Supplemental Information Packet

Cooper Lake Project (FERC No. 2170)

Chugach Electric Association, Inc.

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CLPP Relicensing Document Issuance #5

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1 INTRODUCTION

Chugach Electric Association (Chugach) is in the process of relicensing its Cooper Lake Hydroelectric Project (Project) with the Federal Energy Regulatory Commission (FERC). The current license for the Project expires at the end of April 2007, and Chugach must file an application for a new license on or before April 30, 2005.

The Initial Consultation Package (ICP), which summarizes existing information regarding Project facilities, operations, and environmental resources, was issued to relicensing participants in early June 2002, as the first official step in the consultation required for relicensing. Formal comment letters submitted by relicensing participants in response to the ICP included a number of requests for additional information to supplement the information that was provided in the ICP. Chugach has therefore prepared this document to provide a compilation of information to supplement the ICP, as requested.

The information in this Supplemental Information Packet falls primarily into the categories of description of Project facilities (including potential future modifications to existing facilities) and description of Project operations (existing and potential future operations). Information on Chugach's environmental risk management practices is also provided in this document.

Future issuances of additional supplemental information packets may occur as needed to facilitate consultation during the relicensing process.

2 FACILITIES / OPERATIONS / ENGINEERING

2.1 Description of the Project

The information presented in this section supplements sections I, II, III and VI of the ICP, as noted.

2.1.1 Project Boundary Map

Section VI of the ICP contains a set of Project location maps from the original FERC Project license drawings. These maps show the Project reservoir, structures, and transmission line routes, but the Project boundary is not clearly delineated.

Chugach has recently developed a set of 12 Geographic Information System (GIS) based map sheets that show the location of the existing Project boundary described in the current FERC license for the Project. The boundary encompasses Cooper Lake Dam, Cooper Lake to an elevation of 1,220 feet above mean sea level (msl), the tunnel/penstock system, the Project powerhouse on Kenai Lake, the 6.3-mile-long transmission line from the powerhouse to the Quartz Creek Substation, the Quartz Creek Substation, and the 90-mile long transmission line from the Quartz Creek Substation to the Anchorage Substation. The Project boundary maps are included at the end of this Supplemental Information Packet.

This improved Project boundary map will be used as a consistent basemap for the relicensing documents (including technical studies) for the rest of the relicensing process. Future versions of the Project boundary map may be developed to show additions to Project lands that may be proposed for inclusion in the Project boundary under the next license. Chugach is continuing its review of existing operations and access agreements to determine which additional lands, if any, may be proposed for inclusion in or deletion from the Project boundary.

2.1.2 Hydraulic Capacity of Intake, Tunnel/Penstock, and Powerhouse

Description of the primary Project structures is provided in section II.C of the ICP. The hydraulic capacity of the intake, tunnel/penstock system, and powerhouse were not specified in this section of the ICP, but are as follows:

The maximum hydraulic capacity of the intake, tunnel/penstock, and powerhouse is 380 cfs (i.e., the maximum capacity of the two turbines combined); however, flows through this conduit system are typically much lower than the maximum hydraulic capacity. Powerhouse discharges under current operations range from a low of 0 cfs (at times when the powerhouse is not operating) to a high of 380 cfs (at times when the powerhouse is operating at full pool of 1,194 feet msl and both turbines are operating at maximum output). At a higher pool level of 1,206 feet, this capacity would increase slightly, to 386 cfs.

2.1.3 Project Water Right

As explained in section I.B.2 (p. I-3) of the ICP, the Project operates under a water appropriation issued by the Alaska Department of Natural Resources in December 1971 (with a priority date of February 1961). The water right is 90,600 acre-feet/year from Cooper Lake, plus total outflow from Cooper Creek (which equals inflow to Cooper Lake). Because the 90,600 acre-feet/year water right is less than the usable storage capacity of the reservoir, relicensing participants have questioned whether Chugach will need to apply for a modification to the existing water right or else constrain operations to stay within the water appropriation. Chugach has no plans to change its water right and sees no need to do so. Since the early 1960s (following initial testing of the spillway), the Project has used all annual inflow into Cooper Lake for power generation, in accordance with the water appropriation. In some years, Project water use has exceeded 90,600-acre feet/year (see Table 4). However, the average water use per year since Project construction is approximately 73,000 acre-feet per year, as determined by inflow to the reservoir. Regardless of what the reservoir storage capacity is, water use at the Project is limited by annual inflow to Cooper Lake, and historical operational data does not warrant that Project operations be curtailed to stay within the current water right.

2.1.4 Development of Reservoir Storage Capacity Curve

The storage capacity curve for Cooper Lake is presented in section III.B.4 (p. III-15) of the ICP. Chugach has been requested to explain how the reservoir storage capacity curve was developed and assess its accuracy. Chugach did not find original records to document how the curve was developed. However, it was presumably developed using accepted techniques for calculating the incremental volume of water stored behind the dam with increasing reservoir stage (based on original topographic survey of the Cooper Lake basin). It should be noted that the accuracy of the storage curve for the usable storage behind Cooper Lake has not changed since the curve was originally developed; siltation or other factors that can change available storage capacity in a reservoir would only affect the deeper portions of the reservoir, well below the 1,165-foot-msl elevation that marks the base of the usable storage area of the reservoir. In addition, the relation between reservoir stage and capacity will be refined using direct discharge data that have recently become available for powerhouse discharge, in conjunction with update and enhancement of Chugach's existing reservoir operations model in 2003 (see section 2.2.7, below).

2.1.5 Dam Height (Actual vs. Originally Licensed)

The description of the current Project license in section I.B.1 of the ICP mentions that in a July 11, 1966, amendment, the Federal Power Commission (FPC, the predecessor to FERC), amended the Project license to correctly reflect the actual dimensions of Cooper Lake Dam as constructed, raising the licensed elevation of the fixed spillway from 1,200 to 1,210 feet msl and the licensed elevation of the top of the dam from 1,210 to 1,220 feet msl. Chugach has been requested to provide additional history to explain why the dam was constructed to a height that was different than specified in the original license. Chugach filed with the FPC on June 18, 1962, revised exhibit drawings showing Project works as constructed, and on August 10, 1962, an application for amendment of the license to reflect the revised Project works. This information was supplemented by letter dated April 15, 1963, and by the required Initial Statement of actual legitimate original costs (FPC Form No. 6), filed February 29, 1964. As noted in the FPC's July 11, 1966, Order Further Amending License (Major) and Approving Project Exhibits, the licensee had advised, based on feasibility study results, that the additional head provided by the extra 10 feet of reservoir storage below the spillway would increase annual power output by 600,000 kilowatt-hours (kWh). Based on these records, it is presumed that Chugach constructed the dam 10 feet higher than the originally licensed 1,210 feet msl based on the results of its feasibility study. No further records have been found to further document the construction history and decision-making process related to dam construction.

2.1.6 Potential Future Dam Modifications

As noted in sections II.C.2 and III.E of the ICP, the Cooper Lake Dam spillway is currently not large enough to pass the probable maximum flood (PMF) (which was estimated through a study conducted in 1984) if the starting reservoir level is at the licensed normal maximum elevation of 1,210 feet msl. Therefore, since the mid-1980s, to prevent a situation in which the dam could potentially be overtopped by flood flow (which would pose a significant risk of dam failure), Chugach has maintained the reservoir at a level of 1,194 feet msl or lower, even though the licensed normal maximum operating level of the reservoir is 1,210 feet msl. This reduced normal maximum operating level ensures that there is sufficient unused storage capacity in the reservoir to be able to capture routine floods as well as pass the theoretical PMF-size flood event without overtopping the dam. (It should be noted that a PMF is the estimated extreme rare flood event. Studies indicate that if a flood of this magnitude were to ever occur, the reservoir level if starting at the current maximum normal elevation of 1,194 feet msl would rise to 1,220 [top of dam], and would remain at that level for just under 24 hours before receding. Discharges through the dam spillway would be on the order of 14,000 to 15,000 cfs.)

While operating the reservoir at a lower level provides a safety factor in the event of a PMF, it also reduces hydraulic head and thus generation at the Project. Therefore, Chugach is currently proposing (pending further analysis) to lower the elevation of the spillway of the dam from its current level at 1,210 feet msl to 1,206 feet msl. This modification will enlarge the spillway enough to allow it to safely pass the PMF from a starting reservoir elevation of 1,206 feet msl (which would be the new spillway level) without overtopping the dam. As a further precaution, a 4-foot-high parapet wall will be added to the top of the dam to prevent overtopping of the dam by wave run-up during a PMF event. With these modifications, the reservoir would be able to be safely operated up to a normal maximum operating elevation of 1,206 feet msl as provided for in the license, rather than the currently reduced normal maximum operating level of 1,194 feet msl.

Chugach currently envisions that these structural modifications of the dam and spillway (if they prove feasible) will be proposed in the application for a new license for the Project, and if approved by FERC, the modifications would be made soon after issuance of the new license. It should be noted, however, that as part of its relicensing study program, Chugach intends to reevaluate (using up-to-date methods and assumptions) the PMF study and engineering evaluation on which these proposed modifications were designed, to make sure that any proposal included in the license application is fully supported by current engineering information. As part of this study effort, detailed reservoir operations modeling and cost and economic studies will be conducted to analyze the merits of the dam/spillway modifications. Chugach anticipates that the new PMF analysis and engineering/economic evaluation will be completed by late 2003. Based on these results, the proposal for modifications to the dam/spillway will be confirmed or revised at that time as appropriate.

2.2 Operations and Hydrology

Information presented in this section supplements section III of the ICP (Project Operations and Resource Utilization), except as noted.

2.2.1 Project Inflows

Information on historical inflows to the Project is summarized in section III.A.3.a (and Figure III-4) of the ICP. The information in the ICP is presented in terms of average inflow by month (January 1985– December 2001) into Cooper Lake, as calculated from reservoir levels and monthly powerhouse discharge. Further detail regarding reservoir inflows is provided below.

Cooper Lake inflows are calculated using a formula that incorporates actual measured powerhouse flows and the monthly change in storage measured for Cooper Lake. For months in which this calculation results in a small negative inflow value, the inflow was assumed to be zero. Cooper Lake inflows are presented below in units of acre-feet (Table 1) and cfs (Table 2).

Table 1. Cooper Lake Inflows (acre-feet).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1985	4,397	798	1,267	324	6,535	12,043	18,421	9,785	9,586	4,643	0	9,184	76,983
1986	3,750	2,270	3,247	1,677	5,835	12,674	14,003	8,559	5,966	12,161	3,846	6,823	80,811
1987	3,791	1,748	0	1,655	10,775	13,956	19,535	10,209	6,924	13,405	1,827	1,369	85,194
1988	921	3,291	1,632	0	5,183	29,960	19,141	14,656	9,012	5,240	11,765	2,951	103,754
1989	90	599	0	3,605	8,686	12,120	13,136	14,315	12,682	13,487	1,462	1,808	81,989
1990	1,471	0	984	3,375	15,038	17,515	8,822	607	9,032	4,089	1,604	450	62,988
1991	347	223	6,069	1,843	7,814	12,872	9,589	7,812	11,362	4,887	1,937	2,711	67,466
1992	532	347	1,515	618	10,102	20,260	15,511	9,168	3,208	3,996	5,925	5,127	76,309
1993	2,072	0	129	2,561	11,473	14,609	10,274	13,053	11,125	8,722	3,324	2,895	80,235
1994	1,184	2,457	1,324	2,657	7,929	14,657	11,665	6,475	5,636	4,796	1,874	2,007	62,660
1995	1,140	1,463	782	2,777	12,956	5,794	13,495	5,956	22,117	8,815	2,321	1,043	78,659
1996	272	1,541	271	1,079	5,635	7,684	5,297	3,911	2,633	1,126	1,023	1,056	31,525
1997	915	1,294	482	2,084	7,550	11,294	7,213	5,697	10,464	4,012	6,695	3,316	61,016
1998	872	1,920	1,074	3,230	9,342	22,096	15,579	9,734	9,102	5,335	2,873	2,867	84,023
1999	0	512	838	1,411	7,428	15,775	12,859	6,815	9,452	6,873	0	4,280	66,243
2000	3,187	743	447	1,897	9,064	16,279	15,469	5,904	7,536	5,377	5,190	523	71,616
2001	1,309	0	9,574	727	6,685	25,497	19,522	13,514	6,722	4,604	2,334	1,466	91,952
2002	1,000	1,000	6,417	0	9,246	10,005	12,030	11,076	4,997	----	----	----	----
Average	1,514	1,123	2,003	1,751	8,737	15,283	13,420	8,736	8,753	6,563	3,176	2,934	73,993

Table 2. Cooper Lake Inflows (cfs).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1985	71.5	14.4	20.6	5.5	106.3	202.4	299.6	159.1	161.1	75.5	0.0	149.4	106.3
1986	61.0	40.9	52.8	28.2	94.9	213.0	227.7	139.2	100.3	197.8	64.6	111.0	111.6
1987	61.7	31.5	0.0	27.8	175.2	234.5	317.7	166.0	116.4	218.0	30.7	22.3	117.7
1988	15.0	59.3	26.5	0.0	84.3	503.5	311.3	238.4	151.4	85.2	197.7	48.0	143.3
1989	1.5	10.8	0.0	60.6	141.3	203.7	213.6	232.8	213.1	219.3	24.6	29.4	113.3
1990	23.9	0.0	16.0	56.7	244.6	294.4	143.5	9.9	151.8	66.5	27.0	7.3	87.0
1991	5.6	4.0	98.7	31.0	127.1	216.3	155.9	127.1	190.9	79.5	32.5	44.1	93.2
1992	8.7	6.3	24.6	10.4	164.3	340.5	252.3	149.1	53.9	65.0	99.6	83.4	105.4
1993	33.7	0.0	2.1	43.0	186.6	245.5	167.1	212.3	187.0	141.8	55.9	47.1	110.8
1994	19.3	44.2	21.5	44.6	129.0	246.3	189.7	105.3	94.7	78.0	31.5	32.6	86.6
1995	18.5	26.3	12.7	46.7	210.7	97.4	219.5	96.9	371.7	143.4	39.0	17.0	108.7
1996	4.4	27.7	4.4	18.1	91.6	129.1	86.1	63.6	44.2	18.3	17.2	17.2	43.5
1997	14.9	23.3	7.8	35.0	122.8	189.8	117.3	92.6	175.9	65.3	112.5	53.9	84.3
1998	14.2	34.6	17.5	54.3	151.9	371.3	253.4	158.3	153.0	86.8	48.3	46.6	116.1
1999	0.0	9.2	13.6	23.7	120.8	265.1	209.1	110.8	158.8	111.8	0.0	69.6	91.5
2000	51.8	13.4	7.3	31.9	147.4	273.6	251.6	96.0	126.6	87.5	87.2	8.5	98.9
2001	21.3	0.0	155.7	12.2	108.7	428.5	317.5	219.8	113.0	74.9	39.2	23.8	127.0
2002	16.3	18.0	104.4	0.0	150.4	168.1	195.6	180.1	84.0	-----	-----	-----	-----
Average	24.6	20.2	32.6	29.4	142.1	256.8	218.3	142.1	147.1	106.7	53.4	47.7	102.7

Water year types are defined by the available historical Cooper Lake inflows. Reservoir inflows vary significantly from year to year, and greatly affect how the Project is operated. In a *dry year* (1996 for example) reservoir inflows averaged 43.5 cfs; in an *average year* (1992 for example) reservoir inflows averaged 105.4 cfs; and in a *wet year* (1988 for example) reservoir inflows averaged 143.3 cfs.

2.2.2 Historical Reservoir Operations

Existing and historical reservoir operations are described in section III.A.2 (including Figures III-1 and III-2) of the ICP. Additional information to describe historical reservoir levels, including stratification of typical reservoir level curves for different water-year types, follows.

The Project was designed such that the normal maximum reservoir level of Cooper Lake would be at the spillway crest, 1,210 feet msl, and that spills from the reservoir would occur only during times when this elevation was exceeded. For the past 40 years there has been very little spill over the spillway; the last spill occurred during initial testing of the spillway in the early 1960s. Since 1985, Chugach has maintained the reservoir at a much lower level than the licensed normal maximum reservoir level in order to satisfy FERC's dam safety criteria under CFR Title 18, Part 12, thus avoiding spills entirely.

Currently the normal maximum reservoir level (i.e., the normal operating pool) is held at 1,194 feet msl, 16 feet lower than the existing spillway crest, which is the licensed normal maximum reservoir elevation. Reservoir storage space above the 1,194 msl elevation is used by Chugach for flood surcharge. This flood storage space is used to fully capture and/or attenuate flood inflows resulting from extreme storm events, ranging from annual storms at the low end of the spectrum up to an extremely rare event (i.e., the theoretical PMF) at the high end. All flow releases from the reservoir are currently made through the powerhouse.

Table 3 provides data for the historical beginning-of-month and end-of-month reservoir levels and storage volumes for Cooper Lake for the period from January 1985 through September 2002.

Table 3. Historical Reservoir Levels in Cooper Lake, 1985–2002.

Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level
Jan-85	1,188.10	1,186.20	Jan-86	1,186.30	1,184.00	Jan-87	1,191.20	1,190.00
Feb-85	1,186.10	1,183.00	Feb-86	1,183.90	1,180.90	Feb-87	1,190.00	1,189.50
Mar-85	1,182.90	1,181.30	Mar-86	1,180.80	1,178.70	Mar-87	1,189.30	1,185.10
Apr-85	1,181.30	1,179.10	Apr-86	1,178.60	1,176.40	Apr-87	1,185.00	1,181.70
May-85	1,179.60	1,179.30	May-86	1,175.60	1,176.40	May-87	1,181.70	1,185.00
Jun-85	1,179.50	1,184.50	Jun-86	1,176.00	1,181.10	Jun-87	1,185.00	1,185.50
Jul-85	1,184.50	1,190.80	Jul-86	1,181.20	1,186.30	Jul-87	1,185.60	1,185.70
Aug-85	1,191.00	1,194.00	Aug-86	1,186.80	1,189.80	Aug-87	1,185.70	1,185.00
Sep-85	1,194.20	1,195.00	Sep-86	1,190.00	1,191.00	Sep-87	1,184.90	1,185.10
Oct-85	1,195.00	1,192.00	Oct-86	1,191.00	1,191.90	Oct-87	1,185.10	1,187.40
Nov-85	1,192.00	1,187.50	Nov-86	1,191.90	1,191.30	Nov-87	1,187.30	1,183.60
Dec-85	1,187.00	1,186.30	Dec-86	1,191.20	1,191.30	Dec-87	1,183.50	1,178.90

Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level
Jan-88	1,178.90	1,174.80	Jan-89	1,181.00	1,175.70	Jan-90	1,186.80	1,183.40
Feb-88	1,174.50	1,171.90	Feb-89	1,175.60	1,172.20	Feb-90	1,183.20	1,177.30
Mar-88	1,171.10	1,171.30	Mar-89	1,172.20	1,169.60	Mar-90	1,177.00	1,173.40
Apr-88	1,171.30	1,171.20	Apr-89	1,169.60	1,170.80	Apr-90	1,173.10	1,168.80
May-88	1,172.20	1,174.50	May-89	1,170.80	1,174.50	May-90	1,168.80	1,172.50
Jun-88	1,174.50	1,186.80	Jun-89	1,174.50	1,179.20	Jun-90	1,172.50	1,177.30
Jul-88	1,186.80	1,188.60	Jul-89	1,179.20	1,184.50	Jul-90	1,177.50	1,180.30
Aug-88	1,188.60	1,189.60	Aug-89	1,184.60	1,189.60	Aug-90	1,180.40	1,180.30
Sep-88	1,189.60	1,189.90	Sep-89	1,189.60	1,190.60	Sep-90	1,182.60	1,184.20
Oct-88	1,190.00	1,188.60	Oct-89	1,190.70	1,193.10	Oct-90	1,184.20	1,185.60
Nov-88	1,188.60	1,188.60	Nov-89	1,193.10	1,189.90	Nov-90	1,185.60	1,185.60
Dec-88	1,184.00	1,181.00	Dec-89	1,189.90	1,186.80	Dec-90	1,185.50	1,182.30
Jan-91	1,182.30	1,178.70	Jan-92	1,188.50	1,183.20	Jan-93	1,191.50	1,191.30
Feb-91	1,178.70	1,174.90	Feb-92	1,183.10	1,180.90	Feb-93	1,191.30	1,189.40
Mar-91	1,174.90	1,173.60	Mar-92	1,180.90	1,179.60	Mar-93	1,189.40	1,184.60
Apr-91	1,173.60	1,174.20	Apr-92	1,179.60	1,176.40	Apr-93	1,184.50	1,181.50
May-91	1,174.20	1,177.60	May-92	1,176.30	1,178.20	May-93	1,181.30	1,181.50
Jun-91	1,177.60	1,181.60	Jun-92	1,178.50	1,184.90	Jun-93	1,181.80	1,182.30
Jul-91	1,181.90	1,185.00	Jul-92	1,185.20	1,189.50	Jul-93	1,182.00	1,180.50
Aug-91	1,185.20	1,187.10	Aug-92	1,189.50	1,192.40	Aug-93	1,180.00	1,182.60
Sep-91	1,187.10	1,191.10	Sep-92	1,192.40	1,191.10	Sep-93	1,182.60	1,187.10
Oct-91	1,191.30	1,192.10	Oct-92	1,191.10	1,190.40	0ct-93	1,187.20	1,189.40
Nov-91	1,192.10	1,190.20	Nov-92	1,190.50	1,191.10	Nov-93	1,189.40	1,187.70
Dec-91	1,190.20	1,188.50	Dec-92	1,191.20	1,191.50	Dec-93	1,187.50	1,185.90
Jan-94	1,186.00	1,183.30	Jan-95	1,176.00	1,174.70	Jan-96	1,184.30	1,183.50
Feb-94	1,183.20	1,182.10	Feb-95	1,174.50	1,172.30	Feb-96	1,183.50	1,183.20
Mar-94	1,182.10	1,179.70	Mar-95	1,172.10	1,167.50	Mar-96	1,183.20	1,181.80
Apr-94	1,179.70	1,178.30	Apr-95	1,167.40	1,167.70	Apr-96	1,181.80	1,181.30
May-94	1,178.30	1,177.10	May-95	1,167.80	1,172.30	May-96	1,181.40	1,182.70
Jun-94	1,177.00	1,179.20	Jun-95	1,172.30	1,174.20	Jun-96	1,182.70	1,183.60
Jul-94	1,179.20	1,178.40	Jul-95	1,174.30	1,177.30	Jul-96	1,183.60	1,183.30
Aug-94	1,178.40	1,177.40	Aug-95	1,177.30	1,177.10	Aug-96	1,183.20	1,184.30
Sep-94	1,177.40	1,179.80	Sep-95	1,177.10	1,186.30	Sep-96	1,184.30	1,183.40
Oct-94	1,179.80	1,181.80	Oct-95	1,177.10	1,186.70	Oct-96	1,183.40	1,181.60
Nov-94	1,181.90	1,179.40	Nov-95	1,186.70	1,186.00	Nov-96	1,181.60	1,180.40
Dec-94	1,179.20	1,176.00	Dec-95	1,186.00	1,184.30	Dec-96	1,180.40	1,179.40
Jan-97	1,179.30	1,178.10	Jan-98	1,187.70	1,186.40	Jan-99	1,187.10	1,181.30
Feb-97	1,178.00	1,177.70	Feb-98	1,186.20	1,184.90	Feb-99	1,181.30	1,177.40
Mar-97	1,177.70	1,176.60	Mar-98	1,184.90	1,183.20	Mar-99	1,177.30	1,174.50
Apr-97	1,176.60	1,176.00	Apr-98	1,183.10	1,182.10	Apr-99	1,174.40	1,172.00
May-97	1,176.00	1,177.60	May-98	1,182.10	1,183.10	May-99	1,171.90	1,173.00
Jun-97	1,177.70	1,179.70	Jun-98	1,183.30	1,188.10	Jun-99	1,173.30	1,176.70
Jul-97	1,179.80	1,180.30	Jul-98	1,187.30	1,192.00	Jul-99	1,176.70	1,178.90
Aug-97	1,180.30	1,181.10	Aug-98	1,192.00	1,194.40	Aug-99	1,178.90	1,178.10
Sep-97	1,181.10	1,184.90	Sep-98	1,194.40	1,195.00	Sep-99	1,178.00	1,178.10
Oct-97	1,185.00	1,185.50	Oct-98	1,195.00	1,193.30	Oct-99	1,178.20	1,177.90
Nov-97	1,185.40	1,186.80	Nov-98	1,193.30	1,190.70	Nov-99	1,177.90	1,174.70
Dec-97	1,186.80	1,187.70	Dec-98	1,190.50	1,187.10	Dec-99	1,174.70	1,173.80

Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level	Month	Beginning Lake Level	Ending Lake Level
Jan-00	1,173.80	1,173.20	Jan-01	1,193.40	1,193.90	Jan-02	Float stuck	
Feb-00	1,173.20	1,169.90	Feb-01	1,193.90	1,193.50	Feb-02	Float stuck	
Mar-00	1,169.70	1,164.90	Mar-01	1,193.50	1,192.60	Mar-02	1,180.00	1,178.00
Apr-00	1,164.90	1,165.80	Apr-01	1,192.60	1,187.70	Apr-02	1,178.00	1,173.50
May-00	1,165.80	1,170.00	May-01	1,187.70	1,184.60	May-02	1,173.50	1,173.60
Jun-00	1,170.00	1,177.20	Jun-01	1,184.60	1,187.50	Jun-02	1,173.60	1,175.00
Jul-00	1,177.20	1,183.70	Jul-01	1,187.80	1,189.70	Jul-02	1,175.00	1,177.00
Aug-00	1,183.70	1,186.10	Aug-01	1,189.70	1,192.10	Aug-02	1,177.00	1,178.80
Sep-00	1,186.10	1,189.10	Sep-01	1,192.10	1,191.50	Sep-02	1,178.80	1,178.10
Oct-00	1,189.10	1,191.20	Oct-01	1,191.50	1,191.60	Oct-02		
Nov-00	1,191.20	1,193.20	Nov-01	1,191.60	1,192.50	Nov-02		
Dec-00	1,193.20	1,193.40	Dec-01	1,192.50	1,191.50	Dec-02		

Figures 1 through 3 below illustrate the typical range of historical reservoir fluctuation in dry, average, and wet years (as defined by total reservoir inflows).

Based on the calculated Cooper Lake inflows, the driest year of record in the past 15 years (1996) was selected as the representative dry year, and the wettest year of record (1988) was selected as the representative wet year. The year 1992 was selected as the representative average year because it has an annual average flow that is closest to the long-term average flow. The following figures describe reservoir and Project operations in these typical years.

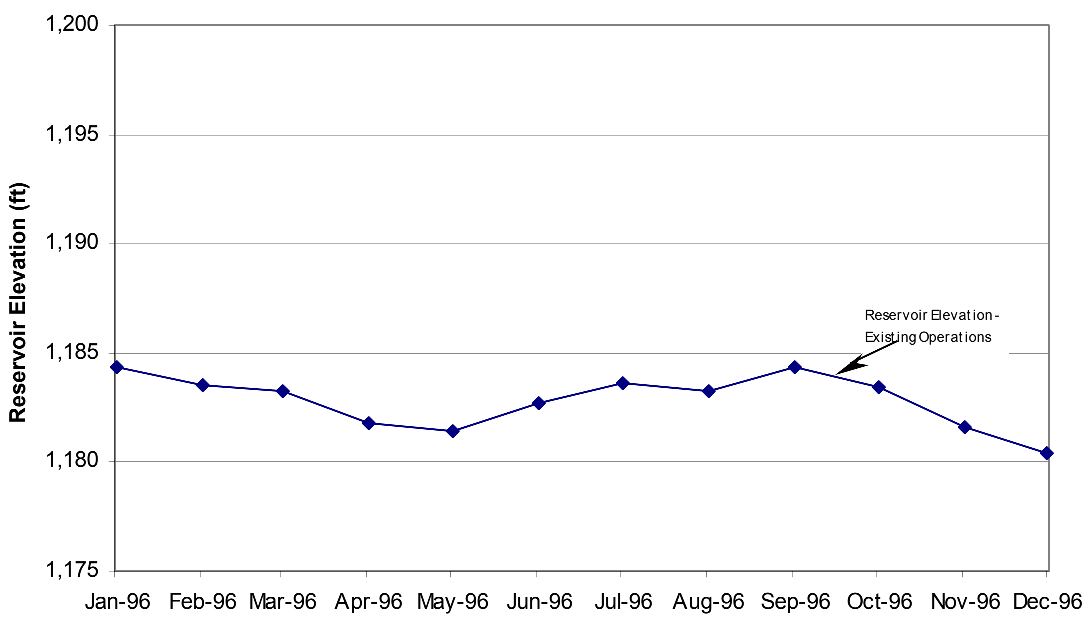

Figure 1. Historical Reservoir Operations in a Dry Year (1996).

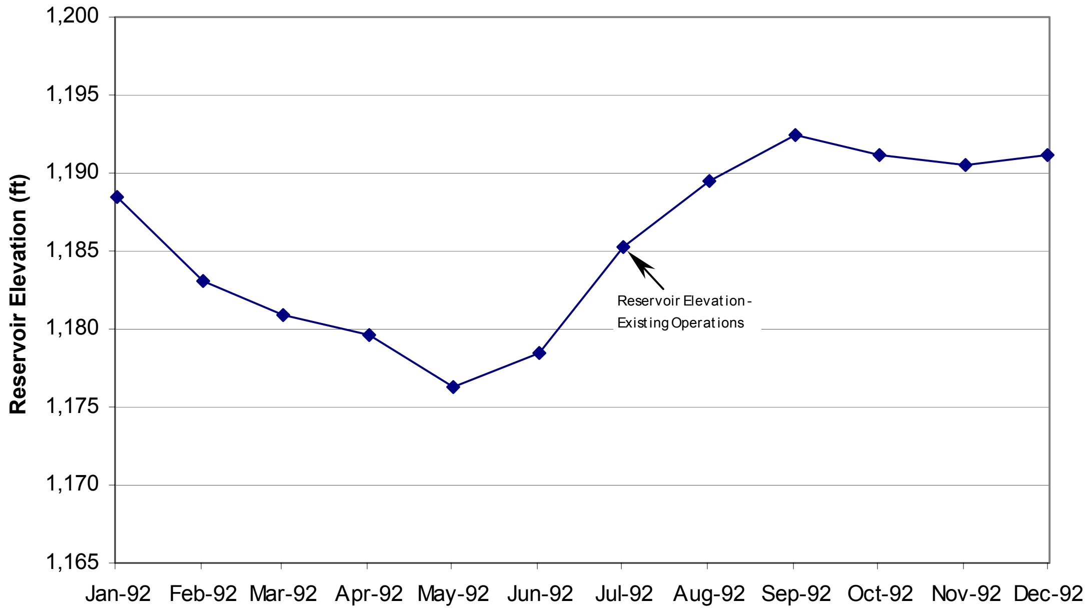

Figure 2. Historical Reservoir Operations in an Average Year (1992).

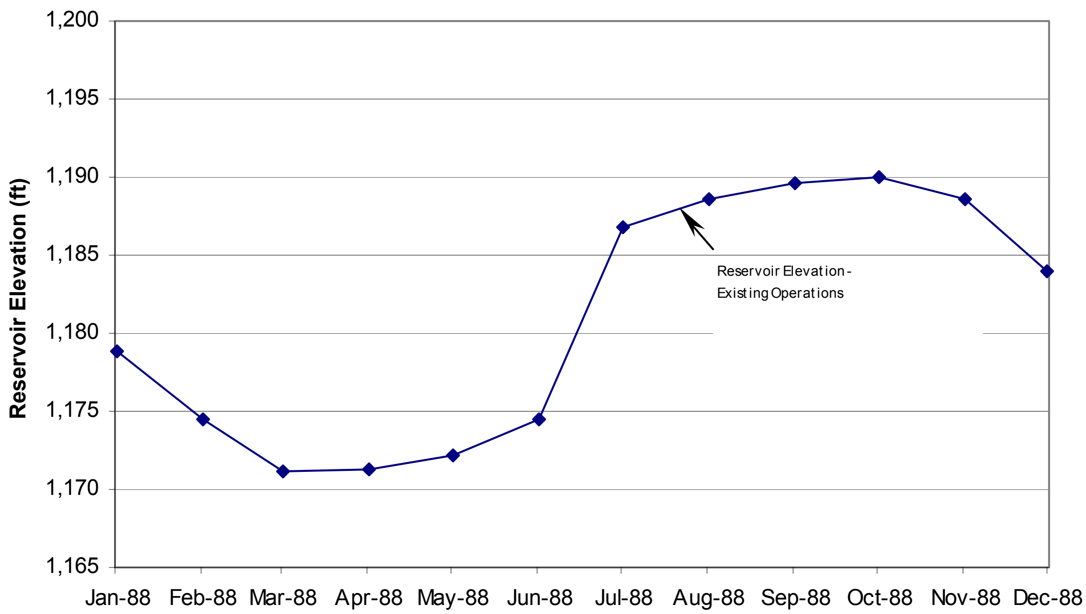

Figure 3. Historical Reservoir Operations in a Wet Year (1988).

As shown in Figures 1 through 3:

- In a *dry year* (1996 for example) the reservoir started out at approximately 1,184 feet msl in January, and was drawn down to about 1,182 feet msl (about 2 feet) by May and then refilled to about its original level by September, and then was drawn down to about 1,180 by year's end. Total fluctuation during the year was about 4 to 5 feet.

- In an *average year* (1992 for example) the reservoir started out at approximately 1,187 feet msl in January, and was drawn down to about 1,170 feet msl (about 12 feet) by May and then refilled to about 1,192 feet msl by year's end. Total fluctuation during the year was about 17 feet.

- In a *wet year* (1988 for example) the reservoir started out at approximately 1,179 feet msl in January, was drawn down to about 1,171 feet msl (about 8 feet) by May, refilled to about 1,190 feet msl by November, and then was drawn down to about 1,184 by year's end. Total fluctuation during the year was about 19 feet.

Figure 4 shows the average reservoir levels for each month of the year, January through December, for a 15-year period of operation, from January 1985 through December 1999. Also shown for comparison purposes are the maximum and minimum pool levels experienced during each month.

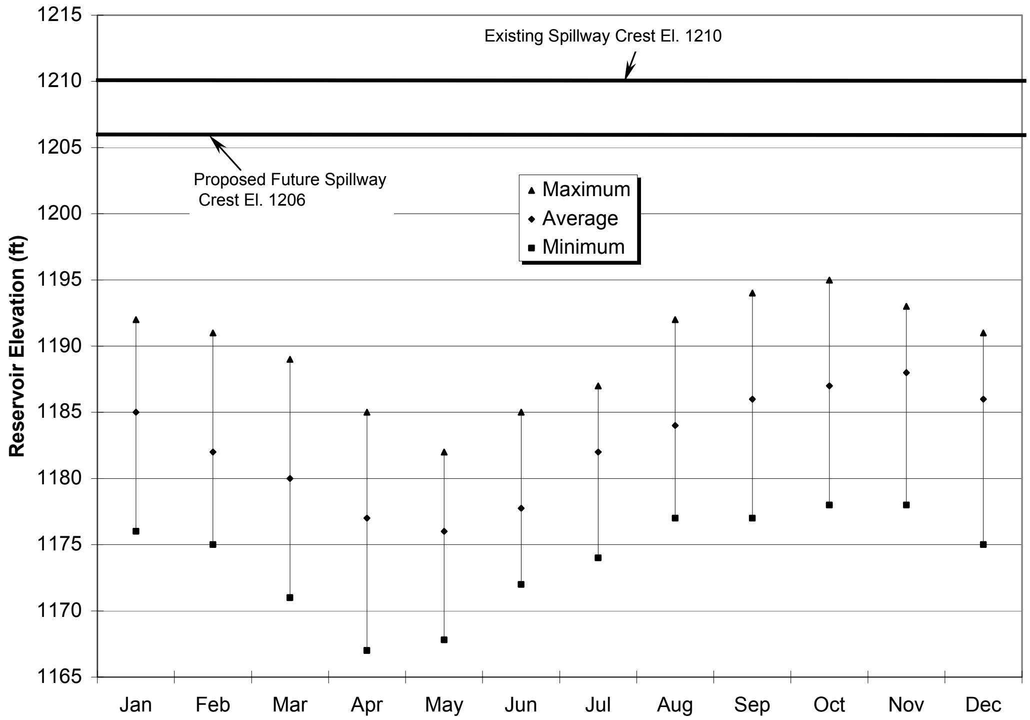

Figure 4. Range of Historic Reservoir Operations.

As indicated in Figures 1–4, the reservoir is typically lowered during the winter and spring months and refills in the summer and fall months. The range of reservoir fluctuation is fairly consistent over the various months of the year. For any given month of the year, the extreme high reservoir level (i.e., in a wet year) is only about 7 or 8 feet above the level experienced in an average year. Similarly, the extreme low reservoir level (i.e., in a dry year) is only about 7 or 8 feet below the level experienced in an average year. As indicated in Figure 4, the pool typically fluctuates (on average) within a zone of about 15 feet.

2.2.3 Potential Future Reservoir Operations

A conceptual description of reservoir operating levels and fluctuation range that may occur with the currently proposed dam/spillway modification and increase in normal maximum reservoir operating level to 1,206 feet msl is included in section III.E of the ICP (Potential for Future Development or Project Enhancements). As noted in that description, if the spillway modifications described above in section 2.1.6 are made, the zone of reservoir fluctuation would increase from its current range of between 1,165 and 1,194 feet msl (with a typical annual fluctuation of about 15 feet). The new full range of operation would be between 1,165 and 1,206 feet msl. However, the total generation and range of annual reservoir fluctuation will continue to be limited by inflow to the lake (which averages about 73,000 acre-feet per year). It is anticipated that the general *shape* of the reservoir elevation curve (see Figures 1 through 4, above) would be similar to the existing curves for most years, although future reservoir levels would likely be on the order of 16 to 20 feet higher than they have been historically. With the higher maximum reservoir operation level and increased storage capacity, however, the Project would potentially be able to store inflow over a greater period of time because the reservoir would not need to be drawn down as far based solely on water management factors. The additional storage capacity would allow greater operational flexibility in the reservoir, providing the ability to shift the timing of generation from the Project to replace more expensive thermal generation during peak demand periods.

At present, more definitive characterization of future reservoir level fluctuations that would occur with the currently proposed dam/spillway modification described in section 2.1.6, above, is not possible. Engineering and economic studies will be performed during 2003 to determine the optimum future reservoir operating levels for power generation and dam safety considerations. In addition, environmental studies being conducted for the Project relicensing will evaluate the potential impacts to environmental resources that might be associated with a higher reservoir operating range. Based on the results of these studies, Chugach will identify proposed reservoir operations for the new license term. Any proposed changes to the historical operation will be evaluated during the course of relicensing studies, and a final proposal will be described in the draft and final license applications.

Until the results of the engineering/economic studies planned for 2003 are available, for the purposes of the environmental studies to evaluate potential future impacts associated with future reservoir operation alternatives, the assumption will be made that the full range of possible future normal reservoir operations will be 12 feet greater than with current normal operations (i.e., 1,165–1,206 feet msl, vs. 1,165–1,194 feet msl).

2.2.4 Historical Project Discharge

Flow data for the Project is provided in section III.A.3.a of the ICP, which explains the method Chugach has used until recently (prior to recent installation of direct gaging of powerhouse flows) for calculating discharge at the powerhouse, and presents summary information on the average monthly discharge from the powerhouse (January 1964 – December 2001; see Figure III-3 in the ICP). Further information regarding Project discharge is provided below.

During normal operations, discharges through the Project powerhouse into Kenai Lake have ranged from a low of 0 cfs (i.e., at times when the plant is not operating) to a high of 380 cfs (i.e., at times when the plant is operating at full pool of 1,194 feet msl and both turbines are operating at maximum output). The maximum hydraulic capacity of the intake, tunnel/penstock and powerhouse is 380 cfs; however, flows through the conduit system are typically much lower than this maximum value.

Typically, the powerhouse operates for a period of about 12 hours each day, generally between the hours of 6:00 A.M. and 10:00 P.M., with power output varying significantly during the course of the day. Powerhouse flows also vary significantly from day-to-day and from season-to-season. The operation of the powerhouse is coordinated closely with Chugach's other hydro resources at Bradley Lake and Eklutna, as well as with Chugach's thermal units, to maximize the value of the Cooper Lake Project generation in the integrated system. As discussed in section

III.C of the ICP, this operating flexibility is what makes the Project a valuable source of energy for the Railbelt Region. Important attributes of the Project include hourly peak-shaving capability and spinning reserve credits, in addition to capacity and energy.

In an average water year, flow through the powerhouse into Kenai Lake averages about 73,000 acre-feet, or roughly 100 cfs. Tables 4 and 5 summarize historical monthly average powerhouse flows in units of acre-feet and cfs, respectively.

Table 4. Cooper Lake Historical Powerhouse Flows (acre-feet).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1985	9,153	8,406	5,124	5,555	7,244	0	2,595	1,985	7,479	12,491	11,376	10,929	82,336
1986	9,419	9,517	8,223	6,798	3,996	708	1,555	981	3,398	9,836	5,398	6,565	66,393
1987	6,875	3,026	9,840	9,680	2,749	12,724	19,288	11,936	6,432	7,689	10,970	12,382	113,592
1988	10,415	9,145	1,189	0	0	637	14,616	12,114	8,245	8,804	11,765	10,204	87,133
1989	12,506	8,294	5,551	962	389	1,236	386	1,802	10,122	7,270	9,730	9,642	67,888
1990	9,850	13,890	9,214	12,890	6,869	6,563	2,231	846	5,139	646	1,604	8,265	78,007
1991	8,923	9,017	9,018	486	0	3,408	2,044	3,095	1,203	2,817	6,836	7,040	53,887
1992	13,675	5,647	4,607	8,096	5,689	4,885	4,731	1,703	6,572	5,796	4,382	4,353	70,135
1993	2,588	4,271	12,132	9,839	10,993	13,404	13,869	6,821	52	3,164	7,627	6,885	91,643
1994	7,814	5,119	7,060	5,955	10,727	9,512	13,547	8,810	0	19	7,837	9,462	85,860
1995	4,114	6,422	10,864	2,132	3,072	1,515	6,606	6,420	10	6,100	4,061	5,232	56,550
1996	2,225	2,270	3,655	2,280	2,502	5,498	6,027	1,228	4,829	5,478	3,893	3,429	43,313
1997	3,735	1,994	3,035	3,467	3,847	6,593	6,025	3,787	1,245	2,780	3,221	1,061	40,791
1998	4,123	5,133	5,229	5,649	6,923	10,209	3,599	3,467	7,521	9,800	9,612	11,486	82,749
1999	12,718	9,721	7,272	6,814	4,965	8,015	7,726	8,693	9,218	7,574	6,590	6,321	95,625
2000	4,541	8,084	10,750	0	0	0	0	0	0	0	0	0	23,375
2001	0	0	11,922	13,260	14,384	18,300	14,705	7,337	8,275	4,345	0	4,058	96,586
2002	18,216	11,084	11,129	9,503	9,020	6,829	7,432	6,873	6,639	----	----	----	----
Average	7,827	6,724	7,545	5,743	5,187	6,113	7,055	4,883	4,799	5,565	6,171	6,901	72,698

Table 5. Cooper Lake Historical Powerhouse Flows (cfs).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1985	148.9	151.4	83.3	93.4	117.8	0.0	42.2	32.3	125.7	203.2	191.2	177.7	113.7
1986	153.2	171.4	133.7	114.2	65.0	11.9	25.3	15.9	57.1	160.0	90.7	106.8	91.7
1987	111.8	54.5	160.0	162.7	44.7	213.8	313.7	194.1	108.1	125.1	184.4	201.4	156.9
1988	169.4	164.7	19.3	0.0	0.0	10.7	237.7	197.0	138.6	143.2	197.7	165.9	120.4
1989	203.4	149.3	90.3	16.2	6.3	20.8	6.3	29.3	170.1	118.2	163.5	156.8	93.8
1990	160.2	250.1	149.9	216.6	111.7	110.3	36.3	13.8	86.4	10.5	27.0	134.4	107.7
1991	145.1	162.4	146.7	8.2	0.0	57.3	33.2	50.3	20.2	45.8	114.9	114.5	74.4
1992	222.4	101.7	74.9	136.1	92.5	82.1	76.9	27.7	110.4	94.3	73.6	70.8	96.9
1993	42.1	76.9	197.3	165.3	178.8	225.3	225.6	110.9	0.9	51.5	128.2	112.0	126.6
1994	127.1	92.2	114.8	100.1	174.5	159.8	220.3	143.3	0.0	0.3	131.7	153.9	118.6
1995	66.9	115.6	176.7	35.8	50.0	25.5	107.4	104.4	0.2	99.2	68.3	85.1	78.1
1996	36.2	40.9	59.4	38.3	40.7	92.4	98.0	20.0	81.2	89.1	65.4	55.8	59.8
1997	60.7	35.9	49.4	58.3	62.6	110.8	98.0	61.6	20.9	45.2	54.1	17.3	56.3
1998	67.1	92.4	85.0	94.9	112.6	171.6	58.5	56.4	126.4	159.4	161.5	186.8	114.3
1999	206.8	175.0	118.3	114.5	80.7	134.7	125.6	141.4	154.9	123.2	110.7	102.8	132.1
2000	73.8	145.6	174.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	32.3
2001	0.0	0.0	193.9	222.8	233.9	307.5	239.2	119.3	139.1	70.7	0.0	66.0	133.4
2002	296.3	199.6	181.0	159.7	146.7	114.8	120.9	111.8	111.6	-----	-----	-----	-----
Average	127.3	121.1	122.7	96.5	84.4	102.7	114.7	79.4	80.6	90.5	103.7	112.2	100.4

Figures 5 through 7 show the average powerhouse discharge (in acre-feet) for each month of the year, January through December, for a typical dry, average and wet year (as defined by total reservoir inflows). Figures 8 through 11 show monthly flow-duration curves for powerhouse discharge. Note that all of the powerhouse flow duration curves are based on average monthly powerhouse flow data for the 15-year period from 1985 through 1999.

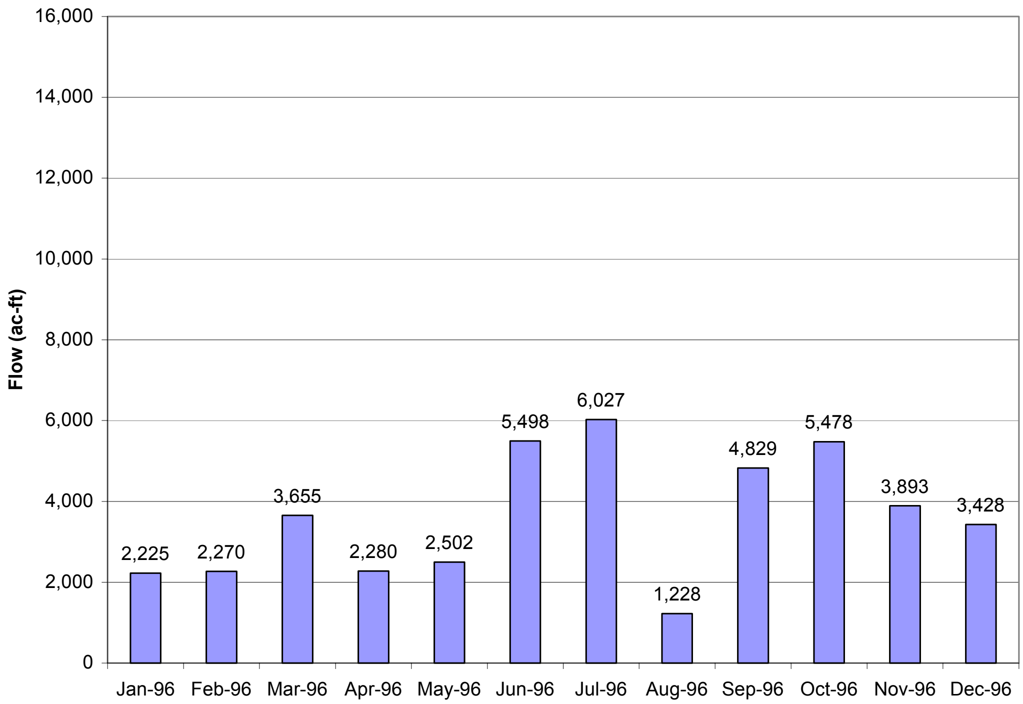

Figure 5. Powerhouse Flow in a Dry Year (1996).

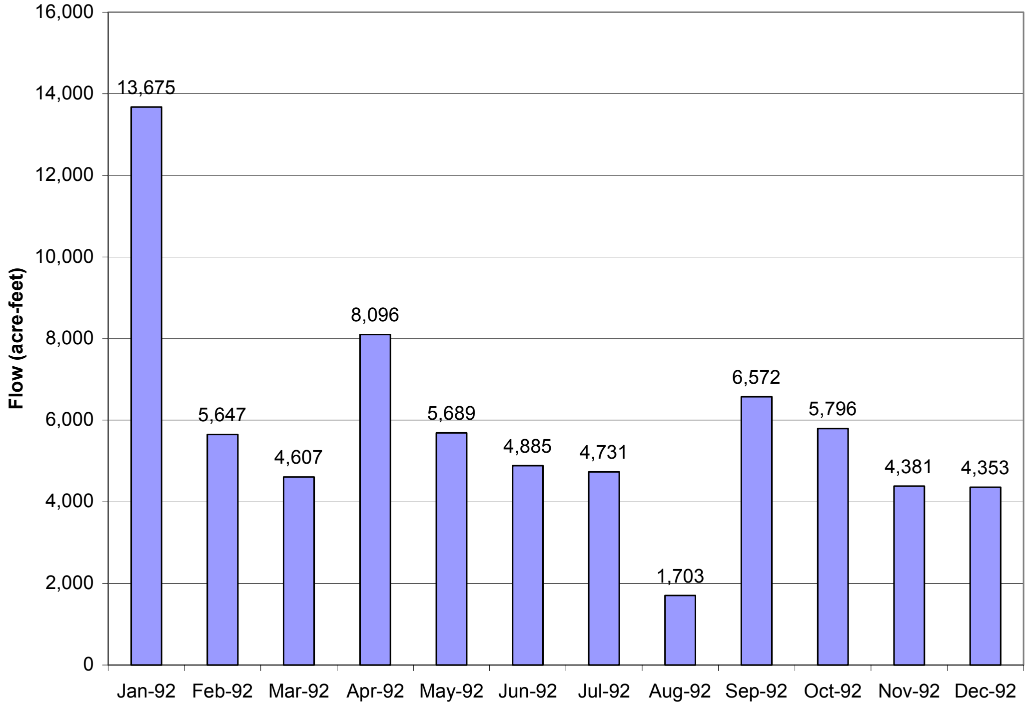

Figure 6. Powerhouse Flow in an Average Year (1992).

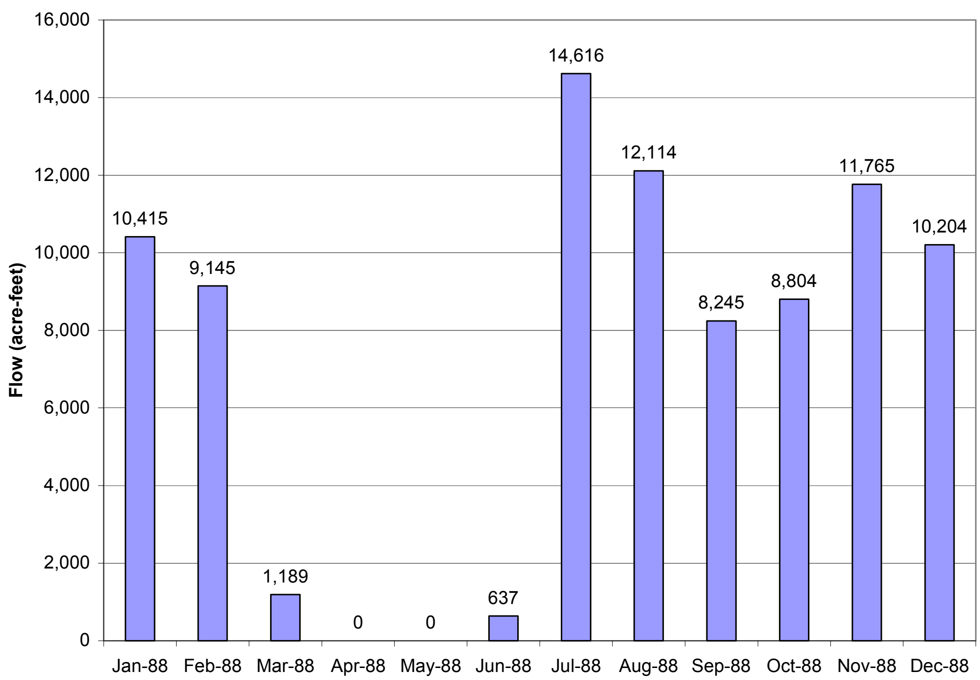

Figure 7. Powerhouse Flow in a Wet Year (1988).

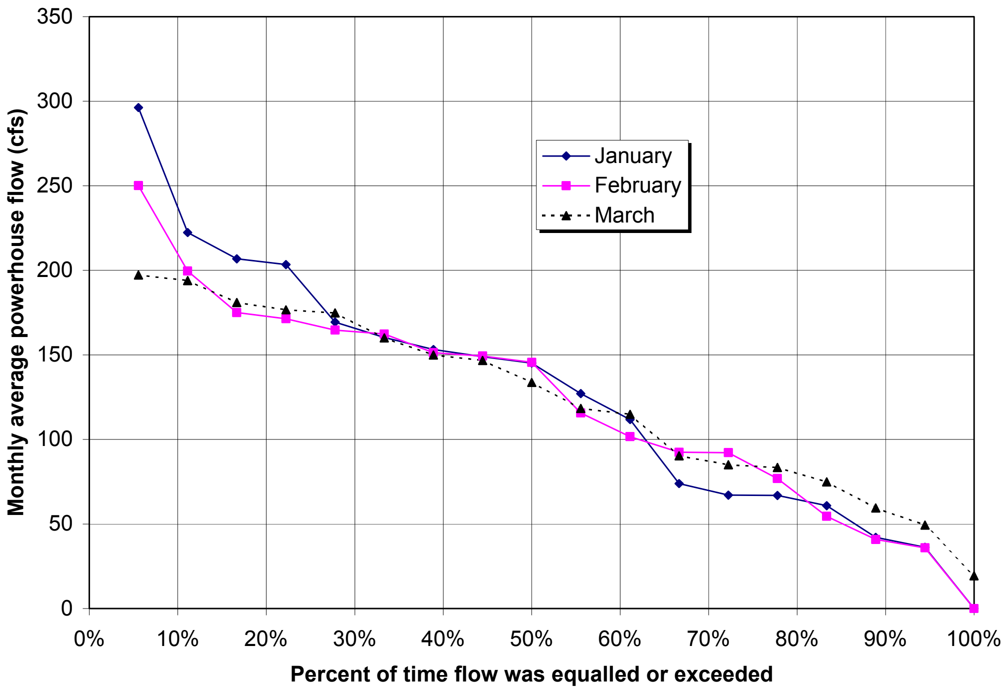

Figure 8. Powerhouse Flow Duration Curves for January, February, and March.

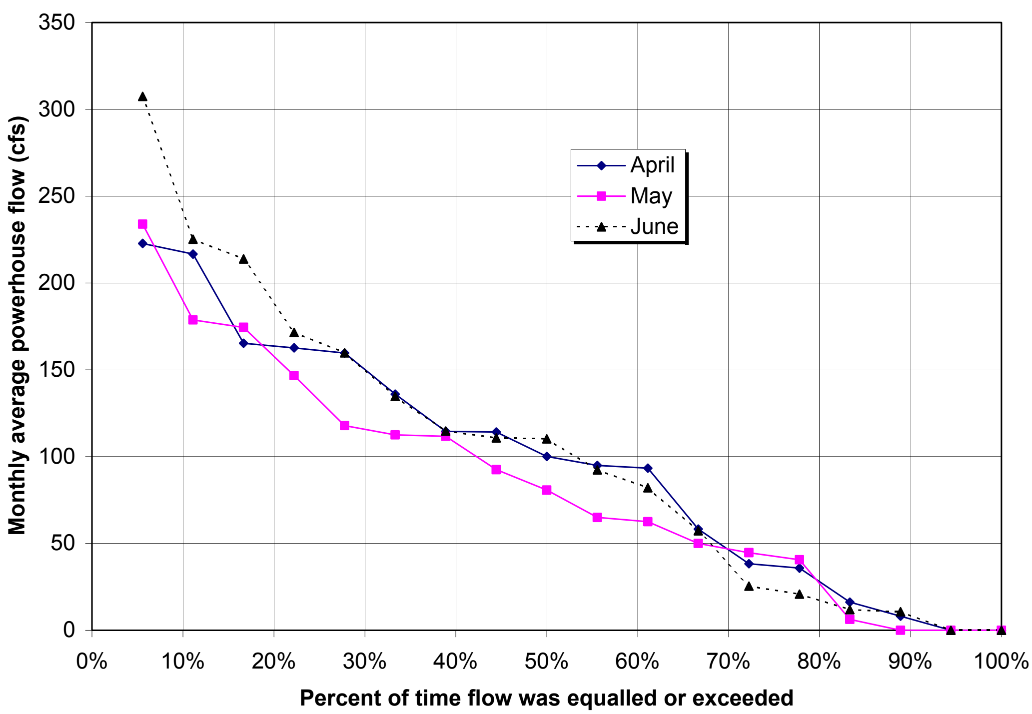

Figure 9. Powerhouse Flow Duration Curves for April, May, and June.

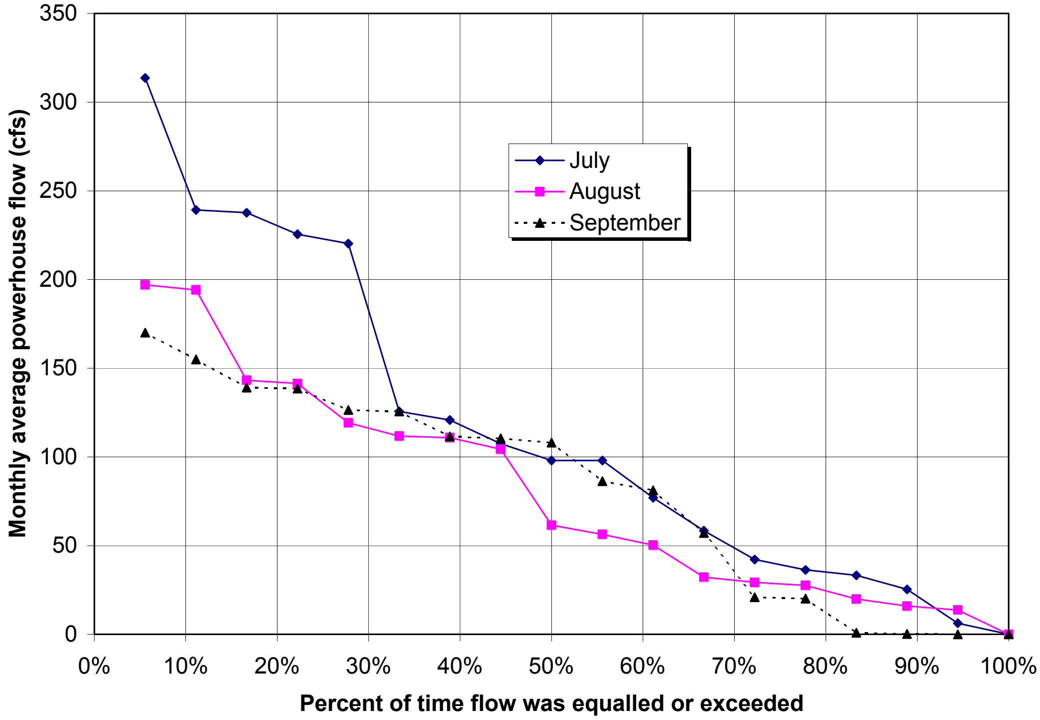

Figure 10. Powerhouse Flow Duration Curves for July, August, and September.

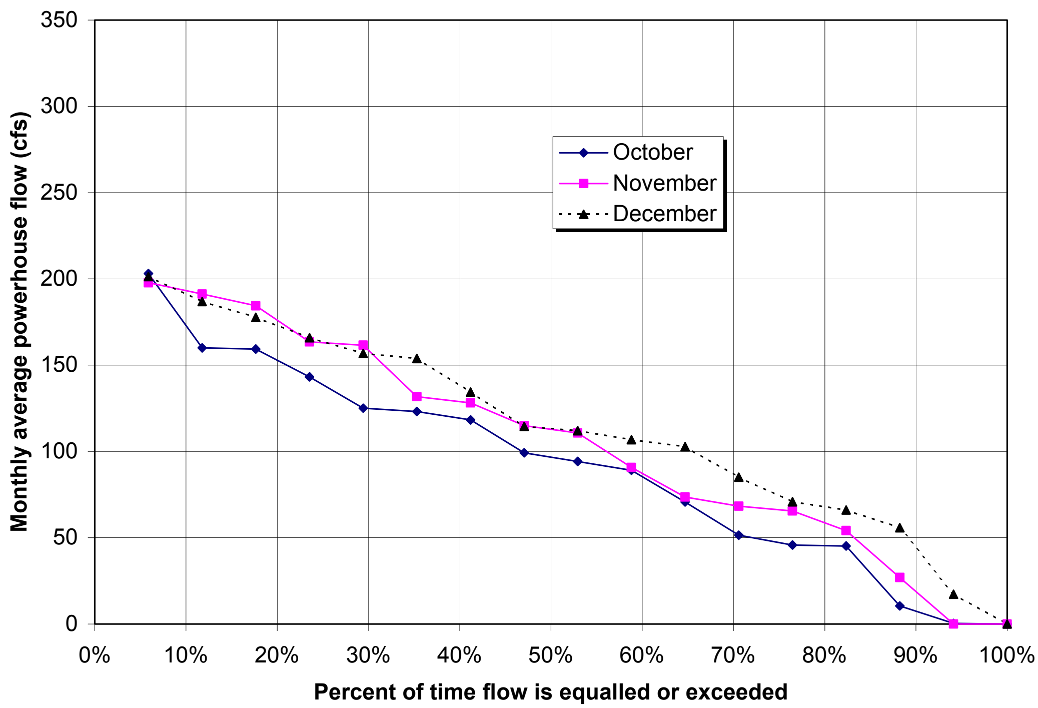

Figure 11. Powerhouse Flow Duration Curves for October, November, and December.

2.2.5 Historical Project Generation

Annual energy production at the Project for the years 1997–2001 is summarized in section III.B.2 (Table III-1) of the ICP. Additional information regarding historical Project generation is provided below.

Annual energy generation during the 15-year period from January 1985 through December 1999 varied between a low of 26,179 megawatt-hours (MWh) and a high of 72,415 MWh. Over that period, Project generation averaged about 48,467 MWh. Table 6 summarizes the monthly historic recorded generation for the Project for each year in the period 1985–1999.

Table 6. Historic Cooper Lake Project Generation (megawatt-hours [MWh]).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1985	5,096	4,703	2,910	2,576	3,927	0	1,014	978	4,814	8,213	7,210	6,555	47,996
1986	5,287	5,655	4,392	3,444	2,387	414	784	463	1,963	6,709	3,326	4,239	39,063
1987	4,404	1,917	6,852	6,782	1,528	8,347	11,576	7,755	3,501	4,916	6,980	7,857	72,415
1988	6,107	5,439	746	0	0	331	9,802	7,635	5,035	6,014	7,512	6,816	55,437
1989	8,388	5,388	3,544	490	207	809	253	1,172	6,850	4,326	6,107	6,367	43,901
1990	6,292	9,370	6,165	8,591	4,583	4,311	1,252	573	3,416	378	951	5,636	51,518
1991	6,062	6,096	2,284	291	0	2,298	1,359	2,052	745	1,883	4,618	4,834	32,522
1992	9,323	3,831	3,127	5,489	3,810	3,240	3,119	1,078	4,434	3,860	2,854	2,954	47,119
1993	1,783	2,887	8,306	6,982	7,689	9,322	10,395	3,794	35	1,870	5,312	4,716	63,091
1994	5,251	3,202	4,670	3,787	7,371	6,655	9,320	6,029	8	10	5,084	6,213	57,600
1995	2,719	4,189	7,461	1,352	2,087	6,209	4,445	4,190	7	4,062	2,550	3,604	42,875
1996	1,948	1,423	2,380	1,558	1,719	4,709	4,216	835	3,491	3,710	2,528	2,306	30,823
1997	2,677	1,350	1,963	2,039	2,258	4,263	4,150	2,382	816	1,368	2,208	705	26,179
1998	2,824	3,587	2,976	3,156	4,159	6,780	1,832	1,955	5,303	6,958	6,300	7,706	53,536
1999	8,628	5,900	4,096	3,826	2,634	4,882	4,966	8,693	5,832	4,358	5,494	3,627	62,936
Average	5,119	4,329	4,125	3,358	2,957	4,171	4,566	3,306	3,083	3,909	4,602	4,942	48,467

Figures 12 through 14 show the average Project generation for each month of the year, January through December, for a typical dry, average and wet year (as defined by total reservoir inflows). It should be noted that there is no strong correlation between the type of water year and the amount of power generation each year. This is because of the way that Chugach utilizes the storage capacity of the reservoir to store and release inflows from year-to-year to meet power demands.

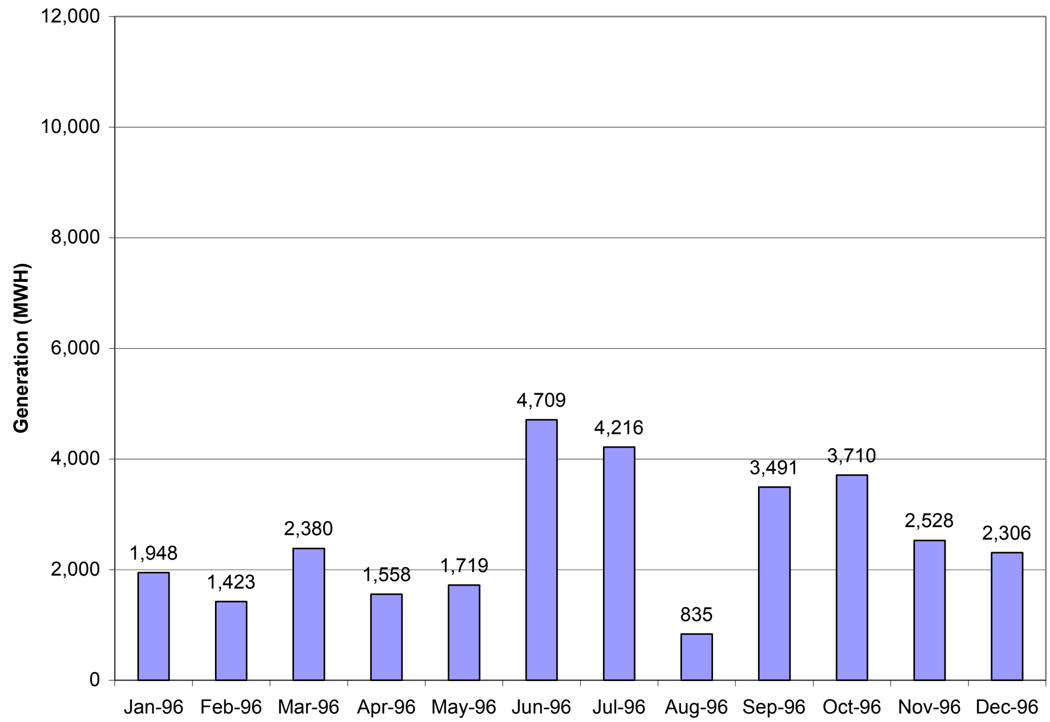

Figure 12. Generation in a Dry Year (1996).

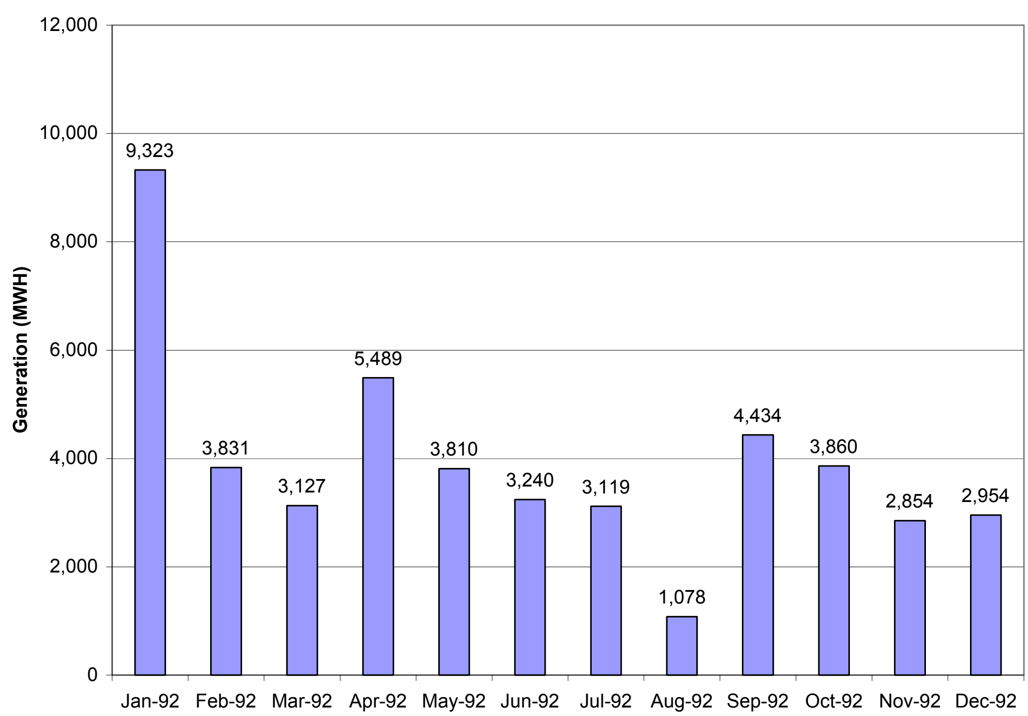

Figure 13. Generation in an Average Year (1992).

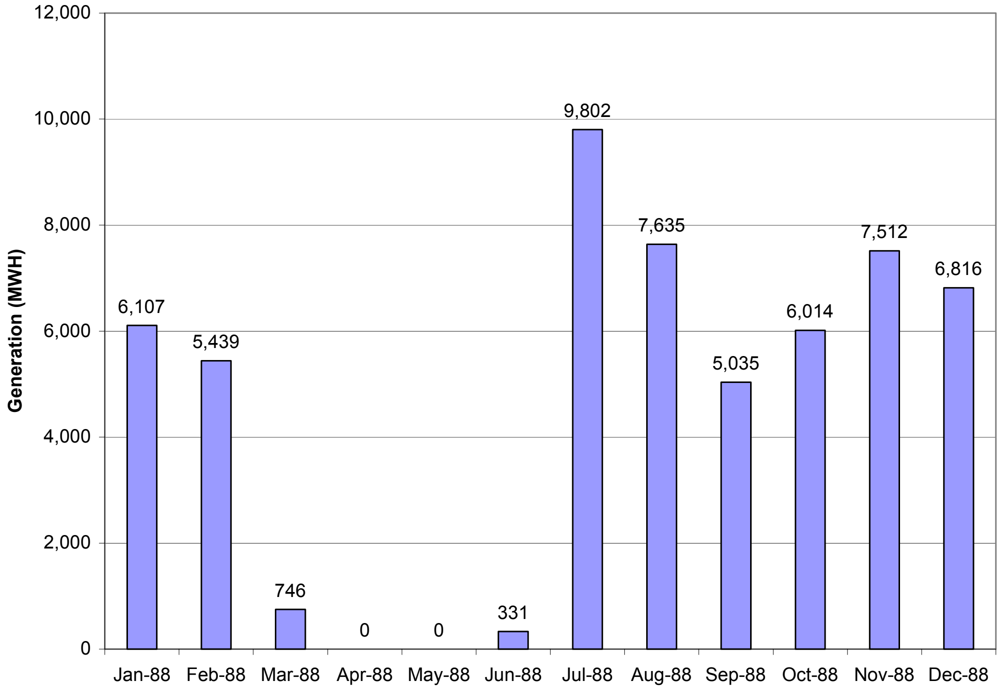

Figure 14. Generation in a Wet Year (1988).

2.2.6 Dispatch of Project Generation

Information on annual energy production and role of the Project generation in Chugach's power supply system are provided in sections III.B.3 and III.C.1, respectively, of the ICP. By way of further explanation regarding Chugach's strategy for operating the Project, in terms of the determining factors for when the Project generates and how generation is dispatched, the following information is offered.

Currently the Project generation is dispatched as a part of the entire Chugach generation system; in other words, the Project is not treated as an independent generator in determining how its generation is dispatched. Chugach's objective in operating the Project is to optimize Chugach's ability to meet load throughout the integrated system, balancing its hydro and thermal energy sources. Within the constraints of the maximum and minimum reservoir operating the levels, Chugach Dispatch operates the Project in the mode most advantageous to the system on any given day or hour. As explained in Section III.C.1 of the ICP, the Project is currently used for peaking purposes and for carrying spin. It can also be used for base load or other system needs as the electrical constraints on the generation and transmission change.

2.2.7 Operations Model to Evaluate Alternative Project Operations

Descriptive information regarding existing operations at the Project is provided in section III of the ICP (Project Operations and Resource Utilization), and supplemented by the information in sections 2.2.5 and 2.2.6, above. However, information regarding potential future operations will need to be developed to support the license application. During the course of the studies to be conducted for relicensing, it will be important for Chugach to have analytical tools that will allow evaluation of potential alternative Project operations to help refine alternatives and to determine the effects on power generation of each alternative under consideration. Chugach is currently in the process of updating and enhancing its existing reservoir operations model, which has been used in the past to calculate powerhouse discharge based on beginning-of-month and end-of-month reservoir levels. The updated operations model will be a mathematical simulation model that will relate inflow to Cooper Lake, power generation, and reservoir stage on a daily basis. The model will also include a module that will allow simulation of potential alternative Project configurations, such as diversion of a portion of Stetson Creek flow to Cooper Lake, a modified reservoir rule curve (associated with potential future dam/spillway modifications), and release of instream flows to Cooper Creek, if warranted.

2.2.8 Penstock Releases to Porcupine Creek

As explained in section II.C.4 of the ICP, the valve system on the Project penstock is used periodically (approximately every five years) to drain the tunnel and penstock for inspection, releasing flow into Porcupine Creek. It was also used to maintain a safe reservoir level while the powerhouse was off line during the 2000–2001 upgrades of the turbine/generator units; on that one occasion, flow was released at a rapid enough rate to cause localized erosion. Maximum possible flow through the valve system without causing erosion of the piping is estimated to be approximately 60 cfs (DE&S 2000). During normal use, however, the valves are adjusted to prevent the discharge into Porcupine Creek from reaching levels that would cause erosion of the piping, streambed, or road crossing. Under this regulated flow release protocol, the tunnel/penstock can be drained in about 12 hours, although the flow is typically released over a 48-hour period instead. If water is released over a 24-hour period, 1.17 cfs would be added to the normal flow of Porcupine Creek. Longer discharge periods would result in even lower flows. Chugach intends that discharge quantities during dewatering will continue to be quite small in future maintenance periods expected to occur during the next license term.

2.2.9 Permitting and Mitigation Records

The ICP did not provide a summary of permitting and mitigation activity for the Project since its inception. Such a compilation is not a relicensing requirement; however, Chugach maintains records for the Project dating back to original construction, and these records are available for public review in Chugach's public information library.

3 WATER USE AND QUALITY

The information below supplements section IV.C of the ICP (Water Use and Quality).

3.1 Chugach's Measures to Minimize Risk of Release of Contaminants

Chugach has established measures that minimize the risk of release of contaminants to the environment. For example, Chugach has completed a significant effort to ensure that future potential risk specifically from polychlorinated biphenyls (PCB) contamination has been minimized (see Chugach's April 1, 2002, Final Report for the Sediment Fish and Food Web

Sampling Project at the Cooper Lake Hydroelectric Project). As part of the PCB remediation which Chugach performed at the Project during the initial phase of the turbine overhaul and upgrade project at the powerhouse, Chugach, pursuant to a plan prepared in consultation with EPA and approved by FERC, removed PCB paint, grease and caulk containing PCBs in the powerhouse. It also completed an investigation of the PCBs in the vicinity of the powerhouse. Specifically, Chugach: removed and disposed of turbine grease and capacitors containing PCBs; removed and replaced windows sealed with PCB-laden caulking; removed PCB-laden paint from the metal turbine equipment, cabinets and switchgear; and removed and disposed of PCB-laden paint from the floor and up to a height of 8 feet on the walls. The original main Project transformer was sold to Chugach as a non-PCB transformer. The transformer fluid was sampled and analyzed three times for PCBs and PCBs were not detected in the transformer fluid before it was removed from service. The present Project transformer is also a non-PCB transformer.

Further, all drains at the powerhouse pass through the oil/water separator for removal of oil and sludge before being discharged through the tailrace into Kenai Lake. The water that is discharged into Kenai Lake through the oil/water separator is essentially water from Cooper Lake that has leaked from around a gasket in the turbines; this water is collected in a sump and passed through the oil/water separator (activated charcoal filter) to remove any contaminants. The volume of water discharged into Kenai Lake via the oil/water separator is relatively small (<< 500 gallons/day). In conjunction with the Alaska Department of Environmental Conservation (ADEC), Chugach conducted four quarters of low-level monitoring for PCBs in its effluent from the powerhouse. All results from this testing indicated the samples were non-detect for PCBs at a detection level of 0.000104 mg/L (see April 24, 2002, letter from Chugach to ADEC).

Chugach maintains a discharge contingency plan that contains an Spill Prevention, Control, and Countermeasure Plan (SPCCP), and Resource Conservation and Recovery Act (RCRA) Contingency Plan for potential discharges from the Project. The SPCCP pertains to all facilities and activities associated with the Project. State regulations require the SPCCP to be updated every five years. The next update to the SPCCP for the Project is currently underway and is expected to be completed by the end of December 2002.

REFERENCES

Chugach Electric Association, Inc. (Chugach). 2002. Final Report for the Sediment, Fish and Food Web Sampling Project at the Cooper Lake Hydroelectric Project, FERC Project No. 2170. April 1, 2002.

Chugach. 2002. Letter report to Tom Chapple, Director, Sate of Alaska Division of Air and Water Quality, Alaska Department of Environmental Conservation. April 24, 2002.