Hydrologic Forecast Centre

Manitoba Transportation and Infrastructure

Winnipeg, Manitoba

MARCH FLOOD OUTLOOK

March 21, 2023

Executive Summary

The March Outlook Report prepared by the Hydrologic Forecast Centre (HFC) of Manitoba Transportation and Infrastructure reports low to moderate risk of significant spring flooding in most Manitoba basins, with the exception of the main stem of the Red River between Emerson and the Floodway inlet which has a major risk of spring flooding due to above normal snowpack in the U.S. portion of the basin. Water levels are expected to remain below dikes and community or individual flood protection levels at all locations wherever there are dikes and community or individual flood protection works.

The risk of spring flooding is generally low for several rivers including the Souris, Roseau, Rat and Pembina Rivers. The risk of spring flooding is low to moderate in the Interlake Region along the Fisher and Icelandic Rivers, and along the main stem of the Assiniboine River. There is also a low risk of flooding for most other Manitoba basins including the Saskatchewan River, Whiteshell Lakes area, and northern Manitoba. With the exceptions of Dauphin Lake and Lake St Martin, most Manitoba lakes, including Lake Winnipeg and Lake Manitoba, are currently projected to remain within their operating ranges after the spring runoff. Dauphin Lake and Lake St Martin are projected to remain slightly above their operating ranges due to above normal base levels throughout the winter.

As in many other years, the risk of flooding could change in any of the basins depending on weather conditions between now and throughout the spring melt.

Soil Moisture Conditions at Freeze up:

Soil moisture at freeze-up is one of the major factors that affects spring runoff potential and spring flood risk. Due to normal to below normal summer and fall precipitation, the soil moisture at freeze-up is normal to below normal for most Manitoba basins. Some localized areas in central Manitoba and in the Interlake

region have above normal soil moisture. The soil moisture is normal to below normal for the Red and Souris River basins (including the U.S. portions of the basin), the Assiniboine River, Qu'Appelle River, Saskatchewan River, Winnipeg River and northern Manitoba basins.

Winter Precipitation:

Winter precipitation has been generally below normal in most central and southern Manitoba basins. Winter precipitation has been normal to above normal throughout northern Manitoba basins, including the Saskatchewan and Churchill River basins. The United States portions of the Red River and Souris River basins have received normal to above normal precipitation since November 1st.

Snow Water Equivalent (SWE):

Snow Water Equivalent (SWE) is the measure of the amount of water content in the snow. Snow water equivalent (SWE) measurements obtained from second round snow surveys conducted in late February and early March indicate SWE measurements range from 34 to 163 mm (1.3 to 6.4 inches) across Manitoba basins. The average water content in the snowpack for most of the southern and central Manitoba basins is in the order of 35 to 90 mm (1.4 to 3.5 inches). The Shellmouth Reservoir basin has an average SWE value of approximately 80 mm (3.1 inches). Northern Manitoba, including the Saskatchewan River basin, has SWE of approximately 65 to 160 mm (2.6 to 6.3 inches).

Base Flows and Levels:

Base flows and levels indicate the amount of water available in the system prior to the spring runoff. Higher base flows indicate higher soil saturation levels and higher spring runoff potentials. Base flows and levels in most rivers have been gradually declining since the fall of 2022. Base flows and levels are generally near normal to above normal in most Manitoba basins.

Soil Frost Depth:

Soil frost depth affects the amount of surface water that infiltrates into the soil. Generally, deeper than normal frost depth means the soil absorbs less water and contributes to increased surface runoff; whereas shallower than normal frost depth means the soil can absorb more melting surface water and can potentially decrease the amount of overland flooding. The frost depth is variable across the watersheds, but is generally considered to be normal to shallower than normal throughout most of the province due to warmer than normal winter temperatures.

Future Weather:

Most parts of Saskatchewan, Manitoba and the U.S. portions of the Red and Souris River basins are expected to receive less than 10 mm of precipitation between March 19th and March 26th. In the longer range, climate outlook issued by the International Research Institute (IRI) at the Columbia Climate School indicates no deviation from normal precipitation in all basins for April, May, June and July. Daily average temperatures are forecasted to remain below zero degrees until end of March. Daily average temperatures forecasted to increase above zero in early April leading to a potential start of the spring runoff. Longer range weather predictions are generally not reliable.

Flood Outlook:

The magnitude of the spring runoff on Manitoba's rivers is still very dependent on weather conditions from now until the spring melt and during the spring melt period. The runoff potential is significantly affected by the amount of additional snow and spring rains, frost depth at the time of runoff, and timing and rate of spring thaw; and the timing of peak flows in Manitoba, the United States, Saskatchewan and Ontario. A late thaw and spring rainstorms could result in a rapid snow melt that increases overland flooding and flows on tributary streams and larger rivers.

The province's practice is to plan and prepare for the unfavourable future weather condition scenario, which is a weather scenario that would have a 1-in-10 chance of occurring from now until the spring run-off. The preliminary spring flood outlook based on current basin conditions and future weather condition scenarios shows the risk of significant flooding is major for the main stem of the Red River between Emerson and the Floodway Inlet. The risk of spring flooding is low to moderate for the Interlake region including, the Fisher and Icelandic Rivers, and along the main stem of the Assiniboine River. However, as in most years, the risk of ice jam related flooding is high for the Icelandic and Fisher Rivers. The risk of significant spring flooding is low for most other Manitoba basins including the Pembina, Roseau, Souris, Rat, Saskatchewan and Carrot Rivers.

Water Control Structures Operations:

The Red River Floodway is expected to be operated this spring to reduce water levels within the City of Winnipeg. The Portage diversion is expected to be operated under unfavourable weather conditions. Also, minimal operation of the Portage Diversion may be necessary under normal and favourable weather conditions to prevent ice jamming on the Assiniboine River east of Portage la Prairie and to control river levels in the City of Winnipeg as well as areas along the Assiniboine River downstream of Portage la Prairie.

The Shellmouth Reservoir is being operated in consultation with the Shellmouth Liaison Committee members in order to reduce the risk of flooding downstream on the Assiniboine River, while at the same time providing sufficient storage for water supply and recreation.

Preparations:

The Manitoba government, local authorities and First Nation communities are continuing to prepare for spring flooding. This includes the completion of the ice cutting and breaking by the Province this spring on the Red and Icelandic rivers, review of existing emergency response plans, information sharing, and preparation of materials, equipment and resources used in flood response.

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Soil Moisture Conditions

In Manitoba, the most common method used to determine soil moisture at freeze-up is the MANAPI model, which is expressed by the API (Antecedent Precipitation Index). The API model indicates the amount of summer and fall rain (May to October) that remains in the top soil layer and has yet to contribute to the spring runoff. The API model results indicate that soil moisture is near normal to below normal for the majority of Manitoba basins (Figure 1). There are pockets of areas in southern and central Manitoba, including areas near Winnipeg, and the Interlake region that have above normal soil moisture. Western Manitoba and most of the U.S. portions of the Red River and Souris River basins have normal to below normal soil moisture. The soil moisture is normal to below normal in the Assiniboine River and Qu'Appelle River basins. The Winnipeg River system in Ontario has below normal soil moisture. Eastern Manitoba and the Whiteshell Lakes area have near normal soil moistures.

The soil moisture content modeled by the National Weather Service (NWS) in the U.S. indicates, soil moisture is normal to below normal for the Red, Souris, Pembina, and Roseau River basins in the U.S. (Figure 2).

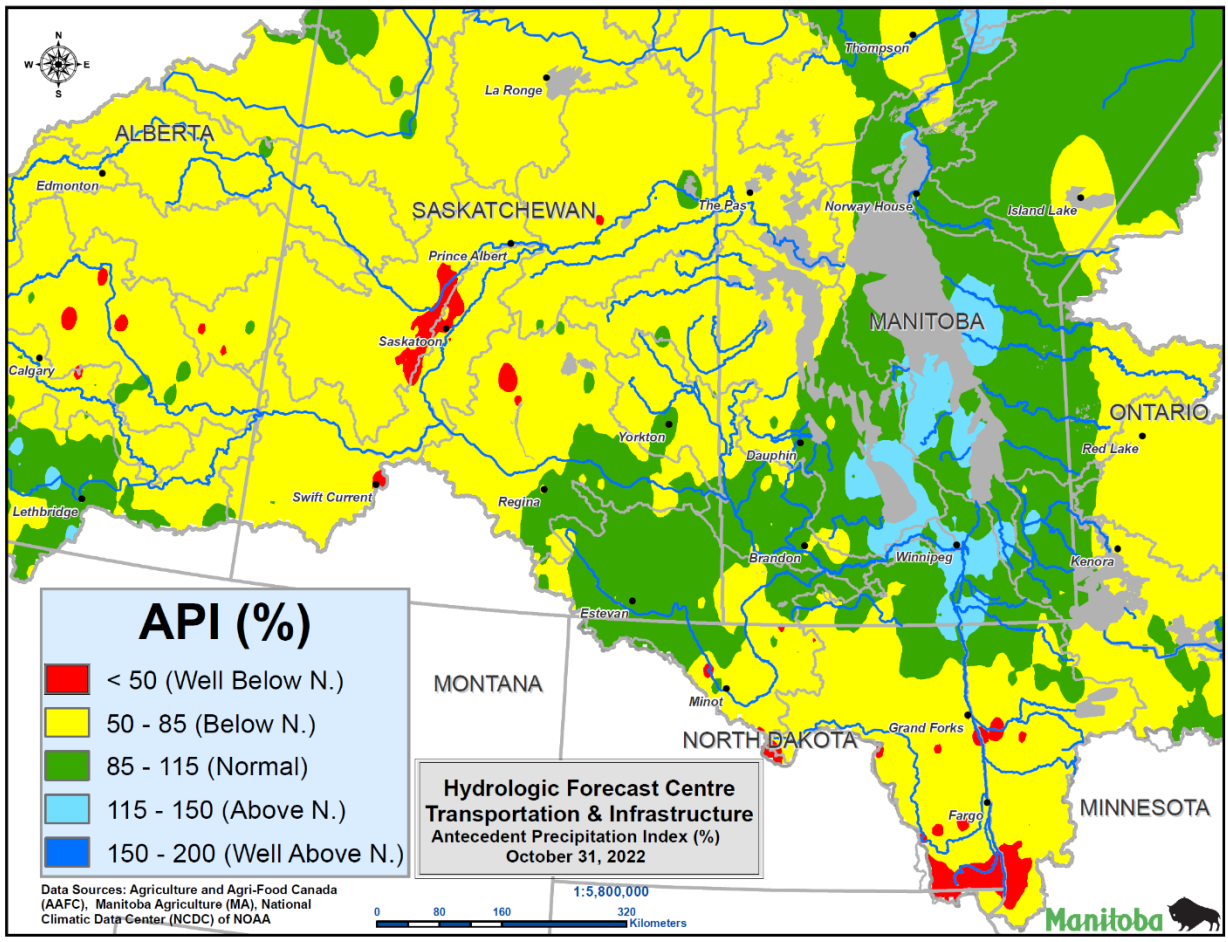

Figure 1 – Soil moisture expressed as Antecedent Precipitation Index (API) for the fall of 2022.

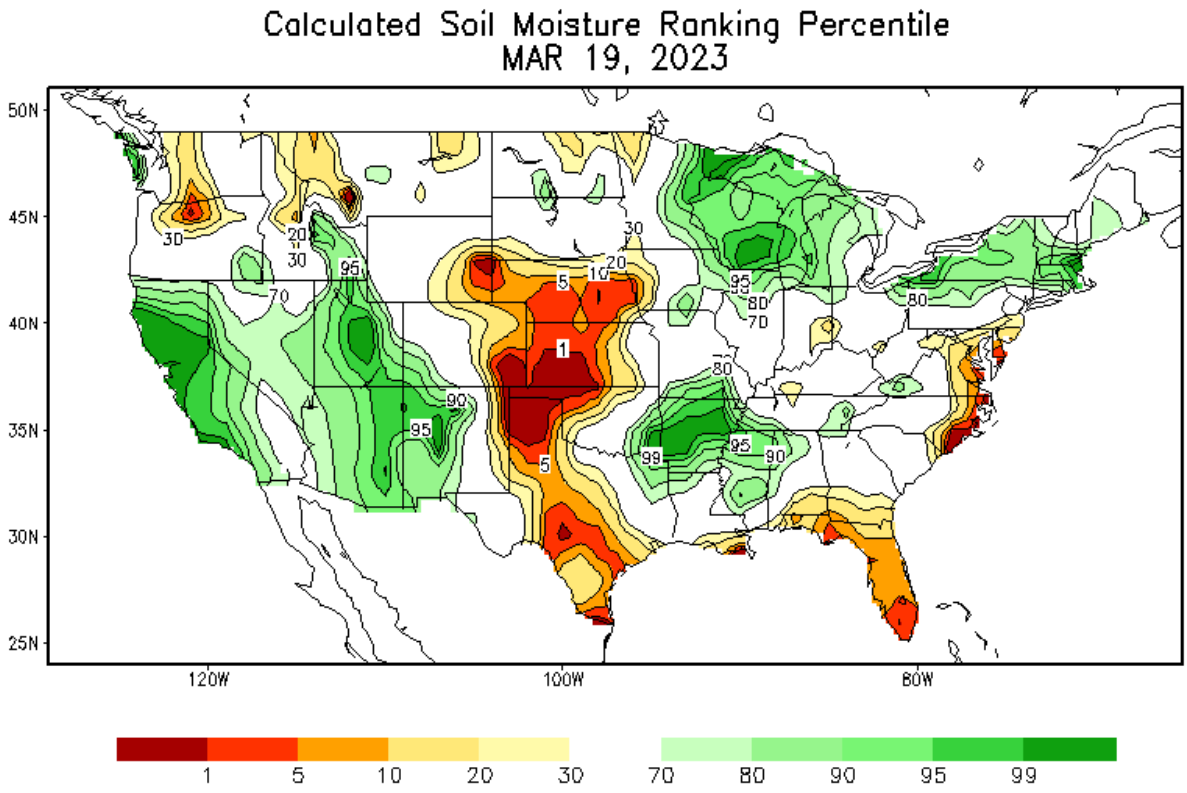

Figure 2 – Calculated soil moisture ranking percentile – NWS.

Winter Precipitation

November to March precipitation is generally below normal across much of southern and central Manitoba and southeastern Saskatchewan. The remainder of Saskatchewan is mostly near normal and northern Manitoba is normal to above normal. The U.S. portion of the Souris River basin and the southern portion of the Red River basin in the U.S. have received normal to above normal winter precipitation. Southeastern Manitoba, including Whiteshell Lakes, has received below normal precipitation during this period (Figure 3).

Generally, the cumulative precipitation amounts across Manitoba, Saskatchewan and the United States portions of the Red and Souris River basins vary significantly. Most areas in southwestern and central Manitoba and southeastern Saskatchewan, including the Interlake region, the Assiniboine River basin and the upstream portion of the Souris River basin, have received 40 to 60 mm (1.6 to 2.4 inches) of winter

precipitation since November 1st. Northern Manitoba has received approximately 80 to 100 mm (3.1 to 3.9 inches) of precipitation near The Pas to over 140 mm (5.5 inches) further north. Southeast Manitoba, including the Whiteshell Lakes area has received approximately 60 to 100 mm (2.4 to 3.9 inches) and further upstream in the Winnipeg River basin there was over 140 mm (5.5 inches) of precipitation. The U.S. portion of the Souris River basin has received 40 to 100 mm (1.6 to 3.9 inches) while the U.S. portion of the Red River basin has received from 40 mm (1.6 inches) in the northern part of the basin to near 140 mm (5.5 inches) of precipitation in the south. (Figure 4).

Compared with historic records, most areas of southern, southwestern and central Manitoba and southeastern Saskatchewan have received below the 40th percentile winter precipitation, which is in the range of dry to very dry. Put another way, historical precipitation records indicate that precipitation has been less than the current record for 40% of the time. Areas in the Interlake region, including around the Fisher and Icelandic Rivers received less than 20 percentile precipitation with pocket of area stretching from the Fisher River basin to Lake St. Martin receiving less than 5 percentile precipitation, which is considered as extremely dry. The U.S. portions of the Red River and Souris River basins have received winter precipitation that ranges from 40 percentile to 95 percentile in the southern reaches of the basins. Northern Manitoba generally ranks above 60 percentile with some areas that are near 95 percentile for winter precipitation (Figure 5).

As can be seen in Figure 6, recorded precipitation as of March 14, 2022 indicates that southern and central Manitoba and southeastern Saskatchewan have precipitation accumulation that is approximately 10 to 50 mm (0.4 to 2.0 inches) less than normal. The U.S. portions of the Red and Souris Rivers have received approximately 10 mm less than normal to 50 mm more than normal further to the south. Northern Manitoba has precipitation accumulation that deviates from the normal by more than 30 mm (1.2 inches) in some areas. Areas near the Pas and the Saskatchewan River basin in Saskatchewan received winter precipitation that in line with historical average precipitation.

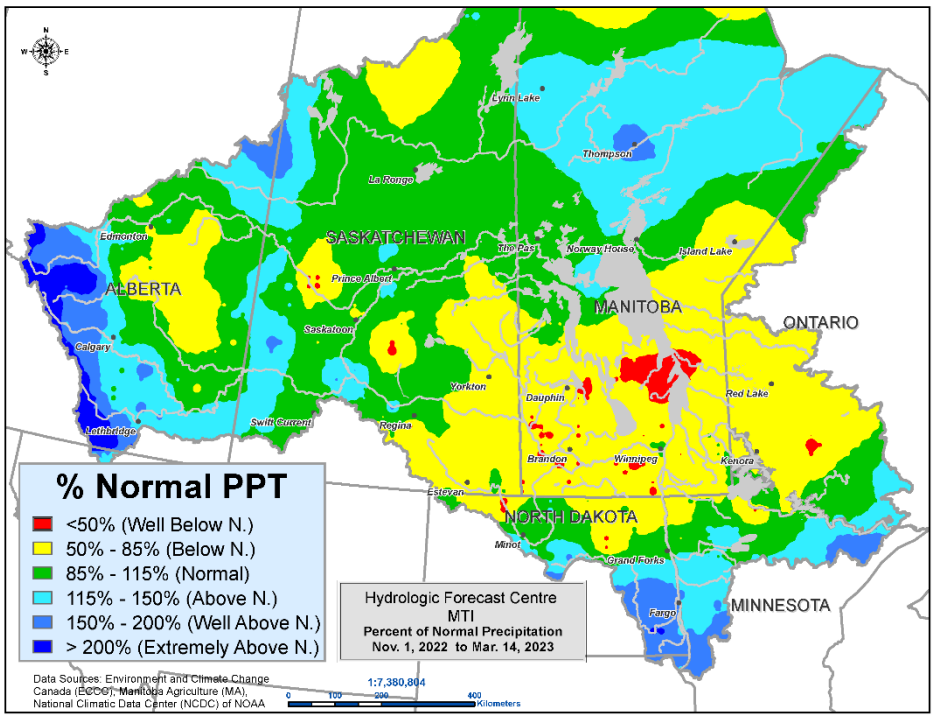

Figure 3 - Percent of normal precipitation from November 1, 2022 to March 14, 2023.

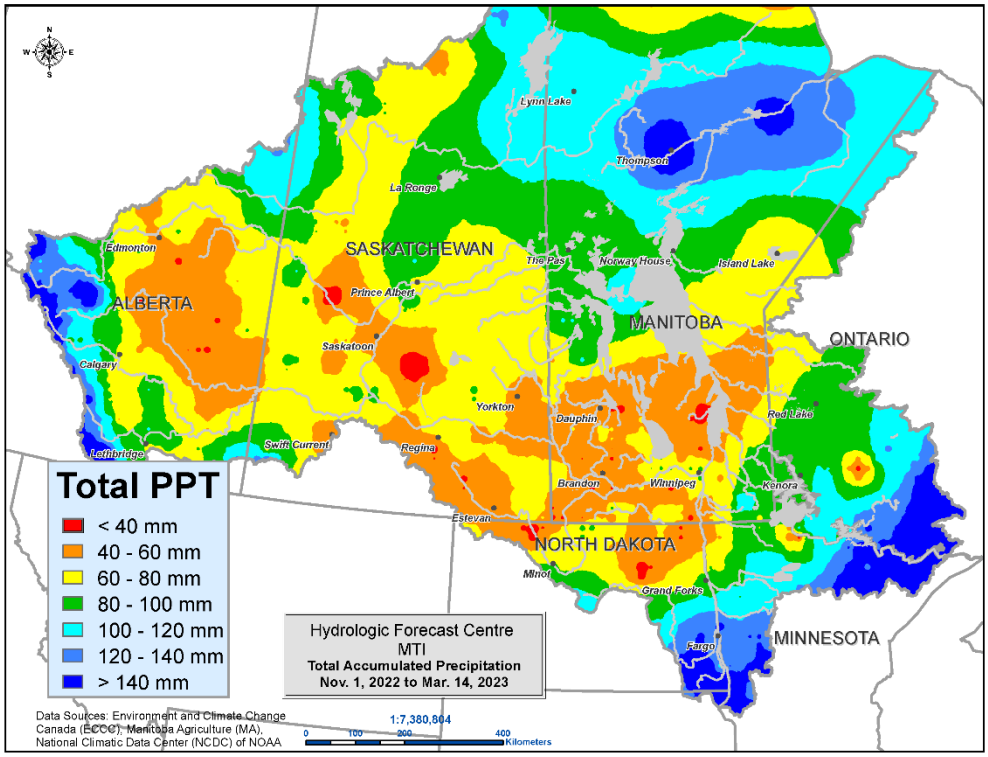

Figure 4 - Cumulative precipitation in mm from November 1, 2022 to March 14, 2023.

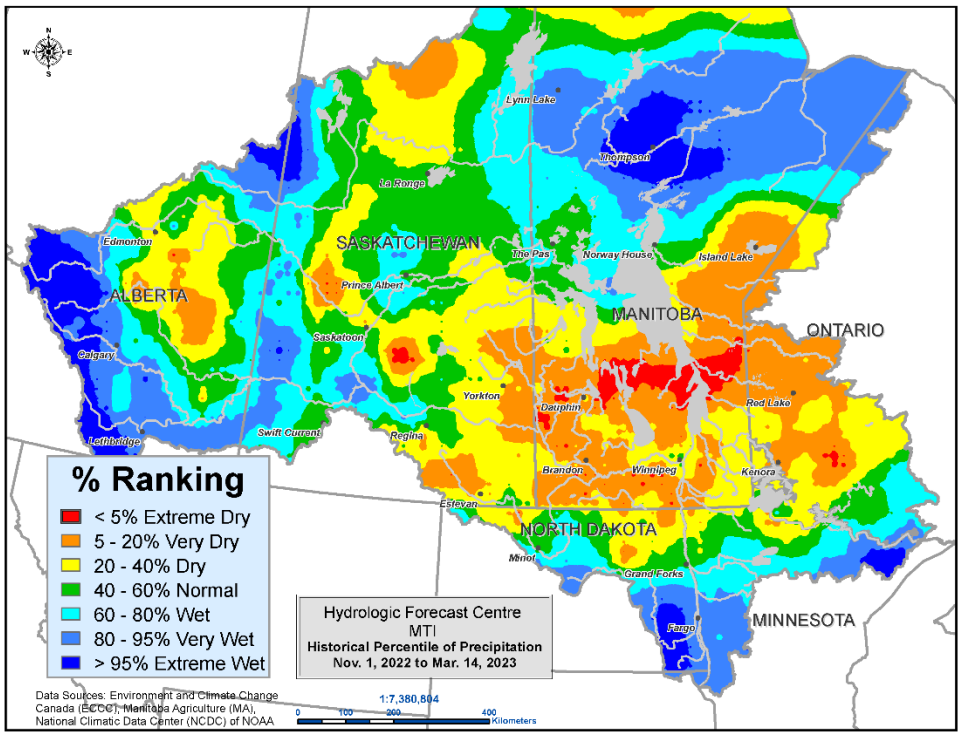

Figure 5 – Percent ranking precipitation from November 1, 2022 to March 14, 2023, compared to historic record.

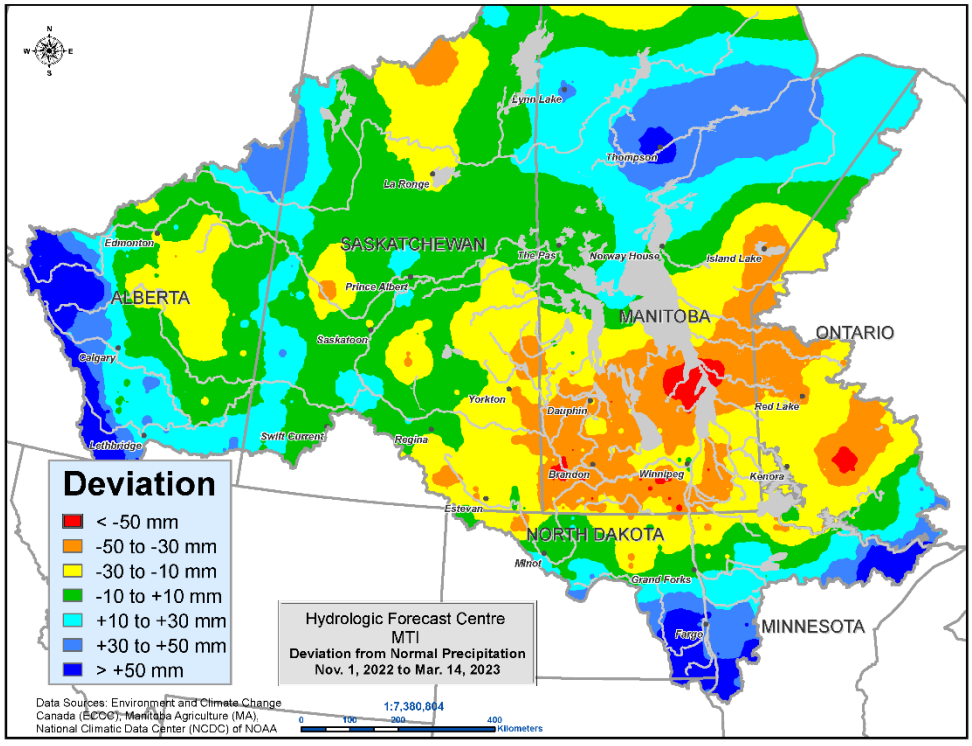

Figure 6 - Precipitation from November 1, 2022 to March 14, 2023, deviation from normal (mm).

Snow Water Content

Snow water equivalent (SWE) measurements obtained from the second round of snow surveys conducted in late February to early March indicate that the average water content in the snowpack is in the order of 35 to 90 mm (1.4 to 3.5 inches) in most of the southern Manitoba basins with a few measurements just outside of this range (Figure 7). The Interlake region had the lowest SWE values of approximately 30 to 60 mm (1.2 to 2.4 inches). The Shellmouth Reservoir basin has an average SWE value of approximately 80 mm (3.1 inches). Northern Manitoba, including the Saskatchewan River basin, has snow accumulation with approximately 65 to 160 mm (2.6 to 6.3 inches) of SWE. The highest measurements were taken at higher elevations, including Riding Mountain Provincial Park, Duck Mountain Provincial Park and the Porcupine Mountains. The department did not conduct a second round of snow water equivalent measurements in the U.S.; however, the department monitors snow accumulation through automatic weather stations and satellite observations.

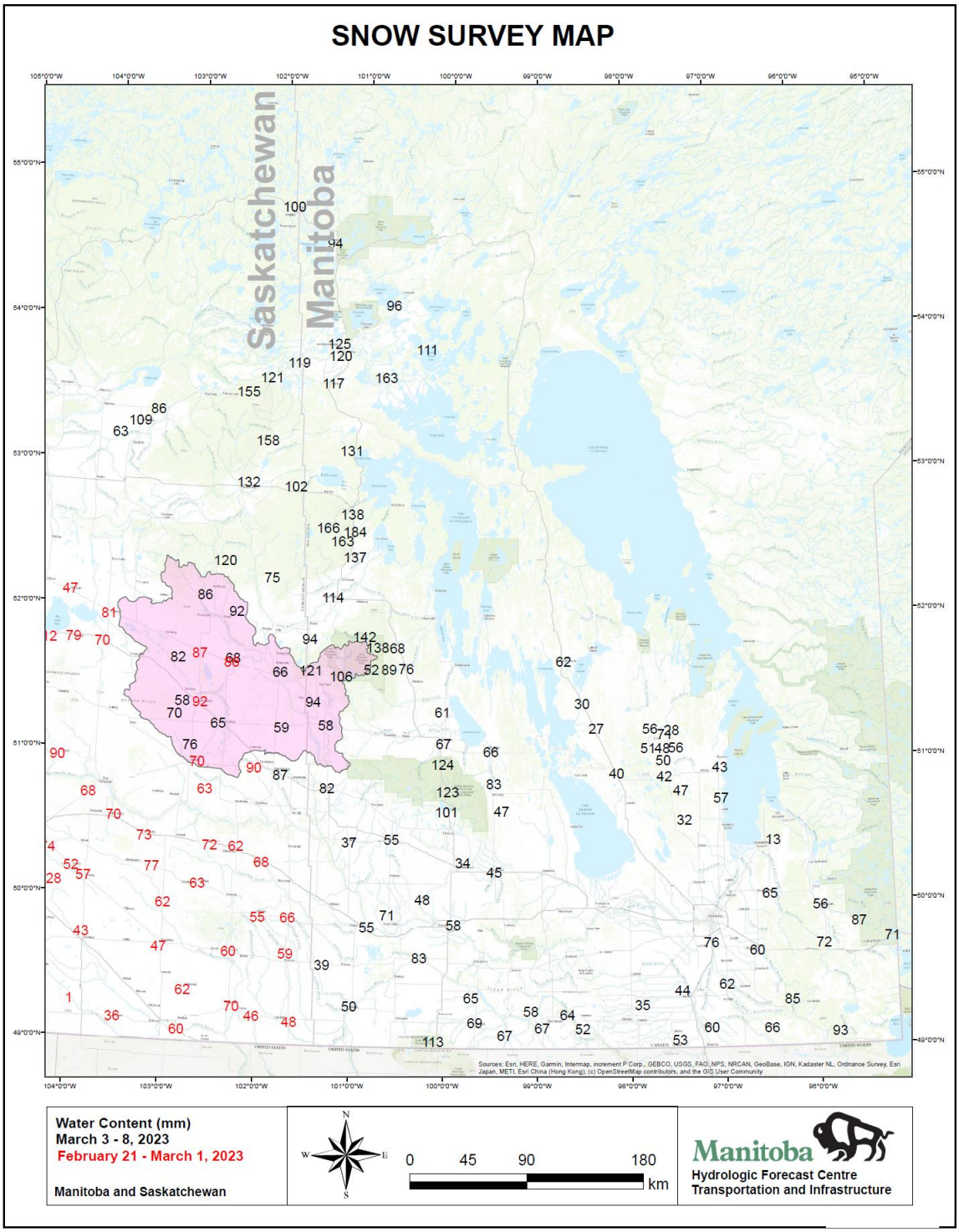

Figure 7– Snow Water Equivalent (SWE) in mm from field measurements conducted in late February and early March 2023. (The readings shown in black were conducted by Manitoba Transportation and Infrastructure staff and the reading shown in red were conducted by Saskatchewan Water Security Agency staff.)

Base Flows and Level Conditions

Base flows and levels indicate the amount of water available in the system prior to the spring runoff. Higher base flows indicate higher soil saturation levels and higher spring runoff potentials. Base flows and levels in most rivers have been gradually declining since the fall of 2022. Base flows and levels are generally normal to above normal in most Manitoba basins (Figure 8).

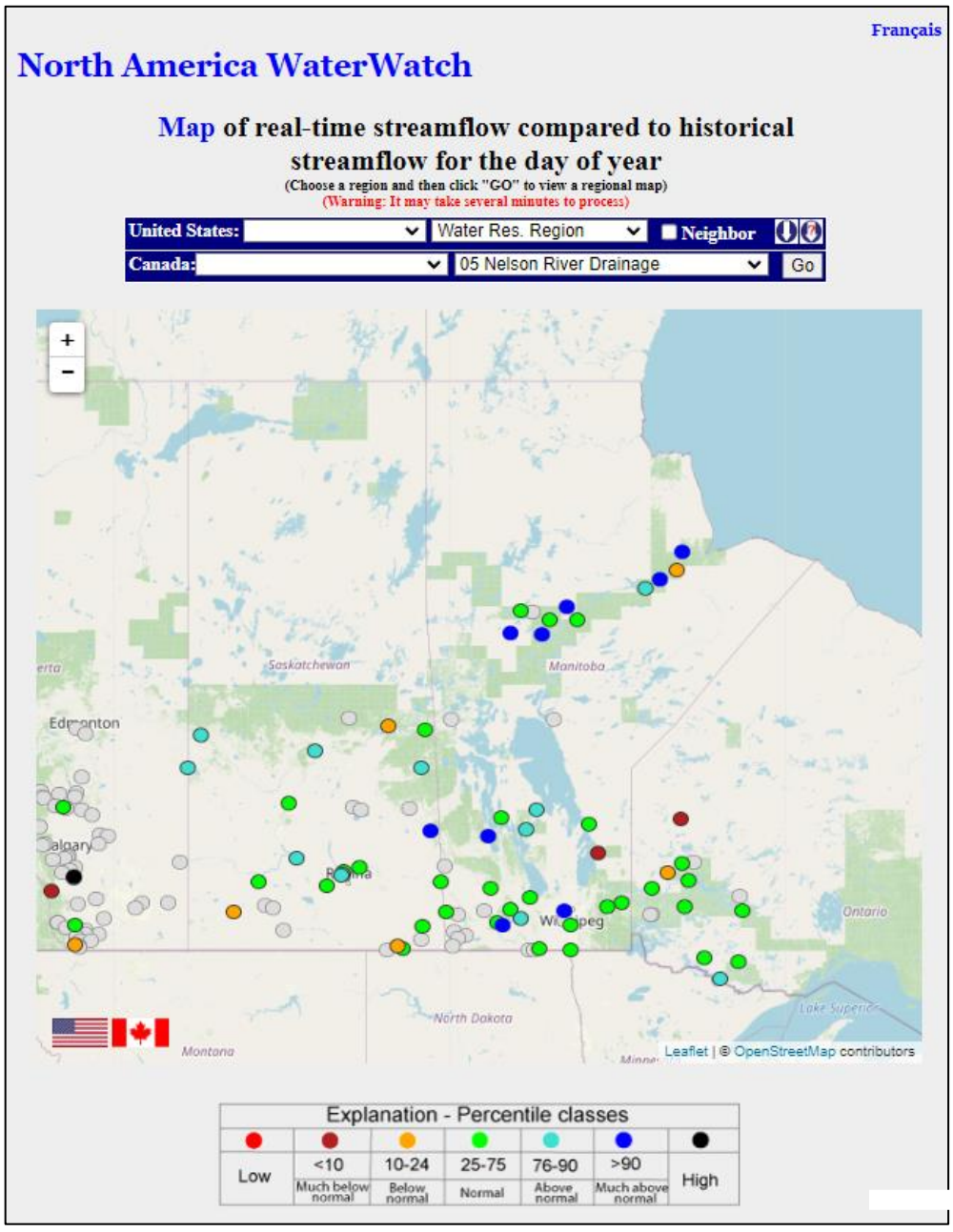

Figure 8 – Base flows and level conditions as of March 15, 2023 (Note: Flows and levels readings at some locations could be ice affected and may not show the actual flows and levels).

Soil Frost Depth

Soil frost depth is dependent on winter temperatures and the amount of snow cover insulation. The frost depth is variable across the watersheds, but is generally considered to be normal to shallower than normal throughout most of the province. Generally, deeper than normal frost depth takes longer to thaw which means the soil absorbs less water and contributes to increased surface runoff; whereas shallower than normal frost depth means the soil can absorb more melting surface water and can potentially decrease the amount of overland flooding. Figure 9 shows comparative measurements of frost depth at various locations across the province.

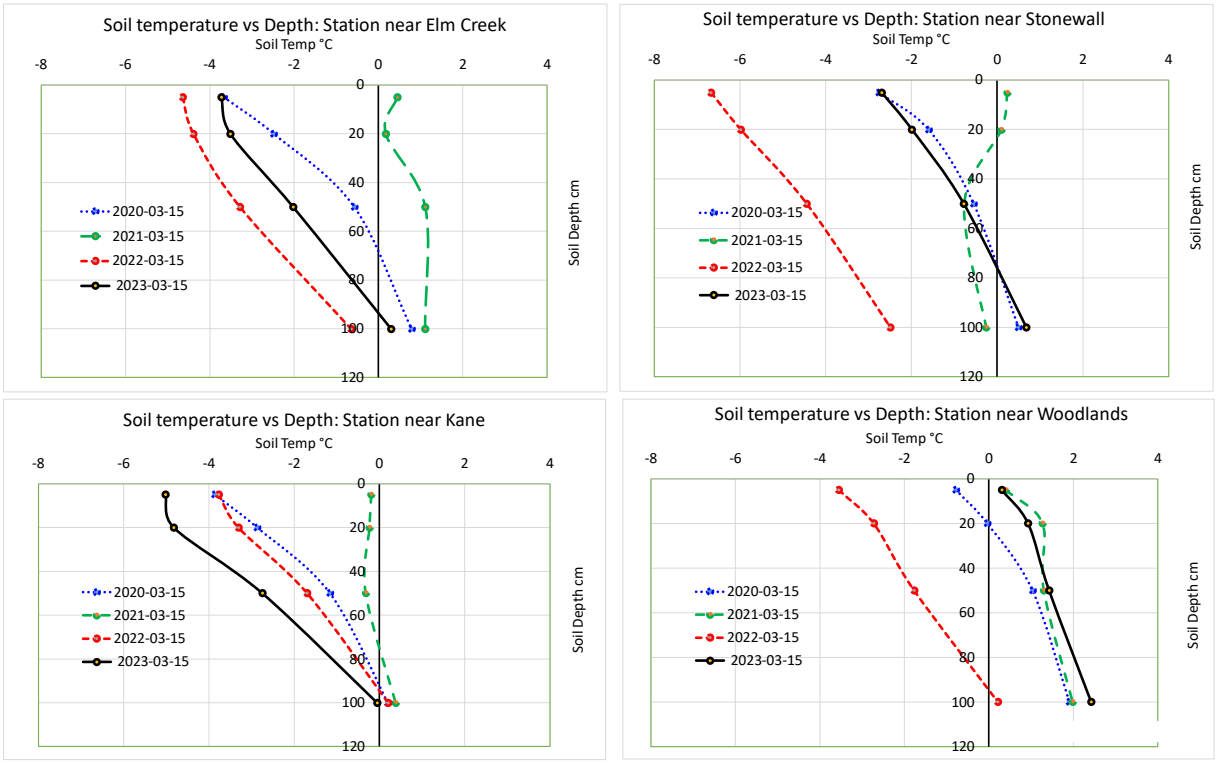

Figure 9 – Frost depth in centimeters at various locations across the province.

Future Weather Outlook

Over the next 7 days, there is very little precipitation forecasted across most parts of Saskatchewan, Manitoba and the U.S. portion of the Red and Souris River as less than 10 mm of precipitation is expected between March 19th and March 26th (Figure 10). There is a potential for up to 20 mm precipitation for the southern portion of the Red River basin in the U.S., but most weather forecast models do not agree on the exact amount and location of this forecasted precipitation system. Daily average temperatures are

forecasted to remain below zero degrees until end of March. Daily average temperatures forecasted to increase above zero in early April leading to a potential start of the spring runoff. In the longer range, climate outlook issued by the International Research Institute (IRI) at the Columbia Climate School indicates near normal precipitation across all basins for April, May, June and July. (Figures 11 and 12). Long term weather predictions are generally not reliable.

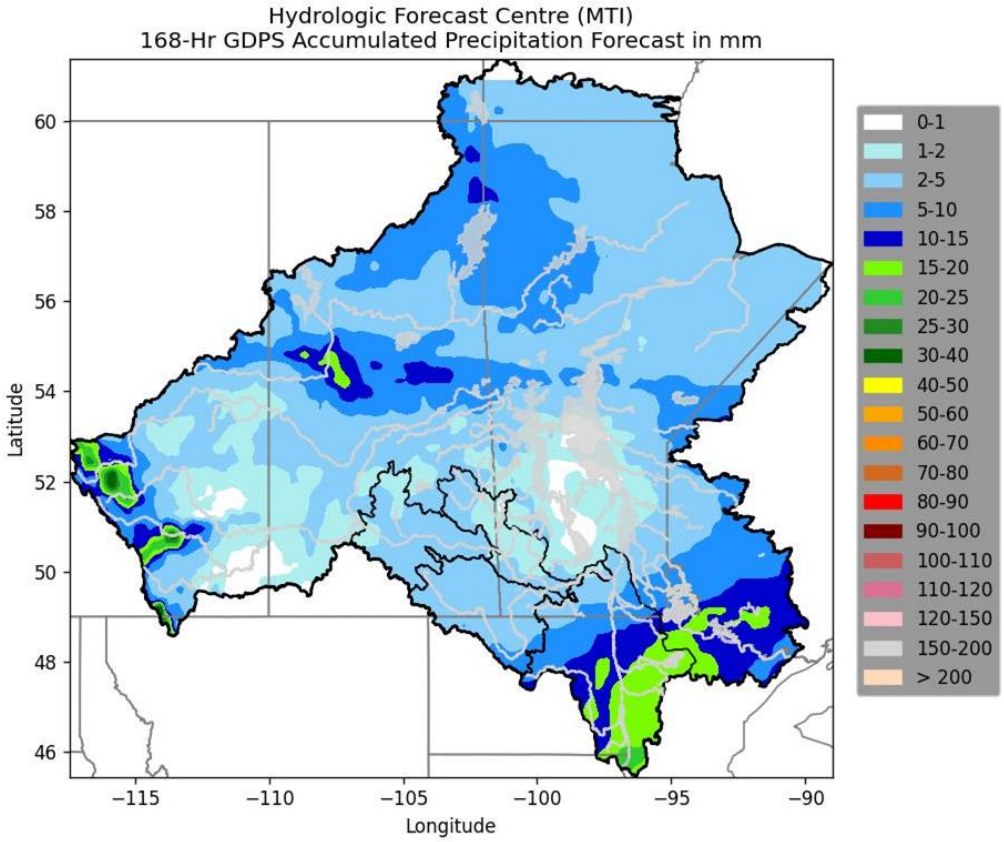

Figure 10 – Short term precipitation forecast between March 19th and March 26th.

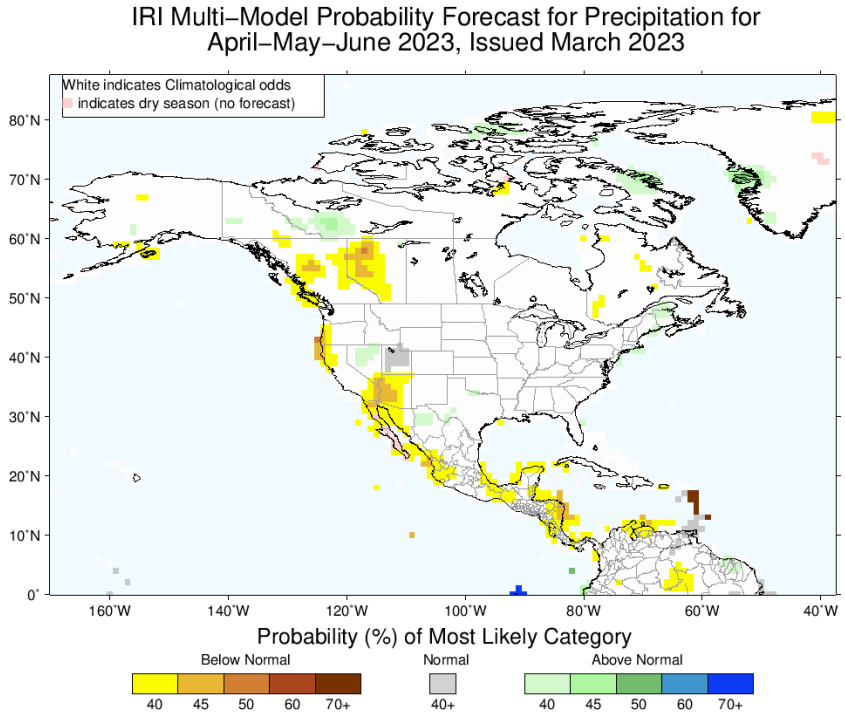

Figure 11 – IRI Multi-Model Probability Forecast for Precipitation for April-May-June 2023, issued March 2023.

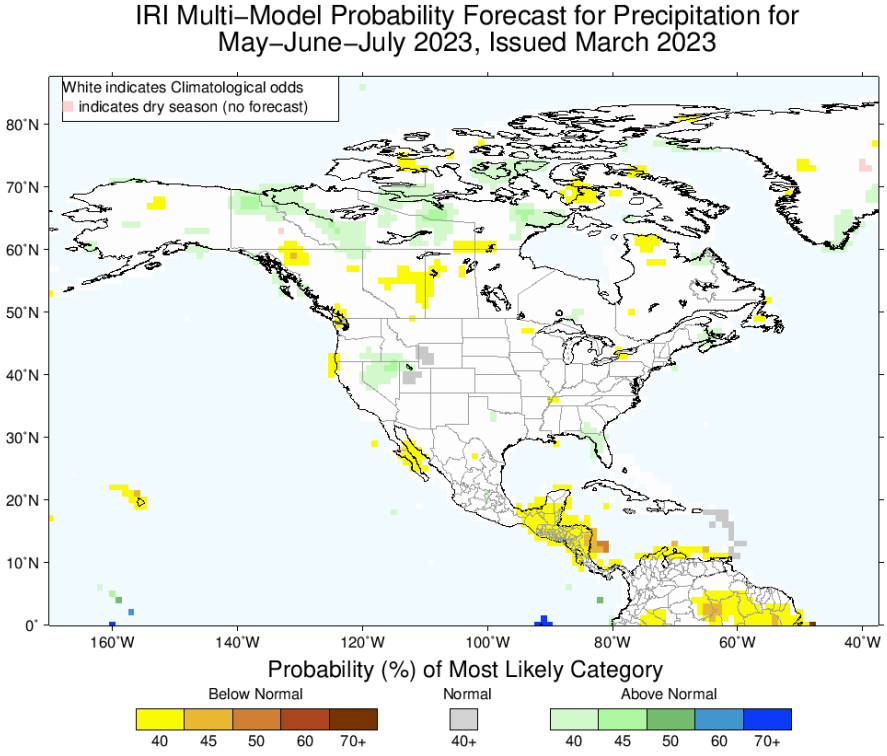

Figure 12 – IRI Multi-Model Probability Forecast for Precipitation for May-June-July 2023, issued March 2023.

Current Lake Level and River Flow Conditions

Current river flow conditions:

- The Dauphin and Fairford Rivers in the Interlake region: flows are above normal for this time of year.
- The Souris, Roseau and Pembina Rivers: near normal flows for this time of year.
- Due to releases from the Shellmouth Dam being reduced only recently, Assiniboine River flows are above normal for this time of year.
- The Red, Carrot, Red Deer, Qu'Appelle, Saskatchewan and Churchill Rivers: flows are near normal for this time of the year.
- There is no current flow/level data for the Fisher River and Icelandic River. Flow/level reporting will resume in spring. Historically, these rivers have very low flows throughout the winter season.

Table 1 summarizes flows at main rivers at selected locations as of March 16, 2023.

Current lake water levels:

- Water levels for major lakes in Manitoba are normal to above normal heading into the spring. With the exception of Lake St. Martin, which is above its operating range, most Manitoba lakes including Lake Winnipeg, Lake Manitoba, and Dauphin Lake are within their respective operating ranges heading into the spring runoff. Even though Dauphin Lake level is within its operating range, the level is well above normal for this time of the year and was exceeded only 8% of the time in historic records.

Table 2 summarizes levels at major lakes as of March 16, 2023.

Table 1. Flows for main rivers at selected locations as of March 16th, 2023.

**Note – The Assiniboine River flows and levels are regulated by the operation of Shellmouth Dam.*

** Note – The Red River Level at James Avenue is measured in relative to the long term mean winter ice level at James avenue, which is 727.57 feet geodetic or 0 ft James.*

River	Location	Most Recent Flow/ Level (Mar 16, 2023)	Minimum Flow/Level	10th Percentile	Normal Flow/Level	90th Percentile	Maximum Flow/Level	Period of Record
Red River	Emerson	1,928 cfs	1 cfs (1937)	331 cfs	2,223 cfs	4,556 cfs	24,367 cfs (1998)	109 years
	Ste. Agathe	1,854 cfs	247 cfs (1977)	678 cfs	3,379 cfs	8,264 cfs	25,780 cfs (1998)	61 years
	St. James Avenue	1.89 ft	-1.79 ft (1991)	-.53 ft	2.13 ft	6.24 ft	12.26 ft (2016)	50 years
Assiniboine River	Russell	870 cfs	11 cfs (1963)	47 cfs	319 cfs	1,019 cfs	1,416 cfs (2007)	109 years
	Brandon	1,028 cfs	38 cfs (1940)	82 cfs	480 cfs	1,062 cfs	2,832 cfs (2016)	109 years
	Holland	1,300 cfs	76 cfs (1963)	300 cfs	932 cfs	1,519 cfs	3,673 cfs (2016)	61 years
	Headingley	1,289 cfs	70 cfs (1963)	160 cfs	611 cfs	1,280 cfs	3,171 cfs (2016)	109 years
Shellmouth Dam Release	Shellmouth	100 cfs	33 cfs (1969)	64 cfs	484 cfs	1,124 cfs	1,600 cfs (2007)	53 years
Souris River	Wawanesa	20 cfs	0 cfs (1963)	0 cfs	96 cfs	253 cfs	1,582 cfs (2015)	109 years
Qu'Appelle River	Welby	155 cfs	5 cfs (1978)	25 cfs	174 cfs	292 cfs	1,056 cfs (2015)	79 years
Fairford River	Fairford	4,273 cfs	48 cfs (1965)	305 cfs	2,820 cfs	5,583 cfs	12,360 cfs (2012)	67 years
Waterhen River	Waterhen	879 cfs	0 cfs (1965)	6 cfs	1,110 cfs	2,906 cfs	5,262 cfs (2017)	71 years
Dauphin River	Dauphin	4,697 cfs	44 cfs (1977)	263 cfs	2,616 cfs	5,933 cfs	9,253 cfs (2012)	45 years
Saskatchewan River	The Pas	9,712 cfs	2,281 cfs (1937)	3,765 cfs	10,900 cfs	19,812 cfs	24,544 cfs (1998)	109years

Table 2: March 16 lake levels, forecasts and corresponding operation ranges.

**Levels on these lakes are managed by operation of dam structures.*

Lakes	Current level, Mar 16 (ft)	Operating range or long term avg. (ft)	Normal level for Mar 16 (ft)	Last time level was equal or higher than the current level	Expected level after 2023 spring runoff	Historical comparison
Lake Manitoba*	811.6	810.5 - 812.5	811.9	811.8 (2018)	811.8 – 812.3	*Historic water level for this time of year is above the current level 70% of the time*
Lake Winnipeg*	713.7	711 - 715	713.6	714.7 (2020)	713.9 – 714.5	*Historic water level for this time of year is above the current level 45% of the time*
Lake St. Martin*	800.8	797 - 800	799.3	801.8 (2018)	800.0 – 800.5	*Historic water level for this time of year is above the current level 20% of the time*
Lake Winnipegosis	830.5	830.3	830.3	831.3 (2019)	831.3 – 832.5	*Historic water level for this time of year is above the current level 43% of the time*
Dauphin Lake*	854.7	853.0 - 854.8	854.0	855.6 (2017)	855.2 – 855.8	*Historic water level for this time of year is above the current level 8% of the time*
Shellmouth Reservoir*	1393.7	1386 - 1400	1393.6	1397.2 (2021)	1400 – 1404	*Historic water level for this time of year is above the current level 48% of the time*
Lake Wahtopanah near Rivers*	1535.2	1535.5	1530.8	1535.6 (2020)		*Historic water level for this time of year is above the current level 14% of the time*
Lake Minnewasta	1072.1	1078.4	1078.4	1081.1 (2020)	-	*Historic water level for this time of year is above the current level 89% of the time*

River Ice Conditions and Ice Jamming[1]

The province has collected ice thickness measurements on the Red and Icelandic Rivers throughout February and early March. Normal ice thickness for this time of the year varies according to air temperature since freeze up, the river flow velocity and the location of the river. The normal ice thickness for Manitoba's central and southern rivers for this time of the year ranges from 68 cm (26.7 inches) to 81 cm (30.6 inches). The completed measurements taken on the Red River north of Selkirk indicate an ice thickness of approximately 64 cm (25 inches). The ice is thinner than it was at this time last year (Figure 13). The ice thickness on the Icelandic River is approximately 59 cm (23 inches)

Spring weather affects the timing and rate of the deterioration of the river ice, and will be a significant factor in determining ice strength at break-up. It is difficult to predict the time of occurrence and extent of ice jamming. However, with the ice cutting and breaking activities completed on the Red and Icelandic Rivers, the chance of ice jamming and related flooding on the lower Red River and Icelandic River should be reduced.

Localized flooding can occur when and where ice jams develop, even with below average river flows. The chances of localized flooding due to snow and ice blockages in drains, ditches and small streams during the early part of the run-off period will depend on the nature of the spring breakup and rate of melt.

[1] See Appendix A for 'Ice Jam' definition

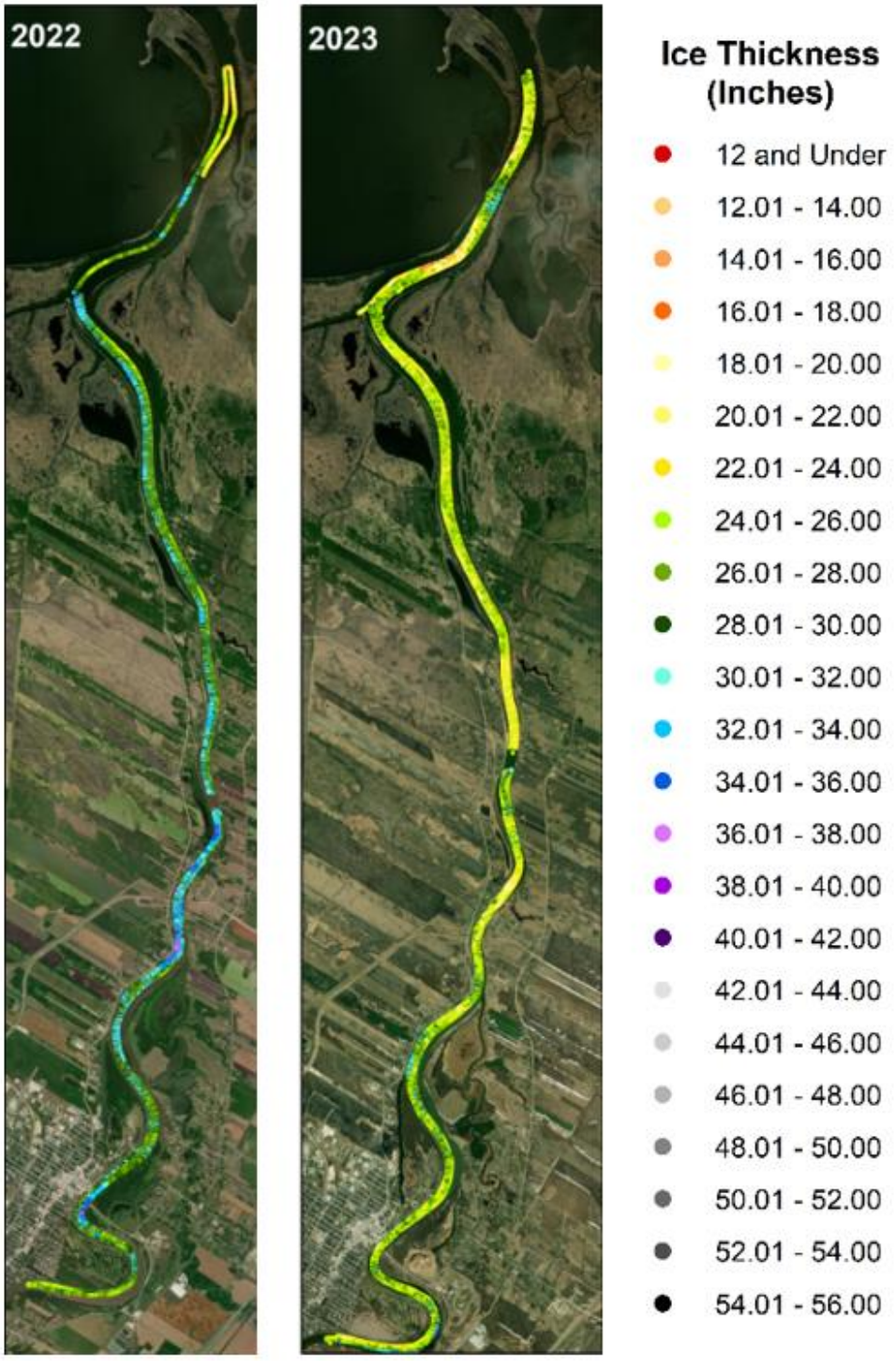

Figure 13 – Ice Thickness Measurements (inches) based on Ground Penetrating Radar: Red River (2022 vs. 2023).

Flood Outlook[2]

Spring flood outlooks provide estimates of peak river flows and lake water levels that are based on current basin conditions, and three possible future weather scenarios. These weather scenarios are: favourable, normal, and unfavourable. These scenarios correspond to three different probabilities of occurrence: lower decile, median, and upper decile. The province's practice is to plan and prepare for the unfavourable (upper decile) future weather conditions. For further information, see Appendix A: Definitions.

The risk of spring flooding is defined by three categories: major spring flooding risk, moderate spring flooding risk, and minor (low) spring flooding risk. Major spring flooding risk is associated with the probability that forecasted flows and levels exceed the bankfull capacity and cause flooding for near normal future weather conditions. Moderate spring flooding risk is associated with the probability that forecasted flows and levels exceed bankfull capacity for the unfavourable future weather conditions but forecasted flows and levels are below the bankfull capacity for normal future weather conditions. Minor (low) spring flooding risk is associated with the probability that forecasted flows and levels will remain below the bankfull capacity even for the unfavourable future weather conditions.

A number of uncertainties exist with respect to the flood outlook. These include, but are not limited to, the following:

- future weather uncertainties (snowfall and spring rainfall);
- winter snowpack, date of the onset of melt, and melt rate (i.e., timing and speed of snow melt);
- uncertainty in meteorological and hydrometric data collected to date;
- timing of the peak flows;
- frost depth at the time of spring melt; and
- hydrologic model prediction uncertainties.

The forecasted 2023 spring runoff potential is based on:

- Measurements of soil moisture at freeze-up (Fall 2022)
- Winter precipitation as of March 14, 2023

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[2] See Appendix A for 'Flood Outlook', 'Weather Scenarios', 'Favourable Weather', 'Normal Weather', and 'Unfavourable Weather' definitions

[7] See Appendix A for 'Minor/Moderate/Major' Flood risk definitions

- Future weather condition scenarios based on historic data

On a broader perspective and compared with historic precipitation records until mid-March, the current runoff potential is below normal for most of southern and central Manitoba and southeastern Saskatchewan (Figure 14). Runoff potential is near normal in the U.S. portion of the Souris River basin and southeastern Manitoba, including the Whiteshell Lakes area. Northern Manitoba and the U.S. portion of the Red River basin both have normal to above normal runoff potential. The runoff potential map (Figure 14) does not include effects of future weather such as snow melt rate, spring rain etc.

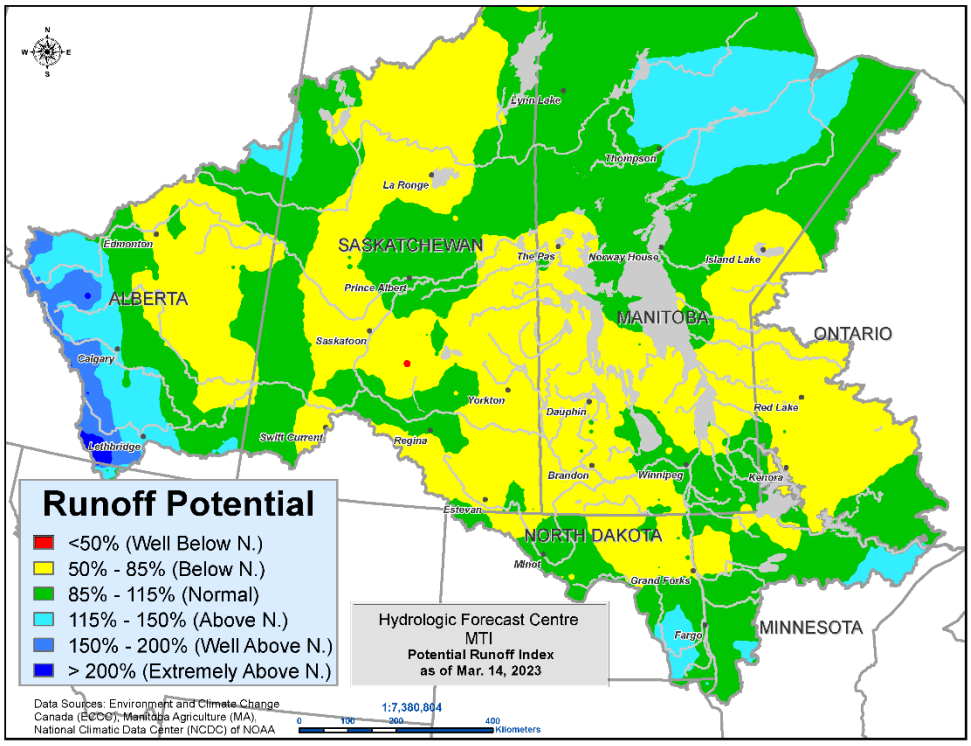

Figure 14 – Runoff Potential map as of March 14, 2023.

Red River

- There is a major risk of significant spring flooding along the main stem of the Red River. The current soil moisture is normal to below normal throughout U.S. portion of the basin and normal to above normal in Manitoba. Winter precipitation has been well above normal in the U.S. portion of the basin and below normal in Manitoba portion of the basin.

- In favourable weather conditions, the risk of flooding is moderate
    - Levels would be similar to peak water levels observed in fall 2019 flood from Emerson to the Red River Floodway Inlet.
- Normal weather: major risk of significant flooding
    - Levels would be near the spring peak levels observed in 2019 spring from Emerson to the Red River Floodway Inlet.
- Unfavourable weather: major risk of significant flooding
    - Levels on the main stem of the Red River would be similar to 2020 from Emerson to Red River Floodway Inlet.
- The flood protection level of the community dikes and the individual flood protection works within the Red River basin are higher than the predicted peak levels, even in the unfavourable weather scenario.

Forecasted peak flows in cubic feet per second (cfs) for the Red River at Emerson and Ste. Agathe are shown in Table 3.

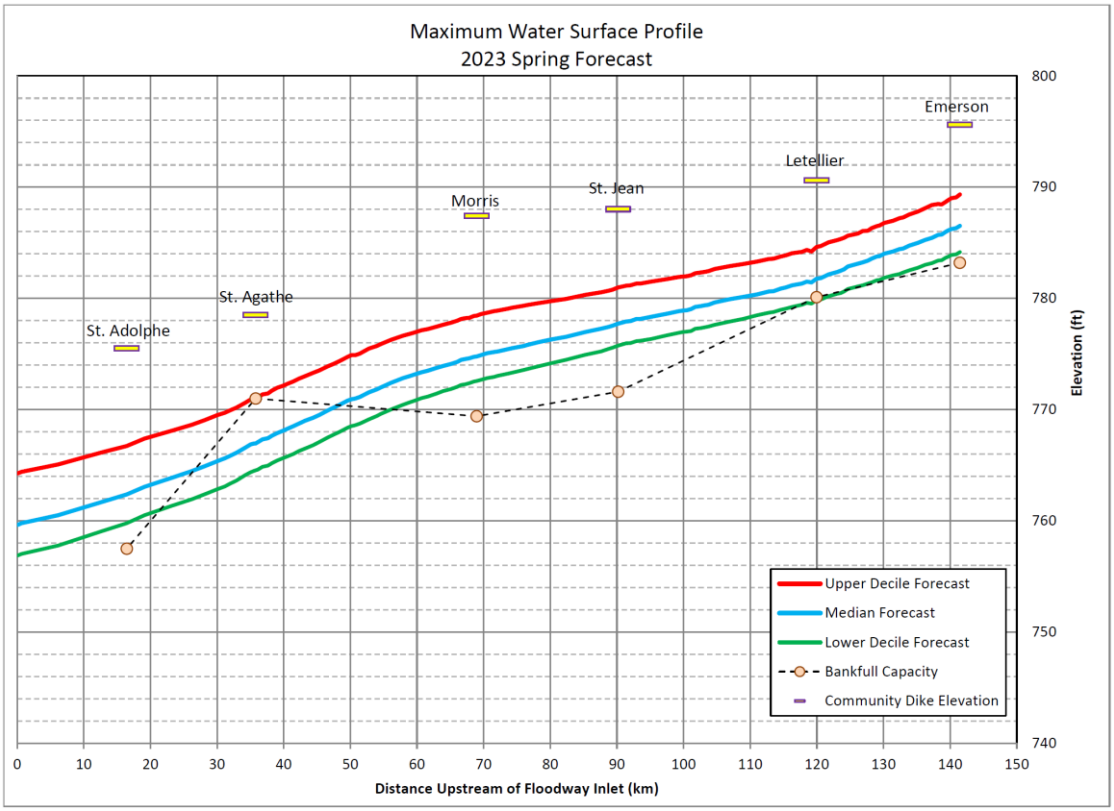

Figure 15 – Forecasted water levels in relation to bankfull capacities and dike elevation in the Red River Valley.

Table 3: Forecasted peak flows for the Red River at Emerson and Ste. Agathe.

	Forecasted Peak Flows (cfs)	
Exceedance Probability	Emerson	Ste. Agathe
Lower Decile	45,000	49,000
Median	54,000	57,000
Upper Decile	68,000	73,000

Red River Floodway

- The Red River Floodway has been operated in 35 out of the 54 years since it has been constructed for the purpose of providing flood protection to the City of Winnipeg.
- Due to the forecasted flows on the Red River, the Floodway is expected to be operated during the 2023 spring melt.
- With the operation of the Red River Floodway and the Portage Diversion, open water peak estimated levels at James Avenue are:
    - Favourable weather: 5.3 to 5.6 m (17.5 to 18.5 ft)
    - Normal weather: 5.6 to 5.8 m (18.5 to 19.0 ft)
    - Unfavourable weather: 5.8 to 5.9 m (19.0 to 19.5 ft)

Roseau River

There is a low risk of significant spring flooding within the Roseau River basin.

- Favourable weather: low risk of flooding. The forecasted flow for Roseau River at Gardenton (1,700 cfs) would be similar to spring peak flow observed in 2019.
- Normal weather: low risk of flooding. The forecasted flow for Roseau River at Gardenton (2,200 cfs) would be similar to spring peak flow observed in 2016.
- Unfavourable weather: low risk of flooding. The forecasted flow for Roseau River at Gardenton (2,900 cfs) would be similar to spring peak flow observed in 2017.

Rat River

There is a low risk of significant spring flooding within the Rat River basin.

- Favourable weather: low risk of flooding. The forecasted flow for Rat River at Otterburne (1,000 cfs) would be similar to spring peak flow observed in 2015.
- Normal weather: low risk of flooding. The forecasted flow for Rat River at Otterburne (1,200 cfs) would be similar to spring peak flow observed in 2016.
- Unfavourable weather: risk of major flooding is low. The forecasted flow for Rat River at Otterburne (1,800 cfs) would be similar to spring peak flow observed in 2017.

Pembina River

There is a low risk of significant spring flooding within the Pembina River basin.

- Favourable weather: low risk of flooding. Forecasted flow for Pembina River at Neche (1,700 cfs) would be similar to spring peak flow observed in 2019.
- Normal weather: low risk of flooding. Forecasted flow for Pembina River at Neche (2,500 cfs) would be a little higher than spring peak flow observed in 2020.
- Unfavourable weather: risk of major flooding is low. Forecasted flow (4,300 cfs) would be lower than spring peak flow observed in 2013.

Souris River (South Western Region)

There is a low risk of significant spring flooding within the Souris River basin. Snow accumulation in the U.S. portion of the Souris River is above normal. Estimated flooding for the Souris River and its tributaries is as follows:

- Favourable weather: minor risk of overland flooding downstream of Minot along the main stem of the Souris River.
    - Levels are expected to be slightly higher than the 2020 spring levels.
- Normal weather: minor risk of overland flooding downstream of Minot along the main stem of the Souris River.
    - Levels are generally expected to be similar to the 2019 spring levels.
- Unfavourable weather: moderate spring flooding risk downstream of Minot along the main stem of the Souris River.
    - Levels are expected to be similar to the 2013 spring levels.

- The existing dikes in the towns of Melita, Souris, and Wawanesa are at an elevation which are high enough to protect against these flood levels.

Forecasted peak flows in cubic feet per second (cfs) for the Souris River at Melita, Souris and Wawanesa are shown in Table 3.

Table 4: Forecasted peak flows for the Souris River.

	Forecasted Peak Flows (cfs)		
Exceedance Probability	Melita	Souris	Wawanesa
Lower Decile	750	1,100	1,700
Median	1,800	2,500	3,100
Upper Decile	4,200	5,600	7,100

Assiniboine River

There is a low to moderate risk of significant spring flooding along the Assiniboine River and most of its tributaries.

- Favourable weather: low risk of overland flooding
    - Levels will remain within the banks from Shellmouth downstream to Portage la Prairie.
- Normal weather: low risk of overbank flooding
    - Levels will be similar to 2018 spring levels from Shellmouth downstream to Brandon.
    - Levels will be slightly higher than 2018 spring levels from Brandon to Portage la Prairie.
- Unfavourable weather: moderate risk of spring flooding
    - Levels will be similar to 2015 spring levels from Shellmouth downstream to Brandon.
    - Levels will be similar to 2022 levels from Brandon to Portage la Prairie.
- Overbank flooding of agricultural land may occur on the Assiniboine River and Qu'Appelle River near St. Lazare under unfavourable future weather conditions.
- The flood protection level of the community dikes in the City of Brandon and the town of St. Lazare are at elevations which are high enough to protect against expected spring water levels.

Table 5 summarizes forecasted peak flows for the Assiniboine River at selected locations.

Table 5: Forecasted peak flows for the Assiniboine River.

	Forecasted Peak Flows (cfs)			
Exceedance Probability	Russell	Miniota	Brandon	Holland/Portage
Lower Decile	350	2,900	4,200	6,900
Median	900	5,600	7,000	11,400
Upper Decile	2,000	9,200	11,600	20,300

Portage Diversion

- The Portage Diversion has been operated 39 out of the 53 years since it has been constructed for the purpose of preventing ice jamming on the Assiniboine River east of Portage la Prairie and to provide flood protection for areas along the Assiniboine River downstream of Portage la Prairie including the City of Winnipeg. Based on the runoff potential in the Assiniboine and Souris basins, the Portage Diversion is expected to be operated under unfavourable weather conditions. Under favourable and normal weather conditions, the Portage Diversion may be operated to reduce ice jam related levels downstream of the diversion.

Shellmouth Dam

- The forecasted inflow volumes into the Shellmouth Reservoir for favourable, normal and unfavourable conditions as of March 15th are 104 million cubic meters (84,000 acre-feet), 168 million cubic meters (136,000 acre-feet) and 320 million cubic meters (260,000 acre-feet), respectively.
- The Shellmouth Dam is being operated to provide storage capacity for reservoir inflows in order to reduce flooding downstream as well as to ensure a sufficient reservoir level for water supply and recreation. The current reservoir level as of March 16th, 2023 is 424.79 m (1393.7 ft).
- The Shellmouth Liaison Committee provides regular input into the dam operations to meet the target level of 427.33 m to 427.94 m (1402 ft to 1404 ft) after the spring runoff. The outflow from the reservoir as of March 15th, 2023 was 27.9 cubic metres per second (985 cubic feet per second) and was recently reduced to 100 cfs.

Interlake Region

- There is a low to moderate risk of significant flooding within the Interlake region. Levels will remain below the bankfull levels for favourable and normal future weather conditions. Levels are projected to exceed bankfull capacities for unfavourable future weather conditions. The unfavourable weather conditions mostly represent heavy rains in April and early May that occur on top of the saturated soil due to snow melt.
- As in most years, the risk of ice jam induced flooding is high for the Icelandic and Fisher Rivers.

Table 6: Forecasted peak flows for the Fisher River at Dallas.

	Forecasted Peak Flows (cfs)
Exceedance Probability	Fisher River at Dallas
Lower Decile	1,200
Median	1,700
Upper Decile	3,200

Fairford River Water Control Structure

- The Fairford River Water Control Structure is currently set to 75% capacity in response to the high water levels experienced on Lake Manitoba through much of 2022. The Lake Manitoba water level is approaching the middle of its desired range, while Lake St. Martin remains high. The department is planning to reduce the Fairford outflow to 50 to 55% (its normal setting as per the operating guideline) once the ice moves from the Fairford River system. This will help reducing the high water level condition at Lake St. Martin.

Eastern Region

- The risk of significant spring flooding is low in the eastern region, including the Whiteshell Lakes area and the Winnipeg River basin.

Manitoba Lakes

- Currently, most major lakes are within their operating ranges. Most lakes are expected to be within or slightly above their normal operating range after the spring runoff. The risk of spring flooding in most Manitoba lakes is low.

Lake Manitoba

- Lake Manitoba's current level is 247.38 m (811.6 ft).
- The current level is 0.09 m (0.30 ft) below normal for this time of year, and is within the operating range of 247.04 m (810.5 ft) to 247.65 m (812.5 ft).
- After spring runoff, the lake level is expected to be within the operating range.

Lake St. Martin

- Lake St. Martin is currently at 244.1 m (800.8 ft).
- The current level is 0.46 m (1.5 ft) above normal for this time of year.
- After spring runoff, the lake level is expected to stay above the operating range for a while before gradually dropping to the operating range. The rate of level drop is dependent on future weather conditions.

Lake Winnipeg

- Lake Winnipeg's current level is 217.54 m (713.70 ft).
- The current level is 0.03 m (0.1 ft) above normal for this time of year and within the operating range of 216.71 m (711 ft) to 217.93 m (715 ft).
- After spring runoff, the lake level is expected to be within the operating range.

Lake Winnipegosis

- Lake Winnipegosis is currently at 253.14 m (830.50 ft).
- The current level is 0.06 m (0.2 ft) above normal for this time of year.
- After spring runoff, the lake level is expected to be near normal levels.

Dauphin Lake

- Dauphin Lake's current level is 260.51 m (854.70 ft).
- The current level is higher than normal for this time of year and just within the operating range of 260 m to 260.54 m (853 ft to 854.8 ft).
- After spring runoff, the lake level is expected to rise above the operating range but will remain below the flood protection level.

Northern Manitoba and The Pas Regions

- The risk of spring flooding is low along the Saskatchewan and Carrot Rivers when considering all potential future weather scenarios.
- Levels along the Saskatchewan and Carrot Rivers at The Pas depend greatly on the outflows and the regulation of Saskatchewan's Tobin Lake. Considering the potential future Tobin Lake outflows and future weather conditions, the peak open water levels on the main stems of the Saskatchewan and Carrot Rivers are expected to be below bankfull levels. Manitoba continually consults with Saskatchewan regarding operation of the dams located in Saskatchewan including the release of flows into Manitoba rivers.
- The risk of major flooding is also low along Swan River under all future weather conditions.
- As in many other years, there is a risk of ice jam related flooding along the Saskatchewan, Carrot and Swan Rivers.

Emergency Management Flood Preparations

- The Manitoba government, local authorities and emergency management partners are continuing to prepare for spring flooding. Manitoba Emergency Measures Organization (EMO) continues to work with all local authorities and emergency management partners to provide guidance and support for preparedness and response activities in the upcoming hazard season. This includes:
    - review of existing emergency plans;
    - provide overall situational awareness by disseminating relevant up to date information;
    - provide training opportunities;
    - prepare resources for use in flood response;
    - host conference calls with local authorities and emergency management partners;

  - provide continuous coordination and collaboration with emergency management stakeholders;
  - work with Indigenous Services Canada (ISC) and Indigenous Reconciliation and Northern Relations (IRNR) on ISC and IRNR-led preparedness activities for First Nations and Northern Affairs Communities; and
  - issue emergency alerts as required.
- The ice-jam mitigation program on the Red River north of Selkirk and the Icelandic River has been completed. Ice cutters and ice breaking equipment completed work along the rivers to break the ice prior to spring run-off.

Future Forecast Information

When the spring melt and runoff begins, operational forecasts will be released on a daily basis.

As in many other years, the risk of flooding could change in any of the basins depending on weather conditions between now and throughout the spring melt.

Appendix A: Definitions

[1] Ice Jam:

- A blockage of ice on a river/stream which restricts flow, resulting in increased water levels upstream.

- Jams may occur due to changing river channel geometry, bends in the river channel, depth and thickness of ice, rate of water level rise, or a solid section of ice downstream.

[2] Flood Outlook:

- Estimated spring peak water levels and flows provided before spring water flow begins.
- Estimates are based on diverse information, such as soil moisture, winter precipitation, snowpack, topography, current water level, channel capacity, and future weather condition scenarios (precipitation, temperatures, etc.).
- Estimates are provided for three weather scenarios (favourable, normal, and unfavourable) which correspond to three different probabilities of occurrence (lower decile, median and upper decile).

[3] Weather Scenarios:

- Used to account for future weather such as additional snow, melt rates and spring rainfall. These are determined by statistical analysis of the past 30 to 40 years of climate data.
- Three scenarios used:
    - Lower decile (favourable)
        - There is a 10% chance of the weather being ‘favourable’ or better. 90% of the time the weather will be worse than this ‘favourable’ condition.
    - Median (normal)
        - There is a 50% chance of the weather being ‘normal’ or better.
    - Upper decile (unfavourable)
        - There is a 10% chance of the weather being ‘unfavourable’ or worse. 90% of the time the weather will be better than this ‘unfavourable’ condition.
- The Province’s practice is to plan/prepare to the upper decile (i.e., unfavourable) condition.

[3] Favourable Weather:

- Characterized by little additional precipitation and a gradual snow melt.
- The lower decile weather condition.

[3] Normal Weather:

- Characterized by normal rainfall and temperature.
- Typically used to describe historic climate conditions.
- The median weather condition.

[3] Unfavourable Weather:

- Significant wide-spread precipitation with a rapid snowmelt.
- The upper decile weather condition.

[5]Flow/Discharge [expressed in cubic feet per second (cfs) or cubic metres per second (cms)]:

- The volume of water that passes a given location within a given period of time.

[6] FPL – Flood Protection Level:

- Is the water level of the greater of the flood of record or the 1-in-200-yr flood, plus a freeboard allowance for a particular waterway (typically 2 ft) or water body (i.e., the freeboard is site specific).
- It is provided by the Hydrologic Forecasting and Water Management (HFWM) branch of Manitoba Transportation and Infrastructure on a site-specific and structure-specific basis.
- This is formally set by the Water Resources Administration Act for the Red River Designated Flood Areas.
- In non Designated Flood Areas, the province uses the determined FPLs. For other works or developments, the FPL is recommended by the province, but ultimately regulated by the local planning districts and/or municipalities.

[7]Definition for minor/moderate/major risk of flooding:

- Minor Risk of Flooding:
    - Forecasted flows and levels will remain below bankfull capacity even for the unfavourable future weather conditions.

- Moderate Risk of Flooding:
    - Forecasted flows and levels exceed bankfull capacity for the unfavourable future weather conditions but forecasted flows and levels are below bankful capacity for normal or favourable future weather conditions.

- Major Risk of Flooding:
    - Forecasted flows and levels exceed bankfull capacity and cause flooding for near normal and unfavourable future weather conditions.

Operational Forecasts:

- Estimated future crest water level, flow and date of occurrence provided once active melt and river flow has begun.

- Estimates are modelled based on observed flow, existing conditions (including channel capacity, topography, and remaining snowpack) and normal future weather.

- Observed conditions are monitored throughout the flood and compared against the historic climate data used to generate the forecast.

- Forecasts are updated when weather conditions are outside the range of historical climate data used to generate the forecast.

- A range of forecasted values is provided further in advance of an upcoming forecasted crest because of unknowns in the basin conditions and river flows, and limitations in the modelling procedures.