



Pend d'Oreille Reservoir. Photo by Fabio Moscatelli.

Columbia River Operations Summary

Fall 2020

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 before heading south 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 13 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.



Columbia River Treaty

The Columbia River Treaty between Canada and the United States was ratified in 1964. The Treaty resulted in the construction of three dams in British Columbia (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 United States and the resulting Kootenai Reservoir, which crosses the Canada–U.S. border.

Water stored, and then released, by Canadian reservoirs provides the U.S. with the potential to generate additional electricity. 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 3,990 gigawatt hours (GWh) per year of energy and 1,141 megawatts (MW) of capacity for the period between August 1, 2019 and July 31, 2020.

The Treaty can be terminated at any time after September 16, 2014, provided that either country provides ten 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 to seek improvements within the existing Treaty framework. Canada and the U.S. started negotiations on modernizing the Columbia River Treaty in the spring of 2018. The negotiating sessions have been occurring approximately every two months, alternating locations between the U.S. and Canada. 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 an annual agreement to address some of Canada's concerns about the timing of water releases from the Libby Dam (VarQ operating regime). This agreement was extended to be in effect until August 2021 and is supplemental to the Libby Coordination Agreement (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 high water event). In addition, BC Hydro will be

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 2019, the Columbia River Treaty Operating Committee signed the 2020 Non-Power Uses Agreement. This annual operating agreement allowed Arrow Lakes Reservoir releases to be reshaped between January and July 2020 to protect Canadian whitefish in exchange for flow benefits for endangered U.S. salmon.

NON-TREATY STORAGE AGREEMENT (NTSA)

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

The 2012 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 high and low-water impacts downstream of Arrow Lakes Reservoir and to improve power and non-power benefits for both countries.



Sunflower. Photo by Andrea Linderman.

Snowpack and runoff

Snowpack in the Columbia basin this year was above normal due to cold and wet conditions for much of the operating year. This resulted in above normal runoff forecast of 104% for the entire Columbia basin between April and September 2020 and 108% of normal for the Canadian portion of the basin. By comparison, the overall runoff in the Columbia basin in 2019 was only 87% of normal.

KINBASKET RESERVOIR

Kinbasket Reservoir is created by the Mica Dam. Kinbasket Reservoir regulates discharges for both the Mica and Revelstoke Generating Stations as well as for power plants further downstream.

Kinbasket Reservoir did not fully refill to its maximum storage level (“full pool”) in 2019 due to below average snowpack and runoff conditions. It reached a maximum level of 752.2 metres (2,454.4 feet) on September 27, 2019, which is 6.27 metres (20.6 feet) below normal full pool. The fall and winter of 2019/20 started relatively dry but quickly turned wetter in December and January and this contributed to significant snow accumulation in the basin. Electricity demand was relatively light in the winter but a late season arctic outbreak in March and prolonged cooler, drier conditions into April resulted in increased demand for electricity. Significantly more draft occurred as a result in March/April 2020 to meet high electricity demand. The minimum water level reached was 720.12 metres (2,362.6 feet) on April 20, 2020. This water level was about 5.30 metres (17.4 feet) higher than the minimum level in 2019.

From February to August 2020, reservoir inflows were about 110% of average. Due to high inflows and a reduced demand for electricity due to COVID-19, the reservoir refilled to reach a maximum level of 754.44 metres (2,475.2 feet) on August 23, 2020. This water level was about 0.2 feet above the normal maximum operating level of 754.4 metres (2,475 feet). This storage of additional water has been approved by the Provincial Comptroller of Water Rights and remains within our Water License limits. Similar high water levels were observed in 2012 and 2013 during high runoff conditions. By comparison, the maximum water level in 2020 was about 8.29 metres (27.2 feet) higher than the maximum level in 2019.

Along with storing additional water, BC Hydro also released a controlled spill of water from the reservoir from August 22 to 24, 2020 to further manage inflows and reservoir levels. During this operation, water was released through the outlet works which is designed to safely pass water.

The normal licensed range for Kinbasket Reservoir is between 754.4 metres (2,475 feet) and 706.96 metres (2,319.42 feet) respectively. The reservoir can be operated up to two feet above its normal maximum 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.



Revelstoke dam outlets. Photo by Jen Walker-Larsen.

REVELSTOKE RESERVOIR

Revelstoke Reservoir is created by the Revelstoke Dam. Revelstoke Reservoir water levels may fluctuate in response to weather patterns, inflow levels, and electricity demand. During the spring freshet and winter peak load periods, it is common to have daily fluctuations of the reservoir within 1.5 metres (5 feet) of full pool. The reservoir is also periodically lowered to 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.

During low demand and high inflow periods, water is occasionally released over the Revelstoke dam spillway to maintain minimum flows or to maintain the reservoir water level. This year, in addition to generation discharge from the Revelstoke generating station, BC Hydro also released a controlled spill of water from the reservoir from July 14 to July 31, 2020 to manage high inflows and to maintain the Revelstoke Reservoir water level at or below normal full pool. Though this was a relatively larger than normal spills for minimum flows, Revelstoke dam spillway is designed to safely pass water and this spill operation did not present any risk to the dam or public.

The licensed range for Revelstoke Reservoir is between 573 metres (1,880 feet) and 554.7 metres (1,820 feet). Most of the time, Revelstoke Reservoir is maintained at or above 571.5 metres (1,875 feet).

ARROW LAKES RESERVOIR

Arrow Lakes Reservoir is created by the Hugh L. Keenleyside Dam. Arrow releases are regulated under the Columbia River Treaty and its supplemental operating agreements. For operations to be consistent with the principles of the Treaty, under wet conditions it is necessary to store excess water so that surplus energy is not generated by downstream U.S. Columbia River projects. Conversely, under dry conditions, storage must be drafted as far as necessary to meet Treaty firm loads consistent with the principles of proportional draft.

Last year, dry conditions were prevalent across the entire Columbia basin and the observed February to September 2019 inflows into Arrow reservoir was only 83% of normal. Arrow Lakes Reservoir reached a peak level of 438.9 metres (1,440 feet), 1.2 metres (4 feet) below normal full pool on June 21, 2019. The reservoir drafted in the summer to meet the provisional draft provisions of the Columbia River Treaty. As the draft began from near-full storage, Arrow Lakes Reservoir summer levels were within recreation range through Labour Day.

As inflows improved in the winter, the system came off proportional draft and Arrow Lakes Reservoir followed a typical draft across the winter to reach a minimum level of 428.2 metres (1,404.8 feet) on March 3, 2020. This is 1.07 metres (3.5 feet) lower than last year's minimum level of 429.25 metres (1,408.3 feet) reached on February 2, 2019.

From February to August 2020, reservoir inflows were about 108% of average. The high inflows supported refill of Arrow Lakes Reservoir in April, May and June to a maximum level of 439.70 metres (1,442.6 feet) on July 2, 2020. This is about 0.43 metres (1.4 feet) below full pool and 0.79 metres (2.6 feet) above the 2019 maximum level. As in past years, Arrow Lakes Reservoir drafted during the summer months, with levels reaching about 435 metres (1,427.4 feet) by Labour Day.

The normal licensed range for Arrow Lakes Reservoir is between 440.1 metres (1,444 feet) and 49.9 metres (1,377.9 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 million acre feet (MAF) of Treaty storage.

DUNCAN RESERVOIR

Duncan Reservoir is impounded by Duncan Dam. Duncan Dam's operations help meet Treaty flood control requirements, help minimize flood risk on Kootenay Lake, and provide minimum fish flows year round as required by the Water Use Plan.

Duncan Reservoir reached a maximum level on August 2, 2019 of 576.5 metres (1,891.2 feet). This water level was 0.24 metres (0.8 feet) below full pool. The reservoir then drafted to about 575.46 metres (1,888 feet) on August 31, 2019 and was held at this level until Labour Day.

From September through late December 2019, Duncan Reservoir was operated to provide the flows necessary for kokanee 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. In 2020, Duncan Reservoir reached a minimum level of 547.21 metres (1,795.3 feet) on April 23, 2020. The reservoir discharge was reduced to a minimum of 3 cubic metres per second (m³/s) or 100 cubic feet per



Glayco Beach on Duncan Reservoir.

second (cfs) on May 23, 2020 to begin reservoir refill and manage water levels of Kootenay Lake.

From February to August 2020, reservoir inflows were about 108% of average. Duncan Reservoir refilled to a maximum of 576.56 metres (1,891.6 feet) on August 2, 2020. This water level is about 0.12 metres (0.4 feet) below full pool.

The normal operating range for Duncan Reservoir is between 576.7 metres (1,892 feet) and 546.9 metres (1,794.2 feet). The reservoir can be operated up to 1.2 feet above its normal maximum level (577 metres or 1,893.2 feet) if approved by the Comptroller of Water Rights. Duncan Reservoir provides 1.4 million acre feet (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 Keenleyside and other dams on the mainstem Columbia, as well as dams on the Kootenay River system. Actual discharges depend on many factors, including upstream runoff and storage operations and Treaty discharge requirements.

In 2020, though the runoff was higher than normal, 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. Columbia River flows peaked at about 4,276 cubic metres per second (m³/s) or 151,000 cubic feet per second (cfs) on June 28, 2020. This flow was well



The Columbia River in Castlegar. Photo by Mary Anne Coules.

below the peak regulated flow experienced in 2012 of 6,090 m³/s (215,000 cfs), and the peak pre-dam flow of 10,590 m³/s (374,000 cfs) in 1961.

BC Hydro's water licence has no minimum discharge requirements for the Columbia River downstream of Keenleyside Dam. Under the Columbia River Treaty, however, we are obliged to reduce flows to a minimum weekly average flow of 5,000 cfs under certain water conditions.

KOOCANUSA (LIBBY) RESERVOIR

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

Koocanusa Reservoir is typically drafted during the winter for Treaty flood risk management. The reservoir reached a minimum level of 732.7 metres (2,403.9 feet) on March 30, 2020, similar to last year's minimum level of 733.26 metres (2,405.7 feet) on March 24, 2019.

Koocanusa Reservoir refilled on above normal inflows to reach a maximum level of 747.24 metres (2,451.6 feet) on August 9, 2020. This water level is about 2.25 metres (7.4 feet) below full pool. Libby Dam continues to be operated under VarQ procedures for U.S. fisheries interests and flood control. The latest Libby Operating Plan provides for:

- Flows as needed during March–April to meet the April 30 flood control target;
- 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.

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

Information regarding the operation of Libby Dam and Koocanusa Reservoir water levels is available from the U.S. Army Corps of Engineers online at [nws.usace.army.mil](https://www.usace.army.mil) or by calling 406 293 3421.

KOOTENAY LAKE

For information regarding Kootenay Lake, please contact FortisBC.

Website: fortisBC.com

Phone: 1 866 436 7847

Want to stay informed of BC Hydro operations?

REGIONAL OPERATIONS UPDATE MEETINGS

BC Hydro hosts its annual Operations Update meetings every spring in the following Columbia basin communities: Castlegar, Cranbrook, Creston, Golden, Meadow Creek, Nakusp, Revelstoke, Valemount and Jaffray.

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.

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 provides reservoir water level forecasts by email each week. To receive these updates, please contact dayle.hopp@bchydro.com.

Near real-time water level information for various locations around our reservoirs is available online at:

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

BC Hydro's toll-free reservoir information line 1 877 924 2444 also provides up-to-date reservoir elevation and river flow information. The recording is updated every Monday, Wednesday and Friday and includes:

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

Questions? Please contact:

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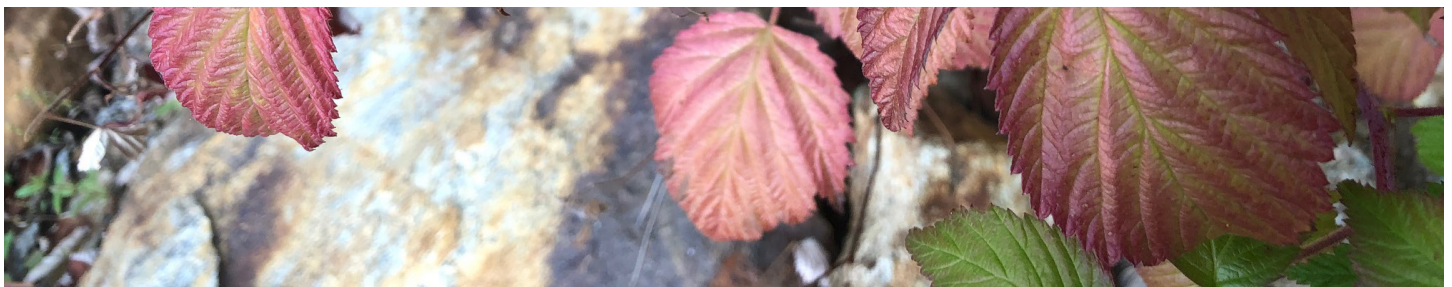
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Wild raspberries. Photo by Jen Walker-Larsen.