# DUNTROON EXTENSION QUARRY

## ADAPTIVE MANAGEMENT PLAN SUMMARY REPORT 2020

WALKER AGGREGATES INC.

PROJECT NO.: 111-53312-03
DATE: APRIL 30, 2021

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April 30, 2021

WALKER AGGREGATES INC.
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Attention: **Mr. Matt McMahon**

Dear Mr. McMahon:

WSP Canada Inc. is pleased to present the enclosed Adaptive Management Plan Annual Summary Report for the Duntroon Extension Quarry. This report documents the monitoring data collected for the performance indicator trigger monitoring program, the long term trend groundwater and surface water monitoring program, the long term trend ecological monitoring program and the ecological enhancement and mitigation monitoring program.

This summary report is for the period of January 1, 2020 through December 31, 2020. Historical data, where available, have been included to provide context to the observed values in 2020. It is noted that the data and reporting conducted to satisfy the long term trend ecological monitoring program and the ecological enhancement and mitigation monitoring program was completed by Stantec Inc. and is appended to this report.

We trust that the information provided is sufficient for your needs at this time. Please contact the undersigned if you have any questions or comments.

Yours sincerely,

Kevin Fitzpatrick, P.Eng.
Senior Project Engineer, Environment

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# EXECUTIVE SUMMARY

The Adaptive Management Plan (AMP) annual summary report is a requirement of the Aggregate Resources Act licensing of the Duntroon Extension Quarry. The licensed property of the Main quarry operates in accordance with Aggregate Resource Act (ARA) license number 3514. The Extension quarry is licenced to WAI under ARA licence number 607841, issued August 6, 2014.

Walker Aggregates environmental commitment is to manage its lands so that in the long term, the ecology is not only maintained but also enhanced beyond its current condition. This will be accomplished through environmental initiatives detailed on the ARA Site Plans and the AMP to ensure that protection, mitigation, and enhancement measures sustain local environmental resource features and functions for future generations.

Aggregate extraction in Phase 1 of the extension quarry began in late June 2016 and was the first year of reporting for the Adaptive Management Plan. The potential impacts for each phase of Quarry operations are outlined in the AMP with details on specific protection and monitoring measures. This annual summary report focuses on quarry operations in Phase 1 and the associated monitoring measures that were completed in support of the AMP in 2020.

Given the extraction that has occurred in the main quarry, extraction in Phase 1 of the extension quarry is not expected to result in negative impacts to off-site water resources and/or ecological features and functions. Therefore, the monitoring and mitigation requirements during this phase of extraction are such that the response of the natural environment system will be monitored by means of the groundwater, surface water and wetland monitoring network, and results compared to predictions.

The AMP consists of four monitoring programs:

- the Performance Indicator Trigger Monitoring program (PITM),
- the Long Term Trend Groundwater and Surface Water Monitoring program (LTT),
- the Long Term Trend Ecological Monitoring program (LTTEM), and
- the Ecological Enhancement and Mitigation Monitoring program (EEMM).

The AMP annual summary report is a consolidated summary report documenting the observations from each of the monitoring programs.

Key findings of the PITM indicate that surface water flows and/or temperatures that did not meet the monthly interim PITM trigger levels at some locations were not related to quarry activities. Since the PITM trigger periods do not come into effect until after Phase 1 (Table 3.2 in the AMP), mitigation action was not required. Based on the findings found from PITM program it is recommended that the trigger levels are adjusted to include the monitoring results found in Phase 1.

Key findings from the LTT found that the monitoring wells closest to the extension quarry have experienced localized drawdown effects as the quarry continues to expand within the Phase 1 extraction footprint. As monitoring has progressed, certain wells have become no longer accessible (BH02-3 CLF1, OW1-6, OW3-1 and NW2). It is recommended that these wells be removed from the monitoring program.

Key findings from the LTTEM found that the habitat at each survey Station was suitable for amphibians and, when comparing 2020 data to previous years' surveys, amphibian communities were similar in diversity and abundance at each Station.

Key findings from the EEMM found that the reforestation areas are contributing to local forest function and on a trajectory to becoming self-sustaining components of the woodland landscape through establishment of a healthy woodlot with enhanced species diversity, a shade-tolerant understorey and wildlife habitat.

# 1 INTRODUCTION

The Duntroon Quarry is located on County Road 91, west of the village of Duntroon on Lot 25, Concession XII in the Township of Clearview, County of Simcoe. The main quarry property is located south of County Road 91 and the extension quarry is located north of County Road 91. The extension quarry property is located adjacent to the approved MAQ Aggregates Inc. (MAQ) Highland Quarry, an independent third party. The locations of these quarry properties and of other lands owned by Walker Aggregates are shown on ***Figure 1***.

The Duntroon Quarry has been in operation on the south side of County Road 91 (main quarry) since the early 1960s. Since 1995 the quarry has been operated by Walker Aggregates Inc. (WAI). The main quarry property operates in accordance with Aggregate Resource Act (ARA) license number 3514. The extension quarry operates under ARA licence number 607841, issued August 6, 2014.

The Adaptive Management Plan (AMP) annual summary report is a requirement of the ARA licensing of the extension quarry. Throughout this summary report, the original AMP, created in December 2013, is referenced for specific details on AMP requirements. The original AMP provides an in-depth review of the monitoring planned during each Phase until final rehabilitation of the site. Additional background information pertaining to the site, contact information and monitoring requirements are found in ***Appendix A***. The quarry phasing is detailed on the ARA Site Plan (#2B of 4 Operational Plan). Phase 1, Phase 2a and Phase 2b of operations are identified on ***Figure 2a – Site Sketch.*** This site sketch is based on quarry conditions as of November 2020.

This report provides a summary of the monitoring completed in 2020 for the AMP. The monitoring components consist of four categories:

- **Performance Indicator Trigger Monitoring (PITM**): Focuses on the quarry's impact on an annual basis comparing monitoring to historical values to ensure the facility is not having an adverse impact on surrounding ecological features.
- **Long Term Groundwater and Surface Water Monitoring Program (LTT**): Reviews monitoring results as well as past data and analyzes to confirm that the data match forecasted trends. This monitoring also makes note should unexpected trends in the data be observed.
- **Long Term Trend Ecological Monitoring (LTTEM**): Compares current data collected on surrounding ecological features with historic observations to confirm that the quarry's activity is not causing unacceptable impacts to plants or to wildlife.
- Ecological Enhancement and Mitigation Monitoring (EEMM):This monitoring confirms that steps are taken, throughout the quarry's life to ensure that upon rehabilitation, the property is left in an improved ecological condition than prior to quarrying.

Currently, extraction is ongoing within Phase 1 and Phase 2a of the extension property. This extraction during Phase 1 and Phase 2a are not expected to result in any negative impacts to off-site water resources or ecological features due to the proximity of the main quarry. Phase 1 of the AMP monitoring program will be used as input to establish baseline ecological features that will be compared to later phases as the quarry expands.

Trigger monitoring criteria for water flows, water temperature and wetland water levels will apply during their respective trigger periods when extraction proceeds beyond Phase 1. Groundwater and surface water monitoring data will be used to further update interim triggers as well as build statistically valid relationships between monitoring locations and control points. Since June 2018, the field monitoring is completed by Walker Industries staff.

# 2 CLIMATE DATA

Historically, climate data from the Thornbury Slama Station were used to assess annual water budget components as part of the monitoring programs at Duntroon Quarry. Operation of the Thornbury Slama station was cancelled in May 2005. After a detailed assessment of nearby climate stations, the Shanty Bay Climate Station, located on Lake Simcoe approximately 60 km east of the Duntroon Quarry, was assessed and provided a reasonable correlation with the climate data from the Thornbury Slama climate station.

The combination of historical climate data and annual weather station data can be used to analyze the impact of deviation from climate norms and their corresponding impact on the surrounding local hydrology and ecosystems.

In 2008, WAI established, an automatic weather station (the WAI station) in the vicinity of Duntroon quarry which provides the following local climate data:

- Wind speed and direction;
- Average hourly air temperature (°C); and
- Total hourly precipitation (mm)

There have been no operational concerns with the Duntroon station since 2015. From August 21 to October 8 and November 4 to December 17, 2020, however, equipment malfunctions resulted in a loss of data.

For the purpose of this annual report, both the Shanty Bay and the WAI climate station data have been evaluated. Once a more consistent record of local climate conditions has been established, the local and regional climate data will be used to prepare seasonal and annual water budget assessments based on the Thornthwaite-Mather method, as used by Environment Canada. The information from the WAI Duntroon climate station can be used to compile seasonal and annual water surplus/deficit amounts for consideration in surface water runoff and groundwater recharge evaluations and for comparison against quarry discharge volumes. As previously noted, the WAI climate station data set is incomplete and, as such, is not included in the interpretation of climate data below.

The 30-Year Climate Normal data and a calculated water budget for the historic Thornbury Slama Station are provided in ***Appendix A***, on Table A-1. The Shanty Bay climate data and the calculated water budget from 2015 though 2020 are provided in Tables A-2, A-3, A-5, A-7 and A-9. The Duntroon WAI climate station data and the calculated water budgets for 2016 through 2020 are provided in Table A-4, A-6, A-8 and A-10. ***Figures A-1*** through ***A-9*** provide a plot of the monthly precipitation and water surplus with the data for the 30-Year Climate Normal provided for comparison.

## 2.1 AIR TEMPERATURE

At the Shanty Bay climate station, the monthly mean temperature in 2020 was 8.2°C, 1.4°C lower than the 30-Year Climate Normal value of 6.8°C. The monthly average temperatures in April and October were between 0.5°C to 0.8°C lower than normal. The months of January to March, June to September, November and December were between 0.3°C to 3.3°C warmer than normal. The month of May was within +/-1°C of the normal.

## 2.2 PRECIPITATION

At the Shanty Bay climate station in 2020, the total amount of precipitation received was 1025 mm, or 59 mm (6.1 %) more than the calculated 30-Year Climate Normal (1971-2000) of 966 mm. The months of February, April, May, October and December received between 11% and 69% more precipitation than normal, while the months of January, July, August, September and November received between 20% and 53% less precipitation than normal. The months of March and June received a normal amount of precipitation (within 10% of the Normal).

## 2.3 ANNUAL WATER BUDGET

The climate data from the Shanty Bay station (temperature and precipitation) is used to calculate a general water budget for the area that provides a measure of water losses to evaporation. The difference between the monthly precipitation and the monthly evaporation (adjusted for daylight hours) yields the estimated water surplus (or deficit). The estimated evaporation is based on the method developed by Thornthwaite, and incorporates a water holding capacity for the soil. The annual water surplus is a measure of the amount of water that is available for surface runoff and groundwater recharge. Results of the water balance are summarized in Table 2-1.

**Table 2-1 2020 Water Balance**

| PARAMETER | THORNBURY SLAMA (30-YEAR NORMAL) | SHANTY BAY 2020 |
|---|---|---|
| Annual Precipitation (mm) | 966 | 1025 |
| Potential Water Surplus (mm) | 368 | 436 |
| Actual Water Surplus (mm) | 395 | 446 |

In 2020, the actual water surplus based on the data obtained from the Shanty Bay climate station was 446 mm; 51 mm (13%) greater than the 30-year average. The water surplus represents the amount of water that is available for infiltration into the ground surface to recharge the groundwater flow system and for surface runoff to the creeks. Partitioning of the annual water surplus into the groundwater recharge and surface water runoff components is estimated based on the site's surface topography (slope), soil or rock type and the type of vegetation that is present.. The MECP has provided estimates of infiltration factors for various types of slope, soil and vegetation cover in their land development guidelines (MOE, 1996). For the general conditions present across the Duntroon Quarry and the surrounding area, the infiltration factor is estimated and presented on Table 2-2.

**Table 2-2 Duntroon Quarry and Surrounding Area Infiltration Factor**

| FEATURE (RANGE OF INFILTRATION FACTORS) | SITE CHARACTERISTICS | CORRESPONDING INFILTRATION FACTOR |
|---|---|---|
| Slope (0.1-0.4) | Hilly land to rolling land | 0.1 to 0.2 |
| Soil Type (0.1-0.4) | Medium combinations of clay and loam to exposed fractured bedrock | 0.2 to 0.4 |
| Vegetation Cover (0.1-0.2) | Cultivated lands to woodland | 0.1 to 0.2 |
| **OVERALL INFILTRATION FACTOR RANGE** | | **0.4 to 0.8** |

Based on the overall infiltration factor range, an estimated range of groundwater recharge and surface runoff components can be separated as seen in Table 2-3.

**Table 2-3 Groundwater Recharge and Surface Water Runoff**

| ANNUAL SURPLUS | GROUNDWATER RECHARGE | SURFACE WATER RUNOFF |
|---|---|---|
| 30 Year Normals<br>(395 mm) | 158 to 316 mm per year<br>0.050 to 0.100 L/s/ha | 237 to 79 mm per year<br>0.075 to 0.025 L/s/ha |
| 2020 Shanty Bay Data<br>(503 mm) | 178 to 357 mm/year | 268 to 89 mm/year |

The infiltration values used are based on average characteristics of the site and actual values may vary based on specific location.

# 3 PERFORMANCE INDICATOR TRIGGER MONITORING PROGRAM

## 3.1 METHODS

The Performance Indicator Trigger Monitoring (PITM) program is the regulatory compliance component of the AMP with respect to water-related issues.

The PITM program's purpose is to monitor the effects of quarry operations on water resources with respect to water levels, flows and temperatures, and to initiate any actions necessary to adapt quarry operations so that the values of each of these parameters remain within their normal patterns of seasonal variation. Any long term changes in prevailing climatic conditions will be incorporated into the AMP by developing statistical relationships between key AMP monitoring stations and two surface water flow and temperature control stations that are located in the Pretty River and Batteaux Creek drainage basins. These two control stations are situated beyond any possible influence of quarry operations or significant water users.

The PITM program provides for the monitoring of water resources that support natural heritage features. These are the features outside of the limit of extraction that are potentially sensitive to fluctuations in water regimes, such as provincially significant wetlands and fisheries.

These locations are monitored so that appropriate actions may be taken to modify routine quarry operations and/or implement contingency mitigation measures, to ensure that quarry operations do not negatively impact water resources which directly support natural heritage features, namely:

- Springs that discharge at the Niagara Escarpment east of the extension quarry. These springs help to sustain surface water flow and fish habitat below the brow of the Niagara Escarpment in tributary streams of the Pretty River and Batteaux Creek;

- Surface water flows that support fish habitat in the Beaver River west of the extension quarry; and
- Surface water levels and flows and groundwater levels that support wetland features and functions.

It is recognized that, in some instances, there may be factors, such as atypical climate conditions, which have no connection to quarry operations that could affect flow and/or temperature conditions at some monitoring locations. The monitoring programs in the AMP are designed to assist in identifying cause and effect relationships. In order to incorporate any effects that long-term trends in regional climatic conditions (i.e. climate change) have on local groundwater springs and/or surface water level and flow conditions that are monitored as part of the PITM, monitoring.

For Phase 1 quarry operations, the potential for off-site water-related effects to any of the provincially significant wetlands and/or Escarpment springs is considered low.

During Phase 1, interim trigger values are based on historic monthly measurements at each monitoring location and are updated annually and as part of the 5-year review of the AMP. Data collected in 2020, as part of the PITM monitoring program, is used to update the interim trigger values and to help incorporate any longer term trends in regional climate on the groundwater springs and/or surface water levels. Trigger values will be updated in 2021 as part of the 5-year comprehensive review.

A description of the PITM regulatory monitoring stations is included in Table 3.3 of the 2013 AMP document. ***Figure 4*** shows monitoring station locations.

During the months of July and August, bi-weekly monitoring is completed at the surface water Escarpment springs (SW10, SW11, SW11A-E, SW21C, SW24A and SW77). Monthly monitoring is conducted at other times of the year. Monitoring includes temperature and an assessment of flow conditions through either the use of an electromagnetic flow meter or by visual assessment.

Water pumped and discharged at the quarry is monitored under a Permit to Take Water and an Environmental Compliance Approval. The quarry discharges into the RR6 wetland, west of the main quarry. Pumping rates and the metered flow of the quarry discharge are regulated under the site's Permit to Take Water and Environmental Compliance Approval for Industrial Discharge.

Temperature and surface water channel flows are e monitored hourly at selected PITM surface water stations. PITM surface water monitoring stations include locations in three separate watersheds:

- The Pretty River tributary system: SW16, SW17, SW17A, SW18 and PR Control,
- The Batteaux Creek tributary system: SW9, SW14, SW15 and BC Control, and
- The Beaver River tributary system: SW1, SW2, SW0-2, SW3, SW6A and SW3B ('RR3 Karst')

Pressure transducers and a staff gauge have been installed at stations: SW1, SW2, SW0-2, SW3, SW6A, SW9, SW15, SW16 and SW18. Staff gauges have been installed at stations: SW14, SW17, SW17A, RR3 Karst, PR Control and BC Control; these stations are real-time logger to web stations. Flow measurements are collected with an electromagnetic flow velocity meter or manually. Field chemistry parameters (temperature, pH, dissolved oxygen and conductivity) are recorded monthly.

During the months of May, June and July, drivepoint monitors in the wetlands are monitored bi-weekly and monthly for the remainder of the year. Monitoring includes measurements of groundwater level, ponded water depth and water temperature. The drivepoints are located in the following wetlands:

- ANSI A wetland: DP6 (vernal pool)
- ANSI B wetland: Bridson DP and DP9
- RR2 wetland: DP5 (vernal pool) and DP7 (vernal pool)
- RR3 wetland: DP10
- RR6 wetland: DP2, DP4 and DP8

During Phase 1 quarry operations, a reference wetland station will be established in either the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from the Ministry of Natural Resources and Forestry (MNRF) and the Nottawasaga Valley Conservation Authority (NVCA). Additional information regarding this reference wetland is discussed in Section 3.2.3.6.

# 3.2 MONITORING RESULTS

The results of the AMP performance indicator trigger monitoring program in 2020 are presented in the following section.

As stated in the AMP, trigger monitoring criteria for water flows, water temperature and wetland water levels will apply during their respective trigger periods when aggregate extraction proceeds beyond Phase 1. In 2020, extraction remained primarily within Phase 1 of the extension property. In August 2020, extraction activities progressed into Phase 2a at the eastern edge of Phase 1. Interim trigger values have been developed for water flows and water temperature using historical monitoring data and a planned update will occur during the 5-year comprehensive report.

## *3.2.1 SURFACE WATER FLOW*

The interim red trigger value is set as the historic lowest monthly value recorded at a specific location for stream flows and/or flow at Escarpment springs. The interim yellow trigger value is calculated either by increasing the red value by 15%, or by using the third-lowest monthly flow value over the historic period of record, whichever is the higher value. Green interim trigger values are set above the yellow interim trigger value.

Interim flow trigger values are outlined in Table 3.5, Appendix B of the 2013 AMP document. Monitoring locations are shown on ***Figure 3***.

### 3.2.1.1 STREAM FLOW

Observations on the 2020 stream flow monitoring results are presented in Table 3-1, below:

**Table 3-1 Surface Water Monitoring Stations - Results**

| MONITORING STATION | FIGURE | OBSERVATIONS |
|---|---|---|
| **Pretty River Tributary System** | | |
| SW16 | B-28 | Surface water flows generally within previously reported range. |
| SW17 | B-29 | Surface water flows generally within previously reported range. |

| | | |
|---|---|---|
| SW17A | B-30 | Surface water flows generally within previously reported range. |
| SW18 | B-32 | Surface water flows generally within previously reported range. |
| PR Control | B-56 | Surface water flows generally within previously reported range. |
| **Batteaux Creek Tributary System** | | |
| SW9 | B-15 | Surface water flows generally within previously reported range. |
| SW14 | B-26 | Surface water flows generally within previously reported range. |
| SW15 | B-27 | Surface water flows generally within previously reported range. |
| BC Control | B-57 | Surface water flows generally within previously reported range. |
| **Beaver River Tributary System** | | |
| SW1 | B-1 | Surface water flows generally within previously reported range; April 2020 stream flow was above the historic range. |
| SW2 | B-2 | Surface water flows generally within previously reported range. |
| SW0-2 | B-4 | Surface water flows generally within previously reported range. |
| SW3 | B-7 | Surface water flows generally within previously reported range. |
| SW6A | B-12 | Surface water flows generally within previously reported range. |
| SW3B ('RR3 Karst') | B-55 | Surface water flows generally within previously reported range; April 2020 stream flow was above the historic range. |

#### 3.2.1.2 ESCARPMENT SPRINGS

The results of the 2020 AMP monitoring program at the Escarpment spring monitoring stations are summarized in Table 3-2, below.

**Table 3-2 Escarpment Springs Monitoring Stations - Results**

| MONITORING STATION | FIGURE | OBSERVATIONS |
|---|---|---|
| SW10 | B-16 | Surface water flows generally within previously reported range. |
| SW11 | B-17 | Surface water flows generally within previously reported range. |
| SW11A | B-18 | Surface water flows generally within previously reported range. |
| SW11B | B-19 | Surface water flows generally within previously reported range. |
| SW11C | B-20 | Surface water flows generally within previously reported range. |
| SW11D | B-21 | Surface water flows generally within previously reported range. |
| SW11E | B-22 | Surface water flows generally within previously reported range. |
| SW21C | B-38 | Surface water flows generally within previously reported range. |
| SW24A | B-46 | Surface water flows generally within previously reported range. |
| SW77 | B-53 | Surface water flows generally within previously reported range; May 2020 stream flow was above the historic range. |

### 3.2.1.3 CONTROL STATIONS

During Phase 1 of quarry operations, the likelihood of quarry-related water effects off-site is considered low. WAI is currently in the process of developing statistically valid relationships for flow and temperature conditions between specified key AMP monitoring locations and control stations in the Pretty River sub-catchment drainage basin and in the Batteaux Creek sub-catchment drainage basin. Larger sample sizes generally lead to increased precision when developing relationships. The statistical validity of the relationships between flow and temperature conditions between the specified AMP monitoring locations and the control stations is expected to increase as data collection progresses.

The key monitoring locations for the Pretty River sub-catchment drainage basin are SW17, SW17A and SW18. In the Batteaux Creek sub-catchment drainage basin, the key monitoring location is SW14.

The control stations have been established at the following locations:

- Batteaux Creek Sub-watershed Station ("BC Control") – surface water control station located at the north side of the road culvert on 21/22 Sideroad, Clearview Township, approximately 1350 m east of Concession 10.
- Pretty River Sub-watershed Station ("PR Control") – surface water control station located at the north side of the road culvert on 30/31 Sideroad, Town of the Blue Mountains, approximately 390 m west of the boundary line between Clearview Township and Town of Blue Mountains.

**Photo 1 - Batteaux Creek sub-watershed control station**

**Photo 2 – Pretty River sub-watershed control station**

In addition to the two control locations, long term gauging stations at the Mad River station at Avening and the Pretty River station at Collingwood were selected for comparison. Statistical relationships between key monitoring

locations and the long term gauging stations will be created and used as a supplementary trigger to replace the initial triggers based on the data collected throughout Phase 1 extraction .

The long term regional flow data for the Mad River and the Pretty River stations are presented in ***Appendix A*** as ***Figures A-12*** and ***A-13***. The data for these figures was obtained from the Government of Canada real-time hydrometric data web-site (https://wateroffice.en.gc.ca). Historical data for the Mad River station (02ED015) is available from 1988 through 2019. Historical data for the Pretty River station (02ED031) is available from 2006 through 2019. The average daily surface water flow data for both stations in 2020 was obtained from the real-time data set.

#### 3.2.1.4 TRIGGER EXCEEDANCES

As stated in Table 3.2 of the AMP, trigger monitoring criteria for water flows, water temperature and wetland water levels will apply during their respective trigger periods as soon as extraction proceeds beyond Phase 1. Interim trigger values have been developed for water flows and water temperature using historical monitoring data. These interim trigger values will be updated as further monitoring data becomes available during Phase 1.

Exceedances of the interim trigger values for stream flow are discussed below in chronological order. Monthly summary tables including measured stream flow and temperature values are included in ***Appendix B*** (Tables B7 – B30).

##### JANUARY 2020

Surface water flow rates and temperatures at the Escarpment springs and the surface water monitoring stations were collected during the January monthly monitoring event (January 15-16, 2020).

- Red zone stream flow interim triggers measured at: SW2.

It is noted that all the escarpment springs and surface water stations, with the exception of SW2, were frozen and were unable to be measured. In the two weeks prior to measuring surface water flows, the average temperature over that time period was minus 1.8 degrees Celsius.

##### FEBRUARY 2020

Surface water flow and temperatures at the Escarpment springs and the surface water monitoring stations were collected during the February monthly monitoring event (February 20 - 21, 2020).

It is noted that all the escarpment springs and surface water stations were frozen and unable to be measured in February 2020.

##### MARCH 2020

Surface water flow and temperature data at the Escarpment springs and the surface water stations were collected during the March monthly monitoring event (March 25 - 26, 2020).

- Green zone stream flow measured at: SW1, SW2, SW3, SW6A, SW17 and SW17A
- Red zone stream flow interim triggers measured at: SW11.

In addition, SW10, SW21C, SW24A, SW77, SW9, SW14, SW15, SW18 and PR Control were frozen and SW11A, SW11B, SW11C, SW11D, SW11E, SW0-2, SW16 and RR3 Karst were flooded. As such, these stations were unable to be measured.

Higher than normal temperatures and precipitation observed from January to March may have resulted in flooding of the surface water courses.

### APRIL 2020

Surface water flow and temperature data at the Escarpment springs and the surface water stations were collected during the April monthly monitoring event (April 27-28, 2020).

- Green zone stream flow measured at SW21C, SW1, SW2, SW6A, SW17 and SW18.
- Yellow zone stream flow measured at SW11 and SW17A.
- Red zone stream flow measured at SW0-2.

It is noted that numerous stations were not measured due to the stations being snow covered or flooded during the April monitoring event. Based on the visual observations of higher than normally observed flows, it is inferred that the flow rates would satisfy trigger levels.

### MAY 2020

Surface water flows and water temperature data were collected at the Escarpment springs and the surface water monitoring stations during the May monthly monitoring event (May 27-28, 2020).

- Green zone stream flow measured at SW11, SW21C, SW1, SW2, SW14, SW15, SW16, SW17A and SW18
- Yellow zone stream flow measured at SW77, SW0-2 and SW6A
- Red zone stream flow measured at SW24A

### JUNE 2020

The surface water flow and temperature data were collected from the Escarpment springs and the surface water monitoring locations during the June monthly monitoring event (June 23-24, 2020).

- Green zone stream flow measured at Escarpment springs stations SW10, SW77 and all surface water stations, except SW18
- Red zone stream flow measured at SW11, SW21C, SW24A and SW18

### JULY 2020

Surface water flow and temperature data were collected bi-weekly at the Escarpment springs in July 2020, as stipulated by the PITM. Monitoring events were completed on July 7, 2020 and during the July monthly monitoring event on July 30-31, 2020. Surface water monitoring stations were measured during the monthly event only.

Biweekly Event (Escarpment springs only)

- Green zone stream flow measured at all Escarpment springs

Monthly Event

- Green zone stream flow measured at all Escarpment spring stations and surface water stations, except SW15.
- Yellow zone stream flow interim triggers measured at: SW15.

### AUGUST 2020

Surface water flow and temperature data were collected bi-weekly at the Escarpment springs in August 2020, as stipulated by the PITM. Monitoring events were completed on August 8, 2020 and during the August monthly monitoring event on August 25-26, 2020. Surface water monitoring stations were measured during the monthly event only.

Biweekly Event (Escarpment springs only)

- Green zone stream flow measured at all stations, except SW10 which was dry

Monthly Event

- Green zone stream flow measured at all Escarpment stations, except SW10 and all surface water stations, except SW15 and SW17A.
- Yellow zone stream flow interim triggers measured at: SW15 and SW17a.

It is noted that PITM trigger station SW10 was observed to be dry during the August biweekly and monthly monitoring events.

### SEPTEMBER 2020

Surface water flow measurements and water temperature data were collected at the Escarpment springs and the surface water monitoring stations during the September monthly monitoring event (September 25-26, 2020).

- Green zone stream flow measured at all Escarpment stations, except SW10 and all surface water stations, except SW1.

It is noted that trigger stations SW10 and SW1 were observed to be dry during the September monitoring event.

### OCTOBER 2020

Surface water flow measurements and water temperature at the Escarpment springs and the surface water monitoring stations were collected during the October monthly monitoring event (October 29-30, 2020).

- Green zone stream flow measured at all Escarpment stations, except SW10 and all surface water stations, except SW1.

It is noted that trigger stations SW10 and SW1 were observed to be dry during the October monitoring event.

### NOVEMBER 2020

Surface water flow measurements and air temperature data were recorded at the Escarpment springs and the surface water monitoring stations during the November monthly monitoring event (November 26-27, 2020).

— Green zone stream flow measured at all Escarpment stations, except SW10 and SW77, and all surface water stations, except SW1.

It is noted that trigger stations SW10, SW77 and SW1 were observed to be snow covered during the November monitoring event and flows were unable to be measured.

#### DECEMBER 2020

Surface water flow measurements and water temperature data were collected at the Escarpment springs and most of the surface water monitoring stations during the December monthly monitoring event (December 22-23, 2020).

Green zone stream flow measured at: all Escarpment springs stations and all surface water monitoring stations, except SW2. Due to freezing temperatures and heavy snowfall prior to sampling, several of the stations were observed to be frozen.

### 3.2.1.5 MITIGATION MEASURES UNDERTAKEN

There were no mitigation measures recommended for 2020. Mitigation measures are not anticipated to be required in Phase 1, since extraction during Phase 1 is not expected to result in negative impacts to off-site water resources and/or ecological features and functions.

An overview of the proposed future mitigation measures that may be implemented if necessary, is outlined in Section 2.3 of the 2013 AMP document.

#### ROUTINE WATER MANAGEMENT MEASURES

In addition to the Site Plans, and this AMP Summary Report, routine water management and mitigation are regulated by approvals under the Ontario Water Resources Act (PTTW No. 7725-AACS54, dated September 22, 2016) and the Environmental Protection Act (ECA No. 1521-A4VJ4X, dated October 17th, 2016). These measures have, to the extent possible, been aligned with the monitoring requirements that exist under the AMP.

The AMP mitigation objectives are based on the release of the required volumes of water to the landscape in the vicinity of the wetlands without negatively affecting the surrounding environment. The initial discharge volumes, if required, will be based proportionately on the respective sizes of the surface drainage catchment areas extracted from the respective watersheds (Beaver River or Batteaux Creek), in each Phase.

The proportionate discharge to each watershed/wetland can be adjusted, as necessary, based on the results of the AMP Performance Indicator Trigger Monitoring Program. Discharge into the wetlands will be managed by adjusting pumping rates and/or by means of flow restrictor valves in discharge lines, as required. Discharge into individual wetlands will be adjusted as necessary to maintain target hydrographs in each wetland/watercourse.

For more information on the proposed discharge points and designs that will be implemented progressively during the excavation of the Phases of the extension quarry, please see Section 2.3 of the 2013 AMP document.

Routine water management activities are expected to keep quarry operations in compliance with the AMP trigger criteria, and protect the surrounding natural environment and water resources.

In the event that the routine water management activities described above do not fully achieve the objectives of the AMP, contingency measures will be implemented.

CONTINGENCY MITIGATION MEASURES

Contingency mitigation measures were not required to be implemented during the 2020 monitoring period. As previously noted, the extraction of Phase 1 of the extension Quarry is not expected to result in negative impacts to off-site water resources and/or ecological features and functions.

An overview of the proposed future contingency measures that may be implemented if necessary, is outlined in Section 2.4 of the 2013 AMP document.

## *3.2.2 SURFACE WATER TEMPERATURE*

For water temperature in streams and/or Escarpment springs, monthly interim trigger values are established for the months of June through September to reflect the period when warm surface water temperatures have the potential to affect sensitive fish habitat areas that are present downstream, below the Escarpment brow. The trigger values are based on historic recorded temperatures with red triggers consisting of the highest monthly temperature recorded. The interim yellow zone trigger value is set at 10% below the interim red zone trigger value. The interim green zone trigger value is anything that is below the yellow zone trigger value.

Interim temperature trigger values are outlined in Table 3.6, ***Appendix B*** of the 2013 AMP document.

### 3.2.2.1 SURFACE WATER COURSES

The surface water monitoring stations (Table 3-1 and 3-2) are monitored once a month during the months of June through September and the surface water temperature is recorded and compared to the interim trigger values developed specifically for each surface water station.

### 3.2.2.2 ESCARPMENT SPRINGS

The Escarpment spring monitoring stations are monitored once a month during the months of June and September and bi-weekly in July and August. Surface water temperature is recorded and compared to the interim trigger values developed specifically for each Escarpment spring monitoring station.

### 3.2.2.3 CONTROL STATIONS

The Batteaux Creek (BC Control) and Pretty River (PR Control) control stations provide context to the recorded surface water temperature data. The control stations are discussed in section 3.2.1.3, above.

### 3.2.2.4 TRIGGER EXCEEDANCES

As outlined in Table 3.2 of the 2013 AMP, trigger monitoring criteria for water flows, water temperature and wetland water levels will apply during their respective trigger periods as soon as extraction activities proceed beyond Phase 1. In 2020, extraction within the Phase 1 area of the extension property was not completed. Interim trigger values have been developed for water flows and water temperature using historical monitoring data. These interim trigger values will be updated as further monitoring data become available during Phase 1.

Exceedances of the interim trigger values for water temperature are discussed below in chronological order. Monthly monitoring summary tables are included in ***Appendix B*** (Tables B7 - B30).

### JUNE 2020

Surface water temperature data were collected from the Escarpment springs and the surface water monitoring stations during the June monthly monitoring event (June 23-24, 2020).

- Green zone temperature measured at SW10 and all surface water monitoring stations.
- Yellow zone temperature measured at SW24A.
- Red zone temperature measured at SW77.

The mean monthly atmospheric temperature in June was greater than the 30 year normal and that may have contributed to the trigger exceedances observed at SW24A and SW77.

### JULY 2020

Surface water flow and temperature data were collected from the Escarpment springs only during the biweekly monitoring event (July 7, 2020) and from the Escarpment springs and the surface water monitoring locations during the July monthly monitoring event (July 30-31, 2020).

Biweekly Event (Escarpment Springs only)

- Green zone temperature measured at: SW10 and SW11.
- Yellow zone temperature measured at: SW21C, SW24A and SW77.

Monthly Event

- Green zone temperature measured at: all Escarpment springs, and at all surface water stations, with the exception of SW17.
- Yellow zone temperature interim triggers measured at: SW17.

The mean monthly atmospheric temperature in July was greater than the 30 year normal and that may have contributed to the trigger exceedances observed. It is also noted that temperatures were unable to be measured at SW77 and SW9 during the monthly event.

### AUGUST 2020

Surface water flow and temperature data were collected bi-weekly at the Escarpment springs in August 2019, as stipulated by the PITM. Monitoring events were completed on August 8, 2020 and during the August monthly monitoring event on August 25-26, 2019. Surface water monitoring stations were measured during the monthly event only.

Biweekly Event (Escarpment springs only)

- Green zone temperature measured at: SW11 and SW24A.
- Yellow zone temperature measured at: SW77.

Monthly Event

- Green zone temperature measured at: SW11, SW24A, SW2, SW0-2, SW15 and SW17.
- Yellow zone temperature interim triggers measured at: SW21C, SW77, SW14 and SW18.

— Red zone temperature interim triggers measured at: SW6A, SW16 and SW17A.

It is noted that SW10 was observed to be dry during both August monitoring events. The mean monthly atmospheric temperature in August was greater than the 30 year normal and that may have contributed to the trigger exceedances observed. .

#### SEPTEMBER 2020

Surface water flow measurements and water temperature data were collected at the Escarpment springs and the surface water monitoring stations during the September monthly monitoring event (September 25-26, 2020).

— Green zone temperature measured at: Escarpment station SW11, and all surface water stations, except SW17A.
— Yellow zone temperature interim triggers measured at: SW21C, SW24A and SW77.
— Red zone temperature interim triggers measured at: SW17A.

The yellow and red zone temperature interim triggers recorded in September 2020 are attributed to the warm air temperature in the period leading up to, and during the monitoring events.

#### 3.2.2.5 MITIGATION MEASURES UNDERTAKEN

Mitigation measures are not expected to be required in Phase 1, since extraction during Phase 1 is not expected to result in negative impacts to off-site water resources and/or ecological features and functions. No mitigation measures were required for 2020.

An overview of the proposed future mitigation measures that may be implemented if necessary, is outlined in Section 2.3 of the 2013 AMP document.

#### ROUTINE WATER MANAGEMENT MEASURES

Routine water management measures are provided in Section 2.1.5.

#### CONTINGENCY MITIGATION MEASURES

Contingency mitigation measures were not required to be implemented during the 2020 monitoring period. As previously noted, the extraction of Phase 1 of the extension Quarry is not expected to result in negative impacts to off-site water resources and/or ecological features and functions.

An overview of the proposed future contingency measures that may be implemented if necessary, is outlined in Section 2.4 the 2013 AMP document.

## *3.2.3 WETLAND WATER LEVEL*

The wetlands function by the retention of water within the majority of their catchment areas, such that nearby wetland features will continue to receive direct precipitation, as well as snowmelt and storm-event surface runoff from the lands to the north and east. In the case of Rob Roy Swamp Wetland Complex (unit RR2 wetland), it will receive runoff from the American Hart's-Tongue Fern and Butternut protection areas to the south.

When required, wetland water levels will be managed during the active extraction phases of the quarry through to final rehabilitation by discharging quarry water into the wetlands in an effort to maintain the seasonal hydro-periods and surface water outflows. Discharge water quality is regulated by approvals under the ECA for discharge.

Design and pumping rates will be refined in consultation with the MNRF, MECP and Conservation Authority staff through the Phase I extraction period as the monitoring database expands. Preliminary target hydrographs have been developed for the three major wetland types and include target ranges for wet, average and dry conditions. These conditions will be based on weather data provided by the WAI climate station and will be updated seasonally.

The data collected throughout Phase 1 will be used to update the preliminary hydrographs. The wetland target refinement process will be verified through the long-term ecological monitoring of wetlands to obtain data on the trends in amphibian habitat conditions, wetland plant species diversity and percent cover, and other ecological indicators of healthy, functional wetlands.

During Phase 1 of quarry operations, a reference wetland station will be established in either the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from MNRF and the Nottawasaga Valley Conservation Authority. This Reference Wetland selection process is discussed in Section 3.2.3.6.

Drivepoint water level and ponded water depth were recorded during the following monitoring events, as outlined in the PITM:

- May bi-weekly event (May 5, 2020)
- May monthly monitoring event (May 27, 2020)
- June biweekly event (June 9, 2020)
- June monthly monitoring event (June 26, 2020)
- July biweekly event (July 7, 2020)
- July monthly monitoring event (July 28, 2020)

Data from these events is included in Table B-31, ***Appendix B***.

Hydrographs for the drivepoint monitors are presented in ***Appendix C (Figures C-63 through C-73)*** and include the water levels inside the drivepoint as well as the elevation of the surface water that is ponded around the drivepoint, where it is present. Table C-8 in ***Appendix C*** includes water level elevations at the drivepoint locations. During the winter and summer months, drivepoints can become unmeasurable when the surrounding water freezes or dries up. These events are noted in Table C-8 where they were observed during the monitoring event. Drivepoint and wetland locations are provided on ***Figure 3 – Monitoring Locations***.

Trends and observations for drivepoint monitoring stations are outlined in Table 3-3, below.

**Table 3-3 Drivepoint Monitoring Stations - Results**

| MONITORING STATION | FIGURE | OBSERVATIONS |
|---|---|---|
| Bridson DP | C-73 | Muted seasonal variation compared to previous years, however, within previously reported values. |
| DP2 | C-64 | Water levels stable since 2010-2011. Seasonal variation observed in 2020. |

| | | |
|---|---|---|
| DP4 | C-66 | Seasonal variation within previously reported values. Water level observed in April 2020 was similar to previous historic low. Further monitoring will determine if the result is considered anomalous. |
| DP5 | C-67 | Seasonal variation within previously reported values. |
| DP6 | C-68 | Seasonal variation within previously reported values. |
| DP7 | C-69 | Limited data set. Seasonal variation within previously reported values. |
| DP8 | C-70 | Limited data set. Muted seasonal variation within previously reported values. Water level observed in April 2020 was a historic low. Further monitoring will determine if the result is considered anomalous. |
| DP9 | C-71 | Limited data set. Muted seasonal variation within previously reported values. |
| DP10 | C-72 | Limited data set. Seasonal variation leading to historic high and low water levels were observed in 2020. |

#### 3.2.3.1 VERNAL BREEDING POOLS WATER LEVELS

Drivepoints DP5 and DP7 are located north of the extension quarry in vernal pools that are part of Rob Roy PSW #2. DP5 was installed in the summer of 2007 and has been monitored monthly, when accessible, since then. Water levels at DP5 in 2019 reflected the atypically dry conditions of the summer of 2019. The water level recorded at DP5 in October 2019 was the lowest recorded value since 2007. DP5 had previously been dry during the year 2007, nine years prior to the initiation of AMP monitoring (as seen in hydrograph ***Figure C-67***). In 2020, the water levels observed at DP5 were similar to years prior to 2019. DP7 was installed in the summer of 2014 and water level monitoring has been completed monthly since the end of 2015. Water levels at DP7 in 2020 were consistent with previous years displaying seasonal variations, with peak water levels recorded in May.

The ANSI A wetland is located north of the extension lands (***Figure 3***). Drivepoint DP6 is located in a vernal pool in the ANSI A wetland. Water levels at DP6 have been monitored on a monthly frequency since the end of 2007 and show typical seasonal variation. Peak water elevations are reported in the spring months. DP6 is often reported as "dry" over the summer months, represented as gaps in the hydrograph between the recorded data points.

#### 3.2.3.2 SOIL GROUNDWATER TABLE LEVELS

Multiple drivepoints are installed within Rob Roy PSW#6, located west of the main quarry, where the quarry sump discharge is directed. DP2 is located directly north of the quarry discharge. This monitoring location was installed in the fall of 1999 and has shown little seasonal variation since 2011. DP2 water levels in 2020 showed a muted seasonal variation when compared to the seasonal variations observed prior to 2011. DP4 is located downstream of the quarry discharge and west of SW1. DP4 has been monitored since the fall of 1999 and remained relatively consistent until 2017. DP4 water levels dropped in 2018 but remained within previously observed seasonal variations. In November 2019, the water level in DP4 rebounded to pre-2018 levels. In 2020, water levels observed at DP4 declined to levels similar to 2018 and early 2019. The April 2020 water level observed in DP4 was similar to a previous historic low observed in 2003. Further monitoring will determine if the result is considered anomalous. DP8 is located south of SW2 and was installed in 2014. The water levels at DP8 have shown little seasonal variation. The April 2020 water level observed in DP8 was an historic low. Further monitoring will determine if the result is considered anomalous.

Rob Roy PSW#3 is adjacent to PSW#2 and can be found north of the MAQ quarry property (Figure 3). DP10 was installed in the wetland at the end of 2015. In 2020, water levels in DP10 were variable with both historic high and low water levels being observed. Further monitoring will determine if the result is considered anomalous.

Bridson DP, located on the former Bridson property, was installed to monitor ANSI B (Figure 3). Water levels at Bridson DP show seasonal fluctuation, with a seasonal low typically observed in the late summer or early fall. In 2020, the seasonal variations observed at Brisdon DP were muted compared to previous years.

Drivepoint DP9 was installed in 2014 and is located north-east of the extension quarry footprint, in the ANSI B buffer lands owned by WAI. In 2020, the seasonal variations observed at DP9 were muted compared to previous years but similar to those observed in 2017.

#### 3.2.3.3 REFERENCE WETLANDS

During Phase 1 of quarry extraction, a reference wetland is to be established in the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from the Ministry of Natural Resources and Forestry and the Nottawasaga Valley Conservation Authority. This wetland will be designated as Reference Wetland 1.

From May until late August of 2019, wetlands mapped in the Nottawasaga Lookout Provincial Park Reserve and adjacent public lands were investigated by staff from Stantec and Walker. Much of the area mapped as wetland was in fact upland forest. The majority of wetlands encountered were on the lower bench of the escarpment and were seepage-dominated without substantial vernal pools. No wetlands that had a similar physiographic location or community composition to the Rob Roy Swamp PSW Complex or ANSI wetlands A and B were encountered. In 2020, the local Conservation Authorities were contacted for consultation; however, no response was received. The search will continue in 2021 in the Pretty River watershed with an emphasis on private lands where long term access agreements can be negotiated

#### 3.2.3.4 TRIGGER EXCEEDANCES

As per Table 3.2 in the AMP, the trigger period for the wetland water levels is spring and early summer (June/July) as soon as extraction proceeds beyond Phase 1. In 2020, extraction within Phase 1 of the extension property was not completed. Minimal extraction occurred in Phase 2. There are no interim triggers for the wetland water levels. Trigger levels based on wetland vegetation and amphibian habitat will be developed and refined through the Phase 1 extraction period as the monitoring database expands and with input from agency staff.

#### 3.2.3.5 MITIGATION MEASURES UNDERTAKEN

Mitigation measures are not expected to be required in Phase 1, since extraction during Phase 1 is not expected to result in negative impacts to off-site water resources and/or ecological features and functions. There were no mitigation measures undertaken in the year 2020.

An overview of the proposed future mitigation measures that may be implemented if necessary, is outlined in Section 2.3 of the 2013 AMP document.

##### ROUTINE WATER MANAGEMENT MEASURES

See section 3.2.1.5 for routine water management measures.

### CONTINGENCY MITIGATION MEASURES

Contingency mitigation measures were not required to be implemented during the 2019 monitoring period. As previously noted, the extraction of Phase 1 of the extension Quarry is not expected to result in negative impacts to off-site water resources and/or ecological features and functions

An overview of the proposed future contingency measures that may be implemented if necessary, is outlined in Section 2.4 of the 2013 AMP document.

## 3.3 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the 2020 performance indicator trigger monitoring program the following conclusions and recommendations are made:

- Certain deficiencies that were apparent with the implementation of the program in 2016, including the flow and temperature interim trigger level values that were adopted for the PITM Escarpment spring and surface water monitoring stations, continued to be evident in the 2020 program. The performance indicator interim triggers for surface water flow and surface water temperature should be re-evaluated to incorporate the conditions observed in 2016 through 2020. The values recorded as having exceeded a specific seasonal maximum or minimum interim "trigger" value occurred as a result of climatic conditions, and not as a result of quarry operations in Phase 1.
- Trigger values will be updated in 2021 as part of the 5-year comprehensive review.
- Surface water stations SW21C, SW24A and SW77 show sensitivity to high air temperatures due to their low flow and shallow nature. These high surface water temperatures are interpreted to be due to climate conditions and are not related to the active extraction in the quarry. The potential for off-site water-related effects to any of the provincially significant wetlands and/or Escarpment springs during Phase 1 is considered to be low.
- During Phase 1 of quarry extraction, a reference wetland is to be established in the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from the Ministry of Natural Resources and Forestry and the Nottawasaga Valley Conservation Authority. The search for the reference wetland will continue in 2021 through examining the Pretty River Provincial Park and accessible private lands . This wetland will be designated as Reference Wetland 1.

For PITM monitoring in 2021, previous data should be included when creating interim triggers for both flows and temperature. As Phase 1 is unlikely to cause adverse impacts to off-site water resources, the data from the years 2016 to 2020 will help account for more recent local climate trends .

# 4 LONG-TERM GROUNDWATER AND SURFACE WATER MONITORING PROGRAM

The Long Term Trend (LTT) groundwater and surface water monitoring program is used to track seasonal and year-over-year natural variations in the groundwater and surface water systems, as well as the progressive response of those systems as the main quarry becomes depleted and extraction at the extension quarry continues over the next few decades followed by several decades of rehabilitation to lakes. The LTT monitoring program will provide data that will update the environmental baseline conditions, and identify short-term and long-term trends.

## 4.1 METHODS

The surface water drainage areas, local catchment areas and monitoring stations for the Pretty River, Batteaux Creek, Beaver River and Mad River systems are provided on Figure 3. The LTT includes selected PITM stations with additional LTT surface water and groundwater stations to help assess the long term trends of the surrounding hydrology.

The LTT monitoring program for the groundwater monitoring stations includes monthly manual groundwater level measurements and a network of pressure transducers that record hourly or twice daily water levels at selected groundwater monitoring wells.

Long term trend monitoring stations are listed, along with a description, in Table 4.1 of the 2013 AMP document. A summary of the well information is included in Table C-1 in Appendix C. LTT monitoring stations include groundwater monitoring wells in the following locations:

- Main quarry: 98-8, 98-9, 98-12 and PW99-1;
- Extension quarry (injection wells): IW1, IW2, IW3 and IW4;
- Extension quarry (monitoring wells): BH02-1, BH02-2, BH02-3, BH02-4, BH02-5 nest, BH02-6, BH03-7 nest, BH03-8, BH08-1, BH08-2, BH08-3, NW1-9, NW10 nest, BH03-9, TW04-1, TW04-2 and TW04-3;
- Osprey quarry property: 101-B, 102-C, 103-D, 104-A, OW1-4, OW3-1 (not accessible), OW5-2 and OW6-3;
- Carmarthen Lake Farms property: CLF1 (not accessible), CLF2, CLF3, CLF4 and CLF5.

On the Osprey Quarry property, monitoring wells OW1-6 and OW3-1 are no longer accessible, as noted in prior annual reports. On Carmarthen Lakes Farms, access to CLF1 has been blocked and the well can no longer be monitored. The removal of these wells from the monitoring program does not affect the overall integrity of the program.

On the Extension property, BH02-3 and BH2-04 are recommended to be removed from the program due to the wells being in close proximity to the extraction face. NW2 was excavated at the end of May as the quarry face approached its' location.

There are several private domestic water wells located around the periphery of the predicted drawdown zone of influence of the extension quarry (Jagger Hims, 2007). Locations of the private domestic wells are identified on Figure 3 as 'RW' (residential wells). Selected monitoring wells are monitored in the AMP under the Long Term Trend Groundwater and Surface Water Monitoring Program:

- East of main and extension quarry: RW1, RW2 (since new ownership WAI haven't received written consent to enter property), RW5, RW6, RW7, RW8, RW16 (owned by WAI), and RW18 (owned by WAI, to be removed before extraction).
- North of extension quarry: RW3, RW4 (owners have asked WAI to no longer monitor their well), RW17.
- West of extension quarry: RW9 (MAQ Aggregates property).

The owners of the RW4 property have requested a temporary stop to monitoring activities.

Electronic pressure transducers were installed at residential wells in close proximity to the quarry and record hourly or twice daily groundwater levels. In addition to the pressure transducers, manual groundwater levels are obtained monthly. A limited number of residential wells are also sampled annually for general chemistry, major and minor ion constituents, nutrients, total petroleum and hydrocarbons, BTEX, total suspended solids and bacteriological parameters.

Some historical wells that were originally monitored are not part of the Long Term Trend monitoring program. These wells are RW10, RW11, RW12, RW13, RW14, RW15 and RW20. RW12 and RW13 are currently included in the routine monitoring but are not part of the Long Term Trend monitoring program. RW14 and RW15 are wells that were historically part of the monitoring network at the main quarry, but have been decommissioned.

The LTT monitoring program also includes drivepoints that are located in the following wetlands:

- ANSI A: DP6 (vernal pool)
- ANSI B: Bridson DP, DP9
- RR2: DP5 (vernal pool), DP7 (vernal pool), Staff Gauge 1 and Staff Gauge 2 (BH03-7 SG1/ SG2)
- RR3: DP11
- RR6: DP1, DP2, DP4, DP8
- CLF wetland: DP3

The groundwater depth, ponded water depth (where available) and surface water temperature are measured monthly at the drivepoints. The surface water depth is recorded monthly at the staff gauges. Selected drivepoint monitors also have pressure transducers installed which record twice daily groundwater levels.

The surface water monitoring program under the LTT monitoring program includes monthly stream flow and temperature measurements at the surface water monitoring stations. Pressure transducers are installed at selected surface water stations to record hourly water level stage. Annual measurement of field chemistry parameters (temperature, pH, conductivity and dissolved oxygen) and water quality sampling also occurs at selected surface water stations.

The LTT surface water monitoring program includes monitoring stations located in the following watersheds:

- The Pretty River tributary system: SW20

- The Batteaux Creek tributary system: SW7, SW8, SW10, SW11E, SW13, SW19, SW21 series, SW22, SW22A and SW22C
- The Beaver River tributary system: SW3C ('RR3 Out')
- Main quarry floor: QFSW2 and dewatering sump

The additional surface water stations with data included in this AMP summary report that are not required under the PITM or LTT monitoring stations are the following: SWB-1, QFSW1, SW3A, SW4, SW5, SW6, SW12, SW12A, SW17B, SW21D, SW22B, SW23, SW24, SW24B, SW24C, SW25, SW26, SW26A, and SW27. The data for these additional stations is included in the report to provide context to the monitoring results for 2020 and to provide a historical record of the data collected in support of the Duntroon Quarry extension. A description of each surface water monitoring station is provided in Table B-1, Appendix B.

It is noted that is has become difficult to get an accurate surface water flow measurement due to woody growth at the SW12A location.

## 4.2 NEW MONITORS INSTALLED

Groundwater monitoring wells and drivepoints were last installed in 2014, as required by the Site Plan for the extension quarry. No new monitors were installed in 2020.

## 4.3 MONITORING RESULTS

### *4.3.1 GROUNDWATER LEVELS*

#### 4.3.1.1 SEASONAL VARIATION

Typically, groundwater levels achieve seasonal high elevations in the spring following the freshet with progressive declines throughout the summer months due to higher evapotranspiration (ET) rates. In the fall, the balance between precipitation rates and lower evapotranspiration rates can result in a rise in groundwater levels. In the winter months, when precipitation is bound up in the snow pack and the shallow ground surface is frozen, groundwater levels tend to decline until the freshet, when the cycle repeats.

The magnitude of seasonal variation is generally the greatest at the topographically high groundwater recharge areas, with less seasonal variation occurring in the topographically lower lying lands and adjacent to surface water courses and/or lakes that serve as groundwater discharge areas.

##### WETLANDS

Wetland water levels displayed the effects of seasonal variation to different degrees. Wetland water levels are discussed in more detail in section 2.2.3, above.

BEDROCK

Groundwater monitoring wells in the long term trend monitoring network showed a varying degree of influence due to seasonal climate conditions. The seasonal variation of groundwater levels in the bedrock is discussed in more detail in the following section, where it applies to selected monitors.

### 4.3.1.2 MAIN QUARRY PROPERTY

Table 5-1 outlines the observations made in 2020 at the groundwater monitoring wells that are part of the Long Term Trend groundwater monitoring network on the Main Quarry property.

**Table 4-1 Main Quarry - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| 98-8 | Groundwater levels have gradually increased at monitoring well 98-8 over time, remaining stable since 2015, with the operation of the main reservoir at the west end of the Main Quarry. Water levels in 2020 were variable and inconsistent with previous water levels or seasonal variations. Further monitoring is recommended to determine if the 2020 groundwater levels are anomalous. | C-2 |
| 98-9 | Approximately 11 m of historical impact from aggregate extraction. Stable groundwater variations since 2003 with water levels showing seasonal fluctuations comparable to previous monitoring years. Water levels in 2020 may be showing influence from the recent tunnel construction. A new maximum groundwater level was reported in October 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-3 |
| 98-12 | Approximately 14 m of historical impact from aggregate extraction. Stable groundwater levels with seasonal variation observed since 2008. | C-4 |
| PW99-1 | Generally stable groundwater levels throughout 2020. The operation of the main reservoir helps to buffer water levels at PW99-1. | C-5 |

Monitoring data from groundwater monitoring well MW6 (Figure C-1) has also been included in Appendix C to supplement the AMP data set, although this monitor is not included in the LTT monitoring program.

A number of historical groundwater monitors on the Main Quarry property have been removed as part of normal aggregate extraction activities. The previously mentioned groundwater hydrographs (RW14, RW15 and RW 20) for monitoring wells that were not accessed in 2020 have not been included in this report.

### 4.3.1.3 OSPREY QUARRY PROPERTY

The following table summarizes the observations made in 2020 at the groundwater monitoring wells that are part of the Long Term Trend groundwater monitoring network on the Osprey Property.

The two groundwater monitoring wells mentioned prior (OW1-6 and OW3-1) were not monitored this year. A groundwater hydrograph with data up until November 2015 has been provided in Appendix C.

**Table 4-2 Osprey Quarry - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| 101-B | Groundwater levels within previously recorded seasonal variations. | C-35 |
| 102-C | Groundwater levels within previously recorded seasonal variations. A historic low groundwater level was observed in February. Further monitoring will determine if the reading is anomalous. | C-36 |
| 103-D | Groundwater levels within previously recorded seasonal variations. | C-37 |
| 104-A | Groundwater levels within previously recorded seasonal variations. | C-38 |
| OW1-4 | Groundwater levels within previously recorded seasonal variations. A historic low groundwater level was observed in January. Further monitoring will determine if the reading is anomalous. | C-39 |
| OW3-1 | No groundwater level data recorded since 2015. | C-40 |
| OW5-2 | Groundwater levels within previously recorded seasonal variations. | C-41 |
| OW6-3 | Groundwater levels within previously recorded seasonal variations. | C-42 |

Groundwater levels on the Osprey Property in 2020 were generally within previously recorded seasonal variations with exceptions noted above.

#### 4.3.1.4 EXTENSION QUARRY PROPERTY

The following tables summarize the observations made in 2020 at the groundwater monitoring wells that are part of the Long Term Trend groundwater monitoring network on the extension quarry property.

**Table 4-3 Extension Quarry Injection Wells – Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| IW1 | Groundwater levels within previously recorded seasonal variations. Approximately 9 m difference between peak and low water levels. | C-6 |
| IW2 | The groundwater level dropped by approximately 15 m to a historic low in July 2019 then rebounded by approximately 5 m and remained stable for the remainder of the year. The cause of this decline is unknown, on-going monitoring is recommended. Groundwater levels in 2020 returned to pre-2019 levels. | C-7 |
| IW3 | Less than 9 m difference between peak and low groundwater levels. | C-8 |
| IW4 | Groundwater levels show fluctuations related to seasonal climate variations. | C-9 |

Water levels at the injection wells show fluctuations related to seasonal climate variation in 2020. Due to the limited period of record for the injection wells, further monitoring is required before more conclusions can be reached with respect to long term trends at these wells.

## Table 4-4 Extension Quarry Monitoring Wells - Results

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| BH02-1 | Historically this monitor has shown drawdown impacts. Approximately 2 m of additional decline in groundwater level since 2011. Seasonal variation in water levels at this monitor is slightly above 10 m. | C-10 |
| BH02-2 | Groundwater level displays a general decline since 2016 as the quarry face moves northeast towards the monitoring location. | C-11 |
| BH02-3 | Groundwater levels are no longer monitored due to the close proximity of the extraction area. | C-12 |
| BH02-4 | Groundwater levels are no longer monitored due to the close proximity of the extraction area. | C-13 |
| BH02-5 nest | Groundwater levels within previously recorded seasonal variations. | C-14 |
| BH02-6 | Monitor is adjacent to the sinking cut made for tunnel construction (Tunnel construction began in October 2015). | C-15 |
| BH03-7 nest | Groundwater levels within previously recorded seasonal variations. | C-16 |
| BH03-8 | Groundwater levels within previously recorded seasonal variations. A new maximum groundwater level was reported in February 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-17 |
| BH08-1 | Groundwater levels within previously recorded seasonal variations. A new maximum groundwater level was reported in January 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-18 |
| BH08-2 | Groundwater levels within previously recorded seasonal variations. | C-19 |
| BH08-3 | Groundwater levels within previously recorded seasonal variations. | C-20 |
| NW1 | Groundwater levels declining after July 2016. New historic low groundwater levels recorded in 2020. | C-21 |
| NW2 | Monitoring ceased in June 2018 due to extraction progression. | C-22 |
| NW3 | Groundwater levels in 2020 were within the previously reported range with the exception of a historic low water level measured in July. Further monitoring will determine if this reading is anomalous. An overall marginal decline in the groundwater level is being observed at this location. | C-23 |
| NW4 | Groundwater levels within previously recorded seasonal variations. | C-24 |
| NW5 | Groundwater levels have shown an overall decline since 2016 with new historic low groundwater levels observed in 2020. | C-25 |
| NW6 | Groundwater levels have shown an overall decline since 2016 with new historic low groundwater levels observed in 2020. | C-26 |
| NW7 | The groundwater level rose to a new historic high elevation set in July 2019 and remained elevated for the duration of 2019. The cause of this is unknown. In 2020, groundwater levels were within previously recorded seasonal variations. | C-27 |
| NW8 | Historic high groundwater elevations were observed in June and July 2020. Further monitoring will determine if the readings are anomalous. | C-28 |
| NW9 | Groundwater levels within previously recorded seasonal variations. | C-29 |

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| NW10 nest | DP groundwater levels remain relatively constant. NW10 shallow and deep monitoring well groundwater levels display variation due to seasonal climatic influence. | C-30 |
| BH03-9 | Monitor began showing seasonal variations in 2016. New minimum groundwater elevation reported in October 2019 due to dry conditions. A new maximum groundwater level was reported in June 2020. Further monitoring is recommended to determine if the reading is anomalous | C-31 |
| TW04-1 | Groundwater levels showing seasonal variations. Groundwater levels have shown a marginal decline since 2013. | C-32 |
| TW04-2 | Groundwater levels showing similar seasonal variations to recent years. | C-33 |
| TW04-3 | Groundwater levels showing similar seasonal variations to 2017 and 2018. Historic high groundwater elevation was observed in January 2020. Further monitoring will determine if the reading is anomalous. | C-34 |

Groundwater levels on the extension quarry property in 2020 display the influence of seasonal variation, as well as influence at some locations from the tunnel excavation and aggregate extraction activities. The influence of the tunnel excavation and aggregate extraction activities are limited to local influence at monitoring wells BH02-6 (immediately next to the tunnel excavation) BH02-3, BH02-4, BH02-1, NW1 and NW4 which are in close proximity to the active aggregate extraction area. The influence of the quarry activities on the groundwater levels at those wells that are in in the footprint of Phase 1 and in the vicinity of the current extraction activities was within anticipated levels.

Groundwater levels at the monitors on the extension quarry property will continue to be monitored as part of the Long Term Trend monitoring program.

#### 4.3.1.5 CARMARTHEN LAKE FARM PROPERTIES

Table 4-5 summarizes the observations made in 2020 at the groundwater monitoring wells that are part of the Long Term Trend groundwater monitoring network on the Carmarthen Lake Farms property.

As noted previously, monitoring well CLF1 is no longer accessible to obtain water levels. The water levels at CLF2, which is in close proximity to CLF1, have historically shown similar trends to the water levels at CLF1. The historical groundwater hydrograph for CLF1 is included in ***Appendix C*** as ***Figure C-43.***

**Table 4-5 Carmarthen Lake Farm Properties - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| CLF2 | Groundwater levels within previously recorded seasonal variations. | C-44 |
| CLF3 | Groundwater levels within previously recorded seasonal variations. | C-45 |
| CLF4 | Groundwater levels within previously recorded seasonal variations. | C-46 |
| CLF5 | Groundwater levels within previously recorded seasonal variations. | C-47 |

#### 4.3.1.6 RESIDENTIAL WELLS

**Table 4-6 Residential Wells - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| RW1 | Groundwater levels within previously recorded seasonal variations with the exception of new maximum groundwater levels reported in April and May 2020. Further monitoring is recommended to determine if the readings are anomalous. | C-48 |
| RW2 | In 2020, groundwater levels were within previously recorded seasonal variations with the exception of a new maximum groundwater level reported in March 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-49 |
| RW3 | Groundwater levels within previously recorded seasonal variations. | C-50 |
| RW4 | At homeowners' request in November 2018, the well is no longer monitored. | C-51 |
| RW5 | Groundwater levels within previously recorded seasonal variations with the exception of a new maximum groundwater level reported in January 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-52 |
| RW6 | Groundwater levels within previously recorded seasonal variations. | C-53 |
| RW7 | Groundwater levels within previously recorded seasonal variations with the exception of new minimum groundwater levels reported in August and September 2020. | C-54 |
| RW8 | RW8 is located on a local topographical high north of the main and extension quarries and outside of their influence. Groundwater levels within previously recorded seasonal variations with the exception of a new minimum groundwater level reported in February 2020. Further monitoring is recommended to determine if the reading is anomalous. | C-55 |
| RW9 | RW9 is located on the CBM quarry property and has not been accessed for monitoring since September 2014. | C-56 |
| RW16 (Bridson) | Groundwater levels within previously recorded seasonal variations. | C-59 |
| RW17 (owned by WAI) | Groundwater levels within previously recorded seasonal variations. | C-60 |
| RW18 (owned by WAI) | New maximum and minimum groundwater levels were reported in January and September through November, respectively. Further monitoring is recommended to determine if the readings are anomalous. | C-61 |
| RW19 (owned by WAI) | Indications of influence due to quarry activities were observed in 2019. This well is located on extension quarry property in close proximity to the active quarry face. New groundwater level minimum set in November 2019. Water levels in 2020 were within seasonal ranges. | C-62 |

Residential wells that are currently monitored but that are not part of the Long Term Trend monitoring program include: RW12 ***(Figure C-57)*** and RW13 ***(Figure C-58)*** have been included to supplement the 2020 AMP summary report.

As the excavation has continued to expand in a north east direction, some drawdown effects have been observed at RW19.

#### 4.3.1.7 DRIVEPOINTS

A majority of the drivepoint monitors are included in the PITM program and 2020 trends were discussed in Section 3, above. Drivepoints that are exclusively part of the Long Term Trend monitoring program include DP1, DP3, DP11 and the staff gauges at BH03-7.

**Table 4-7 Drivepoint Monitoring - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| DP1 | Groundwater levels in 2020 were higher than previously observed. Further monitoring will determine if the readings are anomalous. Groundwater levels have been exhibiting a marginal increase since 2015. | C-63 |
| DP3 | Water levels within previously recorded seasonal variations. | C-65 |
| DP11 | Monitored by Highland Quarry | N/A |
| BH03-7 SG1 / SG2 | Minimal staff gauge readings (multiple records of station being “dry” or “buried in snow”) | C-74 |

Water levels at the drivepoints that are exclusively monitored under the Long Term Trend monitoring program were within previously recorded seasonal variations. DP11 is monitored under the joint monitoring agreement that WAI holds with the owner of the adjacent quarry (MAQ Highland Quarry).

The staff gauges at BH03-7 are monitored on a monthly frequency, as outlined in the AMP, but there is minimal water elevation data due to the stations being reported as “dry” or “buried in snow”.

Drivepoint water elevation data is presented in Table C-8 in ***Appendix C***.

#### 4.3.1.8 GROUNDWATER CONFIGURATION

The borehole monitors and the residential water wells are constructed as open-holes that extend into and sometimes through the dolostone rock strata of the Amabel Formation and the Fossil Hill Formation. The exceptions are BH03-7-I, BH03-7-II, BH02-5 (mid) and NW10 (mid) on the extension lands which are shallow monitoring wells. Information on each monitoring well is found in Table C-1, ***Appendix C***.

In the open-hole monitors, the overburden soil, where present, is cased off with metal casing that is seated into the bedrock. The water levels that are obtained in the monitors and water wells provide a blended measure of the water table and groundwater conditions through the rock column, rather than the piezometric pressure head at a specific elevation. Since the open holes extend above and below the groundwater table, the water levels in these boreholes represent general water table conditions within the rock.

Groundwater level elevations at the monitors were contoured for April 2019 ***(Figure 4)***, October 2019 ***(Figure 5)***, April 2020 ***(Figure 6)*** and October 2020 ***(Figure 7)***. April contours represent spring conditions and October contours represent fall conditions. The groundwater contours are presented to illustrate the local groundwater configuration and general flow directions within the Amabel aquifer. These figures illustrate that the groundwater configuration and flow pattern remain similar exclusive of the change in groundwater levels associated with seasonal climatic conditions.

The interpreted groundwater configuration beneath the extension quarry exhibits an elliptical pattern that is centred upon the areas of higher ground formed by local bedrock hills. A groundwater divide is present in the extension property. The groundwater movement beneath the eastern section of the quarry extension lands is towards the Escarpment and generally to the Batteaux Creek sub-catchment. Beneath the western part of the quarry extension property, the groundwater movement is to the north, generally towards the Pretty River sub-catchment, and to the west, contributing to the Beaver River sub-catchment. A southerly component of groundwater flow towards the main quarry is also present in the vicinity of BH02-6. The presence of the tunnel beneath County Road 91 and the extraction area in the extension quarry (floor elevation approximately 501 m ASL) lowers the groundwater levels in the rock adjacent to the extraction area.

South of the main quarry, groundwater movement is interpreted to be radially away from the higher ground and towards Edward Lake. Edward Lake is interpreted to be a local groundwater discharge area, as well as a collection area for local surface water run-off.

#### 4.3.1.9 QUANTIFICATION OF DRAWDOWN INFLUENCE ZONE

In order to estimate the magnitude and the lateral extent of the zone of influence, and the distance drawdown effects of the main quarry, extension quarry and the MAQ Highland Quarry on the local groundwater system, the historical and recent groundwater level data obtained from the long term trend groundwater monitoring network have been evaluated.

***Figure 8*** provides a summary of the distance-drawdown relationships obtained at individual monitoring well locations. The figure illustrates a lower boundary influence envelope and an upper boundary influence envelope which identify the interpreted minimum and maximum extent of the distance-drawdown relationship.

##### MAIN QUARRY

Within the extraction area of the main quarry there has been a progressive drawdown influence of 12 m to 20 m on the local water table. As the size of the extracted area has increased, so has the zone of influence of the main quarry on the local groundwater system. The magnitude of the drawdown influence is greatest within the extraction area at the main quarry, and decreases relatively quickly with distance away from the extraction faces. The magnitude and lateral extent of the drawdown zone of influence is also variable around the quarry due to the variable hydraulic conductivity in the rock mass.

##### EXTENSION QUARRY

Select monitors on the extension lands have shown influence from tunnel construction and extraction activities that were initiated in 2016. Groundwater monitors NW1 and NW7 have been included on ***Figure 8*** to update the distance-drawdown figure for 2020. These monitoring wells are located on property owned by WAI and the observed drawdown effects at these on-site monitors, due to quarrying, was within anticipated levels. Drawdown effects have remained consistent at NW4 in recent years while drawdown have increased at NW1 as the quarry footprint has increased. Conversely, drawdown effects have decreased to negligible levels at NW7.

##### MAQ HIGHLAND QUARRY

The distance-drawdown effects of the MAQ Highland Quarry on the groundwater monitors on the extension lands is still being developed. The groundwater monitoring wells along the south-west corner of the extension property showed slower than usual recovery in the fall of 2016, but the water levels recovered by the spring of 2017. Since

then water levels have generally been within seasonal variations. Ongoing monitoring of the groundwater levels at NW9 and TW04-1, 2 and 3 is recommended in 2021.

#### 4.3.1.10 GROUNDWATER QUALITY

Annual sampling for the following parameters is required under the Long Term Trend Monitoring Program for two selected residential wells, RW1 and RW2:

- General chemistry,
- Major and minor ion constituents and nutrients,
- Total petroleum hydrocarbons and BTEX,
- Total suspended solids, and
- Bacteriological (E.coli, total coliform, heterotrophic plate count).

The samples from the groundwater monitoring locations were obtained from the two residential properties adjacent (RW1) and downgradient (RW2) from the main and extension properties on May 20, 2020. The samples were collected from outside taps at each property to try and bypass the water treatment systems. Field chemistry parameters (temperature, pH, conductivity and dissolved oxygen) were recorded at the time of sampling and observations on the appearance of the sampled groundwater were noted. Water quality samples were placed in a cooler with loose ice and shipped to an accredited laboratory for analysis (Bureau Veritas Laboratories). The groundwater quality results are presented in Table C-10, ***Appendix C***.

The analytical results from the groundwater quality sampling are compared to the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS, June 2006) and meet this guideline, with the exception of the following:

- The total coliform counts in the sample obtained from RW2 was elevated compared to the ODWQS; which is consistent with historic results. The home-owner was notified by phone and then submitted two samples, collected on July 7$^{th}$ and July 15$^{th}$, to Public Health Laboratory in Orillia, ON . These samples were taken by the resident from the indoor taps of the residence. The results of both analyses show no evidence of fecal contamination.
- The sodium concentration in the samples obtained from RW1 and RW2 did not meet the aesthetic guideline range specified in the ODWQS; which is consistent with historic results. Sodium has an aesthetic objective of 200 mg/L and a suggested maximum concentration of 20 mg/L under the ODWQS. The water quality at RW2 is interpreted to be representative of local groundwater quality, which is naturally hard.
- The hardness in the samples obtained from RW1 and RW2 did not meet the aesthetic or operating guideline ranges specified in the ODWQS; which is consistent with historic results. Hardness has an operating guideline range of 80-100 mg/L indicated in the ODWQS. The water quality at RW2 is interpreted to be representative of local groundwater quality, which is naturally hard.

The ODWQS exceedances for sodium, and hardness are not health related. Operational guidelines in the case of hardness exceedances are established for parameters that, if not controlled, may negatively affect the efficient and effective treatment, disinfection and distribution of the water.

The concentrations of sodium at RW1 and RW2 (110 mg/L and 130 mg/L, respectively) exceeds maximum suggested concentration of 20 mg/L. This result is not related to Quarrying activities.

Residential well sampling at RW1 and RW2 will be completed annually as part of the Long Term Trend monitoring program under the AMP.

## 4.3.2 SURFACE WATER SETTING

### 4.3.2.1 SURFACE WATER CHARACTERISTICS

The following sections outline the observations and monitoring results collected in 2020 at the surface water stations that are included in the Long Term Trend monitoring program.

Surface water monitoring data are presented in ***Appendix B***, which includes: PITM triggers, surface water hydrographs, field chemistry parameters and laboratory analysis results.

#### SURFACE WATER MONITORING STATIONS

**Table 4-8 Surface Water Monitoring - Results**

| MONITORING STATION | OBSERVATIONS IN 2020 | FIGURE |
|---|---|---|
| QFSW2 & Dewatering Sump(s) | Flows are within previously recorded seasonal variations. QFSW2 flows into the main sump (Sump 1). Excess water from the extension quarry is being directed to the sumps in the main quarry. | B-6 |
| SW7 | Station reported as “Dry” in 2020. | B-13 |
| SW8 | Station reported as “Dry” in 2020. | B-14 |
| SW10 | Flows are within previously recorded seasonal variations. | B-16 |
| SW11E | Flows are within previously recorded seasonal variations. | B-22 |
| SW13 | Flows are within previously recorded seasonal variations. | B-25 |
| SW19 | Flows are within previously recorded seasonal variations. | B-33 |
| SW20 | Flows are within previously recorded seasonal variations. | B-34 |
| SW21 | Flows are within previously recorded seasonal variations. | B-35 |
| SW21A | Flows are within previously recorded seasonal variations. | B-36 |
| SW21B | Flows are within previously recorded seasonal variations. | B-37 |
| SW21C | Flows are within previously recorded seasonal variations. | B-38 |
| SW22 | Flows are within previously recorded seasonal variations. | B-40 |
| SW22A | Flows are within previously recorded seasonal variations, with the exception of a historic high flow measured in June 2020. | B-41 |
| SW22C | Flows are within previously recorded seasonal variations. | B-43 |
| SW3C (‘RR3 OUT’) | Flows are within previously recorded seasonal variations, with the exception of a historic high flow measured in March 2020. | B-54 |

Table B-4 in ***Appendix B*** summarizes the high, low and seasonal flows for all of the surface water stations (PITM and LTT), for 2020 and, where available, includes historical data.

Table B-5, ***Appendix B***, tabulates the field chemistry parameters that were collected during each stream flow monitoring event in 2020 as well as the historical data at each monitoring location.

Overall, the results of the Long Term Trend monitoring program in 2020 were consistent with previously measured results for both surface water flow and water temperature.

#### BEAVER RIVER SUBCATCHMENT

The Beaver River Tributary North is an intermittent watercourse in the vicinity of the extension property. The Beaver River Tributary South is a perennial watercourse downstream (west) of Grey County Road 31. Flows to the Beaver River north and south tributary systems are continued through maintenance of wetland hydrology and associated discharge flow from Rob Roy Swamp PSW Complex units RR2 and RR6, respectively, including the pumping of excess quarry water during quarry operation and in the future by rehabilitation lake overflow (extension quarry and main quarry, respectively) after quarry closure. The Beaver River sub-catchment is identified on ***Figure 3.***

#### BATTEAUX CREEK SUBCATCHMENT

Tributaries of the Batteaux Creek that arise from springs below the Escarpment brow also support fisheries within approximately 1 km of their emergence (i.e. 1800 m to 2000 m southeast of the approved extension quarry extraction area). Constructed online ponds and a golf course occur between the springs and the main areas of known fish habitat. Spatial separation and the presence of online ponds, including water withdrawal for irrigation occurring from the Batteaux Creek on-line ponds at the golf course, limit any potential impact of minor changes to flows from these springs on downstream fish habitat arising from quarry operations. The Batteaux Creek sub-catchment is identified on ***Figure 3.***

#### PRETTY RIVER SUBCATCHMENT

The lands between the quarry extraction area and the brow of the Escarpment continue to receive direct precipitation that contributes a substantial part of the recharge to the groundwater system in the dolostone aquifer that sustains local water supplies at residential wells and the seasonal flows at the Escarpment springs. This will continue throughout the extraction period and through to final rehabilitation.

Tributaries of the Pretty River that arise from springs below the Escarpment brow support fisheries within 300 m to 500 m of their emergence (approximately 1300 m to 1500 m northeast of the approved extension quarry extraction area). A constructed pond occurs between some of the springs and the fish habitat in the Pretty River system.

The Pretty River sub-catchment is identified on **Figure 3**.

#### MAD RIVER SUBCATCHMENT

The Mad River sub-catchment is located south of the main quarry and is identified, along with all previously mentioned sub-catchments, on ***Figure 3***. The Mad River sub-catchment does not overlap the extension quarry property.

### 4.3.2.2 SURFACE WATER QUALITY

#### DEWATERING SUMPS

Surface water stations QFSW2 and the Dewatering Sump (Sump 1 and Sump 2, proposed Sump 3) are sampled quarterly for water quality. In 2020, the sampling for QFSW2 was included as the results for Sump 1 (QFSW2

flows into Sump 1). Sump 3 is planned for the quarry floor in the extension quarry and will be included in the water quality sampling program when it is completed.

Field parameters are collected during the sampling event and are recorded in the dedicated project field book. Surface water quality samples are collected in dedicated, pre-labelled containers, placed in coolers filled with loose ice and then shipped to an accredited laboratory for the following analysis:

- General chemistry,
- Major and minor ion constituents and nutrients,
- Total petroleum hydrocarbons and BTEX,
- Total suspended solids, and
- Bacteriological (E.coli, total coliform, heterotrophic plate count).

Water quality samples were obtained from Sump 1 and Sump 2, in the Main Quarry, on March 11, June 2, August 27 and November 25, 2020. It is noted that Sump 2 was frozen during the March sampling event. The results of the quarterly water quality sampling at the dewatering sumps are included in Table B-6, ***Appendix B***.

The water quality samples obtained in the first, second, third and fourth quarter at Sump 1 and Sump 2 met the Provincial Water Quality Objectives.

The relative percent difference (RPD) was calculated for the duplicate results taken during each monitoring event. The RPD was within 20% for all of the parameters suggesting the water quality results are considered acceptable in terms of quality assurance and controls.

Bacteriological results for the water quality analysis at Sump 1 and Sump 2 in 2020 indicate that there were total coliform present in the dewatering sumps. E.coli was present in Sump 1 during all four sampling events and Sump 2 during all three sampling events. The presence of bacteriological parameters in the sumps is expected, since the sumps exist as natural surface water ponds in the bottom of the main quarry and as such are subject to surface water runoff from the quarry floor and are subject to use as temporary waypoints for waterfowl. There is no specific objective for bacteriological parameters under the PWQO.

The water sampled from the dewatering sumps on the Main Quarry floor has hardness concentrations ranging from 230 - 388 mg/L, which is expected since a portion of the water collected in the sumps is from groundwater inflow to the quarry floor.

## SURFACE WATER STATIONS

The AMP monitoring program stipulates that annual sampling be completed at the Escarpment springs and the surface water monitoring stations as listed in Tables 3.3 and 4.2 of the 2013 AMP document. The samples are to be analyzed for the following groups of parameters:

- General chemistry,
- Major and minor ion constituents and nutrients,
- Total petroleum hydrocarbons and BTEX and
- Total suspended solids.

The following Escarpment spring monitoring stations SW10, SW11A, SW11B, SW11C, SW11D, SW11E and SW21C also require laboratory analysis for bacteriological parameters (E.coli, total coliform, heterotrophic plate count).

Samples are to be obtained using standard surface water sampling procedures and then sent to an accredited laboratory for analysis.

The annual water quality sampling event was completed for the surface water monitoring stations on May 20, 2020.

The surface water samples were obtained using standard surface water sampling procedures. Duplicate samples were obtained at SW0-2 and SW3. Field chemistry parameters (temperature, pH, conductivity and dissolved oxygen) were recorded at the time of sampling and observations on the flow volume and appearance of the surface water station were noted. Water quality samples were placed in a cooler with loose ice and shipped to an accredited laboratory for analysis (Caduceon Laboratories).

The relative percent difference (RPD) was calculated for the duplicate results obtained at SW0-2 and SW3. The RPD was within 20% for a majority of the parameters with the exception of total phosphorus at SW0-2 and TKN at SW3. Both the original and duplicate results for both parameters were within the historic range of concentrations at the respective sampling location. Based on the RPD values, the aforementioned parameters are interpreted with caution; however, the majority of the water quality results are considered acceptable in terms of quality assurance and controls.

Surface water quality analytical results are compared to the Provincial Water Quality Objectives (PWQO, July 1994). The water quality samples obtained in the fourth quarter at the designated surface water stations met the PWQO with the exception of the following:

- The concentration of total phosphorus in the sample obtained at SW0-2.
- The concentration of iron in the sample obtained at SW11E.

## 4.4 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the 2020 long term trend monitoring program the following conclusions and recommendations are made:

- Localized drawdown effects are occurring at groundwater monitors BH02-6 and BH02-1 as well as NW1 and NW4. Localized drawdown within the extension quarry property was anticipated.
- Remove wells BH02-3, BH02-4, CLF1, OW1-6, OW3-1 and NW2 in Long Term Trend Monitoring from monitoring program since we no longer have access to them.
- Long Term Trend monitoring will continue in 2021 with no adjustments other than no longer monitoring wells previously mentioned

# 5 LONG-TERM TREND ECOLOGICAL MONITORING PROGRAM

Ecological monitoring, including wetland monitoring, is a component of the Walker Aggregates Inc. Duntroon Extension Quarry Adaptive Management Plan (AMP; Stantec and Hims Geoenvironmental 2013). The Long Term Trend Ecological Monitoring (LTTEM) program was developed to supplement the information from the Long Term Trend Water Monitoring (LTTWM) program with information about the health and functioning of the natural heritage features in the vicinity of the Extension Quarry.

The wetland component of the LTTEM focuses on amphibian vernal breeding pools and ensuring hydroperiods are suitable for continued hydrophytic plant growth in the surrounding wetland zones. Wetland water level monitoring is conducted as part of the Performance Indicator Trigger Monitoring (PITM) and the LTTWM programs and will be interpreted from a natural heritage perspective. Ecological monitoring to complement the water level monitoring includes two components: amphibian monitoring and wetland vegetation monitoring.

The ecological monitoring components were completed by Stantec Consulting Ltd. (Stantec).

## 5.1 AMPHIBIAN MONITORING PROGRAM

Wildlife monitoring in wetlands is focused on amphibians (Anura: frogs and toads and Urodela: salamanders). Amphibians are excellent indicators of the health of the wetland area and water regime trends that could be affecting wetland function. Wildlife monitoring was initiated in 2018 and continued through 2020. The 2020 monitoring program, including methodology and results, is summarized in the *Amphibian Monitoring Program, 2020 Annual Monitoring Report* prepared by Stantec (Appendix D).

The 2020 Amphibian Monitoring Program was completed and reported successfully, fulfilling the requirement of the Adaptive Management Plan. Data of amphibian habitat, egg mass occurrence, incidental observation and breeding calls at each survey Station were collected, providing monitoring data for amphibian community and abundance in the Study Site. Habitat at each survey Station was suitable for amphibians and, when comparing 2020 data to previous years' surveys, amphibian communities were similar in diversity and abundance at each Station

## 5.2 WETLAND VEGETATION MONITORING

Vegetation monitoring was initiated in 2019 and continued in 2020 at wetlands within the Rob Roy Swamp PSW Complex (RR2 and RR6) and ANSI wetlands A & B. The summary report, *Wetland Vegetation Monitoring* 2020 prepared by Stantec (Appendix D), describes the methods and results from 2020 surveys and will be updated annually as part of the AMP reporting schedule.

For the most part, the wetlands remain consistent in their floristic character and remain as vibrant wetland communities. RR6 appears to be experiencing inundation over a long period which is changing the character of the wetland floristic diversity. However, the wetland remains as a wetland feature, but will succeed to a more open canopy wetland environment. This wetland has historically been subject to variable water regimes. Further investigation may be warranted to assess the inundated conditions.

# 6 ECOLOGICAL ENHANCEMENT AND MITIGATION MONITROING PROGRAM

The ecological enhancement and mitigation measures monitoring (EEMM) program includes mitigation and enhancement measures not directly related to the day to day operation of the quarry. The EEMM program is designed to make sure the ecological mitigation measures are properly implemented (e.g. appropriate number and species of trees are planted, amphibian habitat is self-sustaining) and that the resulting features are managed and adapted with changing conditions and trends (e.g. replanting for dead trees, controlling pest damage, control / allowing public access, etc.)

The EEMM program includes the Woodland Program, the Millar Pond relocation, the Bridson Pond enhancement and Butternut tree plantings incorporated into the Woodland Program.

The Woodland Program has been initiated. The Millar Pond was relocated in 2019. The remaining EEMM tasks required no action in 2020.

## 6.1 WOODLAND PROGRAM

The Woodland Program was initiated in 2015, with tree planting and other enhancement measures undertaken over three years from 2015 to 2017. Reforestation efforts were divided between areas of active reforestation and areas of natural regeneration, which were delineated in the field based on site conditions. Active reforestation lands included sodded fields, fallow fields, and worked fields which were treated with techniques including the planting and maintenance of varying sizes and species of trees. Natural regeneration lands consisted of areas of shallow soils, primary succession woodlots and naturalizing, disturbed areas. Grading to create variable microtopography was utilized in both natural regeneration areas and at the margins of active regeneration sites where the physical dimensions or site conditions were not feasible for active regeneration planting techniques.

The summary report, *Reforestation Monitoring Program: 2020 Annual Monitoring Report* prepared by Stantec (Appendix E), describes the methods and results from 2020 surveys as part of the AMP reporting schedule. The Duntroon Quarry Reforestation Plan and planting quantities table are included in the report. These documents track what species of tree have been planted and identifies which areas have been planted in what year.

The monitoring and maintenance of materials planted in 2016 and 2017 were monitored until 2018 and 2019, respectively. The monitoring activities are now focused on canopy closure.

On average, the Active Planting Units and Passive Regeneration Units have met the 2020-2024 targets established in Township Agreement. The degree to which the Planting Units meet the reforestation targets is a reasonable indication of the ecological function of the reforested areas. The current results suggest that the reforestation areas are contributing to local forest function and on a trajectory to becoming self-sustaining components of the woodland landscape through establishment of a healthy woodlot with enhanced species diversity, a shade-tolerant understorey and wildlife habitat.

Reassessment of the forest regeneration will be completed again in 2023.

## 6.2 MILLAR POND RELOCATION

In the fall of 2019, the new Millar Pond was excavated as per the EEEM Program. A figure of the proposed Millar Pond plantings is available in Appendix J of the AMP. Planting and ecological monitoring at the new Millar Pond will commence in the spring of 2021 with results presented in the 2021 AMP Summary Report.

# 7 OPERATIONS IMPROVEMENT WORKSHOP FOR 2020

The operations improvement workshop was not completed in 2020 due to COVID regulations.

As part of its commitment to working with the community, Walker Aggregates will hold an Annual Operations Improvement Workshop for neighbours and other interested stakeholders again in 2021. The 2020 AMP Summary Report will be an agenda item at the Workshop.

# 8 SUMMARY CONCLUSIONS AND RECOMMENDATIONS

Based on our review of the monitoring data collected to support the Adaptive Management Plan groundwater, surface water and ecological monitoring programs in 2020, we offer the following conclusions:

- No adverse impact to the surrounding off-site water resources were found in 2020. Trigger events observed at the surface water stations are not related to quarry activities. The potential for off-site water-related effects to any of the provincially significant wetlands and/or Escarpment springs during Phase 1 is considered to be very low.
- The habitat at each survey Station was suitable for amphibians and, when comparing 2020 data to previous years' surveys, amphibian communities were similar in diversity and abundance at each Station.
- Wetland vegetation monitoring, including installing transects and plots for monitoring purposes, was initiated in 2020. The monitoring represents the second year of terrestrial monitoring on the Subject Lands.
- The woodland monitoring results suggest that the reforestation areas are contributing to local forest function and on a trajectory to becoming self-sustaining components of the woodland landscape through establishment of a healthy woodlot with enhanced species diversity, a shade-tolerant understorey and wildlife habitat.

Based on our review of the monitoring data collected to support the Adaptive Management Plan groundwater, surface water and ecological monitoring programs in 2020, the following recommendations are made:

- Certain deficiencies that were apparent with the implementation of the program in 2016, including the flow and temperature interim trigger level values that were adopted for the PITM Escarpment spring and surface water

monitoring stations, continued to be evident in the 2020 program. The performance indicator interim triggers for surface water flow and surface water temperature should be re-evaluated to incorporate the conditions observed in 2016 through 2020. The values recorded as having exceeded a specific seasonal maximum or minimum interim "trigger" value occurred as a result of atypical climatic conditions, and not as a result of quarry operations in Phase 1.

- Trigger values will be updated in 2021 as part of the 5-year comprehensive review.
- It is recommended that the groundwater stations BH02-3, BH02-4, CLF1, OW1-6, OW3-1 and NW2 should be removed as they are no longer accessible.
- During Phase 1 of quarry extraction, reference wetlands are to be established in the Nottawasaga Lookout Provincial Park or the Pretty River Provincial Park with input from the Ministry of Natural Resources and Forestry and the Nottawasaga Valley Conservation Authority. The search for the reference wetland will continue in 2021 through examining the Pretty River Provincial Park. This wetland will be designated as Reference Wetland 1.
- Ecological monitoring at the new Millar Pond began in 2020 with a visual assessment for success of planted vegetation. This will continue in 2021.

Certain inconsistencies between the 2013 AMP document and the Site Plan should be resolved through consultation with the MNRF. These include certain aspects of wetland monitoring, annual reporting dates and the requirement of monthly reporting during Phase 1, when no adverse influences are expected. These should be addressed prior to the 5-year report.

# 9 BIBLIOGRAPHY


- Jagger Hims. 2007. Level 2 Hydrogeological Assessment Addendum Cumulative Impact Assessment Proposed Expansion and Proposed MAQ Highland Quarry Computer Groundwater Modeling Response to Agency Review Comments.
- Ministry of the Environment and Climate Change (January 2015 e-Laws currency date). Ontario Water Resources Act, R.S.O.1990 and periodic amendments.
- Ministry of the Environment and Climate Change (January 1999). Protocol for the sampling and analysis of industrial/municipal wastewater.
- Stantec Consulting Ltd and Hims GeoEnvironmental. 2013. Adaptive Management Plan - Duntroon Expansion Quarry.
- BSC [Bird Studies Canada]. 2009. Marsh Monitoring Program Participants Handbook for Surveying Amphibians. 2009 Edition. 13 pages. Published by Bird Studies Canada in cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.
- Harding. 1997. Amphibians and Reptiles of the Great Lakes Region. Great Lakes Environment Series. The University of Michigan.
- Stantec. 2010. Duntroon Quarry Expansion Consolidated Natural Environment Report. Lot 25, Concession 12, Township of Clearview