

ECCC Agency Report

Mackenzie River Basin Board Meeting 74
December, 2022



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Canada 

Water-Related Legislation / Policy / Regulations / Planning

Wood Buffalo National Park Action Plan

Since 2019, Parks Canada and its federal, provincial, territorial and Indigenous partners have worked together to support the on-going implementation of the Action Plan. Each partner has specific responsibilities for action within their jurisdiction and authority, and with Indigenous governments, which have stewardship responsibilities for their traditional territories. Committees, working groups and task teams have been established to ensure collaboration in implementing and Strengthening Indigenous Partnerships, Environmental Flows and Hydrology, and Monitoring and Science themes. Updates on the **Environmental Flows and Hydrology (EFH)** actions and recent progress are highlighted below.

Water Control Structures

- Two proposed water control structures are being designed to create a local water management approach in the Peace Athabasca Delta with an aim to restore key areas of the Delta and to support traditional Indigenous use in target areas. Indigenous knowledge and scientific information to inform the design of these water control structures is being gathered by partners. Community members will have opportunities to participate and provide input through upcoming engagement events in Fort Chipewyan, Fort Smith and Fort Resolution.

Strategic Flow Release

- The next phase of work in the strategic flow release protocol development will be supported through a structured decision making process.
- This work will advance the development of a strategic flow release protocol through a “decision sketch” workshop, which is a mock decision-making process and scoping exercise that uses scenarios to clarify the decisions, processes and considerations to inform the development of the protocol.

Environmental Flows Framework Development

- Engagement on the development of a basin-wide environmental flows framework has begun. The eflows framework will look at how water interacts with plants, animals and people and how water is shared within the PAD system. It is a tool to better understand the water levels and water flows needed for a healthy PAD ecosystem and for the people who rely upon it. This framework connects to water monitoring and management actions to support ecological and traditional use objectives.

Contact info:

ECCC Environmental Flows and Hydrology Secretariat: efh-hde@ec.gc.ca

Science, Monitoring and Information

Water Quality Monitoring and Surveillance Report

The Water Quality Monitoring and Surveillance (WQMS) Division of ECCC's Science and Technology Branch supports the Federal government's water quality-related obligations under various acts and agreements, e.g. Canada Water Act; Canadian Environmental Protection Act, 1999 (CEPA); Fisheries Act; International Boundary Waters Treaty Act; Federal/provincial/territorial agreements; Canada-United States water quality agreements; and, Federal Sustainable Development Strategy. Responsibilities include transboundary waters, waters on federal land, and waters of national importance. WQMS main activities consist of water sample collection, data analysis and interpretation, scientific advice, and reporting on results.

In March 2020, in response to the COVID-19 pandemic, ECCC enacted its Business Continuity Plan (BCP) in an effort to prioritize the health and safety of the Department's workforce which focused the efforts of the Department on the delivery of critical services. Consequently, some field and laboratory work related to non-critical services were temporarily suspended, including freshwater quality monitoring. ECCC has developed and has implemented a Departmental strategy for a phased return to field and laboratory work that includes consistent occupational health and safety plans to address COVID-19 considerations. As of early 2022, most of the field and laboratory work had resumed, including non-critical services.

A risk-based adaptive management framework (Contact: gwyn.graham@ec.gc.ca)

ECCC's Freshwater Quality Monitoring and Surveillance (FWQMS) program provides water quality monitoring in Canada through a risk-based adaptive management framework. Decisions on where and how to monitor watersheds are based on the level of risk, helping to ensure focused and objective programming. Risk is assessed based on the nature, probability, frequency and severity of threats to the watersheds. Through this framework, and ongoing collaboration with our provincial, territorial, other government and non-governmental partners, the federal government provides targeted, adaptable and efficient monitoring to ensure quality of service delivery and value for money for Canadians. The FWQMS program framework includes three key components:

- (i) A regular review of ECCC's roles and responsibilities to ensure that our activities are consistent with our departmental mandate;
- (ii) A regular assessment of the level of risk for watersheds using three types of analyses:
 - risk-based site-specific analysis (described below) of all monitoring sites in ECCC's current monitoring network, based on chemical and biological measurements, upstream human activities, and vulnerability of the ecosystem;
 - risk-based basin-level analysis (described below) of all watersheds across Canada to identify areas where monitoring should be conducted or the scope of monitoring enhanced. The analysis is based on the aggregation of multiple point source and non-point source threats;
 - statistical power analysis to assess the ability of the monitoring network to accurately detect change to ensure optimal sampling frequencies; and

(iii) A Quality Management System that focuses on continuous program improvement through a Plan-Do-Check-Improve model.

Risk-based analysis (RBA) is done at the monitoring site level to assess the likelihood, extent and potential severity of impacts from human activities on water quality and the aquatic ecosystem. For each monitoring site, risks are scored between 0 and 10, weighted by risk group based on a list of 14 criteria (e.g., point sources, guideline exceedances, water uses) and aggregated to obtain an overall score out of 100. The higher the score, the higher the potential risk to water quality is at the site (see Figures 1). The WQMS division aims to review RBA sites scores every 5 years.

The risk-based basin analysis (RBBA) is a spatial analysis tool used to quantify the relative risk to water quality from 16 human activities in 1138 sub-sub-drainage areas. These include stressors like point sources of pollution, various types of land use and changes, deposition of atmospheric contaminants and climate change. The RBBA tool aggregates these stressors and classifies basins on a relative risk scale (see Figure 1).

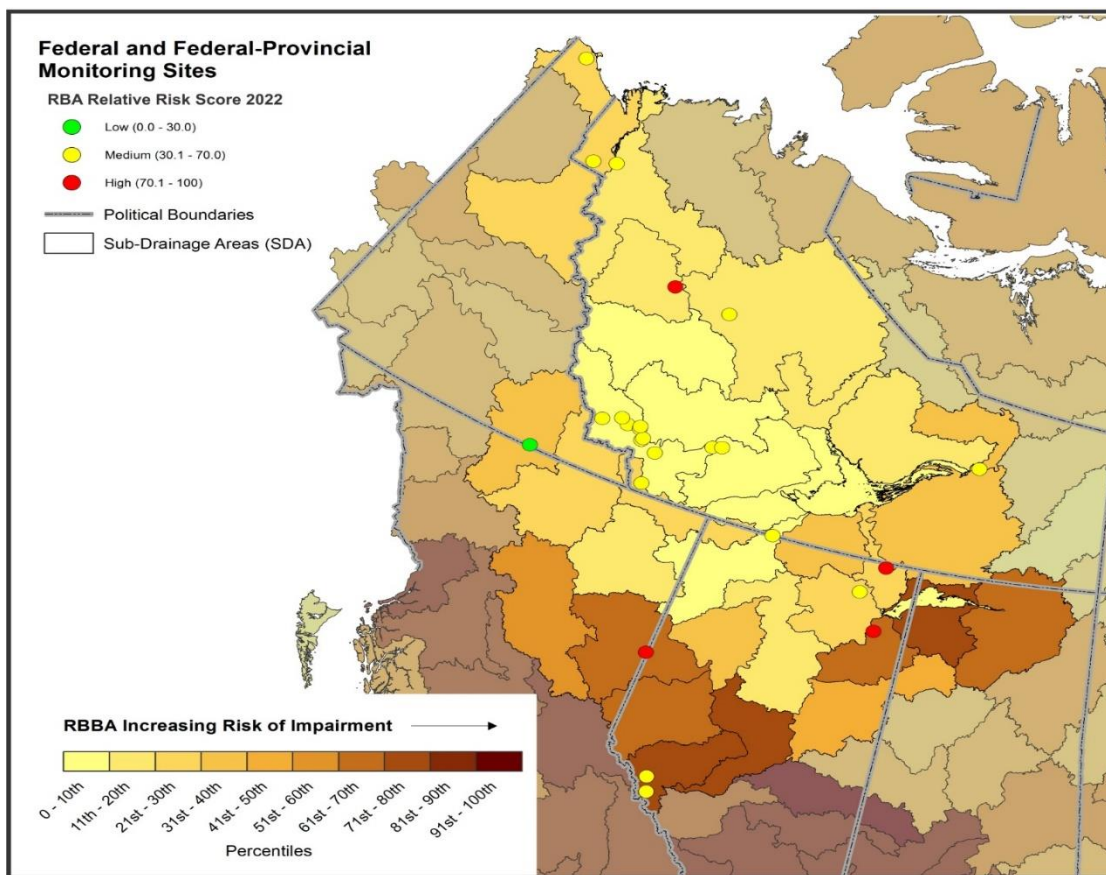


Figure 1: Results of RBBA and RBA analyses for basins of interest to MRBB, 2022.

Open Data (<https://open.canada.ca/data/>)

ECCC provides credible, scientifically sound information to support decision making. The public release of our water quality monitoring data supports the Government of Canada's Directive on Open Government by providing access to water quality data to Canadians. Since January of 2017, national long-term water quality monitoring

data are made available to the public on the Government of Canada's Open Data portal, in both [English](#) and [French](#). The datasets include data for nutrients, metals, major ions, and other physical-chemical variables from 2000 covering 22 basins across Canada. For the few monitoring sites located outside those basins, links are provided where the data are already available online or provided by partners. In addition, automated monitoring and surveillance water quality datasets (e.g., pesticides) are made available through Canada's Open Data Portal.

Other online water quality data sources from ECCC include:

[Acid Sensitive Lakes Study](#) and [Turkey Lakes Watershed Study](#),
[Clean Air Regulatory Agenda Freshwater Inventory and Surveillance of Mercury](#),
[Great Lakes Basin \(GLB\) Monitoring and Surveillance](#),
[National Water Quality Pesticides Surveillance Data](#),
[Canadian Aquatic Biomonitoring Network \(CABIN\)](#),
[Canadian Environmental Sustainability Indicators \(CESI\)](#).

Of particular interest to MRBB, data for the following basins are published and regularly updated:

- [Lower Mackenzie River Basin Long-term Water Quality Monitoring Data - Canada's North - Environment and Climate Change Canada Data](#)
- [Peace - Athabasca River Basin Long-term Water Quality Monitoring Data - Environment and Climate Change Canada Data](#)
- [Canada-B.C. Water Quality Monitoring Program - Interactive Map \(arcgis.com\)](#)

In addition, the most recent data pertaining to the ongoing Oil Sands Monitoring Program are available online through both GoC Open Data ([Surface Water Quality, Oil Sands Region - Environment and Climate Change Canada Data](#)) and the Alberta Government's Oils Sands Environmental Data Viewer (<https://aws.kisters.net/OSM/applications/public.html?publicuser=Guest>) data web portals.

Support to the MRBB (Contact Nancy.Glozier@ec.gc.ca; Kerry.Pippy@ec.gc.ca; Ayisha.Yeow@ec.gc.ca)

The Government of Canada remains committed to the Mackenzie River Basin Transboundary Waters Master Agreement and to continuing cooperation on water monitoring in the region and sharing data.

Environment and Climate Change Canada (ECCC) currently operates 28 stations throughout the Mackenzie Basin as part of the national long term water quality network. Table 1 includes information on these stations, some of which have been in operation since the 1960's. Planned sampling events for all sites total 152 per year, along with approximately 10% additional samples for Quality Assurance/ Quality Control. In 2021, ECCC's water quality monitoring program returned to near normal sampling efforts after the suspension of monitoring during the COVID-19 pandemic, obtaining close to 90% of the planned sampling events in the MRBB between April 2021-March 2022. Samples are analyzed for a range of parameters including nutrients, metals, major ions, physicals and, at a subset of sites, bacteria and organics (pesticides and Polycyclic Aromatic Hydrocarbons (PAHs)).

Table 1. ECCC Water Quality Monitoring Sites in the Mackenzie River Basin

Station	Ter/ Prov	Latitude	Longitude	Start Date of Long Term Monitoring	Status	Frequency (planned samples/yr)
Great Bear R./Great Bear Lake	NT	65.1283	-123.5508	1969	Active	3
Liard River/Fort Liard	NT	60.2414	-123.4753	1998	Active	6
Liard River/Mouth	NT	61.7425	-121.2278	1960	Active	6
Lockhart River/ Artillery Lake	NT	62.8889	-108.4658	1969	Active	3
Mackenzie R./Norman Wells	NT	65.2739	-126.8442	1960	Active	6
Mackenzie R./Strong Point	NT	61.8164	-120.7917	1992	Active	6
Mackenzie River/Arctic Red R.	NT	67.4558	-133.7531	1960	Active	6
Peel River/Ft. McPherson	NT	67.2589	-134.8886	1960	Active	4
Hay R./NWT-Alta. Boundary	NT	60.0036	-116.9719	1969	Active	4
Slave River/Fitzgerald	AB	59.8575	-111.5987	1960	Active	9
Flat River/Mouth	NT	61.5297	-125.4106	1972	Active	3
Flat River/Pk. Boundary	NT	61.4278	-126.6299	1988	Active	3
Prairie Creek/ New park Boundary	NT	61.5219	-124.7126	2010	Active	3
Prairie Creek/above Cadillac Mine	NT	61.5583	-124.8125	2003	Active	3
Prairie Creek/below Cadillac Mine	NT	61.5561	-124.8108	2003	Active	3
Prairie Creek/Mouth	NT	61.2844	-124.4456	1988	Active	3
Prairie Creek/Old Park Boundary	NT	61.3485	-124.4153	2001	Active	3
S.Nahanni R./Nahanni Butte	NT	61.0991	-123.5899	1988	Active	3
S.Nahanni R./Virginia Falls	NT	61.6361	-125.7969	1996	Active	3
Table 1: continued						

Peace River at Peace Point	AB	59.1193	-112.4502	1967	Active	9
Athabasca River at 27th Baseline	AB	58.1743	-111.3664	1989	Active	9
Athabasca River at Highway 16	AB	53.0417	-118.0872	1973	Active	4
Athabasca River above Athabasca Falls	AB	52.6644	-117.8808	1972	Active	4
Liard River at Upper Crossing	YT	60.0477	-128.9018	1983	Active	12
Peace River above Alces River	BC	56.1260	-120.0600	1984	Active	12
Petitot River below Hwy 77	BC	59.98421	-122.92784	2012	Active	4
Murray River at the Mouth	BC	55.5526	-121.2035	2017	Active	6
Ogilvie River above Engineer Creek	YT	63.3581	-138.30556	2016	Active	12

Status of MRBB and PPWB on Whirling Disease - Operational Impacts to Field and Laboratory Operations (Contact: Nancy.glozier@ec.gc.ca; Elaine.Page@ec.gc.ca)

While Whirling Disease has only been recently introduced and detected in Canada, it has been present in the USA for more than 20 years and follows a cycle of activity and relative dormancy. This parasite could eventually invade many prairie river systems leading into Lake Winnipeg, Hudson's Bay and potentially north through the Athabasca and Peace rivers. Whirling disease has no known human health effects and is an infectious disease of finfish caused by a parasite, *Myxobolus cerebralis*. There are no treatment options currently available and containment and prevention are the focus for minimizing the spread of the parasite.

As of the most recently available Whirling Disease Risk Zone map many of the upper watersheds in the Eastern Slopes of the Rocky Mountains have had positive detections and are thus in the High Risk Red Zone in the risk zone map ([Whirling disease decontamination risk zone \[MAP\] - Open Government \(alberta.ca\)](#)) Many of these upper High Risk zones ultimately flow into the Bow, Oldman, Red Deer and North and South Saskatchewan rivers. Due to watershed connectivity, these downstream watersheds may be impacted although they have not been officially declared affected. Other watersheds in Alberta that may be implicated and are listed as at High to Moderate Risk (Yellow Zone) include the Athabasca and Peace rivers.

In response to this ongoing threat, ECCC has liaised and reviewed protocols with Alberta Environment and Parks to implement field and laboratory processes to mitigate spread of this parasite (for more information: <https://www.alberta.ca/whirling-disease.aspx>). In the field, personnel follow the decontamination protocol by using a combination of dedicated field equipment and sampling equipment, decontamination between sites and risk areas to mitigate the spread of the organism. For all samples from Alberta and the Alberta/Saskatchewan border, staff also are required to wipe down the interior of the shipping cooler and each individual sample bottle with a disinfecting wipe prior to shipping to the lab. ECCC labs have implemented a process whereby the instrument waste and any unused sample is collected and treated prior to disposal into municipal sewage. Currently, these modifications for field and laboratory processes have been applied to 6 of the 12 PPWB water quality monitoring sampling sites (all sites on the AB/SK border) and for field processes, 4 water quality sites and up to 50 CABIN

sampling sites per year in the Lower Athabasca River during sampling for Oil Sands related water quality and biomonitoring sampling.

National Hydrometric Network

Environment Canada and Climate Change (ECCC) monitors water level and/or flow at 344 hydrometric stations (Table 2) in the Mackenzie River Basin (MRB) through its water collection and dissemination division, the Water Survey of Canada (WSC). Table 1 indicates the number of WSC stations in the MRB located in each province or territory. Figure 2 shows the locations of WSC monitoring stations in the MRB. The majority of these stations provide real-time data to the public through WSC’s real-time website. WSC operates these stations in support of provincial bilateral agreements, flood monitoring, power generation, climate studies and other scientific research.

Table 2. Active WSC hydrometric stations in the MRB by province and territory.

Province / Territory	Active WSC Hydrometric Stations
Alberta	176
British Columbia	51
Northwest Territories	93
Yukon	15
Saskatchewan	9
Total	344

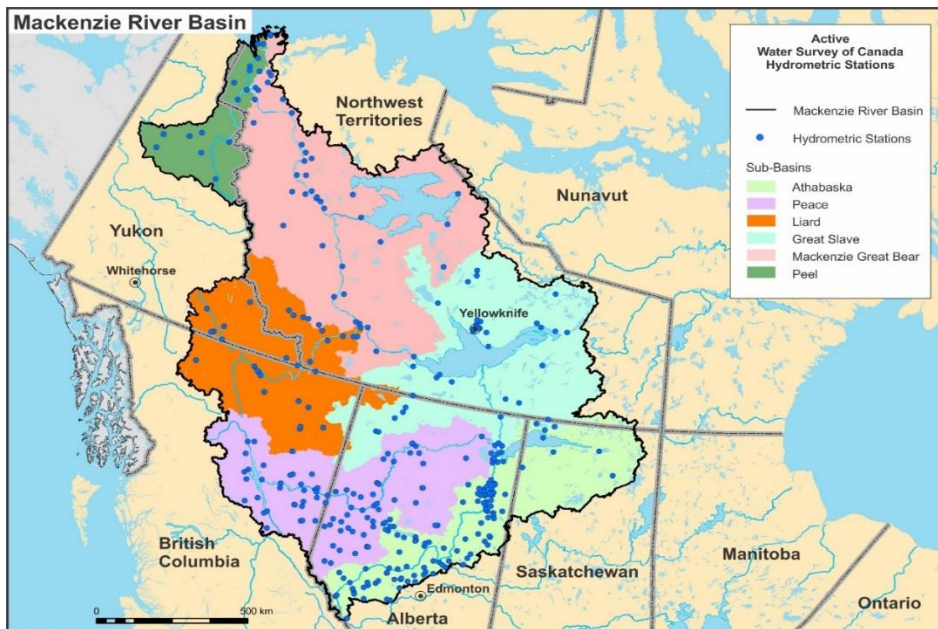


Figure 2 WSC hydrometric monitoring locations in the Mackenzie River Basin. A summary of WSC monitoring operations in the Mackenzie River Basin from provincial and territorial jurisdictions follows:

SASKATCHEWAN

Saskatchewan experienced high to normal water levels in 2022.

COVID-19 did not limit the operation of the hydrometric network in Saskatchewan during this reporting period. Standard operating procedures for working in close proximity and COVID-19 protocols for accommodations and air charters were followed.

There are ongoing discussions to determine a funding agency for Tazin River above Tazin Lake (07QC006). SaskPower no longer has interest and is no longer funding the station. The station is being funded federally during this process (Figure 3).

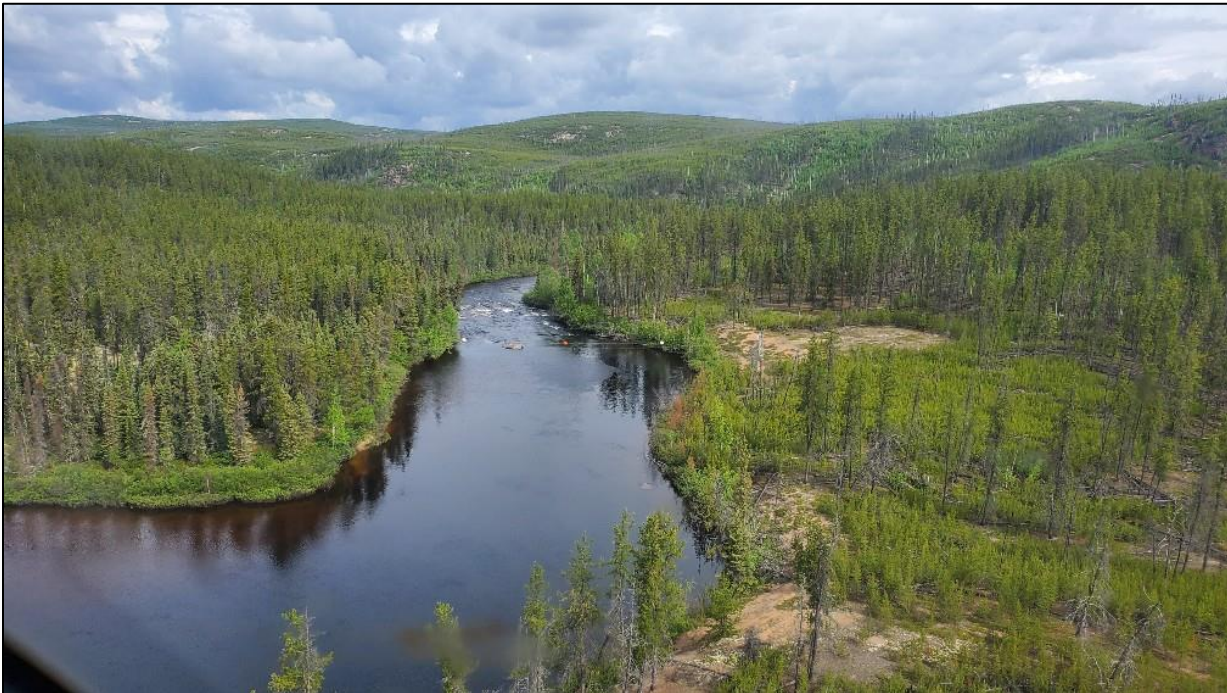


Figure 3. Tazin River above Tazin Lake (07QC006) from June 26, 2022.

ALBERTA

Extreme high flows observed in May and June in northwestern Alberta included the Notikewin River, Keg River, Birch River, Sousa Creek, Steen River and Hay River. Preliminary data suggests record (or near record) high water since these gauges were activated. Steen River near Steen River (07OB004 - Figure 4), Sousa Creek Near High Level (07OA001), Boyer River at Paddle Prairie (07JF005), Hay River near Meander River (07OB003) all recorded the highest measurements in history.



Figure 4 Steen River near Steen River (07OB004).

Historic measurements obtained during high flow events will be used to validate or re-establish the upper ranges of the stage-discharge rating curves.

A radar sensor was installed at Smoky River at Watino (07GJ001) in June 2022 to collect better quality data during high water as this area is prone to sedimentation of conventional water level sensors.

Pembina River near Entwistle (07BB002) was relocated 400m upstream of the current location in May 2022 due to safety concerns. The old gauge is scheduled to be decommissioned in October 2022.

Wapiti River near Grande Prairie (07GE001) is located near a major bridge construction project. Because of the backwater fluctuations created by construction in the vicinity, discharge at this site has been more difficult to determine during the open water season.

Winagami Lake at Provincial Park (07BF006) look-in shelter was damaged in May 2022. Relocation of the gauge is planned for October 2022.

Two stations were upgraded to Geostationary Operational Environmental Satellites (GOES) from cellular modem or landline communications to improve data collection:

- 07BE003 Porter Creek Above Baptiste Lake
- 07BC006 Dapp Creek at Highway No. 44

Freeman River near Fort Assiniboine (07AH001) and Paddle River at Barrhead (07BB006) received logger upgrades in September 2022 to support GOES telemetry and ensure the continued transmission of data.

A camera was installed at the Clearwater River above Christina River (07CD005) station upstream of Fort McMurray.

During the 2022 operating season, technologists focused efforts on improving the benchmark network at various stations throughout the basin. To date, over two dozen benchmarks were installed in the Fort McMurray/Fort Chipewyan area.

Staff conducted an emergency trip in April 2022 to move the Athabasca River at Old Fort (07DD011 - Figure 5) shelter back from the edge before ice breakup. Using a series of ties, winches, and levers, staff successfully moved the shelter to the back of the site and away from the water edge. The subsequent river ice breakup eroded an additional 2 m of bank, which would have sent the shelter into the river resulting in costly remediation efforts.



Figure 5. Athabasca River at Old Fort (07DD011).

BRITISH COLUMBIA

Within the Mackenzie River basin, 51 WSC hydrometric monitoring stations fall within the provincial boundaries of British Columbia. In 2022, there were no changes to the network.

Three stations within the Mackenzie River basin received water level sensor upgrades as part of our station modernization agreement with BC Ministry of Environment and Climate Change Strategy:

- 07EF002 – Williston Lake at Lost Cabin Creek
- 07EF003 – Williston Lake near Schooler Creek
- 07FA004 – Peace River above Pine River

Three additional station sensor upgrades are pending this fiscal year:

- 07FA005 – Graham River above Colt Creek
- 07FB002 – Murray River near the Mouth
- 07EE010 – Pack River at Outlet of McLeod Lake

At the request of BC Hydro, several sites have been or will be upgraded with new air temperature sensors this fiscal year.

Under the National Hydrological Services - Treasury Board renewal funds, the cableway infrastructure at six stations were refurbished and returned to operational service in 2021/2022:

- 07EE009 – Chuchinka Creek near the Mouth – (return to service)
- 07FB004 – Dickebusch Creek near the Mouth – (return to service)
- 07EA005 – Finlay River above Akie River – (return to service)
- 07EA004 – Ingenika River above Swannell River (return to service)
- 07EC004 – Osilinka River near End Lake (return to service)
- 10BE004 – Toad River above Nonda Creek (return to service)
- 10BE007 – Trout River at Kilometre 783.7 Alaska Highway

One station had the cableway removed:

- 07FA007 – Cypress Creek near the Mouth – (removed)

One station was vandalized and is missing data from October 23rd to November 11th, 2021:

- 07FD001 Kiskatinaw Farmington – submersible line cut

Some stations experienced periods of missing data due to sensor issues:

- 07FB001 Pine – August 7 – August 31
- 07FC001 Beaton – May 10 – May 15, July 13 – 28, September 4 – current
- 10CB001 Sikanni – August 19 – current

Freshet began later than normal at almost all sites in northern British Columbia and many sites exceeded the 75th percentile of flows. This is attributed to a late melt and snowpack accumulation late in the year. Below is a sample of hydrographs from the region, Figure 6.

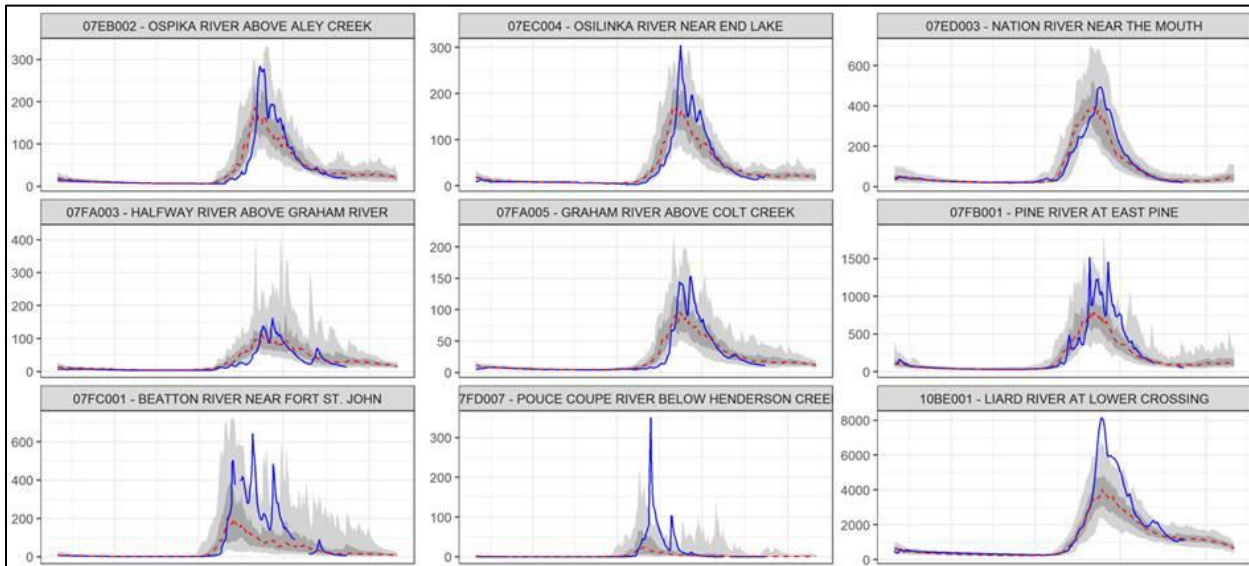


Figure 6 Current discharge rates rated to historical norms (50th percentile) and extremes (5-95th percentile) at select British Columbia stations within the Mackenzie River basin. Blue line denotes current (2022) discharge, and red line denotes 50th percentile, light grey 5th to 95th percentile and dark grey 25th to 75th percentile.

NORTHWEST TERRITORIES AND YUKON

The Great Slave Lake basin continued to experience high water well into 2022. Great Slave Lake at Hay River (07OB002) gauge was destroyed during freshet and the community of Hay River experienced significant flooding. The gauge was restored to active status in mid-June, after a reconnaissance visit in late May. Access to the site was difficult due to the conditions within and surrounding Hay River.

Gauges on the Mackenzie River at Fort Simpson (10GC001) and Mackenzie River at Sans Sault Rapids (10KD001) are also still operating in temporary shelters resulting from damage incurred during the 2021 river ice breakup and flooding event. Both locations are scheduled to have permanent shelters re-built in 2023.

The use of satellite transmitting cameras deployed at strategic locations enabled partners and clients to monitor the ice front and flooding events in near real-time and supplemented water quantity data from the gauges.

COVID continued to limit staff availability in the early parts of 2022, which created logistical challenges for the program, and frequent pivots on short notice were required to maintain operations.

WEBSITE AND CONTACT INFORMATION:

Access to real-time Water Survey of Canada flow and water level data can be found at:

https://wateroffice.ec.gc.ca/mainmenu/real_time_data_index_e.html

Access to historical Water Survey of Canada flow and water level data can be found at:

https://wateroffice.ec.gc.ca/mainmenu/historical_data_index_e.html

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