Seven Mile Dam on the Pend d'Oreille River near Trail, B.C.

Columbia River Operations Summary

Spring 2019

This publication provides an overview of BC Hydro's operations on the Columbia River. At 2,000 kilometres long, the Columbia River is the fourth largest river in North America. The headwaters of the Columbia River are in Canal Flats, British Columbia (B.C.). The river then flows northwest through the Rocky Mountain trench trench before heading south through through B.C. and Washington, emptying into the Pacific Ocean at Astoria, Oregon. Other major tributaries of the Columbia River in Canada include the Kootenay and Pend D'Oreille rivers.

Only 15% of the Columbia River basin lies in Canada. The Canadian portion of the basin is mountainous and receives a lot of snow producing, on average, 30 to 35% of the runoff for Canada and the United States (U.S.) combined. The river's large annual discharge and relatively steep gradient gives it tremendous potential for the generation of electricity. The hydroelectric dams on the Columbia's main stem and many more on its tributaries produce more hydroelectric power than on any other North American river.

BC Hydro's facilities in the Columbia basin include 11 hydroelectric dams, two water storage dams, and a system of reservoirs. Four of the larger reservoirs within Canada are operated according to the Columbia River Treaty and other agreements signed between Canada and the U.S.

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BC Hydro's operating agreements

COLUMBIA RIVER TREATY

The Columbia River Treaty between Canada and the U.S. was ratified in 1964. The Treaty resulted in the construction of three dams in B.C. (the Duncan, Hugh L. Keenleyside and Mica dams) for flood control and to increase hydroelectric generating potential in both countries. The Treaty also provided for the construction of Libby Dam in the U.S. and the resulting Koocanusa Reservoir, which crosses the Canada–U.S. border.

Water stored and then released by the Canadian reservoirs provides the U.S. with the potential to generate additional electricity, as well as to increase flood protection. Under the terms of the Treaty, Canada receives a one–half share of the extra power generation potential in the U.S. This is called the Canadian Entitlement to Downstream Benefits and is owned by the Province of British Columbia.

The Canadian Entitlement varies from year to year, but is currently about 4,161 gigawatt hours (GWh) per year of energy and 1,304 megawatts (MW) of capacity for the period between August 1, 2017 and July 31, 2018. Since September 16, 2014 both Canada and the U.S. have had the option to terminate the Treaty, provided that either country provides 10 years' notice of its intent to terminate.

After extensive consultation with basin residents, the Province decided in March 2014 to continue with the Columbia River Treaty and seek improvements within the existing Treaty framework. More information on the Treaty and its review process can be found at: **engage.gov.bc.ca/columbiarivertreaty**

Other agreements

The Treaty Entities, BC Hydro, Bonneville Power Administration (BPA), and the U.S. Army Corps of Engineers, periodically negotiate and sign supplemental operating agreements when there is mutual benefit to modify the water releases specified by the Columbia River Treaty.

In September 2013, the Treaty Entities signed a short–term agreement to address some of Canada's concerns about the timing of water releases from the Libby Dam, known as the VarQ operating regime. This agreement was extended to be in effect until August 2019 and is supplemental to the Libby Coordination Agreement that was signed in 2000. Under the new agreement, the U.S. has committed to continued coordination with Canada to consider alternative reservoir operations to reduce flood risk in both countries, similar to the extensive collaboration that occurred during the 2012 and 2017 high water events. In addition, BC Hydro is compensated for energy losses at its Kootenay Canal operations that result from the timing of water releases from the Libby Dam. The Entities have also agreed to continue working together to reach a long–term agreement.

In late 2018, the joint Canada–United States Treaty Operating Committee responsible for the implementation of the Flood Control Operating Plan signed the 2019 Non–Power Uses Agreement. This annual operating agreement modifies Arrow Lakes Reservoir releases between January and July 2019 to protect Canadian whitefish in exchange for flow benefits for endangered U.S. salmon.

NON–TREATY STORAGE AGREEMENT (NTSA)

The Kinbasket Reservoir, created by Mica Dam, is licensed by the Province for more water storage than is required to meet the terms of the Columbia River Treaty. This additional storage is called Non–Treaty Storage and the water can only be released across the Canada–U.S. border under agreement between BC Hydro and its U.S. partners. The current Non–Treaty Storage Agreement (NTSA) was signed by BC Hydro and BPA in 2012 and remains in effect until 2024.

The new NTSA gives BC Hydro more control over reservoir levels, provides more energy benefits to B.C. and gives BC Hydro more operating flexibility to balance competing non–power interests on the Columbia system. These interests include recreational activities, wildlife habitat, and fisheries. Since the agreement was signed, BC Hydro and BPA have made good use of NTSA flexibility to reduce the impacts of high and low water levels downstream of Arrow Lakes Reservoir and to improve power and non–power benefits for both countries.

Osprey feed on fish and are often seen along our Columbia reservoirs

BC Hydro Columbia operations

Much of the region's summer and winter generating potential depends on precipitation and snowpack levels. Due to below normal precipitation since the fall of 2018, the runoff for the Columbia basin (Canada and U.S. combined) between April and September 2019 is currently forecast to be 95% of normal. The Canadian portion of the Columbia basin is generally drier than the U.S. portion and the forecast runoff is between 81 to 92% of normal. Many types of future variables affect the ability to predict with certainty a long term forecast including: weather, runoff volumes and patterns, system electricity demands, and Treaty discharge requirements.

Low water runoff means less water in our reservoirs

Lower than normal snowpack and dry weather means less water flowing through our streams and rivers and into our lakes and reservoirs. When the entire Columbia River basin is dry, water levels in our reservoirs become even lower because of the 'proportional draft' provision of the Columbia River Treaty. This provision requires Canada to release additional water over the United States border for power production during below average water conditions. The opposite happens during wet conditions where Canada is obligated to store additional water in our reservoirs for downstream flood control.

KINBASKET RESERVOIR

Kinbasket Reservoir regulates discharges for both the Mica and Revelstoke Generating Stations, as well as for generating stations further downstream.

Kinbasket Reservoir did not fully refill to its normal full pool level in 2018 due to a compressed freshet period and very dry summer conditions. It reached a peak water level of 752.2 metres (2,451.6 feet) on August 17, 2018. This level was 7.13 metres (23.4 feet) below normal full pool. The winter of 2018/19 started relatively mild but quickly became very cold and dry in February and early March. Electricity demand was very high during this period and the reservoir water level dropped significantly in February. The Kinbasket Reservoir reached its minimum level of 714.82 meters (2,345.2 feet) on April 14, 2019. This is about 4.5 metres lower than last year's minimum level on April 23, 2018 of 719.2 metres (2,359.7 feet).

The dry fall and winter resulted in very low snow accumulation. Snowpack for the Kinbasket basin is well below 2018 levels and inflows for March to September 2019 are currently forecast to be 92% of average. Although the reservoir is expected to start refilling in late April, the reservoir is not expected to fully refill this year. The maximum water level is forecast to be between 743.7 and 749.8 metres (2,440 to 2,460 feet) in September 2019.

Under the Water Sustainability Act and the Utilities Commission Act, the Comptroller of Water Rights is responsible for the regulation of BC Hydro's water licenses. The licensed operating range for Kinbasket Reservoir is between 706.96 metres (2,319.42 feet) and 754.4 metres (2,475 feet). Kinbasket Reservoir can be operated at up to two feet above its normal maximum water level, if approved by the Comptroller of Water Rights. Kinbasket Reservoir provides 7 million acre feet (MAF) of Treaty Storage and 5 MAF of Non–Treaty Storage, for a total storage of 12 MAF.

Fishing on Revelstoke Reservoir above Revelstoke Dam

Revelstoke Generating Station

REVELSTOKE RESERVOIR

Revelstoke Reservoir was created by the Revelstoke Dam. Revelstoke Reservoir levels may fluctuate in response to weather patterns, inflow levels and generation requirements. During the spring freshet and winter peak electricity load periods, it is common to have daily fluctuations of the reservoir within 1.5 metres (5 feet) of full pool. The reservoir may be periodically lowered below its normal minimum level of 571.5 metres (1,875 feet) to meet increasing system needs for short term generating capacity or may fill to near full pool during periods of high reservoir inflows.

The licensed operating range for Revelstoke Reservoir is between 554.7 metres (1,820 feet) and 573 metres (1,880 feet). At most times, the reservoir is maintained at or above 571.5 metres (1,875 feet).

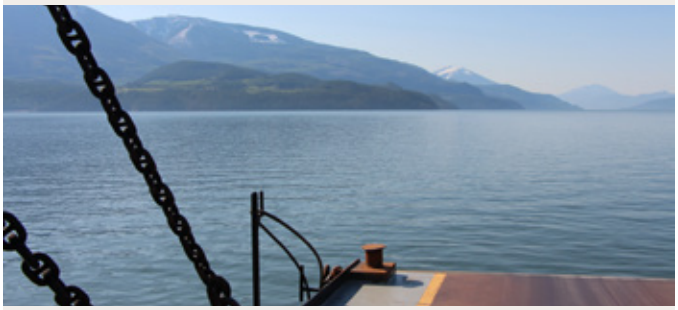
Early spring on Arrow Lakes Reservoir near Revelstoke

ARROW LAKES RESERVOIR

Arrow Lakes Reservoir was created by the Hugh L. Keenleyside Dam. The 2018 freshet was unusually brief with many river systems seeing higher–than–normal peak flows in May and then below normal flows for the balance of the operating year. For this reason, water releases from Arrow Lakes Reservoir were relatively high during the summer and fall to meet the proportional draft provisions of the Columbia River Treaty. However, summer water levels through Labour Day remained within preferred recreational levels because Arrow Lakes Reservoir had refilled close to its normal full pool level in early summer, reaching 439.58 metres (1,442.7 feet), on July 13, 2018. As inflows improved in October and November 2018, the system came off proportional draft and Arrow Lakes Reservoir followed a typical draft across the winter to reach a minimum level of 429.25 metres (1,408.3 feet) on February 2, 2019. This was similar to last year's minimum level reached on March 28, 2018 of 429.16 metres (1,408 feet).

The snowpack in the Arrow Lakes Reservoir basin is lower than Kinbasket and well below 2018 levels. The inflows into Arrow Lakes Reservoir for the period from February to September 2019 are forecast to be 85% of average. Based on this forecast, the reservoir is expected to refill to its maximum permissible level for Treaty flood risk management of 432.8 metres (1,420 feet) by the end of April 2019. However the low inflow forecast along with the potential early release of U.S. fish flows this spring will reduce reservoir refill this year. Arrow Lakes Reservoir is forecast to reach a maximum level between 435.9 and 438.9 metres (1,430 and 1,440 feet) in early July 2019.

The normal licensed operating range for Arrow Lakes Reservoir is between 419.9 metres (1,377.9 feet) and 440.1 metres (1,444 feet). The reservoir can be operated up to two feet above its normal maximum level (to 440.7 metres or 1,446 feet), if approved by the Comptroller of Water Rights. Arrow Lakes Reservoir provides 7.1 MAF of Treaty Storage.



Arrow Lakes Reservoir from Shelter Bay–Galena Bay ferry

DUNCAN RESERVOIR

Duncan Dam's operations help meet Treaty flood control requirements, minimize flood risk on Kootenay Lake and provide minimum fish flows year round, as required by the Water Use Plan. In 2018, the Duncan Reservoir refilled very close to its normal full pool level, reaching a maximum level of 576.6 metres (1,891.7 feet) on August 1, 2018. This water level was 0.1 metres (0.3 feet) below full pool. The reservoir then drafted to about 575.46 metres (1,888 feet) on August 31, 2018 and stayed at this level until Labour Day.

From September through late December 2018, Duncan Reservoir was operated to provide the flows necessary for kokanee and whitefish spawning downstream of the dam. Discharges were later increased to facilitate drafting the reservoir for Treaty flood control requirements during the winter period.

For flood risk management downstream of the Duncan Dam at Meadow Creek and on Kootenay Lake, Duncan Reservoir is normally drafted to its licenced minimum level of 546.9 metres (1,794.2 feet) each year by April or before the start of the freshet.

Snowpack in the Kootenay region is also below average. The inflows into Duncan Reservoir for the period from February to September 2019 are forecast to be 88% of average. Based on the current inflow forecast, Duncan Reservoir is expected to refill close to full pool levels by August 2019.

The normal operating range for Duncan Reservoir is between 546.9 metres (1,794.2 feet) and 576.7 metres (1,892 feet). The reservoir can be operated up to 1.2 feet above its normal maximum level of 577 metres (1,893.2 feet), if approved by the Comptroller of Water Rights. Duncan Reservoir provides 1.4 MAF of Treaty Storage.

COLUMBIA RIVER FLOWS

Columbia River flows downstream of the Kootenay River confluence at Castlegar are the result of flow regulation at Hugh L. Keenleyside and other dams on the main stem Columbia, as well as dams on the Kootenay River system. Actual discharges depend on many factors including upstream runoff, storage operations and Treaty discharge requirements.

In 2018, there were no flood concerns on the Columbia River downstream of Hugh L. Keenleyside Dam. Columbia River flows are measured at the Birchbank flow measuring station downstream of the Kootenay River confluence between Castlegar and Trail. River flows peaked at about 4,332 cubic metres per second (m^3/s) or 153,000 cubic feet per second (cfs) on May 27, 2018. This flow was well below the peak regulated flow experienced in 2012 of 6,090 m^3/s (215,000 cfs), and the peak pre-dam flow of 10,590 m^3/s (374,000 cfs) in 1961.

The 2019 inflows into the reservoirs and peak Birchbank Columbia River flows are forecast to be lower than 2018 although actual flows will depend on the timing and volume ("shape") of runoff. BC Hydro's water licence has no minimum discharge requirements for the Columbia River downstream of Hugh L. Keenleyside Dam, but under the Treaty there is an obligation to reduce to a minimum weekly average flow of 5,000 cfs under certain water conditions.

Paddling the Columbia River

Bullrushes

KOOCANUSA (LIBBY) RESERVOIR

The Koocanusa Reservoir on the Kootenay River is controlled by Libby Dam in Libby, Montana and operated by the U.S. Army Corps of Engineers. The reservoir backs into Canada and provides approximately 5 MAF of storage.

On July 23, 2018 Koocanusa Reservoir reached a maximum level of 746.17 metres (2,448.06 feet), which is 3.33 metres (10.9 feet) below its full pool of 749.5 metres (2,459 feet). Koocanusa Reservoir continues to be operated under VarQ procedures for U.S. fisheries' interests and flood control.

The latest Libby Operating Plan provides for release of:

- flows as needed during March and April to not exceed month–end Flood Risk Management targets;
- at least the minimum flows in May and June necessary to meet the flow rates and sturgeon volume objectives in the U.S. Fish & Wildlife Service Biological Opinion (BiOp) for sturgeon spawning and recruitment;
- minimum bull trout flows as outlined in the BiOp; and
- augmented downstream flows for salmon after the sturgeon flow operation is completed.

Koocanusa Reservoir is typically drafted during the winter for Treaty flood risk management, however draft amounts this year were low due to the very low inflow forecast. The reservoir reached a minimum level of 733.26 metres (2,405.7 feet) on March 24, 2019, about 15.2 metres (50 feet) above last year's minimum level. The inflows into Koocanusa Reservoir from April to August 2019 are currently forecast to be 74% of average. The provision of sturgeon flows may not be required this spring due to the low inflows and will depend on the May inflow forecast.

Information regarding the operation of Libby Dam and Koocanusa Reservoir water levels is available from the U.S. Army Corps of Engineers at **nws.usace.army.mil** or by calling **406 293 3421**.

The normal operating range for Koocanusa Reservoir is between 697.1 metres (2,287 feet) and 749.5 metres (2,459 feet). During periods of high downstream flood risk, the Treaty Entities may coordinate additional storage in Koocanusa Reservoir.

KOOTENAY LAKE

For information regarding Kootenay Lake, please contact FortisBC.

Website: **fortisBC.com**

Phone: **1 866 436 7847**

Koocanusa Reservoir

Want to stay informed of BC Hydro operations?

REGIONAL OPERATIONS UPDATE MEETINGS

BC Hydro will be hosting its annual Operations Update meetings and open houses in May and June 2019.

These meetings are held to:

- Listen to and learn from local residents, stakeholders, First Nations and community representatives who have an interest in the operation of the Columbia River Treaty facilities and BC Hydro facilities in the East Kootenay and Thompson/Okanagan/Columbia regions.
- Provide information on the operations of Columbia River Treaty facilities in Canada and other facilities that are operated in a coordinated manner on the Columbia system.
- Provide an update on BC Hydro activities.

Creston—May 7

Jaffray—May 8

Valemount—June 13

Golden—June 17

Revelstoke—June 17

Nakusp—June 18

Meadow Creek—June 19

Castlegar—June 20

Operations Update meeting in Jaffray.

OPERATIONS UPDATE CONFERENCE CALLS

BC Hydro periodically hosts conference calls to provide updates on our Columbia and Kootenay system operations. If you would like to receive email notifications regarding these meetings and conference calls, please contact Dayle Hopp at **dayle.hopp@bchydro.com**.

BC HYDRO'S RESERVOIR LEVEL UPDATES

BC Hydro's toll-free reservoir information line:
1 877 924 2444

BC Hydro's toll-free reservoir information line provides up to date reservoir water level and river flow information. The recording is updated every Monday, Wednesday and Friday and provides:

- Current water levels: Arrow Lakes Reservoir, Duncan Dam Reservoir, Kinbasket Reservoir, Koocanusa Reservoir, Kootenay Lake, Revelstoke Reservoir, Sugar Lake Reservoir and Whatshan Lake Reservoir.
- Current river flows: Columbia River at Birchbank, Duncan River at the Lardeau Confluence, Shuswap River and the flow downstream from Wilsey Dam at Shuswap Falls.

Reservoir levels can be checked on our website that provides near real-time data:

bchydro.com/energy-in-bc/operations/transmission-reservoir-data/previous-reservoir-elevations.html

Questions? Please contact:

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