Environment and Climate Change Canada
Environnement et Changement climatique Canada

Environment and Climate Change Canada Agency Report 2021

Mackenzie River Basin Board Meeting #70

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Canada

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Aussi disponible en français

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Water-Related Legislation / Policy / Regulations / Planning

Implementation of the 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)** task teams and progress to date are highlighted below. ECCC provides interim secretariat support to the EFH Working Group and task teams.

Environmental Flows and Hydrology Working Group

- The EFH Working Group held a virtual meeting on June 23, 2021 to discuss current priorities and planned activities. Updates were provided on the development of the environmental flows framework and the hydrodynamic model for Lake Athabasca and the Peace Athabasca Delta system.

Indigenous Task Team

- The Indigenous Task Team completed a draft template of the Indigenous Knowledge Sharing and Use Agreement, which is currently under review with Indigenous governments. There is continued discussions on community capacity needs, goals and objectives with other task teams in order to support Indigenous Knowledge gathering work required for the implementation of the Action Plan.

Water Control Structures Task Team

- The Task Team is working on hiring a consultant for the preliminary design and Impact Assessment of the Dog Camp and Big Egg Lake water control structures and Action Plan partners have had an opportunity to provide comments on the draft contracting documents, including engagement and follow up with task team members on technical and community support considerations.

Strategic Flow Release Task Team

- Parks Canada is leading the development of a joint assessment report of the 2020 spring break-up flood with help from the Government of Alberta, BC Hydro, Environment and Climate Change Canada, Government of the Northwest Territories, Mikisew Cree First Nation and the Northwest Territories Métis Nation. Technical work and information gathering is advancing to understand the risks and benefits of a strategic flow release during spring break-up.

Information Sharing Task Team

- The Information Sharing Task Team is reviewing web-based information portals that could support the establishment of a Knowledge Hub. The intention is for this Knowledge Hub to be housed within the proposed Delta Institute. The Task Team is also guiding discussions on communication needs of the Action Plan and how best to share information with communities.

Contact info:

ECCC EFH 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.

A risk-based adaptive management framework (Contact: arash.shahsavarani@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 criterion (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 and 2). 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 Figures 1).

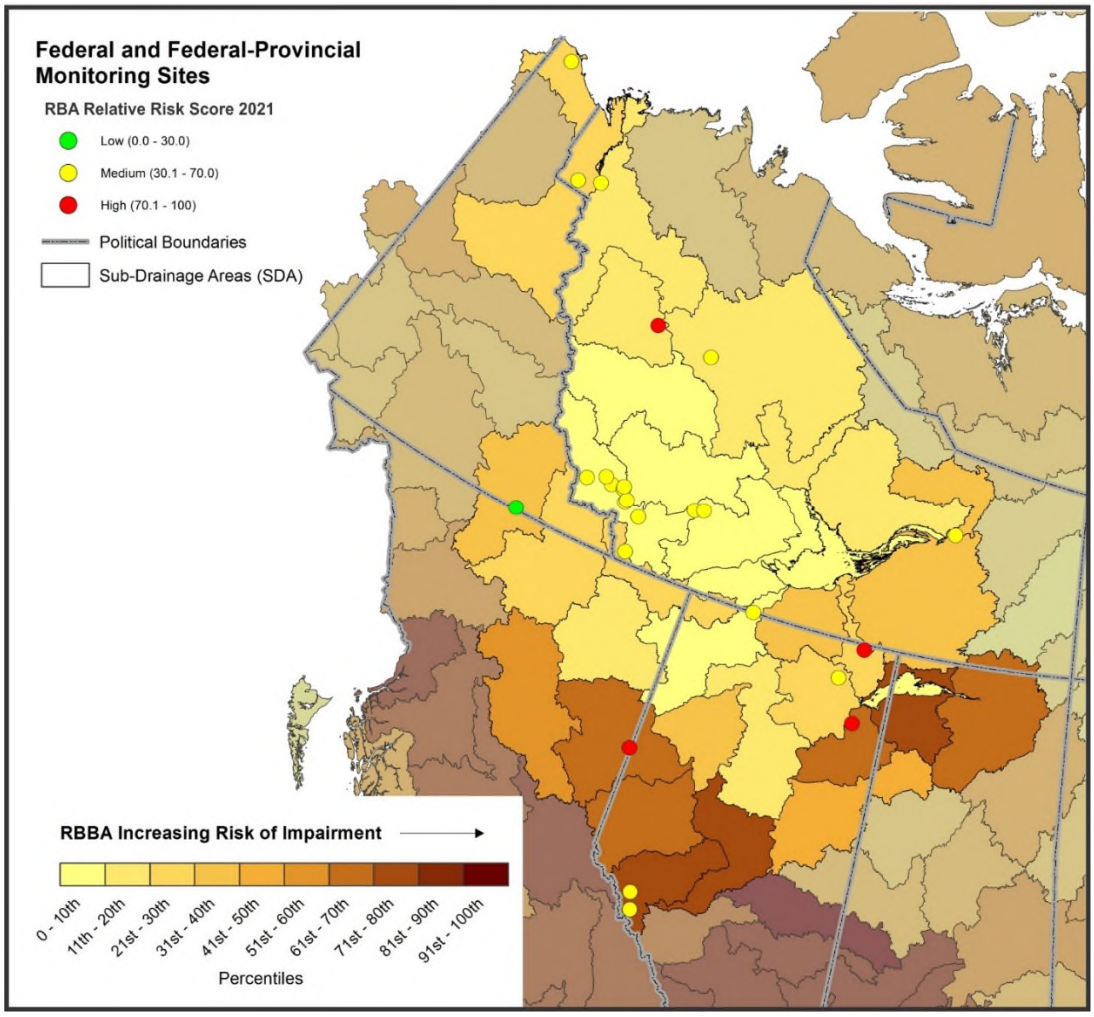

Figure 1: Results of RBBA and RBA analyses for basins of interest to MRBB, 2021.

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. In April 2020, delivery of data to the GoC Open Data Portal was suspended due to the COVID-19 pandemic. This has resulted in a lack of updates to the open domain for 2020/21. In the interim, data were provided directly to partners upon request.

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
- Peace-Athabasca

In addition, the most recent data pertaining to the ongoing Oil Sands Monitoring Program are available online through both (http://data.ec.gc.ca/data/substances/monitor/surface-water-quality-oil-sands-region/) and (https://aws.kisters.net/OSM/applications/public.html?publicuser=Guest) data web portals. (contact: nancy.glozier@canada.ca).

Support to the MRBB (Contact Nancy.Glozier@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 26 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 125 per year as well as approximately 10% additional samples for Quality Assurance/ Quality Control. Due to the suspension of monitoring during the COVID-19 pandemic, ECCC sampled

approximately 35% of the planned sampling events in the MRBB between April 2020-March 2021. Samples are analyzed for a range of parameters including nutrients, metals, major ions, physicals and, at a subset of sites, 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
Table 1 …cont.						
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
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

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

To date, the Bow, Oldman, Red Deer and North Saskatchewan River watersheds have been officially declared as whirling disease impacted (https://www.alberta.ca/whirling-disease.aspx). Due to watershed connectivity, some watersheds are being impacted although they have not been officially declared affected. These watersheds are:

- Milk River Watershed– receives water from the St. Mary's diversion which is in the Oldman River Watershed.
- South Saskatchewan River Watershed – both the Bow River and the Red Deer River join the South Saskatchewan River. The Bow River joins upstream of the PPWB sampling site, the Red Deer River downstream.

Other watersheds that may be implicated and are listed as at risk include:

- Athabasca River Watershed – with headwaters in Jasper National Park and outflows into the Peace Athabasca Delta (PAD), Lake Athabasca and eventually through to the Slave River.
- Peace River Watershed – with headwaters in British Columbia and outflows into the Peace Athabasca Delta (PAD), Lake Athabasca and eventually through to the Slave River.

In response to this new 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 use 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.

Water Level and Flow Report

Environment Canada and Climate Change (ECCC) monitors water level and flow at 332 hydrometric stations in the Mackenzie River Basin (MRB) through its water collection and dissemination branch, the Water Survey of Canada (WSC). Table 2 indicates the number of stations located in the MRB from 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 Hydrometric Stations
Alberta	185
British Columbia	44
Northwest Territories	82
Yukon	12
Saskatchewan	9
Total	332

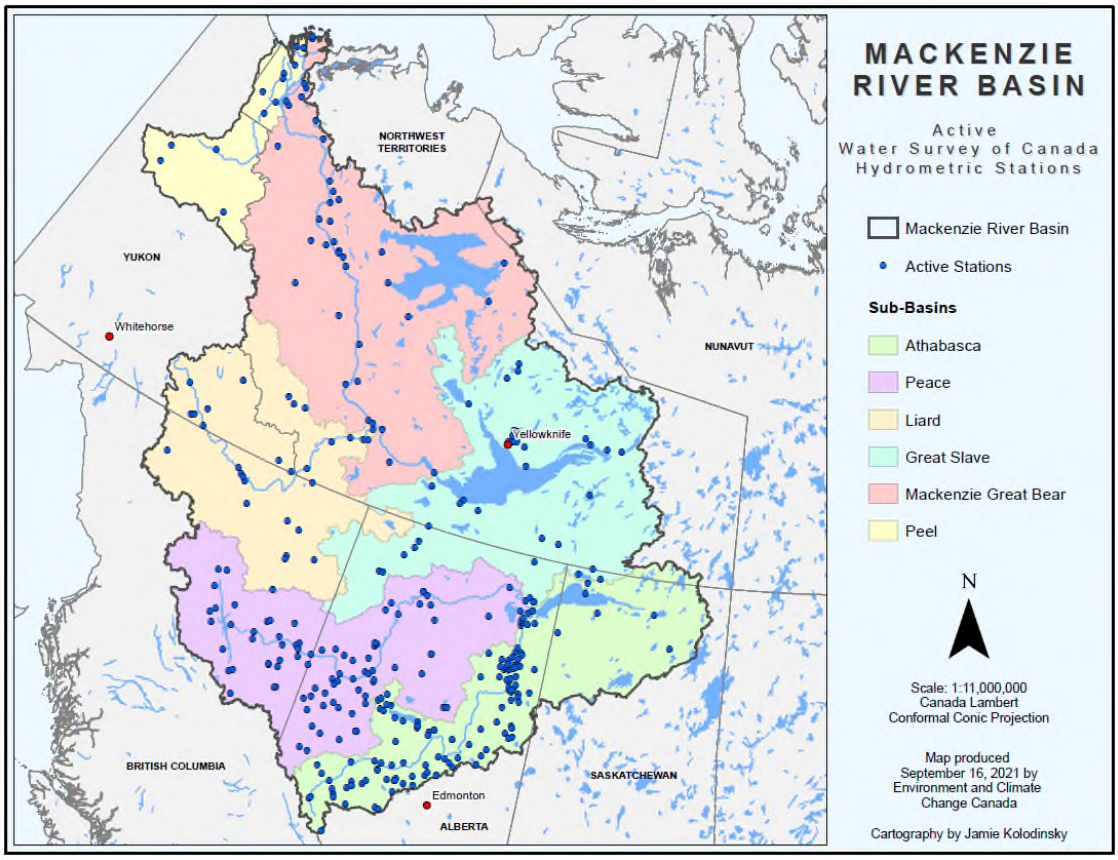

Figure 2. WSC hydrometric monitoring locations in the Mackenzie River Basin.

A summary of WSC monitoring operations in the Mackenzie River Basin from provincial and territorial jurisdictions follows:

SASKATCHEWAN

Saskatchewan experienced high water levels in 2021; however, not as high as the historic levels in 2020.

The gauge house at Douglas River near Cluff Lake (07MA003) was replaced in September 2021 with a tilting mast cabinet after a vandalism incident where the door was chopped in half by an axe. The cabinet was transported to the station by helicopter.

A remote-controlled boat was used to do ADPC discharge measurements at Charlot River at Outlet of Webb Lake (07QC008) and Douglas River near Cluff Lake (07MA003) in 2021.

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. Work was different under COVID-19 but not limiting.

Saskatchewan Power Corporation has indicated it will no longer fund Tazin River above Tazin Lake (07QC006); ECCC is awaiting confirmation on funding for this station from federal/territorial/other interests.

ALBERTA

Over 50% of the hydrometric stations in the Mackenzie River Basin are located within the province of Alberta. Station decommissioning and upgrades to replace aging infrastructure, improve safety, record quality and operational efficiencies continue. Stations with work in progress and completed from the 2021-22 work plan are:

Completed:

- 07BE001 Athabasca River at Athabasca
- 07GE003 Grande Prairie Creek near Sexsmith
- 07JD003 Jackpine Creek at Highway No. 88
- 07BG004 Lily Creek Near Slave Lake
- 07HC001 Notikewin River at Manning
- 07BJ001 Swan River Near Kinuso
- 07DA041 Eymundson Creek Near The Mouth
- 07KC001 Peace River at Peace Point
- 07CD009 High Hill River Near The Mouth

In Progress (as of September 2021):

- 07BF001 East Prairie River Near Enilda
- 07GA002 Muskeg River Near Grande Cache
- 07BC002 Pembina River at Jarvie
- 07GD004 Redwillow River Near Rio Grande
- 07GB001 Cutbank River Near Grande Prairie
- 07HA003 Heart River Near Nampa
- 07GG002 Little Smoky River At Little Smoky
- 07FD006 Saddle River Near Woking
- 07HA005 Whitemud River Near Dixonville
- 07GE002 Kleskun Hills Main Drain Near Grande Prairie

Rat Creek Near Cynthia (07BA002) was upgraded to Geostationary Operational Environmental Satellites (GOES) from cellar modem/land line communications to improve data collection.

The responsibilities for operation of 11 Peace Athabasca Delta stations in the Mackenzie River basin were transferred from NWT to Alberta (Edmonton Office) in January 2021.

In October of 2020 a targeted audit was done on 58 stations for the 2019 data year. The audit focused solely on the Vertical Control and Stage Record components. The benefit of a targeted audit is that a much larger sample of stations are audited, which provides a more complete network evaluation of certain components. Auditors identified areas of improvement for the vertical control component. Overall, auditors were satisfied with the stage record component. Several network wide action items will be carried out in Fall 2021/Winter 2022, particularly around ensuring there is an adequate systems of benchmarks, confirming each benchmark has a detailed description and accurately defining stable/unstable vertical control networks.

COVID-19 continues to impact the program. Mitigation measures are still in place. Staff continue to work by following safe work practices, which include: travelling in separate vehicles, using personal protective equipment and following public health authority guidance. WSC Alberta suffered the loss of critical senior staff and has worked hard to deliver the program while dealing with several vacancies. The impact of the pandemic caused several delays in hiring processes, which increased pressures on the existing staff.

Although WSC Alberta encountered several challenges in delivering the program in 2021, the staff went above and beyond and there was minimal loss of data record.

BRITISH COLUMBIA

Within the Mackenzie River Basin, 44 WSC hydrometric monitoring stations fall within the provincial boundaries of British Columbia. In 2021, one station was removed and one station was added to the monitoring network:

- 07EF001 – Peace River at Hudson Hope (removed)
- 07ED001 – Nation River near Fort St James (added)

While presenting logistical challenges, COVID-19 did not significantly affect the data quality from the majority of the WSC stations within the Mackenzie River Basin. As of 2021, only one station has received limited coverage due to COVID-19 restrictions in inter-provincial travel:

- 10DA001 – Petitot River below Highway No. 77 (limited access)

Despite COVID-19 logistical hurdles, five 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:

- 07FB002 – Murray River near the Mouth
- 07FB008 – Moberly River near Fort St. John
- 07FD001 – Kiskatinaw River near Farmington
- 07FD002 – Peace River near Taylor
- 10DC005 – Adsett Creek at Kilometer 386.0 Alaska Highway

Under the National Hydrometric Services - Treasury Board renewal funds, the cableway infrastructure at two stations were refurbished and returned to operational service in 2021. Cableway construction at an additional three stations is currently underway:

- 07EF004 – Carbon Creek near the Mouth (returned to service)
- 07FB002 – Murray River near the Mouth (returned to service)
- 07FA005 – Finlay River above Akie River (construction underway)
- 07EB002 – Ospika River above Aley Creek (construction underway)
- 07EC004 – Osilinka River near End Lake (construction underway)

Most British Columbia stations within the Mackenzie River basin recorded freshet flow rates that exceeded the 50th percentile of historic flow. Notably, the 07EE – Southern Williston Lake – Parsnip region recorded peak flows above the 95th percentile for historic freshet (Figure 3). Whereas, the 07FC – Beatton region recorded freshet flows below the historic 50th percentile (Figure 3).

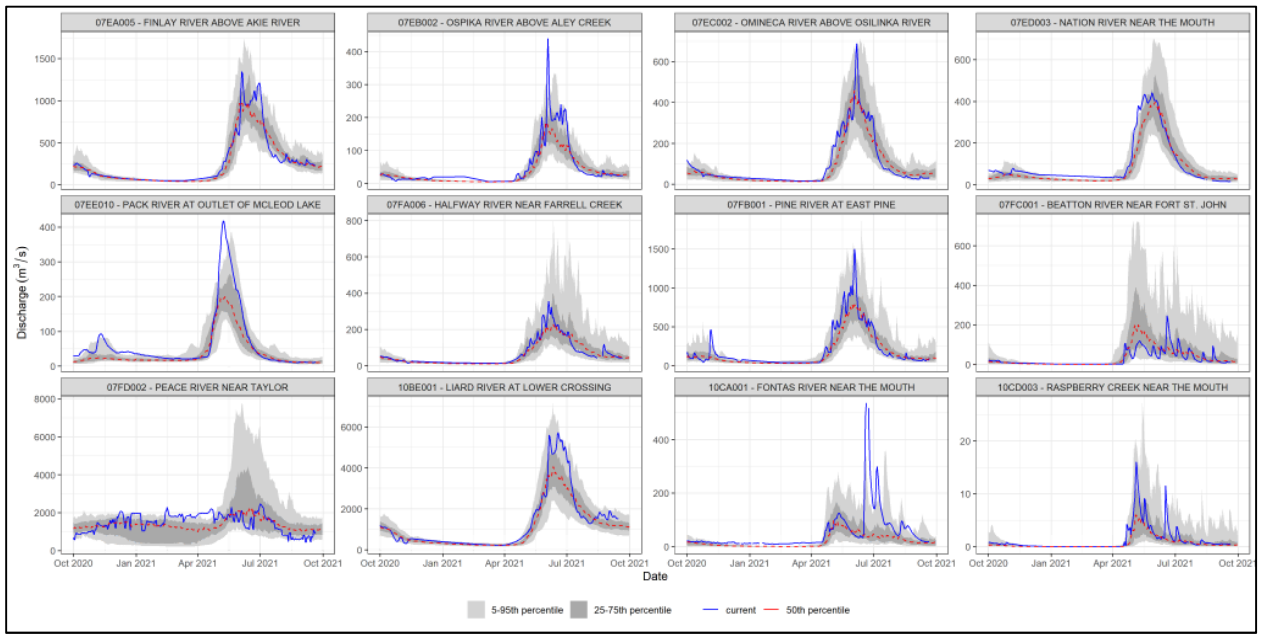

Figure 3. Current discharge rates rated to historic norms (50th percentile) and extremes (5-95th percentile) at select British Columbia stations within the Mackenzie River basin.

NORTHWEST TERRITORIES AND YUKON

Entering the spring of 2021, snowpack in the eastern portion of the Yukon, and western portion of the Northwest Territories (NWT) were above, or well above normal. The snowpack, combined with record high water levels within the Great Slave Lake Basin, resulted in the issuance of several flood warnings and evacuation orders for communities along the Mackenzie corridor. The villages of Fort Simpson, Jean Marie River and Fort Good Hope were all under evacuation order during various periods of breakup. Gauges at Peace River at Peace Point (07KC001), Mackenzie River at Fort Simpson (10GC001) and Mackenzie River at Sans Sault Rapids (10KD001) were destroyed and/or rendered inoperable due to ice jams and subsequent ice runs. The WSC sub-office in Fort Simpson was also

inundated during a flood event. Tributaries in the southern part of the basin, specifically Taltson River below Hydro Dam (07QD007) and Tazin River near the Mouth (07QC007) experienced, and continue to experience, record high flows, creating issues for infrastructure within the basin.

COVID-19 border crossing restrictions impacted the operation of stations located in Alberta by Yellowknife-based staff (e.g., Peace River at Peace Point, 07KC001). Yukon staff also experienced restricted operations at various points within the year to service gauges located in northern British Columbia.

Remote control boats were used during high flows to conduct discharge measurements and reduce risk to staff during challenging monitoring conditions. NuPoint satellite cameras were also used to capture daily images at select locations (Figure 4). Image frequency was increased during critical periods at the request of partners engaged in flood forecasting activities. The images provided a vital source of information on river conditions, especially in areas where gauges were destroyed, or otherwise rendered inoperable during the break-up period.

WEBSITE AND CONTACT INFORMTION:

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

For further information please contact:

Emmanuelle Johnston
National Hydrological Services / Water Survey of Canada
emmanuelle.johnston@ec.gc.ca

Figure 4. NuPoint camera image from Qu'Appelle River near Welby (05JM001).

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