Water Availability and Drought Conditions Report

October 2017

Executive Summary

- This Water Availability and Drought Conditions Report provides an update on drought conditions throughout Manitoba for October 2017.
- During the short term (one month) most of agro-Manitoba and the region surrounding Island Lake experienced moderately to extremely dry precipitation conditions. The remainder of the province observed normal to above normal precipitation.
- During the medium term (three months) much of agro-Manitoba observed moderately dry precipitation conditions, extending north to Thompson and east to Island Lake, with pockets of severely dry conditions. The remainder of the province observed normal to above normal precipitation.
- Over the long term (twelve months), moderately dry conditions were observed across much of agro-Manitoba (excluding the eastern region) extending northeast to encompass Norway House and Island Lake. A region of severely dry conditions was centered over Roblin.
- Most streamflows and lake levels across southern Manitoba were normal or above normal except for the eastern part of the Lake Winnipeg watershed where conditions were below normal. In northern Manitoba, the Hayes River was below normal, but all other monitored sites were normal to much above normal.
- There are currently no major concerns over reservoir water supplies. There have been continued reports of water levels in dugouts becoming low across agro-Manitoba, suggesting on-farm water supplies would benefit from adequate snowfall over the coming winter.
- As of the end of wildfire season there have been 543 wildfires burning a total of 170,107 hectares in Manitoba. Drought Code values remain high for this time of year.
- Generally, the drought conditions observed during the 2017 growing season did not have an unfavourable impact to crop yields, except for soybeans. Hay and pasture land conditions are reported to be variable across agro-Manitoba.
- Environment and Climate Change Canada's seasonal temperature forecast for November-December-January is projected to be below normal across Manitoba. The seasonal precipitation forecast is projected to be above normal across the Lake Manitoba and Lake Winnipeg basins and normal throughout the remainder of the province
- For more information on drought in Manitoba, please visit the Manitoba Drought Monitor website.

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Drought Indicators

Precipitation and streamflow drought indicators have been developed to assess drought conditions. These indicators describe the severity of dryness across Manitoba.

Precipitation Indicator

Precipitation is assessed to determine the severity of meteorological dryness and is an indirect measurement of agricultural dryness. Three precipitation indicators are calculated to represent long term (twelve months), medium term (three months) and short term (one month) conditions. Long term and medium term indicators provide the most appropriate assessment of dryness as the short term indicator is influenced by significant rainfall events and spatial variability in rainfall, particularly during summer storms. Due to large distances between meteorological stations in northern Manitoba, the interpolated contours in this region are based on limited observations and should be interpreted with caution.

Over the short-term (one month) most of agro-Manitoba observed moderately (60 – 85 % of median) to extremely (<40 %) dry precipitation conditions, with increasing dryness towards the southwest corner of the province (Figure 1). Island Lake also observed moderately dry conditions during this time period. The remainder of Manitoba, including eastern agro-Manitoba, saw normal (85 – 115 %) to above normal (>115 %) precipitation conditions.

Over the medium term (three months), moderately dry conditions persisted across much of agro-Manitoba, expanding in extent since September to include the Interlake (Figure 2). Severely dry conditions (40 – 60 %) surrounding Swan Lake and Roblin persisted and expanded to include the region surrounding Dauphin and Gilbert Plains. Precipitation conditions improved in northern Manitoba, where regions of moderately dry to severely dry conditions decreased in extent since September. However, the region between Thompson and Norway House continued to experience moderately dry conditions, and Island Lake conditions remained severely dry.

Over the long term (twelve months), about one third of the province observed moderately dry precipitation conditions (Figure 3) including most of agro-Manitoba extending northeast to encompass Norway House and Island Lake. An isolated area surrounding Roblin observed severely dry conditions during this time period. This spatial extent of dryness over the long term has not been observed over the last few years.

Streamflow Indicator

The streamflow indicator is based on average daily flows compared to historical values for that particular day. This indicator is used to determine the severity of hydrological dryness in a watershed and is summarized on Figure 4, representing hydrological conditions for November 2nd, 2017.

Most southern Manitoba rivers, tributaries and lakes were within the normal range (25 – 75th percentile), with several locations reporting above normal (75 – 90th percentile) or much above normal (>90th percentile) flows or levels. East of Lake Winnipeg, the Bloodvein River above Bloodvein Bay and Round Lake at the Outlet continued to experience below normal conditions (10 – 25th percentile), with the addition of Weaver Lake to this category. Additionally, the Boyne River near Carman was classified as much below normal (< 10th percentile); however, this river is regulated by Stephenfield Reservoir and outflows were recently increased.

Streamflows along the Churchill, Burntwood, Nelson, and Seal Rivers were categorized as normal to much above normal. However, the Hayes River below Gods River continued to experience below normal flows. The streamflow conditions along the northerly tributaries to the Burntwood and Nelson Rivers have improved, and all are now in the normal to above normal range (Odei River near Thompson, Taylor River near Thompson, Limestone River near Bird, Weir River above the mouth, and Kettle River near Gillam).

Streamflow percentile plots for all of the rivers and lakes included on Figure 4 are available on the Manitoba Drought Monitor website under the *Drought Monitoring Map* tab.

Canada and United States Drought Monitors

Several governments, agencies and universities monitor the spatial extent and intensity of drought conditions across Canada and the United States, producing maps and data products available through the Canadian Drought Monitor and United States Drought Monitor websites. The Canadian Drought Monitor is managed through Agriculture and Agri-Food Canada, while the United States Drought Monitor is a joint effort between the National Drought Mitigation Centre (at the University of Nebraska-Lincoln), the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Drought monitor assessments are based on a suite of drought indicators, impacts data and local reports as interpreted by federal, provincial/state and academic scientists.

The Canadian and United States Drought Monitor maps have been amalgamated for this report (Figure 5), and use the following drought classification system:

- D0 (Abnormally Dry) – represents an event that occurs every 3 to 5 years;
- D1 (Moderate Drought) – 5 to 10 year event;
- D2 (Severe Drought) – 10 to 20 year event;
- D3 (Extreme Drought) – 20 to 50 year event; and
- D4 (Exceptional Drought) – 50+ year event.

Additionally, the map indicates the duration of drought as either short-term (S; less than 6 months) or long-term (L; more than 6 months).

The October 31st, 2017, the Canadian Drought Monitor assessment showed that drought conditions across the Canadian Prairies are slowly beginning to improve; however regions of D3

(extreme drought) are still present in southern Alberta, while areas of D4 (exceptional drought) still exist in southern Saskatchewan. In Manitoba, the spatial extent of D0 (abnormally dry) conditions decreased. However, the regions of D1 (moderate drought) persisted in central and northwest agro-Manitoba.

As of November 2nd, 2017, the Unites States Drought Monitor indicated that drought conditions in North Dakota and northern Minnesota are still present, but continue to improve. There are no longer any D2 (severe drought conditions) conditions reported in North Dakota. The western half of the state is primarily D1 giving way to D0 towards the east. The region with no drought conditions along North Dakota's eastern state border continued to expand.

Water Availability

Reservoir Conditions

Of the fifteen water supply reservoirs updated on in this report (Table 2), nine are automated and have real-time water level information available. The remaining six locations require site visits to collect water level information and therefore do not always have recent water level readings. Note that Table 2 specifies which reservoirs have real-time monitoring capabilities and the *Observed Date* column summarizes the date corresponding to the most recent water level measurement.

As of November 6th, 2017, real-time reservoir levels continued to slowly decline, with the exception of the Vermilion Reservoir which increased from 90 to 97 % of full supply level and Stephenfield Reservoir increased from 75 to 78 % over the month of October. Seven of the nine real-time reservoirs were close to (> 85 %) or at full supply level. Jackson Lake (74 % of full supply level) and Stephenfield (78 %) were slightly lower, as denoted within the brackets.

The non-automated water supply reservoirs were not visited during the month of October. Based on the September water level measurements, five of the six reservoirs were close to (> 85 %) full supply level, except for Lake Irwin, which was at 68 % of full supply level.

Reservoirs are being managed to conserve water as necessary. Overall, there are currently no concerns over reservoir water supplies.

On Farm Water Supply

Farm water supply updates from Manitoba Agriculture's final Crop Report: Issue 25 (October 16th, 2017) are summarized in Table 1. If conditions were not commented on within Issue 25, the date corresponding to the most recently reported conditions is provided in brackets.

Table 1: On Farm Water Supply (Dugout) Conditions.

Region	General Dugout Condition
Eastern	The availability of livestock water was rated as adequate. Late summer rains helped to fill dugouts.
Interlake	Dugouts are 10 - 50% full and water quality varies from poor to good.
Southwest	60 % full (September 25th).
Central	85 % adequate (October 2nd). Livestock water supply is low - groundwater has declined, dugouts are lower than normal and many sloughs are drying up.
Northwest	95 to 100 % adequate. Some dugouts rated at 50 to 60 % full. Reports of isolated cases of dugouts drying up. Poor water quality is also concern with lower water levels.

This information indicates that in many instances on-farm water supplies will require adequate snowfall to be replenished for next summer, in contrast to the previous few years where above normal precipitation has generally kept on-farm supplies nearly full all year round.

Soil Moisture

Manitoba Agriculture's mapping of topsoil (0 – 30 cm) conditions as of November 6th, 2017 show most of agro-Manitoba was experiencing adequate to dry topsoil conditions (Figure 6). Dry soil moisture conditions were located primarily in the southwest region and the municipalities surrounding Lake Manitoba; however, isolated regions of dry conditions also existed within the northwest, central and eastern districts. Alonsa (northwest) and Moosehorn (Interlake) reported very dry conditions. Topsoil moisture condition maps are available at: http://www.gov.mb.ca/agriculture/weather/pubs/topsoil-moisture-conditions.pdf.

Aquifers

Groundwater levels in major aquifers are generally good. Groundwater hydrographs from 2014 to the end of October 2017 for the Assiniboine Delta aquifer, the Oak Lake aquifer, and the Carbonate aquifer near Anola are provided on Figure 7.

Water level responses to seasonal or yearly precipitation fluctuations in most aquifers lag considerably behind surface water responses, so even prolonged periods of below normal precipitation may not have a significant negative effect on groundwater levels. Most aquifers also store very large quantities of groundwater and can continue to provide water during extended periods of dry weather. Consequently, the major concern regarding groundwater and dry periods relates to water levels in shallow wells constructed in near surface sand aquifers. As the water table drops, there is less available drawdown in shallow wells and some wells may 'go dry', even in short-term drought conditions.

Wildland Fires

The Provincial Wildfire Program reported 11 wildfires during October, bringing the wildfire season to a close with a total of 543 wildfires as of October 27th, 2017. A total of 170,107 hectares were burned by this date overall, with approximately 610 hectares occurring in October (0.4 % of the overall total). High Drought Code values at the end of the wildfire season (October 31st, 2017) highlight the cumulative effects of the dry conditions throughout most of the growing season on the average moisture content of deep, compact organic layers (Figure 8).

Drought Impacts

Overall, drought impacts reported within Manitoba for the month of October have mostly been minimal to moderate. However, one instance of severe impacts was reported.

The Agroclimate Impact Reporter is a Canadian database of agroclimate impacts that is managed by the National Agroclimate Information Service of Agriculture and Agri-Food Canada. During the month of October, three municipalities registered minimal drought impacts on agricultural operations, one reported moderate drought impacts and one reported severe drought impacts with the Impact Reporter. Most of these reports continued to come from the southwest (60 %; one severe report in the RM of Wallace), with the remaining reports from the central and northwest regions. There were no drought impacts reported from the eastern region. These reports generally echo the impacts summarized in the Manitoba Crop Reports below.

Manitoba Agriculture reports that harvest is complete across the province. Overall, despite the dry conditions during much of the growing season, in most regions crop yields for spring cereals and canola are better than average. However, lower soybean yields were reported due to dry conditions during pod filling. Additional information on reported yields can be found in Manitoba Agriculture's Crop Reports.

Hay and pasture land conditions are reported to be variable across agro-Manitoba. In the southwest, some areas reported that feed quality is poor and will need to be supplemented to increase quality. The northwest region reported forage yields in the Roblin area and corn silage yields around Swan River were lower due to the dry conditions. Pastures with less management were reported as suffering from overgrazing. In the central region, livestock feeding is above average due to dry conditions. Overstocked pastures or those on lighter soils stopped growth in the late summer providing very little regrowth for grazing. In the eastern region, soil moisture conditions on hay and pasture land were reported as 20 % short and 20 % very short (60 % adequate). Some producers began feeding livestock several weeks earlier than last year due to dried up pastures. Straw is rated as 10 % inadequate (90 % adequate). Pastures in the Interlake are rated as fair to good. There are concerns about low dugout levels and subsoil moisture needs to be replenished.

Drought continues to persist in North Dakota. However, conditions are improving. For up to date drought information on drought conditions in North Dakota, visit http://www.ndresponse.gov/.

Future Weather

Environment and Climate Change Canada's seasonal forecast for the next three months (November-December-January) projects temperatures to be below normal across Manitoba (Figure 9). Precipitation over the next three months is forecasted to be above normal across the Lake Manitoba and Lake Winnipeg basins and a large portion of the Nelson River drainage basin in Saskatchewan and Alberta. The reminder of Manitoba is forecasted as normal (Figure 10). The National Oceanic and Atmospheric Administration indicates that ENSO neutral conditions are currently present. There is an increasing chance (55 – 60 %) of La Niña conditions during the fall and winter of 2017 – 2018 in the Northern Hemisphere.

Table 2: Reservoir Status (Southern and Western Manitoba).

Water Supply Reservoir Levels and Storages – November 6th, 2017.								
Lake or Reservoir	**Community Supplied**	**Target Level (feet)**	**Latest Observed Level (feet)**	**Observed date**	**Supply Status (Recent - Target) (feet)**	**Storage at Target Level (acre-feet)**	**Storage at Observed Level (acre-feet)**	**Supply Status (observed storage/target storage) (%)**
Lake of the Prairies (Shellmouth)[1]	Brandon, Portage	1,402.5*	1,399.27	November 1, 2017	-3.23	300,000	260,295	87%
Lake Wahtopanah (Rivers)	Rivers	1,536*	1,535.43	November 11, 2017	-0.57	24,500	23,868	97%
Minnewasta (Morden)	Morden	1,082*	1,079.38	November 2, 2017	-2.62	3,150	2,730	87%
Stephenfield	Carman	972*	970.22	October 28, 2017	-1.78	3,810	2,982	78%
Vermilion	Dauphin	1,274*	1,273.70	November 6, 2017	-0.30	2,600	2,522	97%
Goudney (Pilot Mound)		1,482*	1,482.02	November 11, 2017	0.02	450	451	100%
Jackson Lake		1,174*	1,170.85	November 6, 2017	-3.15	2,990	2,217	74%
Manitou (Mary Jane)		1,537*	1,535.91	November 6, 2017	-1.09	1,150	1,053	92%
Turtlehead (Deloraine)	Deloraine	1,772*	1,770.44	November 6, 2017	-1.56	1,400	1,317	94%
Kenton Reservoir		1,448	1,447.03	**September 22, 2017**	-0.97	600	527	88%
Killarney Lake		1,615	1,614.06	**September 11, 2017**	-0.94	7,360	6,929	94%
Lake Irwin		1,178	1,175.43	**September 12, 2017**	-2.57	3,800	2,599	68%
Elgin	Elgin	1,532	1,531.20	**September 21, 2017**	-0.80	520	464	89%
Rapid City		1,573.5	1,573.39	**September 22, 2017**	-0.11	200	192	96%
St. Malo		840	839.70	**August 31, 2017**	-0.30	1,770	1,722	97%

[1] Summer target level and storage.
* Real-time water level gauge.

Drought Definitions

Meteorological Drought is generally defined by comparing the rainfall in a particular place and at a particular time with the average rainfall for that place. Meteorological drought leads to a depletion of soil moisture and this almost always has an impact on agricultural production. Meteorological droughts only consider the reduction in rainfall amounts and do not take into account the effects of the lack of water on water reservoirs, human needs or on agriculture. A meteorological drought can occur without immediately impacting streamflow, groundwater, or human needs. If a meteorological drought continues, it will eventually begin to affect other water resources.

Agricultural Drought occurs when there is not enough water available for a particular crop to grow at a particular time. Agricultural drought depends not only on the amount of rainfall but also on the use of that water. Agricultural droughts are typically detected after meteorological drought but before a hydrological drought. If agricultural drought continues, plants will begin to protect themselves by reducing their water use, which can potentially reduce crop yields.

Hydrological Drought is associated with the effect of low rainfall on water levels in rivers, reservoirs, lakes, and aquifers. Hydrological droughts are usually noticed some time after meteorological droughts. First, precipitation decreases and after some time, water levels in rivers and lakes drop. Hydrological drought affects uses that depend on water levels. Changes in water levels affect ecosystems, hydroelectric power generation, and recreational, industrial and urban water use. A minor drought may affect small streams causing low streamflows or drying. A major drought could impact surface storage, lakes, and reservoirs thereby affecting water quality and causing municipal and agricultural water supply problems.

Rainfall also recharges groundwater aquifers through infiltration through the soil and run-off into streams and rivers. Once groundwater and surface waters are significantly impacted by lack of precipitation, a “hydrologic drought” occurs. Aquifer declines can range from a quick response (shallow sand) to impacts extending over multiple years. Impacts can include depletion of shallow depth wells, drying of farm dugouts, and changes to ground water quality.

Socioeconomic Drought occurs when the supply fails to meet the demand for an economic good(s) such as domestic water supplies, hay/forage, food grains, fish, and hydroelectric power, due to weather related water supply shortages from one or both of natural or managed water systems. At any time during meteorological, hydrological, or agricultural droughts, a socioeconomic drought can occur.

Acknowledgements

This report was prepared with information from the following sources which are gratefully acknowledged:

- Manitoba Infrastructure - Reservoir level information: *http://www.gov.mb.ca/mit/floodinfo/floodoutlook/river_conditions.html*
- Environment and Climate Change Canada: Flow and lake level information: *http://www.wateroffice.ec.gc.ca/index_e.html*
- Manitoba Sustainable Development's Fire Program: *http://www.gov.mb.ca/conservation/fire/*
- Environment and Climate Change Canada three month climatic outlook: *http://weatheroffice.gc.ca/saisons/index_e.html*
- Manitoba Agriculture: *http://www.gov.mb.ca/agriculture/crops/seasonal-reports/crop-report-archive/index.html*
- AAFC Drought Watch (including the Canadian Drought Monitor): *http://www.agr.gc.ca/drought*
- United States Drought Monitor: *droughtmonitor.unl.edu/*
- National Oceanic and Atmospheric Administration: ENSO: Recent Evolution, Current Status and Predictions: *http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf*

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Past reports are available on the Manitoba Drought Monitor website.

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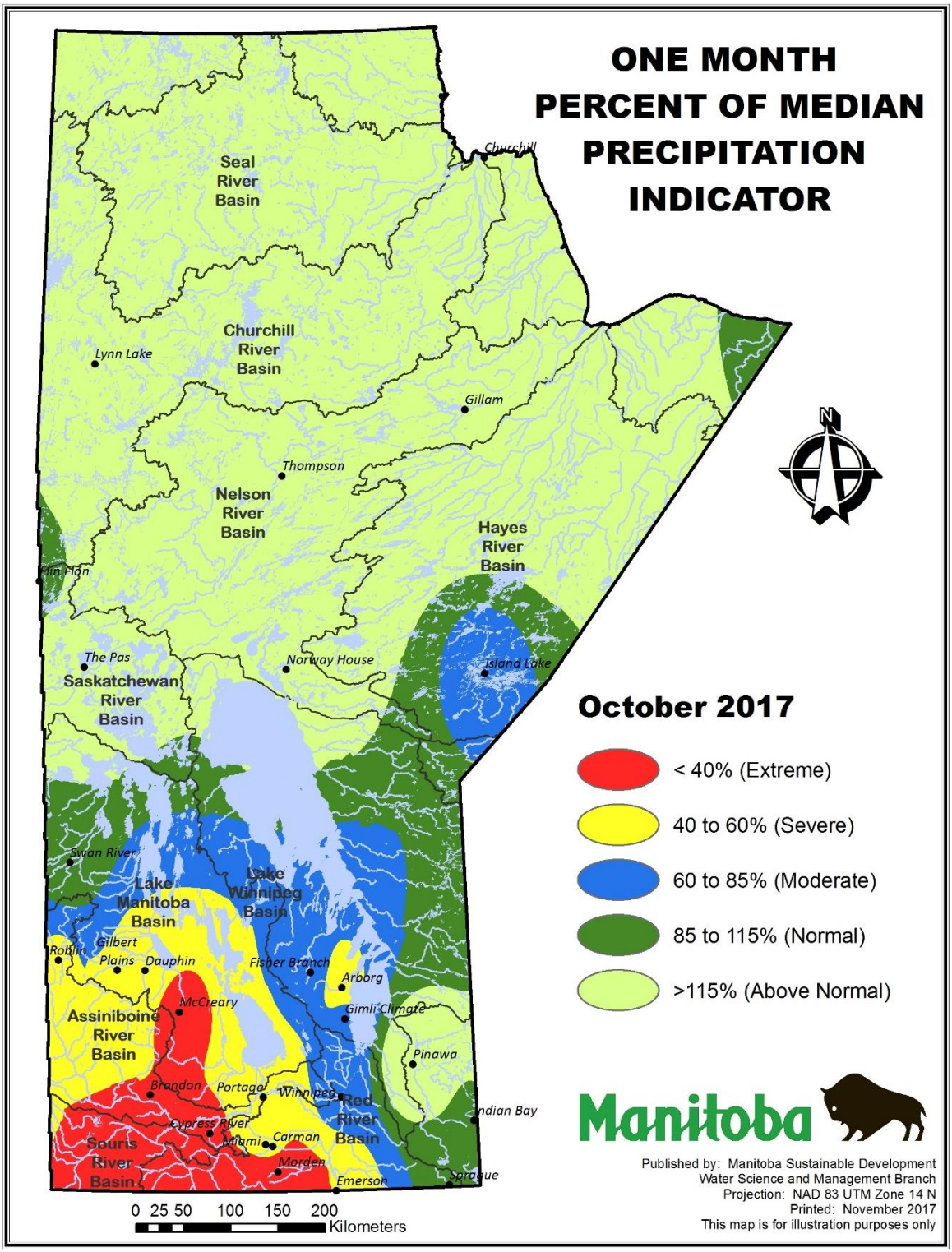

Figure 1: Short term precipitation indicator (percent of one month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

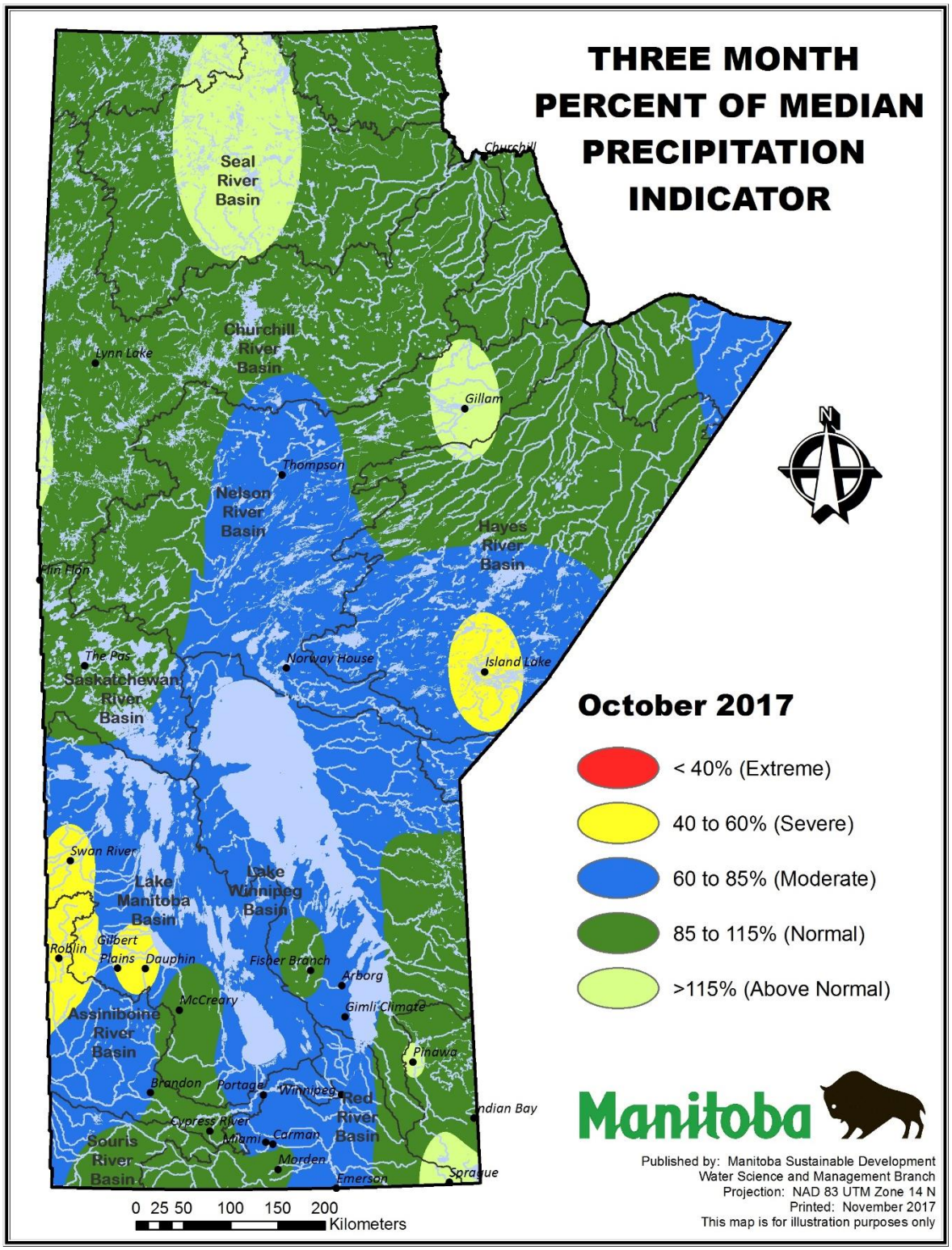

Figure 2: Medium term precipitation indicator (percent of three month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

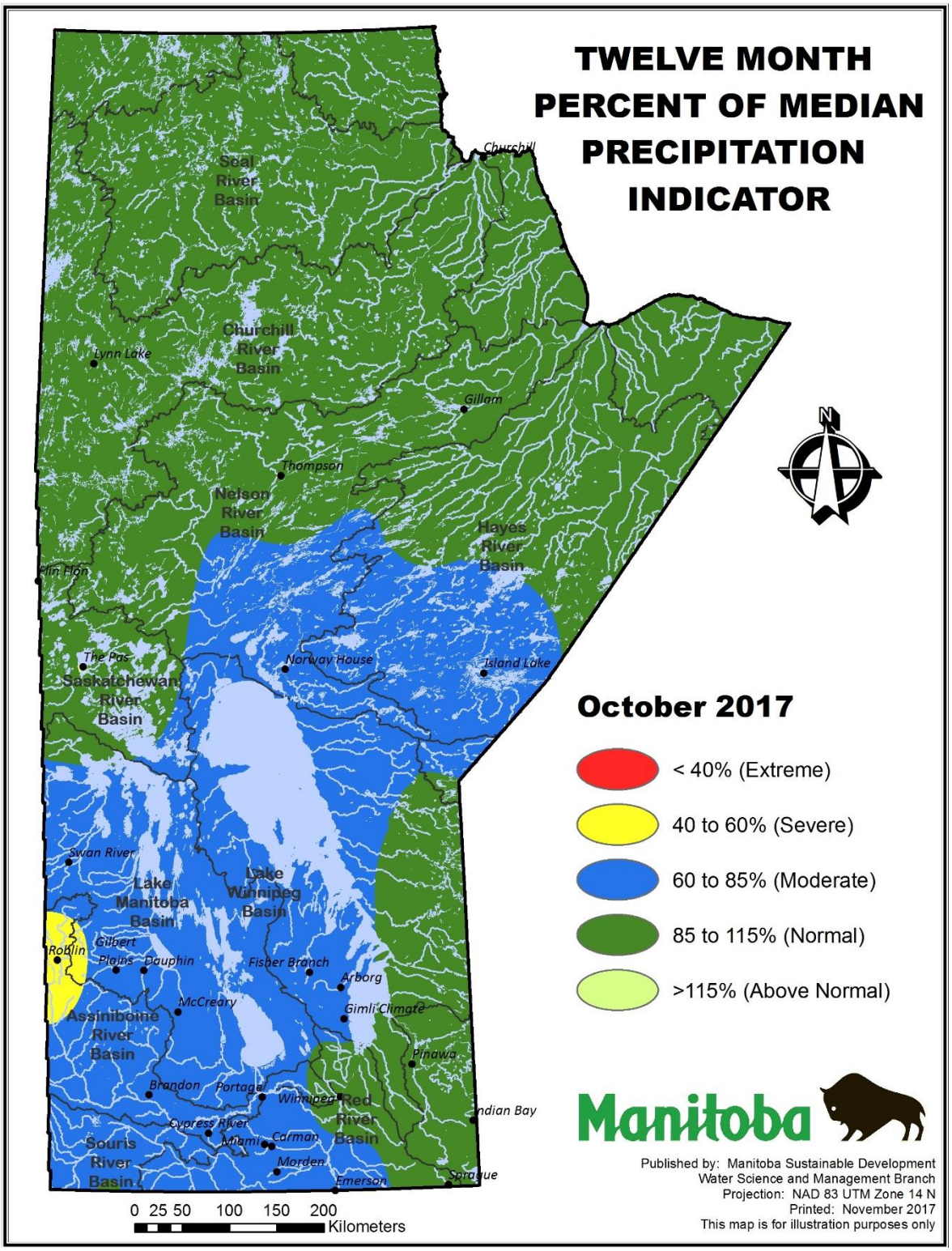

Figure 3: Long term precipitation indicator (percent of twelve month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

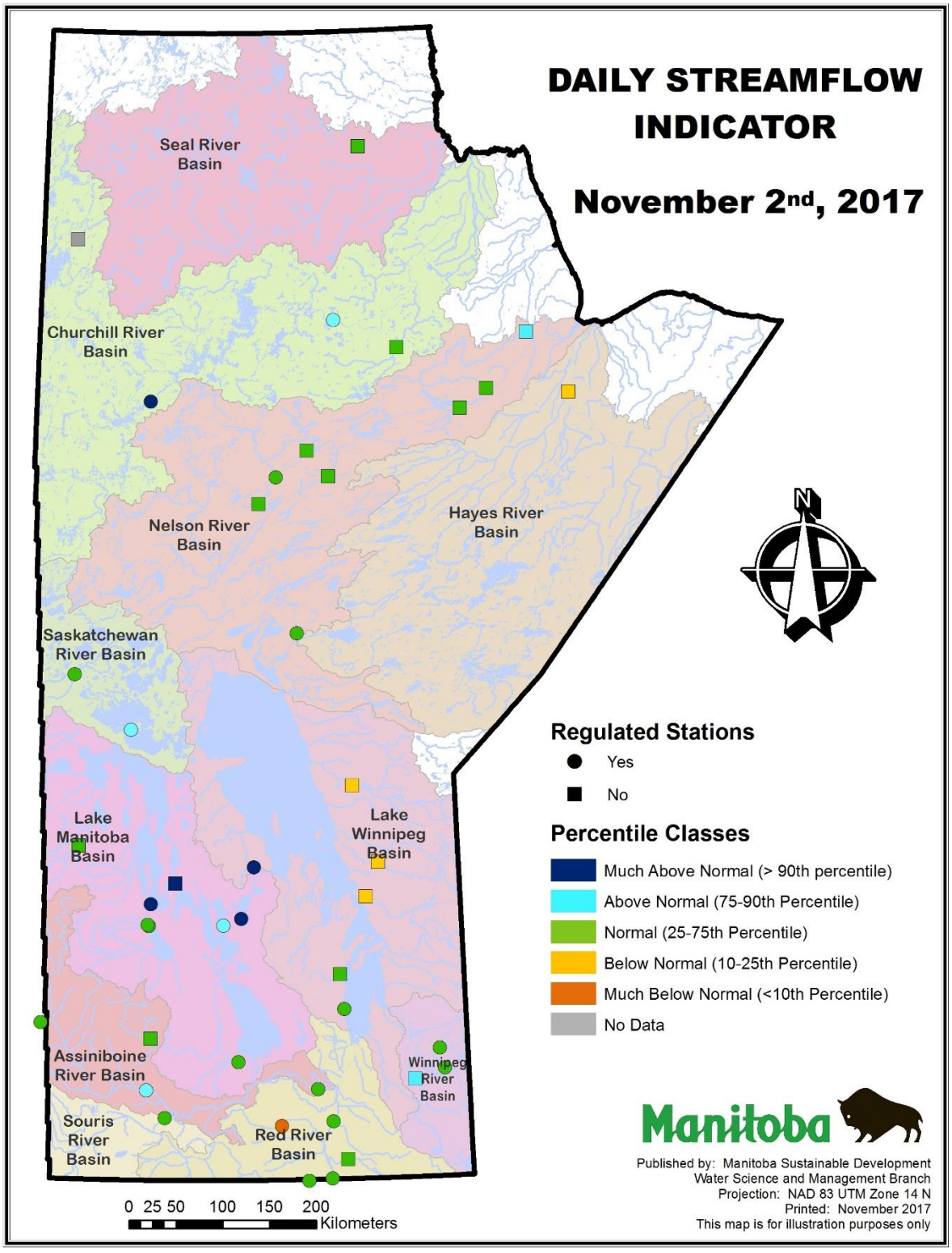

Figure 4: Daily streamflow indicator for November 2nd, 2017. Real-time daily streamflow and water levels are compared to historical values for the specified day.

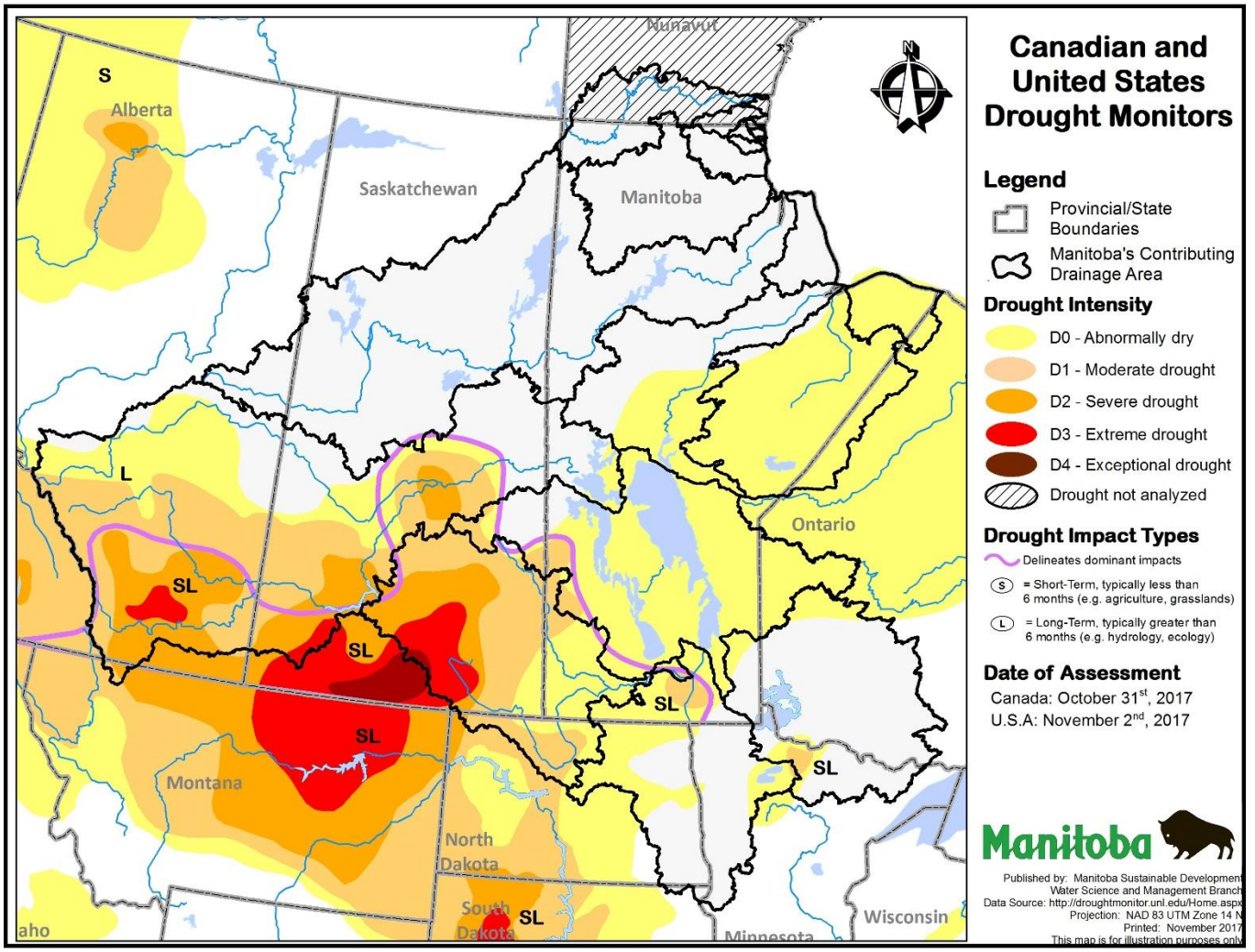

Figure 5: Canadian and United States Drought Monitors' classification of short-term (S) and long-term (L) drought conditions. Canadian Drought Monitor assessment date is October 31st, 2017. United States Drought Monitor assessment date is November 2nd, 2017.

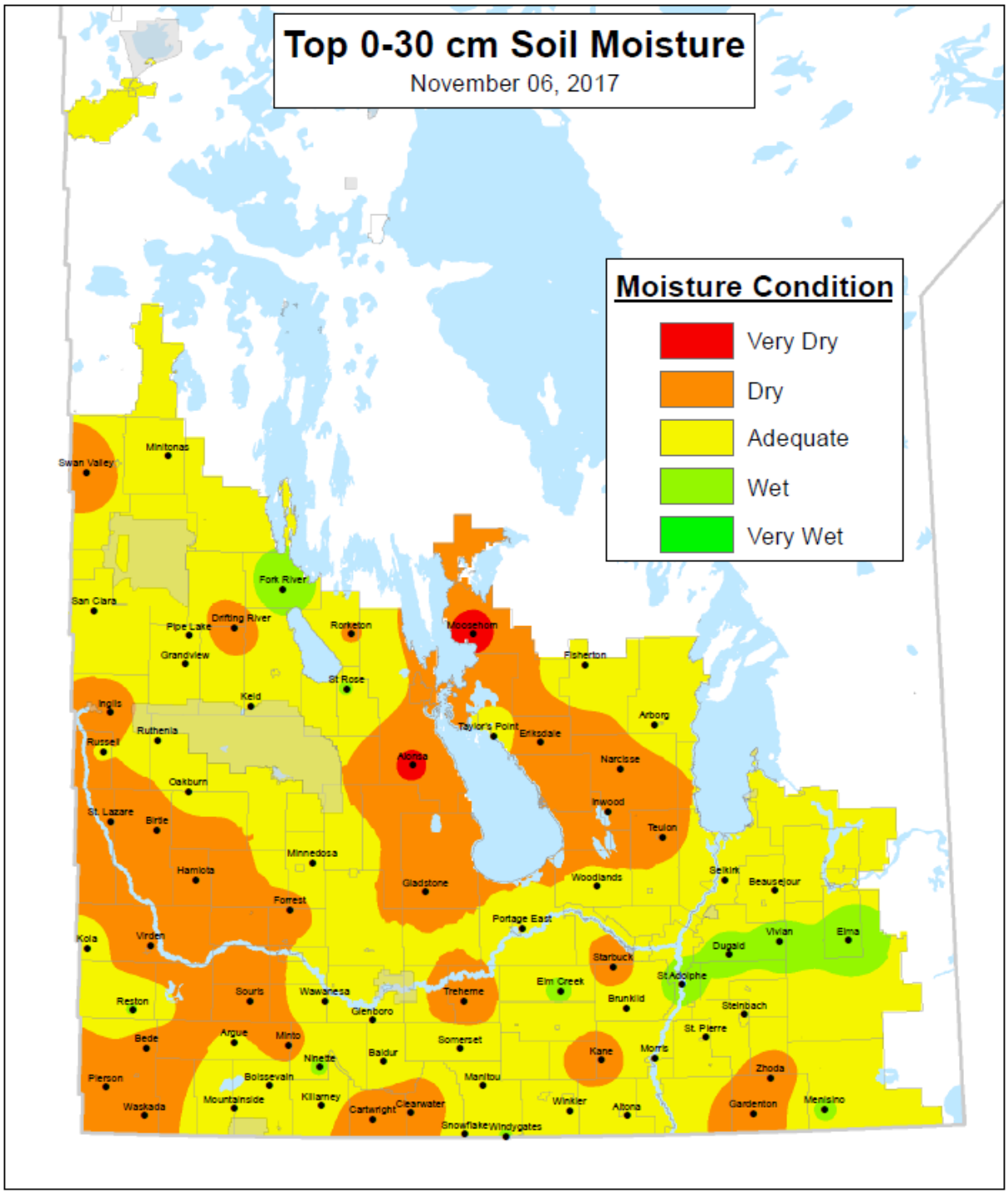

Figure 6: Manitoba Agriculture's November 6th, 2017 mapping of soil moisture conditions in the top 0 – 30 cm.

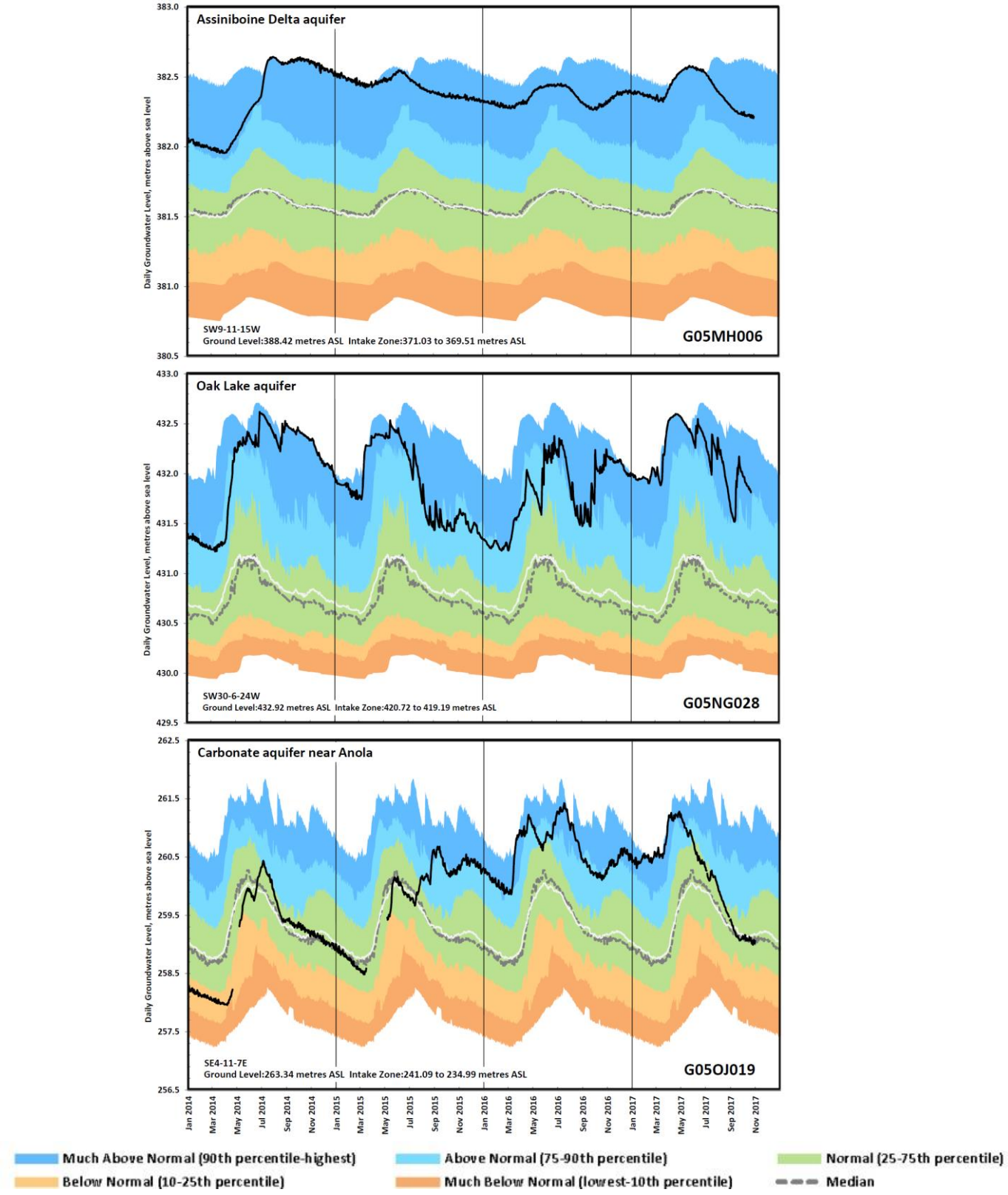

Figure 7: Groundwater hydrographs from 2014 to November 1st for the Assiniboine Delta aquifer, the Oak Lake aquifer, and the Carbonate aquifer near Anola.

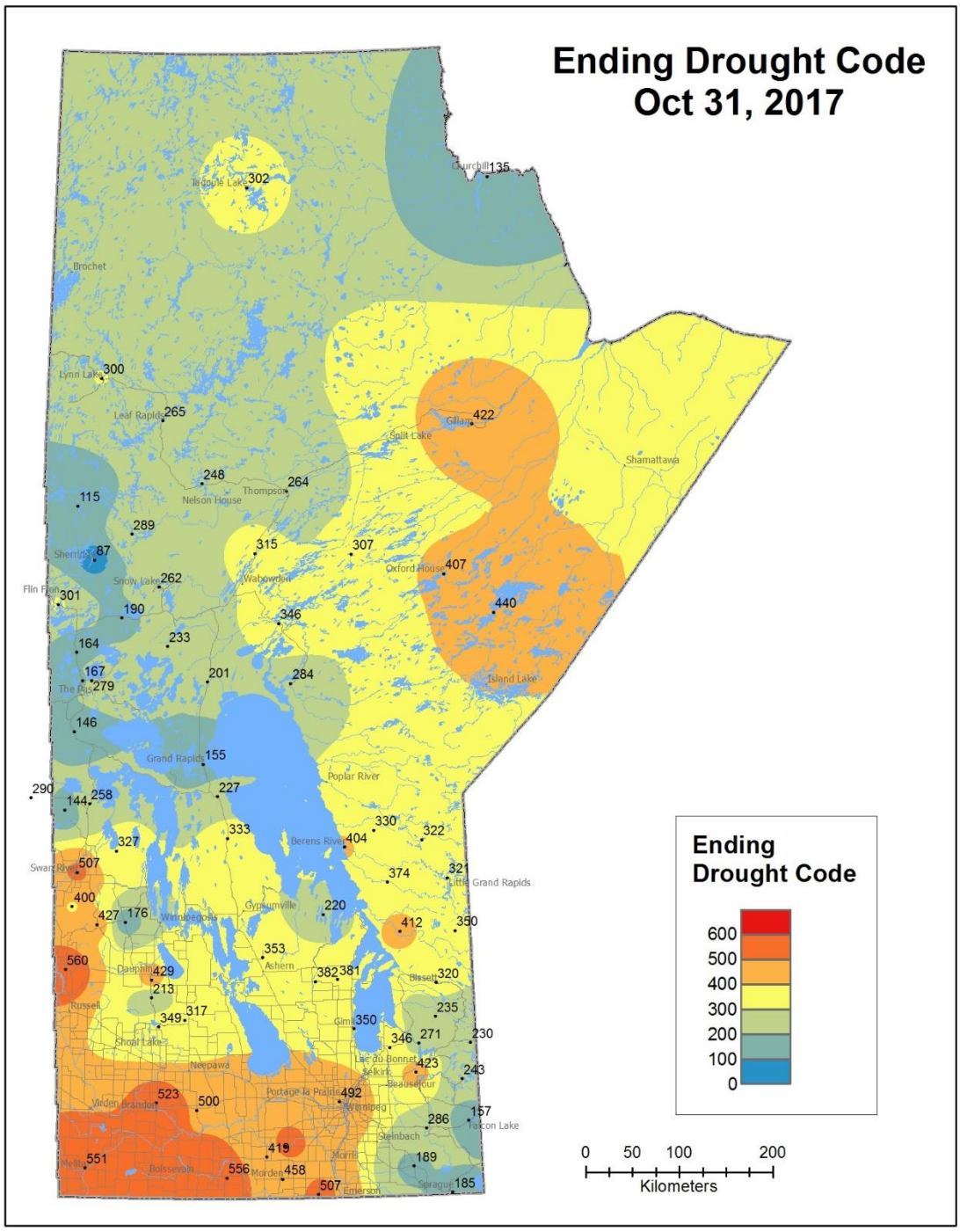

Figure 8: Wildfire hazard mapping for October 31st, 2017, showing the Drought Code component of the Canadian Forest Fire Weather Index System. Map generated by the Manitoba Fire Program.

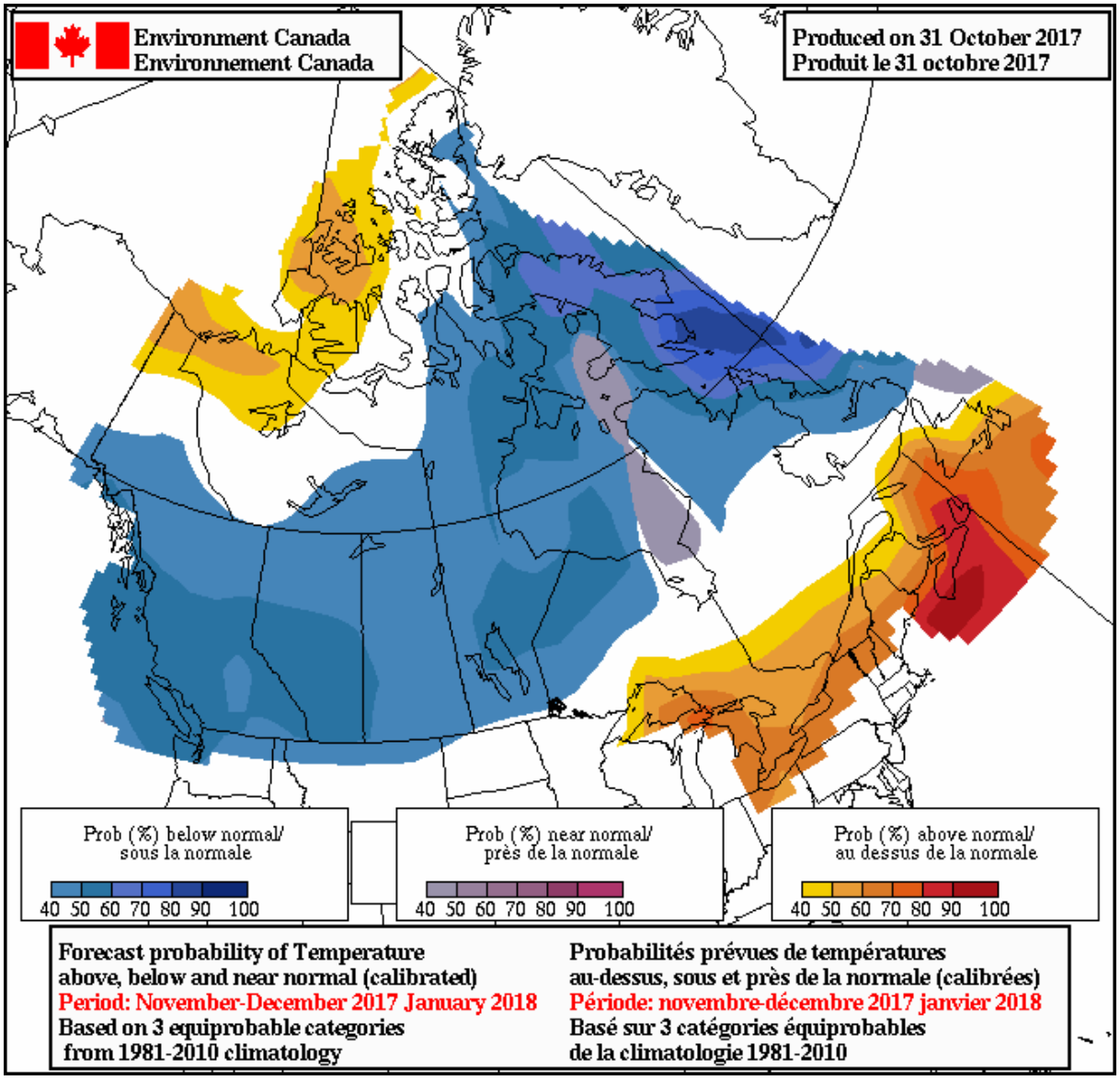

Figure 9: Environment and Climate Change Canada's seasonal (three month) temperature outlook for November-December-February.

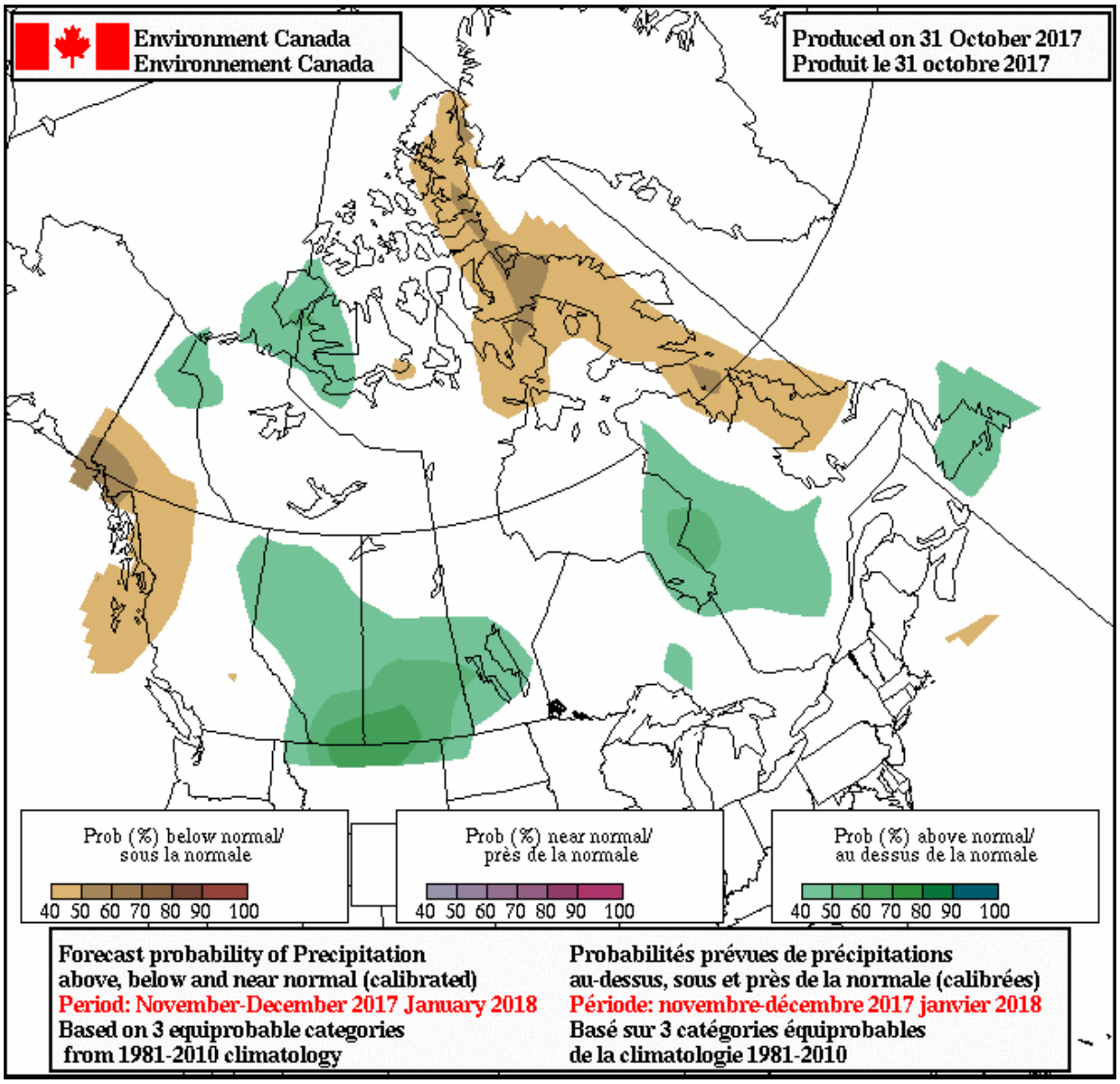

Figure 10: Environment and Climate Change Canada's seasonal (three month) precipitation outlook November-December-January.