NWT Water Monitoring Spring Break-Up Report

May 9, 2026 at 15:30

Surveillance des eaux aux TNO Rapport sur la débâcle printanière

9 mai 2026 à 15 h 30

NWT break up reports will be published routinely as break up unfolds. These reports will focus on regions with active snowmelt and ice break up. The geographic focus of the report will shift as conditions change. Additional information about basin conditions can be found in the ECC Snow Survey Bulletin and Spring Water Outlook, available here. If you have any photos or information about break up in your community, feel free to reach out to us: nwtwaters@gov.nt.ca.

Current Status:

- Break-up is near complete for the Hay River.
    - According to drone imagery captured this morning, rubble ice is blocking the east channel of the Hay River delta, while the west channel is clear.
    - After a rapid rise of nearly 2 m between May 7th and 8th, water level measured on the Hay River near the Town of Hay River is now rising slowly (20 cm in the last 12 hours).
- Break-up is progressing along the Mackenzie River.
    - According to satellite imagery acquired on May 8th, relatively intact ice remains between Fort Providence and just upstream of Fort Simpson.
    - After continued ice movement, a large open water section now stretches between Fort Simpson and Camsell Bend.
    - Water level measured on the Mackenzie River near Norman Wells is rising underneath relatively intact ice.
- Break-up is progressing quickly along the Peel River and the Arctic Red River.
    - Water level measured on the Peel River near Fort McPherson has risen by nearly 2 m in the last 24 hours. The water level is currently at 10 m which is within average range for the freshet peak.
    - Significant ice movement has been observed at the gauge just upstream of Fort McPherson, as of 12:00 MDT today.

Nous publierons régulièrement des rapports sur la débâcle aux TNO au fur et à mesure de l'évolution de la situation. Ces rapports se concentreront sur les régions où la fonte des neiges et la débâcle sont en cours. Nous changerons de région géographique en fonction de l'évolution de la situation. Vous trouverez des informations complémentaires sur l'état du bassin dans le Bulletin sur les relevés nivométriques et l'Aperçu des eaux printanières du MECC, disponibles ici. Si vous avez des photos ou des renseignements en lien avec la débâcle dans votre collectivité, n'hésitez pas à communiquer avec nous à l'adresse suivante : nwtwaters@gov.nt.ca.

Situation actuelle

- La débâcle est presque terminée sur la rivière Hay :
    - D'après les images prises ce matin à l'aide d'un drone, des fragments de glace bloquent le bras est du delta de la rivière Hay, tandis que le bras ouest est dégagé.

    - Après une crue rapide de près de 2 m entre le 7 et le 8 mai, le niveau de l'eau mesuré sur la rivière Hay, près de la ville de Hay River, augmente désormais lentement (20 cm au cours des 12 dernières heures).
- La débâcle suit son cours le long du fleuve Mackenzie :
    - Selon les images satellites prises le 8 mai, il reste de la glace relativement intacte entre Fort Providence et le secteur tout juste en amont de Fort Simpson.
    - La glace s'est déplacée de façon continue, et il y a maintenant une large zone d'eau libre entre Fort Simpson et Camsell Bend.
    - Le niveau d'eau mesuré sur le fleuve Mackenzie près de Norman Wells monte sous la glace relativement intacte.
- La débâcle progresse rapidement le long de la rivière Peel et de la rivière Arctic Red.
    - Le niveau d'eau mesuré sur la rivière Peel, près de Fort McPherson, a augmenté de près de 2 m au cours des 24 dernières heures. Il s'élève actuellement à 10 m, ce qui se situe dans la fourchette moyenne pour le pic de crue printanière.
    - À 12 h (heure des Rocheuses) aujourd'hui, on observait un mouvement important de la glace à la jauge située tout juste en amont de Fort McPherson.

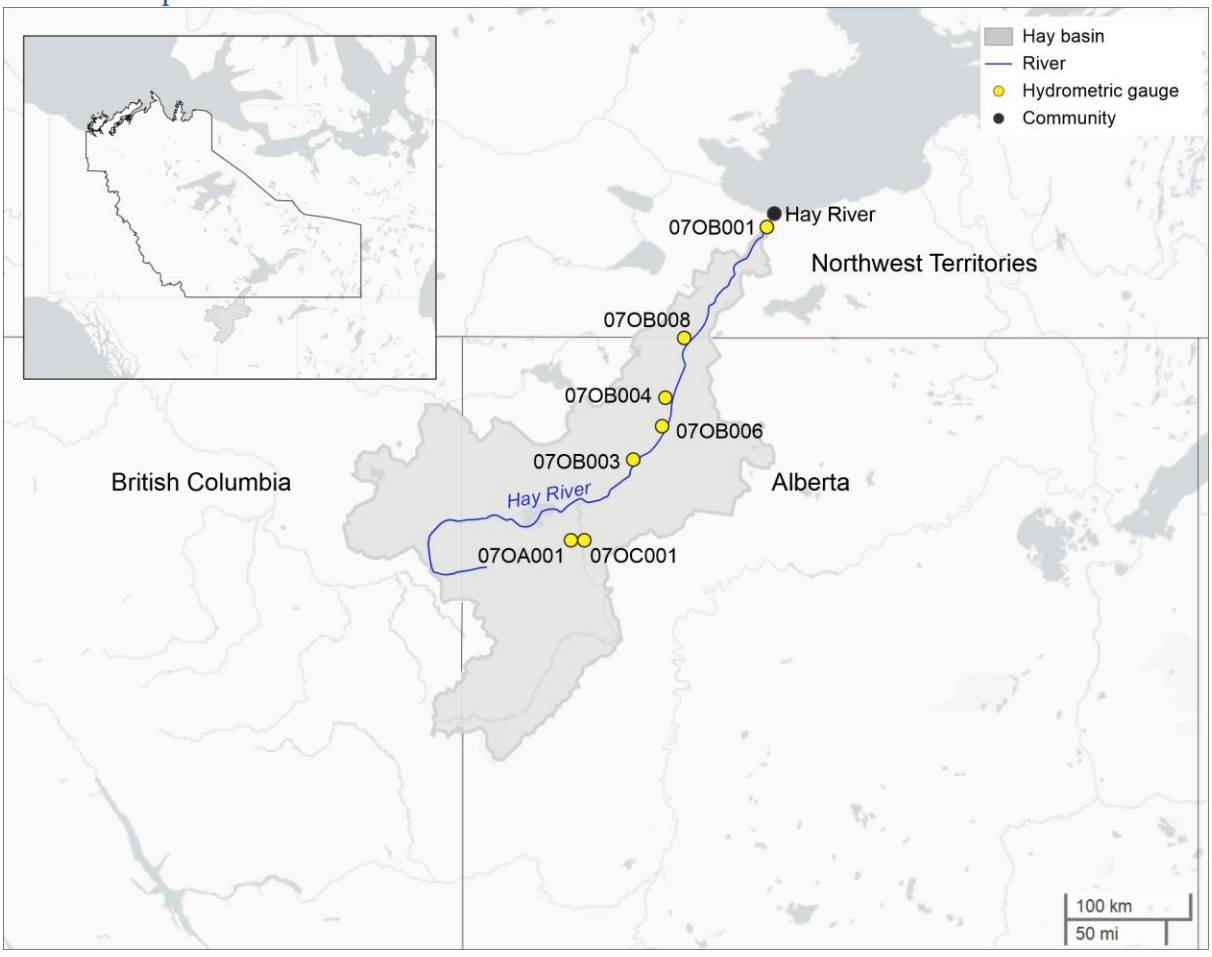
Contents

Hay River

Current Status:

- Break-up is near complete for the Hay River.
    - According to drone imagery captured this morning, rubble ice is blocking the east channel of the Hay River delta, while the west channel is clear.
    - After a rapid rise of nearly 2 m between May 7th and 8th, water level measured on the Hay River near the Town of Hay River is now rising slowly (20 cm in the last 12 hours).
    - According to satellite imagery, very little river ice remains upstream of the Town of Hay River.
- Above average temperatures for the remainder of this weekend and into next week should result in further ice degradation and the release of rubble ice from the east channel.
- Refer to the Town of Hay River website for the most up-to-date information, as well as webcam images of current conditions.

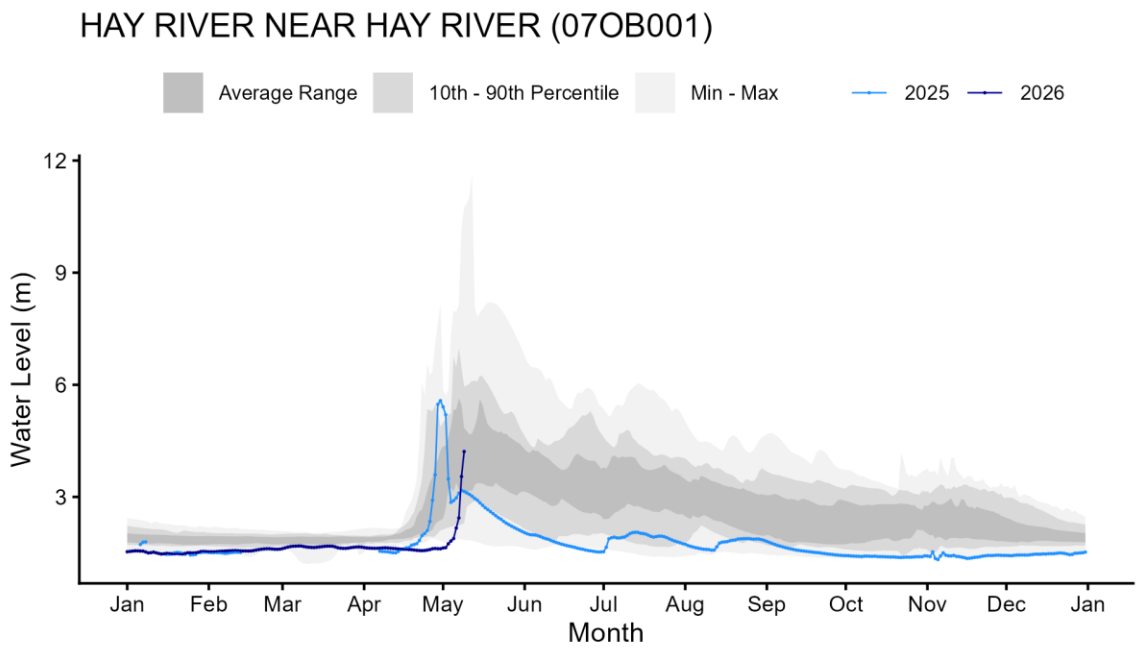
Station Map:



Above: Map of Hydrometric Stations and nearby communities for the plots included in this section.

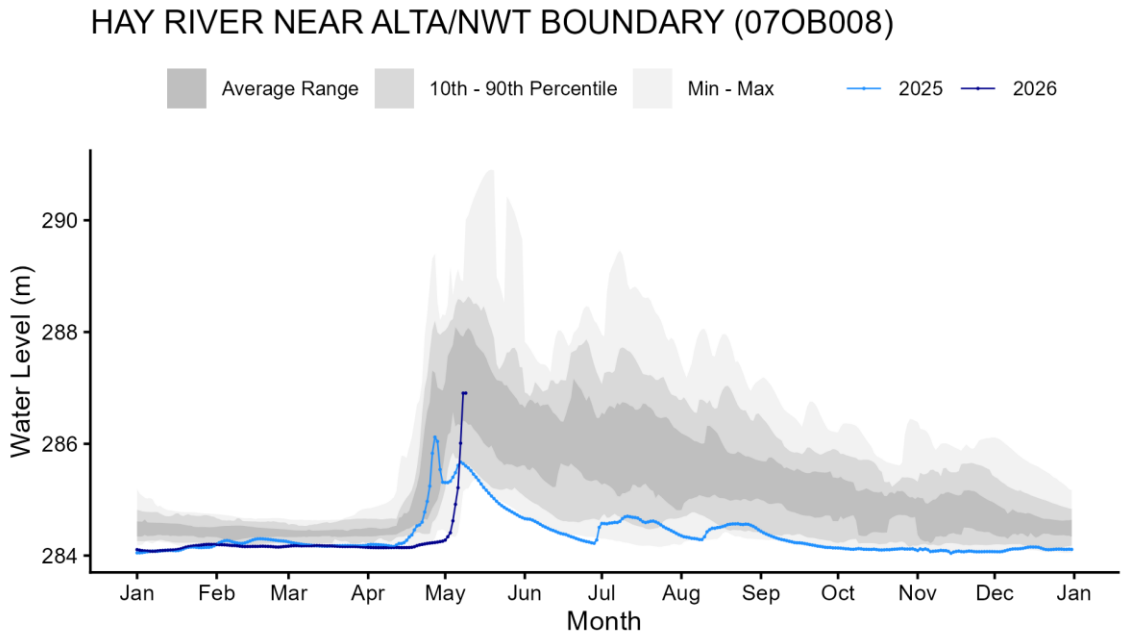
Hydrometric Data:

Hay River near Hay River [07OB001]



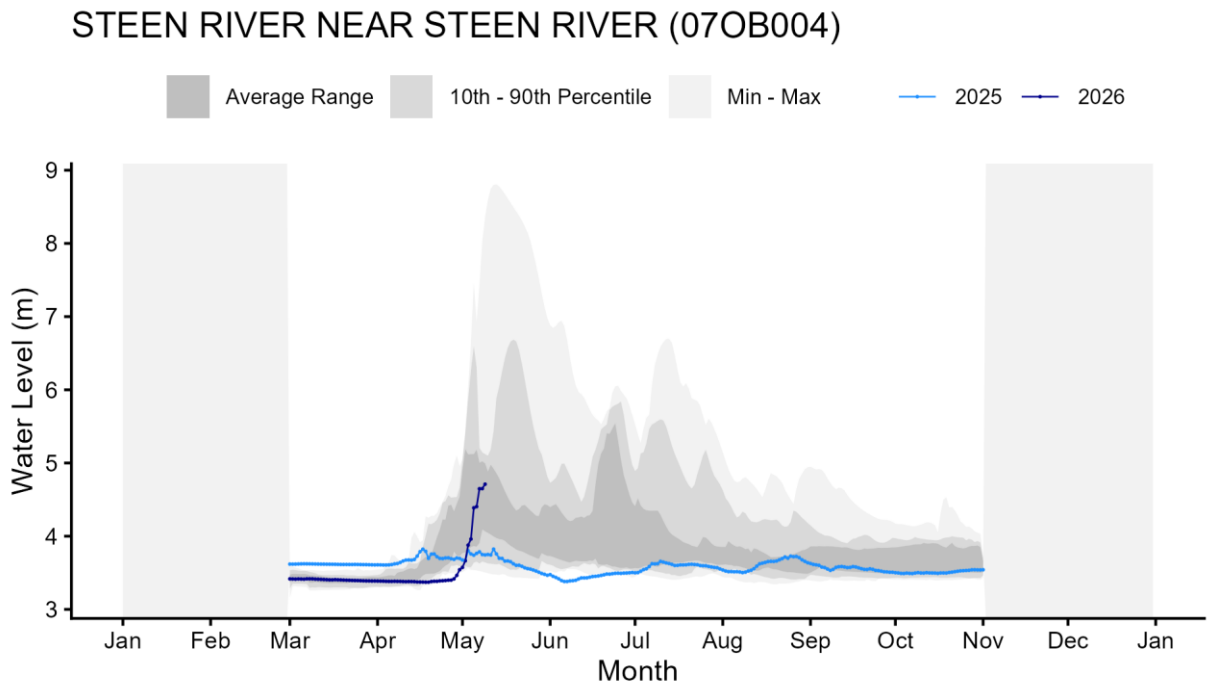
Above - Water level data for Hay River near Hay River [07OB001]. Daily average levels for the previous year also are shown here.

Hay River near Alta/Nwt Boundary [07OB008]



Above - Water level data for Hay River near Alta/Nwt Boundary [07OB008]. Daily average levels for the previous year also are shown here.

Steen River near Steen River [07OB004]



Above - Water level data for Steen River near Steen River [07OB004]. Daily average levels for the previous year also are shown here.

Gauge photos:

Hay River near Hay River [07OB001]

Above - Hay River near Hay River [07OB001] hydrometric gauge photo from May 9 at 15:00. Photo courtesy of Water Survey of Canada and GNWT.

Hay River near Alta/Nwt Boundary [07OB008]

Above - Hay River near Alta/Nwt Boundary [07OB008] hydrometric gauge photo from May 9 at 13:00. Photo courtesy of Water Survey of Canada and GNWT.

Drone imagery:

Above – Image was captured on May 9th, 2026 around 10 am MDT. Photo courtesy of the Town of Hay River and Travis Wright. The image shows the Hay River delta, looking downstream, with rubble ice in the east channel and open water for the west channel.

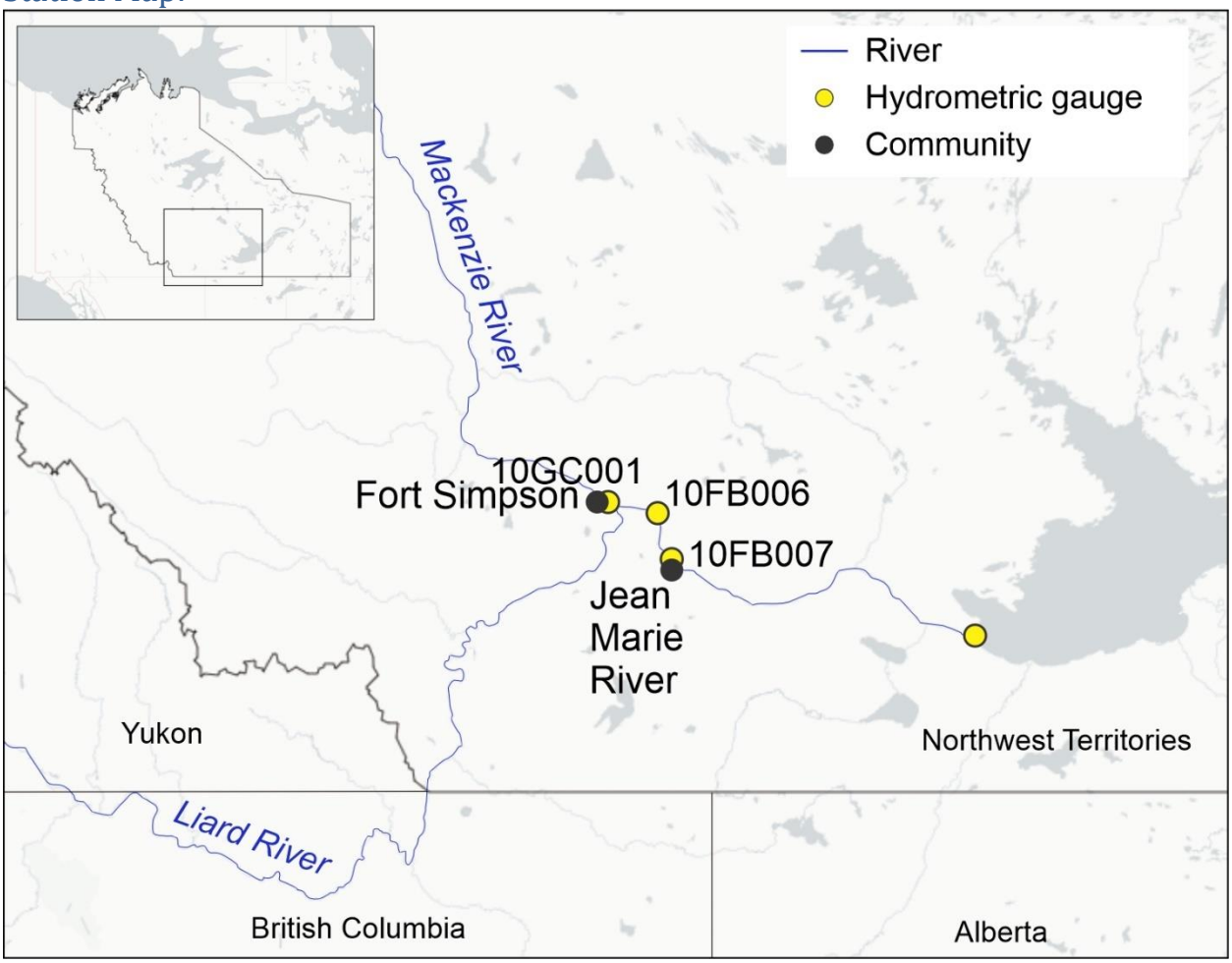
Above – Image was captured on May 9th, 2026 around 10 am MDT. Photo courtesy of the Town of Hay River and Travis Wright. The image shows the Hay River delta and Great Slave Lake, looking upstream, with rubble ice in the east channel and open water for the west channel.

Upper Mackenzie River

Current Status:

- Break-up is progressing along the Mackenzie River.
    - According to satellite imagery acquired on May 8th, relatively intact ice remains between Fort Providence and just upstream of Fort Simpson.
    - After continued ice movement, a large open water section now stretches between Fort Simpson and Camsell Bend.
- Water level measured on the Mackenzie River near Jean Marie River continues to slowly rise and is fluctuating in response to ice movement.
- Well above average to above average temperatures for the rest of this weekend into next week should result in continued break-up and ice degradation for the Upper Mackenzie River.

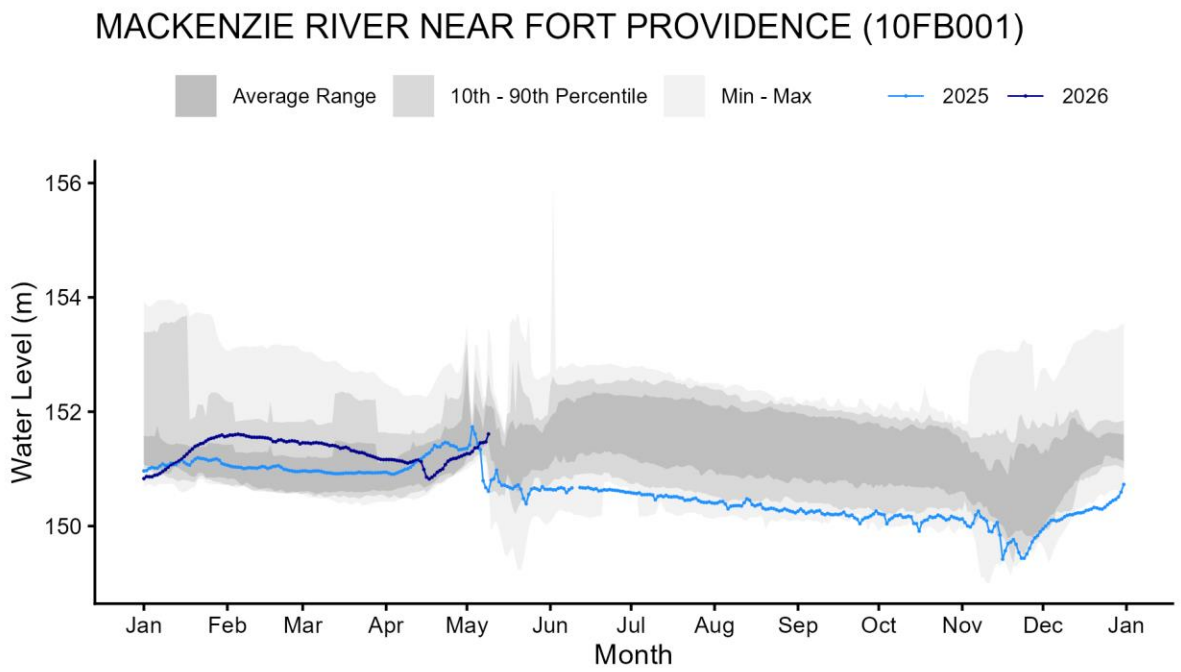
Station Map:



Above: Map of Hydrometric Stations and nearby communities for the plots included in this section.

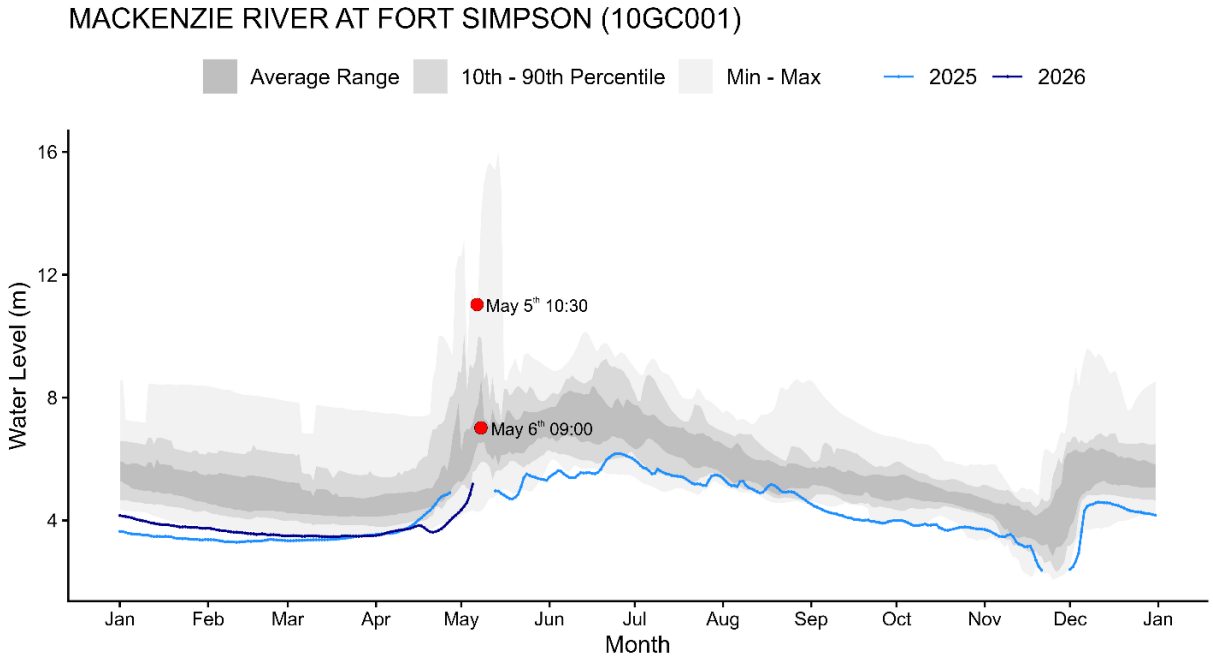
Hydrometric Data:

Mackenzie River near Fort Providence [10FB001]



Above - Water level data for Mackenzie River near Fort Providence [10FB001]. Daily average levels for the previous year also are shown here.

Mackenzie River at Fort Simpson [10GC001]



Above - Water level data for Mackenzie River at Fort Simpson [10GC001]. Daily average levels for the previous year also are shown here. Data points from the Village of Fort Simpson gauge have been added onto this graph (shown as red circles). The Village gauge has not been live recording since May 6th.

Gauge photos:

Mackenzie River at Strong Point [10FB006]

Above - Mackenzie River at Strong Point [10FB006] hydrometric gauge photo from May 9 at 11:00. Photo courtesy of Water Survey of Canada and GNWT.

Mackenzie River at Jean Marie River [10FB007]

Above - Mackenzie River at Jean Marie River [10FB007] hydrometric gauge photo from May 9 at 11:00. Photo courtesy of Water Survey of Canada and GNWT.

Mackenzie River at Fort Simpson [10GC001]

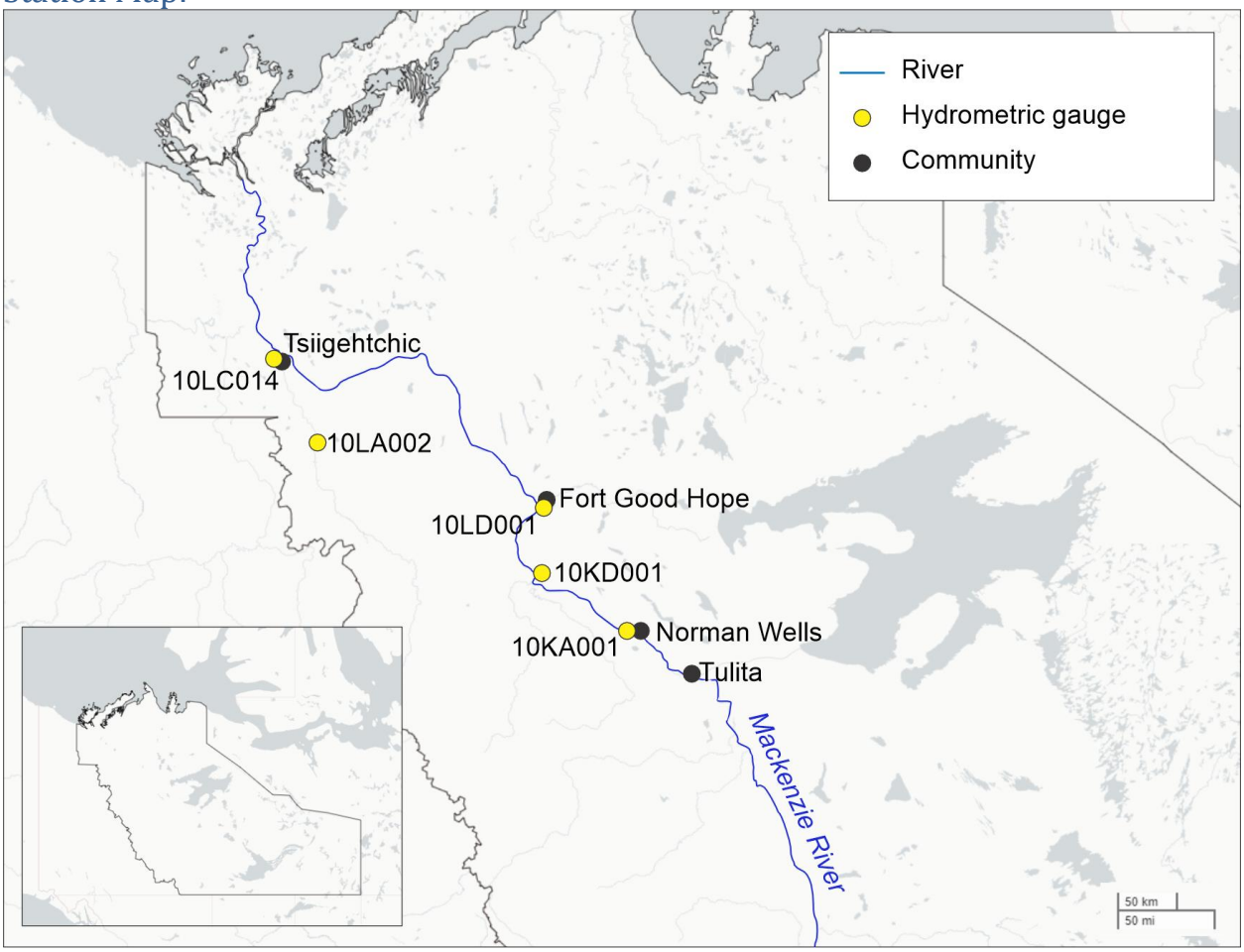
Above - Mackenzie River at Fort Simpson [10GC001] hydrometric gauge photo from May 9 at 11:00. Photo courtesy of Water Survey of Canada and GNWT.

Central Mackenzie River

Current Status:

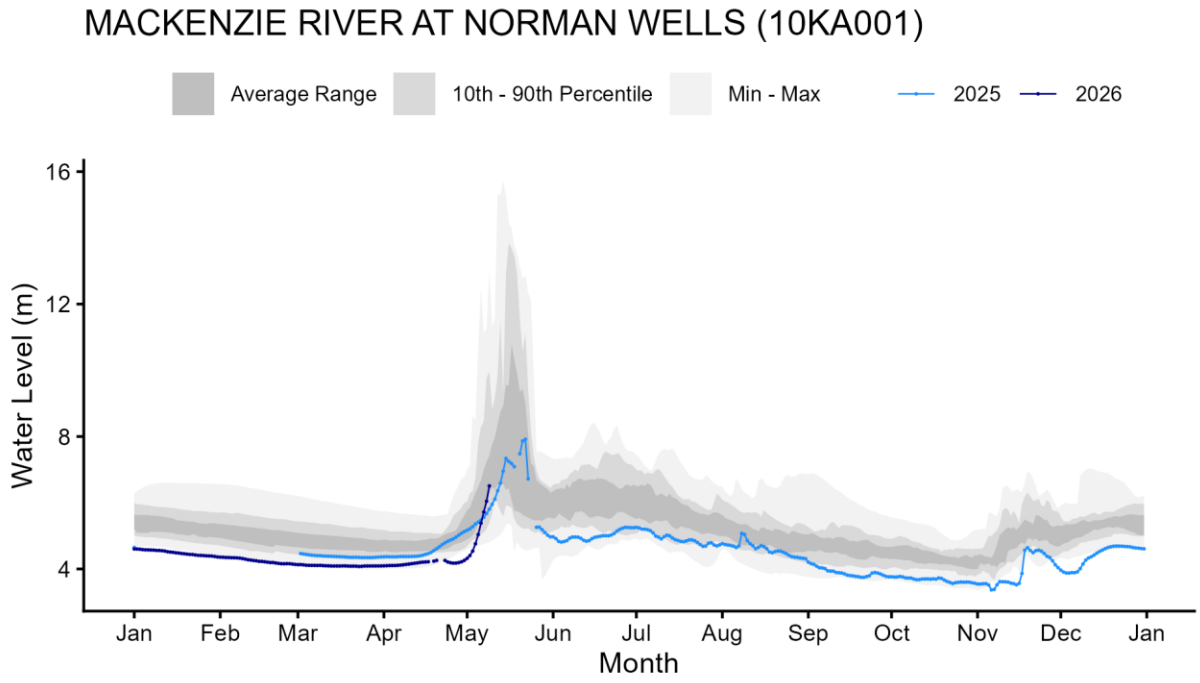
- Break-up is starting to progress along the Central Mackenzie River.
    - Water level measured on the Mackenzie River near Norman Wells is rising underneath relatively intact ice.
    - There are large open water sections between Fort Simpson and just upstream of Tulita.
    - River ice remains relatively intact between Tulita and Fort Good Hope, though some ice movement has been observed downstream of the Ramparts near Fort Good Hope as of 13:00 MDT today.
- Well above average to above average temperatures for the rest of this weekend into next week should result in continued break-up and ice degradation for the Central Mackenzie River.

Station Map:



Above: Map of Hydrometric Stations and nearby communities for the plots included in this section.

Mackenzie River at Norman Wells [10KA001]



Above - Water level data for Mackenzie River at Norman Wells [10KA001]. Daily average levels for the previous year also are shown here.

Mackenzie River at Norman Wells [10KA001]

Above - Mackenzie River at Norman Wells [10KA001] hydrometric gauge photo from May 9 at 13:00. Photo courtesy of Water Survey of Canada and GNWT.

Mackenzie River at Fort Good Hope [10LD001]

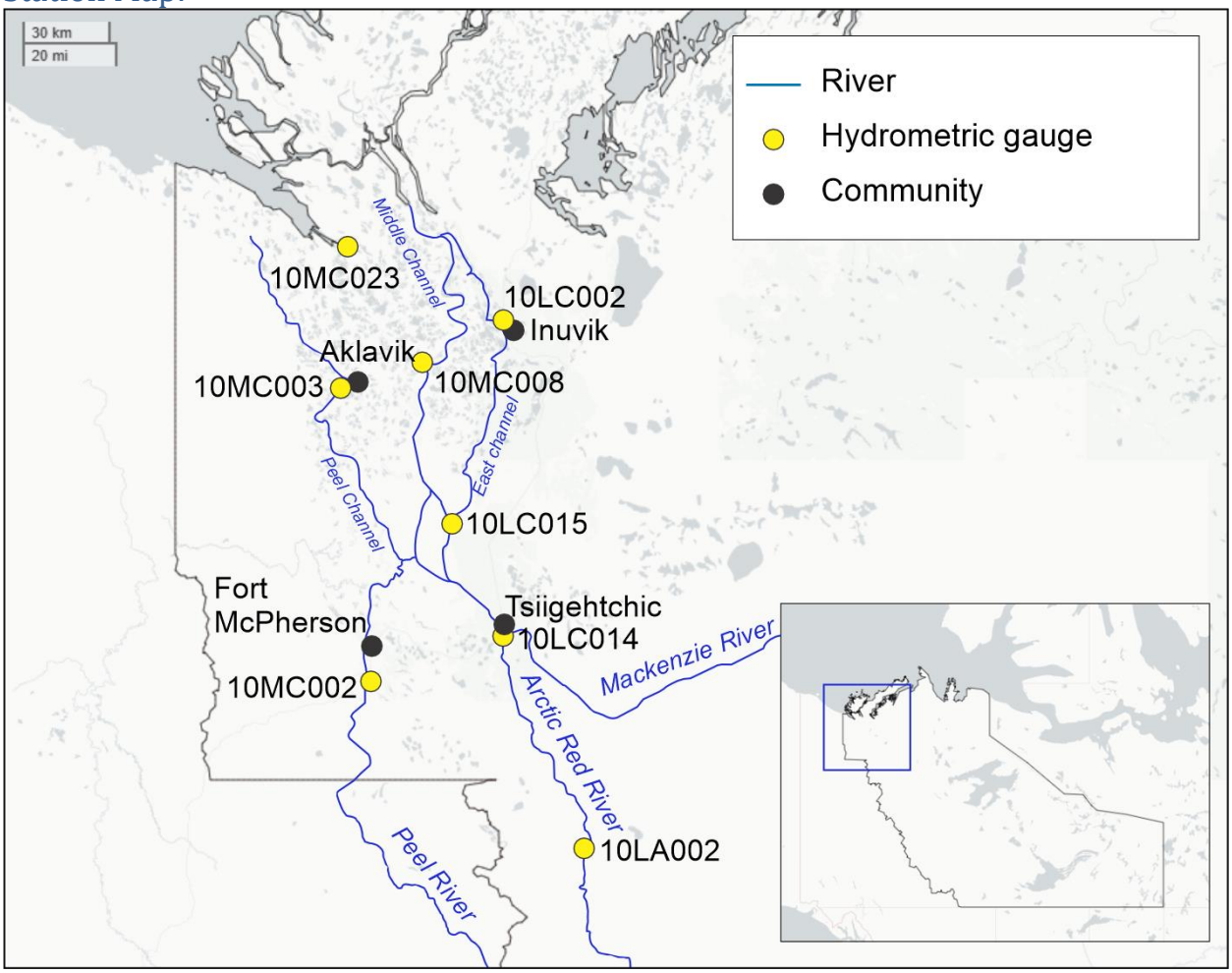
Above - Mackenzie River at Norman Wells [10LD001] hydrometric gauge photo from May 9 at 13:00. Photo courtesy of Water Survey of Canada and GNWT.

Peel River & Arctic Red River

Current Status:

- Break-up is progressing quickly along the Peel River and the Arctic Red River.
    - Water level measured on the Peel River near Fort McPherson has risen by nearly 2 m in the last 24 hours. The water level is currently at 10 m which is within average range for the freshet peak.
    - Significant ice movement has been observed at the gauge just upstream of Fort McPherson, as of 12:00 MDT today.
    - Water level measured on the Arctic Red River appears to have peaked at 8.7 m on May 7th at 23:35, which corresponds to a well above average freshet peak. The water level has since decreased by over 3 m.
- After a recent period of above average temperatures in Fort McPherson, average to slightly below average temperatures for the rest of this weekend into next week should limit ice degradation and snowmelt in the Peel River basin.
- Precipitation is expected in the Peel River basin in the form of snow (reaching 5-15 cm in higher terrain) throughout the weekend and will taper off by Monday morning.

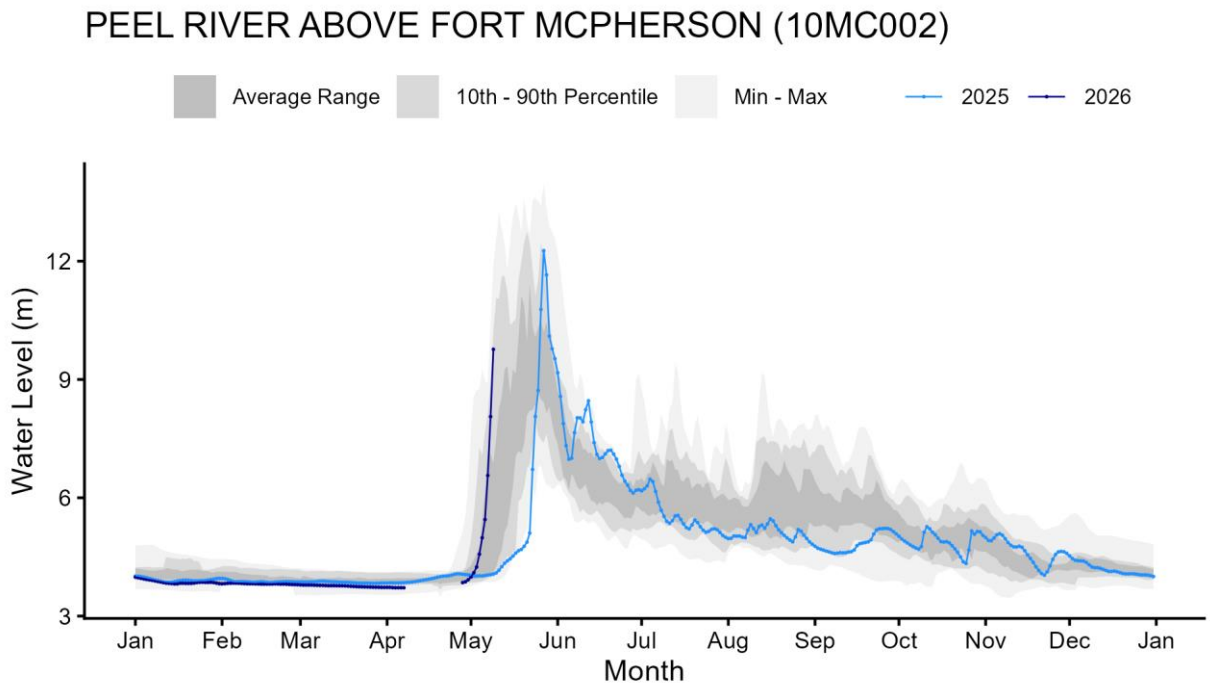
Station Map:



Above: Map of Hydrometric Stations and nearby communities for the plots included in this section.

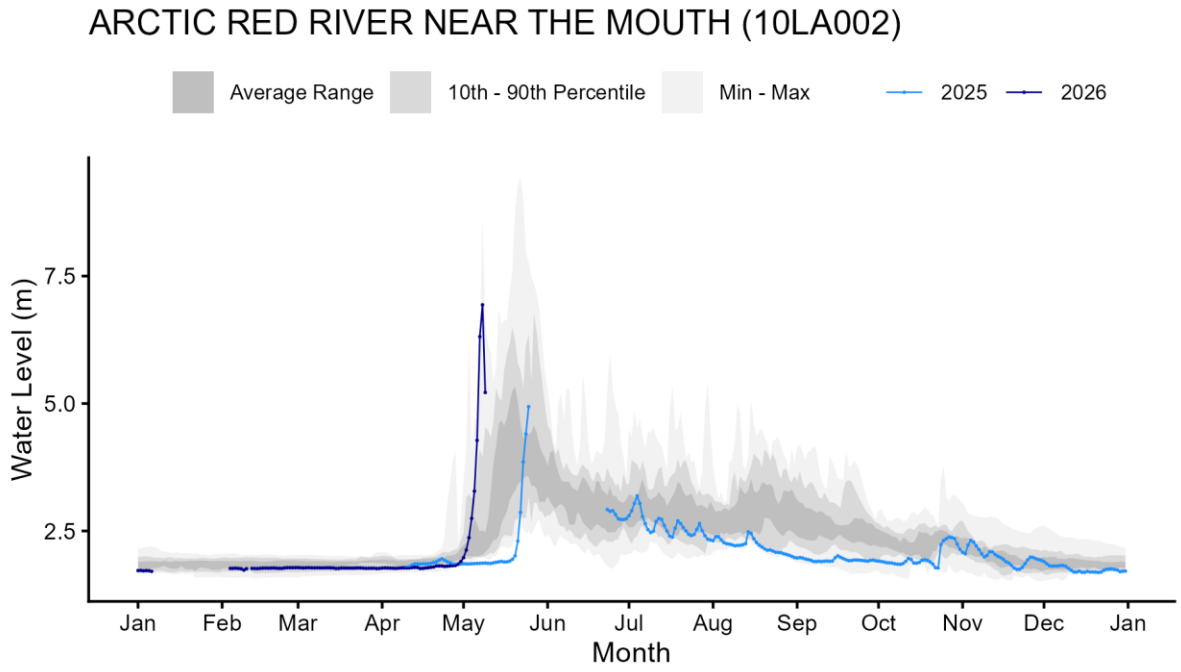
Hydrometric Data:

Peel River above Fort Mcpherson [10MC002]



Above - Water level data for Peel River above Fort Mcpherson [10MC002]. Daily average levels for the previous year also are shown here.

Arctic Red River near the Mouth [10LA002]



Above - Water level data for Arctic Red River near the Mouth [10LA002]. Daily average levels for the previous year also are shown here.

Gauge photos:

Peel River above Fort Mcpherson [10MC002]

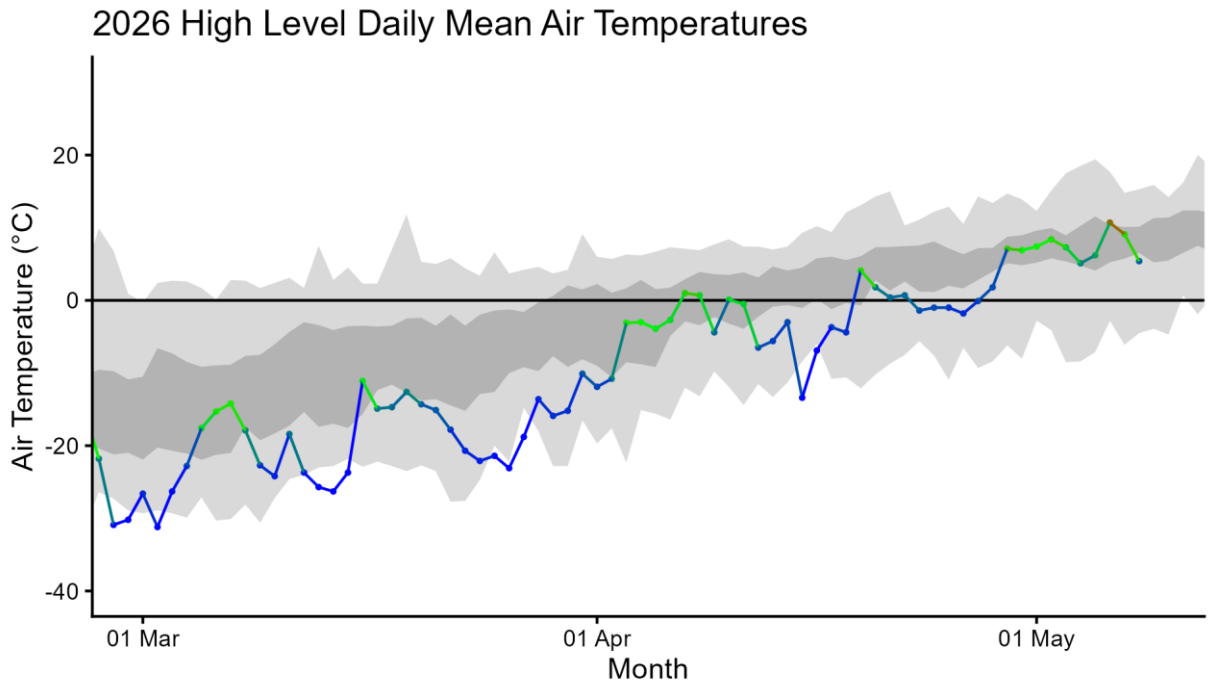
Above - Peel River above Fort Mcpherson [10MC002] hydrometric gauge photo from May 8 at 12:00. Photo courtesy of Water Survey of Canada and GNWT.

Above - Peel River above Fort Mcpherson [10MC002] hydrometric gauge photo from May 9 at 12:00. Photo courtesy of Water Survey of Canada and GNWT.

Weather Data:

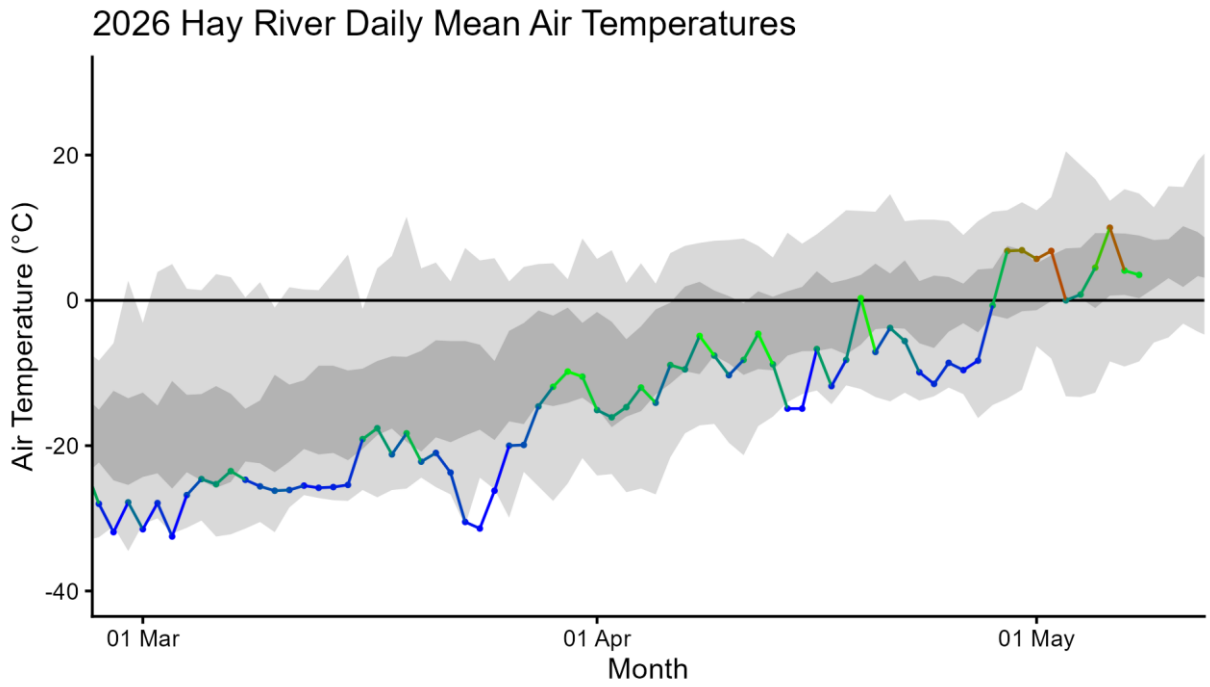
- In the Hay River basin, temperatures over the past 10 days have been generally average.
- In the Liard River basin, after a long stretch of above average temperatures, temperatures over the last couple days have been average.
- In the Dehcho Region, temperatures over the last few days have decreased from above average to average.
- In the Sahtu Region, temperatures have been near to above average over the past few weeks.

High Level Air Temperature



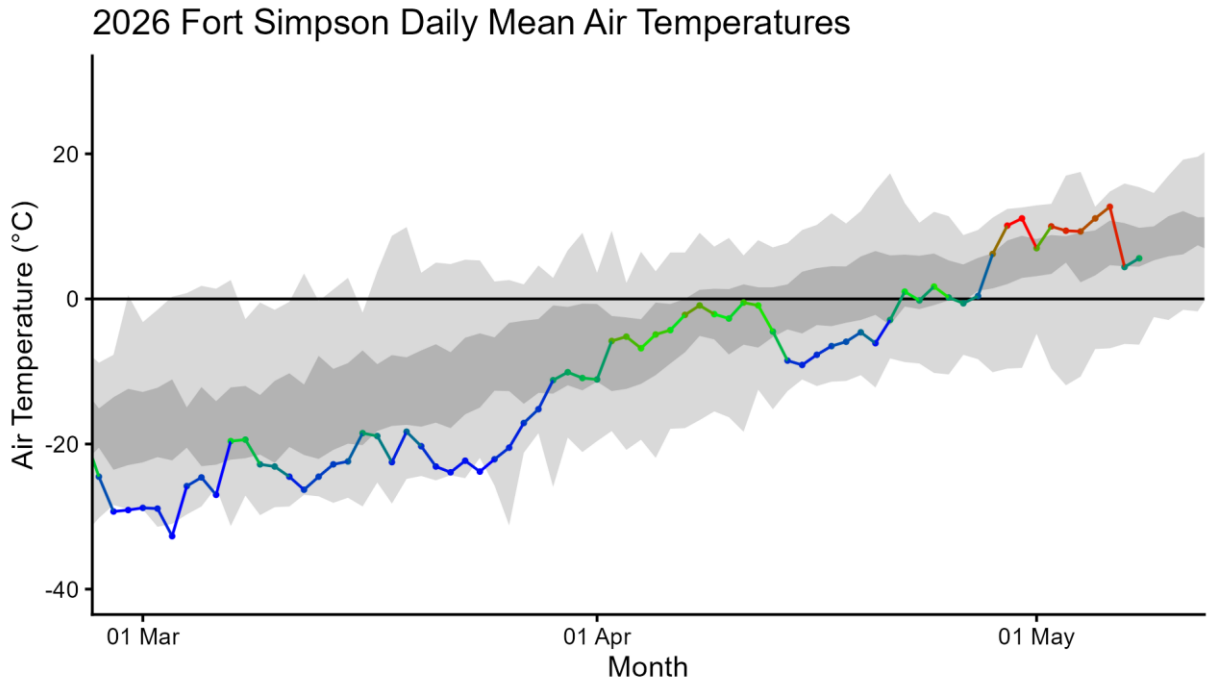
Above - Daily mean air temperature for High Level. Shaded areas represent the historical range (1991-2025).

Hay River Air Temperature



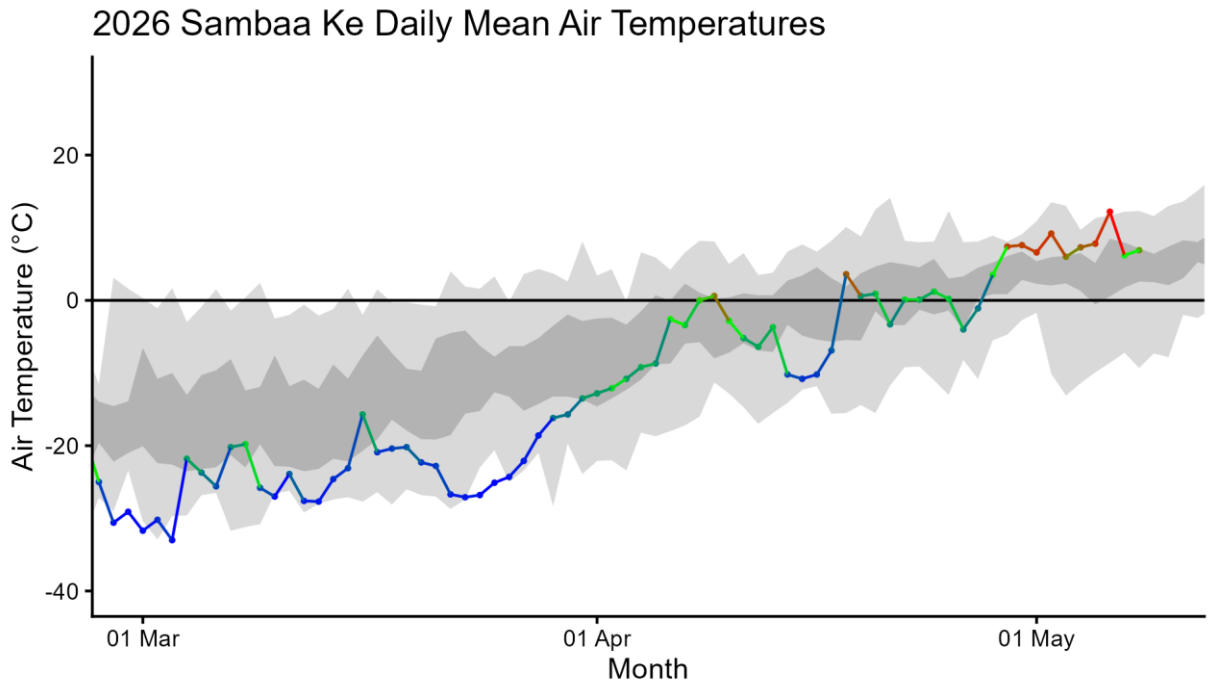
Above - Daily mean air temperature for Hay River. Shaded areas represent the historical range (1991-2025).

Fort Simpson Air Temperature



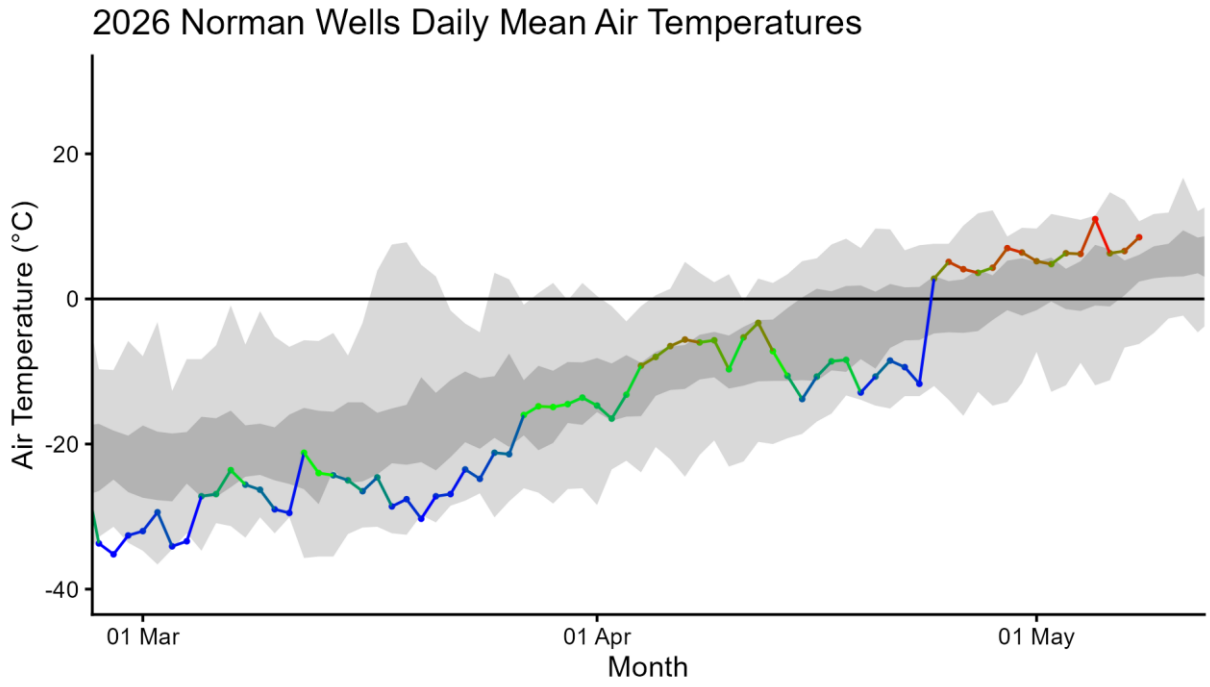
Above - Daily mean air temperature for Fort Simpson. Shaded areas represent the historical range (1991-2025).

Sambaa Ke Air Temperature



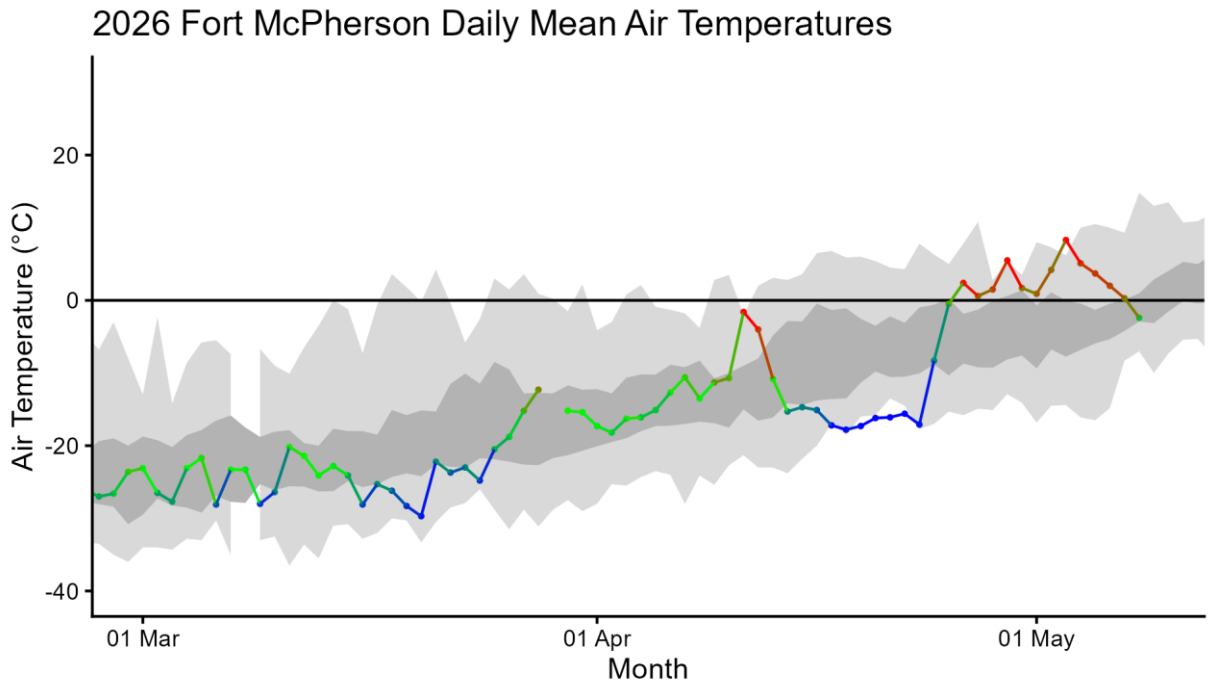
Above - Daily mean air temperature for Sambaa Ke. Shaded areas represent the historical range (1991-2025).

Norman Wells Air Temperature



Above - Daily mean air temperature for Norman Wells. Shaded areas represent the historical range (1991-2025).

Fort McPherson Air Temperature



Above - Daily mean air temperature for Fort McPherson. Shaded areas represent the historical range (1991-2025).

Weather Forecasts:

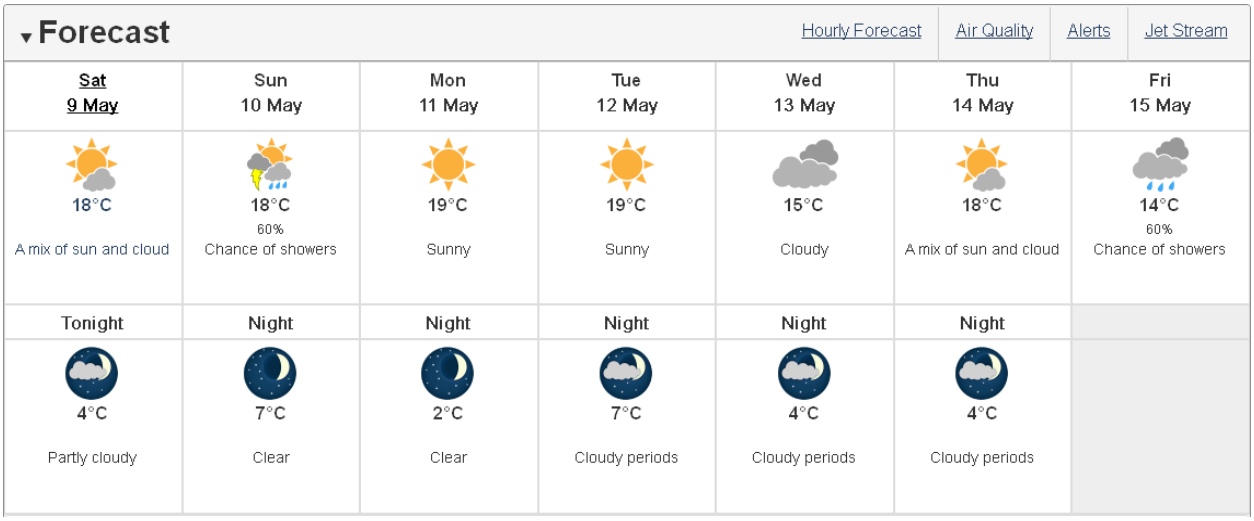
- In the Hay River basin, forecasted temperatures for the forecast period May 9-15 start above average from May 9-11, becoming average throughout the remainder of the forecast period. Scattered showers totaling 10-20mm are forecast over the basin over the weekend, with no anticipated impact on water levels.

- In the Dehcho Region, forecasted temperatures remain above average for the forecast period May 9-15, starting well above average May 9-11, and ending slightly above average throughout the remainder of the forecast period. No significant precipitation is forecast in the area over the weekend.

- In the Sahtu Region, forecasted temperatures for the forecast period May 9-15 start well above average May 9-10, becoming average throughout the remainder of the forecast period. Scattered showers are expected between Norman Wells and Fort Good Hope are expected over the weekend, with no anticipated impact on water levels.

- In the Peel and Arctic Red River basins, forecasted temperatures for the forecast period May 9-15 are average to slightly below average. Precipitation is expected in the basin in the form of snow (reaching 5-15 cm in higher terrain) throughout the weekend and will taper off by Monday morning.

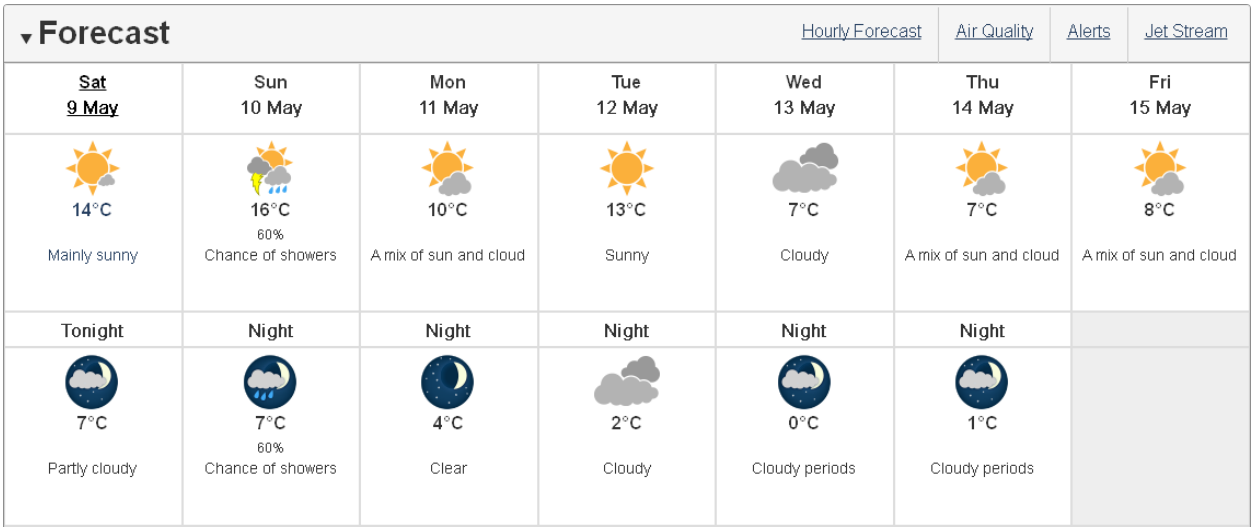
High Level seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
18°C A mix of sun and cloud	18°C 60% Chance of showers	19°C Sunny	19°C Sunny	15°C Cloudy	18°C A mix of sun and cloud	14°C 60% Chance of showers
Tonight	Night	Night	Night	Night	Night	
4°C Partly cloudy	7°C Clear	2°C Clear	7°C Cloudy periods	4°C Cloudy periods	4°C Cloudy periods	

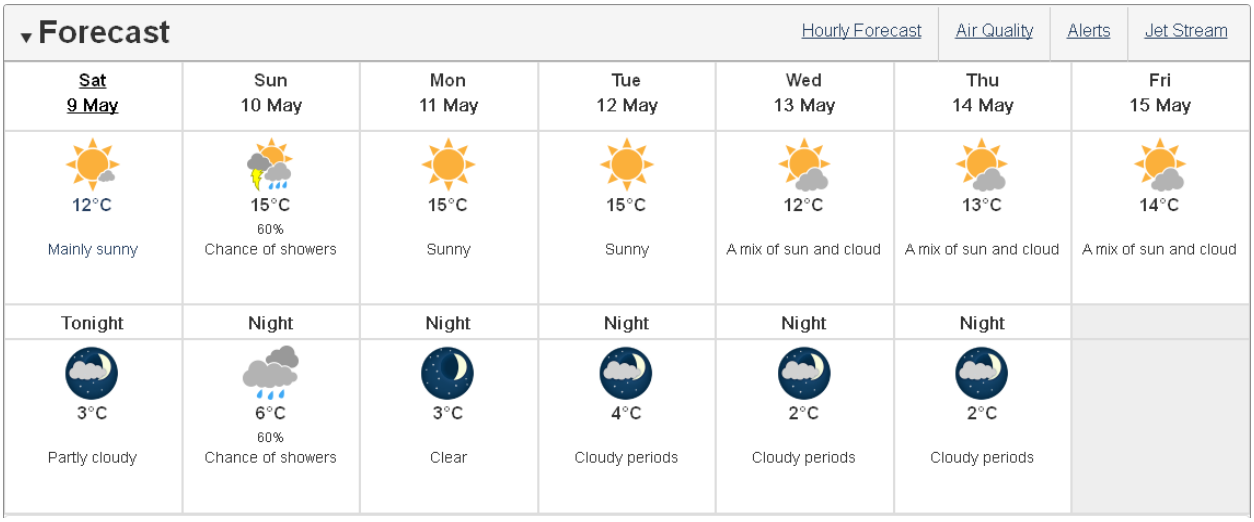
Hay River seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
14°C Mainly sunny	16°C 60% Chance of showers	10°C A mix of sun and cloud	13°C Sunny	7°C Cloudy	7°C A mix of sun and cloud	8°C A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
7°C Partly cloudy	7°C 60% Chance of showers	4°C Clear	2°C Cloudy	0°C Cloudy periods	1°C Cloudy periods	

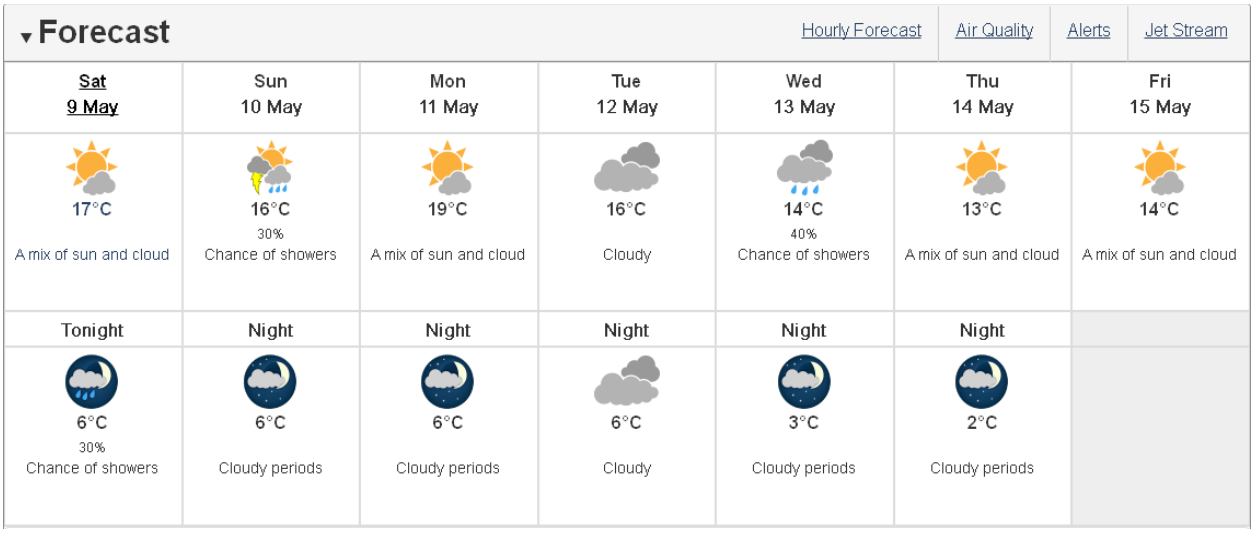
Fort Smith seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
12°C Mainly sunny	15°C 60% Chance of showers	15°C Sunny	15°C Sunny	12°C A mix of sun and cloud	13°C A mix of sun and cloud	14°C A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
3°C Partly cloudy	6°C 60% Chance of showers	3°C Clear	4°C Cloudy periods	2°C Cloudy periods	2°C Cloudy periods	

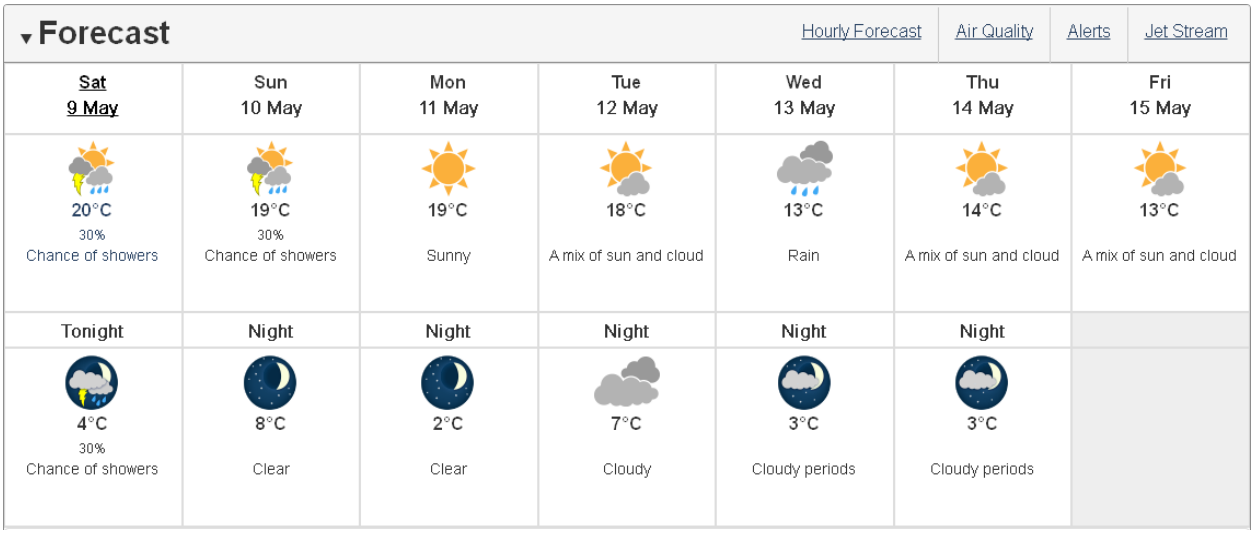
Fort Simpson seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
17°C A mix of sun and cloud	16°C 30% Chance of showers	19°C A mix of sun and cloud	16°C Cloudy	14°C 40% Chance of showers	13°C A mix of sun and cloud	14°C A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
6°C 30% Chance of showers	6°C Cloudy periods	6°C Cloudy periods	6°C Cloudy	3°C Cloudy periods	2°C Cloudy periods	

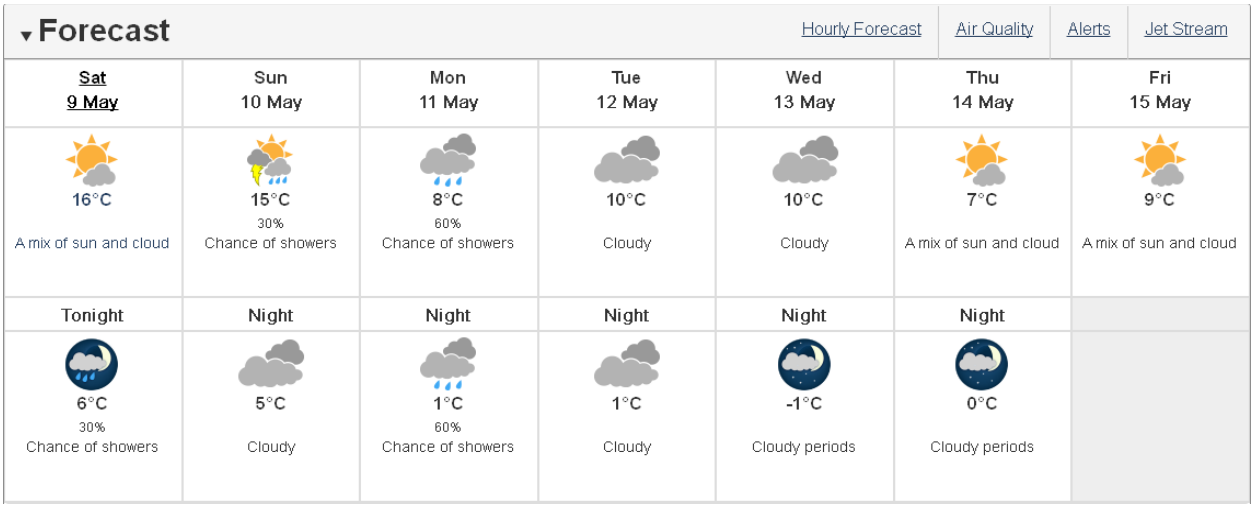
Sambaa Ke seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
20°C 30% Chance of showers	19°C 30% Chance of showers	19°C Sunny	18°C A mix of sun and cloud	13°C Rain	14°C A mix of sun and cloud	13°C A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
4°C 30% Chance of showers	8°C Clear	2°C Clear	7°C Cloudy	3°C Cloudy periods	3°C Cloudy periods	

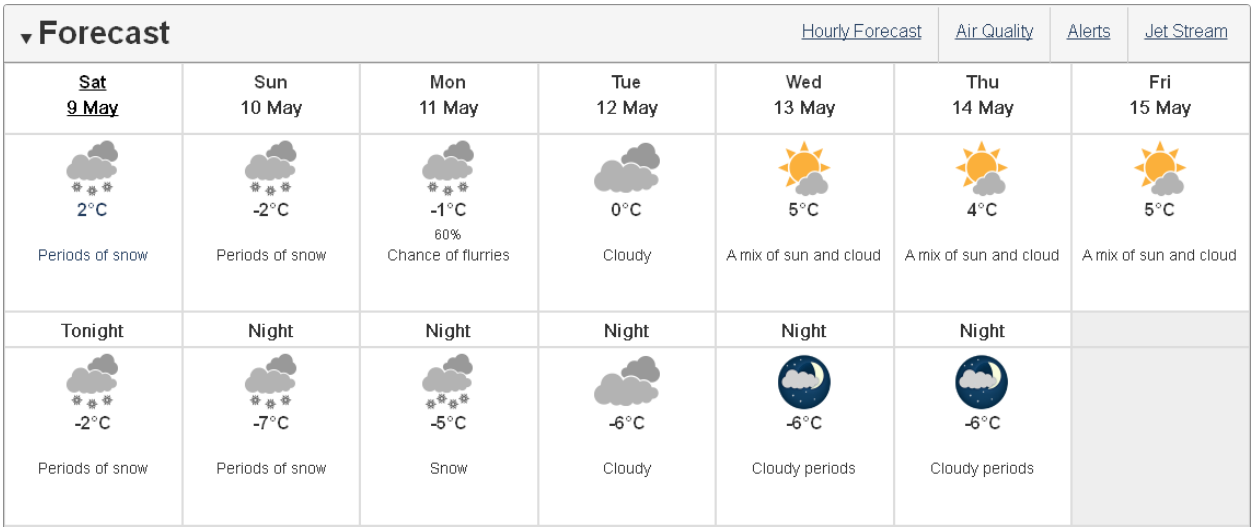
Norman Wells seven-day weather forecast:



Forecast — Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
16°C A mix of sun and cloud	15°C 30% Chance of showers	8°C 60% Chance of showers	10°C Cloudy	10°C Cloudy	7°C A mix of sun and cloud	9°C A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
6°C 30% Chance of showers	5°C Cloudy	1°C 60% Chance of showers	1°C Cloudy	-1°C Cloudy periods	0°C Cloudy periods	

Fort McPherson seven-day weather forecast:



Forecast

Hourly Forecast | Air Quality | Alerts | Jet Stream

Sat 9 May	Sun 10 May	Mon 11 May	Tue 12 May	Wed 13 May	Thu 14 May	Fri 15 May
2°C	-2°C	-1°C	0°C	5°C	4°C	5°C
Periods of snow	Periods of snow	60% Chance of flurries	Cloudy	A mix of sun and cloud	A mix of sun and cloud	A mix of sun and cloud
Tonight	Night	Night	Night	Night	Night	
-2°C	-7°C	-5°C	-6°C	-6°C	-6°C	
Periods of snow	Periods of snow	Snow	Cloudy	Cloudy periods	Cloudy periods	

Factors to Watch:

It is important to note that much of the water contributing to NWT rivers originates from outside of the NWT, which is why we also rely on information from the Yukon, British Columbia, Alberta and Saskatchewan.

The potential and severity of flooding will depend in large part on the weather over the upcoming weeks and how this interacts with existing ice conditions, water levels and snowpack amounts.

The primary factors that influence water levels in the spring are:

- Ice jams (can result in out-of-bank flows, even if there are below normal flows)
- Rate of melt of ice and snow:
    - Gradual vs quick melt
    - Rain on snow or ice events (rain brings a lot of energy to help melt happen more quickly)
- Current water levels
- How wet the ground was in the fall
- Snowpack

Spring Break up on NWT Rivers: Mechanical vs Thermal

In any given year, spring flooding can occur in a number of NWT communities, including Hay River, Jean Marie River, Fort Simpson, Fort Liard, Tulita, Fort Good Hope, Fort McPherson and Aklavik. Spring flooding is caused by ice jam-induced flooding and can occur irrespective of existing water levels. However, if existing water levels are high, the impact of an ice jam flood can be much worse.

Ice jams typically occur on north-flowing rivers where warm weather and snowmelt cause ice to break up on the southern reaches of a river. As this ice flows north (downstream), it meets a more solid ice cover, hits the ground, or gets stuck in a river bend. When this happens, the pieces of floating ice jam can form a dam, which causes water levels to rise rapidly. This is called a **mechanical break up**, whereby the ice downstream is broken up by the force of ice moving into it.

If there is warm and sunny weather throughout early spring, the ice may thermally erode and weaken. This provides less of a resisting force for ice and water moving down the river and will have less of a chance of causing water levels to rise behind an ice jam. This is called a **thermal break up**.

The causes of mechanical and thermal break ups are usually dependent on the weather during early spring. Warm weather, sunshine, and rain on snow events are usually a good way to bring extra energy into the system to help melt the ice. Warm temperatures in the upstream part of a basin could also cause a rapid snowmelt and move water to the river very quickly. This could lead to ice-jam conditions downstream if the ice has not yet received

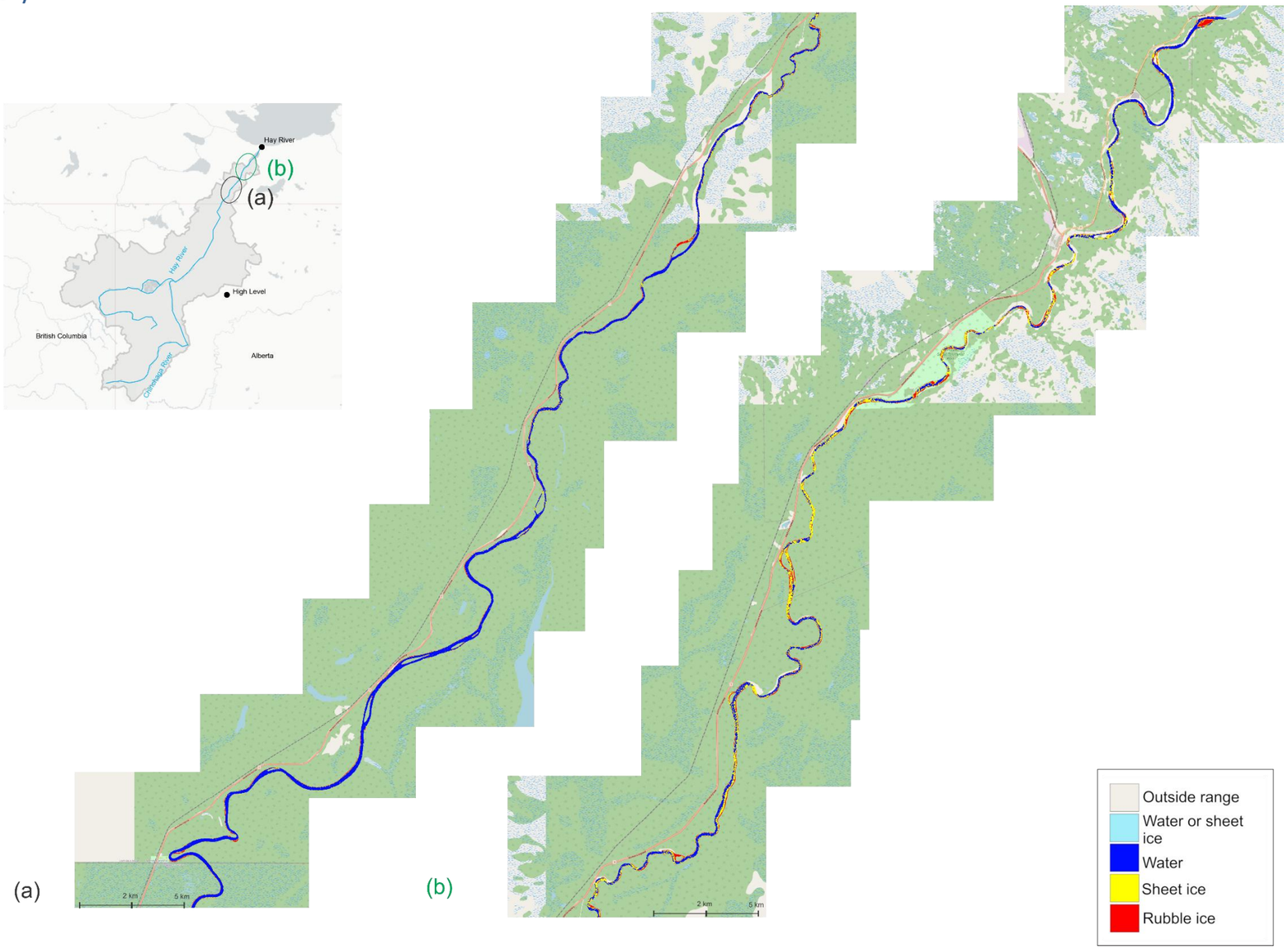
enough energy to degrade. Another important factor is the thickness of the ice. Thicker ice takes longer to melt and can increase the chances of ice jams. If an ice jam occurs, the location of the ice jam is also very important. Each river reach has different locations that are prone to ice jams. The location of the ice jam can be an important factor as to whether or not a community floods. Furthermore, ice will jam and then move again at multiple locations along a river as break up progresses downstream. The timing and location of each jam can also influence if a community will flood.

Technical Note:

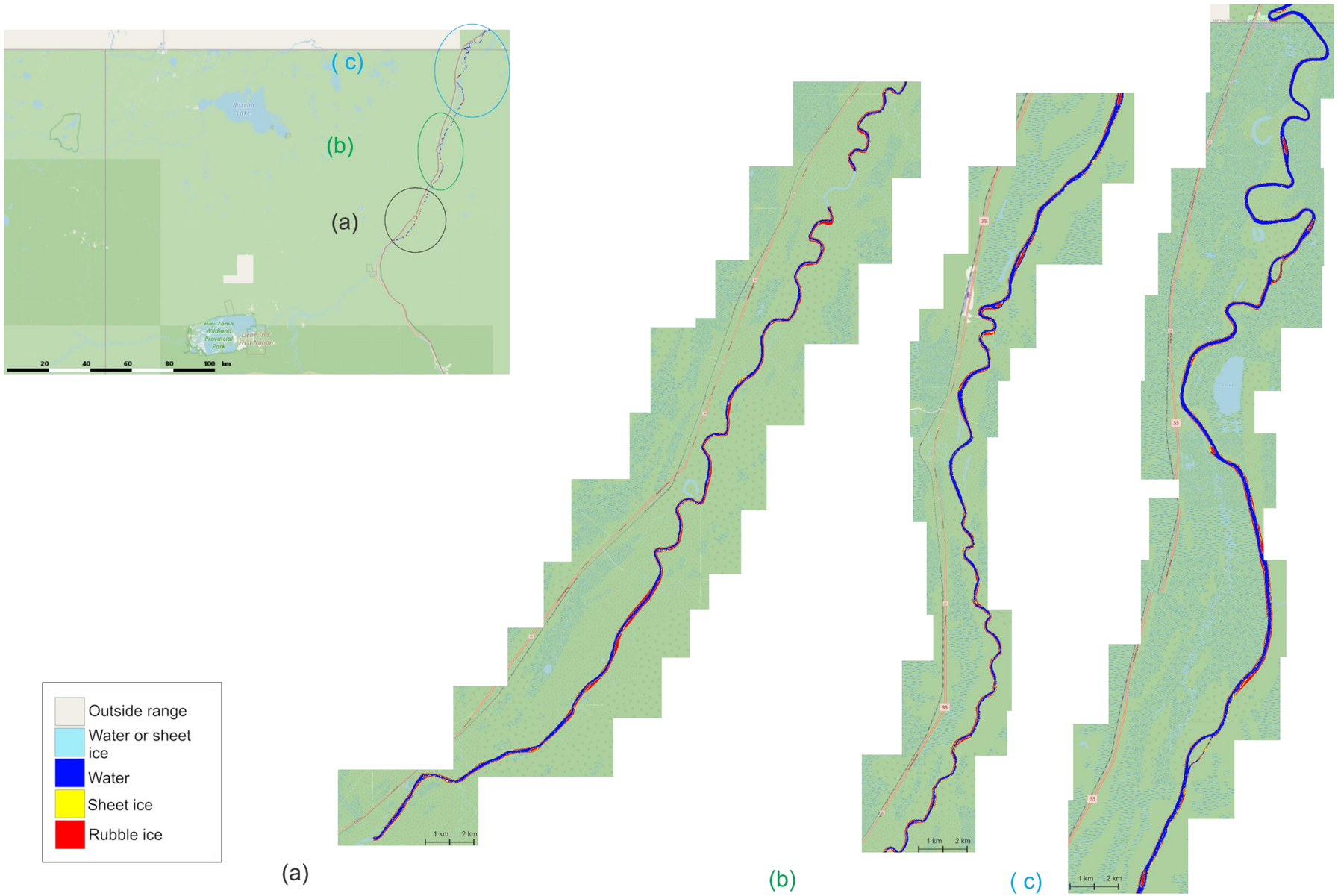
- The figures in this report plot water levels. The values on the y-axis are (in most cases) relative to an arbitrary datum. This means that the values on each gauge can be compared to different years but should not be used to compare water levels from one location to the next.

For example, the Hay River near the border gauge (07OB008) records a level of about 288 m. The Hay River near Hay River gauge (07OB001) usually records a level of about 4 m. This **does not mean** that the water level at the Hay River at the border site is 284 m higher than the water level at the Hay River near Hay River site.

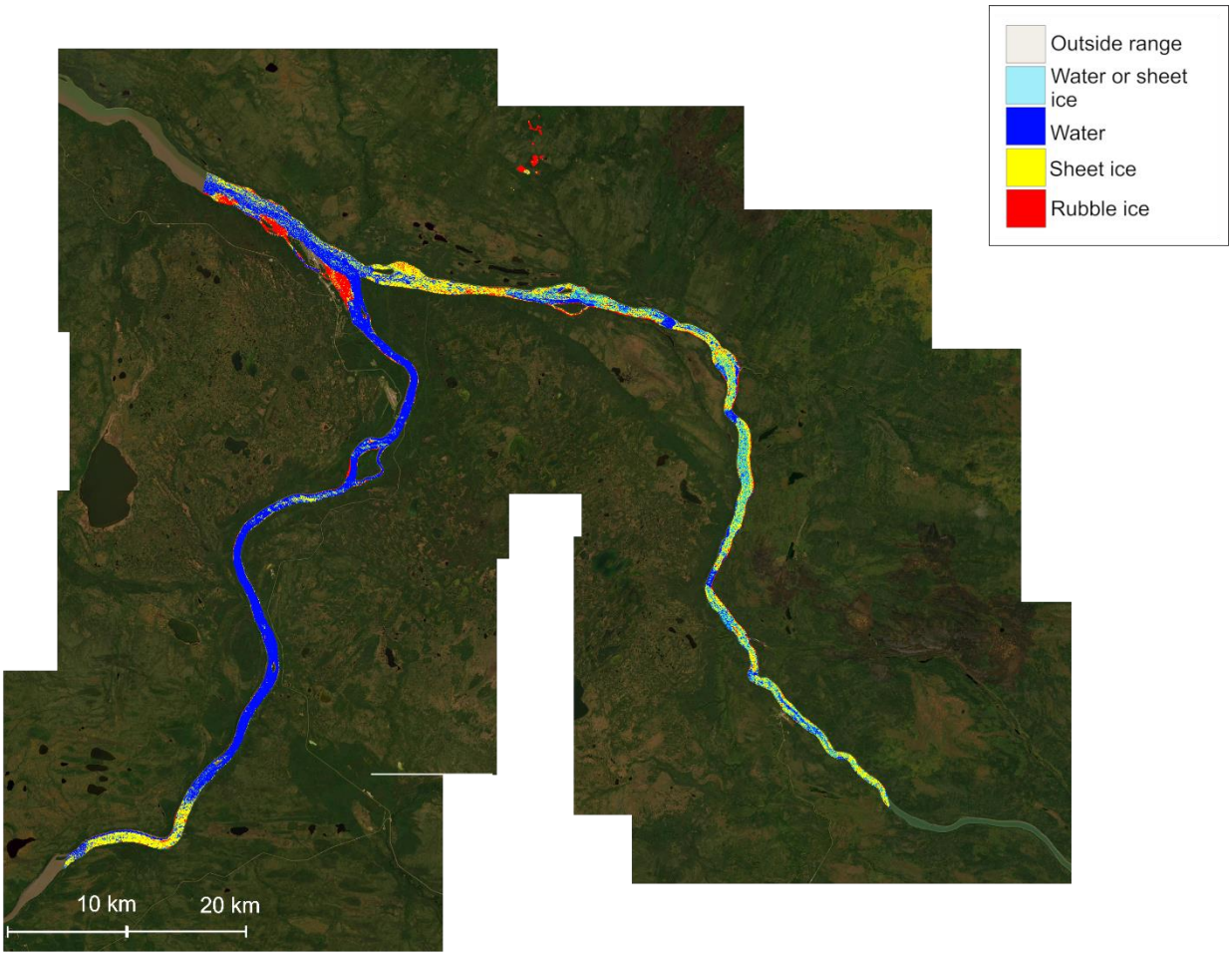
Appendix A: River Ice Imagery



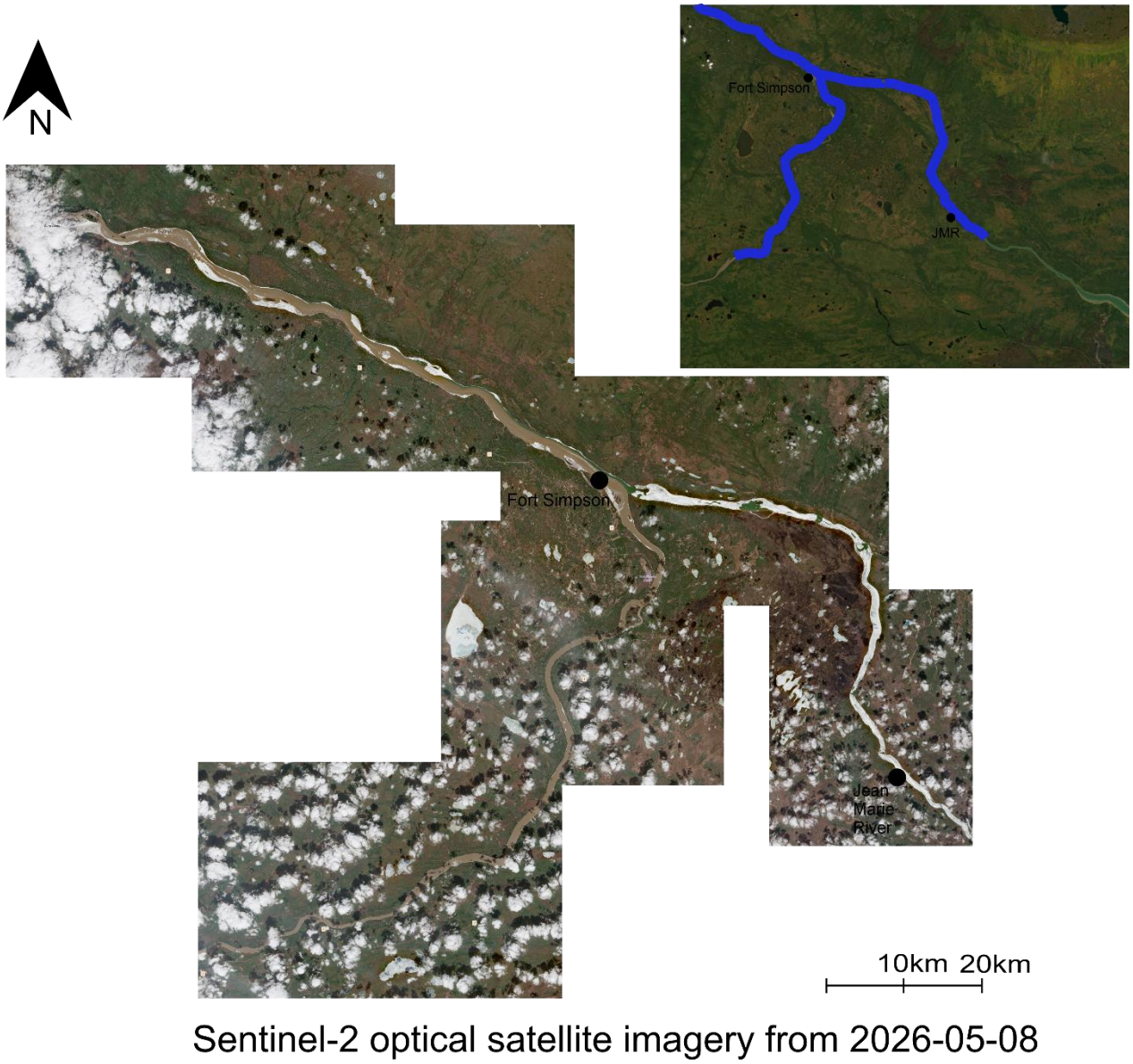
Above – Classified river ice images acquired at 19:05 MDT on May 8, 2026 and 08:05 MDT on May 9, 2026 showing Hay River for a stretch of ~120 km downstream of AB/NWT border reaching 20km downstream of Enterprise. Ice classification shows predominantly open water (blue) with few sections (largest being roughly 6 km) of relatively intact ice (yellow) along the banks indicating residual ice in the final stages of thermal degradation. The image is courtesy of the federal government's Government Operations Centre. The river ice classification was completed using the IceBC algorithm.



Above – Classified river ice images acquired at 19:05 MDT on May 8, 2026 and 08:05 MDT on May 9, 2026 showing Hay River for a stretch of ~110 km upstream of AB/NWT border reaching Meander River. Ice classification shows predominantly open water (blue) with rubble ice (red) along the banks indicating residual ice in the final stages of thermal degradation. The image is courtesy of the federal government's Government Operations Centre. The river ice classification was completed using the IceBC algorithm.



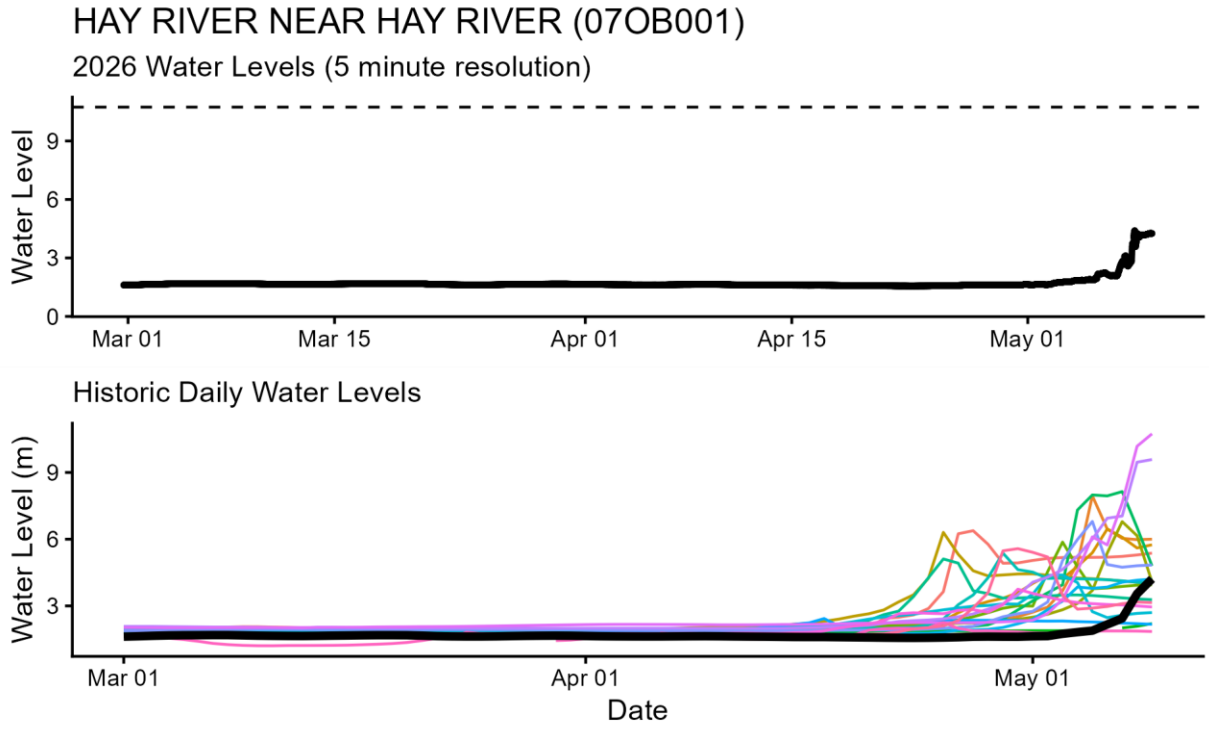
Above – Classified river ice images acquired for (1) Liard River at Confluence (~70 km) and Mackenzie River Downstream of Fort Simpson (~15 km) on May 8, 2026 at 19:29 MDT and (2) Mackenzie River upstream of Fort Simpson (~75 km) on May 9, 2026 at 08:05 MDT, showing predominantly open water along the Liard River and downstream of Fort Simpson and along Mackenzie upstream of Fort Simpson, mixed sections of relatively intact ice and open water. Ice classification shows predominantly open water (blue) with rubble ice (red) along the banks indicating residual ice in the final stages of thermal degradation. The image is courtesy of the federal government's Government Operations Centre. The river ice classification was completed using the IceBC algorithm.



Above – Sentinel-2 optical satellite image over the confluence of the Mackenzie River and the Liard River on May 8, 2026, showing predominantly open water along the Liard River and downstream of Fort Simpson along the Mackenzie River. There are mixed sections of intact ice and open water upstream of Fort Simpson along the Mackenzie River.

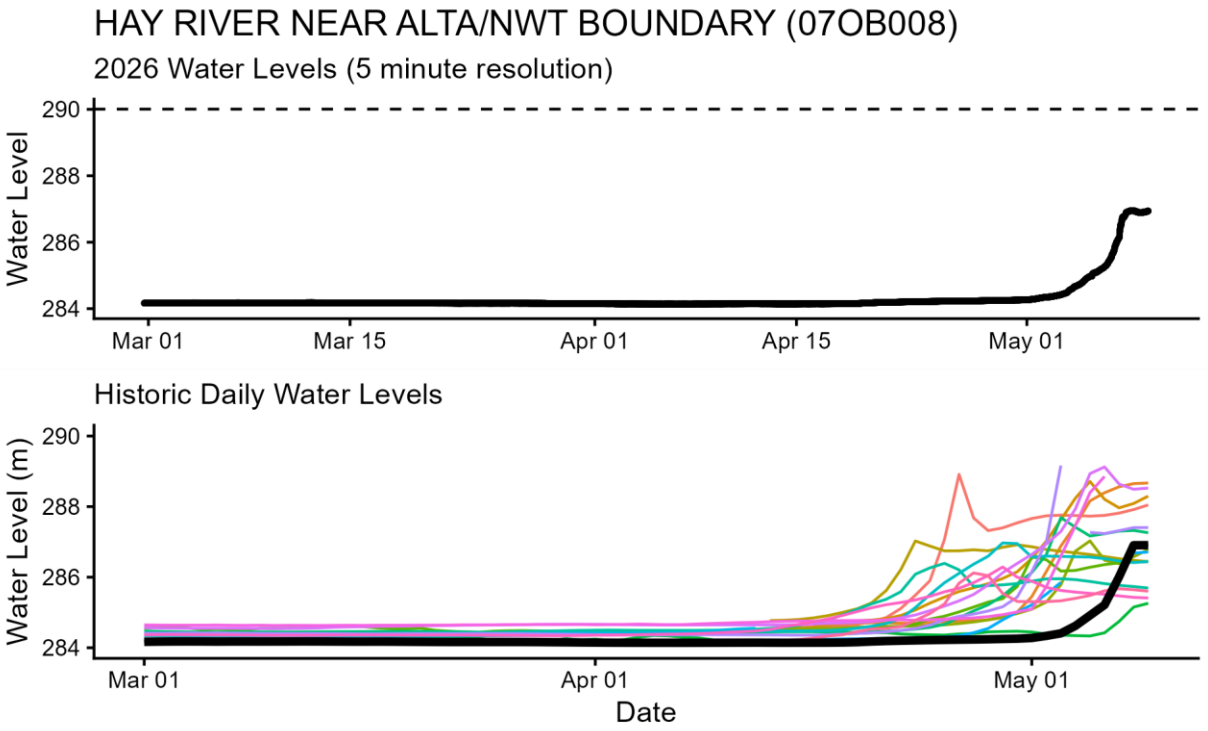
Appendix B: High resolution and historic water level plots

Hay River Near Hay River (07OB001)



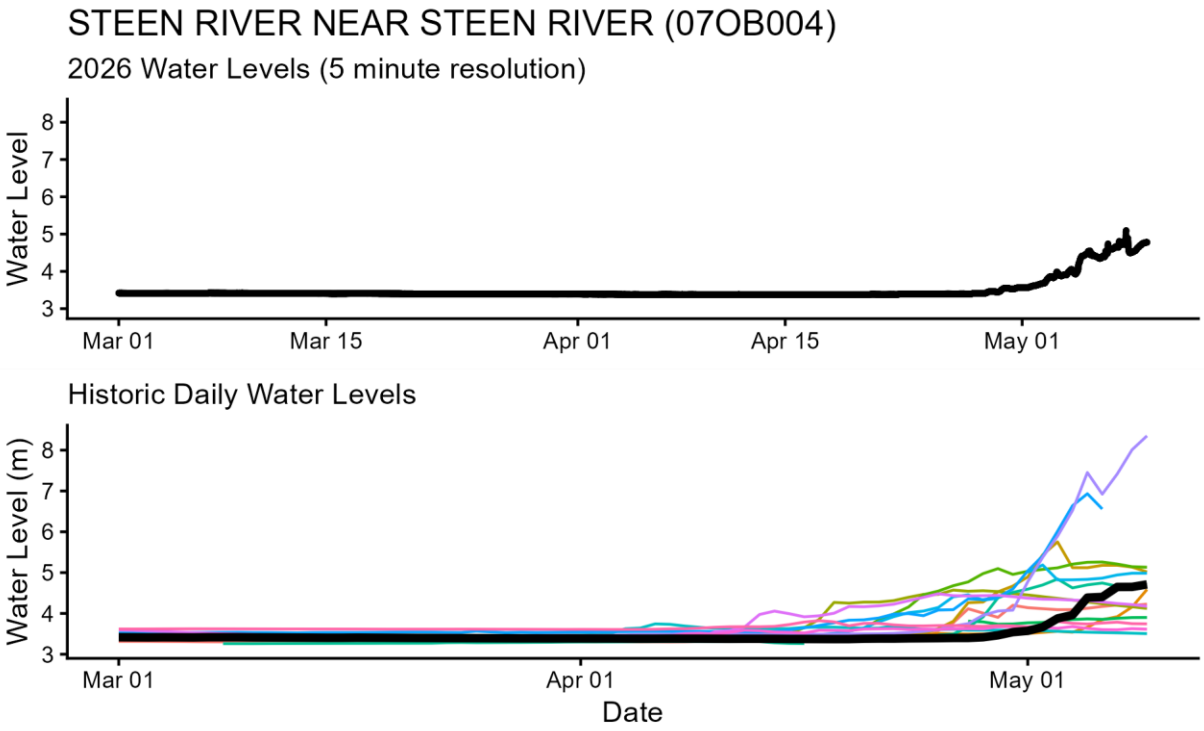
Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Hay River Near Alta/Nwt Boundary (07OB008)



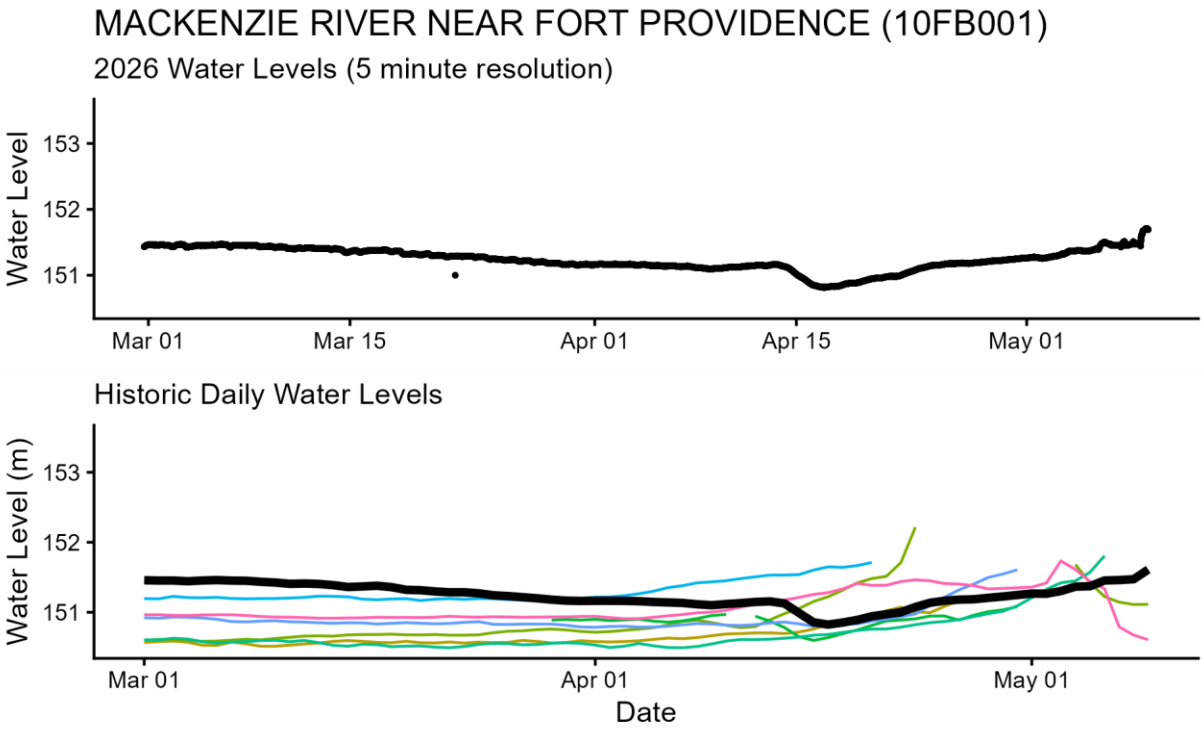
Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Steen River Near Steen River (07OB004)



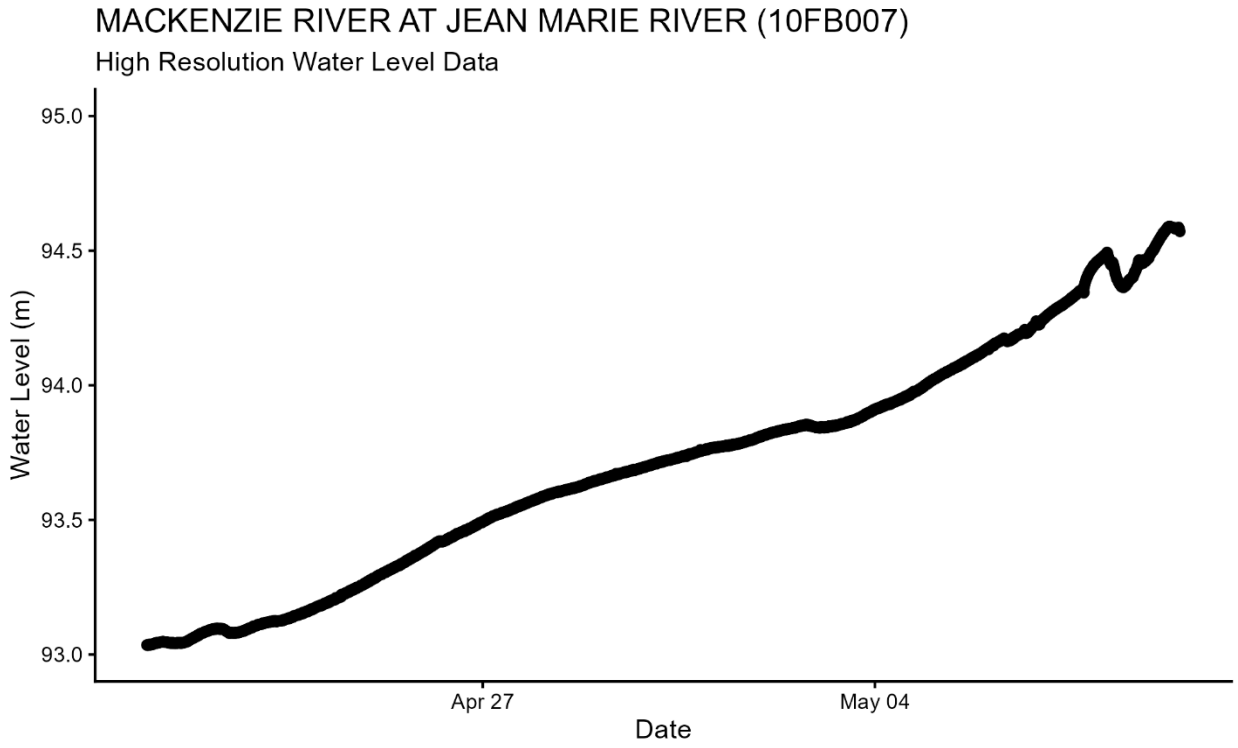
Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Mackenzie River Near Fort Providence (10FB001)



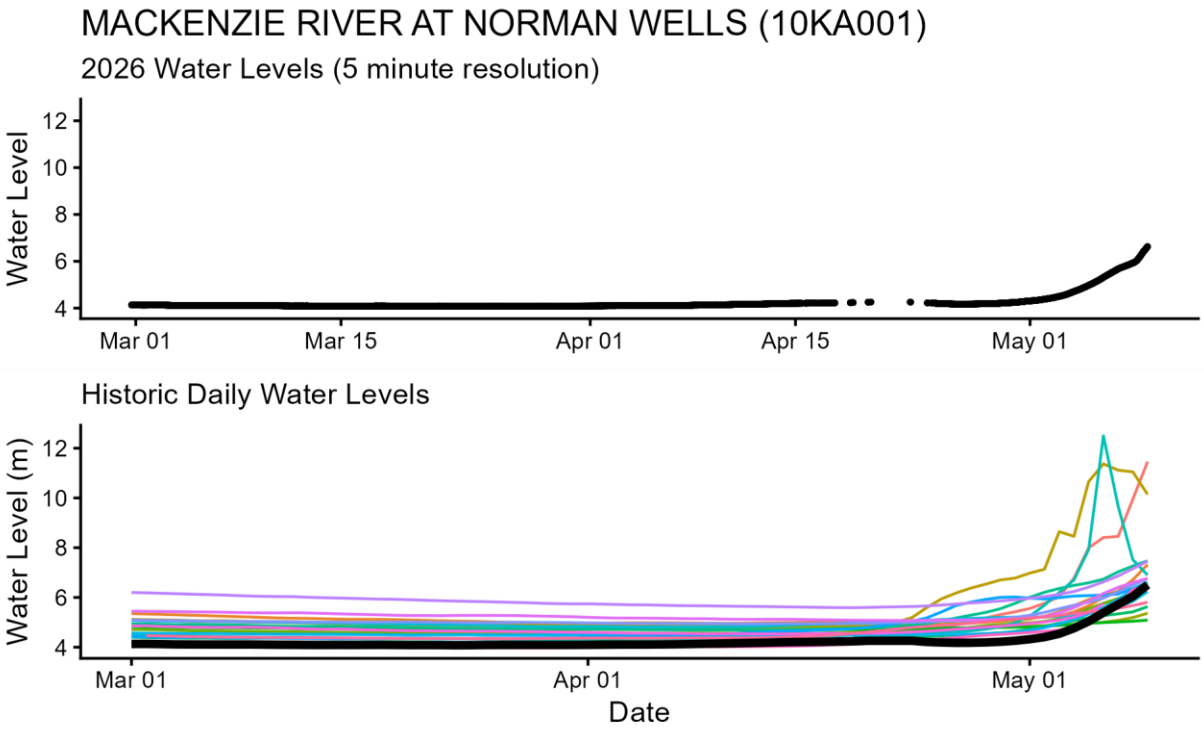
Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Mackenzie River At Jean Marie River (10FB007)



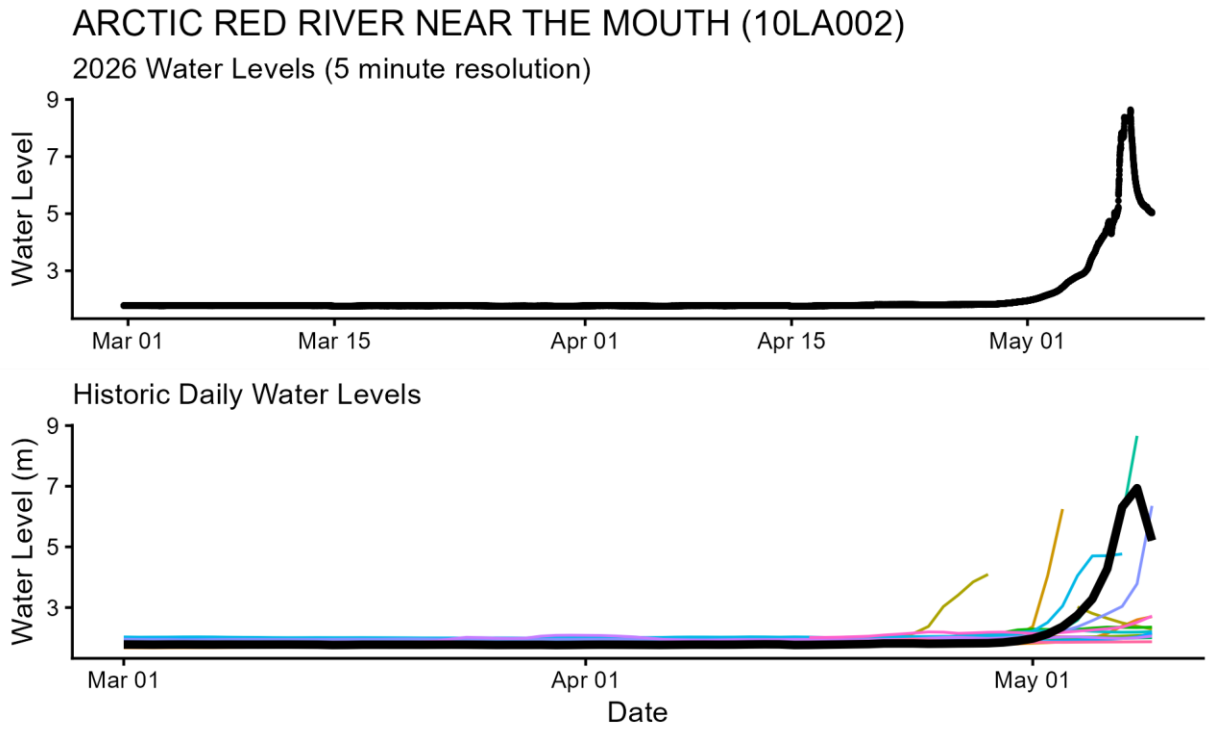
Above – This figure presents real time water level data at 5-minute resolution.

Mackenzie River At Norman Wells (10KA001)



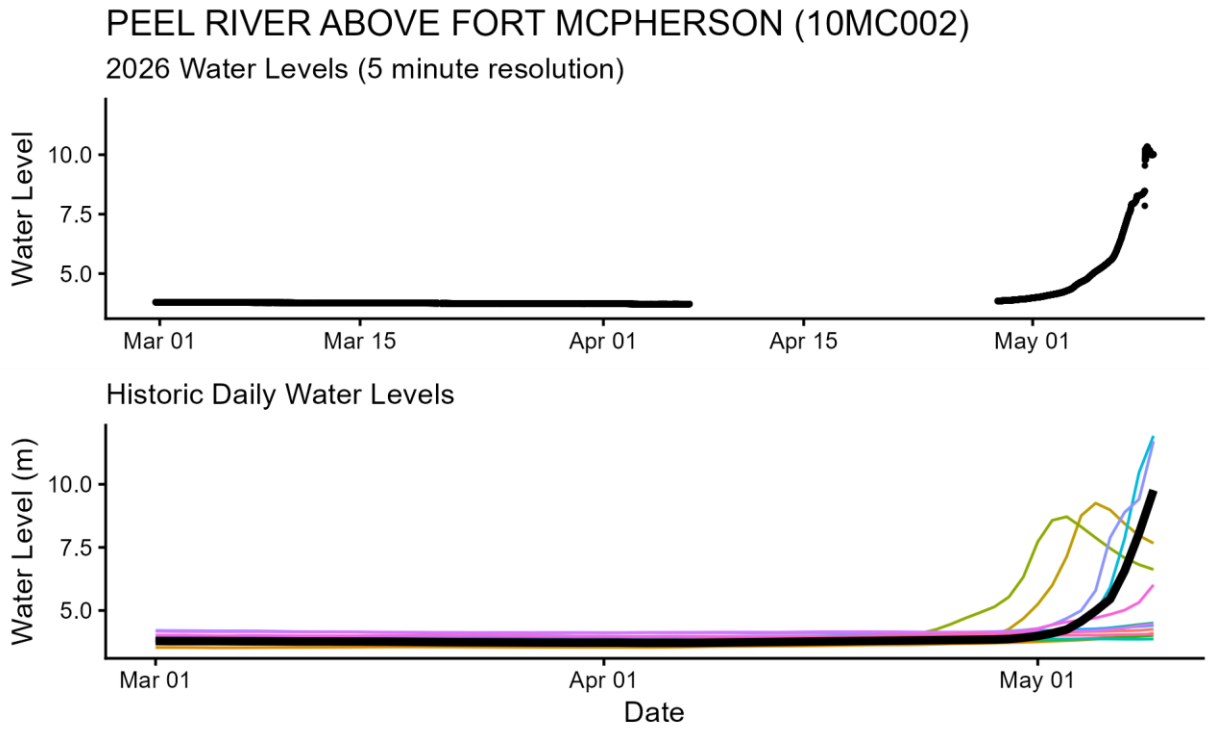
Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Arctic Red River Near The Mouth (10LA002)



Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.

Peel River Above Fort Mcpherson (10MC002)



Above - The upper graph in the figure presents real time water level data at 5-minute resolution. The lower graph shows daily average levels relative to the previous 20 years.