EXHIBIT B: PROJECT OPERATIONS AND RESOURCE UTILIZATION

1 Contents and Purpose of This Exhibit

Kenai Hydro, LLC (KHL), a wholly-owned subsidiary of Homer Electric Association, Inc. (HEA), is filing this Draft License Application (DLA) for an original license for the Grant Lake Hydroelectric Project (FERC No. 13212 [Project or Grant Lake Project]) under Part I of the Federal Power Act.

Exhibit B of this DLA describes the proposed operations of the Project, water availability and use, and production and use of Project generation under an original license.

2 Project Site Selection and Proposed Operations

2.1. Project Site Alternatives

2.1.1. Crescent Lake

On October 1, 2008, KHL received a preliminary permit from the FERC to study the potential development of a small hydroelectric projects at Crescent Lake (P-13209) on the Kenai Peninsula. Crescent Lake is located 4 miles south of the community of Moose Pass, Alaska and approximately 25 miles north of Seward, Alaska. KHL conducted a reconnaissance study to evaluate the feasibility of a hydroelectric project at this location. The reconnaissance study considered environmental conditions, recreation, subsistence use, cultural and historical resources, land ownership, mining claims and water rights, energy generation, anticipated development costs and an economic evaluation of the proposed project. Based upon the results of this evaluation, agency input and public comments the Grant Lake/Creek project was considered the more viable resource and selected for further evaluation.

2.1.2. Ptarmigan Lake/Creek

On October 1, 2008, KHL received a preliminary permit from the FERC to study the potential development of a small hydroelectric project at Ptarmigan Lake/Creek (P-13210) on the Kenai Peninsula. Ptarmigan Lake is located 6 miles south of the community of Moose Pass, Alaska and approximately 25 miles north of Seward, Alaska. KHL conducted a reconnaissance study to evaluate the feasibility of a hydroelectric project at this location. The reconnaissance study considered environmental conditions, recreation, subsistence use, cultural and historical resources, land ownership, mining claims and water rights, energy generation, anticipated development costs and an economic evaluation of the proposed project. Based upon the results of this evaluation, agency input and public comments the Grant Lake/Creek project was considered the more viable resource and selected for further evaluation.

2.1.3. Falls Creek

On October 1, 2008, KHL received a preliminary permit from the FERC to study the potential development of a small hydroelectric projects, Falls Creek (P-13211) on the Kenai Peninsula.

Falls Creek is located approximately 1.5 miles south of the community of Moose Pass, Alaska and approximately 25 miles north of Seward, Alaska. KHL conducted a reconnaissance study to evaluate the feasibility of a hydroelectric project at this location. Two alternatives were considered; a stand-alone project that would discharge water back into Falls Creek and a project that would divert water from Falls Creek north to Grant Lake, where water would be used to generate power from the Grant Lake Project. The reconnaissance study considered environmental conditions, recreation, subsistence use, cultural and historical resources, land ownership, mining claims, water rights, energy generation, anticipated development costs and an economic evaluation of the proposed project. Based upon the results of this evaluation, agency input and public comments the Grant Lake/Creek Project was considered the more viable resource and selected for further evaluation. Since the Grant Lake project was selected for further evaluation, the Falls Creek diversion into Grant Lake was carried forward for further evaluation. Additional investigation into the engineering feasibility and the economics associated with the Falls Creek diversion led Kenai Hydro to determine that the Falls Creek Diversion portion of the project was infeasible. On March 31, 2011 KHL petitioned FERC to surrender the Falls Creek project preliminary permit.

2.1.4. Grant Lake/Creek

Hydroelectric potential at Grant Lake has been evaluated several times as a potential power source for the Kenai Peninsula area. In 1954, R.W. Beck and Associates (cited by Ebasco 1984) prepared a preliminary investigation and concluded that a project at the site had significant potential. The U.S. Geological Survey (USGS) conducted geologic investigations of proposed power sites at Cooper, Grant, Ptarmigan, and Crescent Lakes in the 1950s (Plafker 1955). In 1980, CH2M Hill (CH2M Hill 1980) prepared a prefeasibility study for a Grant Lake project and concluded that a project developed at the site would be feasible. The Grant Lake Project was referenced in the 1981 U.S. Army Corps of Engineers (USACE) National Hydroelectric Power Resources Study (USACE 1981). The most extensive study was performed by Ebasco Services, Inc. in 1984 for the Alaska Power Authority (now Alaska Energy Authority; Ebasco 1984). The studies included a detailed examination of water use and quality; fish resources; botanical and wildlife resources; historical and archaeological resources; socioeconomic impacts; geological and soil resources; recreational resources; aesthetic resources; and land use (Ebasco 1984). Two of the alternatives evaluated by Ebasco included the diversion of adjacent Falls Creek into Grant Lake to provide additional water for power generation.

During the 1986-87 periods a preliminary application document was filed by Kenai Hydro, Inc. (no relation to the current KHL) for a project at Grant Lake. Support for the application included an instream flow study. Because of competing projects, political considerations, and inexpensive natural gas the project was never pursued beyond the preliminary application phase.

On October 1, 2008, KHL received a preliminary permit from the FERC to study the potential development of a small hydroelectric project at Grant Lake/Creek (P-13212) on the Kenai Peninsula. KHL conducted a reconnaissance study to evaluate the feasibility of a hydroelectric project at this location. The reconnaissance study considered environmental conditions, recreation, subsistence use, cultural and historical resources, land ownership, mining claims and water rights, energy generation, anticipated development costs and an economic evaluation of the proposed project. Based upon the results of this evaluation, agency input and public comments the Grant Lake/Creek project was considered the more viable resource and selected for further evaluation.

On August 6, 2009, KHL filed a Pre-Application Document (PAD), along with a Notice of Intent (NOI) to file an application for an original license for the Grant Lake/Falls Creek project (P-13211/13212) under Part I of the Federal Power Act (FPA). On September 15, 2009, FERC approved the use of the Traditional Licensing Process (TLP) for development of the license application and supporting materials.

2.2. Project Facility Designs, Processes, and Operations Alternatives

2.2.1. Configuration Alternatives

Grant Lake has been studied on multiple occasions since the 1950s as a potential hydropower site. The previous study efforts included:

- 1954 – R.W. Beck and Associates preliminary investigation (as cited in Ebasco 1984)
- 1955 – USGS geological investigations of proposed power sites at Cooper, Grant, Ptarmigan, and Crescent Lake (Plafker 1955)
- 1980 – CH2M Hill prefeasibility study (CH2M Hill 1980)
- 1984 – Ebasco Services Project Feasibility Analysis (Ebasco 1984)

Within these previous studies, development of the hydroelectric potential was considered under a range of alternative configurations. The alternatives analysis cumulated with a more robust evaluation by Ebasco in their 1984 engineering evaluation (Ebasco 1984). The Ebasco analysis included size alternatives. Alternatives A, B, and C (below) focused on building a dam on the Grant Lake outlet as well as a saddle dam on the north of the natural outlet. These alternatives were designed to provide storage for power generation as well as increase the operating head on the powerhouse. Alternative D consisted of a lake tap near the existing Grant Lake outlet with no dams proposed. The final two alternatives, E and F, re-routed the adjacent Fall Creek flow into grant Lake with a dam (Alternative A) and no dam (Alternative D) configuration. Alternatives A, B, C, and D would use only the natural inflow from Grant Lake. Alternatives E and F would use the Grant Lake inflow plus Fall Creek for power generation.

KHL utilized these same alternatives as the starting point in the current licensing process. The previous work efforts were reviewed and updated, where required, to provide a basis for the alternatives development and analysis. A seventh alternative, Alternative G, was developed to reflect the additional environmental baseline data and the operational criteria required to address specific identified issues. A brief description of each alternative is presented in the following subsections.

Further details regarding the configuration alternatives are provided in the Supporting Design Report in Exhibit F (Attachment F-1) of this DLA.

2.2.1.1. Alternative A – Intake Upstream of Saddle Dam

Alternative A consists of raising Grant Lake from its existing natural outlet at approximately elevation 703 feet NAVD 88 to a normal maximum lake elevation of 745 feet NAVD 88. The lake raise would be accomplished by constructing a main dam at the natural outlet of Grant Lake. A second dam would be constructed across a low saddle area located north of the main dam. Water would be conveyed from Grant Lake to a power house located on the east shore of Upper Trail Lake via a power conduit approximately 3,840 feet long with an intake structure located upstream from the saddle dam. The intake to the power conduit would be a submerged circular vertical concrete structure with vertical trashracks would be located approximately 1,300 feet upstream from the toe of the saddle dam. A steel pipeline would extend from the intake to a surge tank. A steel penstock would continue from the surge tank to the powerhouse. The discharge from the powerhouse would be through a tailrace channel to Upper Trail Lake. The powerhouse would house a single vertical Francis turbine operating with a maximum hydraulic capacity of 385 cubic feet per second (cfs) at a net head of 247 feet. The powerhouse would have an installed capacity of 6 megawatts (MW).

The substation would be located adjacent to the powerhouse. The transmission line would extend from the powerhouse south to Grant Creek, then cross the Trail Lake Narrows to the existing 115 kilovolt (kV) transmission line located adjacent to the Seward highway. A total of 5.1 miles of access road would connect the Project features to the Seward Highway.

2.2.1.2. Alternative B – Intake at Main Dam with Tunnel and Surface Conduit

Similar to Alternative A, the Grant Lake elevation would be raised from 703 feet NAVD 88 to a normal maximum operating elevation of 745 feet NAVD 88 by constructing the main dam and saddle dam as described with Alternative A. With this alternative, the intake would be located at the main dam location. Water would be conveyed from the Grant Lake intake to a power tunnel using a 7-foot-diameter low pressure penstock. The first 300 feet of penstock under the dam would be placed in a rock trench and encased in concrete. The remaining 400 feet to the power tunnel would be installed on the surface supported by concrete saddles. The power tunnel would be horse shoe shaped and 9-foot-diameter fitted with an underground surge chamber. At the downstream end of the tunnel, a 5-foot-penstock would extend to a powerhouse with an installed capacity of 6 MW. The powerhouse would have essentially the same mechanical and electrical configuration as described for Alternative A. A short tailrace channel would carry the water from the powerhouse to the east bank of Upper Trail Lake. Approximately 2.0 miles of access roads would be required for the Project. The transmission line would follow the same approximate route across Trail Lakes Narrows.

2.2.1.3. Alternative C – Intake at Main Dam with Surface Conduit

Similar to Alternatives A and B, Alternative C utilized the same two dams to raise Grant Lake from approximately 703 feet NAVD 88 to 745 feet NAVD 88. The intake would be located at the main dam using a similar intake configuration as Alternative B. A 6.75-foot-diameter steel power conduit would extend from the intake beneath the dam to a surge tank located at the downstream toe of the main dam. A 5.35-foot diameter, 2,000-foot-long steel penstock would extend from the surge tank to the powerhouse. The powerhouse would be located approximately 80 feet from the east bank of Upper Trail Lake. The powerhouse would consist of a concrete foundation and a steel superstructure. The mechanical and electrical equipment would be similar to Alternatives A and B as well as the 6 MW rated capacity.

2.2.1.4. Alternative D – Lake Tap with Powerhouse at Upper Trail Lake

With this alternative, the main dam and saddle dam as proposed with the Alternatives A, B, and C would be eliminated. Alternative D does not involve the water elevation at Grant Lake. A lake tap would supply water from a low level power tunnel and a short length of penstock to a powerhouse located on Upper Trail Lake. The lake tap would have an intake invert at approximately elevation of 643 feet NAVD 88. The lake tap would consist of an inclined 10-foot-diameter circular tunnel which would incorporate a rock trap located just downstream of the intake portal. A trashrack would be placed on the intake portal to exclude debris from entering the power conduit. A 9-foot-diameter horseshoe shaped power tunnel would extend approximately 3,300 feet from the lake tap to the powerhouse. A 5-foot-diameter, 500-foot-long steel penstock would then extend from the downstream tunnel portal to the powerhouse located on the east bank of Upper Trail Lake. A gate shaft would be located approximately 200 feet downstream from the lake tap. An isolation gate would be located in the gate shaft. A conventional powerhouse with a concrete foundation and steel superstructure would be located approximately 180 feet from the east bank of Upper Trail Lake. The powerhouse would have a single vertical Francis turbine operating under a net head of 198 feet with an installed capacity of 5 MW.

2.2.1.5. Alternatives E and F – Diversion of Falls Creek

These alternatives would divert runoff from the Falls Creek drainage, located directly south of the Grant Lake drainage, into Grant Lake for additional power production. For both of these alternatives, the diversion of Falls Creek would be accomplished using a diversion dam and conduit to convey water from Falls Creek into Grant Lake. For Alternative E, the diversion of Falls Creek is used in combination with raising Grant Lake from its existing elevation of 703 feet NAVD 88 to a maximum normal operating elevation of 745 feet NAVD 88. This is accomplished with the same two dam configuration as presented for Alternative A. The power conduits, powerhouse, transmission, and access would be similar to the configuration proposed for Alternative A. The powerhouse would have a rated capacity of 7 MW.

Alternative F consisted of the Falls Creek diversion coupled with the no dam Alternative D configuration. The power tunnel, powerhouse, transmission, and access would be similar to the configuration proposed for Alternative A. The powerhouse would have a rated capacity of approximately 6 MW.

2.2.1.6. Alternative G – Lake Intake with a Powerhouse on Grant Creek

Alternative G was developed essentially as an outgrowth of Alternative D with the basic features modified to address considerations raised as part of the environmental baseline studies completed in 2009 through 2014. These studies identified aquatic habitat and resources within Grant Creek from the confluence with Upper Trail Lake up to the outlet of the canyon area of Grant Creek (Reaches 1 through 4). The area within the canyon area (Reach 5), though not identified as productive habitat as the lower area of Grant Creek, provided limited habitat for specific species. Measures to protect and enhance these areas were then identified and incorporated into Alternative G. This alternative consists of a conventional intake tower located in Grant Lake fitted with a selective withdrawal intake gate and an isolation bulkhead gate. Water is conveyed via a 10-foot-diameter, 3,300-foot-long horseshoed shaped tunnel. The upper reach of the tunnel would be unlined and constructed on a 1 percent slope. The lower reach of the tunnel would be lined and constructed at 15 percent slope. A surge chamber is located at the junction between the two tunnel sections. A rock trap is located at the downstream end of the unlined tunnel directly under the surge chamber. Steel liners will be installed at both the upstream and downstream portals to provide structural strength of the tunnel through the transition areas. A 72-inch diameter steel penstock extends from the downstream tunnel portal to the powerhouse. The powerhouse would be a conventional concrete foundation with a steel superstructure. Two Francis turbines with a combined rated capacity of 5 MW at a maximum hydraulic capacity of 385 cfs and a net operating head of 171 feet. Water is conveyed from the powerhouse back to Grant Creek in an excavated tailrace channel with a fish barrier located at the outfall back into Grant Creek. The tailrace channel discharges into Grant Creek near the outlet of the canyon section of Grant Creek. A detention pond is located on the south side of the powerhouse providing the additional benefit of spinning reserve operation. The transmission line will extend approximately 1 mile from the substation located adjacent to the powerhouse west to the existing 115 kV transmission line. The transmission line will follow the powerhouse access road which extends from the Seward Highway across the Trail Lakes Narrows. An access road will also be provided to the intake structure.

2.2.1.7. Proposed Configuration

In the previous alternatives analysis (Ebasco 1984), Alternative D was the recommended alternative with a consideration for diverting Fall Creek as presented within Alternative F. With this alternative, the powerhouse was located approximately 180 feet from the east bank of Upper Trail Lake. Under most operating conditions, Grant Creek would have been dewatered.

As outlined in the alternatives description, development of Alternative G incorporated a number of design modifications which provided a net benefit in environmental conditions. These design modifications included:

1) Relocate the powerhouse for the bank of Upper Trail Lake on the north side of Grant Creek to the south side of Grant Creek to the outlet of the canyon reach (Reach 5).

2) Relocate the intake from the north side of the natural outlet of Grant Lake to the south side and replace the lake tap with a conventional intake structure with the capabilities of selective water withdrawal for downstream temperature control.

3) Re-align the access road to eliminate parallel alignment of the Iditarod National Historic Trail (INHT).

4) Eliminate the 2-foot-tall diversion structure at the top of the Grant Creek natural outlet.

5) Provide a bypass pipe from the lake intake to the base of the existing falls at the Grant Lake outlet to provide a minimum flow of 5 cfs to 10 cfs in Reach 5.

6) Reroute the transmission line to follow the powerhouse access road directly west to the existing 115-kV transmission line.

7) Modify the proposed single Francis unit 5-MW powerhouse to a two unit configuration to provide more flexibility to release flows to meet downstream flow considerations for aquatic habitat in the winter months.

Alternative G has been selected as the preferred alternative for the Project. This site configuration was selected because it represented the optimum environmental configuration by eliminating the dams, placing the powerhouse tailrace upstream of the prime aquatic habitat, and eliminated the Falls Creek water diversion.

2.2.2. Proposed Design

The proposed Project would divert water from Grant Lake and deliver the flow to a powerhouse located near the outlet of the existing Grant Creek natural, incised rock canyon. The proposed Project consists of the following primary components:

- An intake structure in Grant Lake.
- A tunnel extending from the lake intake to a steel penstock.
- A powerhouse with two Francis turbines providing an anticipated combined 5-MW output with a maximum design flow of approximately 385 cubic feet per second (cfs).
- A tailrace detention pond.
- Switchyard with disconnect switch and step-up transformer.
- An overhead 115 kilovolt (kV) transmission line.
- A pole mounted disconnect switch where the transmission line intersects the main power distribution line.

Detailed descriptions of the proposed Project facilities are provided in Exhibit A and the preliminary design drawings of the proposed Project are provided in Exhibit F of this DLA.

2.2.3. Grant Lake Operational Model

An operations model was developed for the Project. The model takes into account the natural inflows, habitat constraints, the Project engineering details, and operational desires to simulate Project operations. The model outputs include discharge, reservoir elevations, and energy production on a daily time step. The gross annual energy production is adjusted to account for transmission losses, unplanned outages, and station service.

The operations model was used to simulate operations of the proposed Project using historic hydrologic data. The hydrologic data is a composite record consisting of gaged and extended streamflow records for Grant Creek that was collaboratively developed with the Grant Lake Instream Flow Subgroup. The hydrologic data represents 66 years of streamflow from January 1948 through December 2013.

2.3. Project Operations During Adverse, Average, and High Water Years

The Project will operate to generator 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 Reach 5 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.

2.3.1. Adverse Water Years

During adverse flow years the lake elevation will be monitored closely in relation to anticipated inflow and predicted lake fill rates. The powerhouse production could be reduced in adverse flow years to maintain the instream flow requirements and hit target lake levels during the spring runoff period. The estimated annual generation analysis reflected this operation scenario using a dry period year to determine the estimated powerhouse production and required lake refill sequence.

2.3.2. Average Water Years

During average water years, the Project will be operated to maximize power production and minimize spill conditions. The lake will be operated within the maximum lake elevation of 703 feet NAVD 88 and minimum of 690 feet NAVD 88. The lake will be drawn down in the winter to the minimum elevation 690 feet NAVD 88 to provide the maximum storage volume to capture the spring runoff. Flow predictions will be utilized based on snow pack and environmental conditions to optimize the rule curve for filling the lake. The lake will refill reaching the maximum operating elevation of 703 feet NAVD 88 while maximizing the powerhouse production as close to the 385 cfs maximum powerhouse flow for as long of a duration as possible. The average water year was reflected in the estimated power production forecasts by selecting an average flow year as part of the generation analysis.

2.3.3. High Water Years

During high water years, the Project will likely spill at a large quantity for a longer duration than average flow years. As indicated previously, flow prediction methods will be utilized to estimate the total volume of runoff as well as the rate of inflow. The powerhouse will then be operated to create adequate storage volume in the lake to capture the predicted volume. When the lake reaches elevation 703 feet NAVD 88, the excess flow will spill over the natural outlet. During spill conditions, the powerhouse will be operated at the maximum hydraulic capacity of 385 cfs.

3 Existing Resource Utilization

3.1. Plant Control

The Project will operate in a fully automated manner with no onsite personnel. The system can be monitored remotely using a fiber optics tie to the KHL system. The powerhouse control room will include a computerized system which will monitor the lake elevation, water temperature, system pressures, wicket gate settings, and plant output. These parameters along with the system alarms will be monitored remotely. Adjustments to the system operating parameters will be made remotely based on the Project operations rule curves and system integration. The facility will be visited monthly by HEA staff to inspect and maintain the facilities.

3.2. Annual Plant Factor

The annual plant factor is computed using the following equation:

Annual Plant Factor = Annual Energy Production (MW-hours) / [Rated Capacity (MW) x 8760 (hours/year)]

Based on the average annual energy production, simulated for 1948 through 2013, and the rated generation capacity, the annual plant factor is 0.43.

3.3. Dependable Capacity and Average Annual Energy Production

The dependable capacity is based on the discharge that can be maintained more than 95 percent of the time, the minimum available head, conduit head loss, machine efficiency, and station service load. Based on these constraints, the Project has a dependable capacity of 0.15 MW.

Based on 66 years of streamflow data run through the Project operations model, the average annual energy production is anticipated to be 18,600 megawatt hours (MWh).

3.3.1. Project Flow Data

The streamflow record utilized for the generation analysis was a composite of recorded streamflow and record extension. Grant Creek has an 11-year USGS streamflow gage record for water years 1948-1958 at USGS gage 15246000. Intermittent streamflow monitoring was conducted in 1981-1983, 2009, and from 2013 to present. A record extension was performed based on the USGS gage 15258000, Kenai River at Cooper Landing, record. A composite streamflow record was created for Grant Creek that represents 66 years of daily streamflow data for calendar years 1948 through 2013. The monthly and annual flow statistics for the 66 year composite record are provided in Table B.3-1. The composite stream flow record was also used to generate an average annual hydrograph based on the average of the daily flow values (Figure B.3-1). The average hydrograph was utilized in the generation analysis, in addition to the individual years of streamflow data.

Table B.3-1. Grant Creek monthly flow statistics, in cfs (calendar years 1948-2013).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Maximum	326	227	116	160	566	2,140	1,210	1,383	1,731	1,295	851	570	2,140
Mean	52	43	33	36	146	409	503	444	367	233	123	73	206
Minimum	12	11	6	13	17	102	210	173	65	45	28	18	6

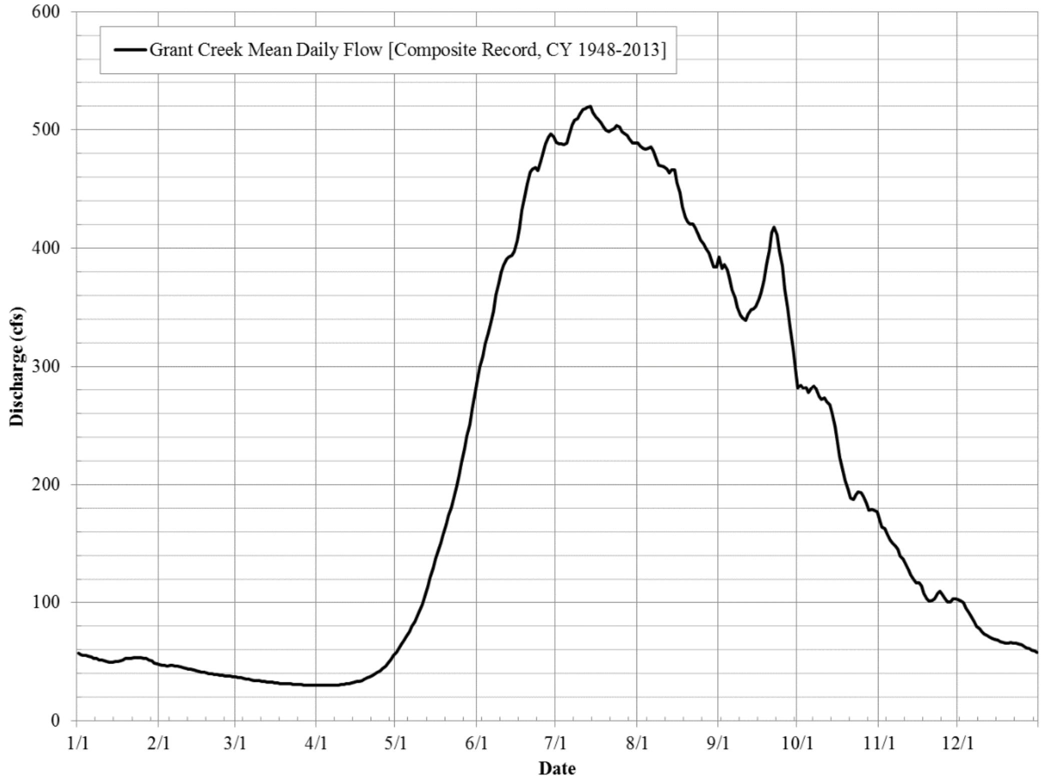

Figure B.3-1. Grant Lake average annual hydrograph.

3.3.2. Flow Duration Curves

A flow duration analysis was conducted for Grant Creek based on the 66-year composite record, calendar years 1948 through 2013. Exceedance percentiles were computed for annual and monthly daily average flows and are provided in Table B.3-2. The monthly flow duration curves are plotted in Figure B.3-2. Annual flow duration curves for with Project and without Project conditions are provided in Figure B.3-3.

Table B.3-2. Grant Creek annual and monthly daily average flow exceedance percentile, in cfs (calendar years 1948-2013).

Exceedance Percentile	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0%	326	227	116	160	566	2,140	1,210	1,383	1,731	1,295	851	570	2,140
5%	110	108	65	71	340	649	718	685	804	579	294	162	575
10%	87	70	51	61	286	582	644	595	612	427	234	119	499
15%	74	57	45	53	242	546	597	552	525	359	181	99	448
20%	64	51	41	47	215	512	573	524	480	317	151	87	402
25%	57	48	39	43	193	487	551	498	440	281	134	78	353
30%	54	45	37	40	176	463	533	480	405	255	123	73	303
35%	50	42	35	36	162	439	520	464	370	233	114	70	243
40%	48	39	33	34	149	425	509	447	346	212	105	65	186
45%	47	38	32	33	139	412	499	433	329	196	99	63	142
50%	45	36	30	31	127	398	488	422	313	182	94	59	110
55%	43	34	29	29	114	382	479	411	298	170	89	57	87
60%	41	32	27	28	103	363	467	398	282	158	85	54	71
65%	38	31	25	26	93	342	458	387	266	148	80	51	59
70%	36	29	23	25	83	323	447	372	250	137	76	49	49
75%	34	27	22	24	72	308	433	360	231	125	72	45	43
80%	32	25	21	22	62	290	419	346	215	115	67	42	37
85%	29	23	19	21	53	270	400	330	193	102	60	39	32
90%	25	20	18	19	45	238	382	316	166	90	55	36	27
95%	20	17	15	18	36	204	361	289	139	76	44	28	21
100%	12	11	6	13	17	102	210	173	65	45	28	18	6

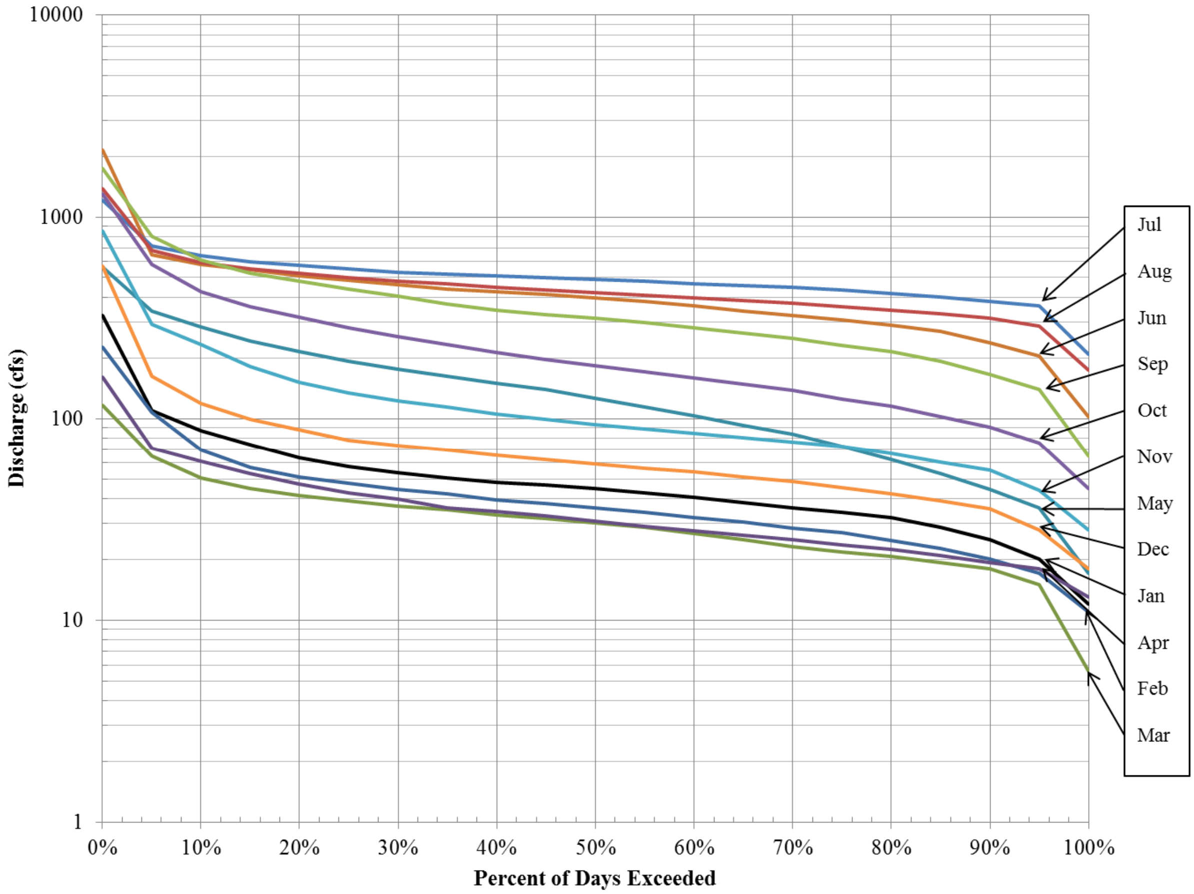

Figure B.3-2. Grant Lake monthly flow duration curves (calendar years 1948-2013).

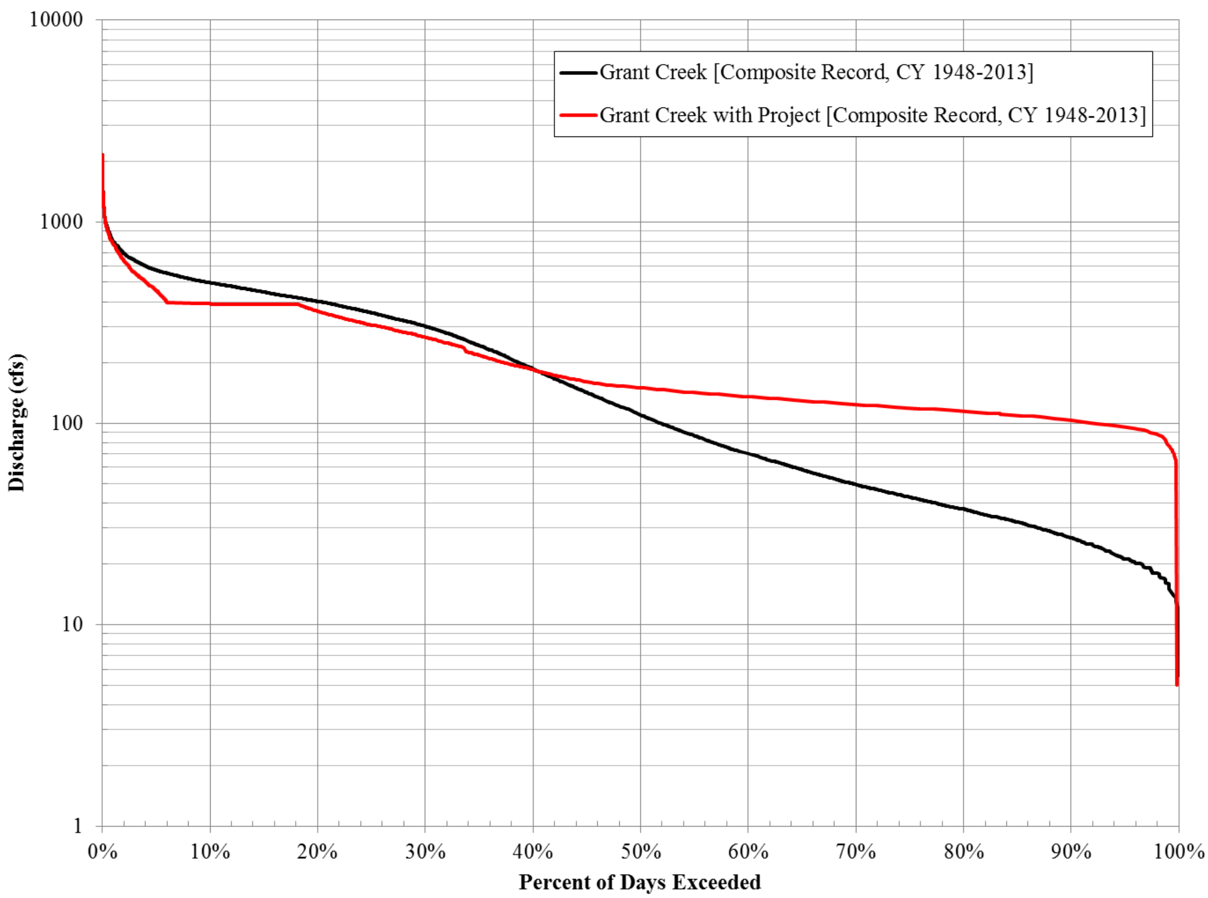

Figure B.3-3. Grant Lake annual flow duration curves with Project and without Project conditions (calendar years 1948-2013).

3.3.3. Critical Streamflow

The critical streamflow value used to compute the dependable capacity was 96 cfs. This flow corresponds to the 95 percent exceedance probability for Grant Creek under proposed operating conditions with the Project in place (see Figure B.3-3).

3.3.4. Storage Capacity

The Project will utilize the natural storage capacity of Grant Lake and will not include any additional impoundment. The gross storage volume of Grant Lake at the normal maximum lake elevation (703 feet NAVD 88) is 251,920 acre-feet. The Project will draw Grant Lake down to a maximum depth of 13 feet. The net storage volume between normal maximum lake elevation, 703 feet NAVD 88, and the minimum lake elevation, 690 feet NAVD 88, is 18,791 acre-feet. Figure B.3-4 illustrates the storage capacity for Grant Lake. When Grant Lake is full, elevation 703 feet NAVD 88, the surface area is 1,703 acres. Figure B.3-5 illustrates the storage area curve for Grant Lake. The storage and surface area curve information for Grant Lake is also tabulated in Table B.3-3.

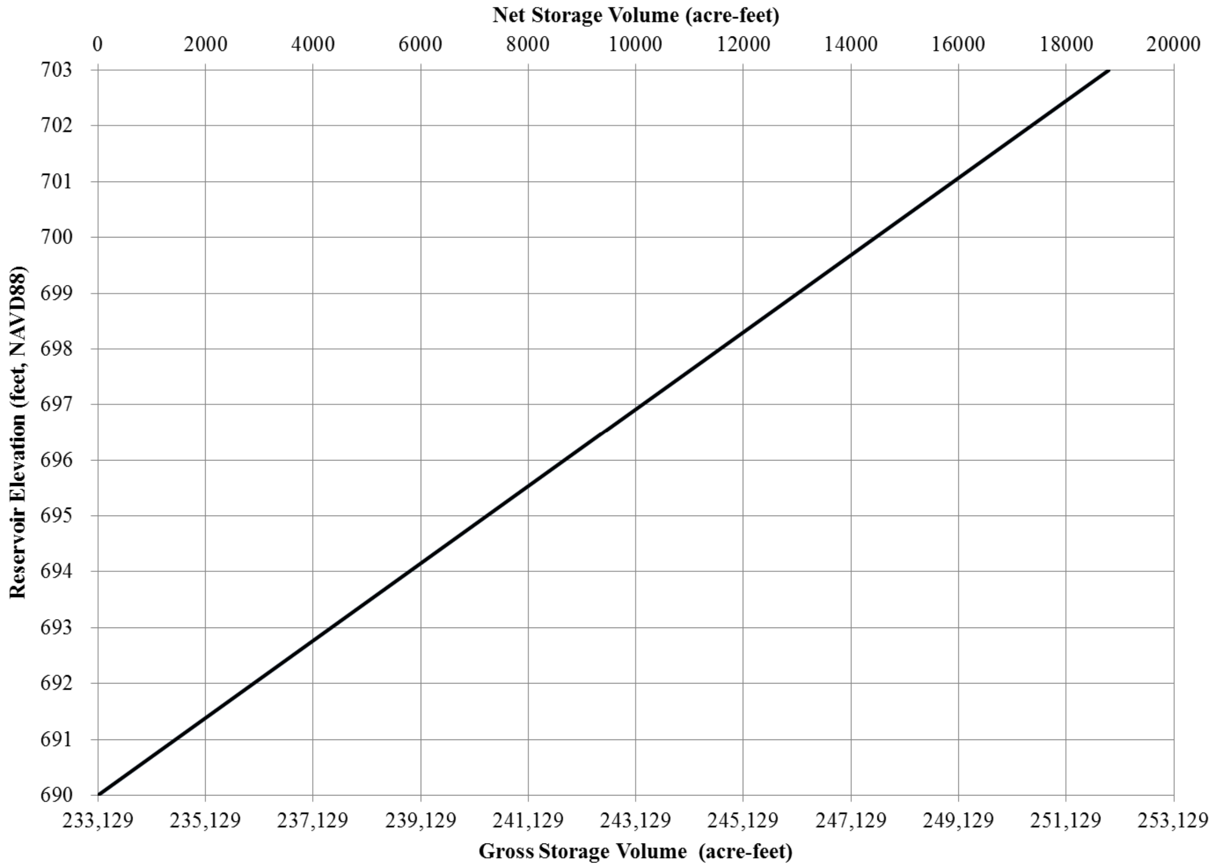

Figure B.3-4. Grant Lake storage capacity curve.

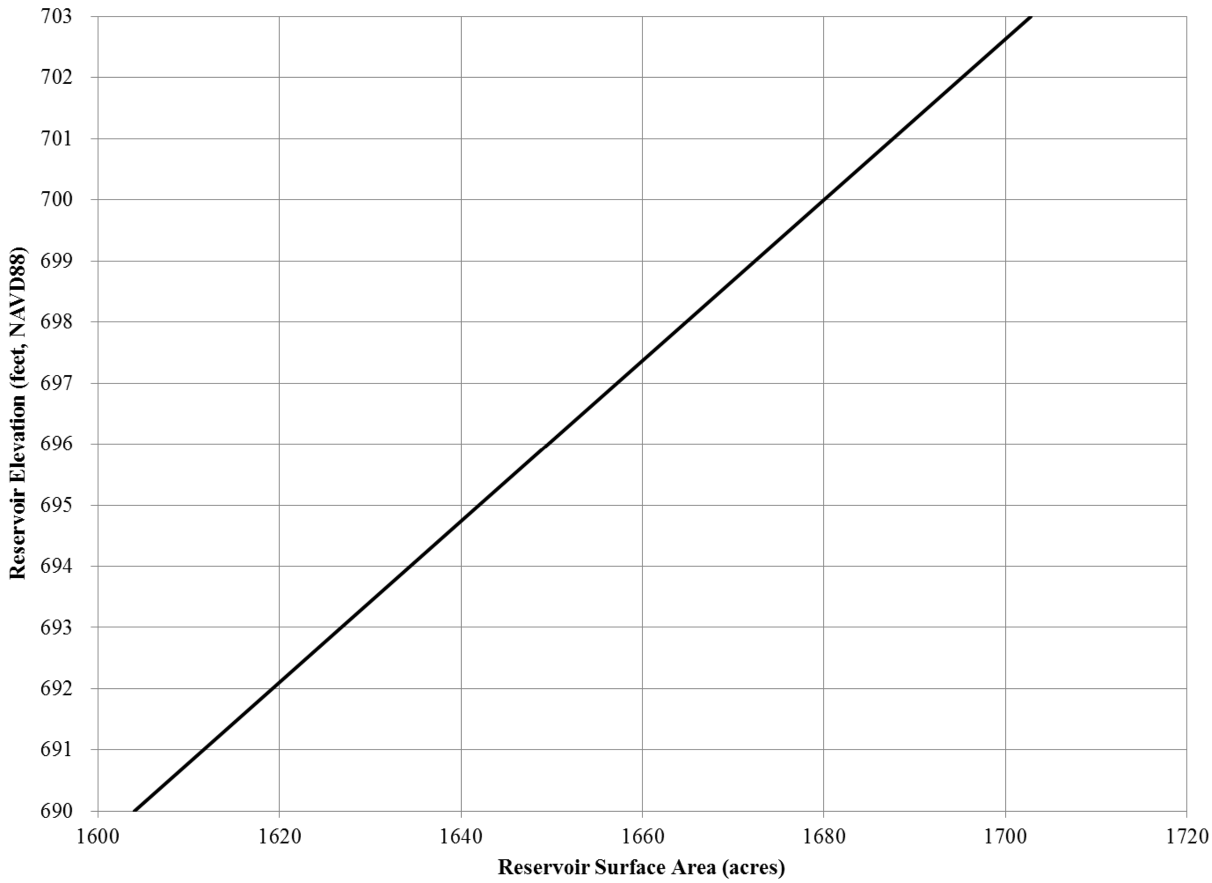

Figure B.3-5. Grant Lake surface area curve.

Table B.3-3. Grant Lake storage and surface area relative to lake elevation.

Lake Elevation feet, NAVD 88	Gross Storage acre-feet	Net Storage acre-feet	Surface Area acres
703	251,920	18,791	1,703
702	250,475	17,345	1,695
701	249,029	15,900	1,688
700	247,584	14,455	1,680
699	246,138	13,009	1,672
698	244,693	11,564	1,665
697	243,247	10,118	1,657
696	241,802	8,673	1,650
695	240,356	7,227	1,642
694	238,911	5,782	1,634
693	237,465	4,336	1,627
692	236,020	2,891	1,619
691	234,575	1,445	1,612
690	233,179	--	1,604

3.3.5. Rule Curve

The rule curve for the Project is intended primarily to provide for instream flows and power generation. Grant Lake will be drafted in fall and winter and refilled in spring and summer. The normal maximum lake elevation will be 703 feet NAVD 88 and the minimum lake elevation will be 690 feet NAVD 88. Figure B.3-6 illustrates the anticipated rule curve on an annual basis.

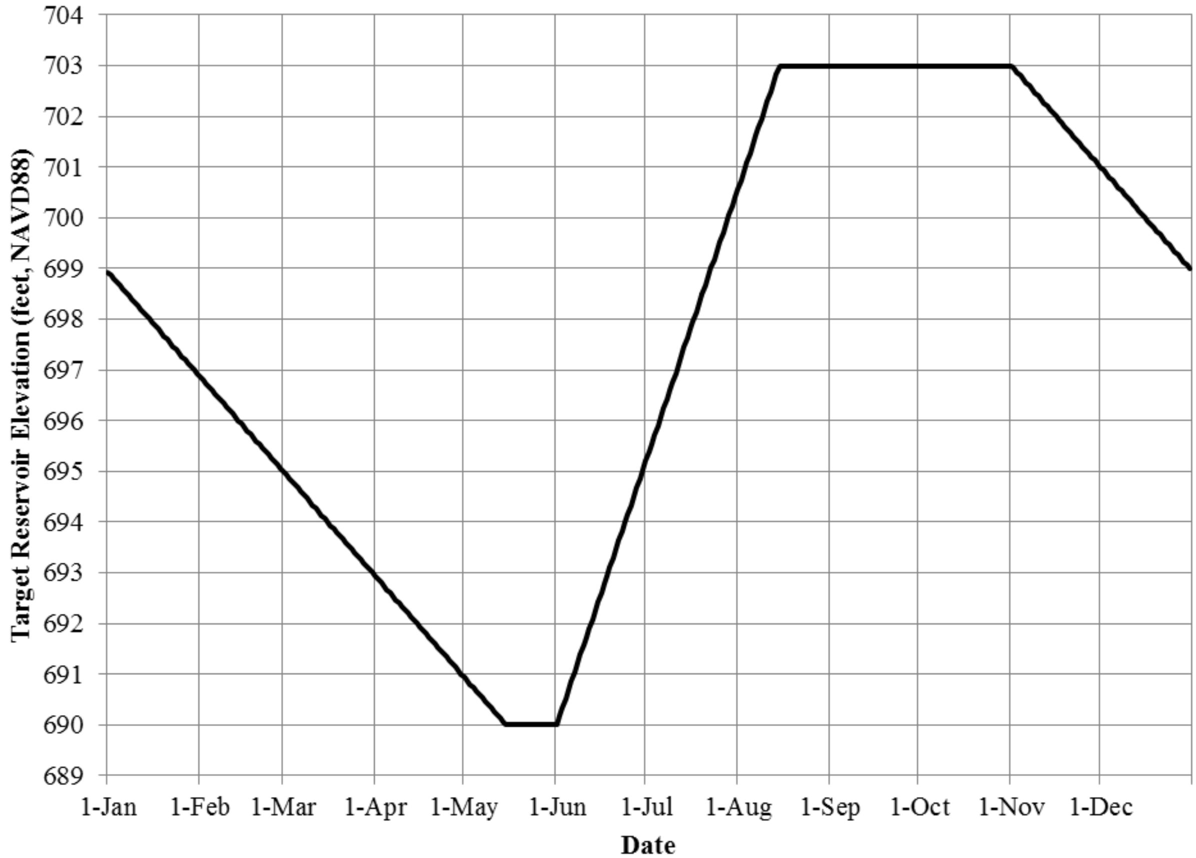

Figure B.3-6. Grant Lake rule curve.

3.3.6. Tailwater Rating Curve

The tailwater elevations for the Project were developed using a hydraulic model of Grant Creek. The tailwater location is located where the tailrace channel will return powerhouse flow to Grant Creek at the downstream on the incised canyon (Reaches 4 and 5 transitions). Figure B.3-7 provides the tailwater rating curve for Grant Creek.

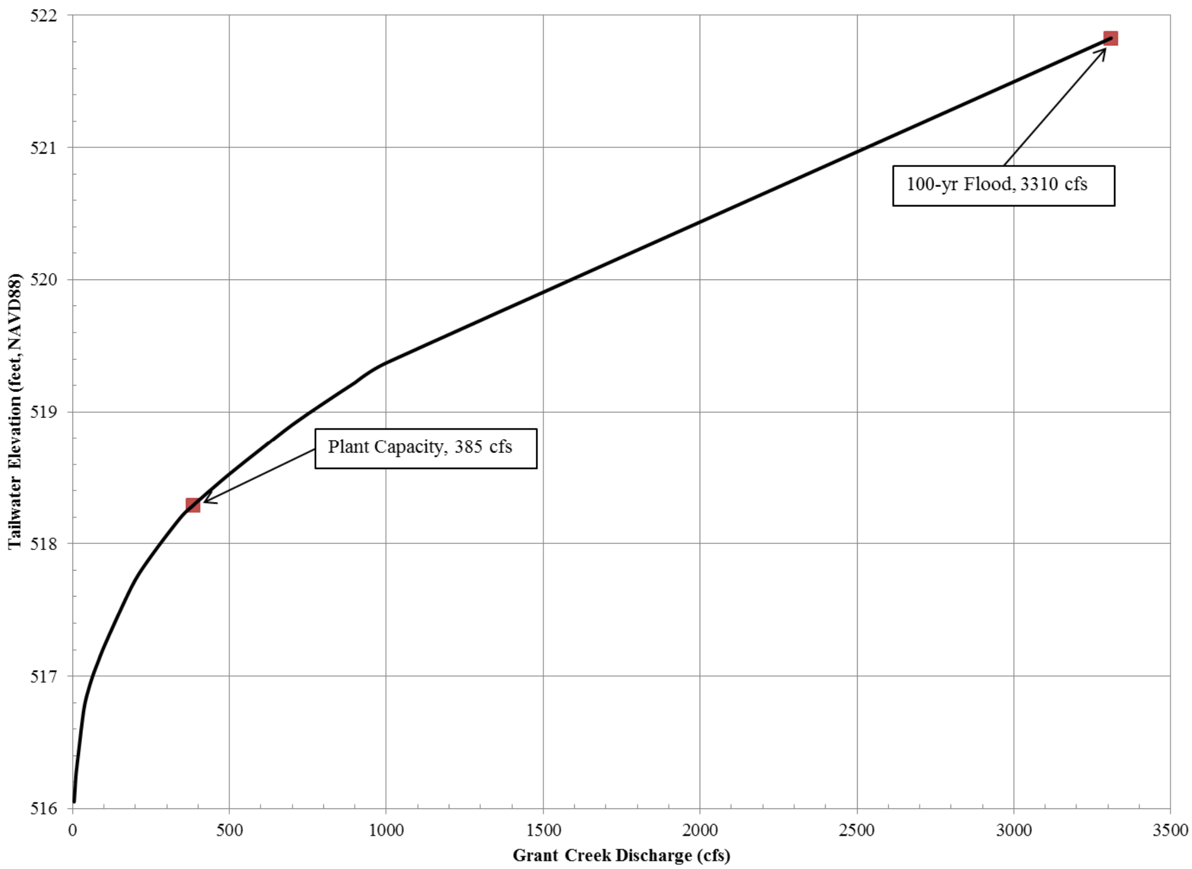

Figure B.3-7. Grant Lake tailwater rating curve.

3.3.7. Power Plant Hydraulic Capacities and Capabilities

The Project powerplant will consist of twin horizontal Frances turbines each paired with an electric generator. Each of the two units will have a rated generation capacity of 2.5 MW and a hydraulic capacity of 192.5 cfs. The minimum operating flow for the plant is estimated at 30 percent of the hydraulic capacity of a single unit, 58 cfs. Table B.3-4 provides the flow, efficiency, and generator output under maximum and minimum operating conditions. Figure B.3-8 provides the powerplant capacity curve which plots power generation versus net head.

Table B.3-4. Grant Lake Project Maximum and Minimum Operating Conditions.

Hydraulic capacity	Flow (cfs)	Efficiency (%)	Generator output (kW)
Maximum	385	89%	4,986
Minimum	58	33%	42

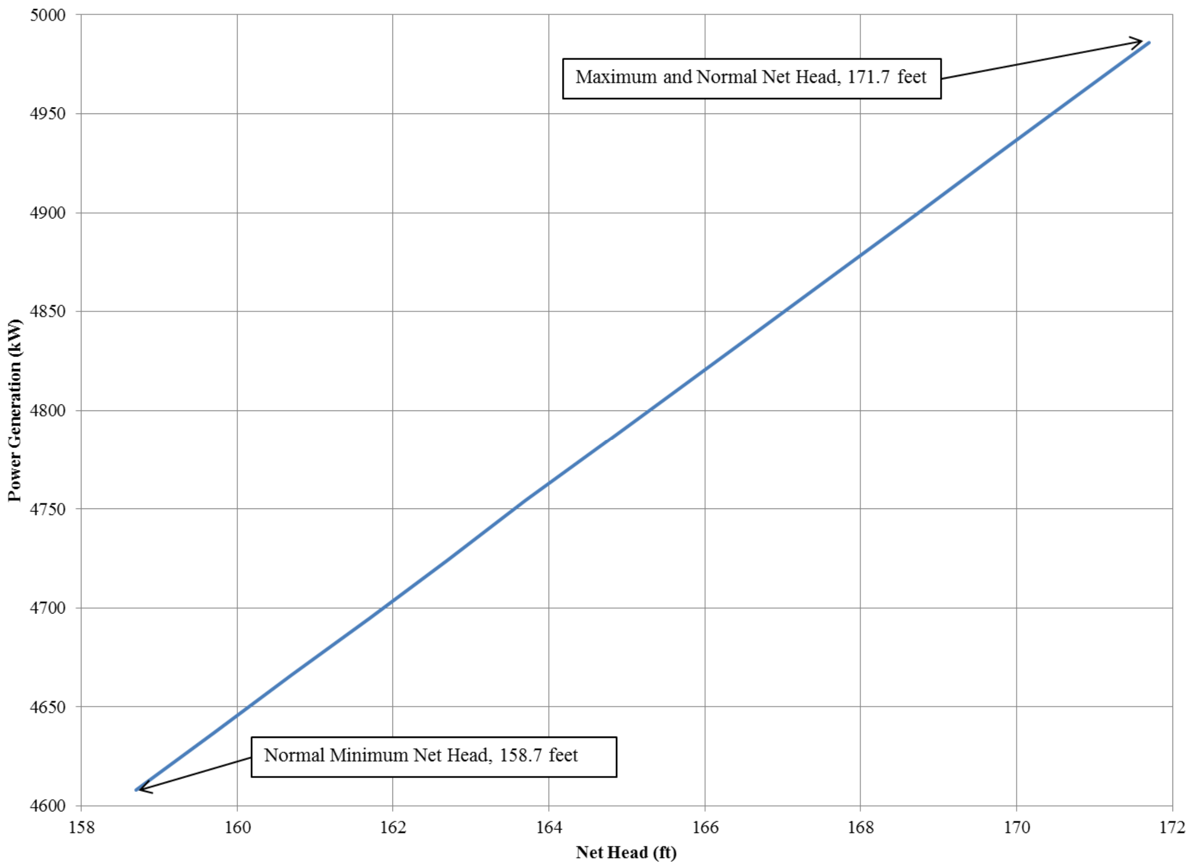

Figure B.3-8. Project power generation vs. net head.

4 System and Regional Power Needs

HEA has over 22,400 member-owners and provides power to over 33,300 meters located throughout the Kenai Peninsula. HEA generates the power needed to serve members from its 12 percent share of the Bradley Lake hydroelectric facility, the Nikiski Combine Cycle Plant, the Soldotna Combustion Turbine Plant and the Bernice Lake Power Plant. With the exception of HEA's 12 percent share of Bradley Lake, power which accounts for 9 percent HEA's generation needs, HEA is highly dependent on natural gas. The Cook Inlet of Alaska faces declining natural gas production and directly associated increasing natural gas prices. HEA is seeking to diversify its generation portfolio, add additional sources of renewable energy and reduce its exposure to increasing natural gas prices.

For reasons of environmental stewardship and sustainable long term generation, HEA's Board of Directors has set a renewable energy goal of 22 percent of HEA's power will be provided from renewable resources by 2018.

HEA's load forecast is depicted in Figure B.4-1. The projections are taken from HEA's Equity Management Plan.

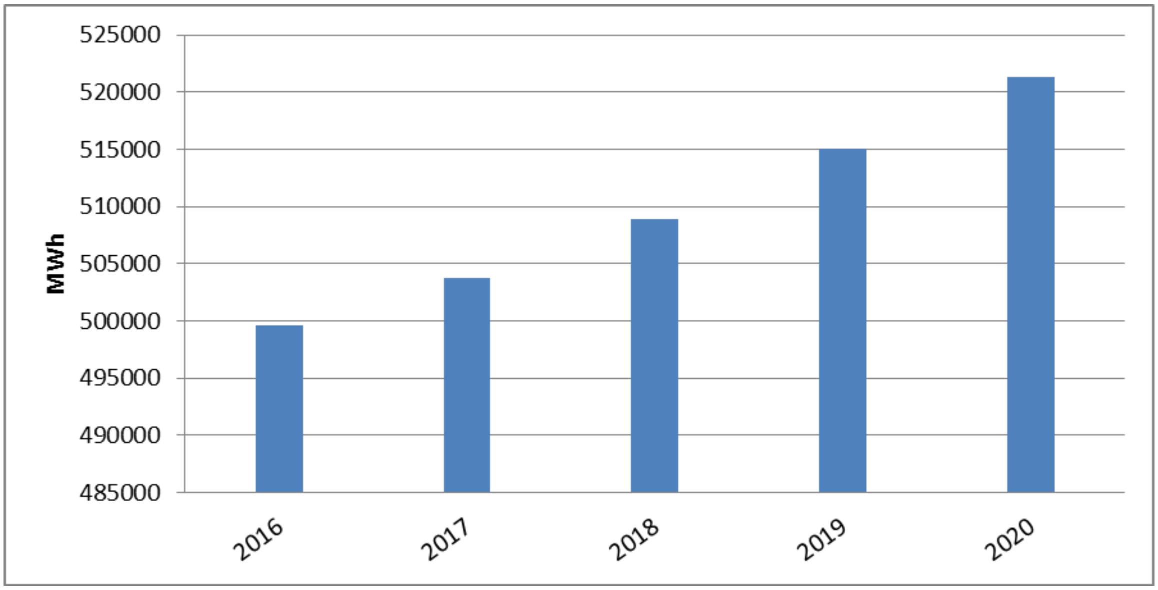

Figure B.4-1. HEA's load forecast.

HEA's load duration curve is depicted in Figure B.4-2.

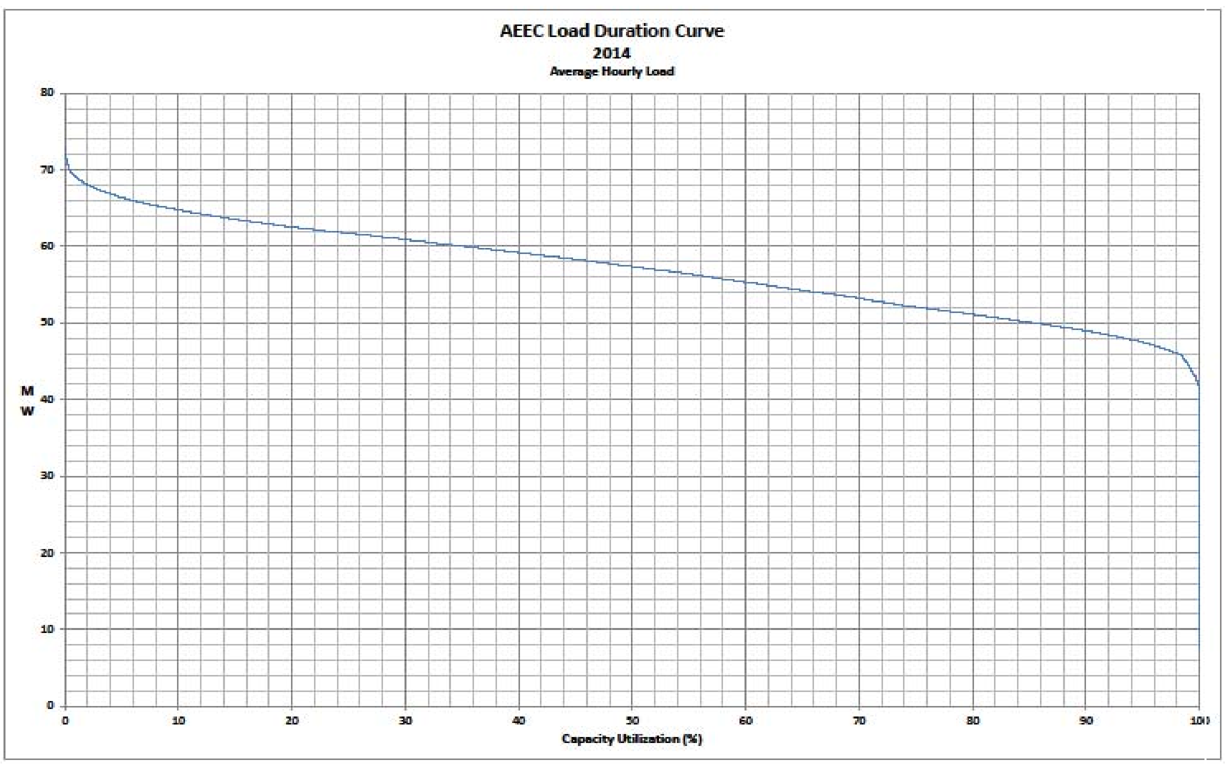

Figure B.4-2. HEA's load duration curve.

HEA is interconnected to a regional Alaskan grid known as the "Railbelt" via a three phase, 115-kV transmission line. The Railbelt is generally defined as the service areas of six regulated public utilities: Anchorage Municipal Light & Power (ML&P), Chugach Electric Association (Chugach), Golden Valley Electric Association (GVEA), HEA, Matanuska Electric Association (MEA), and the City of Seward Electric System (SES). This region covers a significant area of the state and contains the majority of the state's population and economic activity; it extends from Homer to Fairbanks and includes areas such as Anchorage, Fairbanks, and the Matanuska-Susitna Valley. HEA can provide power to Alaskan residents from Anchorage to Fairbanks via wholesale and economy energy sales to the other five interconnected electric utilities.

Electricity generated at the Project would be transmitted via Chugach Electric's 115-kV transmission line that extends from the Lawing Substation near the Project to the Quartz Creek Substation where it enters HEA's transmission and distribution system.

The Project would become an integral component of HEA's overall generation portfolio. Except for the small amount of electricity used to power the auxiliary Project equipment and facilities, the power generated by the Project would be dispatched as a part of the entire HEA generation system. The Project generation would be pooled with other HEA generation resources and shared among retail and wholesale purchasers. As with all generation resources available to HEA, the Project would be dispatched economically to minimize total generation costs while meeting, licensing requirements, reliability requirements and contractual service obligations. KHL's objective in operating the Project is to optimize HEA's ability to meet load throughout the integrated system, balancing its hydro and thermal energy sources. Within the constraints of the licensed operating levels, KHL would operate the Project in the temporal mode most advantageous to the system.

The energy from the Project would primarily be used for base load as well as taking advantage of any available spinning reserve. It would occasionally be used for peaking where appropriate. This added source of generation that is quite distant from other generation sources on the Railbelt grid will improve power quality, reduce voltage drop and provide a generation source to an area of the system that would otherwise be susceptible to an outage with a single transmission line interruption. Additionally, the location of the Project that is near the boundaries of two other electric utilities that currently wheel power across HEA's systems, sets up the possibility that future, mutually beneficial wheeling arrangements may be possible.

5 Future Resource Utilization

At this time, KHL has no plans for additional water power project developments.

6 References

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