



NWT Snow Survey Bulletin & Spring Water Levels Outlook 2021
Water Management and Monitoring Division, ENR
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This is an outlook for anticipated spring water levels in the NWT with information compiled from several sources. As hydrologic conditions in much of the NWT have been unprecedented from the summer of 2020 onward, it will be particularly difficult to anticipate water levels this spring (2021). Real-time hydrometric data provided by Environment and Climate Change Canada's (ECCC) Water Survey are always provisional, and can be particularly prone to error in winter as a result of ice conditions. Hydrometric data for NWT rivers are from stations that make up the NWT Hydrometric Network, a partnership between ECCC and the Government of the Northwest Territories (GNWT).

The Department of Environment and Natural Resources (ENR) on-the-ground snow surveys were conducted from mid-March through early April. These surveys measure the amount of snow water equivalent (SWE) on the ground. The amount of SWE is the amount of water obtained from a given area if all of the snow is melted. SWE varies based on the depth of snow and its density. SWE is an important piece of information ENR looks at when anticipating spring water levels, however a high snow pack alone does not necessarily lead to high water. The snow's interaction with existing soil moisture conditions, water levels, river ice conditions (i.e. breakup and or jams) and temperature and precipitation during snow melt shape local water conditions. During the freshet period (approximately mid-April to early May), it is normal for flow and water levels to be extremely variable.

North Slave Region

Due to high rain amounts in summer 2020 in the North and South Slave regions, the antecedent soil moisture conditions are very high and basins are 'full', meaning that it is likely that most of snowmelt will run off the land directly, instead of infiltrating into the soil. This runoff will add to the existing water levels of most local streams. Basins in the region are currently well-connected due to high precipitation in 2020 – this means that the total area contributing to a stream's flow is also near or at its maximum potential. Much depends, however, on the rate of melt and rain received through late spring and summer.

ENR snow surveys show that the snowpack in the Yellowknife and Snare River basins are just above average amounts at 106% and 109% of normal, respectively, as of late March 2021.

Provisional flows on gauged watersheds in the North Slave region are ranging from just above average (e.g., Cameron River below Reid Lake) to record high volumes (e.g., Waldron River near the mouth). ECCC's remotely sensed snow water equivalent (SWE) data for the Snare and

Yellowknife river basins for late March indicate there appears to be slightly higher SWE than indicated for the snow surveys, but ENR is currently assessing the validity of using this product and method in the Territory.

Hay River Basin

For the **Hay River** watershed, the March 1st spring runoff outlook of Alberta Environment and Parks estimates an average range (85-115% of normal) for runoff for the upper Hay River basin, and April 1st SWE in the Alberta portion of the basin also reflect average amounts. Provisional hydrometric data for the Hay River near Hay River indicates that flow volume has been above average over the winter months, dropping to average in April.

Slave River Basin

The primary tributaries to the **Slave River** basin are the Peace River, Athabasca River and Lake Athabasca/Peace-Athabasca Delta. Provisional data show that current flow on the Slave River is well above average, while flows on the Peace River at Peace Point and the Athabasca River at Embarras Airport are above average. Water levels on Lake Athabasca near Crackingstone Point remain above average.

In terms of SWE, as of April 1st, the British Columbia (BC) River Forecast Centre is reporting 112% of average SWE for the BC portion of the Peace River, while Alberta Environment and Parks (AB) is reporting a broad range from 40-200% of average in various parts of this large basin. However, AB is forecasting a below average to average river runoff for the Peace River. For the Athabasca River, AB indicated a SWE ranging from 85-200% across the basin, with a below average to average runoff forecast.

Great Slave Lake water level has remained at a record high level since July 2020, and the level in 2021 has generally followed that of an average winter, although offset to the high water condition.

Taltson and Tazin River Basins

According to the Water Security Agency of Saskatchewan, above normal runoff is expected over the Lake Athabasca basin this spring. Like much of the region, the northern part of Saskatchewan received well above normal rainfall in the summer of 2020, resulting in above normal (and record) flows and lake levels within the Lake Athabasca basin. Flows on both the Tazin and Taltson rivers continue to be at record high volumes. The Saskatchewan portion of the Tazin basin shows above average SWE. ENR surveys in the Taltson River basin also found an above average SWE (132%).

Liard River Basin

For the **Liard River** basin, Government of Yukon snow pack data for April 1st indicate that the snow pack in the upper Liard basin is at 154% of normal for this time of year. While the current (April 1st) flow for the Liard River upstream of Upper Liard (Yukon) is near average, the Yukon Government says the high snowpack increases the likelihood of high spring freshet flows. Snow accumulation in the British Columbia portion of the Liard basin is above average as of April 1st (overall, 122% of normal) (BC River Forecast Centre), while the provisional flow volume for the Liard River at Lower Crossing (BC) is approximately average at this time.

Dehcho and Sahtu Regions

ENR snow surveys in the **Dehcho region** completed in March 2021 indicate that snowpack in the region was above average (116%). It is important to note that the survey sites do not reflect potential snowpack in the mountains. Provisional flow volume on the **Liard River at both Fort Liard and the mouth** has been above average over much of the winter, with volume dropping to closer to average as of March. Estimated flow volume on the **Mackenzie River** has remained at near record values at Fort Simpson since December, while provisional data indicate record high water levels on the Mackenzie River at Norman Wells.

ENR snow surveys in the Sahtu region were completed during the second week of March 2021, so the percentage of average (77%) may not reflect the full month of March's snow pack.

Peel River Basin and Beaufort Delta Region

The Government of Yukon Snow Survey data for the Peel River basin for April 1st estimates the SWE to be approximately 102% of normal, with above average flow volume on the Yukon gauge on the Peel River. The estimated flow volume on the **Peel River above Fort McPherson** has been above average over the entire winter. Provisional data show that the **Mackenzie River** flow volumes above Aklavik (Peel Channel) and at Inuvik (East Channel) are both at record volumes for this time of year.

Factors to Watch

The potential and severity of freshet flooding will depend in large part on the weather over the upcoming weeks and how this interacts with existing water levels and snow pack amounts. The following variables are the primary factors that influence snowmelt runoff and water levels:

- Existing soil and basin conditions (connectivity)
- Current water levels
- Snow pack
- Rate of melt:

- Sudden extremely warm temperatures
- Rain on snow events
- Extreme amounts of rain
- Breakup conditions and ice jams (can result in out-of-bank flows, even if there are below normal flows)

Based on water level records, precipitation records, and observations of icings (i.e. aufeis), it can be inferred that antecedent soil moisture conditions are very high in most parts of the NWT and that a higher than normal percent of the snowmelt water will flow directly to streams, rivers, and lakes. It remains difficult to accurately predict the streamflow and lake level response during snowmelt as much is dependent on the timing and intensity of the melt season and the conditions noted above. As every year, several NWT communities are at risk of ice jam floods, regardless of preceding conditions.

Given the above normal rain in the summer and fall in the North and South Slave regions (and sub-basins that contribute to Great Slave Lake) in 2020, there is increased runoff potential of snowmelt water to streams, rivers and lakes.

Water level data are part of the NWT Hydrometric Monitoring Network, funded by ECCC and ENR, and operated by the Water Survey of Canada. Data can be seen and/or downloaded at https://wateroffice.ec.gc.ca/search/searchRealTime_e.html. Please be reminded that real time data should always be considered provisional.

Other resources:

Province of British Columbia

<https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/river-forecast-centre/snow-survey-water-supply-bulletin>

Province of Alberta

<https://rivers.alberta.ca/#>

Province of Saskatchewan

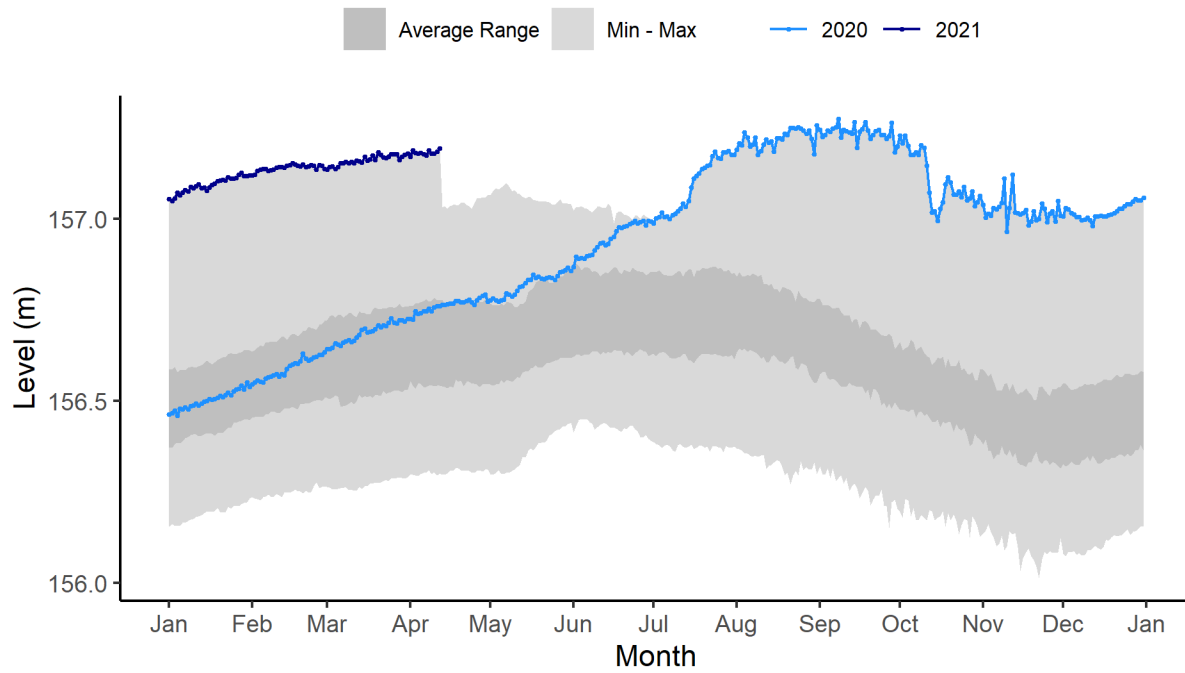
<https://www.wsask.ca/Global/Lakes%20and%20Rivers/Provincial%20Forecast/2021/March%202021%20Spring%20Forecast.pdf>

Yukon Territory

<https://yukon.ca/en/snow-surveys-and-water-supply-forecasts#snow-and-water-supply-data>

Appendix A: Water level and flow plots (as of the week of April 12th, 2021)

GREAT SLAVE LAKE AT YELLOWKNIFE BAY (07SB001)



GREAT SLAVE LAKE AT HAY RIVER (07OB002)

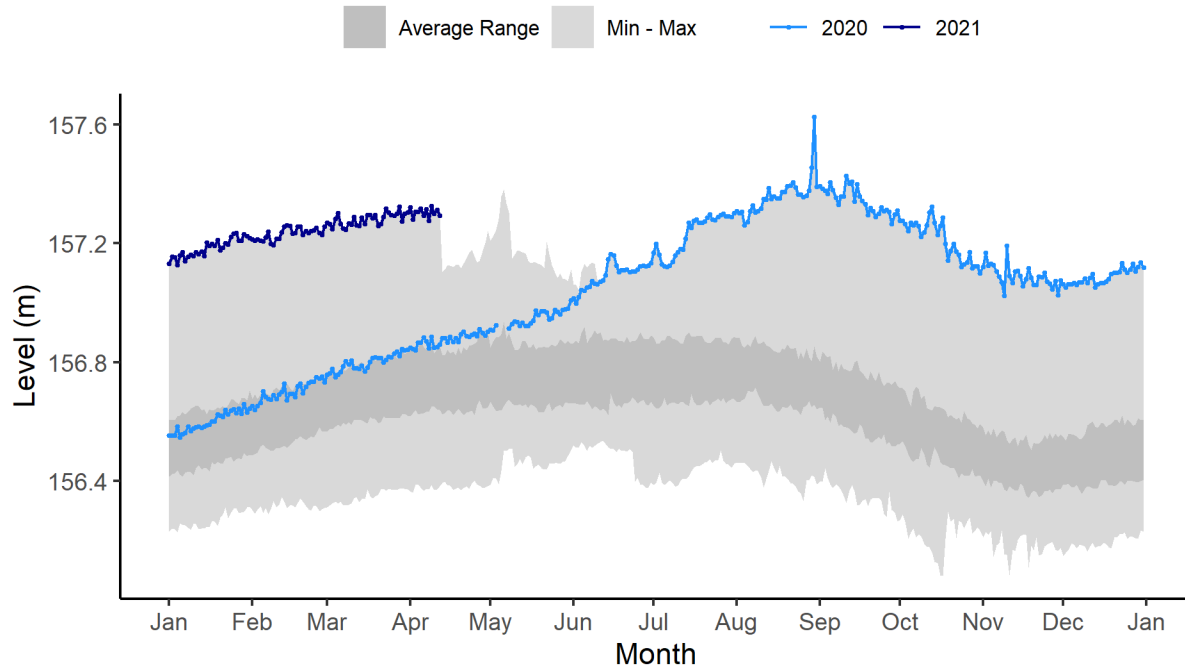


Figure 1: Water levels on Great Slave Lake for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums at: a) Yellowknife Bay; and b) Hay River.

HAY RIVER NEAR HAY RIVER (07OB001)

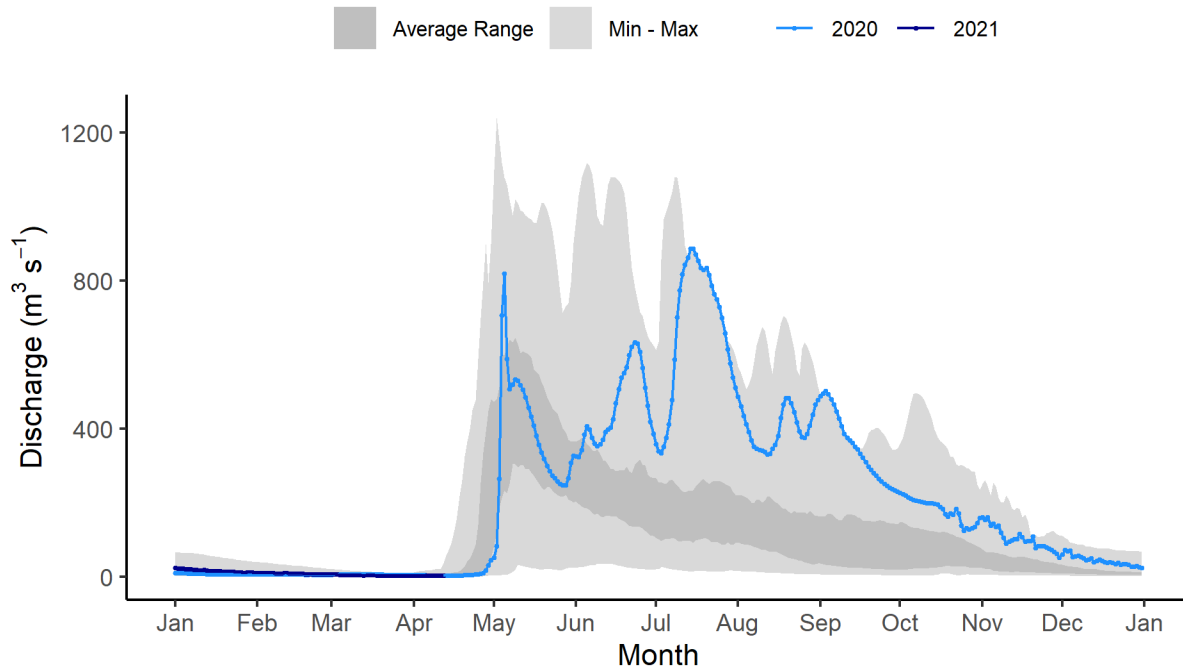


Figure 2: Water flows on the Hay River near Hay River for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

SLAVE RIVER AT FITZGERALD (ALBERTA) (07NB001)

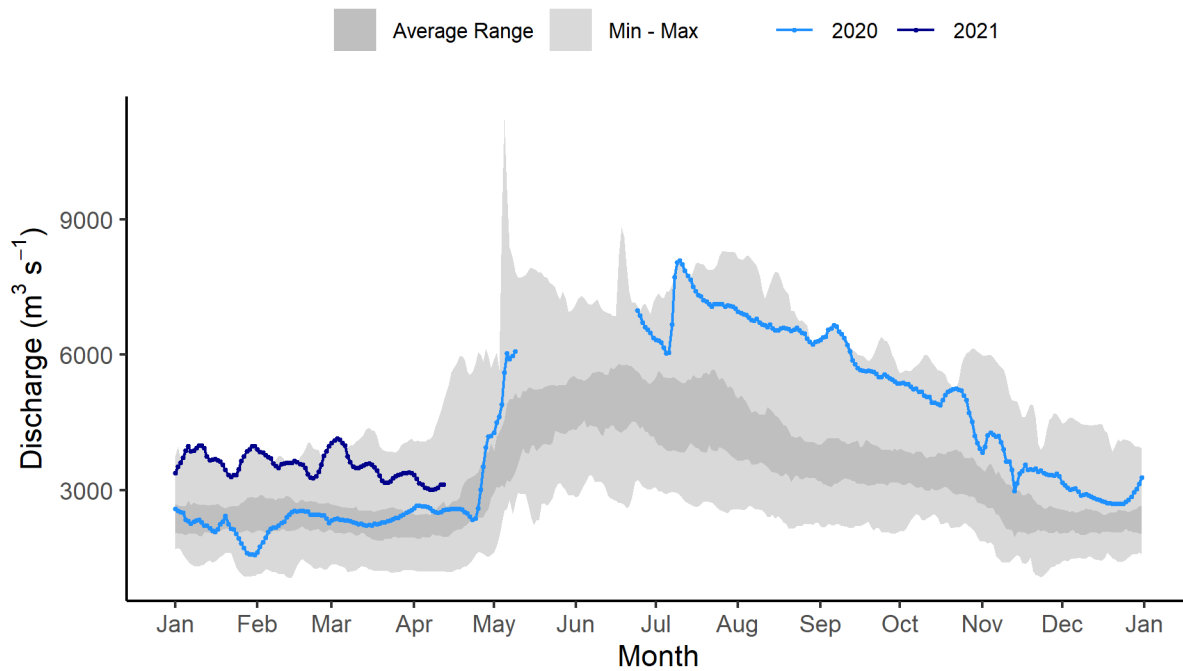


Figure 3: Water flows on the Slave River at Fitzgerald for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

LIARD RIVER AT FORT LIARD (10ED001)

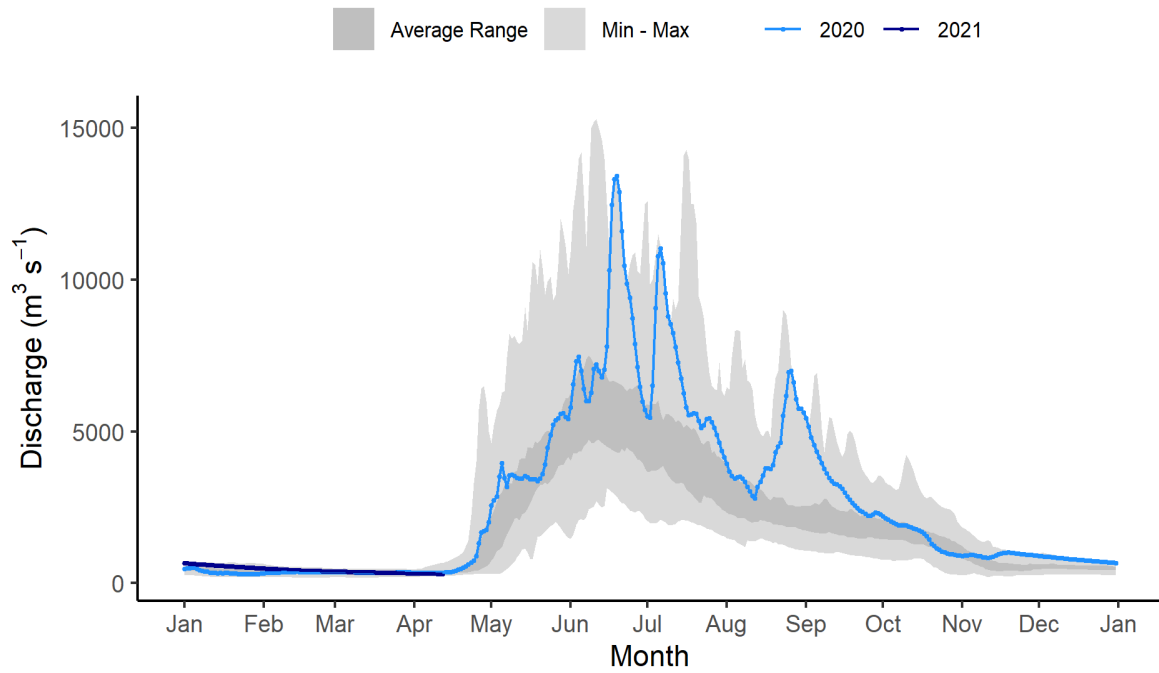


Figure 4: Water flows on the Liard River at Fort Liard for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

MACKENZIE RIVER AT FORT SIMPSON (10GC001)

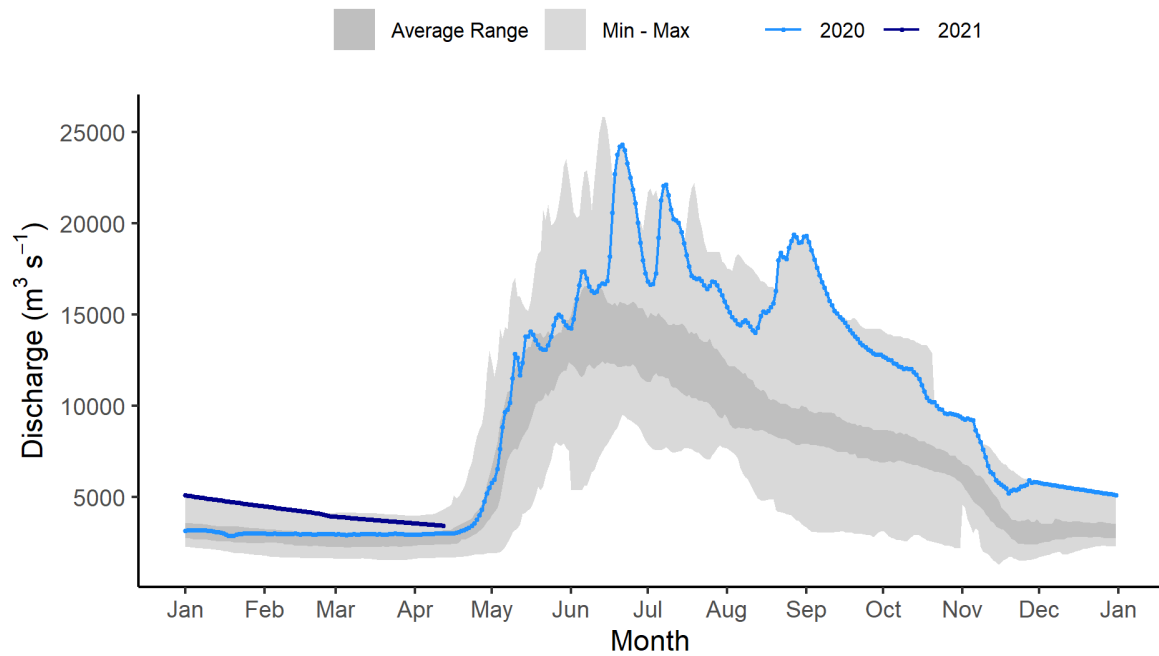


Figure 5: Water flows on the Mackenzie River at Fort Simpson for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

MACKENZIE RIVER AT ARCTIC RED RIVER (10LC014)

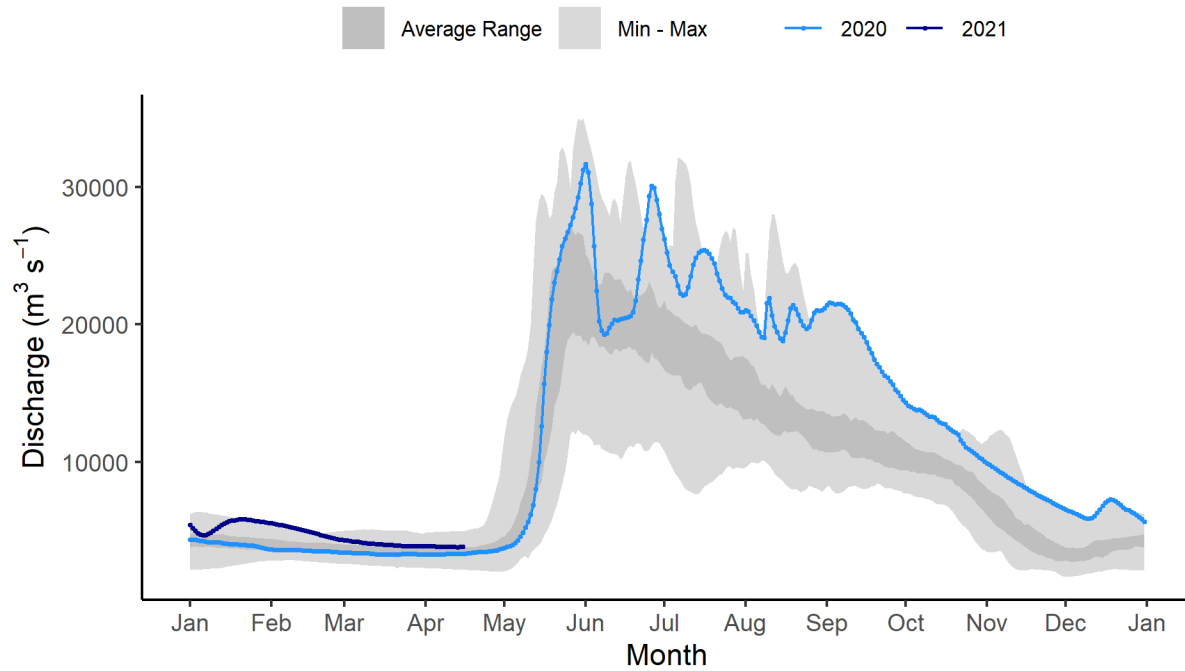


Figure 6: Water flows on the Mackenzie River at Arctic Red River for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

PEEL RIVER ABOVE FORT MCPHERSON (10MC002)

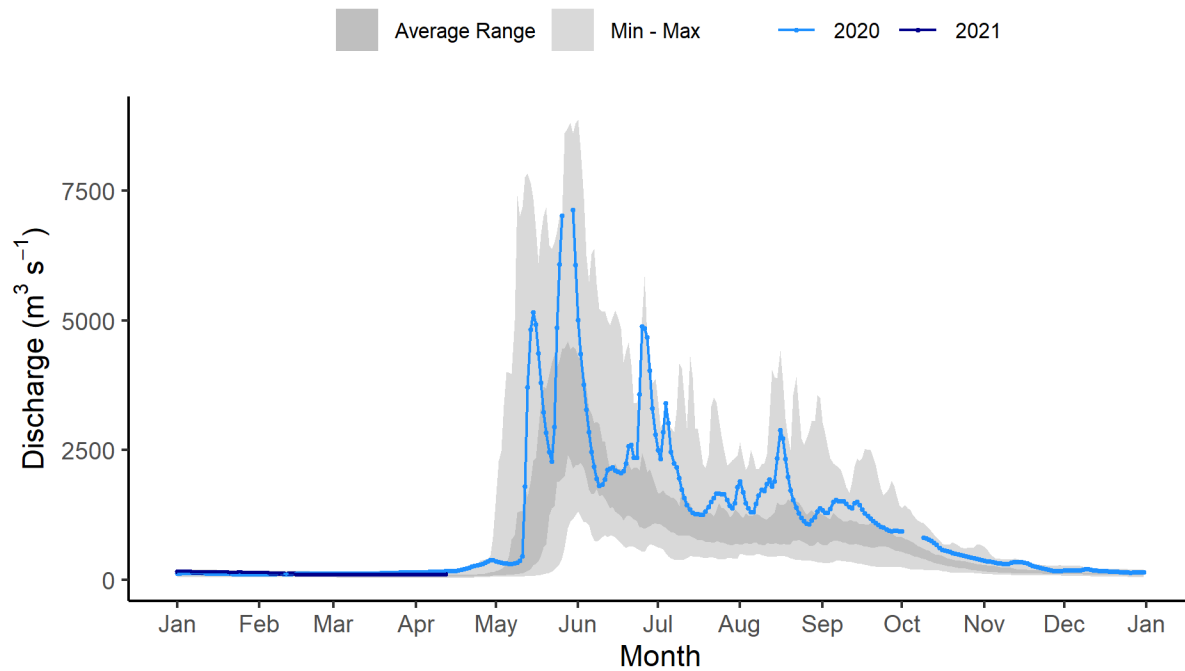


Figure 7: Water flows on the Peel River above Fort McPherson for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

MACKENZIE RIVER (PEEL CHANNEL) ABOVE AKLAVIK (10MC00)

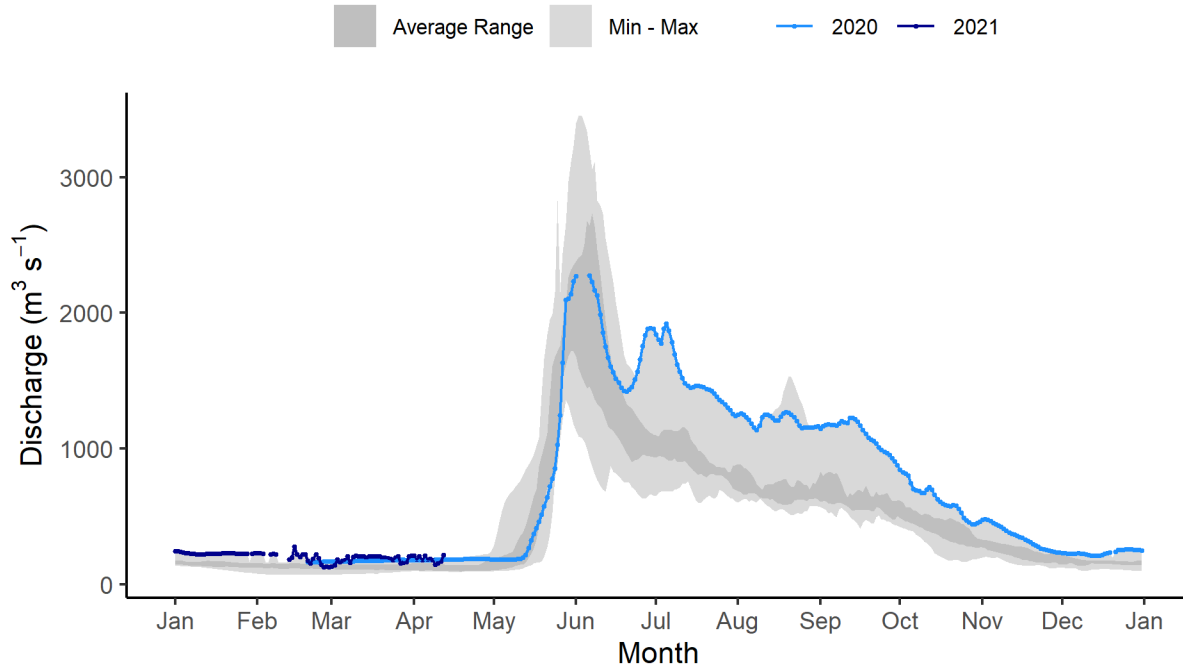


Figure 8: Water flows on the Mackenzie River (Peel Channel) above Aklavik for 2020 and 2021, relative to the historic average range (defined as the interquartile range) and historic maximum and minimums

**ENR Spring Snow Surveys - Northwest Territories
Snow Water Equivalent - March 2021**

	Long	Lat	Length of Record (years)	Yrs of record between 2001-2020 (years)	2001-2020 Mean SWE SWE (mm)	Current Mean Value Mar-Apr 2021 surveys Depth (cm) SWE (mm)		% of Normal (using 2001-2020 mean SWE) 2021 (%)	Regional Average 2021
Yellowknife River Basin					italics: <20 years				
Tibbitt Lake (Ingraham Tr Km 64 NW)	-113.38	62.50	39	20	81.2	57.1	89.0	109.6	
Bluefish Hydro	-114.25	62.68	26	15	79.4	55.8	80.0	100.8	
Allan Lake	-113.05	62.95	33	20	85.1	59.6	95.5	112.2	
Denis Lake	-112.62	63.37	34	20	103.2	71.1	127.0	123.1	
Little Latham Lake	-113.63	63.20	34	20	96.2	55.3	89.0	92.5	
Nardin Lake	-113.85	63.51	34	20	100.2	57.9	100.0	99.8	
Sharples Lake East	-112.82	63.90	34	20	100.3	67.5	119.5	119.1	
Jolly Lake	-112.21	64.12	9	5	132.4	53.6	124.0	93.7	
MEANS						59.7	103.0		106.3
Snare River Basin									
Big Spruce Lake	-116.00	63.50	43	20	103.7	53.2	87.0	83.9	
Ghost Lake	-115.07	63.88	44	20	102.6	66.2	107.0	104.3	
Indin Lake	-115.03	64.38	43	20	107.5	75.7	135.5	126.0	
Snare Lake	-114.04	64.20	43	19	101.7	75.1	126.5	124.4	
Winter Lake	-113.03	64.50	43	19	79.5	55.1	106.0	133.3	
Mattberry Lake	-115.96	64.09	44	20	94.8	60.0	96.0	101.3	
Castor Lake	-115.99	64.52	44	20	108.9	64.8	97.0	89.1	
Mesa Lake	-115.14	64.85	44	20	122.8	69.5	141.0	114.8	
Big Lake	-112.55	64.48	24	19	125.1	52.0	122.5	97.9	
White Wolf Lake	-114.60	65.00	26	19	139.3	57.6	167.5	120.2	
Christison Lake	-114.90	64.38	27	20	116.0	47.7	123.5	106.5	
MEANS						61.5	119.0		109.2
Other North Slave Region									
Mosquito Creek	-116.16	62.7	22	5	98.1	38.4	107.0	109.1	
South Slave Region									
Boundary Lake	-115.55	59.48	28	14	163.4	92.6	183.5	112.3	
Fort Smith	-111.86	60.00	38	19	90.2	52.9	100.0	110.9	
Hook Lake	-112.78	60.67	31	18	96.5	70.2	112.0	116.1	
Little Buffalo Tower	-113.79	61.00	39	19	122.1	74.3	152.5	124.9	
Nyarling River	-114.17	60.33	38	19	107.7	73.1	146.0	135.6	
Pine Point A	-114.36	60.82	39	19	139.8	82.1	179.0	128.0	
Thubun Lake	-111.75	61.50	36	17	86.9	64.7	98.5	113.3	
MEANS						72.8	138.8		120.2
Taltson River Basin									
Piers Lake	-111.17	60.32	37	18	100.8	79.9	152.0	150.8	
Tortuous Lake	-111.70	60.75	51	18	91.7	66.6	111.0	121.0	
Dunvegan Lake	-107.28	62.33	53	18	122.6	73.6	139.5	113.8	
Whirlwind Lake	-108.68	60.25	50	16	105.8	77.3	147.0	138.9	
Alcantara Lake	-108.28	60.90	51	18	113.2	78.9	150.0	132.5	

Hill Island Lake	-109.90	60.50	52	17	104.5	77.0	138.0	132.1
Thekulthili Lake	-110.23	60.97	51	17	96.2	70.8	125.0	129.9
Nonacho Lake	-109.67	61.72	52	17	110.1	71.8	121.5	110.4
Halliday Lake	-109.03	61.38	53	18	114.0	88.4	164.5	144.3
Gray Lake	-108.30	61.80	54	19	116.2	79.5	162.0	139.4
Dymond Lake	-106.28	61.38	51	17	130.1	82.2	144.5	111.1
Powder Lake (Forestry)	-109.41	61.04	7	6	105.8	85	164.5	155.5
MEANS						77.6	143.3	
Dehcho Region								
Checkpoint (previously JMC)	-121.25	61.45	21	8	107.0	66.4	114.0	106.5
Crown Fire site, Forestry	-117.15	61.58	4	3	85.0	55.1	91.0	107.1
Enterprise, Forestry	-116.15	60.56	4	3	103.7	64.2	117.0	112.8
Fort Providence, Forestry	-117.46	61.26	7	6	93.9	69.0	106.5	113.4
Fort Simpson	-121.33	61.80	26	7	100.3	61.9	114.0	113.7
Fort Liard, Forestry	-123.40	60.23	7	6	79.3	59.1	105.0	132.4
Hay River (Forestry)	-115.84	60.77	5	4	109.5	58.2	96.0	87.7
Jean Marie River (Forestry)	-120.65	61.52	7	6	89.7	74.3	123.0	137.1
Kakisa River	-117.27	61.00	40	20	110.1	64.2	108.5	98.5
Kimble Tower, Forestry	-117.73	61.14	7	6	108.6	65.9	114.0	105.0
Nahanni Butte Rd, Forestry	-123.11	61.95	7	6	104.2	66.8	127.0	121.9
Ndulee Lookout, Forestry	-122.53	62.15	7	6	85.8	67.0	109.5	127.6
Swede Creek	-116.57	60.27	40	20	98.6	70.5	120.5	122.2
Trout Lake, Forestry	-119.81	61.14	7	6	85.0	58.5	94.0	110.6
Wrigley, Forestry	-123.41	63.20	7	6	77.1	73.6	116.5	151.1
MEANS						65.0	110.4	
Sahtu Region* *Sahtu surveys completed 2nd week of March								
Colville Lake	-126.06	67.02	6	5	85.2	56.3	67.0	78.6
Déline	-123.43	65.19	5	4	102.0	58.2	75.0	73.5
Fort Good Hope	-128.61	66.27	5	4	100.8	58.2	81.0	80.4
Norman Wells	-126.76	65.28	6	5	98.2	46.3	62.2	63.3
Tulit'a	-125.53	64.90	5	4	99.6	60.5	87.0	87.3
MEANS						55.9	74.4	
Inuvik/Gwich'in Regions								
Rengleng River	-133.83	67.63	36	17	135.6	50.6	71.5	52.7
Caribou Creek	-133.48	68.05	36	17	122.4	45.5	68.0	55.6
Fort McPherson	-134.74	67.47	6	5	110.9	63.6	84.5	76.2
Midway Lake	-135.44	67.23	6	5	142.3	68.0	99.5	69.9
James Creek	-136.00	67.14	5	4	67.4	86.1	100.6	149.3
MEANS						62.8	84.8	

131.6

116.5

76.6

80.7

Number of Transects Sampled in 2021 = 64