Water Availability and Drought Conditions Report

August 2017

Executive Summary

- This Water Availability and Drought Conditions Report provides an update on drought conditions throughout Manitoba for August 2017.
- During the short term (one month) Manitoba saw continued dryness with most of the province experiencing moderately to extremely dry precipitation conditions, except for a few areas that observed normal amounts of precipitation.
- During the medium term (three months) almost all of Manitoba experienced moderately dry precipitation conditions, with some areas of severely dry conditions. The areas surrounding Churchill, Indian Bay and Dauphin experienced normal precipitation conditions.
- Over the long term (twelve months), most of Manitoba experienced normal to above normal precipitation, except for most of the Interlake, central Manitoba and a region surrounding Roblin which experienced moderately dry conditions.
- Most streamflows and lake levels across the province are normal. However, several tributaries in southern Manitoba dropped to below normal or much below normal conditions. In northern Manitoba, the Hayes River is below normal, and some northerly tributaries to the Nelson River are observing below normal to much below normal flows.
- There are currently no major concerns over reservoir water supplies. There have been reports of dugouts getting low across agro-Manitoba, suggesting on-farm water supplies would benefit from future precipitation and adequate snowfall over the coming winter.
- As of September 1st, 2017, there have been 501 wildfires burning a total of 148,376 hectares in Manitoba. Large evacuations of several northern communities occurred during August due to continued warm temperatures and dry and windy conditions.
- Most of agro-Manitoba would benefit from additional precipitation at this time for late season crops and pastures. Topsoil conditions across most of agro-Manitoba are classified as dry.
- Environment and Climate Change Canada's seasonal temperature forecast for August, September and October 2017 is projected to be above normal across Manitoba. The seasonal precipitation forecast is projected to be normal across most of the province with a few pockets of below normal precipitation.
- For more information on drought in Manitoba, please visit the Manitoba Drought Monitor website.

Manitoba
Sustainable Development

Drought Indicators

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

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) Manitoba saw continued dryness with much of the province observing moderately dry (60 - 85 % of median) or severely dry (40 - 60 % of median) precipitation conditions, while many locations across Manitoba experienced extremely dry (< 40 % of median) precipitation conditions (Figure 1). Exceptions include the southwest corner of the province, an isolated area surrounding McCreary, and a portion of the Seal River Basin which experienced normal or above normal precipitation over the past month.

Over the medium term (three months), the area of moderately dry precipitation conditions expanded to include almost the entirety of Manitoba with some areas of severely dry conditions (Figure 2). Areas surrounding Churchill, Indian Bay and Dauphin experienced normal precipitation conditions.

Over the long term (twelve months), most of Manitoba experienced normal to above normal precipitation conditions (Figure 3). However, most of the Interlake, central Manitoba and a region surrounding Roblin experienced moderately dry conditions during this period.

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 September 1st, 2017.

As of the beginning of September, most southern Manitoba rivers, tributaries and lakes were within the normal range (25 – 75th percentile), with a few locations reporting above normal (75 – 90th percentile) flows or levels. Lake Manitoba and Lake St. Martin are still reporting levels that are much above normal (> 90th percentile). However, several tributaries in southern Manitoba have begun to experience below normal conditions (10 – 25th percentile; Little Saskatchewan

River near Minnedosa, Souris River at Wawanesa, Whitemud River at Westbourne) or much below normal conditions (< 10th percentile; Bloodvein River above Bloodvein Bay).

Streamflows along northern Manitoba rivers and tributaries show a range of conditions, with the majority of locations reporting normal to much above normal flows. However, the Hayes River below Gods River is experiencing below normal flows, and some northerly tributaries to the Nelson River (Limestone River near Bird, Weir River above the mouth, and Kettle River near Gillam) are observing below normal to much below normal flows for this time of year.

Streamflow percentile plots for select Manitoba rivers are available on the Manitoba Drought Monitor website under the *Current Drought Conditions* 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. The 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, and use the following drought classification system:

- D0 (Abnormally Dry) – represents an event that occurs every 3 - 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 August 31st Canadian Drought Monitor assessment indicate that the bottom two-thirds of Manitoba is experiencing short term moderately dry (D0) conditions. Parts of central, southwest and northwest agro-Manitoba are classified as moderate drought (D1) conditions. The Saskatchewan and North Dakota portions of the Assiniboine-Souris River Basin are experiencing severe (D2) to extreme (D3) drought conditions, while the headwaters of the Saskatchewan River Basin are classified at moderate to severe drought.

The Unites States Drought Monitor indicated as of August 29th, 2017, drought conditions in North Dakota are still present but improved through August. The pockets of D4 (exceptional drought)

have almost all been degraded to D3 (extreme drought), and the amount of D3 area in the state has reduced by half. Most of the province was experiencing D0 to D2 (severe drought conditions) as of August 29th, 2017. Minnesota continued to observe D0 and D1 conditions in the northwest corner of the state.

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 September 1st, 2017, there are a range of water supply conditions observed at the fifteen reservoirs monitored across southern Manitoba. Of the real-time reservoirs, five of the eight are close to (> 90 %) or at full supply level. Jackson Lake (85 % of full supply level), Stephenfield (76 %) and Vermillion (62 %) are reporting lower supply status values, as denoted within the brackets.

The non-automated water supply reservoirs have water levels measurements taken between April 26th (Kenton, Rapid City) and July 26th (Elgin), 2017. Of these six reservoirs, five are reported at ≥ 97 % of full supply level. Rapid City and Kenton reservoirs are scheduled to receive site visits during the month of September and level readings will be taken at that time.

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

On Farm Water Supply

Manitoba Agriculture's Crop Report: Issue 19 (September 5th, 2017) summarized farm water supply as follows (Table 1):

Table 1: On Farm Water Supply (Dugout) Conditions

Region	General Dugout Condition
Eastern	Dugouts are low, approximately 25% full
Interlake	25 to 40 % full
Southwest	50 % full
Central	Adequate, but rain is needed to refill dugouts
Northwest	Low water levels have producers monitoring their livestock water sources

This information suggests that on-farm water supplies will require precipitation and 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.

Aquifers

Groundwater levels in major aquifers are generally good. Groundwater hydrographs from 2014 to the end of August 2017 for the Assiniboine Delta aquifer, the Oak Lake aquifer, and the Carbonate aquifer near Anola are provided on Figure 6.

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

Throughout much of August, continued warm temperatures and dry conditions kept fire danger levels elevated in most forested areas of the province. The Provincial Wildfire Program reported 107 wildland fires occurred during August, bringing the total number of fires to 501 as of September 1st. A total of 148,376 hectares were burned by this date, in comparison to the beginning of August, when the total burned area was 31,688 hectares (an increase of 370 %). Most of the area burned is located in the northeast (87 %) and eastern (10 %) portions of the province, with the remaining regions accounting for the last two per cent.

Fire crews battled several major fires during the month of August. A wildfire northwest of Lynn Lake resulted in the closure of PR 394 and also impacted the community of Kinoosao, Saskatchewan. The community of Poplar River had to be evacuated as a safety precaution due to a large and persistent wildfire that ignited the first week of August (approximately 4,600 hectares in size). Fox Lake First Nation (to the east of Split Lake) was temporarily evacuated as a safety precaution due to an encroaching wildfire (approximately 2,000 hectares in size). A wildfire starting mid-August in the Island Lake region (approximately 23,000 hectares in size) resulted in the evacuation of Wasagamack First Nation, St. Theresa Point and Garden Hill First Nation. The Canadian Red Cross continues to manage the evacuations.

As of September 1st, there were 128 fires still actively burning. The Poplar River wildfire was about 3.5 km from the community, the wildfire near Fox Lake First Nation was approximately 6 kilometres from the community and the Island Lake fire was within one kilometer of Wasagamack

First Nation. Fire crews and water bombers continue suppression work on these wildfires, and wildfire risk remains moderate to extreme in many regions (Figure 8). Some areas of the province may have experienced (or continue to experience) degraded air quality due to the fires in Manitoba, as well as wildfire smoke drifting from British Columbia and the Northwest Territories. More up to date wildfire conditions and restrictions, including burning bans, are available at the Wildfire Program's website (www.gov.mb.ca/wildfire).

Drought Impacts

Overall, drought impacts reported within Manitoba for the month of August have ranged from minimal to severe.

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 July, five municipalities registered minimal drought impacts on agricultural operations, eleven reported moderate drought impacts and two reported severe drought impacts with the Impact Reporter.

Most of these reports came form the southwest (39 %; one report of severe drought impacts) and central (33 %; one report of severe drought impacts) agricultural regions, with the remainder from the northwest (11 %), Interlake (6 %) and eastern (11 %) regions. The Agroclimate Impact reporter also presents these impacts in map format, which can be seen on Figure 7. The map demonstrates that the lack of precipitation during the 2017 growing season has resulted in essentially all of agro-Manitoba experiencing minimal to moderate drought impacts to agricultural operations, with some areas severely impacted.

Manitoba Agriculture's mapping of topsoil (0 – 30 cm) conditions as of September 5th show most of agro-Manitoba is experiencing dry topsoil conditions, with very dry conditions in parts of the southwest region (RMs of Two-Borders, Wallace-Woodworth, Sifton and Grassland), central region (RMs of Norfolk-Treherne, Cartwright-Roblin and Louise), eastern region (RMs of Stuartburn and Piney), and the Interlake (RMs of Armstring, West Interlake and Grahamdale). Some areas of adequate topsoil moisture exist, primarily in the central and northwest regions. Manitoba Agriculture reports that rain is still needed for late season crops and on pastures, as many pastures are dry and rated to be in poor or very poor condition. The central region reported that supplemental feeding is expected to start earlier than usual this year due to the poor condition of pastures.

Currently, harvest is underway across the province, with good progress being made in cereal crops and canola. Reported yields can be found in Manitoba Agriculture's Crop Reports.

Drought continues to persist in North Dakota, however conditions are improving. Emergency programs remain in place, such as the Emergency Hay Transportation Assistance Program and

the Livestock Water Supply Program. For up to date drought information in North Dakota, visit http://www.ndresponse.gov/.

Future Weather

Environment and Climate Change Canada's seasonal forecast for the next three months (August-September-October) projects temperatures to be above normal across Manitoba (Figure 9). Precipitation over the next three months is forecasted to be normal except for two isolated pockets forecasted to be below normal (northwest agro-Manitoba and towards the northwestern corner of the province; Figure 10). The National Oceanic and Atmospheric Administration indicate that ENSO neutral conditions are currently present. ENSO neutral conditions are favoured throughout the Northern Hemisphere during winter 2017 - 2018.

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

Water Supply Reservoir Levels and Storages – September 1st, 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	1,402.71*	September 1, 2017	0.21	300,000	302,548	101%
Lake Wahtopanah (Rivers)	Rivers	1,536	1,535.85*	September 1, 2017	-0.15	24,500	24,333	99%
Minnewasta (Morden)	Morden	1,082	1,080.85*	August 6, 2017	-1.15	3,150	2,959	94%
Stephenfield	Carman	972	970.04*	August 23, 2017	-1.96	3,810	2,898	76%
Vermilion	Dauphin	1,274	1,270.22*	September 1, 2017	-3.78	2,600	1,607	62%
Goudney (Pilot Mound)		1,482	1,482.03*	September 1, 2017	0.03	450	451	100%
Jackson Lake		1,174	1,172.19*	September 1, 2017	-1.81	2,990	2,540	85%
Manitou (Mary Jane)		1,537	1,536.58*	September 1, 2017	-0.42	1,150	1,112	97%
Turtlehead (Deloraine)	Deloraine	1,772	1,771.36*	**July 30, 2017**	-0.64	1,400	1,368	98%
Kenton Reservoir		1,448	1,448.43	**April 26, 2017**	0.43	600	617	103%
Killarney Lake		1,615	1,615.06	**June 12, 2017**	0.06	7,360	7,388	100%
Lake Irwin		1,178	1,177.82	**July 6, 2017**	-0.18	3,800	3,693	97%
Elgin	Elgin	1,532	1,531.77	**July 26, 2017**	-0.23	520	504	97%
Rapid City		1,573.5	1,572.90	**April 26, 2017**	-0.60	200	158	79%
St. Malo		840	840.49	**June 5, 2017**	0.49	1,770	1,851	105%

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

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*

For further information, please contact:

Carly Delavau, Ph.D, P.Eng.
Water Supply and Drought Management Engineer
Surface Water Management Section, Water Science and Watershed Management Branch
Manitoba Sustainable Development
Box 14, 200 Saulteaux Crescent
Winnipeg, Manitoba R3J 3W3
Ph. (204) 806-4557, Fax (204) 945-7419
E-mail Carly.Delavau@gov.mb.ca

Past reports are available on the Manitoba Drought Monitor website.

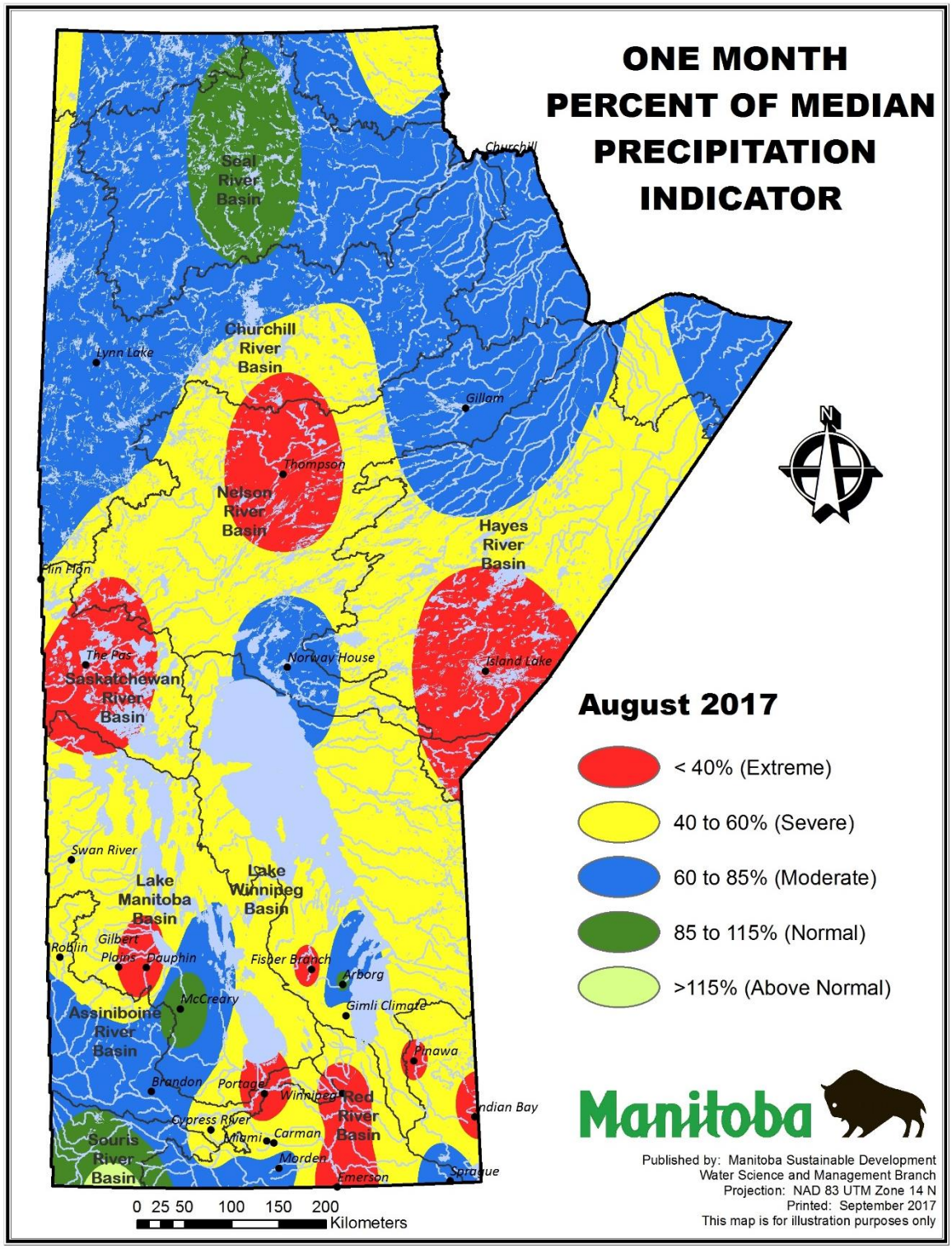

Figure 1: Short term precipitation indicator (percent of one month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

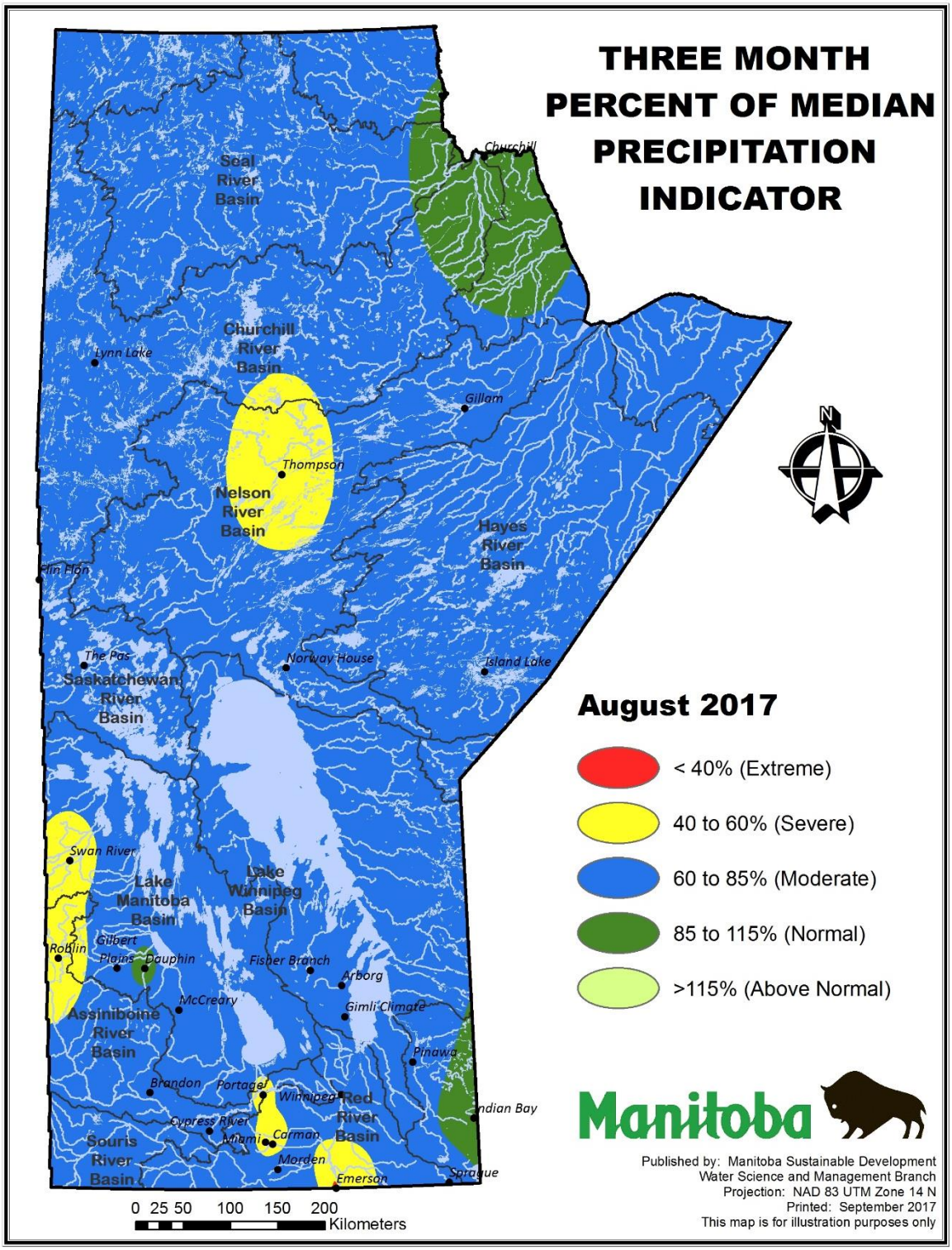

Figure 2: Medium term precipitation indicator (percent of three month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

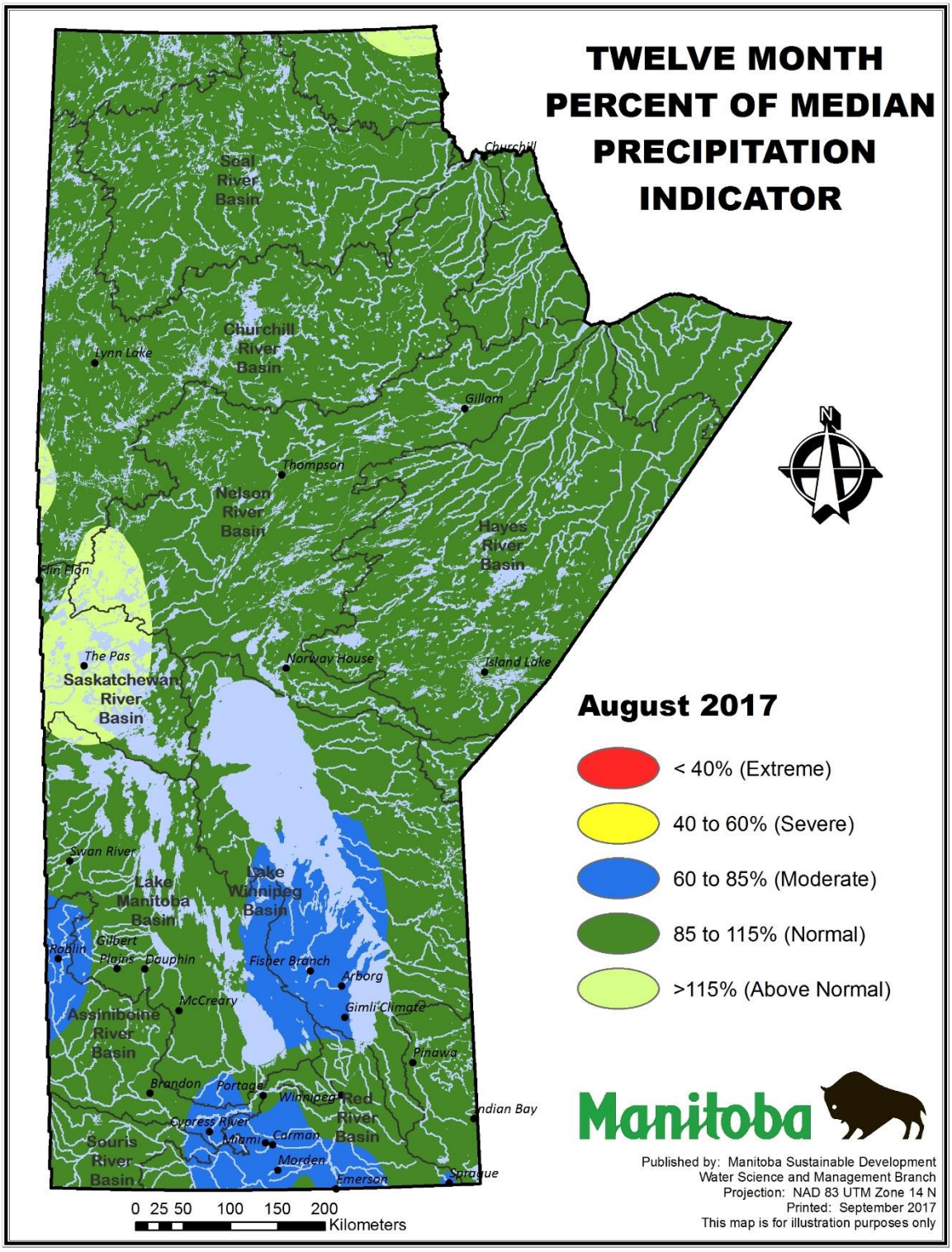

Figure 3: Long term precipitation indicator (percent of twelve month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

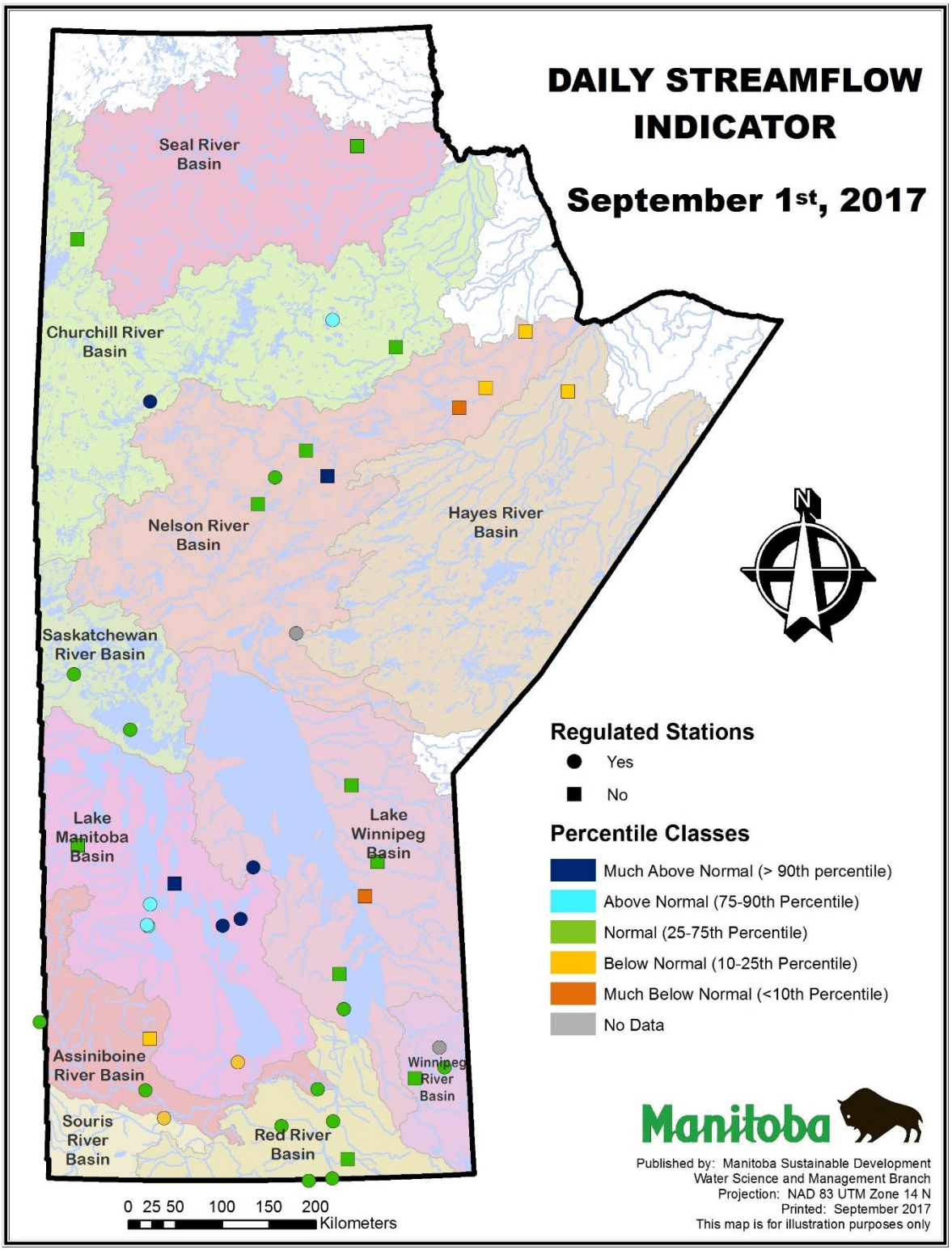

Figure 4: Daily streamflow indicator for September 1st, 2017. Real-time daily streamflow and water levels are compared to historical values for the specified day.

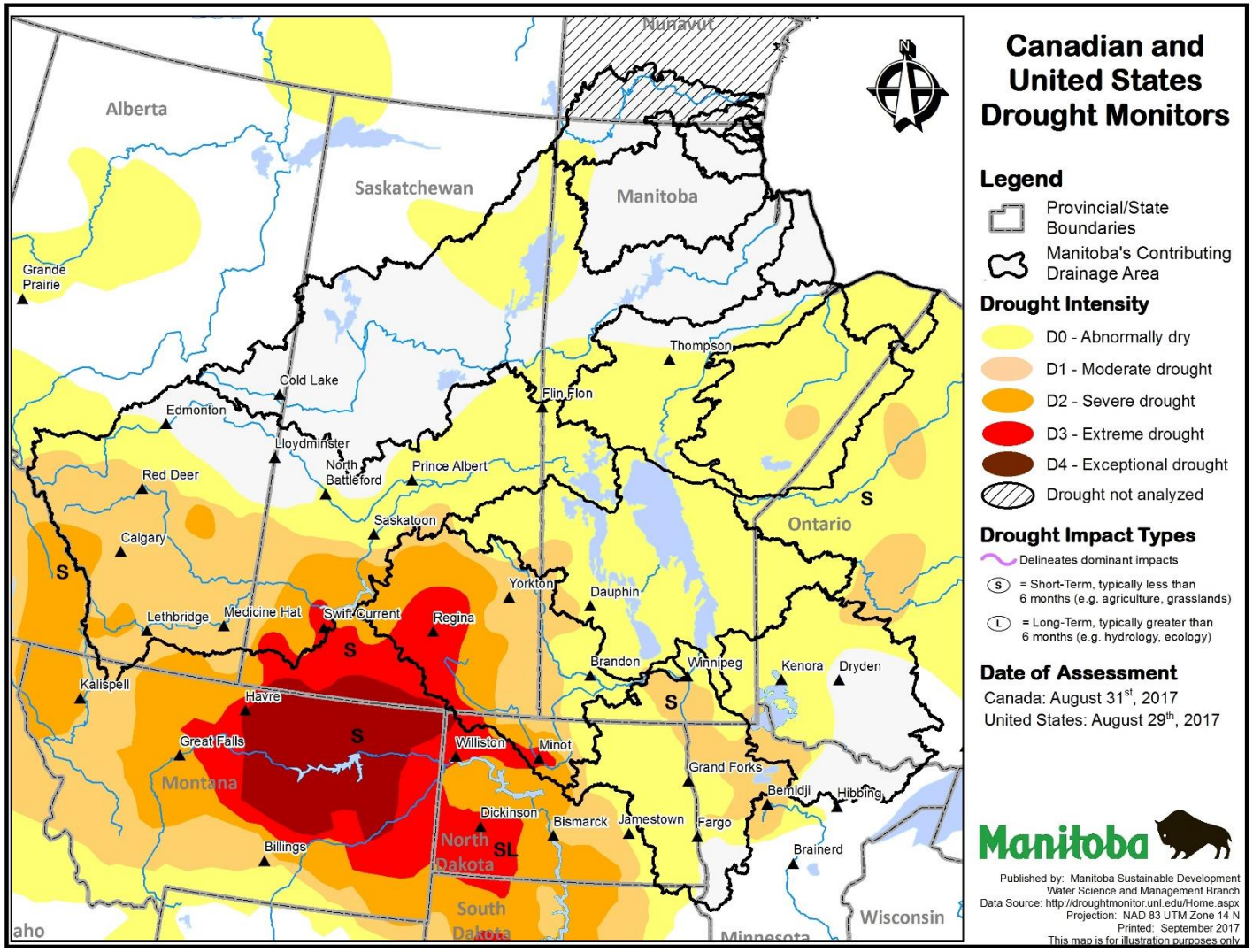

Figure 5: Canadian and United States Drought Monitors' classification of short-term (S) and long-term (L) drought conditions. Canadian Drought Monitor assessment date is August 31st 2017. United States Drought Monitor assessment date is August 29th, 2017.

Manitoba
Sustainable Development

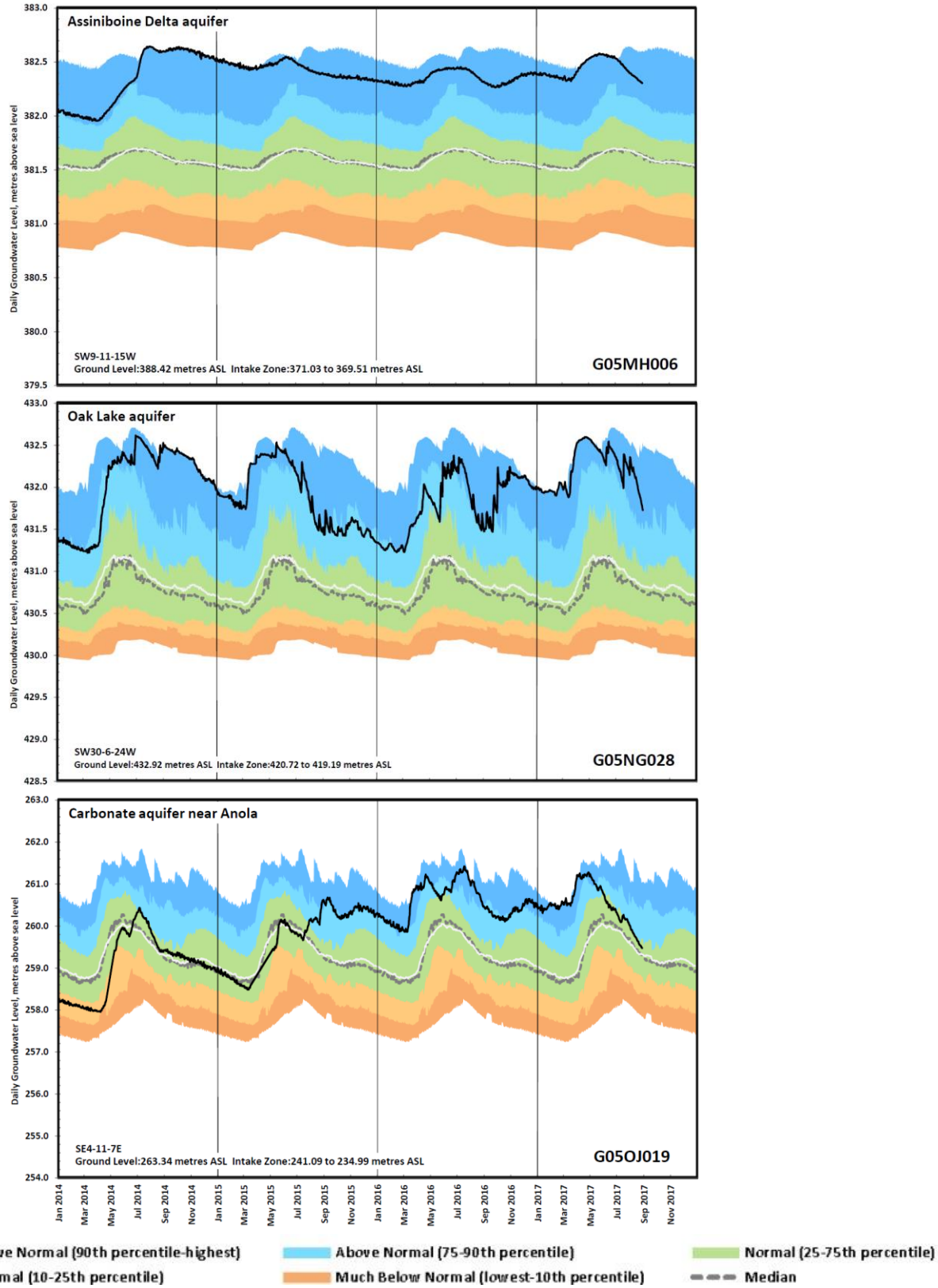

Figure 6: Groundwater hydrographs from 2014 – current for the Assiniboine Delta aquifer, the Oak Lake aquifer, and the Carbonate aquifer near Anola.

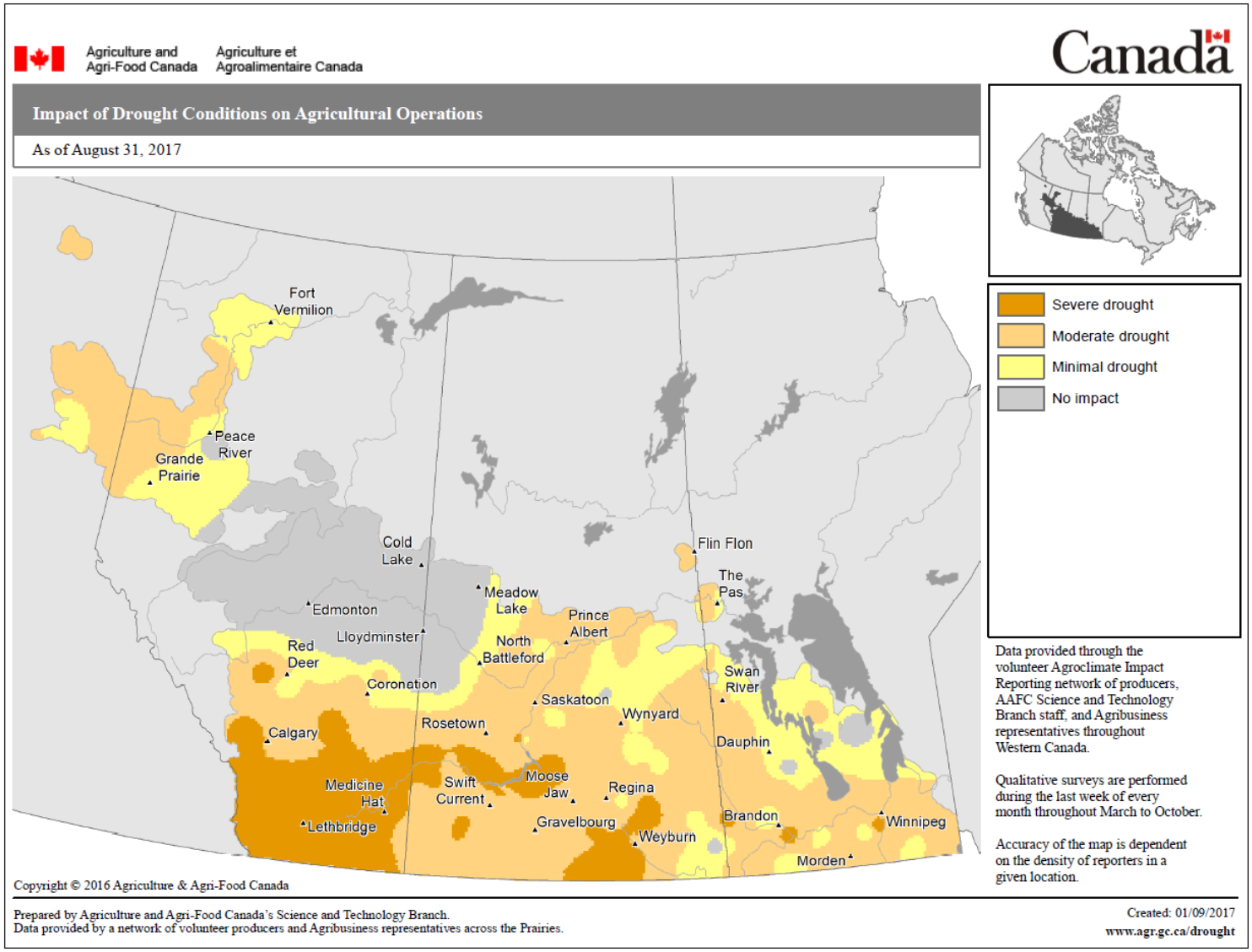

Figure 7: Agriculture and Agri-Food Canada's impact of drought conditions on agricultural operations mapping as of August 31st, 2017.

Manitoba Sustainable Development

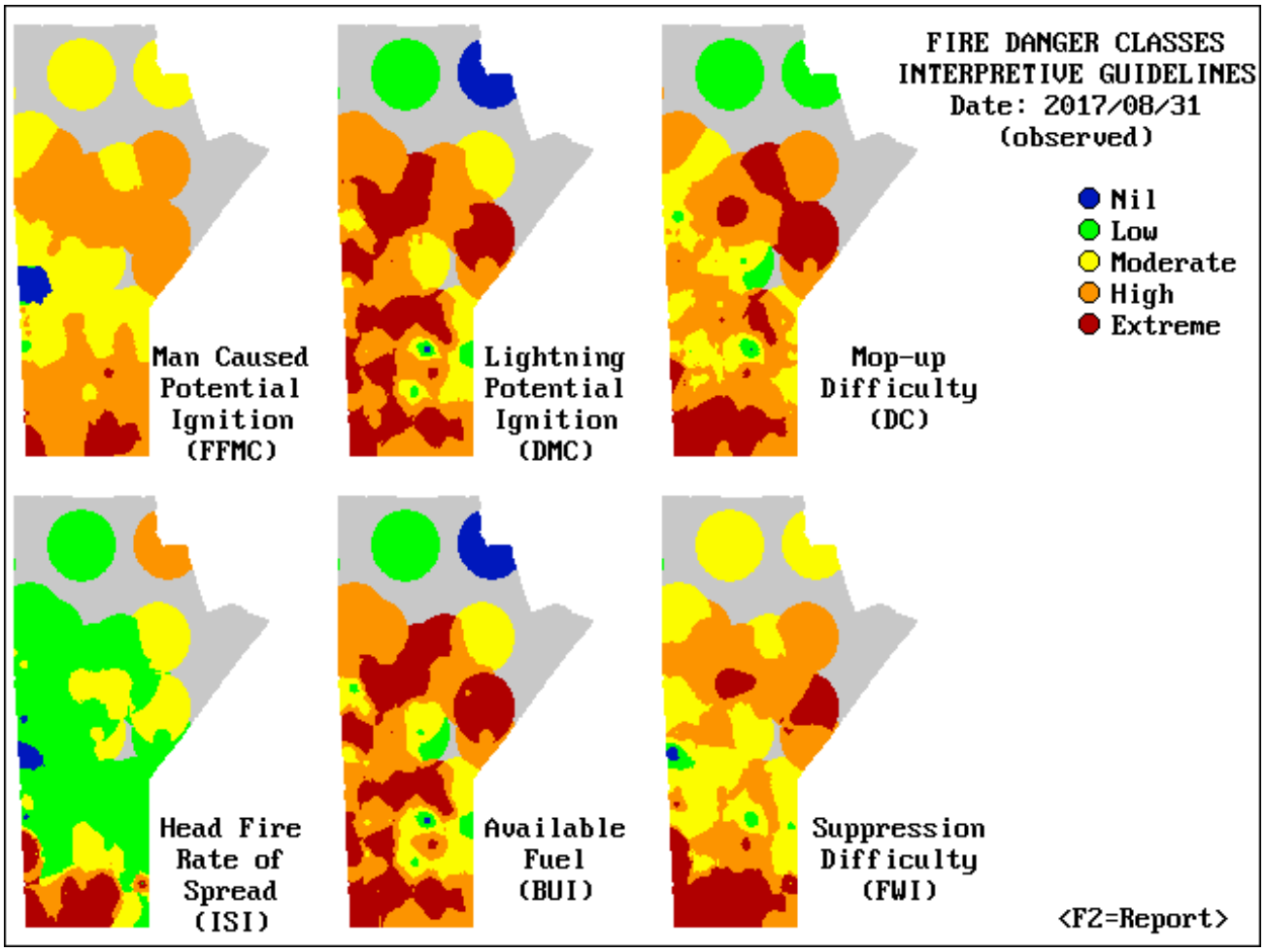

Figure 8: Predicted wildfire hazard mapping for September 8th, 2017, including the six components of the Canadian Forest Fire Weather Index System generated by the Manitoba Fire Program.

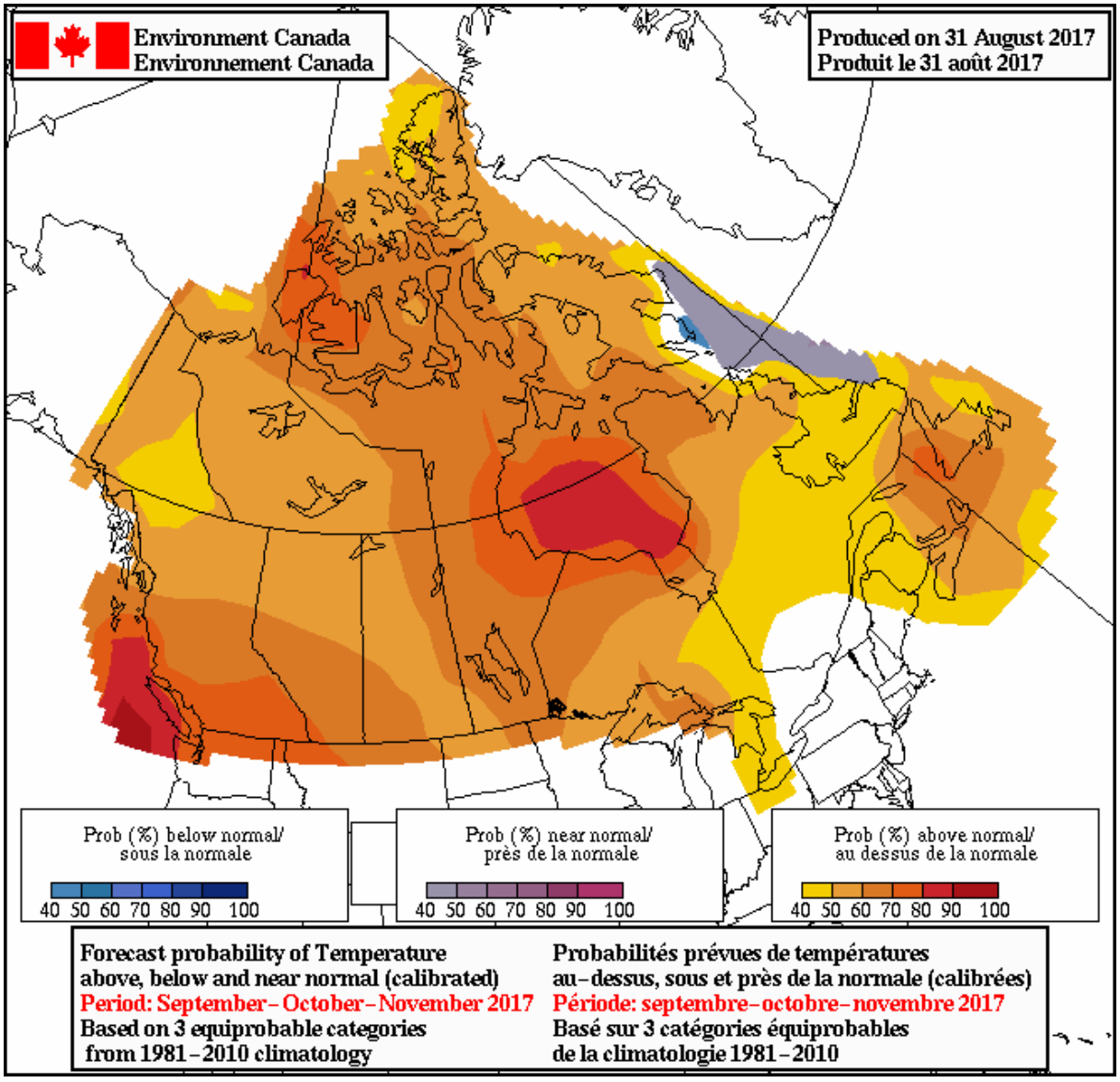

Figure 9: Environment and Climate Change Canada's seasonal (three month) temperature outlook for September-October-November.

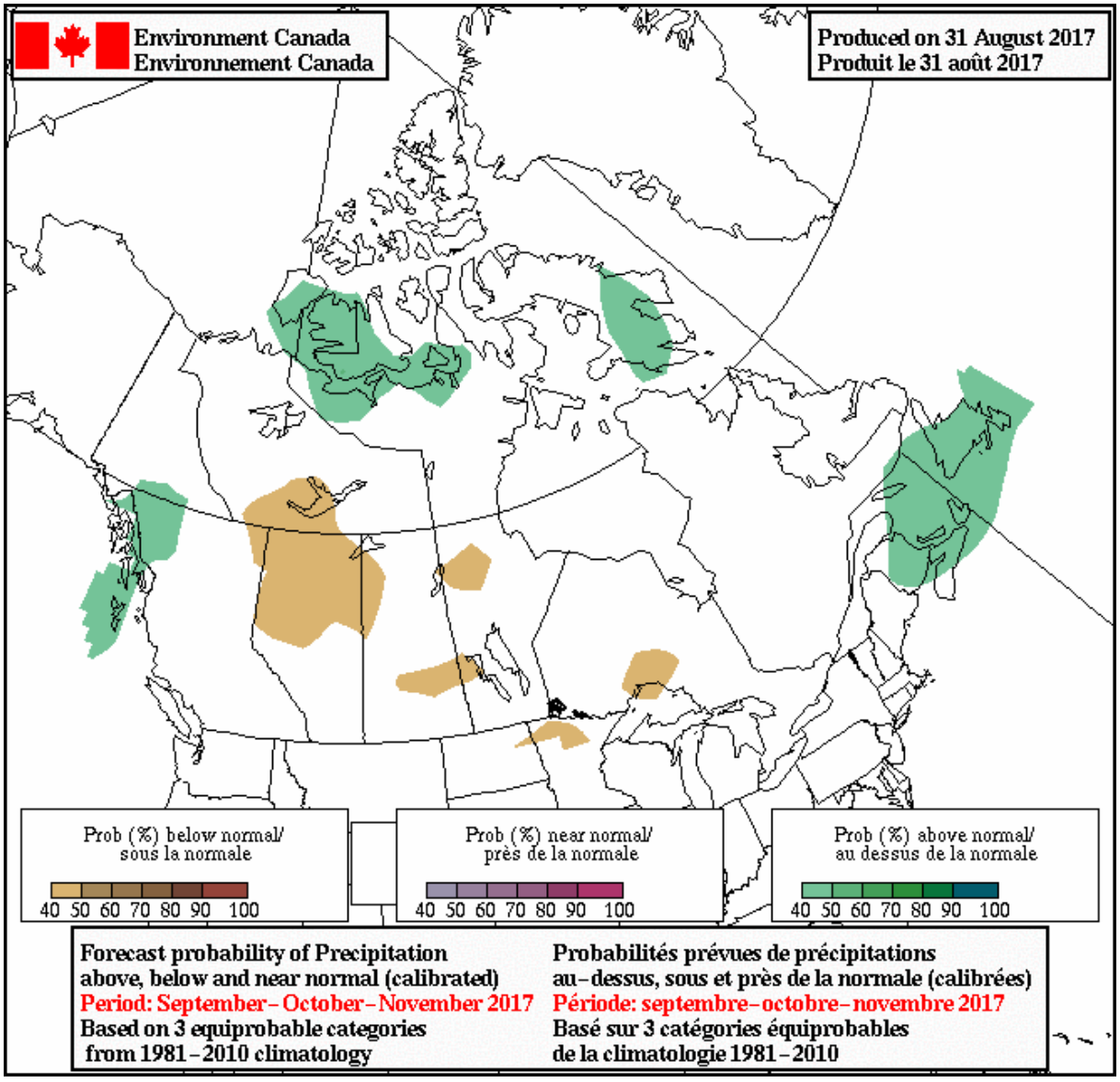

Figure 10: Environment and Climate Change Canada's seasonal (three month) precipitation outlook for September-October-November.