

Hydrologic Forecast Centre

Manitoba Infrastructure

Winnipeg, Manitoba

MARCH FLOOD OUTLOOK REPORT FOR MANITOBA

MARCH 27, 2019

Overview

The Manitoba Hydrologic Forecast Centre has prepared an updated March flood outlook. The risk of major flooding has increased for the Red River and tributaries due to significant precipitation that has occurred in the US portion of the Red River basin. The Assiniboine River, the Souris River, the Saskatchewan River and the Carrot River are expected to experience moderate flooding. The risk of significant flooding remains low in other parts of Manitoba, including the Interlake, Central, Northern, and Whiteshell Lakes regions. The risk of lake flooding is minor at this time as most major lakes are expected to be within their operating ranges or within their normal levels after the spring runoff.

Winter Precipitation

Winter (November to March) precipitation has been tracking above normal to well above normal within the U.S. portion of the Red River and the Souris River watersheds. Winter precipitation has been tracking near normal for the Saskatchewan River and Carrot River watersheds in Saskatchewan. Winter precipitation is below normal for all other portions of Manitoba and for south eastern and north eastern portions of Saskatchewan (Figure 1).

Most areas of the Red River and the Souris River basins in the U.S. received between 70 and 120 mm (2.8 to 4.7 inches) of precipitation from November 1, 2018 to March 24, 2019, with the exception of the southern portion of the Red River basin which received over 120 mm (4.7 inches) of precipitation. Generally, all other Manitoba watersheds received between 50 and 70 mm (between 2.0 and 2.8 inches) of precipitation (Figure 2).

In central and western basins, the last 35 days were particularly dry as there was little to no precipitation recorded. However, two major precipitation systems occurred within the Red River basin during this time period and brought a combined amount of 5 to 50 mm (0.2 to 2 inches) of precipitation. (Figure 3).

Snow Water Equivalent

There have been significant strong wind events, and snow movement on the ground, in the past few weeks. Snow water equivalent (SWE) measurements were conducted by Manitoba Infrastructure staff and by the gamma airborne survey. They indicate that SWE ranges from 90 mm to 150 mm (3.5 to 5.9 inches) in the U.S. portion of the Red River basin (Figure 4). For all other basins, modeled snow water equivalent analysis by the Snow Data Assimilation System (SNODAS) indicates SWE generally varies from zero in the Interlake, northern and western regions, to 75 mm (3 inches) in southern Manitoba (Figure 5).

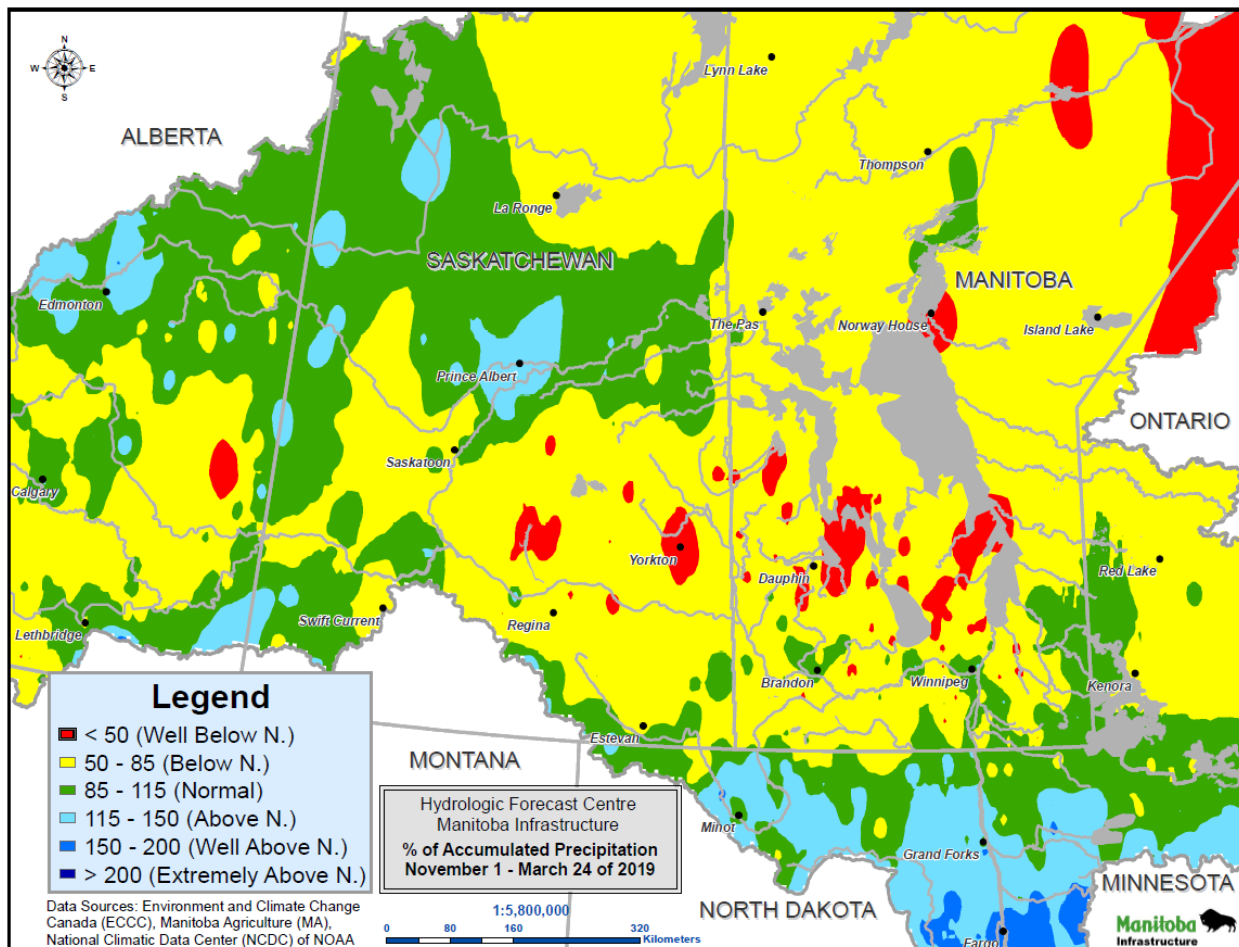


Figure 1 - Percent of normal precipitation from November 1, 2018, to March 24, 2019.

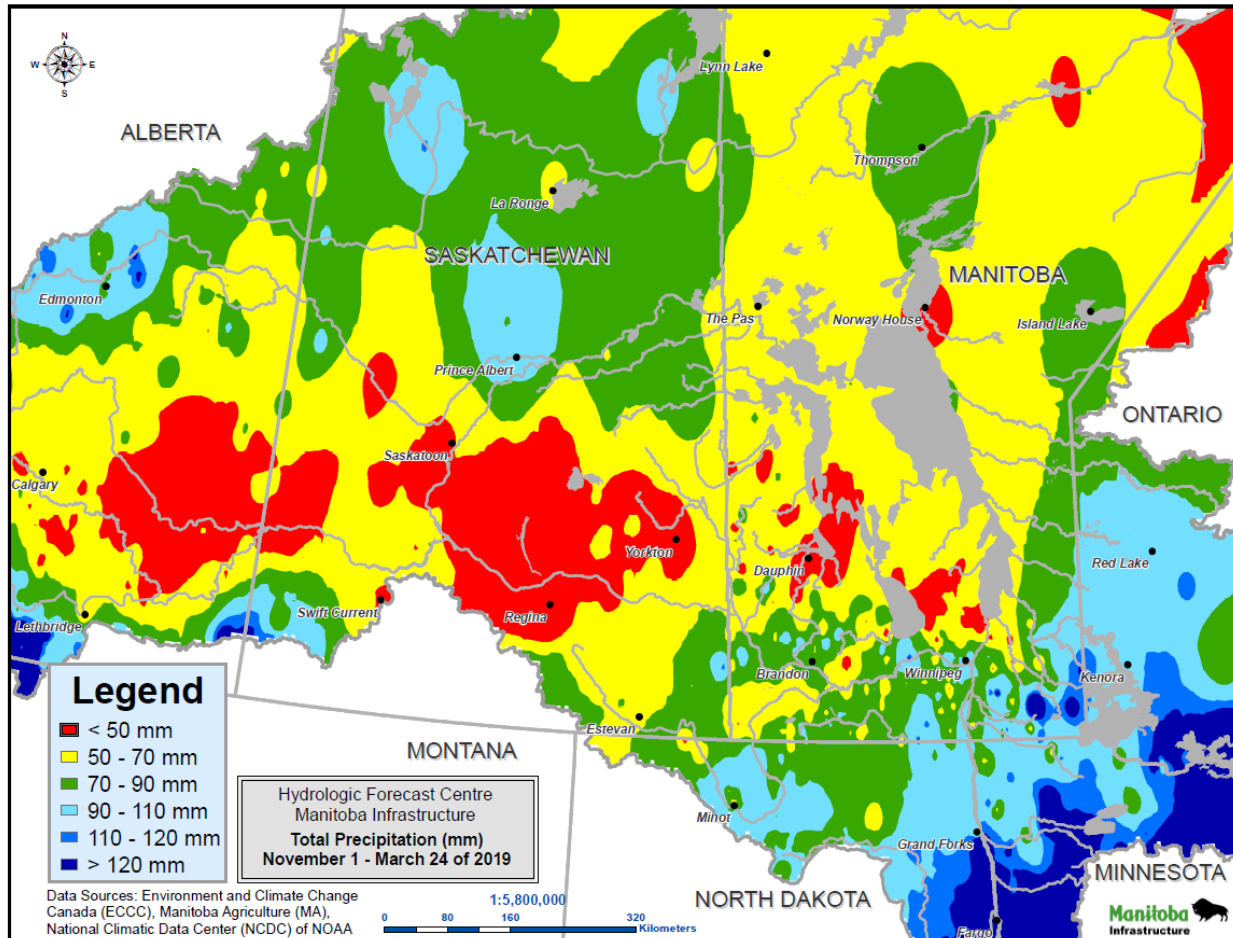


Figure 2 - Cumulative precipitation from November 1, 2018 to March 24, 2019.

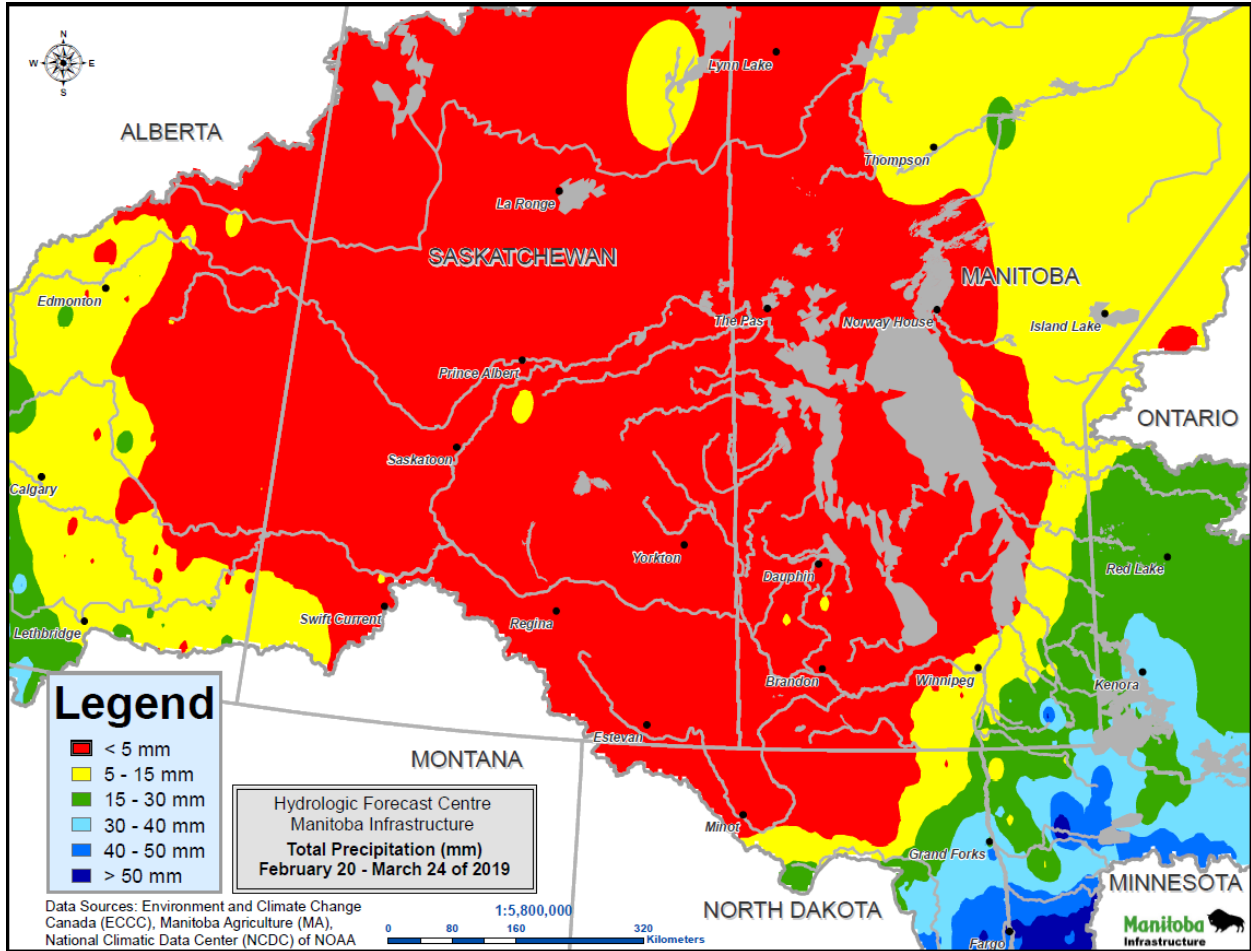


Figure 3 - Cumulative precipitation from February 20, 2019 to March 24, 2019.

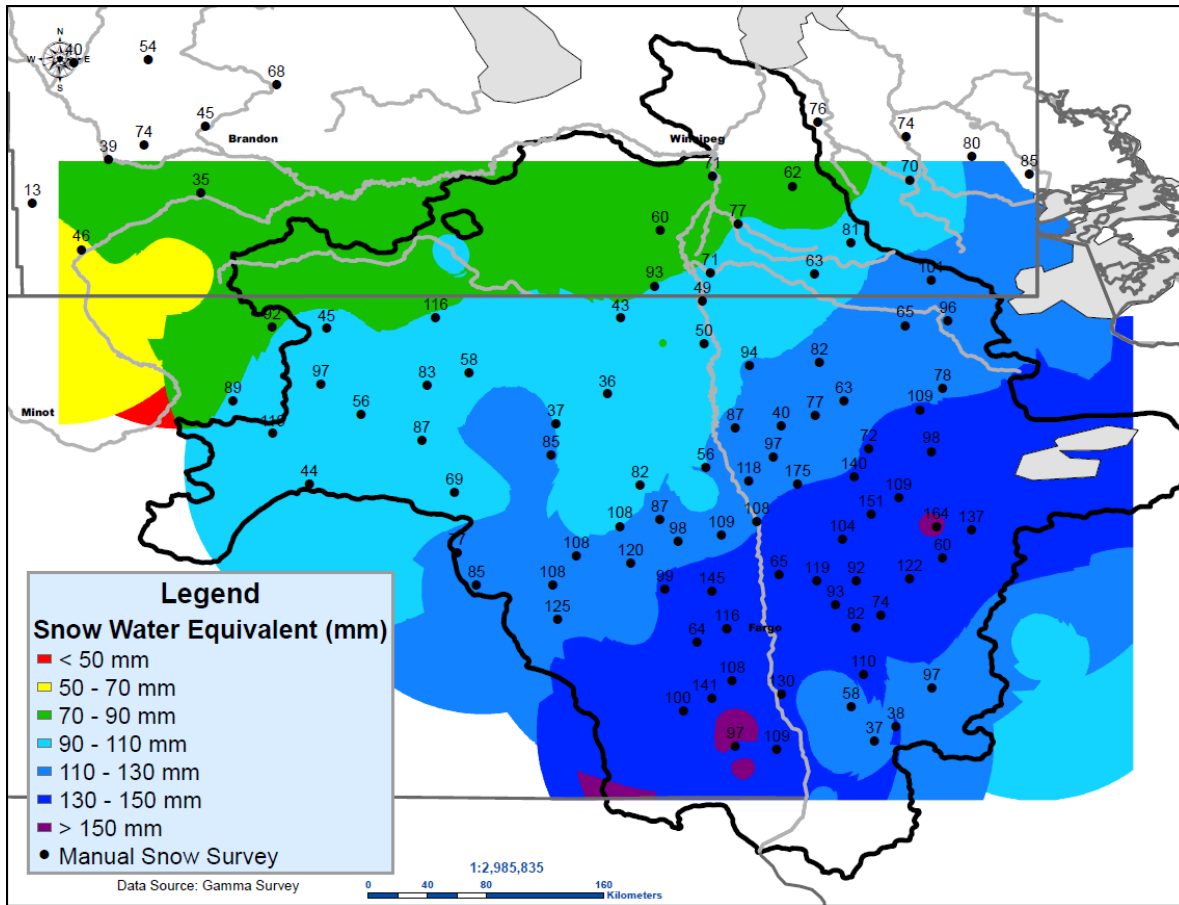


Figure 4 – Snow water equivalent (SWE) in mm, from gamma survey and field measurements.

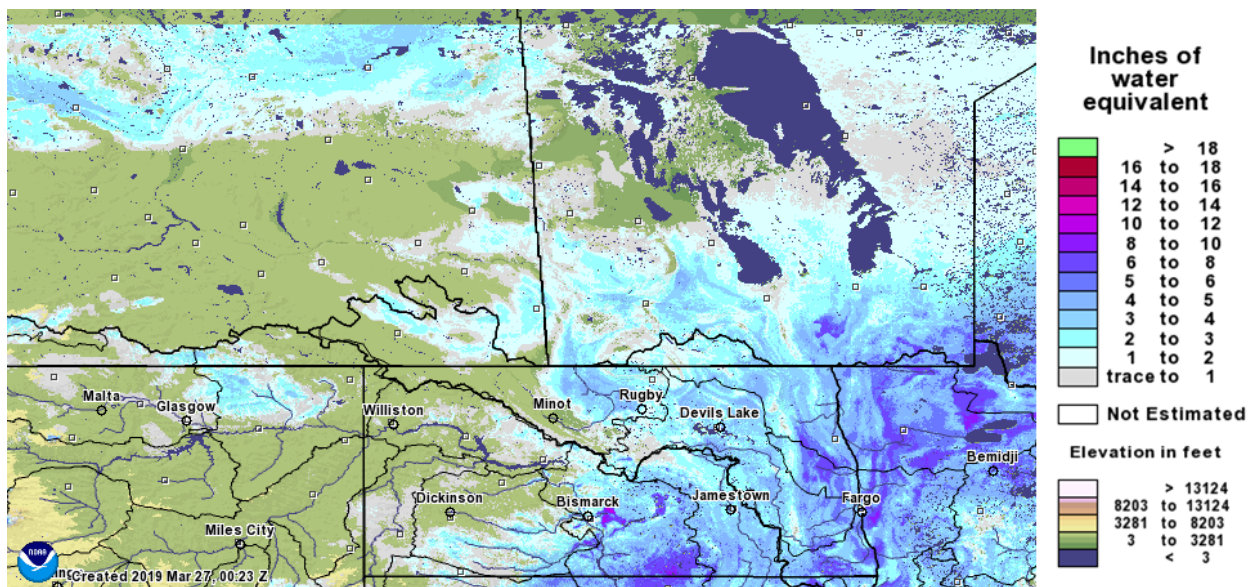


Figure 5 – Modeled snow water equivalent analysis (SWE) by Snow Data Assimilation System (SNODAS)

Soil Frost Depth

Frost depth is widely variable across the province. Measurements at selected locations indicate frost depth is generally normal to deeper than normal throughout most of Manitoba. Generally, deeper than normal frost depth means that the soil could be partially frozen at the time of spring runoff and could absorb less surface water than it would normally absorb.

Soil Moisture Conditions at Freeze Up

Soil moisture conditions at freeze up were generally normal to below normal in all Manitoba basins. Southern Manitoba, including the Red River Valley and central and western Manitoba, were all within the normal to below normal range. Northern Manitoba, including the Pas Region, and eastern Manitoba were near normal.

Current Flow and Water Level Conditions

The current flow and water level conditions in rivers and lakes throughout the province as of March 26, 2019 range from near normal to slightly above normal. Water level and flow readings at most gauges could be ice affected.

River Ice Conditions and Ice Jamming¹

Based on river ice thickness measurements conducted in February and March, ice thickness for the Red River at and north of Selkirk generally ranges between 56 cm (22 inches) and 102 cm (40 inches). Average ice thicknesses are 69 cm (27 inches) on the downstream reaches of the Fisher River, 76 cm (30 inches) on the Icelandic River at Riverton, and 94 cm (37 inches) on the Brokenhead River. These ice thickness ranges are generally considered to be within normal to above normal range. Ice cutting, and ice breaking with the Amphibex ice breakers, was conducted on the Red River at and north of Selkirk, Fisher River, Brokenhead River and Icelandic River to weaken the winter ice prior to spring break-up. Ice cutting and breaking will also be completed at the outlet of the Portage Diversion to reduce the risk of ice jamming at the outlet.

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 runoff period will depend on the nature of the spring breakup and the rate of melt.

¹ See Appendix A for 'Ice Jam' definition

Future Weather

Environment and Climate Change Canada's latest long term forecast for southern portion of Manitoba and Saskatchewan indicate colder than normal temperatures for March, April and May. Temperature forecasts are near normal for central and northern Manitoba and Saskatchewan. The forecast indicates a higher chance of above normal precipitation across southern Manitoba and near normal precipitation for northern and central Manitoba.

The United States National Weather Service's (NWS) one-month forecast indicates near normal temperatures in April for the Red and Souris River basins in the US. The NWS three-month forecast suggests below normal temperatures and near normal precipitation across the Red and Souris River basins for April, May and June.

Below normal temperature forecasts can result in a later melt that might coincide with the spring rain and increase the spring flooding risk.

Flood Outlook

The magnitude of the spring flood flows on Manitoba's rivers is still dependent on weather conditions from now till the spring melt period and during the spring melt period. The flood potential is significantly affected by the amount of additional snow and spring rain; the frost depth at the time of spring thaw; the timing and rate of the spring thaw; and the timing of peak flows in Manitoba, the United States, Saskatchewan and Ontario. A single precipitation event similar to the rainstorm that occurred in the summer of 2014 could change the flood outlook significantly.

The March flood outlook provides estimated peak river levels or flows that are based on current basin conditions, and three possible future weather scenarios. These weather scenarios are favourable, normal, and unfavourable, which 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 weather scenario, which is a weather scenario that would have a 1 in 10 chance of occurring.

Red River:

The risk of major flooding continues to be high for the Red River and its tributaries. Table 1 shows the Red River valley forecasted peak levels corresponding to three different probabilities of occurrence at various communities. Table 2 shows the Red River and tributaries forecasted peak flows corresponding to three different probabilities of occurrence. The forecasted maximum water surface profile for the Red River

valley in comparison with the community dike elevations and bankfull capacities is also shown in Figure 5. Figures 6b and 7 show forecasted peak flow probabilities in comparison with the 2011 and 2009 peak flows for the Red River at Ste. Agathe and Emerson, respectively. The 2019 forecasted peak flows and historic annual peak flow comparisons for the Red River at Emerson is also shown in Figure 8.

Red River Valley

- With favourable weather conditions, levels along the Red River south of Winnipeg (between Emerson and the Red River Floodway Inlet) will be close to the levels observed in the 2009 spring flood.
- With normal or average weather conditions, water levels in the Red River valley are forecasted to be higher than 2009 levels by 6 cm (0.2 ft) on average.
- With unfavourable weather conditions, including late season snow, spring rains and a more rapid snowmelt, water levels will be higher than 2009 levels by 15 cm (0.5 ft) at the southern end of the valley (near Emerson) to 24 cm (0.8 ft) at the north end (near Ste. Agathe).

Red River Floodway Operation and Winnipeg James Avenue Water Level:

Due to the expected high flows on the Red River, the Floodway is expected to be operated during the 2019 spring melt. The Portage Diversion on the Assiniboine River is also expected to be operated to regulate flows on the Assiniboine River downstream of Portage la Prairie and levels in Winnipeg. With the operation of these structures:

- James Avenue peak water level in Winnipeg is expected to be 5.8 m (19.0 ft) in favourable weather conditions.
- Under normal future weather conditions, James Avenue peak water level is expected to be 6 m (19.6 ft).
- Under unfavourable weather conditions, James Avenue peak water level is forecasted to reach 6.2 m (20.5 ft).

The 2019 forecasted peak flows and historic annual peak flow comparisons for the Red River in Winnipeg at James Avenue is shown in Figure 6a.

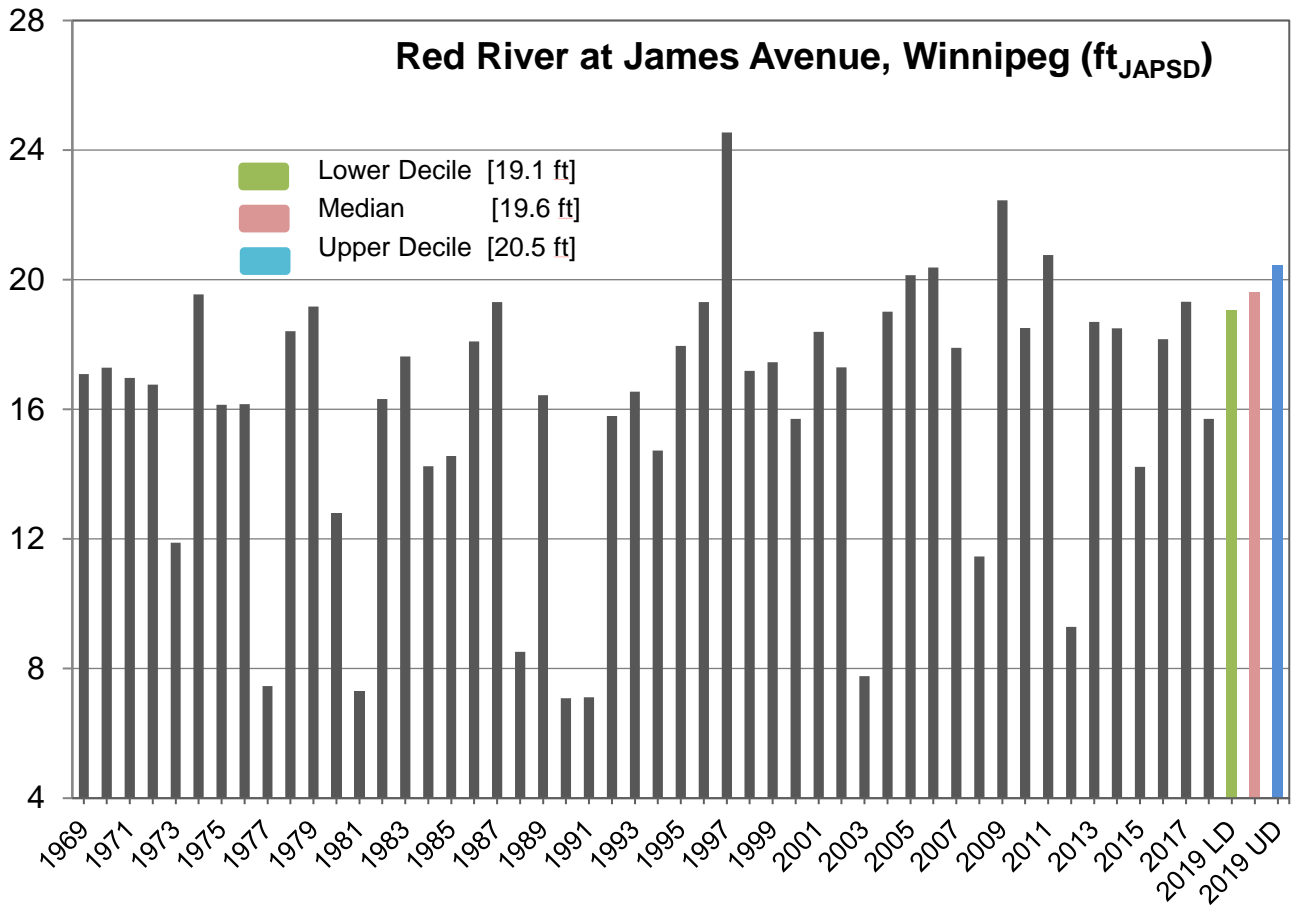


Figure 6a – Historic Annual Peak Flow and 2019 Forecasted Flows for the Red River in Winnipeg at James Avenue

Pembina River and Roseau River

- With unfavourable weather conditions, there is a high risk of moderate flooding along the Pembina River and there is a high risk of major flooding on the Roseau River.
- With normal and favourable weather conditions, the risk of flooding on the Pembina River is low.
- With normal and favourable weather conditions, there is a risk of moderate flooding on the Roseau River.

Table 1: Forecasted Levels within the Red River Valley (in feet)

Community (Gauge Location)	Forecasted Levels (ft)			Upper Decile Level in excess of 2009 flood level (ft)
	Lower Decile (~2009 flood)	Median (> 2009 flood)	Upper Decile (>>2009 flood)	
Emerson	790.7	791.0	791.3	0.5
Letellier	785.0	785.5	785.9	0.7
St. Jean	782.8	783.1	783.3	0.4
Morris	781.8	782.0	782.3	0.4
Ste. Agathe	773.5	774.0	774.5	0.8
St. Adolphe	769.0	769.6	770.1	0.9
City of Winnipeg (James Avenue Station)	19.0	19.6	20.5	

Table 2: Red River and Tributaries Forecasted Flows (cubic feet per second)

Exceedance Probability	Red River and Tributaries Forecasted Flows (cfs)			
	Red River at Ste. Agathe	Red River at Emerson	Pembina River at Gretna	Roseau River at Gardenton
Lower Decile (Favourable Weather)	88,000	85,000	5,800	3,500
Median (Normal Weather)	96,000	92,000	7,400	4,100
Upper Decile (Unfavourable Weather)	103,000	98,000	8,600	4,700

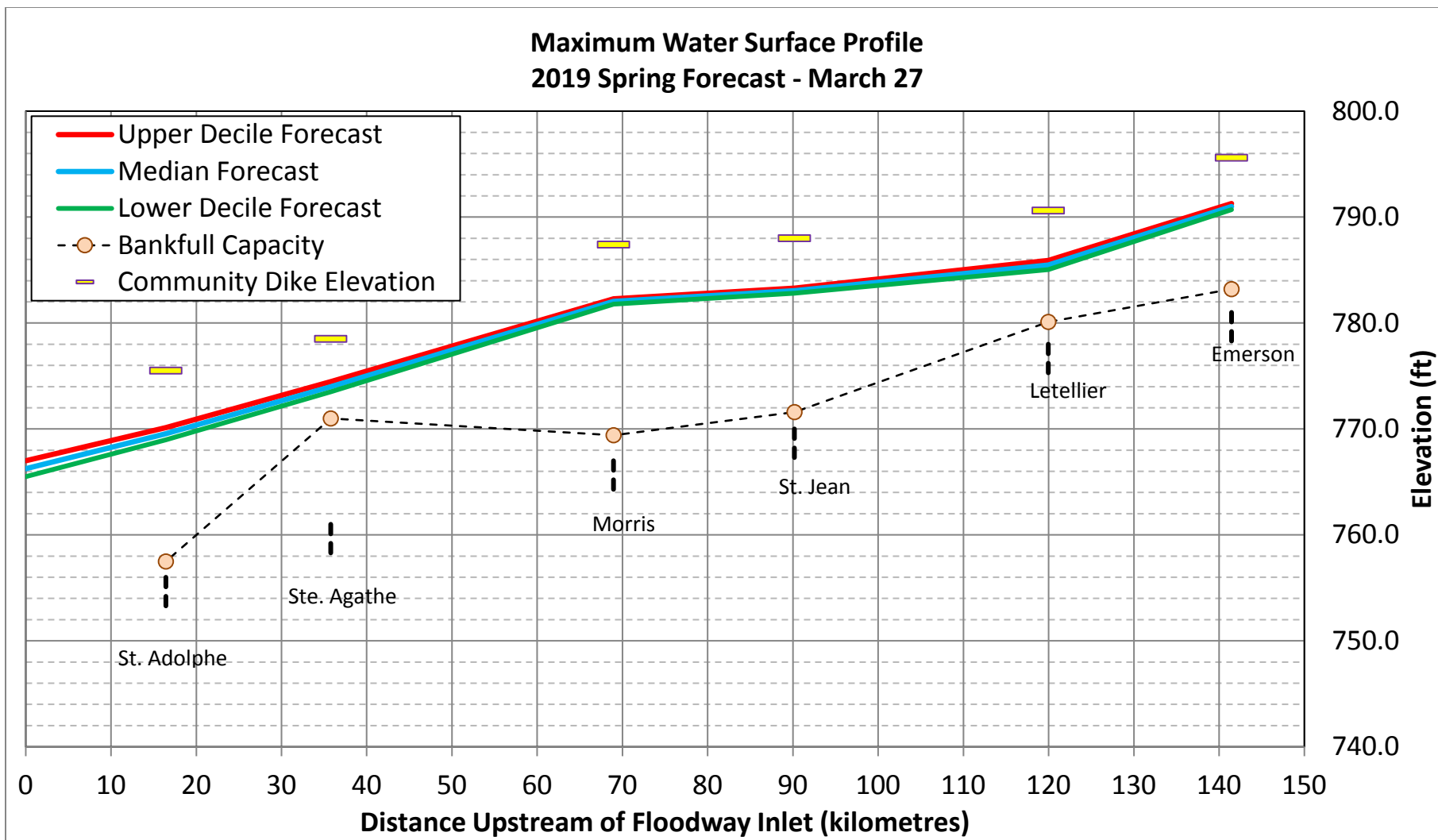


Figure 6b – Maximum water surface profile for Red River Valley

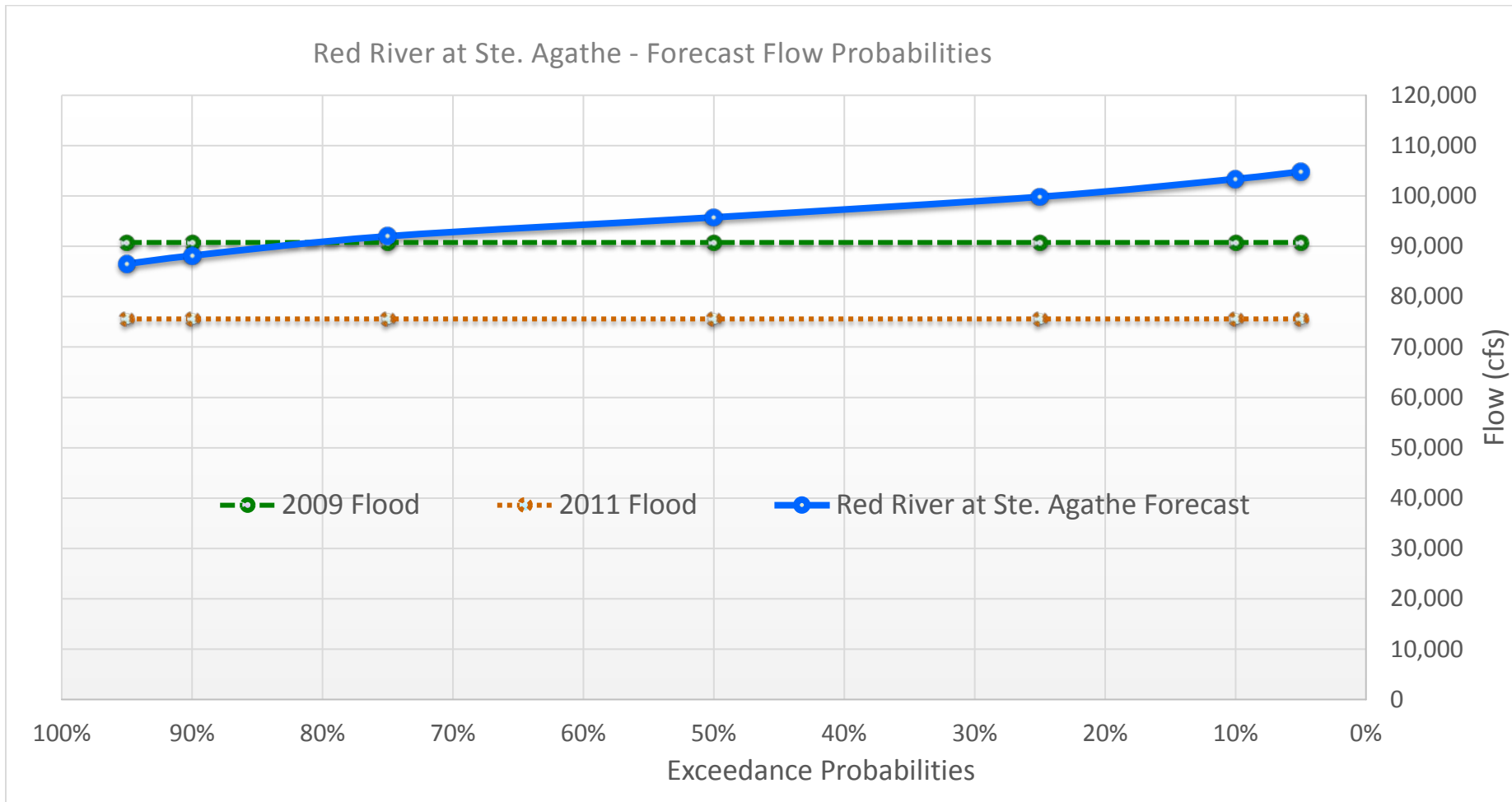


Figure 7 – Forecasted flow probabilities for Red River at Ste. Agathe

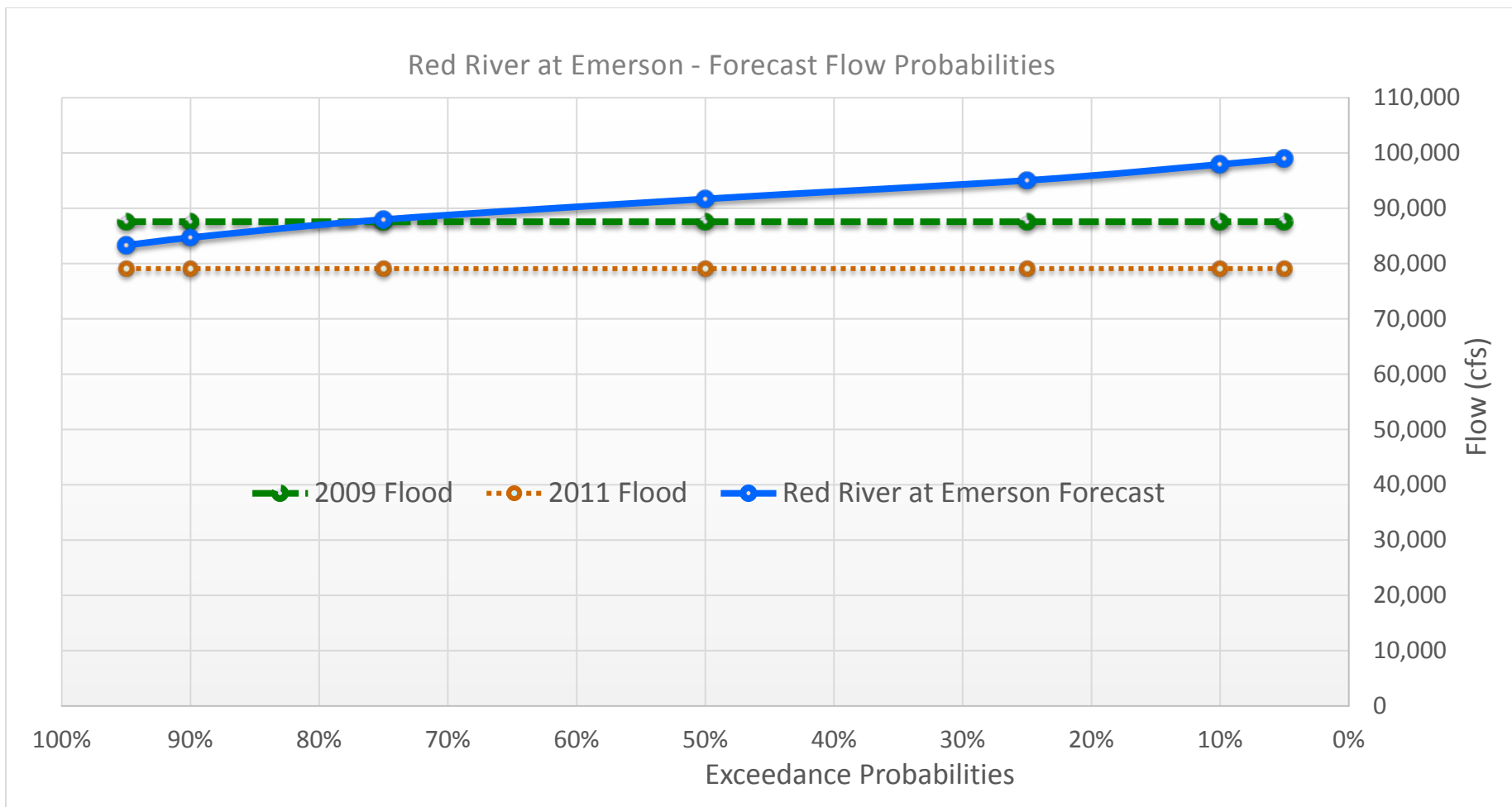


Figure 8 – Forecasted flow probabilities for Red River at Emerson

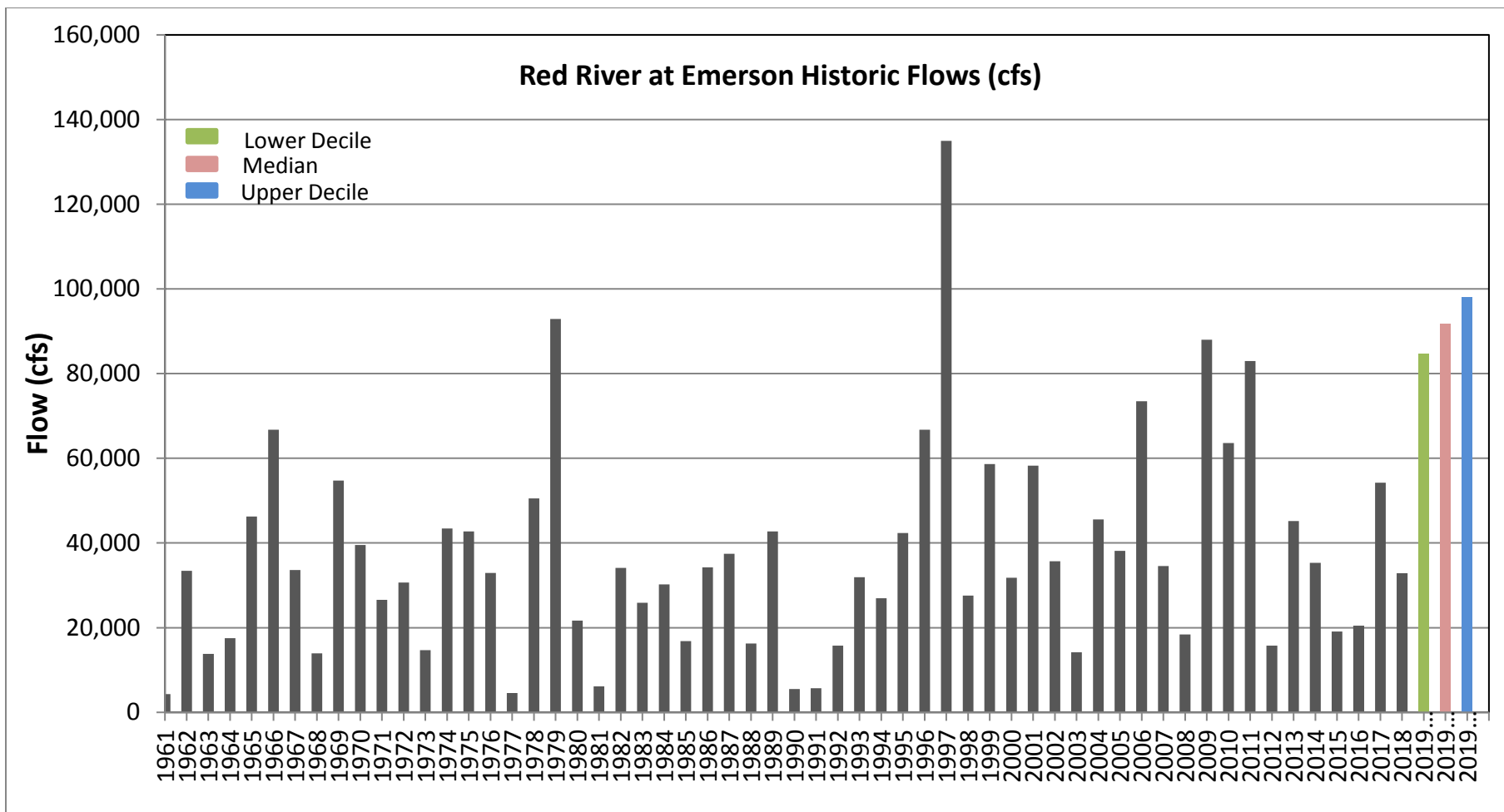


Figure 9 – Historic Annual Peak Flow and 2019 Forecasted Flows for the Red River at Emerson

Assiniboine and Souris Rivers:

There is a high risk of moderate flooding, i.e., flooding of low lying areas and agricultural lands, along the Assiniboine and Souris Rivers.

- With favourable weather conditions, water levels on the Assiniboine River from the Shellmouth to Brandon will be similar to 2018 levels, and water levels between Brandon and Winnipeg will be similar to 2015 levels.
- With normal weather conditions, water levels on the Assiniboine River from Shellmouth to Brandon will be similar to 2015 levels, and water levels from Brandon to Winnipeg will be similar to 2015 levels.
- With unfavourable conditions, water levels on the Assiniboine River from Shellmouth to Brandon will be similar to 2005 levels, and water levels downstream of Brandon to Winnipeg will be similar to 1995 levels or slightly lower than the 2017 levels.

Moderate flooding is also expected on the Souris River between the U.S. border and Wawanesa.

- With favourable weather conditions, water levels on the Souris River between the U.S. border and Wawanesa will be similar to 2009 levels. In normal future weather conditions, levels will be similar to 2013 levels.
- With unfavourable weather conditions, water levels on the Souris River between the U.S. border and Wawanesa will be similar to 1995 levels.

Table 3 and Table 4 show forecasted peak flows for the Assiniboine and Souris Rivers corresponding to the three different probabilities of occurrence. Figure 9 shows forecasted flow probabilities for the Assiniboine River at Brandon and at Portage la Prairie. Figure 10 shows forecasted flow probabilities for the Souris River at Wawanesa. The 2019 forecasted flows and historic annual peak flow comparisons for the Assiniboine and Souris Rivers are also shown in Figures 11 to 13.

Portage Diversion and Shellmouth dam

The Portage Diversion is expected to be operated this year to control water levels downstream of the diversion and in the City of Winnipeg. The Portage Diversion has been operated 36 out of the 49 years since it has been constructed for the purpose of preventing ice jamming on the Assiniboine River east of Portage la Prairie and providing flood protection to the City of Winnipeg and the areas along the Assiniboine River downstream of Portage la Prairie.

The Shellmouth Dam is being operated to draw down the reservoir to provide storage capacity for reservoir inflows, in order to reduce flooding downstream. The current reservoir water level as of March 26th, 2019 is 424.04 m (1391.21 ft). The forecasted inflow volumes into the Shellmouth Reservoir for favourable, normal and unfavourable conditions are 148,000 acre-feet, 275,000 acre-feet and 350,000 acre-feet, respectively. The Shellmouth reservoir is being operated to be within the desirable range of 427.33 m to 427.94 m (1402 ft to 1404 ft) after the spring runoff. The Shellmouth Reservoir Regulation Liaison Committee provides regular input into the decision regarding 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 current outflow from the reservoir is 15.6 cms (cubic metres per second) (552 cfs (cubic feet per second)).

Table 3: Assiniboine River Forecasted Flows

Exceedance Probability	Assiniboine River Forecasted Flows (cfs)				
	Russell	Miniota	Brandon	Holland	Portage
Lower Decile (Favourable Weather)	1,500	4,100	7,800	15,000	16,000
Median (Normal Weather)	2,300	6,000	10,000	20,000	21,000
Upper Decile (Unfavourable Weather)	3,400	8,700	14,000	28,000	29,000

Table 4 Souris River Forecasted Flows

Exceedance Probability	Souris River Forecasted Flows (cfs)		
	Melita	Souris	Wawanesa
Lower Decile (Favourable Weather)	3,700	5,800	6,300
Median (Normal Weather)	4,800	7,400	8,000
Upper Decile (Unfavourable Weather)	8,000	11,200	12,400

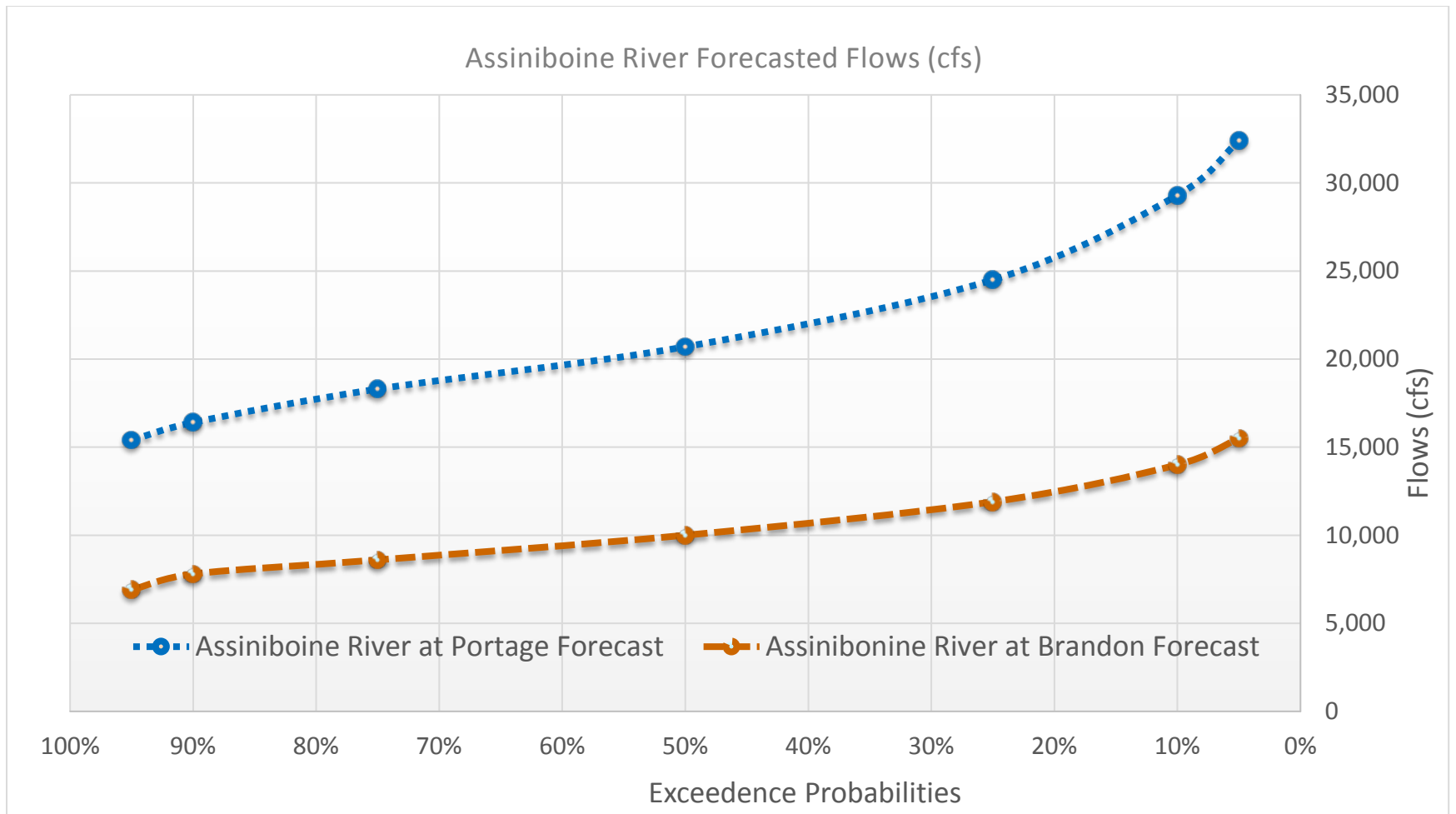


Figure 10 – Forecasted Flow Probabilities for Assiniboine River at Portage and Brandon

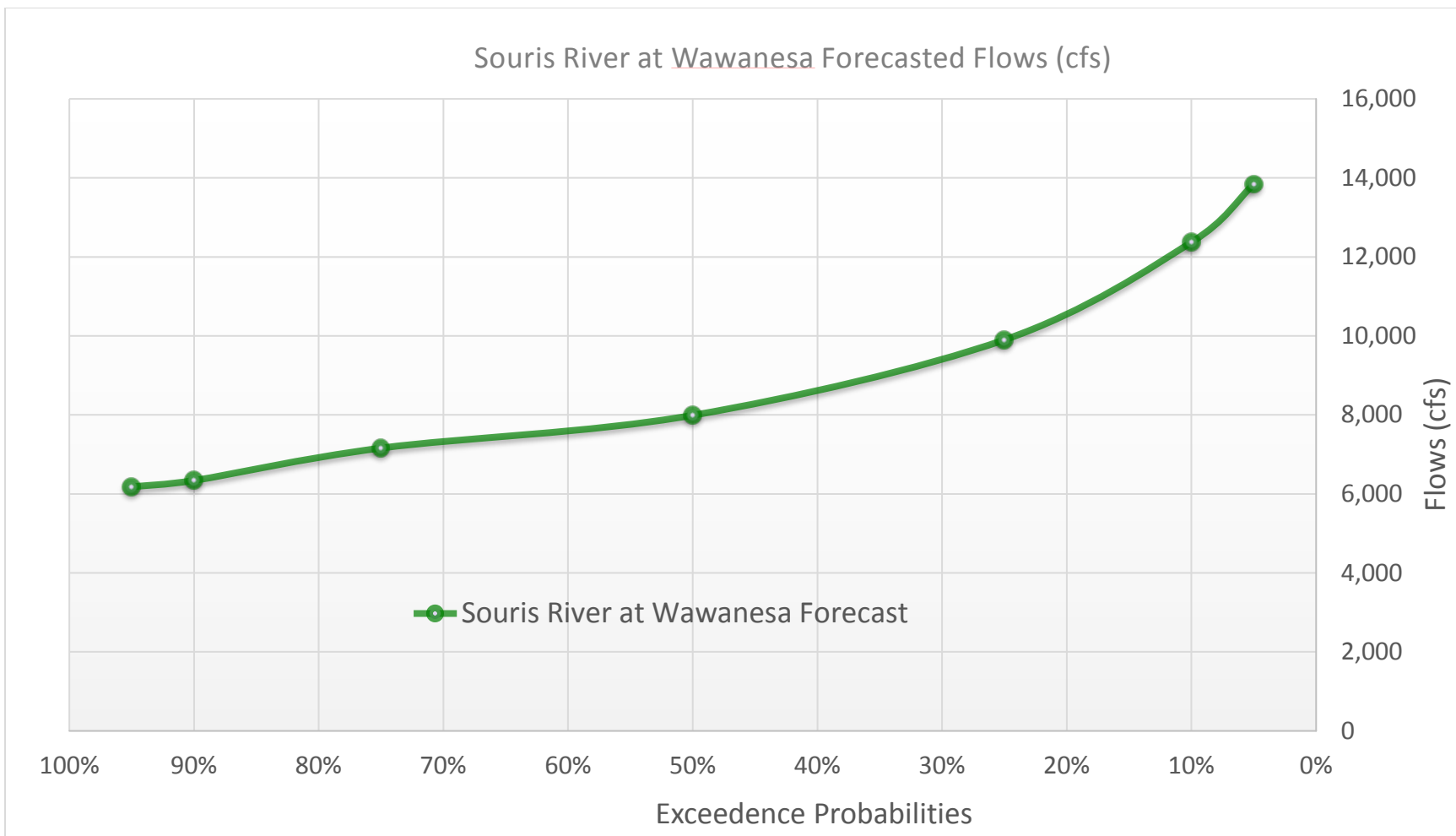


Figure 11 – Forecasted Flow Probabilities for Souris River at Wawanesa

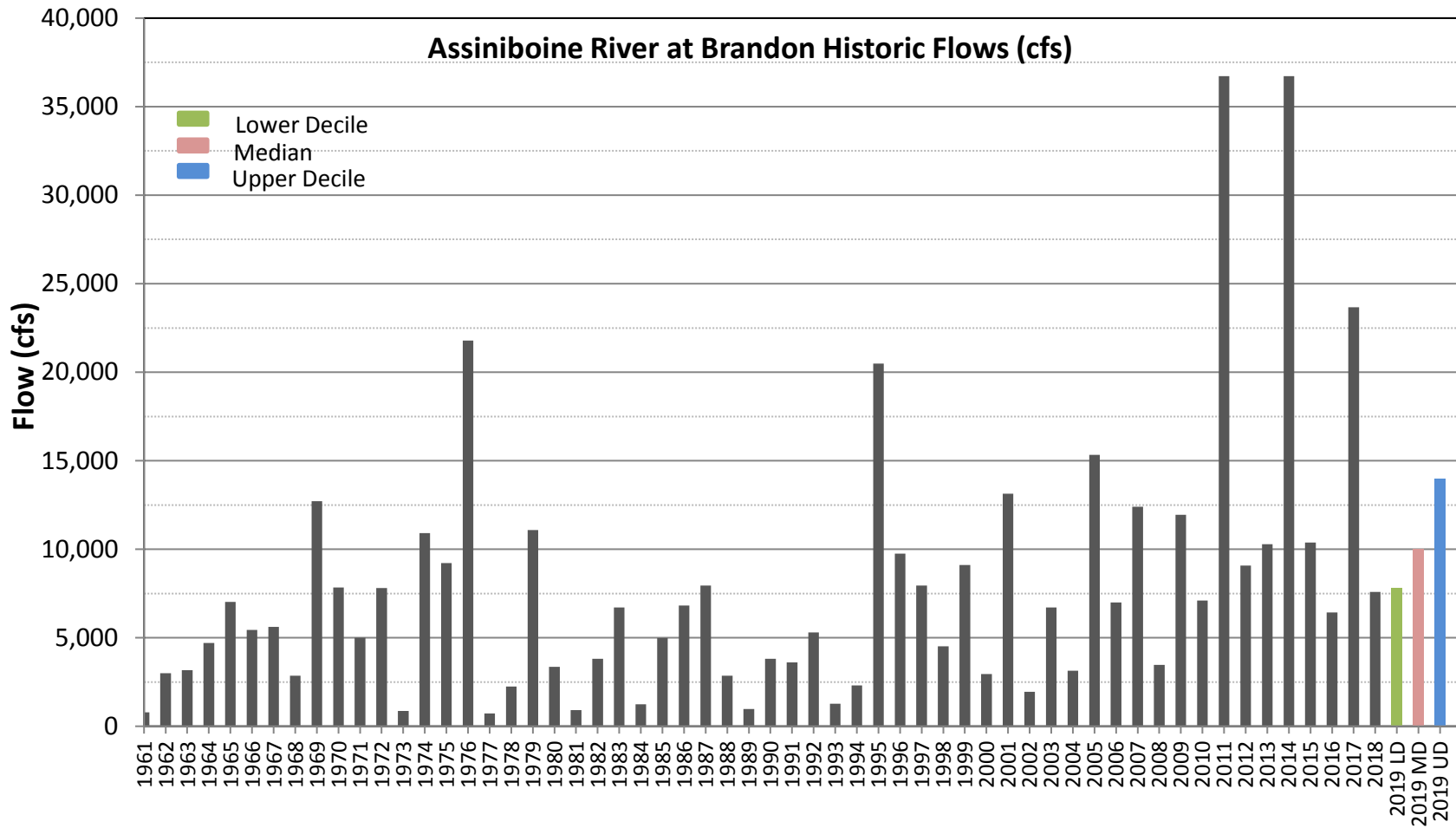


Figure 12 – Historic Annual Peak Discharge and 2019 Forecasted Flow for the Assiniboine River at Brandon

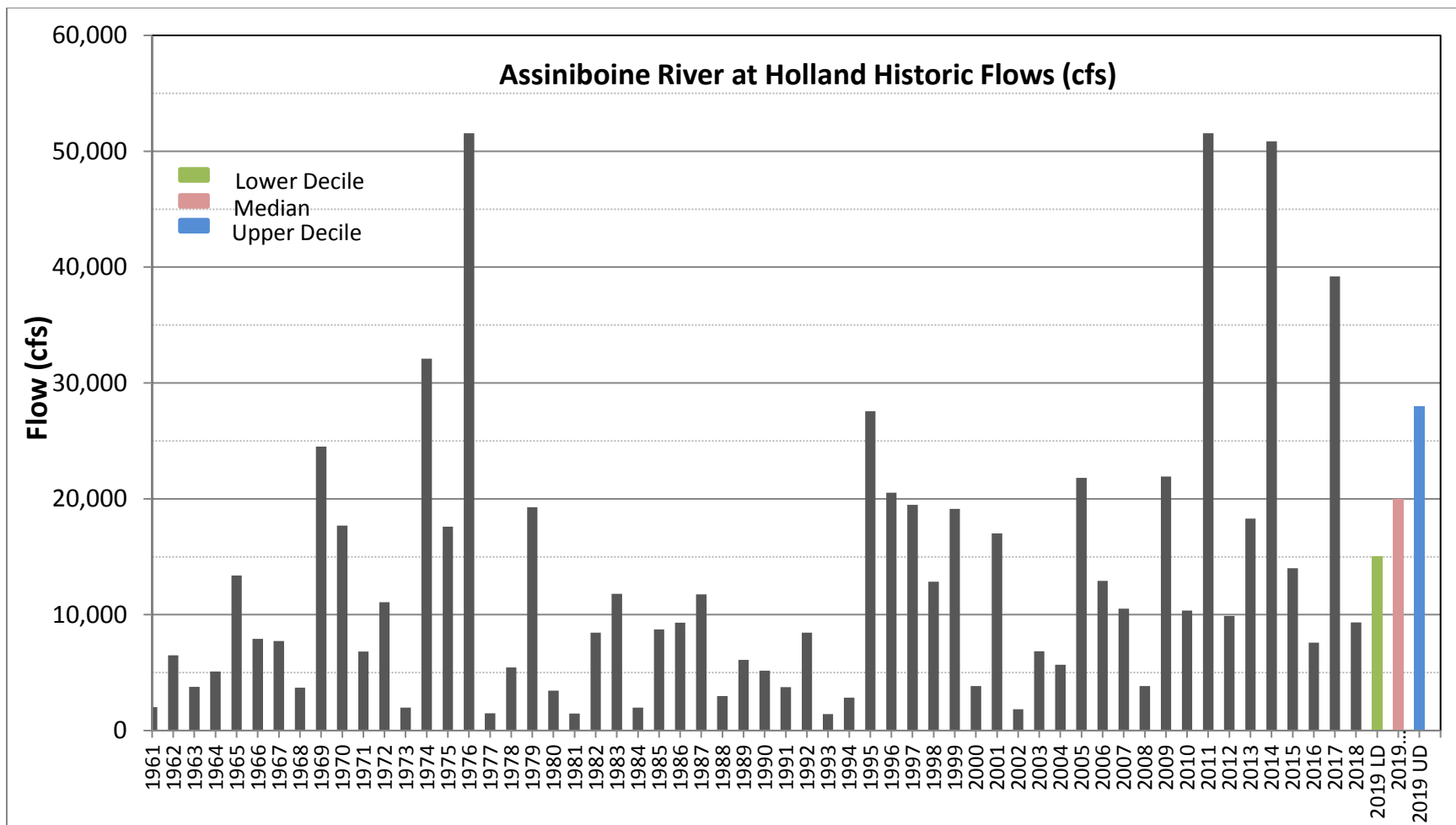


Figure 13 – Historic Annual Peak Discharge and 2019 Forecasted Flow for the Assiniboine River at Holland

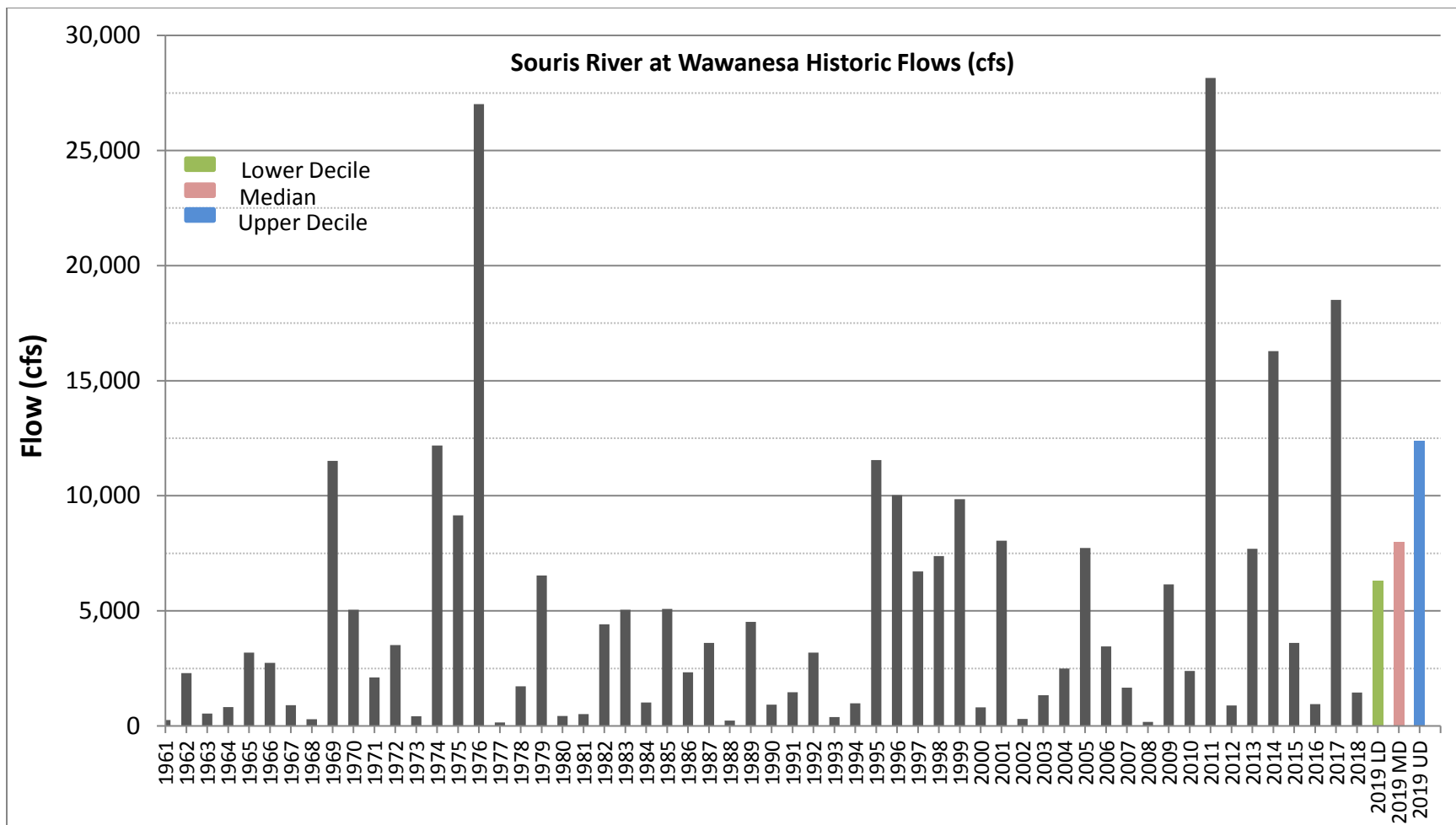


Figure 14 – Historic Annual Peak Discharge and 2019 Forecasted Flow for the Souris River at Wawanesa

Central, Eastern & Northern Regions:

The risk of overland flooding is low to moderate in the Interlake, Whiteshell Lakes and Northern regions of the Province.

- Interlake and Whiteshell Lake regions have a low risk of overland flooding.
- Northern Manitoba, including the Saskatchewan and Carrot rivers, has a moderate risk of overland flooding.
- There is a risk of ice jam related flooding on these rivers due to normal to above normal ice thickness.

Lakes

All major Lakes have a minor risk of lake flooding, and all lakes are expected to be within their desirable ranges after the spring runoff, with the exception of Lake Winnipegosis, which will continue to be above the normal water level.

Flood 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.

The ice-jam mitigation program is on-going. The ice cutters and Amphibex ice breaking machines have completed working on the Red, Fisher, Brokenhead and Icelandic Rivers. Ice cutting and breaking work will take place in early April at the Portage Diversion outlet to weaken the ice and reduce the risk of ice jamming.

Future Forecast Information

The spring melt and runoff has not yet begun. Once the spring runoff period is underway, operational forecasting will begin, and daily updates will be provided for required basins as the melt progresses.