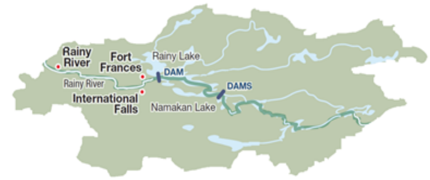


Factsheet # 5

Title: Basin Monitoring by the Water Levels Committee

Background

The Water Levels Committee (WLC) of the International Rainy-Lake of the Woods Watershed Board is responsible for monitoring hydrologic conditions in the Rainy River watershed and the actions of the dam operators in managing the levels of Rainy Lake and the Namakan Reservoir. This factsheet describes what data the WLC relies upon to fulfill this duty.

Precipitation Monitoring

Managing the levels of Namakan Reservoir and Rainy Lake is a matter of balancing the flow of water out of the lakes (outflow) with the flow entering the lakes (inflow). Predicting changes in inflow to the lakes, or inflow forecasting, relies on accounting of all the water in the system. A key component in this accounting is precipitation across all areas that drain into the lakes, also known as the watershed.

Traditional means of precipitation monitoring involve rain gauges, either at staffed locations, such as airports, or at remote locations. Rain gauges capture the rain that falls at a specific location and measures how much rain falls over time. The WLC makes use of rainfall data from locations across the watershed collected each day by meteorological agencies, hydrometric agencies, dam operators, and volunteers (Figure 1). With this data, estimates of precipitation across the watershed are computed.

While these stations provide a good sampling of rainfall across the watershed, the point location nature of the rain gauges can result in inaccuracies when used to estimate precipitation over the whole watershed. Sometimes rain storms can pass between the gauges and are not detected at all, leading to an underestimation of rainfall in the watershed. At other times a storm may deliver a lot of rain over one rain gauge but not anywhere else, in which case it may lead to an overestimation of rainfall in the watershed. These over- and under-estimations often occur in the summer, when small, localized thunderstorms are common.

Since 2014, the WLC has been making use of a more robust estimate of how rainfall is distributed around the basin, that helps deal with the problem of sparse rain gauges. This product, known as the Canadian Precipitation Analysis (CaPA), is produced by Environment and Climate Change Canada. It combines the data from local rain gauges with precipitation estimates from radar and short-term forecasts, and applies a sophisticated processing algorithm to come up with a total precipitation estimate for all of North America (see Figure 2 for an example). These data are made available every 3 hours, with 24-hour total precipitation published each morning. The WLC collects these data and processes them to determine total precipitation across the extent of the watershed.

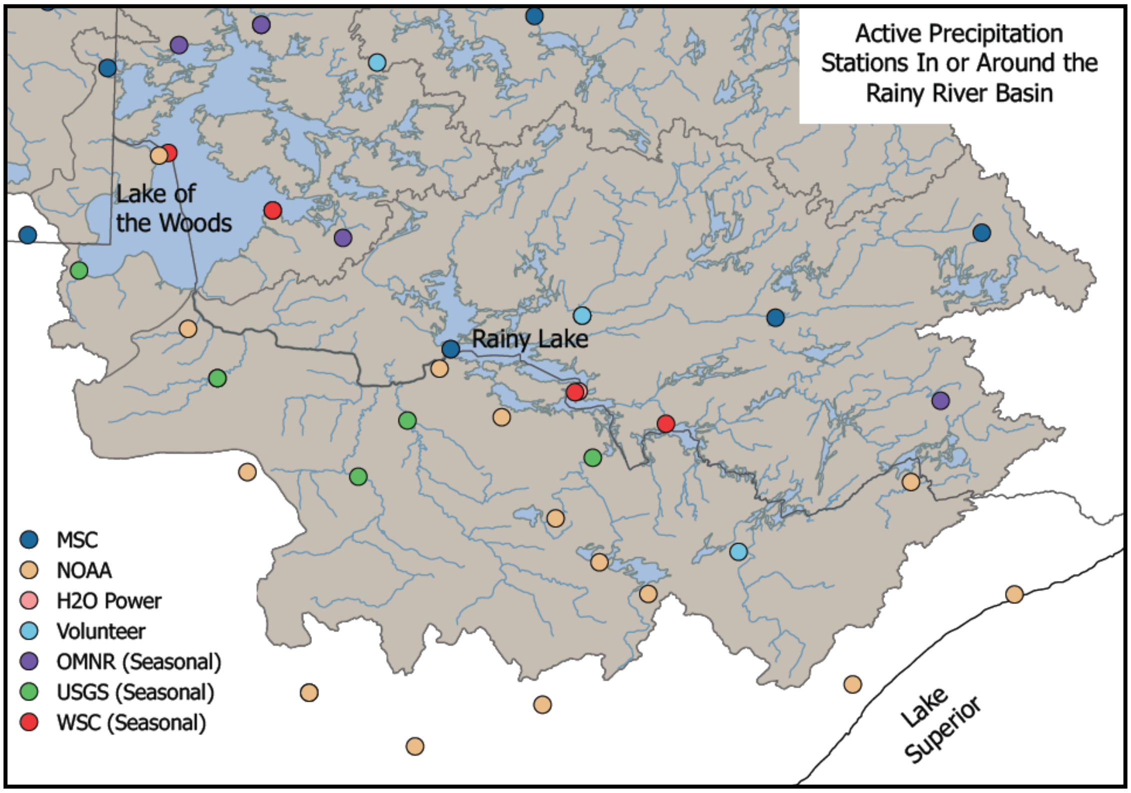


Figure 1. Rain Gauges in and Around the Rainy River Watershed. MSC: Meteorological Service of Canada; NOAA: National Ocean and Atmospheric Administration; OMNR: Ontario Ministry of Natural Resources; USGS: United States Geological Survey; WSC: Water Survey of Canada.

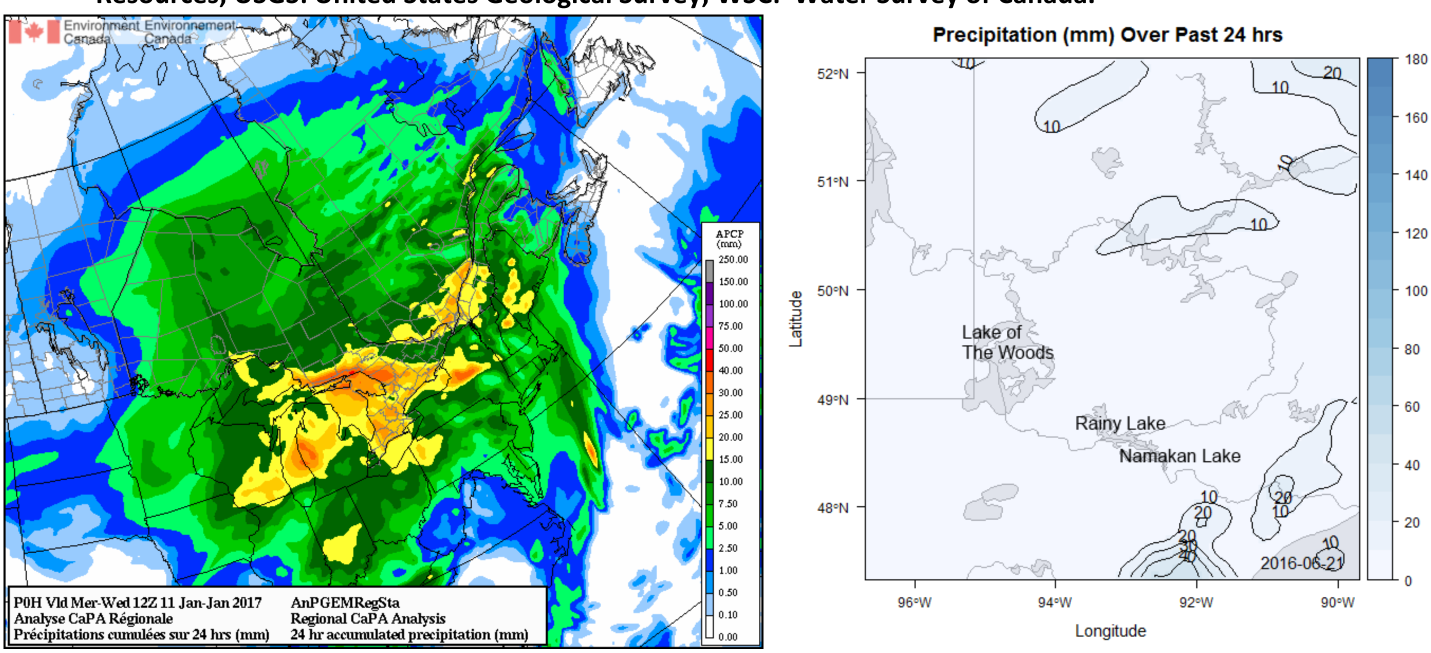


Figure 2. Examples of CaPA Outputs – 24-hour Precipitation Estimates

Water Level and Flow Monitoring

Another set of critical information necessary to predict future lake levels is amount of water flowing into the lake from rivers and streams that feed into the lake, as well as the current levels of the lakes. The WLC collects hourly data on water levels and river flows at major lakes and rivers in the Rainy River watershed through a network of water level and streamflow gauges managed by the WSC and USGS. These gauges automatically collect and transmit data year-round, and technicians from these agencies routinely inspect them to ensure accurate measurements. In addition, the dam operators for Namakan Reservoir and Rainy Lake provide daily summaries of outflows from the dams in the watershed. With this information, the WLC has a comprehensive view of flow conditions across the watershed and can quickly determine the response of the system to recent weather conditions. Locations of water level and flow measurements are shown in Figure 3.

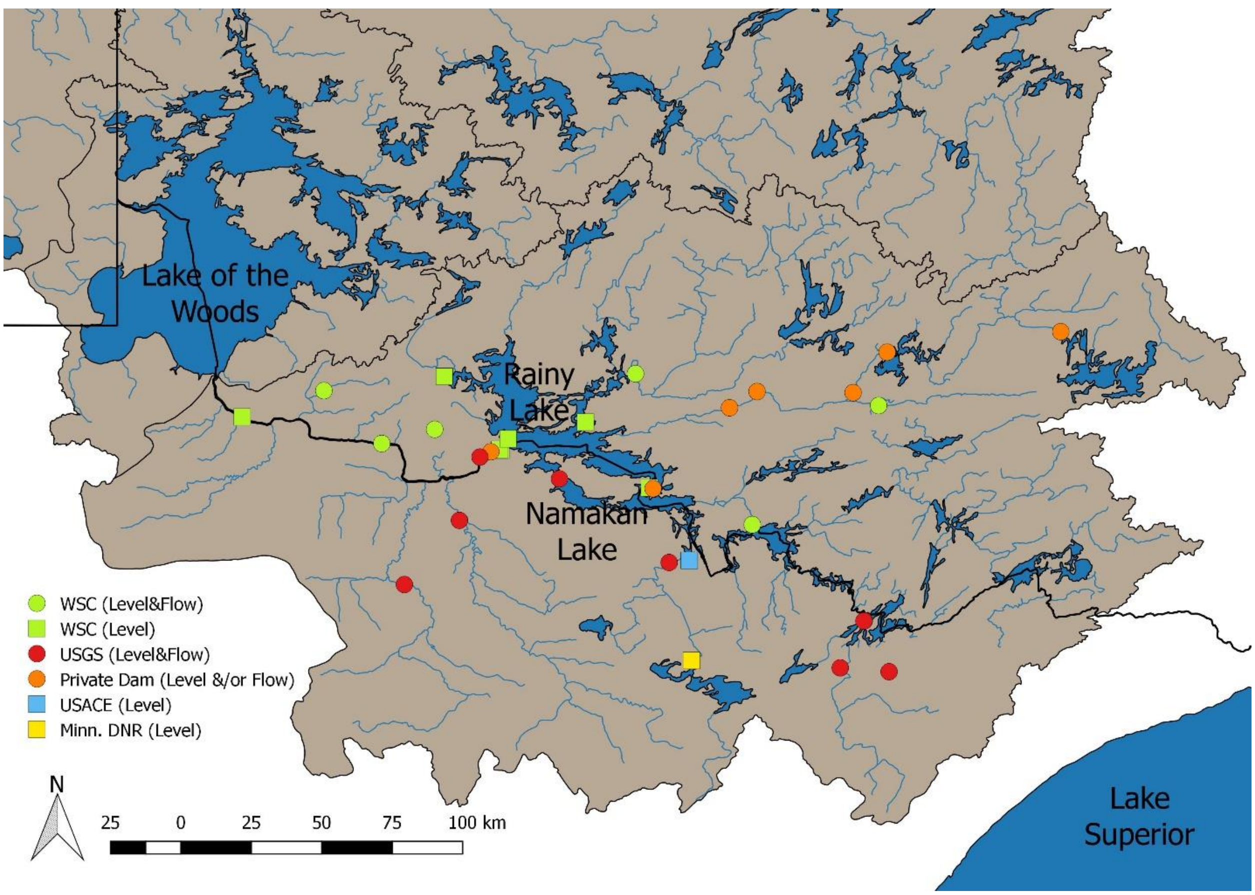
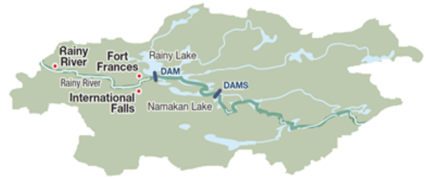


Figure 3. Water Level and Flow Measurement Locations. WSC: Water Survey of Canada; USGS: United States Geological Survey; USACE: United States Army Corps of Engineers; Minn DNR: Minnesota Department of Natural Resources



Other Data

The Water Levels Committee also collects air and water temperature data from various locations around the watershed. Air temperature data is a key input to the operational inflow forecasting model used by the Water Levels Committee (see Factsheet #6). Knowing the temperature of the air helps predict whether precipitation will fall as rain or as snow, and in the spring temperature data can help predict how quickly the snow that's on the ground will melt and contribute to flows into the lake.

Understanding how much snow is on the ground during the winter is very important, as snowmelt is an important source of flow into the lakes in spring. During the winter, data on the depth of the snowpack is obtained from several sources, but more useful in terms of forecasting spring flows are estimates of the amount of water in the snow, referred to as Snow-Water Equivalent (SWE). Individual snow measurements are reported at meteorological stations, and both Canadian and American meteorological agencies produce estimates of SWE across the watershed throughout the winter (see Figure 4). At the beginning of March, the Water Levels Committee receives data from manual snow surveys conducted at several locations across the basin that can be compared to remotely monitored estimates.

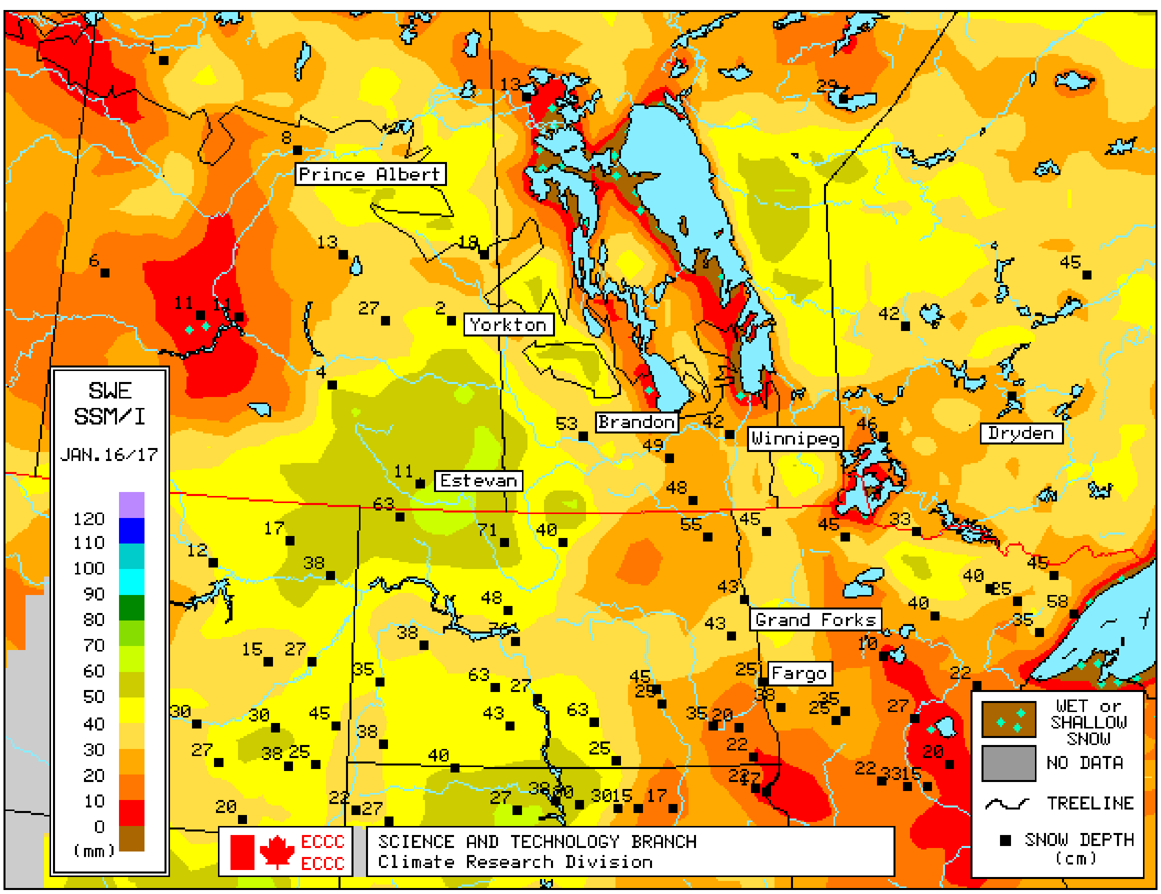
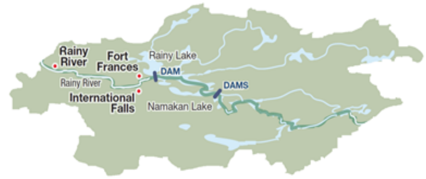


Figure 4. Snow-Water Equivalent Estimates from Environment and Climate Change Canada



Climate Indices

Beginning in 2016-17, the WLC, in participation with the Rule Curve Study Board, began examining links between spring runoff conditions and global weather phenomena, like the well-known *El Niño* and *La Niña* phases of Pacific Ocean warming. Cycles such as these have been demonstrated to have far-reaching effects on weather across the globe. These cycles are monitored by agencies which produce ratings, or scores, that reflect measurable changes in the climate. In the preliminary work done by the Study Board, there is evidence that winter values of the index that measures the *El Niño* and *La Niña* processes may be useful in assessing risk of above or below normal spring flow conditions.

Resources

Nearly all of the data products described above and used by the Water Levels Committee are made freely available online by the agencies responsible for their production. The following list provides links to some of these and other sources of data relevant to the hydrology of the basin.

Precipitation and Temperature Monitoring

Meteorological Service of Canada

Weather Data: https://weather.gc.ca/

CaPA Precipitation Maps: http://weather.gc.ca/analysis/

National Weather Service

Duluth Forecast Office Observed Weather Reports: http://w2.weather.gov/climate/index.php?wfo=dlh

Daily Surface Weather Map Archives:

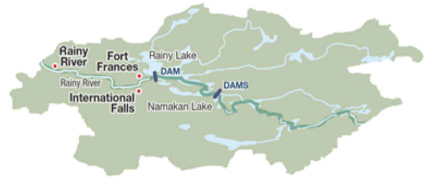
http://www.wpc.ncep.noaa.gov/dailywxmap/index.html

NWS Advanced Hydrologic Prediction Service Observed Precipitation Map (does not cover Ontario)

http://water.weather.gov/precip/index.php

Minnesota RAWS (Remote Automatic Weather Stations)

http://www.raws.dri.edu/wraws/mnF.html



Snow Monitoring

National Operational Hydrologic Remote Sensing Center Interactive Snow Information

http://www.nohrsc.noaa.gov/interactive/html/map.html?station=WROM5

Minnesota Department of Natural Resources Week Snow Depth and Rank Maps

http://www.dnr.state.mn.us/climate/snowmap/index.html

Water Level and Flow Data

Water Survey of Canada

http://wateroffice.ec.gc.ca/google_map/google_map_e.html?search_type=province&province=ON

United States Geological Survey

https://waterdata.usgs.gov/MN/nwis/current/?type=flow

H2O Power LP

http://www.h2opower.ca/water-management/

Lake of the Woods Control Board

http://lwcb.ca/waterflowdata.html

***El Niño* Southern Oscillation (ENSO) Resources**

Climate.gov ENSO Blog

https://www.climate.gov/news-features/department/enso-blog

Midwestern Regional Climate Center – Regional El Niño & La Niña Impacts and Outlooks

http://mrcc.isws.illinois.edu/pubs/pubsElNino.jsp