriate in this instance, given that project-related activities such as ground and facility maintenance or recreational use resulting in ground disturbance could cause the spread of invasive species onto project lands and adjacent lands and waters.

During operation the proposed seasonal 13-foot drawdown would expose bare soil around the perimeter of Grant Lake during the winter/spring season. The vegetation of reservoir drawdown zones often differs substantially from that of areas that are not periodically inundated. Typically, there are more opportunistic species, namely non-native invasive plants, which quickly colonize the drawdown zones. These invasive plants often dominate these disturbed zones and could spread to adjacent upland areas.

Because the substrate in the lake fluctuation zone is steep and contains little fine sands or gravels suitable for plant establishment, colonization of invasive species in this area would be minimal. Under the proposed project operation, the areas exposed during lake drawdowns during the winter/spring seasons would be inundated in late summer during the flowering period for invasive species known to occur in the vicinity of the proposed project, so seed production would be limited.

Operation of the project is not expected to negatively affect bypassed reach vegetation. Kenai Hydro's proposed bypassed weir and pump system would provide minimum instream flows to the bypassed reach that would reduce water level fluctuations and minimize streambank erosion. Although the proposed flows in the upper bypassed reach could expose minor amounts of channel bed and bank, it would not result in appreciable opportunities for invasive plant introduction because these areas are steep and bedrock-lined with limited substrate for plants to germinate. Further, invasive plant species known to occur in the project area are all upland species and therefore would not likely colonize these rocky riparian areas. We anticipate proposed project flows would have minimal effects on existing vegetation along the bypassed reach. Therefore, efforts to monitor invasive plant infestations in the bypassed reach would not be a necessary component of the Vegetation Management Plan.

Kenai Hydro's Vegetation Management Plan includes all lands within the FERC project boundary that would either be affected, or have the potential to be affected, by project operations. This could include occurrences of project-related erosion or invasive plant infestations. Invasive plants often dominate reservoir drawdown zones and can establish and spread to adjacent upland areas and potentially downstream locations. However, surveys for and treatment of invasive plant infestations and site restoration would be conducted on lands affected by the project during the first growing season after construction completion and year 5 post-construction to monitor project restoration. Additionally, Kenai Hydro's proposed facilities would be cited at least 100 feet from stream crossings (where practicable) as recommended by Alaska DFG and would maintain a buffer distance from the ordinary high water of Grant Creek and Grant Lake. This buffer would reduce the potential for bank erosion and prevent ground disturbance in these riparian corridors, minimizing opportunities for invasive plant establishment.

Project operation would also include occasional vehicular use of the project access road, which could transport weed seeds into the project area. However, Kenai Hydro would operate the project remotely, thus maintenance traffic would be infrequent. Proposed recreation use of the project area may also transport invasive plants into and around the project area. Increased hiking, hunting, boat use, and camping along access roads, the transmission line corridor, and on Grant Lake may readily bring invasive plants from outside the project area to substrates where they can become established.

Therefore, Kenai Hydro's proposed surveys would identify any need for additional control measures.

Measures to control the spread of invasive species at sites where soil and vegetation disturbance occurs is critical to limiting the spread of invasive weeds because these are the most likely sites of new colonization. As such, Kenai Hydro's proposal to restore disturbed areas within 1 year upon completion of construction activities would limit opportunities for potential establishment of invasive plant species. Kenai Hydro's proposed measures for protective buffers, site restoration, and survey and treatment of invasive plant infestations would minimize effects on vegetation and would also limit potential effects on special-status plant species discussed below.

Forest Service preliminary 4(e) condition 19 specifies Kenai Hydro develop an aquatic invasive species management plan. However, we anticipate that Kenai Hydro's Vegetation Management Plan, with the modifications discussed above, adequately addresses direct and indirect effects of proposed construction and operation of the project on terrestrial resources.

Effects of Project Construction and Operation on Special-status Plants

Proposed project construction and operation could affect special-status plants by removal or disturbance of individual plants, habitat loss or degradation, and introduction and spread of invasive plants. To minimize the potential effects of project construction and operation on special-status plant species that could occur on proposed project lands, including the pale poppy, Kenai Hydro proposes to implement the following protection and monitoring measures as presented in its Vegetation Management Plan:

- If any previously undiscovered sensitive plants are encountered on NFS lands at any time prior to or during implementation of the project, the Forest Service would be notified and an appropriate course of action would be determined to avoid or mitigate disturbance.
- During the license period of the proposed project, a site-specific, sensitive plant survey would be conducted prior to any new project-related, ground-disturbing activities occurring on NFS lands. The survey would be done in consultation with the Forest Service consistent with current sensitive plant survey protocols.
- The target sensitive species list would be reviewed and updated prior to sensitive plant surveys.
- A geographic information system database with records of sensitive plant occurrences and invasive plant infestations would be queried as part of the evaluation process for any new ground-disturbing activities.
- The existing pale poppy population within the project boundary would be managed through monitoring surveys during years 1 and 5 after license

issuance to assess the effects that operational activities could have on the north shore Grant Lake population and its habitat.

Our Analysis

A small population of pale poppy occurs on NFS lands located in a floodplain forest and scrub community near the north shore of Grant Lake. Although we do not anticipate direct effects on the existing pale poppy population from project construction or recreation activity, operational effects are possible because of the proposed 13-foot seasonal drawdown of Grant Lake, which could affect soil moisture content for existing populations.

The proposed lake level fluctuations of an additional 2 feet would be similar in range to what currently occurs, but the proposed operation would follow a lake level rule curve for drawdowns and subsequent refilling of the lake over time (see section 3.3.2.2, *Aquatic Resources, Environmental Effects*). This additional storage would be on the lower end of the fluctuation range, and, because of the steep-sided, sparsely vegetated nature of most of the shoreline, we anticipate proposed project operation would have minimal effects on shoreline vegetation including the existing pale poppy population. The proposed lake level fluctuations could also potentially cause some additional shoreline erosion or disturbance to riparian plant communities, but these effects would be minimal compared to current lake level fluctuation patterns.

Although the Grant Lake water elevation drop to 690 feet during the early part of the growing season may have an overall drying effect on pale poppy substrate, the pale poppy should not be negatively affected because it is an upland species that is able to grow in very dry habitats. Reservoir fluctuations may help to maintain suitable habitat for the pale poppy by preventing the establishment of dense shrub thickets along the shoreline. Pale poppy plants observed on nearby Cooper Lake are able to tolerate some inundation and wave action during the growing season and ice scour during the winter (FERC, 2006). Therefore, we anticipate that the existing population along the Grant Lake shoreline would tolerate similar stresses.

However, potential indirect effects on sensitive plant species from the drawdown of the lake could include introduction and spread of invasive plant species in both upland areas in the vicinity of the pale poppy population and below the current high water level in the drawdown zone. Currently, the only invasive plant species present in the vicinity of the existing pale poppy population is common dandelion. Kenai Hydro's Vegetation Management Plan describes measures to assess whether the project is negatively affecting the pale poppy population on NFS lands and establishes a framework for adaptive management to modify project operation for sensitive plant management. This plan also includes monitoring the known pale poppy population during years 1 and 5 after license issuance to assess any potential operational effects on the population or its habitat. The plan also details measures to help minimize the establishment and spread of invasive plants in the vicinity of the pale poppy population and in the project area through timely control. Implementing the Vegetation Management Plan during construction and operation would ensure that measures to protect sensitive resources, such as pale poppy, are implemented appropriately.

Although we expect Kenai Hydro's pre-licensing surveys were effective in identifying sensitive species populations present in 2013, new pale poppy populations or other Forest Service sensitive species could have become established within areas of proposed disturbance. If Kenai Hydro modifies the Vegetation Management Plan to include surveys for Forest Service sensitive species, including the pale poppy, within areas of proposed ground disturbance prior to any ground-disturbing activities and consults with the Forest Service if any new populations are identified, the potential for effects on previously unidentified or recently established populations would be reduced. This additional protective measure would benefit any population of pale poppy or Forest Service sensitive plant population that may have established after licensing surveys were completed.

Use of Pesticides in Riparian Areas and on NFS Lands

Improper use of pesticides has the potential to affect untargeted vegetation or wildlife species. Pesticide use near water features has the potential to affect water quality. Such use could have adverse effects on terrestrial and aquatic resources in the project area.

Forest Service final 4(e) condition 14 specifies that Kenai Hydro may not use herbicides to control undesirable woody and herbaceous vegetation and aquatic plants, and pesticides may not be used to control undesirable insects, rodents, and non-native fish on NFS lands without the prior written approval of the Forest Service. The condition specifies that Kenai Hydro submit a request to the Forest Service for approval of planned uses of herbicides and pesticides covering annual planned use and that the request be updated as required. The condition further specifies that Kenai Hydro's requests include, at a minimum, the following information for Forest Service review: (1) whether pesticide applications are essential for use, (2) specific locations of use, (3) specific herbicides and pesticides proposed for use, (4) application rates, (5) dose and exposure rates, and (6) safety risks and time frames for application.

Forest Service final 4(e) condition 14 would also prohibit pesticide use on NFS lands within 500 feet of known locations of the western toad or known locations of Forest Service special-status or culturally significant plant populations. Additionally, the condition specifies that application of pesticides must be consistent with Forest Service riparian conservation objectives. The condition also specifies that Kenai Hydro use only EPA-registered materials for the specific purpose planned and strictly follow label instructions in the preparation and application of herbicides and pesticides and disposal of excess materials and containers.

Although Kenai Hydro outlines BMPs for invasive plant management and control in its Vegetation Management Plan, pesticide application and use is not included as a measure. Kenai Hydro does, however, agree to support the Forest Service's recommendations for approval prior to pesticide application and use and would adhere to these conditions if incorporated into the license order.

Our Analysis

Forest Service final 4(e) condition 14 prohibits pesticide use on NFS lands within 500 feet of known locations of the western toad. However, no evidence exists to indicate that the western toad occurs in the project area,[57] so we do not see the need for Kenai Hydro to provide specific buffers around western toad habitat.

Kenai Hydro's annual request to the Forest Service for prior approval of planned uses of herbicides and pesticides would improve coordination with the Forest Service and support Forest Service riparian conservation objectives, particularly for special-status or culturally significant plant populations.

Effects of Project Construction and Operation on Avian Communities

Vegetation clearing, construction noise, potential introduction and/or spread of invasive plant species, construction and operation of transmission lines including ROW maintenance activities, changes in lake and creek levels, and increased human activity could affect avian communities during construction and operation of the project.

To minimize the effects of project construction and operation on avian communities at the project, Kenai Hydro proposes to implement an Avian Protection Plan, which seeks to limit avian mortality by:

- avoiding disturbances during the breeding season;
- designing the power lines per current Avian Power Line Interaction Committee (APLIC)[58] avian protection standards (APLIC, 2006, 2012) and submitting final engineering plans to stakeholders and to the Commission for approval, prior to construction; and
- minimizing vegetation removal and establishing vegetation removal timelines to minimize disturbance during the avian breeding season (May 1 to July 15) during construction and operation.

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[57] Alaska DFG indicates the western toad does not occur on the Kenai Peninsula and that the nearest known location to the project area is 50 miles to the east on Montague Island http://www.adfg.alaska.gov/index.cfm?adfg=westerntoad.rangemap.

[58] APLIC is a collaboration among numerous electrical utilities and research groups and FWS that was formed to identify the causes of and develop methods and designs to minimize avian electrocutions and collisions at power lines. APLIC has released guidelines to address avian electrocution (APLIC, 2006).

If Kenai Hydro could not completely avoid vegetation removal during the breeding season, it proposes to complete a risk assessment to determine the periods during which vegetation removal would cause the least impact on breeding birds. Following finalization of its risk assessment, Kenai Hydro would develop a plan and timeline to minimize effects on breeding birds resulting from vegetation clearing or other disturbances during proposed project construction and operation. Kenai Hydro proposes to conduct pre-construction nest surveys prior to vegetation clearing or removal activities during the breeding season. Kenai Hydro proposes to use a qualified biologist to conduct pre-construction pedestrian surveys in suitable habitat within 100 feet of the proposed project (disturbance areas) 1 to 3 days prior to any vegetation removal. Kenai Hydro proposes to establish 1,320-foot buffers around active raptor nests and 100-foot buffers around active nests of other avian species and develop species-specific nest protection plans in consultation with FWS that would document the specific methodology for safeguarding the individual nest

Kenai Hydro also proposes to employ a third-party ECM for the duration of construction, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects*. As proposed, the ECM would be onsite during all vegetation removal activities to ensure that construction activities avoid or minimize effects on avian species. Forest Service final 4(e) condition 20 specifies, the ECM would have the authority to temporarily suspend construction and vegetation removal if these activities were likely to result in take of any species listed under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act. Kenai Hydro proposes that if the ECM were to suspend work, the ECM would immediately consult with the appropriate agencies to determine the best course of action to eliminate or minimize the potential for take. Construction activities would not resume until an agreed upon action(s) had been implemented.

Kenai Hydro also proposes to implement its Vegetation Management Plan, as described above to limit effects on vegetation communities that provide habitat for avian species including measures to minimize the spread of invasive plant species.

FWS (10(j) recommendation 19) recommends that Kenai Hydro design and construct the transmission line according to APLIC guidance (APLIC, 2006) to reduce risk of electrocution to raptors and other avian species. Kenai Hydro agrees with this recommendation and has included this measure in its Avian Protection Plan. Kenai Hydro also proposes to incorporate measures from the APLIC (2012) guidance to reduce avian collisions with power lines. Kenai Hydro proposes to submit its final engineering plans to FERC and requisite stakeholders[59] for review and approval prior to construction. These final engineering plans would detail applicable measures adopted from the APLIC guidance.

[59] We interpret this term to include FWS, the Forest Service, and Alaska DFG.

Our Analysis

Vegetation clearing, noise, and disturbance associated with equipment and crews would largely be restricted to the 18-month construction period. Many displaced birds would likely move to abundant suitable habitat adjacent to the project site. Effects would be greatest during the breeding season potentially resulting in disruption of feeding, mating, and nesting activities. Permanent removal and temporary disturbance of vegetation would result in the loss of some nesting, foraging, and cover habitat.

Avoiding or minimizing vegetation clearing activities during the breeding season (May 1 through July 15), as proposed in Kenai Hydro's Avian Protection Plan, would limit effects during this sensitive period. If vegetation removal during the breeding season is unavoidable, conducting pre-vegetation removal nest surveys and implementing avoidance buffers around nests, as proposed, would reduce the potential for nest abandonment and accidental damage to nests, adults, and chicks near construction areas. However, it is not clear whether all construction activities would require vegetation removal. Some activities, like blasting or instream work, may occur without associated vegetation removal. As written, it is not clear how Kenai Hydro's proposed plan would ensure nest surveys are implemented prior to any construction effects with potential to disturb nesting birds. Rather than framing survey schedules around pre-vegetation clearing activities, as stated in the Avian Protection Plan, modifying the plan to require nest surveys prior to any construction activities with potential to disturb nesting birds would ensure all activities are included.

The 1,320-foot buffer proposed by Kenai Hydro for raptor nests is consistent with recommendations in the National Bald Eagle Management Guidelines and should limit impacts to nesting bald eagles, if present (FWS, 2007). Kenai Hydro's proposed nest surveys would identify any bald eagle nests with potential for disturbance associated with construction noise or tree removal. However, loss of nesting habitat for bald eagles is unlikely because no tree removal is proposed on the north and east sides of Grant Lake, where cottonwood stands most suitable for bald eagle nesting occur. Kenai Hydro also proposes to limit tree removal when re-routing the INHT, as described above in the *Effects of Project Construction on Vegetation Communities* subsection. These activities would not likely disturb cottonwood trees, which could provide suitable nesting habitat for bald eagles or other raptors, because the trail is generally located in upland areas.

Upon completion of construction activities, implementation of Kenai Hydro's Vegetation Management Plan (see section 3.3.3.2 in the *Effects of Project Construction on Vegetation Communities* subsection) would minimize effects on avian communities due to habitat loss and disturbance by revegetating temporarily disturbed areas and limiting the potential spread of invasive plant species. Because of the remote nature of the proposed project, the Forest Service's final 4(e) condition 20 would ensure that an ECM is present and has the authority to stop work or issue change orders if there is an unanticipated effect of project construction on environmental resources. Kenai Hydro's use of an onsite ECM would also ensure that pre-construction nest surveys and nest buffers are properly implemented.

The 1.1-mile-long, 115-kV transmission line is relatively short but could present a collision risk and electrocution hazard for avian species that reside within or move through the project area. Large-bodied birds, such as raptors and wading birds, are at greatest risk because of their long wingspans that can reach between conductors. Larger, less agile species are also less able to avoid collisions with transmission lines. APLIC guidelines provide specific recommendations for conductor spacing and arrangement to reduce the risk of avian electrocutions and provide descriptions of devices for marking lines to increase visibility and allow birds to avoid collisions. Line-marking devices are most effective when placed at stream crossings, near wetlands and ridgelines, or at other locations along the line where avian densities are likely to be high and collision risk is greatest such as the section of proposed transmission line that would be constructed across Trail Lake Narrows. Design and construction of the proposed transmission line with consideration to the APLIC guidance would reduce the risk of injury and mortality to birds including several Forest Service species of special interest known to occur on proposed project lands (e.g., northern goshawk, osprey, bald eagle, and trumpeter swan). Kenai Hydro's proposal to submit its final engineering plans to the Commission and requisite stakeholders[60] for review and approval prior to construction, as included in its Avian Protection Plan, would ensure that the transmission line is designed in a way that effects on avian communities are minimized. These final engineering plans would detail applicable measures adopted from the APLIC guidance.

Project operation would include lake level changes that could affect nesting opportunities for shorebird (e.g., spotted sandpiper, semipalmated plover), waterfowl (e.g., trumpeter swan, greater scaup), and other waterbird species (e.g., red-throated loon, red-necked grebe) that nest in lacustrine habitats. During project operation, a 13-foot drawdown would begin in winter and extend into late May, followed by a gradual return to pre-drawdown levels from late May to early August. Most nesting birds associated with lacustrine habitats nest prior to August, when the lake would not have fully returned to pre-drawdown levels. Lower lake levels would increase the distance from suitable nesting habitat associated with shoreline vegetation to the lake's edge and expose sections of steep, rocky terrain. Such changes could reduce the suitability of nesting habitat by increasing the distance to aquatic foraging habitats and creating hazards for vulnerable fledglings attempting to reach the lake in June and July when most species young fledge. Therefore, the project could have some long-term effects on waterbird species nesting around the perimeter of Grant Lake.

Changes in lake and creek outflow levels during the winter may indirectly affect waterfowl that overwinter in the region, including trumpeter swans and diving ducks, by

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[60] We interpret this term to include FWS, Forest Service, and Alaska DFG.

decreasing or altering open water habitat at the mouth of Grant Creek and at the outflow at Trail Lake Narrows. Decreased open water availability could lead to decreased resting and foraging habitat during the winter season, resulting in adverse effects on these species. However, under proposed project operations, winter flows in Grant Creek would be higher that current conditions. These flows would maintain, or potentially expand, open water areas in Trail Lake Narrows. Therefore, we do not expect any adverse project-related effects on the open water areas.

As described in section 3.3.2.2, *Environmental Effects, Fishery Resources*, construction of the project could result in temporary adverse effects on fishery resources, including salmonids, that provide prey resources for bald eagles and other piscivorous raptors and water birds because fish would likely avoid areas near active construction. However, construction plans would limit adverse effects on water quality, so adverse impacts on fishery resources are not expected to persist in the long term. Additionally, Kenai Hydro's proposed project operation would benefit fishery resources by providing higher winter flows that would provide additional rearing habitat. Therefore, we do not expect project operation to have adverse effects on prey abundance for bald eagles along with other piscivorous raptors and water birds.

Effects of Project Construction and Operation on Bears

Construction activities may result in temporary disturbance to bears on proposed project lands. In addition, increased human presence associated with project construction and operation could increase the risk of bear-human encounters.

FWS (10(j) recommendation 12) and Alaska DFG (10(j) recommendation 11) recommend that Kenai Hydro prepare and implement a bear safety plan to minimize potential bear-human encounters. Interior and Alaska DFG recommend that, at a minimum, the plan include provisions for: (1) keeping construction sites and refuse areas clear of substances that attract bears, (2) installing bear-proof garbage receptacles and other measures during construction to prevent bears from obtaining food or garbage, (3) minimizing possible conflict with bears during construction and operation, (4) dealing with problem bears,[61] and (5) notifying authorities of any bear-human conflict. In response to these agency recommendations, Kenai Hydro has agreed to consult with Interior and Alaska DFG to develop a bear safety plan.

Our Analysis

Vegetation clearing and other activities associated with construction may result in temporary disturbance to bears on the proposed project lands due to noise and the

[61] Although the agencies do not specifically define *problem bears*, we understand this term to refer to bears that repeatedly visit a construction area despite implementation of other measures in the plan, including trash management and use of bear-proof containers.

presence of equipment and crews, but would not be expected to affect bears in the long term because effects of construction would be temporary.

Construction and operation of the proposed project would result in habitat fragmentation associated with placement of the access road and transmission line ROW. Unlike brown bears, black bears are highly adaptable to habitat disturbance and fragmentation and tolerant of human-generated disturbance. However, the proposed project would affect a limited amount of habitat compared to the large amount of nearby suitable habitat; consequently, the potential for substantial effects from fragmentation on bear habitat is limited.

The greatest potential for effects on bears could come from increased human activity on proposed project lands during construction and operation, including ROW maintenance activities. The risk of bear-human encounters is likely to increase particularly with construction and maintenance workers, potentially leading to injury or mortality for both humans and bears. Allowing non-motorized use of the project access road, as described in section 3.3.4.2, in the *Effects of Operation on Public Access* subsection, would also increase the risk of bear-human encounters for the public during project operation.

Implementing a bear safety plan, as recommended in Interior's 10(j) recommendation 12 and Alaska DFG's 10(j) recommendation 11, would reduce the bear-human encounters and minimize effects on bears. Keeping proposed construction sites and refuse areas clear of food or garbage and installing bear-proof garbage receptacles, as recommended by Interior and Alaska DFG, would avoid attracting bears, limiting the potential for bear-human encounters. Provisions for minimizing possible conflict with bears during construction and operation, dealing with problem bears, and notifying authorities of any bear-human conflict, which would be documented in the plan, would further minimize effects on bears by ensuring agency staff are aware of any concerns and can take appropriate actions to remove problem bears if needed.

Effects of Project Construction and Operation on Mountain Goats

Noise and disturbance produced by helicopters or other aircraft (if necessary) used during construction of the proposed project could affect mountain goats within and near proposed project lands.

FWS 10(j) recommendation 13 and Alaska DFG 10(j) recommendation 12 recommend that Kenai Hydro minimize the use of helicopters or airplanes near mountainsides adjacent to Grant Lake and Grant Creek and maintain a 1,500-foot distance between aircraft and mountain goats at all times.

In comments on the draft EIS, the Forest Service states that it has developed no-fly zones to reduce these impacts to goats and sheep throughout the Forest and will provide this information to Kenai Hydro. Forest Service recommends that these no-fly zones be used for all helicopter and aircraft use associated with the project.

Our Analysis

Alaska DFG notes that close-range flights can elicit strong negative responses in ungulates, such as deer, moose, mountain goats, and elk, with mountain goats being more susceptible to disturbance than other ungulates. Disturbance can cause mountain goat groups to separate, including females and their dependent offspring, and individuals to panic, potentially resulting in injuries and/or mortality. Following disturbances, mountain goats may remain alert for up to several hours, reducing the time spent foraging thereby resulting in increased energy expenditure and reduced nutrient intake.

Kenai Hydro does not indicate whether or not its construction plans include the use of helicopters or other aircraft. However, if helicopters or other aircraft were used, effects would most likely occur on south-facing slopes on the north side of Grant Lake, the principal area of mountain goat use in the Grant Lake Basin, or to and from the project. Mountain goats are most likely to occur on these slopes at high altitudes, about 2.5 miles north of the project. Potential effects from aircraft use during project construction would be infrequent, if occurring at all, because the range and preferred habitats of mountain goats occur at higher elevations than where the proposed project would be constructed and largely outside the proposed project lands. Operation of the project would not affect mountain goats because we expect helicopter or aircraft use would be limited to the construction phase. Based on the topography near the project area and the location of proposed project features, it is unlikely that approaching aircraft would need to fly within 1,500 feet of mountain goat habitat. However, flight paths frequently depend on line-of-sight visibility, and we cannot rule out the potential need for a flight path near the north end of Grant Lake. Therefore, if Kenai Hydro were to use aircraft to access proposed project lands, flight paths that maintained a minimum 1,500-foot distance from the mountainsides identified with suitable habitat, as FWS and Alaska DFG recommend, and follow Forest Service no-fly zones would minimize potential effects on mountain goats occurring in the area.

Effects of Project Construction and Operation on Wildlife Movement, Distribution, and Abundance

Construction of the proposed project would generate noise, increase human presence and equipment activity, and disturb wildlife habitat. Operation of the proposed project would alter existing flow levels in Grant Creek and potentially alter ice processes on Grant Lake. These effects could affect the movement, distribution, and abundance of wildlife, including Forest Service management indicator species and species of special interest (see table 3-26).

Our Analysis

Noise and the presence of heavy machinery and construction crews could disturb wildlife in the immediate vicinity of the project, including, including Forest Service management indicator species and species of special interest (see table 3-26), causing them to temporarily deviate from project construction areas. These potential disturbances would be limited to two construction seasons, as proposed by Kenai Hydro. Given the extent of suitable habitat in areas surrounding the proposed project, temporary effects of construction are not anticipated to result in permanent changes in distribution or abundance or result in noticeable disruption of seasonal movement patterns for any wildlife species.

Project operation would result in changes in lake levels during the winter. As a result, ice processes on Grant Lake could be altered, which could affect wildlife travel routes across Grant Lake if the project effects near shore ice structure or ice thickness on the lake. Moose and grey wolf are most likely to be affected by alternation of ice processes. However, as discussed in section 3.3.2.2*, Aquatic Resources, Effects of Project Construction on Water Quantity*, project drawdowns would be gradual and would generally not affect ice processes. As lake levels fall post freeze-up, near-shore ice formations would subside and create uneven surfaces that could impede wildlife access, but these areas would not prohibit wildlife crossing because we expect wildlife would be able to cross the shore ice and access lake ice. We have not identified any evidence to suggest project operations would affect ice thickness. Therefore, potential changes in ice processes associated with winter lake drawdown are not anticipated to affect the size, distribution, or abundance of terrestrial mammal populations on the Kenai Peninsula.

Project operation would result in changes in flow in Grant Creek (see figure 3-16), which could have seasonal effects on littoral wildlife habitat at Trail Lake Narrows. Because flows would remain within approximately 100 cfs of current flows, potential effects on littoral wildlife habitat are expected to be minimal. Flows would be slightly higher during winter and lower during the summer compared to existing conditions. As a result, additional littoral habitat may be exposed during the summer, potentially benefitting species that use these habitats, including birds, amphibians, reptiles, and mammals. Therefore, seasonal effects on littoral wildlife habitat at Trail Lake Narrows is not expected to adversely affect wildlife movement, distribution, or abundance.

Effects of Project Operation on Moose Browse Habitat

Operation of the proposed project would alter lake levels from natural conditions, including the growing season (approximately June–September), which could affect moose browse habitat at the upper end of Grant Lake.

Our Analysis

Operation of the proposed project would cause lake levels in Grant Lake to fluctuate gradually throughout the year compared to existing conditions (see section 3.3.2.2, *Water Quantity, Environmental Effects,* and figure 3-6). These changes could affect riparian vegetation structure and abundance of moose browse at the upper end of Grant Lake. Based on mapping in the project area (Ebasco, 1984), about 80 acres of moose browse habitat occurs at the upper end of Grant Lake.

From late July to January, lake levels would be about 1 to 4 feet higher than existing conditions with the maximum lake level occurring in September (see figure 3-6).

Topography and bathymetry data are not available to accurately quantify the extent of inundation above the current highwater mark. However, based on aerial photos taken during the site visit in 2010, we estimate the inundation zone would extend 15 to 20 feet inland from the current highwater line. Inundation could result in the loss of some plants in this area, but this loss is not expected to have a substantial effect on browse availability. Of the preferred moose browse species that occur in the project area (young willow, birch, aspen, and cottonwood trees), cottonwood and birch are most tolerant of both flooding and extreme cold, and would therefore be less likely to be affected by inundation. Additionally, disturbance associated with fluctuations in water levels and movement of ice would lead to increased production of young shoots.

From February to early July, lake levels would be 1 to 7 feet lower than existing conditions with the lowest level occurring in May (see figure 3-6). These lower levels would occur during the growing season (June–September).

While generation of moose browse in the Grant Creek delta at the upper end of Grant Lake is likely driven largely by riverine process associated with spring runoff, lowering of the water table at the beginning of the growing season could reduce soil moisture availability, potentially resulting in changes to vegetation density or species composition over the long term. However, such affects would likely diminish with distance from the Grant Lake shoreline. Moreover, annual rainfall in the area would be sufficient to sustain preferred browse species despite proposed project-related fluctuations in lake levels during the growing season. Average annual rainfall in the region was 69.58 inches from 2000–2018 (NOAA, 2019b) and minimum annual rainfall requirements for preferred moose browse species range from 7 to 35 inches (see table 3-28; USDA-NRCS, 2019a, 2019b, 2019c, 2019d, 2016, 2008a, 2008b, 2006). Additionally, none of the preferred moose browse species in the Grant Lake basin are obligate wetland species and all of the species also occur in typically drier upland habitats in Alaska.

Table 3-28. Minimum annual rainfall requirements for preferred moose browse species in the Grant Lake basin (Sources: USDA-NRCS 2019a, 2019b, 2019c, 2019d, 2016, 2008a, 2008b, 2006).

Species (*Scientific Name*)	**Minimum Annual Rainfall (inches)**	**Habitat Characteristics**
Sitka willow (*Salix sitchensis*)	35	Found on or near lake shores, wetland margins, forest edges, wet openings, and clearings at low to middle elevations.
Quaking aspen (*Populus tremuloides*)	7	Occurs in a wide variety of habitats (including soil type and moisture

Species (*Scientific Name*)	Minimum Annual Rainfall (inches)	Habitat Characteristics
		conditions) and within a great range of elevation.
Paper birch (*Betula papyrifera*)	12	Widely distributed across northern North America and adapted to a variety of soils with ample moisture.
Black cottonwood (*Populus trichocarpa*)	10	Grows on alluvial sites, riparian habitats, and moist woods on mountain slopes, at elevations of 0–6900 feet.

Sufficient rainfall combined with runoff processes, which would remain unaltered by the project, should continue to provide adequate conditions for germination and recruitment of moose browse despite changes in lake levels during the growing season. Therefore, we anticipate that operation of the proposed project is expected to result in only minor adverse impacts to moose browse habitat at the upper end of Grant Lake because fluctuations in lake levels could alter vegetation community structure, but rainfall and runoff process would likely sustain most preferred moose browse species and allow for continued recruitment.

Effects of Project Construction and Operation on Access to Harvestable Wildlife

Construction and operation of the proposed project could affect access to harvestable wildlife on proposed project lands by providing access to Grant Lake and surrounding lands via the project access road. Kenai Hydro proposes to restrict motorized vehicle access. However, as discussed in section 3.3.4.2, in the subsection *Effects of Project Operation on Public Access,* providing pedestrian access on the access road would benefit recreational resources.

Our Analysis

Kenai Hydro's access road could increase access for hunting mountain goat, bear, and moose at Grant Lake and lands adjacent to the proposed project. However, Kenai Hydro proposes to keep the road closed to unauthorized motorized vehicles. It is also not anticipated that increased pedestrian access facilitated by the access road would result in a noticeable increase in hunting in the area surrounding the proposed project. As discussed in section 3.3.4.2, *Recreational Resources, Environmental Effects* most hunting access to Grant Lake is through fly-in services. Therefore, we expect potential effects of project construction and operation on access to harvestable wildlife to be negligible.

3.3.4 Recreation Resources and Land Use

3.3.4.1 Affected Environment

General Recreational Setting

The overall landscape character near the project is natural with diverse topography, large lakes, fast-moving rivers, alpine tundra, and taiga forest. Most of the area is undeveloped with a few public recreation facilities. Long-standing trail systems exist at and to the west of the project; ice fields extend to the east. Seward Highway, connecting Anchorage to Seward, is the main route of access to the project and passes about 1 mile west of the proposed powerhouse in a north to south direction. This highway is designated a National Scenic Byway and is one of the most used highways in the state. The maximum average daily traffic count on the highway in January and July 2012 was 611 and 3,802 vehicles, respectively.

Few developed recreation facilities are available near the project. Almost all recreation use is either trail- or water-based (figure 3-24). Water features used for recreation include Upper and Lower Trail Lakes, Vagt Lake, and Grant Lake. The community of Moose Pass has commercial docks used for aerial sightseeing—also referred to as flightseeing—and a shallow-sloped gravel beach that provides boat launch access to Upper Trail Lake. The Vagt Lake Trailhead (near milepost 25 of the Seward Highway) has an area that was used in the past to access Vagt Lake Trail and as an informal boat launch for Lower Trail Lake. However, ARRC, the landowner, gated the road leading to this area to prohibit vehicular access because of public safety concerns near the adjacent railroad tracks. The only other trailhead parking available is along the road leading to private homes and Crown Point Mining Road. The Vagt Lake Trailhead is a designated access point for accessing the planned INHT[62] route by using the Vagt Lake Trail. Alaska DNR (2004) *Final Finding and Decision to Grant a Public Easement for the Iditarod National Historic Trail* states the intent to upgrade this trailhead to accommodate up to 50 vehicles. The Forest Service-selected alternative for implementing the INHT Comprehensive Plan also describes the agency's intent to develop the Vagt Lake Trailhead (Forest Service, 2004),[63] and the Forest Service provided a design of the planned development to FERC staff (email from K. Kromrey,

[62] The INHT is a system of constructed and planned routes connecting Seward and Nome. *Existing* refers to constructed trail segments, *planned* refers to the trail segments the Forest Service plans to construct, and *proposed re-route* refers to Kenai Hydro's proposed route to relocate the planned INHT route away from the project infrastructure.

[63] The map for the Trail Lakes area states: "Vagt Lake (MP 25.5) (to be reconstructed as part of the Seward Hwy MI 18-25.5 project."

Recreation Program Manager, Chugach National Forest, Anchorage, AK, to K. Olcott, Outdoor Recreation Planner, Commission, Washington D.C., April 18, 2018).

Trails

The project is near three established trails and a portion of the planned INHT route (figure 3-24). Vagt Lake Trail begins at a trailhead located at about milepost 25 of Seward Highway and connects to the southern end of Vagt Lake where it joins the planned INHT route and continues about 0.5 mile, terminating at the western shore of Vagt Lake. The trail is closed to saddle and pack stock from April 1 to June 30 and motorized vehicles from May 1 to November 30.

Saddle Trail begins at the eastern shore of Upper Trail Lake and connects to Grant Lake about 1 mile north of the Grant Creek outlet. The trail is accessible at the shoreline by boat or canoe in the summer and by snowmachine or cross-country skis in the winter. This trail is a point of access for the planned INHT route and is managed for non-motorized use during the summer and motorized use during the winter.

Case Mine Trail, located a mile north of Saddle Trail, is accessed from Upper Trail Lake. In the winter, access is available by cross-country skiing or snowmachine. In the summer, most visitors access the trail using a railroad bridge that crosses Upper Trail Lake immediately west of Moose Pass; ARRC considers such use as trespassing. Motorized use on this trail is authorized for a current federal mining claim holder for mining purposes, but recreational motorized use is not allowed on this trail. The trail connects to the northern shore of Grant Lake at the north-south/east-west bend in the lake.

The INHT, a trail in the National Trails System, traverses about 2,000 miles of western Alaska and extends from Seward to Nome following the routes as depicted on maps identified as *Seward-Nome Trail* in the Bureau of Outdoor Recreation's National Trail System recommendation to the President and Congress (U.S. Bureau of Outdoor Recreation, 1977). Certain portions of the INHT are currently developed and in use, while other sections are planned but not yet constructed. Figure 3-25 shows the planned and constructed routes of the INHT in the vicinity of the project.

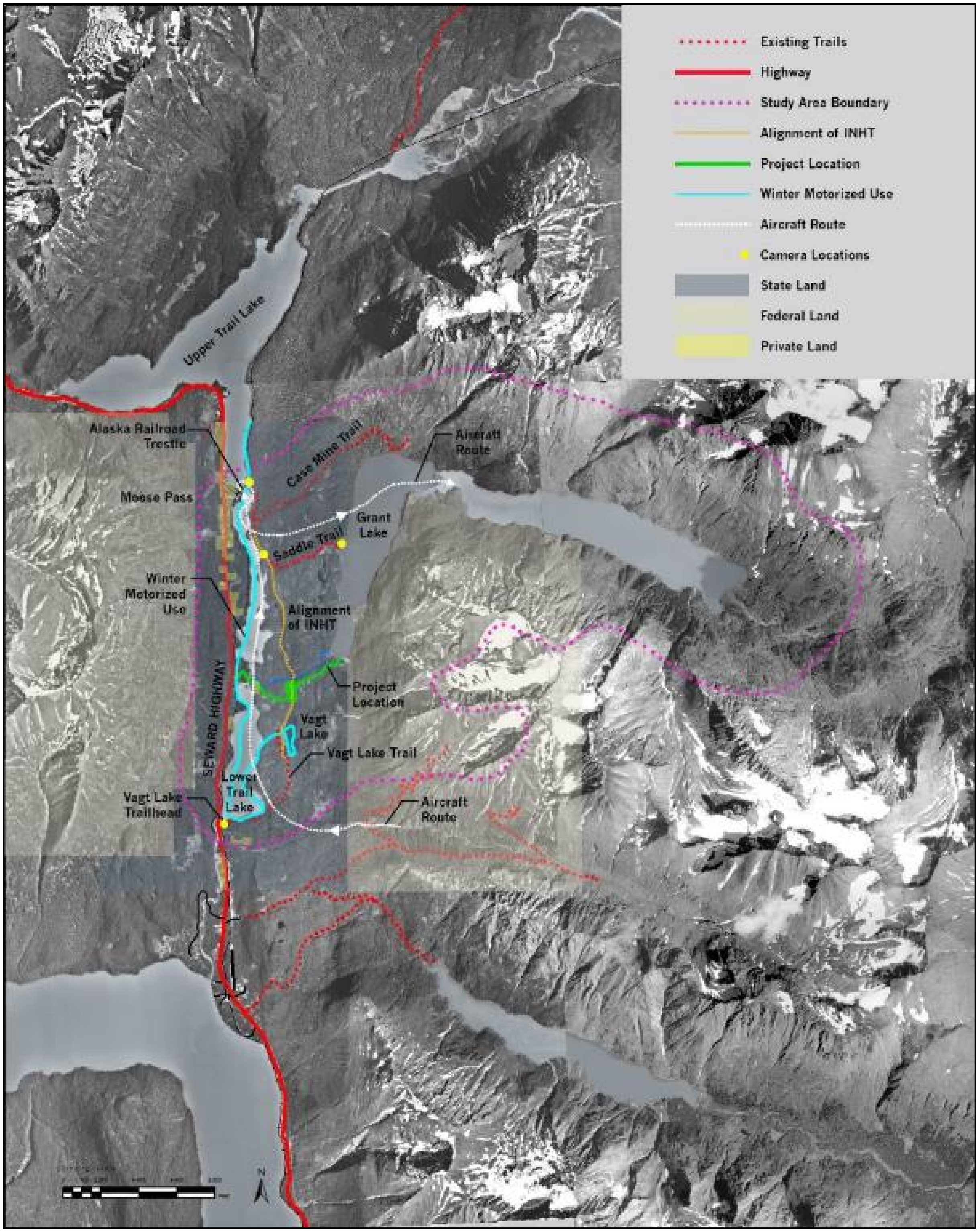

Figure 3-24. Recreation facilities, trails, and public roads near the Grant Lake Project (Source: Kenai Hydro, 2018a, as modified by staff).

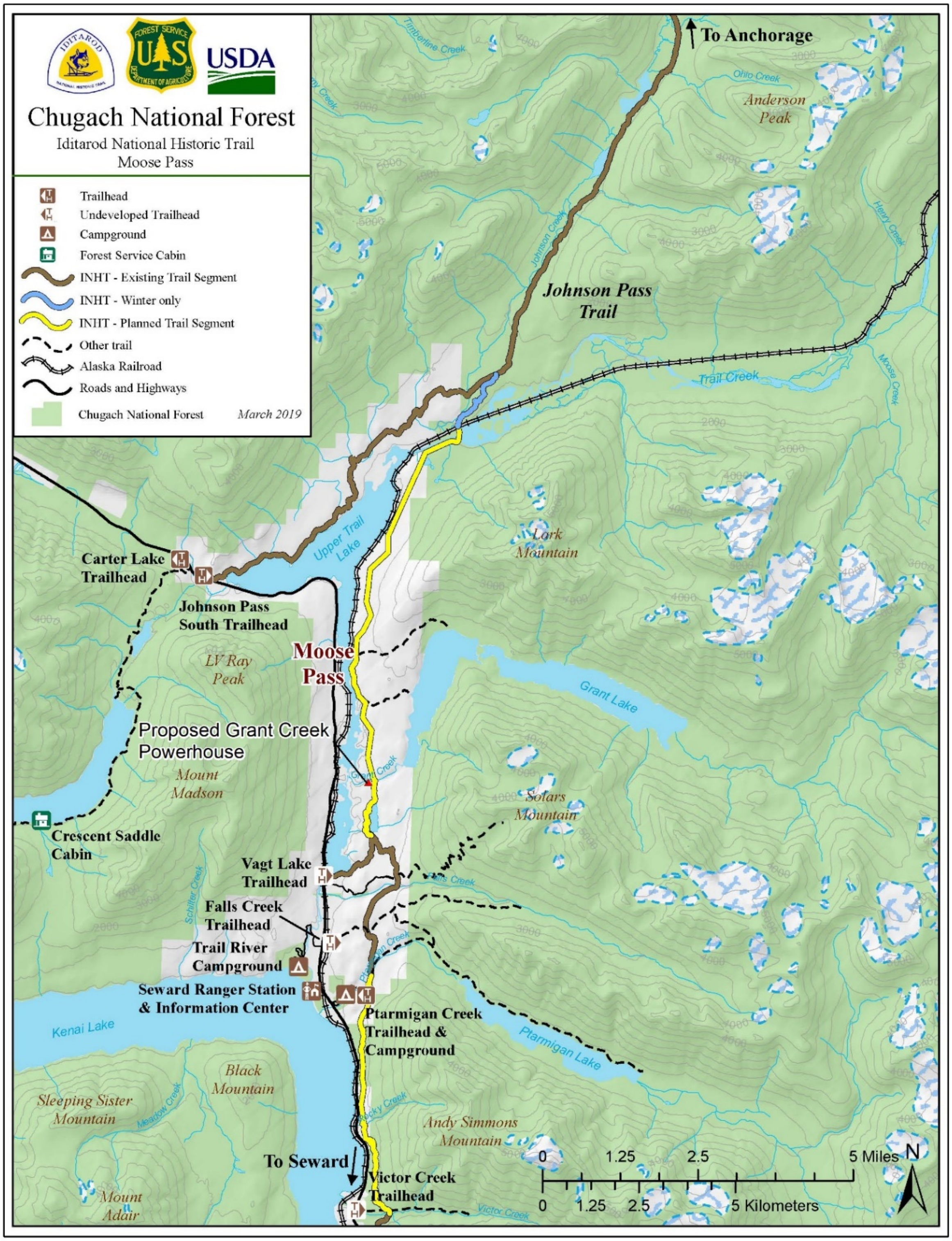

Figure 3-25.Planned and constructed INHT routes in the vicinity of the project (Source: personal communication, K. Kromrey, Recreation Program Planner, Chugach National Forest, Anchorage, AK, and K.Olcott, Outdoor Recreation Planner, FERC, Washington DC, March 5, 2019).

The INHT is a system comprising a primary trail route of about 1,000 miles connecting Seward and Nome and more than 1,300 miles of other trails, which connect with gold strikes, communities, and access points (i.e., connecting trails). The National Trail designation mandates that the Secretary of the Interior is responsible for the INHT and development of a management plan for the INHT that:

- identifies the historic INHT system and side and connecting trails;
- identifies all significant natural, historic, and cultural resources to be preserved;
- includes specific objectives and practices to be observed in the management of the INHT;
- describes details of any anticipated cooperative agreements to be consummated;
- describes procedures for establishing a uniform marker for the INHT and providing markers to cooperating agencies; and
- identifies access needs to the INHT where appropriate and acquisition needs for significant sites or segments.

The designation also directed the formation of an advisory council with the following members:

- a member of each federal or independent agency administering land through which the INHT route passes;
- a member to represent the State, appointed by the Governor; and
- one or more members appointed to represent private organizations and individual landowners or land users who have an established and recognized interest in the INHT.

Bureau of Land Management prepared the comprehensive management plan for the INHT (INHT Plan) in 1986 (BLM, 1986). A plan objective states that public use of INHT segments should be encouraged, protected, and managed to the extent that such use does not affect the historic values of the INHT, and ROWs, easements, management corridors, cooperative agreements, and access improvements will all be used to meet this objective. Because the INHT crosses lands managed by several agencies, these entities have entered into agreements that commit the agencies to a cooperative management philosophy for the trail and the specific objectives stated in the INHT Plan.

Today, the Alaska Railroad follows the primary historic route of the INHT between Seward and Girdwood, and the Seward Highway closely parallels this route. The planned INHT segment in this area bypasses the railroad ROW and Seward Highway and is, therefore, a commemorative route. The INHT Plan direction for this INHT segment is to:

- construct a parallel recreational trail between Seward and Portage adjacent to, but outside, existing railroad and highway ROWs;
- brush and mark a route as determined by the Forest Service; and
- reserve an adequate ROW on this proposed route to provide both summer and winter access.

The INHT Plan identifies specific historic site recommendations, lists priority sites for management (e.g., cabins and mines), and specifies constructing and improving structures such as shelters and air strips for each segment of the INHT. Eight priority sites are listed for the INHT segment between Seward and Girdwood, but none of these sites are near the project, and no construction or improvements are specified for this trail segment.

Certain portions of the trail are currently developed and in use, while other sections are planned but not yet constructed. The route for the section of the planned INHT near the project area has been laid out, flagged and brushed but not constructed. The Forest Service has obtained a 100-foot-wide easement from the State of Alaska (Alaska DNR, 2004) for constructing and maintaining the INHT along the west shore of Vagt Lake, continuing north to cross Grant and Trail Creeks (figure 3-24). The planned route crosses Grant Creek, generally in a north to south direction, near the proposed powerhouse. The State of Alaska currently reserves a 1,000-foot-wide corridor for managing land adjacent to the INHT consistent with the INHT Plan.

Recreation in the Project Vicinity

Grant Lake and the surrounding area provides settings for many recreational activities.

Alaska DFG states that it does not consider Grant Lake to be a fishing destination but reports some angling use in Lower Trail Lake, Vagt Lake, and Grant Creek downstream of Grant Lake. Grant Lake is also a drop-off location for mountain goat, bear, and moose hunting; however, Kenai Hydro's recreation observations indicate the area near Grant Lake probably receives low hunting use.

Most recreation activities occurring in the vicinity of the project are associated with water, trails, and scenery and include hiking/walking, cycling, camping, fishing, boating, hunting, using snowmachines, snowshoeing, cross-country skiing, ice fishing, aerial sightseeing, and driving for pleasure.

The level of use varies seasonally with much higher use occurring in the summer than in the winter. Summer uses include hiking on Vagt Lake Trail; camping at Vagt Lake; fishing in Upper Trail Lake, Lower Trail Lake, and Vagt Lake; hiking on Saddle Trail and Case Mine Trail; and small aircraft takeoffs and landings at Trail Lake. During its recreation surveys, Kenai Hydro observed small watercraft use on Upper and Lower Trail Lakes and observed an aluminum boat at Grant Lake in 2014, but it was not in use at the time observed. Surveyors recorded about 12 anglers on Grant Creek over the entire summer and fall 2013 data collection period. Kenai Hydro reports that most anglers would probably have boated to Grant Creek to fish because hiking to the creek would be difficult. Kenai Hydro observed motorized trail use at the Vagt Lake Trailhead and observed some motorized vehicle use on the Case Mine Trail and from Trail Lake to Grant Lake. Kenai Hydro attributes this use to the mine permit holder.

At four monitoring locations near Moose Pass, Kenai Hydro observed 1,679 visitors between March 2014 and September 30, 2014 (figure 3-26). The majority of summer visitors were identified as hikers and most (1,151 visitors) used the Vagt Lake Trail. More than 300 visitors were observed using the monitoring locations for short periods, possibly using these areas as a rest stop along Seward Highway (noted on figure 3-26 in the Break category). More than 200 people visited the area to fish, and motorized activity was fairly low with only 11 visitors using the trails with off-highway vehicles or dirt bikes.

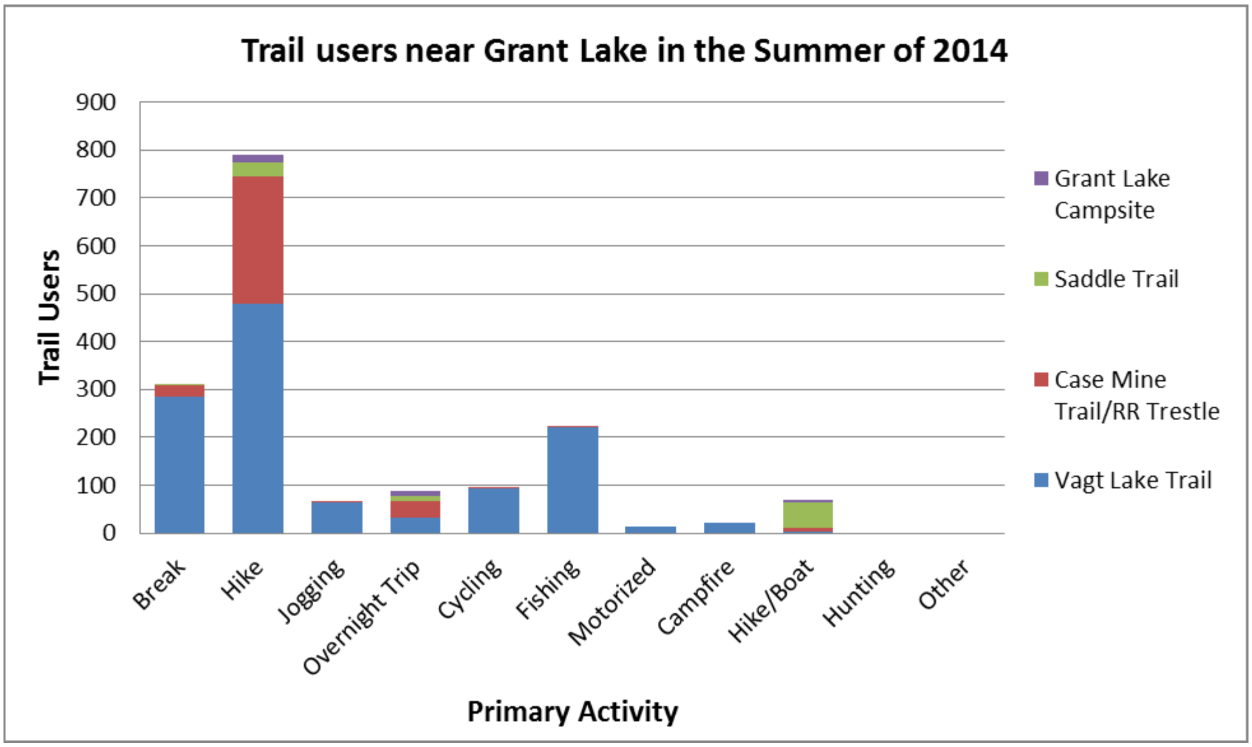

Figure 3-26. Number of summer visitors observed by monitoring location and recreation activity (Source: Kenai Hydro, 2018a, as modified by staff).

Kenai Hydro also observed and recorded winter use near the project. Surveyors made three trips to the Vagt Lake Trailhead, Saddle Trail, railroad trestle near Moose Pass, and Grant Lake. In March of 2013, Kenai Hydro observed high levels of snowmachine use originating at the Vagt Lake Trailhead and continuing northeast across Lower Trail Lake to a partially flagged route leading to Vagt Lake. Another starting point was in Moose Pass, near an existing boat ramp. Other snowmachine users were observed traveling north-south along the western shores of Upper and Lower Trail Lakes and across Upper Trail Lake toward Johnson Pass. Users did not ride through Trail Lake Narrows (i.e., the channel between Upper and Lower Trail Lakes) because the watercourse was not frozen. This condition appears to be a normal occurrence, keeping a portion of Lower Trail Lake with open water during the winter. Open water was also observed at the railroad trestle, located between Moose Pass and the rail line. Despite signs prohibiting public access, users traveled on the railroad tracks for passage around these open water areas. Kenai Hydro observed evidence of cross-country ski, snowshoe, and ice skate use on Grant Lake from visitors using the Case Mine Trail and the Saddle Trail but did not observe any sign of snowmachine use. Kenai Hydro's observations in the winter of 2014 and 2015 showed the same lack of snowmachine use at Grant Lake; however, snow levels were low in those periods. Kenai Hydro found no evidence that the informal trails that parallel Grant Creek are used for winter access to the creek or Grant Lake. Steep terrain, dense vegetation, and the lack of formally constructed trails likely limit snowmachine use along Grant Creek.

Land Use

Land surrounding most of Grant Lake is public land managed by the Forest Service as part of Chugach National Forest. Land between Grant Lake and the Seward Highway is mostly owned by the State of Alaska and managed by Alaska DNR. Limited private ownership (mainly rural residential) exists in the lower portions of the Grant Creek drainage and along Seward Highway. Four active mining claims are located on federal lands on the north side of Grant Lake's lower basin (figure 3-27).

Applicable land management guidelines are described in the Kenai River Comprehensive Plan (Alaska DNR, 1997), Kenai Area Plan (Alaska DNR, 2001), and Chugach National Forest Revised Land and Resource Management Plan (Forest Service, 2002).

Kenai River Comprehensive Management Plan

The Kenai River Comprehensive Management Plan (Alaska DNR, 1997) proposes incorporating a number of state parcels adjoining Trail Lakes and Trail River into the Kenai River Special Management Area and proposes that these actions be accommodated within the Kenai Area Plan (see below). It also proposes providing a 200-foot vegetated buffer along the shore of the lakes and river. Alaska DNR notes these actions are to protect fish populations and resources of the Kenai River.

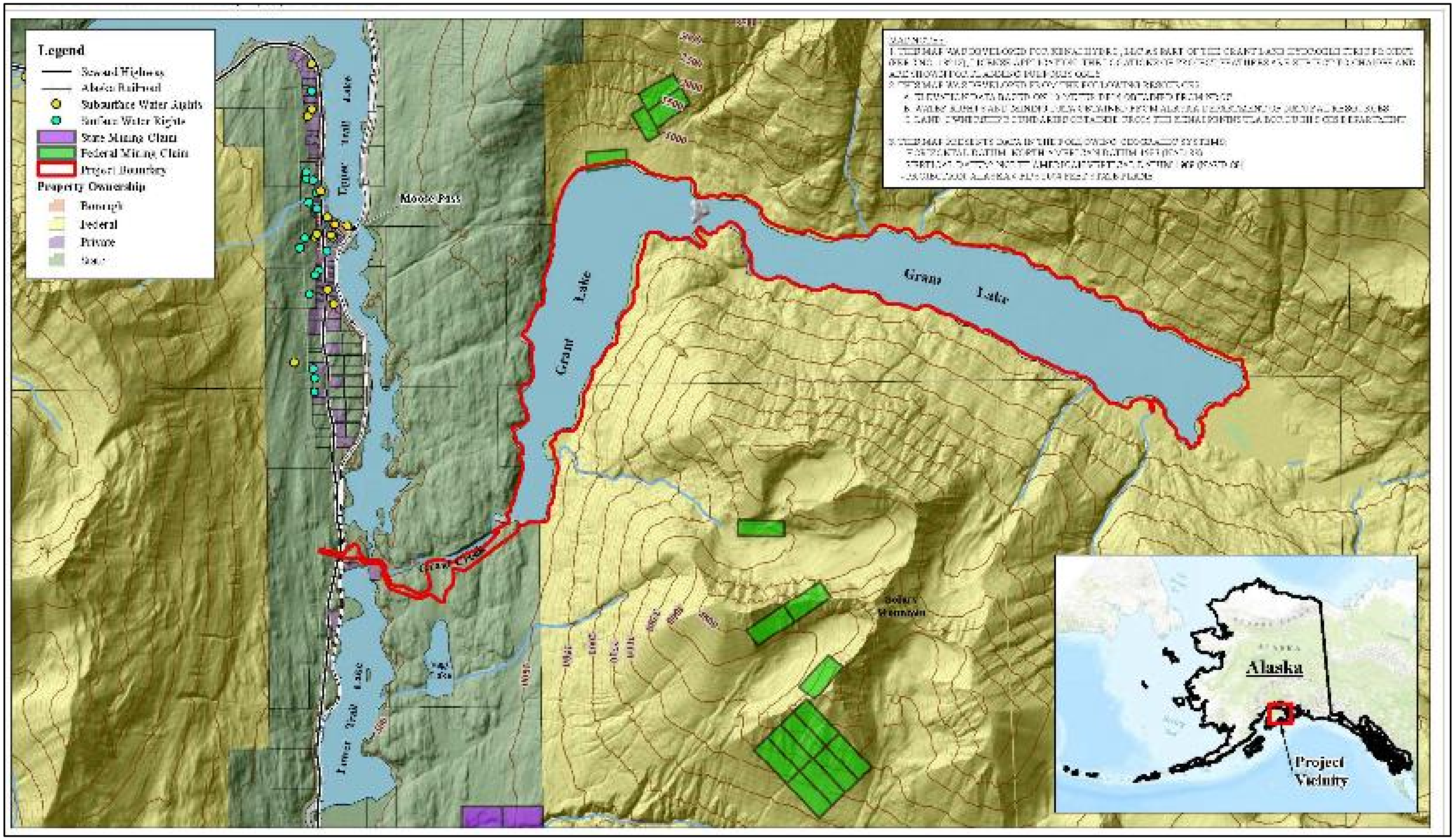

Figure 3-27. Land ownership in the vicinity of the Grant Lake Project (Source: Kenai Hydro, 2018a, as modified by staff).

Kenai Area Plan

The Kenai Area Plan contains goals, objectives, and management direction for state lands in the planning area near the Kenai River. The plan contains general guidelines applicable to all state lands and specific guidelines pertaining to land in designated management units. Some of the plan's general guidelines applicable to land near the project include:

- Public Recreation and Tourism

- Authorizations may be allowed adjacent to public recreation facilities, including public use cabins, lodges, or fuel stops, if Alaska DNR determines that the two uses can be made compatible by design, siting, or operating guidelines or if no feasible and prudent alternative exists for the activity. This guideline also applies to sites reserved for future recreation facilities.
- Facilities on state-owned uplands and tide lands should be located and designed to blend in with the natural surroundings. Stipulations to accomplish this guideline may be attached to a development plan to address location, size, color, materials, requirements for vegetative or topographic screening, or other measures as appropriate.
- Seward Highway Scenic Byway (Corridor Development Areas[64]). The scenic buffer (150 feet outward from the ROW boundary) shall remain in its undeveloped, natural state, except to provide reasonable access from the highway to private or public lands on either side of the highway. These access roads serve several individual road or driveway access needs by a single access through the scenic buffer wherever possible, to avoid proliferation of individual roads or driveways through the buffer. Physical access from the highway to private or public lands shall be located no closer than 500-foot intervals. Access to private or public lands should be located in such a manner as to provide access to either side of the highway at one point of intersection. A wider or narrower buffer strip can be reserved, depending on vegetative cover, the view from the roadway, topography, highway noise levels, expected future needs for additional transportation facilities, or other relevant factors.

  No utility line or lines may be placed or constructed within the scenic buffer, except to directly cross the scenic buffer to serve adjacent properties, or they may be placed along the exterior 25 feet of the scenic

[64] The plan has three corridor classifications: Corridor Nodal Development Areas, Corridor Development Areas, and Corridor Preservation Areas. The management units near the project are classified as Corridor Development Areas.

buffer (the portion farthest from the highway ROW) to serve any properties as long as the primary function of the buffer is not impaired.

- Trails and Access

- When conveying land or issuing authorizations along the INHT the authorization or conveyance is subject to the route (or alternate route) and a buffer along the route that ensures continuous trail links along the INHT. The route is protected by a 1,000-foot-wide corridor (500 feet on each side of the centerline). This width allows flexibility to re-route the trails within the corridor, separate motorized and nonmotorized uses on individual trails within the corridor and includes a visual and sound buffer between the recreation corridor and adjacent uses. To minimize potential land use conflicts or the impact of the trail's existence on adjacent land uses, the corridor width may be expanded or reduced. These width adjustments, as well as rerouting of the trail corridor, may be permitted in specific instances.

  The trail corridor width may be reduced to a minimum width of 400 feet where the adjacent land use would not adversely affect the trail experience. A wider corridor may also be desirable in certain instances to incorporate high-quality adjacent-land features and scenery or to buffer the impacts from adjacent land uses including high-density residential, industrial, or commercial uses.

  No permanent structures or equipment should be placed within the trail corridor if they could adversely affect the trail experience unless the management intent for the unit specifically allows for it. Where necessary, trail crossings may be permitted to allow access to lands on both sides of the trail.

  The plan also states that the intent of the guidelines applicable to the INHT is not necessarily to protect the fidelity of the original INHT route, as much as to provide a suitable route that captures the idea of a continuous trail between Seward and Turnagain Arm.

  Regarding land use in corridors, land use activities within a trail corridor (for example, permits, leases, timber sales and material sales) should be managed so as to not adversely affect trail use over the long term or the aesthetic character of the trail. This does not preclude trail crossings or rerouting of trails. Rerouting of trails for a short distance may be permitted to minimize land use conflicts or to facilitate use of a trail if alternate routes provide opportunities similar to the original. If trails are re-routed, provision should be made for construction of new trail segments if warranted by type of use. Historic trails which follow well-established routes should not be re-routed unless necessary to maintain trail use.

The project is within or adjacent to at least three management units identified in the Kenai Area Plan (figure 3-28). Table 3-29 lists the resource or use for which the unit is designated and the management intent for each unit in addition to the land classifications correlated to the land use designations. The land classifications are the formal record of uses and resources for which state of Alaska lands will be managed.

Chugach National Forest Land and Resource Management Plan

Lands east of the western shore of Grant Lake lie within Chugach National Forest. The Forest Service manages these lands in accordance with direction contained in the Revised Land and Resource Management Plan for Chugach National Forest. The Forest Service also has construction and management responsibilities for the INHT in the vicinity of the project.

The Forest Service manages the area in and around Grant Lake as part of the Kenai Mountains Roadless Area to meet goals for improved and developed recreation opportunities, while maintaining landscape character and providing for timber management. Grant Lake has a management prescription for *Fish, Wildlife, and Recreation Management* and extending to the east, areas managed as *Backcountry* begin about 1 to 5 miles north and east of Grant Lake.

Under, *Fish, Wildlife, and Recreation Management*, the Forest Service manages the area around Grant Lake to provide a variety of habitats for fish and wildlife species and year-round recreational opportunities in both developed and dispersed settings. Ecological processes, as moderately affected by human activity, dominate lands managed under this prescription. These areas may have evidence of resource management and improvements for fish and wildlife habitat and provide a wide range of recreation opportunities. Opportunities for solitude and quiet may be limited because of frequent contact with other users near the road or trail systems. People should expect some challenge and a degree of risk when traveling cross-country in areas with this designation. The Recreation Opportunity Spectrum for the area near the project is semi-primitive motorized, and the scenic integrity objective for these lands is “moderate.” Land with this designation has evidence of human use such as trails, hardened campsites and historic structures. Historic cabins, trails, and aboveground features may be stabilized with limited onsite interpretation. Roads and trails may be present and new roads may be built for resource management activities or providing access to trailheads, camping areas or recreation concentration areas. These roads, however, may be closed either seasonally or year-long to meet wildlife habitat objectives. Examples of use and occupancy activities consistent with the management intent of lands with this designation include campgrounds, new roads and trails, utility systems, administrative and permitted motorized access, and parking lots at trailheads.

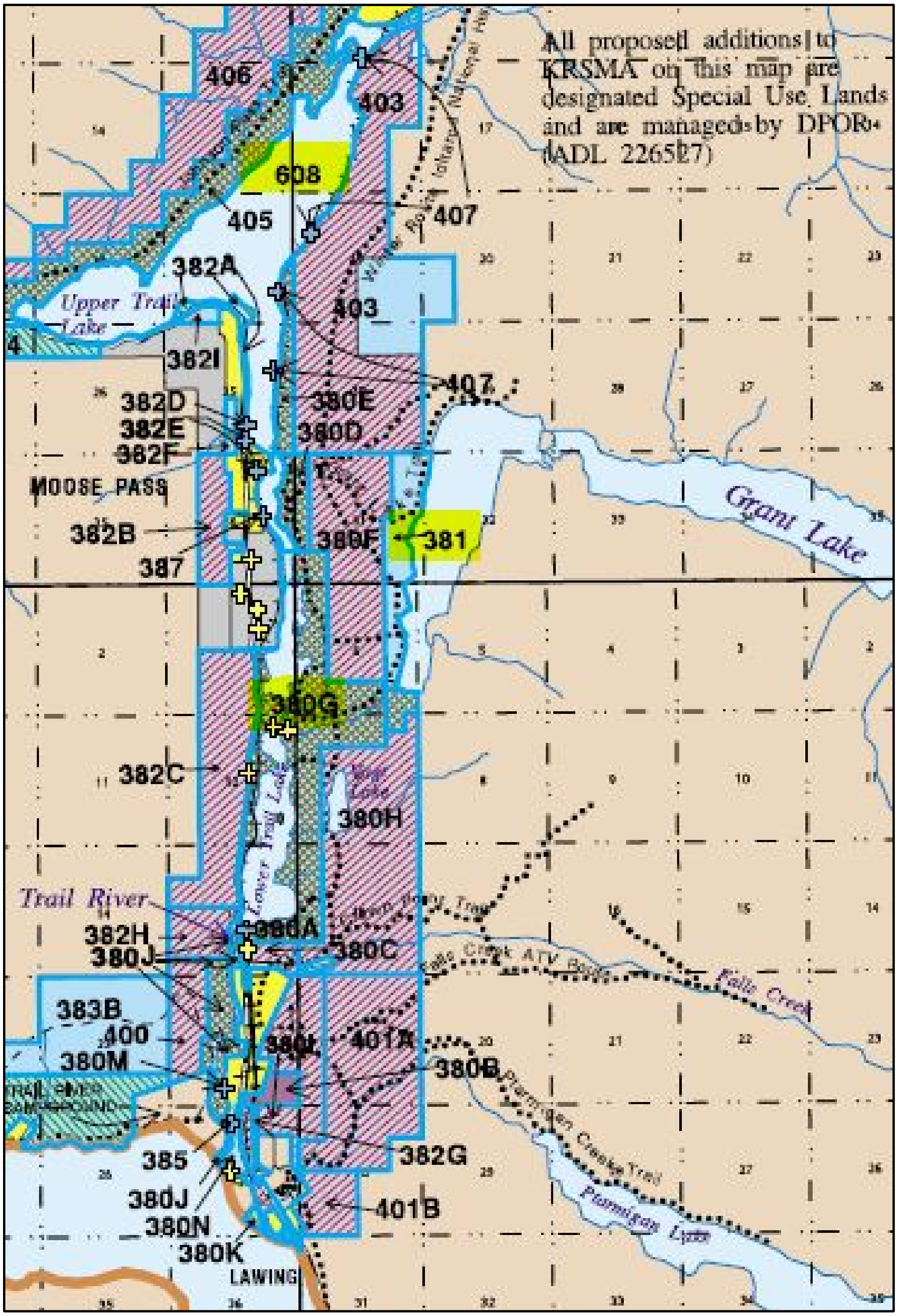

Figure 3-28. Kenai Area Management Plan management units near the project. Unit numbers are highlighted in yellow (Source: Alaska DNR, 2001).

Table 3-29. Land use designations and management direction for Kenai Area Plan management units (Source: Alaska DNR, 2001).

Management Unit No. and Name	Land Use Designation	Resource or Use for Which Unit is Designated and Management Intent
380G—Lower and Upper Trail lakes shorelines	Habitat[a] Public recreation and tourism—dispersed use[b]	The east side of the Trail River and Lake system used as a brown bear movement corridor between Trail Creek and Snow River drainages. Important Kenai River habitat and recreation values. Scenic waterfall at the outlet of Grant Lake and precipitous mountain walls with a relief greater than 3,500 feet on the east shore of the lake. Riparian habitat values for Kenai River fishery, scenic viewshed from Seward Highway. Grant Creek is an anadromous fish stream below the falls that prevent fish passage to Grant Lake. Lower creek supports king, coho and sockeye salmon spawning. The riparian and lacustrine areas provide habitat for mink and river otters. Moose use unit for winter range. Mountain goat winter habitat between 500 and 1,000 feet. The INHT traverses this unit. Manage for trails-related recreation.

Management Unit No. and Name	Land Use Designation	Resource or Use for Which Unit is Designated and Management Intent
381—West Shore Grant Lake	Habitat[a] Public recreation and tourism-dispersed use[b]	Trail and lake-oriented recreation. The Grant Lake Trail (also known as Case Mine Trail), Al Solar's Mill Road, and Plateau Trail pass through this unit. Spectacular relief including very steep mountain wall rises east of Grant Lake. This unit is part of a brown bear movement corridor between Trail Creek and Snow River drainages. Grant Creek is an anadromous fish stream below the falls which currently prevent fish passage to Grant Lake. Moose, rutting and winter concentration area. In the lake adjacent to this unit: ducks and geese, general distribution; freshwater fish, general distribution of rainbow trout and Dolly Varden/Arctic char. The portions of this unit that are in the SE 1/4 SE1/4 of Section 6 and within Section 8 should be added to the Kenai River Special Management Area.
608—Trail River, Upper and Lower Trail Lakes	Habitat[a] Harvest[a] Public recreation and tourism-dispersed use[b]	Important Kenai River habitat and recreation values. River and lake are important for salmon production and migration, high value resident fish, bear feeding, and swans. High value waterbody for public recreation.

[a] Corresponding land classification is land primarily valuable for: (1) fish and wildlife resource production, whether existing or through habitat manipulation, to supply sufficient numbers or a diversity of species to support commercial, recreational, or traditional uses on an optimum sustained yield basis; or (2) a unique or rare assemblage of a single or multiple species of regional, state, or national significance.

[b] Corresponding land classification is land that is suitable for recreation uses, waysides, parks, campsites, scenic overlooks, hunting, fishing or boating access sites, trail corridors, or greenbelts along bodies of water or roadways.

Grant Lake, on NFS lands, is designated for winter motorized use. The Forest Service has an easement from the State of Alaska for the Case Mine Trail, which is managed for non-motorized use during both winter and summer, although the holder of a mining claim is allowed motorized vehicle access during the summer. The Forest Service also manages the Saddle Trail, which is listed as an INHT access trail and managed for non-motorized use during the summer and motorized use during the winter.

3.3.4.2 Environmental Effects

Recreation Resources

Kenai Hydro proposes to construct project infrastructure in an area that has no development, is used for dispersed recreation, and is in within and adjacent to the easement to construct the planned INHT segment. This section analyzes the effects of proposed measures, 4(e) conditions, and recommendations pertaining to public access, recreation use, and INHT.

Effects of Construction on Public Access

Construction activities would require restricting public access for safety and security reasons for about 18 months when Kenai Hydro would need to prohibit the public from accessing a broad area extending from Seward Highway eastward to Grant Lake, including the Grant Creek corridor. In the event of any temporary trail closures as a result of construction activities, Kenai Hydro would temporarily construct short-term re-routes of the specific trail to facilitate continued use during project development.

National Park Service (Park Service) preliminary 10(a) recommendation 3 recommends that Kenai Hydro establish a project status website to provide real-time information to the public about the status of access to the area, install signage at key locations, and provide a public point of contact.

Our Analysis

Kenai Hydro's study shows that few visitors use the area, and when they do, they mainly use it for dispersed uses such as hiking, fishing and snowmobiling. Most of this use is associated with Vagt Lake, which is about 0.5 mile south of and not near the construction area. Consequently, area closures for the 18-month construction period would affect very few visitors. Anglers would still have access to Grant Creek along the streambank trails, and hikers would still have access to Grant Lake along the Saddle Trail and Case Mine Trail. We have not identified any effects of construction on aerial sightseeing operations. Therefore, minimal benefit would be realized by providing a Park Service-recommended public outreach program to provide construction information.

Effects of Operation on Public Access

After construction, Kenai Hydro would fence areas near the powerhouse, penstock, tunnel, tailrace, and other project infrastructure to prohibit public use. Kenai

Hydro would also construct a 1-mile-long, 24-foot-wide, double-lane, graveled surface powerhouse access road with a new bridge to span Trail Lake Narrows and a 0.9-mile-long, 16-foot-wide, single-lane, graveled surface road to access the intake at Grant Lake. The transmission line route would mostly parallel the powerhouse access road, cross Seward Highway, and continue to the west. Kenai Hydro would gate the powerhouse access road to prohibit public access near Seward Highway.

Our Analysis

The proposed project would result in the public no longer being able to access from about 5 to 10 acres near the powerhouse, detention pond, and laydown area, including a portion of land along the south side of Grant Creek and near the intake facilities (about 1 acre). With an observed annual use of only 12 anglers fishing in Grant Creek during Kenai Hydro's study, the result of this closure of land to public use would have a minor effect on angling. Further, public use would only be prohibited for about 100 feet along the southern shoreline in the vicinity of the powerhouse while the remainder of Grant Creek (about 0.5 mile) would be available for public use. Because Kenai Hydro's study showed no boating or snowmachine use of Grant Lake, prohibiting public use near the intake would not likely affect this use. Although Kenai Hydro would prohibit the public from snowshoeing and cross-country skiing (the only two observed uses at Grant Lake near the intake), the area where the public would be excluded would be extremely small compared to the 1,741-acre footprint of Grant Lake that would be remain available for this use.

The project access road would provide a new point of access to otherwise undeveloped land. Because non-motorized trail and off-highway vehicle uses are popular activities in this area, the access road could attract such uses. Kenai Hydro's proposal to install a gate and *no trespassing* signage on the access road would minimize potential use of the access road and address concerns about encouraging motorized access where none currently exists. Kenai Hydro believes the gate, signage, and absence of a parking area would deter public use of the access road. However, the amended final license application provides examples of recurrent trespassing on ARRC's land near the project by those seeking recreational access to adjacent land, and it is likely that without vigilant monitoring and enforcement, similar activity would also exist at the project access road, with motorized vehicle use on project lands.

Prohibiting public motorized use of the access road in the summer would address local residents' concerns about encouraging motorized use near the project and would reduce the potential for unauthorized motorized use and on adjacent NFS lands. However, allowing non-motorized access to Grant Lake via the access road would be consistent with land management objectives for state and federal lands near the proposed access road to allow and encourage trail use, and it would not interfere with Kenai Hydro's ability to operate and maintain the project. The road would provide a third route of access to Grant Lake, potentially increasing dispersed recreation opportunities at the lake and the number of visitors to the lake. This additional route could also increase access to the area for hunting. Unless a parking area were provided to support this use, it is likely the public would park along Seward Highway, causing public safety concerns about pedestrians crossing or walking along the highway and railroad tracks as well as congestion along the highway. These concerns could be addressed if a parking area were collocated with the access road gate at a distance from Seward Highway and the railroad corridor. An appropriate location may be at the 9,000-square-foot area that would be disturbed for bridge construction. Installing a single unit vault restroom at the parking area would minimize effects of improper sanitation, which have been documented at other trailhead parking areas in the region where restroom facilities are not provided.[65]

Developing a public access plan would provide an integrated approach for managing public access near the project that considers public safety, security for project infrastructure, O&M, and compliance with rules and regulations applicable to state and federal lands occupied by the project. Elements of a public access plan may include:

- Descriptions and maps showing locations roads, trails (including the planned INHT route), gate(s), signs, and a parking area with a single-unit vault restroom between and including Seward Highway and Grant Lake;
- Designs for gates and signs (including sign messages);
- Methods used for monitoring gate effectiveness and vandalism;
- Procedures and schedules for maintaining gate(s);
- Descriptions, by location, of allowable types access (e.g., motorized, non-motorized) in winter and non-winter months;
- Identification of the applicant’s responsibility for operating and maintaining roads, gates, signs, parking area (including single-unit vault restroom);
- Consultation with state and federal land management agencies about plan content, including Alaska DNR, Forest Service, and Kenai Borough; and
- Methods for periodically reviewing plan effectiveness and the process to implement revisions, if needed, to achieve plan objectives and protect environmental resources.

The bridge across Trail Lake Narrows would span the watercourse about 20 feet above the water surface. Boats use Trail Lake Narrows, and the clearance would be sufficient to maintain boating access at this location. Because Trail Lake Narrows does not usually freeze, generally making it unsuitable for snowmachine use, the bridge would not affect snowmachine use.

[65] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

Effects of Project Operation on Recreational Use

In addition to the effects related to access, project-related reservoir fluctuations and modified flows in Grant Creek could affect recreation activities.

Our Analysis

The lower winter water surface elevation would not have an effect on the existing winter recreation activities at Grant Lake. The additional 3.5-foot drawdown would gradually occur and not cause ice settlement, which would create an unstable surface. The suitability of the surface of Grant Lake for winter activities would continue to depend on climatic factors (e.g., snow, temperature) and opportunities for snowmachine, cross-country ski, snowshoe, and ice skate use would be the same as what currently exists. Because most of the observed use at the lake in June, July, and August consisted of hikers and this use is not water-dependent, any change in elevation caused by the project would not affect the existing uses. In September through November, the water surface would be 3 to 4 feet higher than currently exists and the resulting increased water surface area would not diminish access for hunters using float planes.

Kenai Hydro would create an off-stream detention pond to provide a storage reservoir for flows generated during rare instances when the units being used for spinning reserve were needed for the electrical transmission grid. By diverting increased flows from generation into the detention pond and slowly releasing flow back into Grant Creek, this operation would prevent a sudden increase in the water surface levels of Grant Creek. Because flows would slowly change and angling use in the reach is low, the expected fluctuation would not affect angling in Grant Creek.

Iditarod National Historic Trail

To construct the commemorative segment of the INHT, Alaska DNR issued a 100-foot-wide easement to the Chugach National Forest within a 1,000-foot-wide corridor reserved to the State of Alaska (figure 3-29). Kenai Hydro's proposed project infrastructure including the powerhouse, penstock, detention pond, transmission line, and access road would be located within or cross a portion of this easement and management corridor.

Kenai Hydro proposes to re-route the planned INHT (figure 2-1) and construct the portion of the re-routed trail between Vagt Lake and Grant Creek.

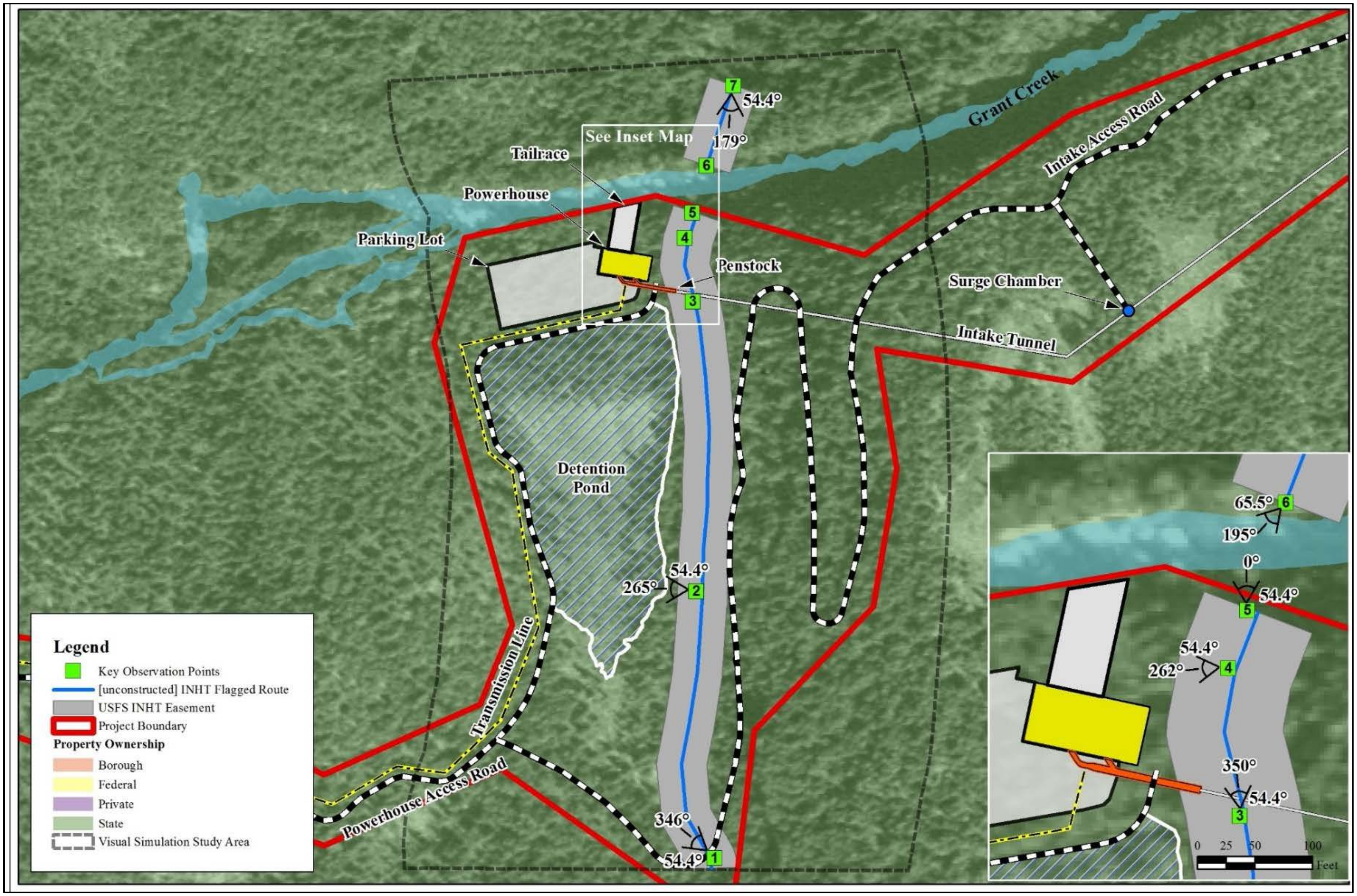

Figure 3-29. Planned INHT route near the proposed project infrastructure (Source: Kenai Hydro, 2017a, as modified by staff).

Forest Service final 4(e) condition 21 contains requirements related to placement of project infrastructure near the planned INHT route. This condition would require Kenai Hydro to:

- coordinate with the Forest Service on design and development of the access road at its intersection with the INHT;
- account for potential drainage effects in the design of the access road and be responsible the incremental expense of drainage features resulting from the project;
- maintain and reconstruct the trail associated with any damage caused by the access road;
- consult with the Forest Service to ensure trail function, operability, and sustainability remain intact;
- bear additional costs for the trail and bridge caused by penstock construction;
- during construction and 5 years thereafter, remove down trees caused by project construction;
- provide administrative access on the project access road to the Forest Service;
- develop a scenery management plan (Condition 19); and
- prevent public access from the INHT to project facilities.

The Park Service recommends (preliminary 10(a) recommendation 1) that Kenai Hydro convene a work group to evaluate other INHT re-route alternatives if the license allows locating the powerhouse within the INHT corridor as identified in the existing easement granted to the Forest Service. The Park Service recommends the Commission establish a budget and schedule for completion of this process.

In response to agency concerns, Kenai Hydro identified an alternative trail route that would provide separation between project infrastructure and the INHT and benefit visitor use by providing enhanced views of Trail Lake and background mountain peaks. Despite these positive attributes, the Forest Service and other agencies, organizations, and individuals do not support the proposed trail location because the proposed route would not support traditionally associated trail activities (e.g., snowmachine use), has sharp turns and steep changes in grade, would be about two times longer than the planned route,[66] and does not follow a more desirable general north to south trending direction.

[66] The existing route is about 3,800 feet long and the re-routed trail would be about 8,400 feet long.

Our Analysis

We analyze the effects of the proposed measure, Forest Service final 4(e) condition 21, and Park Service recommendations by assessing their consistency with plans applicable to the INHT as described in the Kenai Area Plan and INHT Plan and project nexus. We also assess whether constructing and operating project infrastructure within the planned INHT corridor is consistent with applicable land management plan direction and the Alaska DNR easement to the Forest Service for constructing the INHT.

The compatibility of the project with the INHT has been the subject of extensive consultation between Kenai Hydro, agencies, and interest groups and numerous comment letters, which clearly indicate a preference to not locate project infrastructure in the planned INHT route as identified in Alaska DNR's 1,000-foot-wide easement. Kenai Hydro's proposed re-route would have sharp turns and steep changes in grade, be about two times longer than the planned route, and would not follow a more desirable general north to south trending direction. These attributes of Kenai Hydro's proposed trail route would not meet visitor expectations of having an expeditious route of travel and the proposed route would not be consistent with the INHT Plan objectives of providing a trail suitable for winter and summer access. Additionally, the project would incur costs for construction, maintenance and acquiring new easements to re-route segments of the trail. For these reasons, constructing the trail in the planned location would better align with the intent of the INHT.

Kenai Hydro's proposed measure to re-route the planned INHT would be consistent with Kenai Area Plan direction to not place permanent structures or equipment within the corridor. However, this plan guidance applies to those "structures or equipment that could adversely affect the trail experience," yet the plan does not describe the intended trail experience. Alaska DNR's easement to the Forest Service suggests a desire for a recreation experience in an undeveloped area by stating that it reserves a 1,000-foot buffer along the corridor to conserve the wilderness characteristics of the Iditarod trail. The planned INHT route in the vicinity of the project passes near points of development including the Seward Highway, the community of Moose Pass and snowmachine use as well as some off-highway vehicle use in the area is permitted. Despite wording in the easement, the existing environment has evidence of development that is inconsistent with a wilderness setting. The project would introduce additional facilities into the area but considering the present level of development and motorized vehicle use in the surrounding area and considering that facilities could be located or screened to minimize their appearance, the incremental change in the existing appearance would be minimal and not inconsistent with the existing condition. Because the proposed facilities would not adversely affect the recreation experience, locating structures or equipment within the planned INHT corridor would not conflict with the Kenai Area Plan guidance.

Further, Alaska DNR has opined that development across and along the easement for the INHT corridor can be allowed under certain circumstances. In 2015, Alaska DNR commented on a draft environmental document prepared by the U.S. Army Corps of Engineers for Salmon Creek Section 205 Flood Risk Management Project, which proposed constructing and upgrading trails. Alaska DNR stating:

> Crossing of ADL 228890[67] could be authorized as long as the 1,000-foot buffer is intact, the wilderness characteristics of the trail are conserved, and conflicting uses adequately separated (letter from L. Schick, Alaska DNR, to M. Noah, Corps, June 25, 2015).

Subsequently, on April 20, 2017, Alaska DNR issued a decision to issue easements for constructing the U.S. Army Corps of Engineers-proposed facilities of a gravel access road (Alaska Digital Library No. 232705) and parking area (Alaska Digital Library No. 232706) in 2017 (Alaska DNR, 2017). With regard to the request for an easement to locate facilities within the INHT corridor, Alaska DNR states its decision,

> …considers the proposed level of development of the access road (a gravel road approximately 12-feet wide) and its colocation with the segment of the INHT to be appropriate for the authorized uses and a compatible use of ADL 228890-A. In consideration of the alignment of the INHT and 1,000-foot buffer in this area, a singular crossing of ADL 228890-A by 23705 would not feasibly minimize the effect to the INHT and buffer. Co-location of ADL-228890-A and 232705 more successfully preserves the characteristics of the trail than aligning the access road parallel or adjacent to the INHT by minimizing the development of lands necessary to accommodate both authorizations.

Alaska DNR's 2017 decision, together with our assessment that locating project infrastructure in the planned INHT corridor would not diminish the trail experience, indicate that it would not be necessary to re-route the planned INHT, as Kenai Hydro proposes, to meet the Kenai Area Plan guidance.

Within the 1,000-foot-wide easement corridor for the planned INHT, it is also necessary to assess effects on the eventual 100-foot-wide corridor where the Forest Service would ultimately construct the INHT. Because the route passes through State of Alaska lands and the agency's Land and Resource Management Plan does not pertain to non-NFS land within the forest boundary, the Land and Resource Management Plan does not contain specific guidelines for managing the segment of the planned INHT near the project. The Decision Notice and Finding of No Significant Impact for the Seward to Girdwood Iditarod National Historic Trail (USDA 2004) indicates INHT segments near

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[67] ADL (Alaska Digital Library No.) 228890 is the easement issued to the Forest Service for constructing the commemorative section of the INHT.

the project would be constructed using trail class 3[68] standards which are appropriate for lands with semi-primitive and roaded natural ROS classifications. Although either of these classifications may be applicable to the INHT route near the project, the Chugach LRMP shows NFS land adjacent to the Alaska DNR land, through which the easement passes, has a semi-primitive motorized ROS classification with a moderate scenic integrity objective.

Because examples of use, occupancy, and activities consistent with semi-primitive motorized classification include new roads and trails, utility systems, and administrative and permitted motorized access, constructing and operating project infrastructure near the planned INHT route would be consistent with allowable uses on NFS lands with this classification.

The environmental assessment for the Seward to Girdwood Iditarod National Historic Trail (USDA 2003) states the selected route alternative is consistent with the scenic integrity objectives contained in the Chugach Land and Resource Management Plan but an objective is not specified for the trail route. Forest Service comments characterizing the area as a predominantly unmodified setting of high scenic value are not consistent with the moderate scenic integrity objective assigned to NFS lands adjacent to the planned INHT route, which crosses Alaska DNR land. Because a moderate scenic integrity objective refers to landscapes where the valued landscape character appears slightly altered and noticeable deviations must remain visually subordinate to the landscape character being viewed, constructing and operating project infrastructure near the INHT would be consistent with this scenic integrity objective. Accordingly, project infrastructure could be located such that it would not encroach on Forest Service rights conveyed by the Alaska DNR easement.

Elements contained in Forest Service condition 21, such as consulting with the Forest Service regarding design plans, providing administrative access on the project access road, repairing project-related damage, developing a scenery management plan, and restricting public access to project facilities are duplicative of coordination and actions that would be undertaken to comply with Forest Service administrative conditions, other 4(e) conditions, and standard license articles. Consequently, the level of resource protection would likely be the same with or without implementing these measures as part of the license.

The remaining elements of Forest Service Condition 21 pertain to additional design and costs necessary to construct and maintain the INHT because of project infrastructure. Although careful planning and coordination with the Forest Service would

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[68] Definition of this scale of trail development is: Developed/Improved; obvious and continuous tread, typically with native materials; infrequent obstacles; trail structures and bridges may be common; typically, semi-primitive to roaded natural setting (USDA, 2004).

likely minimize the need to modify the design for the trail or bridge, the measure would ensure Kenai Hydro would be responsible for the incremental costs only attributed to the project.

Park Service 10(a) recommendation 1 recommends that Kenai Hydro engage agencies, interested parties, and experts to evaluate other INHT route location alternatives. Kenai Hydro believes it has adequately consulted with agencies and others and used appropriate trail design criteria to identify the best alternative trail location. Kenai Hydro documented its extensive consultation efforts to identify an alternative INHT route dating back to 2010. The Park Service has not provided a basis for concluding that its recommended consultation process differs from Kenai Hydro's past attempts to identify an alternative route. Additionally, the Park Service recommends that this consultation process have an established budget and schedule and that it be subject to Commission oversight. Implementation of the Park Service's recommended consultation process would be redundant because a mechanism for agency comment would already be included in any license, and it is unclear how this consultation process would provide additional benefit to recreation resources in the project area. Furthermore, it is not necessary to set a schedule because Kenai Hydro has already completed an extensive consultation process to identify its proposed alternative route for the INHT.

3.3.4.3 Cumulative Effects

Foreseeable future actions related to recreation resources include the Forest Service's planned construction of the commemorative segment of INHT near Grant Creek. The planned INHT route passes near proposed project infrastructure.

Our Analysis

As discussed in the preceding section and in section 3.3.5, *Aesthetic Resources*, the project infrastructure would introduce human-made features into an area where none currently exist. Although the project would cause an incremental increase of human-made structures, these structures would be minimal as compared to the nearby development of community of Moose Pass, Seward Highway, and Alaska Railroad. The project road, transmission line, powerhouse, and other infrastructure would be located and screened to minimize their visibility, but they would still likely be seen by visitors. The presence of the project infrastructure near the planned INHT route would have a minimal cumulative effect on recreation resources because visitors would notice the additional constructed features, but this would not be inconsistent with any applicable planning guidelines.

Land Use

Kenai Hydro proposes to construct project infrastructure on State of Alaska land and cross the ROWs for the ARRC railway and Seward Highway. Project operation would use Grant Lake, located on federal land managed by the Forest Service, Chugach National Forest.

Kenai Hydro's proposed measures include:

- obtaining the necessary rights from Alaska DNR, Forest Service, and ARRC to construct and operate the project;
- developing and implementing an ESCP, hazardous materials containment/fuel storage plan, and spill prevention, control and containment plan and fire prevention plan;
- adhering to BMPs during construction;
- developing and implementing an INHT re-route plan; and
- restricting public access by signing and gating/fencing the project access road near Seward Highway.

Forest Service final 4(e) condition 19 would require Kenai Hydro to develop and implement several plans. We assume the scope of Kenai Hydro's proposed plans would be similar to plans the Forest Service would require for an ESCP and fire prevention plan. The Forest Service final 4(e) condition would also require Kenai Hydro develop a construction plan. We analyze the effects of these measures relative to the project boundary, applicable land management objectives and guidance, and public access.

Project Boundary

Kenai Hydro proposes a project boundary that would follow a contour of 703 feet around Grant Lake and encompass all generation and transmission facilities and the access roads to the powerhouse and intake.

Our Analysis

In accordance with Commission regulations, the project boundary must enclose all principal project works and lands necessary for O&M of the project and other project purposes, such as recreation, shoreline control, or protection of environmental resources (18 CFR § 4.51). The proposed boundary location around Grant Lake would encompass land up to the maximum water surface elevation of the lake but it would not provide a shoreline buffer. Because the surrounding land is NFS land, a buffer would not be necessary to maintain public shoreline access. The proposed approximate 20-foot buffers around the project infrastructure, detention pond, lay down/parking areas and along the corridors for the access roads and transmission line would provide sufficient area for operating and maintaining the project infrastructure, encompass land potentially affected by the project, and is consistent with the Commission's guidance that the project boundary not extend more than 200 feet from project infrastructure. Kenai Hydro appropriately proposes to acquire rights from the affected landowners to construct and operate the project, as required by Commission regulations.

The transmission line and the access road would cross and intersect, respectively, the Seward Highway Scenic Byway in an area classified as a Corridor Development Area in the Kenai Area Plan. Kenai Hydro states the proposed project access road intersection would be about 100 yards from an existing driveway that accesses private land. At this distance, the location of the intersection would not be consistent with the guideline for allowing reasonable access from the highway to private or public lands on either side of the highway with such access points occurring at no closer than 500-foot intervals. The visual simulation (see figure 3-39 in *Aesthetic Resources*) shows a pull-out across from the access road intersection but it does not show the private driveway. During the planning and design phase of the project, Kenai Hydro should consider alternative locations for the access road to achieve the minimum distance interval. The transmission line corridor would also be consistent with the guidelines which allow utility lines to directly cross the scenic buffer.

Land and Resource Management

The proposed project would modify the landscape, increase the ease of public access to the area, and introduce periodic operating and maintenance activities in an undeveloped area of state and federally owned lands near the Seward Highway and Alaska Railroad.

Our Analysis

The ESCP, hazardous materials containment/fuel storage plan, and spill prevention, control and containment plan Kenai Hydro proposes, and as final 4(e) condition 19 would require, would minimize potential project effects of erosion, pollution, and wildland fire that could affect resources within and adjacent to the project boundary. Adhering to BMPs, as Kenai Hydro proposes, would also have these effects. Developing the plans in consultation with the Forest Service and Alaska DNR would ensure that plan content is consistent with agency land management direction and agency concerns are addressed.

Forest Service final 4(e) condition 19 would require Kenai Hydro develop a construction plan. Although the agency does not describe the intended plan's content, it is likely Kenai Hydro's iterative proposed process for preparing and securing agency design approval would provide sufficient information about project construction. However, a separate plan that synthesizes schedule, construction locations and activities, and access restrictions would allow the Forest Service to determine whether any conflicting uses may occur. Developing this plan in consultation with the Forest Service would also allow the agency to review the adequacy of measures Kenai Hydro would implement to limit public access during construction. Implementing this plan would provide for public safety during construction by identifying locations when and where public use should be excluded and ensure the Forest Service has adequate information to continue managing public use of the NFS lands.

Although Kenai Hydro's proposal to re-route the planned INHT would meet the guidance and objectives of the Kenai Area Plan, this measure would not be necessary to achieve consistency with the plan or avoid infringing on the rights conveyed to the Forest Service for constructing a commemorative route for the INHT on State of Alaska land.

Analysis of the project relative to the INHT is provided in the environmental effects section of recreation resources.

Public Access

The project access road would create an additional cleared route of access to Grant Lake which could attract off-highway vehicle use and increase visitor use at Grant Lake. Kenai Hydro proposes to gate and fence the access road to only allow access for operating and maintaining the project.

Our Analysis

Suitable uses for land in the affected management units of State of Alaska lands include recreation uses, hunting, fishing or boating access sites, trail corridors, or greenbelts along bodies of water or roadways (Alaska DNR, 2001). This scope of intended uses indicates the project should include measures that support recreational access. Kenai Hydro's proposal to gate and fence the access road does not appear consistent with this intent; however, this measure responds to concerns about unauthorized off-highway vehicle use on the access road and adjacent land which has potential effects such as erosion, vegetation damage, pollution, and noise. Non-motorized use on the access road would have minimal, if any, effects and would be consistent with the intent to manage these lands, as expressed in the Kenai Area Plan, for recreation uses. Non-motorized uses of the access road would also not impede Kenai Hydro's access for project O&M. The access road would provide an additional route for visitors to access Grant Lake, thereby improving recreational access for dispersed recreation opportunities and potentially increasing use and sanitation needs. If non-motorized access were allowed, concerns about public safety associated with parking along Seward Highway or the ARRC railway could be addressed by installing the proposed gate at a distance from these ROWs and providing a parking area with a single-unit vault restroom near the gate. Accordingly, allowing year-round non-motorized use of the road for access to Grant Lake and constructing a parking area to support this use would provide recreation benefits for project visitors.

3.3.5 Aesthetic Resources

3.3.5.1 Affected Environment

The area where the project is located is a highly distinctive, highly visible, and highly valued area of the Kenai Peninsula. The area near the project is characterized by mountains with serrated ridgelines, waterbodies with turquoise waters, and clear streams that provide marked contrast with the colors and patterns of the forest (figure 3-30). Vegetation consists primarily of a mixed deciduous/coniferous forest that leads to high altitude and colorful alpine vegetation that contrasts with geological features and scree slopes. The community of Moose Pass is a distinctive, small, nearby community with a low level of development that is in keeping with the landscape. Driveways leading to the few residences near Moose Pass adjoin the Seward Highway near the project.

Note: Upper and Lower Trail Lakes (Unit 1) in the foreground and Kenai Lake in the distance at the top of the photograph. Grant Lake is to the left and out of view.

Figure 3-30. View of the project area, looking south (Source: Kenai Hydro, 2018a, as modified by staff).

Views of the area are limited to those using the Seward Highway and Alaska Railroad; residents of Moose Pass; and those who travel by snowmachine, skis, and snowshoes and on foot or horseback. Residents, recreationists, and aircraft passengers are the primary viewers of the project area. The project area can be viewed from all distance zones; however, the topography of the area limits distance zones to the foreground for most viewers. Kenai Hydro established three landscape units to evaluate aesthetic resources for the project (figure 3-31)—Trails Lake Valley (Unit 1), Grant Lake West (Unit 2), and Grant Lake East (Unit 3). All three units have distinctive landscapes[69] with a high level of scenic integrity that is mainly undisturbed. The only evidence of

[69] Areas where landforms, vegetative patterns, water characteristics, and cultural features combine to provide unusual, unique, or outstanding scenic quality. These landscapes have strong positive attributes of variety, unity, vividness, mystery, intactness, order, harmony, uniqueness, pattern, and balance.

human presence is associated with the Seward Highway and the ARRC corridor, including the community of Moose Pass. Although these elements provide evidence of human presence, the roadway, railway, and the community of Moose Pass are within scale and context of the setting.

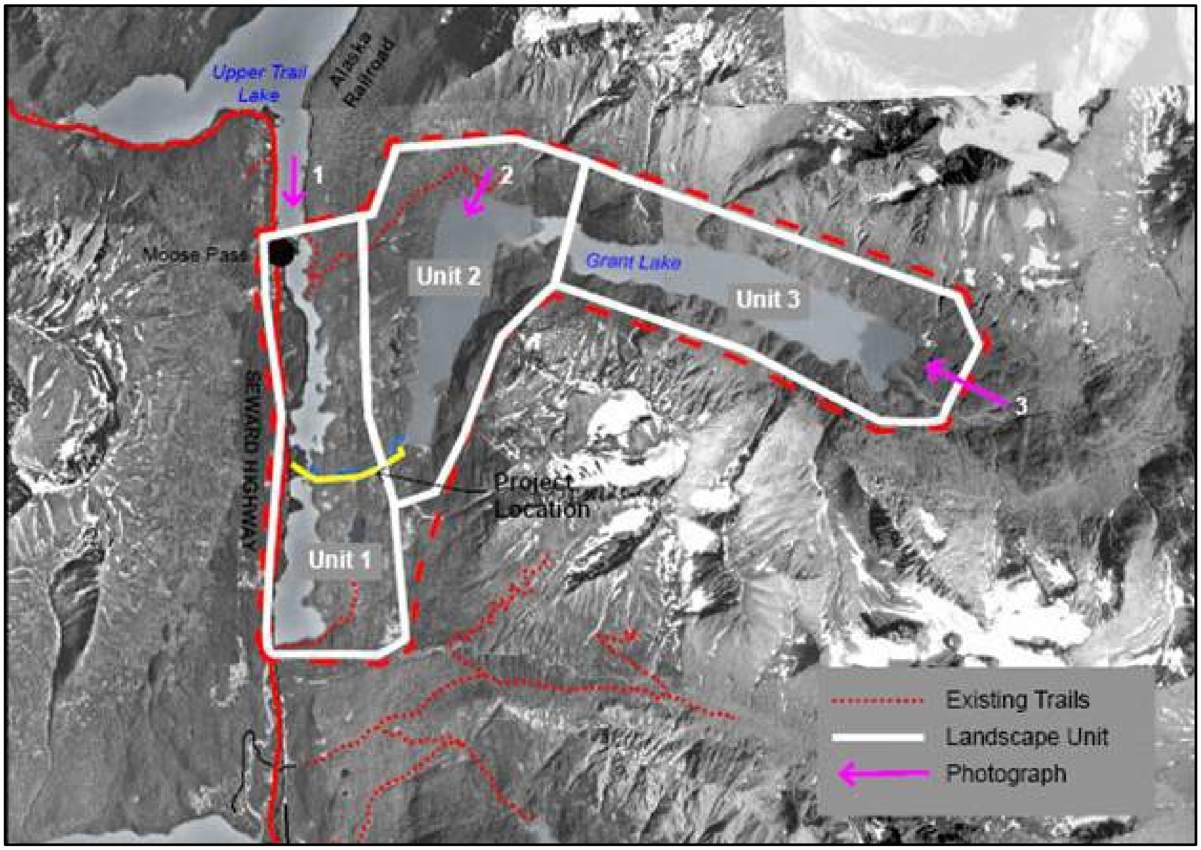

Figure 3-31. Landscape units for analyzing aesthetic resources (Source: Kenai Hydro, 2018a, as modified by staff).

Except for the land at the east end of Grant Lake, NFS lands adjacent to the project have a moderate scenic integrity objective that refers to landscapes where the valued landscape character appears slightly altered and noticeable deviations must remain visually subordinate to the landscape character being viewed. The land at the east end of Grant Lake has a high scenic integrity object that refers to landscapes where the valued landscape character is intact with only minute, if any, deviations, and the existing landscape character and sense of place is expressed at the highest possible level (figure 3-32).

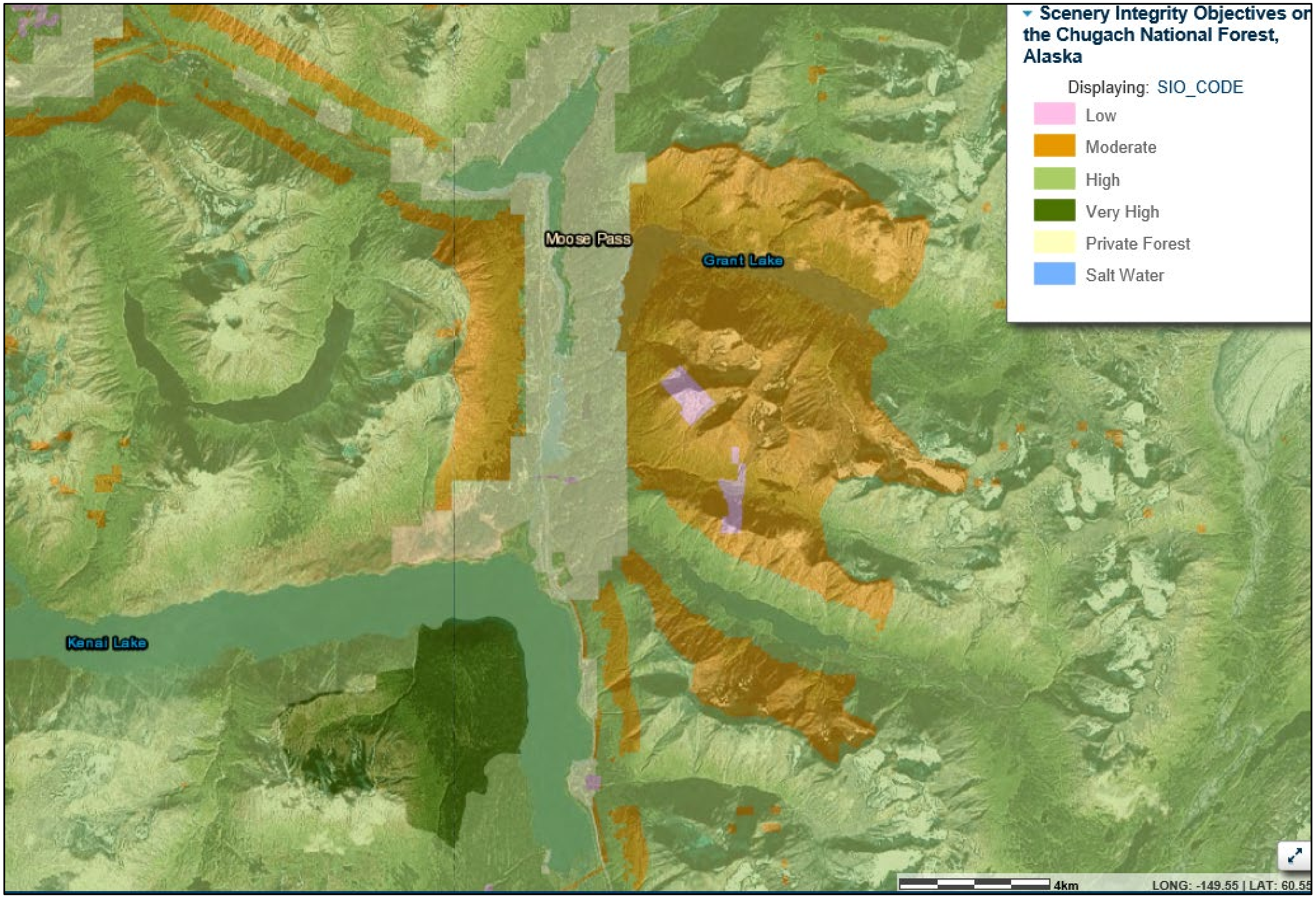

Figure 3-32. Scenic integrity objectives for National Forest System land in the vicinity of the project (Source: Databasin, 2018).

3.3.5.2 Environmental Effects

Kenai Hydro would construct buildings and other infrastructure and equipment on land with no existing development, except for the roads and buildings located along Seward Highway. The access road would intersect and the transmission line would cross the Seward Highway. The project would construct an intake extending above the surface of Grant Lake and fluctuate the water level in the lake. O&M would require periodic vehicular access in the area.

Kenai Hydro proposes to design the project to provide separation between project facilities and Grant Creek, using colors and textures that are complementary to the landscape. Kenai Hydro would stage construction so that equipment was kept onsite and schedule most work to occur during the summer. Kenai Hydro also proposes to re-route the INHT away from the project.

The Park Service recommends screening, to the extent possible, all project facilities, including the roads, buildings, transmission lines, detention pond, and staging areas, using existing and created landforms and vegetation, and building exterior paint colors that blend with the landscape. The agency also recommends using directional security lights only in the immediate vicinity of project facilities using the lowest effective illumination and temperatures.

Forest Service final 4(e) condition 19 requires Kenai Hydro develop a scenery management plan.

Construction

The project would be constructed during an 18-month period when Kenai Hydro would remove vegetation; grade soil; and construct the access roads, bridge, and project infrastructure.

Our Analysis

Construction would increase traffic and noise, especially during access road construction and as construction vehicles arrive and leave the project at the intersection of the access road and the Seward Highway. Increased traffic may affect Seward Highway travelers in terms of congestion and possible delays. Construction noise would quickly dissipate with distance from construction activities because of topography and vegetation resulting in minimal additional noise in the area. Kenai Hydro's proposal to stage equipment away from key viewpoints would limit views of construction equipment. The few visitors who attempt the difficult access around Grant Lake and flightseers may view construction activity, the coffer dam, laydown areas, and staged materials located at the southwest shore of Grant Lake during the construction period. Scheduling construction during the summer, as Kenai Hydro proposes, would minimize the need for lighting work sites, which would minimize the effects of stray lighting in the area. These effects would be minimal considering their localized nature, they would only occur during two summer seasons, and a low number of potentially affected residents, highway users, and recreationists would be affected.

Operation and Maintenance

Maintenance Access

After construction, Kenai Hydro would need vehicular access to all project infrastructure to inspect and maintain the facilities throughout the term of the license.

Our Analysis

Views of vehicles and personnel associated with monthly maintenance activities at the powerhouse, penstock, detention pond, and intake would have minor effects on visual resources. Except for winter snowmachine use, which is allowed on Alaska DNR-managed lands where the road would be located, Kenai Hydro would prohibit motorized vehicle access, which would limit viewers in the area. INHT users would occasionally notice vehicles using the access road where the INHT, as planned or proposed to be re-routed, would cross the access road. INHT users would also occasionally notice vegetation removal and trimming to maintain the transmission line corridor. Crossing the INHT, as planned or re-routed, at a right angle would minimize the extent of these short-duration effects.

Seward Highway travelers would view vegetation removal and trimming associated with maintaining the transmission line and access road. These activities and resulting view of an unvegetated corridor through the forest canopy would appear similar to existing activities to operate and maintain utility corridors and driveways near Moose Pass. Although the cleared corridor would be visible year-round, active maintenance activity would probably only occur, at most, every year or two and last for only few days. At highway speed, travelers would only briefly view the corridor and associated maintenance activities on the order of seconds. Because similar maintenance activities are not uncommon in the area and would have a short duration, the incremental increase would be hardly noticeable to Seward Highway travelers.

Water Surface Fluctuation

The project would draw water from Grant Lake for power generation, resulting in lower reservoir elevations during late fall, winter and spring, as compared to exiting conditions.

Our Analysis

Currently, Grant Lake fluctuates about 6 to 8 feet over the course of a year and may fluctuate as much as 11 feet. The project may cause Grant Lake to fluctuate up to about 13 feet. Project operation would expose a greater swath of unvegetated shoreline than currently exists. The additional 5 to 7 vertical feet (approximate) of shoreline exposed from the drawdown would probably be unnoticeable because it would typically occur from fall through late winter when snow typically covers the ground (figure 3-33).

Even if the shoreline is not snow-covered, the view of the shoreline is eclipsed by views of the adjacent landscape (figures 3-34 through 3-38), so the additional exposed shoreline would not appear different from what currently exists. Flightseers over Grant Lake would likely be too far above the project to detect the small difference in water surface fluctuation.

Although Kenai Hydro proposes measures that would address most concerns about visual resources, if Kenai Hydro were to develop and implement a scenery management plan, as specified in Forest Service final 4(e) condition 19, concerns about constructing and operating the project in a way that minimizes effects on visual resources would be addressed. Developing this plan in coordination with the Forest Service, Alaska DNR, and the Park Service would ensure visual resources are adequately protected on state and federal land associated with the project by specifying processes for agency coordination for maintenance activities and monitoring over the license term. Incorporating the Park Service's recommendation for security lighting in a scenery management plan would have an additional effect of limiting stray lighting in the area.

Project Access Road and Infrastructure

The project would introduce constructed features (i.e., access road, transmission line, powerhouse, penstock, detention pond, and intake tower) to an existing landscape that has a natural appearance.

Project Access Road and Transmission Line

The powerhouse access road would be a 24-foot-wide, two-lane, gravel surfaced road about 1 mile long. The road would cross Trail Lake Narrows with a new, single-span bridge. The 1.1-mile-long, 115-kV transmission line would be mostly co-located within the access road corridor, which would be about 150-feet wide. Kenai Hydro would use Douglas fir wood poles, or other type approved and rated for the application, spaced about 250-feet apart to support the 1.1-mile, three-phase, 115-kV transmission line. Kenai Hydro would mount the conductors on horizontal supports and mount a static line with an embedded fiber optic cable above the conductors. The poles would be about 59-feet tall, and conductors would have a minimum 30-foot ground clearance. The access road extending from the powerhouse access road about 0.9 mile to the intake would be 16-feet wide, single-lane, and have a graveled surface; the corridor would be 100-feet wide.

Figure 3-33. Simulations showing changes in water surface elevations associated with the project operation in from October through April (Source: Kenai Hydro, 2017a, as modified by staff).

Figure 3-34. Simulations showing changes in water surface elevations associated with the project operation in May (Source: Kenai Hydro, 2017a, as modified by staff).

Figure 3-35. Simulations showing changes in water surface elevations associated with the project operation in June (Source: Kenai Hydro, 2017a, as modified by staff).

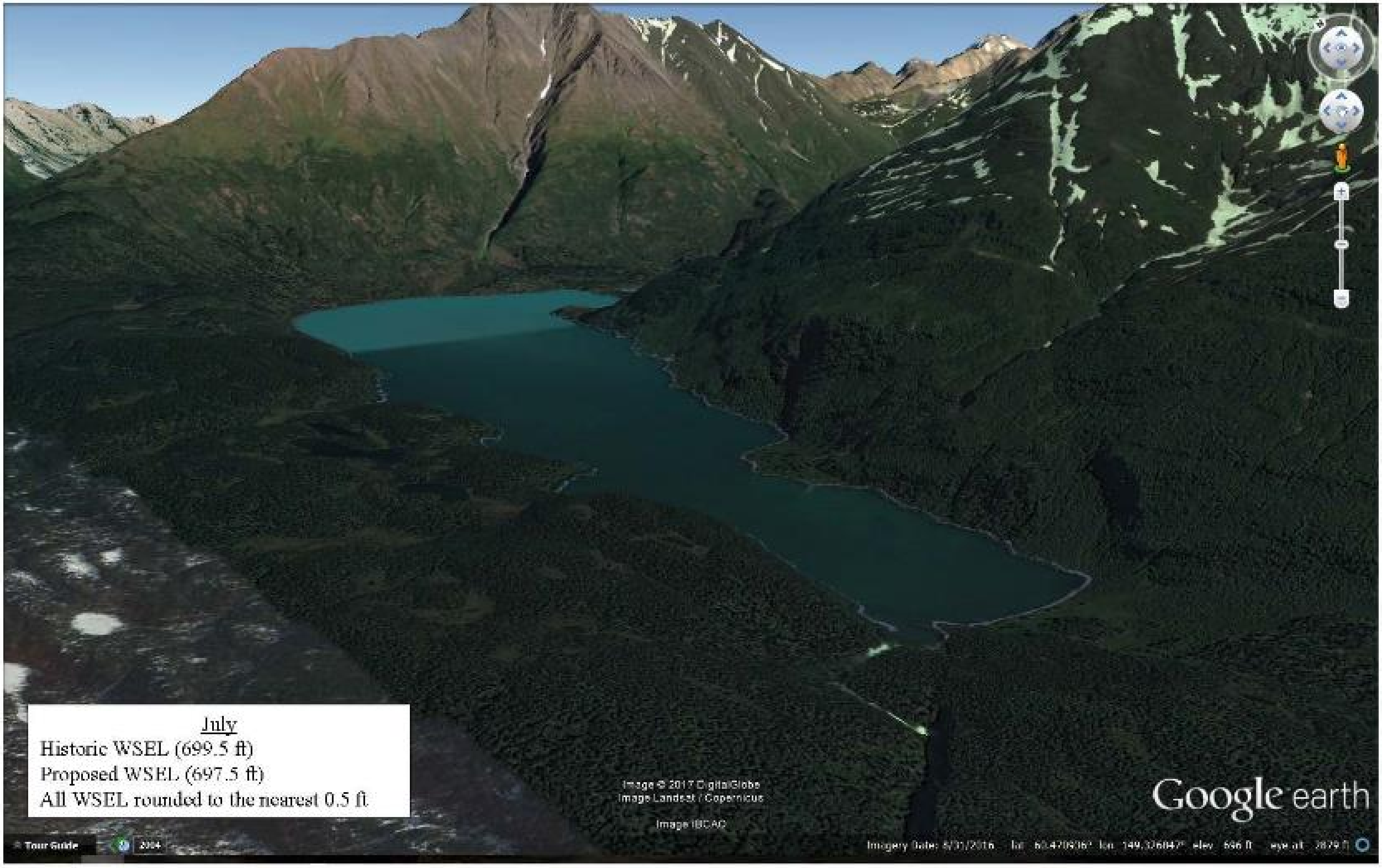

Figure 3-36. Simulations showing changes in water surface elevations associated with the project operation in July (Source: Kenai Hydro, 2017a, as modified by staff).

Figure 3-37. Simulations showing changes in water surface elevations associated with the project operation in August (Source: Kenai Hydro, 2017a, as modified by staff).

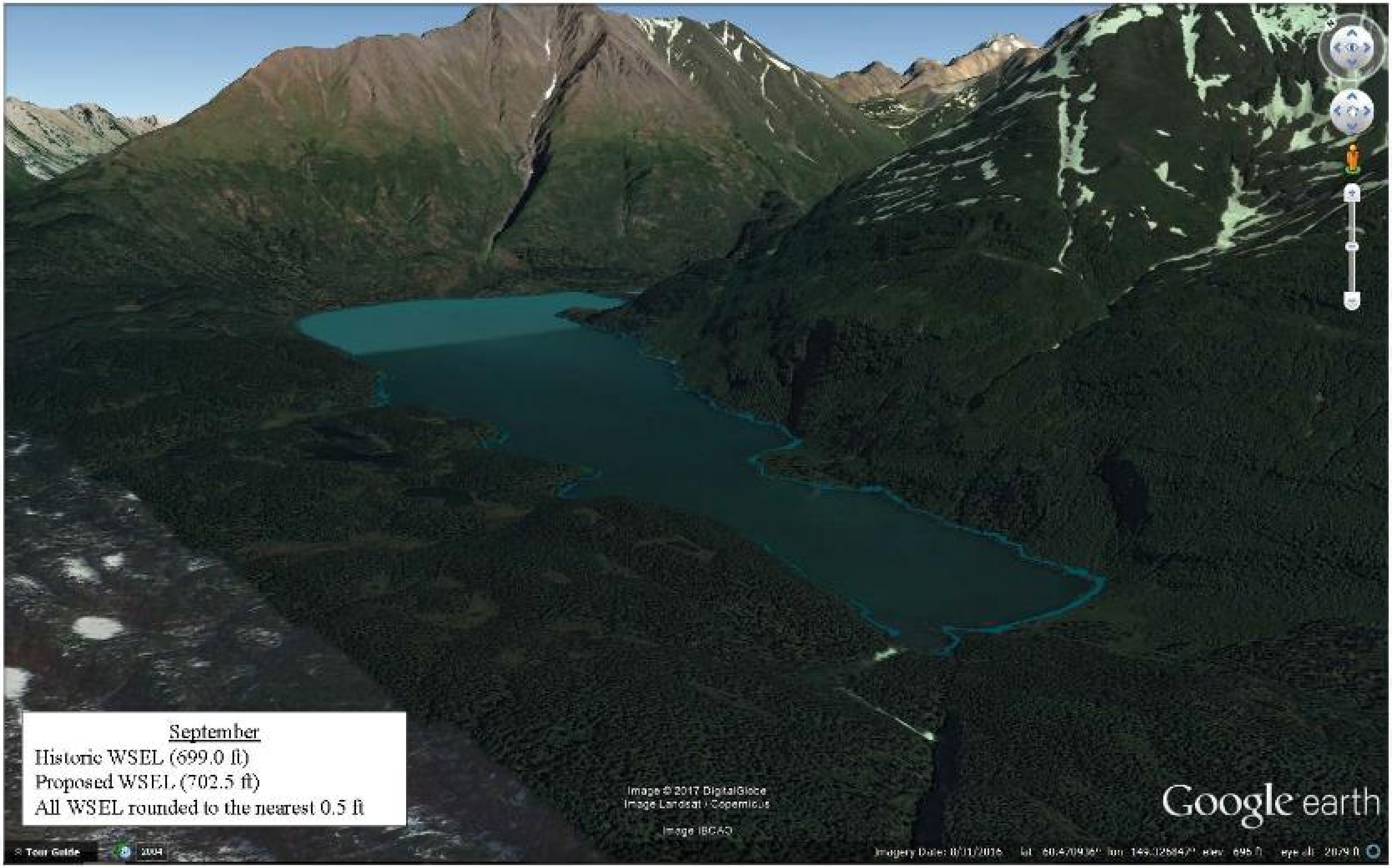

Figure 3-38. Simulations showing changes in water surface elevations associated with the project operation in September (Source: Kenai Hydro, 2017a, as modified by staff).

Our Analysis

The powerhouse access road and transmission line would create a linear corridor void of tall forest vegetation through the 150-foot scenic buffer along the Seward Highway; other project infrastructure would not be visible from the Seward Highway (figure 3-39). The changed appearance would be mostly unnoticed by Seward Highway travelers because the corridors would be similar to areas cleared for other driveways intersecting the highway; most visitors drive past the proposed corridors at about 50 miles per hour generating a view that lasts from about 4 to 15 seconds. Locating the transmission line to cross and the access road to intersect the Seward Highway at right angles, as Kenai Hydro proposes, would reduce the extent of this minimal effect.

Figure 3-39. Existing view (left) and visual simulation (right) of the proposed project access road intersecting the Seward Highway (Source: Kenai Hydro, 2018a, as modified by staff).

Future visitors to the area would also encounter the 150-foot-wide access road and transmission line corridor at the proposed re-routed INHT crossing (figure 3-40). This corridor would present a foreground view that contrasts with the surrounding closed forest canopy; however, topography and dense, tall vegetation adjacent to the corridor would limit the distance at which the road and transmission line would be visible. The taller vegetation adjacent to the corridor would obscure middleground and background views of the corridor except as viewed from the air. The appearance of the access road and transmission line would be somewhat similar to other constructed elements such as the INHT Bridge or nearby existing features of the Seward Highway, railway, and community of Moose Pass. Constructing the access road corridor to cross the re-routed INHT at a right angle, as Kenai Hydro proposes, would minimize the effect of this contrasting view. Although the project would alter foreground views of landscape, the Alaska DNR-managed lands at this location are not specifically managed for their scenic value, and the development would have an appearance that is consistent with the intended management.

Figure 3-40. Existing view (left) and visual simulation (right) of the proposed project access road crossing the proposed re-route of the INHT (Source: Kenai Hydro, 2018a, as modified by staff).

These same visual effects associated with the access road and transmission line corridor would occur if the INHT were constructed in the planned corridor and would occur about 0.25 mile east of where the proposed re-routed INHT would cross the access road. Additional visual effects at the planned INHT route could be caused by project infrastructure located near the trail. Kenai Hydro's visual simulations show the project features would be mostly screened by topography and the dense forest canopy and vegetative cover in the area (figures 3-41 through 3-43).[70] Implementing Kenai Hydro's proposal to design and blend infrastructure with the surrounding area using appropriate colors and textures would further minimize project appearance. Additionally, insulating the powerhouse, as proposed, would limit the extent of noise to the area immediately near the powerhouse. Forest cover and topography would quickly absorb any noise audible from the powerhouse. Kenai Hydro's infrastructure design together with carefully locating the trail within the easement corridor would provide a visual and sound buffer between the INHT and adjacent project infrastructure and operation.

[70] Despite the lack of consideration in the visual simulations for necessary vegetation clearance for proper maintenance near infrastructure, we expect the infrastructure would still be sufficiently screened. We expect these views would still only slightly alter foreground views and infrastructure would not have an appearance that is inconsistent with the existing management goals.

Figure 3-41. Visual simulation of the proposed project access road crossing (lower right corner) the planned INHT route (Source: Kenai Hydro, 2017a, as modified by staff).

Figure 3-42. Visual simulation of the proposed powerhouse from planned INHT route (view looking west from the planned INHT route) (Source: Kenai Hydro, 2017a, as modified by staff).

Figure 3-43. Visual simulation of the proposed powerhouse (on right side of figure) from planned INHT route (view looking south toward the planned trail bridge crossing Grant Creek) (Source: Kenai Hydro, 2017a, as modified by staff).

Visitors to the project area would likely have screened or partial views of project infrastructure and facilities. Although the project would alter foreground views of landscape, Alaska DNR does not specifically manage lands at this location for their scenic value and the development would not have an appearance that is inconsistent with the existing management goals.

Visitors using the intake access road to travel to Grant Lake would also see the intake tower extending about 8 to 20 feet above the water surface. Viewing project infrastructure may contrast with an expectation of viewing an undeveloped landscape near Grant Lake. However, this changed appearance would be consistent with designated moderate scenic integrity objective, applicable to NFS lands from which visitors could view the project, because the view of the intake tower would only slightly alter the landscape and would be visually subordinate to the landscape character being viewed.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the National Historic Preservation Act

Section 106 of the NHPA as amended and its implementing regulations found at 36 CFR 800 require the Commission, as lead federal agency, and the cooperating agencies to consider the effect of their undertakings on any historic properties and allow the Advisory Council on Historic Preservation (Advisory Council) an opportunity to comment.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In this document, the term "cultural resources" is used to include properties that have not been evaluated for eligibility for listing in the National Register. Historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4. For example, dilapidated structures or heavily disturbed archaeological sites may not have enough contextual integrity to be considered eligible. TCPs are a type of historic property eligible for the National Register because of their association with cultural practices or beliefs of a living community that: (1) are rooted in that community's history, or (2) are important in maintaining the continuing cultural identity of the community (Parker and King, 1998). In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. However, properties that are less than 50 years old may be considered eligible for listing in the National Register if they have achieved significance within the past 50 years and are of exceptional importance or if they are a contributing part of a National Register-eligible district.

Section 106 also requires that the Commission seek concurrence with the Alaska SHPO on any finding involving effects or no effects on historic properties and allow the Advisory Council an opportunity to comment. If Native organizations' properties have been identified, section 106 also requires that the Commission consult with interested Native organization tribes that might attach religious or cultural significance to such properties (i.e., TCPs).

Kenai Hydro provided the Commission with cultural resources information, analyses, and recommendations, in accordance with the Advisory Council's regulations for implementing section 106 at 36 CFR 800.2(a)(3) and the Commission's regulation at 18 CFR 380(f). The federal land managing agencies have obligations regarding cultural resources under other federal laws and regulations, including the Federal Land Policy and Management Act, the Antiquities Act of 1906, section 110 of the NHPA, the Archaeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1970, and the Native American Graves Protection and Repatriation Act.

Construction, maintenance, and operation of the proposed project could adversely affect historic properties (i.e., cultural resources listed or eligible for listing in the National Register). These historic properties could include prehistoric or historic archaeological sites, districts, buildings, structures, and objects, as well as locations of traditional value to Native organizations. Direct effects could include destruction or damage to all, or a portion, of a historic property. Indirect effects could include the introduction of visual, atmospheric, or audible elements that affect the setting or character of a historic property.

If existing or potential adverse effects on historic properties are identified at the proposed project, Kenai Hydro must develop an HPMP that provides measures to avoid, reduce, or mitigate the effects. During development of the HPMP, Kenai Hydro should consult with the Commission, Advisory Council, Alaska SHPO, Bureau of Land Management, and Native organizations to obtain their views on the management of historic properties. In most cases, the HPMP would be implemented by execution of a PA that would be signed by the Commission, the Advisory Council (if it chooses to participate), the Alaska SHPO, the Forest Service, and other consulting parties as appropriate.

On August 14, 2009, the Commission sent letters initiating consultation with federally recognized Native American tribes and tribal organizations who are indigenous to the area near the proposed project. Nine tribal organizations received letters from the Commission—the Native Village of Eklutna, Ninilchik Traditional Council, Kenaitze Indian Tribe, Salamat of Native Association, Inc., Kenai Natives Association, Inc., Cook Inlet Region, Inc., Chugach Alaska Corporation, Chenega Corporation, and Qutekcak Native Tribe. These letters asked about the organizations' interest in the proposed project and invited the tribes to meet with Commission staff to discuss their participation. No responses were received.

In its September 16, 2009, Notice of Intent to File License Application, Filing of Pre-application Document, and Approving Use of the Traditional Licensing Process, the Commission designated Kenai Hydro as the Commission's non-federal representative for carrying out day-to-day consultation with regard to the project pursuant to section 106 of the NHPA; however, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the project on any historic property. Kenai Hydro also established a cultural resources working group for the proposed project that included eight of the nine tribal organizations identified above and the Forest Service, Alaska SHPO, City of Seward, Resurrection Bay Conservation Alliance, and the Commission. Working group meetings were held on June 24, 2010, April 3, 2013, and March 21, 2014. A Cultural Resources Working Group site visit was also conducted on July 15, 2015, to review a possible route for the commemorative INHT. Additionally, by letter filed on June 4, 2014, Commission staff included Mr. Mark Luttrell as a cultural resources consulting party for the project (letter from T. Konnert, Chief, West Branch Division of Hydropower Licensing, FERC, Washington D.C., to M. Luttrell, Seward, AK, June 4, 2014).

Kenai Hydro provided the Commission with documentation of regular consultation with group participants regarding study status, results, and the development of the HPMP for the project.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property within a project's APE could be affected by the issuance of an original license. The APE is determined in consultation with the Alaska SHPO and is defined as "the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties," including TCPs (36 CFR 800.16[d]).

In its application, Kenai Hydro defines the APE for the proposed project as:

> an area 100 feet beyond the perimeter of all Project features, such as the location that would be impacted by powerhouse construction, areas along Grant Creek that may experience increased use, and corridors for road access and transmission line alignments. The proposed APE also includes an area around Grant Lake extending from the current waterline to 30 feet above the proposed maximum lake elevation, or up to 733 feet NAVD 88. Possible archaeological resources that could currently be under water, but may be exposed in the future due to drawdown or decreased lake level, would be addressed in an HPMP. The APE was expanded in 2014 to include a proposed re-alignment for the planned INHT. The APE considered for traditional cultural properties (TCPs) was larger than the APE for archaeological and historical sites. As such it included the general project area surrounding Grant Lake and Grant Creek, Upper and Lower Trail Lakes, and the Seward Highway corridor around Moose Pass.

In its amended final license application, Kenai Hydro states that the Alaska SHPO concurred with the definition of the APE in a March 11, 2015, letter. This letter has not been filed with the Commission.

Cultural History Overview

Archival research conducted by Kenai Hydro provided background information relevant to understanding prehistoric, ethnographic, and historic lifeways within and adjacent to the project area. This information is summarized below (as provided in Meitl et al., 2015).

Prehistoric and Ethnographic Context

The earliest known archaeological sites documented near proposed project were recorded along the upper Kenai River at Beluga Point. Artifacts recovered from these sites reflect core and blade technology characteristic of the early Holocene. Other artifacts recovered in this area date to between 4,500 and 3,500 years before present.

These two early occupations are separated by a distinct time gap, but people known as the "Riverine Kachemak" (also known as Pacific Eskimos) exploited the salmon fishery in the interior of the Kenai Peninsula and along the Susitna River between 3,000 and 1,000 before present. Sites dating to about 1,850 to 1,750 before present that contain semi-subterranean house depressions associated with the Riverine Kachemak have been documented. It is believed that these people were related to groups residing in the vicinity of Cook Inlet and were also connected to people in the Bristol Bay area.

The ethnographic Dena'ina displaced the Kachemak about 1,000 years ago. Archaeological evidence of these people is found along the banks of the Kenai River and throughout the region. Like the Kachemak, the Dena'ina relied on salmon, but they also hunted beluga whales and seals and large terrestrial game such as moose, caribou, mountain sheep and goats, and bears. Birds taken included grouse, ducks, ptarmigan, eagles, and owls. Other dietary staples consisted of eggs, berries, roots, and seaweed. Dena'ina residential structures were similar to those of the Kachemak. Winter houses were semi-subterranean, rectangular, and were constructed of logs with a roof of sod, moss, and earth. Rooms within the house included a bathhouse and sleeping rooms. Structures occupied during the warmer summer months were less formative, consisting of poles lashed together and roofed with skins. These were also used as smoke houses to dry fish. Temporary structures and lean-tos were similar to the summer houses. Food caches consisted of elevated houses and moss-lined pits used to store fish. While the last traditional Dena'ina village appears to have been abandoned by 1905, some Dena'ina continued to live in houses along the Kenai River in 1910.

Historic Context

The earliest-known exploration of lands near the proposed project were conducted between 1848 and 1850 by Petr Doroshin, a Russian gold mining engineer. However, because of difficulties transporting materials, Doroshin's interest in mining in the interior of the Kenai Peninsula diminished. After the state of Alaska was sold to the United States, American trappers frequently crossed the peninsula, but it was further exploration for gold that resulted in increased settlement of the region. While several groups and individuals sought gold with limited success along the Kenai River in 1869 and 1870, like Doroshin, they too found these endeavors difficult to finance. Joseph M. Cooper was one such prospector, and he established a trading post in the early 1880s at what is now known as Cooper Landing. The first mining claims in the upper Kenai River area were filed in 1895. Other claims were filed in 1896 and 1897. In 1898, a hydraulic plant was established on Cooper Creek and another on Kenai Lake. The most profitable claims were along Cooper and Stetson Creeks although prospecting continued on the Kenai River. After the discovery of gold in the Klondike, many miners left the Cook Inlet and Kenai River area. However, trouble reaching the Klondike resulted in the return of many of these miners. Between 1900 and 1941, and after the main gold rush, a number of claims were filed at Grant Lake. J.F. Case and E.E. Whitney established the original Case Mine in 1911. Case Mine activity occurred at various locations along the northern shore of the lake, and production at the mine was reported until 1949. Al Solars established several four quartz claims (the Solars prospect) on the southern shore of Lake Grant. However, no development or production was reported for the claims. For the most part, mining in Alaska ended in 1942 when the World War II War Production Board closed all mines that employed more than five men. When the closure ended in 1945, mining costs were high, and the price of gold was low; however, Case Mine remained in operation. Two of the claims worked by Case were owned by the Grant Lake Mining Company. In 1983, it was reported that Grant Lake Mine was one of the largest gold producers on the Kenai Peninsula and that Case Mine also saw success. This mine remains in production and is operated by White Rock Mining.

Trails in the Kenai River area that were established by the Dena'ina were later used by both Russian and American explorers. During the gold rush, these trails were not sufficient to carry miners, materials, and mail, and by 1902, the Alaska Central Railroad surveyed a route for a railroad. Construction began in 1904, and the town of Seward was established as the end of the train route. By 1907, the rail system extended 52 miles. In 1909, the project was reorganized under a new company, the Alaska Northern Railway. Only 20 additional miles to Kern Creek had been constructed when the Alaska Northern Railway went bankrupt in 1910. In 1912, Congress established the Alaska Railway Commission. The Commission recommended that a government railroad be constructed from Kern Creek to Kuskokwim Valley. The Alaska Railway Act was passed in 1914, and a route for the railway between Seward and Anchorage was surveyed and constructed.

The Alaska Road Commission was created in 1905, and in 1908, the Seward to Nome Mail Trail was constructed. This trail, later called the Iditarod Trail, connected settlements, trading posts, and mines. A wagon road was also constructed between Moos Pass and Johnson Pass. Following the establishment of the Chugach National Forest in 1909, the Forest Service and the Alaska Road Commission shared responsibility for many of the roads until 1920 when Alaska became a state. The Bureau of Public Roads then managed the roads. The Seward Highway was constructed between 1948 and 1951 and was paved in 1954.

Cultural Resources Studies

To determine the extent of previous studies and to identify previously recorded cultural resource sites in the study area, Kenai Hydro reviewed existing Alaska Heritage Resources Survey (AHRS) and Forest Service records. Additional information was also sought from individuals who could have knowledge of historic properties near the proposed project. The record search indicated that nine cultural resource sites had been previously recorded within the project APE. These resources include a portion of the Alaska Railroad (SEW-00029), three trails (Seward-Moose Pass Trail [SEW-00285], Grant Lake Trail [SEW-01455]), Grant Lake Road [SEW-01454]), Solars Sawmill (SEW-00285), Case Mine (SEW-00659), two cabins (SEW-00768, SEW-00823), and a Grant Lake dock site (SEW-01144).

Following completion of the record searches, Kenai Hydro conducted intensive archaeological field surveys within the project APE between 2013 and 2014. Sensitive areas within the APE were identified using criteria provided in a Forest Service sensitivity model outlined within an appendix to a Forest Service PA (Chugach National Forest, 2002). These criteria include, but are not limited to, an area's proximity to trails, mines, and water bodies, degree of slope, and vegetation type. Most of the project APE was determined to be of high potential for the presence of cultural resources. The purpose of the surveys was to document new, unrecorded archaeological resources and, where necessary, to evaluate the National Register eligibility of previously recorded resources. The field surveys consisted of a team of archaeologists walking parallel transects within the APE and conducting intuitive subsurface testing to identify the presence or absence of subsurface archaeological deposits and/or features.

The potential National Register eligibility of each identified cultural resource site was based on the criteria specified in 36 CFR 800.4 and the guidance provided in National Register Bulletin 15 (Park Service, 1997) and National Register Bulletin 36 (Park Service, 1993). These criteria are:

- **Criterion A.** Association with events that have made a significant contribution to the broad patterns of our history;
- **Criterion B.** Association with the lives of persons significant in our past;
- **Criterion C.** [Resources] that embody the distinctive characteristics of a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- **Criterion D.** [Resources] that have yielded or may be likely to yield, information important in prehistory or history.

The research potential of each site was also assessed based on site condition, integrity, location, and other factors.

In its Cultural Resources Study Plan, Kenai Hydro also indicated that a Subsistence and Cultural Use Study would be implemented to address potential TCPs that could be affected by the proposed project. This study would be coordinated with other resource studies and would require consultation with identified tribal organizations and agencies. Potential project-related effects on identified areas would also be assessed.

Results of Cultural Resource Studies

The results of the cultural resources studies were presented in *Grant Lake Hydroelectric Project (FERC No. 13212) Cultural Resources Study Final Report* (Meitl et al., 2015) filed with the Commission on February 24, 2015. During the survey, 57 locations containing evidence of human activity were recorded. However, only 24 of these locations (including the 9 previously recorded locations) were considered to be potential historic properties, assigned AHRS numbers, and evaluated for their National Register eligibility. Eight of the 24 sites were determined to be eligible for listing in the National Register (including 1 historic district and 3 sites that contribute to the district's eligibility), 15 sites were determined to be ineligible for listing on the National Register, and 1 site remains unevaluated. Additionally, while the INHT, which is eligible for listing on the National Register, passes near the project APE, it is not located within the APE itself. However, when constructed, a portion of the commemorative INHT would be located in the APE. This new commemorative portion of the INHT has been determined to be ineligible for listing on the National Register. Table 3-30 summarizes all resources within the APE, including the pending commemorative INHT. No potential TCPs were identified during the cultural resources study.

Table 3-30. Eligible cultural resources within the project APE (Source: Kenai Hydro, 2018a).

AHRS Number	Site Description	National Register Eligibility
SEW-00029	Alaska Railroad	Eligible (criterion A)
SEW-00148	Seward-Moose Pass Trail	Eligible; nominated
SEW-00285	Solars Sawmill	Eligible (criterion D)
SEW-00659	Case Mine District (includes Case Mine Camp, Lakeside Trail, mill site, mine workings)	Eligible (criteria A and D)
SEW-00768	Grant Lake cabin	Ineligible
SEW-00822	Grant Lake Prospect	Ineligible
SEW-00823	North Grant Lake Cabin	Eligible as contributing to Case Mine District
SEW-01144	Dock site at Grant Lake	Ineligible
SEW-01454	Grant Lake Road to Case Mine	Eligible as contributing to Case Mine District
SEW-01455	Grant Lake Trail	Eligible (criterion A)
SEW-01515	Trail	Ineligible
SEW-01516	Trail	Ineligible
SEW-01517	Four depressions	Ineligible
SEW-01518	Wire cables	Ineligible
SEW-01519	Prospect pit	Ineligible
SEW-01520	Cable crossing on Grant Creek	Ineligible

AHRS Number	Site Description	National Register Eligibility
SEW-01521	Sawmill-Upper Trail Lake Trail	Undetermined (additional information needed)
SEW-01522	Case Mine prospect pits	Eligible as contributing to Case Mine District
SEW-01523	Prospect pit	Ineligible
SEW-01524	Five depressions	Ineligible
SEW-01525	Depression	Ineligible
SEW-01526	Depression	Ineligible
SEW-01527	Scatter of historic artifacts	Ineligible
SEW-01528	Pulley and cable	Ineligible
--	Commemorative INHT (unconstructed)	Ineligible

The Case Mine District (SEW-00659) consists of several discrete activity areas that include a mill site, camp area, the Lakeside Trail (tractor shed area), mine workings, and other areas. Three additional elements include Grant Lake Road to Case Mine (SEW-01454), the Case Mine prospect pits (SEW-01522), and the North Grant Lake Cabin (SEW-00823, also known as the Case Mine Dynamite Shack). These three resources are associated with the mine and contribute to the Case Mine District, but are distinct from the mine itself and therefore received individual AHRS numbers.

The National Register status of the Sawmill-Upper Trail Lake Trail (SEW-01521) remains unknown. Only the eastern end of the trail is located within the project APE, and this area was not accessible during field surveys because of erosion and fallen trees. For this reason, the trail's National Register eligibility could not be assessed.

In a letter filed on April 18, 2016, the Alaska SHPO concurred with Kenai Hydro's National Register evaluations of resources documented within the project APE (letter from J.E. Bittner, SHPO, Alaska DNR, Division of Parks and Recreation, Office of History and Archaeology, Anchorage, AK, to M. Salzetti, Kenai Hydro, LLC, Homer, AK, March 10, 2015).

Kenai Hydro's cultural resources report states that, to date, no potential TCPs were identified during the cultural resources study but consultation with Native organizations would continue and any TCPs identified in the future would be evaluated.

3.3.6.2 Environmental Effects

Project-related Effects on Cultural Resources

Project-related effects on cultural resources within the APE are likely to occur from project construction, O&M, use and maintenance of project roads, recreation, vandalism, and mitigation measures associated with other project environmental resources. Project effects are considered adverse when an activity may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register. If adverse effects are found, consultation with the Alaska SHPO and other parties would be required to develop alternatives or modifications to avoid, minimize, or mitigate such adverse effects. Within the project APE, the Alaska SHPO determined that six historic-era archaeological sites and six architectural resources are ineligible for listing on the National Register. Kenai Hydro has identified project effects on eligible or unevaluated resources that may occur as a result of project construction, maintenance, and operation (Kenai Hydro, 2018a). As is discussed in more detail below, Kenai Hydro would address project-related effects on cultural resource through implementation of an HPMP.

Our Analysis

In the short term, construction activities associated with the proposed project may result in direct effects on archaeological sites and historic structures in the project APE. Over the license term, other activities such as road maintenance and recreational use could also affect these resources. Access to cultural resources sites can result in the collection of important artifacts or the dismantling of structures for firewood or other purposes. Specific project-related effects on eligible and unevaluated resources are identified in table 3-31.

Table 3-31. Project effects on eligible cultural resources within the project APE and proposed treatment (Source: Kenai Hydro, 2018a).

AHRS Number	Site Description	Project Effect	Evaluation of Effect	Proposed Treatment
SEW-00029	Alaska Railroad	Project access road	No adverse effect	Consideration during future planning; interpretive signage
SEW-00148	Seward-Moose Pass Trail	Project access road	No effect	Consideration during future planning; possible monitoring during construction; interpretive signage
SEW-00285	Solars Sawmill	Erosion and exposure,	Adverse effect	Close access road to the public; periodic

AHRS Number	Site Description	Project Effect	Evaluation of Effect	Proposed Treatment
		public visitation		monitoring; interpretive signage
SEW-00659	*Case Mine District and Components:*	*Public visitation*	*Adverse effect*	Periodic monitoring; interpretive signage
	Case Mine camp area	Public visitation	Adverse effect	
	Lakeside Trail	None	No effect	
	Lakeside Trail area	Public visitation	Adverse effect	
	Mill site	None	No effect	
	Mine workings	None	No effect	
	North Grant Lake Cabin (SEW-00823)	Public visitation	Adverse effect	
	Grant Lake Road to Case Mine (SEW-01454)	None	No adverse effect	
	Case Mine prospect pits (SEW-01522)	None	No effect	
SEW-01455	Grant Lake Trail	None	No adverse effect	Consideration during future planning
SEW-01521	Sawmill-Upper Trail Lake Trail	Unknown	No adverse effect	Consideration during future planning
--	Commemorative INHT	None	No effect	Consideration during future planning; interpretive signage

According to Kenai Hydro's archaeological site record for the Solars Sawmill (SEW-00285), the site has changed a great deal since it was originally recorded in the early 1980s. A historic cabin that had been observed at the site has since collapsed, and only a few pieces of lumber of a second structure remained. A fisheries research camp associated with the Chugach National Forest had been established at the site, and the site record implies that much of the lumber from this second structure was used to construct the camp. Kenai Hydro observed a plywood tent platform and an earthen berm at the site that suggests that the land at the site had been cleared, possibly with heavy equipment. A recent outhouse was also present. Kenai Hydro's report also reports that in 2009, it observed submerged historic features, including stone jetties, at the site (Mark Luttrell 2014 personal communication as cited by Meitl et al., 2015). In addition to the past effects, Kenai Hydro states that continued public access and use as a modern campsite would result in adverse effects. Fluctuation in the lake level and shoreline erosion and exposure of submerged features and associated artifact concentrations could also result in effects, including lateral displacement of feature elements and vertical deflation of associated artifacts. Additional exposure of artifacts along the shoreline would also attract more unauthorized collection by the public on the site.

The Case Mine District contains three distinct areas within the APE that are connected by a trail. These areas contain a number of elements that contribute to the District's National Register eligibility. While Kenai Hydro would not locate infrastructure associated with the proposed project near the District, such as Solars Sawmill, the site is easily accessible by both trail and boat and is heavily used by the public. Kenai Hydro notes that public access was adversely affecting the artifacts and features associated with three components of the District that contribute to the District's eligibility (the Case Mine camp area, the Lakeside Trail area, and the North Grant Lake Cabin). As such, the District itself would be adversely affected. Kenai Hydro also notes that the District includes active mining claims, but activity associated with mining activity is not related to the proposed project.

Kenai Hydro concludes that all other eligible or unevaluated sites documented within the project APE were either not experiencing effects or effects as a result of public visitation were not adverse.

In its letter filed on April 18, 2016, the Alaska SHPO determined that an overall finding of adverse effect is appropriate for the proposed project but acknowledged that some resources would see an adverse effect while others would not (letter from J.E. Bittner, Alaska State Historic Preservation Officer, Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Office of History and Archaeology, to M. Salzetti, Manager, Kenai Hydro, LLC, Homer, AK. March 10, 2015).

Management of Historic Properties

Kenai Hydro filed a draft HPMP to address project-related effects on eligible or potentially eligible cultural resources within the APE with its April 18, 2016, final license application. By letter filed on October 3, 2016, Kenai Hydro states that it provided the consulting parties with copies of the draft HPMP in September of that same year (letter from M. Salzetti, Manager, Kenai Hydro, LLC, Homer, AK, to K.D. Bose, Secretary, FERC, Washington, D.C., September 30, 2016). Kenai Hydro filed a final HPMP (dated January 2018) with the amended application on January 16, 2018.

Forest Service final 4(e) condition 19 requires the implementation of a "Heritage Resources Management Plan"; the HPMP filed with the application constitutes the plan required by the condition.

Kenai Hydro prepared the HPMP considering the Commission and Advisory Council's joint document, *Guidelines for the Development of Historic Properties Treatment Plans for FERC Hydroelectric Projects* (Commission and Advisory Council, 2002) and designed the document to prescribe both general processes and specific actions to manage historic properties over the term of any new license issued. Kenai Hydro intends for the HPMP to serve as a guide for operating personnel performing necessary project-related activities and to prescribe site treatments designed to address ongoing and future effects on historic properties.

In its HPMP, Kenai Hydro proposes several general management measures for historic properties, including but not limited to the appointment of an HPMP coordinator to oversee implementation of the plan over the license term,[71] a requirement for employee training to ensure that employees are knowledgeable of cultural resources and the requirements of the HPMP, a plan for monitoring eligible or potentially eligible resources, plans for additional cultural resources inventories and site evaluations, a plan for the treatment of inadvertent discoveries, procedures for the treatment of human remains that may be identified during project-related activities, a plan for the curation of cultural materials recovered during implementation of mitigation measures, plans for public interpretation at specific locations, and requirements for annual cultural resources reporting to the Commission, the Alaska SHPO, the Forest Service, participating Native organizations, and other consulting parties as appropriate. Additionally, the HPMP contains a list of activities that Kenai Hydro proposes be exempt from section 106 consideration. In addition to general management measures and protocols, the HPMP also discusses specific project effects on all resources and provides measures to avoid, lessen, or mitigate adverse effects on those that are eligible or potentially eligible for listing on the National Register.

In its HPMP, Kenai Hydro also proposes to install interpretive panels and conduct periodic monitoring of Solars Sawmill and Case Mine District to resolve adverse effects attributable to public visitation. The interpretive panels would warn visitors not to remove artifacts from the sites or to disturb site features and structures. Additionally, the project access road near Solars Sawmill would be closed to the public.

On March 1, 2019, the Forest Service filed its comments on the April draft 2018 HPMP and requested that it be provided with a copy of the January 16, 2018 final HPMP. In its comments, the Forest Service requested that Kenai Hydro revise the draft HPMP as follows: (1) reference, as appropriate, the *Programmatic Agreement Among USDA Forest*

[71] The HPMP coordinator would act as the ECM for cultural resources involving construction and operation of the project.

Service, Alaska Region, the Advisory Council on Historic Preservation, and the Alaska State Historic Preservation Officer, Regarding Heritage Resource Management on National Forests in the State of Alaska (Forest Service PA; 2017); (2) remove references to the *Programmatic Agreement Among The Federal Energy Regulatory Commission And The Alaska State Historic Preservation Officer For Managing Historic Properties That May Be Affected By A License Issuing To Chugach Electric Association, Inc. For the Cooper Lake Hydroelectric Project In Kenai Peninsula Borough, Alaska (FERC No. 2170-029)*; (3) clarify of the difference between reconnaissance investigations and intensive field surveys; (4) clarify the federal recognition status of the Qutekcak Native Tribe; (5) include section 106 training for the HPMP coordinator and clarification regarding duties, responsibilities, and qualifications; (5) clarify cultural resources planning activities that do not require section 106 review; (6) include notification and other protocols for inadvertent discovery of human remains considering the measures provided in the Forest Service PA; and (7) address specific comments related to management of Solars Sawmill and the Case Mine District.

Also, on March 1, 2019, the Alaska SHPO filed its comments on the January 16, 2018 final HPMP (letter from J.E. Bittner, Alaska State Historic Preservation Officer, Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation, Office of History and Archaeology, to K. Hogan, Office of Energy Projects, Federal Energy Regulatory Commission). In its comments, the Alaska SHPO advised the Commission to notify the ACHP of its March 10, 2015 finding that the project would result in adverse effects to historic properties and that that the Commission execute an agreement document to implement the HPMP. The SHPO also commented that figures in the HPMP should be revised to reflect the location of the Commemorative Iditarod Trail and that it wished to consult with Kenai Hydro further to ensure that the new route would be consistent with the gold rush characteristics that the trail was intended to portray. The Alaska SHPO noted that installation of interpretive signs (particularly for the Alaska Railroad, Seward-Moose Pass Trial, Commemorative Iditarod Trail, Solars Sawmill, and Case Mine District) would require specific agency authorizations, could be more harmful than other mitigation options such as public education and awareness, and recommended further consultation to determine appropriate management measures. Finally, the Alaska SHPO recommended that specific criteria provided in the Forest Service PA executed between the Forest Service, Advisory Council, and Alaska SHPO be included in the HPMP to ensure that there is no confusion between the requirements in the Forest Service PA and the stipulations that would be provided in the Commission's PA, which would implement the HPMP.

Our Analysis

Kenai Hydro's proposed HPMP includes measures that are consistent with most of the Commission and Advisory Council's 2002 guidelines. However, inclusion of additional information in a final HPMP would improve the document for full compliance under section 106. The HPMP would satisfy Forest Service's final 4(e) condition 19. Section 3.2 of the HPMP describes the roles and responsibilities of consulting parties.

However, although section 3.2.6 discusses the roles that Native organizations have played during the licensing process, it does not identify any specific Native organizations by name nor does it discuss how they might be involved in the future other than receiving copies of annual reports. We assume that the Native organizations identified under the definition of "consulting parties" in the acronyms and abbreviations section of the HPMP would be those that would also be specified in section 3.2.6, but clarification would be appropriate. Additionally, because Commission staff granted Mr. Mark Luttrell cultural resources consulting party status for the project, Mr. Luttrell should also be included in definition of "consulting parties" in the HPMP. Mark Luttrell's qualifications as consulting party in the HPMP include being a practicing professional archaeologist in the state of Alaska who has intimate knowledge of cultural resources within the project area. He has also assisted with the applicant's contract archaeologist and participated in cultural resources work group meetings involved with this licensing. Also, many of his observations are incorporated into the HPMP.

Section 3.4 of the HPMP does not discuss Kenai Hydro's efforts to identify potential TCPs at the project. Section 4.3 of the Cultural Resources Study Plan calls for the implementation of a subsistence and cultural use study, and section 3.2 of Kenai Hydro's final cultural resources study report (Meitl et al., 2015) states that the "identification of TCPs has relied on consultation with the aforementioned Native organizations" and that no TCPs were identified. However, neither the report nor the HPMP discuss when this consultation occurred, which tribes were consulted, or if any tribal concerns regarding potential TCPs or traditional use areas were expressed. Further, the study report also states that Kenai Hydro would "continue to consult with Native groups with close traditional ties to the project area and will evaluate any TCPs identified in the future." However, as mentioned in the paragraph above, the HPMP does not specify the circumstances under which Native organizations would be consulted in this regard. Such circumstances would include any possible tribal concerns involving culturally significant plants that might be affected by project construction, especially ground-disturbing activities. Clarification regarding the status of the TCP study and the conditions under which additional consultation with Native organizations would occur would improve the HPMP.

The APE, as depicted in figure 1.3-2 of Kenai Hydro's cultural resources report and figure 4 of the HPMP, does not include a small section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line. This section of the transmission line is contained within the proposed project boundary. The HPMP should either explain why this section of the transmission line was excluded from the APE or include a plan to survey this area in the future. Additionally, Kenai Hydro states in the HPMP that the Alaska SHPO concurred with the definition of the APE in a March 11, 2015, letter, but this letter does not appear to have been filed with the Commission. A copy of this letter should be included in an appendix to the HPMP.

Section 4.10 of the HPMP, states that an HPMP coordinator would be appointed at the time of any license acceptance. This individual would coordinate all HPMP activities pertaining to cultural resources. Consideration of the Forest Service's recommendation that the HPMP coordinator receive section 106 training and other comments related to coordinator responsibilities would ensure that this individual fully understands the requirements of both section 106 and the requirements of the HPMP. Additionally, while Attachment E-3 of the amended final license application provides a general schedule for implementation of some of the measures contained within the HPMP, the schedule does not include all HPMP measures nor is the schedule provided in the HPMP itself. Inclusion in the HPMP of specific deadlines for the completion of HPMP tasks (e.g., employee HPMP training and cultural resources monitoring) would ensure that all HPMP tasks can be tracked and are completed in a timely manner.

In the HPMP, Kenai Hydro proposes to conduct "periodic" monitoring of affected historic properties. While the HPMP states that timing of monitoring of the Solars Sawmill site (SEW-00285) and the Case Mine District (SEW-00659) would be coordinated with the Forest Service, the HPMP should contain a specific monitoring plan that details: (1) the circumstances under which monitoring would occur, both during construction activities and afterward; (2) who would participate in the monitoring; (3) how frequently regular monitoring would be undertaken after construction and over the license term; and (4) how monitoring results would be disseminated to consulting parties and used. For example, if regular monitoring of a particular historic property over the license term indicates that project-related effects are ongoing, the plan should identify what would "trigger" further review and a possible change in site management. Including these details in the HPMP would ensure that the Alaska SHPO, the Commission, the Forest Service, Native organizations, and other parties are regularly informed of the condition of significant cultural resources within the project APE, both during construction and over the term of the license.

Kenai Hydro consulted with the Alaska SHPO on its National Register evaluations and assessment of project effects and filed documentation of this consultation with the Commission. Kenai Hydro states that the consulting parties were provided with copies of the draft HPMP in September of 2016 and the final HPMP in January of 2018. However, per the Forest Service's March 1, 2019 letter, the Forest Service states that it did not receive a copy of the final HPMP. Additionally, Kenai Hydro's January 2018 HPMP also does not address the Alaska SHPO's s March 1, 2019 comments in which the SHPO stated that further consultation regarding proposed mitigation measures for effects to historic properties was needed, particularly with regard to the use of interpretive signs as a mitigation measure. We agree that further consultation with the Alaska SHPO and the Forest Service to reach agreement on the management of historic properties would be appropriate. For example, the Case Mine District (SEW-00659) and the Solars Sawmill site (SEW-00285) are heavily used by the public, and the associated site records document the long-term and detrimental effects of this use. The HPMP could clarify the rationale behind the proposal for periodic monitoring and interpretation to resolve adverse effects versus implementation of other more active management/mitigation measures (such as data recovery and complete documentation and recordation of all site features) and could consider the Forest Service's comments regarding these two resources. Additionally, section 5.5.3 of the HPMP states that fluctuations in the lake level could increase erosion at the Solars Sawmill site and expose historic features of the site, including the jetties observed by Luttrell, that are typically submerged. The HPMP states that these effects are expected to be minor. Additionally, the HPMP also states that effects to the Case Mine District as a result of reservoir drawdown would also be minor. However, inclusion in the HPMP of a requirement to inspect and document any features at the site should they be exposed during a drawdown (or any other period of low lake level) and to formally assess site conditions and project effects would ensure that these effects are appropriately addressed in accordance with section 106.

Revision of the January 2018 HPMP to consider the March 1, 2019 comments of the Alaska SHPO and Forest Service and in consultation with these two agencies and other consulting parties, would help to minimize potential effects on historic properties over any license term and ensure compliance with section 106.

- the specific Native organizations that will be consulted and how they will be involved;[72]
- addition of Mark Luttrell as a consulting party;
- a discussion of the methods used to conduct the TCP study, which Native organizations were consulted, the results of such consultation, and the conditions under which Native organizations would continue to be consulted in the future;
- clarification of the survey status of the section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line;
- a specific schedule for completion of all HPMP measures;
- a monitoring plan that specifies the circumstances under which monitoring would occur, who would conduct the monitoring, how frequently regular monitoring would take place, and how monitoring results would be disseminated and used;
- specific factors that would trigger implementation of more active management/mitigation measures over periodic monitoring;

[72] Consultation would cover their role and participation involving the construction plan to survey areas prior to ground-disturbing activities for culturally significant plants and record and collect them, if necessary.

- a provision to formally evaluate and assess project effects on submerged cultural resources should they be exposed in the future; and
- an appendix containing documentation and copies of all section 106 consultation throughout the licensing process, including documentation of Alaska SHPO concurrence on the project APE and concurrence with all measures contained within the HPMP (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.

To meet the section 106 requirements, the Commission intends to execute a PA with the Alaska SHPO for the proposed project for the protection of historic properties that would be affected by project construction and operation. The terms of the PA would require Kenai Hydro to address all historic properties identified within the project APE through a revised final HPMP.

3.3.7 Socioeconomic Resources

3.3.7.1 Affected Environment

The project is located within the boundaries of the Kenai Peninsula Borough. The nearest community is the unincorporated town of Moose Pass—population about 206—about 1.5 miles to the northwest of Grant Lake. The nearest major town is Seward, population about 2,830, located about 25 miles south of Moose Pass.

Population Demographics

Population density in the project vicinity is relatively low. The project area is about 100 miles from Anchorage, Alaska's largest city. The population of the area is centered near the Seward Highway.

The population characteristics of the project area are similar to those of the Kenai Peninsula Borough, as a whole. Population growth was greatest during the 1970s and early 1980s. The most recent U.S. Census data for selected places in the Kenai Peninsula Borough are shown in table 3-32. Total population change on a percentage basis was greatest in Cooper Landing and Moose Pass, which from 2010 to 2016 saw population increases of 69 and 62 percent, respectively.

Table 3-32. Population growth (number and percent of change) in the Kenai Peninsula Borough and selected places in the borough (2010–2016) (Source: U.S. Census 2010, 2016a).

Location	2010	2016	Total Change
Kenai Peninsula Borough	55,400	57,637	4%
Homer	5,003	5,418	8%

Location	2010	2016	Total Change
Kachemak City	472	537	14%
Kenai	7,100	7,551	6%
Seldovia (city)	255	247	(3%)
Seward	2,693	2,714	1%
Soldotna	4,163	4,471	7%
Cooper Landing	289	489	69%
Moose Pass	219	354	62%

Table 3-33 presents a profile of the fast-growing population centers closest to the project, by comparison to the larger Kenai Peninsula Borough. Population centers in the project area containing the largest workforce as a proportion of total population were Seward and Moose Pass, with workforce percentages of 87.8 and 84.5 percent respectively. Residents identifying as Alaskan Native comprised 15 percent in Moose Pass, compared to 8 percent in the Borough overall. Moose Pass also contains the highest poverty levels among families of any location in the project area, with 27.6 percent of families below poverty compared to 7.1 percent for the Borough overall.

Table 3-33. Population Demographic Profile for Selected Places within Kenai Peninsula Borough near the project area, 2016 (Source: U.S. Census, 2016b, c).

	Percent of Total Population					
Location	**Potential Work Force (Age 16+)**	**White**	**Alaskan Native Origin**	**Total Number of Families**	**Median Family Income**	**Percent Families Below Poverty**
Kenai Peninsula Borough	79.6%	84%	8%	13,701	$82,242	7.1%
Seward	87.8%	95%	5%	468	$86,875	7.7%
Cooper Landing	67.3%	85%	0%	151	$78,542	4.0%
Moose Pass	84.5%	69%	15%	123	$146,250	27.6%

Land Ownership

Most of the lands in the project area are public, either state or federal. However, there are several areas of private ownership along the Seward Highway. Borough land management policies are described in the Kenai Peninsula Borough Comprehensive Plan and the Kenai Peninsula Borough Coastal Zone Management Plan. Table 3-34 and figure 3-44 show land ownership in the Kenai Peninsula Borough. Land use is predominantly characterized as vacant and is shown in figure 3-45.

Table 3-34. Kenai Peninsula Borough land ownership information (Source: Kenai Hydro, 2018a).

Owner	Square Miles	Percent of Total
University of Alaska	25.9	0.1%
Cities	26.9	0.1%
Mental Health Trust	27.7	0.1%
Kenai Peninsula Borough	107.3	0.4%
Private	401.7	1.6%
Native	1,593.6	6.4%
State	3,426.6	13.9%
Federal	10,610.9	42.9%
Total Upland	16,220.6	65.5%

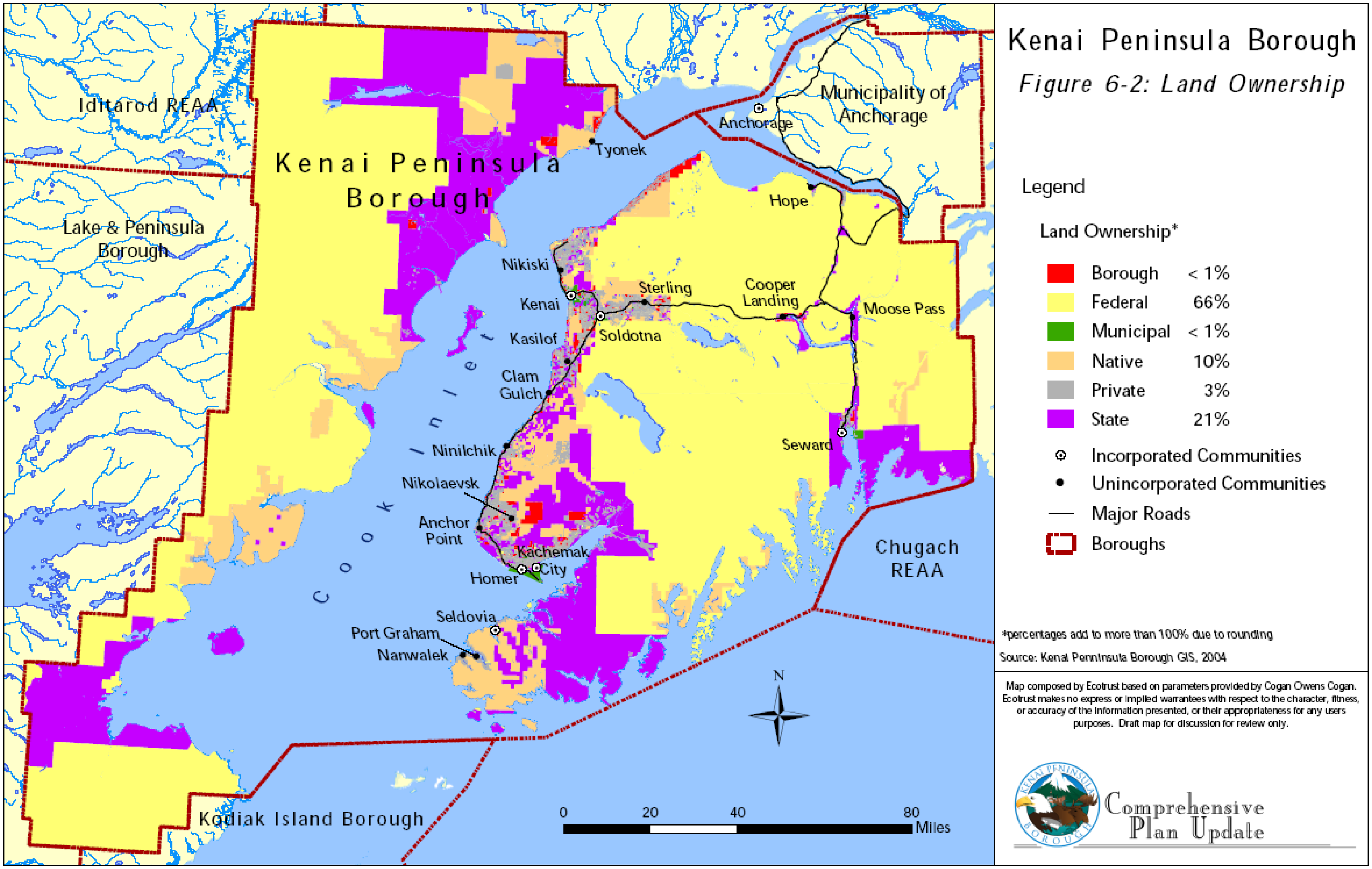

Figure 3-44. General Kenai Peninsula land ownership delineation (Source: Kenai Hydro, 2018a, as modified by staff).

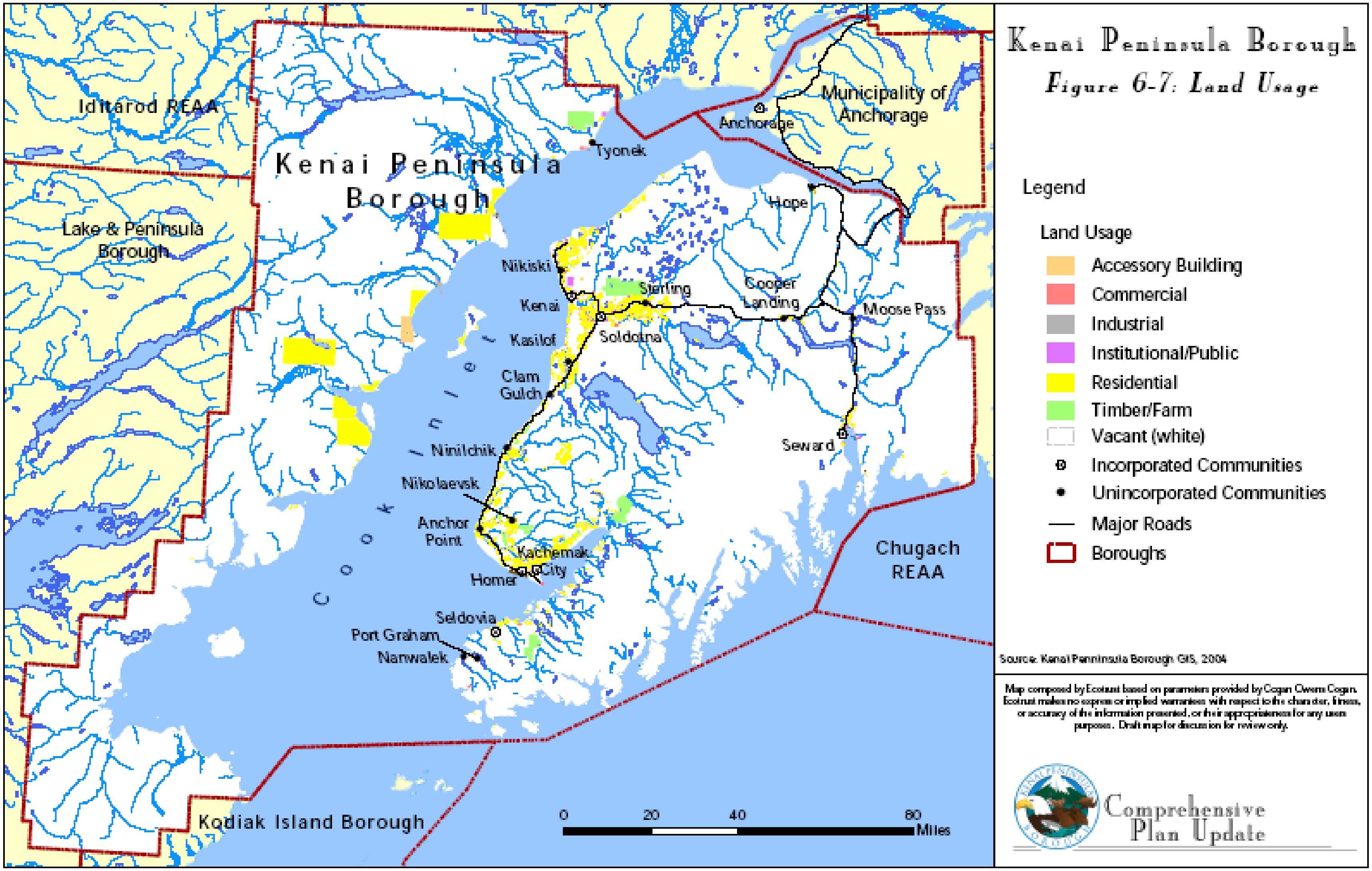

Figure 3-45. Land use in the Kenai Peninsula Borough (Source: Kenai Hydro, 2018a, as modified by staff).

Regional, Local, and Tribal Economies

Industry and Employment

Table 3-35 presents a profile of industry and employment for the fast-growing population centers closest to the project and compares them to the larger Kenai Peninsula Borough. While educational services and health care and social assistance represents the largest industry sector by total employment for the Borough overall (24.2 percent of total workforce employment), other employment sectors represent the largest sources of employment for population centers in the project area. The arts, entertainment, and recreation, and accommodation and food services sector comprise 21.4 percent and 34.4 percent of total employment in Seward and Cooper Landing, respectively. Retail trade is the largest employment sector in Moose Pass (32.9 percent), followed by educational services, and health care and social assistance (22.9 percent). Construction represents 19 percent of employment in Cooper Landing. The rate of unemployment in Moose Pass is 22.4 percent, which is more than four times that of the Kenai Peninsula Borough. Other population centers exhibit unemployment rates closer to the Kenai Peninsula Borough rate of 5.3 percent.

Table 3-35. Population industry and employment profile for selected places within Kenai Peninsula Borough near the project area, 2016 (Source: U.S. Census, 2016c).

Location	Three Largest Industries by Percent of Total Employment	Percent Unemployment
Kenai Peninsula Borough	1.Educational services, and health care and social assistance (24.2%)	5.3%
	2.Agriculture, forestry, fishing and hunting, and mining (12.5%)	
	3.Retail trade (11.3%)	
Seward	1.Arts, entertainment, and recreation, and accommodation and food services (21.4%)	4.4%
	2.Public administration (18.9%)	
	3.Educational services, and health care and social assistance (10.9%)	
Cooper Landing	1.Arts, entertainment, and recreation, and accommodation and food services (34.4%)	4.6%
	2.Construction (19.0%)	
	3.Retail trade (10.4%)	

Location	Three Largest Industries by Percent of Total Employment	Percent Unemployment
Moose Pass	1.Retail trade (32.9%) 2.Educational services, and health care and social assistance (22.9%) 3.Agriculture, forestry, fishing and hunting, and mining (20.7%)	22.4%

Income and Occupation

Table 3-36 provides a profile of income and occupation for the fast-growing population centers closest to the project and compares them to the larger Kenai Peninsula Borough. Per capita income is highest in Moose Pass, at $49,223 and with zero percent of the population employed in the construction sector. Cooper Landing has 19 percent employment in the construction sector and a per capita income of $30,090. Seward has 5.9 percent employment in the construction sector and a per capita income of $27,810. By comparison, in the Kanai Peninsula Borough, construction constitutes 8% percent of total workforce and per capita income is $32,556.

Table 3-36. Population income and occupation profile for selected places within Kenai Peninsula Borough near the project area, 2016 (Source: U.S. Census, 2016c).

Location	Per Capita Income	Percent of Total Workforce Employed in Construction
Kenai Peninsula Borough	$32,556	8.0%
Cooper Landing	$30,090	19.0%
Moose Pass	$49,223	0.0%
Seward	$27,810	5.9%

Subsistence Hunting and Gathering

Although subsistence hunting occurs throughout Alaska all year long and is central to the customs and traditions of many cultural groups in Alaska, the project is located within the Anchorage–Mat-Su–Kenai Peninsula Non-subsistence Use Area (Alaska DFG, 2018a). Non-subsistence use areas are defined as areas where dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life.

For some rural Alaska residents, subsistence hunting is critical to their nutrition, food security, and economic stability. Subsistence hunting in Alaska is normally managed under the same regulations as general season, drawing, and registration hunts, and a hunting license and harvest tag is usually required. Game may be harvested for cultural and subsistence uses under a number of authorized programs. The project is located within Game Management Unit 7. Depending on the community and area, moose, caribou, deer, bears, Dall sheep, mountain goats, and beavers are commonly used land mammals. Seals, sea lions, walruses, and whales make up the marine mammal harvest (Alaska DFG, 2018b).

The Alaska Board of Fisheries and the Alaska Board of Game may not authorize subsistence hunting and fishing in non-subsistence use areas. In these areas, the subsistence priority does not apply. Since the project is located within a non-subsistence use area, the issue of subsistence hunting and fishing is not relevant to project actions.

Public Sector

Kenai Peninsula Borough is incorporated as a second-class borough and as such levees taxes and fees, which fund borough government and services. The Kenai Peninsula Borough operates the schools and the landfill, but most other services such as sewer, water, fire, and law enforcement are managed locally by each city. The 43 schools in the Kenai Peninsula School District have 8,341 students enrolled and employ 578 teachers (Alaska Department of Community and Regional Affairs, 2018).

Electricity

A majority of the electricity supplied to the Kenai Peninsula is provided by the Homer Electric Association. However, Chugach Electric supplies electricity to the project area. The proposed project would supply Homer Electric Association customers.

3.3.7.2 Environmental Effects

Construction Effects on Socioeconomic Resources

Project construction has the potential to affect local economies through additional demands on local construction labor force. Additionally, Seward Highway road maintenance may be required as a result of increased construction traffic transiting locally to and from the project area during construction.

Kenai Hydro would place priority on employing local construction personnel where available. However, given the relatively small workforce population local to the project area, additional assistance would be required. Kenai Hydro would employ additional qualified construction staff as needed to ensure high quality construction with an emphasis on efficiency and long-term operation. Kenai Hydro anticipates that the lodging requirements of construction staff would be accommodated within the local communities of Moose Pass and Seward.

As with most multi-season construction efforts, onsite labor needs and associated payroll would fluctuate and coincide with the periods most conducive to development of discrete infrastructural components. Table 3-37 provides Kenai Hydro's monthly estimates for staffing and associated payroll costs. These estimates are based on certain assumptions with respect to receipt of a FERC license and may fluctuate based on timing and specific requirements set forth in the license.

Table 3-37. Kenai Hydro monthly labor estimates and associated payroll expenditures for construction of the Grant Lake Project (Source: Kenai Hydro, 2018a).

	2019			**2020**		
Month	**Monthly Staffing Totals**	**Percent of Staffing by Month**	**Monthly Staffing Costs**	**Monthly Staffing Totals**	**Percent of Staffing by Month**	**Monthly Staffing Costs**
Jan	NA	NA	NA	15	2.45	$311,714
Feb	NA	NA	NA	15	2.45	$311,714
Mar	NA	NA	NA	15	2.45	$311,714
Apr	NA	NA	NA	20	3.27	$415,619
May	15	2.45	$311,714	22	3.59	$457,181
Jun	30	4.90	$623,428	50	8.17	$1,039,047
Jul	45	7.35	$935,142	52	8.50	$1,080,609
Aug	60	9.80	$1,246,856	52	8.50	$1,080,609
Sep	54	8.82	$1,122,170	33	5.39	$685,771
Oct	40	6.54	$831,237	15	2.45	$311,714
Nov	42	6.86	$872,799	15	2.45	$311,714
Dec	20	3.27	$415,619	2	0.33	$41,562

Note: NA — Data not available

Our Analysis

Over the short-term, construction of the project would contribute slightly to additional employment and income within the regional economy. Depending on contractor hiring practices, some portion of the project-induced employment would likely benefit individuals residing within the project area. However, because workforce requirements for the project would be relatively modest and at least some portion of those employed would likely commute from existing residential locations in the region rather than relocate temporarily from more distant points of origin, the project would not generate major population growth associated with the in-migration of construction-phase workers. As a result, the project would not generate major increases in demand for local housing or strain public services.

The location of the project area away from established residential areas would reduce the potential for construction-related disturbances to residents from noise, dust, or construction vehicle traffic effects. The Seward Highway (AK-9), which crosses through the west side of the project boundary, is a state highway and thus has adequate capacity to accommodate traffic and transportation related to the project.

Any construction personnel temporarily relocated to the project area during the construction phase would be housed within existing lodging or rental housing in and around the project area, which is available in adequate supply. Although limited accommodations exist in Moose Pass (including the Midnight Sun Log Cabins and Trail Lake Lodge), the town of Seward has numerous accommodations because Seward is a popular destination for tourism, and the hospitality industry is well established. Because there would be no significant influx of new population into the economic area, the project would not affect government services. The new facilities constructed as part of this project would not displace any businesses or residences.

Additional Seward Highway road maintenance may be required because of increased construction traffic transiting locally to and from the project area during construction; however, Kenai Hydro would store most equipment onsite during the construction season, thereby limiting the amount of additional highway use (Kenai Hydro, 2018a).

To the extent that construction materials would be procured from sources located within the local economy, project-related spending on supplies within the project area would likely result in a positive short-term effect on local tax revenues, income, and employment.

Operation Effects on Socioeconomic Resources

Project operation could place some demands on the local workforce during the lifetime of the project. Once operational, Kenai Hydro would operate the project remotely. Although Kenai Hydro could employ a single local resident near the project to conduct regular checks related to maintenance, safety, and adequate operation, it is more likely that Kenai Hydro/Homer Electric Association personnel would travel to the local project area on an as-needed basis.

Kenai Hydro currently has no control over local public power (electricity) costs because the Chugach Electric Association provides power to the local area. However, electric reliability would most likely increase in the communities of Moose Pass and Seward as a result of the proximal/distributed generation associated with the project. Additionally, hydropower swap agreements between the Homer Electric Association and the Chugach Electric Association or the City of Seward (Grant Lake Project power for

Bradley Lake Project power[73]) could avoid transmission wheeling tariffs that would reduce power costs for both entities.

Our Analysis

Operation of the project would have limited, long-term socioeconomic effects on the local workforce population and economy. However, because any increase in total employment would be negligible, no long-term adverse effects would occur as a result of project operation. There would be no long-term, beneficial or adverse effects on local income, sales, employment, and tax revenues in the project area.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the proposed Grant Lake Project would not be constructed. The existing physical, biological, cultural, and socioeconomic resources associated with the area would not be affected, and electrical generation from the project would not occur. The power that would have been developed from a renewable resource would be replaced from other power plants and likely primarily fossil-fueled facilities, and the environmental benefits of generating power from a renewable resource would not be realized. Beneficial effects of the project on winter habitat for anadromous species in Grant Creek would also not occur.

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[73] The Bradley Lake Project (FERC No. 8221) is located on the Kenai Peninsula and diverts water from Bradley Lake to a powerhouse on Kachemak Bay, about 22.5 miles east northeast of Homer, Alaska. The Bradley Lake powerhouse has two 45-MW generating units.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Grant Lake Project's use of Grant Lake and Grant Creek for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[74] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, the analysis includes an estimate of: (1) the cost of individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 4-1 summarizes the assumptions and economic information used in the analysis. This information was provided by Kenai Hydro in its amended final license application. The values provided by Kenai Hydro are reasonable for the purposes of the analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; licensing costs; normal O&M cost; and Commission fees.

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[74] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 4-1. Parameters for the economic analysis of the Grant Lake Project (Source: Kenai Hydro, 2018a, as modified by staff).

Parameter	**Value**
Period of analysis (years)	30
Period of financing	20
State and local tax rate	Exempt
Federal income tax rate	Exempt
Construction cost[a]	$53,878,050 (2018)
Licensing cost[b]	$5,819,260 (2018)
Annual O&M[c]	$111,560 (2018)
Energy value[d]	$124.43/MWh
Capacity value ($/kilowatt-year)[e]	0
Contingency spinning reserve value[f]	$50,000
Interest rate[g]	4.0
Discount rate[h]	3.0

[a] Kenai Hydro, 2018a, exhibit D, table D-4-1. Escalated from 2015 dollars to 2018 dollars. We removed estimated capital costs for plan development and equipment from this value and provide those costs separately in the environmental measures to enable cost comparisons among proposed and recommended measures.

[b] Licensing costs include the administrative, legal/studies, application preparation, and other expenses to date. Kenai Hydro, 2018a, exhibit D, section 11. Escalated from 2015 dollars to 2018 dollars.

[c] Annual O&M includes routine costs to operate the project and maintain project equipment, but does not include insurance value provided because that is calculated separately. Kenai Hydro, 2018a, exhibit D, table D.5-1. Escalated from 2015 dollars to 2018 dollars. We removed estimated annual costs for environmental measures from this value and provide those costs separately in the environmental measures to enable cost comparisons among proposed and recommended measures.

[d] Kenai Hydro, 2018a, exhibit D, section 6.2.

[e] There is no capacity market in this area of Alaska.

[f] Kenai Hydro, 2018a; Kenai Hydro cited a range of $40,159 to $70,257 (exhibit D, section 6.1). Staff assumed a conservative value of $50,000 and converted it to a $/MWh value of $2.69/MWh and added it to the energy value to get a composite power rate of $127.12/MWh.

[g] Kenai Hydro, 2018a; Kenai Hydro cited a range of 3.0 to 4.65 percent (exhibit D, section 5.1). Staff assumed a rate of 4.0 percent.

[h] S Kenai Hydro, 2018a, exhibit D, section 6.2.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this final EIS: Kenai Hydro's proposal, the staff alternative, and staff alternative with mandatory conditions. Under a no-action alternative, the project would not be constructed, so that alternative is not included in table 4-2.

Table 4-2. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Grant Lake Project (Source: staff).

	Kenai Hydro's Proposal	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Installed capacity (MW)	5	5	5
Annual generation (MWh)	18,600	18,600	18,600
Annual cost of alternative power ($/MWh)	$2,364,430 127.12	$2,364,430 127.12	$2,364,430 127.12
Annual project cost ($/MWh)	$3,981,320 214.05	$3,953,810 212.57	$3,973,240 213.62
Difference between the cost of alternative power and project cost ($/MWh)	($1,616,890) (86.93)	($1,589,380) (85.45)	($1,608,810) (86.50)

[a] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, the project would not be constructed.

4.2.2 Applicant's Proposal

The applicant's proposal is the project as proposed by Kenai Hydro. Table 4-3 shows the staff-recommended additions, deletions, and modifications to Kenai Hydro's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on a total installed capacity of 5 MW and an average annual generation of 18,600 MWh, the cost of alternative power would be $2,364,430, or about $127.12/MWh. The average annual project cost would be $3,981,320, or about $214.05/MWh. Overall, the project would produce power at a cost that is $1,616,890, or $86.93/MWh, more than the cost of alternative generation.

4.2.3 Staff Alternative

The staff alternative includes the same developmental upgrades as Kenai Hydro's proposal and, therefore, would have the same capacity and energy attributes. Table 4-3 shows the staff recommended additions, deletions, and modifications to Kenai Hydro's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on a total installed capacity of 5 MW and an average annual generation of 18,600 MWh, the cost of alternative power would be $2,364,430, or about $127.12/MWh. The average annual project cost would be $3,953,810, or about $212.57/MWh. Overall, the project would produce power at a cost that is $1,589,380, or $85.45/MWh, more than the cost of alternative generation.

4.2.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative with the exception of several mandatory conditions that would not be compatible with staff-recommended measures or would be required in addition to staff-recommended measures. This alternative would have an average annual generation of 18,600 MWh, and an average annual cost of alternative power of $2,364,430, or about $127.12/MWh. The average annual project cost would be $3,973,240, or about $213.62/MWh. Overall, the project would produce power at a cost that is $1,608,810, or $86.50/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 gives the cost of each of the environmental enhancement measures considered in the analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4-3. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of constructing and operating the Grant Lake Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
General				
1. Provide an ECM to oversee the project during major construction activities. Ensure the ECM has stop work authority. (Forest Service 4(e) 20)	Kenai Hydro, Forest Service, staff	$0	$9,480 [d]	$9,480
2. Develop an annual compliance report that includes a summary of compliance activities for the previous year and annual stakeholder meeting presentations of results.	Kenai Hydro	$0	$19,570	$19,570
3. Conduct an annual project review meeting during construction and the first 5 years of operation. (FWS 10(j) 18, Alaska DFG 10(j) 18, NMFS 10(j) 14)	Alaska DFG, FWS, NMFS	$0	$1,990 [e]	$1,990
4. Conduct an annual consultation meeting. (Forest Service 4(e) 4)	Forest Service	$0	$5,000 [f]	$5,000
Geology and Soils Resources				
5. Develop an ESCP to minimize erosion and sediment disposition during construction.	Kenai Hydro	$20,000[g]	$3,790 [g]	$5,050

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
6. Develop an ESCP that includes: (1) soil, groundwater, and vegetation conditions; (2) preventive measures based on site-specific conditions; (3) location of areas for storage or deposition of removed overburden including erosion control to be used in those areas; and (4) prescriptions for revegetation of all disturbed areas, including location of treatment areas, plant species and methods to be used, and an implementation schedule. (Alaska DFG 10(j) 13, FWS 10(j) 14, NMFS 10(j) 10)	FWS, NMFS, Alaska DFG	$20,000[h]	$4,740[h]	$6,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
7. Develop an ESCP to control erosion, stream sedimentation, dust, and soil mass movement consistent with the standards and guidelines of the Chugach National Forest Land Management Plan, the Soil and Water Conservation Handbook (FSH 2509.22), and the national BMPs and that includes: (1) a description of the actual site conditions, including any existing erosion or sedimentation problems from roads, stream crossings, trails, or other facilities; (2) detailed descriptions, design drawings, and specific topographic locations of all control measures; (3) measures to divert runoff over disturbed land surfaces, including sediment ponds at the diversion and powerhouse sites; (4) revegetating test-drive areas outside the roadbed; (5) measures to dissipate energy and prevent erosion at the tailrace; (6) a monitoring and maintenance schedule; and (7) and other measures the Forest Service and licensee mutually identify as needing care to ensure resource protection. (Forest Service 4(e) 19)[j]	Forest Service, staff	$20,000[i]	$5,690[i]	$6,950

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
8. Include in the staff-recommended ESCP measures to sample for lead in Grant Lake sediments that may by mobilized during project construction and operation, including measure to prevent mobilization if needed	Staff	$20,000[f]	$0	$1,260
9. Develop a construction plan. (Forest Service 4(e) 19)[j]	Forest Service, staff	$10,000[k]	$0[l]	$630
10. Develop a spoil disposal plan. (Forest Service 4(e) 19)[j]	Forest Service, staff	$10,000[k]	$0[l]	$630
Aquatic Resources				
11. Consult with NMFS and Alaska DFW following biological monitoring after start of operations to evaluate benefits of removing the logjam in Reach 1 and remove if necessary to maintain aquatic habitat.	Kenai Hydro	$21,160	$0	$1,330
12. Provide channel maintenance flows of 800 cfs for a continuous 8-hour period once a year for 2 years in every 10-year moving window to promote sediment recruitment and transport from the bypassed reach to Grant Creek. (FWS 10(j) 4, NMFS 10(j) 4, Alaska DFG 19(j) 4)	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$0	$0[m]	$0
13. Provide minimum flows in the bypassed reach as described in table 3-19.	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$0	$0	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
14. Provide minimum flows downstream of the tailrace in Grant Creek as described in table 3-21.	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$0	$0	$0
15. Enhance flows in Reaches 2 and 3 side channels.	Kenai Hydro	$0	$0[n]	$0
16. Implement ramping rate restrictions to limit downramping to 1 inch per hour from November 16 through May 15 and 2.25 inches per hour from May 16 through November 15 and limit upramping to 1 inch per hour during the winter (November 16 through May 15), and 2 inches per hour during the summer (May 16 through November 15). Monitor ramping rates at a gage in the project tailrace.	Kenai Hydro	$10,000[o]	$1,000[o]	$1,630
17. Implement ramping rate restrictions to limit downramping to 1 inch per hour and limit upramping to 1 inch per hour during the winter (November 16 through May 15), and 2 inches per hour during the summer (May 16 through November 15). (FWS 10(j) 3, NMFS 10(j) 3, Alaska DFG 10(j) 3) Monitor ramping rates at a gage downstream of the tailrace	FWS, NMFS, Alaska DFG, staff	$0	$0[p]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
18. Provide fail-safe provisions in the project design and operation to ensure that required flow releases are provided continuously to the bypassed reach and the reaches of Grant Creek downstream of the tailrace during routine maintenance periods, emergency project shutdowns, and interruptions to the power grid. (Alaska DFG 10(j) 6, FWS 10(j) 6, NMFS 10(j) 6)	Kenai Hydro, FWS, Alaska DFG, NMFS, staff	$0[q]	$0[q]	$0
19. Monitor streamflows in the intake structure/penstock (site ISF-1).	Kenai Hydro	$15,000[r]	$1,000[r]	$1,950
20. Monitor streamflows in the Grant Creek bypassed reach at the bypass pump and weir slide gate (site ISF-3).	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$30,000[s]	$2,000[s]	$3,890
21. Monitor streamflows in Grant Creek downstream of the tailrace (site ISF-2).	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$15,000[r]	$1,000[r]	$1,950
22. Measure channel maintenance flows in Grant Creek by subtracting the flows through the powerhouse/penstock from the flows measured by the stream gage downstream of the tailrace and monitor the flows throughout the duration of the release.	FWS, Alaska DFG, staff	$0	$0[t]	$0
23. Monitor reservoir levels.	Kenai Hydro, staff	$0	$0[t]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
24. Develop a reservoir management and inundation plan. (Forest Service 4(e) 19)[j]	Forest Service	$10,000[k]	$0[l]	$630
25. Use variable depth withdrawals from the project intake from the surface to 2 feet below the lowest lake surface elevation (688 feet NAVD88).	Kenai Hydro, staff	$0[u]	$0[u]	$0
26. Implement the Operation Compliance Monitoring Plan, which includes: (1) level and temperature monitoring in Grant Lake; (2) flow and temperature monitoring in Grant Creek bypassed reach; (3) flow and temperature monitoring in Grant Creek-tailrace; (4) failsafe provisions; (5) schedule for installing, maintaining, and collecting flow and temperature instrumentation; and (6) reporting.	Kenai Hydro	$20,000[v]	$0	$1,260

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
27. Develop an operation compliance monitoring and reporting plan with measures to: (1) use stream gages that meet USGS stream gage standards, (2) comply with minimum flow requirements in the bypassed reach and downstream of the tailrace, (3) comply with requirements for channel maintenance flows, (4) use of monitoring sites ST-2 (GC200) and RT-1 (at a depth of 0.5 meter) to compare temperatures in Grant Lake and Grant Creek, and (5) use real-time differences in temperature as the compliance metric for comparing Grant Creek and Grant Lake.	Staff	$25,000[f]	$0	$1,580
28. Develop a streamflow monitoring plan.	FWS, NMFS, Alaska DFG	$10,000[w]	$0[l]	$630
29. Develop an instream flow plan. (Forest Service 4(e) 19)[i]	Forest Service	$10,000[k]	$0[l]	$630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
30. As part of the Operation Compliance Monitoring Plan, monitor water temperatures continuously in Grant Lake upstream of the intake structure (RT-1), in the intake structure (IT-1), and in the downstream end of the Grant Creek bypassed reach upstream of the tailrace (ST-1), and monitor water temperatures every 15 minutes in Grant Creek downstream of the tailrace (ST-2 [GC200]).	Kenai Hydro	$40,000[x]	$4,000[x]	$6,520
31. As part of the streamflow monitoring plan, monitor water temperatures year-round, for the duration of the license, at intervals of no more than one hour in Grant Lake near the intake at a depth of 0−0.5 meter, in the intake structure, and in Grant Creek downstream of the tailrace, following USGS water temperature monitoring protocols.	FWS	$30,000[y]	$3,000[y]	$4,890
32. As part of the streamflow monitoring plan, monitor water temperatures year-round during the first 5 years of operation at intervals of no more than 1 hour in Grant Lake away from the influence of the project intake at a depth of 0−0.5 meter, in the intake structure, and in Grant Creek downstream of the tailrace, following USGS water temperature monitoring protocols.	Alaska DFG	$30,000[y]	$3,000[y]	$4,890

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
33. As part of the streamflow monitoring plan, monitor water temperature year-round in Grant Lake near the intake at a depth of 0−1 meter, in the intake structure, and in Grant Creek downstream of the tailrace, following USGS water temperature monitoring protocols.	NMFS	$30,000[y]	$3,000[y]	$4,890
34. As part of the operation compliance monitoring and reporting plan, monitor water temperature year-round in Grant Lake near the intake at a depth of 0.5 meter (RT-1) and in Grant Creek downstream of the tailrace (ST-2 [GC200]), following USGS water temperature monitoring protocols.	Staff	$20,000[z]	$2,000[z]	$3,260
35. As part of the Operation Compliance Monitoring Plan, compare water temperature in Grant Lake to water temperature at the downstream end of the Grant Creek bypassed reach upstream of the tailrace to determine if the average monthly water temperature difference is no more than 1ºC.	Kenai Hydro	$0	$0[t]	$0
36. As part of the streamflow monitoring plan, compare water temperature in Grant Creek to water temperature downstream of the tailrace to ensure the water temperature difference is no more than 0.5ºC.	Alaska DFG	$0	$0[t]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
37. As part of the streamflow monitoring plan, compare water temperature in Grant Creek to water temperature downstream of the tailrace to ensure the average monthly water temperature difference is no more than 1ºC.	FWS	$0	$0[t]	$0
38. As part of the operation compliance monitoring and reporting plan, use monitoring sites ST-2 (GC200) and GLT-1 (at a depth of 0.5 meter) to compare temperatures in Grant Lake and Grant Creek and use real-time differences in temperature as the compliance metric for comparing Grant Creek and Grant Lake. Modify intake depths to ensure Grant Creek is within 0.5ºC (+1.0ºC during ice break-up) from Grant Lake GLT-1 at a depth of 0.5 meter.	Staff	$0	$0[t]	$0
39. Develop a water temperature monitoring plan (NMFS 10(j) 8).	FWS, NMFS, Alaska DFG	$10,000[aa]	$0[aa]	$630
40. Develop a spill prevention, control, and containment plan that includes measures to minimize the potential for hazardous material spillage and methods for immediate, local containment if a spill occurs.	Kenai Hydro,	$10,000[bb]	$0[l]	$630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
41. Develop a hazardous materials containment and fuel storage plan that includes measures to contain all hazardous materials used during construction and operations.	Kenai Hydro	$10,000[bb]	$0[bb]	$630
42. Develop a hazardous materials plan that includes all measures related to hazardous material storage, spill prevention, and containment. (FWS 10(j) 16, Alaska DFG 10(j) 15, NMFS 10(j) 11)	FWS, Alaska DFG, NMFS, staff	$10,000[k]	$0[l]	$630
43. Develop a hazardous substances plan.	Forest Service	$10,000[k]	$0[l]	$0
44. Develop a solid waste and wastewater plan. (Forest Service 4(e) 19)[j]	Forest Service, staff	$10,000[k]	$0[l]	$630
45. Conduct turbidity monitoring upstream from and 100-feet downstream from construction activities during construction. (Alaska DFG 10(j) 14, NMFS 10(j) 10)	FWS, Alaska DFG, NMFS, staff	$0	$9,100[cc]	$9,100
46. Conduct turbidity monitoring downstream of the tailrace at 15-minute intervals during construction. (FWS 10(j) 15)	FWS	$0	$10,050[dd]	$10,050
47. Implement the Biotic Monitoring Plan for construction and operation monitoring of juvenile and adult salmonids during the first year of construction and during years 2 and 5 of project operation.	Kenai Hydro	$10,000[ee]	$9,640[ee]	$10,270

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
48. Modify the proposed Biotic Monitoring Plan to include SMART objectives, and add minnow trapping in winter and adaptive management criteria. (FWS 10(j) 9)	FWS	$10,000[ff]	$7,560[ff]	$8,190
49. Implement the Biotic Monitoring Plan for enhancement mitigation in the bypassed reach, Reach 2/3, and Reach 1, and assess the need for gravel augmentation.	Kenai Hydro	$21,160	$2,970	$4,310
50. Modify the proposed Biotic Monitoring Plan to continue salmonid investigations and gravel assessment on 5-year intervals for the life of the license, include a mechanism for decision-making and implementation of recommendations, conduct winter fish studies, from December through March, identify overwintering habitats for juveniles, and develop methodologies for fish presence and abundance indices. (FWS 10(j) 21)	FWS	$0	$940[hh]	$940
51. Develop an aquatic habitat restoration and monitoring plan. (Forest Service 4(e) 19)[j]	Forest Service	$10,000[k]	$0[l]	$630
52. Develop a fish mitigation and monitoring plan. (Forest Service 4(e) 19)[j]	Forest Service	$10,000[k]	$0[l]	$630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
53. Develop a spawning gravel monitoring plan. Conduct gravel monitoring in years 1, 10, 15, 20 and 30 of operation, with a report filed with the Commission after each year of monitoring. After monitoring in years 20 and 30, if results indicate a declining trend in spawning gravel, develop a mitigation plan to include gravel augmentation or modifications to channel maintenance flows to meet sediment recruitment and transport objectives based on monitoring results.	Staff	$5,000[ii]	$1,090[ii]	$1,410
54. Collect 100 tissue samples each from Coho, sockeye, and pink salmon in year 1 and 2 for genetic analysis for a total of 600 samples. (FWS 10(j) 20)	FWS	$0	$1,460[jj]	$1,460
55. Design the powerhouse tailrace to exclude fish from entering the powerhouse and to avoid or minimize the potential for fish injury or mortality. (FWS 10(j) 7, NMFS 10(j) 7, Alaska DFG 10(j) 7)	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$0	$0[t]	$0
56. Adhere to timing windows for instream construction activities and stream crossings. (FWS 10(j) 10, Alaska DFG 10(j) 9, NMFS 10(j) 9)	Kenai Hydro, FWS, Alaska DFG, NMFS, staff	$0	$0[t]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
57. Locate clearings, road corridors, and the transmission line a minimum of 100 feet away from the ordinary high water of Grant Creek. (FWS 10(j) 11, NMFS 10(j) 10, Alaska DFG 10(j) 10)	Kenai Hydro, FWS, NMFS, Alaska DFG, staff	$0	$0[t]	$0
Terrestrial Resources				
58. Restore areas that have been utilized for temporary construction and infrastructure development to "natural" conditions.	Kenai Hydro	$0	$0[kk]	$0
59. Implement the Vegetation Management Plan filed with the amended final license application that includes minimizing the introduction and spread of invasive plant species during construction, conducting invasive plant management and control, revegetating areas temporarily disturbed during construction, maintaining vegetation, performing general sensitive plant species protection and monitoring, and conducting pale poppy population management. (Forest Service 4(e) 19)[j]	Kenai Hydro, Forest Service, staff	$10,580[ll]	$6,240[ll]	$6,910

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
60. Modify the proposed Vegetation Management Plan to also include: (1) locating equipment inspections and/or wash stations well outside of riparian/aquatic zones; (2) treating aquatic invasive plants if any are detected in project waters; (3) monitoring the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (4) restoration success criteria, based on existing vegetation conditions; (5) a description of the data collection and analysis methods for monitoring that corresponds with success criteria; (6) monitoring restoration success and supplement plantings, as needed, until success criteria are met for two consecutive growing seasons; (7) conducting pre-construction surveys for Forest Service sensitive plants within areas of proposed ground disturbance; and (8) consulting with the Forest Service to obtain written approval prior to pesticide use and prohibit pesticide use on NFS lands within 500 feet of known locations of Forest Service special-status or culturally significant plant populations.	Staff	$15,000[f]	$5,000[f]	$5,950
61. Develop a terrestrial and aquatic invasive management plan. (Forest Service 4(e) 19)[j]	Forest Service	$10,000 [k]	$0[l]	$630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
62. Obtain written approval from the Forest Service prior to use of any pesticide or herbicides on NFS lands and prohibit pesticide use on NFS lands within 500 feet of known locations of the western toad or known locations of Forest Service special-status or culturally significant plant populations. (Forest Service 4(e) 14)	Forest Service	$0	$0[t]	$0
63. Implement the Final Avian Protection Plan filed with the amended final license application that includes migratory birds and bald eagles. (Forest Service 4(e) 19)[j]	Kenai Hydro, FWS, Forest Service, staff	$10,580[ll]	$9,460[ll]	$10,130
64. Modify the proposed Avian Protection Plan to also include nest surveys prior to any construction activities with potential to disturb nesting birds, not just before vegetation clearing activities.	Staff	$0[t]	$0[t]	$0
65. Develop a bear safety plan. (FWS 10(j) 12, Alaska DFG 10(j) 11)	Kenai Hydro, FWS, Alaska DFG, staff	$1,330[f]	$0[f]	$80

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
66. Avoid the use of helicopters or airplanes near mountainsides adjacent to Grant Lake and Grant Creek. Maintain a 1,500-foot clearance from mountain goats and follow designated no-fly zones for mountain goats and sheep in route and within the project area. (FWS 10(j) 13, Alaska DFG 10(j) 12)	FWS, Alaska DFG, Forest Service, staff	$0	$0[t]	$0
67. Develop a wildlife mitigation and monitoring plan. (Forest Service 4(e) 19) [j]	Forest Service	$10,000[k]	$0[l]	$630
68. Develop a threatened, endangered, proposed for listing, and sensitive species plan. (Forest Service 4(e) 19)[j]	Forest Service	$10,000[k]	$0[l]	$630
Recreation, Land Use, and Aesthetic Resources				
69. Re-route the INHT around the project area and construct the southern portion of the trail from Vagt Lake to Grant Creek.	Kenai Hydro	$146,740	$0	$9,250
70. Develop a plan for INHT access and re-route. (Forest Service 4(e) 21)	Forest Service	$257,170[mm]	$1,460[mm]	$17,670
71. Develop a maintenance and operation plan for the re-routed trail segment and trail bridge. (Forest Service 4(e) 19)[j]	Forest Service	$10,000[k]	$0[l]	$630
72. Conduct an INHT re-route workshop of the project if licensed to allow the powerhouse in the existing INHT easement. (Park Service 10(a) 1)	Park Service	$45,000[f]	$0	$2,840

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
73. Provide temporary signs to inform the public about construction activities and include Kenai Hydro contact information for questions or concerns that may arise.	Kenai Hydro, Park Service, staff	$5,000[f]	$0	$320
74. Provide real-time public notification of construction schedule and access issues via a website and point of contact. (Park Service 10(a) 3)	Park Service	$10,000[nn]	$950[nn]	$1,580
75. Construct a parking area with a single-unit vault restroom and signage to support non-winter visitor use on the project access road.	Staff	$86,210[oo]	$2,080[oo]	$7,510
76. Develop a public access plan to describe locations and entities responsible for installing and maintaining infrastructure such as gate(s), parking area, restroom, and signs to manage public access in the vicinity of the project access road between Seward Highway and Grant Lake.	Staff	$7,000[pp]	$810[pp]	$1,250
77. Restrict public access to project infrastructure by signing and gating/fencing the access road to address local residents' concerns about encouraging motorized use near the project and reduce the potential for unauthorized motorized use on adjacent NFS lands.	Kenai Hydro, staff	$8,500[f]	$700[f]	$1,240

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
78. Develop a fire prevention plan. (Forest Service 4(e) 19)[j]	Kenai Hydro, Forest Service, staff	$5,290	$5,290	$5,620
79. Minimize effects of project facilities on visual resources and light pollution.	Park Service, staff	$1,000[f]	$0	$60
80. Develop a scenery management plan. (Forest Service 4(e) 19)[j]	Forest Service, staff	$10,000[k]	$0[l]	$630
Cultural Resources				
81. Implement the final HPMP filed with the amended final license application.	Kenai Hydro	$10,580	$1,080	$1,750

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
82. Implement a revised HPMP that includes the following: (1) identification of specific Native organizations that will be consulted and how they will be involved; (2) addition of Mark Luttrell as a consulting party; (3) discussion of the methods used to conduct the TCP study, which Native organizations were consulted, and the results of such consultation, and conditions under with they would continue to be consulted; (4) clarification of survey of the proposed transmission line west of the Seward Highway to its interconnection; (5) schedule for completion of all HPMP measures; (6) detailed monitoring plan to monitor identified sites; (7) implementation of active management/ mitigation measures if warranted; (8) provision to formally evaluate and assess project effects on submerged cultural resources should they be exposed in the future; and (9) appendix containing documentation and copies of all section 106 consultation throughout the licensing process, including Alaska SHPO concurrence on the APE and HPMP measures (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.	Staff, Alaska SHPO, Forest Service	$15,580[f]	$5,000[f]	$5,980

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a, b]	Annual Cost (2018$)[a, c]	Levelized Annual Cost (2018$)
83. Develop a heritage resource protection plan. (Forest Service 4(e) 19) [j]	Forest Service	$10,000[k]	$0[l]	$630

[a] Kenai Hydro provided the cost in its January 16, 2018, amended final license application unless otherwise noted.

[b] Capital costs typically include equipment, construction, permitting, and contingency costs.

[c] Annual costs typically include O&M costs and any other costs that occur on a yearly basis.

[d] Staff estimates the cost to be $50,000 per year in years 1 through 4.

[e] Staff estimates a cost of $5,000 per year in years 1 through 9 (4 years of construction and 5 years of operation).

[f] Cost estimated by staff.

[g] Staff estimated the costs to develop and implement the plan and removed them from the overall construction cost and annual O&M cost, respectively, to enable us to compare similar agency and staff measures. The annual cost was based on an estimate of $20,000 per year in years 1 through 4.

[h] Staff estimated the cost to develop the plan and $25,000 per year in years 1 through 4 for implementation.

[i] Staff estimated the cost to develop the plan and $30,000 per year in years 1 through 4 for implementation.

[j] The Forest Service details for the plan in their comments in response to the REA notice, although they only requested a plan be developed under Forest Service 4(e) condition 19. Staff estimated the cost to develop and implement the plan based on the details in their comments.

[k] The Forest Service did not provide any details for the plan its 4(e) condition 19, so staff only estimated a cost to develop the plan.

[l] A cost to implement the plan cannot be estimated until the plan is completed.

[m] If adequate flows are available without needing to divert flows from the powerhouse, there would be no lost energy to implement the measure. If not, powerhouse operation may need to reduce or stop to ensure adequate flows. The worst case scenario would be a loss of 40 MWh (5 MW times 8 hours) in each year that generation would be lost.

[n] The flow enhancements are proposed to be provided as part of the normal operation of the project, so we assume no effect on the proposed annual generation.

[o] There would be no additional cost for this measure because the monitoring devices are included elsewhere.

[p] Staff estimated the costs to develop and implement the plan and removed them from the overall construction cost and annual O&M cost, respectively, to allow comparison with similar agency and staff measures. The annual cost was based on an estimate of $30,000 per year in years 1 through 4.

[q] Kenai Hydro stated the cost is included in the overall construction cost.

[r] Staff estimated the capital and annual O&M cost for one flow gage and removed them from the overall construction cost and annual O&M cost, respectively, to show the estimated cost of the measure.

[s] Staff estimated the capital and annual O&M cost for two flow gages and removed them from the overall construction cost and annual O&M cost, respectively, to show the estimated cost of the measure.

[t] Staff estimates there would be no additional cost to implement this measure.

[u] The capital cost to allow variable depth withdrawal is included in the overall construction cost and the operation of the gates is included in the overall O&M cost for the project.

[v] Staff estimated the cost to develop the proposed plan and removed it from the overall capital cost of the project to enable us to compare to the staff-recommended plan. The implementation cost of the plan is covered under the individual proposed minimum flow and water temperature monitoring measures.

[w] Staff estimated the cost to develop the plan; the cost of implementation would be covered under the individual measures to monitor flows are designated locations.

[x] Staff estimated the capital and annual O&M cost for four temperature monitoring locations and removed them from the overall construction cost and annual O&M cost, respectively, to allow comparison with similar agency and staff measures.

[y] Staff estimated the capital and annual O&M cost for three temperature monitoring locations and removed them from the overall construction cost and annual O&M cost, respectively, to allow comparison with similar agency and staff measures.

[z] Staff estimated the capital and annual O&M cost for two temperature monitoring locations and removed them from the overall construction cost and annual O&M cost, respectively, to allow comparison with similar agency and staff measures.

[aa] Staff estimated the cost to develop the plan; the cost to implement the plan is included in the agency water temperature monitoring measure.

[bb] Staff estimated the capital cost to develop the plan and removed it from the overall construction cost, to show the estimated cost of the measure.

[cc] Staff estimates the cost to implement the measure to be $48,000 per year in years 1 through 4.

[dd] Staff estimates the cost to implement the measure to be $53,000 per year in years 1 through 4.

[ee] Staff estimated the cost of the plan and estimates annual costs of $60,000 in year 1, and $75,000 in years 6 and 9 to implement the measure.

[ff] Staff estimates the cost to be $20,000 per year in years 1-5, 10, 15, 20, 25, and 30.

[gg] Staff estimates the cost would be $50,000 per year in years 1-5, 10, 15, 20, 25, and 30.

[hh] Staff estimates the cost would be $5,000 per year in years 5, 10, 15, 20, 25, and 30.

[ii] Staff estimates a capital cost of $5,000 to develop the plan; $5,000 per year for sampling in years 1, 10, 15, 20, and 30; and $5,000 in years 20 and 30 for trend analysis. Prepare a report after each sampling year.

[jj] Staff estimates the annual cost would be $15,000 in years 1 and 2.

[kk] The cost to implement this measure is included in the cost of the vegetation management plan.

[ll] Staff estimated the capital cost to develop the plan and removed it from the overall construction cost, to show the estimated cost of the measure. Kenai Hydro provided the annual cost.

[mm] The capital cost includes: $30,000 for a plan in year 1 (staff); $0 for easements (cost cannot be estimated); $15,000 to finalize the plan in year 2 (staff); and $212,170 to construct for the trail re-route and bridge (Kenai Hydro). The annual cost would be $1,460 for maintenance of the trail (Kenai Hydro) and bridge.

[nn] Staff estimates a capital cost of $10,000 to develop the website and $5,000 per year in years 1 through 4 to update the plan as needed.

[oo] Staff estimates a capital cost of $88,800 in year 2 to construct a parking area with a gravel compacted surface with vehicle barriers ($15,000); one information board ($2,000); approximately seven directional/regulatory signs ($2,800) and one single vault restroom ($69,000), and annual cost of $2,300 for O&M of these facilities.

[pp] Staff estimates a capital cost of $7,000 in year 1 to develop the initial plan and $5,000 per year to periodically review and revise the plan in years 6, 11, 16, 21, and 26.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the Grant Lake Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the staff alternative, as the preferred option. We recommend this option because: (1) issuance of an original hydropower license by the Commission would allow Kenai Hydro to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 5 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife resources, and would provide improved recreation opportunities at the project.

In the following section, we make recommendations as to which environmental measures proposed by Kenai Hydro or recommended by agencies and other entities should be included in any license issued for the project. In addition to Kenai Hydro's proposed environmental measures, we recommend additional staff-recommended environmental measures to be included in any license issued for the project. We also discuss which measures we do not recommend including in the license.

5.1.1 Measures Proposed by Kenai Hydro

Based on our environmental analysis of Kenai Hydro's proposal discussed in section 3 and the costs discussed in section 4, we recommend including the following environmental measures proposed by Kenai Hydro in any license issued for the project. Our recommended modifications to Kenai Hydro's proposed measure are shown in ***bold italic*** type face, and parts of measures we do not recommend are shown in ~~strikeout~~.

Project Construction

- Designate a third-party ECM ***with authority to stop work as needed*** to oversee construction activities and ensure compliance with measures to protect natural resources.
- Develop an ESCP that includes BMPs to prevent sediment mobilized during construction from entering Grant Creek or Grant Lake ***and includes: (1) a description of existing soil, groundwater, and vegetation conditions; (2) site-specific preventive measures; (3) identification of areas for storage or deposition of overburden, and implementation of erosion control measures in those areas; (4) measures to sample for lead in Grant Lake sediments that could be disturbed by project construction and operation, and, if lead is present, measures to prevent mobilization; and (5) an implementation schedule.***
- Restore areas disturbed by construction to pre-existing conditions.
- Consult with Alaska DFG, NMFS, and FWS to finalize design details for fish exclusion measures in the tailrace.
- Consult with Alaska DFG's habitat biologist to establish timing windows for instream construction and stream-crossing activities.
- Develop a bear safety plan that includes: (1) keeping construction sites and refuse areas clear of substances that attract bears, (2) installing bear-proof garbage receptacles and other measures during construction and operation to prevent bears from obtaining food or garbage, (3) minimizing possible conflicts with bears during construction and operation, (4) establishing protocols for dealing with problem bears,[75] and (5) notifying authorities of any bear-human conflict.

Project Operation

- ***Combine the proposed hazardous materials containment/fuel storage plan and spill prevention control and containment plan into a single hazardous materials plan that includes the following measures to be implemented during project construction and operation: (1) designation of specific areas to maintain and refuel vehicles and equipment, (2) measures for containment and cleanup in the event of a spill or accident, (3) provisions to remove oil and other contaminants from condensate and leakage from***

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[75] Although the agencies do not specifically define *problem bears*, we understand this term to refer to bears that repeatedly visit a construction area despite implementation of other measures in the plan, including trash management and use of bear-proof containers.

the turbines and other equipment in the powerhouse, and (4) a reporting schedule.

- Provide the following minimum flows in the bypassed reach: 5 cfs from January 1 through July 31, 10 cfs from August 1 through September 31, 7 cfs from October 1 through October 31, and 6 cfs from November 1 through December 31 to protect aquatic habitat and support benthic macroinvertebrates.

- Provide the following instantaneous minimum flows downstream of the tailrace: 60 cfs from January 1 through May 15, 80 cfs from May 16 through May 31, 150 cfs from June 1 through June 30, 195 cfs from July 1 through September 1, 150 from September 1 through September 30, 125 cfs from October 1 through October 15, 72 cfs from October 16 through November 15, and 60 cfs from November 16 through December 31 to protect habitat for salmonids and benthic macroinvertebrates.

- Use variable depth withdrawals from the project intake ***and adjust on a real-time basis to maintain Grant Creek temperature targets[76] established by real-time water temperature monitoring of Grant Lake (at a depth of 0.5 meter).***

- Provide channel maintenance flows of 800 cfs to the Grant Creek bypassed reach for a continuous 8-hour duration, once per year, for a minimum of 2 years in each moving 10-year period to promote sediment recruitment and transport from the bypassed reach to Grant Creek.

- Limit upramping rates to 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15). Limit downramping rates to ***a year-round maximum of 1 inch per hour (when operational control exists).***

- ***Develop an*** operation compliance monitoring ***and reporting*** plan which includes: (1) ***real-time water surface elevation monitoring*** ~~level~~ and ***real-time*** temperature monitoring in Grant Lake ***near the intake at a depth of 0.5 meter;*** (2) ***real-time*** flow ~~and temperature~~ monitoring in Grant Creek bypassed reach; (3) ***real-time*** flow and temperature monitoring in Grant Creek ~~tailrace~~ ***downstream of the tailrace at ST-2 (GC200);*** (4) ***provisions to minimize effects of equipment malfunction on Grant Creek water*** **temperature**;; (5) a schedule for installing, maintaining, and collecting flow

[76] Staff-recommended temperature targets for Grant Creek are GLTS ± 0.5ºC (GLTS+1ºC during ice out).

and temperature instrumentation; and (6) reporting of ***Grant Creek water temperatures and Grant Lake elevations***

- Implement the Vegetation Management Plan filed on January 16, 2018, that includes: (1) non-native, invasive plant management and control; (2) revegetation; (3) vegetation maintenance; (4) sensitive plant species protection and monitoring; and (5) pale poppy population management. ***Modify the plan to also include measures to: (1) locate equipment inspections and/or wash stations well outside of riparian/aquatic zones; (2) treat aquatic invasive plants if any are detected in project waters; (3) monitor the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (4) develop restoration success criteria, based on existing conditions, to determine whether revegetation efforts are successful; (5) develop data collection and analysis methods for monitoring that correspond with success criteria; (6) monitor restoration success and supplemental plantings, as needed, until success criteria are met for two consecutive growing seasons; (7) conduct pre-construction surveys for Forest Service sensitive plant species within areas of proposed ground and vegetation disturbance and consult with the Forest Service if needed to minimize effects on newly identified populations; and (8) obtain written approval from the Forest Service prior to using herbicides or pesticides on NFS lands.***

  - Implement components of the Avian Protection Plan that address effects of project operation on migratory species and bald eagles and minimizes potential for electrocutions or collisions with the project transmission line. ***Modify the proposed Avian Protection Plan to include nest surveys prior to any construction activities that have the potential to disturb nesting birds, not just before vegetation clearing activities.***

- Develop a fire prevention plan.

- ***Modify*** the HPMP ***to include: (1) identification of the specific Native organizations that will be consulted and how they will be involved; (2) addition of Mark Luttrell as a consulting party; (3) discussion of the methods used to conduct the TCP study, which Native organizations were consulted; results of such consultation; and conditions under which Native organizations would continue to be consulted in the future; (4) clarification regarding the survey status of the section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line; (5) a specific schedule for completion of all HPMP measures; (6) a monitoring plan that specifies the circumstances under which monitoring would occur, the party responsible for conducting the monitoring, how frequently regular***

monitoring would occur, and how monitoring results would be disseminated and used; (7) specific factors that would trigger implementation of more active management/mitigation measures over periodic monitoring; (8) a provision to formally evaluate and assess project effects on submerged cultural resources if they are exposed in the future; and (9) documentation and copies of all section 106 consultation throughout the licensing process, including documentation of Alaska SHPO concurrence on the project APE and concurrence with all measures contained within the HPMP (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.

5.1.2 Additional Measures Recommended by Staff

In addition to Kenai Hydro's proposed measures listed above, we recommend including the following staff-recommended measures in any license issued for the Grant Lake Project:

Project Construction

- Develop a construction plan that includes: (1) a detailed construction schedule; (2) a description of construction methods and BMPs to be employed and measures to reduce the risk of introduction or spread of invasive plants; (3) requirements to delineate construction areas using fencing and/or flagging; (4) identification of measures to avoid streams, wetlands, and pond habitats to the extent possible during construction; (5) provisions for environmental training of construction staff regarding laws, regulations, and BMPs to avoid or reduce effects on native plant and wildlife species including special-status species and their habitats; and (6) identification of other resource-specific protection plans that should be considered during construction activities.
- Develop a spoils disposal plan includes: (1) means and methods to dispose of any materials excavated during construction, (2) mapped locations of any proposed temporary and/or permanent spoil pile locations, (3) descriptions of the composition of any materials expected to be excavated on the site, (4) proposed use of excavated materials in the construction process, (5) any plans to dispose of materials offsite, (6) methods to prevent spoil materials from leaching from spoil piles into adjacent waterways and wetlands, and (7) identification of other resource-specific protection plans that should be considered during construction activities.
- Avoid the use of helicopters or airplanes near the mountainside adjacent to Grant Lake and Grant Creek to protect mountain goats. Follow designated no-fly zones

for mountain goats and sheep in route and within the project area and maintain a 1,500-foot clearance between aircraft and mountain goat habitat.

Project Operation

- Develop a solid waste and wastewater plan to protect water quality in Grant Creek from waste and sewage generated on site.
- Adjust intake withdrawal depth on a real-time basis based on the real-time Grant Creek and Grant Lake temperature monitoring to ensure Grant Creek temperature below the tailrace meets the following: (1) for the 30-day period when Grant Lake is going through its ice break-up, Grant Creek temperature be maintained at the temperature recorded in Grant Lake at a depth of 0.5 meter + 1.0°C (+/- 0.5°C); (2) once the spring turnover is complete and Grant Lake is ice-free, Grant Creek temperatures remain within +/- 0.5°C of Grant Lake temperature measured at a 0.5 meter depth, and (3) the same +/- 0.5°C criterion be maintained when Grant Lake is ice-covered.
- Develop and implement a salmonid spawning gravel monitoring plan, that includes: (1) methods to assess the distribution and abundance of salmonid spawning gravel; (2) spawning gravel assessments in years 1, 10, 15, 20, and 30; and (3) a trend analysis in years 20 and 30 to determine the rate of any spawning gravel reduction and appropriate measures to address any reduction in spawning gravel recruitment; and (4) reporting schedule to include reports after each sampling year.
- Develop a scenery management plan to minimize views of project facilities from the INHT and direct security lighting toward the ground to limit effects of light pollution.
- Install a gate and construct a parking area with a single-unit vault restroom on the project access road, east of the Seward Highway and railroad corridor and west of the access road bridge over Trail Lake Narrows to support non-winter visitor use of the project access road.
- Develop a public access plan to describe locations of and entities responsible for installing and maintaining infrastructure such as gate(s), parking area, restroom, signs to manage public access in the vicinity of the project access road between Seward Highway and Grant Lake.

The following section presents the basis for our recommended measures and our recommended modifications to the proposed measures.

Environmental Compliance Monitor

Kenai Hydro, consistent with the Forest Service (final 4(e) condition 20), proposes to provide an onsite, third-party ECM during all phases of construction to ensure adherence to all applicable BMPs and methods outlined in the monitoring and management plans. The ECM would manage all activities associated with implementing BMPs and the monitoring and management plans. Staff's modification, pursuant to final 4(e) condition 20, would ensure the ECM has the authority to stop work in the field to protect environmental resources, if need be; the ECM would act as a liaison with the Forest Service.

As discussed in section 3.3.2.2, in the *Effects of Project Construction on Water Quality* and *Construction Effects on Fisheries Resources* subsections, and in section 3.3.3.2, in the *Effects of Project Construction and Operation on Avian Communities* subsection, an onsite ECM would be able to assess the effectiveness of BMPs put in place to protect water quality, fish habitat, and nesting birds during construction. However, if construction activities continue despite observations of spills or erosion, these activities could exacerbate effects on water quality and fishery resources. Similarly, if vegetation-clearing activities encroach on buffers designated to protect nesting birds, these species could be injured, or their nests destroyed. Given the remote nature of the project, having an ECM on site to monitor project construction activities and ensure measures effectively protect environmental resources is appropriate. Ensuring the ECM has authority to stop work as the Forest Service specifies, would enable the ECM to stop construction activities to prevent further contamination.

Therefore, we recommend Kenai Hydro provide an ECM during construction activities and grant the ECM the authority to stop work when needed to protect natural resources from effects of construction activities. We estimate the cost of this measure to be $9,480, and the benefits to the environmental resources would be worth the cost.

Erosion and Sediment Control Plan

Consistent with the Forest Service final 4(e) condition 19, Kenai Hydro proposes to develop and implement an ESCP within 1 year of license issuance. This plan would include measures to minimize erosion and sediment deposition during construction.

Alaska DFG (10(j) recommendation 13) and FWS (10(j) recommendation 14) recommend that the plan include: (1) soil, groundwater, and vegetation conditions; (2) site-specific preventive measures; (3) identification of areas for storage or deposition of overburden and erosion control to be used in those areas; (4) prescriptions for revegetation of all disturbed areas, including location of treatment areas, plant species and methods to be used; and (5) an implementation schedule. The agencies also recommend that Kenai Hydro prepare the plan after consultation with the Forest Service, Alaska DFG (Alaska DFG recommendation), FWS, and other requesting agencies.

As discussed in section 3.3.1.2, in the subsection *Construction Effects on Geology and Soils,* the Forest Service, in the comments section of its letter filed in response to the Commission's Ready for Analysis notice, recommends the ESCP use site-specific measures to control erosion, stream sedimentation, dust, and soil mass movement consistent with USDA guidance.

As discussed in section 3.3.1.2, in the subsection *Construction Effects on Geology and Soils*, an ESCP is needed to protect water quality and aquatic resources during construction. Implementing the agency recommendations would provide for site-specific measures to prevent erosion of terrestrial habitats and the sedimentation and subsequent degradation of aquatic habitat during construction activities.

Therefore, we recommend Kenai Hydro develop the ESCP, consistent with Forest Service condition 19 and recommendations of Alaska DFG, FWS, NMFS, in consultation with NMFS, FWS, Forest Service, and Alaska DFG. However, we note that Alaska DFG's and FWS's recommended provision for the revegetation of all disturbed areas would be included in the Vegetation Management Plan discussed below rather than the ESCP.

We estimate that the levelized annual cost of developing an ESCP would be $6,950, and the benefits to aquatic and terrestrial resources would be worth the cost.

Lead Sampling and Analysis

As discussed in section 3.3.2.1, in the *Water Quality Sampling* subsection, Kenai Hydro found lead concentrations in water that exceeded the freshwater chronic standard in Grant Lake and Grant Creek. While the source(s) are unknown, these values suggest that activities that disturb lake sediments, either through excavation, or, operationally, in response to increased water velocities near the intake, could potentially mobilize sediment-bound lead, resulting in downstream transport. Therefore, we recommend Kenai Hydro, in consultation with Alaska DFG, FWS, ADEC, and the U.S. Army Corps of Engineers, modify the ESCP to include: (1) pre-construction sediment sampling for lead in Grant Lake where construction or operation could disturb sediments, and (2) measures to prevent sediment-bound lead, if present above screening values (see below) from being mobilized during construction or operation and entering Grant Lake or Grant Creek. The modified ESCP would describe pre-construction sediment sampling in Grant Lake, including:

- Definition of the project's zone of influence (the area of the lake bed where construction or operational activities would disturb sediments, e.g., excavation within the cofferdam to construct the project intake and outlet weir and areas where water currents associated with project operation could mobilize sediment near the intake).
- Use of the U.S. Army Corps of Engineers screening values for lead in sediment, developed through the Sediment Evaluation Framework (SEF) for the Pacific Northwest (Northwest Regional Sediment Evaluation Team, 2018). SL1, corresponding to a concentration below which adverse effects to benthic communities would not be expected, is 360 mg/kg, and SL2, above which more than minor adverse effects may be observed in benthic organisms, is >1300 mg/kg.

- Field equipment, methods, and plan for sampling particle size and lead concentration in Grant Lake sediments following the Sediment Evaluation Framework (SEF) for the Pacific Northwest (Northwest Regional Sediment Evaluation Team, 2018).
- Reporting to FERC and regulatory agencies.

Lead concentration results would guide the next step:

- If sediment lead concentrations are below 1300 mg/kg screening level: construction would proceed as planned.
- If sediment lead concentrations are greater than 1300 mg/kg screening level: Kenai Hydro should develop a plan to delineate the construction area and the operational zone of influence in which project construction and operation may disturb Grant Lake sediments.[77] The plan should consider measures to prevent the resuspension and transport of lead from sediments to the water column; such as, those methods described in Contaminated Sediment Remediation Guidance for Hazardous Waste Sites (EPA, 2005)).

We estimate that the levelized annual cost of modifying the ESCP to include lead sampling as recommended by staff, would be $1,260, and the benefits to water quality and benthic communities would be worth the cost.

Hazardous Materials Plan

Consistent with Forest Service final 4(e) condition 19, Kenai Hydro proposes to develop a hazardous materials containment/fuel storage plan and a spill prevention, control, and containment plan, to reduce potential for accidental spill of hazardous materials into project waters. Although Kenai Hydro proposes to develop the two plans in consultation with stakeholders, it does not provide any specific details for the plans.

Alaska DFG (10(j) recommendation 15) and FWS (10(j) recommendation 16) recommend that Kenai Hydro combine the two plans into a single comprehensive plan. FWS also recommends that the plan: (1) designate specific areas for vehicle and equipment fueling and maintenance, (2) include measures for spill containment and cleanup, and (3) remove oil and contaminants from turbine condensate and leakage and other equipment in the powerhouse.

Based on the analysis in section 3.3.2.2, in the *Effects of Construction on Water Quality* subsection, we find use of hazardous materials in the project area would create

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[77] To determine the operational zone of influence the plan should include a hydrodynamic analysis to evaluate how water velocities near the intake may influence and entrain sediment-bound lead from the lake bottom.

potential for inadvertent spill of these materials into waterways. Developing a hazardous materials plan, with provisions recommended by FWS, would better describe proposed measures and strengthen the proposed plan to minimize potential effects on water quality. In addition, we find that including an element for reporting observations of oily sheens and turbidity plumes on surface waters would document fuel and oil spills and identify any need for additional containment measures. Combining fuel storage, spill prevention/control, and containment into a single plan would simplify agency consultation, the Commission's plan approval process, and compliance reporting.

Therefore, we recommend Kenai Hydro develop, in consultation with Alaska DFG, FWS, and the Forest Service, a hazardous materials plan that includes: (1) specific areas for the maintenance and refueling of vehicles and equipment, (2) contingencies with appropriate measures for containment and cleanup in the event of a spill or accident, (3) provisions to remove oil and other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse, and (4) reporting requirements. We estimate that the levelized annual cost of developing the plan, as recommended by staff, would be $630, and the benefits to aquatic resources would be worth the cost.

Project Construction Plan

Forest Service final 4(e) condition 19 specifies that Kenai Hydro develop a project construction plan. However, the Forest Service does not provide any detail as to what the plan should include.

Kenai Hydro proposes several plans that include measures to prevent effects of construction activities on natural resources. These include the development of an ESCP, stormwater pollution prevention plan, and hazardous materials containment/fuels storage plan; and the implementation of its proposed Vegetation Management Plan and Avian Protection Plan. Additionally, Kenai Hydro proposes to consult with Alaska DFG to identify timing restrictions for construction in Grant Creek and to consult with Alaska DFG, FWS, and NMFS for final design of the tailrace fish screen.

As discussed in section 3.3.3.2, in the *Effects of Project Construction on Vegetation Communities* subsection, implementation of Kenai Hydro's proposed plans with our recommended modifications would identify locations for protection measures, including silt fence, runoff control, control of invasive plant species, and buffer areas to protect sensitive plant species and nesting birds, that Kenai Hydro would use during construction activities to protect sensitive resources. However, it is unclear how Kenai Hydro would identify potential conflicts among the plans. For example, the ESCP could include placement of silt fence in an area identified as occupied nesting habitat through implementation of the Avian Protection Plan. Developing a construction plan, as the Forest Service specifies, would consolidate proposed site-specific location and design information for protection measures into a set of maps and drawings that would facilitate agency consultation and communication with contractors.

Additionally, as discussed in section 3.3.4.3, in the *Land and Resource Management* subsection, Kenai Hydro's proposed iterative process for preparing and securing agency design approval would provide information about project construction. However, a separate plan that synthesizes schedules, construction locations and activities, and access restrictions would demonstrate whether any conflicting uses may occur. Implementing this plan would provide for public safety during construction by identifying locations when and where public use should be excluded and ensure the Forest Service has adequate information to continue managing public use of the NFS lands. As discussed in section 3.3.6.2, *Project-related Effects on Cultural Resources,* Kenai Hydro also must consult further with Native organizations to find out whether culturally significant plants could be affected by project construction. A project construction plan would afford Native organizations with the opportunity to conduct surveys, and record and collect any culturally significant plants within construction areas prior to ground-disturbing activities.

Developing this plan in consultation with FWS, NMFS, the Forest Service, Alaska DFG, and Alaska DNR would allow the agencies to suggest measures Kenai Hydro could implement to manage public access to public lands during construction and protect natural resources.

Therefore, we recommend Kenai Hydro develop, in consultation with FWS, NMFS, the Forest Service, Alaska DFG, and Alaska DNR, a construction plan that integrates the components of the ESCP, Vegetation Management Plan, Avian Protection Plan, stormwater pollution prevention plan, and hazardous materials plan and spoils disposal plan and includes: (1) a detailed construction schedule; (2) a description of construction methods and BMPs to be employed, including identification of measures to reduce the risk of introduction or spread of invasive plants; (3) requirements to delineate construction areas using fencing and/or flagging; (4) identification of measures to avoid streams, wetlands, and pond habitats to the extent possible during construction; (5) provisions for environmental training of construction staff regarding laws, regulations, and BMPs to avoid or reduce effects on native plant and wildlife species including special-status species and their habitats; and (6) identification of other resource-specific protection plans that should be considered during construction activities.

We estimate that the levelized annual cost of developing a project construction plan would be $630, and the benefits to aquatic and terrestrial resources would be worth the cost.

Spoils Disposal Plan

Kenai Hydro proposes to re-use excavated materials as part of project construction, such as crushing excavated rock for road surfaces and using top soil to restore disturbed areas for revegetation.

Forest Service final 4(e) condition 19 specifies that Kenai Hydro develop a spoils disposal plan. However, the Forest Service does not provide any additional details about what the plan should include.

We anticipate spoil materials would be stockpiled onsite, but it is not clear where stockpiles would be located. The analysis in section 3.3.1.2, in the *Construction Effects on Geology and Soils* subsection, indicates that a spoils disposal plan would provide additional information to guide construction activities and ensure protection of environmental resources, including water quality, and botanical and wildlife resources. Therefore, we recommend that Kenai Hydro develop, in consultation with the Forest Service, FWS, NMFS, Alaska DFG, and Alaska DNR, a spoils disposal plan that includes: (1) means and methods used to dispose of any materials excavated during construction, (2) mapped locations of any proposed temporary and/or permanent spoil pile locations, (3) descriptions of the material composition of any materials expected to be excavated onsite and appropriate uses of such materials for construction, (4) proposed use of excavated materials in the construction process, (5) any plans to dispose of materials offsite, (6) methods to be employed to prevent spoil materials from leaching from spoil piles into adjacent waterways and wetlands, and (7) identification of other resource-specific protection plans that should be considered during construction activities.

We estimate that the levelized annual cost of developing a spoils disposal plan would be $630, and the benefits to aquatic and terrestrial resources would be worth the cost.

Solid Waste and Wastewater Plan

Kenai Hydro proposes to construct a sanitary wastewater holding tank or septic system to ensure solid waste and wastewater from the project do not affect water quality in Grant Creek. Forest Service 4(e) condition 19 specifies Kenai Hydro prepare a solid waste and wastewater plan; however, the Forest Service does not provide any specifics as to what measures the plan would include.

Based on the analysis in section 3.3.2.2, in the *Effects of Project Operation on Water Quality* subsection, Kenai Hydro's proposed construction of a sanitary waste holding tank or septic system would likely prevent wastewater from entering Grant Creek. However, consulting with the Forest Service and Alaska DFG on the specific location and design of these facilities would ensure that they are effective and appropriately designed for site-specific conditions and further reduce potential effects on water quality. Therefore, we recommend Kenai Hydro develop, in consultation with the Forest Service and Alaska DFG, a solid waste and wastewater plan. We estimate that the levelized annual cost of the plan would be $630, and the benefits to aquatic and fisheries resources would be worth the cost.

Turbidity Monitoring

FWS (10(j) recommendation 15) and Alaska DFG (10(j) recommendation 14) recommend that Kenai Hydro monitor turbidity both upstream and downstream of all construction activities and/or discharge points for overland flows that cross construction areas and discharge into Grant Creek. Both FWS and Alaska DFG recommend that if turbidity 100 feet downstream of the construction area exceeds Alaska water quality standards (25 NTU above natural conditions) (see table 3-5), then Kenai Hydro, per the ESCP to be developed, would cease construction activities, locate sediment sources, and implement appropriate sediment control measures. Additionally, FWS recommends Kenai Hydro monitor turbidity at 15-minute intervals downstream of the tailrace at gage location ST-2 (GC200). In its response to agency comments Kenai Hydro states that it would comply with these conditions if incorporated into the license order but did not modify its proposal to include turbidity monitoring.

As discussed in section 3.3.1.2, in the *Construction Effects on Geology and Soils* subsection, and in section 3.3.2.2, in the *Effects of Project Construction on Water Quality* subsection, construction activities would result in ground disturbance that could increase erosion potential and affect water turbidity levels. Implementation of Kenai Hydro's proposed ESCP with our recommended modifications would reduce the potential for sediment to enter project waters. However, monitoring is needed to ensure measures implemented as part of the plan are effective throughout the construction period. State monitoring standards require monitoring turbidity upstream of the work area as a control and monitoring turbidity 100 feet downstream of the construction area to identify increases in sedimentation. Such monitoring would alert the ECM that additional measures are required. Stopping construction activities, identifying the source of sediment, and implementing appropriate control measures would minimize any project-related effects of sedimentation on water quality and aquatic resources and ensure that they are timely addressed. As discussed in section 3.3.2.2, in the *Effects of Project Construction on Water Quality* subsection, we find localized monitoring would readily identify and address erosion containment issues if turbidity levels exceed those stipulated by current Alaska DEC standards (see table 3-5). Therefore, we recommend that Kenai Hydro conduct turbidity monitoring upstream and downstream of all construction activities and/or discharge points for overland flows that cross construction areas and discharge into Grant Creek. However, we conclude that additional monitoring at the ST-2 (GC200) stream gage location, as FWS recommends, would not provide additional benefit to water quality.

We estimate that the levelized annual cost of turbidity monitoring would be $9,100, and the benefits to water quality protection and aquatic resources would be worth the cost.

Ramping Rates

Alaska DFG (10(j) recommendation 3), FWS (10(j) recommendation 3), and NMFS (10(j) recommendation 3) each recommend that Kenai Hydro operate the proposed project to avoid sudden changes (either increases or decreases) in the flow in Grant Creek. The agencies recommend Kenai Hydro limit downramping rates to a maximum of 1 inch per hour (when operational control exists) and limit upramping rates to 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15). Additionally, Alaska DFG (10(j) recommendation 5) recommends Kenai Hydro install and maintain a gage downstream of the project tailrace (ST-2 [GC200]) as the compliance point for ramping rates. As discussed below in *Water Temperature in Grant Creek,* Kenai Hydro would also use this gage to monitor temperature.

In its reply comments, Kenai Hydro agrees to implement the agencies' recommended upramping rates but proposes alternative downramping rates of a maximum of 2.25 inches per hour from May 16 through November 15. For the remainder of the year, Kenai Hydro agrees to limit downramping rates to 1 inch per hour, consistent with the Alaska DFG, FWS, and NMFS recommendations. Kenai Hydro also disagrees with Alaska DFG's recommended ramping rate compliance location. Kenai Hydro states there is potential for non-project-related flows to enter the bypassed reach (through either overland flow, groundwater accretion, or precipitation), which would contribute to ramping rates in Grant Creek downstream of the tailrace. Therefore, Kenai Hydro proposes to monitor ramping at a gage in the project tailrace, to isolate effects of the project.

Based on the analysis in section 3.3.2.2, in the *Ramping Rates* subsection, maintaining ramping rates in line with current changes in stage would help maintain fish productivity and historical habitat conditions in Grant Creek. Stage/flow changes that exceed those currently occurring in the winter have the potential to flush salmonid eggs and alevins from the gravel, potentially limiting reproductive success. Subsequently limiting upramping to 1 inch per hour during the winter period, as recommended, would eliminate this risk. Excessive downramping rates could cause fish stranding as water levels quickly recede and fish become trapped in dewatered sections of the stream channel. Based on the analysis of downramping rates under existing conditions, we find that Grant Creek regularly experiences downramping rates greater than 1 inch per hour, suggesting the Alaska DFG, FWS, and NMFS recommendation could be overly protective since existing salmonid populations in Grant Creek persist with higher downramping rates. However, we have not identified a substantial difference in cost between the agency-recommended and Kenai Hydro-proposed downramping rates. Therefore, we conclude that the agency-recommended ramping rates are more protective of the resource and their implementation would be consistent with the FPA. We recommend Kenai Hydro limit downramping rates to a year-round maximum of 1 inch per hour (when operational control exists), and limit upramping rates to 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15).

Ramping rates are intended to protect aquatic resources in Grant Creek, and any effects of changes in water volume on ramping rates are dependent on channel morphology. Although there may be some non-project accretion in the bypassed reach, the project would also modify flows in the bypass, which would contribute to stage change below the tailrace. Although the magnitude of these changes relative to flows through the powerhouse would be small and have little contribution to ramping rates downstream of the tailrace, the dimensions of the tailrace do not reflect the existing Grant Creek contours and would not provide an accurate assessment of ramping rates observed in reaches downstream of the project. Because the tailrace channel dimensions are not consistent with channel dimensions of Grant Creek where the aquatic resources reside, it is more appropriate to use the ST-2 (GC200) gage location in Grant Creek as the compliance monitoring point for ramping rates, not a gage in the project tailrace, as Kenai Hydro proposes.

Details regarding the exact monitoring protocols—location, equipment and station design, methods, and compliance reporting—should be included in the project operation compliance monitoring and reporting plan discussed below. We estimate our recommended ramping rates and associated monitoring would not have any additional cost because the recommended gage (ST-2 [GC200]) is proposed in this location to monitor other flow related measures, so a separate gage is not required and benefits to aquatic resources would be worth the cost. In contrast, the levelized annual cost Kenai Hydro's ramping rate monitoring would be an additional $1,630 more than our recommendation due to the installation of an additional gage in the tailrace.

Water Temperature in Grant Creek

Kenai Hydro proposes an operational regime that minimizes temperature differences between Grant Creek and Grant Lake, thereby maintaining the existing Grant Creek thermal regime. As discussed in section 3.3.2.2, flows from Grant Lake to the powerhouse and bypassed reach would not change average annual discharge from Grant Lake, thus we would expect no change in residence time that could alter water temperatures or change lake trophic status. Further, in contrast to a deep withdrawal that would increase Grant Lake temperatures by removing cooler water and expanding the warmer epilimnion, the proposed surface withdrawal would maintain the existing, natural outlet depth.

Consistent with NMFS 10(j) recommendation 8, FWS 10(j) recommendation 8, and Alaska DFG 10(j) recommendation 8, Kenai Hydro proposes to evaluate the effects of project operation on water temperatures in Grant Creek by monitoring water temperature in Grant Lake near the intake structure at a depth of 0.5 meter and in Grant Creek downstream of the tailrace. However, Kenai Hydro's proposal and NMFS's and FWS's recommendations are not consistent on the threshold criteria for these temperature comparisons. Consistent with FWS's recommendation, Kenai Hydro proposes to operate the project to ensure monthly average lake and creek temperatures are within 1ºC. However, NMFS recommends that Kenai Hydro operate the project to ensure that water temperatures in Grant Creek are not warmer or colder than pre-project temperatures by a target range of 0.5 to 1.0°C. NMFS does not specify the period (daily, monthly, annual average) for comparison, and Alaska DFG does not specifically provide threshold criteria for lake and creek temperatures.

As indicated in the analysis in section 3.3.2.2, in the *Water Temperature Monitoring* subsection, NMFS's recommendation to operate the project in a manner that provides pre-project temperatures in Grant Creek is problematic. Water temperature data for Grant Creek are limited and insufficient to determine variability in temperature over multiple years and therefore do not provide suitable target temperatures for the duration of the project license. Furthermore, it is not clear how NMFS's recommended measure would preserve annual variability during operations. Creation of an artificial temperature regime in Grant Creek that is isolated from temperature variation in Grant Lake and other drainages may be detrimental to salmonids and other aquatic resources. Therefore, we do not recommend adherence to pre-project water temperature targets as a condition of any license issued for the project.

In contrast to establishing water temperature targets, in section 3.3.2.2, we discuss maintenance of the existing Grant Creek thermal regime, which, based on Kenai Hydro's data, is largely driven by the temperature of Grant Lake surface waters. Figure 3-9 demonstrates that 2013 water temperatures measured downstream of the proposed project tailrace at ST-2 (GC200) closely matched water temperatures in Grant Lake at 0.5 meter below the surface (within 1ºC except for the ice break up period, see below). Operating the project to minimize differences between Grant Creek temperatures below the tailrace and Grant Lake temperatures at 0.5 meter below the surface, while not setting specific targets, would maintain existing, pre-project relationships between Grant Creek and Grant Lake temperatures critical to timing and emergence of anadromous fish and provide annual variability that benefits aquatic resources. Such operations would be consistent with Kenai Hydro's proposal and Alaska DFG and FWS recommendations.

As a result, we recommend Kenai Hydro monitor water temperature in real-time at two locations: (1) at a depth of 0.5 meter in the vicinity of the project intake in Grant Lake; and (2) downstream of the tailrace at ST-2 (GC200), as recommended by FWS and Alaska DFG. Based on the analysis in section 3.3.2.2, in the subsection *Water Temperature Monitoring,* we recommend measuring the real-time water temperature compliance targets for Grant Creek at a 0.5-meter depth in Grant Lake at a location void of influence from the project's intake. Compliance with the real-time water temperature target would be measured at ST-2 (GC200).

As discussed in section 3.3.2.2, Grant Creek water temperatures measured at ST-2 (GC200) were typically warmer in May than concurrent Grant Lake water temperatures measured at a 0.5-meter depth (as shown in figure 3-9). These warmer temperatures occur during the spring turnover of Grant Lake when the lake transitions from ice covered to an open water (ice break-up) condition, and Grant Creek water temperature responds more rapidly to the warm spring air temperatures than Grant Lake surface waters, resulting in a greater variability between Grant Creek and Grant Lake water temperatures than is seen at other times of the year. In recognition of this process we recommend two temperature threshold criteria for maintaining the existing water temperature regime in Grant Creek. First, for the 30-day period when Grant Lake is going through its ice break-up, we recommend Grant Creek temperature be maintained at the temperature recorded in Grant Lake at a half meter depth + 1.0°C (+/- 0.5°C). Second, once the spring turnover is complete and Grant Lake is ice-free, we recommend that Grant Creek temperatures remain within +/- 0.5°C of Grant Lake temperature measured at a 0.5-meter depth. The same +/- 0.5°C criterion would be maintained when Grant Lake is ice-covered.

Methods for determining the onset of and duration of spring turnover (which triggers the +1°C criterion) as well as monitoring protocols (i.e., location, equipment and station design, methods, and compliance reporting) should be included in the project operation compliance monitoring and reporting plan discussed below. Because this recommendation utilizes equipment and project capabilities already proposed by Kenai Hydro, we do not anticipate that it would affect costs of the proposed project.

Operation and Compliance Monitoring and Reporting

As discussed in section 3.3.2.2, in the subsections *Effects of Project Operation on Water Temperature in Grant Creek*, *Effects of Project Operation on Aquatic Habitat in the Bypassed Reach*, and *Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace*, project operation would modify the timing and magnitude of flows in the bypassed reach and in Grant Creek downstream of the tailrace and would likely influence water temperature in Grant Creek. Kenai Hydro proposes to implement its Operation Compliance Monitoring Plan, which includes measures to monitor flow and temperature in Grant Lake, the project bypassed reach, and the project tailrace. Forest Service final 4(e) condition 19 specifies that Kenai Hydro prepare a reservoir management and inundation plan.

As recommended by staff, and discussed in this section, the project would provide: (1) minimum flows in the bypassed reach, (2) minimum flows downstream of the project tailrace, (3) channel maintenance flows, (4) ramping rate restrictions, and (5) monitoring and maintenance of target water temperatures. We recommend Kenai Hydro modify its proposed operation compliance monitoring plan in consultation with NMFS, FWS, USGS, and Alaska DFG, to document compliance with operational requirements listed above and add a reporting component to the plan. The operations component of the plan would incorporate all staff-recommended flow and water temperature monitoring data requirements and specify the operational protocols for compliance with each. The monitoring component of the plan would articulate specific monitoring locations, equipment and station design, and methods. The reporting component of the plan would include a provision for annual operation and compliance reports, which would document compliance with all license requirements for flow, ramping rates, and water temperature. The annual reports would also track and report other operational events such as spinning reserve operations, channel maintenance flows, and results of the periodic monitoring of salmonid spawning habitat and, if warranted, include proposed measures to maintain salmonid spawning habitat. Additionally, as specified in Forest Service final 4(e) condition 4, the annual report would include: review of non-routine maintenance; discussion of any foreseeable changes to project facilities; discussion of any revisions or modifications to approved plans; identification of any new protection measures needed for newly listed sensitive species; and identification of any planned pesticide use. Prior to filing the annual report with the Commission, Kenai Hydro would submit the report to NMFS, FWS, the Forest Service, USGS, and Alaska DFG for comment and describe how the final report addresses agency comments.

Our recommended operation compliance monitoring and reporting plan would satisfy the intent of the Forest Service's recommended instream flow and reservoir management and inundation plans. We estimate that the levelized annual cost of our recommended operation compliance monitoring and reporting plan would be $1,580, and the benefit to aquatic resources would warrant the cost.

Gravel Management

Consistent with Alaska DFG (10(j) recommendation 4), FWS (10(j) recommendation 4), and NMFS (10(j) recommendation 4), Kenai Hydro proposes to provide flows of 800 cfs to the bypassed reach for a minimum of 8 hours during at least 2 years of every 10-year period of the project license to facilitate sediment recruitment and transport from Reaches 5 and 6 to Reaches 1 through 4.

Based on our analysis in section 3.3.2.2, in the *Sediment Management* subsection, we find that project operation would reduce flows in Reaches 5 and 6, and these reduced flows would reduce gravel recruitment and transport processes relative to existing conditions. However, providing channel maintenance flows, as Kenai Hydro proposes and FWS, NMFS, and Alaska DFG recommend, would likely mitigate the reduction in gravel transport processes. If adequate flows are available without needing to divert flows from the powerhouse, there would be no lost energy to implement the measure. However, if flows are insufficient, powerhouse operation may need to reduce or stop to provide the channel maintenance flows. The worst case scenario would be a loss of 40 MWh (5 MW times 8 hours), or approximately $5,000, in each year that generation would be lost. As such, this cost would be worth the benefit of limiting changes to gravel recruitment and transport processes, and the resulting adverse effects on aquatic resources. Therefore, we recommend Kenai Hydro provide channel maintenance flows of 800 cfs to the bypassed reach for an 8-hour duration during at least 2 years of every 10-year period.

As discussed in section 3.3.2.2, in the *Gravel Monitoring and Augmentation* subsection, while our recommended channel maintenance flows may sustain existing gravel transport, the reduction in flow magnitude, duration, and frequency through Reaches 5 and 6 would likely limit the erosional processes Grant Creek relies upon for gravel recruitment. In response, a decrease in spawning gravel abundance may be observed over time, which could have long-term adverse effects on the Grant Creek salmonid population. Therefore, consistent with Forest Service's 4(e) condition 19's aquatic habitat restoration and monitoring plan, Kenai Hydro proposed, in addition to releasing periodic channel maintenance flows, to monitor gravel recruitment in years 1, 5, and 10. NMFS recommends that Kenai Hydro monitor gravel every 5 years for the life of the license stating that, if spawning gravels were to be depleted, it likely would not be detected in the first 5 years of project operation and may take 20 to 30 years or more to be substantial enough to be detected. Alaska DFG recommends monitoring gravel conditions during years 5, 10, and 20 of project operation. Alaska DFG also recommends Kenai Hydro prepare a final report of its findings along with the identification of measures to mitigate any adverse effects.

To determine the long-term effectiveness of the periodic channel maintenance flow releases on gravel recruitment within Grant Creek, we recommend Kenai Hydro monitor spawning gravel recruitment in Reaches 1 through 4 in Grant Creek. Monitoring gravel abundance in year 1, as Kenai Hydro proposes, would provide a baseline inventory of available gravel for comparison with future data collection efforts. Because any potential effects of the project on channel substrate would likely occur slowly, effects may not be discernable during the first 10 years of operation. Consequently, Kenai Hydro-proposed gravel monitoring schedule (during year 1 of construction and years 5 and 10 of operation) would not be sufficient to determine project effects. On the other hand, as discussed in section 3.3.2.2, in the *Gravel Monitoring and Augmentation* subsection, NMFS's recommendation to monitor gravels on a 5-year interval for the life of the license may be unnecessary if channel maintenance flows are found to be adequate to maintain sediment recruitment at current levels. We do not recommend monitoring in year 5 of the license because construction of the project is expected to take several years, and it would be difficult to determine project effects on spawning gravel recruitment after only a couple of years of project operation. Subsequently, we recommend Kenai Hydro monitor gravel abundance in Grant Creek during year 1 of the license to provide a baseline inventory, and then again in years 10, 15, 20 and 30 of the license. The salmonid spawning gravel monitoring plan should be developed in consultation with FWS, NMFS, and Alaska DFG, and include: (1) methods for inventorying salmonid spawning gravel in Grant Creek; (2) gravel abundance inventories in years 1, 10, 15, 20, and 30 of the license; (3) provisions for reporting inventory results, for each sampling year in the annual report specified above; and (4) the inclusion of a salmonid spawning gravel recruitment trend analysis in the years 20 and 30 annual reports. If a decline in spawning gravel is observed after 20 years of operation, the trend analysis should identify actions to improve spawning habitat, such as an increase in the frequency, duration, or magnitude of channel maintenance flows, or gravel augmentation. Following sampling in year 30, the final report should include analysis of whether mitigation measures (if needed after year 20) are effective in modifying trends, or if no mitigation was implemented, if results are consistent with the trend observed at year 20.

We estimate that the levelized annual cost of development and implementation of salmonid spawning gravel monitoring plan would be $1,410, and the benefits to aquatic and fisheries resources would be worth the cost.

Vegetation Management Plan

To minimize potential effects associated with project construction and operation on vegetation communities, Kenai Hydro proposes to implement its Vegetation Management Plan. The proposed Vegetation Management Plan covers all lands within, and adjacent to, the project boundary with the potential to be affected by the proposed project. The plan describes the necessary measures (i.e., BMPs) to minimize effects on vegetation communities, including: (1) employing appropriate measures to minimize the introduction and spread of invasive plant species during construction; (2) employing invasive plant management and control during the first growing season after construction completion and year 5 post-construction; (3) revegetating the project area during the first growing season after construction is complete; (4) removing vegetation in construction areas, and maintaining non-herbaceous vegetation every 8 to 10 years during the license term for safety and reliability clearances along road and transmission line corridors; (5) employing general sensitive plant species protection and monitoring prior to ground-disturbing activities associated with project construction on NFS lands; and (6) managing the pale poppy population within the project boundary.

Forest Service final 4(e) condition 14 would prohibit pesticide use on NFS lands within 500 feet of known locations of western toad and known locations of Forest Service special-status or culturally significant plant populations. Additionally, the condition specifies that application of pesticides must be consistent with Forest Service riparian conservation objectives. The condition also specifies that Kenai Hydro obtain written approval before applying pesticides on NSF lands.

Forest Service final 4(e) condition 19 would require Kenai Hydro to develop an aquatic invasive species management plan that includes 1) actions to reduce the potential for introduction of aquatic invasive plants; such as, locating equipment inspections and/or wash stations well outside of riparian/aquatic zones and requiring all equipment/material potentially entering riparian/aquatic zones be either inspected or washed prior to entering stream, lake or riparian zones; and 2) treatments if aquatic invasive plants are detected.

Based on the analysis in section 3.3.3.2, in the *Effects of Project Construction on Vegetation Communities* subsection, we find Kenai Hydro's Vegetation Management Plan would ensure that Kenai Hydro revegetates and maintains disturbed areas to their pre-construction state, provides appropriate measures to minimize the introduction and spread of invasive plant species, provides protection for sensitive plant species, and appropriately manages pale poppy populations. However, although the proposed plan states Kenai Hydro would comply with the state or federal land manager's methods for assessing the success of revegetation efforts, it includes no details regarding success criteria or a monitoring schedule. We find that these details are a critical component of a revegetation plan; therefore, the inclusion of survey methods, survey schedules, and specific guidelines for supplemental plantings would provide the details needed to evaluate whether the plan would effectively guide restoration efforts.

Based on the analysis in section 3.3.3.2, in the *Effects of Project Construction and Operation on the Potential Spread of Invasive plant Species* subsection, Kenai Hydro's Vegetation Management Plan already includes measures for washing construction vehicles and equipment used during instream work. These measures would apply equally to terrestrial and aquatic invasive plant species and reduce potential for introduction of all invasive plants. However, modifying the plan to stipulate that equipment inspection and cleaning stations are located well outside of riparian/aquatic zones, as Forest Service final 4(e) 19 specifies, would ensure invasive propagules are not inadvertently washed into waterways. Including treatment of aquatic invasive plants found in project effected waters would also ensure that if any aquatic plants are introduced during project construction they are appropriately treated to prevent adverse effects on aquatic resources.

Based on the analysis in section 3.3.3.2, in the *Effects of Project Construction and Operation on Special-status Plants* subsection, Kenai Hydro's Vegetation Management Plan would protect known locations of the pale poppy, a designated Forest Service sensitive plant species. However, although we expect Kenai Hydro's pre-licensing surveys were effective in identifying sensitive species populations present in 2013, new pale poppy populations or other Forest Service sensitive species could have become established within areas of proposed disturbance since the 2013 surveys. Conducting surveys for sensitive plant species within areas of proposed disturbance, prior to construction activities, would ensure new populations are identified. If new populations are discovered, consultation with the Forest Service to identify appropriate avoidance or mitigation measures would reduce potential effects on sensitive plant species.

Based on the analysis in section 3.3.3.2, in the *Use of Pesticides in Riparian Areas and on NFS Lands* subsection, we find incorporating Forest Service's specified measure to prohibit pesticide use on NFS lands within 500 feet of known locations of Forest Service special-status or culturally significant plant populations would protect these species from adverse effects. Consultation with the Forest Service would help to identify known locations of sensitive resources, including special-status or culturally significant plant populations where protection buffers are needed. However, because there are no reported occurrences of western toad in the project area and range maps for this species do not include the Kenai Peninsula, we do not recommend including protection buffers for this species.

Therefore, we recommend that Kenai Hydro, in consultation with Alaska DFG and the Forest Service, modify the proposed Vegetation Management Plan to also include measures to: (1) locate equipment inspections and/or wash stations well outside of riparian/aquatic zones; (2) treat aquatic invasive plants if any are detected in project waters; (3) monitor the success of revegetation efforts monthly between April and September during construction and annually thereafter for 5 years; (4) develop restoration success criteria, based on existing vegetation conditions; (5) develop data collection and analysis methods for monitoring that correspond with success criteria; (6) monitor restoration success and supplement plantings until success criteria are met for two consecutive growing seasons; (7) conduct pre-construction surveys for Forest Service sensitive plant species within areas of proposed disturbance and, if found, consult with the Forest Service to minimize effects on newly identified populations; (8) obtain written approval from the Forest Service prior to using herbicides or pesticides on NFS lands. We estimate the revised plan would have a levelized annual cost of $5,950, and the benefits to vegetation resources would be worth the cost.

With our recommend modifications to the proposed Vegetation Management Plan, we do not find any additional benefit of developing a separate aquatic invasive species management plan. However, we recognize that development of an aquatic invasive species management plan is included in Forest Service final 4(e) condition 19 and would be included as a mandatory condition in any license issued for the project if it is included in the final 4(e) condition.

Avian Protection Plan

Kenai Hydro's proposed Avian Protection Plan includes a variety of measures to minimize project effects on bird communities. These measures generally focus on minimizing effects of construction on nesting birds and minimizing potential bird collisions or electrocutions associated with the proposed project transmission line. As discussed in section 3.3.3.2, in the *Effects of Project Construction and Operation on Avian Communities* subsection, we find the plan would reduce potential project effects on birds. However, we note that the descriptions of measures related to protection for nesting birds define protection activity timelines based on scheduled vegetation clearing activities. Although vegetation removal is most likely to affect nesting birds and surveys prior to vegetation removal are appropriate, we also expect other construction activities not requiring vegetation removal, such as blasting or instream work, could disturb nesting birds. As written, it is unclear if Kenai Hydro's Avian Protection Plan would include nest surveys prior to all project-related activities with the potential to disturb nesting birds. Therefore, we recommend Kenai Hydro modify the Avian Protection Plan to clearly indicate that surveys for bird nesting activity, as described in the Avian Protection Plan, would occur prior to any project activities with potential to disturb nesting birds. We expect that the proposed plan would cover the majority of activities necessitating surveys, and our modification would not result in a substantial increase in survey needs. Therefore, we do not expect our recommendation would have any additional cost and would provide additional protection to nesting birds.

Protection for Mountain Goats from Aircraft

Kenai Hydro might need to use helicopters to transport materials to the construction site, which could potentially disturb mountain goats in the vicinity of the proposed project. FWS (10(j) recommendation 13) and Alaska DFG (10(j) recommendation 12) recommend that Kenai Hydro minimize the use of helicopters or airplanes near mountainsides adjacent to Grant Lake and Grant Creek and maintain a 1,500-foot distance between aircraft and mountain goats at all times.

As discussed in the analysis in section 3.3.3.2, in the *Effects of Project Construction and Operation on Mountain Goats* subsection, we find that aircraft accessing proposed project lands would increase the risk of disturbance that could negatively affect mountain goats residing in the vicinity of the proposed project. Such disturbance could lead to habitat abandonment or injury. Therefore, we recommend that Kenai Hydro maintain 1,500 feet between aircraft and potential mountain goat habitat and follow Forest Service designated no-fly zones for mountain goats and sheep in route and within the project area. We find this measure would not have any additional cost and would benefit mountain goats in the vicinity of the proposed project lands.

Public Outreach for Construction Activities

The Park Service recommends that Kenai Hydro establish a project status website to provide real-time information to the public about the status of access to the area, install signage at key locations, and a provide a public point of contact. Kenai Hydro agrees to install temporary signs documenting construction activities and listing a primary contact at Kenai Hydro for any questions/concerns that may arise during construction activities.

Based on the analysis in section 3.3.4.2, in the *Effects of Construction on Public Access* subsection, we find few visitors use the proposed construction area, and those that do mainly use it for dispersed uses such as hiking and fishing. Installing signs to notify visitors of construction activities and provide a point of contact at Kenai Hydro would reduce potential risks to public safety and inform visitor use. However, most of the recreation use in the project area is associated with Vagt Lake, which is about 0.5 mile south of and not near the construction area. Consequently, we conclude area closures for the 18-month construction period would affect very few visitors. Anglers would still have access to Grant Creek along the streambank trails, and hikers would still have access to Grant Lake along the Saddle Trail and Case Mine Trail. Therefore, we do not recommend development of the Park Service's recommended public outreach website and providing a point of contact. However, we do recommend the installation of signs, which we estimate would have a levelized annual cost of $1,580, and public benefits are worth the cost.

Public Access and Parking

Following construction, Kenai Hydro proposes to install a gate on the project access road and prohibit public access to project lands.

Based on the analysis in section 3.3.4.2, in the *Effects of Operation on Public Access* subsection*,* Kenai Hydro's proposed fencing around project infrastructure would displace the public from using about 5 to 10 acres near the powerhouse, detention pond, and laydown area, which includes a portion of land along the south side of Grant Creek and about 1 acre at Grant Lake near the intake facilities. We find the project would have limited effect on the availability of recreation land. Allowing non-motorized access and winter motorized use to Grant Lake via the project access road would be consistent with land management objectives for state and federal lands in proximity to the project[78]. Providing recreational access via the proposed access road would allow and encourage trail use, and it would not interfere with Kenai Hydro's proposed operation.

Therefore, we recommend Kenai Hydro construct and maintain a parking area outside the Seward Highway and the ARRC railroad corridor and near the project's access road and bridge over Trail Lake Narrows, allow non-motorized use of the project access road, and provide a gate and signage to prohibit motorized vehicle use of the access road during the non-winter months. To address Forest Service concerns about human waste disposal and sanitation, we recommend Kenai Hydro install and maintain a single-unit vault restroom at the parking area. To ensure the recommended public access improvements are properly located and managed, and maintained, we recommend Kenai Hydro develop a public access plan that in consultation with Alaska DNR, the Forest Service, and Kenai Borough. The plan should allow for year-round non-motorized use and winter motorized use consistent with applicable land and resource management plans[79] and should include: (1) descriptions and maps showing locations roads, trails (including the planned INHT route), gate(s), signs, and a parking area with a single-unit vault restroom between and including Seward Highway and Grant Lake; (2) designs for gates and signs (including sign messages); (3) methods used for monitoring gate effectiveness and vandalism; (4) a schedule for completion of the parking area and toilet facilities within 1 year from the start of project operation; (5) procedures and schedules for maintaining gate(s) and facilities; and (6) methods for

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[78] Alaska DNR land management regulations allow snowmachine use on state-owned lands during the winter months.

[79] Applicable land management guidelines are described in the Kenai River Comprehensive Plan (Alaska DNR, 1997), Kenai Area Plan (Alaska DNR, 2001), and Chugach National Forest Revised Land and Resource Management Plan (Forest Service, 2002).

periodically reviewing plan effectiveness and the process to implement revisions, if needed, to provide recreation access and protect environmental resources.

We estimate the parking area with a single-unit vault restroom and developing a public access plan would have a levelized annual cost of $7,510, and the benefits to recreation resources would be worth the cost.

Scenery Management

Construction and operation of the project would introduce features to the visual landscape that would conflict with the existing natural scenic views. Kenai Hydro proposes to design the project to provide separation between project facilities and Grant Creek by using colors and textures that blend with the landscape. Kenai Hydro would stage construction so that equipment would be kept onsite and would schedule most work to occur during the summer to limit the need for additional lighting during the construction period. Kenai Hydro also proposes to revegetate areas temporarily disturbed during construction.

The Park Service recommends screening, to the extent possible, all project facilities including the roads, buildings, transmission lines, detention pond, and staging areas using existing and created landforms, vegetation, and exterior paint colors that blend with the landscape. The agency also recommends using directional security lights only in the immediate vicinity of project facilities using the lowest effective illumination and temperatures. Forest Service final 4(e) condition 19 specifies that Kenai Hydro develop a scenery management plan but provides no additional detail as to what measures the plan would include.

Based on the analysis in section 3.3.5.2, *Aesthetic Resources, Environmental Effects*, we conclude that construction would increase traffic and noise at the intersection of the access road and the Seward Highway. We find these effects would quickly diminish with distance from the construction activities. These effects would be minimal considering their localized nature, and they would only occur during two summer seasons.

During project operation, effects of the project on visual resources would consist of views of the access road and transmission line corridor from the Seward Highway. Recreation users who access the project on foot would have partial views of the powerhouse, penstock, transmission line, and detention pond and unobstructed views of the bridge over Trail Lake Narrows. Additionally, visitors using the intake access road to travel to Grant Lake would also see the intake tower extending about 8 to 20 feet above the water surface. Finally, project lighting would be visible at night and contribute to light pollution in the immediate area. We conclude viewing project infrastructure may contrast with an expectation of viewing an undeveloped landscape near Grant Lake. However, Alaska DNR does not specifically manage lands at this location for their scenic value, and the development would not have an appearance that is inconsistent with the existing management goals. We find this changed appearance would be consistent with the designated moderate scenic integrity objective, applicable to NFS lands from which visitors could view the project, because the view of the intake tower would only slightly alter the landscape and would be visually subordinate to the landscape character being viewed.

Implementing a scenery management plan would reduce the effects of the project on visual resources. The plan would include developing revegetation plans for construction sites, determining color palates for project infrastructure, describing processes for agency coordination for maintenance activities, and monitoring views of project infrastructure over the license term. Monitoring these views is necessary because effective screening is expected to be achieved a few years after planting when vegetation becomes established and is taller and denser. Considering vegetation will die or fall during the license term, monitoring permanent photo points would assist in determining whether supplemental planting during the license term is necessary to screen views of project infrastructure, particularly near the INHT. Incorporating the Park Service's recommendation for security lighting in a scenery management plan would have an additional effect of limiting stray lighting in the area.

We estimate development of a scenery management plan would have a levelized annual cost of $630, and the benefits to visual resources would be worth the cost.

Historic Properties Management Plan

Kenai Hydro proposes to implement the HPMP filed with its amended final license application to provide for the management of cultural resources and historic properties within the proposed project APE. The Alaska SHPO, Forest Service, and Commission staff commented on the HPMP and recommend additional modifications to it. The analysis presented in section 3.3.6.2, *Cultural Resources, Environmental Effects*, indicates that, although the HPMP includes many of the standard requirements of an HPMP, some measures contained within the HPMP still require some clarification and/or more detail. In addition, other measures should be included in the HPMP to ensure that O&M of the project would not adversely affect historic properties over the term of any original license. Consequently, we recommend modification of Kenai Hydro's HPMP in consultation with the Alaska SHPO, Forest Service, and other consulting parties to consider their comments and to include with the following revisions: (1) identification of the specific Native organizations that would be consulted and how they would be involved; (2) addition of Mark Luttrell as a consulting party; (3) a discussion of the methods used to conduct the TCP study, which Native organizations were consulted, the results of such consultation, and the conditions under which Native organizations would continue to be consulted in the future; (4) clarification of the survey status of the section of the proposed transmission line extending west from where it crosses the Seward Highway to its interconnection with the main power distribution line; (5) a specific schedule for completion of all HPMP measures; (6) a monitoring plan that specifies the circumstances under which monitoring would occur, who would conduct the monitoring, how frequently regular monitoring would take place, and how monitoring results would be disseminated and used; (7) specific factors that would trigger more active management/mitigation measures over periodic monitoring; (8) a provision to formally evaluate and assess project effects on submerged cultural resources should they be exposed in the future; and (9) an appendix containing documentation and copies of all section 106 consultation, including documentation of Alaska SHPO concurrence on the project APE and concurrence with all measures contained within the HPMP (including the use of monitoring and installation of interpretive signs as mitigation measures), and an appendix that details the extent to which each comment received on the HPMP is addressed in the revised plan.

We estimate that the levelized annual cost to revise and implement the HPMP for the project would be $5,980, and the benefits of cultural resource protection justify the cost.

5.1.3 Measures Not Recommended by Staff

Staff finds that some of the measures recommended by other interested parties would not contribute to the best comprehensive use of the Grant Creek water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following section discusses the basis for staff’s conclusion not to recommend such measures.

Annual Project Review Meeting

Kenai Hydro proposes to prepare an annual report detailing activities related to compliance with license conditions over the prior year.

Alaska DFG and FWS (10(j) recommendations 18) recommend that Kenai Hydro hold annual consultation meetings with the agencies to review study and monitoring reports and compliance with license articles. Forest Service (final 4(e) condition 4) specifies that Kenai Hydro conduct annual meetings with agencies to discuss measures needed to ensure protection and use of the NFS lands and resources affected by the project. The Forest Service expects the meeting agenda to include status of license condition implementation, monitoring results, review of non-routine maintenance activities, foreseeable changes to project facilities, revisions to plans, review of changes to sensitive species lists, maintenance plans, reservoir management and flow schedules, and planned pesticide use.

As discussed above, we recommend consultation with the agencies on such specific project-related actions as developing protection plans and assessing certain monitoring results. Annual review meetings for the more generic purpose of reviewing sensitive species lists or reviewing overall license implementation would serve no specific, project-related purpose and is not otherwise needed for the Commission to administer the terms of any license issued for the project. Therefore, we have no justification for recommending a license condition requiring routine annual consultation meetings with the agencies.

Although we are not recommending a license condition for annual consultation meetings and annual reviews of sensitive species lists, we recognize that these measures are included in the Forest Service's final 4(e) condition 4 and would be included as mandatory conditions in any license issued for the project.

Adult and Juvenile Salmonid Monitoring

As part of its Biotic Monitoring Plan, Kenai Hydro proposes to monitor adult and juvenile salmonids in Grant Creek to assess potential project effects on salmonid populations. In its comments on the Biotic Monitoring Plan, Alaska DFG supports salmonid monitoring.

We discuss the proposed and recommended salmonid monitoring protocols in section 3.3.2.2, in the *Biotic Monitoring in Grant Creek* subsection. We note that, although monitoring would provide general information on aquatic habitat and the abundance and distribution of salmonids in the project area, it would neither directly benefit fisheries resources nor specifically isolate a project-related effect. On the latter point, we identify a multitude of non-project-related factors with potential to influence salmon populations in Grant Creek, including commercial and recreational harvest, ocean survival, predation, land use practices, and/or degraded habitat located in the Kenai River Watershed outside the project vicinity. While some project effects can be approximated by comparing fish monitoring results for Grant Creek to other concurrent fish population assessments in the Kenai River Watershed, this analysis would be restricted to those fish populations within a significantly limited distance to minimize other external variables, such as habitat quality and land use practices near spawning grounds. These external variables prevent the use of general biotic monitoring to isolate project-related effects on salmonid populations. Finally, generic biotic monitoring would not relate to any pending or ongoing Commission action, including compliance with the terms of any license issued for the project.

We estimate that the levelized annual cost of adult and juvenile salmonid monitoring would be $9,640, and for the reasons noted above, we conclude that the lack of any project-related benefits to aquatic resources would not be worth the cost. However, we recognize that development of a fish mitigation and monitoring plan is included in Forest Service preliminary 4(e) condition 19 and would be included as a mandatory condition in any license issued for the project if it is included in the final 4(e) condition.

Salmonid DNA Sampling

In lieu of Kenai Hydro's proposed measures for gravel augmentation, FWS recommends (10(j) recommendation 20) that Kenai Hydro collect genetic tissue samples for species DNA analyses. FWS states that there is an opportunity to obtain live fish DNA samples during the construction of the project access road. FWS recommends Kenai Hydro collect tissue from adult salmon from Grant Creek in consecutive sample years until 200 coho, 100 sockeye, and 200 pink salmon samples have been collected.

FWS states that DNA collections are needed for Grant Creek to support population baselines used to identify appropriate post-project mitigation measures over the life of the project license. FWS also recommends Kenai Hydro collect tissue samples from 50 to 100 rainbow trout and Dolly Varden adults for DNA analysis. FWS states that tissue samples from rainbow trout and Dolly Varden from Grant Creek would improve the FWS spatial coverage for these species in the Kenai River Watershed and would improve the FWS estimates of genetic diversity for both species.

Kenai Hydro states that it will not commit to the collection of genetic samples from live fish. However, Kenai Hydro states that it would be willing to gather tissue samples from carcasses found opportunistically during project O&M activities.

In section 3.3.2.2, in the *Biotic Monitoring in Grant Creek* subsection, we conclude that FWS's recommendation to collect tissue samples for genetic analysis would, as a general matter, improve the existing genetic baselines for salmonids in Grant Creek. Genetic sampling of live adult salmonids would enable trends to be evaluated over time. However, project construction and operation, with our recommended protection and enhancement measures, would not result in a significant change in the genetic structure of salmonid populations in Grant Creek. In addition, as discussed above in *Adult and Juvenile Salmonid Monitoring*, there are a multitude of non-project-related factors with potential to influence salmon populations in Grant Creek. DNA collection and genetics monitoring are not capable of isolating the multitude of potential effects on Grant Creek's salmonid populations. Consequently, we find that collecting DNA samples would not support a project-specific evaluation of project effects on salmonid populations in Grant Creek; therefore, we do not recommend genetic analysis of the project area fish population.

We estimate FWS's recommended DNA sampling would have an annual levelized cost of $1,460, and the lack of project-related benefits to fisheries resources would not be worth the cost.

Iditarod National Historic Trail

The proposed project powerhouse, penstock, detention pond, transmission line, and access road, would be located within or cross a portion of Alaska DNR's 1,000-foot INHT management corridor, and the intake access road would cross the Forest Service's 100-foot easement for the INHT. Forest Service final 4(e) condition 21 includes several measures related to the construction of the proposed project near the trail corridor. These measures include: (1) coordinate with the Forest Service on design and development of the access road at its intersection with the INHT; (2) account for potential drainage effects in the design of the access road and be responsible the incremental expense of drainage features resulting from the project; (3) maintain and reconstruct the trail associated with any damage caused by the access road; (4) consult with the Forest Service to ensure trail function, operability, and sustainability remain intact; (5) bear additional costs for the trail and bridge caused by penstock construction;

(6) during construction and 5 years thereafter, remove down trees caused by project construction; (7) provide administrative access on the project access road to the Forest Service; (8) develop a scenery management plan (Condition 19); and (9) prevent public access from the INHT to project facilities.

We analyze Forest Service final condition 4(e) 21 in section 3.3.4.2, in subsection *Iditarod national Historic Trail.* Based on our analysis, the elements contained in Forest Service condition 21, such as consulting with the Forest Service regarding design plans, providing administrative access on the project access road, repairing project-related damage, and restricting public access to project facilities are duplicative of coordination that would occur as components of the development of our recommended project construction plan, erosion and sediment control plan, vegetation management plan, and scenery management plan as discussed above in section 5.1.2. Therefore, we conclude specific license articles for elements 1, 2, 3, 4, 6, 8, and 9, as listed above, would be redundant and do not recommend their incorporation in any license that may be issued for the project.

The remaining elements 5 and 7 of Forest Service Condition 21 pertain to additional design and costs necessary to construct and maintain the INHT because of project infrastructure. We conclude these measures are administrative and do not recommend they be included as environmental measure is any license that may be issued for the project.

However, we recognize that these measures are included in Forest Service final 4(e) condition 21 and would be included as a mandatory condition in any license issued for the project.

Operational Changes

FWS (10(j) recommendation 21) recommends project operations plans include process provisions for how any determined need for operational changes would be incorporated into the project. Any license issued for the project would include the standard license reopener provisions to address any necessary changes in operations if conditions warrant operational changes. Therefore, we do not recommend including such provisions in the project plans.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Project construction would disturb soils in the project area, resulting in temporary adverse effects on soil resources. Kenai Hydro's proposed ESCP, with our recommended modifications, would reduce potential for erosion. Additionally, our recommended measures for turbidity monitoring, a spoils disposal plan, and a construction plan would further limit potential effects of project construction on erosion, sedimentation, and water pollution. Even with implementation of these plans, there would still be temporary increases in sediment and turbidity levels that would cause short-term effects on biota in Grant Lake, Grant Greek, and Trail Lake Narrows.

Project operation would cause flow fluctuations in the bypassed reach and in Grant Creek downstream of the tailrace. Reducing flows in the bypassed reach could reduce transport of gravel and fine sediment within Grant Creek. Kenai Hydro's proposed channel maintenance flows and our recommended salmonid spawning gravel monitoring plan would ensure suitable spawning and rearing habitat is available to salmonids and minimize adverse effects downstream of the project.

Project construction would result in the permanent loss or alteration of about 10.2 acres of vegetated wildlife habitat, including about 8.4 acres of forested habitat and 1.8 acres of herbaceous habitat. Roughly 1.5 acres of temporary disturbance would also occur during construction. The use of construction equipment could introduce invasive plant species and provide opportunities for them to colonize areas where land is disturbed during project construction. However, revegetating the disturbed areas and ensuring successful establishment of native vegetation as outlined in the Vegetation Management Plan would help control the introduction and spread of invasive plants.

Construction activities, and to a lesser extent, project operation, would disturb wildlife through increased noise and human presence. The overhead transmission line could result in bird collisions and cause direct injury or mortality of individual animals. Designing the transmission line consistent with practices outlined by APLIC, including marking to increase visibility, would minimize the potential for collision to the greatest extent possible. Existing recreational access to the project area, while generally minor and limited to dispersed use, would be periodically interrupted during the construction period. Some noise associated with project operation, as well as partial views of project facilities, would also affect visitors to the area.

5.3 SUMMARY OF SECTION 10(J) RECOMMENDATIONS AND 4(E) CONDITIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that, whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to our February 8, 2018, notice accepting the application to license the project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, Alaska DFG, NMFS, and Interior collectively filed 33 recommendations under section 10(j) of the

FPA. In the draft EIS, we made the preliminary determination that 23 of the 33 recommendations fell within the scope of section 10(j). Of those recommendations determined to be within the scope of section 10(j), we determined in the draft EIS that three are inconsistent with the purpose and requirements of the FPA or other applicable law. These recommendations included: (1) conducting turbidity monitoring at the gage downstream of the tailrace at 15-minute intervals during construction; (2) recording temperature within the project intake to use as a target temperature for temperature in Grant Creek below the tailrace; and (3) operate the project to maintain water temperature in Grant Creek to be within 0.5°C of pre-project temperatures in Grant Creek.

We sent letters to NMFS and FWS on October 19, 2018, informing them of our preliminary determination of inconsistencies for their recommendations and requesting concurrence, comments, or alternative recommendations. The agencies did not request a 10(j) meeting; however, we discussed inconsistencies between the agencies' recommendations and the purposes and requirements of the FPA or other applicable law during the afternoon public meeting for the draft EIS on November 28, 2018, in Moose Pass, Alaska. Following is a summary of the meeting discussions for each of the recommendations that are within the scope of section 10(j) but found to be inconsistent or partially inconsistent with the purpose and requirements of the FPA or other applicable law.

5.3.1.1 Turbidity Monitoring

In the draft EIS, as discussed in section 5.1.2, *Turbidity Monitoring*, we did not recommend adopting FWS' recommendation to include turbidity monitoring below the tailrace at 15-minute intervals during construction. Rather, we recommend Kenai Hydro monitor turbidity upstream and downstream of all in-stream construction activities and/or discharge points for overland flows that cross construction areas and discharge into Grant Creek. FWS did not make any comments about turbidity monitoring during the draft EIS meeting or in its written comments on the draft EIS. Therefore, the inconsistencies with FWS recommendation monitor turbidity downstream of the tailrace and sections 4(e) and 10(a) of the FPA remain unresolved.

5.3.1.2 Water Temperature in Grant Creek During Project Operations

In the draft EIS, as discussed in section 5.1.2, *Water Temperature in Grant Creek,* we did not recommend adopting NMFS' recommendation to maintain water temperature in Grant Creek within 0.5°C of pre-project temperatures in Grant Creek. Rather, we recommend Kenai Hydro monitor temperature in Grant Lake, at a depth of 0.5 meter, in real time and operate the project to maintain water temperature in Grant Creek within 0.5ºC of water temperature measured in Grant Lake. We extend that tolerance to up to 1.5ºC during the ice break-up period.

Additionally, we did not recommend adopting NMFS and FWS recommendations to monitor water temperature within the Grant Lake intake. We also did not adopt NMFS and Alaska DFG recommendations to monitor temperature for the first 5 years of project operation, then consult with agencies to determine a need for additional monitoring. Rather, we recommend Kenai Hydro monitor water temperature in Grant Lake at a depth of 0.5 meter in the vicinity of the project intake in Grant Lake; and in Grant Creek downstream of the tailrace. Under our recommendation, Kenai Hydro would continuously adjust the intake depth to control temperature in Grant Creek.

During the public meeting about the draft EIS, NMFS agreed with our approach but suggested that over the duration of the license term, the timing of ice off process could shift and in would be more appropriate to tie the higher 1.5°C tolerance to the ice off process rather than to a specific month. NMFS, FWS, and Alaska DFG did not comment on our recommended monitoring locations or continuous monitoring and intake level adjustment.

Following review of NMFS comments, as discussed in section 5.1.2 *Additional Measures Recommended by Staff,* we modified our recommendation to allow up to a 1.5 ºC between Grant Creek and Grant Lake for a 30-day period extending from the onset of spring melt to ice out. As a result, the inconsistencies with NMFS recommendation to maintain pre-project temperatures in Grant Creek and sections 4(e) and 10(a) of the FPA are resolved. During the meeting, we asked if there were any other comments on our recommendations related to temperature monitoring and there were no replies to the contrary. Therefore, we consider inconsistencies between NMFS and FWS recommendations for temperature monitoring within the intake structure and NMFS and Alaska DFG recommendations to consider discontinuing temperature monitoring after five years be resolved.

5.3.1.3 Final 10(j) Recommendations

Following the draft EIS meeting, Alaska DFG filed final 10(j) recommendations on January 9, 2019 that are materially the same as their preliminary conditions, as amended, that were presented in the draft EIS. FWS did not file final 10(j) recommendations with its comments on the draft EIS.

NMFS filed final 10(j) recommendations on March 1, 2019. NMFS withdrew preliminary recommendations for maintaining pre-project temperatures in Grant Creek and changes to Kenai Hydro’s proposed Biotic Monitoring Plan. NMFS modified its recommendation to monitor stream flow to include a stilling well at the stream gage downstream of the project and to recommend Kenai Hydro post project flows to a website available to NMFS and other stakeholders. NMFS’s letter also included the following new 10(j) recommendations: (1) fail-safe provisions to ensure bypass and tailrace flows are provided at all times including following unanticipated interruption in generation or equipment failure; (2) consultation with Alaska DFG for the timing of instream construction activities; (3) turbidity monitoring upstream and 100 feet downstream of all construction activities; (4) notification of non-compliance events within 7 days and filing of a detailed description within 30 days of the event; (5) provide access to the project for NMFS employees; and (6) conduct annual project review meetings with NMFS and project stakeholders.

Alaska DFG, NMFS, and Interior collectively filed 28 recommendations under section 10(j) of the FPA.[80] We found 21 of the 28 recommendations to be within the scope of section 10(j). Of those recommendations determined to be within the scope of section 10(j), we determined that two are inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5-1 lists each of these recommendations and whether they are adopted in the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section. Sections 5.1.2, *Additional Measures Recommended by Staff*, and 5.1.3, *Other Measures Not Recommended by Staff*, discuss the reasons we do or do not recommend adopting measures that we have determined are within the scope of section 10(j).

[80] As shown in table 5-1, Alaska DFG filed 18 recommendations on January 9, 2019; NMFS filed 14 recommendations on March 1, 2019; and Interior filed 21 recommendations on April 9, 2018, and amended with an errata filed on May 2, 2018.

Table 5-1. Fish and wildlife agency recommendations for the Grant Lake Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
1. Conduct an annual project review meeting during construction and first 5 years of operation.	Alaska DFG, FWS, NMFS (recommendations 18, 18, and 14)	No, not a specific measure to protect fish and wildlife	$1,990	No (see section 5.1.3)
2. Develop and implement an ESCP.	Alaska DFG, FWS (recommendations 13 and 14)	Yes	$6,000	Yes
3. Provide channel maintenance flows of 800 cfs for an 8-hour duration in at least 2 years out of every moving 10-year window for the duration of the license.	Alaska DFG, FWS, and NMFS (recommendations 4, 4, and 4)	Yes	$0	Yes
4. Develop a stream gaging plan that includes: (1) installation of a flow and temperature gage meeting USGS standards downstream of the project tailrace, (2) monitoring and recording flows in the bypass, (3) monitoring and recording channel maintenance flows, (4) monitoring and recording ramping rates, and (5) annual reporting.	Alaska DFG, FWS, and NMFS (recommendations 5, 5, and 5)	Yes	$630	Yes, but incorporated into our recommended operations compliance monitoring and reporting plan.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
5. Develop and implement a hazardous materials containment/fuel storage plan.	Alaska DFG, FWS, and NMFS (recommendations 15, 16, and 11)	Yes	$630	Yes
6. Conduct turbidity monitoring upstream and 100-feet downstream of all construction activities.	Alaska DFG, FWS, NMFS (recommendations 14, 15, and 10)	Yes	$9,100	Yes
7. Conduct turbidity monitoring at the gage downstream of the tailrace at 15-minute intervals during construction.	FWS (recommendation 15)	Yes	$10,050	No (see section 5.1.3)
8. Design the powerhouse tailrace to exclude fish from entering the powerhouse.	Alaska DFG, FWS, and NMFS (recommendations 7, 7, and 7)	Yes	$0	Yes
9. Conduct hourly temperature monitoring in Grant Lake at a depth of 0-0.5 meter away from influence of the project intake and downstream of the project tailrace at the stream gage site and maintain Grant Creek temperatures consistent with recorded lake temperatures.	Alaska DFG, FWS, NMFS (recommendations 8, 8, and 8)	Yes	$4,890	Yes, but we recommend monitoring at a depth of 0.5 meter in Grant Lake year-round.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
10. Record temperature within the project intake	FWS (recommendation 8)	Yes	Part of the cost shown under item 9 and 10	No (see section 5.1.3)
11. Monitor temperature in Grant Creek and Grant Lake for the first 5 years of project operation, then consult with agencies to determine a need for additional monitoring.	NMFS and Alaska DFG (recommendations 8 and 8)	Yes	Part of the cost shown under item 9 and 10	No. We recommend real-time temperature monitoring at a depth of 0.5 meter in Grant Lake year-round to establish a real-time water temperature target for Grant Creek for the duration of the license.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
12. Hourly temperature monitoring in Grant Creek and Grant Lake for the duration of the license.	FWS (recommendation 8)	Yes	Part of the cost shown under item 9	Yes, but we recommend real-time temperature monitoring at a depth of 0.5 meter in Grant Lake year-round to establish a real-time water temperature target for Grant Creek.
13. Use hourly temperature to operate the project to maintain water temperature in Grant Creek within 0.5ºC of water temperature in Grant Lake.	NMFS and Alaska DFG (recommendations 8 and 8)	Yes	Part of the cost shown under item 9	Yes, except we recommend a Grant Creek water temperature target during ice out to be up to 1.0ºC warmer than Grant Lake.

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
14. Use hourly temperature to operate the project to maintain water temperature in Grant Creek within 1.0ºC of water temperature in Grant Lake.	FWS (recommendation 8)	Yes	Part of the cost shown under item 9	Yes, except we recommend maintain water temperature in Grant Creek within 0.5ºC of target.
15. Follow Alaska DFG timing windows for instream and stream construction activities and stream crossings.	Alaska DFG, NMFS and FWS, (recommendations 9, 9, and 10)	Yes	$0	Yes
16. Site clearings, road corridors, and the transmission line corridor a minimum of 100 feet away from the ordinary high water of Grant Creek.	Alaska DFG, FWS and NMFS (recommendations 10, 11, and 10)	Yes	$0	Yes
17. Provide minimum flows of 5 to 10 cfs, depending on season, in Reaches 5 and 6.	Alaska DFG, FWS, and NMFS (recommendations 1, 1, and 1)	Yes	$0	Yes
18. Provide minimum flows of 60 to 150 cfs, depending on season below the project tailrace.	FWS, NMFS Alaska DFG (as stated in Kenai Hydro's proposed flows filed August 6, 2018)	Yes	$0	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
19. Provide provisions to ensure flow releases are provided continuously to the bypassed reach and downstream of the tailrace at all times including during any routine maintenance, emergency project shutdowns, or unanticipated interruptions to power generation	Alaska DFG, FWS, NMFS (recommendations 6, 6, and 6)	Yes	$0	Yes
20. Provide down ramping rates of 1 inch per hour and upramping rates of 1 inch per hour from November 16–May 15 and 2 inches per hour from May 16–November 15, as measured at the stream gage downstream of the tailrace.	Alaska DFG, FWS, and NMFS (recommendations 3, 3, and 3)	Yes	$0	Yes
21. Modify Biotic Monitoring Plan to include SMART objectives and add minnow trapping in winter and adaptive management criteria.	FWS (recommendations 9)	No, not a specific measure to protect fish and wildlife	$8,190	No (see section 5.1.3)
22. Collect adult salmon tissue samples for DNA analysis.	FWS (recommendation 20)	No, not a specific measure to protect fish and wildlife	$1,460	No (see section 5.1.3)

Recommendation	Agency	Within the Scope of Section 10(j)	Annual Cost	Adopted?
23. Implement the Avian Protection Plan that includes migratory species and bald eagles.	FWS (recommendation 19)	Yes	$9,460	Yes
24. Develop and implement a bear safety plan.	Alaska DFG and FWS, (recommendations 11 and 12)	Yes	$80	Yes
25. Avoid the use of helicopters or airplanes near mountainsides adjacent to Grant Lake and Grant Creek. Maintain a 1,500-foot clearance from slopes with suitable mountain goat habitat.	Alaska DFG and FWS, (recommendations 12 and 13)	Yes	$0	Yes
26. Notify Alaska DFG, NMFS and FWS of non-compliance events.	Alaska DFG, NMFS and FWS, (recommendations 16, 12, and 17)	No, not a specific measure to protect fish and wildlife	N/A	Yes
27. Provide Alaska DFG and NMFS employees access to the project site.	Alaska DFG, NMFS (recommendation 17 and 13)	No, not a specific measure to protect fish and wildlife	N/A	Yes
28. Include process provisions for how any determined need for operational changes will be incorporated into the project	FWS (recommendation 21)	No, not a specific measure to protect fish and wildlife	N/A	No (see section 5.1.3)

5.3.2 Land Management Agencies' Section 4(e) Conditions

In section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the final 4(e) conditions submitted by the Forest Service and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we include the condition in our staff alternative.

Of the Forest Service's 22 final conditions, we consider 17 of the conditions (conditions 1 through 3, 5 through 13, and 15 through 18 and 22) to be administrative or legal in nature and not specific environmental measures. Therefore, we do not analyze these conditions in this EIS. Table 5-2 summarizes our conclusions with respect to the four final 4(e) conditions that we consider to be environmental measures. We include in the staff alternative two conditions as specified by the agency, modify one condition to adjust the scope of the measure, and do not recommend one condition; the measures not adopted in total are discussed in more detail in section 5.1, *Comprehensive Development and Recommended Alternative.*

Table 5-2. Forest Service final section 4(e) conditions for the Grant Lake Project (Source: staff).

Condition	**Annualized Cost**	**Adopted?**
No. 14: Restrict the use of pesticides on public lands managed by the Forest Service without prior written approval	$0	Yes
No. 19: Consult on resource plans	N/A	In part; we adopt six plans the Forest Service lists in the recommendation and adopt two plans with modification. The remaining plans were considered but not adopted because no details other than cost estimates to develop the plans were provided.
No. 20: Provide an ECM during project construction	$9,480	Yes

Condition	Annualized Cost	Adopted?
No. 21: Iditarod National Historic Trail	$0	No, these measures are duplicative of other Forest Service and FERC standard measures

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 14 comprehensive plans that are applicable to the Grant Lake Project, located in Alaska. No inconsistencies were found.

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Southern Southeast Regional Aquaculture Association

U.S. Army Corps of Engineers

APPENDIX A

Comments on Draft Environmental Impact Statement

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE GRANT LAKE HYDROELECTRIC PROJECT

Grant Lake Hydroelectric Project—FERC Project No. 13212-005–Alaska

The Federal Energy Regulatory Commission (Commission or FERC) issued its draft environmental impact statement (EIS) for the licensing of the Grant Lake Hydroelectric Project (project) on October 19, 2018. Comments were due by January 9, 2019. In addition, Commission staff conducted two public meetings in Moose Pass, Alaska, on November 28, 2018, to take oral comments on the draft EIS. A court reporter recorded statements made at the meetings and all statements were incorporated into the Commission's public record for the proceeding.[81]

In this appendix, we summarize the written comments received on the draft EIS that pertain to our analysis; provide responses to those comments; and indicate, where appropriate, how we modified the final EIS. We group the comment summaries and responses by topic for convenience. Although we do not summarize comments that point out minor revisions to the draft EIS in this appendix, we have made those revisions in the final EIS. We also do not summarize comments that only express opinions either for or against the proposed project or the staff alternative or simply reiterate a stakeholder's position or recommendation previously provided. The following entities filed comments on the draft EIS:

Commenting Entity	Filing Date
Jan Konigsberg	December 3, 2018
Kenai River Special Management Area Advisory Board	December 10, 2018
Environmental Protection Agency	December 11, 2018
Kenai Hydro, LLC	January 8, 2019
Kenai River Watershed Foundation Inc.	January 9, 2019
Alaska State Historic Preservation Officer	January 9, 2019
Iditarod Historic Trail Alliance	January 9, 2019
Alaska Department Fish and Game	January 9, 2019
U.S. Department of the Interior	February 13, 2019
National Marine Fishery Service (NMFS)	March 1, 2019
Forest Service	March 1, 2019

[81] See transcripts of the November 28, 2018, scoping meetings, eLibrary accession nos. 20190109-4006 and 20190109-4007.

GENERAL

Comment G1: The U.S. Environmental Protection Agency (EPA) comments that the draft EIS does not describe the standard operating levels for Grant Lake in section 2.2.3. EPA further comments that the description of Kenai Hydro, LLC's (Kenai Hydro's), proposed use of the project for peaking energy generation is unclear and recommends revising the final EIS to clarify the proposed project operation throughout the year.

Response: Section 2.2.3 of the draft and final EISs describes the maximum and minimum operating levels for Grant Lake. Figure 3.6, in section 3.3.2.2, in the *Effects of Project Operation on Water Quantity* subsection, depicts the proposed fluctuations in Grant Lake elevations under existing and proposed operation scenarios over the course of the year. We describe the proposed peaking operation in section 2.2.3 of the draft and final EISs. Our understanding of the proposed peaking operation is that Kenai Hydro would typically undergo peak generation during the winter if demand warrants. In the spring, Kenai Hydro would operate the project in essentially a run-of-river mode up to the hydraulic capacity of the project (385 cubic feet per second [cfs]) and store all inflows above 385 cfs until the reservoir is full. Because peaking operations would depend on energy demand and load conditions, there is not a predetermined schedule for when peaking operation would be implemented.

Comment G2: EPA states that the analysis in section 3.3, which presents the potential effects of the proposed action on each resource area, does not allow for a clear distinction among the three alternatives—proposed action, staff alternative, staff alternative with mandatory conditions. EPA recommends revising section 3.3 to clearly distinguish the potential effects of each of the three action alternatives and suggests it may be most efficient to discuss the potential impacts of the proposed action in detail first. Following this analysis, EPA recommends discussing the other two action alternatives in regard to: (1) which impacts are similar to the proposed action, (2) which impacts are different from the proposed action, and (3) supporting details for impacts that differ.

Response: The structure of our analysis in section 3 is to (1) identify an issue of concern; (2) describe the applicant's proposed measures to address the issue; (3) discuss agency comments regarding the proposed measures, agency recommendations, and any comments responding to agency comments and recommendations; and (4) present the analysis of effects from the proposed alternative and stakeholder recommendations in the *Our Analysis* subsection. In section 5, we provide our conclusions and present the staff recommended alternative, which is based on the *Our Analysis* found in section 3. We further summarize the proposed alternative, staff alternative, and staff alternative with mandatory conditions in the Executive Summary, section 2, and section 5.

Comment G3: EPA comments that because of the format of section 5 of the draft EIS and the use of the term *recommend* throughout the section, the process through which license requirements would be finalized and the methods through which those requirements would be implemented and enforced are not clear to the reader. EPA recommends that the final EIS state the specific permit requirements associated with the preferred alternative and discuss methods and responsible parties for the implementation and enforcement of those requirements.

Response: The "recommended" measures in section 5 are made to the Commission for the Commission's consideration to include as conditions of any license that the Commission issues for the project. If the Commission issues a license for the project and includes the measures recommended by Commission staff as license conditions, compliance with the license conditions would be administered by the Commission. The Commission's decision on whether or not to issue a license is made in a license order issued apart from the EIS.

Comment G4: EPA recommends that section 5 of the final EIS include draft versions of the staff-recommended environmental plans, including information about who would be responsible for implementing and enforcing plan requirements, recommended by FERC staff.

Response: Kenai Hydro submitted drafts of its proposed Operation Compliance Monitoring Plan, Biotic Monitoring Plan, Vegetation Management Plan, Avian Protection Plan, and Historic Properties Management Plan with its amended final license application. We describe measures included in the proposed plans in the relevant resource sections in section 3 and evaluate the benefits of the proposed plans. Our recommendations in section 5 of the draft and final EISs specifically present how those plans should be modified to further minimize or mitigate project effects. If the Commission were to license the project, the final license order would identify which plans Kenai Hydro is required to prepare as components of license conditions. Following license issuance, Kenai Hydro would prepare draft versions of the plans and provide the drafts to agencies specified in the license condition for review and comment. Kenai Hydro would file a final version of the plan with the Commission for approval, describing how the final plan addresses agency comments. Commission approval would be required prior to Kenai Hydro's implementation of any plan. Project licensees are responsible for plan implementation, and the Commission is responsible for compliance administration.

Comment G5: EPA states that while the hazardous materials plan is listed in the draft EIS under recommended measures applicable to project construction, the need for hazardous materials management and spill prevention, control, and containment also extends to project operation and that some provisions of the plan apply specifically to project operation. EPA recommends that the hazardous material plan and the final EIS specify that this plan applies to project construction and operation and clarify the mitigation measures applicable to each project phase to reduce project effects.

Response: Staff's recommended hazardous materials plan would apply to both construction and operation. We revised section 2.3, *Staff Alternative*, and section 5.2.1, *Measures Proposed by Kenai Hydro*, to clearly indicate that the measure applies to both construction and operation.

Comment G6: During the evening meeting on the draft EIS, a commenter asked about staff's recommendation for a hazardous materials plan, noting that the purpose of the plan would be to limit effects of hazardous material spills. The commenter asked what level of spills were expected to occur.

Response: As discussed in section 5.1.2 of the draft and final EIS, in the *Hazardous Materials Plan* subsection*,* the staff-recommended hazardous materials plan would include measures to prevent and avoid hazardous material spills. Therefore, spills are unlikely. However, the plan would include provisions for immediate, local containment, in the unlikely event of a spill. The plan would also: (1) identify specific locations where vehicle and equipment maintenance and refueling would occur; (2) provide provisions regarding removing oil or other contaminants from condensate and leakage from the turbines and other equipment in the powerhouse; and (3) present reporting requirements. The plan would be prepared in consultation with the Alaska Department of Fish and Game (Alaska DFG); U.S. Department of the Interior, Fish and Wildlife Service; and U.S. Department of Agriculture, Forest Service (Forest Service).

Comment G7: EPA comments that it is unclear why the list of resources considered in the cumulative effects analyses in section 3.2 is different than the list of resources considered in the analysis of impact of the proposed action and alternatives in section 3.3.

Response: During the National Environmental Policy Act scoping process, water quantity, water quality, aquatic resources, and recreation resources were resources that were identified as having potential to be cumulatively effected by the proposed project in combination with other past, present, and reasonably foreseeable future activities.[82] The scoping process did not identify any other actions that would have cumulative effects on geology and soils, terrestrial resources, or cultural resources. Thus, these resources are not discussed in the cumulative effects section.

Comment G8: The Forest Service comments that it intends that its reservoir management and inundation plan, (4(e) condition 19), would identify: (1) seasonal reservoir fluctuations, and (2) National Forest System (NFS) lands potentially inundated because of the anticipated fluctuations.

Response: Figure 3-6 in the draft and final EISs shows Kenai Hydro's proposed rule curve for project operations and provides identification of seasonal reservoir fluctuations. Section 2.2.3, in the *Project Operation* subsection of the draft and final EISs, describes the proposed project operation. We modified text in section 2.2.3 of the final EIS to clarify that the range of lake elevations under proposed operations would vary from the current normal maximum elevation of 703 feet down to a minimum of 690 feet.[83] Kenai

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[82] See Scoping Document 4 issued on December 7, 2016 (FERC Accession Number 20161207-3014).

[83] All elevations are North American Vertical Datum 88

Hydro's proposed weir at the Grant lake outlet would provide a level crest elevation across the natural rock outlet resulting in an even flow distribution across the natural outlet. During large flow events, the lake level will mirror historic conditions because the proposed weir would not increase the lake elevation above historic levels. Therefore, the proposed project would not inundate any additional NFS lands beyond what is currently inundated when Grant Lake is at is normal maximum elevation. For this reason, we did not need to conduct a more detailed analysis of this measure. Nevertheless, the Forest Service's recommended reservoir management and inundation plan (4(e) condition 19) is a mandatory condition and would be required by any license issued for the project.

NEED FOR POWER

Comment NP1: Jan Konigsberg comments that the need for power analysis in the draft EIS insinuates that many of the existing generation facilities in the Alaska Railbelt (Railbelt) would need to be replaced.[84] Mr. Konigsberg provides a list of thermal generation plants in the region and notes the year generation began and recent overhauls to these facilities. He states that the assertion that nearly all of the Railbelt's existing thermal generation is 25 years or older is incorrect and total generating capacity could remain in place for the next 35 to 50 years. Mr. Konigsberg also questions Kenai Hydro's statement that the project is needed to provide spinning reserve and load following capacity, noting that the 80-megawatt (MW) Nikiski combined-cycle plant and 120-MW Bradley Lake hydroelectric project (FERC Project No. 8221) provide these resources. Mr. Konigsberg asserts that the need for power is not substantiated; therefore, the project is not in the public interest. The Kenai River Watershed Foundation concurs; its comments state that no significant short- or long-term need exists for Grant Lake hydroelectric power.

Response: We discuss the need for power in section 1.2.2 in the draft and final EIS. From a need for power perspective (energy and capacity), output from a renewable resource would benefit the Railbelt region by helping it to reduce dependence on gas and oil generation and, as a renewable, would protect against the escalation of non-renewable gas and oil prices.

The Kenai Peninsula electrical system is interconnected to the Railbelt region. Output from the Grant Lake Project would be available as a renewable energy source throughout the system, and the relatively small capacity and generation of the project would be easily integrated into the system.

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[84] The Alaska Railbelt region includes developments along the Alaska Railroad between the Kenai Peninsula and Fairbanks. The region includes the Mat-SU Valley, Anchorage, the Kenai Peninsula, Talkeetna, and Fairbanks.

The project would, in part, enable Homer Electric Association's goal to increase the percentage of its load fed by renewable resources (initial goal of 22 percent by 2018) and the State of Alaska's goal of 50 percent renewable power by 2025.[85] Homer Electric Association has stated that it proposes the project to diversify its portfolio, add renewable energy, and reduce exposure to increasing natural gas prices all of which would provide a public benefit to the region. Power from the project could also be used locally by Homer Electric Association's customers on the western side of the Kenia Peninsula.

GEOLOGY AND SOILS

Comment GS1: The Kenai River Watershed Foundation comments that the area just sustained a 7.0 magnitude earthquake and is subject to frequent smaller earthquakes, which could affect the power tunnel.

Response: The final project design would be developed in accordance with applicable engineering codes and regulations, including parameters for earthquake zones. In addition, 18 CFR § 12.41 requires all licensees to make adequate provision for installing and maintaining appropriate monitoring instrumentation whenever any physical condition that might affect the stability of a project structure has been discovered or anticipated. The instrumentation must be satisfactory to the Regional Engineer and may include, for example, instruments to monitor movement of joints, foundation or embankment deformation, seismic effects, hydrostatic pore pressures, structural cracking, or internal stresses on the structure.

WATER RESOURCES

Comment WR1: EPA states that while the draft EIS discusses the potential for heavy metal leaching associated with lake level changes and concludes that this effect is unlikely to occur based on the characteristics of the shoreline, it does not discuss the likely source, or sources, of the elevated lead concentrations detected in Grant Lake and Grant Creek. Therefore, EPA recommends that the final EIS include follow-up water quality monitoring to ensure that lead levels are not increased by construction or operation of the proposed project.

Response: Section 3.2.2.2, in the *Effects of Project Construction on Water Quality* subsection, of the draft and final EISs presents the potential sources of lead. Potential anthropogenic contributions include mining. Staff notes that mining has occurred in the Grant Lake Watershed and discusses recent approval by the Seward Ranger District of a mining plan for operating the White Rock Mine on the north side of Grant Lake. In

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[85] The Homer Electric Association's resources include the 80-MW Nikinski Station (natural gas), 80-MW Bernice Lake Station (natural gas), 48-MW Soldatna Station (natural gas), 2.4-MW Seldovia Station (diesel), and a 14.8-MW share of the 120-MW Bradley Lake Hydro Station.

addition, as discussed in section 3.3.2.1 of the draft and final EIS, in subsection *Water Quality Sampling*, water samples taken from Grant Lake in June 2009 tested positive for lead with concentrations of 1.1 µg/L.

As discussed in section 3.3.2.2, of the final EIS, in subsection *Water Quality* the project has potential to contribute to lead levels in Grant Creek through sediment erosion. Our recommended erosion control and hazardous materials plans (discussed in section 5.1.2 in subsections *Erosion and Sediment Control Plan* and *Hazardous Materials Plan* of the draft and final EISs) are designed to minimize effects on turbidity of construction and avoid and contain spills of hazardous materials.

In addition, as discussed in section 3.2.2.2, in the *Effects of Project Construction on Water Quality* subsection, of the final EISs our analysis recognizes that if lead is present in Grant Lake substrate near the location of the project intake, construction and operation activities, disturbance of the substrate could result in the mobilization of lead into Grant Creek. As a result of this analysis, in section 5.1.2, subsection *Lead Sampling and Analysis,* of the final EIS, we recommend Kenai Hydro modify the Erosion and Sediment Control Plan to include: (1) pre-construction sediment sampling for lead, and (2) measures to prevent sediment-bound lead from mobilizing during construction or operation of the project. With implementation of these sampling and capping measures (if needed) we conclude potential for lead mobilization would be eliminated and water quality monitoring during project operations would not be needed.

Comment WR2: David Lisi requested an analysis of how project operations would affect water temperature in Grant Lake and whether lake temperatures at a depth of 0.5 meter under project operation conditions would follow the same patterns as current temperatures at that depth.[86]

Response: Factors determining post-construction water temperatures at a depth of 0.5 meters would be the same as those under current conditions—air temperature, short- and long-range radiation, and wind speed. We added discussion of effects of project operations on lake temperatures in section 3.3.2.2, in the *Effects of Project Operations on Water Quality* subsection, of the final EIS. Our analysis indicates that lake drawdowns would reduce the volume of water in Grant Lake by 4.6 percent and would reduce surface area by 4 percent. The maximum change in the ratio of lake volume to area would be 1 percent, and the annual average lake volume to area ratio would be unchanged. As a result, shifting the outflow from the natural outlet to the proposed intake structure and withdrawing water near the surface of Grant Lake is not expected to alter the thermal

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[86] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4007).

regime or stratification patterns of the lake and would not change the lake temperature at a depth of 0.5 meter.

Comment WR3: A commenter requested that the final EIS include analysis of how project operations would affect temperature in the bypassed reach.[87] Similarly, EPA recommends that the final EIS include an analysis of the pre- and post-project water temperature thermal gradients along Grant Creek to assess how resulting water temperatures may affect fish metabolic rates, growth, and development.

Response: Pre-project temperature data document that Grant Creek temperatures mimic those of the Grant Lake outlet, regardless of the location in Grant Creek. Figure 3-3, in section 3.3.2.1, in the *Fish Populations* subsection, of the draft and final EISs shows daily mean temperatures at sites monitored in Grant Creek during 2013 (the most complete data set available). All sites, including GC100 and GC600, which are the upper-most and lower-most sites monitored on Grant Creek, were nearly identical, showing that longitudinal changes in temperature within Grant Creek were negligible. Further analysis of these two sites specifically indicates that the average difference in mean daily temperature was 0.1 degree Celsius (°C) from May through September. The average difference between Site GC600 and Site GC500 at the upstream and downstream ends of the proposed bypassed reach was also 0.1°C. We added analysis of potential effects of project operation on water temperature in the bypass reach to the final EIS in section 3.3.2.2, subsection *Effects of Project Operation on Water Temperature in Grant Creek.* Based on our analysis we expect proposed project operation would result in average water temperatures at the downstream end of the bypassed reach that are about 1°C cooler in April, about 1°C warmer in May, slightly warmer in June (average 0.1°C), and on average 0.5°C to 0.9°C warmer in July through September, as compared to current conditions. We also added analysis to section 3.3.2.2 of the final EIS, in subsection *Effects of Project operation on Aquatic Habitat in the Bypassed Reach.* We conclude that due to limited spawning habitat available in the bypass reach, project-induced temperature increases during this time would be small and are not expected to affect salmonids that may be spawning in Reach 5. Therefore the project would not affect fish metabolic rates, growth, and development in Grant Creek.

Comment WR4: The U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) notes that staff recommend allowing increased temperature variability between Grant Creek and Grant Lake in May (by increasing the temperature threshold from 0.5°C to 0.1°C) to be consistent with existing temperature patterns. The agency requested staff consider

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[87] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

rewording the recommendation to tie this threshold to the ice-out period, rather than to a specific calendar month.[88]

Response: As discussed in section 3.3.2.2, in the *Effects of Project Operation on Water Temperature in Grant Creek* subsection, of the final EIS, the process of ice- break-up during the spring turnover of Grant Lake is the driving factor in the larger difference between Grant Lake and Grant Creek temperatures compared to other times of year. Subsequently, the timing of the ice break-up period could fluctuate; therefore, we agree, and section 5.1.2, in the *Water Temperature in Grant Creek* subsection the final EIS now refers to the ice-break up period instead of the month of May for compliance with water temperature criteria and or recommended temperature thresholds. We now recommend the following temperature criteria: (1) for the 30-day period when Grant Lake is going through its ice break-up, Grant Creek temperature be maintained at Grant Lake + 1.0°C (+/−0.5°C); (2) once the spring ice break-up is complete and Grant Lake is ice-free, Grant Creek temperatures remain within +/−0.5°C of Grant Lake; and (3) the same +/−0.5°C criterion be maintained when Grant Lake is ice covered.

Comment WR5: Interior comments that coordination between Kenai Hydro and the U.S. Geological Survey (USGS), Alaska Science Center, would ensure USGS in Alaska has a full understanding of the project, the data collection methods, and data availability.

Response: We agree coordination with USGS during development of the staff-recommended operation compliance and reporting plan would allow USGS to provide comments on stream gage data collection methods and be informed of data collected at the project. We modified section 5.1.2, *Operation Compliance Monitoring and Reporting* subsection, to include USGS in the list of agencies with which Kenai Hydro would consult during plan preparation and the list of agencies that would receive annual reports from Kenai Hydro, for comment, prior to the report being filed with the Commission.

AQUATIC RESOURCES

Comment AQ1: EPA comments that staff does not provide support for the statement in section 3.3.2.2, page 3-58, of the draft EIS that maintaining "the pre-project thermal regime of Grant Creek could limit the genetic integrity of Grant Creek salmonid stocks over time" and recommends that staff revise the final EIS to include supporting information.

Response: EPA misinterpreted our analysis. NMFS's 10(j) recommendation was meant to establish pre-project water temperature targets for Grant Creek based on pre-project temperature data collected in Grant Creek. However, as indicated in our analysis in

[88] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

section 3.3.2.2 of the draft EIS, in subsection *Effects of Project Operation on Water Temperature* using the limited pre-project water temperature dataset to establish a thermal regime in Grant Creek would limit annual variability that may otherwise be seen under natural conditions. As a result, we conclude that limiting Grant Creek water temperature to those recorded during the short-term study would reduce annual variability present under existing conditions. The reference to reduced genetic integrity was in recognition that limiting exposure of salmonids populations to natural variability previously inherent in the system could, through natural selection, reduce the genetic variability associated with greater temperature tolerances in the salmonid populations.[89]

Comment AQ2: EPA comments that while the draft EIS includes a table of run timing for a few of the fish species in Grant Creek, it does not sufficiently analyze the potential effects of project operation on fish species, populations, and habitats. Therefore, it recommends that the staff revise the final EIS to include a species life-stage periodicity chart to help the reader understand how the timing of potential effects from project operation would affect fish species.

Response: We revised section 3.3.2.1, *Aquatic Specie*s, *Affected Environment,* to include a life-stage periodicity chart. Data about life stages are included in the draft and final EISs in our analysis of the project's operational effects on fish habitat in the bypassed reach and downstream of the tailrace. Based on our analysis in section 3.3.2.2, we find that project construction may have limited short-term, localized effects on water quality, and project operation would result in slightly lower flows in Grant Creek in the spring and summer and slightly higher flows in the late fall and winter. Our recommended measures, including minimum instream flows in the bypassed reach and downstream of the project tailrace, ramping rate requirements, channel maintenance flows, and construction-related measures to protect water quality would maintain aquatic habitat diversity. These measures, coupled with the implementation of our recommended water temperature management, would minimize project effects on aquatic habitat and therefore are adequate to prevent population level effects on resident and anadromous fish species in Grant Lake and Grant Creek.

Comment AQ3: Because flow fluctuations caused by spinning reserve and load-following operations may result in stranding and/or trapping of fry and juvenile fish, EPA recommends revising the final EIS to include an analysis of potential relevant scenarios

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[89] In its final 10(j) recommendations, files on March 1, 2019, NMFS no longer recommends maintaining pre-project temperatures in Grant Creek. NMFS final 10(j) recommendation 8 recommends Kenai Hydro use the adjustable gates in the proposed intake to ensure water temperature in Grant Creek below the tailrace match the water temperature of Grant Lake at a depth of 0.5 meter. Therefore, text in the draft EIS responding to NMFS preliminary 10(j) 7 that recommended maintaining pre-project temperatures in Grant Creek was removed from the final EIS.

for the rate of change in flow to downstream habitat reaches under load-following and spinning reserve operations.

Response: As discussed in section 2.2.3, *Project Operation*, of the draft EIS, when the project is operated to provide spinning reserve generation, flows from the powerhouse would be diverted to a detention pond to prevent effects of rapid flow changes on aquatic resources in Grant Creek. Pursuant to our recommendation, all project operational scenarios would be subject to our recommended downramping rates of a maximum of 1 inch per hour (when operational control exists), and upramping rates of 1 inch per hour during the winter (November 16 through May 15) and 2 inches per hour during the summer (May 16 through November 15). In the draft and final EISs, we discuss the effects of spinning reserve operations and analyze project ramping rates in section 3.3.2.2, in the *Effects of Spinning Reserve and Load Following on Aquatic Resources and Habitat in Grant Creek* subsection and *Ramping Rates* subsection, respectively. We provide our recommended ramping rates in section 5.1.2, in the *Ramping Rates* subsection, of the draft and final EISs.

Comment AQ4: EPA comments that the draft EIS notes that channels and bedforms in Reaches 2 through 4 are sensitive to changes in flow regime and sediment load, and the proposed minimum flows would result in a 12 percent loss in spawning and rearing habitat for salmonids. Therefore, it recommends that staff include a temporal timespan for the spawning and rearing habitat loss in the final EIS and explain what the loss of habitat means in terms of habitat persistence and availability over time.

Response: We revised section 3.3.2.2, in the *Sediment Management* subsection and the *Gravel Monitoring and Augmentation* subsection, of the final EIS to include an additional analysis of changes in the flow regime on sediment load in Grant Creek. Our analysis indicates that changes in peak flow duration, timing, and magnitude may modify the contributions of the bypassed reach to sediment load in Grant Creek. However, the goal of our recommended channel maintenance flows, adaptively managed as described in section 5.1.2 of the final EIS, in subsection *Gravel Management*, is to sustain the natural processes of erosion and sediment transport mechanism and protect spawning gravel abundance in the Grant Creek stream channel and maintain habitat persistence and availability over time.

In section 3.3.2.2, in the *Effects of Proposed Operations on Aquatic Habitat Downstream of the Project Tailrace* subsection, of the draft and final EISs, our analysis includes the expected change on habitat for spawning and rearing of salmonid species in Grant Creek under the proposed flow regime. These calculations are based on the timing that salmonid life stages are present in Grant Creek and their habitat use by life history (i.e., when salmon are rearing or rainbow trout are spawning). Our analysis finds that the amount of spawning habitat for all salmonid species would remain the same as under current conditions in an average water year because the project would have little or no effect on flows in lower Grant Creek during the salmonid spawning periods in a normal water year. In a low water year, while the minimum instream flow requirements would apply, a loss of an average of 11 percent of spawning habitat for all salmonids may be observed during those water year types.[90] However, low water years have occurred 13 out of 66 years in the period of record; subsequently, the effect of the project during low water years is expected to be minimal on the spawning habitat availability over time. Combined with the staff-recommended measures to protect spawning gravels (discussed above), we anticipate the level of spawning habitat would depend on water year type, and given the infrequency of low water years and that our recommend flow regimes would maintain 89 percent of the spawning habitat during low water years, we would expect the existing fisheries resources in Grant Creek to be maintained at its current levels for the term of any license.

Comment AQ5: EPA disagrees with the staff conclusion that the project would not have population level effects on fish species and states that it is likely the project would reduce the salmonid spawning populations in Grant Creek. Specifically, the loss of spawning and rearing habitat would ultimately reduce spawning population and reduced spawning success, and reduced rearing habitat would mean a reduction in survival of juveniles. EPA also notes that thermal impacts may reduce the survival of incubating eggs and could cause additional losses. These additive impacts would almost certainly result in population reductions. EPA, therefore, recommends that the final EIS include an adequate analysis of the potential for population level effects on the Grant Creek fish species, including effects of water temperature on the growth and development of incubating eggs and emergence timing.

Response: As demonstrated in section 3.3.2.2, in the *Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace* subsection, of the draft and final EISs, during a normal water year, the project would have little or no effect on habitat availability in lower Grant Creek during the Chinook, coho, and sockeye salmon and Dolly Varden spawning periods and would have only a slight decrease in habitat availability during the first 2 weeks of the 6-week rainbow trout spawning period. Section 3.3.2.2 of the draft EIS also notes that increased flows in winter for all water years would have a benefit for rearing of rainbow trout fry, and Chinook, coho, Dolly Varden, and rainbow trout juveniles. However, the draft and final EISs recognize that a reduction in juvenile rearing habitat would occur for these species during the summer (June through October) of low water years and during late May and June of normal water years while the reservoir is filling. About 80 percent of salmonid rearing habitat would remain available in late May and June of normal water years, and combined with the increase in rearing habitat provided by increase winter flows from January to early May, the annual survival of juveniles is expected to be maintained at close to current levels. As articulated in section 3.3.2.2 of the draft and final EISs, project effects on spawning

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[90] Low water years are considered years when no spill occurs into the bypassed reach and the only flow in the bypassed reach year-round are minimum flows provided by the project.

and rearing habitat would not reduce spawning success or survival of juveniles in normal years, and the effect of the project in low water years would still provide 88 percent of the existing habitat for spawning and rearing salmonids in Grant Creek.

Regarding EPA's concerns that water temperature may reduce the survival of eggs, we present our analysis of the water temperature monitoring regime as it relates to project operations in section 3.3.2.2, in the *Water Temperature Monitoring* subsection. As discussed in section 5.1.2, in the *Water Temperature in Grant Creek* subsection, of the draft and final EISs, we recommend that Kenai Hydro operate the project to provide water temperatures that mimic pre-project conditions. Maintaining pre-project conditions would protect against project-induced temperature differences that may affect growth, development, and survivability of incubating eggs and emergence timing.

Comment AQ6: EPA comments that while FERC asserts that no project-related purpose exists for the collection of fish tissue samples for genetic analysis, it believes that baseline genetic fish tissue collection and monitoring are viable protection, mitigation, and enhancement measures. EPA asserts that the acquisition of a robust genetic baseline of Grant Creek species pre- and post-project operations would be valuable for documenting secondary and cumulative project impacts to the biodiversity of populations in the Kenai River Watershed and could inform species management.

Response: Collection of fish tissue samples for genetic analysis monitoring does not provide any species protection or mitigation measures for project effects or enhancement measures for the species. Section 3.3.2.2 of the draft and final EISs and section 5.1.3, the *Salmonid DNA Sampling* subsection, present a thorough analysis of the recommendation to collect genetic samples. Our analysis indicates that although collecting genetic samples would inform state and federal fish and wildlife agency management decisions, those management decisions are not a specific project purpose. Further, the collection of fish tissue samples would not isolate a project-related effect, and DNA sampling would not inform any pending or ongoing Commission action, including compliance with the terms of any license issued for the project.

Comment AQ7: EPA comments that Trail Lake Narrows offers complex aquatic habitat that supports a variety of salmonid life stages and recommends that staff revise the final EIS to include an analysis of potential effects of proposed project operations on fishery resources and habitats in this area.

Response: In the final EIS, we now include section 3.3.2.2, *Effects of Proposed Operations on Trail Lake Narrows*, to provide a more thorough analysis of the effects of project operation on the Trail Lake Narrows. Our analysis indicates that the changes to the hydrograph in Grant Creek would have little effect on flows in the Trail Lake Narrows because lower flows when the project would be operated to fill the reservoir would coincide with high snowmelt runoff in other upstream tributaries to the Trail River system, and the variation in flows from Grant Creek would be within the natural variation observed at Trail Lake Narrows. Higher flows in winter would result in only minor changes at Trail Lake Narrows, and winter habitat would remain varied, freezing in colder years and remain flowing in warmer years. Although project operation could reduce the distribution and availability of spawning gravels and large woody material, adequate channel maintenance flows provided through the bypassed reach would maintain the existing spawning gravel recruitment and gravel and large woody material transport from Grant Creek into the Trail Lake Narrows.

Subsequently, we conclude that the proposed Grant Lake Project, with our recommended minimum instream and channel maintenance flows of adequate frequency, duration, and magnitude, would not affect the complex aquatic habitat of the Trail Lake Narrows.

Comment AQ8: EPA comments that reduced peak flows and lower velocities in Grant Creek from project operation would result in higher retention of large woody material in the mainstem channel (Reaches 1 through 4). EPA recommends that staff revise the EIS to include an analysis of the potential for increased large woody material retention to create fish passage barriers and impacts on habitat quality and quantity in Trail Lakes Narrows.

Response: We revised section 3.3.2.2, the *Effects of Operation on Transport of Materials* subsection, of the final EIS to provide a more thorough analysis of the potential for higher retention rates of wood in the main channel. Project effects on the Trail Lake Narrows are discussed in the *Effects of Proposed Operations on Trail Lake Narrows* subsection. Our analysis finds that large woody material in the Grant Lake system is limited, so the amount of contribution of wood from Grant Creek to habitat in Trail Lake Narrows is also expected to be limited. Grant Creek is 1 of 10 tributaries to Upper and Lower Trail Lakes, and a potential decrease in large woody material contribution in 1 of the 10 tributaries is not anticipated to substantially affect the habitat complexity in the Trail Lake Narrows. As a result, staff concludes that project operation would make modifications to flow that are not expected to substantially affect habitat in the Trail Lake Narrows, and channel maintenance flows would adequately maintain transport of sediment and large woody material in a manner similar to the existing conditions.

Comment AQ9: EPA recommends that staff revise the final EIS to include an analysis of the potential impacts from decreased side channel connectivity to pink salmon spawning habitat in Reach 1 of Grant Creek.

Response: We revised section 3.3.2.2 of the final EIS to include an analysis of the effects of project operation on pink salmon habitat. Our analysis in the *Effects of Project Operation on Aquatic Habitat Downstream of the Project Tailrace* subsection indicates that project operation would not decrease side channel connectivity in Reach 1. Habitat connectivity to the Reach 1 distributary—the only side channel in Reach 1—is provided at flows greater than 190 cfs, and minimum instream flows below the tailrace are recommended to be 195 cfs during the pink salmon spawning season. Therefore, project operation would not affect any spawning that may occur in the Reach 1 distributary.[91]

Comment AQ10: The Forest Service states that reduced flows in the bypassed reach, under project operation could reduce erosion potential and thus reduce contributions of spawning gravel to the stream channel. The agency states that its recommended monitoring of spawning gravel in Grant Creek is necessary and recommends a gravel monitoring and augmentation plan be developed to determine whether the recommended channel flushing flows are sufficient to protect spawning habitat in Grant Creek. NMFS states that the recommended channel flushing flows should be considered a hypothesis and that monitoring is needed to test whether higher flows or gravel augmentation are needed to maintain existing spawning habitat. Alaska DFG comments that only monitoring can inform resource agencies and Kenai Hydro whether the channel maintenance flows are (or are not) meeting the goal of retaining downstream fish spawning habitat.

Response: We revised section 3.3.2.2, the *Sediment Management* subsection and *Gravel Monitoring and Augmentation* subsection, of the final EIS to include additional analysis of changes in the flow regime on erosional processes and sediment recruitment in Grant Creek. This analysis indicates that the reduction in flow magnitude, duration and frequency through Reaches 5 and 6 would likely limit the erosional processes Grant Creek relies upon for gravel recruitment, and a decrease in spawning gravel abundance may be observed over time. As a result of this analysis, we now recommend in section 5.1.2, *Gravel Management* subsection, of the final EIS the Kenai Hydro: (1) monitor gravel recruitment, (2) conduct trend analysis of available gravel over time, and (3) if trend analysis indicate a decline in spawning gravel, identify and propose actions to improve spawning habitat in Grant Creek (e.g., increase in the frequency, duration, and/or magnitude of channel maintenance flows, or augment gravel in Grant Creek).

Comment AQ11: Alaska DFG notes that the draft EIS states the agency's recommended ramping rates are too conservative because data collected during licensing studies show that naturally occurring stage changes fluctuate at higher rates than the agency recommended ramping rate.[92] Alaska DFG states that the observed stage changes that were in exceedance of the agency recommendations are likely an artifact of gage placement with no stilling basin and should not be considered accurate. Subsequently, the agency disagrees that its rates are *overly conservativ*e when compared to existing natural conditions, as described in the draft EIS.

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[91] We note that during fisheries investigations in Grant Creek, 10 pink salmon were observed at the weir across Grant Creek, and 2 redds were observed in the mainstem channel of Reach 1. No pink salmon or redds were observed in the Reach 1 distributary.

[92] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4007).

Response: We revised section 3.3.2.2, *Ramping Rates* subsection, of the final EIS to clarify our description of the data collection method. Subsequently, we modified our characterization of the agency-recommended ramping rates in section 5.1.2, *Ramping Rates* subsection, of the final EIS to eliminate the phrase "*overly conservative*".

Comment AQ12: Alaska DFG and NMFS comment that, in several instances, the draft EIS erroneously indicates that the agency recommended and applicant proposed minimum flows in Grant Creek below the tailrace range from 60 cfs to 150 cfs. The agencies note that the correct agency recommended and applicant proposed minimum flows are found in table 3-20 of the draft EIS.

Response: We revised the final EIS to correct the inconsistencies about minimum flows. All references to the minimum flows below the tailrace now reflect the 60 to 195 cfs recommendation, consistent with the proposed and recommended minimum flows identified in table 3-20 of the draft EIS.

Comment AQ13: Alaska DFG, Interior, and NMFS comment that the draft EIS is inconsistent about the location of the recommended channel maintenance flows. Alaska DFG and Interior note that in some places in the draft EIS (pages xix, 2-9, and 5-3) that the channel maintenance flows are described as 800 cfs "downstream of the tailrace" and in other places (pages 3-87, 3-88, and 3-89) the channel maintenance flows are described as 800 cfs "through the bypassed reach." Alaska DFG, Interior, and NMFS note that the correct recommendation from all of the resource agencies should only be for channel maintenance flows of 800 cfs "through the bypassed reach."

Response: We revised the final EIS to correct the inconsistencies about the location of channel maintenance flows and to reflect that the resource agencies' and our recommended channel maintenance flows of 800 cfs should be delivered to the bypassed reach.

Comment AQ14: Alaska DFG, Interior, and NMFS comment that in the draft EIS, staff do not recommend the agency's recommended fish monitoring measures for both adult and juvenile salmonids during project construction and project operation. Alaska DFG, Interior, and NMFS note that fish monitoring measures were not recommended in the draft EIS because it is not clear how these measures would isolate project effects from other nonproject-related variables that could affect fish population dynamics. Alaska DFG, Interior, and NMFS note project effects can be isolated, to some extent, by comparing the fish monitoring results for Grant Creek to the results of other fish population assessments in the Kenai River Watershed (e.g., Cooper Creek, Russian River, and Kenai River).

Response: Section 3.3.2.2, the *Effects or Project Operation on Aquatic Habitat Downstream of the Project Tailrace* subsection and section 5.1.3, the *Adult and Juvenile Salmon Monitoring* subsection, of the draft and final EISs present our analysis of the recommendation to monitor juvenile and adult salmonids. This analysis indicates that monitoring salmonids would not specifically isolate a project-related effect. We agree that some project effects can be approximated by comparing fish monitoring results for Grant Creek to other concurrent fish population assessments in the Kenai River Watershed, but this analysis is restricted to data gathered on fish populations within a limited distance from the project to minimize other external variables, such as habitat quality and land use practices. Also, without modified salmonid monitoring programs that reflect specific triggers for modifying the project, such as minimum flows in either the bypassed reach or below the tailrace, we cannot recommend implementing juvenile and adult salmonid monitoring as proposed by Kenai Hydro or recommended by the resource agencies.

We maintain the position that under the recommended measures—minimum instream flows in the bypassed reach and downstream of the project tailrace, ramping rate requirements, channel maintenance flows, gravel monitoring plan, and construction-related measures to protect water quality—would maintain aquatic habitat diversity. These measures, coupled with the implementation of our recommended water temperature management, would minimize project effects on aquatic habitat; and therefore, should not affect the salmonid populations in Grant Creek.

Comment AQ15: Contrary to the draft EIS's assertion that spawning habitat in Grant Creek is limited and supports only low salmon productivity, NMFS states that escapement studies conducted during the 1990s, when salmon were more abundant, document "very large numbers" of escaping sockeye and Chinook salmon from Grant Creek. Consequently, NMFS argues that Grant Creek fisheries surveys dating to the 1990s demonstrate that Grant Creek is very productive and asks that FERC consider these earlier fisheries studies in the final EIS.

Response: In section 3.3.2.1 of the final EIS, in the *Fish Populations* subsection, we revised our analysis to better address salmon escapement from Grant Creek. In addition to recent fishery survey data collected since 2009 to support the development of the Grant Lake Project license application, the draft EIS considered Grant Lake fishery survey data made available in 1983, 1984, 1987, and 1996. In the final EIS we now provide the following additional data from fish population studies conducted in Grant Creek to section 3.3.2.1, in subsection *Fish Populations.* The final EIS now includes data from studies conducted in 1984, 1963, 1952, and 2009. Kenai Hydro estimated that escapement to Grant Creek was 90 Chinook salmon and 1,169 sockeye salmon in 2013. The results of Kenai Hydro's 2013 surveys, included in the draft EIS, are well within range of previous findings. An review of the Commission's record for the Grant Lake project and affiliated dockets did not identify any Grant Creek escapement studies conducted during the 1990s that were not already included in our analysis.. Subsequently, it is unclear what fisheries studies from the 1990s NMFS is referring. However, in response to the NMFS comment, we have revised section 3.3.2.2 of the final EIS, in subsection *Effects of Project Operation on Aquatic Habitat in Grant Creek* and no longer describe the habitat in Grant Creek as supporting only low salmon productivity.

Comment AQ16: NMFS comments that pink salmon have been identified as spawning in Grant Creek; and therefore, Grant Creek is also essential fish habitat (EFH) for pink salmon. NMFS recommends that the accuracy of the assumption that the Project could improve EFH be determined through NMFS' recommended monitoring to allow early detection and mitigation of adverse effects.

Response: We revised the section 3.3.2.2 of final EIS, subsection *Essential Fish Habitat* to include pink salmon in the analysis of project effects on EFH.

As discussed above in responses to comment AQ14, we maintain the position that under the recommended measures—minimum instream flows in the bypassed reach and downstream of the project tailrace, ramping rate requirements, channel maintenance flows, gravel monitoring plan, and construction-related measures to protect water quality—would maintain aquatic habitat diversity. These measures, coupled with the implementation of our recommended water temperature management, would minimize project effects on aquatic habitat. However, as discussed in our response to comment A10 above, we conclude there is potential for project operations to reduce sediment recruitment into Grant Creek and we have modified section 5.1.2 in the final EIS to include gravel monitoring. Therefore, we modified section 1.3.6 in the final EIS and rather than concluding the project would benefit EFH in Grant Creek, we find the project should not affect EFH in Grant Creek.

Comment AQ17: NMFS, Alaska DFW, FWS and Kenai Hydro state that they are in the process of developing a Memorandum of Understanding that would provide for adult and juvenile salmon monitoring during seven years spread throughout the first 25 years of Project operations.

Response: While, for reasons discussed herein, and as discussed in section 5.1.3 of the final EIS, in subsection *Adult and Juvenile Salmon Monitoring,* we do not recommend implementing salmonid monitoring programs proposed by Kenai Hydro and recommended by the resource agencies.

TERRESTRIAL RESOURCES

Comment T1: Monica Adams requested that the final EIS clarify whether Kenai Hydro's proposed Vegetation Management Plan includes measures to prevent transport of invasive weeds to the project site.[93]

Response: Kenai Hydro's proposed and our recommended Vegetation Management Plan would prevent the spread of invasive plant species into and from the project site through conformance with best management practices (BMPs). Section 3.1, *Invasive Plant Management and Control*, of the plan specifies that Kenai Hydro begin construction

[93] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4007).

activities in un-infested areas before working in infested areas, use weed-free construction materials, clean construction vehicles and equipment prior to use, limit the amount and length of time that bare ground is exposed, and minimize ground disturbance and erosion during construction. We revised section 3.3.3.2, *the Effects of Project Operation on the Potential Spread of Invasive Plant Species* subsection, to provide more information regarding the Vegetation Management Plan and measures that Kenai Hydro would implement at the project to control invasive weeds.

Comment T2: The Forest Service notes that shallow-rooted spruce trees along the Iditarod National Historic Trail (INHT) route could become windthrown (uprooted or broken by wind) when adjacent trees are removed and root zones impacted during construction. The Forest Service requests that Kenai Hydro be responsible for the removal of any windthrown trees along the INHT route that may be affected by vegetation clearing during construction of the project facilities.

Response: As discussed in section 3.3.3.2, *Effects of Project Construction on Vegetation Communities*, Kenai Hydro's proposed Vegetation Management Plan includes measures to address the removal of vegetation in construction areas within the project boundary, and maintenance of these areas every 8 to 10 years during the license term. The frequency and nature of maintenance could be adjusted depending on the condition of the vegetation (i.e., removal of windthrown trees). The Vegetation Management Plan describes removal and maintenance of vegetation along access road ROWs, the transmission line corridor, and in cleared areas around project features. This maintenance would also include locations where the INHT route intersects these project features, but would not include the entire INHT route. Because the Forest Service did not indicate a frequency for removing windthrown trees along the INHT route where construction occurred, Kenai Hydro would include this activity in the maintenance schedule outlined in the Vegetation Management Plan.

Comment T3: The Forest Service recommends Kenai Hydro develop an aquatic invasive species management plan siting that aquatic invasive species have the potential to cause significant environmental and economic impacts, could substantially interfere with the hydroelectric facility operations, and are extremely costly and difficult to eradicate once established.

Response: As discussed in section 3.3.3.1, *Terrestrial Resources, Affected Environment*, of the draft and final EISs, very few observations of invasive plant populations have been reported in the vicinity of the proposed project. Of those observations, none were aquatic invasive species. Kenai Hydro's Vegetation Management Plan and staff-recommended construction plan provide appropriate measures to minimize the introduction and spread of invasive plant species. Although the Vegetation Management Plan is intended primarily for terrestrial invasive species, many of the proposed measures would also minimize the introduction of aquatic invasive species. For example, during construction and restoration, Kenai Hydro would avoid or minimize all types of travel through areas infested with invasive plants, or restrict to those periods when spread of seed or propagules are least likely; require the use of weed-free construction materials; clean construction equipment prior to use; and clean vehicle tires, vehicle undercarriage areas, shovels, and buckets to reduce the potential for invasive species introduction. Kenai Hydro's proposed and staff-recommended measures such as protective buffers, ESCP, and timely site restoration would further reduce the potential for the transport of invasive species entering the waterways through erosion or runoff. Invasive plant infestations associated with project construction and operations would be monitored and treated in consultation with the Alaska DNR, the Forest Service, and their respective invasive plant management plans (discussed in section 3.3.3.2, *Effects of Project Operation on the Potential Spread of Invasive Plant Species*). Although aquatic invasive species are not likely to establish at the project as a result of project construction or operation, Kenai Hydro's Vegetation Management Plan would adequately address unanticipated direct and indirect effects of proposed construction and operation of the project on both terrestrial and aquatic resources. Additionally, as discussed in section 5.1.2, we recommend Kenai Hydro modify its proposed Vegetation Management Plan in consultation with Alaska DFG and the Forest Service to include additional measures for the management of invasive species, such as addressing observation of new or unanticipated invasive species, as necessary.

Comment T4: During the afternoon public meeting on the draft EIS, a commenter requested that the final EIS include an analysis of how the project operation would affect vegetation resources along the banks of the bypassed reach.[94]

Response: We revised section 3.3.3.2 of the final EIS to address potential effects of project operation on vegetation along the bypassed reach. Kenai Hydro's proposed bypassed weir and pump system would provide our recommended minimum instream flows to the bypassed reach, which would reduce water level fluctuations and minimize streambank erosion. These flows would vary over the course of the year with lower flows in the upper reaches (Reaches 5 and 6) of Grant Creek compared to higher flows in the lower reaches (Reaches 1 through 4) of Grant Creek (downstream of the powerhouse tailrace) in accordance with minimum flow requirements for the project. Although project operation is not expected to negatively affect bypassed reach vegetation, the proposed lower flows in the upper bypassed reach could expose minor amounts of channel bed and bank. However, this minor exposure would not result in appreciable opportunities for invasive plant introduction since these areas are steep and bedrock-lined with limited substrate availability. The lower bypassed reach and its side channels would continue to be maintained under the proposed flows and the limited, existing vegetation would continue to be supported. Invasive plant species known to occur in the project

[94] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

area are all upland weeds that would not likely colonize these rocky riparian areas. Therefore, we anticipate project operation would have minimal effects on existing vegetation along the bypassed reach.

Comment T5: Kenai Hydro notes that Forest Service preliminary 4(e) condition 20 would provide the ECM with stop work or change order authority (emphasis added), whereas the draft EIS describes the recommendation as including stop work and change order authority. Kenai Hydro agrees with ensuring the ECM can stop work but says the ECM should not have the authority to make decisions about work orders which would likely require expenditures that would need approval within the organization.

Response: The ECM would monitor construction activities to ensure protection measures are implemented and functional. If the ECM observes instances where the protection measures are insufficient or not functioning properly, the ECM would have the authority to stop work to limit further adverse effects. We agree that stop work authority would protect natural resources in such instances until new measures are put in place. Because the implementation of additional measures could require approval within the Kenai Hydro organization, we agree it may not be appropriate for the ECM to have authority to issue change orders. We revised the final EIS to modify our recommendation to include only stop work authority and no longer recommend the ECM should have the authority to issue change orders.

Comment T6: The Forest Service comments that the upper end of Grant Lake has moose browse habitat and requests the final EIS include analysis of the potential effects of project-related reservoir fluctuations on the persistence of that habitat. The Forest Service states it would support off-site mitigation, if appropriate.[95]

Response: We revised section 3.3.3.2, the *Effects of Operation on Moose Browse Habitat* subsection, of the final EIS to address the potential effects of the project on moose browse habitat at the upper end of Grant Lake. That analysis indicates that fluctuating reservoir levels associated with project operation could influence vegetation density and species composition at the upper end of Grant Lake. Under proposed operations, the level of Grant Lake will be higher in winter and lower in spring than under existing conditions. However, rainfall combined with runoff processes, which would remain unaltered by the project, should continue to sustain most preferred moose browse species including young willow, birch, aspen, and cottonwood trees and provide adequate conditions for germination and recruitment despite changes in lake levels during the growing season (see table 3-28). In winter, while lake levels would be elevated over typical winter conditions they would still be below the existing normal maximum elevation and would not inundate lands above the normal high water line.

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[95] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

Comment T7: The Alaska State Historic Preservation Officer (SHPO) comments that in table 3-26 in the draft EIS, the INHT route should be analyzed using a trail width of 5 to 10 feet, not 100 feet.

Response: Table 3-27 in the final EIS provides acreages of temporary and permanent effects of the INHT on vegetation communities. Because initial construction of the trail could include heavy machinery for grading, we use a wider trail corridor (100 feet) for the temporary effects. As indicated in the footnote, the permanent effects are calculated based on a 10-foot wide trail where trail use and maintenance would prevent regrowth of vegetation. We revised section 3.3.3.2, the *Effects of Project Construction on Vegetation Communities* subsection, to clarify corridor widths used for the effects analysis.

RECREATION RESOURCES

Comment RR1: Kenai Hydro comments that the staff recommendation states motorized access would not be allowed on the access road but then indicates snowmachines would be allowed to use the road. Kenai Hydro questioned whether the access road would be suitable for snowmachine use and cross-country skiing because it would be plowed for operational access. Kenai Hydro requested the final EIS clarify whether staff's recommendation includes access for snowmachines and reiterated it is opposed to allowing public use of the access road.

Response: As discussed in section 3.3.4.1, *Land Use*, winter motorized use is allowed on Alaska Department of Natural Resources (Alaska DNR) managed land where the project access road would be located. Kenai Hydro proposes to prohibit all public use of the project access road. In contrast, the staff recommendation provides for year-round non-motorized use and snowmachine use of the project access road during the winter. Our staff recommendation aligns with land management objectives and allowable uses on Alaska DNR-managed land where the project would be located. Additionally, we supplemented the staff recommendation to include the development of a public access plan that provides a comprehensive approach to managing public access near the project access road.

Comment RR2: The Forest Service commented that the staff recommendation for developing a parking area, as staff recommends, should include providing a restroom to address potential sanitation concerns.[96]

Response: We revised section 3.3.4.3, *Land and Resource Management*, in the final EIS to state the expected increased recreational access associated with the project access road would increase sanitation needs. We also revised section 5.1.2, *Public Access and*

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[96] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

Parking, to include installing, operating, and maintaining a single-unit vault restroom at the parking area to address the sanitation concern.

Comment RR3: The Forest Service commented that the change in elevation of Grant Lake, as shown in figure 3-6 in section 3.3.2.2, *Effects of Project Operation on Water Quantity* is nearly six times the natural rate reported by Ebasco (1984) and cited in the draft EIS. Consequently, and in order to adequately analyze the project effects on winter recreation on Grant Lake, the Forest Service comments that more detail/analysis should be provided as to how this change will affect the safety and stability of the ice of Grant Lake.

Response: The ice-related project effects on Grant Lake are discussed in section 3.3.2.2, *Effects of Project Operation on Water Quantity*. The expected lower than current water surface elevations during the winter could influence the structure of near-shore ice cover. As ice on the lake subsides, near shore ice would fracture and refreeze. Kenai Hydro's proposal to operate the project for spinning reserve could result in localized ice cover modification. Because the spinning reserve capacity for the proposed project would be primarily available in the winter when Grant Lake inflows were low and ice cover was high, the quick withdraw of water from Grant Lake could result in minor localized ice cover subsidence in the area immediately around the project intake.

Comment RR4: The Forest Service states that the term "wilderness characteristics" in the INHT easement document is not used in the context of congressionally designated wilderness, but in terms of maintaining a natural environment adjacent to the trail. The Forest Service states that while the Seward Highway and some houses are within 0.5 to 1 mile from the planned INHT route, topography and vegetation screen these features from trail users. The Forest Service comments that locating the powerhouse 75 to 100 feet from the centerline of the trail will be noticeable to the trail user and is not in alignment with "conserving the wilderness characteristics" intended for the 1000-foot buffer. The Forest Service requests the final EIS disclose the effects of construction, operation, and maintenance of the powerhouse and associated facilities within the 1000-foot buffer on user experience and associated undeveloped character of the area.

Response: As explained in section 3.3.5.2, *Project Access Road and Infrastructure*, we acknowledge potential effects at the planned INHT route associated with views and sounds of project infrastructure located near the trail. Although the Forest Service believes "wilderness characteristics" in the context of the easement refers to "maintaining a natural environment," our analysis is based on land management decisions which assign defined scenic integrity objectives. As defined, the potential minimal effects of the project would be consistent with a landscape having a moderate scenic integrity objective. Additionally, implementing a scenery management plan, as required by Forest Service 4(e) condition 19 and recommended by staff would further minimize potential visual and audible project effects near the planned INHT route.

Comment RR5: The Forest Service commented that its intent for managing segments of INHT were disclosed in its 2004 Environmental Assessment and Decision Notice for the

Seward to Girdwood Iditarod National Historic Trail Project and are consistent with the 1986 Comprehensive Management Plan for the INHT, and are not merely aspirational as the wording in section 3.3.4.2, *Iditarod National Historic Trail* indicates.

Response: The decision notice for the Seward to Girdwood Iditarod National Historic Trail Project (USDA 2004) documents the Forest Service selection of Alternative 4 which describes the management intent to construct segments of the trail ranging from trail class 2 to 5 levels of development. The map for the selected alternative shows the trail segments near the project would be developed to trail class 3 standards which are typically appropriate for semi-primitive to roaded natural ROS classifications. The 2004 Environmental Assessment states that the selected alternative is consistent with scenic integrity objectives contained in the Chugach Land and Resource Management Plan however it does not state an assigned objective to the trail route. We revised section 3.3.4.2, *Iditarod National Historic Trail*, to include this information.

Comment RR6: The Forest Service commented that the statements in section 3.3.4.1 *Chugach National Forest Land and Resource Management Plan* regarding the semi-primitive motorized recreation opportunity spectrum are inaccurate. The recreation opportunity spectrum setting guides the management of recreation activities and development of recreation infrastructure across a broad area and is not appropriate in guiding whether other types of buildings and uses are appropriate for the area. Management of recreation uses within a recreation opportunity spectrum setting can be more restrictive than the setting allows but should not be more permissive.

Response: The types of allowable buildings and uses listed in section 3.3.4.1 are not based on the designated recreation opportunity spectrum but rather they are those listed in the Chugach Land and Resource Management Plan as activities that may be allowed on lands within the Fish, Wildlife, and Recreation Management Area.

Comment RR7: The Forest Service commented that it disagrees with the conclusion in section 3.3.4.2, *Iditarod National Historic Trail* that constructing and operating project infrastructure near the INHT would be consistent with the scenic integrity objective applicable to adjacent NFS lands. The Forest Service further commented that with the existing vegetation near Grant Creek and the proximity of the planned powerhouse, fenced detention pond, access road, and the 6-foot diameter steel penstock to the planned INHT route, it is likely that these facilities will not be visually subordinate within the existing natural landscape and the construction of the hydroelectric facility will result in more than slightly altered deviations in the landscape character.

Response: Although the environmental assessment for the Seward to Girdwood Iditarod National Historic Trail (USDA 2003) states the selected route alternative is consistent with the scenic integrity objectives contained in the Chugach Land and Resource Management Plan, an objective is not specified for the trail route. Consequently, it would be reasonable to apply the moderate scenic integrity objective which is assigned in the Chugach Land and Resource Management Plan to the NFS land adjacent to the planned trail route. To meet the moderate scenic integrity objective the landscape character can appear slightly altered and noticeable deviations must remain visually subordinate to the landscape character being viewed. As explained in section 3.3.5.2, *Project Access road and Infrastructure*, we acknowledge potential effects at the planned INHT route associated with views and sounds of project infrastructure located near the trail. However, our analysis of the visual simulations determined the project features would be mostly screened by topography and the dense forest canopy and vegetative cover in the area. Designing and blending infrastructure with the surrounding area using appropriate colors and textures would further minimize project appearance. Additionally, insulating the powerhouse, as proposed, would limit the extent of noise to the area immediately near the powerhouse. Forest cover and topography would quickly absorb any noise audible from the powerhouse. Accordingly, our analysis identifies the potential effects but concludes these would appear visually subordinate by carefully designing infrastructure and locating the trail within the easement corridor to provide a visual and sound buffer between the INHT and adjacent project infrastructure and operation. Additionally, implementing a scenery management plan, as required by Forest Service 4(e) condition 19 and recommended by staff would further minimize potential visual and audible project effects near the planned INHT route.

Comment RR8: The Forest Service states that decision by Alaska DNR to grant an easement for construction of a gravel access road along the INHT is not a comparable situation to the proposed hydroelectric project crossing the INHT. The Forest Service states that the section of the INHT referenced is located 20 miles south of the project area, is a INHT where summer motorized use is allowed on the trail, was used for logging access previously, and has housing subdivisions close to the 1000-foot buffer. The Forest Service states the existing characteristics of the trail, the motorized uses, and the need for the flood mitigation for the adjacent neighborhoods led the Forest Service to agree that a road co-located on the INHT alignment would not interfere with purpose of the trail for which its rights were granted.

Response: We acknowledge there may be somewhat different circumstances however, as discussed in section 3.3.4.2, *Iditarod National Historic Trail,* neither the INHT Comprehensive Management Plan nor the Kenai Area Plan describe an intended trail experience as a wilderness experience and neither plan specifies land management practices that would prohibit development near the INHT. Alaska DNR's authorized crossing of the INHT portrays its considerations related to land use management decisions for the INHT corridor.

Comment RR9: Forest Service state that figure 3-40 visual simulation in the draft EIS does not accurately represent the current vegetation screening between the trail alignment and the proposed powerhouse location. It also does not consider the area around the facility that would be cleared of vegetation to facilitate construction of the facility and for protection of the facility and workers during high wind events. The Forest Service believes the powerhouse will be more visible than represented. Forest Service requests the final EIS specify what type of clear zone will be needed around all proposed facilities, disclose the visual impacts of the clear zone on the trail alignment, and if any trees would need to be removed within the 100-foot easement to facilitate a clear zone for the facilities. Similarly, the INHT Alliance comments that the analysis of views of project infrastructure does not consider fencing, vegetation clearance, and the lack of foliage during the winter.

Response: Section 3.3.5.2, *Project Access Road and Infrastructure* of the draft and final EISs present the effects of the project infrastructure as viewed from the INHT. Because photo renderings of the project infrastructure do not consider vegetation clearance, the infrastructure may be slightly more visible to INHT users than what is presented in the photo renderings. We revised section 3.3.5.2, *Project Access Road and Infrastructure* to indicate the photo renderings show a more concealed view of project infrastructure because they did not consider vegetation clearing necessary for project operation and maintenance. Regardless, our recommendation to screen views with vegetation and to paint project infrastructure would minimize the project's appearance to trail users. Therefore, despite the photo renderings' failure to consider vegetation clearance, we expect that project infrastructure would still only slightly alter foreground views and would not have an appearance that is inconsistent with the existing management goals for Alaska DNR-managed lands and NFS lands.

Comment RR10: The Forest Service states it disagrees that the planned infrastructure is consistent with the purpose of the 1000-foot INHT buffer and will not affect the 100-foot-wide trail. The Forest Service requests the effects analysis disclose that the proposed hydroelectric facilities are not consistent with the intent of the INHT buffer which is to "conserve the wilderness characteristics of the Iditarod Trail; provide enough width to separate conflicting uses such as motorized and non-motorized uses in areas where multiple uses are recommended; and allow for development of future compatible trail uses" (ADL 228890) and, as described in the Kenai Area Plan, to provide a "visual and sound barrier between the recreation corridor and adjacent uses."

Response: As explained in section 3.3.5.2, *Project Access Road and Infrastructure*, we acknowledge potential effects at the planned INHT route associated with views and sounds of project infrastructure located near the trail. However, our analysis of the visual simulations determined the project features would be mostly screened by topography and the dense forest canopy and vegetative cover in the area. Designing and blending infrastructure with the surrounding area using appropriate colors and textures would further minimize project appearance. Further, insulating the powerhouse, as proposed, would limit the extent of noise to the area immediately near the powerhouse. Forest cover and topography would quickly absorb any noise audible from the powerhouse. Accordingly, our analysis identifies the potential effects but concludes these would appear visually subordinate by carefully designing infrastructure and locating the trail within the easement corridor to provide a visual and sound buffer between the INHT and adjacent project infrastructure and operation. Additionally, implementing a scenery management plan, as required by Forest Service 4(e) condition 19 and recommended by staff would further minimize potential visual and audible project effects near the planned INHT route.

Comment RR11: Jeff Estes recommended the final EIS evaluate an access road alternative that would start at Crowne Point Road and travel north in the new right-of-way about 1.7 miles to the project.[97] Mr. Estes commented that use of this alternative could provide public access closer to Grant Lake, but the road could be gated to prevent public access to project facilities. Mr. Estes further commented that the road would not cross the INHT, would not require construction of a bridge over Trail Lake Narrows, and the project transmission line could return along the access road and connect to the Lawing Substation, located along the Seward Highway a short distance north of the intersection with Crown Point Road. Mr. Estes suggested that removing the need for the bridge and a multi-million-dollar substation would counter the economic increases of the longer access road and transmission line.

Response: Kenai Hydro proposed the access road recommended by Mr. Estes in its Notice of Intent and pre-application document for the proposed Grant Lake / Falls Creek Projects (P-13212 and P-13211, respectively).[98] We reviewed that access road alternative when the project was proposing to include a pipeline that would carry water diverted from Falls Creek to Grant Lake. However, Kenai Hydro modified its proposed project to remove the Falls Creek Diversion in May 2010 and subsequently eliminated the access road that also served the Falls Creek development. The alternate route that Mr. Estes recommends would extend north from the existing Crown Point Road to the east of the proposed Grant Lake powerhouse. From that point, the road would extend west to the powerhouse and east to the intake structure. Since the current route for the INHT would pass to the east of the powerhouse, but west of the north-south portion of the alternate access road connecting to Crown Point Road, the trail would still need to cross the alternate access road leading to the powerhouse. Therefore, this alternative would not eliminate the need for the access road to cross the INHT as asserted by Mr. Estes.

It is true that the alternate access road suggested by Mr. Estes would not require a bridge; however, it would be about 1.7 miles longer than the proposed access route. We estimate the cost of the bridge to be about $581,900 (2018 dollars). Therefore, even with the elimination of the bridge, the alternate route proposed by Mr. Estes would be about $1,385,000 (2018 dollars) more expensive and would disturb an additional 5 acres of land. It would require construction vehicles and project operation and maintenance staff to travel an additional 5 miles to the project site and increase traffic on Crown Point Road. The longer route would also increase project maintenance costs.

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[97] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

[98] Notice of Intent (NOI), Pre-Application Document (PAD), Request for designation as non-federal representative, and request to use the TLP of Kenai Hydro, filed August 6, 2009 (accession number 20090806-5072).

Both the proposed and alternative access road routes could provide recreation benefits by allowing motorized access to Grant Lake. However, with the exception of snowmobile use in winter, we do not recommend providing motorized access on the access road to preserve the existing non-motorized character of the project area and be consistent with current state and federal land management objectives. It is not clear why the alternate route would provide better recreational access to Grant Lake

Finally, as discussed in section 5.1.2, in the *Public Access and Parking* subsection, we recommend the Kenai Hydro develop a plan to allow public access along the project access road to Grant Lake. We note that once constructed, the INHT would also provide access to the project area.

As to the matter of eliminating the need for a substation, re-routing the project transmission line to interconnect at the Lawing Substation would not eliminate the need for the project to construct the substation. As proposed, the project would construct a switchyard adjacent to the powerhouse with a step-up transformer to increase generation voltage from 4,160 volts to 115 kilovolts (kV). The proposed 115-kV transmission line would connect with the existing 115-kV transmission line on the west side of the Seward Highway. Kenai Hydro estimates the cost of the switchyard, including the step-up transformer, would be $406,000 (2018 dollars).

The proposed transmission line would be 1.1 miles long, while the alternate transmission line would about 4.4 miles long, at a cost of approximately $3,508,000 (2018 dollars) more than for the proposed transmission line. The alternate transmission line would also require additional ground disturbance and vegetation removal and would increase maintenance costs. Regarding Mr. Estes asserted cost saving associated with a grid connections at the Lawing Substation; this substation receives power at 115 kV and steps it down via transformers to 69 kV, 24.9 kV, and 12.5 kV for local distribution. However, the Lawing Substation does not have a step-up transformer needed to increase the project's generation voltage from 4,160 volts to 115 kV. Therefore, the equipment needed to connect to the grid at this alternative location is the same as at the proposed location. Subsequently, there would be no cost savings associated with the use of the Lawing Substation as Mr. Estes asserts.

We estimate the total cost of Mr. Este's alternate access road and transmission line/grid connection to be nearly $5 million (2018 dollars) more than Kenia Hydro's proposal. Therefore, we conclude the effects on terrestrial resources and economic costs of Mr. Estes' recommendation would not be in the public interest. Subsequently, we do not include a detailed analysis of Mr. Estes' alternate access road and transmission line route in the final EIS.

Comment RR12: Kenai Hydro commented that it is opposed to allowing public access on the project access road based on consultation with members of the local community and other stakeholders and because it believes sufficient public access is available via the Case Mine Trail, Saddle Trail, and the INHT when it is constructed. Kenai Hydro also believes the project access road would not be suitable for winter recreation activities (e.g., snowmachine use, skiing, and snowshoeing) because the road would be plowed for project access.

Response: Public access on the project access road is discussed in section 3.3.4.2, *Effects of Operation on Public Access*, of the draft and final EISs. We agree that prohibiting motorized access on the project access road during the non-winter months is necessary to discourage trespass and motorized use from occurring off of authorized routes and this approach would address concerns raised by the local community. However, allowing year-round non-motorized use and snowmachine use during the winter months of the access road would be consistent with Alaska DNR's land management objectives to allow and encourage trail use on state and federal lands near the proposed access road, as well as the Federal Power Act which states that projects be developed for beneficial public uses, including recreational purposes. Plowing may affect suitability for some winter recreation activities; however, users could choose whether to use the road based on conditions. Additionally, we revised section 5.1.2, *Public Access and Parking*, of the final EIS to require Kenai Hydro develop a public access plan to provide a comprehensive approach to managing public access near the project access road.

Comment RR13: Kenai Hydro comments that the staff-recommended parking area near the gate on the project access road is unnecessary because the primary intent of the gate is to restrict public access as opposed to allowing some extent of motorized or non-motorized use.

Response: As discussed in section 3.3.4.2, *Effects of Operation on Public Access,* allowing year-round, non-motorized use of the project access road is consistent with management objectives applicable to Alaska DNR and National Forest System lands. The parking area would accommodate safe visitor parking off Seward Highway for this use. Kenai Hydro's proposal to restrict public access on the project access road on the grounds that it would be necessary for safe and secure project operation is unfounded, because as noted in section 5.1.2, *Public Access and Parking*, Kenai Hydro could develop a public access plan to provide a comprehensive approach to managing public access near the project access road in manner that would protect both public and project safety.

Comment RR14: Kenai River Watershed Foundation comments that limiting access on the project access road would not prevent all motorized access creating security and safety concerns.

Response: Section 3.3.4.2, *Effects of Operation on Public Access*, of the draft and final EISs disclose potential effects such as erosion, vegetation damage, pollution, and noise associated with unauthorized vehicle use on the access road and adjacent land. We agree that it is necessary to discourage trespass and motorized use from occurring off authorized routes. We revised the section 5.1.2, *Public Access and Parking,* of the final EIS to supplement the staff recommendation to require Kenai Hydro to develop a public access plan to provide a comprehensive approach to managing public access near the project access road. Concerns about controlling motorized public access can be addressed by developing the public access plan in consultation with federal and state land management agencies.

Comment RR15: The Alaska SHPO comments that Kenai Hydro would construct facilities in an undeveloped area. The project would have an adverse effect on the trail experience and conflicts with the Kenai Area Plan and INHT Comprehensive Management Plan.

Response: Section 3.3.4.2, *Iditarod National Historic Trail* subsection, of the draft and final EISs present our discussion of project consistency with the INHT Comprehensive Management Plan. The draft EIS discloses that neither the Kenai Area Plan nor the INHT Comprehensive Management Plan describe the intended trail experience and that no plans specify managing land near the project as wilderness or otherwise prohibiting development. Consequently, we find that the project development is not in conflict with either plan.

Comment RR16: The Alaska SHPO disagrees with the staff recommendation to not re-route the INHT; it recommends adopting the National Park Service recommendation to convene a work group to identify another route.

Response: Section 3.3.4.2, *Iditarod National Historic Trail*, presents our analysis of the National Park Service recommendation to convene a work group to identify an alternative route. We note that the planned INHT route was selected using a public planning process and achieves a variety of specific objectives: (1) it provides the most direct route of travel, (2) has the least grade change, and (3) is suitable for winter and summer access. Further, the proposed project, including measures to design, site, and screen infrastructure, would not conflict with management guidance or objectives applicable to Alaska DNR and National Forest System lands. Therefore, it is not necessary to convene a work group to consider other potential routes.

Comment RR17: The INHT Alliance comments that the discussion in section 3.3.4.2, *Iditarod National Historic Trail,* about Alaska DNR authorizing a crossing of the INHT is misleading and not pertinent because it refers to a location that is "historically a motorized logging road with existing year-round motorized use, not a trail."

Response: As discussed in section 3.3.4.2, *Iditarod National Historic Trail,* neither the INHT Comprehensive Management Plan nor the Kenai Area Plan describe an intended trail experience as a wilderness experience and neither plan specifies land management practices that would prohibit development near the INHT. Alaska DNR's authorized crossing of the INHT portrays its considerations related to land use management decisions for the INHT corridor.

Comment RR18: The INHT Alliance comments that the final EIS should describe how close the INHT would be to fenced project infrastructure.

Response: Figure 3-26, section 3.3.4.2, *Iditarod National Historic Trail* subsection, of the draft EIS depicts the approximate location of the planned INHT route near project infrastructure. Using the scale provided in figure 3-26, we estimate the distance between the approximate locations of the tread of the INHT and the powerhouse to be about 75 feet. We estimate the distance between the INHT tread and the proposed fence around the switchyard and the wildlife exclusion fence around the tailrace to be about 100 feet and 150 feet, respectively.

Comment RR19: The INHT Alliance comments that the draft EIS does not disclose how the staff recommendation to prohibit vehicular access on the project access road, except for winter snowmachine use, would prevent trespass and damage and how the 1,000-foot-wide INHT corridor would provide a buffer sufficient to separate conflicting motorized and non-motorized uses.

Response: Section 3.3.4.2, *Effects of Operation on Public Access* of the draft and final EISs discloses potential effects such as erosion, vegetation damage, pollution, and noise associated with unauthorized vehicle use on the access road and adjacent land. As indicated in our analysis Kenai Hydro's proposal for a gate and signage is insufficiently detailed to determine whether it would be sufficient to deter unauthorized motorized use. Subsequently, we revised the section 5.1.2, *Public Access and Parking,* of the final EIS to supplement the staff recommendation to require Kenai Hydro to develop a public access plan to provide a comprehensive approach to managing public access near the project access road. The recommended plan would address concerns about controlling motorized public access in consultation with federal and state land management agencies.

The comment regarding the 1,000-foot INHT corridor refers to Alaska DNR's rationale for reserving this distance in its easement to the Forest Service for the planned INHT route. Our analysis in section 3.3.4.2, *Iditarod National Historic Trail* is based on the location of the as-built INHT, which will be within a 100-foot-wide right-of-way for the trail that will be constructed within the 1,000-foot corridor.

Comment RR20: The INHT Alliance comments that the analysis does not explain how constructing project facilities in an area that is currently undeveloped aligns with the intent of the INHT. The analysis describes the area as undeveloped yet refers to nearby development (e.g., Alaska Railroad, Seward Highway) when assessing the project in terms of consistency with comprehensive plans.

Response: We describe the footprint of land where project infrastructure would be constructed as undeveloped in sections 3.3.4.2, *Effects of Operation on Public Access* and 3.3.4.3, *Land and Resource Management*. We revised section 3.3.4.2, the *Iditarod National Historic Trail*, of the final EIS to clarify that points of development (e.g., Seward Highway, residential development) exist about 1 mile west of the project.

To assess plan consistency, we considered management direction specific to the individual management units of Kenai Area Plan. Although the footprint where the project would be constructed does not have any development, management plan direction does not prohibit development.

Comment RR21: The INHT Alliance comments that the project conflicts with the Kenai Area Plan because "no permanent structures or equipment should be placed within the trail corridor if they could adversely affect the trail experience unless the management intent for the unit specifically allows for it."

Response: We discuss Kenai Area Plan guidance with regard to placing structures or equipment in the INHT corridor in section 3.3.4.2, *Iditarod National Historic Trail*. The Kenai Area Plan guidance to not place structures or equipment within the corridor would pertain if their placement would adversely affect the intended trail experience; however, neither the Kenai Area Plan nor the INHT Comprehensive Management Plan describe the intended trail experience. Even without such a description, we acknowledge that the presence of project structures may influence the trail experience and the staff recommendation includes measures to minimize the project's appearance with vegetative screening, painting, and infrastructure design to blend with the surrounding environment. Because we include measures to minimize project effects to trail users, we conclude the project would change, but not adversely affect, the trail experience. Therefore, constructing the project would be consistent with the plan guidance even though development is not listed as specific management intent for the management unit where the project would be constructed.

Comment RR22: The INHT Alliance comments that the project conflicts with the Kenai Area Plan because "no permanent structures or equipment should be placed within the trail corridor if they could adversely affect the trail experience unless the management intent for the unit specifically allows for it."

Response: As discussed in section 3.3.4.2, in the *Iditarod National Historic Trail* subsection, the Kenai Area Plan does not describe the intended trail experience for the INHT. We conclude that although the project would introduce additional facilities into the area, the present level of development and motorized vehicle use in the surrounding area and our recommended measures to screen facilities to minimize their appearance from trail users, the incremental change in the existing appearance would be minimal and not inconsistent with the existing condition. Therefore, we conclude the project does not conflict with the Kenai Area Plan.

LAND USE

Comment LU1: Jim Estes commented that the Kenai River Special Management Area specifies setback requirements which do not allow development along the Trail Lakes shoreline.[99] Mr. Estes noted that the Kenai Hydro's proposed bridge across Trail Lake Narrows appears to conflict with this setback requirement.

Response: This comment refers to the setback requirement of the Kenai Area Plan presented on page 2-53 in table 2-4, *Reserved Access, Building Setbacks, and Fish*

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[99] See draft environmental impact statement meeting transcripts, filed January 9, 2019 (accession number 20190109-4006).

Habitat Management Zones: *Minimum Widths Adjacent to Waterbodies*. As the table 2-4 note explains, exceptions to the specified setbacks include, "Structures such as docks, bridges, and culverts whose purpose is access to or across the stream or lake." Accordingly, the setback does not apply to constructing the bridge across Trail Lake Narrows and there is no conflict with the Kenai Area Plan.

CULTURAL RESOURCES

Comment CR1: The Alaska SHPO commented that while a National Register of Historic Places (National Register) eligibility recommendation for site SEW-00029 (Alaska Railroad) was prepared, the eligibility status of site has not yet been determined and the text of the final EIS should be revised to reflect the site's current status.

Response: In the first bullet of the letter filed on April 18, 2016, the Alaska SHPO concurred with Kenai Hydro's National Register evaluations of resources documented within the project area of potential effects (APE), including site SEW-00029 (letter from J.E. Bittner, SHPO, Alaska DNR, Division of Parks and Recreation, Office of History and Archaeology, Anchorage, AK, to M. Salzetti, Kenai Hydro, LLC, Homer, AK dated March 10, 2015).

Comment CR2: The Alaska SHPO recommends that section 5.0 of the final EIS include a discussion regarding the preparation and implementation of a PA, particularly in section 5.1.1 in the *Project Operations and Project Construction* subsection. The Alaska SHPO also inquiries about duplicate text related to the HPMP in section 5.1.2.

Response: Section 3.3.6.2 states that to meet the section 106 requirements, the Commission intends to execute a PA with the Alaska SHPO for the proposed project for the protection of historic properties that would be affected by project construction and operation. The terms of the PA would require Kenai Hydro to address all historic properties identified within the project APE through a revised final HPMP. Section 5.1.1 of the EIS pertains to measures proposed by Kenai Hydro with Commission staff's recommended modifications to the measures shown in italics. Kenai Hydro proposed to implement an HPMP. Any license issued for the project would contain an article requiring adherence to the stipulations of the PA, including but not limited to the revision of the HPMP or implementation of a revised and approved HPMP. We revised section 5.1.2 of the final EIS to delete the duplicate text.

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APPENDIX B

Grant Lake Hydroelectric Project—FERC No. 13212
Forest Service, Alaska Region, Chugach National Forest Final 4(e) Terms and Conditions

General
Condition No. 1 – Requirement to Obtain a Forest Service Special-Use Authorization
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Condition No. 3 – Approval of Changes
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Condition No. 5 – Compliance with USDA Regulations and Other Laws
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General

License articles contained in the Federal Energy Regulatory Commission's (Commission) Standard Form L-2 issued by Order No. 540, dated October 31, 1975, cover those general requirements that the Secretary of Agriculture, acting by and through the USDA Forest Service, considers necessary for adequate protection and use of the land and related resources of the Chugach National Forest. Under authority of section 4(e) of the Federal Power Act (16 U.S.C. 797(e)), the following terms and conditions are deemed necessary for adequate protection and use of Chugach National Forest lands and resources. These terms and conditions are based on those resources enumerated in the Organic Administration Act of 1897 (30 Stat. 11), the Multiple-Use Sustained Yield Act of 1960 (74 Stat. 215), the National Forest Management Act of 1976 (90 Stat. 2949), and any other law specifically establishing a unit of the National Forest System or prescribing the management thereof (such as the Wilderness Act or Wild and Scenic Rivers Act), as such laws may be amended from time to time, and as implemented by regulations and approved Land and Resource Management Plans prepared in accordance with the National Forest Management Act. Therefore, under section 4(e) of the Federal Power Act, the following conditions covering specific requirements for protection and use of the National Forest System lands shall also be included in any license or license amendment issued for the Grant Lake Hydroelectric Project.

Condition No. 1 - Requirement to Obtain a Forest Service Special-Use Authorization

The Licensee shall obtain a special use authorization from the Forest Service for the occupancy and use of National Forest System lands. The Licensee shall obtain the executed authorization before beginning ground-disturbing activities on National Forest System lands or within one year of license issuance if no construction or reconstruction was proposed in the application for license.

The Licensee may commence ground-disturbing activities authorized by the License and special use authorization no sooner than 60 days following the date the Licensee files the Forest Service special use authorization with the Commission, unless the Commission prescribes a different commencement schedule.

In the event there is a conflict between any provisions of the License and Forest Service special use authorization, the special use authorization shall prevail to the extent that the Forest Service, in consultation with the Commission, deems necessary to protect and use National Forest System lands and resources.

Condition No. 2 – Forest Service Approval of Final Design

Prior to undertaking activities on National Forest System lands and easements, the Licensee shall obtain written approval from the Forest Service for all final design plans for project components that the Forest Service deems as affecting or potentially affecting National Forest System lands and resources. As part of such prior written approval, the Forest Service may require adjustments in final design plans and facility locations to preclude or mitigate impacts and to assure that the project is compatible with on-the ground conditions. Should the Forest Service, the Commission, or the Licensee determine that necessary changes are a substantial change; the

Licensee shall follow the procedures of Article 2 of the license. Any changes to the license made for any reason pursuant to Article 2 or Article 3 shall be made subject to any new terms and conditions the Secretary of Agriculture may make pursuant to section 4(e) of the Federal Power Act.

Condition No. 3 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes affect National Forest System lands and easements the Licensee shall obtain written approval from the Forest Service prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from the Forest Service, and a minimum of 60-days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of the Forest Service for such changes.

The Licensee shall file a copy of this report with the Forest Service at the same time it is filed with the Commission. This condition does not relieve the Licensee from other requirements of this license.

Condition No. 4 – Consultation

Each year during the 60-days preceding the anniversary of this license, or as arranged with the Forest Service, the Licensee shall consult with the Forest Service regarding measures needed to ensure protection and use of the National Forest System lands and resources affected by the Project. At least 30 days in advance of the meeting the Licensee shall provide notice of the upcoming meeting to the Forest Service.

Representatives from the National Marine Fisheries Service, U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, interested tribes, other agency representatives, and other interested parties concerned with operation of the Project may attend the meeting.

The goal of the meeting is to share information. Consultation will include, but not be limited to

- A status report regarding implementation of license conditions
- Results of any monitoring studies performed over the previous year in formats agreed to by the Forest Service and the Licensee during development of the resource management plans
- Review of any non-routine maintenance
- Discussion of any foreseeable changes to Project facilities or features
- Discussion of any revisions or modifications to resource management plans approved as part of the license
- Discussion of needed measures for species newly listed as threatened, endangered, or sensitive, changes to existing management plans that may no longer be warranted due to

delisting of species, or to incorporate new information about a species requiring protection

•Discussion of current year maintenance plans and operation and maintenance activities planned for the next calendar year

•Review and discussion of reservoir management, inundation and instream flow schedules from the previous year and for the next calendar year

•Discussion of any planned pesticide use.

Within 60-days following such consultation, the Licensee shall file with the Commission evidence of the consultation with any recommendations made by the Forest Service.
During the first several years of license implementation, it is likely that more consultation than just one Annual Meeting will be required, given that this is a new project that will be undergoing construction.

The Forest Service reserves the right, after notice and opportunity for comment, to require changes in the Project and its operation through modification of the Section 4(e) conditions to accomplish protection and use of National Forest System lands and resources.

Condition No. 5 - Compliance with USDA Regulations and Other Laws

The Licensee shall comply with the regulations of the Department of Agriculture for activities on National Forest System (NFS) lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations regarding the area or operations on or directly affecting NFS lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 6 – Surrender of License or Transfer of Ownership

Prior to any surrender of this license, Licensee shall provide assurance acceptable to the Forest Service that Licensee will restore any project area directly affecting National Forest System lands to a condition satisfactory to Forest Service upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee must prepare a restoration plan identifying the measures to be taken to restore National Forest System lands including financial mechanisms to ensure performance of the restoration measures.

In the event of a transfer of the license or sale of the project, the Licensee shall assure, in a manner acceptable to the Forest Service, that the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by the Forest Service to evaluate Licensee's proposal, Licensee must conduct an analysis to Forest Service specifications, using experts approved by the Forest Service, to estimate the costs associated with surrender and restoration of any project area affecting National Forest System lands. In addition, the Forest Service may require Licensee to pay for an independent audit of the transferee to help the Forest Service determine whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 7- Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this license.

Condition No. 8 – Self Insurance

The Licensee shall indemnify, defend, and hold the United States harmless for any violations incurred under any laws and regulations applicable to, or judgments, claims, penalties, fees, or demands assessed against the United States caused by, or costs, damages, and expenses incurred by the United States caused by, or the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee's indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 9 - Damage to Land, Property, and Interests of the United States

The Licensee, including any agents or employees of the licensee acting within the scope of their employment, has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to National Forest System lands shall be determined in accordance with the Federal Power Act and standard Form L-2 Articles 22 and 24.

Condition No. 10 - Risks and Hazards on National Forest System Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting National Forest System (NFS) lands or easements within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on NFS lands shall be performed after consultation with the Forest Service. In emergency situations, the Licensee must notify the Forest Service of its actions as soon as possible, but not more than 48 hours, after such actions have been taken. Whether or not the Forest Service is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 11 - Access

The Forest Service reserves the right to use or permit others to use any part of the licensed area on National Forest System lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act.

Condition No. 12 - Maintenance of Improvements

The Licensee shall maintain all its improvements and premises on National Forest System lands or easements to standards of repair, orderliness, neatness, sanitation, and safety acceptable to the Forest Service. The Licensee shall comply with all applicable Federal, State, and local laws, regulations, including but not limited to, the Federal Water Pollution Control Act, 33 U.S.C. 1251 et seq., the Resources Conservation and Recovery Act, 42 U.S.C. 6901 et seq., the Comprehensive Environmental Response, Control, and Liability Act, 42 U.S.C. 9601 et seq., and other relevant environmental laws, as well as public health and safety laws and other laws relating to the siting, construction, operation, maintenance of any facility, improvement, or equipment.

Condition No. 13 – Boundary Markers and Survey

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on National Forest System lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," or (2) the specifications of the Forest Service. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 14 – Pesticide and Herbicide Use Restrictions

Herbicides may not be used to control undesirable woody and herbaceous vegetation, and aquatic plants, and pesticides may not be used to control undesirable insects, rodents, non-native fish, etc., on National Forest System lands without the prior written approval of the Forest Service. The Licensee must submit a request for approval of planned uses of herbicides and pesticides. The request must cover annual planned use and be updated as required by the Forest Service. The Licensee shall provide information essential for review in the form specified by the Forest Service.

The Licensee must provide at a minimum the following information

- whether pesticide applications are essential for use
- specific locations of use
- specific herbicides and pesticides proposed for use
- application rates

- dose and exposure rates
- safety risks and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Pesticide use will be excluded from National Forest System (NFS) lands within 500 feet of known locations of the Rough-skinned newt, and Forest Service Special Status or culturally significant plant populations. Application of pesticides must be consistent with Forest Service riparian conservation objectives.

On NFS lands the Licensee shall use only those materials registered by the U.S. Environmental Protection Agency for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of herbicides and pesticides and disposal of excess materials and containers.

Condition No. 15 – Revision of Forest Service 4(e) Terms and Conditions

The Forest Service reserves the right, after notice and opportunity for comment, to require changes in the Project and its operation through revision of the Section 4(e) conditions to accomplish protection and use of National Forest System lands and resources.

The Forest Service also reserves the right to modify these conditions, if necessary, to respond to any significant changes that warrant a revision of these conditions, for example, a Final Biological Opinion issued for this Project by the National Marine Fisheries Service or United States Fish and Wildlife Service or certifications issued for this Project by the State of Alaska..

Condition No. 16 – Signs

The Licensee shall consult with the Forest Service prior to erecting any signs on National Forest System lands and easements relating to this license. The Licensee must obtain the approval of the Forest Service as to the location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee erected signs to neat and presentable standards

Condition No. 17 – Additional National Forest System Lands

If the Licensee proposes ground-disturbing activities on or affecting National Forest System lands that were not analyzed in the Commission's Environmental Impact Statement, the Licensee, in consultation with the Forest Service, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity.

The Licensee shall conduct or fund the necessary environmental analysis including, but not limited to, scoping, site-specific resource analysis, and cumulative effects analysis sufficient to meet the criteria set forth in Forest Service regulations for National Environmental Policy Act (NEPA) compliance in existence at the time the process is initiated. The Licensee may refer to or rely on previous NEPA analysis for the activity to the extent the analysis is not out of date as determined by the Forest Service. Contractors used by the Licensee to conduct the NEPA process must be approved by the Forest Service in advance of initiating the work.

Additional lands authorized for use by the Licensee in a new or amended special use authorization shall be subject to laws, rules, and regulations applicable to the National Forest System. The terms and conditions of the Forest Service special use authorization are enforceable by the Forest Service under the laws, rules, and regulations applicable to the National Forest System.

Condition 18 - Use of Explosives

In the use of explosives, the Licensee shall exercise the utmost care not to endanger life or property and shall comply with Federal, State and local laws and ordinances. The Licensee shall contact the Forest Service prior to blasting to obtain the requirements of the Forest Service. The Licensee shall be responsible for all damages resulting from the use of explosives and adopt precautions to prevent damage to surrounding objects. The Licensee shall furnish and erect special signs to warn the public of the Licensee's blasting operations. The Licensee shall place and maintain such signs, so they are clear to the public during all critical periods of blasting operations.

The Licensee shall store all explosives in compliance with all applicable Federal, State and local laws and ordinances.

When using explosives on National Forest System lands, the Licensee shall adopt precautions to prevent damage to landscape features and other surrounding objects. When directed by the Forest Service, the Licensee shall leave trees within an area designated to be cleared as a protective screen for surrounding vegetation during blasting operations. The Licensee shall remove and dispose of trees so left when blasting is complete. When necessary, and at any point of special danger, the Licensee shall use suitable mats or other approved methods to smother blasts.

Condition No. 19 – Resource Management Plans

Within one year of license issuance, and in consultation with the Forest Service and applicable Federal and State agencies, the Licensee shall file with the Commission plans addressing specific resource issues and management objectives covered by the Chugach National Forest Land and Resource Management Plan, and an implementation schedule.

The Licensee shall submit the draft plans for Forest Service review and approval, prior to submitting the plans to the Commission. The Licensee shall provide at least 90 days for Forest Service review and approval before the filing deadline in the license. Upon Commission approval, the Licensee shall implement the Plans. The required plans include:

- Construction Plan
- Erosion and Sediment Control Plan
- Fire Prevention Plan

- Hazardous Materials Plan
- Historic Properties Management Plan
- Reservoir Management and Inundation Plan
- Scenery Management Plan
- Solid Waste and Wastewater Plan
- Spoils Disposal Plan
- Aquatic Invasive Species Management Plan
- Vegetation Management Plan Spoil Disposal Plan
- Terrestrial and Aquatic Invasive Species Management Plan
- Threatened, Endangered, Proposed for Listing, and Sensitive Species Plan
- Vegetation Management Plan
- Wildlife Mitigation and Monitoring Plan

Condition No. 20 - Environmental Compliance Monitor

Several important items require monitoring during the construction phase of the project. To ensure adherence to license conditions, mitigation measures, and other environmental aspects of project construction, the Forest Service will require the Licensee to provide a qualified environmental compliance monitor to oversee the project during major construction activities (e.g. vegetative or land disturbing, spoil producing, blasting activities). Items to be monitored include but are not limited to those stated in the Resource Management Plans listed in Condition No. 19.

The compliance monitor is a liaison between the Forest Service and Licensee. The compliance monitor should have the authority to stop work or issue change orders in the field should conditions so warrant. The compliance monitor should be a third-party contractor independent of the Licensee, subject to approval by both the Licensee and the Forest Service. Once major construction activities are complete the compliance monitor will no longer be needed.

Condition No. 21 - Iditarod National Historical Trail

The Forest Service has a planned route for a segment of the Iditarod National Historic Trail that will be built near the power plant facility. The access road for the Grant Lake outlet and the tunnel/penstock will have to cross this planned trail alignment. The following conditions apply due to the proximity of the trail and project infrastructure:

a.Within one year of license issuance and prior to construction, the Licensee shall coordinate with the Forest Service to ensure that planned hydroelectric facilities minimize adverse impacts to the planned location of the Iditarod National Historic Trail and 100-foot wide easement. The Licensee shall coordinate with the Forest Service on design and development of the access route, focusing on the access road and Iditarod National Historic Trail intersection.

b.Licensee must ensure that the construction and maintenance of the access road minimizes adverse impacts to the trail alignment and 100-foot wide easement for the trail. Concentration of flows from road construction must be mitigated to the extent possible so that the trail remains intact and functional. Licensee must coordinate road drainage structure design with the Forest Service to ensure increased drainage is accounted for and incorporated into trail design and construction. Based on the current trail design, increases in number and size of trail drainage structures necessitated from concentrated roadway flows is the responsibility of the Licensee. If drainage issues on the road impact the trail and easement the Licensee will be responsible for all maintenance and reconstruction on the trail associated with the damage event.

c.Licensee must coordinate with the Forest Service regarding the intersection location between the penstock and the trail alignment and 100-foot easement. Licensee shall ensure that trail function, operability, and sustainability remain intact during project construction and throughout the life of the license. If construction of the penstock located near the powerhouse imposes additional construction costs for either the trail or the trail bridge, Licensee will pay these additional costs.

d.During and after construction for a period of five years the Licensee will remove any trees that blow down across the Iditarod National Historic Trail alignment due to construction of the hydroelectric facilities (access road, detention pond, penstock and tunnel, powerhouse, etc.).

e.Licensee shall provide Forest Service with road access to Grant Lake for administrative activities, including, but not limited to trail maintenance, fire response, monitoring, and law enforcement purposes.

f.The scenery management plan (Condition No. 19) must address minimizing views of project facilities from the Iditarod National Historic Trail. The Plan should address directing security lighting toward the ground to limit effects of light pollution, developing revegetation plans for construction sites, determining color palates for project infrastructure, describing processes for agency coordination for maintenance activities, and monitoring views of project infrastructure over the license term.

Licensee shall coordinate with the Forest Service on measures to prevent public entrance to project facilities from the Iditarod National Historic Trail.

Condition No. 22 - Reroute of Iditarod National Historical Trail

If, at any point during design, construction, and operation of the hydroelectric facility it becomes necessary to reroute any portion of the Iditarod National Historic Trail to accommodate the facility the following condition will apply:

1. The Licensee must develop a plan for the Iditarod National Historic Trail reroute in consultation with the Forest Service, Bureau of Land Management (National Historic Trail Administrator), and State of Alaska Department of Natural Resources (DNR). The plan must be approved by the Forest Service. The plan shall ensure that all trail infrastructure developed by the Licensee as part of the rerouted Iditarod National Historic Trail system meets applicable standards of quality set by the Forest Service, if the Licensee or its assigns occupies an interest in the Project facilities. The plan must include an implementation schedule and coordination procedures for design, construction, and maintenance of the rerouted portion of the Iditarod National Historic Trail

   segments from Vagt Lake, crossing Grant Creek, and north of Grant Creek to where the rerouted trail joins with the original trail alignment. This must be accomplished within two years of when the need for the reroute is identified. Components of this work include:

   a. Licensee shall work with the State of Alaska DNR and the Forest Service to secure to the Forest Service a 100-foot-wide easement for the rerouted section of the Iditarod National Historic Trail from the State of Alaska.

   b. Licensee shall complete a design narrative for the rerouted trail segments according to Forest Service specifications. The design narrative will describe the rerouted sections of trail including tread width, length, number and kind of trail structures needed, bridge, and other specific trail details to be included in the design. The design narrative will include an estimated cost of construction. The Forest Service must approve the design narrative prior to start of detailed design of trail or bridge construction. The Licensee shall design and construct all trail segments that deviate from the existing planned trail alignment and easement using Forest Service trail construction and engineering standards identified in the Forest Service Directives and the National Strategy for Sustainable Trail Systems. The trail will be designed for pedestrian, bicycling, and pack and saddle stock uses. Trail design and construction must incorporate the Iditarod National Historic Trail design standards. Trail location must be approved by the Forest Service in advance of construction.

   c. The Licensee shall conduct geotechnical and hydrologic investigations according to

   Forest Service engineering specifications to ensure that the proposed bridge location over Grant Creek is feasible for construction and can be maintained in perpetuity. The investigation report shall be reviewed and approved by the Forest Service prior to approval of the bridge location. The final proposed bridge location must be approved by the Forest Service.

   d. If the reroute requires moving the bridge from its planned location, then the Licensee must construct a bridge across Grant Creek that meets Forest Service engineering specifications and Iditarod National Historic Trail design standards.

Approval of the bridge design by the Forest Service is required prior to construction.

e.The Licensee shall submit to the Forest Service an as-built survey for the entire trail reroute, using minimum mapping requirements set forth by the State of Alaska Department of Natural Resources for the Iditarod National Historic Trail segments crossing State of Alaska managed lands. The as-built survey must be completed and submitted for Forest Service approval within one year of completion of the construction of the rerouted trail segments. The as-built survey shall depict the centerline of the 100foot wide easement. All surveying and platting shall meet Forest Service engineering specifications.

f.Contractors used by the Licensee to construct trail reroute facilities must adhere to the designs and locations approved by the Forest Service. The Licensee shall make accommodation for Forest Service representatives to inspect the work during construction to ensure compliance with design requirements. Should the Forest Service representatives, during inspection, detect deviations from the design requirements, the Licensee shall promptly act to cause their contractor to correct any deviations in the form of re-work and use of corrected construction methodologies. The Forest Service shall inspect the constructed facilities prior to the termination of the contract(s) to ensure compliance with approved designs.

g.Should annual and long-term maintenance costs of the reroute exceed those anticipated for the Forest Service planned route the Licensee will be responsible for annual maintenance, deferred maintenance, long term repairs and replacements of assets, and condition surveys as well as health and safety operations of the rerouted trail segment and trail bridge for the duration of the license.

i. Trail maintenance tasks include removing blowdown annually and after any major storm events, brushing (4-year cycle), tread maintenance and repair, drainage maintenance and repair, and trail structure maintenance and repair.

ii. Condition surveys must be completed once every five years following Forest Service standards or when conditions or events warrant.

The trail bridge at Grant Creek will be inspected once every four years following the Chugach National Forest's condition survey schedule by an individual certified by the Region 10 bridge program manager. Additionally, an emergency condition survey must be completed if any unforeseen structural damage occurs to the bridge. Annual maintenance needs will also be completed, this may include adding gravel to the bridge approach, replacing damaged railing, replacing deck boards, etc.