Hydrologic Forecast Centre

Manitoba Infrastructure

Winnipeg, Manitoba

FEBRUARY HIGH WATER OUTLOOK

February 26, 2021

Executive Summary

The February High Water Outlook prepared by the Hydrologic Forecast Centre of Manitoba Infrastructure reports the risk of major spring flooding in most Manitoba basins is low. Due to below normal soil moisture at freeze-up in southern and central Manitoba basins and below normal to well below normal winter precipitation until mid-February in these basins, the risk of major spring flooding is low for all southern and central Manitoba basins. Southern and central Manitoba basins include the Assiniboine River, Red River, Souris River, Pembina River, Roseau River and Qu'Appelle River basins and Interlake region.

The risk of major spring flooding is low to moderate for northern Manitoba basins, including the Saskatchewan and Churchill River basins, because these basins have normal to above normal soil moisture and received below normal to slightly above normal winter precipitation.

Most of the major lakes are below normal levels for this time of the year and within their operating ranges. The risk of flooding for most lakes is low.

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 of the southern and central Manitoba basins. Soil moisture is normal to above normal in the Little Saskatchewan River basin and in areas close to Brandon. Northern Manitoba basins, including the Saskatchewan River and Churchill River basins, have normal to above normal soil moisture.

Winter Precipitation:

Winter precipitation has been below normal to well below normal throughout most of south and central Manitoba, southeastern Saskatchewan and the United States portions of the Red and Souris River basins. All southern and central Manitoba river basins, including the Assiniboine, Red, Souris, Qu'Appelle, Roseau and Pembina Rivers, have received below normal to well below normal precipitation since November. Some areas in southwestern Manitoba have experienced near record low precipitation since November. Winter precipitation has been below normal to slightly above normal for northern basins, including the Saskatchewan and Churchill River basins.

Snow Water Equivalent (SWE):

Snow Water Equivalent (SWE) is the measure of the amount of water content in the snow. SWE estimates obtained from field measurements and the Snow Data Assimilation System (SNODAS) indicate that the average water content in the snowpack is in the order of 10 to 50 mm (0.4 to 2.0 inches) in most of the southern and central Manitoba basins. The southeast corner of the province has slightly higher snow accumulation where the SWE varies between 50 and 70 mm (2.0 to 2.8 inches). The Shellmouth Reservoir basin has SWE values in the range of 20 to 40 mm (0.8 to 1.6 inches) in the southern portion of the basin and 40 – 50 mm (1.6 to 2.0 inches) in the northern and eastern parts of the basin. Northern Manitoba, including the Saskatchewan River basin, has highest snow accumulation with approximately 70 to 145 mm (2.8 to 5.7 inches) of SWE.

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 declining since the Fall of 2020. Base flows and levels are generally above normal in northern Manitoba and near normal to below normal in southern and central Manitoba. An exception in the south is the Red River, which has above normal flows for this time of the year.

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 similar to the frost depth observed in February 2020 throughout most of the province.

Future Weather:

There is no significant precipitation forecasted for the next 10 days for all Manitoba basins. Both Environment and Climate Change Canada and the United States National Weather Service predict near normal temperature and precipitation for March, April and May.

High Water 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. 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 high water outlook based on current basin conditions and future weather condition scenarios shows the risk of major flooding is low for most Manitoba basins, including the Red, Assiniboine, Souris, Qu'Appelle, Roseau and Pembina Rivers and the Interlake and Whiteshell Lakes regions. Northern Manitoba basins, including the Saskatchewan and Churchill River basins, are at a low to moderate risk of major flooding.

Water Control Structures Operations:

The Red River Floodway is not expected to be operated under normal and favourable weather conditions. If unfavourable weather occurs and higher flows are experienced, the Floodway will be operated to reduce water levels within the City of Winnipeg. Minimal operation of Portage Diversion may also be necessary to mitigate ice related water level rises on the lower Assiniboine River. 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, municipalities and First Nations are continuing to prepare for spring flooding. This includes review of existing emergency response plans, information sharing, and preparation of resources used in flood response.

Contents

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 normal to below normal for most Manitoba basins, with the exception of northern basins, which have normal to above normal soil moisture. The Assiniboine River, Qu'Appelle River, and the Interlake areas have below normal soil moisture. Localized areas in western and southeastern Manitoba have normal to above normal soil moisture; this includes the Little Saskatchewan River basin and the Roseau River basin. Northern Manitoba, including the Saskatchewan and Churchill River basins, has normal to above normal soil moisture. The soil moisture is normal to below normal for the Red River basin (including the United States portion of the basin) and below normal to well below normal for the Souris River basin (including the United States portion of the basin). (Figure 1).

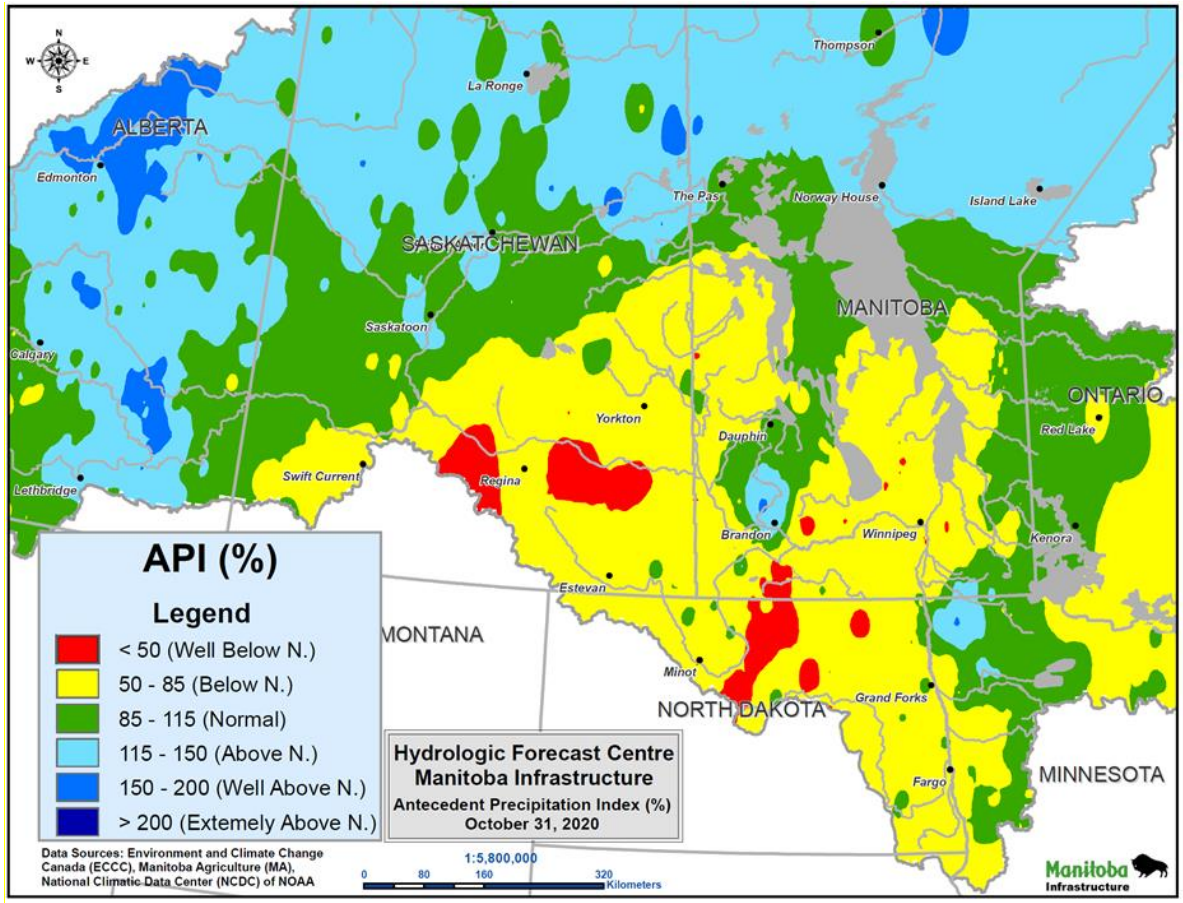

Figure 1 – Soil moisture expressed as Antecedent Precipitation Index (API) for the fall of 2020.

Winter Precipitation

November to mid-February precipitation has been below normal to well below normal throughout most of central and southern Manitoba and most of southeastern Saskatchewan. Northern Manitoba and Saskatchewan have received below normal to slightly above normal precipitation since November 1. The United States portions of the Red and Souris River basins received well below normal precipitation over this period (Figure 2).

Generally, most southern basins in Manitoba and Saskatchewan as well as the United States portions of the Red and Souris River, have received very little winter precipitation, 0 – 35 mm (0 – 1.4 inches). The southeast corner of Manitoba has received slightly more winter precipitation, 35 – 65 mm (1.4 – 2.6 inches). Winter precipitation values increase moving towards the northern regions. In Saskatchewan, the Assiniboine River basin upstream of the Shellmouth Reservoir and the Qu'Appelle River basin received 35 – 50 mm (1.4 – 2.0 inches) and the Saskatchewan River basin received approximately 50 – 65 mm (2.0 – 2.6 inches). (Figure 3).

The accumulated winter precipitation in most of central and southern Manitoba and southeast Saskatchewan is below 20 percent when compared to accumulated precipitation records from the past forty years (Figure 4). Put another way, the current accumulated winter precipitation has been exceeded over 80 percent of the time in the past forty years. Some areas in southwestern Manitoba have received near record low precipitation during this time. As can be seen in Figure 5, precipitation record as of February 15, 2021 indicates that there has been 30 to 50 mm (1.2 – 2.0 inches) less precipitation than normally would have been recorded at this time of the year in most central and southern Manitoba basins.

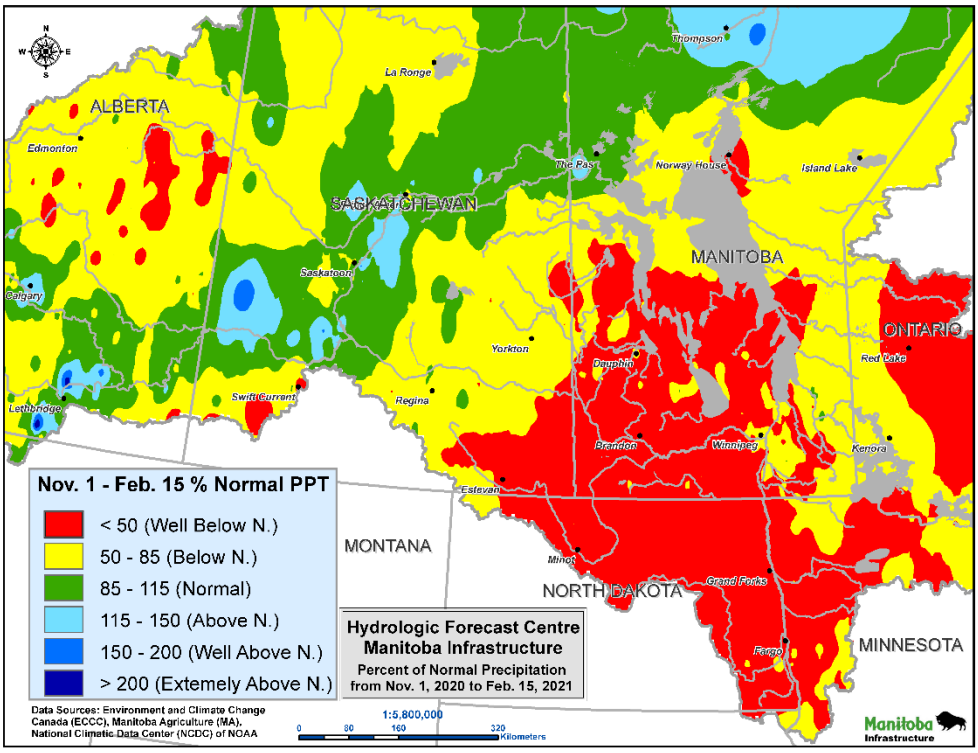

Figure 2 - Percent of Normal Precipitation from November 1, 2020 to February 15, 2021.

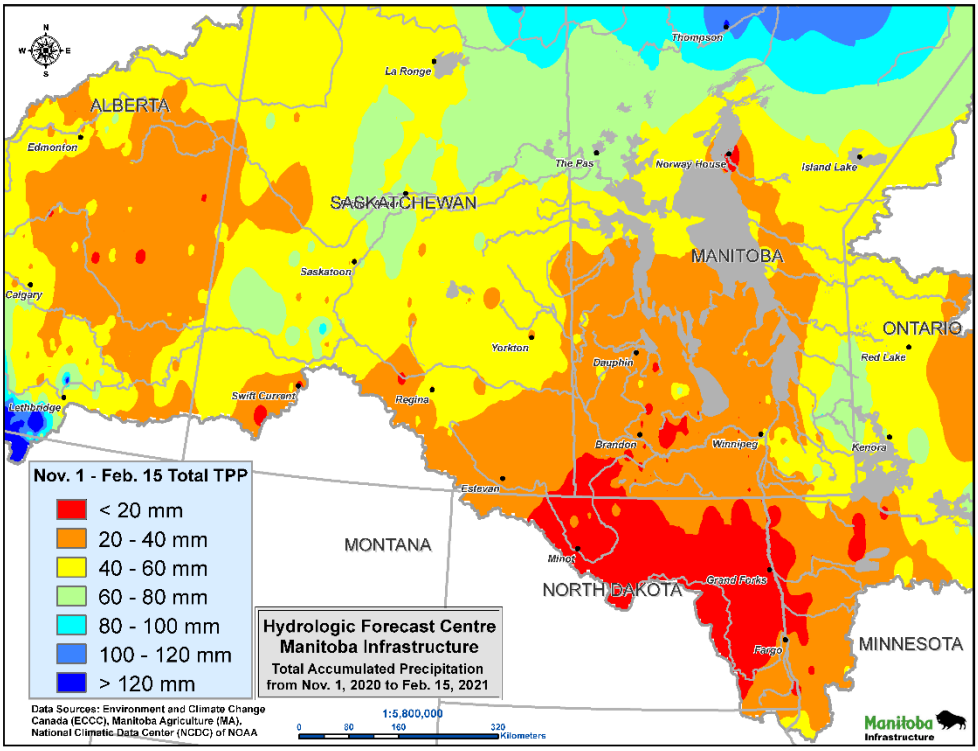

Figure 3 - Cumulative precipitation in mm from November 1, 2020 to February 15, 2021.

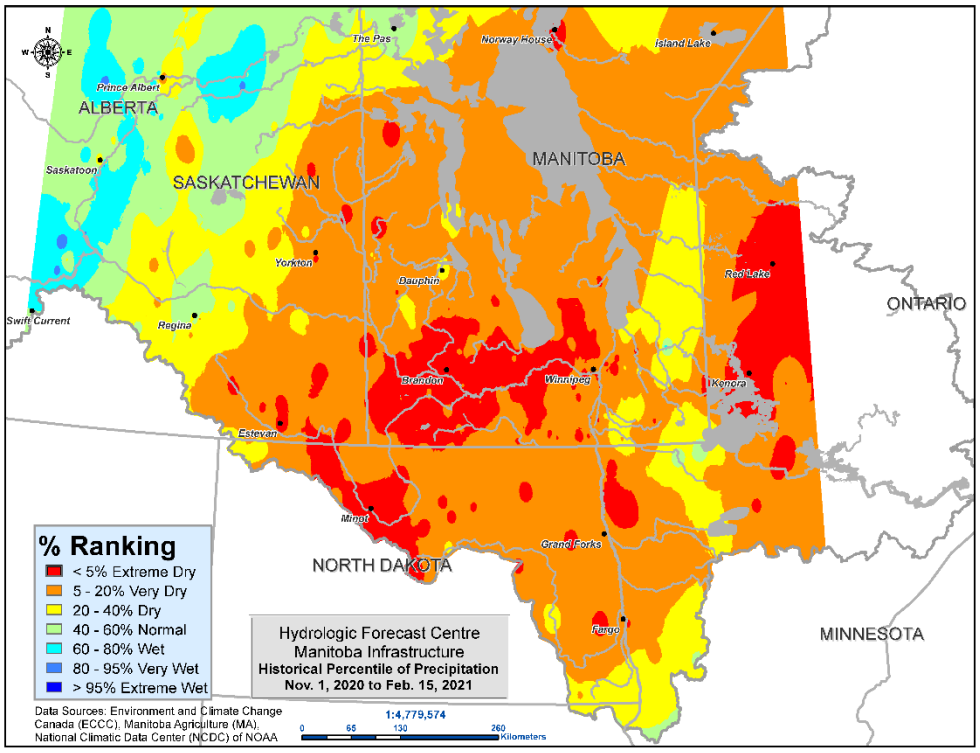

Figure 4 – Percent ranking precipitation from November 1, 2020 to February 15, 2021, compared to historic record.

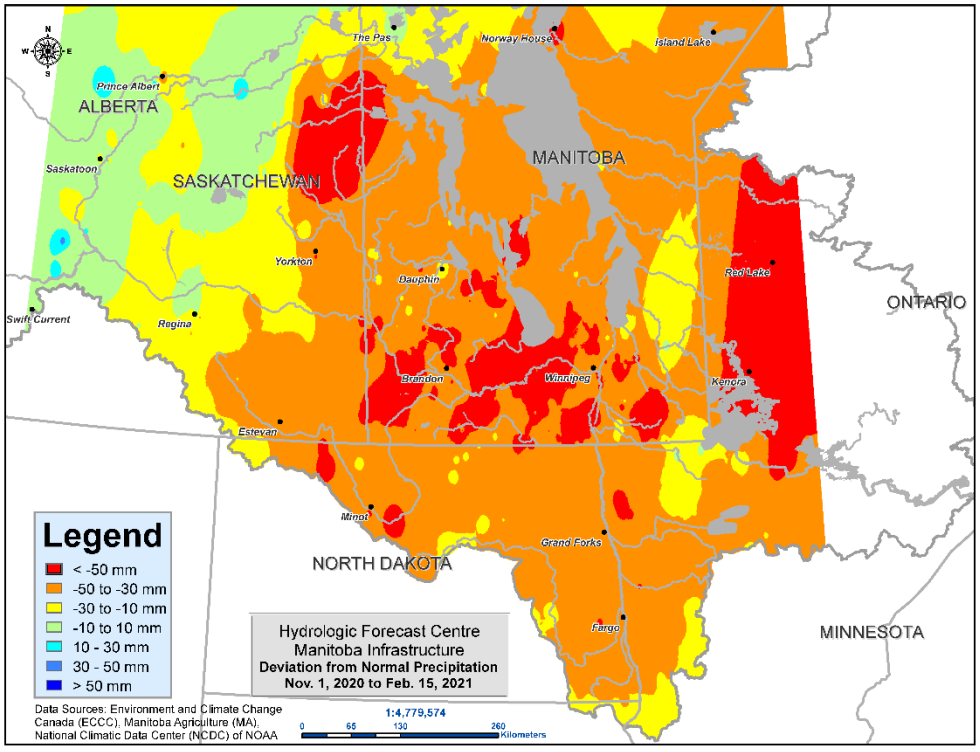

Figure 5 - Precipitation from November 1, 2020 to February 15, 2021, deviation from normal (mm).

Snow Water Content

Snow water equivalent (SWE) estimates obtained from February field measurements (Figure 6) and the Snow Data Assimilation System (SNODAS) (Figure 7) indicate that the average water content in the snowpack is in the order of 10 to 50 mm (0.4 to 2.0 inches) in most of the southern and central Manitoba basins. The southeast corner of the province has slightly higher snow accumulation where the SWE varies between 50 and 70 mm (2.0 to 2.8 inches). The Shellmouth Reservoir basin has SWE values in the range of 20 to 40 mm (0.8 to 1.6 inches) in the southern portion of the basin and 40 – 50 mm (1.6 to 2.0 inches) in the northern and eastern parts of the basin. Northern Manitoba, including the Saskatchewan River basin, has highest snow accumulation with approximately 70 to 145 mm (2.8 to 5.7 inches) of SWE.

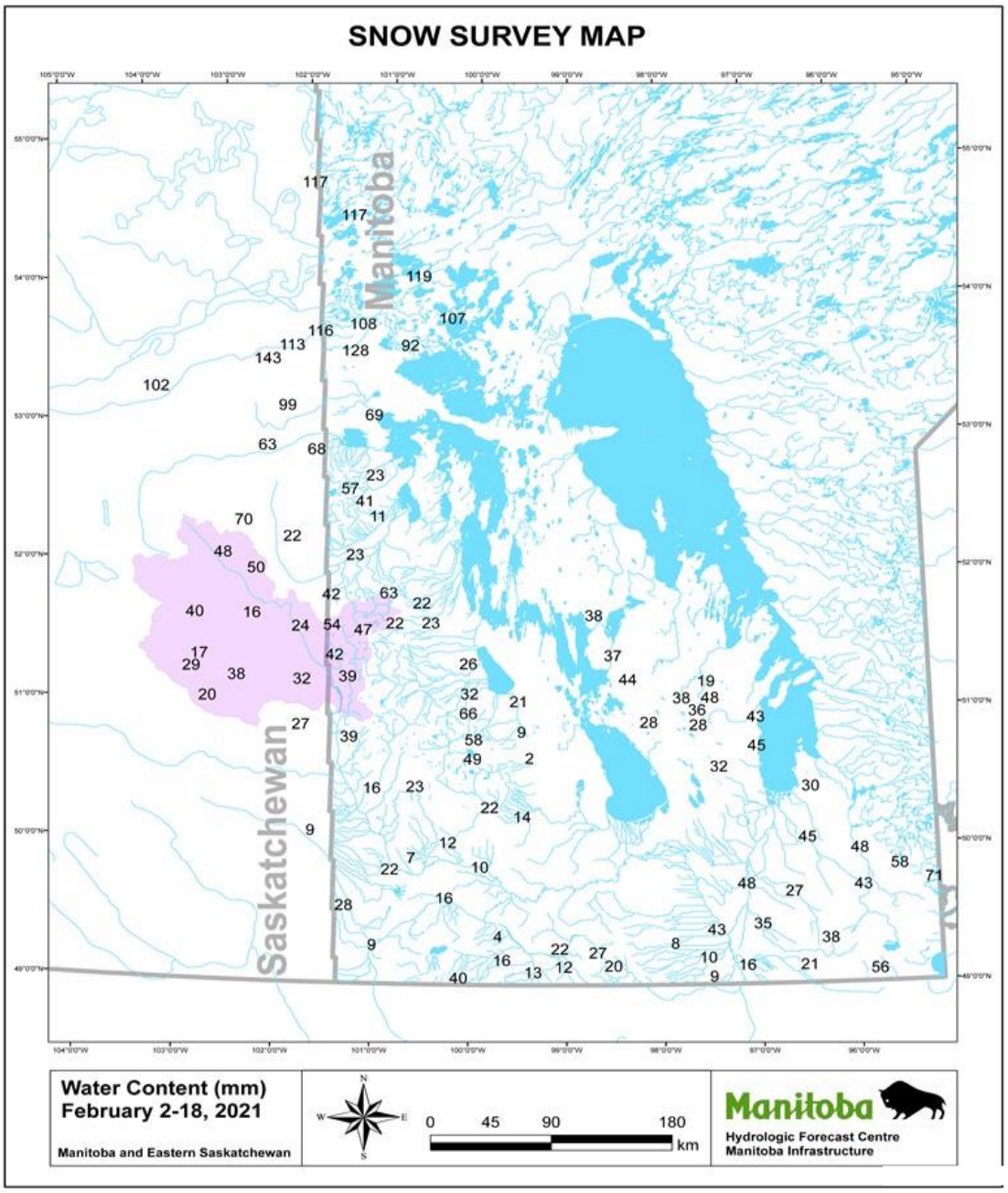

Figure 6 – Snow Water Equivalent (SWE) in mm from field measurements.

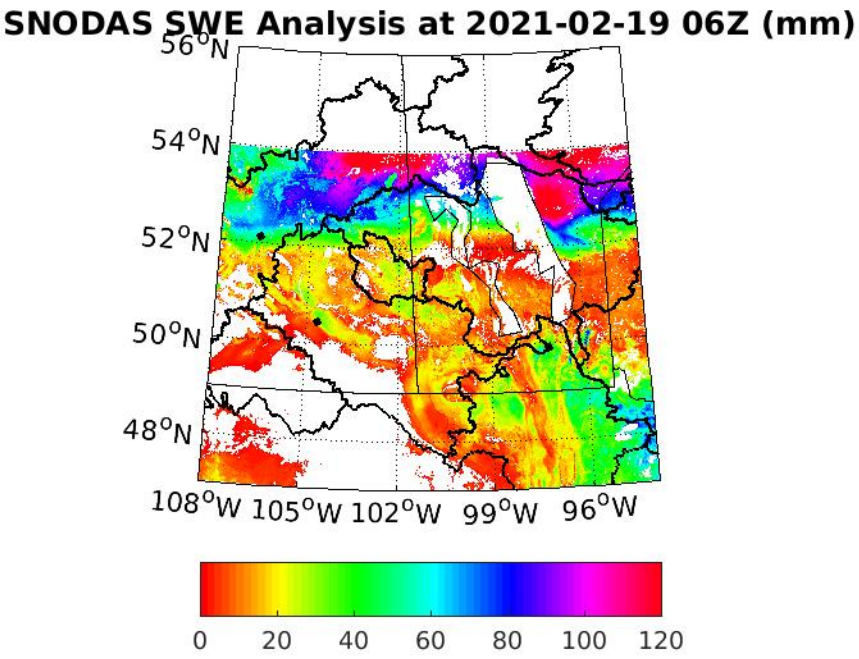

Figure 7 – Snow Water Equivalent (SWE) from Snow Data Assimilation System (SNODAS).

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 declining since the Fall of 2020. Base flows and levels are generally above normal in northern Manitoba and near normal to below normal in southern and central Manitoba. One exception in the south is the Red River, which has above normal flows for this time of the year. (Figure 8).

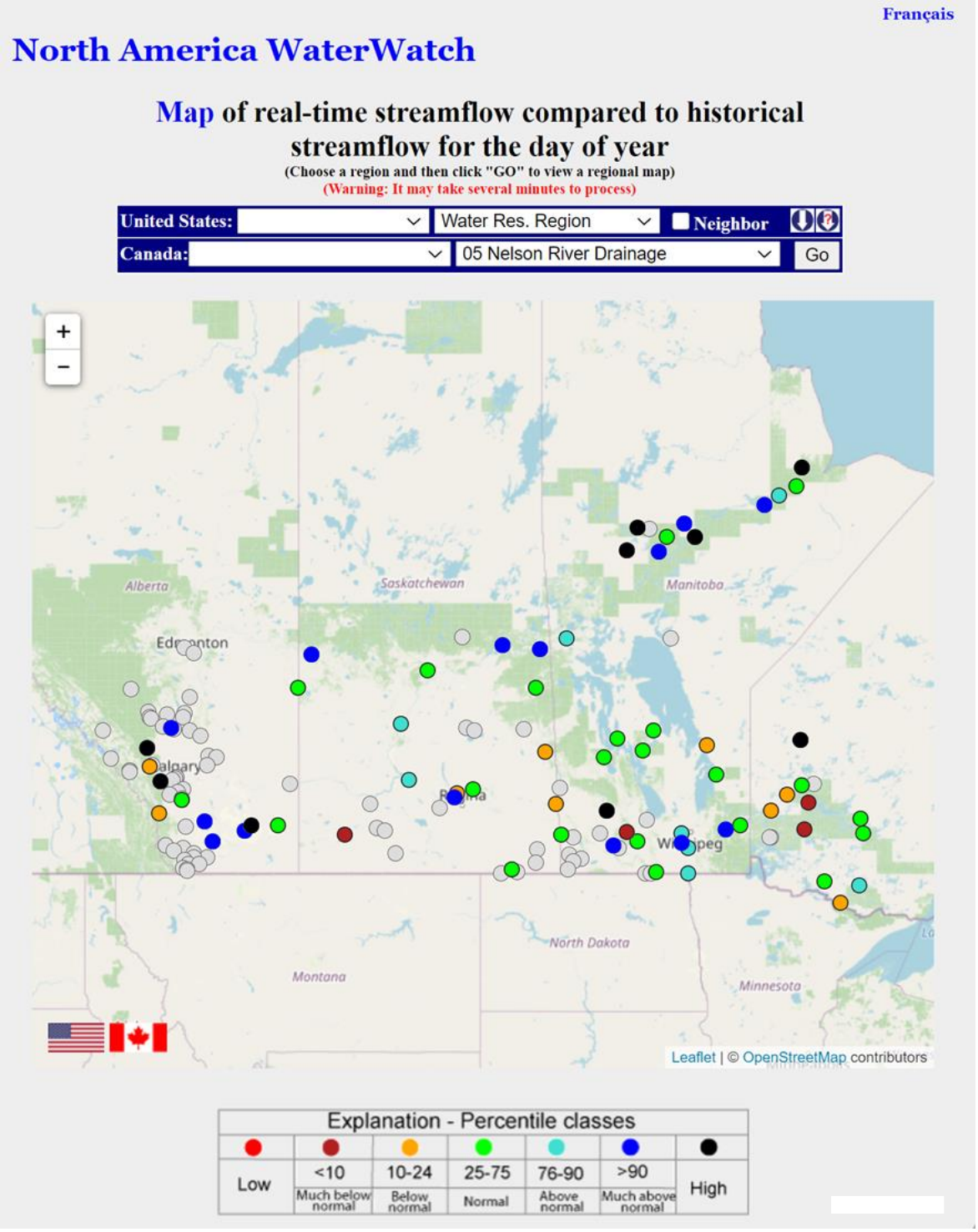

Figure 8 – Base flows and level conditions as of February 17, 2021 (Note: Flows and levels readings at some locations could be ice affected and may not show the actual flows and levels).

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 similar to 2020 throughout most of the province. 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. Figure 9 shows comparative measurement of frost depth at various locations across the province.

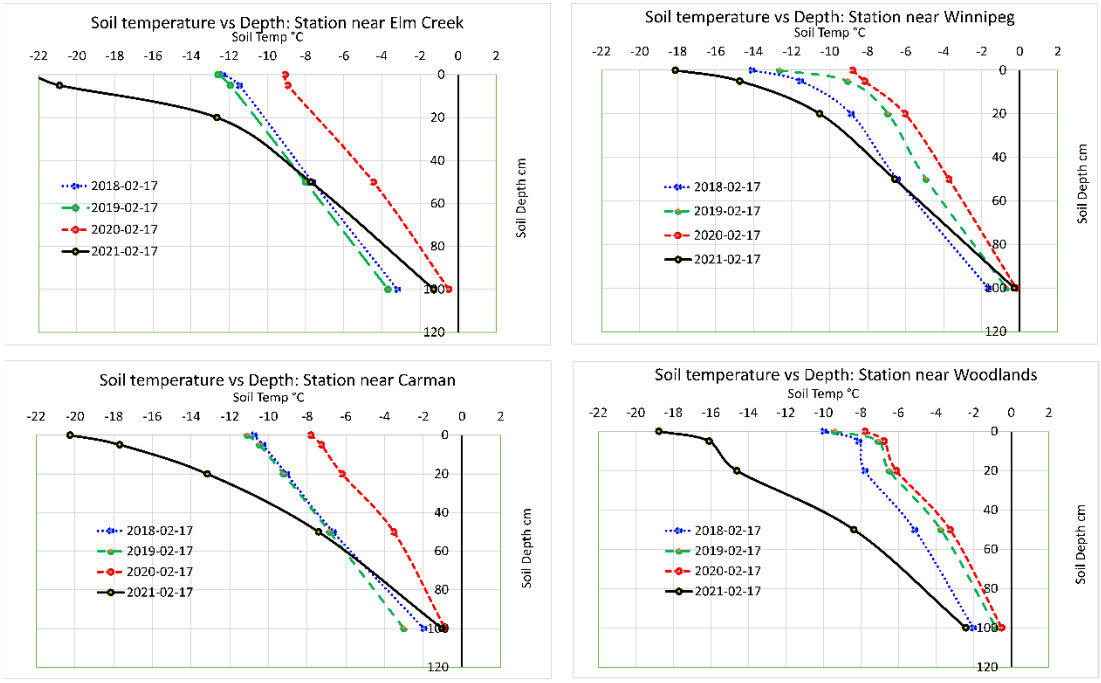

Figure 9 – Frost depth in centimeters at various locations across the province.

Future Weather Outlook

Future weather predictions are generally not reliable. Regardless, there is no significant precipitation forecasted for the next 10 days for all Manitoba basins (Figure 10). In the longer range, both Environment

and Climate Change Canada and the National Weather Service predict higher chance for near normal temperature and precipitation for March, April and May (Figure 11 and 12).

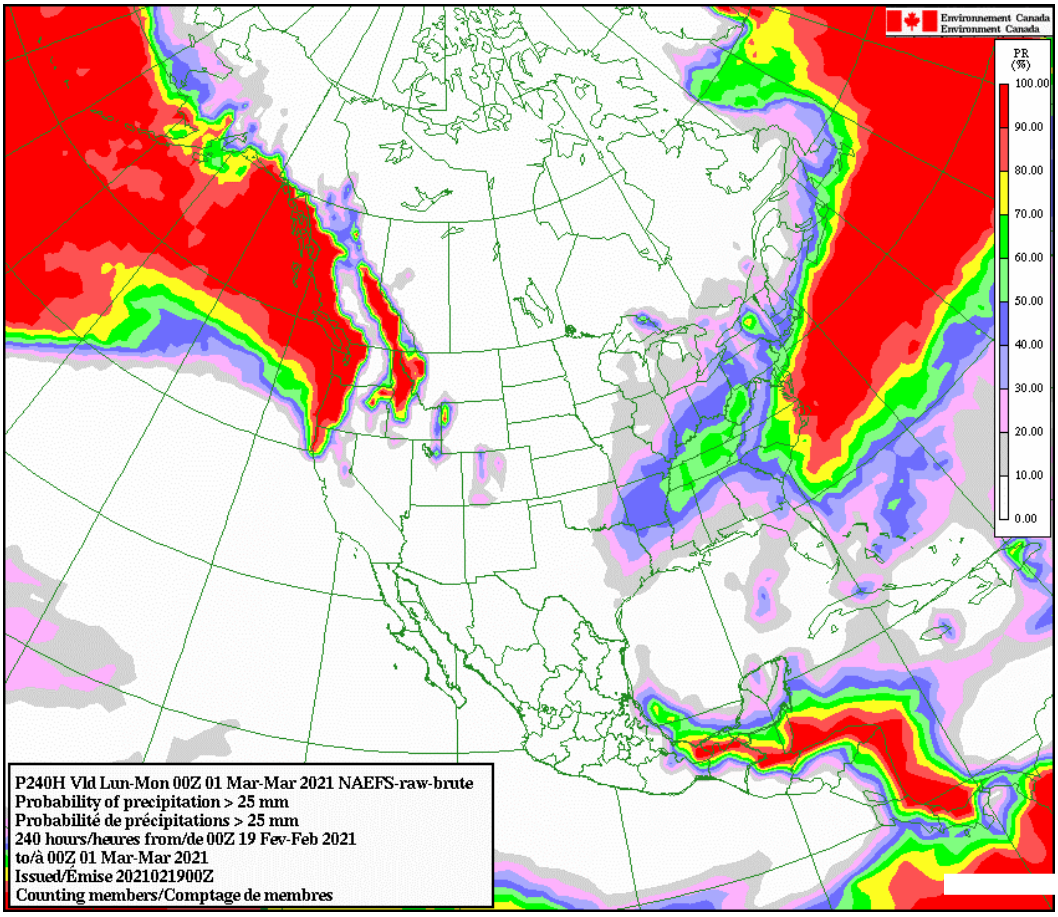

Figure 10 – Probability of receiving accumulated precipitation in excess of 25 mm between February 19th and March 1st

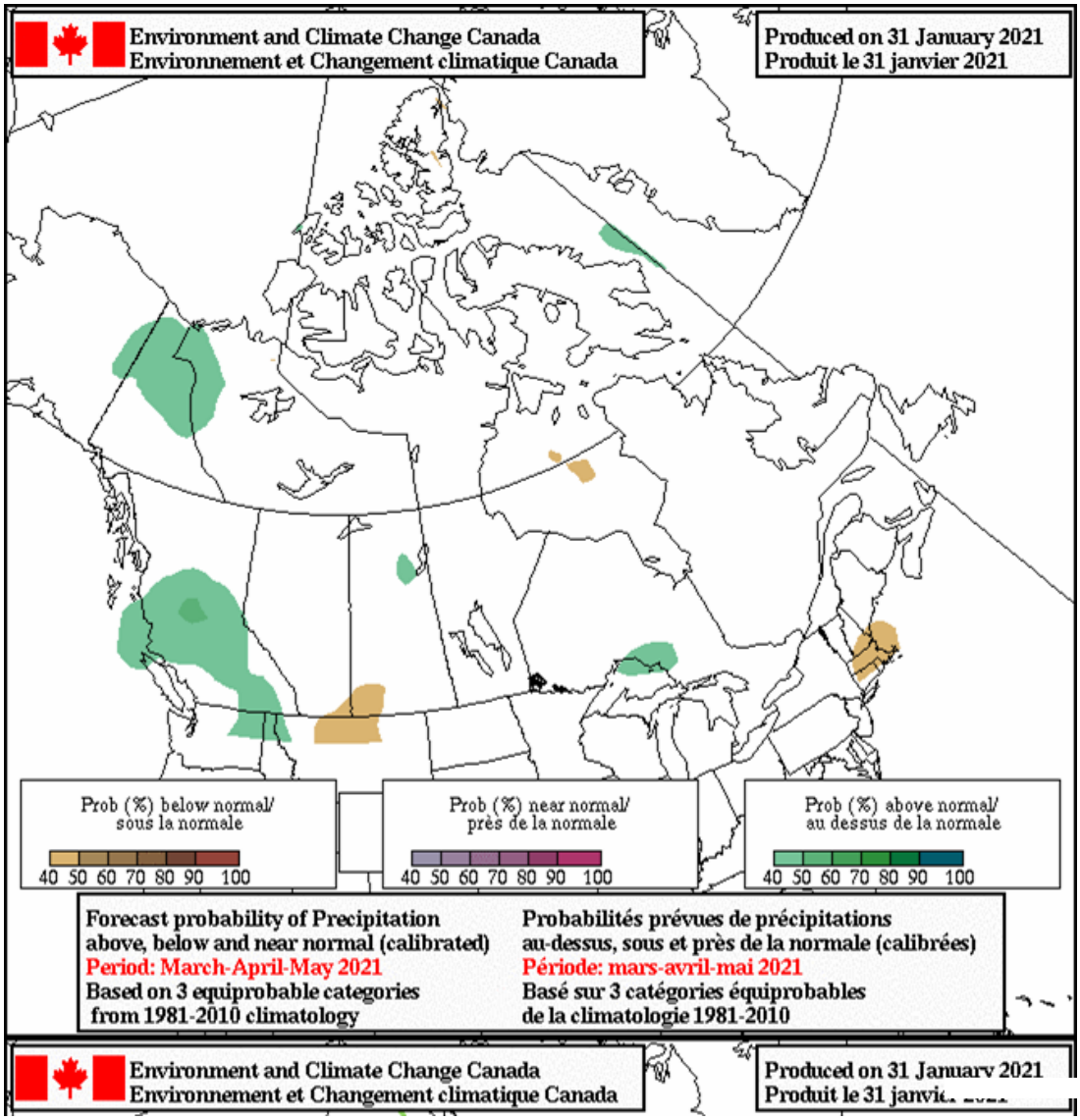

Figure 11 – Environment and Climate Change Canada's probabilistic long range precipitation outlook for March, April and May.

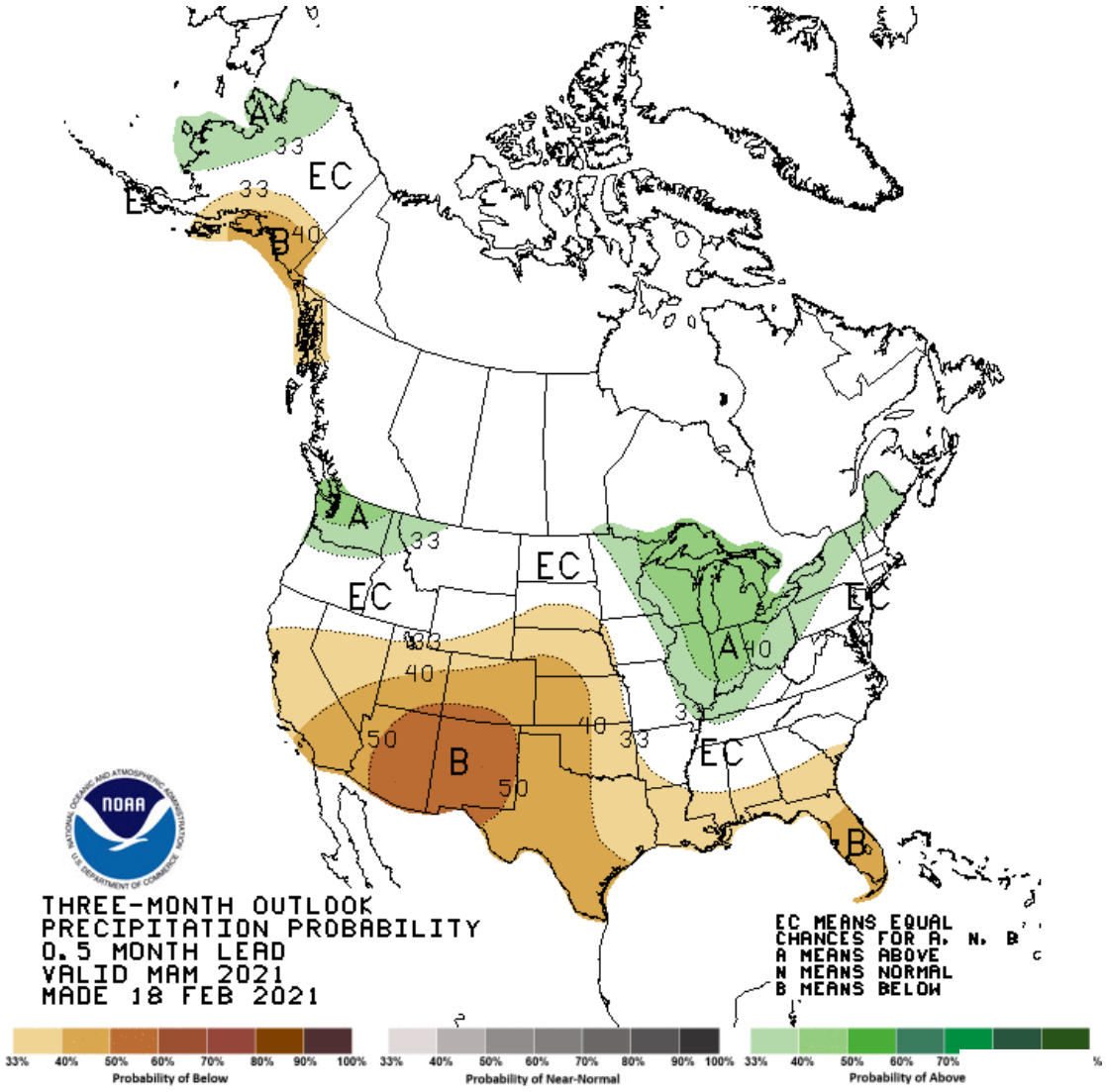

Figure 12 – The National Weather Service (NWS) long range precipitation outlook for March, April and May.

Lake Level and River Flow Conditions

Water levels and flows at freeze-up:

- Red, Saskatchewan and Churchill Rivers: above normal flows;
- Carrot and Assiniboine Rivers: near normal flows;
- Souris, Qu'Appelle, Waterhen, Dauphin and Fairford Rivers: below normal flows
- Lake Manitoba, Lake Winnipegosis, Dauphin Lake, Lake St. Martin and Lake Winnipeg: below normal levels (but within their respective operating ranges);

Current river flow conditions:

- Souris, Qu'Appelle, Roseau and Pembina Rivers: near normal to below normal flows for this time of year
- Red, Saskatchewan and Churchill Rivers: flows are above normal for this time of the year
- Assiniboine, Carrot, Red Deer Rivers: flows are near normal for this time of year
- Interlake rivers (including the Waterhen, Fisher, and Fairford Rivers): flows are below normal for this time of year

Current lake water levels:

- The water level for major lakes in Manitoba are below normal heading into the spring. Most lakes are within their respective operating ranges heading into the spring runoff.

River Ice Conditions and Ice Jamming[1]

The Red River currently has near normal ice thickness. Based on February measurements this year, the ice thickness is approximately 60 cm (24 inches) on average. The ice is thinner than it was last year at this time (Figure 13). Normal ice thickness for this time of the year varies according to the river flow velocity and the location of the river; it typically ranges between 46 cm (18 inches) and 76 cm (30 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 currently underway on the Red River, the chance of ice jamming and related flooding on the lower Red 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

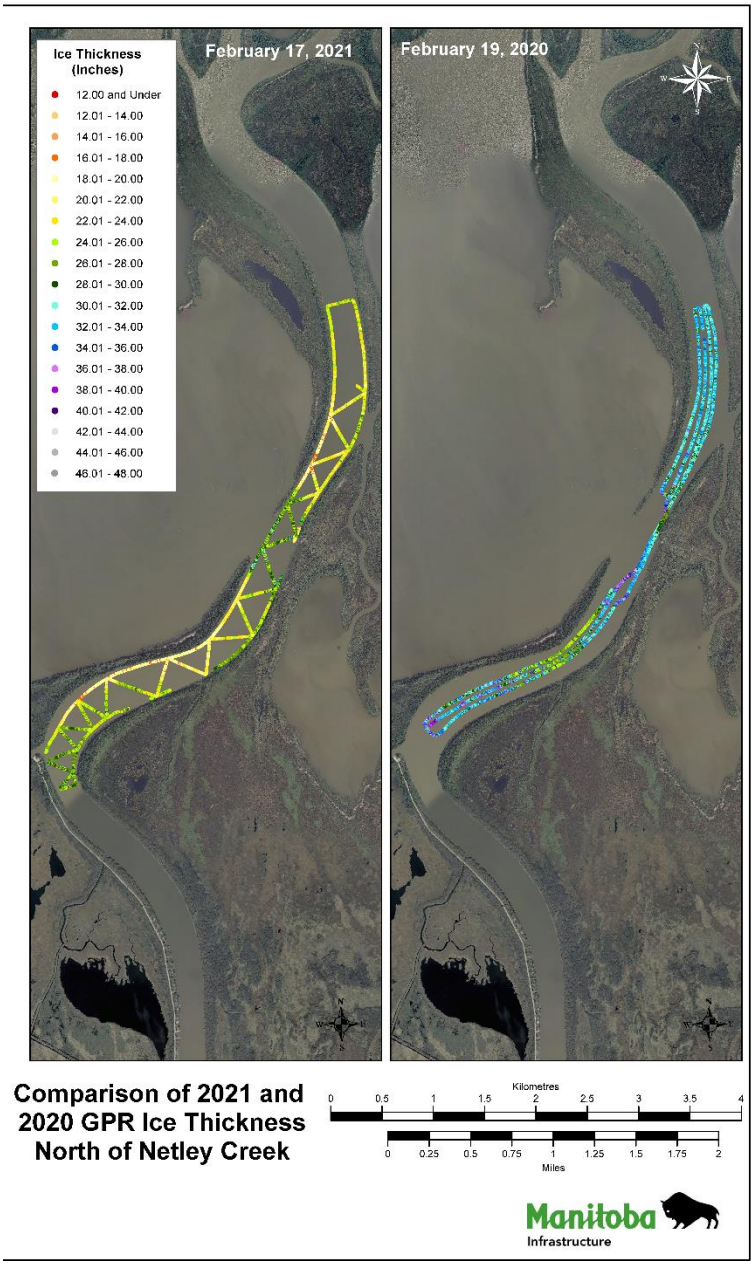

Figure 13 – Ice Thickness Measurements (inches) based on Ground Penetrating Radar: Red River (2020 vs 2021)

High Water Outlook[2]

Spring high water 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 extent of flooding is defined by three categories: major flooding, moderate flooding, and minor (no) flooding. Major flooding is associated with property damages and significant economic impacts. Moderate flooding is associated with flooding of agricultural lands and low-lying areas. In moderate flooding, economic impacts are limited because flood levels are below the tops of most roads and are well below the flood protection levels of community and individual flood protection works. Minor (no) flooding is associated with no or very limited overland flows and peak river water levels generally remain within the river banks.

A number of uncertainties exist with respect to the high water 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,
- computer model prediction uncertainty.

---

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

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

Red River and Tributaries

- There is a low risk of major spring flooding along the Red River and its tributaries, including the Pembina River and Roseau River.
- The Red River and its tributaries are expected to remain within their banks for all future weather scenarios.
- 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.

Red River Floodway

- The Red River Floodway has been operated in 34 out of the 52 years since it has been constructed for the purpose of providing flood protection to the City of Winnipeg.
- Due to the anticipated low flows on the Red River, the Floodway is not expected to be operated under normal or favourable weather conditions during the 2021 spring melt.
- There is a slight chance the Floodway could be operated under unfavourable weather conditions to reduce levels within the City of Winnipeg.
- The ice-induced peak level at James Avenue is estimated to be between 2.45 m (8.0 ft) to 5.5 m (18.0 ft).
- Open water peak estimated levels at James Avenue are:
    - Favourable weather: 1.98 m (6.5 ft)
    - Normal weather: 3.2 m (10.5 ft)
    - Unfavourable weather: 5.03 m (16.5 ft).

Assiniboine River and Its Tributaries

- There is a low risk of major spring flooding along the Assiniboine River and its tributaries, including the Souris River and Qu'Appelle River.
- The Assiniboine River and its tributaries are expected to remain within their banks for normal and favourable future weather scenarios.
- Only very minor overbank flooding of low laying areas may occur on the Assiniboine River and Qu'Appelle River near St. Lazare under unfavourable weather conditions.

- The flood protection level of the community dikes in the City of Brandon and in towns of Melita, Souris, Wawanesa, and St. Lazare are at elevations which are high enough to protect against expected spring water levels.

Portage Diversion

- The Portage Diversion has been operated 37 out of the 51 years since it has been constructed for the purpose of preventing ice jamming on the Assiniboine River east of Portage and to provide flood protection for the City of Winnipeg and areas along the Assiniboine River downstream of Portage. Based on the runoff potential in the Assiniboine and Souris basins, there is a chance that 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 February 18th are 62 million meter cube (50,000 acre-feet), 148 million meter cube (120,000 acre-feet) and 278 million meter cube (225,000 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 recreation and water supply. The current reservoir level as of February 18th, 2021 is 425.83 m (1397.09 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 February 18th, 2021 is 2.5 cubic metres per second (90 cubic feet per second).

Interlake Region

- The risk of major flooding within the Interlake region is low.
- As in most years, the risk of ice jamming is high for the Icelandic and Fisher Rivers.

Fairford River Water Control Structure

- The flow through the Fairford River Water Control Structure is currently operating at 50-60% of maximum capacity. If and when the Lake Manitoba water level reaches 247.65 m (812.5 ft), the structure will be fully opened, in accordance with the operating guidelines.

Eastern Region

- The risk of major flooding is low in the eastern region, including the Winnipeg River basin.

Manitoba Lakes

- Currently, most major lakes are within their operating ranges. Inflow into most Manitoba lakes is below normal. Most lakes are expected to be within 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 247.17 m (810.92 ft).
- The current level is 0.27 m (0.89 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 243.27 m (798.14 ft).
- The current level is 0.38 m (1.25 ft) below normal for this time of year.
- After spring runoff, the lake level is expected to be below flood protection works.

Lake Winnipeg

- Lake Winnipeg's current level is 217.40 m (713.25 ft).
- The current level is 0.08 m (0.26 ft) below normal for this time of year and within the operating range of 216.71 m (711 ft) to 217.93 m (715 ft).

Lake Winnipegosis

- Lake Winnipegosis is currently at 253.07 m (830.28 ft).
- The current level is 0.22 m (0.72 ft) below 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 260.28 m (853.94 ft).
- The current level is 0.04 m (0.13 ft) below normal for this time of year and within the operating range of 260 m to 260.5 m (853 ft to 854.7 ft).
- After spring runoff, the lake level is expected to be near normal levels.

Northern Manitoba and The Pas Regions

- The risk of major flooding is low to moderate 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 bank full levels.
- 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.

Flood Preparations

- As a matter of standard practice in the lead-up to the spring flood season, the Manitoba government and municipalities review existing emergency response plans, share information, and prepare flood response resources.
- The ice-jam mitigation program north of Winnipeg has commenced with ice cutters and ice breaking equipment working along the Red River to break the ice.

Future Forecast Information

If the spring melt and runoff has not yet begun, a second high water outlook will be published with updated information towards the end of March when further precipitation and other factors are available.

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] Runoff Potential:

- Indication of how much water is expected to flow overland as opposed to being absorbed into the ground.
- Is based on soil moisture measurements at freeze up, most recent snowpack conditions, and estimated future weather conditions.
- Is a contributing factor into high water outlook determinations.
- Described in comparison to normal historical runoffs (i.e., normal, near normal, slightly above normal, etc.).
- Can change significantly if future precipitation and melt rates differ from the average.

[3] High Water 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 - 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 MI 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 flooding:

- Minor Flooding:
    - Minimal or no property damage is expected, but there is potential for some public impact, such as inundation of roads below the FPL[6].

- Moderate Flooding:
    - Potential for flooding of agricultural and low-lying areas.
    - Flood water levels are expected to be below the FPL.

- Major Flooding:
    - Potential for extensive inundation of buildings, structures and roads below the FPL near drains, streams, rivers and lakes.
    - Flood water levels could exceed the FPL.
    - Evacuations and relocation of personal property to higher elevations or safer locations will likely be required.

- Major highway closures associated with substantial economic impacts will likely be required.

Additional terminology:

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.