Grant Lake Hydroelectric Project (FERC No. 13212)

Operation Compliance Monitoring Plan
Draft

Kenai Hydro, LLC

May 2015

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Acronyms and Abbreviations

ADF&G	Alaska Department of Fish & Game
ARRC	Alaska Railroad Corporation
BMP	Best Management Practices
cfs	cubic feet per second
°C	degrees Celsius
DLA	Draft License Application
ECM	Environmental Compliance Monitor
FERC	Federal Energy Regulatory Commission
HVAC	heating, ventilating, and air conditioning
INHT	Iditarod National Historic Trail
KHL	Kenai Hydro, LLC
kV	Kilovolt
kW	Kilowatt
MW	Megawatt
NAVD 88	North American Vertical Datum of 1988
OCMP or Plan	Operation Compliance Monitoring Plan
Project	Grant Lake Hydroelectric Project
RM	river mile
USGS	United States Geological Survey

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Operation and Compliance Monitoring Plan
Draft
Grant Lake Hydroelectric Project (FERC No. 13212)

1 INTRODUCTION

This document provides a draft of Kenai Hydro, LLC's (KHL) proposed Operation Compliance Monitoring Plan (OCMP or Plan) for the Grant Lake Hydroelectric Project (Project), Federal Energy Regulatory Commission (FERC) No. 13212. Activities associated with the proposed construction and operation of the Project include the diversion of water from an intake structure at Grant Lake for power generation and creating a bypass reach (Reach 5) of approximately 0.5 miles. The diversion of Grant Lake water will also alter the pre-Project streamflow hydrograph, but is being designed to maintain the seasonal water temperature regime of Grant Creek downstream of the powerhouse.

This draft OCMP has been developed to provide instream flows to the bypass reach. Secondly, the monitoring of flows and temperatures in Grant Creek below the powerhouse will insure that the Project is operating within defined parameters established to protect aquatic resources. The development of this document is a collaborative process in which KHL is establishing key monitoring and operational parameters based on agency responses to the aquatic and water resources study reports conducted in 2013 as part of the Project licensing process (KHL 2014a, 2014b, and 2014c).

1.1. Location

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

1.2. Project Description

The Grant Lake Project will consist of the Grant Lake/Grant Creek development, an intake structure in Grant Lake, a tunnel, a surge chamber, a penstock, a powerhouse, tailrace channel

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

with fish exclusion barrier, access roads, a step-up transformer, a breaker, a switchyard, and an overhead transmission line. The powerhouse will contain two Francis turbine generating units with a combined rated capacity of 5 megawatts (MW) with a maximum design flow of 385 cubic feet per second (cfs). The general proposed layout of the Project is shown in Figure 2.

1.2.1. Grant Creek Diversion

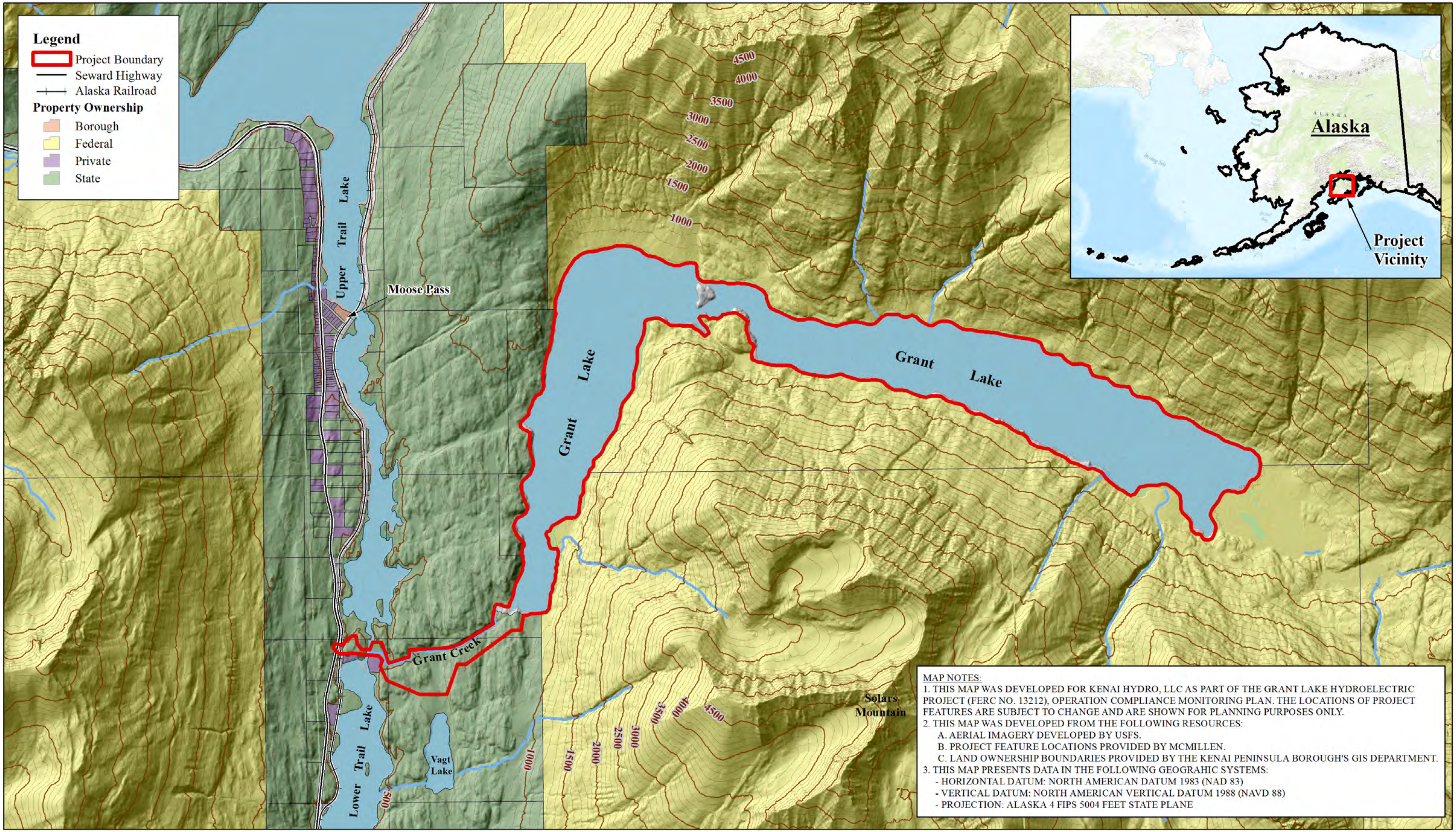
The proposed Project consists of a reinforced concrete intake structure located on the south side of the natural lake outlet. No structural modifications would be made to the existing lake natural outlet. The Project will divert water up to a maximum of 385 cfs into the intake structure. When the lake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

1.2.2. Grant Lake Intake

The Project water intake would be a concrete structure located approximately 500 feet east of the natural outlet of Grant Lake and adjacent to the shore. The intake structure consists of a reinforced concrete structure extending from approximately elevation 675 NAVD 88 feet up to a top deck elevation of 715 feet NAVD 88. The structure has an outside dimension of 38 feet by 20 feet. The structure includes intake trashracks, selective withdrawal intake gates with wire rope hoist, and a roller gate located on the water conveyance intake. The intake is divided into three bays, each fitted with an intake gate to provide flexibility for delivering the full flow range of 58 cfs to 385 cfs. The gate position within the water column will be set to deliver the required water temperature to Grant Creek below the powerhouse. The roller gate would be 11 feet tall by 11 feet wide and fitted with a wire rope hoist lift mechanism. Electrical power will be extended from the powerhouse to the intake to operate the intake and isolation gates. Pressure transducers will be installed to monitor the water level at the lake as well as within the intake tower. An access bridge 16 feet wide would be installed from the lake shore out to the intake structure.

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

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



REV	DATE	BY	DESCRIPTION

Drawing Scale: 0 0.25 0.5 1 Miles

N

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Developed For:

Homer Electric Association, Inc.
A Touchstone Energy® Cooperative

GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

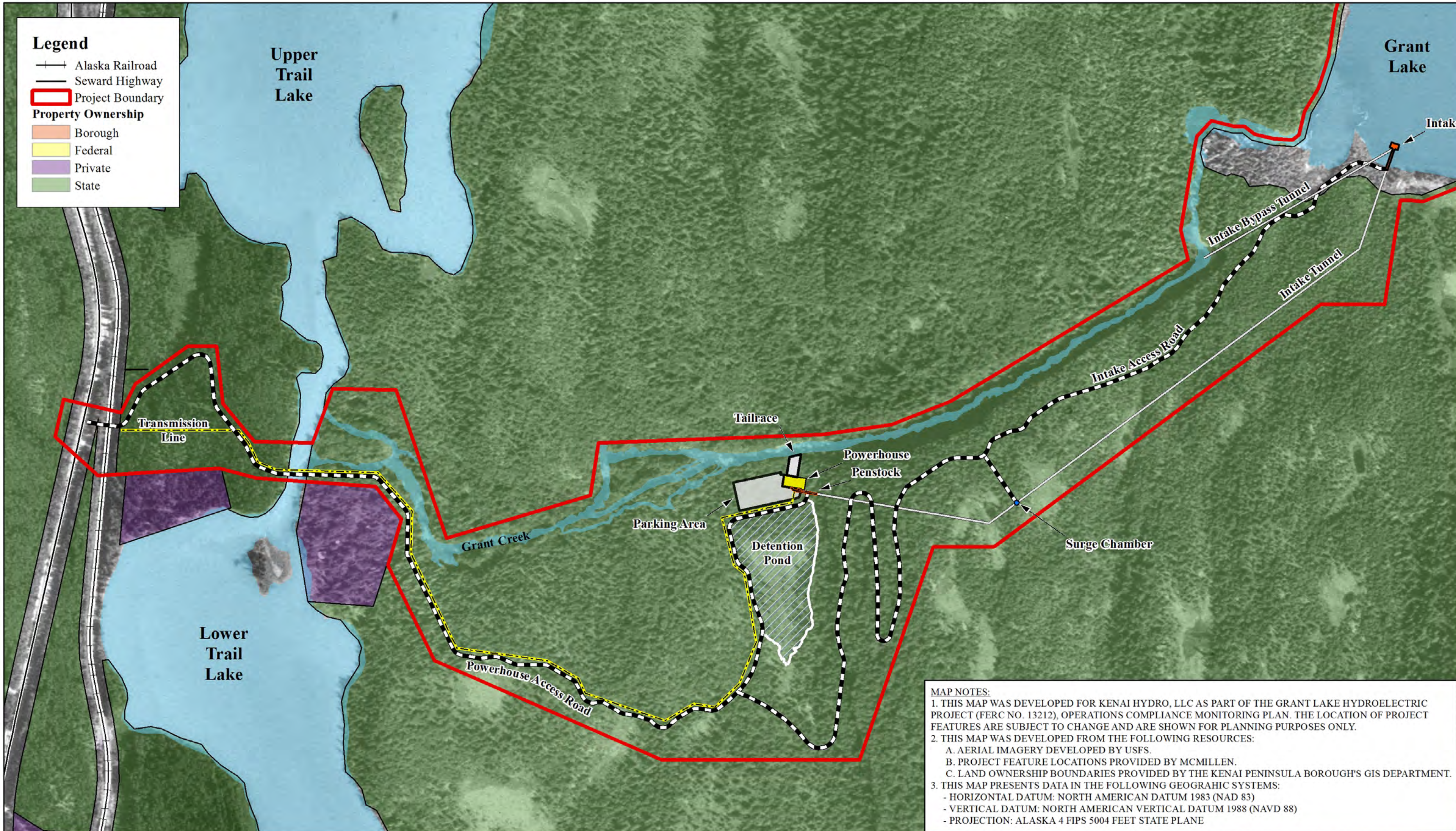
OPERATION COMPLIANCE MONITORING PLAN

Figure 1
Location Map of Project Vicinity

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

DRAWING

SCALE: 1:35,000



MAP NOTES:

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

REV	DATE	BY	DESCRIPTION

N

Drawing Scale:

0 250 500 1,000 Feet

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GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

OPERATION COMPLIANCE MONITORING PLAN

Figure 2
General Project Features And Facilities

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

DRAWING

SCALE: 1:5,000

1.2.3. Tunnel and Surge Chamber

The intake structure would connect to a tunnel extending to the Project powerhouse. The tunnel would be approximately 3,300 feet long with a 10-foot-horseshoe shape. Drill and shoot techniques would be used to construct the tunnel using an entrance portal at the powerhouse for access. The lower 900 feet of tunnel would be constructed at a 15 percent slope. This section of the tunnel will be concrete lined. The upper 2,400 feet of tunnel would be constructed at a 1 percent slope and would be unlined. This proposed arrangement provides a low pressure hydraulic conduit in the upper tunnel reaches suitable for an unlined tunnel. A surge chamber is located at the transition between the two tunnel slopes. This chamber is approximately 10 feet in diameter and would extend from the tunnel invert elevation of 670 feet NAVD 88 to the ground surface at approximately elevation 790 feet NAVD 88. The surge chamber provides a non-mechanical relief for hydraulic transients that could occur if a load rejection occurs at the powerhouse. Rock anchors and shotcrete stabilization techniques would be used to stabilize the tunnel exposed rock surface where required. A rock trap would be located at the surge chamber location to collect dislodged rocks from the unlined tunnel section.

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

1.2.4. Penstock and Surge Tank

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

1.2.5. Tailrace

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

1.2.6. Tailrace Detention Pond

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

1.2.7. Powerhouse

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

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

1.2.8. Transmission Line/Switchyard

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

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

1.2.9. Appurtenant Facilities

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

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

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

1.2.10. Access Roads

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

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

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

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

1.2.11. Project Operations

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

2 PROJECT OPERATIONAL AND MONITORING REQUIREMENTS

2.1. Background and Objectives

Following a series of natural resource studies conducted in 2013 and consultation with stakeholders, certain physical conditions (i.e. instream flows and water temperature) were discussed as critical to minimizing impacts to biological and water resources. Key study results as well as generic operational expectations were the following:

- Established relationships between flow and habitat so that Project operations shall not diminish available habitat for resident and anadromous fish species.
- Grant Lake temperatures at shallow depths of 0.5 meters and 1.5 meters most closely resemble water temperatures in Grant Creek. Project waters should be diverted from these depth strata so that the thermal regime of Grant Creek matches pre-Project conditions.

The objective of the OCMP is to insure a comprehensive and adaptive operational scenario that insures recommended instream flow and temperature regimes for the Project are provided. The OCMP outlines the responsibilities of KHL to properly release, monitor, and report instream flows and water temperatures affected by the Project while addressing agency concerns. The OCMP also outlines the necessary procedures taken during potential emergency situations, project maintenance, and non-compliance events.

2.2. Proposed Project Operation

KHL proposes to utilize 18,790 acre-feet of net storage for power production. Waters diverted or spilled from Grant Lake will follow one of three outflow route options. Waters to be utilized for power production will be conveyed to the powerhouse via an intake, tunnel and penstock along the southeastern bank of Grant Creek. The powerhouse shall return all water to the alluvial reach of Grant Creek where it shall flow downstream approximately 0.5 miles to its natural sequence of Trail Lake Narrows, Lower Trail Lake, Trail River, and Kenai Lake. The second flow route shall divert Grant Lake water to the base of the bedrock waterfall at the outlet of Grant Lake and serve as the primary source for bypass flow volumes in the bypass reach. After entering river mile (RM) 1.0 of the Grant Creek system, bypass flows progress down the 0.5 mile bypass reach before converging with waters at the tailrace of the Grant Lake powerhouse. A third routing option occurs when inflows to Grant Lake exceed the plant capacity of 385 cfs and bypass flow requirements of 5-10 cfs (seasonally dependent). Under these conditions water shall be spilled over the natural Grant Lake outlet and be conveyed the entire 1.0 mile length of the Grant Creek channel.

The Project proposes to annually vary reservoir levels by 13 feet. Typical full pool elevations and volumes of 703 feet NAVD 88 and 251,920 acre-feet will be maintained, while minimum lake levels will be decreased from natural conditions to an elevation of 690 feet NAVD 88 and 233,130 acre-feet.

Details of the annual reservoir level fluctuation for Grant Lake are summarized below:

- January 1-May 15. Lowering of reservoir levels (drafting) for power production and bypass flows. Outflow exceeds inflow.
- May 15-May 31: Maintain minimum reservoir level of 690 feet NAVD 88. Only inflow to Grant Lake available for power production and bypass flows.
- June 1-August 15: Raising of reservoir levels (filling). Inflows exceed outflow for power production and bypass flows.
- August 16-October 31: Maintain maximum reservoir level of 703 feet NAVD 88. Only inflow to Grant Lake available for power production and bypass flows.

- <u>November 1-December 31:</u> Lowering of reservoir levels (drafting) for power production and bypass flows. Outflow exceeds inflow.

2.3. Proposed Grant Lake Level Requirements

The Project does not intend nor have the infrastructure to raise lake elevations above 703 feet NAVD 88. The Project will be required to insure lake levels do not drop below the proposed minimum elevation of 690 feet NAVD 88. Seasonal reservoir elevations shall adhere to the general guidelines summarized in Section 2.2.

2.4. Proposed Grant Creek Instream Flow Requirements

KHL held a collaborative workshop in Anchorage, Alaska on July 8, 2014 during which, the following instream flow regime for the bypass reach of Grant Creek (RM 0.5-1.0) was proposed.

Dates	Diversion Flow to Bypass Reach
January 1 – July 31	5 cfs
August 1 – September 7	10 cfs
September 8 – October 31	7 cfs
November 1 – December 31	5 cfs

Water used for power production would be returned to Grant Creek at the downstream end of the Canyon Reach (RM 0.5). For the tailrace reach (RM 0.0-0.5), peak flow events would be reduced in the summer while winter flows would be slightly elevated from pre-Project conditions. From approximately August 16 through October 31, inflow volumes would match outflows downstream of the powerhouse. Figure 3 displays the annual hydrograph of the proposed Project and pre-Project flow volumes. Although there will be no specific instream flow requirements for the tailrace reach, flows will be monitored to assess the deviation from pre-Project conditions.

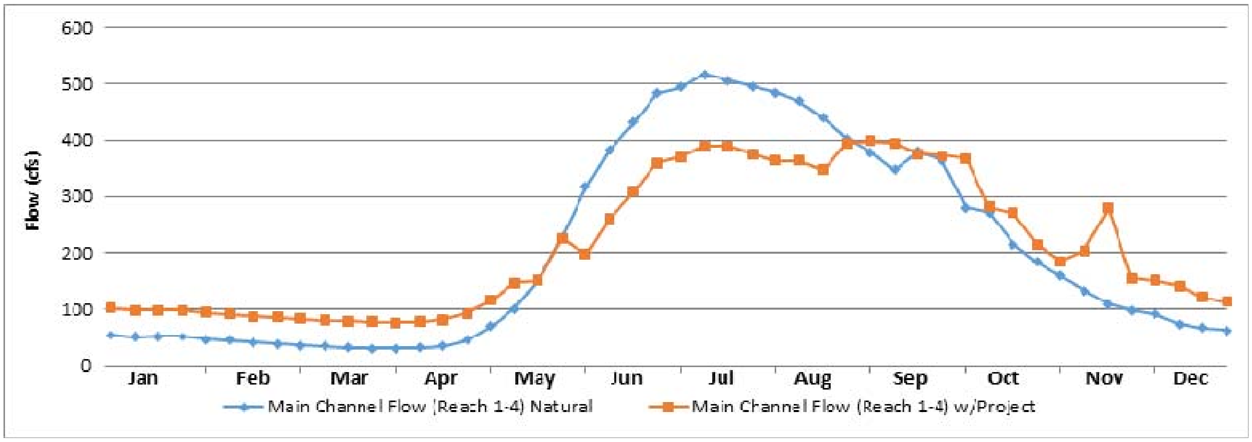


Figure 3. Grant Creek annual flow hydrographs tailrace reach - natural vs. proposed project.

2.5. Proposed Grant Lake and Grant Creek Temperature Requirements

The correlation of Grant Creek stream temperatures with the shallow depths of Grant Lake are detailed in the Water Resources Study Report (KHL 2014c) and summarized in Table 1. Based on the these data, the Project will divert waters from Grant Lake to the bypass reach or the powerhouse at either 0.5 m or 1.5 m below the water surface elevation of Grant Lake. KHL will monitor temperature at select locations throughout the Project area to insure monthly lake and creek temperatures agree within 1 degree Celsius (°C).

Table 1. 2009-2014 mean monthly temperatures at Grant Lake depths of 0.5 m and 1.5 m and Grant Creek.

Month	Average Temperature (°C)		
	Grant Lake 0.5 m	**Grant Lake 1.5 m**	**Grant Creek**
January	1.0	2.2	1.2
February	1.2	2.4	1.5
March	1.4	2.6	1.6
April	1.4	2.8	1.9
May	4.8	5.2	5.1
June	9.3	8.7	8.9
July	11.9	11.4	11.5
August	12.3	12.0	12.2
September	10.8	10.7	10.4
October	6.9	6.9	6.8
November	4.0	4.1	3.6
December	1.3	2.0	1.0

Notes:
1 Shaded cells indicate best correlation of lake and stream temperatures.

3 LAKE LEVEL FLOW AND TEMPERATURE MONITORING

The location of all proposed monitoring stations within the Project boundary are summarized in Figure 4. Additional details of each monitoring station are provided in the sections below.

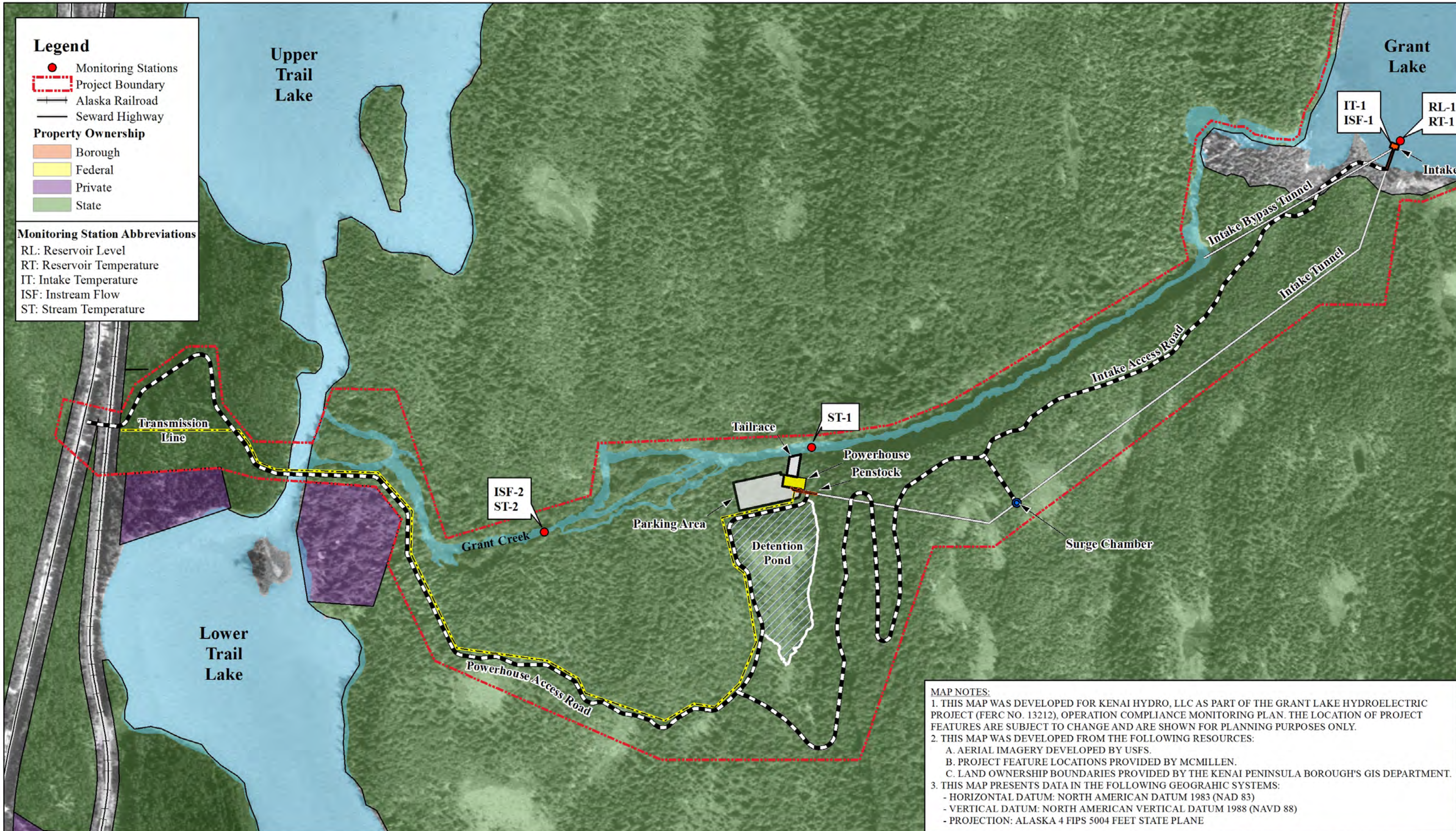
3.1. Level and Temperature Monitoring - Grant Lake

At the Grant Lake intake structure, KHL will install appropriate instrumentation to monitor water surface elevations (Station RL-1). Utilizing this information, the real time control system will calculate reservoir stage measurements. KHL will also install water temperature monitoring instrumentation to detect and record reservoir temperatures upstream of the intake structure as well as inside of the intake structure (Stations RT-1 and IT-1). The intake structure instrumentation information will be transmitted to the control system located in the powerhouse via a fiber optic link. The powerhouse will be linked to the HEA Dispatch Center via a telemetry system (e.g. landline, cellular, satellite) to transmit appropriate supervisory control and data acquisition signals.

The control system will continuously monitor Grant Lake water temperatures. The water temperatures at this site will be used, in combination with temperature data from the lower bypass reach of Grant Creek (Station ST-1), to meet temperature criteria described in Section 2.5. Lake level and associated water temperature data will be collected for the duration of the licenses term. All data will be summarized and documented as part of the annual compliance report/meeting process described in Section 4. If deviations in temperature of more than 1 °C are documented, KHL will determine the reason and if it is determined to be the result of infrastructural or operational considerations as opposed to anomalous natural conditions, the stakeholder group associated with the Annual Compliance Report will be consulted during the annual process and modifications to the operational regime will be agreed upon to confirm that temperature conditions are adhered to.

3.2. Flow and Temperature Monitoring - Grant Creek Bypass Reach

Measurements of flow volumes at the bypass pipe will start at commencement of Project operations and will ensure compliance with the minimum required flow releases of 5-10 cfs (Station ISF-1). Diversion flows will be measured at the intake structure utilizing a telescoping weir to provide flow volumes to the bypass tunnel. The overflow weir is an accurate flow measurement system that will also allow for adjustments in bypass flows to be instantaneously quantified.



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

GRANT LAKE HYDROELECTRIC PROJECT - FERC PROJECT NO.13212

OPERATION COMPLIANCE MONITORING PLAN

Figure 4
Proposed Lake Level, Streamflow,and Temperature Monitoring Stations in the Project Vicinity

DESIGNED Jake Woodbury
DRAWN Jake Woodbury
CHECKED C. Warnock
ISSUED DATE 5/4/2015
DRAWING
SCALE: 1:5,000

Temperatures will be monitored at the downstream end of the bypass reach (Station ST-1). Measurements of Grant Creek water temperatures will be taken every hour to calculate mean daily temperature values. In addition to internal or local storage of data, the temperature instrumentation will be connected to the powerhouse control system. The water temperatures at ST-1 will serve as the location that establishes reference temperatures. All diverted water from Grant Lake will be adjusted to meet temperature criteria described in Section 2.5 – Proposed Grant Lake and Grant Creek Temperature Requirements. Instream flow and associated water temperature data will be collected for the duration of the licenses term. All data will be summarized and documented as part of the Annual Compliance Report process described in Section 4. If inconsistencies associated with KHL's instream flow or water temperature requirements are documented, KHL will determine the reason and if it is determined to be the result of infrastructural or operational considerations as opposed to anomalous natural conditions, the stakeholder group associated with the Annual Compliance Report will be consulted during the annual process and modifications to the operational regime will be agreed upon to confirm that temperature conditions are adhered to.

3.3. Flow and Temperature Monitoring-Grant Creek Tailrace Reach Flow

As part of the 2013 licensing studies, KHL installed a United States Geological Survey (USGS)-approved stage recorder to monitor streamflows. The stream gage is at the same location as USGS Gage No. 15246000, which was operational from 1947-1958. The current stream gage was serviced and calibrated from April 2013 to December 2014, extending the period of record and establishing a reliable stage-discharge rating equation (KHL 2014c). The gauge was then re-established in February 2015 with the intent of KHL maintaining for the duration of the license. The gage is currently equipped with a self contained bubbler system utilizing an H-3553 pump transducer and an H-500XL data recorder manufactured by Design Analysis Associates, Inc. Once the powerhouse is built and the Project commissioned, this system will add a thermistor to the H-500XL data recorder and connect into the powerhouse control system. Measurements of Grant Creek stage and temperature in the tailrace reach will be collected every 15 minutes to summarize mean daily flow and temperature values. Photos of the existing stream ISF-2 stream gage are provided in Figure 5. The Grant Creek stream gauge will be operated and maintained for the duration of the license term. All streamflow data will be summarized and documented as part of the Annual Compliance Report process described in Section 4.

Figure 5. Monitoring equipment at Station ISF-2.

3.4. Failsafe Provisions

Failsafe provisions will be provided in project design and operation to ensure that flows are provided continuously to Grant Creek during maintenance periods and any emergency project shutdowns.

1. Bypass flow: The instream flow release pipe will be continuously open to appropriately accommodate the required instream flow. An 18-inch diameter pipeline will be installed using directional bore techniques from the new intake structure in the lake to the base of the falls. An overflow weir and control gate will be installed in the intake to allow controlled release of water from the reservoir to the base of the falls. The water will be pulled from the surface of the lake to maintain consistent temperature conditions at the base of the falls and within the bypass reach. The amount of flow released will be controlled through the overflow weir in the intake where accurate flow measurement can be accomplished.

2. Powerhouse: An energy dissipation bypass valve is provided at the powerhouse to allow flow discharge in the event that the powerhouse is not connected to the transmission grid or an outage is required for the turbine/generator equipment. The energy dissipation valves discharges directly into the project tailrace providing flow to Grant Creek. The energy dissipation bypass valve will open automatically to maintain flows in Grant Creek as the turbine is brought offline during an emergency operating procedure. For normal startup and shutdown operation, the powerhouse bypass valve will be opened in step with the turbine shutdown to maintain the required flow regime in Grant Creek.

3.5. Schedule for Installing, Maintaining, and Collecting Flow and Temperature Instrumentation

All temperature and water level monitoring equipment will be installed during Project construction and be operational before the Project operations commence. Maintenance and calibration of all monitoring equipment will occur per manufactures specifications to ensure instrumentation accuracy and function. All monitoring stations will operate for the life of Project.

4 REPORTING AND COORDINATION

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

- A summary of the actions that KHL implemented during the previous calendar year related to:
    - Grant Lake elevations and water temperature
    - Grant Creek bypass reach instream flows and water temperatures
    - Grant Creek tailrace reach streamflows and water temperatures
- A discussion of any substantial differences between the actions provided in this Plan and the actions that KHL implemented, including explanations for any substantial differences.
- Results of any surveying that occurred during the previous calendar year, conclusions that KHL draws from the monitoring results, and any change to this Plan that KHL proposes based on the monitoring results.
- Stakeholder input with respect to any necessary modifications to the existing Plan.

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

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

5 REFERENCES

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KHL. 2014b. Grant Lake Hydroelectric Project (FERC No. 13212). Aquatic Resources Study – Grant Creek Aquatic Habitat Mapping and Instream Flow Study, Final Report. Prepared by McMillen LLC for Kenai Hydro, LLC. June 2014.

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