

**Hydrologic Forecast Centre
Manitoba Infrastructure and Transportation
Winnipeg, Manitoba**

SECOND SPRING FLOOD OUTLOOK FOR MANITOBA

March 27, 2015

Overview

Good News: Spring Flood risk is mostly passed

- The Hydrologic Forecast Centre's second 2015 spring flood outlook indicates that spring snowmelt is already finished in most of the southern, southwestern, and Interlake regions, and the resulting peak tributary and river flows have already passed and generally have remained within banks.
- Above freezing temperatures in early March throughout southern and central Manitoba and the adjacent provinces and states have caused early spring snow melt. The temperature rise was gradual and has resulted in a slow melt rate.
- Peak spring runoff has already passed for the Red River and tributaries, the Souris River and tributaries, the Qu'Appelle River, and the southern and Manitoba portions of the Assiniboine River and its tributaries.
- Peak spring runoff has occurred for the Pembina River and tributaries, the Roseau River, the Fisher River, the Icelandic River, and the Whitemouth River. All rivers and creeks in the western part of the province, including the Duck Mountain area and the Riding Mountain areas, have also peaked.
- Because of this, the good news is the risk of flooding due to the spring runoff is already passed or substantially low in most areas.

Spring runoff is yet to start within northern and northwestern regions: The risk of flooding will be minor to moderate

- Temperature has generally been below freezing throughout northern and northwestern regions, with short, sporadic periods of above zero temperatures. Because of this snowmelt and spring runoff has either not commenced, or a smaller first melt has occurred, with a larger melt and runoff yet to come.
- The Saskatchewan River, the Carrot River and the Saskatchewan portion of the Assiniboine river watersheds have substantial amount of snow on the ground that has not melted yet.
- However, winter precipitation records and soil moisture before freeze up are near normal within the aforementioned regions, and the resulting runoff potential is near normal.
- Therefore, the flood risk within these regions is minor to moderate.

Lakes Forecast: Most lakes are expected to be below the flood stage after the spring runoff

- Most of the major lakes including Lake Manitoba, Lake Winnipegosis, and Lake St. Martin have not started to see the effect of the spring runoff. Most of the lakes are expected to be below the flood stage after the spring runoff, except Whitewater Lake, which is already well above the long term normal level.
- Lake Manitoba is expected to peak between 813.08 ft to 813.18 ft after the spring runoff. This is below the flood stage of 814 ft, but above its upper operating range of 812.5 feet. Lake Winnipegosis is expected to peak between 833.01 ft to 833.40 ft. Lake St. Martin is expected to peak between 801.29 to 801.44 ft. Dauphin Lake is expected to peak between 855.6 ft to 856.3 ft, which is below the flood stage of 858 ft. Whitewater lake is near peak level of 1633 ft, which is 5 ft above the long term average level.
- Whiteshell Lakes are expected to see minimal rise in water level due to spring runoff, as the runoff potential for this region was normal to below normal.
- Most of the lakes are still frozen and the effect of wind and ice pile up is very negligible at this time. Once lake ice weakens and lake ice coverage reduces by 30% in area, ice pile up risk due to high winds increases.

The March 23 to 24 Precipitation Event: Will have minimal effect

- There was a major snow storm throughout southern Manitoba and south eastern Saskatchewan between March 23 and 24 that has resulted on average 4 to 10 inches of snow (10 to 25 mm of snow water equivalent).
- This precipitation event will not have a major effect on flows and levels. Almost all rivers and creeks within this region are on recession and will have adequate capacity to handle the runoff generated from this event.

Ice Jamming: Generally ice is still in place in Manitoba rivers – Lakes still frozen

- All of Manitoba's rivers and lakes still have significant ice thickness. Ice jamming of the magnitude that we have seen in 2009 on the Red is unlikely due to the efforts of the ice jam mitigation program and the low spring freshet peak.
- Heavy ice is still present on most areas of the lower Assiniboine River. The Portage Diversion has been activated on March 25 to reduce the effect of ice jams on communities downstream of Portage la Prairie.
- Along the Icelandic River generally the ice stayed in place last week and the winter snow melt did not cause the ice to float away. Most of the snow has melted producing a very minimal flow in the river. The remaining ice was in poor condition. The amphibex completed ice breaking at Riverton by March 20th. Conditions are the same on the Fisher River; the winter snow mostly melted, ran and left the ice in place.
- The ice cutting work that has been done by the North Red Community Water Maintenance Corporation on the north Red, Icelandic, and Brokenhead rivers has significantly reduced the potential of ice jams.

- There is still a chance of localized flooding due to ice jams on Saskatchewan River at the Pas and Carrot River when melt starts. Major ice jams are difficult to predict as to location and magnitude; the possibility of ice jams on these areas cannot be ruled out.

Future Weather: No major storm predicted – temperature normal to below normal

- The short term weather forecast indicates a very minimum precipitation event in the next 7 to 10 days throughout most areas across the province.
- The short term weather forecast also indicates the mean daily temperature will be above zero beginning on March 28 for most parts of central and southern Manitoba.
- Long term weather forecasts are not often reliable and are of minimal use in flood forecasting.

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Spring Flood Risk has mostly passed

Due to a combination of warmer than average temperatures throughout much of March, and a well below normal to below normal accumulated snowpack, many rivers in southern, southeastern, and southwestern Manitoba have already experienced their spring crests, as indicated below.

Attached Tables 1-3 detail the observed spring peak water levels and/or flows for major rivers, smaller watersheds and lakes. Within Tables 1 and 2 it is indicated if the river or tributary has not yet reached its primary spring crest. For further information on terminology, please see Appendix A: Definitions.

Red River

- The Red River crested at Emerson on March 20th and Selkirk on March 22nd.
- The Red River Floodway was not operated during the spring melt this year.
 - Ice-affected peak level at James Avenue was 2.30 m (7.55 feet)

Pembina River

- The Pembina River crested at Rock Lake on March 25th.

Roseau River

- The Roseau River peaked on March 25th.

Assiniboine River

- The downstream portion of the Assiniboine River crested at Miniota on March 21th and at Holland on March 25th. The Assiniboine River crest is passing through Portage la Prairie and Headingley and is expected to reach Winnipeg by the end of March.
- The Qu'Appelle River at St. Lazare had its first peak at Welby on March 17th. The second peak is anticipated to occur by the end of March and is expected to be slightly above the first peak.

Portage Diversion

- The Portage Diversion has been operated 32 out of the 44 years since it has been constructed. One of the primary purposes of the Portage Diversion is preventing ice jamming on the Assiniboine River east of Portage and to provide flood protection to the City of Winnipeg in accordance with the operating guidelines.
- The Portage Diversion was operated beginning March 25th, 2015 to maintain a flow of 5000 cfs down the Lower Assiniboine River. The river will be held at 5000 cfs until the reservoir inflow decreases to below 5000 cfs, or when the ice clears out from the river east of Portage.

Shellmouth Dam

- Upstream of Lake of the Prairies (Shellmouth Reservoir), the primary snowmelt peak has not yet occurred. Flooding potential is considered to be minor.
- The Shellmouth Dam was operated to draw down the reservoir to provide storage capacity for reservoir inflows to reduce flooding downstream. The current reservoir level is 423.92 m (1388.95 feet). The Dam is operated in consultation with the Shellmouth Operations Liaison Committee (SLC), to meet the summer target level of 427.5 m (1402.5 feet).
- Outflow from the reservoir is currently maintained at 50 cfs and operation decisions are regularly made in consultation with the SLC. For the current outflow conditions, the forecasted peak reservoir levels are expected to be between 1402 ft to 1406 ft after the spring runoff.

South West Region

- Souris River crested at Melita on March 19th and at Wawanesa on March 17th.

Interlake Region

- Fisher River at Peguis crested on March 18th.
- Icelandic River crested at Riverton on March 18th.
- Whitemud River crested at Westbourne on March 20th.

Fairford Control Structure

- Fairford Control Structure flows have recently been reduced from 9000 cfs to 7800 cfs to avoid ice jamming for communities on the lower Dauphin River. Once the risk of jamming has passed, the control structure will be fully opened to allow an increased outflow from the lake. It is forecasted that the flow will peak at 10,000 cfs.

Eastern Region

- The Winnipeg River flows are operated by Manitoba Hydro. Manitoba Hydro publishes flows and levels on the Winnipeg River system on their website. The Lake of the Woods Control Board (LWCB) regulates the reservoirs in the headwaters of the Winnipeg River in Ontario. The LWCB at the March 10th regulatory meeting indicated that the two major Winnipeg River reservoirs Lac Seul and Lake of the Woods were just below normal for this time of year but will be managed to reach summer target levels. Winnipeg River flow in Manitoba will be near normal given average weather for the remainder of spring and summer.

Spring runoff is yet to start within northern and northwestern regions: The risk of flooding will be minor to moderate

Northern Manitoba and The Pas Regions

Temperature has generally been below freezing throughout northern and northwestern regions, with short, sporadic periods of above zero temperatures. Because of this snowmelt and spring runoff has either not commenced, or a smaller first melt has occurred, with a larger melt and runoff yet to come.

- Soil moisture is generally normal throughout the Saskatchewan River Basin, with regions of below normal conditions in central Alberta, and above normal conditions in southern Alberta and Saskatchewan. However, the accumulated snowpack is above normal to well above normal throughout much of the basin, with the exception of some areas within Alberta and south western Saskatchewan. The main stem of the Saskatchewan River at The Pas is expected to be below bank full level in the unfavourable weather scenario, although much will depend on future weather and the regulation of Saskatchewan's Tobin Lake outflows.
- Saskatchewan River potential flooding ranges from minor to moderate when considering all potential weather scenarios.
 - Favourable to normal weather: minor risk of flooding.
 - Levels will be similar to 2002 levels
 - Unfavourable weather: minor to moderate risk of flooding
 - Moderate runoff potential exists in the upstream portions of the basin (central Saskatchewan) due to above normal snow accumulation in these areas.
 - Levels will be similar to 2010 levels
- The Carrot River, the Red Deer River and the Swan River have a minor to moderate risk of flooding.

Upper Assiniboine River Watershed

The soil moisture analysis based on weighted May to October precipitation indicates normal to above-normal conditions throughout much of the upper Assiniboine River watershed.

- Upstream of Lake of the Prairies there has been a rise in streamflow due to initial melting in early- to mid-March, and a reduction in flow as temperatures plunged below zero. Flows are now beginning to increase again as temperatures slowly warm.
- It is expected that the Upper Assiniboine flows will crest between the first and second week of April.

Lakes Forecast: Most lakes are expected to be below the flood stage after the spring runoff

Most of the major lakes including Lake Manitoba, Lake Winnipegosis, and Lake St. Martin have not started to see the effect of the spring runoff. Most of the lakes are expected to be below the flood stage after the spring runoff, except Whitewater Lake, which is already well above the long term normal level

Lake Manitoba

- Lake Manitoba's current level is 247.8 m (812.9 feet).
- Normal weather: 247.83 m (813.1 ft)
- Unfavourable weather: 247.86 m (813.2 ft)
- The peak lake level under both weather scenarios exceeds the upper operating range level of 247.7 m (812.5) ft, however is below the flood stage of 248.1 m (814 ft). The lake level is expected to fall to operating range of 812.5 ft between late July and mid August.

Lake St. Martin

- Lake St. Martin is currently at 244.33 m (801.61 feet).
- Normal weather: 244.24 m (801.3 ft)
- Unfavourable weather: 244.27 m (801.4 ft)

Lake Winnipeg

- Lake Winnipeg's current level is 217.65 m (714.07 feet).
- The operating range is 216.41 m – 217.93 m (710 ft – 715 ft).
- Manitoba Hydro publishes forecasted Lake Winnipeg levels on their website.

Lake Winnipegosis

- Lake Winnipegosis is currently at 253.8 m (832.8 feet).
- Normal weather: 253.9 m (833.0 ft)
- Unfavourable weather: 254.02 m (833.4 ft)

Dauphin Lake

- Dauphin Lake's current level is 260.7 m (855.3 feet).
- Normal weather: 260.79 m (855.6 ft)
- Unfavourable weather: 261.0 m (856.3 ft)
- The summer target level is 260.5 m (854.8 feet).

Shoal Lakes

- The Shoal Lakes current level is 261.58 m (858.2 ft) at North Shoal Lake
- Normal weather: 261.94 m (859.4 ft)
- Unfavourable weather: 262.14 m (860.0 ft)
- Peak observed in 2011 was at 262.59 m (861.52 ft).

Whitewater Lake

- Whitewater Lake's current level is 497.7 m (1632.9 feet).
- Normal weather: 497.74 m (1633 ft)
- Unfavourable weather: 497.85 m (1633.5 ft)
- Peak observed in 2013 was at 497.74 m (1633.0 ft).

Pelican Lake

- Pelican Lake's current level is 411.9 m (1351.5 feet).
- Normal weather: 411.94 m (1351.5 ft)
- Unfavourable weather: 412 m (1351.7 ft)
- Peak observed in 2011 was 412.6 m (1353.6 ft).
- The summer target level is 411.9 m (1351.5 ft).

Rock Lake

- Rock Lake's current level is 405.5 m (1330.4 feet).
- Normal weather: 405.54 m (1330.5 ft)
- Unfavourable weather: 405.69 m (1331.0 ft)
- Peak observed in 2011 was at 408.3 m (1339.7 ft).
- The summer target level is 405.1 m (1329.0 ft).

Oak Lake

- Oak Lake's current level is approximated at 430.4 m (1412.1 feet).
- Normal weather: 429.71 m (1409.8 ft)
- Unfavourable weather: 430.01 m (1410.8 ft)
- Peak observed in 2011 was at 430.4 m (1412.2 ft).

Red Deer Lake

- Normal weather: 262.01 m (859.6 ft)
- Unfavourable weather: 262.50 m (861.2 ft)
- Peak observed in 2011 was 263.5 m (864.7 ft).
- The summer target level is 262.0 m (859.5 ft).

The March 23 to 25th Precipitation Event: Will have minimal effect

Winter Precipitation & Snow Water Content

Within the southern-most basins (Souris, Qu'Appelle, Red River, and portions of the Interlake region), the winter snowpack had melted and bare ground conditions were reached within these areas. Environment Canada satellite imagery (Figure 1), snow survey data (Figure 2), and meteorological station observations indicate the Assiniboine River upstream of Shellmouth, the Saskatchewan River basin, and northern portions of the Interlake region have seen a depletion in

snow cover due to the warmer temperatures experienced in early- to mid-March. However, portions of the snowpack still remain, with snow water equivalent varying substantially throughout the region, ranging from approximately 20 mm to 90 mm.

Due to the recent precipitation event that occurred over March 23-25th, approximately 10-25 mm of snow water equivalent (4 to 10 inches of snowfall) is now present within portions of the aforementioned regions (Figure 3). This precipitation event will not have a major effect on flows and levels. Almost all rivers and creeks within this region are post-peak and will have adequate capacity to handle the runoff generated from this event.

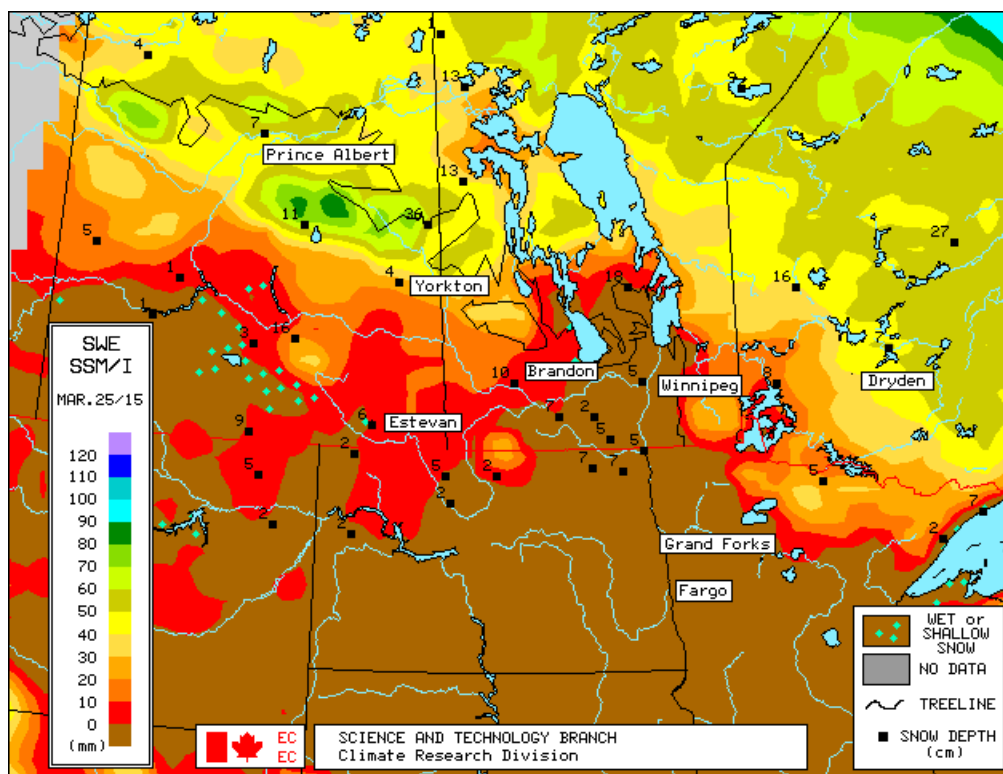


Figure 1 - Environment Canada satellite-derived snow water equivalent (SWE) for March 25th, 2015.

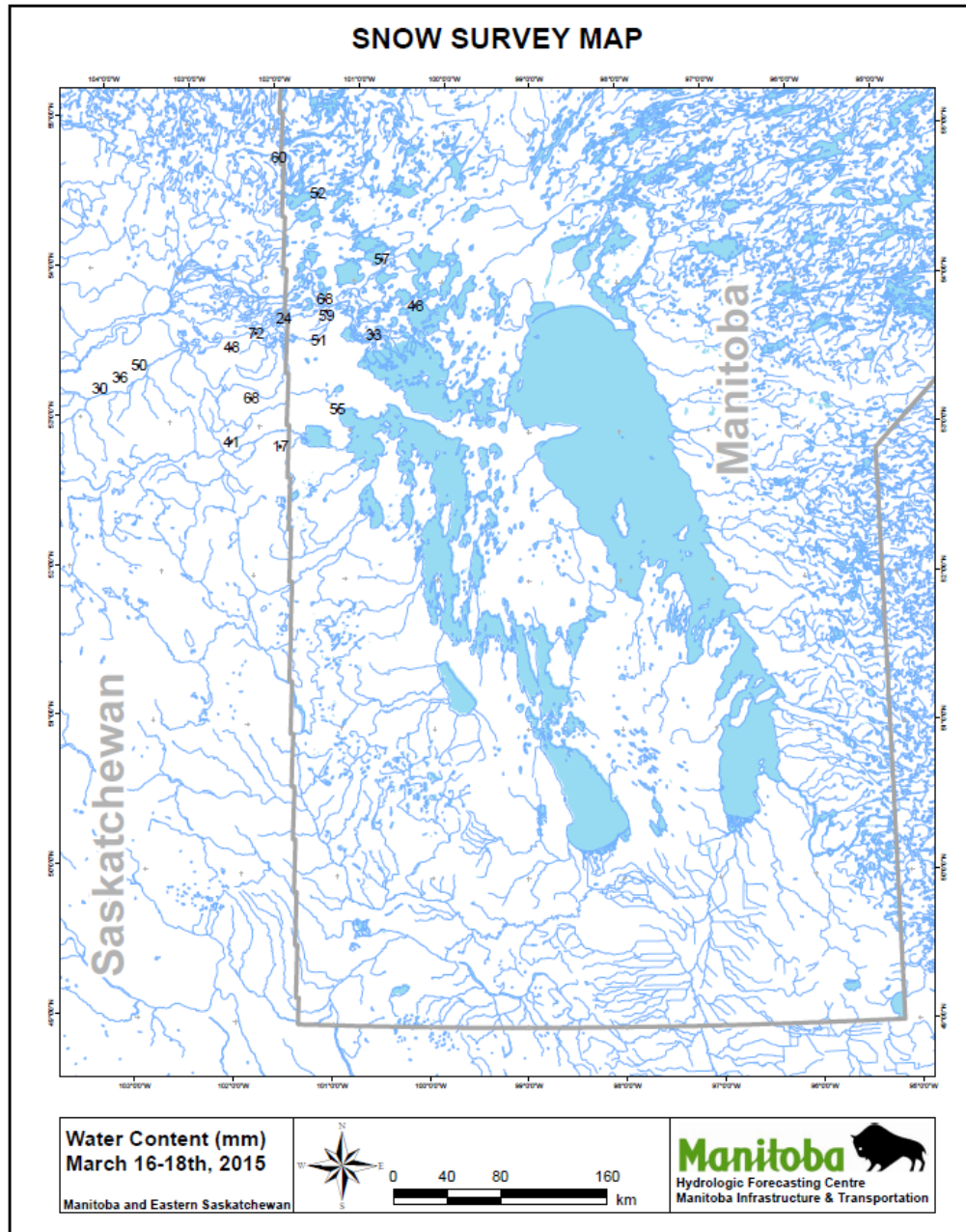


Figure 2 – March 16th – 18th, 2015 snow survey results in millimetres of water content.

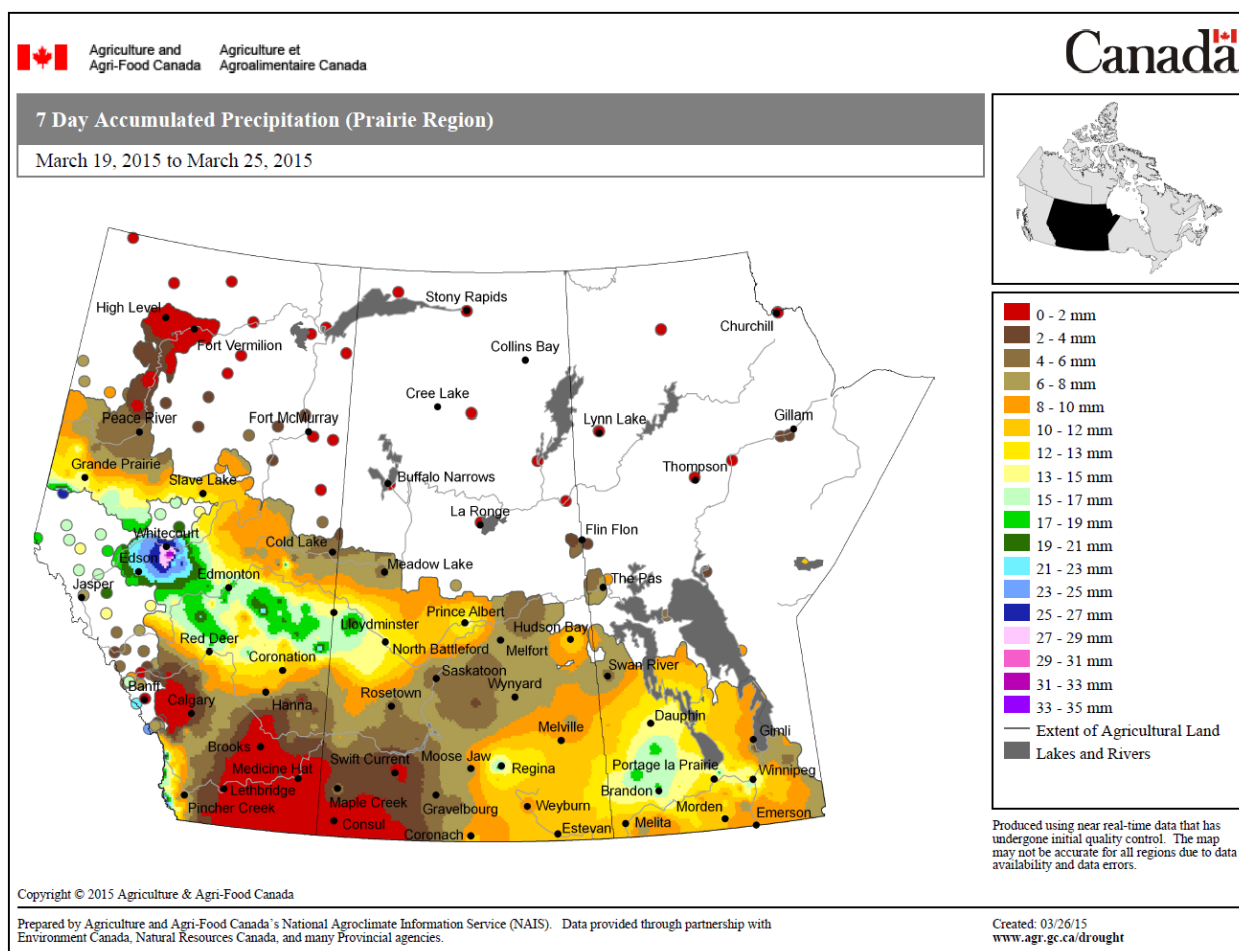


Figure 3 – Accumulated precipitation over March 19th – 25th, 2015.

Ice Jamming: Generally ice is still in place in Manitoba Rivers – Lakes still frozen

- All of Manitoba's rivers and lakes still have significant ice thickness. Ice jamming of the magnitude that we have seen in 2009 on the Red is unlikely due to the efforts of the ice jam mitigation program and the low spring freshet peak.
- Heavy ice is still present on most areas of the lower Assiniboine River. The Portage Diversion has been activated on March 25 to reduce the effect of ice jams on communities downstream of Portage la Prairie.
- Along the Icelandic River generally the ice stayed in place last week and the winter snow melt did not cause the ice to float away. Most of the snow has melted producing a very minimal flow in the river. The remaining ice was in poor condition. The amphibex completed ice breaking at Riverton by March 20th. Conditions are the same on the Fisher River; the winter snow mostly melted, ran and left the ice in place.

- The ice cutting work that has been done by the North Red Community Water Maintenance Corporation on the north Red, Icelandic, and Brokenhead rivers has significantly reduced the potential of ice jams.
- There is still a chance of localized flooding due to ice jams on Saskatchewan River at the Pas and Carrot River when melt starts. Major ice jams are difficult to predict as to location and magnitude; the possibility of ice jams on these areas cannot be ruled out.

Future Weather: No major storm predicted – temperature normal to below normal

- The short term weather forecast indicates a very minimum precipitation event in the next 7 to 10 days throughout most areas across the province.
- The short term weather forecast also indicates mean daily temperature will be above zero beginning on March 28 for most parts of central and southern Manitoba.
- Long term weather forecasts are not very reliable and are mostly unknown at this point in time.

Future Forecast Information

- This is the final outlook. Daily flood reports with operational forecasts¹ may be issued beginning in April if there is significant river flow.
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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 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 normal future weather conditions
- Is a contributing factor into flood outlook determinations
- Described in comparison to normal historical conditions (i.e. normal, near normal, slightly above normal, etc.)
- Can change significantly if future precipitation and melt rates differ from the average

³ 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, 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, determined by statistical analysis of the past 30-40 years of climate data
- Three scenarios used:
 - Lower decile
 - There is a 10% chance of the weather being that 'favourable' or better. 90% of the time the weather will be worse than this 'favourable' condition.
 - Median
 - There is a 50% chance of the weather being 'normal' or better.
 - Upper decile
 - There is a 10% chance of the weather being that 'unfavourable' or worse. 90% of the time the weather will be better than this 'unfavourable' condition.
- Province's practice is to plan/prepare to the upper decile condition.

³ Favourable Weather:

- Characterized by little additional precipitation and a gradual snow melt

³ Normal Weather:

- Characterized by normal rainfall and temperature
- Typically used to describe historic climate trends

³ Unfavourable Weather:

- Significant wide spread precipitation with a rapid snowmelt

⁴ Minor Flooding:

- Minimal or no property damage is expected, but there is potential for some public impact, such as inundation of roads below the FPL⁷.

⁴ Moderate Flooding:

- Potential for some inundation of buildings, structures and roads below the FPL near drains, streams, rivers and lakes.
- It may be necessary to evacuate of people and moving property to higher elevations or safer locations.

⁴ Major Flooding:

- Potential for extensive inundation of buildings, structures and roads below the FPL near drains, streams, rivers and lakes.
- Flood water levels are expected to be below the FPL.
- It likely will be required to evacuate some people and move property to higher elevations or safer locations.

⁴ Severe Flooding:

- Potential for very extensive inundation of many buildings, structures and roads above and below the FPL.
- Flood water levels are expected to exceed the FPL.
- It is likely that significant evacuations and movement of property to high elevations or safer locations will be required.

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 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.

⁷ FPL:

- The greater of the flood of record or the 1-in-100-yr flood, plus a freeboard allowance for a particular waterway (typically 2 feet) or water body (site specific).
- It is provided by the HFWM branch of MIT on a site specific and structure specific basis.
- This is formally set by the Water Resources Administration Act for the designated flood areas.
- In non DFA area, the FPL is recommended by the Province, but ultimately regulated by the local planning districts and/or municipalities.