Arrow Lakes Reservoir. Photo by Gary Van Os.

Columbia River Operations Summary

Spring 2021

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 to generate 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.

BC Hydro
Power smart

CS-607

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 and is currently about 3,980 gigawatt hours (GWh) per year of energy and 1,141 megawatts (MW) of capacity for the period between August 1, 2020 and July 31, 2021.

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 an agreement, reviewed annually, to address some of Canada's concerns about the timing of water releases from Libby Dam, known as the VarQ operating regime. This agreement was extended to be in effect until August 2021 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, 2017, and 2018 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 Libby Dam.

In December 2020, the joint Canada–United States Treaty Operating Committee signed the 2021 Non–Power Uses Agreement. This annual operating agreement modifies Arrow Lakes Reservoir releases between January and July 2021 to protect Canadian whitefish and trout 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 to store more water 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.

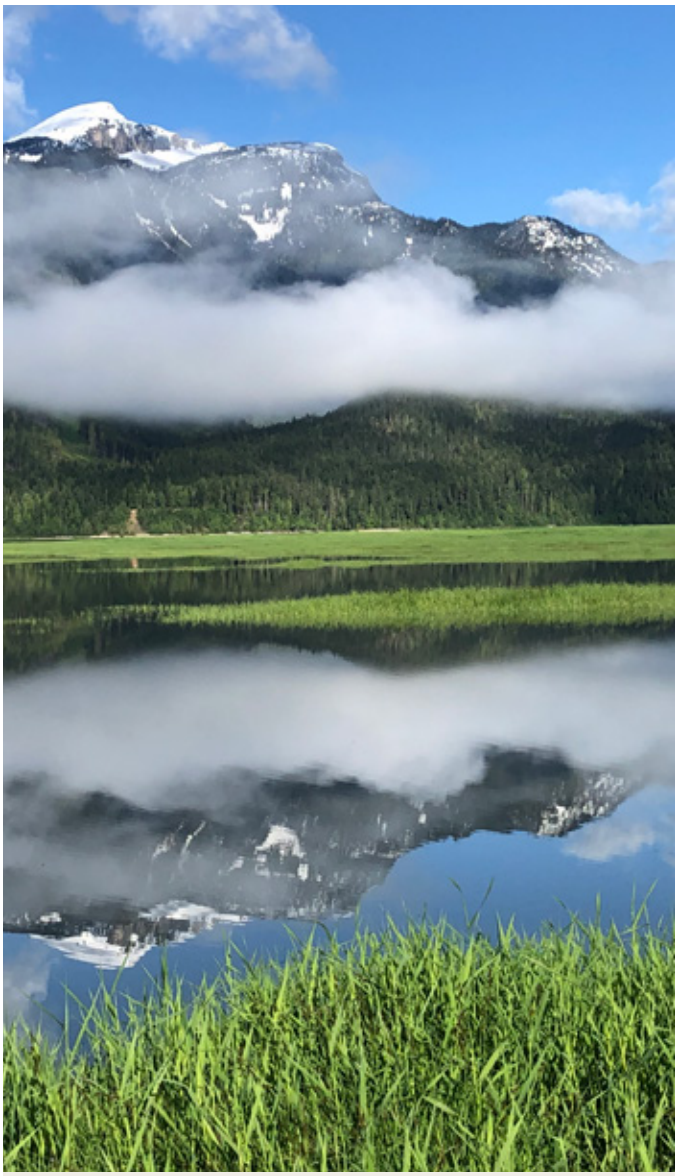
The new NTSA gives BC Hydro more control over reservoir levels, provides more energy benefits to B.C. and gives BC Hydro more operating flexibility to balance competing non–power interests on the Columbia system. These interests include recreational activities, wildlife habitat, and fisheries. Since 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.

Columbia River at Centennial Park in Revelstoke. Photo by Jen Walker–Larsen.

BC Hydro's 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 2020, predominantly in the lower Columbia Snake basin, the runoff for the entire Columbia basin (Canada and U.S. combined) between April and September 2021 is currently forecast to be 93% of normal. By comparison in 2020, the actual runoff at The Dalles was 104% of normal.

The Canadian portion of the Columbia basin is generally wetter than the U.S. portion and the forecast runoff is between 97 and 110% of normal. By comparison in 2020, the actual runoff was 109% 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.



Cartier Bay wetland south of Revelstoke. Photo by Jen Walker-Larsen.

KINBASKET RESERVOIR

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

Kinbasket Reservoir refilled fully in 2020 due to above average snowpack and runoff conditions. It reached a peak water 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). The storage of additional water was approved by the Provincial Comptroller of Water Rights and remains within our water license limits.

Kinbasket Reservoir is typically drafted across the fall and winter period to meet loads and system requirements. An early arctic outbreak in October and another cold snap in February followed by cooler than normal March and April led to increased generation from Mica; otherwise electricity demand was relatively light in other periods due to a mild winter. The minimum level for Kinbasket Reservoir this year is forecast to be 718.41 metres (2,357 feet) in April, about 1.71 metres (5.6 feet) below last year's minimum level of 720.12 metres (2,362.6 feet) on April 20, 2020.

The fall and winter of 2020/21 were generally wetter than average, specifically in October, December and February, and this contributed to significant snow accumulation in the basin. Snowpack for the Kinbasket basin is currently above average and well above 2020 levels. Deep snowpack is expected to result in high inflows for the February to September 2021 Water Supply Forecast, currently forecast to be 111% of average. Although the reservoir is forecast to be lower than average levels in April, the reservoir is expected to refill to within 3.0 metres (10 feet) of normal full pool level this summer due to the high inflow forecast. Depending on the rate of snowmelt and rainfall during freshet, we may store additional water in Kinbasket Reservoir and raise the water level up to 0.3 metres (1 foot) above its normal full pool level.

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.

REVELSTOKE RESERVOIR

Revelstoke Reservoir was created by 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 system needs for short–term generating capacity or energy 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).

Sutherland Falls on Revelstoke Reservoir. Photo by Jen Walker–Larsen.

Purple lupins growing on roadside south of Revelstoke. Photo by Jen Walker–Larsen.

ARROW LAKES RESERVOIR

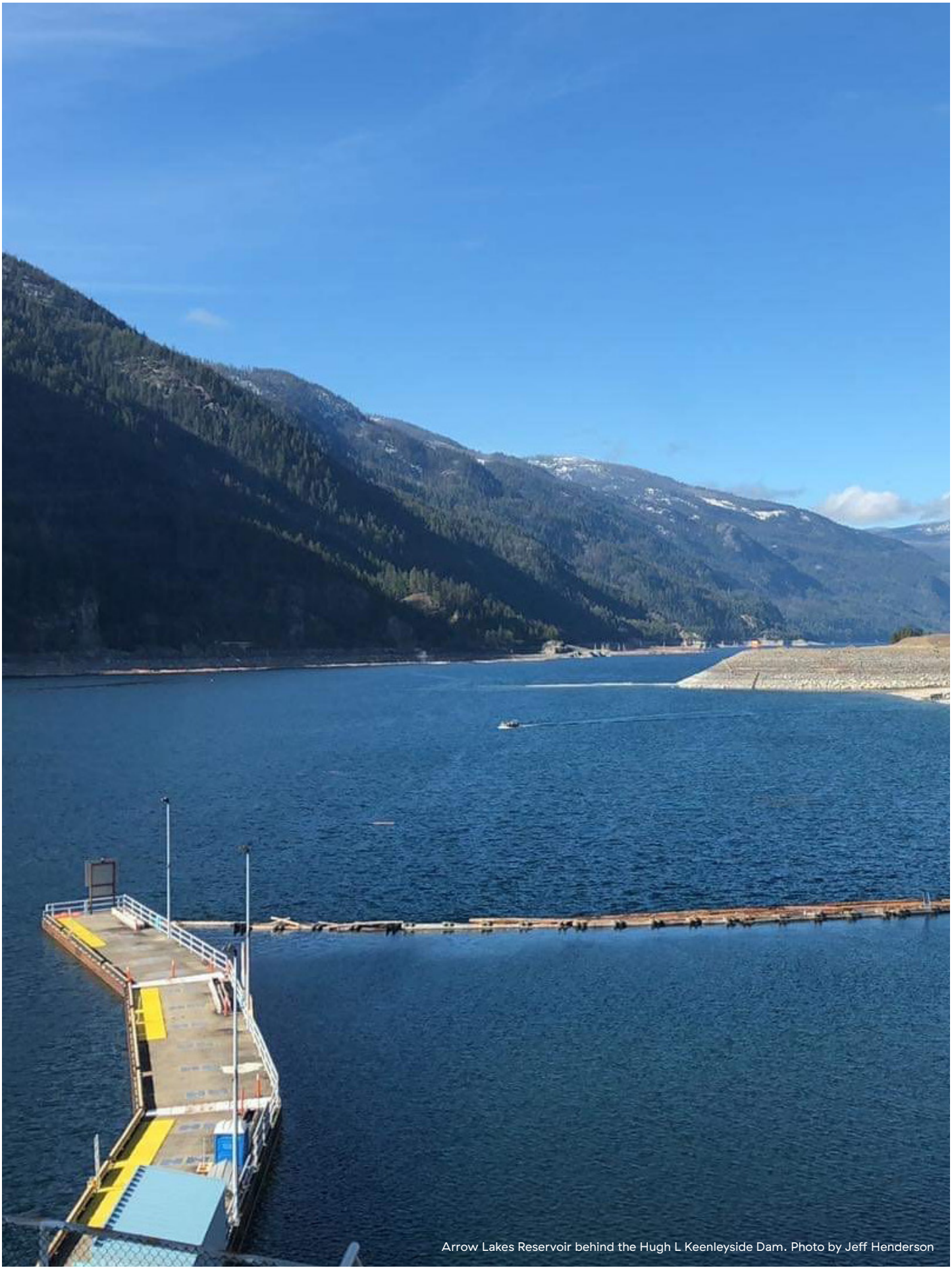
Arrow Lakes Reservoir was created by the Hugh L. Keenleyside Dam. Arrow discharges are regulated under the Columbia River Treaty and its supplemental operating agreements.

The observed February to September 2020 inflows into Arrow Lakes Reservoir was 107% of average. Arrow Lakes Reservoir refilled on above normal inflows to reach a peak level of 439.7 metres (1,442.6 feet), 0.43 metres (1.4 feet) below normal full pool on July 2, 2020. Despite a relatively wet spring, summer was dry and runoff was lower than average. The reservoir drafted in the summer to meet the provisional draft provisions of the Columbia River Treaty. Under dry conditions, the coordinate system operates in proportional draft in the summer and fall resulting in more water releases from Arrow Lakes Reservoir. Conversely, under wet conditions, less water releases are required.

As inflows improved in October 2020, the system came off proportional draft and Arrow Lakes Reservoir followed a typical draft across the winter to reach a minimum level of 426.5 metres (1,399.2 feet) on February 25, 2021. This is 1.71 metres (5.6 feet) lower than last year's minimum level of 428.2 metres (1,404.8 feet) reached on March 3, 2020.

Snowpack in the Arrow Lakes Reservoir basin is currently above average but well below 2020 levels. As such, the inflows into Arrow Lakes Reservoir for the period from February to September 2021 are forecast to be about average, lower than the 2020 observed runoff at 107% of average. Based on this forecast, the reservoir is currently expected to refill to within 1.8 metres (6 feet) from normal full pool in early July 2021.

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 behind the Hugh L Keenleyside Dam. Photo by Jeff Henderson

DUNCAN RESERVOIR

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

In 2020, the Duncan Reservoir refilled very close to its normal full pool level, reaching a maximum level of 576.6 metres (1,891.6 feet) on August 2, 2020. This water level was 0.12 metres (0.4 feet) below full pool. The reservoir then drafted to about 575.46 metres (1,888 feet) on August 31, 2020 and stayed at this level until Labour Day.

From September through late December 2020, 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 Duncan basin is above average. The inflows into Duncan Reservoir for the period from February to September 2021 are forecast to be 102% of average. Based on the current inflow forecast, Duncan Reservoir is expected to refill close to full pool by late July 2021.

The Columbia River downstream of Castlegar. Photo by Mary Anne Coules.

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.

The Hugh L. Keenleyside Dam. Photo by Mary Anne Coules.

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 mainstem 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 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. 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 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.

The 2021 inflows into the reservoirs and peak Columbia River flows at Birchbank are forecast to be slightly lower than 2020, although actual flows will depend on the timing and volume 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.

KOOCANUSA RESERVOIR

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

Koocanusa Reservoir reached a maximum level of 747.2 metres (2,451.6 feet), which is 2.25 metres (7.4 feet) below its full pool of 749.5 metres (2,459 feet), on August 9, 2020. Koocanusa Reservoir continues to be operated under VarQ procedures for U.S. fisheries' interests and flood control.

Koocanusa Reservoir is typically drafted during the winter for Treaty flood risk management. The reservoir is forecast to reach a minimum level of 731.5 metres (2,400 feet) in April 2021, similar to last year's minimum level of 732.7 metres (2,403.9 feet) on March 30, 2020. The 2021 forecast minimum level for Koocanusa Reservoir is about 10.67 metres (26 feet) above average.

The inflows into Koocanusa Reservoir from April to August 2021 are currently forecast to be only 94% of average based on the USACE April official runoff forecast, compared to 107% of average runoff in 2020. The provision of sturgeon flows will be required this spring 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.

Koocanusa Reservoir. Photo by Sally MacDonald.

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

Every year we host meetings and open houses throughout the Columbia and Kootenay regions to:

- Listen to and learn from local residents, stakeholders, Indigenous Nations and community representatives who have an interest in the operation of the Columbia River Treaty facilities and BC Hydro facilities in the Southern Interior.
- 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.

This year, we will be hosting our annual Operations Update meetings in May and June by conference call or virtually due to the COVID-19 pandemic:

East Kootenay Operations Update Meeting
Wednesday, May 19
12:00 p.m. to 1:30 p.m. Mountain Time

Columbia Operations Update Meeting
Tuesday, June 15
6:30 p.m. to 8:00 p.m. Pacific Time

Duncan Operations Update Meeting
Tuesday, June 22
6:30 p.m. to 8:00 p.m. Pacific Time

To register, please contact Tracey Hill at **tracey.hill@bchydro.com.**

Raindrops on grass. Photo by Jen Walker-Larsen.

Water levels for our reservoirs can be found on our website that provides near real-time data: **bchydro.com/energy-in-bc/operations/transmissionreservoir-data/previous-reservoir-elevations.html.**

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.

Questions? Please contact:

Dag Sharman
Community Relations Manager
Southern Interior
250 549 8531
dag.sharman@bchydro.com

Mary Anne Coules
Stakeholder Engagement Advisor
Lower Columbia
250 365 4565
maryanne.coules@bchydro.com

Jen Walker-Larsen
Stakeholder Engagement Advisor
Upper Columbia
250 814 6645
jennifer.walker-larsen@bchydro.com

Sally MacDonald
Public Affairs Officer
East Kootenay
250 489 6841
sally.macdonald@bchydro.com