

**PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY**

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February 28, 2018

**VIA ELECTRONIC MAILING**

Ms. Kimberly D. Bose, Secretary  
FEDERAL ENERGY REGULATORY COMMISSION  
888 First Street, NE  
Washington, DC 20426

Re: **Lake Chelan Hydroelectric Project No. 637**  
**License Article 405b – 2017 Annual lake Level Report**

Dear Secretary Bose:

The Federal Energy Regulatory Commission (Commission) issued the “Order Modifying and Approving Operations Compliance and Monitoring Plan (Plan), Article 405” on November 30, 2007. The Plan satisfied the License Article 405 requirement of the “Order on Offer of Settlement and Issuing New License”<sup>1</sup> (License) and “Order on Rehearing”<sup>2</sup> for the Lake Chelan Hydroelectric Project (Project) on November 6, 2006, and April 19, 2007, respectively.

Under Ordering Paragraph (C) modifying the Plan under Article 405, Chelan PUD is required to file the following report with the Commission.

(C) The licensee shall file annually with the Commission by February 28, beginning in 2009, their Annual Lake Level Report. The licensee shall allow the resource agencies, Tribes and non-governmental organizations specified under Article 405, 30 days to provide comments and/or recommendations on their report before filing with the Commission. The filing shall include comments and/or recommendations from the consulted entities and the licensee’s response to any comments. If the licensee does not adopt a recommendation, the report shall include the licensee’s reasons, based on project-specific information. Based on review of the report, the Commission reserves the right to require changes to the project to ensure compliance with the license.

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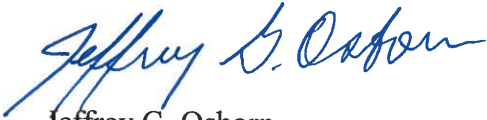
<sup>1</sup> 117 FERC ¶ 62,129.

<sup>2</sup> 119 FERC ¶ 61,055.

In accordance with the above Order requirement, Chelan PUD hereby files the 2017 Annual Lake Level Report. This report compares monthly actual and minimum (target) lake levels; and runoff volume forecasts and other factors influencing achievement of targeted lake levels. A final draft of this report was provided to the resource agencies, Tribes and non-governmental organizations required in the license for 30-day review (see report Section 6).

Please do not hesitate to contact me regarding any questions or comments regarding this report.

Sincerely,



Jeffrey G. Osborn  
License Compliance Supervisor  
Public Utility district no. 1 of Chelan County  
[jeff.osborn@chelanpud.org](mailto:jeff.osborn@chelanpud.org)  
(509) 661-4176

Enclosure: Lake Chelan 2017 Annual lake Level Report

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# **LAKE CHELAN ANNUAL LAKE LEVEL REPORT 2017**

**LICENSE ARTICLE 405**

**Draft**

**LAKE CHELAN HYDROELECTRIC PROJECT  
FERC Project No. 637**

**February 28, 2018**



**Public Utility District No. 1 of Chelan County  
Wenatchee, Washington**

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## ***SECTION 1: EXECUTIVE SUMMARY***

The Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) received a new license (License)<sup>1</sup> from the Federal Energy Regulatory Commission (FERC) on November 6, 2006, authorizing Chelan PUD to operate the Lake Chelan Project (Project) for a period of 50 years. License Article 405 requires Chelan PUD to file annually with FERC a report comparing monthly actual and target lake levels, runoff volume forecasts, and other factors influencing achievement of target lake levels.

Lake levels were successfully managed to meet the license objectives and lake elevation targets. During the 2016-2017 Operating Cycle, lake levels were near or above target minimum lake levels that are required under the project license. Lake levels were managed using spill as defined in the Lake Chelan Operations Management Plan.

During 2017, Chelan PUD managed lake levels as runoff volume forecasts evolved through winter and spring. Runoff volume forecasts for the April 1 to July 31 time period were for 89% of average runoff volume on February 1 and 106% of average runoff volume on April 1. Actual runoff volume for the April 1 to July 31 time period was just over 131% of average.

In late May, regional April through July runoff volume forecasts for the Lake Chelan basin increased dramatically, some to greater than 140% of average. High inflow forecasts were threatening to result in the lake elevation going above the license limit.

One of the priority operating objectives is to reduce high flows in the Chelan River (below 6,000 cfs)<sup>2</sup> to protect fish habitat. Spill for headwater control resulted in a peak hourly flow of 7,810 cfs in the Chelan River on May 30 and a maximum daily average flow of 7,465 cfs on May 29. Lake level management provided adequate flood control and resulted in meeting minimum required flows in the Chelan River, both priority operating objectives.

Table 1 below provides monthly actual and lake level targets May through October 2017. Chelan PUD manages lake levels following an annual draft and refill cycle, generally beginning in August, which starts water releases from Lake Chelan to meet operating objectives and for power generation from September through March, then refills Lake Chelan from April through July.

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<sup>1</sup> Federal Energy Regulatory Commission Order on Offer of Settlement and Issuing New License and Order on Rehearing for the Lake Chelan Hydroelectric Project No. 637 were issued November 6, 2006, and April 19, 2007, respectively, to the Public Utility District No. 1 of Chelan County.

<sup>2</sup> Section 3.1 of Chapter 8, Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.

**Table 1: Comparison of Actual and Target Lake Levels**

<b>Date</b>	<b>License Target Lake Level (feet)</b>	<b>2017 Actual Lake Level (end of day)* (feet)</b>	<b>Difference between Actual and Target Lake Level (feet)</b>
May 1, 2017	1,087.6	1,087.9	0.3
June 1, 2017	1,094.0	1,096.9	2.9
July 1, 2017	1,098.0	1,099.4	1.4
August 1, 2017	1,099.0	1,099.6	0.6
September 7, 2017	1,098.7	1,099.0	0.3
October 1, 2017	1,097.2	1097.4	0.2

\* USGS Gage #12452000 Lake Chelan at Chelan

## ***SECTION 2: INTRODUCTION***

Chelan PUD received a new license (License)<sup>3</sup> from the FERC on November 6, 2006, authorizing Chelan PUD to operate the Lake Chelan Project for a period of 50 years. The License sets a minimum lake level of 1,079 feet and a maximum lake level at 1,100 feet. Chelan PUD manages lake levels within the minimum and maximum elevations according to license operating objectives and for power generation.

License operating objectives include monthly minimum (target) lake levels for May 1 through October 1, intended to balance the needs of recreation, erosion, and fish protection. As described in Chapter 8 of the Comprehensive Plan monthly minimum (target) lake elevations are managed with the following objectives in mind:

- Maintaining minimum flows in the Chelan River (this objective has priority over lake levels);
- Reducing high flows in the Chelan River (this objective has priority over lake levels);
- Satisfying regulatory requirements for flood control (adjusting lake level);
- Providing usable lake levels for recreation (which varies between elevation 1,090 feet and 1,098 feet, depending on the slope of the shoreline and boat dock configurations);
- Reduce shoreline erosion;
- Preventing fish passage blockages (due to tributary barriers); and
- Minimizing the effect of refill on attainment of flow objectives for salmon in the mainstem Columbia River.

Chelan PUD monitors snowpack in the Lake Chelan runoff basin and predicts snowmelt runoff volume from December through August. Chelan PUD manages power generation and spill to reach lake level targets by using runoff volume and precipitation forecasts, past experience with runoff timing and actual lake levels.

License Article 405 requires Chelan PUD to file annually with FERC a report comparing monthly actual and target lake levels, runoff volume forecasts and other factors influencing achievement of lake level targets. This Lake Level Report documents decisions and other information regarding achievement of monthly target lake levels beginning May 2017 through October 2017.

Chelan PUD is using a hydropower system simulation model (CHEOPS) developed specifically to assist with lake level management decisions. The CHEOPS computer model uses historical information, a target curve, and operational constraints to provide a predictive tool for making operational decisions. Historical information includes a data set of Lake Chelan hydrologic variables which now dates back to 1929. A target curve is a collection of elevations with corresponding dates which are used to guide the computer model and subsequent operating decisions. Operational constraints include minimum and maximum generation limits and spill requirements or limitations. The use of a target curve, in conjunction with professional experience and actual hydrologic behavior of the lake environment, provides the best available

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<sup>3</sup> Federal Energy Regulatory Commission Order on Offer of Settlement and Issuing New License and Order on Rehearing for the Lake Chelan Hydroelectric Project No. 637 were issued November 6, 2006, and April 19, 2007, respectively, to the Public Utility District No. 1 of Chelan County.

basis for balancing license objectives and the likelihood of being within reasonable predictive probability of meeting monthly lake level targets.<sup>4</sup> In some years, late runoff may affect the ability to meet lake level targets, and, therefore, lake level targets would be met as soon as practicable.

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<sup>4</sup> Section 3.1 of Chapter 8, Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.



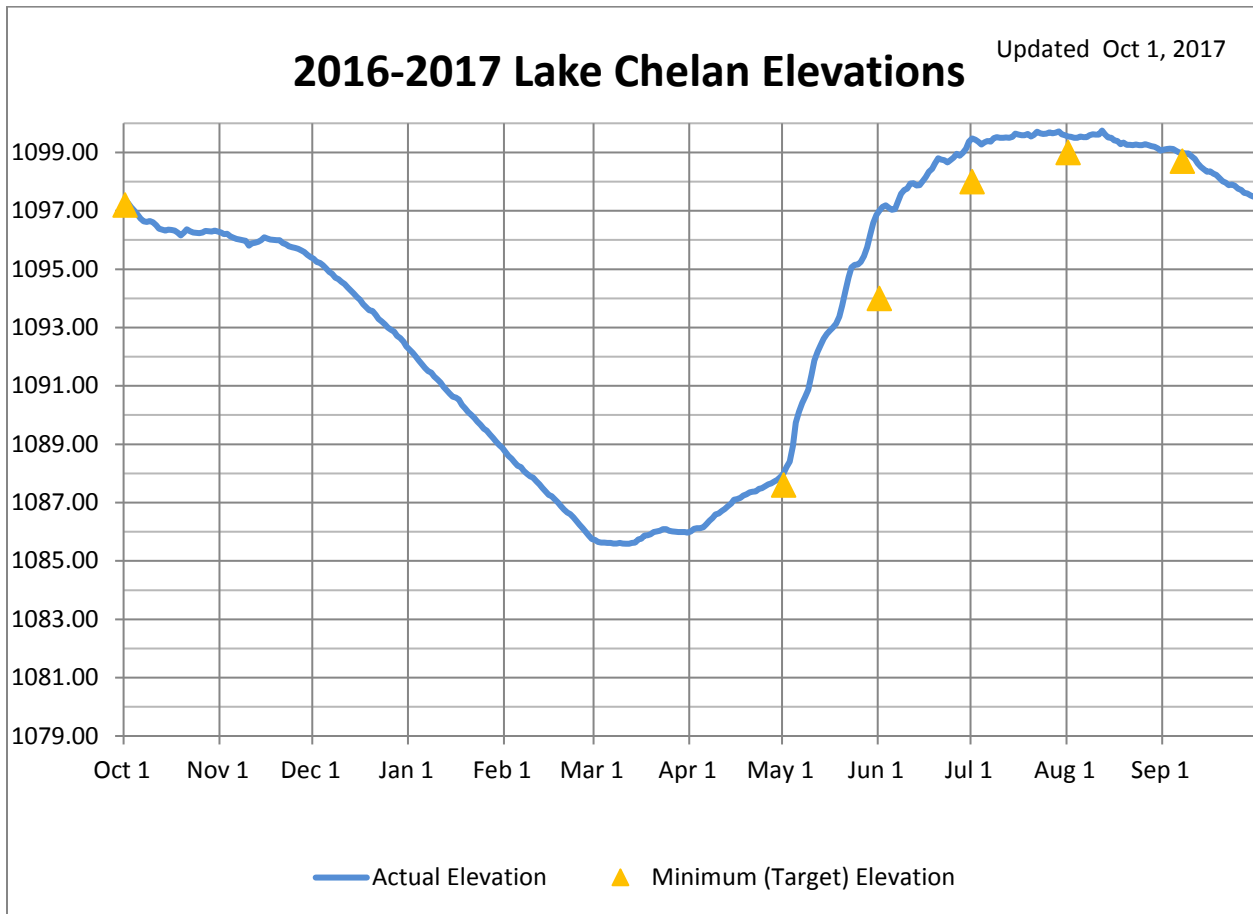
### **SECTION 3: COMPARISON OF ACTUAL AND TARGET LAKE LEVELS**

Table 2 below provides monthly actual and target lake levels from May through October 2017. Lake levels are recorded at the end of the day, 2400 hours. Chelan PUD manages lake levels following an annual draft and refill cycle, generally beginning in August, which starts water releases from Lake Chelan to meet operating objectives, lake level targets, and for power generation from September through March, then refills Lake Chelan from April through July (Figure 1). Lake levels were managed successfully using generation and spill as defined in Chapter 8 of the Lake Chelan Comprehensive Plan.

**Table 2: Comparison of Actual and Target Lake Levels**

<b>Date</b>	<b>License Target Lake Level (feet)</b>	<b>2017 Actual Lake Level (end of day)* (feet)</b>	<b>Difference between Actual and Target Lake Level (feet)</b>
May 1, 2017	1,087.6	1,087.9	0.3
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August 1, 2017	1,099.0	1,099.6	0.6
September 7, 2017	1,098.7	1,099.0	0.3
October 1, 2017	1,097.2	1,097.4	0.2

\* USGS Gage #12452000 Lake Chelan at Chelan



**Figure 1. 2016-2017 Lake Chelan Elevations**

## **SECTION 4: ACTUAL AND FORECASTED RUNOFF**

April 1 through July 31, 2017, runoff volume forecasts for the Chelan Basin were produced on February 1 and April 1 of 2017. The runoff volume forecast on February 1 of 89% was below average and the runoff volume forecast on April 1 increased considerably to 106% of average. No March 1 forecast was done as no snow survey was performed due to inclement weather. Runoff volume forecasts and lake level are summarized below in Table 3.

**Table 3: Runoff Volume Forecasts for April 1 – July 31, 2017**

Date	Forecasted Percent of Average Runoff	Forecasted Runoff Volume (SFD)
February 1	89%	467,339
March 1	NA	NA
April 1	106%	556,606

Actual runoff volume for April 1 through July 31 was just over 131% of average, producing 688,763 second-foot-days (SFD)<sup>5</sup> of water.

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<sup>5</sup> The volume of water represented by a flow of 1 cubic foot per second for 24 hours.

## **SECTION 5: DECISIONS RELATED TO LAKE LEVEL**

Chelan PUD manages Lake Chelan lake levels with the intent of meeting lake level management practices and objectives described in Chapter 8 of the Comprehensive Plan (including target lake levels to the extent consistent with the objectives), and providing efficient operation of Chelan PUD generating resources. All actual monthly minimum (target) elevations May through October were within the expected ranges required under the project license. Details are provided later in this section.

Operations during the fall of 2016 are summarized in this paragraph, as these operations set up operations for 2017. Beginning September 26, 2016, generation through December 2016 was scheduled at near maximum to draft the lake to create room for spring runoff, to provide flood control, and to generate electricity. Due to very heavy October rains, lake levels were higher than the forecasted annual operating range, so rather than keep spill at minimum requirements and begin a pumping operation to provide spawning flows for Chinook salmon in the fall, the spill was maintained at required spawning flow level through November. Snowpack accumulation by the end of December 2016 was just a little below average. Cumulative inflows from the start of the water year (October 1) were considerably greater than average. While near-term inflow projections were substantially greater than average, inflows were projected to drop below average in later winter. Considering actuals to date and forecasts, there was the expectation of having plenty of water to meet tailrace security flows for Chinook salmon later in the winter.

**Table 4: Lake Chelan Basin Percent of Average Precipitation for fall/winter 2016/2017**

	October 2016	November 2016	December 2016	January 2017	February 2017	March 2017
% of 86-yr Average	316%	109%	104%	62%	193%	255%

The lake level on January 1, 2017 was 1,092.2 feet. Generation continued to be scheduled at near maximum month average capacity during January and February in order to continue to draft the lake, while retaining enough water to maintain tailrace security flows through March. Generation was reduced for most of March and much of April to operate to the target curve. Accumulated inflows remained higher than average.

The lake reached a just slightly higher than average, but earlier than average, low point of 1,085.59 feet on Mar 12, 2017. The April through July runoff forecast on April 1 was at 106% of average.

With the exception of a 4 ½ day outage of unit A1 for mechanical issues at the beginning of May, generation was at full capability from April 20 through June 10. At the start of this time period, lake levels were right at the target curve. Inflows began increasing substantially in mid-May and remained above turbine capability until late July. On May 22, 2017, spill was increased for headwater control and continued nonstop through July 17 to manage the refill rate of Lake Chelan and meet license objectives and lake level targets. Light load hour generation was curtailed for portions of June due to negative power prices once spill was reduced below 6,000

cfs. In late May, regional April through July runoff volume forecasts for the Lake Chelan basin increased dramatically, some to greater than 140% of average. The actual runoff volume ended up at slightly higher than 131% of average. High inflow forecasts were threatening to result in the lake elevation going above the license limit. Refill timing was early, with over 85% of the April 1 to July 31 runoff occurring by July 1 (80% is considered average).

One of the priority operating objectives is to reduce high flows in the Chelan River (below 6,000 cfs)<sup>6</sup> to protect fish habitat. Spill for headwater control resulted in a peak hourly flow of 7,810 cfs in the Chelan River on May 30 and a maximum daily average flow of 7,465 cfs on May 29. Lake level management did provide adequate flood control and resulted in meeting minimum required flows in the Chelan River, both priority operating objectives.

Initially, the runoff year was thought to be an average year (80% to 118% water year is considered average), so spill was increased to 200 cfs by May 15. During spill for headwater control, the forecast changed to a wet year (>118% water year is considered wet). When not spilling for headwater control after that, spill remained at approximately 320 cfs through July 15, to meet fish flow objectives in Reach 4 of the Chelan River. Increase in spill above 80 cfs is required in average or wet runoff years between May 15 and July 15.

Once inflows dropped below turbine capacity for the season in late July, light load generation and then heavy load generation was reduced. On August 1, the lake elevation was above the target elevation of 1,099.0 at 1,099.6. A maximum end-of-hour lake level of 1,099.75 feet was achieved on August 13, and a maximum daily average lake level of 1,099.68 feet was achieved on August 14.

The lake was gradually drafted through August and early September, and reached the September 7 minimum lake level target of 1,098.7 feet on September 13. The lake continued to be gradually drafted to just above the October 1 minimum lake level target of 1,097.2 feet on that date. Beginning on October 1<sup>st</sup>, generation was increased to full capacity to continue drafting the lake. Generation stayed at full capacity throughout October for all but three days due to a single unit outage. On October 15, pumping operations began to provide flows for Chinook salmon spawning in the Reach 4 Habitat Channel of the Chelan River. Near record high inflows occurred over Thanksgiving weekend, but the high inflows quickly returned to near average inflows, so spill was not needed. In December 2017, full generation sustained to continue drafting the lake. These fall actions were taken to create room for additional fall/winter rains and snow runoff in the spring as well as meet fish, flood control, tributary mouth obstruction, and erosion reduction control goals, and to generate electricity.

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<sup>6</sup> Section 3.1 of Chapter 8, Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.

## **SECTION 6: CONSULTATION**

As required in Article 405 (c), Chelan PUD distributed a draft of this report to the following resource agencies, Tribes and non-governmental organizations for review and comment. Chelan PUD received no comments on the draft report.

<b>Agency</b>	<b>Contact</b>
Washington Department of Ecology	David Bowen, Mark Peterschmidt, Breean Zimmerman
NOAA National Marine Fisheries Service	Justin Yeager
U.S. Geological Survey (USGS)	Nick Elwell
U.S. National Park Service	Annelise Lesmeister, Ashley Rawhouser, Hugh Anthony
U.S. Forest Service	Kari Grover-Wier, Paul Willard, Ana Cerro-Timpone
U.S. Fish and Wildlife Service	Steve Lewis
Washington State Parks and Recreation Commission	Ryan Layton
Washington State Recreation and Conservation Office	Karen Edwards
Confederated Tribes of the Colville Reservation	Bill Towey
The Yakama Nation	Bob Rose
The Confederated Tribes of the Umatilla Indian Reservation	Carl Merkle
City of Chelan	Mike Cooney, Mike Jackson
Citizen, Senior Fisheries Biologist	Phil Archibald
Manson Parks and Recreation Department	Robin Pittman
Lake Chelan Recreation Association	Richard Uhlhorn, Jim Urness
American Whitewater	Tom O'Keefe
Washington Department of Fish and Wildlife	Graham Simon, Travis Maitland