Grand River Conservation Authority

Report number: GM-12-22-106

Date: December 16, 2022

To: Members of the Grand River Conservation Authority

Subject: Current Watershed Conditions as of December 7, 2022

Recommendation:

THAT Report Number GM-12-22-106 – Current Watershed Conditions as of December 7, 2022 be received as information.

Summary:

The year started fairly typical with cold temperatures followed by a spring melt and rainstorm. Reservoirs were filled with spring runoff and flow augmentation began in May. Then conditions changed and most of the rest of the year was characterized by extended periods of no rain interspersed with small shots of light rain. Stream flows dropped and augmentation increased leaving reservoir levels dropping faster than they could recover. The watershed was moved to a Level 1 low water condition at the end of June and a Level 2 condition by mid-July.

The fall months were even drier than the summer with most of the watershed receiving about half of the normal precipitation from September to November. Reservoir discharges were dropped to minimum to conserve water in storage and most of the large reservoirs were below normal operating through the fall months. As of December 7, there was some recovery of reservoir levels, but conditions are still very low moving into freeze up.

Groundwater levels also dropped with some wells reporting the lowest November levels in a 17 year record. Lower groundwater levels will affect groundwater discharge to watercourses reducing baseflows next year.

The winter forecast is mixed. There is agreement for near normal winter temperatures and near to above normal precipitation. One forecast is that there will be an active storm track over the watershed which could deliver regular storms of mixed precipitation and lake effect snow.

Report:

Precipitation

This year will likely be one of the driest years on record for most of the watershed. The exception is along the Lake Erie shoreline. The climate station at Byng Island Conservation Area recorded 111 percent of normal precipitation over the last year. With the highest amounts over the last 3 months at 134 percent of normal. This part of the watershed has seen 100 to 300 mm more precipitation than other areas.

In contrast, the rest of the watershed received approximately 80 percent of normal precipitation over the past 12 months. That works out to approximately 180 millimeters less precipitation than is normally recorded in a year. The fall months were especially dry with only about 50 percent of normal precipitation during the September to November period. Long term trends are shown in Table 1 for eight climate stations in the watershed and a visual representation of trends for the Shand climate station is given in Figure 1.

Table 1: Precipitation trends as a percentage (%) of the long-term average over the last 18 months

Climate Station	Last Month	Last 3 Months	Last 6 Months	Last 12 Months	Last 18 Months
Shand	69%	52%	69%	86%	94%
Conestogo	70%	58%	74%	88%	98%
Guelph	49%	42%	60%	81%	99%
Luther	74%	61%	73%	86%	96%
Woolwich	59%	51%	60%	74%	83%
Laurel	48%	48%	50%	72%	95%
Shades	45%	46%	58%	73%	97%
Brantford	45%	60%	60%	78%	97%

The driest months of the year were July and September. July was very dry in Waterloo with the Laurel Dam climate station only recording 19 millimeters of rain, which was the third driest July on record dating back to 1950. The last time conditions were similar was in 2001. September was driest in Guelph with the Guelph Dam climate station recording only 21 millimeters. That was the fourth driest September in Guelph dating back to 1950 and the driest since 1998.

Wet months were spread out this year with August and February being the only months that were consistently wetter than normal across the watershed. High precipitation in these months was the result of single large storm events. In February, about a month's worth of precipitation were recorded during a single storm event on February 16 and 17. In August, most of the rain was recording in the first few days of the month with very dry extended periods before and after.

The first week of December saw fairly typical precipitation. Both snow and rain have been recorded in December, but far more rain than snow. The snowpack has not formed yet.

Air Temperatures

2022 started out cold and then was close to or warmer than normal throughout the rest of the year. January was the coldest month of the year with temperatures approximately 3.5 degrees below normal. There were multiple cold weather warnings and some days saw daytime high temperatures below minus 25 degrees.

Months with above average temperatures included May, August and November. The average temperature in May was over a degree above normal across the watershed, while August was warmest in the middle of the watershed. November was also abnormally warm with numerous days over 20 degrees and humidex readings even higher.

Warmer than usual temperatures have continued into the first part of December. A visual representation of these trends for the Shand climate station is given in Figure 2.

Groundwater Resources

Groundwater levels in the Provincial Groundwater Monitoring Network and Grand River Conservation Authority monitoring wells across the watershed were analyzed to the end of November and are shown in Figure 3.

Groundwater levels recovered in the first part of the year from very low levels observed in 2021 aided by wet conditions last fall and this year's spring snowmelt. Levels started to decrease over the early summer months, especially in the north-central part of the watershed. Decreasing levels continued over the late summer and fall, coinciding with the period of very low precipitation. By November a number of wells recorded their lowest average monthly water

level. The period of record for the groundwater monitoring wells ranges from 8 to 20 years. The period for the wells showing record lows ranges from 8 to 17 years.

Lake Erie Water Levels

Levels in Lake Erie continued to decline from the record highs of 2020. By the middle of the year levels were only 0.3 meters above the long term average, whereas in 2021 levels averaged closer to 0.5 meters above the long term average.

During November, the average lake level was approximately 0.25 meters above the long-term average, which was approximately 0.45 meters below November 2021. There were two small high lake level events over the past month which resulted in Flood Watch messages issued on November 19 and 29. Lake levels did not reach the warning threshold and no flooding was reported.

The long term forecast for Lake Erie is for lake levels to continue to decline over the next few months before following the normal spring rise in levels. Levels are forecast to stay below high levels in 2020 and may start to track closer to the long term average by early next year. Figure 4 shows the range of water levels that is expected over the next six months as well as the observed water levels over the last three years.

Reservoir Conditions

Reservoir levels have varied over the year. Cold temperatures in January reduced inflows to the reservoirs and levels dropped well below normal winter levels. Snow melt and high precipitation in February helped to bring the reservoirs back to their normal operating levels and they were gradually filled over the spring period.

Augmentation requirements in the spring were variable until the middle of June when the lack of rainfall affected stream flows and increased the need for higher augmentation. Augmentation accounted for over 70 percent of the flow through Kitchener throughout the summer. High requirements for augmentation continued through the summer and fall and only fell slightly when downstream flow targets were reduced to their fall values in October. Augmentation for sites on the Grand River is shown on Figure 5.

The combination of low rainfall and high augmentation pressure put strain on the reservoirs and levels dropped below the lower rule curve starting early in the summer at Woolwich, mid-summer at Guelph, early September at Shand and early October at Conestogo. Downstream flow targets were maintained during the summer and early fall period. Discharges were minimized when the switch was made to the lower fall flow targets, but with no fall storm events reservoir levels continued to decline until late November. The last two weeks have seen some recovery in levels, but only Luther reservoir remains at a normal operating level for this time of the year. Some of the other reservoirs are within their lower rule curve, but below the normal winter holding level.

Reservoir levels and operating rule curves are shown in Figures 6 and 7 for the four largest reservoirs.

Low Water Response

Given the dry conditions, the Grand River Low Water Response Team was active in 2022. The Grand River Low Water Response Team put the watershed in a Level 1 low water condition on June 30 and upgraded to a Level 2 condition on July 21. The watershed remains in a Level 2 condition and will likely stay in Level 2 until all of the large reservoirs are back to normal operating levels. At Level 1 the Low Water Response Team asks water users to reduce use by 10 percent and at Level 2 by 20 percent.

The Grand River Low Water Response Team is comprised of representatives from municipalities, agriculture, golf course operators, aggregate operations, water bottlers, and provincial ministries. It meets as needed to carry out the Ontario Low Water Response Program in the Grand River Watershed.

Long Range Forecast

Environment and Climate Change Canada is forecasting near normal temperatures for most of the watershed with a greater chance of above normal temperatures in the northern part of the watershed. The precipitation forecast is for near normal precipitation for the December to February period.

The winter forecast from the Weather Network is for near normal temperatures and above normal precipitation. They are predicting that there will be an active storm track over southern Ontario which will bring mixed precipitation and lake effect snow.

Flood Preparedness

Conditions are being monitored closely. Staff continue to hold weekly meetings as part of planning initiatives, dam operations and flood emergency preparedness.

A meeting was held with municipal flood coordinators, community emergency management coordinators, police, other agencies and GRCA staff involved with the GRCA flood warning system. The meeting was well attended and described in a separate board report.

An updated Grand River Flood Warning System guide is being published and will be mailed to municipalities, police and other agencies involved with the GRCA flood warning system.

Financial Implications:

Not applicable

Other Department Considerations:

Not applicable

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Figures:

Figure 1: Shand Dam Monthly Precipitation 2018 to December 7, 2022

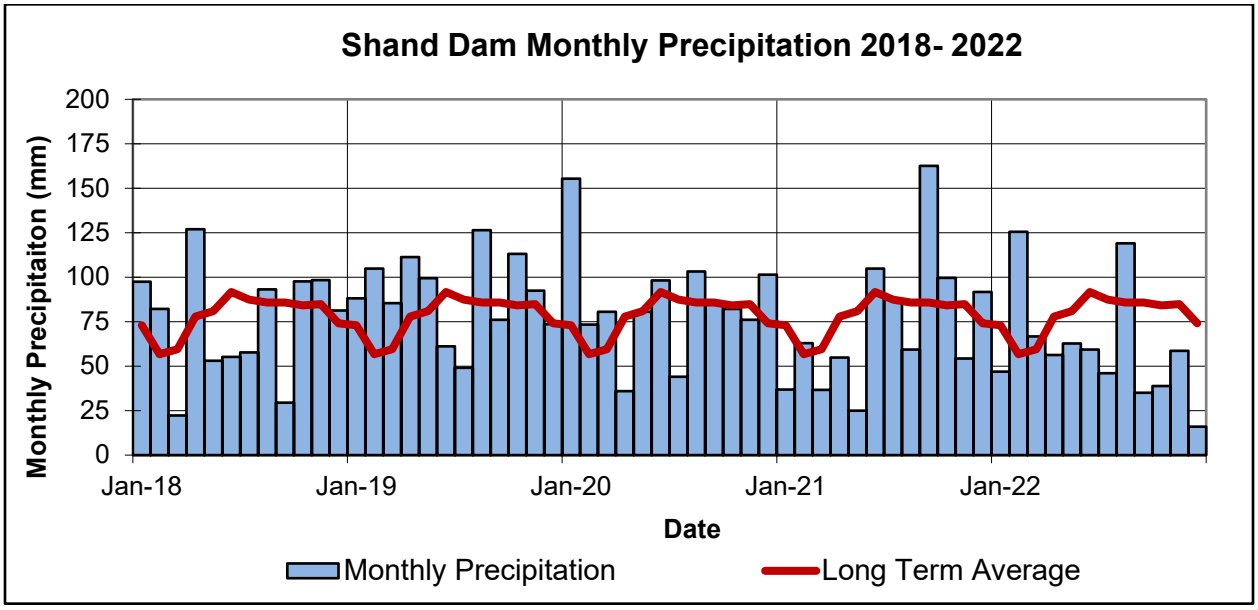


Figure 2: Monthly Average Air Temperatures at Shand Dam from 2018 to December 7, 2022

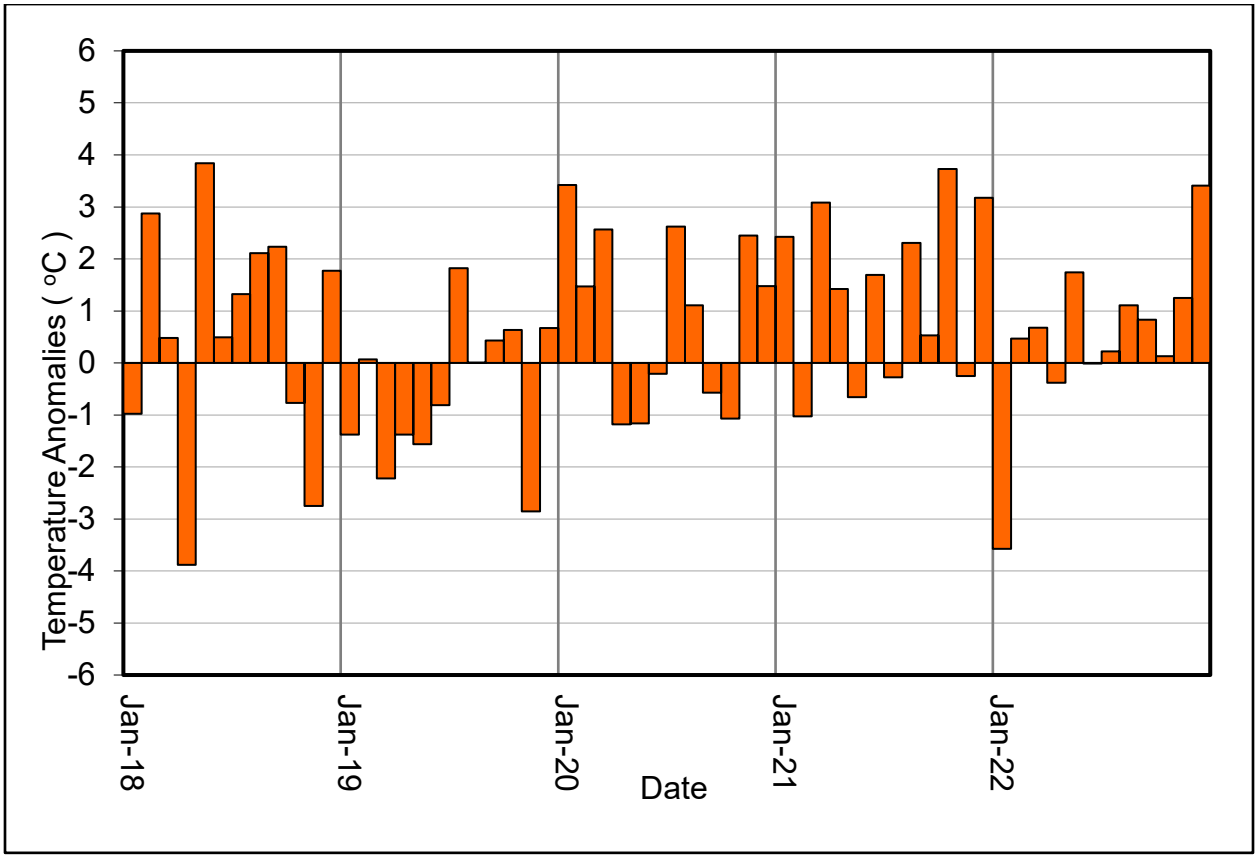


Figure 3: Groundwater conditions at GRCA monitored groundwater wells

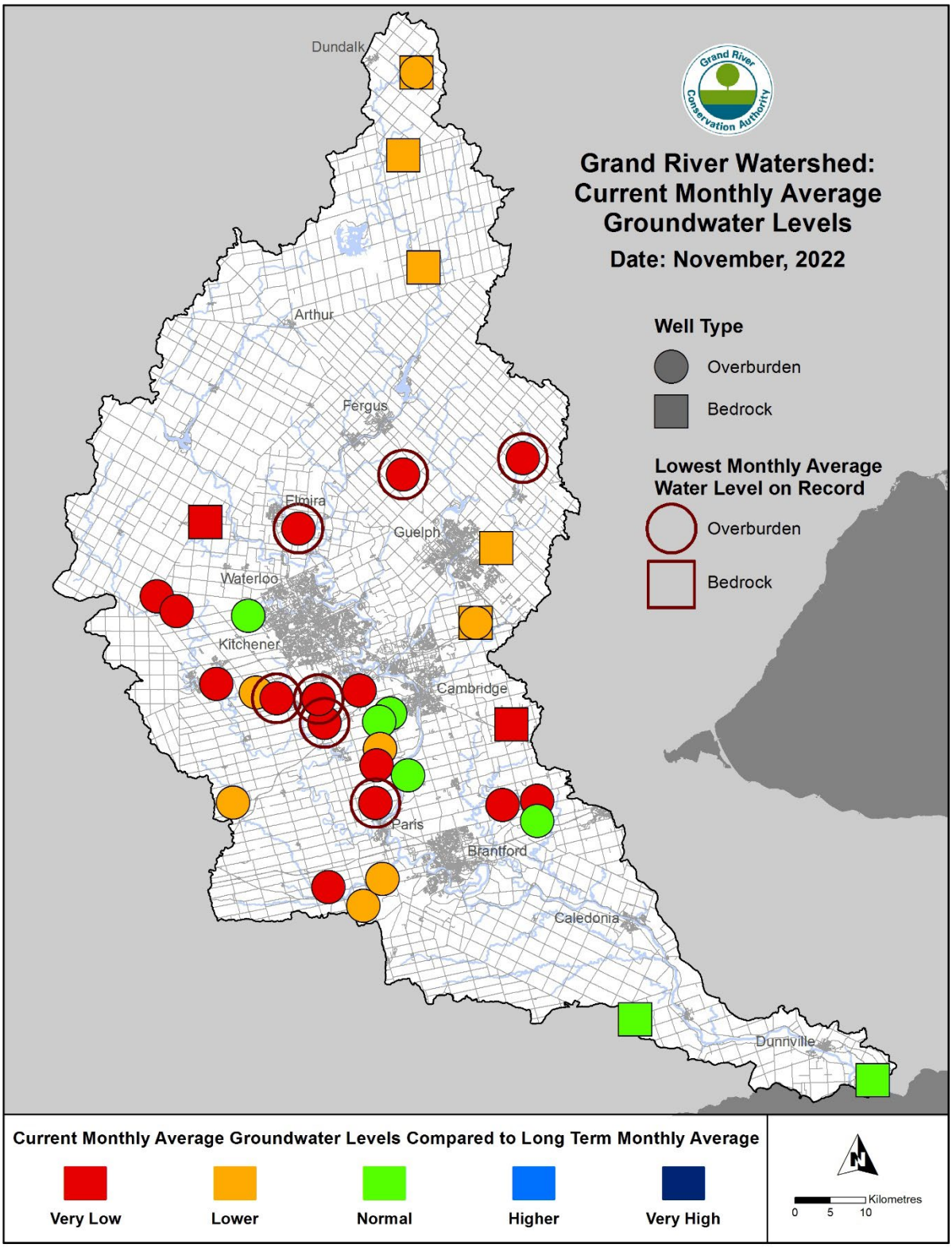


Figure 4: Water levels for Lake Erie at Port Colborne

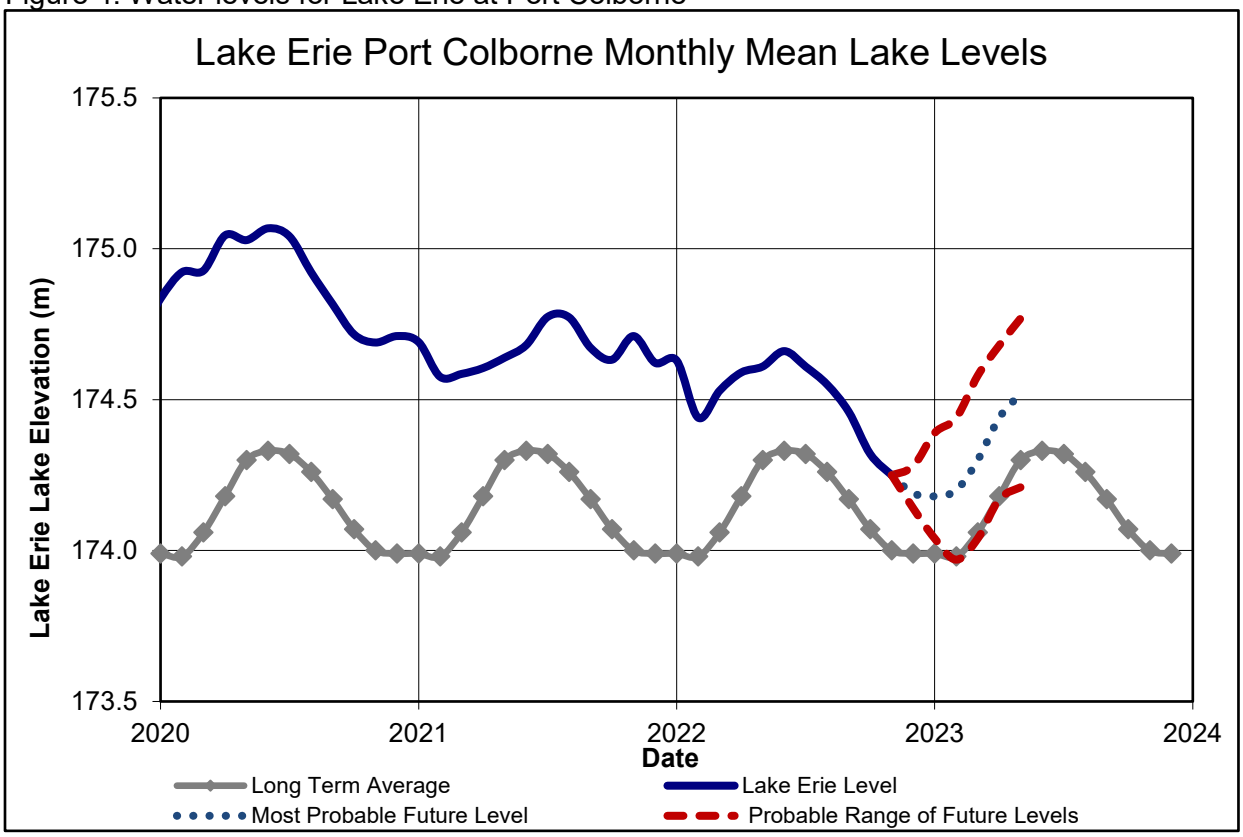


Figure 5: Grand River Augmentation

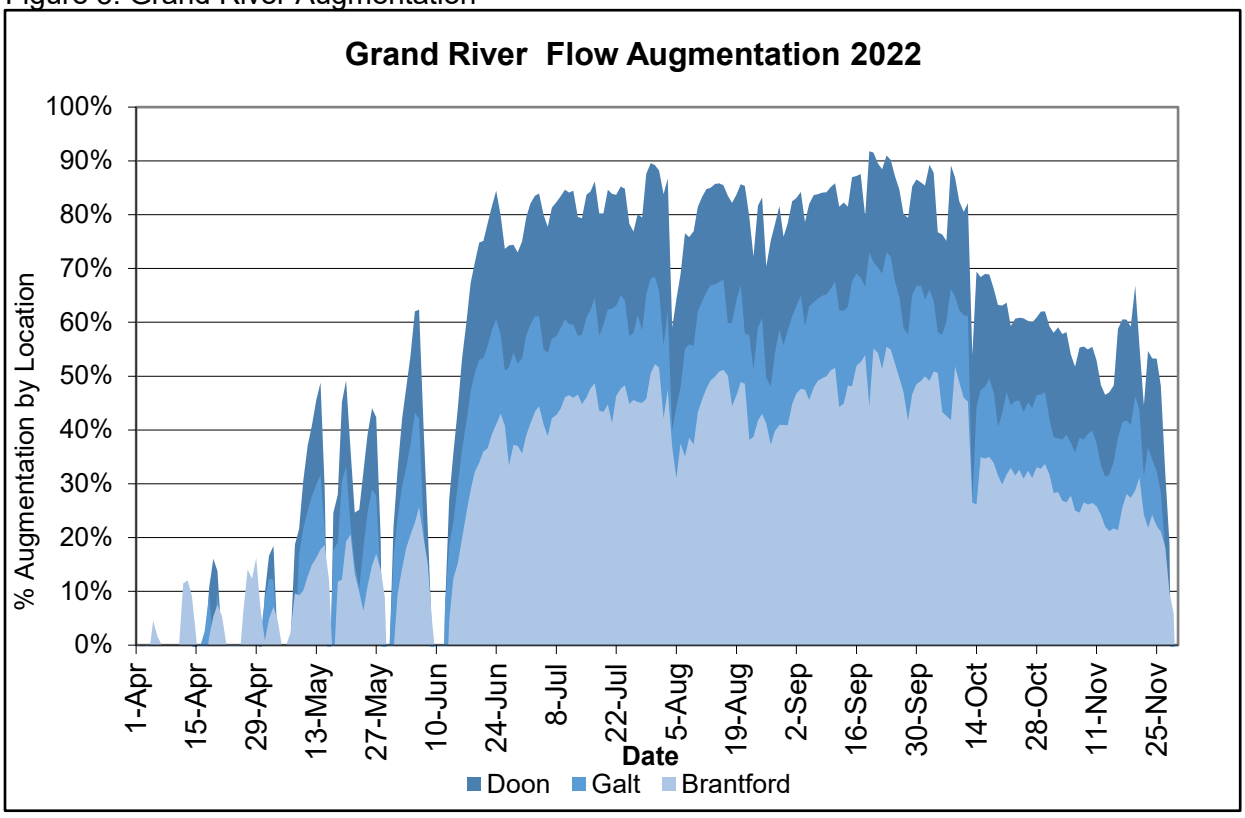
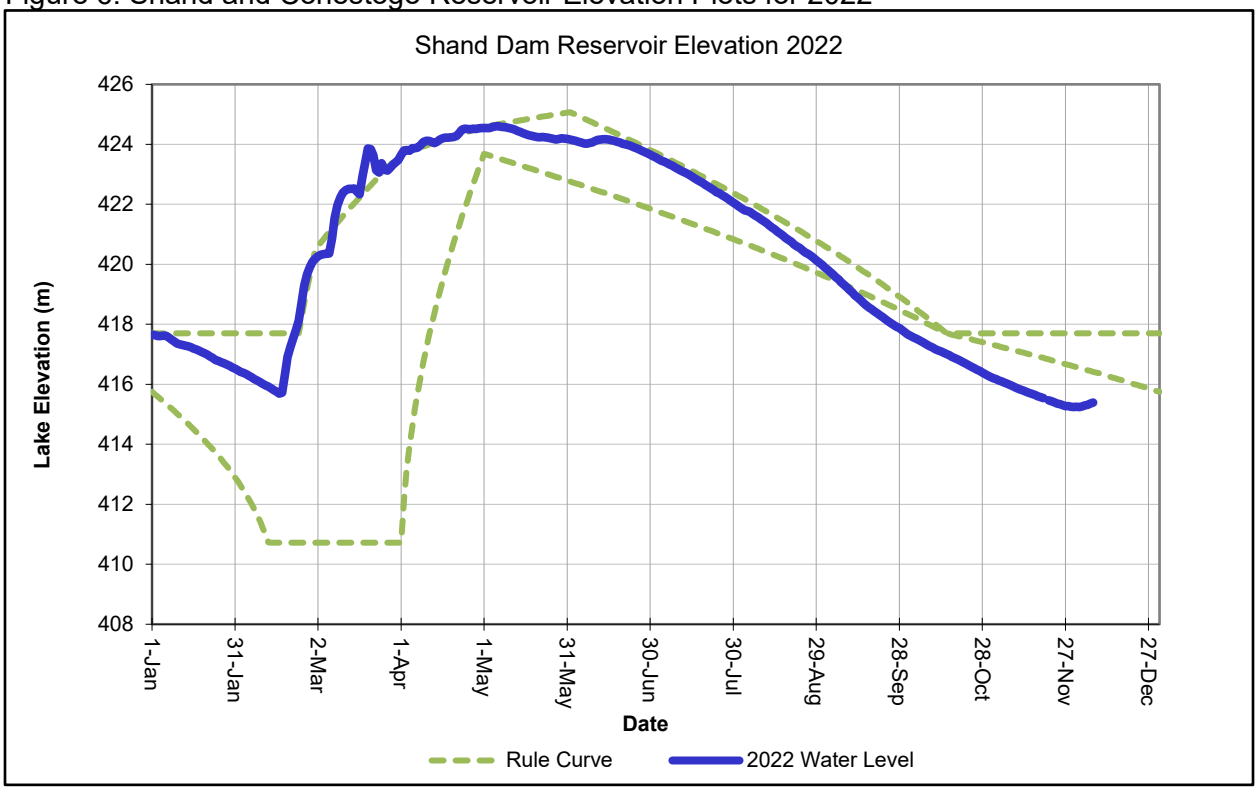


Figure 6: Shand and Conestogo Reservoir Elevation Plots for 2022



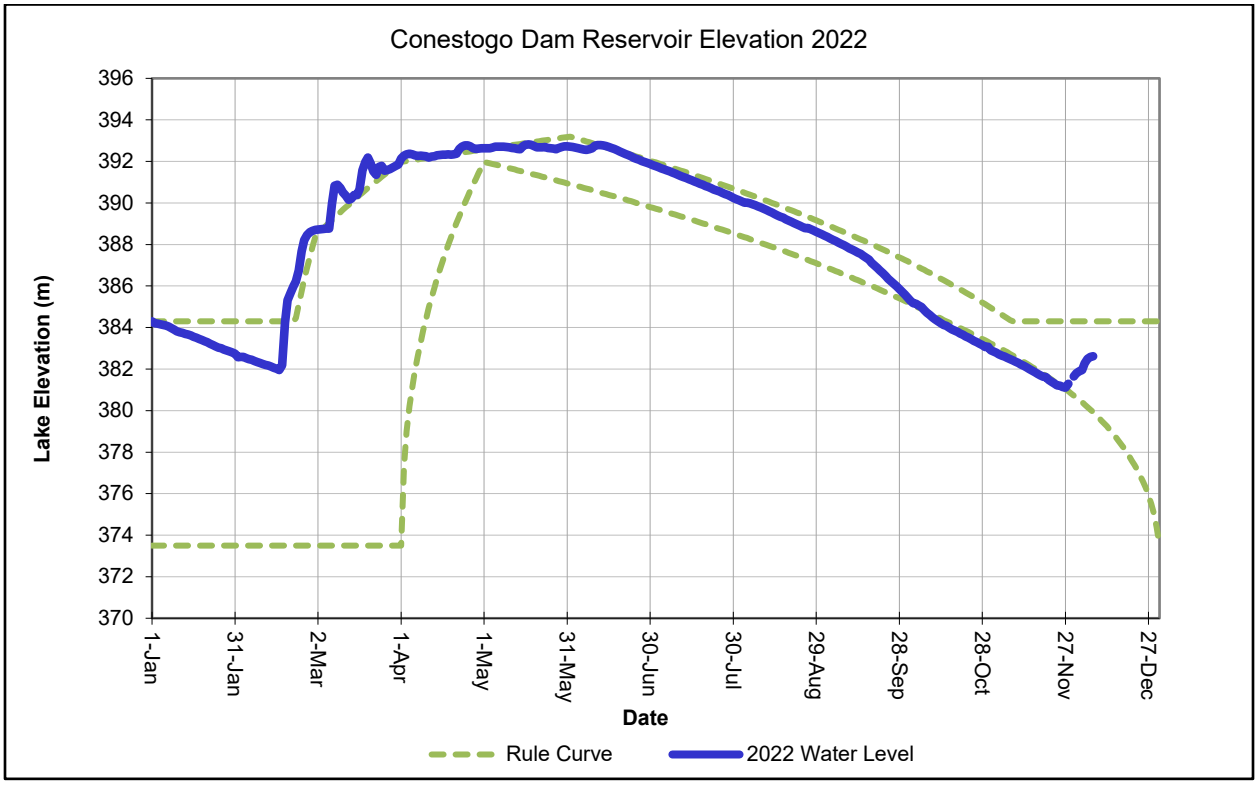


Figure 7: Guelph and Luther Reservoir Elevation Charts for 2022