Otonabee CONSERVATION

Drought Monitor Report

Low Water Response Program

Air Temperature, Precipitation Receipts, and Streamflow for the Otonabee Region Watershed

January – May 2020 | Prepared by: Gordon Earle | Water Resources Technologist

SUMMARY

Solar radiation, temperature and precipitation are the three main climate variables influencing soil moisture, surface water levels and groundwater supplies. This Drought Monitor Report delivers information about these weather phenomena in relationship to the Ontario Low Water Response Program indicators of drought to explain current local conditions.

In 2019, the Otonabee Region watershed experienced drought conditions beginning in August. Dry conditions persisted until they were alleviated in the Fall. Further improvement of conditions occurred in January 2020, due to above-normal precipitation. This was largely a result to two rain events that occurred January 11 (55-60mm) and January 25 (30-40mm). January's above-normal precipitation total resulted in markedly stronger than normal January streamflow.

In February 2020, well-below normal precipitation levels resulted in the average monthly streamflow dropping to normal levels; however, there was no concern for Spring drought, as substantial rainfall in the Fall of 2019 and January 2020 resulted in good freeze-up conditions.

Well-above normal air temperatures in March 2020 brought an earlier than normal Spring Freshet. Significant snowmelt run-off caused above-average monthly streamflow in March 2020.

The earlier than normal Spring snowmelt combined with slightly below normal precipitation receipts in March and April, and substantially below-normal precipitation in May, gave rise to the emergence of late-Spring, Level 1 drought conditions with Peterborough Airport climate station reporting a 54.7 millimeter (26.5%) deficit in 3-month total precipitation receipts. The Trent University climate station also reported a deficit, but remained above the Level 1 drought threshold.

AIR TEMPERATURE

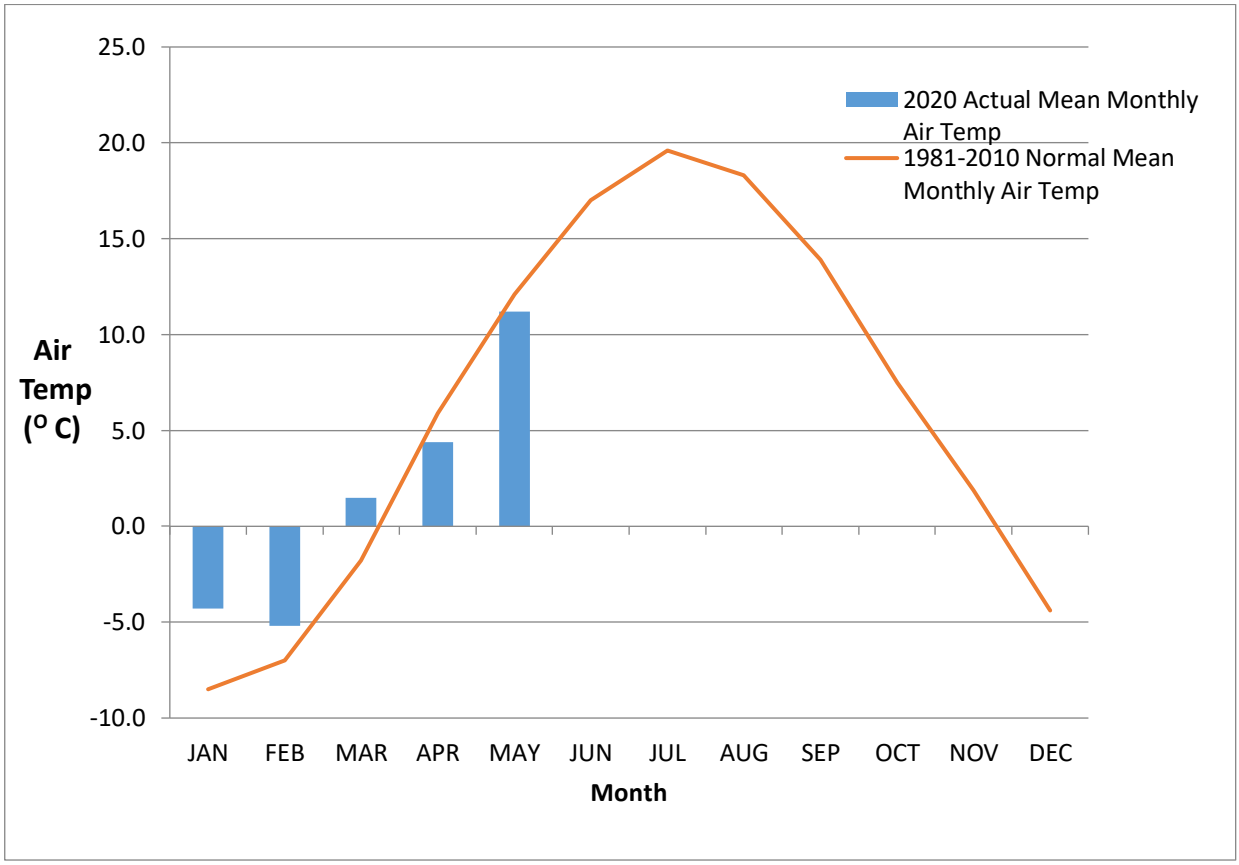

Figure 1: Mean monthly air temperature (^{O}C) observed at Peterborough Airport for January 2020 through May 2020 compared with the 30-year normal (1981-2010) air temperature (^{O}C)

Average daily air temperatures varied considerably throughout the first quarter of the year. January saw average daily air temperatures fluctuate between -15.2 (January 17) and +5.9 (January 11). February average daily air temperatures moved between - 18.1 (February 14) and +0.7 (February 10). March average daily air temperatures ranged from -10.6 (March 01) to +10.9 (March 29). Periodic above-zero air temperatures resulted in days when precipitation arrived as rain and there was snowmelt.

Mean monthly air temperatures were significantly warmer during the first quarter of 2020. January and February were 50% and 25% warmer than normal, respectively. At 180% warmer than normal, March was most extraordinary.

Conversely, April and May both saw below normal mean monthly air temperatures. April was 25% colder than normal, while May was approximately 7% cooler.

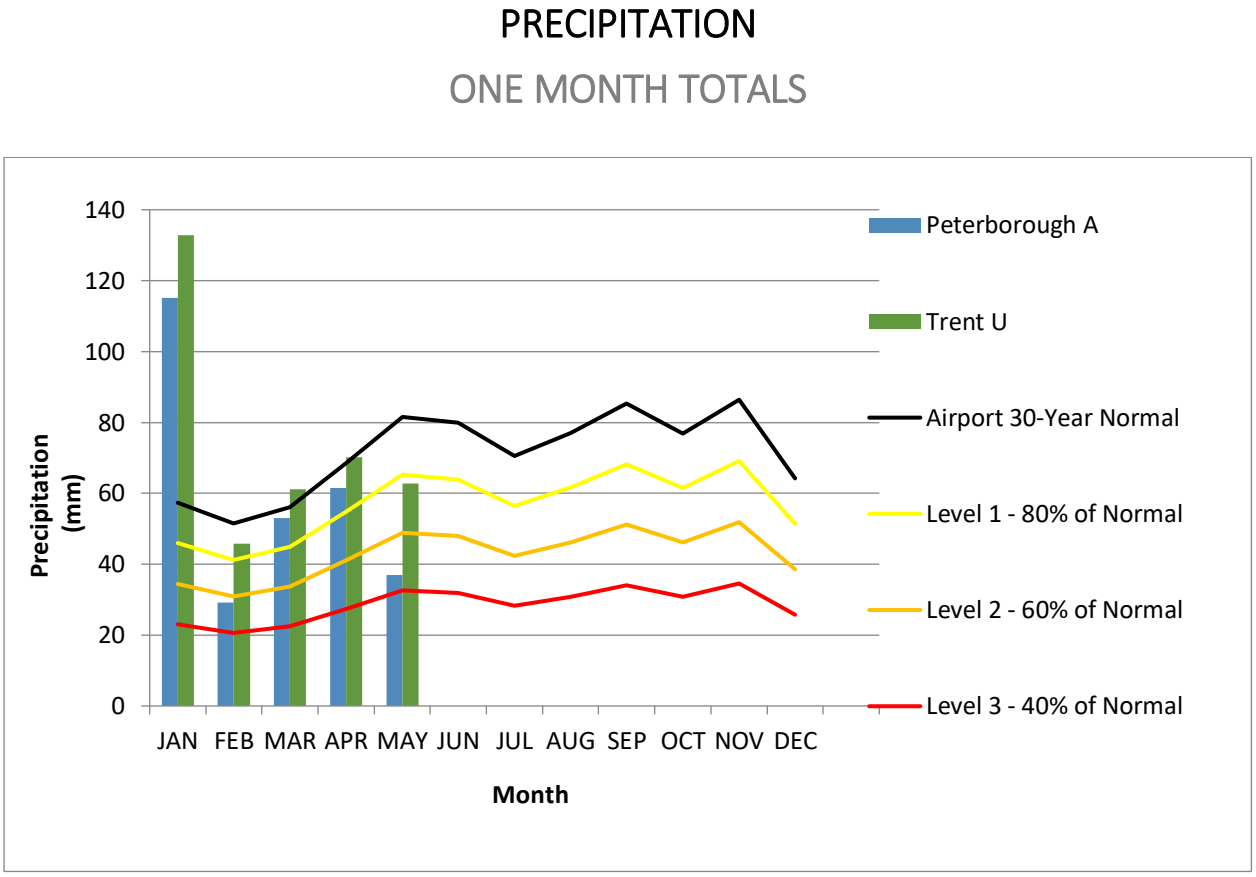

Figure 2: Total monthly precipitation (millimeters) received at Peterborough Airport and Trent University climate stations between January 2020 and May 2020 compared with the 30-year normal (1981-2010) monthly precipitation receipts (millimeters) and the Level 1 (80% of normal), Level 2 (60% of normal) and Level 3 (40% of normal) drought indicator thresholds.

The Region received above-normal precipitation throughout January. This was largely due to 55 to 60 millimeters of precipitation received on the 11th. The normal level for the Peterborough Airport meteorological station is 57.4 millimeters so there was the equivalent of a full month of precipitation in one day. Another significant event occurred on the 25th when the Region received 30 to 40 millimeters of precipitation. Above-zero air temperatures meant that precipitation received on both dates was in the form of rain.

A significant reduction in precipitation was observed in February, with near-normal precipitation in March and April, followed by well-below normal precipitation receipts in May.

THREE MONTH TOTALS

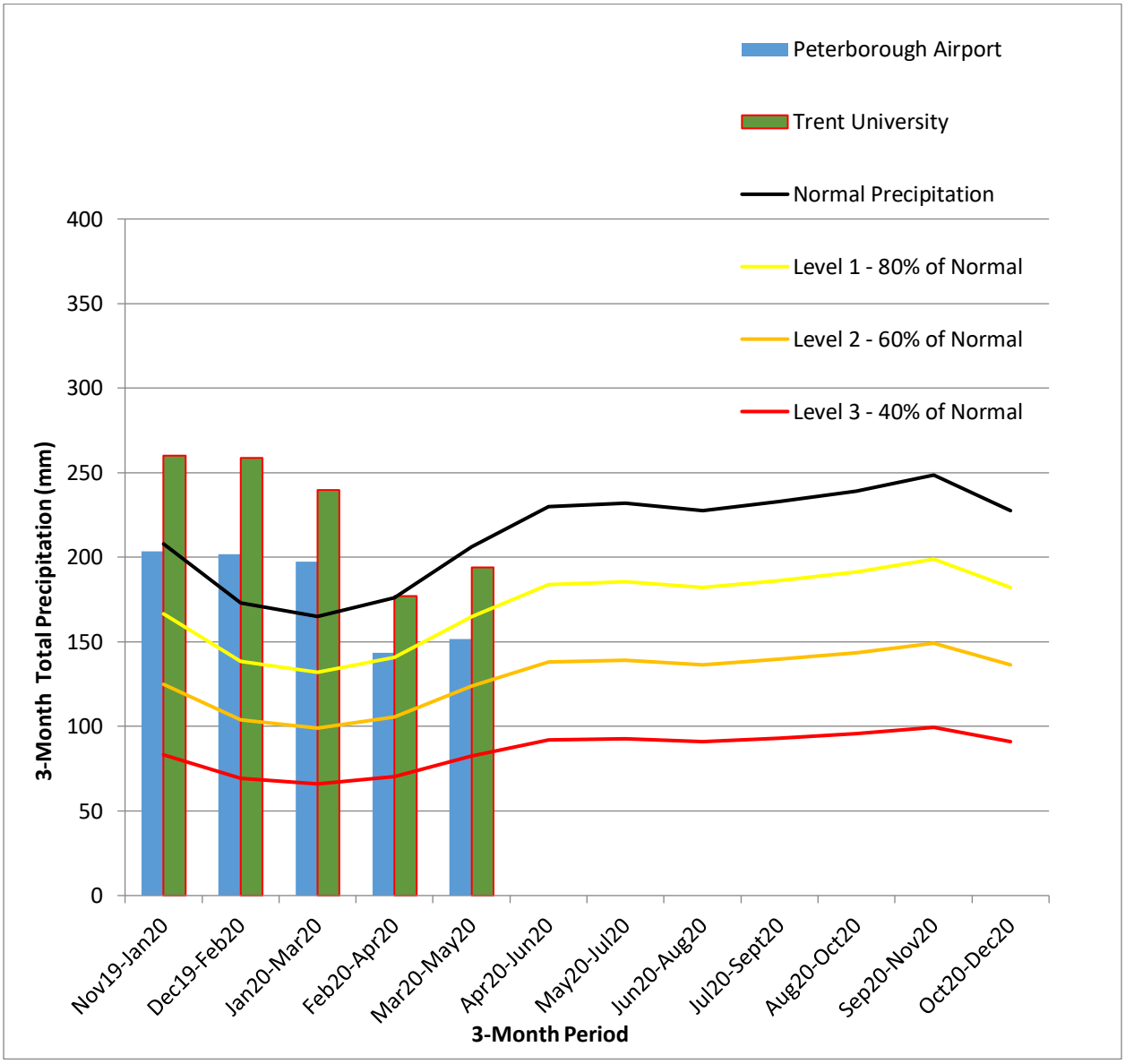

Figure 3: Actual 3-month precipitation totals (millimeters) received at Peterborough Airport and Trent University climate stations compared with the 30-year normal (1981-2010) 3-month precipitation totals (millimeters), and the Level 1 (80% of normal), Level 2 (60% of normal) and Level 3 (40% of normal) drought indicator thresholds.

During the first quarter of the year, the 3-month totals ranged from normal to above-normal. This was the result of well-above-normal receipts in January.

Below-normal precipitation receipts in February, March, and April resulted in the 3-month total for the period ending April to drop below-normal, but the amounts received at both the

Peterborough Airport and Trent University climate stations remained above the Level 1 drought threshold, albeit less than 3 millimeters above the threshold at Peterborough Airport. As a result, soil moisture concerns were emerging; however, normal or above-normal precipitation in May could have prevented the emergence of drought.

Well-below-normal precipitation receipts in May resulted in the 3-month precipitation totals at Peterborough Airport climate station that signaled the on-set of short-term / seasonal drought. At the end of May 2020, the Peterborough Airport climate station was experiencing a 54.7 millimeter (26.5%) deficit in 3-month total precipitation receipts, a Level 1 drought. The Trent University climate station also had a 3-month precipitation deficit by the end of May, but remained well above the Level 1 drought threshold.

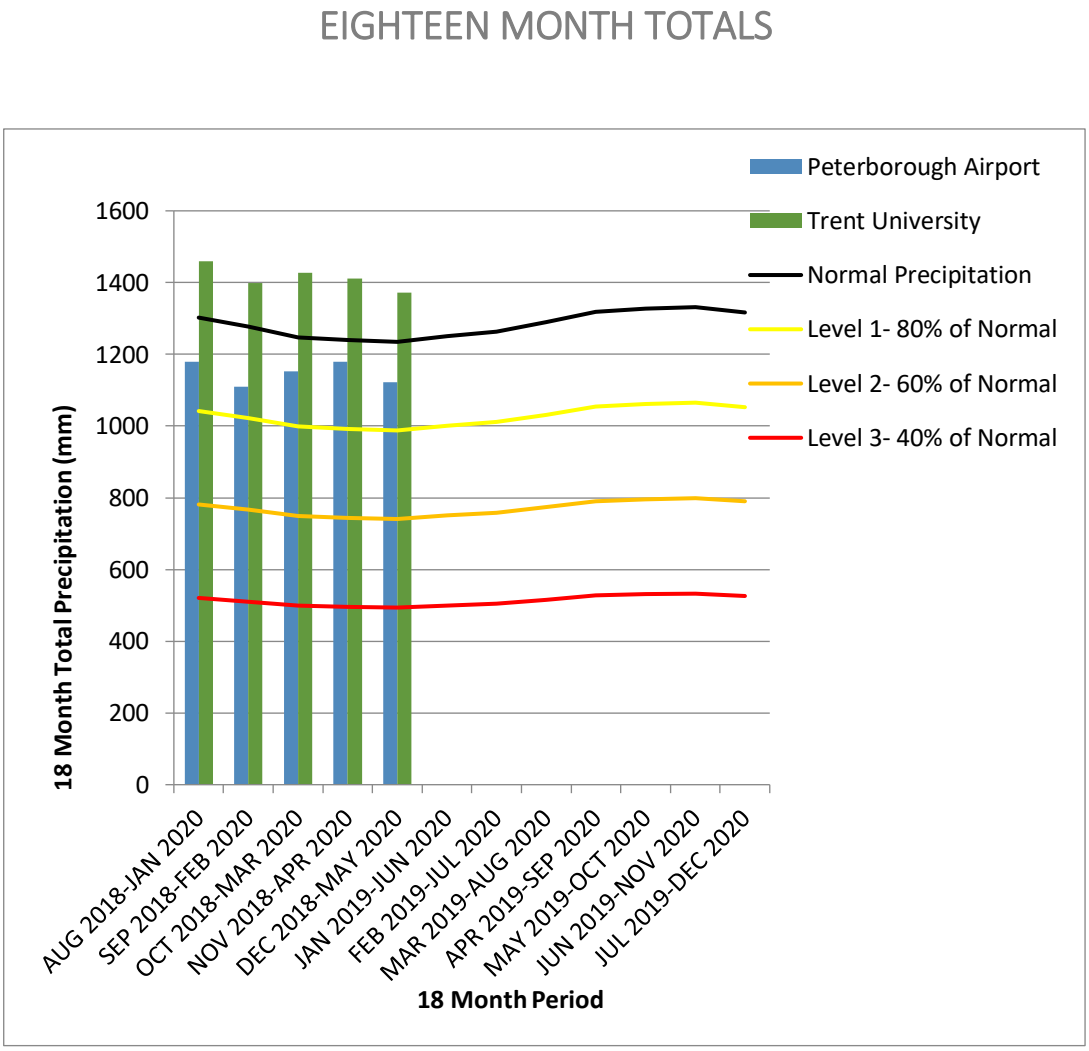

Figure 4: Actual 18-month precipitation totals (millimeters) received at Peterborough Airport and Trent University climate stations compared with the 30-year normal (1981-2010) 18-month precipitation totals, and the Level 1 (80% of normal), Level 2 (60% of normal) and Level 3 (40% of normal) thresholds.

The 18-month precipitation totals received at the Peterborough Airport meteorological monitoring station was below normal during the first 5 months of 2020. However, the below-normal levels were still above the Level-1 drought threshold. The 18-month total received at Trent University was above normal for the same period. Therefore, there are long-term drought concerns.

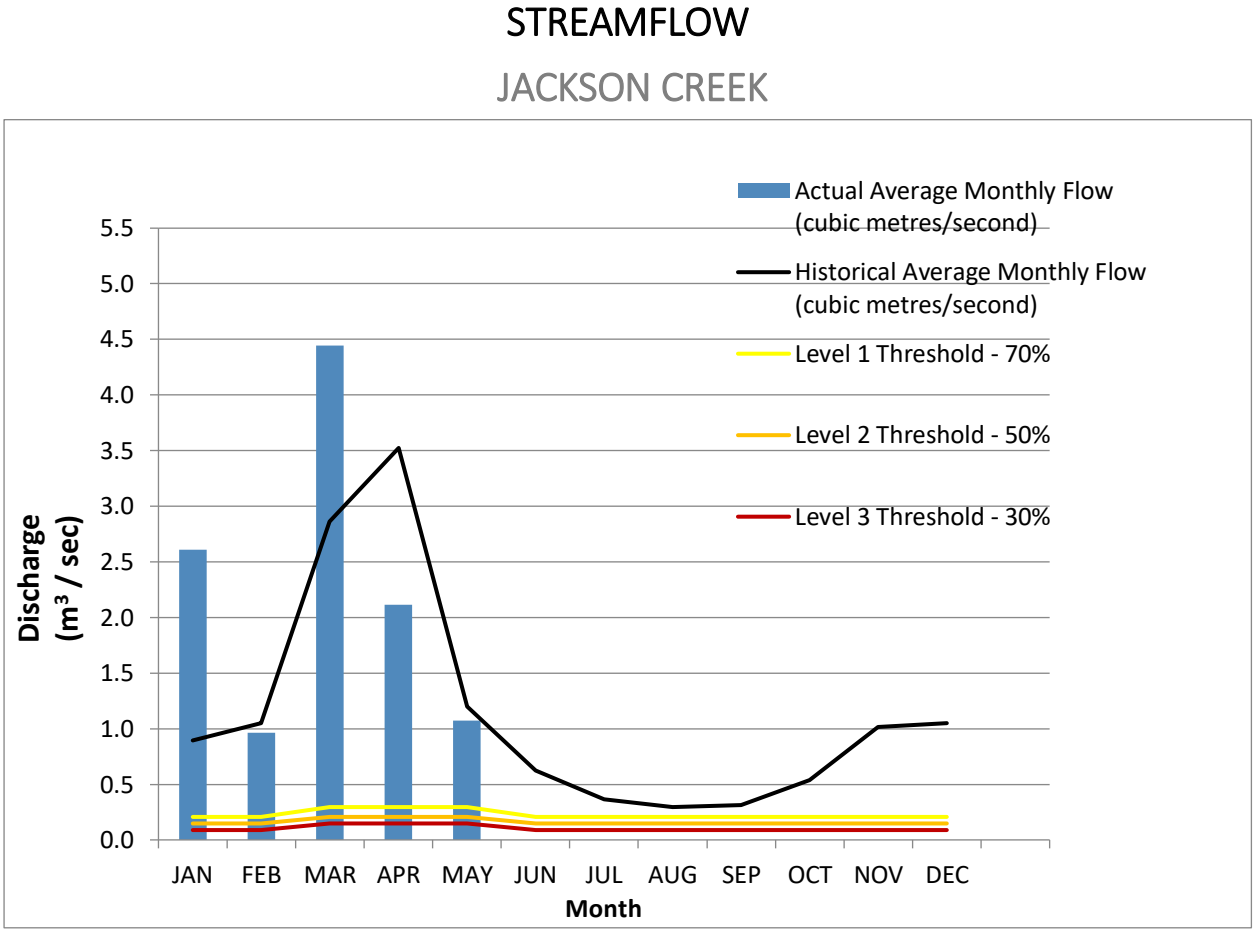

Figure 5: Average monthly streamflow (cubic meters per second) observed on Jackson Creek in the City of Peterborough (Station ID: 02HJ001) between January 2020 and May 2020 compared with the long-term historical average monthly streamflow (cubic meters per second) and the Level 1, Level 2 and Level 3 drought indicator thresholds.

In January 2020, above-normal air temperatures and precipitation receipts combined to cause markedly stronger-than-normal stream flows throughout the Region. Jackson Creek was no exception showing well-above the long-term historical average. In February, levels returned to normal due to colder air temperatures and below-normal precipitation receipts. In March, above-normal air temperatures caused snowmelt. Snowmelt combined with normal precipitation levels resulted in higher-than-normal water levels/flows in Jackson Creek.

Normally, the Spring freshet peaks in April. However, in 2020, the peak occurred in March, resulting in April streamflow being well below normal. In April, the average monthly streamflow on Jackson Creek was 60 percent of the historical average.

May saw below-normal average monthly flows owing to below-normal May rainfall receipts.

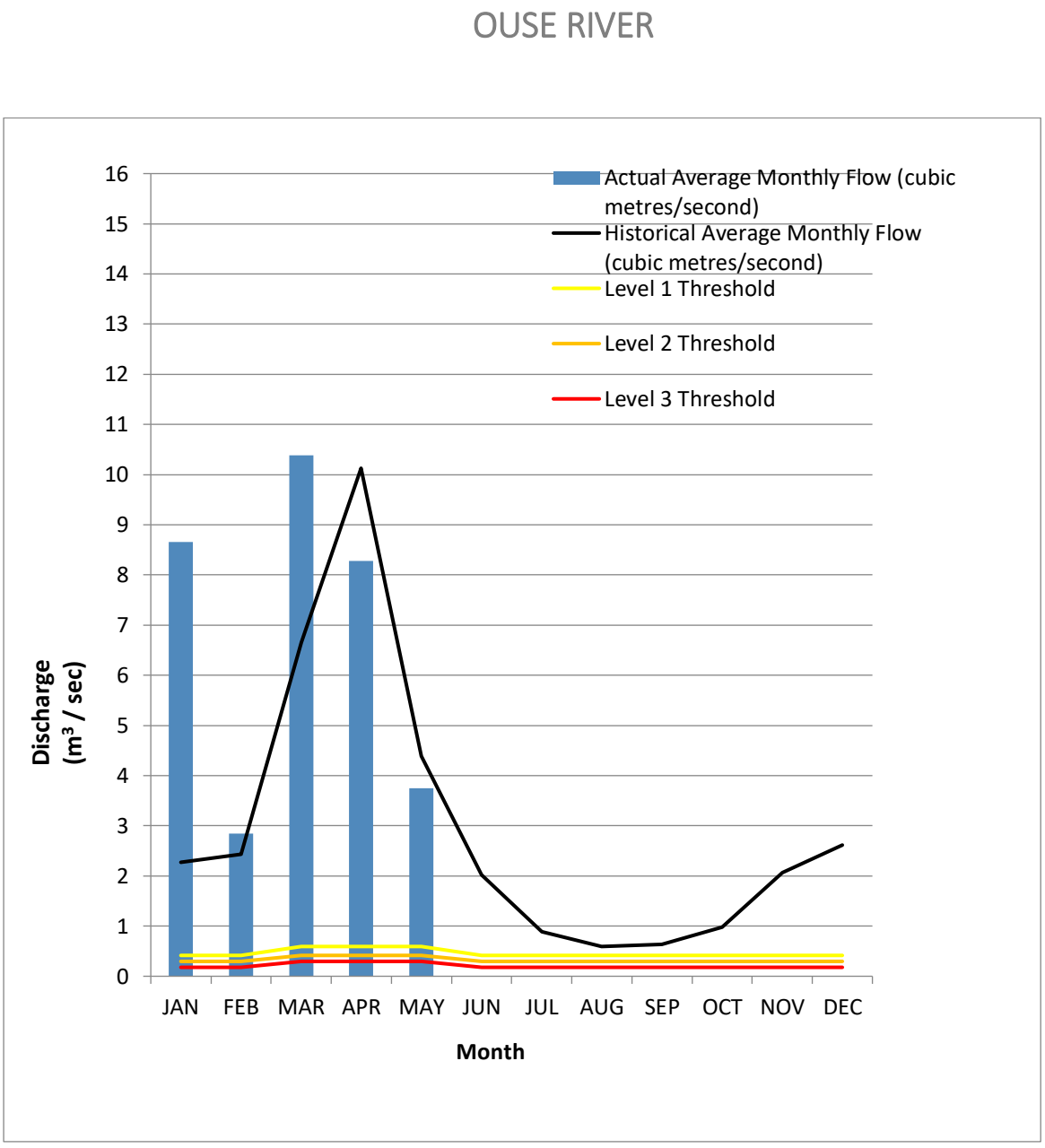

Figure 6: Average monthly streamflow (cubic meters per second) observed on Ouse River near the Hamlet of Westwood (Station ID: 02HJ003) between January 2020 and May 2020 compared with the long-term historical average monthly streamflow (cubic meters per second) and the Level 1, Level 2 and Level 3 drought indicator thresholds.

In the first quarter of 2020, water levels / flows on the Ouse River fluctuated considerably. Flow rates were above-average in January, average in February and above-average in March. Like Jackson Creek, it can be seen that the Ouse River also experienced the peak of the Spring freshet in March as opposed to April when it normally occurs.

The average monthly streamflow for April and May flows were below the historical average, but were still quite strong.

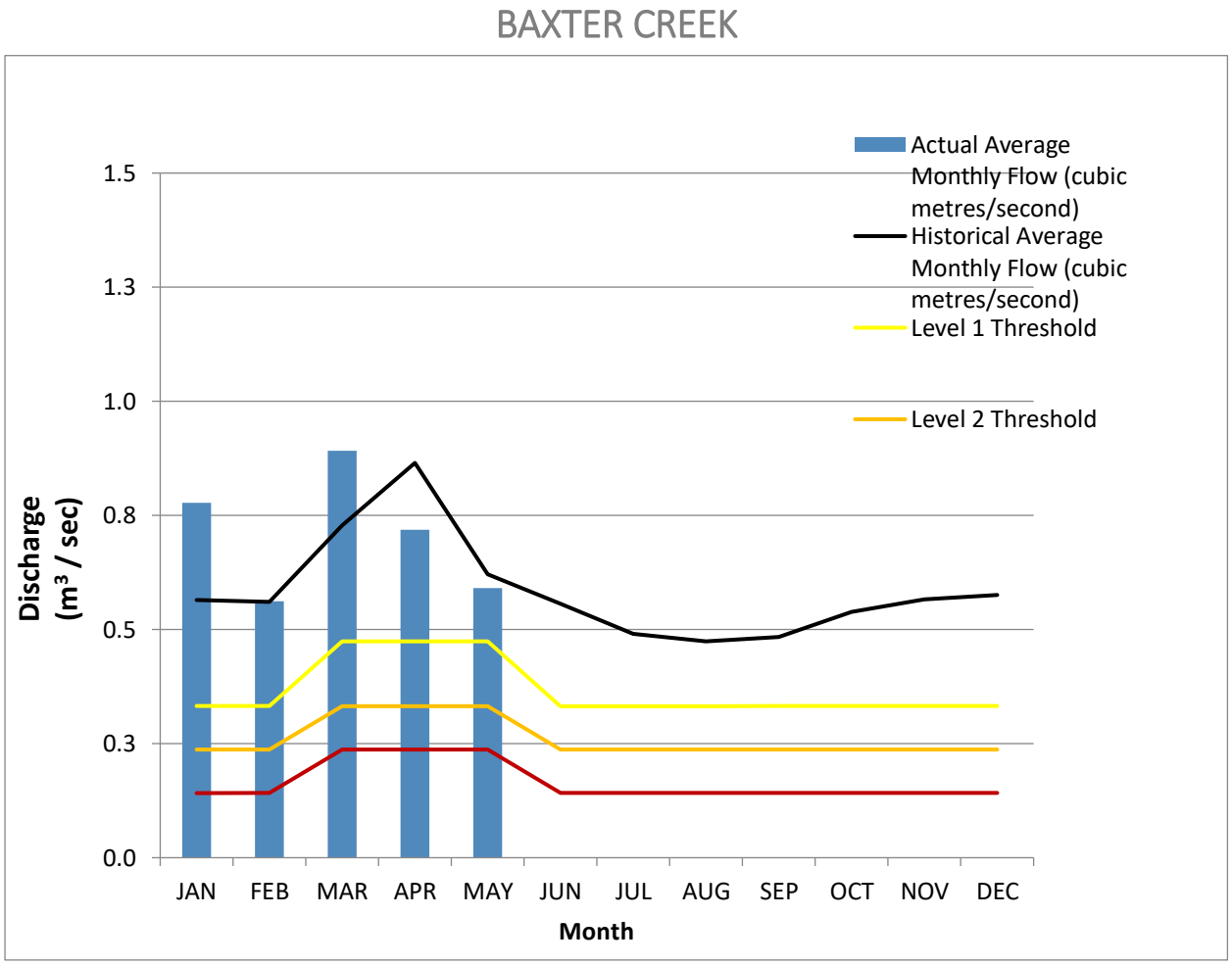

Figure 7: Average monthly streamflow (cubic meters per second) observed on Baxter Creek in Millbrook (Station ID: 02HJ007) between January 2020 and May 2020 compared with the long-term historical average monthly streamflow (cubic meters per second) and the Level 1, Level 2 and Level 3 drought indicator thresholds.

In the first 5 months of 2020, Baxter Creek followed the same pattern as Jackson Creek and the Ouse River with above-average flows in January, average flows in February, above-average flows in March, and below-average flows in both April and May.