Water Availability and Drought Conditions Report

July 2017

Executive Summary

- This Water Availability and Drought Conditions Report provides an update on drought conditions throughout Manitoba for July 2017.
- During the short term (one month) most of the central, southwestern, and northwestern agricultural regions and small portions of the eastern region observed moderately to severely dry precipitation conditions. The Interlake, most of the eastern region, and the area surrounding Dauphin were normal to above normal. Northern Manitoba also experienced moderately to severely dry conditions except for Churchill, which was normal to above normal.
- During the medium term (three months) all of agro-Manitoba, expect for a small region surrounding Dauphin, observed moderately dry precipitation conditions while portions of the central, eastern, and southwest regions were severely dry. Northern Manitoba experienced moderately dry to normal precipitation conditions.
- Over the long term (twelve months), most of Manitoba experienced normal to above normal precipitation with the exception of isolated pockets surrounding Arborg, Carman and Emerson, which were moderately dry over this period.
- Streamflows and lake levels across the province are generally normal with many of the southern lakes at much above normal levels. The Bloodvein River above Bloodvein Bay and the Burntwood River near Thompson remain at below normal conditions.
- There are currently no major concerns over reservoir water supplies. There have been reports of dugouts getting low within parts of northwest, southwest and eastern agro-Manitoba, suggesting on-farm water supply shortages could develop if meteorological drought conditions continue.
- As of August 2nd, 2017, there have been 210 wildfires burning a total of 31,688 hectares in Manitoba. A Fire Bulletin was recently issued indicating the risk of wildfires has been elevated due to recent hot and dry conditions.
- Most of agro-Manitoba would benefit from additional precipitation at this time.
- 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 Manitoba.
- 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 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.

Throughout the month of July the central, southwestern, and northwestern agricultural regions and a small portion of the eastern region saw moderately dry (60 - 85 % of median) to severely dry (40 - 60 % of median) precipitation conditions (Figure 1). Exceptions include a region surrounding Dauphin, the Interlake, and most of the eastern agricultural region, which observed normal (85 – 115 % of median) to above normal (>115 % of median) precipitation over the past month. The majority of northern Manitoba also observed moderately to severely dry precipitation conditions during July, except for the region surrounding Churchill, which experienced above normal precipitation.

Over the medium term (three months), similar to April-May-June, all of agro-Manitoba, except for a small region surrounding Dauphin, continued to experience moderately dry precipitation conditions. Several areas within the central, eastern, and northwest regions were classified as severely dry (Figure 2). Large portions of northern Manitoba experienced moderate precipitation conditions, while the remainder experienced normal to above normal (The Pas) precipitation.

Over the long term (twelve months), most of Manitoba experienced normal to above normal precipitation conditions (Figure 3). Isolated areas centered over Arborg, Carman and Emerson experienced moderately dry conditions.

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 August 1st, 2017.

As of the beginning of August, most southern Manitoba rivers and tributaries were within the normal range (25 – 75th percentile), with a few locations reporting above normal (75 – 90th

percentile) flows. However, many of the lakes in the region (Winnipeg, Winnipegosis, Manitoba, St. Martin, Dauphin) remained at much above normal (> 90th percentile) levels. The Bloodvein River above Bloodvein Bay continued to experience below normal (10 – 25th percentile) streamflow conditions as of August 1st, 2017.

After peaking in mid- to late-May at near record high flows at many locations, some of the rivers and tributaries in northern Manitoba have returned within normal ranges, while others (e.g. The Grass, Churchill, and Seal River systems) are still experiencing above normal to much above normal streamflow conditions as of early August. The Burntwood River continues to remain low at much below normal (< 10th percentile) conditions, likely due to operations for hydro-power production.

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 July 31st Canadian Drought Monitor assessment was not finalized when this report was published. Please visit their website to view the most recent assessment once it becomes available (http://www.agr.gc.ca/drought).

The Unites States Drought Monitor indicated that as of July 25th (Figure 5) large regions of the Red River Basin continue to experience abnormally dry (D0) conditions with regions of moderate

drought (D1) conditions along the Manitoba-United States border and in the eastern portion of the basin. In the United States, the Souris River Basin is currently experiencing moderate to severe (D2) drought conditions, which further degrade to extreme (D3) drought conditions in the southern portion of the basin. Although outside of the contributing drainage area to Manitoba, the western half of North Dakota and the eastern half of Montana are experiencing exceptional drought (D4) conditions across large regions.

Water Availability

Reservoir Conditions

Water supply reservoirs are generally close to (> 90 %) or at full supply level (Table 2), with the exception of Rapid City which is at 79 %. Please note, however, the most recent measurement at this reservoir is from April 26th, 2017, and current conditions are unknown. It is anticipated the reservoir will receive a site visit during the month of August and a level reading will be taken at that time. Overall, there are no concerns over reservoir water supplies currently.

On Farm Water Supply

Manitoba Agriculture's Crop Report: Issue 14 (July 31st, 2017) summarized farm water supply as follows (Table 1):

Table 1: On Farm Water Supply (Dugout) Conditions

Region	General Dugout Condition
Eastern	Adequate
Interlake	Adequate
Southwest	60 % full as of July 24th – beginning to suffer from the hot dry weather
Central	Adequate
Northwest	Reports of livestock watering dugouts getting low near the Assiniboine River Valley area

This information suggests that on-farm water supply shortages could develop if meteorological drought conditions continue over the upcoming months.

Aquifers

Groundwater levels in major aquifers are generally good. Some aquifers are near maximum recorded levels or in some instances have set new maximum recorded levels during the spring of 2017. Groundwater hydrographs from 2014 to the end of July 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.

Wildfires

The Provincial Wildfire Program reported that as of August 2nd, 2017, there have been 210 wildfires burning a total of 31,688 hectares. Almost all of the area burned is located in the northeast portion of the province (98 %), with the remaining regions accounting for the last two per cent. As of August 2nd, there were 55 fires still actively burning, 44 within the northeastern region, four in the northwest, and seven in the eastern region. None of the fires were considered to be out of control.

As of the 3rd of August, Manitoba Sustainable Development and the Office of the Fire Commissioner published a Fire Bulletin (#3) stating that the risk of wildfires has been elevated due to hot and dry conditions. Fire Risk and Drought Code maps reflective of August 7th conditions (Figure 7) indicate moderate fire risk across most of southern Manitoba with pockets of high risk conditions. All of northern Manitoba remains at low risk. 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, there have been moderate drought impacts reported within Manitoba for the month of July.

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, seven municipalities registered minimal drought impacts and five more RMs reported moderate drought impacts on agricultural operations with the Impact Reporter.

The RMs reporting minimal impacts were spread across agro-Manitoba and included: Stuartburn, Rhineland, Morton, Oakland, Shoal Lake, Thompson and Lorne. Reporting producers generally stated that rain is needed soon for crops to reach potential yields. Other comments echoed those from the most recent Manitoba Agriculture Crop Report, indicating that hayland and pastures are

in need of rainfall as they are showing signs of moisture stress. Although livestock water availability was classified as adequate in eastern agro-Manitoba, a reporter from Stuartburn stated the dugouts in this RM are at about 50 % capacity and without rainfall could be dry within the next few months.

The five municipalities registering moderate drought impacts with the Impact Reporter were primarily located in southwestern and northwestern agro-Manitoba and included: Arthur, Wallace (two submissions), Rossburn, Daly and McCreary. Reporting producers generally stated similar impacts as summarized above, noting that impacts can be localized but in some areas are quite severe (e.g. in regions of light soils). Two reporters from the RM of Wallace indicated that some producers' hay crops have been below 50 % of 2016 yields. Another reporter from Arthur stated that if a sufficient rainfall does not occur shortly, there will be crops that prematurely ripen, and the second cuts of alfalfa and hay will be dismal or non existent. This same reporter indicated that prices for the first hay crop are inflated in value due to emerging shortages. Reporters were not aware of producers having to sell livestock at this point in time. A reporter from the RM of Daly in the southwest region confirmed that dugouts are drying up in that region.

Currently within North Dakota, 23 counties and the Standing Rock Sioux Tribe have declared drought emergencies. The United States National Drought Mitigation Centre's Impact Reporter is reporting high numbers of impacts to agriculture (crops, pasture and livestock) and increased number and risk of wildland fires in North Dakota (and surrounding states). Most of the impacted counties are located in the western half of the state. The United Sates portion of the Souris River Basin is almost composed entirely of counties that have declared drought emergencies. If conditions persist, hydrologic drought impacts may begin to occur within the upstream and mid-reaches of the Souris River Basin, which may potentially have downstream implications for Manitoba. The United States Department of Agriculture (USDA) is now allowing emergency grazing on Conservation Reserve Program lands for counties with D2 to D4 drought conditions. The USDA has also authorized emergency haying as of July 16th, 2017.

Future Weather

The short-range (Tuesday, August 8th to Thursday, August 10th) weather forecast for Manitoba from Environment and Climate Change Canada's Regional Climate Model predicts a system centered over the northwest and southwest agricultural regions, tracking across the Interlake and parts of south-central Manitoba. Most of southwestern Manitoba is forecasted to receive 10 to 20(+) mm over the next few days; however, the system could bring as much as 50 to 70 mm in some areas of northwest agro-Manitoba. The long range forecast (August 11th to August 18th) does not call for any major precipitation during this period. Please note that long range precipitation forecasts have considerable uncertainty and are likely to change in the upcoming days.

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 8). Precipitation over the next three months is forecasted to be normal (Figure 9). 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 – August 2nd, 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) (%)**
Elgin	Elgin	1,532.00	1,531.77	July 26, 2017	-0.23	520	504	97%
Lake of the Prairies (Shellmouth)*	Brandon, Portage	1,402.50	1,404.03	August 2, 2017	1.53	300,000	321,138	107%
Lake Wahtopanah (Rivers)	Rivers	1,536.00	1,536.09	August 2, 2017	0.09	24,500	24,698	101%
Minnewasta (Morden)	Morden	1,082.00	1,080.96	August 2, 2017	-1.04	3,150	2,977	95%
Stephenfield	Carman	972.00	971.52	August 2, 2017	-0.48	3,810	3,585	94%
Turtlehead (Deloraine)	Deloraine	1,772.00	1,771.36	July 30, 2017	-0.64	1,400	1,368	98%
Vermilion	Dauphin	1,274.00	1,272.78	August 2, 2017	-1.22	2,600	2,278	88%
Goudney (Pilot Mound)		1,482.00	1,481.53	August 2, 2017	-0.47	450	417	93%
Jackson Lake		1,174.00	1,172.64	August 2, 2017	-1.36	2,990	2,650	89%
Kenton Reservoir		1,448.00	1,448.43	**April 26, 2017**	0.43	600	617	103%
Killarney Lake		1,615.00	1,615.06	**June 12, 2017**	0.06	7,360	7,388	100%
Lake Irwin		1,178.00	1,177.82	July 6, 2017	-0.18	3,800	3,693	97%
Manitou (Mary Jane)		1,537.00	1,536.61	August 2, 2017	-0.39	1,150	1,115	97%
Rapid City		1,573.50	1,572.90	**April 26, 2017**	-0.60	200	158	79%
St. Malo		840.00	840.49	**June 5, 2017**	0.49	1,770	1,851	105%
* 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*

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Past reports are available on the Manitoba Drought Monitor website.

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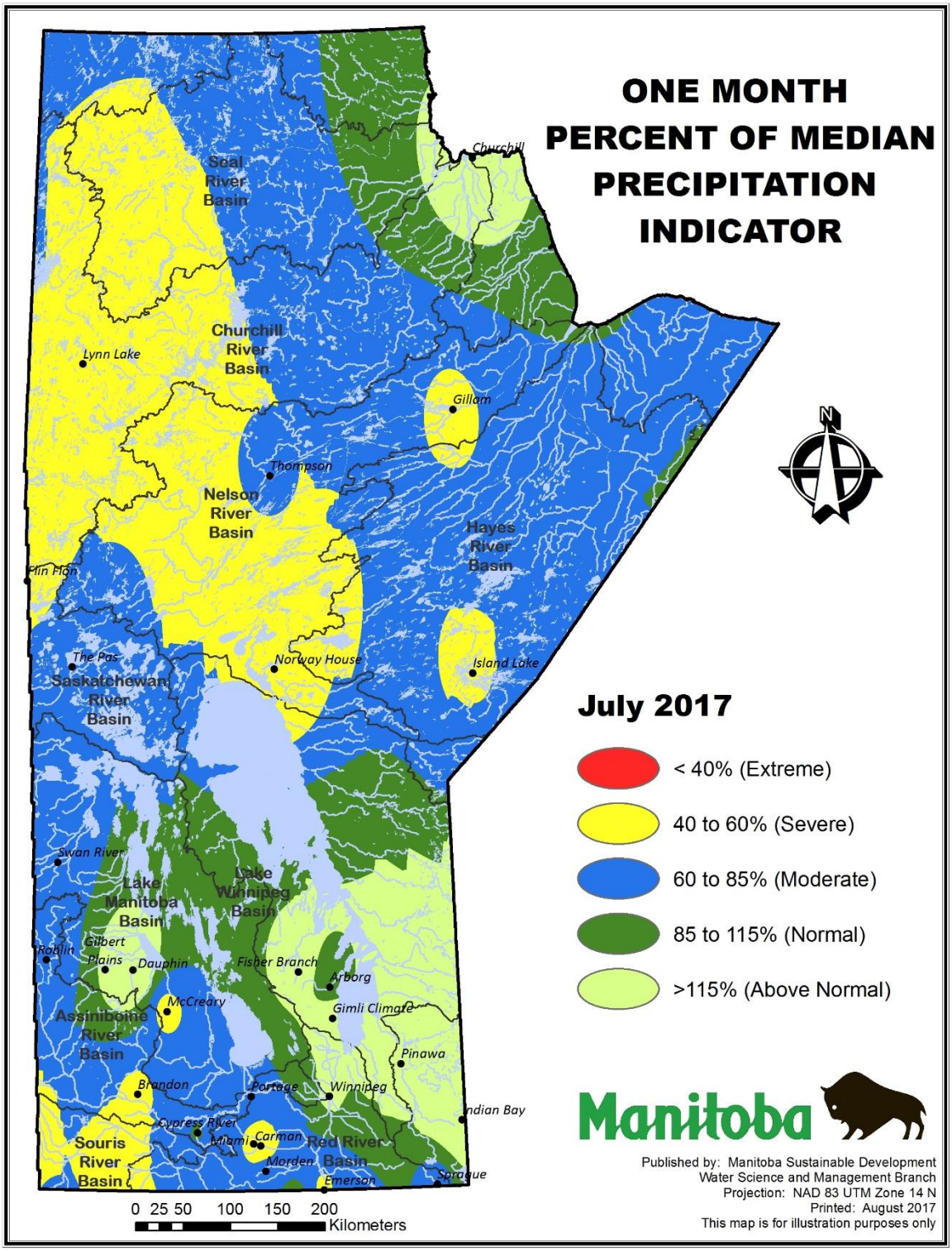

Figure 1: Short term precipitation indicator (percent of one month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

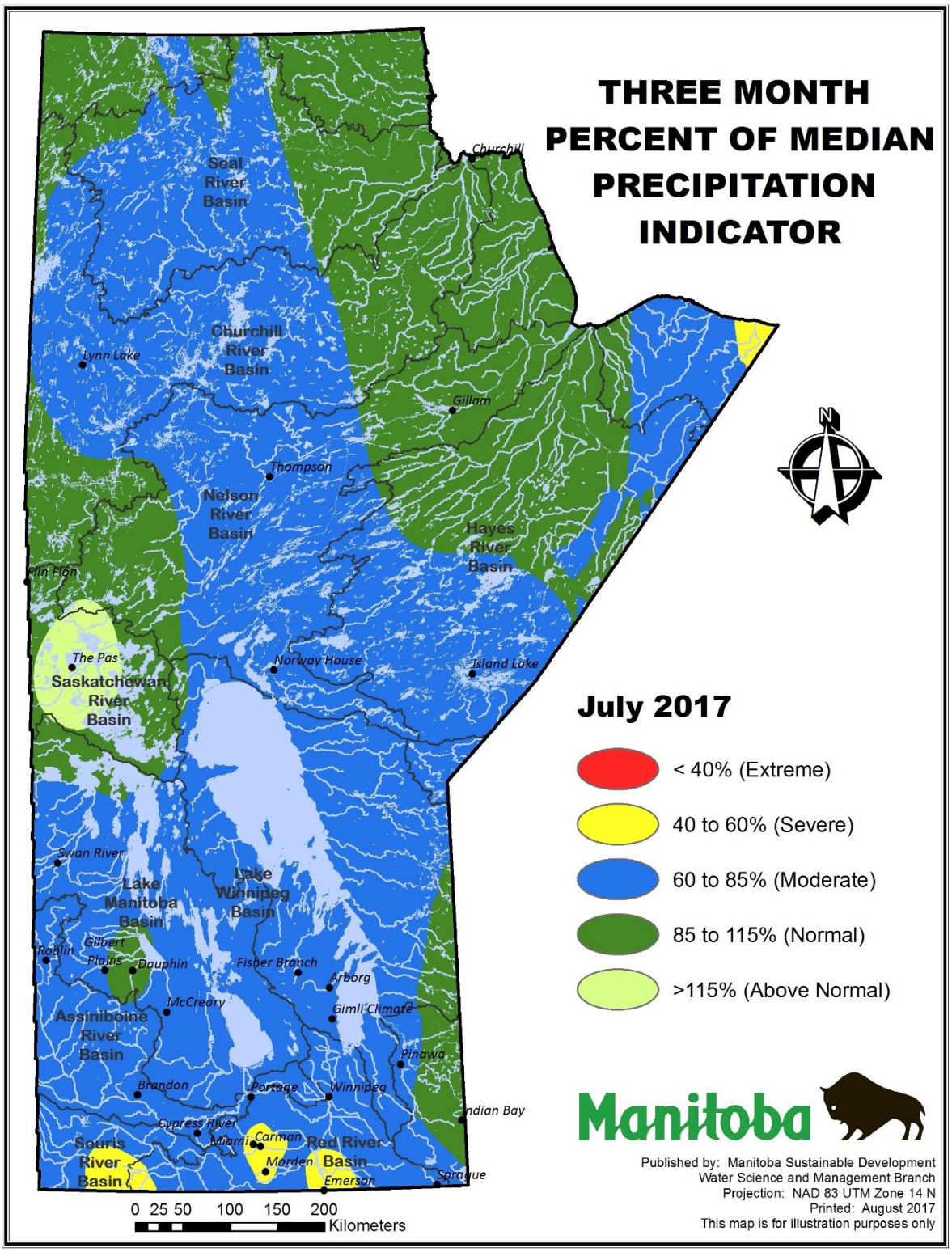

Figure 2: Medium term precipitation indicator (percent of three month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

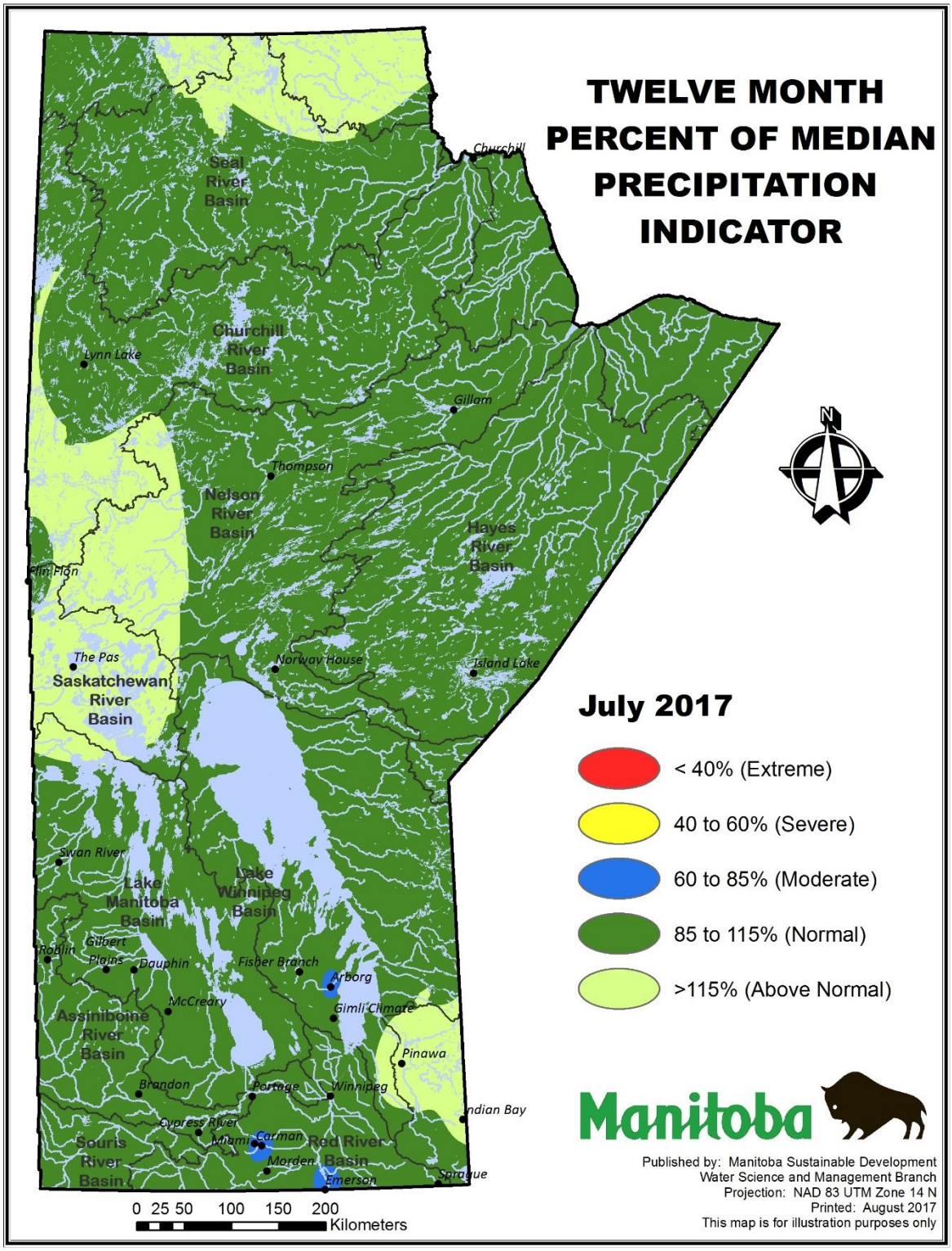

Figure 3: Long term precipitation indicator (percent of twelve month median precipitation). Baseline medians are computed from 45 years of data (1971 – 2015).

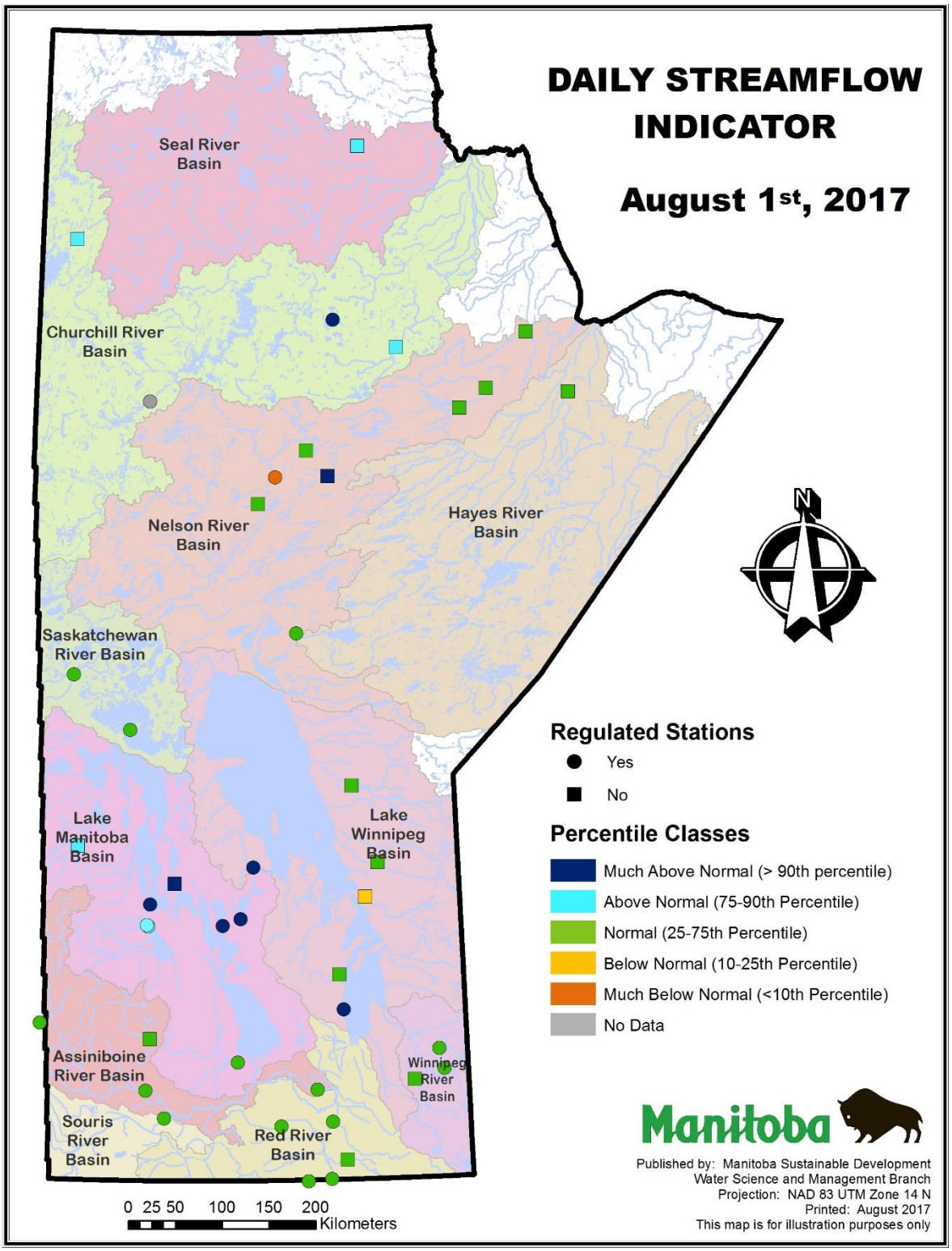

Figure 4: Daily streamflow indicator for August 1st, 2017. Real-time daily streamflow and water levels are compared to historical values for the specified day.

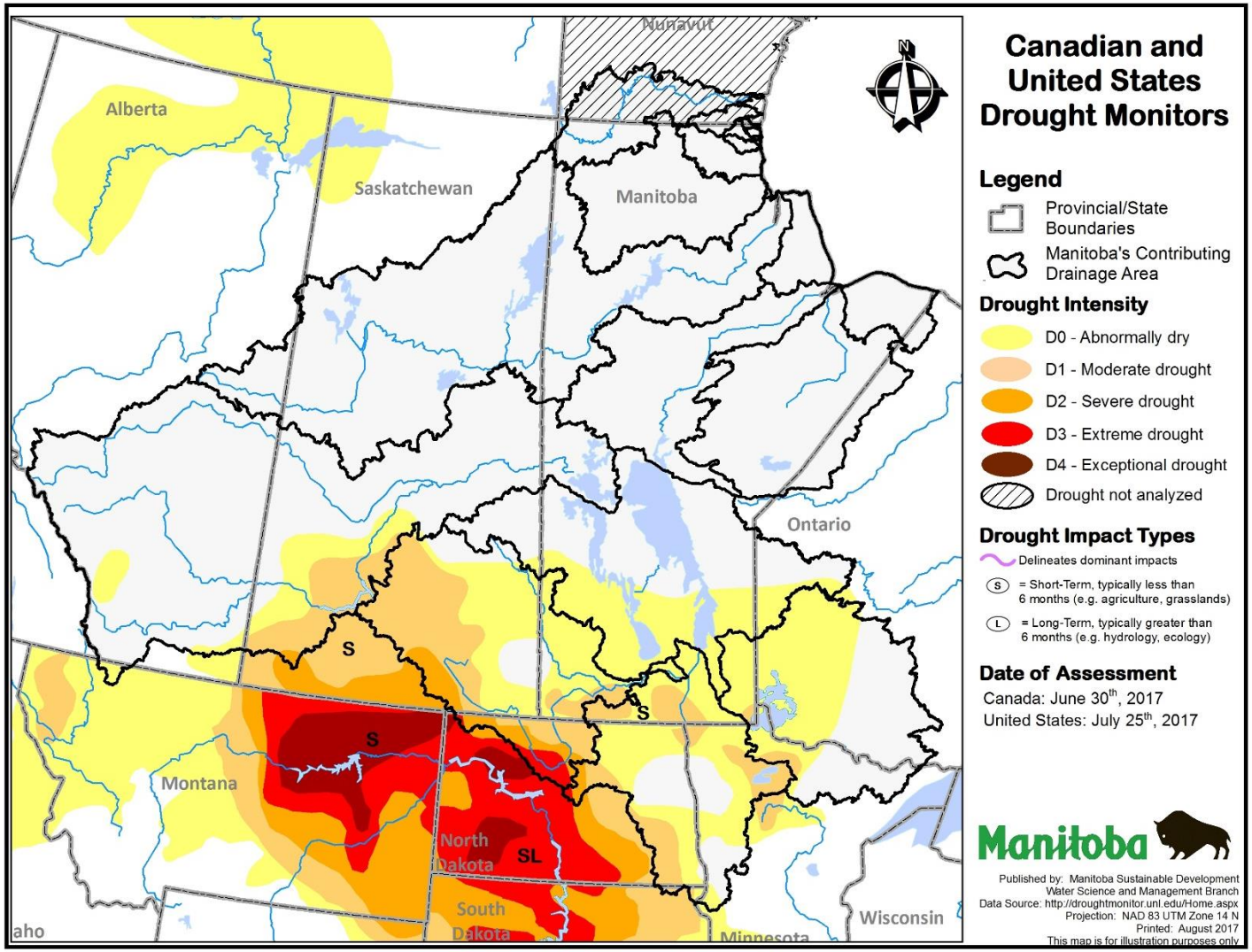

Figure 5: Canadian and United States Drought Monitors' classification of short-term (S) and long-term (L) drought conditions. Canadian Drought Monitor assessment date is June 30th, 2017. United States Drought Monitor assessment date is July 25th, 2017.

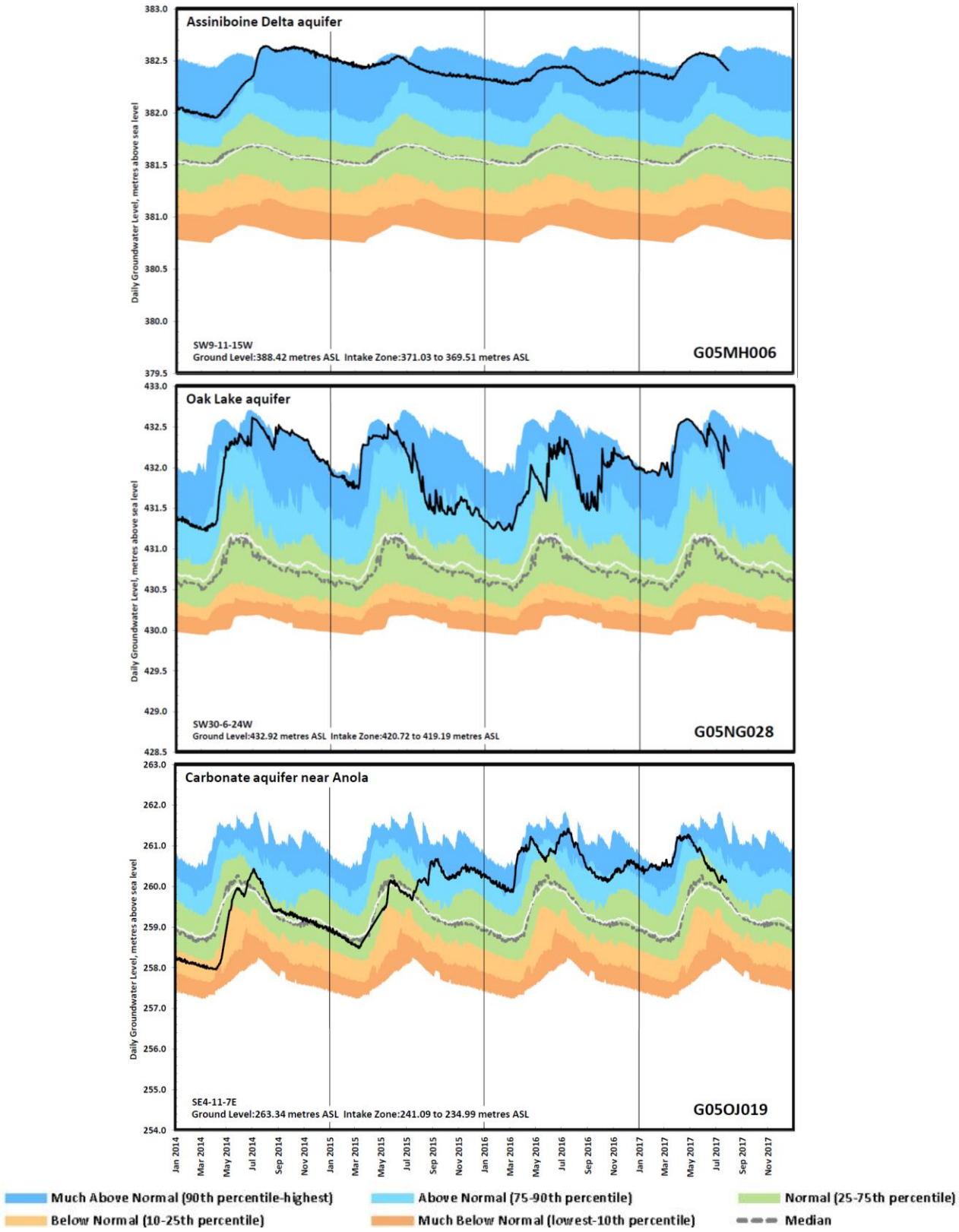

Figure 6: Groundwater hydrographs from 2014 – current for the Assiniboine Delta aquifer, the Oak Lake aquifer, and the Carbonate aquifer near Anola.

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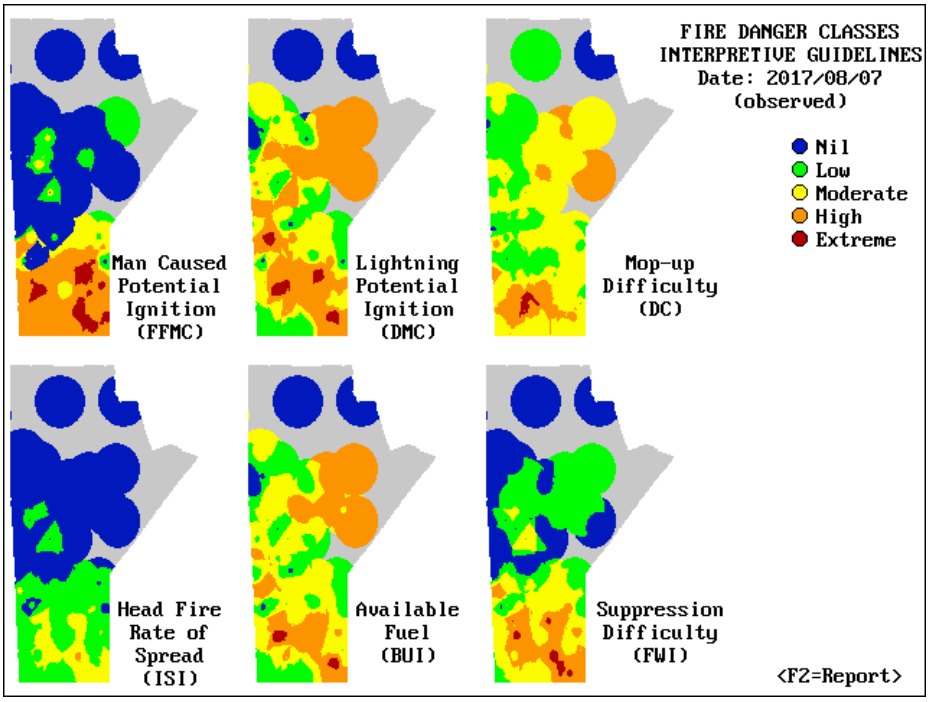
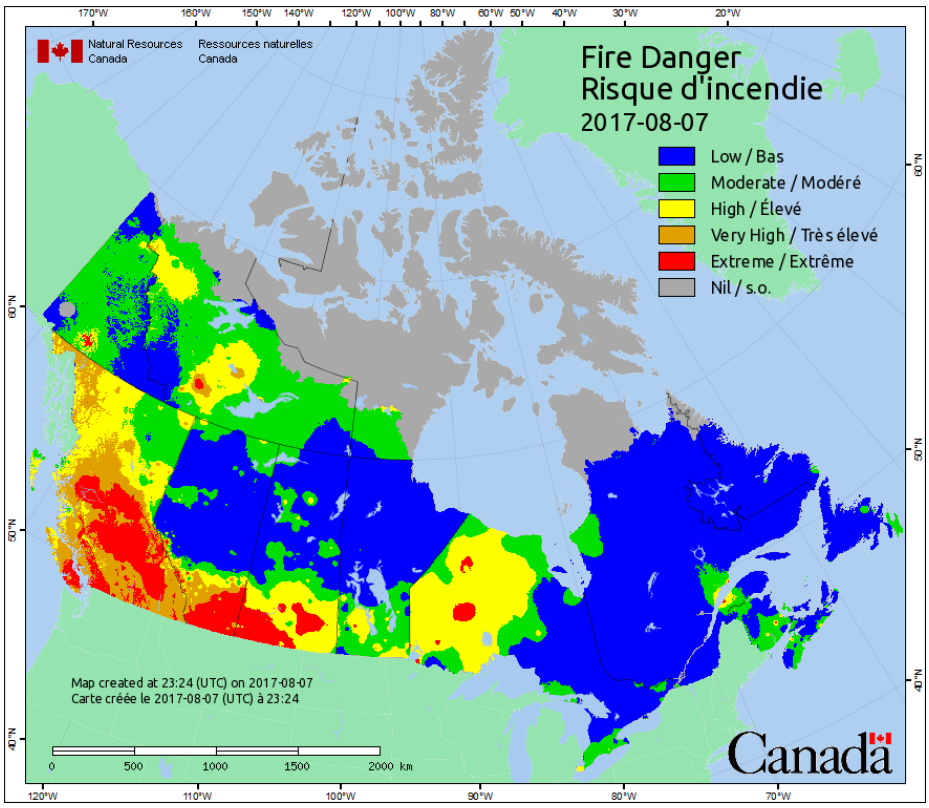


(a)



(b)

Figure 7: Wildfire hazard maps, including (a) the six components of the Canadian Forest Fire Weather Index System generated by the Manitoba Fire Program, and (b) Fire Danger mapping from Natural Resources Canada.

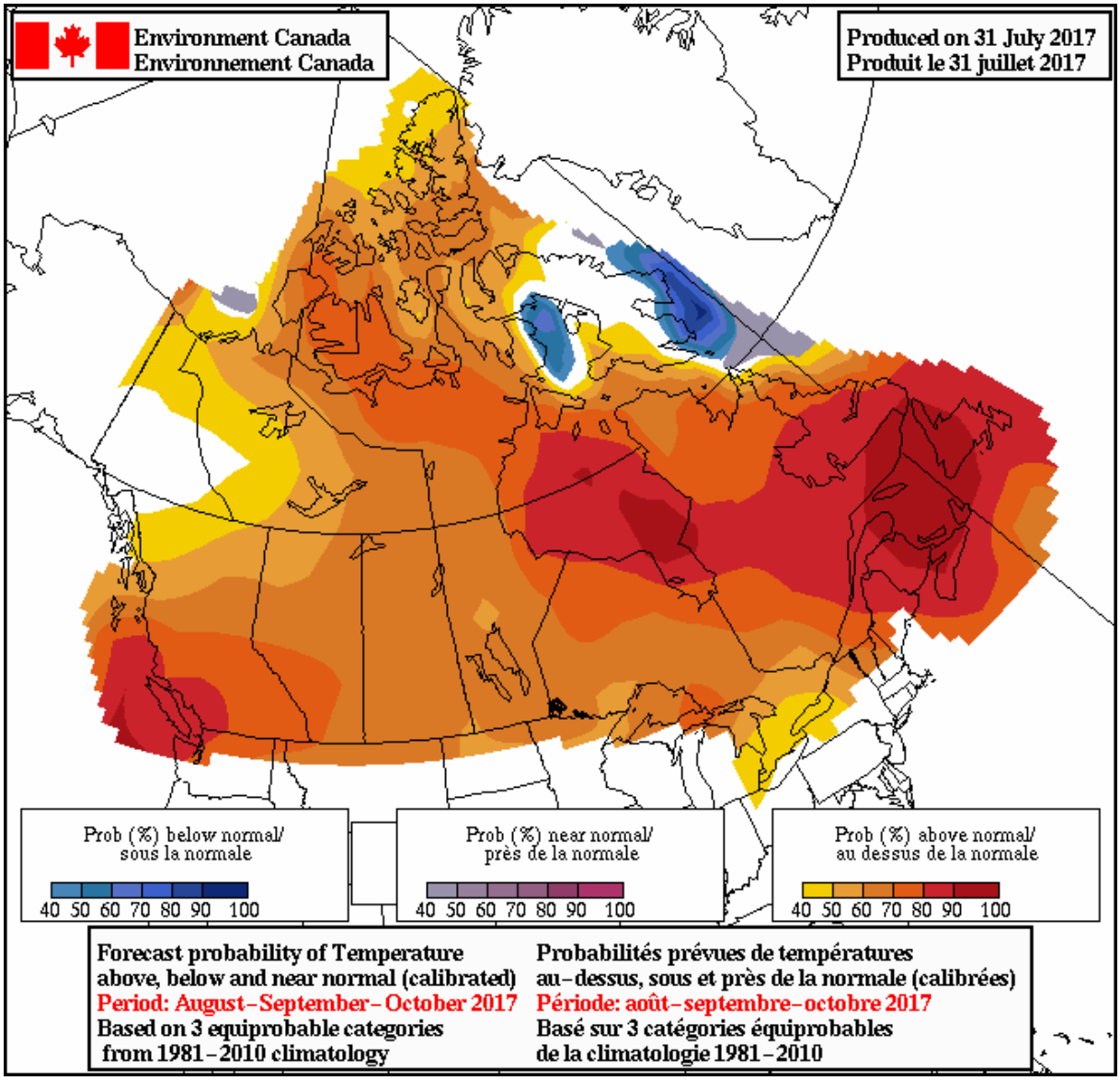


Figure 8: Environment and Climate Change Canada's seasonal (three month) temperature outlook for August-September-October.

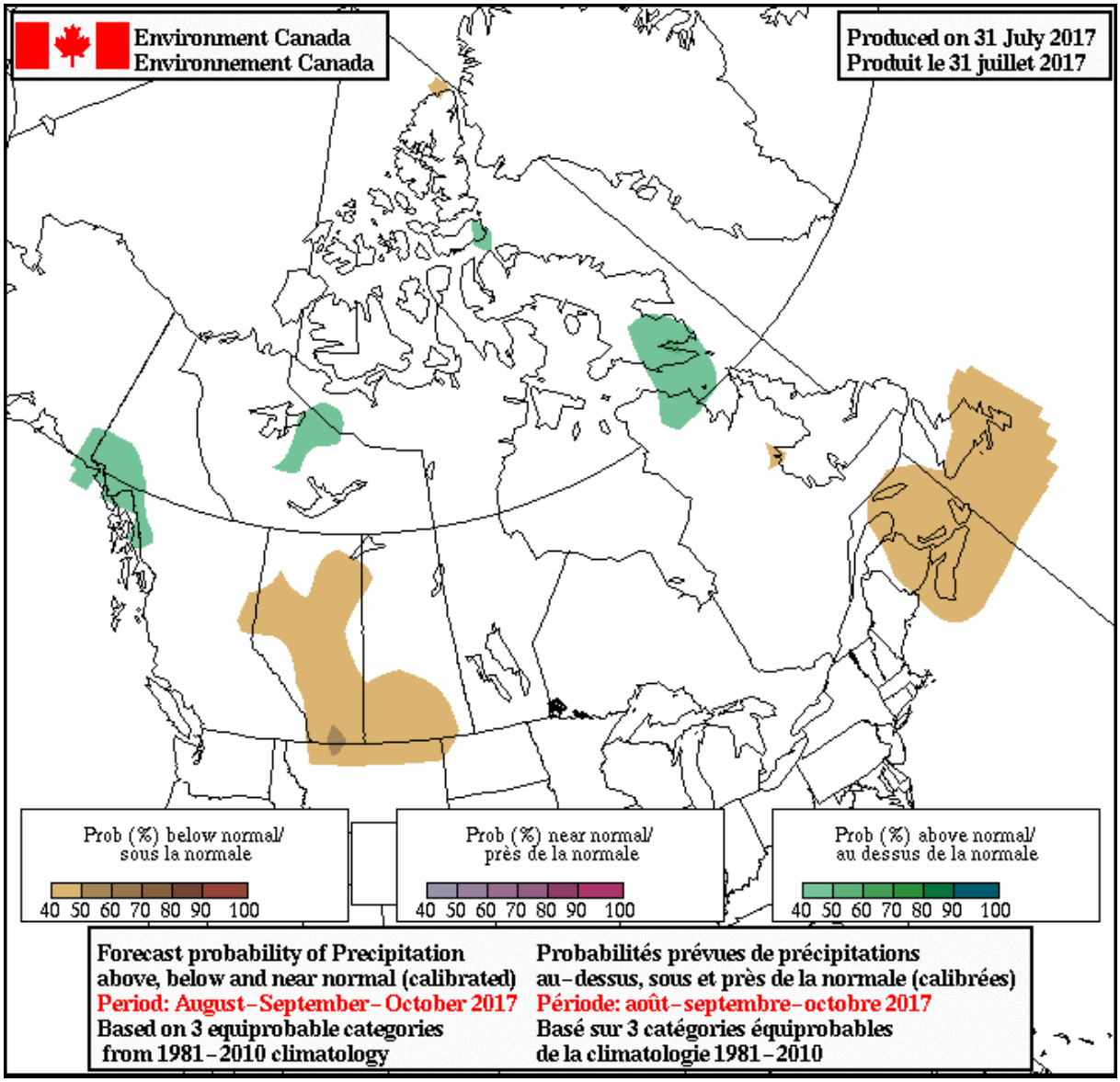


Figure 9: Environment and Climate Change Canada's seasonal (three month) precipitation outlook for August-September-October.