# 2022 Annual Water Monitoring Report

Dufferin Aggregates Milton Quarry
Region of Halton

Dufferin Aggregates,
a division of CRH Canada Group Inc.

Technical Reference Report Version

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**MEMORANDUM**

To: Tina Dufresne, District Manager, Halton-Peel District Office
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Joe Muller, Niagara Escarpment Commission
Sandy Dobbyn, Niagara Escarpment Commission

From: Walter Heyden, Site Manager, DFA Milton

Date: March 31, 2023

**Subject: 2022 Monitoring Report**
**Dufferin Aggregates Milton Quarry, Region of Halton, Ontario**

Please find enclosed a copy of our 2022 Monitoring Report for the Milton Quarry, dated March 31, 2023. The report was prepared by GHD and covers the 2022 calendar year. Dufferin Aggregates is a division of CRH Canada Group Inc.

One hard copy is being sent to the Halton Hills Library. If you require a hard copy of the report please contact Kyle Fritz of GHD at 519-998-5765. A link to download the report will be provided via email to the distribution list.

Should you have any questions I may be contacted at 905-878-6051 or by email at walter.heyden@ca.crh.com.

Sincerely,

Walter Heyden
Site Manager, DFA Milton

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**Waterloo, Ontario N2L 3X2**
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**Our ref:** 010978

**31 March 2023**

**Mr. Walter Heyden**
**Dufferin Aggregates**
**9410 Dublin Line**
**Milton, Ontario**
**L9T 2Y3**

**2022 Annual Water Monitoring Report**
**Dufferin Aggregates Milton Quarry, Region of Halton, Ontario**

Dear Mr. Heyden

Enclosed please find a copy of the 2022 Annual Water Monitoring Report for the Milton Quarry, Region of Halton, Ontario prepared by GHD.

If you should have any questions, please do not hesitate to contact us.

Regards

**Kyle Fritz, P.Eng.**

kyle.fritz@ghd.com

Encl.

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# Appendices

# 1. Introduction

GHD Limited (GHD) was retained by Dufferin Aggregates (Dufferin), a division of CRH Canada Group Inc., to complete the 2022 Annual Water Monitoring Report for the water-related monitoring program at the Milton Quarry (Site). The Site is located within the Towns of Milton and Halton Hills, in the Regional Municipality of Halton. The Site location is presented on Figure 1.1.

The Site consists of the Main Quarry, North Quarry, and East and West Cell (Extension Quarry) areas. In total, an area of 552 hectares (ha) (1,364 acres) is licensed by the Ministry of Natural Resources and Forestry (MNRF) under the Aggregates Resources Act (ARA) for aggregate extraction at the Site, including 468 ha (1,156 acres) in the Main Quarry and North Quarry, and 85 ha (209 acres) in the Extension. Quarrying operations are ongoing in the Main Quarry and the North Quarry under ARA License No. 5481 and in the Extension under ARA License No. 608621. Extension extraction commenced in 2007 with Phase 1 (East). Phase 2 (West Cell) extraction above the water table began in fall 2012. Extraction below the water table in Phase 2 began in June 2013 and continued through 2020. Phase 3 (East Cell) extraction above the water table began in 2016, and extraction below the water table in Phase 3 began in 2017 and continued through 2022.

The various approvals and agreements related to aggregate extraction at the Site have resulted in the development of an environmental monitoring program and the construction and operation of a Water Management System (WMS) that supports aggregate extraction activities and facilitates water storage/handling, mitigation of water-related environmental features, and long-term rehabilitation.

This report presents the results of the monitoring programs for the Main Quarry, North Quarry, and Extension.

The results and interpretations presented in this report are based on monitoring data collected by Dufferin, GHD, Goodban Ecological Consulting Inc. (GEC), and WSP at the Site and surrounding area, up to and including 2022. The 2022 monitoring program was undertaken based on the conditions presented in the following permits/approvals:

- Aggregate Resources Act Licenses 5481 and 608621.
- Amended Permit to Take Water (PTTW) No. PTTW No. 5256-BUUP62 (issued November 2, 2020).
- Amended Environmental Compliance Approval No. 6124-C42GL4 (issued June 21, 2021).
- Work Permit No. AUR-45-03/04 issued by MNRF under the Lakes and Rivers Improvement Act (LRIA) on September 3, 2003.
- October 2003 Water Management Agreement (Extension Quarry) between Dufferin and Conservation Halton (CH).
- Updated Adaptive Environmental Management and Protection Plan (AMP) May 2003 – Modified December 2011 implemented through the Extension Site Plans, Ontario Water Resources Act (OWRA approvals), and the AMP Agreement.

This report and previous annual reports present the results of the monitoring activities required by the various applicable permits/approvals for the Site. In addition to the required monitoring, various additional monitoring activities have been undertaken in the areas of the North Quarry and the Extension since the mid-late 1990s. This additional monitoring has been conducted to establish baseline hydrogeologic conditions and to facilitate evaluation of various aspects related to quarrying and mitigation in the Extension. All monitoring data collected in relation to the Site in 2022 are presented in this report. Historical data are also presented and discussed, where appropriate, to facilitate interpretation of the 2022 monitoring results.

This report is organized as follows:

Section 1 Introduction

Section 2 Background

Section 3 Quarrying and WMS Construction/Operation

Section 4 Hydrometeorologic Monitoring

Section 5 Hydrologic/Hydrogeologic Monitoring

Section 6 Water Taking and Discharge

Section 7 Water Quality Monitoring

Section 8 Residential Well Monitoring

Section 9 Ecological Monitoring

Section 10 Annual AMP Reporting Summary

Section 11 Conclusions

Section 12 Recommendations

Section 13 References

An electronic copy of this document is provided in Appendix A.

# 2. Background

This section presents background information relevant to the monitoring activities that are conducted at the Site.

This section is organized as follows:

Section 2.1 Hydrologic/Hydrogeologic Setting

Section 2.2 Permits and Approvals

Section 2.3 AMP

Section 2.4 Additional Monitoring

## 2.1 Hydrologic/Hydrogeologic Setting

The physiographic setting of the Milton area comprises two distinct features. The two features are the Dolostone Plain above the Niagara Escarpment (Escarpment) and the Halton Till Plain below the Escarpment. The Escarpment is a major feature, which trends in a general northeast to southwest direction (directions refer to "planning" north, which is approximately 45 degrees west of true north), and locally represents approximately 60 metres (m) of topographic relief.

The Dolostone Plain is characterized by undulating topography and localized wetlands. The bedrock of the Escarpment consists of a sequence of dolostones, shales, and sandstones, which overlies a thick shale formation that extends easterly at the base of the Escarpment.

The upper rock in the Niagara Escarpment is the dolostone of the Amabel Formation[1], which is approximately 15 to 30 m in thickness in the Main Quarry, 15 to 35 m in thickness in the North Quarry, and 25 to 35 m thick in the Extension. Structural features that occur within the Amabel Formation include fractures, joints, and bedding planes. The Amabel Formation is underlain by the Reynales Formation, which

[1] The traditional nomenclature has been retained to be consistent with the Site Approvals.

is a thin (generally 2 to 3 m) grey-brown, fine-grained, interbedded argillaceous dolostone, with similar or lower permeability relative to the Amabel Formation.

The dominant hydrostratigraphic unit at the Site is the unconfined dolostone bedrock aquifer consisting of the Amabel and Reynales Formations. Underlying the dolostone bedrock aquifer is the Cabot Head shale, which is approximately 18 m in thickness in the Main Quarry, 14 m in thickness in the North Quarry, and approximately 19 m in thickness in the Extension. This formation has a relatively low hydraulic conductivity and acts as an aquitard. The elevation of the groundwater table is typically observed in the upper portion of the Amabel Formation, except where it is lowered by quarry and/or Escarpment dewatering effects. The Quarry is located in the West Sixteen Mile Creek Watershed. A generally shallow tributary of the West Sixteen Mile Creek, referred to as Sixth Line Tributary, receives surface water runoff and groundwater discharge from the Site and surrounding lands. Sixth Line Tributary is located to the north of the Extension and west of the Main and North Quarries, as shown on Figure 1.1. Sixth Line Tributary has permanent flow due to groundwater discharge (from seeps, springs, and upwelling), and is designated as a cold water fishery along Sixth Line Road near the North Quarry and to the north of the Extension.

In the Main Quarry, a tributary channel of Sixteen Mile Creek (referred to as the Hilton Falls Reservoir Tributary [HFRT]) was intercepted in 1990 to allow for quarrying activities. The flow regime intercepted by the quarry has been replaced by discharge from the Main Quarry to maintain base flow.

## 2.2 Permits and Approvals

This section provides the background for the annual hydrologic/hydrogeologic monitoring program for the Main Quarry, North Quarry, and Extension, including the various permits, approvals, and agreements pertaining to monitoring at the Site.

### 2.2.1 Summary of Monitoring Program Requirements

The Site monitoring program was first implemented in 1990 and has evolved since that time through permit/approval requirements and the collection of baseline data to support licensing and extraction in the Extension. In June 2013, with the commencement of extraction below the water table in Phase 2 of the Extension, the full mitigation and monitoring provisions of the AMP came into effect.

Monitoring locations are presented on Figures 2.1 through 2.5. Table 2.1 summarizes the monitoring requirements of the AMP that apply for 2022, along with references to where the required monitoring results can be found in this report. Table 2.2 summarizes the monitoring requirements of the other (i.e., non-AMP) approvals/agreement, along with references to where the required monitoring results can be found in this report.

### 2.2.2 ARA Licenses 5481 and 608621

Dufferin conducts aggregate extraction and processing in the Main Quarry and North Quarry under ARA License No. 5481. Environmental monitoring is required under the PTTW, ECA, and the LRIA permit for the Site.

The MNRF issued ARA License No. 608621 to Dufferin in February 2007 for aggregate extraction in the Extension. This license addresses environmental mitigation by requiring that the AMP be implemented for extraction below the water table in Phase 2 and Phase 3 of the Extension.

### 2.2.3 Amended Permit to Take Water (PTTW)

The MECP issued Amended PTTW No. 0117-8BHQPL to Dufferin on December 16, 2010 for water taking in the Main Quarry and Extension. This permit was valid for the Site until Amended PTTW No. 8575-A3BKYB was issued on November 23, 2015 when the PTTW amendment was conducted to reflect Dufferin's corporate name change. The MECP issued PTTW No. 5226-UUP62 to Dufferin on November 2, 2020 and this PTTW is currently valid for the Site. The PTTW in effect for the Site in 2022 is presented in Appendix B.

The PTTW establishes limits on water takings and requires the implementation of a monitoring program. The PTTW contains conditions for both interim and long-term operating conditions at the Site. The Site is currently operating under ***interim conditions*** and will continue to do so in the near term. Once it is clear that water quantity and quality criteria can be reliably met for the Reservoir over the long term and the Reservoir becomes the sole source to provide the required base flow to the HFRT, Dufferin will notify the MECP District Manager and apply to the MECP Director for an amendment to the ECA to transition from interim to long-term conditions, as specified in the ECA and as noted in the PTTW.

### 2.2.4 Amended Environmental Compliance Approval (ECA)

The MECP issued Amended Environmental Compliance Approval (ECA) No. 3406-8U6RQ5 to Dufferin on September 13, 2012. The amendment to the existing approval was conducted at that time to reflect the satisfaction of Condition 10 of the October 27, 2009 approval (MECP approval of the Pre-Extraction Report). On June 6, 2016 MECP issued a letter to CRH advising that their corporate name change has been registered with respect to ECA No. 3406-8U6RQ5 in MECP's records. An ECA amendment was submitted in 2021 to allow for flow monitoring to clusters of recharge wells, rather than requiring individual metering. Amended ECA No. 6124-C42GL4 was issued on June 21, 2021 and this ECA is currently valid for the Site. The ECAs in effect for the Site in 2022 are presented in Appendix C.

The ECA contains conditions for both interim and long-term operating conditions at the Quarry. The quarry is currently operating under ***interim conditions*** and will continue to do so in the near term. Once it is clear that water quantity and quality criteria can be reliably met for the Reservoir over the long term and the Reservoir becomes the sole source to provide the required base flow to the HFRT, Dufferin will notify the MECP District Manager and apply to the MECP Director for an amendment to the ECA to transition from interim to long-term conditions, as specified in Condition 3 of the ECA.

The ECA requires water quality monitoring of all effluent discharged from the Site, water level monitoring at trigger and recharge monitoring wells, and ecological monitoring of the Brook Trout spawning areas in the Sixth Line Tributary.

### 2.2.5 Lakes and River Improvement Act (LRIA) Work Permit No. Aur-45-03/04 and Main Quarry Rehabilitation Plan

The LRIA Work Permit No. AUR-45-03/04 was issued to Dufferin on September 3, 2003 for the construction of the Main Quarry west side rehabilitation components, including the Reservoir. A copy of LRIA Work Permit No. AUR-45-03/04 is presented in Appendix D. The LRIA permit requires that the Main Quarry Discharge (to the HFRT) be done in accordance with plans agreed to by CH (based on their modeling analyses) and that the temperature of discharge flows to the Hilton Falls Reservoir Tributary be recorded hourly with a data logger, from June 1 to September 30.

### 2.2.6 CH Agreement and CH/Region Agreement

The following two agreements between Dufferin, CH, and the Region (AMP Agreement Only) are in effect:

- Water Management Agreement (Extension Quarry) (October 2003)
- AMP Agreement (August 2003)

These agreements are discussed below.

***Water Management Agreement (Extension Quarry)***

The Water Management Agreement (Extension Quarry) between CH and Dufferin took effect on June 12, 2007, superseding the previous Water Management Agreement (Main Quarry). This agreement includes requirements for discharge from the Main Quarry to the HFRT and a monitoring program for the Main Quarry/North Quarry.

### *AMP Agreement*

The AMP Agreement between the Region, CH, and Dufferin took effect following MNRF issuance of ARA License No. 608621 and commencement of Site preparation activities in Phase 1 (East) of the Extension. This agreement requires the implementation of the AMP for extraction activities in the Extension Phases 2 and 3.

## 2.3 AMP

The AMP was developed in support of the mitigation and management measures for the Extension Quarry. The AMP forms the framework for managing the implementation and operation of the mitigation measures to ensure that water resources and associated ecological features are protected.

The AMP is required to be implemented for aggregate extraction in Phases 2 and 3 of the Extension by ARA License No. 608621 and the associated Site Plans, the Water Management Agreement (Extension Quarry) between Dufferin and CH, and the AMP Agreement between Dufferin, CH, and the Region. Although the AMP pertains to Extension Phase 2 and Phase 3 extraction, it included requirements for background data collection and other work prior to the commencement of Phase 2 extraction. The overall approach of the AMP is discussed below.

Groundwater flow within the Amabel aquifer supports water resources in the area, including private water supply wells, cold water fisheries, and wetlands. The AMP incorporates comprehensive mitigation measures to prevent any adverse effects on water resources from either a water quantity or water quality perspective. Under active quarry conditions, mitigation measures include operation of the WMS consisting of quarry dewatering and discharge to the Reservoir and drawing water from the Reservoir for use in a groundwater recharge system based on a series of recharge (injection) wells along appropriate segments of the quarry perimeter. The groundwater recharge system is designed to generally maintain the natural groundwater levels in the vicinity of the wetlands and other water dependent features around the quarry and beyond. Quarry rehabilitation will involve the creation of three separate lakes created by extraction in three quarry cells. Once these lakes attain their designed water levels, they will serve to passively maintain surrounding groundwater levels and associated water resources. Some active management of water will continue post-rehabilitation, to ensure the lakes are maintained at appropriate levels, the on-Site wetlands are maintained, and may include some localized seasonal groundwater recharge along the eastern part of the quarry area.

The purpose of the adaptive management approach is to recognize the inherent variability in the natural environment and implement a flexible system of mitigation and monitoring to ensure the mitigation measures provide ongoing protection of water resources. The AMP is based on the planned implementation of proven mitigation measures and an organized process of design, implementation, monitoring, evaluation, and optimization for the active quarry operation and rehabilitation periods.

The AMP establishes the water resources monitoring program for the Extension. The key performance monitoring aspect for the mitigation measures for the Extension is to maintain groundwater levels at defined trigger monitoring wells that ensure protection of the adjacent water resources and associated features.

The AMP includes measures to ensure the proactive construction, demonstration, and verification of the WMS. A response action framework is defined to provide a structured response to any conditions where the target levels are not being suitably maintained, including Agency notification.

Target water levels are required for trigger wells to regulate the performance of the mitigation measures. The AMP establishes the protocol for defining appropriate target levels, as well as the methodology for adapting them in the future in response to changes in any relevant factors, including climate change.

The approach using groundwater recharge wells operated to maintain target water levels in trigger wells is consistent with the North Quarry Recharge Well System requirements although the AMP includes further details for monitoring and mitigation operations for the Phase 2 and Phase 3 Extension Quarry.

It is also necessary to ensure that the quality of recharged water is acceptable for the protection of adjacent water resources. Water quality monitoring and other supplemental monitoring programs are defined in the AMP to provide a comprehensive monitoring and evaluation program.

The AMP focuses on the protection of ecological water resources as they are more sensitive to water level variations than water supply wells; therefore, the protection of ecological features generally provides protection of water supply wells. Dufferin is fully committed to protecting the water supplies (both quantity and quality) for neighbours as is currently done under the existing domestic well program for the Site, and detailed requirements are included in the AMP.

In addition to this annual report, the AMP requires a comprehensive 5-year review commencing with the start of extraction below the water table in the West Cell (Phase 2). The first 5-year review covered the period from June 2013 to December 2018 and was submitted under separate cover (GHD, 2020).

## 2.4 Additional Monitoring

In addition to the monitoring required by the above approvals, additional monitoring is conducted for a number of purposes, including to ensure that the WMS is operated appropriately and to provide additional characterization of conditions. The additional monitoring beyond the requirements of the Site approvals that was conducted in 2022 includes the following:

- Water level monitoring at trigger wells and recharge monitoring wells associated with operating portions of the recharge well system at more frequent intervals than required (e.g., North Quarry trigger wells typically monitored once or twice per week rather than twice per month as required by the PTTW).
- Annual water level monitoring at all available Main Quarry monitoring wells not required by the Site approvals.
- Water quality monitoring at WMS locations required in the future under long-term conditions but not currently required under interim conditions (including North Quarry and Central Sump discharges to the Reservoir).
- Expanded monthly list of water quality monitoring parameters (i.e., same list as required by ECA for recharge water) for WMS water quality sampling locations.
- Monthly surface water elevation monitoring at all staff gauges and other surface water level monitoring stations associated with Sixth Line Tributary and Extension wetlands, subject to access.
- In 2022 Dufferin voluntarily installed a new staff gauge, location SG67, in Wetland W10 northeast of the East Cell. The wetland pool is currently instrumented; however, the existing gauging was only accessible for a brief period in the spring prior to JESA breeding and visual concealment due to vegetation growth. The new location is more accessible and visible from a greater distance, allowing for continuous access and monitoring until wetland dryout.
- Monthly photos at staff gauges to further document the conditions of the various surface water features.
- Additional temperature monitoring at the culvert where the Main Quarry discharge to the HFRT crosses under Sixth Line (SG50).

The types of additional monitoring activities will vary over time based on the conditions that are encountered.

# 3. Quarrying and WMS Construction/Operation

This section presents information related to quarrying and WMS construction/operation activities conducted at the Site in 2022.

This section is organized as follows:

Section 3.1 Quarrying Activities in 2022

Section 3.2 WMS Construction Activities in 2022

Section 3.3 WMS Operation in 2022

# 3.1 Quarrying Activities in 2022

In 2022, bedrock production extraction occurred in the East Cell with minor extraction also occurring in the Main Quarry. Figure 2.7 presents the 2022 limits of extraction, as well as the 2021 limits of extraction and the licensed extraction limits for comparative reference.

***Main Quarry***

Main Quarry extraction was limited to the removal of minor remaining reserves along the southern extraction limit west of the scalehouse. Ongoing clean-up of remaining reserves will continue until rehabilitation is complete within the processing area.

***East Cell***

In 2022, upper bench extraction finished expanding into the northern portion of the East Cell. Lower bench extraction was advanced in the central and northeastern parts of the East Cell. Floor extraction started in the southwest corner of the East Cell and has proceeded eastward following the lower bench excavation.

# 3.2 WMS Construction Activities In 2022

An additional nine recharge wells were installed in the Extension in 2022 to increase recharge capacity in areas where it was anticipated to be needed in the future based on existing recharge capacity and Dufferin's mining plans. These wells are ready for connection to the system when needed via temporary (above-grade) or buried waterlines. Nine recharge wells were connected to the water management system with buried piping. No recharge wells were disconnected from the water management system in 2022.

In the North Quarry there were no changes or additions to the WMS. The North Quarry recharge system is presented on Figure 2.3.

In the West Cell, the recharge connection was utilized at MWx1-15 in 2022. The West Cell recharge system is presented on Figure 2.4.

In the East Cell, nine additional recharge wells (RW301E-22, RW301F-22, RW308G-22, RW308H-22, RW311L-22, RW311M-22, RW312B-22, RW312J-22, RW314B-22) were installed in 2022 and connected to the recharge system. As an additional precautionary measure, bedrock grouting was proactively completed adjacent the eastern limit of the East Cell to limit the potential future recirculation as the excavation approaches the final Extraction Limit in this area. The new wells and grouting were installed on the northwest through east sides of the East Cell in anticipation of future recharge needs as the East Cell lower bench is advanced to its final Extraction Limits. The East Cell recharge system is presented on Figure 2.5.

# 3.3 WMS Operation In 2022

This section presents information related to operation of the WMS in 2022.

## 3.3.1 Main Quarry/North Quarry/Extension Water Handling

In order to maintain dry working conditions in the Main Quarry, North Quarry, and Extension, the WMS dewatering components collect surface water and groundwater inflow from the quarry areas and convey it to the Reservoir where it is stored and/or discharged from the Site. Some of the water collected from the North Quarry and Extension is diverted for quarry operations, as needed. The water in the Reservoir can be retained to increase storage or can be discharged (to the HFRT to provide the required baseflow), pumped to

the Main Quarry Lake/Wetland Complex (to maintain a lake level of approximately 302.5 to 303.5 m above mean sea level [AMSL]), pumped to the recharge well system, or used in the Main Quarry operations area.

Lake Filling commenced in the West Cell in mid-2021 and continued through 2022. As at the end of 2022, the water level in the West Cell was approximately 309 m AMSL (final lake level of 326 m AMSL) and total water in storage is currently 800,000 $m^3$. It is anticipated that during the lake filling period some water will be returned to the Reservoir via the North Quarry Sump annually so the rate of filling does not exceed the water surplus for the site. Sufficient water will remain in storage in the Reservoir to meet both mitigation and off-site discharge (HFRT) requirements; however, a lower operating level is being maintained to create more capacity for full capture of the spring freshet.

Dufferin met the minimum required annual discharge to the HFRT of 700,000 cubic metres ($m^3$) in 2022 (see Section 6.2.3). As presented in the 2021 Annual Water Monitoring Report (GHD, 2022), no Excess Water was anticipated to be available for discharge in 2022 to the HFRT. No surplus water was discharged to the HFRT in 2022; however, the required 700,000 $m^3$ discharge was completed in cooperation with Conservation Halton.

During 2022, water was discharged to the HFRT from both the West Sump and the Reservoir outfall to an on-Site wetland located immediately east of Sixth Line. Flow from the wetland via the HFRT is in a westerly direction through a culvert beneath Sixth Line. The HFRT downstream (west) of Sixth Line is also a component of the wetland in this area. Water discharges from the HFRT flow into the Hilton Falls Reservoir. Water discharged from the Hilton Falls Reservoir is subsequently discharged to the Kelso Lake Reservoir. Conservation Halton owns and manages both of these reservoirs.

### 3.3.2 Recharge Well System

Dufferin continued to operate the North Quarry and Extension portions of the recharge well system throughout 2022 in accordance with the related approvals. Short-term power outages occasionally occur at the Site, including an outage in February 2022 due to inclement weather. Generally, these outages are not a concern because water levels are typically restored to above target within a matter of a few hours or days.

Operating and monitoring information related to the recharge well system is presented in the following sections:

Section 5 Hydrologic/Hydrogeologic Monitoring

Section 6 Water Taking and Discharge

Section 7 Water Quality Monitoring

# 4. Hydrometeorologic Monitoring

In the fall of 1990, a hydrometeorologic station with computerized data logging equipment was established by Dufferin in the Main Quarry. Data collection first began in October 1990. The station was moved from the west central area to the recharge pumping station in 2008. The following data were collected in 2022:

Air Temperature - Hourly average of readings taken every 5 seconds.

Precipitation - Total accumulation recorded every 15 minutes by a tipping bucket rain gauge.

Evaporation - Total evaporation manually recorded twice per week using a Class "A" evaporation pan.

Hydrometeorologic data for precipitation, evaporation, and air temperature from 1991 to 2022 are presented graphically in Appendix E.

This section is organized as follows:

Section 4.1 Air Temperature

Section 4.2 Precipitation

Section 4.3 Evaporation

Section 4.4 Summary

# 4.1 Air Temperature

The Site weather station measures air temperature every 5 seconds and records hourly average temperatures. When air temperature measurements are not available from the Site weather station, the data is supplemented with temperature data from the Acton Wastewater Treatment Plant (WWTP) located approximately 9 kilometres (km) from the Site and Georgetown WWTP. Average monthly air temperatures for 2022 are presented in Table 4.1, and graphically on Figure 4.1, along with the long-term monthly average temperatures for comparative reference. Average daily air temperatures from 2022 are presented in Appendix E Table E.1.

Cool conditions were observed at the start of winter 2022 in January with monthly average temperatures 3.4°C colder than the long-term average. The balance of the year was slightly warmer than typical, with a net annual result of 0.3°C above average. The coldest day of the year occurred on January 15, 2022 with an average daily temperature of -18.5°C. The hottest average daily temperature of the year was recorded on August 7, 2022 at 26.3°C. The highest and lowest monthly average temperatures in 2022 were in July at 21.2°C and in January at –9.0°C, respectively.

# 4.2 Precipitation

During 2022, the Milton Quarry rain gauge was operational between April 12 and November 14. The rain gauge only collects rainfall data and therefore is typically operated during non-freezing conditions. During periods when data was not available from the Site weather station, the data is supplemented, first using precipitation data from the Acton Wastewater Treatment Plant (WWTP) located approximately 9 km from the Site, and then with data from the Georgetown WWTP. The supplemented precipitation data is presented on Figure 4.2. Historical yearly precipitation data is presented in Appendix E Figure E.1.

GHD obtained 2022 rainfall and air temperature data collected at the Acton WWTP from the Credit Valley Conservation Authority (CVC) which operates a heated tipping bucket rain gauge year-round. GHD only utilized the precipitation data for the winter period (November to March) when air temperatures for the month were consistently above -5°C, as there are some concerns with the accuracy of precipitation generated by heated tipping buckets when air temperatures are below -5°C.

Precipitation data for 2022 were obtained from Environment Canada (the Ontario Climate Centre) for the Georgetown WWTP station in Georgetown, Ontario (located approximately 13 km from the Milton Quarry). Precipitation data for the full year was qualified as preliminary (by Environment Canada) at the time of this report. Environment Canada has not conducted the full QA/QC process on the data; however, this data was reviewed and edited and is considered appropriate for this report. The Georgetown WWTP station precipitation dataset was complete with two missing days of data; therefore, supplementation with Toronto International Airport was required in February and December of 2022. The Georgetown WWTP station has a complete record of precipitation data between 1882 and 2022, including snowfall data during the winter months that have been converted to precipitation.

Monthly precipitation totals for 2022 are presented in Table 4.2. Daily precipitation totals are also provided in Appendix E Table E.2 for reference.

The 2022 total annual precipitation for the Milton Quarry was 595 millimetres (mm), which is approximately 270 mm lower than the long-term average (1991 to 2021). 2022 was a significantly dry year, with only one month having above average precipitation, three months were average and the remainder of the year below

average. Conditions at the start of the year in January were significantly drier than the long-term average, and almost half of the mean precipitation was recorded (45 mm recorded versus the mean of 70 mm), followed by a significantly wetter than average February, exceeding the long-term average by about 32 mm. Average conditions were observed in March, whereas the rest of the year excluding December experienced drier conditions than the long-term average. This made 2022 the driest year on record for Milton Quarry since monitoring records began in 1991.

The Georgetown WWTP total annual precipitation for 2022 (670 mm) was lower than its long-term average (1991 to 2021), by approximately 160 mm. The 2022 Georgetown WWTP precipitation data reveals the significant impact that isolated storms can have on the area. During the months of February and August, the Georgetown WWTP monthly data exceeded the precipitation observed at the Milton, as well as both long-term averages. A clear difference between Georgetown WWTP and the Milton Quarry precipitation for some months in 2022 can be seen on Figure 4.2; however, most months are very similar. A comparison of precipitation at Milton Quarry and the Georgetown WWTP is presented in Appendix E Table E.3.

While some month-to-month variability was present, conditions were typical through March 2022. Subsequently, a significant reduction in precipitation was observed for the balance of the year. Total precipitation was recorded to be 595 mm in 2022 and was lower than the long-term average by approximately 270 mm. Observations in 2022 indicate it was the driest year recorded since monitoring commenced in 1991.

## 4.3 Evaporation

Pan evaporation is measured at the Site using a Class "A" evaporation pan. The evaporation pan is monitored at a minimum twice weekly by collecting manual water level measurements and making the required water level adjustments. Equivalent measured lake evaporation is calculated by multiplying the measured pan evaporation by the pan coefficient (0.70) after correcting for rainfall into the pan. The evaporation pan, similar to the rain gauge, is not used during winter months. The measured lake evaporation data is presented graphically on Figure 4.3 for months with a complete monitoring record. The monthly measured lake evaporation on Figure 4.3 is presented with the long-term Milton Quarry (1991-2021) mean evaporation observed at the Site. Historical yearly lake evaporation data is presented in Appendix E Figure E.2.

Table 4.3 presents measured and supplemented lake evaporation on a monthly basis. The supplemented lake evaporation includes an over-winter evaporation estimate of 154 mm, as presented in the 5-Year AMP Review Report. The over-winter estimate represents evaporation occurring between November and April.

The total supplemented lake evaporation at the Milton Quarry in 2022 is estimated to be 607.5 mm. Recorded evaporation is 55 mm below the long-term average (1991 to 2021, excluding 1996 to 1999) of 662.5 mm.

The annual lake water surplus/deficit, which is the difference between the precipitation and lake evaporation is -12 mm, indicating a water deficit over the lake area for the year. The deficit observed in 2022 is much lower than the long-term average surplus of 209 mm. Historical annual precipitation surplus data is presented in Appendix E Table E.4.

## 4.4 Summary

The overall average air temperature for 2022 was 8.1°C, which is warmer than the long-term average of 7.8°C for the Milton Quarry. The highest and lowest monthly average temperatures in 2022 were in July at 21.2°C and in January at -9.0°C, respectively. The highest daily average temperature was recorded in August at 26.3°C and the lowest daily average temperature was recorded in January at -18.5°C. Monthly temperatures in 2022 were comparable to the long-term average, apart from January being approximately 3°C cooler than usual.

While some month-to-month variability in precipitation was present, conditions were typical through March 2022. Subsequently, a significant reduction in precipitation was observed for the balance of the year.

The 2022 total annual precipitation for the Milton Quarry was 595 mm, which is approximately 270 mm below average.

The total supplemented lake evaporation at the Milton Quarry in 2022 is estimated to be 607.5 mm and is below the long-term average of 662.5 mm. An annual water deficit of -12 mm was calculated for the lake area at the Site in 2022.

# 5. Hydrologic/Hydrogeologic Monitoring

This section presents the hydrologic/hydrogeologic monitoring data collected in 2022 for the Main Quarry, North Quarry, and Extension.

Monitoring locations are shown on Figures 2.1 (Main Quarry), 2.2 (North Quarry and Extension), 2.3 (North Quarry portion of the recharge well system), 2.4 (West Cell portion of the recharge well system), and 2.5 (East Cell portion of the recharge well system). Monitoring well installation details are presented in Appendix N (Table N.1). Water level and flow monitoring data are provided in Appendices G and H, in graphical and tabular form, respectively. Stratigraphic and instrumentation logs for monitoring wells are presented in Appendix F.

In 2022, water resources reflected precipitation patterns. Spring recharge and water levels early in the year were typical and a typical peak occurred in early March. Conditions in the balance of 2022 were exceptionally dry and water levels declined rapidly through the fall in areas not supported by the groundwater recharge system. These results are evident on background well hydrographs presented in Attachment 11 of Appendix G. Surface water availability and the Site water budget are discussed in detail in Section 6.

Further information is provided as organized below:

Section 5.1 Main Quarry

Section 5.2 North Quarry Recharge System

Section 5.3 Extension Recharge Well System

Section 5.4 Spring-Summer Target Transition

Section 5.5 Target Level Adjustments for 2023

Section 5.6 Other Hydrologic Monitoring

## 5.1 Main Quarry

Hydrologic/hydrogeologic monitoring in the Main Quarry includes measurement of surface water elevations (including the Reservoir and the Main Quarry Lake/Wetland Complex), and groundwater elevations at monitoring wells.

Monitoring of pumped flows is also conducted as reported in Section 6.

### 5.1.1 Surface Water Elevations

In 2022, the water level in the Reservoir ranged between 307.45 and 305.40 m AMSL (see hydrograph in Appendix G, Attachment 1). The typical seasonal Reservoir level pattern is a sharp increase with the onset of the spring freshet followed by a decrease during the summer when discharge needs for mitigation and evaporation exceed inflows from dewatering and precipitation. Despite the overall dry conditions in 2022, the typical sharp spring increase did occur, likely influenced by above average precipitation in February 2022.

The surface water elevation in the Main Quarry Lake/Wetland Complex fluctuated within the normal range (see hydrograph in Appendix G, Attachment 1). The water level generally follows the typical seasonal trend of a relatively high water level in the spring and relatively low water level in the fall.

### 5.1.2 Groundwater Elevations

Five monitoring wells (MW1 to MW5) were previously installed near the licensed boundary of the Main Quarry to obtain groundwater level data at locations surrounding the quarry. The recorded groundwater levels are used to evaluate long-term changes in the water table that may be related to the effects of quarrying, including rehabilitation.

It is noted that these monitoring wells are now located at distances ranging from approximately 6 m (MW5) to 42 m (MW1) from the quarry face. As a result, the groundwater elevations reflect a dewatered condition and no significant changes are anticipated in the future from Main Quarry activities other than at MW5, which is close to the Reservoir and may increase in the future with flooding of the North Quarry cell.

Hydrographs are presented in Appendix G, Attachment 2. A summary of groundwater elevation data is presented in Appendix H. The hydrographs allow comparison of seasonal trends and identification of any significant changes in the groundwater elevations through the years.

The hydrographs for monitoring wells MW1, MW2, MW3, and MW4/4A/4B/4C[2] generally show the effects of historical quarry dewatering and a similar trend of seasonal fluctuations between the years 1991 to 2022. In general, the increase in groundwater elevations each year correlates with the occurrence of the spring freshet, with surplus precipitation relative to potential evaporation. The decline in groundwater elevations each year is generally attributed to the normal seasonal water deficit from late spring to early fall. Since 2008, the groundwater elevation at MW5 has been influenced more by the water level in the Reservoir than by natural groundwater levels.

## 5.2 North Quarry Recharge System

The North Quarry groundwater recharge used the North Quarry recharge pond(s) from commencement of extraction in 2000 until 2007. In 2007, the North Quarry portion of the recharge well system was commissioned and the recharge ponds were subsequently removed from service and decommissioned. Additional recharge wells have been added to the North Quarry portion of the recharge well system since 2007 as needed.

Hydrologic/hydrogeologic water level monitoring associated with the North Quarry recharge system includes measurement of groundwater elevations at recharge monitoring wells, trigger wells, and background wells. North Quarry recharge system monitoring locations are presented on Figure 2.3.

### 5.2.1 North Quarry Trigger Wells

Two sets of Trigger Well hydrographs are presented in this report. Hydrographs for North Quarry trigger wells that present 2022 groundwater elevation data, the associated 2022 target levels, and a representation of the recharge rates for the recharge wells located in close proximity are presented on Figures 5.1 through 5.7. Hydrographs for North Quarry trigger wells that present all available historical groundwater elevation data are presented in Appendix G, Attachment 4.

Groundwater elevations at North Quarry trigger wells were generally maintained at or above the target levels by the groundwater recharge well system throughout 2022. North Quarry extraction is nearly complete with remaining reserves predominantly located within a shallow floor bench. As a result, North Quarry trigger well water levels are less influenced by natural seasonal fluctuation, and instead track the target levels more closely. This effect is the result of the reduction in the area of upgradient groundwater recharge catchment and the increased influence of the recharge well system on the trigger wells. In the area of BH37, careful WMS operation to limit springtime groundwater levels has resulted in greatly reduced spring peak groundwater levels relative to earlier recharge operations, conserving water and reducing the potential risk of water concerns at the adjacent property.

[2] MW4C replaced MW4B, which was destroyed in January 2007. MW4B replaced MW4A (blocked at depth) in July 2003. MW4A replaced MW4 (destroyed) in Fall 1998.

### 5.2.2 North Quarry Recharge Monitoring Wells

Water levels in the North Quarry recharge monitoring wells reflect water levels close to points of groundwater recharge (recharge wells). They are used for operational purposes through automated measurement and control by the Programmable Logic Controllers (PLCs) in the recharge control valve huts or manual measurements at some locations. The automated control system monitors groundwater levels at selected recharge monitoring wells and adjusts the recharge flowrates at associated recharge wells such that programmable groundwater elevation set points are maintained at the recharge monitoring wells. Hydrographs for North Quarry recharge monitoring wells are presented in Appendix G, Attachment 3.

## 5.3 Extension Recharge System

Dufferin commenced operating the Extension recharge well system in May 2013 to satisfy the mitigation requirements of the AMP for the commencement of extraction below the water table in the West Cell. During 2022, the Extension recharge system was operated in accordance with the mitigation provisions of the AMP to maintain water levels at Extension trigger wells at or above the 2022 target levels.

Hydrologic/hydrogeologic water level monitoring associated with the Extension groundwater recharge well system includes water levels at trigger wells, recharge monitoring wells, and background wells. Extension recharge system monitoring locations are presented on Figures 2.4 and 2.5.

### 5.3.1 Extension Trigger Wells

Two sets of Trigger Well hydrographs are presented in this report (2022 hydrographs and long-term hydrographs). Hydrographs for Extension trigger wells that present 2022 groundwater elevation data, the associated 2022 target levels, and a representation of the 2022 recharge rates for the recharge wells located in close proximity are presented on Figures 5.8 through 5.31. Hydrographs for Extension trigger wells that present all available historical groundwater elevation data at trigger wells are presented in Appendix G, Attachments 7 (West Cell) and 9 (East Cell).

During 2022, groundwater elevations at Extension trigger wells were generally maintained at or above the target levels by the groundwater recharge well system, with a limited number of exceptions. These exceptions fall into three categories as described below.

The largest decrease below the target level was registered in transducer data (e.g., Figure 5.29 – OW5-80) in February when a power outage occurred due to severe weather, as discussed above in Section 3.3.2. The decrease associated with this event is observable in other trigger wells; however, it is most identifiable at this location due a combination of proximity to the extraction face and responsiveness to the WMS.

Several more minor but noticeable dips in water levels below target levels were recorded. While conditions in the first half of 2022 were quite dry, relatively few of these below-target water levels were recorded. In 2022, the following brief instances occurred where a water level was measured below the target level:

- The water level at OW38-04 dropped below the target level on October 13,2022. Recharge was increased and the water level recovered at or above the target level by October 14, 2022.
- The water level at OW52-07 dropped below the target level on February 25, 2022. Recharge was increased and the water level recovered at or above the target level by March 2, 2022.
- The water level at OW52-07 dropped below the target level on May 21, 2022. Recharge was increased and the water level recovered at or above the target level by May 26, 2022.

The third category of instances where transducer water level data show brief water level drops to slightly below target levels (many of which are related to short-term recharge shutdowns for routine maintenance or WMS additions); these are not cause for concern with respect to the water-dependent ecological features because of the protective nature of the target levels (i.e., corresponding to long-term average conditions in most cases).

No "Occurrence" was recorded as defined by the AMP.

### 5.3.2 On-Site Wetlands

Hydrographs for on-Site wetlands V2, W7, and W8 are presented on Figures 5.32, 5.33, and 5.34, respectively.

During 2022, water levels in the on-Site wetlands were generally maintained at or above target levels through direct diffuse discharge from the water management system as required. In 2022 no instances occurred where a water level was recorded below the target level.

Wetland water levels are plotted with nearby groundwater monitors in Appendix G Attachment 15. As anticipated, a reduction in groundwater support for on-Site wetlands has been observed with the advancement of bedrock extraction in the East Cell. Changing conditions are summarized as follows:

- Groundwater levels adjacent Wetland W7 are consistently below the historically observed range. The change in adjacent groundwater conditions is most apparent at BH47 where more than 10 m of drawdown is observed; however, at least 3 m of drawdown is also present in OW74-08 and BH46. As was previously reported, notable drawdown has been evident in the vicinity of W7 since fall 2019.
- Groundwater levels adjacent Wetland W8 exhibit approximately 3 m of drawdown at BH43-I, and more than 3 m at O73-08. Notable drawdown has been evident in the vicinity of W8 since 2020.
- Groundwater levels adjacent Wetland V2 are consistently below the historically observed range. The change in adjacent groundwater conditions is most apparent in monitoring well OW72-08, where approximately 20 m of drawdown is evident. Notable drawdown has been evident in the vicinity of V2 since spring 2017.

It is important to note that while groundwater conditions varied adjacent to the on-Site wetlands, the target levels were continuously maintained in an appropriate manner (as per the AMP, Appendix C "On-Site Wetlands") from an ecological perspective.

### 5.3.3 Extension Recharge Monitoring Wells

Water levels in the Extension recharge monitoring wells reflect water levels close to points of groundwater recharge (recharge wells). They are used for operational purposes, either through manual measurements or through automated measurement and control by the PLCs in the recharge control valve huts. The automated control system monitors groundwater levels at recharge monitoring wells and adjusts the recharge flowrates at associated recharge wells such that programmable groundwater elevation set points are maintained at the recharge monitoring wells. Hydrographs for Extension recharge monitoring wells are presented in Appendix G, Attachments 6 (West Cell) and 8 (East Cell).

## 5.4 Spring-Summer Target Transition

Transition periods have been implemented since commencement of WMS operations and facilitate adjustment of recharge rates by the operator prior to implementation of upcoming targets. Adjustment of these periods is contemplated by the Adaptive Management Plan (AMP Page 29) which provides, "The transition plan/period will be refined on a regular basis depending upon observed conditions prior to and following commencement of recharge system operation."

The 5-Year AMP Review (GHD, 2020) included evaluation of the transition periods and a refinement was made to the spring-summer transition period for implementation in 2020. Full documentation and rationale are provided within Section 5.5.2 of the 5-Year AMP Review Report (GHD, 2020). A summary of the implementation is provided below:

- The transition was refined to provide additional flexibility in the event that climatic support ceases, as determined by background well water elevations.
- A below average May water level, as observed in the background well, will trigger a modified spring-summer transition period for the associated trigger wells for that calendar year. The modified transition will apply from the water level measurement date (mid-May) to the end of June.

- All reasonable and practicable efforts will continue to be implemented using available installed WMS infrastructure to sustain the spring target level through the normal end of the target period, including operating associated recharge wells at their maximum effective capacity.
- The spring period minimum level and associated AMP "Red Zone" requirements will continue to apply as normal.

Less water was available than usual during the first 5 months of the year and resulted in depressed groundwater conditions. Conditions in 2022 were uncharacteristically dry with significantly reduced precipitation observed starting in April. Despite reasonable wet conditions in the winter, reduced recharge during April and May resulted in low water elevations. On May 10, 2022 the following background (i.e., natural) water level measurements were reported relative to their respective average May water elevations:

- BH112 – 331.98 m – 9 cm below average
- OW39-04 – 324.10 m – 9 cm below average
- OW68-07 – 343.32 m – 15 cm below average

Based on the reported water levels and the implementation approach identified in the 5-Year AMP Review Report (GHD, 2020), the transition commenced for Extension trigger wells on May 10, 2022. This change was communicated to the agencies in an email dated May 10, 2022.

The 5-Year AMP Review focused on the Extension WMS so the recommendation was not initially applied to the North Quarry. Following the successful implementation of the revised spring-summer transition approach for the Extension, starting in 2021 the revised spring transition was applied for the North Quarry.

## 5.5 Target Level Adjustments for 2023

Section 2.3 of the Establishment of Target Levels report for the North Quarry (CRA, April 2005) defines the requirements and protocol for adjusting North Quarry target levels annually (based on trends in the background well data) once recharge wells are operational and controlling the groundwater levels. These annual adjustments allow mitigation measures to reflect both short-term variations and long-term climatic trends. The initial North Quarry target levels were also presented in the Establishment of Target Levels Report (CRA, 2005).

Similarly, the AMP and the Pre-Extraction Report define the requirements and protocol for adjusting Extension target levels annually. The initial Extension target levels and minimum levels were presented in the Pre-Extraction Report (CRA, 2011a).

Appendix I includes a summary of the North Quarry and Extension target level adjustments and the Extension minimum level adjustments for 2023. A summary of the 2022 and 2023 target levels for the North Quarry and Extension trigger wells is presented in Tables 5.1a to 5.1e for comparative reference.

Section 6.1 of the AMP requires that Dufferin provide Extension target water levels for future operating seasons to the agencies at least three months prior to the start of the relevant operating season. Dufferin provided winter and spring 2023 Extension target level adjustments to the agencies in a GHD memorandum dated September 30, 2022. Adjustments to the winter and spring Extension minimum levels were also provided to the agencies in that memorandum.

As discussed in the 2017 Annual Water Monitoring Report, West Cell background wells OW40-04 and OW41-04 appear to have been influenced by nearby beaver activity in Sixth Line Tributary. Ongoing flooding and potential beaver activity has been observed in the area again since mid-2021 and is once again affecting water levels at OW40-04 and OW41-04. As has been the case since 2018, background well OW39-04 is used for the calculation of targets at associated trigger wells OW27-04, OW28-04, OW29-04, and OW30-04.

## 5.6 Other Hydrologic/Hydrogeologic Monitoring

Other hydrologic/hydrogeologic monitoring conducted at the Site includes groundwater elevations, surface water elevations, and surface water flow measurements at various locations in the North Quarry, Extension, and surrounding lands. This includes the supplementary monitoring program outlined in the AMP, monitoring required by the PTTW, and other monitoring.

Surface water flow gauging (monitoring) is conducted at SW4 (Pumphouse) and Sixth Line Tributary (SW20) throughout the year.

North Quarry and Extension monitoring well locations are presented on Figures 2.2, 2.3, 2.4, and 2.5. Hydrographs for all North Quarry and Extension monitoring wells that were included in the 2022 monitoring program are presented in Appendix G, Attachments 5 and 10, respectively. Hydrographs for all background monitoring wells and domestic wells are presented in Appendix G, Attachments 11 and 12, respectively. Groundwater and surface water elevation data are provided in Appendix H. Hydrographs for surface water monitoring locations along the 6th Line Tributary, the West Cell wetlands, and the East Cell wetlands, are presented in Appendix G, Attachments 13, 14, and 15, respectively.

An overall evaluation of the results of the groundwater elevation, surface water elevation, and flow monitoring results for the North Quarry and the Extension areas follows.

### 5.6.1 Groundwater Flow Patterns

Groundwater elevation contour plots for April 2022 and October 2022 are presented on Figures 5.35 and 5.36, respectively. These figures show groundwater elevations under high and low water level conditions in 2022. It is noted that the timing of maximum and minimum levels varies somewhat by location; however, the selected monitoring events are generally representative of high and low groundwater conditions for the year as influenced by the climatic conditions of 2022.

Dewatering for the extracted areas of the North Quarry and Extension has lowered nearby groundwater elevations in the surrounding area. The operation of the North Quarry recharge system maintained a positive gradient towards Sixth Line Tributary to the west in 2022. In 2022, the operation of the Extension recharge system continued to maintain a positive gradient towards the Sixth Line Tributary to the north and towards the off-Site wetlands.

### 5.6.2 BH65, BH66, and OW69-08

Section 4.4 of the Pre-Extraction Report (CRA, November 2011a) outlines that historical monitoring "envelopes" will be established for BH65, BH66, and OW69-08 to facilitate data evaluation to ensure protection of water resources in this area. The Extension groundwater recharge well system is operational in accordance with the mitigation provisions of the AMP. The baseline data sets for BH65, BH66, and OW69-08 are complete and the water level "envelopes" have been established as shown on Figures 5.37 to 5.39, respectively. The key minimum levels for these envelopes are defined consistent with the trigger well approach as evident on the charts.

Water levels observed since commencement of below water extraction in the West Cell (Spring 2013), including the water levels measured in 2022, have generally remained above their historical minimum levels with the exception of late 2022 at OW69-08. In October 2022, GHD measured the lowest background groundwater level in more than a decade at OW68-07, with the prior minima established in 2007. Monitoring well OW69-08 was not installed in 2007 and this minima was not registered within the baseline monitoring data set. The "below the envelope" observation at supplemental monitoring well OW69-08 is consistent with regionally dry climatic conditions and measured background water levels and it appears that this somewhat lower water level is attributable to seasonal climatic conditions and not a result extraction related activities. It is noted that this information was previously communicated to the Agencies on October 18, 2022 and subsequent follow-up was provided on November 22, 2022.

Water levels at BH65 and BH66 remained within the historic range in 2022, although BH66 exhibited a water level very close to the historical minimum. Further observations in early 2023 demonstrate that the groundwater levels at BH65, BH66, and OW69-08 have increased dramatically and are well within their historical range. These results confirm that the unusually low groundwater levels are attributable to the dry climatic conditions experienced in 2022. Further information will be included in the 2023 Annual Monitoring Report, including updating the minimum historical level in accordance with the AMP. No quarry influence is evident at BH65, BH66 or OW69-08.

### 5.6.3 BH113

Monitoring well BH113, located north of Sixth Line Tributary to the northeast of the Pumphouse Pond, continues to show behaviour that is influenced by local hydraulic connection to the recharge well system to the south. GHD previously (CRA, November 2011a) identified this local condition. As a result, BH113 was removed from the proposed background monitoring well network and retained as a supplemental monitoring well. Monitoring has continued at this location as a component of the supplemental monitoring program and data is reviewed regularly and included in the annual report.

The monitoring data illustrates that groundwater levels at BH113 are highly correlated to groundwater levels, trends, and the overall behavior corresponds to trends in WMS operation as exhibited by recharge monitoring well OW77-11. The minimum seasonal groundwater levels at BH113 continue to remain well above (approximately 2 m) the adjacent surface water levels in Sixth Line Tributary and continue to support southwesterly flow and discharge to the creek. In 2022, further operational adjustments were made to the WMS that positively affected BH113.

It is recognized that ongoing monitoring and adjustment is warranted and GHD will continue to evaluate conditions to the north of the East Cell as extraction approaches the final extraction limits.

### 5.6.4 SW4 Pumphouse Flow Monitoring

Surface water flow monitoring at SW4 (see Figure 2.5) is conducted weekly from July to September and monthly for the remainder of the year in accordance with the AMP. This is not a structure installed to facilitate monitoring, but rather a feature from previous land use activities. Flow is measured using a timed-volume method. Water flow has typically been measured at two ports on the SW4 pump house; the upper port and the lower port. In 2016 the lower port was re-plugged (historically the lower port was commonly plugged until regular maintenance was initiated) to conserve recharge water and support upgradient groundwater levels, as recommended in the 2015 annual monitoring report. The plug acts to raise water levels by approximately 10 cm at BH48, thus less recharge is required in this area. Air and water temperatures are also recorded concurrent with flow measurements. This monitoring was initiated in 2005, although some data are available prior to 2005. At SW4, flows generally vary with the groundwater level; with higher flows in spring and lower flows in summer and fall.

All SW4 flow monitoring results are presented in Appendix N (Table N.2) and the flows are shown on Figure 5.40. No reduction in flow is currently identified as a result of quarrying activities. The 2022 flow data at SW4 are consistent with or above historic flows, despite extremely dry climatic conditions.

### 5.6.5 Streamflow Monitoring Station – Sixth Line Tributary

The stream flow monitoring station (SW20A) is located on Sixth Line Tributary (west of the Reservoir) and includes a triangular-notched weir installed in a box culvert with an automated level recorder (station SW20A). This location was established in August 1994 and monitoring commenced on June 6, 1995. A parallel 900-mm corrugated metal culvert located approximately 20 m east of the weir (station SW20B) functions as a by-pass during high flow conditions (or blockage of the weir).

A beaver dam upstream of SW20 has in the past raised water levels causing relatively constant flow through the overflow channel (SW20B). During 2022, some minor beaver activity was observed, and a dam was visible about 100 m upstream of the weir. The bypass channel at SW20B was active from the February event

until June during 2022. The highest measured flows occurred in March and April at both SW20A and the bypass channel (SW20B). The hydrologic monitoring program includes collection of stream flow data at locations SW20A and SW20B, as shown on Figure 2.1.

Collection of flow data at these monitoring stations continued in 2022 including the recording of continuous data with a pressure (level) transducer and monthly manual flow measurements. Refer to the 2021 Annual Water Monitoring Report (GHD, 2022) and prior reports for further details on historic monitoring activities.

Stream flows are calculated using the water level data (described above) and standard weir formulae. The stream flow values are verified through field measurements of flow velocity and depth, at locations immediately adjacent to the weir, to confirm that the weir measurements are representative.

#### 5.6.5.1 Results

The manually recorded and calculated continuous stream flow data for 2022 are shown on Figure 5.41, along with precipitation data for 2022 as recorded at the Milton Main Quarry weather station and supplemented with data reported by the Georgetown WWTP station in Georgetown, Ontario and the Acton WWTP station in Acton, Ontario (as discussed in Section 4.2). It should be noted that the flow through location SW20B is small relative to the flow through SW20A and plots along the bottom of the hydrograph as a result. Continuous flows in January and February are noted as estimated as ice conditions were observed at the monitoring location during these months.

When compared to previous monitoring years, SW20A flows in 2022 during the winter months were slightly lower. The spring freshet occurred in late-March as a defined peak, which resulted in the highest flows of the year. The 2022 calculated peak flow of 1.266 $m^3/s$ occurred on March 25, 2022, following three days with average temperatures ranging from 1.0°C to 6.0°C. The average flow calculated for 2022 was 0.16 $m^3/s$, which is comparable to both the 2021 and 2020 average flows but reduced relative to the 2019 average flow of 0.23 $m^3/s$. Responses to precipitation events are evident throughout the monitoring period by observed flow peaks.

Active flow at SW20B was observed from February to June as a result of the spring freshet and elevated water levels at SW20A which caused flow within the bypass channel. The highest measured flow in SW20B occurred on February 8, 2022. During this site visit, a flow of 10.6 L/s was recorded. A similar flow of 10.1 L/s was noted during the following site visit on March 10, 2022. Flow tapered off from April to June, followed by a dry channel for the remainder of the year at SW20B.

# 6. Water Taking and Discharge

This section presents the 2022 water takings and discharges for the Site. The monitoring of these flows is conducted to fulfill the monitoring requirements of the PTTW that are related to individual water taking limits, to facilitate the calculation of the total water taking for the Site per the PTTW, and to facilitate the evaluation of the water budget for the Site that is required by the PTTW and the AMP.

This section is organized as follows:

Section 6.1 Flowmeter Calibration Verification

Section 6.2 PTTW Water Takings

Section 6.3 PTTW Overall Water Taking

Section 6.4 WMS Flows

Section 6.5 Water Budget Evaluation

Section 6.6 Excess Water Estimate

# 6.1 Flow Meter Calibration Verification

Calibration verification is conducted annually on flow meters and open channel flow measuring instrumentation used to monitor water flows in the WMS. The WMS flow meter calibration was conducted in 2022 as follows:

- Calibration verification of flow meters associated with the West Sump and Recharge Pumping Station was conducted using a top-mounted strap-on portable transit time flowmeter. Differences between the Site flow meter readings and the portable transit time flow meter readings were found to be less than 5 percent and deemed to be acceptable.
- Calibration verification of the flow meter associated with the North Quarry Sump was conducted using two top-mounted strap-on portable transit time flowmeters (a Rosemount and a Krohne). The calibration verification indicated a 12% discrepancy between the Krohne strap on meter and a 1% discrepancy with the Rosemount meter. This variability has not been observed in results to date, and is not observed in the Reservoir water budget. The Krohne result has been identified as potentially anomalous and will be reviewed further in 2023 when reduced discharge rates allow for maintenance. A subsequent calibration verification will be completed thereafter.
- Calibration verification of the flow meter associated with the Central Sump was conducted using a top-mounted strap-on portable transit time flowmeter. The difference between the Sump flow meter and the portable transit time flow meter readings was approximately 5 percent and this difference is deemed acceptable. In the 2021 Annual Report it was recommended to review the 2022 calibration and determine if a magnitude comparable to the 2021 calibration of 8% was measured; the 2022 calibration was acceptable and decreased from the higher calibration measured in 2021, therefore, no additional investigation is required.
- Calibration verification of the open channel flow measurement instrumentation associated with the Reservoir outfalls P-01 and P-02 was conducted by gradually reducing the discharge flows and verifying the zero calibration. At P-01, typical flows range from 0 to 3,500 L/min, and zero calibration was confirmed at 0 L/min. At P-02, there was no flow for most of 2022, however overall flow ranged from 0 to 300 L/min, and zero calibration was confirmed at 0 L/min. This is deemed to be acceptable.
- Calibration verification of the flowmeters associated with individual recharge wells was conducted by comparing the total flow at the recharge pumping station against the sum of the flows recorded for the individual recharge points (recharge wells and wetland surface water discharges; see Table 6.3). The total recharge pumping station flow was found to be less than 2 percent higher than the total of all flows measured at the individual recharge points. This is deemed to be acceptable.

# 6.2 PTTW Water Takings

This section presents a summary of 2022 water takings that correspond to the water taking limits outlined in the PTTW for interim conditions.

## 6.2.1 North Quarry and Extension Dewatering

In 2022 West Cell Extension dewatering was accomplished by temporary dewatering equipment installed on the slope of the West Cell Buttress with flow conveyed across the East-West Pillar into the North Quarry Sump. East Cell Extension dewatering was similarly accomplished by conveying water overland from the East Cell Sump directly into the North Quarry. At the North Quarry Sump, water from North Quarry, West Cell and East Cell dewatering was pumped to the Main Quarry.

A summary of North Quarry and Extension dewatering quantities for 2022 is presented in Table 6.1. Daily North Quarry and Extension dewatering quantities for 2022 are presented in Appendix N (Table N.10) and compared against the daily limit shown for Source 1 in Table A of the PTTW. There were no exceedances of the PTTW daily flow limit for North Quarry and Extension dewatering in 2022.

The calculated annual water taking from the environment for North Quarry and Extension dewatering is presented in Appendix N (Table N.3) based on the parameter values incorporated into the PTTW approvals. The calculated water taking is 1,032,792 cubic metres per year ($m^3$/year) and is less than the PTTW limit of 1,359,000 $m^3$/year (see Condition 3.5 of the PTTW). An alternate calculation was performed using updated water budget parameter values refined for the AMP 5-Year Review (GHD, 2020). The alternate calculation is presented in Appendix N (Table N.3a) and reflects a slightly lower water taking of 990,645 $m^3$/year. Note that both water takings are unchanged from last year, as no new area stripping has occurred since 2021.

A summary of North Quarry water handling over the period of 2001 through 2022 is presented in Table 6.2 including both the original and alternate water-taking values.

### 6.2.2 Recharge System

The 2022 capacity of the recharge pumping station was approximately 18,000 litres per minute (L/min), well below the PTTW flow rate limit of 36,000 L/min (Source 2 in Table A of the PTTW).

A summary of recharge system water takings is presented in Table 6.3. Daily recharge system water takings are presented in Appendix N (Table N.11). Daily recharge system data for individual recharge wells are presented in Appendix K (Attachment 5). As presented in Table N.11, there were no exceedances of the PTTW daily water-taking limit in 2022. Note that the high PTTW limit is intended to allow for potential future increase in the rate of groundwater recharge pumping due to anticipated high rates of recirculation of recharge water back into the quarry. The high PTTW limits are not indicative of any high consumptive use of water now or in the future as the quarry consumes very little water.

There were no exceedances of the PTTW limits for recharge system flows in 2022.

### 6.2.3 Main Quarry Discharge

This PTTW limit includes discharge to the HFRT from the Main Quarry Lake/Wetland Complex and/or from the Reservoir.

A summary of Main Quarry discharge water takings is presented in Table 6.4. Daily Main Quarry discharge water takings are presented in Appendix N (Table N.12). As presented in Table N.12, there were no exceedances of the PTTW daily water-taking limit in 2022.

As discussed in Section 3.3.1, no Excess Water was allocated for discharge in 2022. The minimum HFRT discharge requirement (700,000 $m^3$) was met and total discharge to the HFRT was 736,023 $m^3$. Discharge was provided from both the Main Quarry Lake/Wetland Complex and the Main Quarry Reservoir. The target average daily flows of 0.058 $m^3$/s (during July through September) and of 0.010 $m^3$/s (during January through June and October through December) were generally met as an average over each period. This discharge occurred in accordance with the objectives of, and consultation with, Conservation Halton.

A summary of Main Quarry discharge water takings over the period of 1991 through 2022 is presented in Table 6.5.

## 6.3 PTTW Overall Water Taking

The PTTW requires the calculation of the overall water taking for the Site using the method presented in the PTTW.

Calculations related to the 2022 overall water-taking are presented in Table 6.6 (calculations to estimate the total volume of water used for operations in 2022 are presented in Appendix J). The overall water taking for 2022 was 1,916,014 $m^3$ (1,916,014,271 L), which is approximately 30 percent of the annual limit of 6,417,600 $m^3$ (6,417,600,000 L) established in the PTTW for interim operating conditions.

## 6.4 WMS Flows and Temperature

Water flows and temperature are measured at a number of points throughout the WMS. Some of these points correspond to water takings under the PTTW (as presented above in Section 6.1), some correspond to water handlings under the PTTW, and others are strictly for water balance or operational purposes.

WMS flow and temperature data are presented in charts and tables in Appendix K. Where applicable, PTTW limits are identified on the charts and tables.

## 6.5 Water Budget Evaluation

This section presents an evaluation of the 2022 water budget for the Site.

### 6.5.1 Background and Methodology

The water budget estimates the total volume of water entering the quarry, the total volume of water leaving the quarry, and the resulting change in water storage within the quarry on an annual basis. The water budget for the Site is discussed in the AMP (Section 4.4 and Appendix E).

The water budget is important to the overall operation, planning, and general management of water handling activities at the Site, and ensures that sufficient water is available for:

- Discharge to the HFRT as required by the LRIA permit and the CH Water Management Agreement
- Operation of groundwater recharge system
- Quarry operations (dust control and aggregate washing)
- Quarry rehabilitation (including lake filling)

More specific objectives of the water budget evaluations identified in the AMP (both short and long term) include:

- Verify that the amount of water available/in storage is consistent with water budget forecasts to confirm the representativeness of the overall water budget calculations
- Identify if more or less water is available than forecasted such that filling time and associated operational and cost aspects can be appropriately addressed
- Establish the annual distribution of water from the Reservoir in accordance with an agreed water hierarchy
- Establish the amount of "excess" water that may be available
- Confirm the representativeness of key water budget parameter values that have the potential to significantly affect the reliability of the long-term water budget calculations in a negative manner (i.e., potentially less water available than forecast)
- Identify and adapt to any long-term trends in water budget availability that are evidenced by the monitoring data and/or recognized by the scientific community

The AMP (Section 4.4 and Appendix E) presents the water budget verification program for the Site. The water budget verification program outlined in the AMP is summarized as follows:

1. Complete water budget analysis as described herein. This analysis occurs at different levels of detail at different frequencies:

- Ongoing – assessment of flow and storage data relative to previous measurements, forecasted water budget conditions, and ongoing operations and climatic conditions.
- Annual – review of data relevant to individual monitoring parameters and overall water budget.
- 5-Year Review – analysis of overall water budget considerations and recalibration of water budget with updated forecast of future conditions.

2. Identification of whether actual water budget conditions are consistent with forecasted conditions, or whether more/less water is available.

Due to necessary assumptions for un-measurable or difficult-to-measure values, a water budget evaluation is subject to a degree of variability or uncertainty. Regardless, the water budget evaluations are effective tools to help assess conditions as they evolve and understand trends and variability.

## 6.5.2 Water Budget Evaluation

This section presents the results of the ongoing and annual water budget evaluations conducted in 2022.

***Ongoing Water Budget Evaluation***

The Reservoir currently provides the majority of the water storage at the Site and water budget evaluations are performed for it on an ongoing basis. Throughout 2022, ongoing water budget evaluations included monitoring water levels in the Reservoir (see hydrographs in Appendix G, Attachment 1) and comparison of the resulting actual water storage changes (using stage-storage information) relative to the calculated water storage changes (using flow data and stage-storage information).

A summary of ongoing Reservoir water budget evaluations for each month over the period of January 2022 through December 2022 is presented in Appendix N (Table N.4). The estimated change in storage within the Reservoir is -513,567$m^3$, whereas the water budget calculates a change of -552,544 $m^3$. This indicates that more water (38,977 $m^3$) was available than predicted by the water budget. This represents a discrepancy of 0.3 percent relative to the total water handled or transferred through the reservoir on an annual basis, and attests to the appropriateness of the parameters selected.

***Annual Water Budget Evaluation***

The water budget for the whole Milton Quarry Site was initially presented in the AMP (Appendix E, Table E.2), was updated in CRA's December 2003 Witness Statement in relation to Consolidated Board Hearings – Case No: 03-086 (Witness Statement), and was updated again in the Pre-Extraction Report (CRA, 2011). The Site water budget was further updated in the 5-Year AMP Review, and subsequently as a component of the Milton Quarry East Extension (MQEE) Geology and Water Resources Assessment report (GWRA). Additional groundwater flow modelling was undertaken for the GWRA and the relevant data incorporated into the water budget. The same water budget parameter values (i.e., the most current values) are employed herein and presented in Appendix N (Tables N.5 and N.6). The predictive water budget provided in Table N.5 is applied for the 2022 annual water budget evaluation for estimation of components that are not directly measurable (e.g., groundwater inflow).

Adjustments to the water budget and assessment of water budget accuracy are completed on an annual basis in Appendix N (Table N.6). Measurable parameters (e.g., precipitation and evaporation) are adjusted, and a comparison of observed and calculated conditions is made. If a discrepancy larger than the safety factor (in the negative) is observed, then sensitivity analysis may be completed to determine potential sources of error to the water budget.

The observed annual surplus (deficit) for the Site was -110,940 $m^3$ in 2022 and the calculated available surplus is -8,168 $m^3$. This indicates that some water was drawn from storage to facilitate ongoing mitigation and downstream discharge (700,000 $m^3$) to the HFRT. These conditions are anticipated to occur from time-to-time during periods of reduced precipitation as occurred in 2022.

The water budget overestimates available water by 102,940 $m^3$ for 2022 (i.e., less water is observed to be available at the Site than calculated by the water budget). This amount represents approximately 0.9 percent of the water handled by the Site and is deemed acceptable. The water budget parameters and estimated available water remain conservative and fit for purpose (e.g., ongoing confirmation that sufficient water is available to meet the mitigation objectives).

In 2022, storage of water within the Reservoir decreased by 513,567 $m^3$, the Lake/Wetland storage decreased by 81,318 $m^3$, and West Cell Storage increased by 447,922 $m^3$. The net change in storage at the site in 2022 was -146,963 $m^3$ as would be expected given the extremely dry conditions observed. Volumes

are tracked and accounted for in the surplus/deficit estimate above. Appendix N (Table N.7) presents the storage calculation for the Lake/Wetland.

***Summary***

The ongoing and annual water budget evaluations demonstrate the variability inherent in water budget assessments; however, they also demonstrate the results are sufficiently accurate to serve their intended purpose of assessing shorter and longer term conditions.

Overall, the annual water budget evaluation for 2022 and previous years indicates that there is sufficient water available for the successful performance of the Milton Quarry WMS and rehabilitation in the near-term and long-term.

## 6.6 Excess Water Estimate

Excess Water is defined in the October 2003 Water Management Agreement (Extension Quarry) as any water stored in the Reservoir at the end of the year above the elevation of 306 m AMSL that is not required to meet the needs outlined in paragraphs 1 to 8 of the Water Hierarchy (Schedule 6 of the Water Management Agreement [Extension Quarry]) in the following year. Section 3.5 of the Water Management Agreement (Extension Quarry) outlines that Excess Water is to be allocated during the following year in accordance with the Water Hierarchy, subject to reasonable interim adjustments agreed to by Dufferin and CH, as may be necessary to reflect actual versus estimated results.

Excess Water was available for the first time in 2008 when the water level in the Reservoir reached the normal operating range. Prior to 2008, any surplus water was used for filling the Reservoir. During 2022 there was no Excess Water available for discharge to the HFRT, as presented in the March 2021 GHD memorandum entitled "Excess Water Determination for 2021".

The calculation for Excess Water that is available for discharge in 2023 is presented in Appendix N (Table N.8). Based on the planned quarry extraction and lake filling in the West Cell in 2023, it is calculated that no Excess Water will be available for discharge during 2023, beyond the planned minimum discharge of 700,000 m3 (required discharge). If any Excess Water becomes available for discharge, to the extent practical the discharge will be coordinated with CH.

# 7. Water Quality Monitoring

This section presents a summary of 2022 water quality monitoring for the Site.

This section is organized as follows:

Section 7.1 Background

Section 7.2 Main Quarry Water Quality

Section 7.3 Recharge System Water Quality

Section 7.4 Other WMS Locations

Section 7.5 Temperature

## 7.1 Background

The ECA requires water quality sampling at the following locations under interim operating conditions:

1. Effluent (discharge) from the West Sump in the Main Quarry Lake and/or from the Reservoir to the HFRT (weekly and monthly sampling)

2. Effluent (discharge) from the Recharge System pumping station to the Recharge Well System (weekly and monthly sampling)
3. Effluent (discharge) from the North Quarry Sump to the North Quarry Recharge Well System (if any)

In addition, following startup of the recharge well system, three recharge wells (including the first and last wells along the distribution header and the closest recharge well to DW103) are required to be sampled monthly for benzene, toluene, ethylbenzene, xylenes (collectively referred to as BTEX), metals, and general chemistry parameters, as specified in the ECA.

Items 1 and 2 above are discussed in Sections 7.2 and 7.3, respectively. Item 3 above is not applicable for 2022 because there was no direct connection from the North Quarry Sump to the recharge well system.

Items 1, 2, and 3 constitute "effluent" from the works approved under the ECA and the effluent criteria listed in the ECA apply. Other water quality monitoring data are collected for analysis purposes and compared to Provincial Water Quality Objectives (PWQOs) and/or historical conditions, as appropriate.

The ECA establishes the following sampling schedule and Effluent Limits for the effluent water quality samples collected in accordance with items 1 through 3 above.

| Parameter | Frequency | ECA Effluent Limit |
|---|---|---|
| Total Suspended Solids | Weekly | 25 mg/L (monthly average) |
| Oil & Grease | Monthly | 15 mg/L |
| Un-ionized Ammonia | Monthly | 0.02 mg/L |
| pH (field)* | Monthly | Between 6.0 and 9.5 |
| Temperature (field)* | Monthly | No objective |

Note:
* These parameters are collected in the field for calculation of the un-ionized ammonia concentration.

A non-compliance is deemed to have occurred if any single result for oil and grease or un-ionized ammonia is greater than the Effluent Limit. Similarly, a non-compliance for pH is deemed to have occurred if any single measurement is outside of the specified range. A non-compliance for TSS is deemed to have occurred if the arithmetic mean concentration of all samples taken in a calendar month is greater than the Effluent Limit.

The results of this water quality monitoring are discussed in the following sections.

# 7.2 Main Quarry Discharge Water Quality

This section presents a summary of 2022 water quality monitoring for the Main Quarry and associated discharge to the HFRT.

Water quality sampling of the discharge from the West Sump in the Main Quarry Lake/Wetland Complex to the HFRT was conducted in accordance with the ECA in 2022. The water quality results for the monthly and weekly sampling are provided in Appendix L, with comparison to the ECA Effluent Limits. A summary of the 2022 analytical data is presented in Table 7.1. No exceedances of the Effluent Limits were observed. The discharge from the Main Quarry Lake/Wetland ceased in mid-November and consequently no discharge samples were collected for the balance of the year.

Water quality sampling of the discharge from the Reservoir to the HFRT was also conducted. In 2022, discharge to the HFRT from the Reservoir occurred throughout the year. The water quality results for the monthly and weekly sampling are provided in Appendix L, with comparison to the ECA Effluent Limits. A summary is presented in Table 7.2.

One of 52 samples was identified with an elevated total suspended solids of 28.8 mg/L versus the ECA Effluent Limit of 25 mg/L in a sample collected on November 10, 2022. This result is not characteristic of recharge water quality and was identified as likely erroneous. The arithmetic mean of TSS concentrations for

the month of November is 9.45 mg/L, below the effluent limit, and an exceedance is not deemed to have occurred.

In general, the discharge water quality is good, and similar to previous years. The comparison of all the discharge water quality data for 2022 to the PWQOs does not indicate any adverse effects to the downstream system. Occasionally there are detections of some metal parameters in the Main Quarry discharge (e.g., cobalt, silver, and zinc) including aluminum in 2022 above the PWQO concentrations; however, these are not considered indicative of adverse effects from the quarry as they have historically been present in background samples, they are infrequent and/or relatively low, and/or due to the nature of the receiving water.

No water quality concerns are evident in the Main Quarry discharge water quality.

# 7.3 Recharge System Water Quality

This section presents a summary of 2022 water quality monitoring for the groundwater recharge system.

## 7.3.1 Recharge Pumping Station

Water quality sampling of the discharge from the recharge pumping station to the recharge watermain was conducted in accordance with the ECA in 2022.

The water quality results for the monthly and weekly water samples in the watermain at the recharge pumping station are provided in Appendix L, with comparison to the ECA Effluent Limits. A summary is presented in Table 7.3. No exceedances of the Effluent Limits were observed.

No water quality concerns are evident in the Reservoir water quality.

## 7.3.2 Recharge Wells

Water quality sampling of the recharge water at selected recharge wells was conducted in 2022 in accordance with the ECA to monitor recharge water quality discharged upstream of Sixth Line Tributary with respect to the ambient surface water quality.

The water quality results for the monthly recharge well samples are provided in Appendix L, with comparisons to the ECA Effluent Limits and PWQOs. A summary is presented in Table 7.4. The comparison of recharge well sample results to ECA Effluent Limits and PWQOs is intended to provide a convenient basis for evaluation of the data; these criteria are not concentration limits under the ECA.

In 2022 there were no detections of metal parameters in the recharge water above the PWQO concentrations. During years when there are detections above the PWQO, they are not considered indicative of adverse effects from the quarry as they have historically been present in background samples, they are infrequent and/or relatively low, and/or due to the nature of the receiving water, as discussed in prior annual monitoring reports.

No water quality concerns are evident in the recharge wells.

# 7.4 Other WMS Locations

While not required by the ECA, water quality sampling at the North Quarry Sump and the Central Sump was undertaken in 2022. This sampling was done to characterize water quality at these locations that will correspond to discharge points (effluent) under the ECA once the WMS is operating under Long-Term Operating Conditions. As such, it is useful to monitor water quality at these locations to evaluate any potential future need for water quality improvements via changes to operating practices or water treatment; however, ECA Effluent Limits are not applicable under current Interim Operating Conditions.

The water quality results for the North Quarry Sump and Central Sump are presented in Appendix L and summarized in Tables 7.5 and 7.6, respectively, with comparisons to the (non-applicable) ECA Effluent Limits and the PWQOs.

No concentrations above the (non-applicable) PWQO were observed at the North Quarry Sump with the exception of some metals parameters, as is typically observed. No concentrations above the (non-applicable) PWQO were observed at the Central Sump with the exception of phosphorous and some metals parameters (aluminum, boron, cobalt, iron, zinc); however, these results are also generally consistent with long-term water quality monitoring results at these locations.

In general, the water at these locations is comparable to the water in the Reservoir (as determined through sampling of recharge and Main Quarry discharge water) and continue to exhibit good water quality.

# 7.5 Temperature

This section presents a summary of 2022 water temperature monitoring.

## 7.5.1 Surface Water Temperatures

***HFRT Discharge Temperature Monitoring***

The LRIA Permit requires hourly temperature recording of all discharges to the HFRT from June 1 to September 30. To meet this requirement, water temperature loggers are installed at the West Sump and the Reservoir outfall. An additional temperature logger is also voluntarily installed on a temporary basis where the HFRT crosses Sixth Line (from the wetland) to collect supplementary temperature data. In 2022, the temperature loggers were operational for the entire year. HFRT discharge temperature monitoring results from these locations are presented on Figure 7.1 along with air temperature monitoring results from the on-Site hydrometeorological station for comparative reference.

Review of Figure 7.1 reveals that the water temperatures in the Reservoir, West Sump, and wetland are generally similar. Daily temperature fluctuations in the Reservoir and West Sump were muted in comparison to the wetland, where shallow water is more susceptible to ambient temperatures.

***Sixth Line Tributary Temperature Monitoring***

As required by the AMP, surface water temperature monitoring near four trigger well monitoring locations along the key cold water fishery reaches north of the Extension was continued in 2022. This monitoring was first implemented in 2007. In consultation with Dufferin's fishery biologist (WSP), the four locations were selected based on their ecological and hydrogeological relevance. The locations selected for monitoring are shown on Figure 2.2, and include SG41, SG42, SG47, and SG48. There is a surface water logger installed at each location at/above the streambed and a second logger installed in a streambed piezometer at SG47.

Surface water temperatures in the Sixth Line Tributary generally vary diurnally from the spring to the fall, while the temperature remains relatively constant during the winter months while under ice.

Temperature monitoring results are presented in Appendix M. Based on review of the 2022 temperature monitoring results for Sixth Line Tributary monitoring locations, the following observations are made:

- Temperatures at SG41 were generally consistent with previous years. Temperatures in the summer were average in relation to temperatures since the start of recharge mitigation. Peak temperatures were comparable to temperatures prior to commencement of groundwater recharge under the provisions of the AMP in May 2013.
- Temperatures at SG42 were generally consistent with previous years. Temperatures in the summer were average in relation to temperatures since the start of recharge mitigation. Temperatures were consistent with temperatures prior to commencement of groundwater recharge under the provisions of the AMP in May 2013.
- Temperatures at SG47 were generally consistent with previous years with the exception of the summer peak, when temperatures briefly peaked due to suspected shallow logger positioning. These results are

comparable to previous shallow/dry conditions when the logger was observed to be dry. SG47 has a streambed logger (installed in a streambed piezometer) to assist with discerning temperature data that may be biased high by the water level dropping below the logger in the summer. Moderation of temperatures is evident. Relatively cooler groundwater discharge moderates or reduces temperatures through the warmer summer months. In addition, diurnal variability is absent or muted relative to fluctuations observed in the open channel.

- At SG48, 2022 temperature data continue to indicate significant moderation by groundwater discharge. Increased temperature moderation from increased groundwater seepage became evident with the startup of Extension recharge in May 2013, and the pattern has continued to be observed since that time. Overall the temperatures remain within pre-recharge levels. The temperatures have less diurnal variation through the year in comparison to pre-recharge (2013) years, indicating that the data logger is still situated over the groundwater seep.

Further discussion of 2022 and historical Sixth Line Tributary temperatures in the context of Brook Trout habitat conditions is presented in Appendix N.

### 7.5.2 Groundwater Temperatures

***Sixth Line Tributary Temperature Monitoring***

As required by the AMP, groundwater temperature monitoring is conducted at four (4) Extension trigger wells near the Sixth Line Tributary surface water temperature monitoring locations discussed above (including OW37-04, OW38-04, OW60-07, and OW63-07). Groundwater temperature monitoring is also conducted at various additional locations in the North Quarry and Extension in conjunction with automated water level monitoring, including background wells (OW39-04, OW40-04, OW41-04, OW68-07, and BH112) and selected additional wells. Groundwater temperature monitoring locations are identified on Figure 2.2.

Temperature monitoring results are presented in Appendix M. Groundwater temperatures are generally relatively stable within the range of 6°C to 9°C. Groundwater temperatures measured in Milton Quarry wells typically fluctuate seasonally from as little as 0.5ºC to approximately 5ºC. These minor temperature fluctuations are caused by transient heat conduction from the surface, and may be out of phase and attenuated in comparison to the temperature of the ground surface because of the time lag for heat to be conducted to the depths of the temperature loggers in the wells. Recharge water also affects some locations depending upon their proximity to recharge wells, recharge flow rates, and recharge water temperature. Consistent with previous years, varying responses to snowmelt and precipitation were also apparent in 2022.

At OW60-14, increased seasonal temperature fluctuations are apparent from groundwater recharge, however no adverse influences on creek temperature are indicated in the monitoring results.

# 8. Residential Well Monitoring

Dufferin has historically monitored the residential domestic wells at selected properties near the Site as part of their neighbour relations program. This residential well monitoring was subsequently formalized and refined for inclusion in the Extension AMP requirements.

The residential well monitoring program currently consists of quarterly water level monitoring and annual water quality monitoring at up to 21 residences (24 locations) in the vicinity of the Milton Quarry, subject to access from the property owners, which meets or exceeds the requirements of the AMP. All current and historical residential well locations included in the Extension AMP requirements (including 3 additional residential wells included in Dufferin's neighbour relations program but outside of the AMP baseline survey zone) are presented on Figure 8.1.

The emergence of COVID-19 and subsequent declaration of a global pandemic by the World Health Organization (WHO) on March 11, 2020 precipitated a change in the residential well monitoring program in

2020. GHD formally re-commenced monitoring in fall 2021. Significant attempts were made to re-connect with residents in 2022, including issuance of multiple letters on both GHD and Dufferin letterhead.

Appendix N (Table N.9) presents a summary of residential well monitoring conducted in 2022, including a summary of monitoring activities conducted and explanations for instances where monitoring was not conducted.

Hydrographs for residential wells at which water level monitoring was conducted in 2022 are presented in Appendix G, Attachment 12. A summary of 2022 residential well groundwater elevation data and water quality data are presented in Tables 8.1 and 8.2, respectively.

Based on the results of the residential well monitoring program, there is no indication that Dufferin operations have had any adverse water quantity or quality effects on the residential wells in the vicinity of the quarry.

# 9. Ecological Monitoring

A variety of ecological monitoring studies are completed in association with the Milton Quarry as described below.

Ecological monitoring of Sixth Line Tributary is undertaken to satisfy the requirements of the ECA, PTTW, and the AMP. The Sixth Line Tributary ecological monitoring includes monitoring Brook Trout spawning west of the North Quarry and monitoring Brook Trout spawning and macrobenthic invertebrate communities to the north of the Extension. This monitoring is currently conducted annually, and was conducted in 2022. The findings of the ecological monitoring for brook trout and for macrobenthic invertebrate are discussed in Section 9.1.

Ecological monitoring of terrestrial and wetland features is conducted pursuant to the AMP for the Extension. This monitoring is currently conducted annually, and was conducted in 2022. The findings of the ecological monitoring of the wetlands are discussed in Section 9.2.

Ecological monitoring is also conducted to monitor the effects of Main Quarry rehabilitation on the existing biota in the adjacent wetlands. Main Quarry ecological monitoring was originally requested by CH (Trow, Dames & Moore, 1989). The basic requirement for Main Quarry ecological monitoring is continued in the Water Management Agreement (Extension Quarry) with CH. The rehabilitation measures for the quarry are anticipated to have minimal influence on the hydrology and biota in the area immediately beyond the Main Quarry. In some instances, influences are expected to be favorable. This monitoring is currently conducted biannually. In the 2018 annual monitoring report, it was recommended that Dufferin cease the biannual ecological monitoring program because the west side of the Main Quarry has been in its final rehabilitated form since around 2008 and conditions at the two offsite monitoring stations west of Sixth Line have been similar from 1993 to 2020. Communications since 2019 between Dufferin Aggregates and Conservation Halton have continued to consider this recommendation. While the recommendation is being considered, biannual monitoring has continued and was conducted in 2020 and 2022.

## 9.1 Sixth Line Tributary

### 9.1.1 Brook Trout Survey

The results of the 2022 Brook Trout survey are provided in the WSP report entitled, "2022 Brook Trout Spawning Survey Along Sixth Line Tributary of Sixteen Mile Creek in the Vicinity of Dufferin Aggregates Milton Quarry Site" (WSP, 2023b), a copy of which is presented in Appendix O.

The overall findings of the 2022 Brook Trout survey are summarized as follows:

***Sixth Line Reaches:***

- The 2022 spawning surveys marked the second year of confirmed spawning within the Sixth Line reaches with the observation of a total of eight Brook Trout in the attendance of two separate redds located approximately 8 m downstream of the middle culvert and 100 m upstream of the middle culvert.
- This compared to the three year period (2018 to 2020) when no Brook Trout were observed and spawning within the Sixth Line reaches could not be confirmed. Furthermore, indirect or unconfirmed evidence of spawning in 2022 (total of five probable redds and six scrapes) was similar to the observations in 2021 (total of seven probable redds and six scrapes), 2020 (seven probable redds and five scrapes) and 2019 (six probable redds and nine scrapes).
- It was not clear why confirmation of use by adult trout was not being documented during the 2018 to 2020 spawning surveys, but it is possible the spawning activity at the particular sites was brief due to only smaller numbers of fish using each site, so that the survey windows did not capture their presence.
- The level of spawning activity varies naturally year-to-year based on a wide variety of factors (e.g., surface flow levels and other climatic factors, groundwater flow levels, beaver dams and associated accessibility, varying spawning year class(es) due to varying incubation success in previous year(s), food availability, competition, fishing activity, and other stress factors), as demonstrated in the findings over the years. However, in recent years as noted, there had been an increase in spawning activity, confirmed redds and adult observations making the sudden drop in 2018 all the more obvious and suggestive of an event occurrence rather than any decline in habitat quality (or associated water quality or groundwater discharge).
- Some variation in spawning can also be expected to occur depending on the specific timing of the surveys year to year in relation to the height of the spawning season. However, similar to 2018, the timing of the 2019 and 2020 surveys (when spawning was not confirmed), appeared to correspond generally with peak activity of all of the previous years when spawning was confirmed. As noted, no direct cause has been identified however it is speculated that angling pressure might have caused the sudden change noted in 2018. There were no other habitat factors evident during the survey and the thermal monitoring, groundwater indicators and groundwater movement patterns to the creek remain unchanged.
- The results of the 2022 thermal data collected in the main ‘historical’ redd indicate that groundwater discharge continues to occur into the redd site within the stream bed during the spawning period and is moderating the local environment. The 2021 results of the temperature survey within the permanent spring further indicate that groundwater discharge continues to occur along this area of the Sixth Line reaches during the spawning season. This information is consistent with GHD’s monitoring of groundwater flow patterns toward the stream reaches. Therefore, despite the lack of confirmed redds or Brook Trout observations along the Sixth Line reaches during the 2018 to 2020 period, the key element that supports habitat conditions suitable for Brook Trout, that is groundwater discharge, persisted during that time and continued into 2021 and 2022 when confirmation of Brook Trout spawning returned.

*Townline reaches:*

- In 2019 the AMP recommended transitioning the aquatic monitoring (i.e., spawning surveys) for the Townline reaches from the annual frequency to a biennial frequency for the 10-year period following the 5-Year Review (i.e., in 2021, 2023 etc.), assuming monitoring findings had remained stable. In 2021 a full set of spawning surveys (four) were completed in the Townline reaches. In 2022, the spawning surveys were not completed along the Townline reaches as per the biennial frequency recommendation in the 2019 AMP.
- Consistent with the previous 17 years, no spawning activity was observed along the Townline reaches in 2021. The most recent evidence of Brook Trout along these reaches was the observation of one scrape (possible redd) and three adult Brook Trout (in different locations to scrape) in 2004. The initiation of the lack of observations and apparent change in spawning activity coincided with the construction of a beaver dam in 2003, and two smaller dams in 2004, upstream of Town Line, which would have had an effect on the local habitat conditions and Brook Trout population.

- It appears that the local Brook Trout population along the Townline reaches has been extirpated. While the spawning surveys have been continued in order to assess the potential recovery of the local population, such a recovery appears unlikely. However, continuation of temperature monitoring is recommended as an indication of the groundwater discharge and maintenance of the coldwater habitat conditions.
- The 2022 thermal data collected in the main 'historical' redd along the Townline reaches indicate that groundwater discharge continues to occur into the redd site within the stream bed during the spawning period and is moderating the local environment. In 2015 a new/additional temperature monitor/logger was installed deeper below the fine sediments at this location (SG47) that clearly shows evidence of groundwater discharge in 2015 and throughout 2016 to 2022. This temperature logger (monitoring groundwater discharge) and the existing logger (monitoring surface flows) at this location will continue monitoring through the 2023 period and beyond. The other stream temperature monitors/loggers also continue to show the general influence of groundwater moderation.

### 9.1.2 Macrobenthic Invertebrate Community Survey

The results of the 2022 macrobenthic invertebrate community survey are provided in the WSP report entitled, "2022 Benthic Macroinvertebrate Community Monitoring Along Sixth Line Tributary of Sixteen Mile Creek in the Vicinity of Dufferin Aggregates Milton Quarry Site, 2005 – 2022" (WSP, 2023a), a copy of which is presented in Appendix P.

The overall findings of the 2022 macrobenthic invertebrate community survey are summarized as follows:

- The 2022 benthic community monitoring findings represent the aquatic habitat conditions in the tenth year of below-water table extraction in the Milton East and West Cell Quarry Extension. Overall, the findings continue to show that the benthic community at Station 1 is indicative of generally good water and habitat quality, reflecting conditions and variability expected in a small groundwater fed, headwater stream. The benthic community at Station 2 appears to represent fair habitat and water quality, with some metrics varying outside the established baseline ranges. Also, typical of small headwater streams which are influenced by various climatic and physical factors, year to year variability is evident within the overall pattern. The benthic community at Station 1 appears fairly diverse and exhibits good representation of families that are sensitive to poor water and habitat quality, such as EPT taxa. The community at Station 2 appears less diverse, particularly in 2019, 2020, and 2021 when indices appeared to be trending toward fairly poor water quality; however, indices in 2022 indicate a return to values within previously established ranges for richness, diversity, community composition, and water quality indices.
- The 2022 indices at Station 1 were all within the ranges established during the baseline monitoring years except abundance, which was higher. The 2022 metrics were also within the previous during-extraction range, with the exception of greater proportion of Chironomidae and associated lower proportion of EPT taxa in 2022. These results are typical of most years at Station 1, with most values within previously established ranges. At Station 2, previously in 2021 the majority of metrics calculated were outside the baseline range and/or the previously established during-construction range, in the direction indicating greater impairment of the habitat. However, in 2022 almost all metrics had returned to previously established ranges, or better indicating a recovery in habitat and water quality at this station. The patterns could be considered to be natural fluctuations that might be expected in a small headwater stream, however the recovery of the invertebrate community in 2022 is correlated with the timing of the removal of the beaver dam and debris at Station 2 in 2021.
- No changes in relation to groundwater inputs to the watercourse can be identified; groundwater indicators (watercress) continue to be observed at both stations. The 2022 results from other monitoring components support continued groundwater and habitat integrity in this watercourse. Water resources analysis shows groundwater continues to move toward the channel as outlined in the overall 2022 monitoring report (GHD 2022). The thermal monitoring done during the Brook Trout spawning survey also indicates that groundwater continues to discharge to key sites such as the site of the previous spawning redd in the Town Line Reach (WSP, 2023b).

- Although the 5-Year AMP monitoring recommendations contemplated transitioning the monitoring to a biennial frequency following 2019, it is recommended given the patterns apparent at Station 2 that annual monitoring be continued, to further assess whether the values in 2022 indicate a true reversal of the previously observed declining trend in quality, or reflects natural fluctuation and cycles in the invertebrate community. Re-evaluation of the biennial monitoring will be completed during the next 5-Year review. Local habitat conditions in relation to depositional patterns will also continue to be monitored during the sampling and flow patterns reviewed with GHD annually.

## 9.2 Extension Wetlands

The results of the 2022 Extension wetland ecology monitoring are provided in the Goodban Ecological Consulting Inc. (GEC) report entitled, "2022 – Wetland Ecology Monitoring" (GEC, 2023), a copy of which is provided in Appendix Q.

The overall findings of the 2022 Extension wetland ecology monitoring are summarized as follows:

- Based on the available wetland ecology monitoring data, off Site wetlands W10, W21 and W41, and on Site wetlands W7 and W8 appear to be functioning within the normal ranges of variation for these types of wetland features, in terms of spring high water levels, hydroperiod, amphibian breeding activity and vegetation composition and structure. Some natural changes to vegetation structure and composition are occurring as a result of the December 2013 ice storm and infestations of ash trees by the Emerald Ash Borer. Wetland W9 was added to the wetland monitoring network in 2013 and it appears to be functioning within the normal ranges of variation for this type of wetland.
- Off-Site Wetland W5 appears to have experienced reduced hydroperiod, reduced amphibian breeding activity and changes to vegetation composition and structure during the period from 2002 2012. Between 2013 and 2022, with the operation of the groundwater recharge well system under the mitigation provisions of the AMP, Wetland W5 was wetter than in the recent past. As a result, the cover/height of Reed Canary Grass was considerably reduced and the cover of some other native wetland plant species has increased. Amphibian breeding activity in W5 increased during the period 2013 through 2022, relative to 2012. The mitigation measures implemented in 2013 through 2022 appear to have had a positive effect on Wetland W5 (e.g., increased amphibian activity, reduction of Reed Canary Grass and increase in native wetland plant species).
- On-Site Wetland V2 appeared to have experienced reduced spring high water levels, reduced hydroperiod, reduced amphibian breeding activity and changes to vegetation composition and structure until 2008. The mitigation measures implemented in 2009 through 2022 appear to have had a positive effect on Wetland V2 (e.g., increased amphibian activity; positive changes in vegetation composition and structure such as control of encroaching woody vegetation, etc.).

## 9.3 Main Quarry

The results of the 2022 Main Quarry ecology monitoring program are provided in the Goodban Ecological Consulting Inc. (GEC) report entitled, "Offsite Ecology Monitoring Program for the Rehabilitation of the Milton Quarry 2022 Report" (GEC, 2023b), a copy of which is provided in Appendix R.

The overall findings of the 2022 Main Quarry ecology monitoring are summarized as follows:

- In 2022, conditions at the salamander pool (Plot 1) were similar to conditions documented in the previous monitoring reports (covering the period 1993 to 2020). In terms of vernal pool vegetation, the monitoring data collected during 2023 are similar to previous monitoring events. Some reduction in canopy cover has occurred as a result of the December 2013 ice storm.
- In 2022, conditions at the wetland (Plot 2) were similar to conditions documented in the previous monitoring reports (covering the period 2008 to 2018). A new pumping regime which increased pumping volumes during the late summer period likely contributed to the robustness of the cattails (>2.0 m in height) and other wetland plants observed during the 2008 to 2022 monitoring events. Earlier monitoring

events (1993-2005) covered a time period where discharge to the Hilton Falls Tributary was based on the old pumping regime and vegetation sampling occurred earlier in the year (June). In terms of wetland vegetation, the monitoring data collected during 2022 are similar to previous monitoring events.

- Conditions at the two monitoring stations have been similar from 1993 to 2022. The west side of the Main Quarry has been essentially in its final rehabilitated form (e.g., Reservoir, Lake, and Wetland) since around 2008 and no significant changes to the rehabilitation are planned.
- Considering that the west side of the Main Quarry has been in its final rehabilitated form since around 2008 and conditions at the two offsite monitoring stations west of Sixth Line have been similar from 1993 to 2022, it is recommended that monitoring at these locations be discontinued. If the monitoring at these locations is not discontinued, the next monitoring event would occur in 2024.

# 10. Annual AMP Reporting Summary

Section 6.1 of the AMP identifies specific components to be included in the Annual Water Monitoring Report. The following summarizes the reporting for the noted components for ease of reference with the noted components shown in bold text:

- Status and summary of quarry operations (e.g., development, extraction, and rehabilitation).
- Refer to Section 3.1.
- Status and summary of mitigation system development and implementation.
- Refer to Sections 3.2 and 3.3.
- Complete presentation of monitoring results, including summary of any notifications provided under the response action framework (Section 1.3).
- Refer to Sections 4 through 9 for the various components of the monitoring program. Monitoring data is provided within the tables and appendices associated with this annual report.
- No "occurrence" was recorded as defined by the AMP.
- Summary of response actions taken to maintain target levels (and effectiveness of actions).
- Refer to Section 5.3.1 regarding Extension trigger well water levels.
- Explanation and assessment of potential for impacts resulting from any period or area in which water level or water quality targets were not continuously maintained.
- As described in Sections 5.3.1 and 5.3.2, there were a limited number of brief periods in 2022 during which target levels were not continuously maintained. In all instances water levels were promptly restored as intended by the AMP. No impacts to the environment were observed or indicated. It is important to recall that the targets were established at conservatively high levels such that "Small, short-term fluctuations in trigger well water levels below the target levels (i.e., days to weeks) will not create any noticeable adverse ecological effects…" (AMP, Section 3.1.3.1).
- As described in Section 7, during 2022 water quality targets for all effluent from the WMS were maintained and no exceedances of the Effluent Limits were observed.
- Target levels and minimum water levels (once initial levels are set and then adjusted levels for following years).
- Refer to Section 5.5 and Table 5.1.
- Assessment of supplemental monitoring program findings, including ecological aspects.
- Refer to Sections 4 through 8 regarding supplemental "water" monitoring and Section 9 regarding supplemental ecological monitoring.
- Evaluation of overall water budget and determination of "excess water" for the subsequent year.

- Refer to Section 6.6 and Appendix N (Tables N.6 and N.8).
- Discussing groundwater mitigation system requirements for the subsequent year as the quarry develops.
- The overall WMS, including reservoir, pumping stations, recharge wells, and wetland diffuse discharges continue to perform as expected. Dufferin plans to continue to proactively implement additional recharge wells as needed to meet the anticipated future increases in recharge system demands as the quarry progresses over time.
- Documentation of any anomalies/glitches that occurred and/or any minor variations that were implemented throughout the year (refer to Section 5).
- No significant glitches or minor variations occurred in 2022. Removal and correction of data anomalies (data errors) is part of an overall data collection and reporting process. Sometimes anomalous data may be saved in the database or uploaded to webDT as a result of the requirement for promptly providing agency access to collected data. Some anomalies only become apparent over time or through detailed comparison of one location to another. As data undergoes further review and evaluation, in 2022 as in all years, we identified and corrected/removed anomalies (data errors) from the database and webDT, as warranted.
- The winter target level for on-Site wetland W7 was maintained in 2022 (to support turtle use) instead of allowing the feature to go dry every 2 to 3 years.
- Review appropriateness of response/notification timelines identified in Section 1.3 and Appendix F as well as the reset period for the operating response period described in Appendix F.
- The mitigation system operated effectively during 2022, and no changes are recommended to the timelines or the reset period.
- Evaluation of the suitability of the interim extraction area and any continued/future interim extraction.
- Full-scale production is occurring in the East Cell and no further interim extraction is anticipated in the future.
- Summary of any amendments/updates to the AMP which were agreed to throughout the year.
- No amendments or updates to the AMP were implemented in 2022.
- Conclusions.
- Refer to Section 11.
- Recommendations, including any proposed amendments to the AMP reflecting knowledge gained from actual operating conditions and monitoring results (e.g., reduction in minimum monitoring frequency).
- Refer to Section 12.
- No amendments to the AMP are recommended as a result of this report.

In addition, the AMP identifies that the following two questions should be considered as part of the Annual Water Monitoring Report. The following provides a response, summarizing the evaluation included in this 2022 Annual Water Monitoring Report.

***Are the operating practices consistent with the mitigation performance objectives?***

Yes. Overall, target levels have been maintained at the trigger wells in a manner that is protective of water resources. No significant fluctuations occurred in 2022, and water levels were consistently above the target levels with only a limited number of very short duration exceptions. Water levels were promptly restored to target levels when they dropped below targets. The ecological features (wetlands W7, W8, and V2) were provided with sufficient water to function within the normal range for these types of wetlands. Drops below target levels are not repeatedly occurring.

***Are the mitigation measures protective of the groundwater dependent ecological features?***

Yes. Overall the ecological features and functions are being maintained and protected. In some instances, enhancement relative to historic conditions are noted such as at wetland V2 and wetland W5. Refer to Section 9 for further discussion.

# 11. Conclusions

Based on the results of the 2022 monitoring program, the following conclusions are provided:

1. Monitoring was completed for the Milton Quarry to satisfy the required objectives of the related Permits, Approvals, and Agreements.
2. Water-related mitigation measures implemented at the Milton Quarry include operation of the WMS. The WMS generally consists of quarry dewatering, water storage in the Reservoir, and drawing water from the Reservoir for discharge to the HFRT and the recharge well system, as well as maintaining the Main Quarry lake level and providing water for operations use. The quarry is currently operating under interim conditions as specified in the PTTW and ECA and will continue to do so in the near term.
3. While some month-to-month variability was present, conditions were typical through March 2022. Subsequently, a significant reduction in precipitation was observed for the balance of the year. Total precipitation was recorded to be 595 mm in 2022 and was lower than the long-term average by approximately 270 mm. Observations in 2022 indicate it was the driest year recorded since observations commenced in 1991.The Reservoir water level was managed within an operating range of 305.5 to 307 m AMSL during the dry conditions observed in 2021, slightly down from the normal operating range of 306 to 308 m AMSL.
4. The surface water elevation in the Main Quarry Lake/Wetland Complex fluctuated within the normal range of 302.5 to 303.5 m AMSL.
5. Groundwater levels at monitoring wells MW1 through MW5 in the Main Quarry in 2022 reflected seasonal trends as influenced by climatic conditions, with the exception of MW4 (relatively close to the quarry face) and MW5 (relatively close to the quarry face and influenced by the Reservoir).
6. Groundwater levels to the west of the North Quarry were maintained by the recharge well system at elevations at or above the 2022 target levels.
7. The operation of the Extension groundwater recharge well system generally maintained water levels at trigger wells and the on-Site wetlands at or above the 2022 target levels, except for some minor short-term variations.
8. The North Quarry and Extension target levels were adjusted for 2023 to account for variations in natural climatic and groundwater conditions. The approved protocol per the AMP was used.
9. In 2022, all water takings were in compliance with PTTW limits.
10. In 2022, water discharge from the Main Quarry to the HFRT met the flow requirements set out in the CH Agreement.
11. An overall evaluation of the water budget for the quarry was conducted. The overall conclusion of this evaluation is that there is sufficient water available for the successful performance of the Milton Quarry WMS and rehabilitation in the near term and the long term. There is no Excess Water identified for 2023 in addition to the minimum required discharge.
12. The quality of the water discharged from the West Sump in the Lake/Wetland Complex and from the Reservoir to the HFRT was good and generally similar to historic conditions.
13. The water quality in the Reservoir, recharge watermain, and the recharge wells associated with the recharge well system is suitable for groundwater recharge.
14. There is no indication that Dufferin's operations have had any adverse water quantity or quality effects on the residential wells in the vicinity of the quarry.

15. The 2022 spawning surveys marked the second year of confirmed spawning within the Sixth Line reaches with the observation of a total of eight Brook Trout in the attendance of two separate redds located approximately 8 m downstream of the middle culvert and 100 m upstream of the middle culvert.
16. The level of spawning activity varies naturally year-to-year based on a wide variety of factors (e.g., surface flow levels and other climatic factors, groundwater flow levels, beaver dams and associated accessibility, varying spawning year class(es) due to varying incubation success in previous year(s), food availability, competition, fishing activity, and other stress factors), as demonstrated in the findings over the years. However, in recent years as noted, there had been an increase in spawning activity, confirmed redds and adult observations making the sudden drop in 2018 all the more obvious and suggestive of an event occurrence rather than any decline in habitat quality (or associated water quality or groundwater discharge).
17. The results of the 2022 thermal data collected in the main 'historical' redd indicate that groundwater discharge continues to occur into the redd site within the stream bed during the spawning period and is moderating the local environment. The 2021 results of the temperature survey within the permanent spring further indicate that groundwater discharge continues to occur along this area of the Sixth Line reaches during the spawning season. This information is consistent with GHD's monitoring of groundwater flow patterns toward the stream reaches. Therefore, despite the lack of confirmed redds or Brook Trout observations along the Sixth Line reaches during the 2018 to 2020 period, the key element that supports habitat conditions suitable for Brook Trout, that is groundwater discharge, persisted during that time and continued into 2021 and 2022 when confirmation of Brook Trout spawning returned.
18. The 2022 benthic community monitoring findings represent the aquatic habitat conditions in the tenth year of below-water table extraction in the Milton East and West Cell Quarry Extension. Overall, the findings continue to show that the benthic community at Station 1 is indicative of generally good water and habitat quality, reflecting conditions and variability expected in a small groundwater fed, headwater stream. The benthic community at Station 2 appears to represent fair habitat and water quality, with some metrics varying outside the established baseline ranges. Also, typical of small headwater streams which are influenced by various climatic and physical factors, year to year variability is evident within the overall pattern. The benthic community at Station 1 appears fairly diverse and exhibits good representation of families that are sensitive to poor water and habitat quality, such as EPT taxa. The community at Station 2 appears less diverse, particularly in 2019, 2020, and 2021 when indices appeared to be trending toward fairly poor water quality; however, indices in 2022 indicate a return to values within previously established ranges for richness, diversity, community composition, and water quality indices.
19. Based on the available wetland ecology monitoring data, off Site wetlands W10, W21, and W41, and on Site wetlands W7 and W8 appear to be functioning within the normal ranges of variation for these types of wetland features, in terms of spring high water levels, hydroperiod, amphibian breeding activity and vegetation composition and structure. Some natural changes to vegetation structure and composition are occurring as a result of the December 2013 ice storm and infestations of ash trees by the Emerald Ash Borer. Wetland W9 was added to the wetland monitoring network in 2013 and it appears to be functioning within the normal ranges of variation for this type of wetland.
20. Off-Site Wetland W5 appears to have experienced reduced hydroperiod, reduced amphibian breeding activity and changes to vegetation composition and structure during the period from 2002 to 2012. Between 2013 and 2022, with the operation of the groundwater recharge well system under the mitigation provisions of the AMP, Wetland W5 was wetter than in the recent past. As a result, the cover/height of Reed Canary Grass was considerably reduced and the cover of some other native wetland plant species has increased. Amphibian breeding activity in W5 increased during the period 2013 through 2022, relative to 2012. The mitigation measures implemented in 2013 through 2022 appear to have had a positive effect on Wetland W5 (e.g., increased amphibian activity, reduction of Reed Canary Grass and increase in native wetland plant species).
21. On-Site Wetland V2 appeared to have experienced reduced spring high water levels, reduced hydroperiod, reduced amphibian breeding activity and changes to vegetation composition and structure until 2008. The mitigation measures implemented in 2009 through 2022 appear to have had a positive

effect on Wetland V2 (e.g., increased amphibian activity; positive changes in vegetation composition and structure such as control of encroaching woody vegetation, etc.).

22. In 2022, conditions at the salamander pool (Plot 1) were similar to conditions documented in the previous monitoring reports (covering the period 1993 to 2020). In terms of vernal pool vegetation, the monitoring data collected during 2023 are similar to previous monitoring events. Some reduction in canopy cover has occurred as a result of the December 2013 ice storm.
23. In 2022, conditions at the wetland (Plot 2) were similar to conditions documented in the previous monitoring reports (covering the period 2008 to 2018). A new pumping regime which increased pumping volumes during the late summer period likely contributed to the robustness of the cattails (>2.0 m in height) and other wetland plants observed during the 2008 to 2022 monitoring events. Earlier monitoring events (1993-2005) covered a time period where discharge to the Hilton Falls Tributary was based on the old pumping regime and vegetation sampling occurred earlier in the year (June). In terms of wetland vegetation, the monitoring data collected during 2022 are similar to previous monitoring events.

Overall, in 2022 the water management system continued to be successfully implemented. Operation of the system demonstrated the ability to maintain target levels on a sustained basis. The water budget was in line with the climatic conditions in 2022. No significant negative impacts to the off-Site ecological features were evident.

# 12. Recommendations

Based on the conclusions of the 2022 water and ecology monitoring program and the status of the equipment at the Site, the following recommendations are provided:

1. The monitoring program, as presented herein and summarized in Tables 2.1 and 2.2, should be continued to satisfy the objectives of the related Permits/Approvals.
2. Continue North Quarry and Extension mitigation measures pursuant to the Site Permits/Approvals and the AMP.
3. Continue to monitor water budget and refine the recharge system operation to continue to maintain targets while maximizing available water surplus or water available for lake-filling.
4. The ongoing Brook Trout monitoring will continue to assess the year-to-year pattern and watch for further evidence of Brook Trout are spawning. Angling activity will continue to be monitored.
5. Brook Trout monitoring (i.e., spawning surveys) of the Sixth Line reaches will continue on an annual basis. Brook Trout monitoring of the Townline reaches (i.e., spawning surveys) has switched to a biennial frequency (i.e., full spawning surveys to resume in 2021, 2023, etc.), following the AMP recommendation.
6. Continue the annual benthic monitoring program and re-evaluate frequency during the next 5-year review to facilitate continued assessment of patterns in the benthic community.

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All of Which is Respectfully Submitted,

GHD

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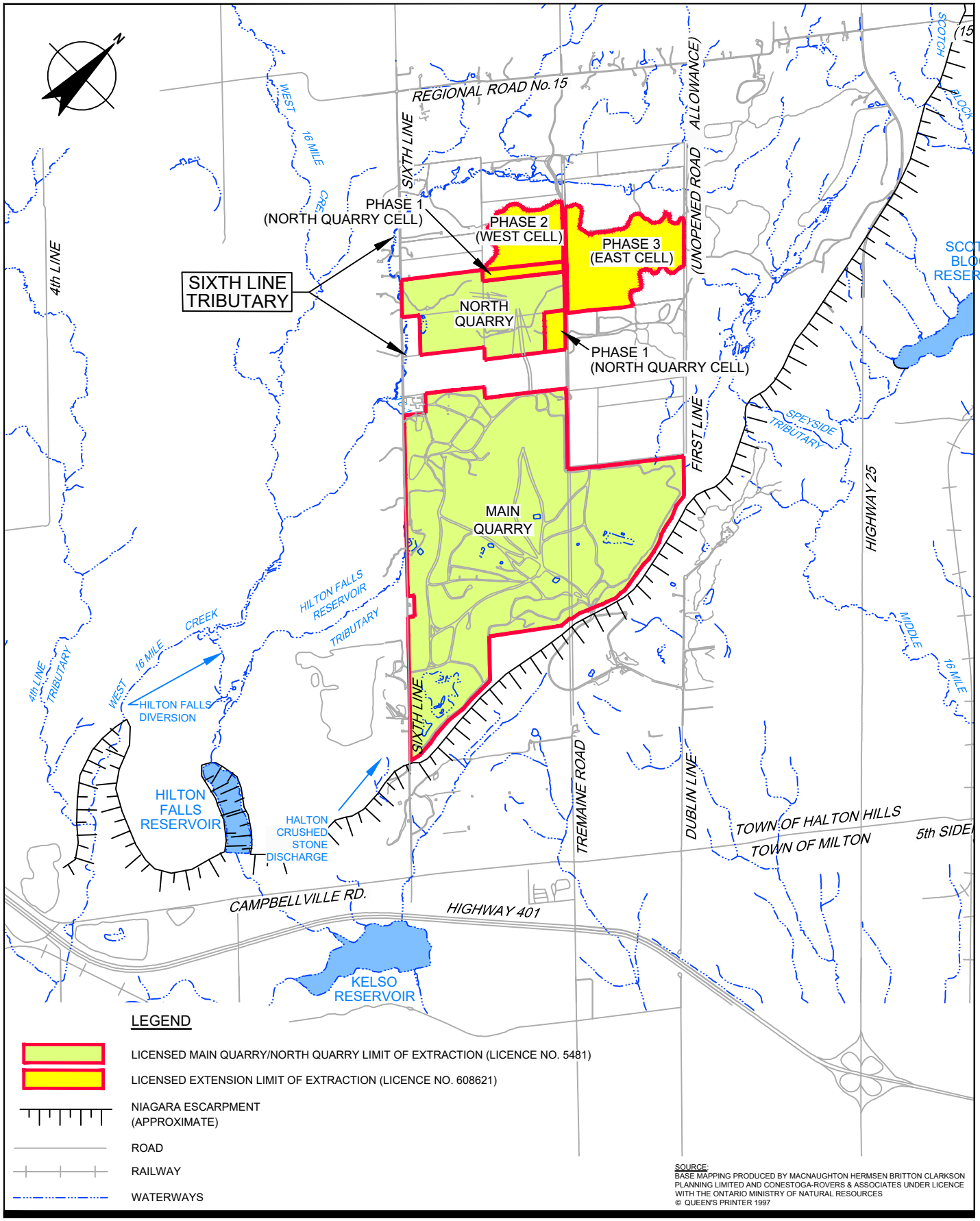
# Figures

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Dufferin Aggregates

GHD

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **10978**
Date **March 2023**

**SITE LOCATION MAP**

**FIGURE 1.1**

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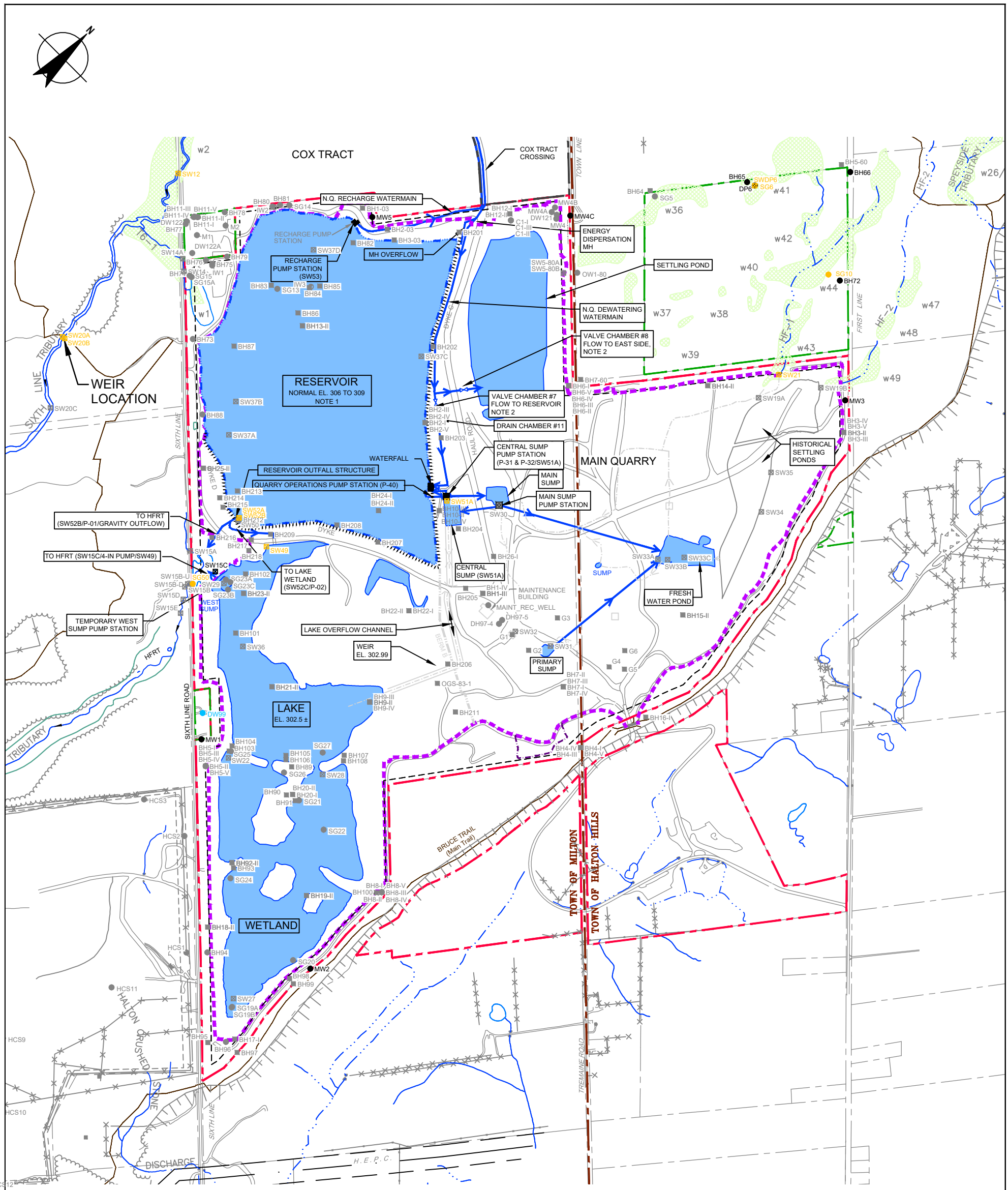


## LEGEND

- MONITORING WELL LOCATION
- DW103 — RESIDENTIAL WELL IN USE
- MP1 — MINI PIEZOMETER LOCATION
- SW10 — SURFACE WATER MEASUREMENT LOCATION
- IN1-07 — BOREHOLE INCLINOMETER LOCATION
- MONITORING LOCATIONS SHOWN IN GREY ARE NOT INCLUDED IN CURRENT MONITORING PROGRAM EITHER BECAUSE THEY ARE INACCESSIBLE OR BECAUSE THEY NO LONGER EXIST
- SG8 — STAFF GAUGE LOCATION
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- MUNICIPAL BOUNDARY
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- DUFFERIN LEASED
- MAIN QUARRY LIMITS DECEMBER 2008
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- NIAGARA ESCARPMENT
- WATERMAIN (AS-BUILT/EXISTING)
- OVERLAND FLOW
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
© QUEEN'S PRINTER 1997
BOUNDARY INFORMATION COMPILED FROM SURVEYS AND SKETCHES PREPARED BY FRED G, CUNNINGHAM, ONTARIO LANDS SURVEYORS, MILTON, ONTARIO, DECEMBER 2,1997.

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Dufferin Aggregates

GHD

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**MONITORING LOCATIONS**
**MAIN QUARRY**

Project No. **10978**
Date **March 2023**

**FIGURE 2.1**

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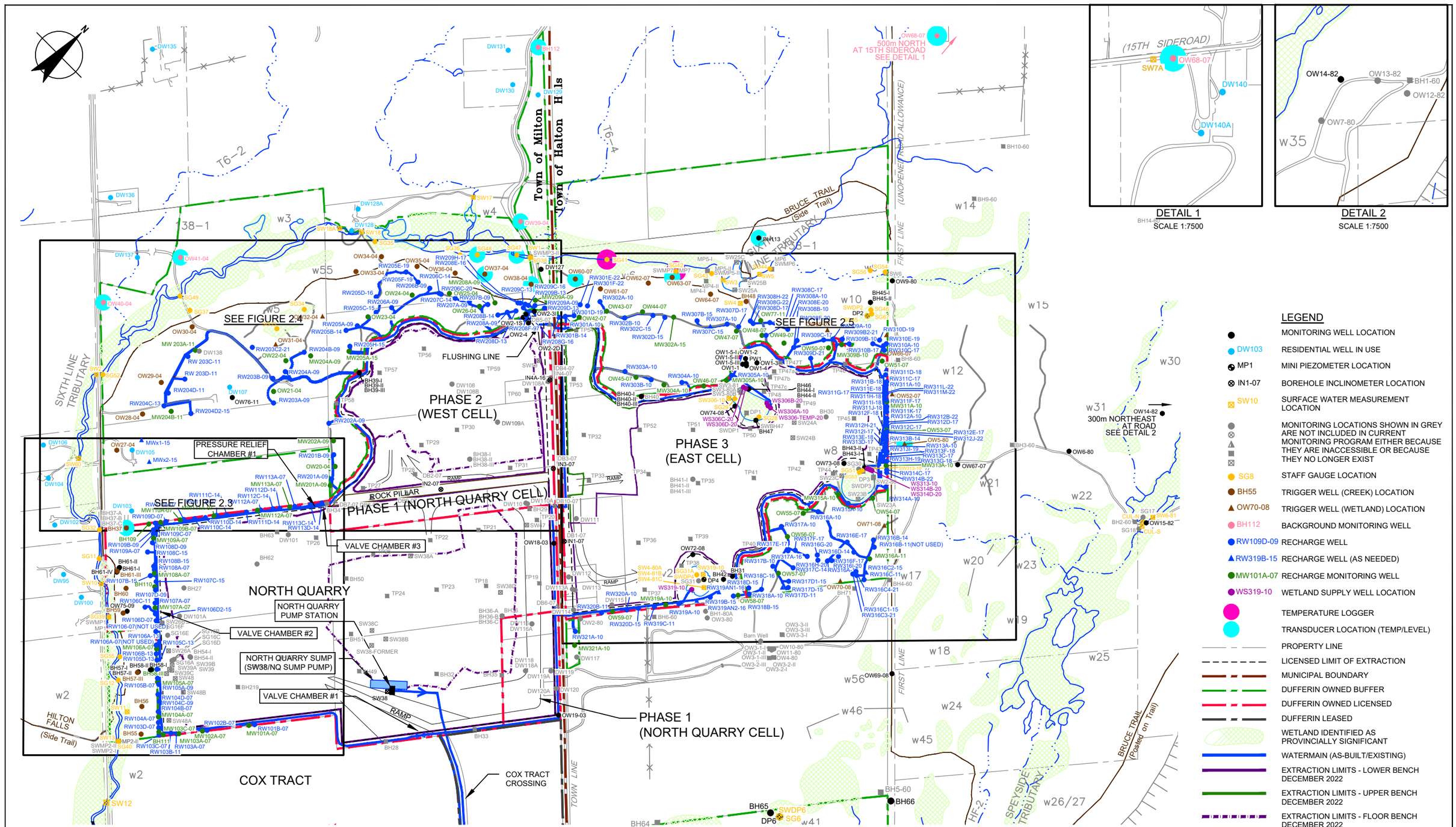


DETAIL 1
SCALE 1:7500

DETAIL 2
SCALE 1:7500

## LEGEND

- MONITORING WELL LOCATION
- DW103 — RESIDENTIAL WELL IN USE
- MP1 — MINI PIEZOMETER LOCATION
- IN1-07 — BOREHOLE INCLINOMETER LOCATION
- SW10 — SURFACE WATER MEASUREMENT LOCATION
- MONITORING LOCATIONS SHOWN IN GREY ARE NOT INCLUDED IN CURRENT MONITORING PROGRAM EITHER BECAUSE THEY ARE INACCESSIBLE OR BECAUSE THEY NO LONGER EXIST
- SG8 — STAFF GAUGE LOCATION
- BH55 — TRIGGER WELL (CREEK) LOCATION
- OW70-08 — TRIGGER WELL (WETLAND) LOCATION
- BH112 — BACKGROUND MONITORING WELL
- RW109D-09 — RECHARGE WELL
- RW319B-15 — RECHARGE WELL (AS NEEDED)
- MW101A-07 — RECHARGE MONITORING WELL
- WS319-10 — WETLAND SUPPLY WELL LOCATION
- TEMPERATURE LOGGER
- TRANSDUCER LOCATION (TEMP/LEVEL)
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- MUNICIPAL BOUNDARY
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- DUFFERIN LEASED
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- WATERMAIN (AS-BUILT/EXISTING)
- EXTRACTION LIMITS - LOWER BENCH DECEMBER 2022
- EXTRACTION LIMITS - UPPER BENCH DECEMBER 2022
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

0 100 200 300m
1:10000

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
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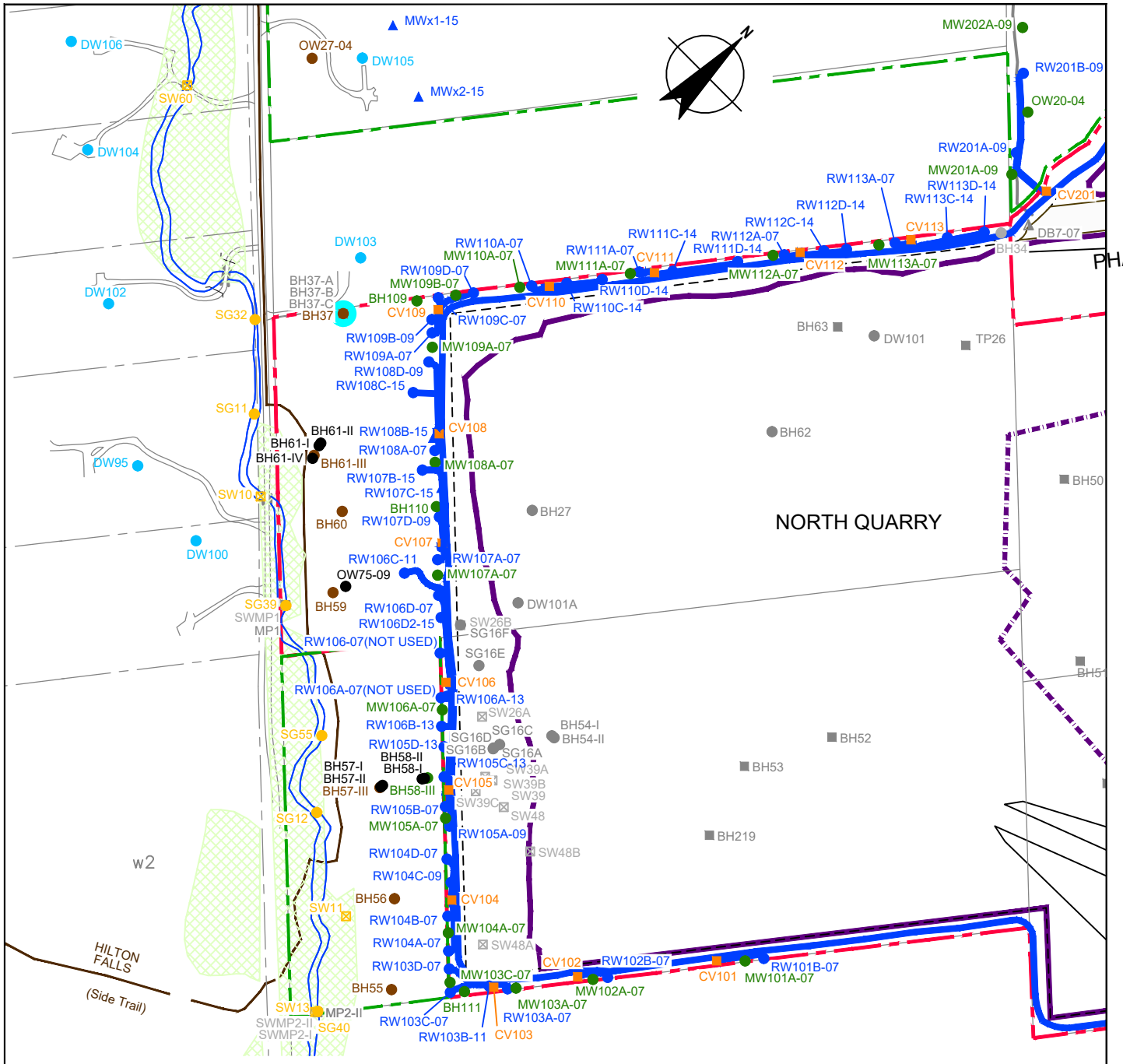
MILTON QUARRY
REGION OF HALTON, ONTARIO

MONITORING LOCATIONS
NORTH QUARRY AND EXTENSION

Project No. **10978**
Date **March 2023**

**FIGURE 2.2**




## LEGEND

- MONITORING WELL LOCATION
- DW103 RESIDENTIAL WELL IN USE
- SW10 SURFACE WATER MEASUREMENT LOCATION
- MONITORING LOCATIONS SHOWN IN GREY ARE NOT INCLUDED IN CURRENT MONITORING PROGRAM EITHER BECAUSE THEY ARE INACCESSIBLE OR BECAUSE THEY NO LONGER EXIST
- CV103 CONTROL VALVE HUT
- TEMPERATURE LOGGER
- TRANSDUCER LOCATION (TEMP/LEVEL)
- SG8 STAFF GAUGE LOCATION
- BH55 TRIGGER WELL LOCATION
- RW109D-09 RECHARGE WELL
- MWx1-15 RECHARGE WELL (AS NEEDED)
- MW101A-07 RECHARGE MONITORING WELL
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- WATERMAIN (AS-BUILT/EXISTING)
- EXTRACTION LIMITS - LOWER BENCH DECEMBER 2022
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
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0 50 100 150m
1:5000

Dufferin Aggregates

GHD

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **10978**
Date **March 2023**

**MONITORING LOCATIONS**
**NORTH RECHARGE SYSTEM**

**FIGURE 2.3**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D103_WA-172.dwg
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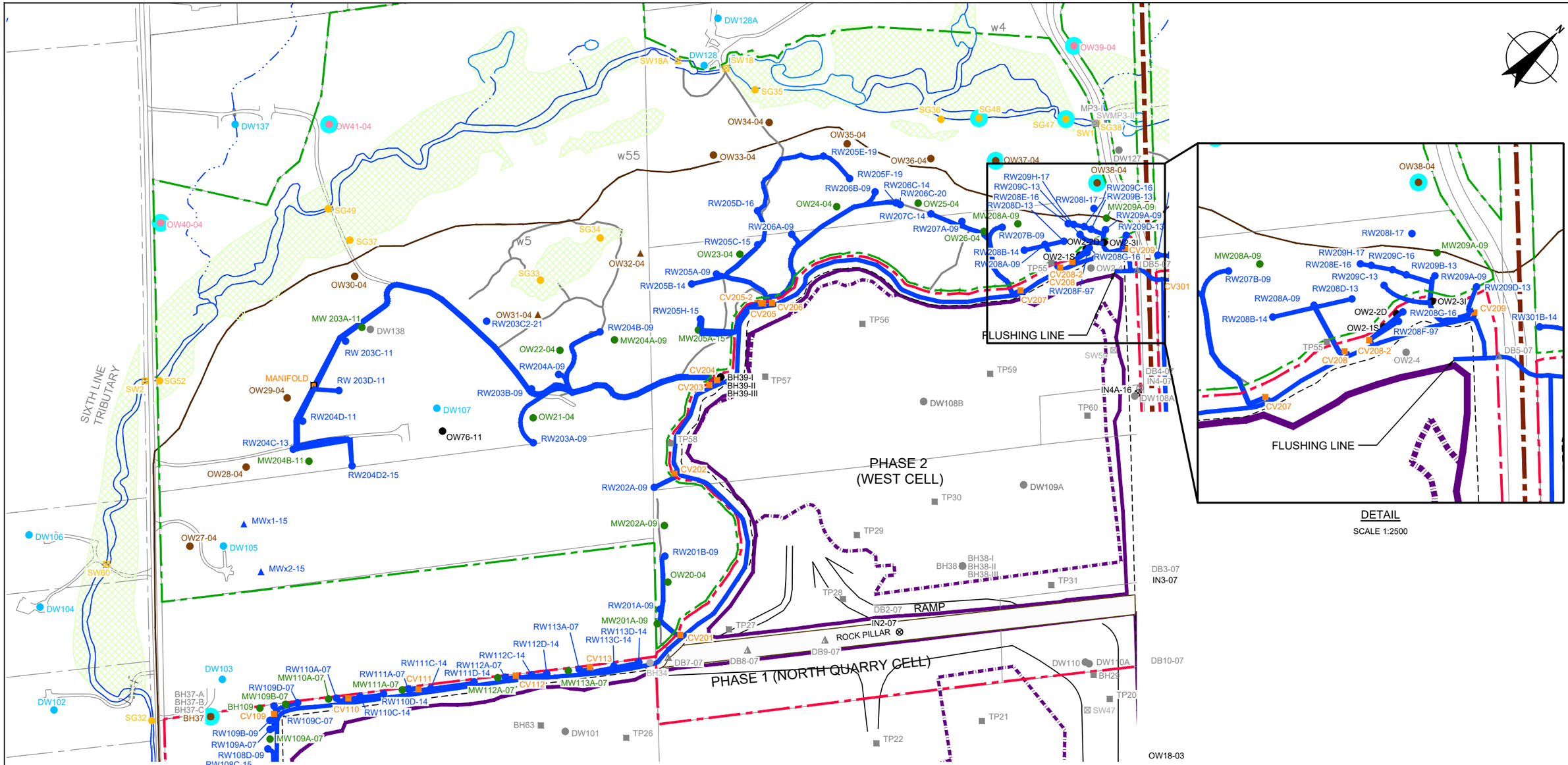


## LEGEND

- MONITORING WELL LOCATION
- DW103 — RESIDENTIAL WELL IN USE
- DW113A — DUFFERIN OWNED FORMER DOMESTIC WELL USED AS MONITORING WELL
- IN1-07 — BOREHOLE INCLINOMETER LOCATION
- SW10 — SURFACE WATER MEASUREMENT LOCATION
- MONITORING LOCATIONS SHOWN IN GREY ARE NOT INCLUDED IN CURRENT MONITORING PROGRAM EITHER BECAUSE THEY ARE INACCESSIBLE OR BECAUSE THEY NO LONGER EXIST
- SG8 — STAFF GAUGE LOCATION
- BH55 — TRIGGER WELL LOCATION
- OW70-08 — TRIGGER WELL (WETLAND) LOCATION
- BH112 — BACKGROUND MONITORING WELL
- RW109D-09 — RECHARGE WELL
- MWx1-15 — RECHARGE WELL (AS NEEDED)
- MW101A-07 — RECHARGE MONITORING WELL
- TEMPERATURE LOGGER
- TRANSDUCER LOCATION (TEMP/LEVEL)
- CV103 — CONTROL VALVE HUT
- MANIFOLD
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- WATERMAIN (AS-BUILT/EXISTING)
- EXTRACTION LIMITS - LOWER BENCH DECEMBER 2022
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
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0 50 100 150m
1:5000

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **10978**
Date **March 2023**

**WEST CELL RECHARGE SYSTEM**

**FIGURE 2.4**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\10978\Digital_Design\ACAD\Figures\RPT172\10978-GHD-00-00-RPT-EN-D103_WA-172.dwg
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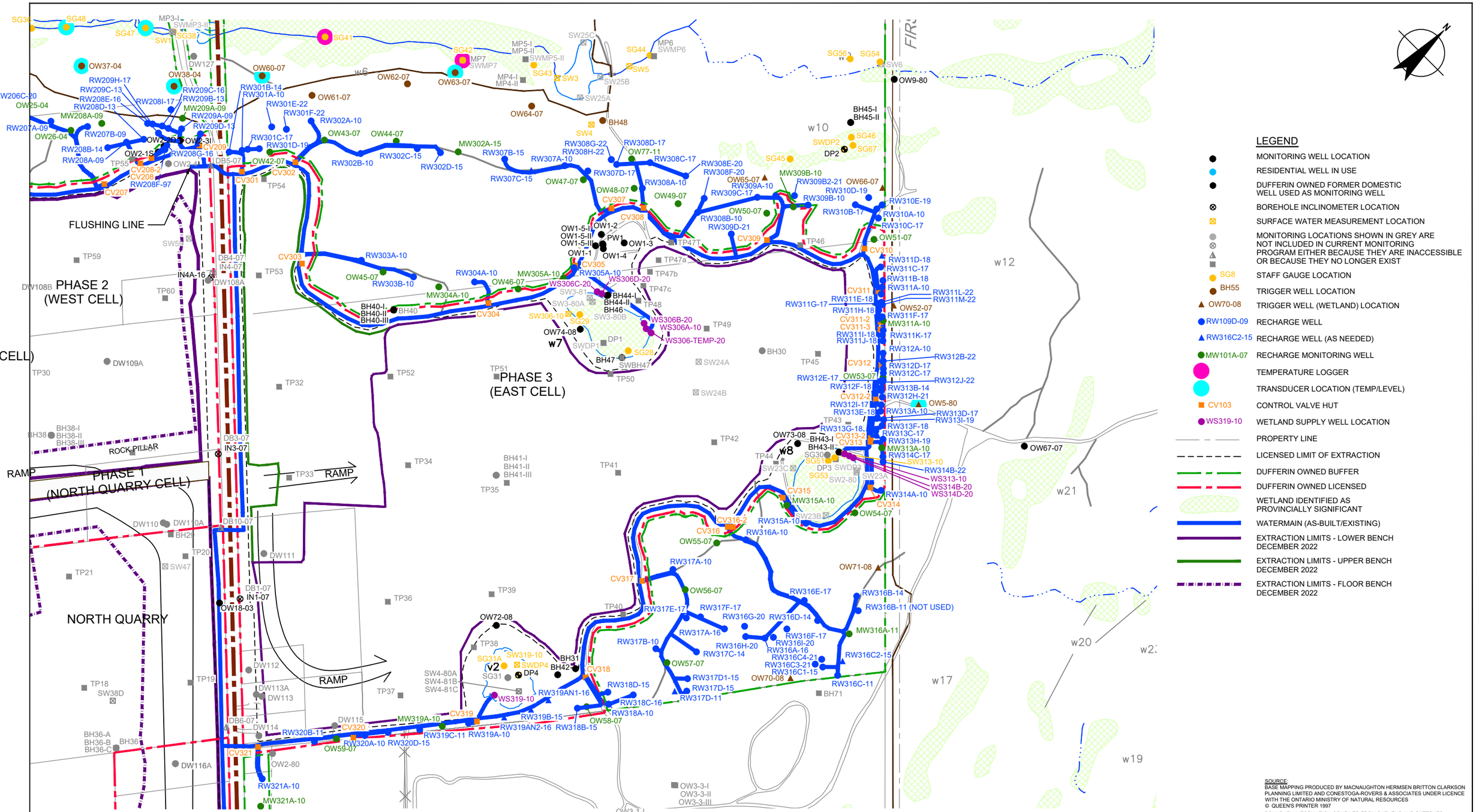


SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
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0 50 100 150m
1:5000

MILTON QUARRY
REGION OF HALTON, ONTARIO

EAST RECHARGE SYSTEM

Project No. **10978**
Date **March 2023**

**FIGURE 2.5**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D103_WA-172.dwg
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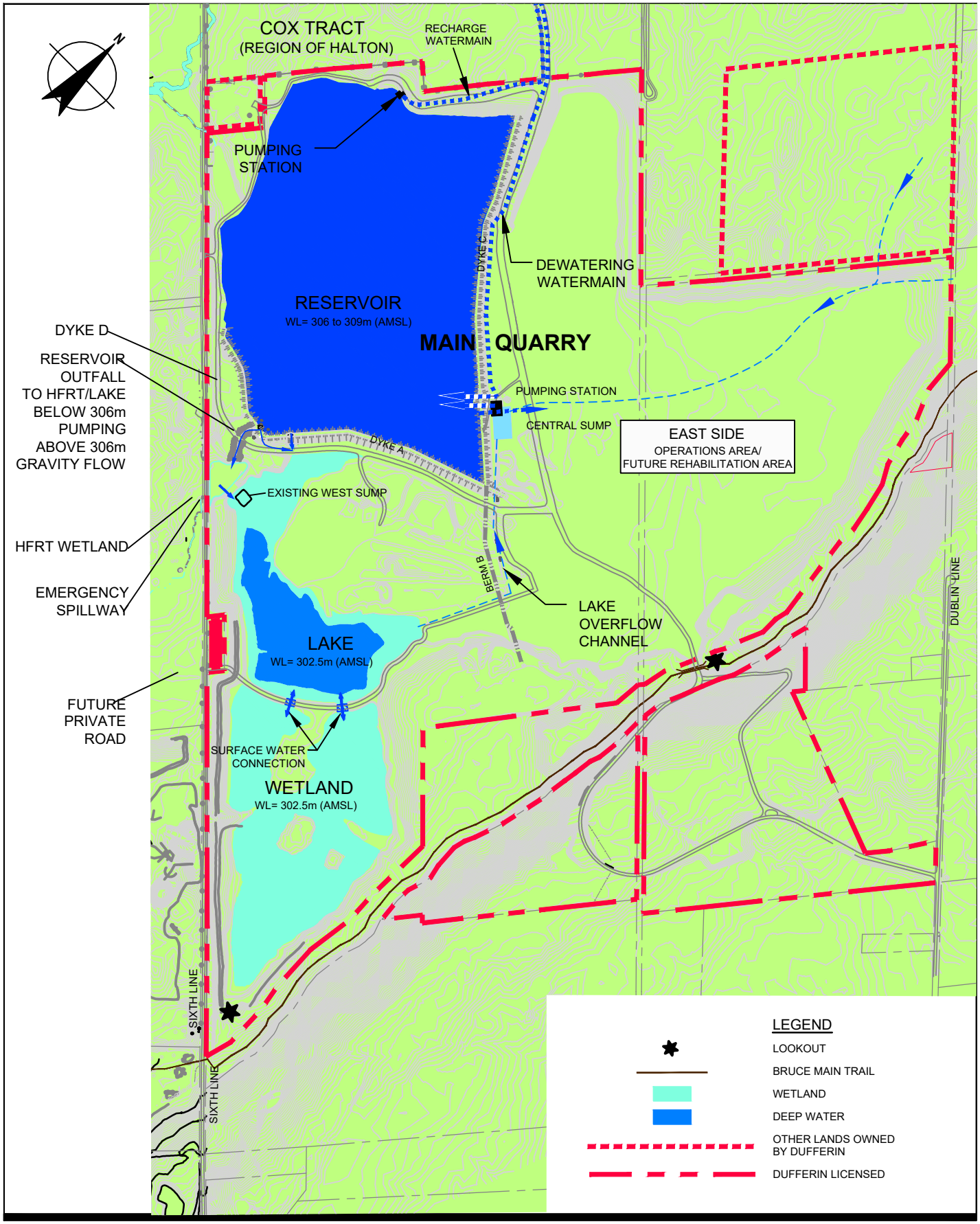


0 150 300 450m

1:15000

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **10978**
Date **March 2023**

**MAIN QUARRY**
**REHABILITATION PLAN CONCEPT**

**FIGURE 2.6**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D104_WA-172.dwg
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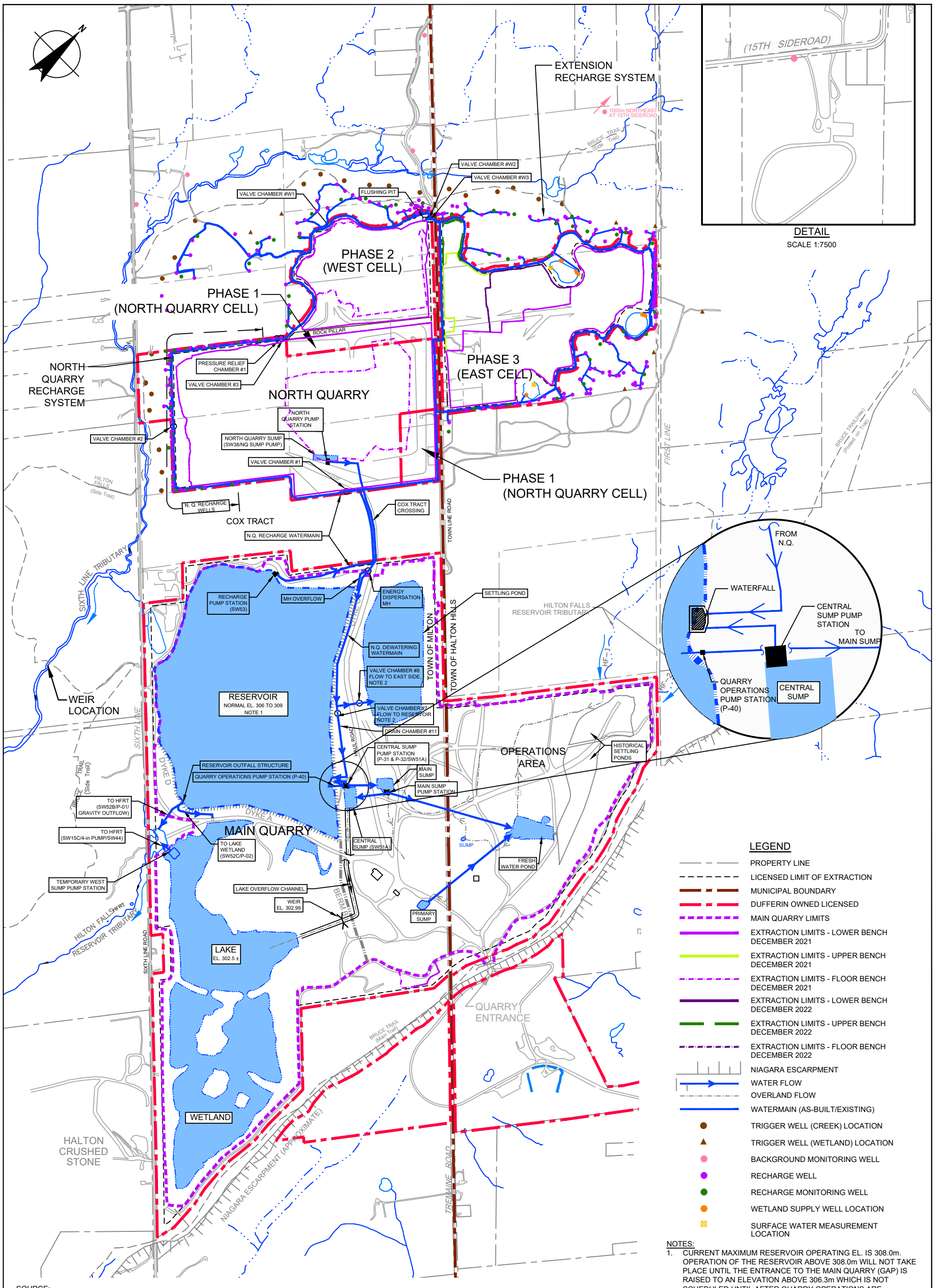


SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES


NOTES:
1. CURRENT MAXIMUM RESERVOIR OPERATING EL. IS 308.0m. OPERATION OF THE RESERVOIR ABOVE 308.0m WILL NOT TAKE PLACE UNTIL THE ENTRANCE TO THE MAIN QUARRY (GAP) IS RAISED TO AN ELEVATION ABOVE 306.3m WHICH IS NOT SCHEDULED UNTIL AFTER QUARRY OPERATIONS ARE COMPLETE.
2. VALVE OPERATION FOR VC #7 AND #8 SHOULD ALWAYS HAVE ONE VALVE "OPEN" AND THE OTHER "CLOSED". IF BOTH VALVES ARE "OPEN" WATER WILL FLOW FROM WATERFALL POND TO EAST SIDE.

0 150 300 450m
1:15000

MILTON QUARRY
REGION OF HALTON, ONTARIO

EXISTING CONDITIONS AND WATER MANAGEMENT SYSTEM OVERVIEW

Project No. **10978**
Date **March 2023**

**FIGURE 2.7**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D105_WA-172.dwg
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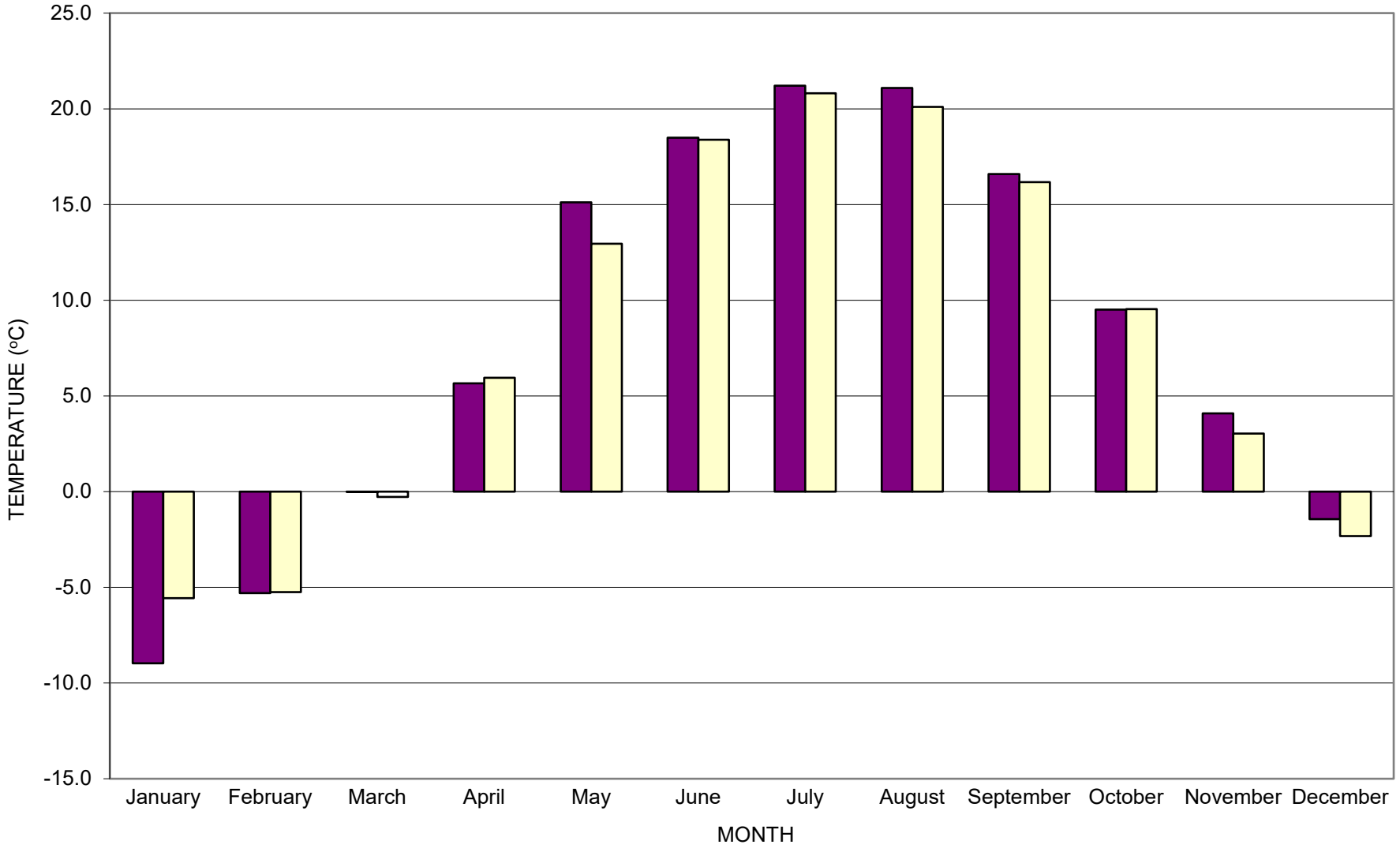


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**Note:**
Air temperature data was collected at the quarry from 1995 to 1998 and then from 2000 to present.

figure 4.1
2022 MONTHLY MEASURED AIR TEMPERATURE AVERAGES
DUFFERIN MILTON QUARRY
Region of Halton, Ontario

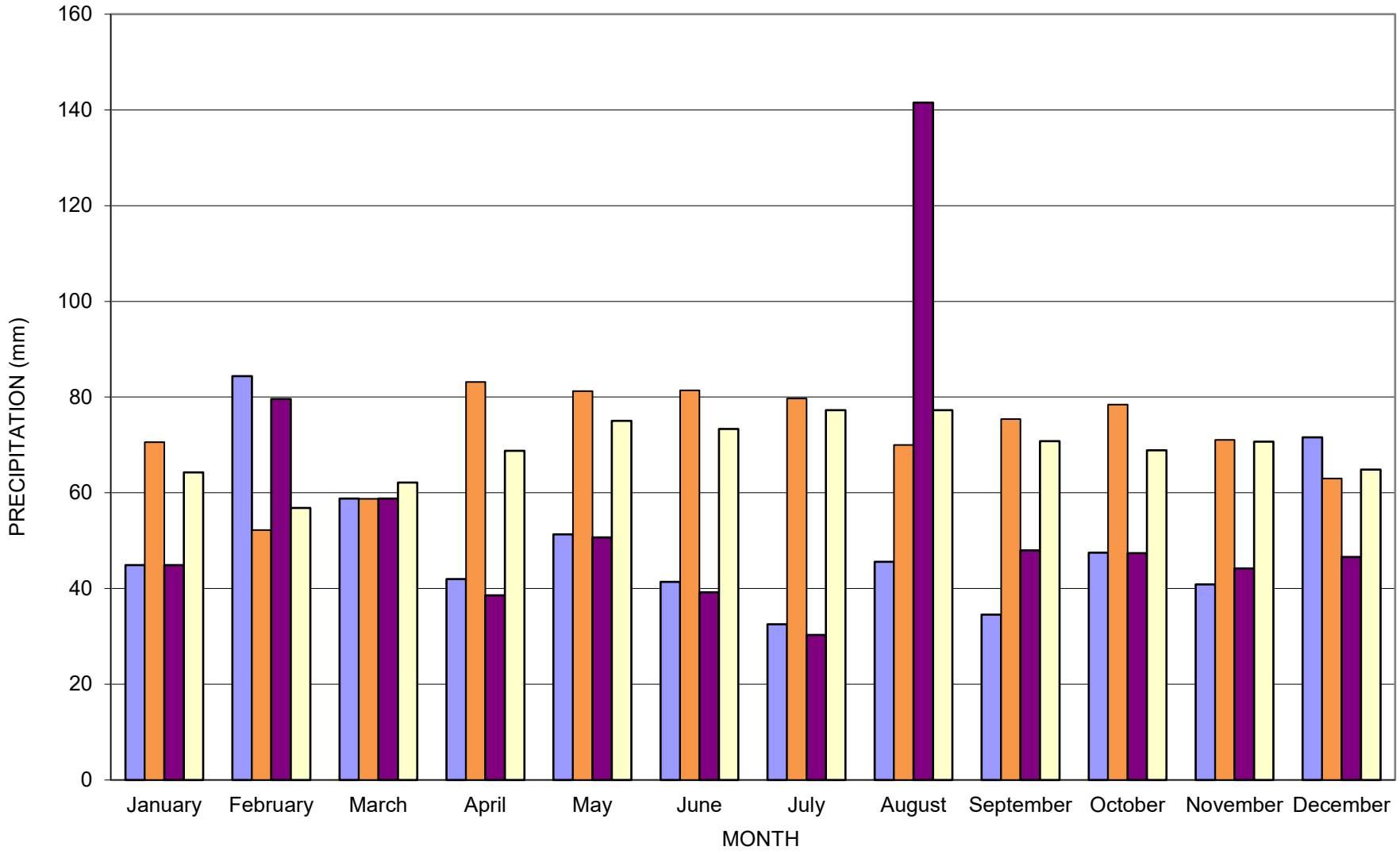


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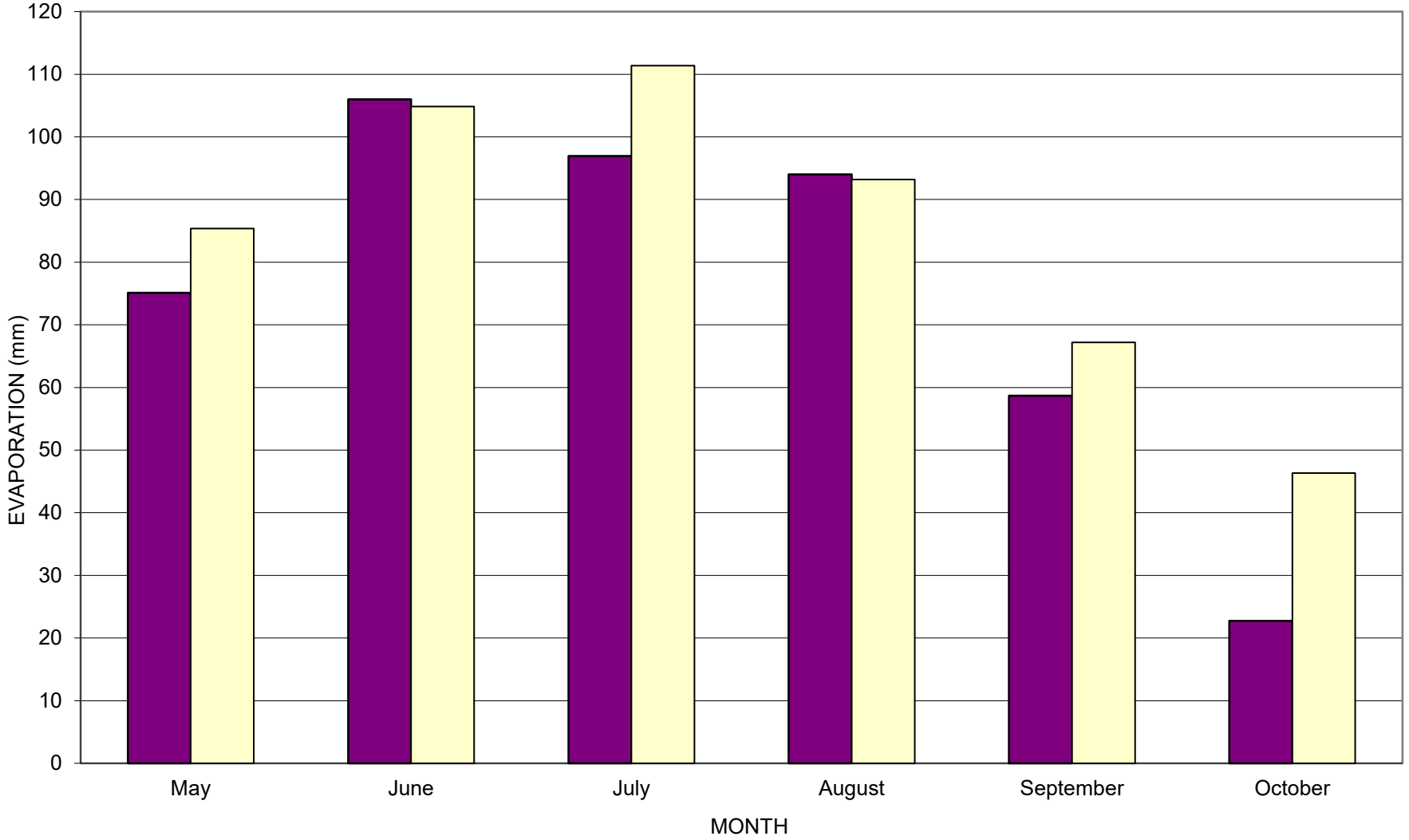
figure 4.2
2022 MONTHLY SUPPLEMENTED PRECIPITATION TOTALS
DUFFERIN MILTON QUARRY
Region of Halton, Ontario

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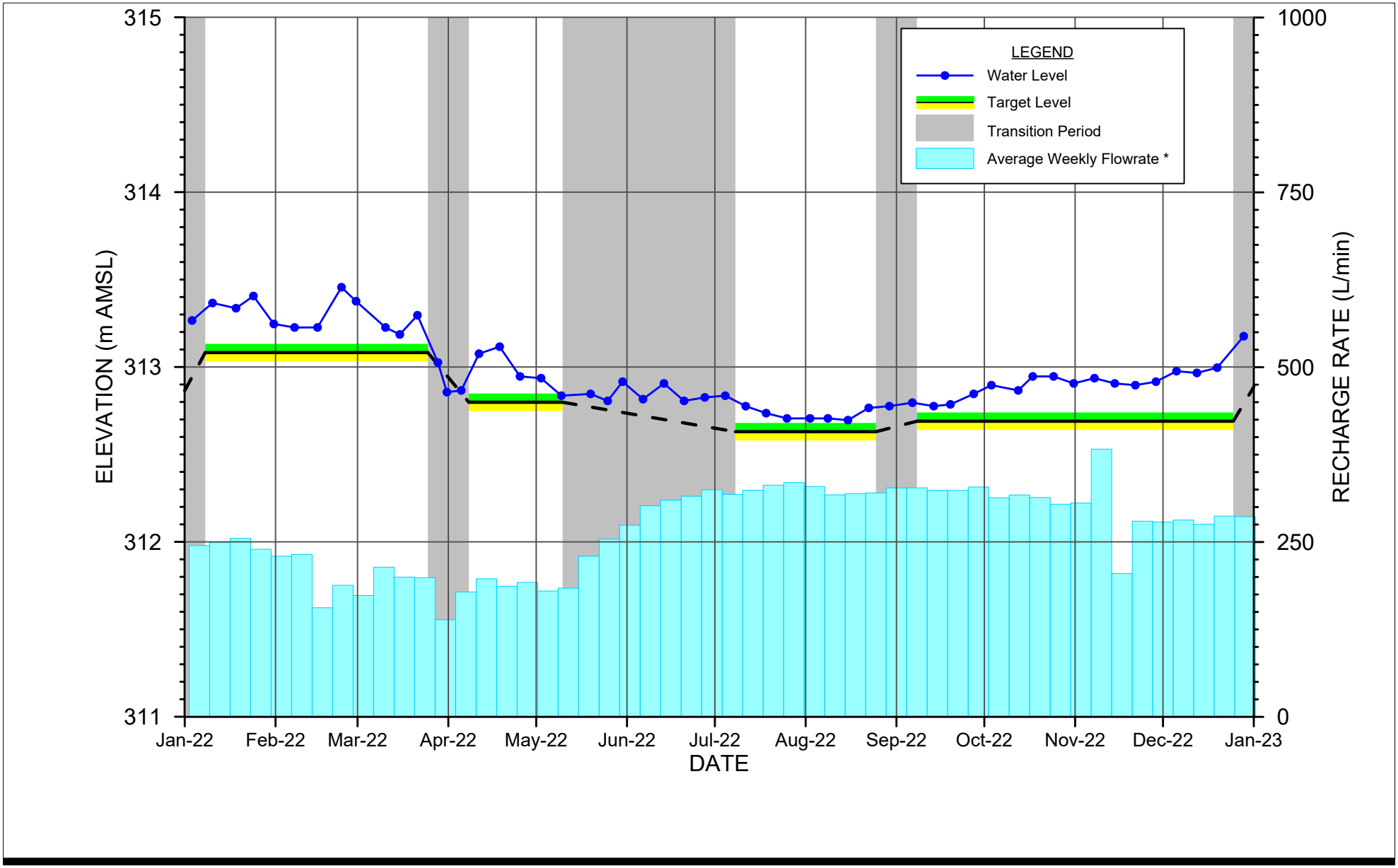
**Note:**
The Milton Quarry evaporation pan operated from April 12, 2022 to November 14, 2022. Partial months (April and November) have been excluded above. Measured lake evaporation is obtained by multiplying measured pan evaporation by a 0.70 correction factor.

figure 4.3
2022 MONTHLY MEASURED LAKE EVAPORATION TOTALS
DUFFERIN MILTON QUARRY
Region of Halton, Ontario




* Includes flow from RW103A-07, RW103B-11, RW103C-07, RW103D-07
RW104A-07, RW104B-07, RW104C-09, and RW104D-07

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - BH55**
**NORTH QUARRY**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.1**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH55.grf
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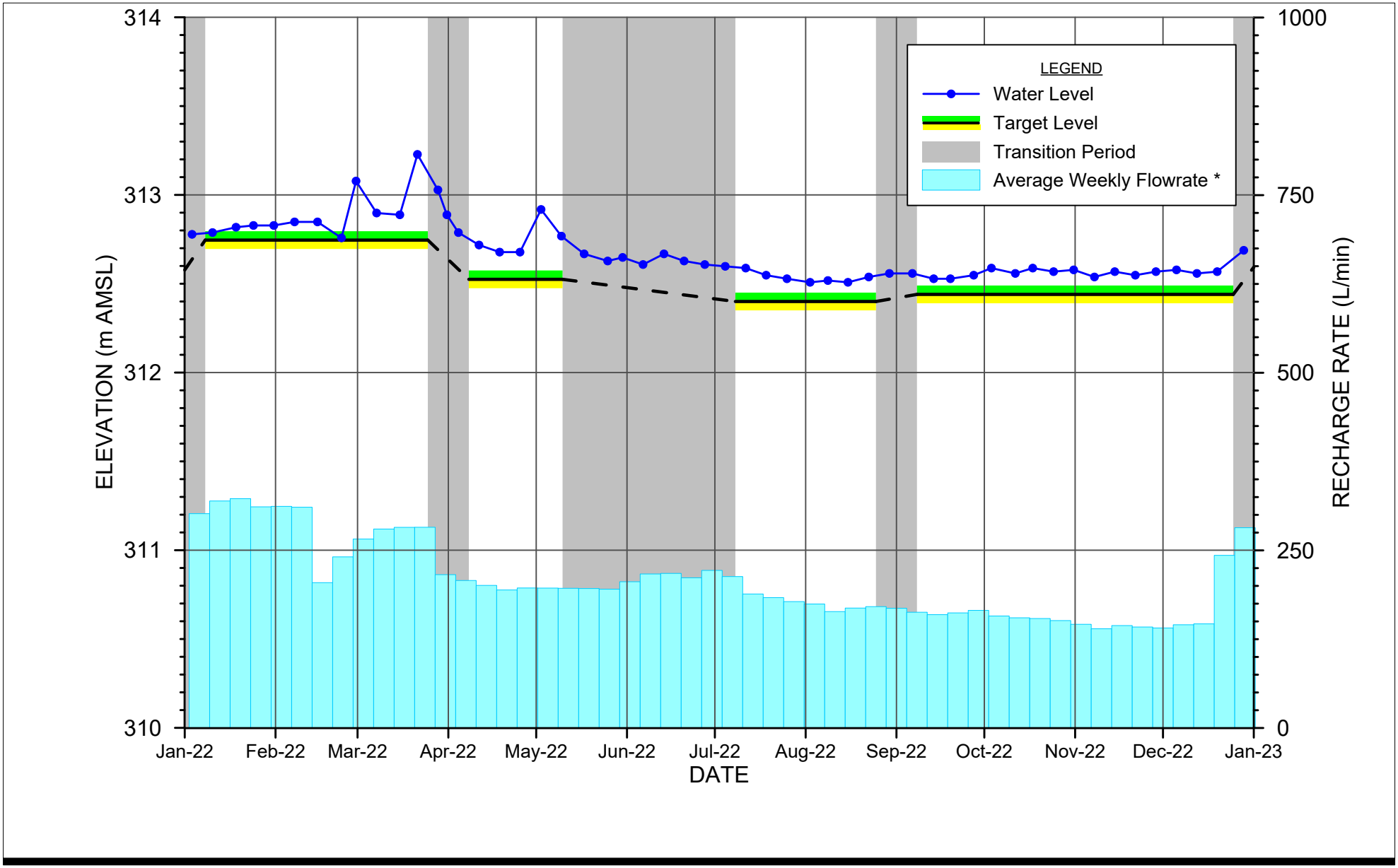


* Includes flow from RW104A-07, RW104B-07, RW104C-09, and RW104D-07

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - BH56**
**NORTH QUARRY**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.2**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH56.grf
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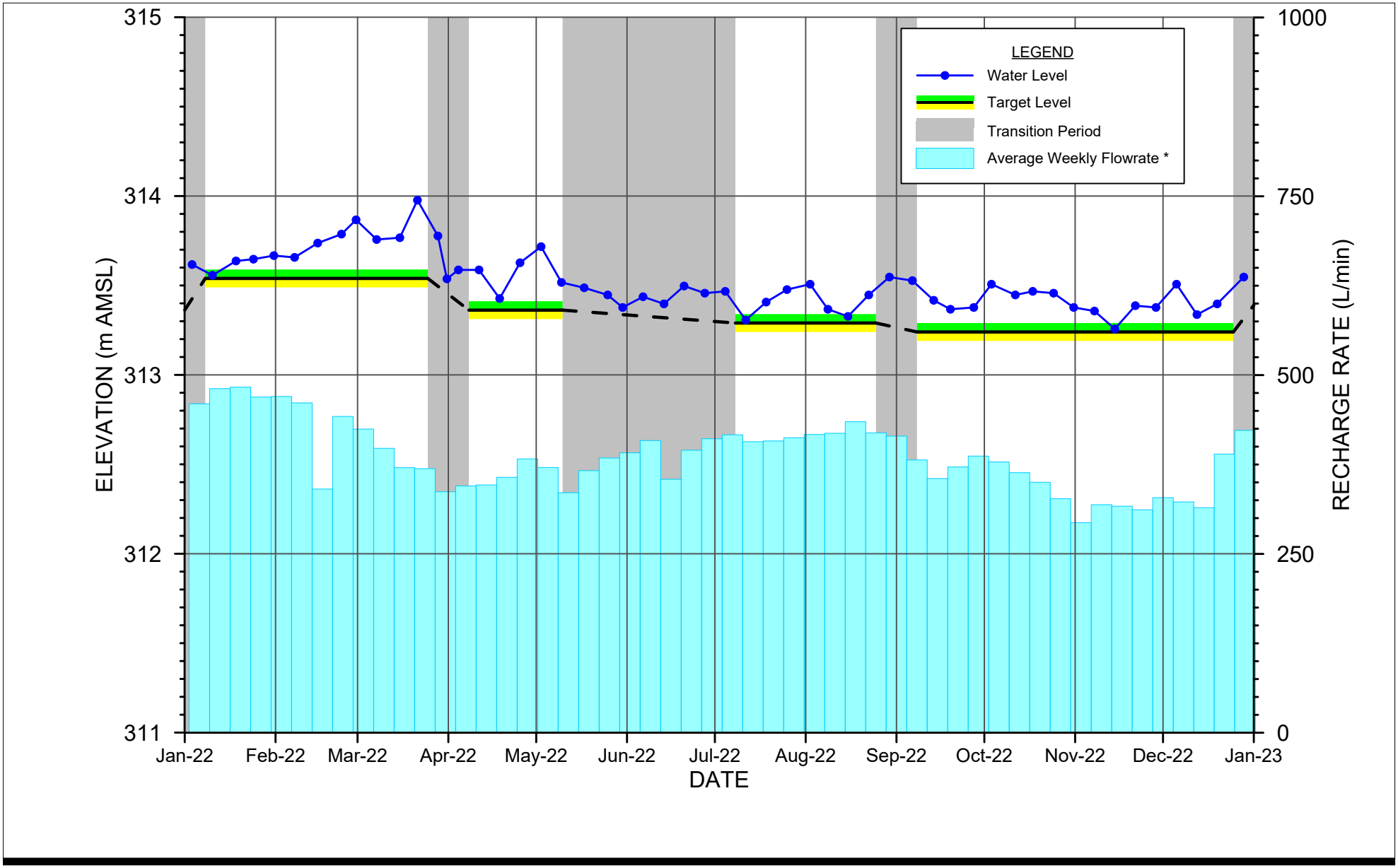


* Includes flow from RW104C-09, RW104D-07, RW105A-09, RW105B-07, RW105C-13, RW105D-13, RW106A-07, RW106A-13, and RW106B-13

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - BH57-III**
**NORTH QUARRY**

**FIGURE 5.3**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH57-III.grf
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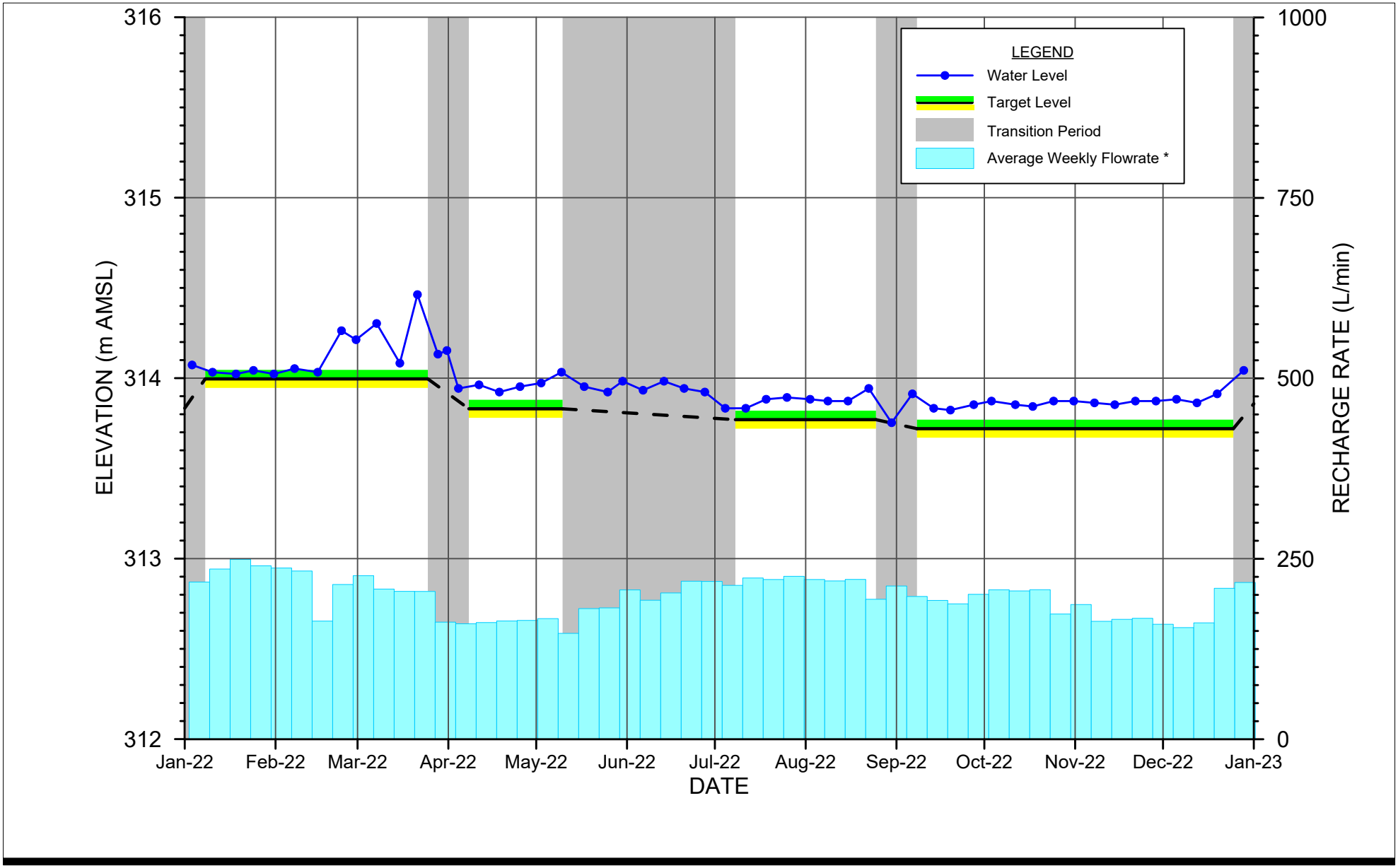


* Includes flow from RW105A-09, RW106A-13, RW106B-13, RW106C-11 RW106D-07, RW106D2-15, RW107A-07, and RW107D-09

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - BH59**
**NORTH QUARRY**

**FIGURE 5.4**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH59.grf
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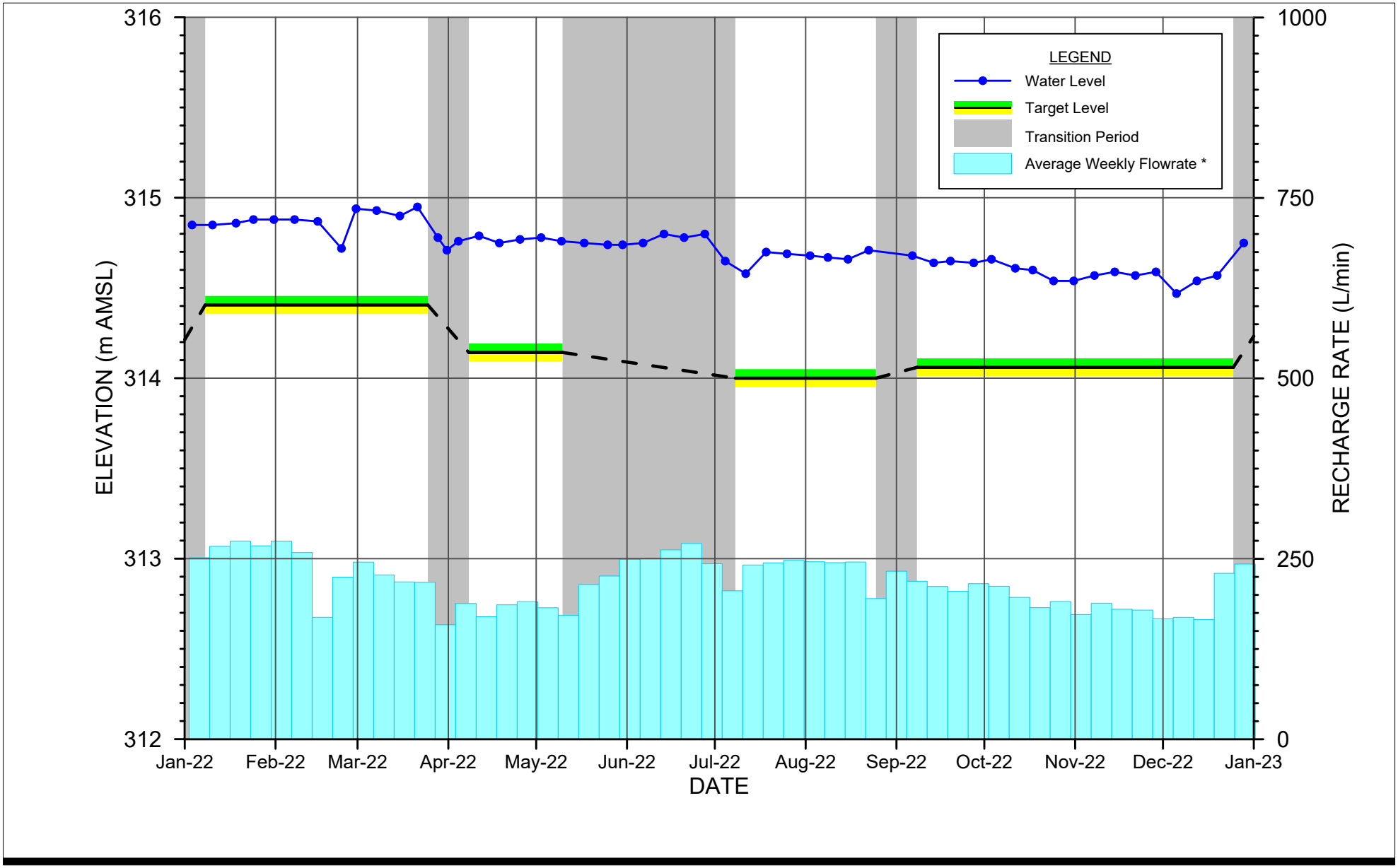


* Includes flow from RW106C-11, RW107B-15, RW107D-09, RW108A-07, and RW108D-09

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - BH60**
**NORTH QUARRY**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.5**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH60.grf
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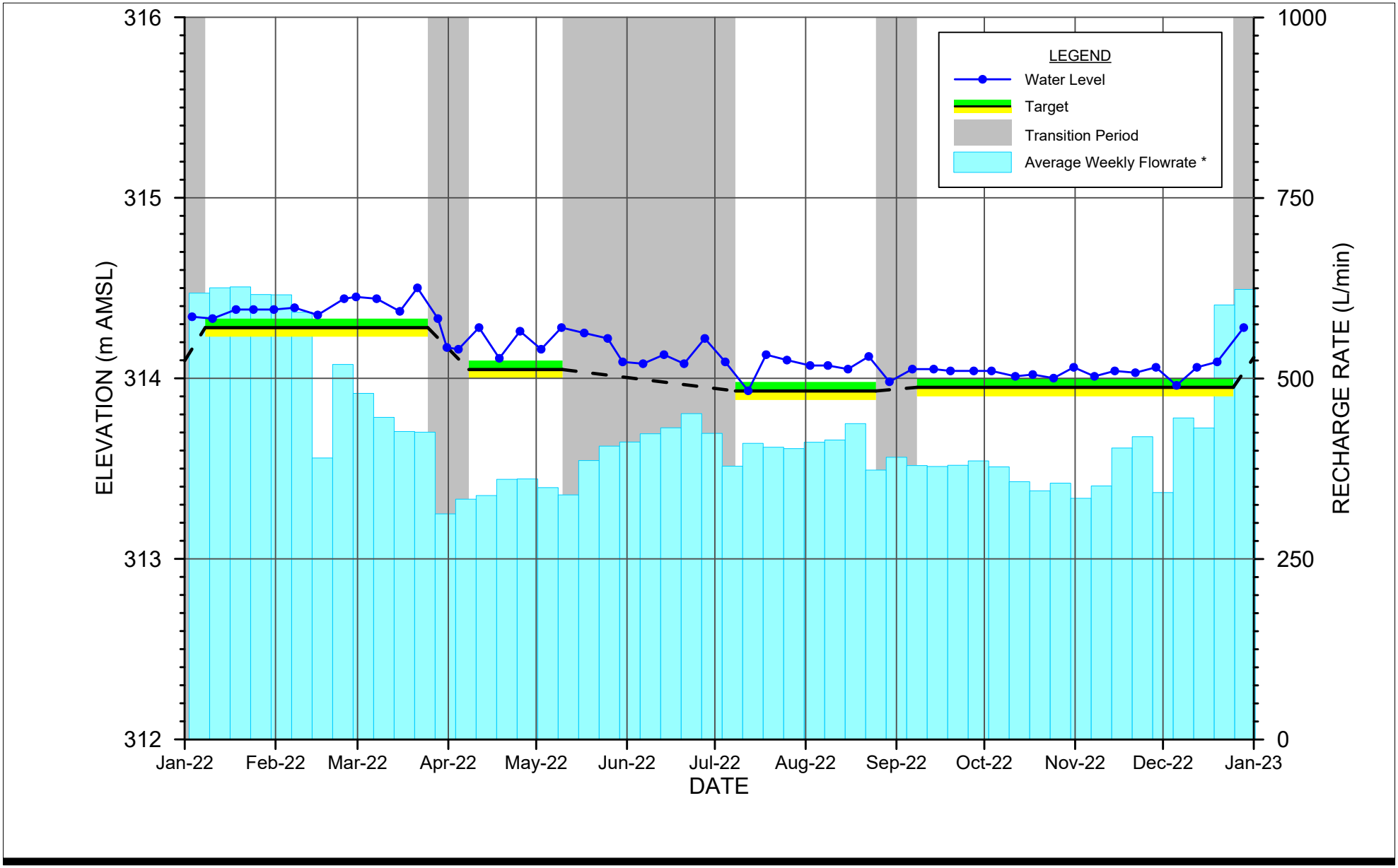


* Includes flow from RW106C-11, RW107B-15, RW107C-15, RW107D-09, RW108A-07, RW108B-15, RW108C-15, and RW108D-09.

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - BH61-III**
**NORTH QUARRY**

**FIGURE 5.6**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH61-III.grf
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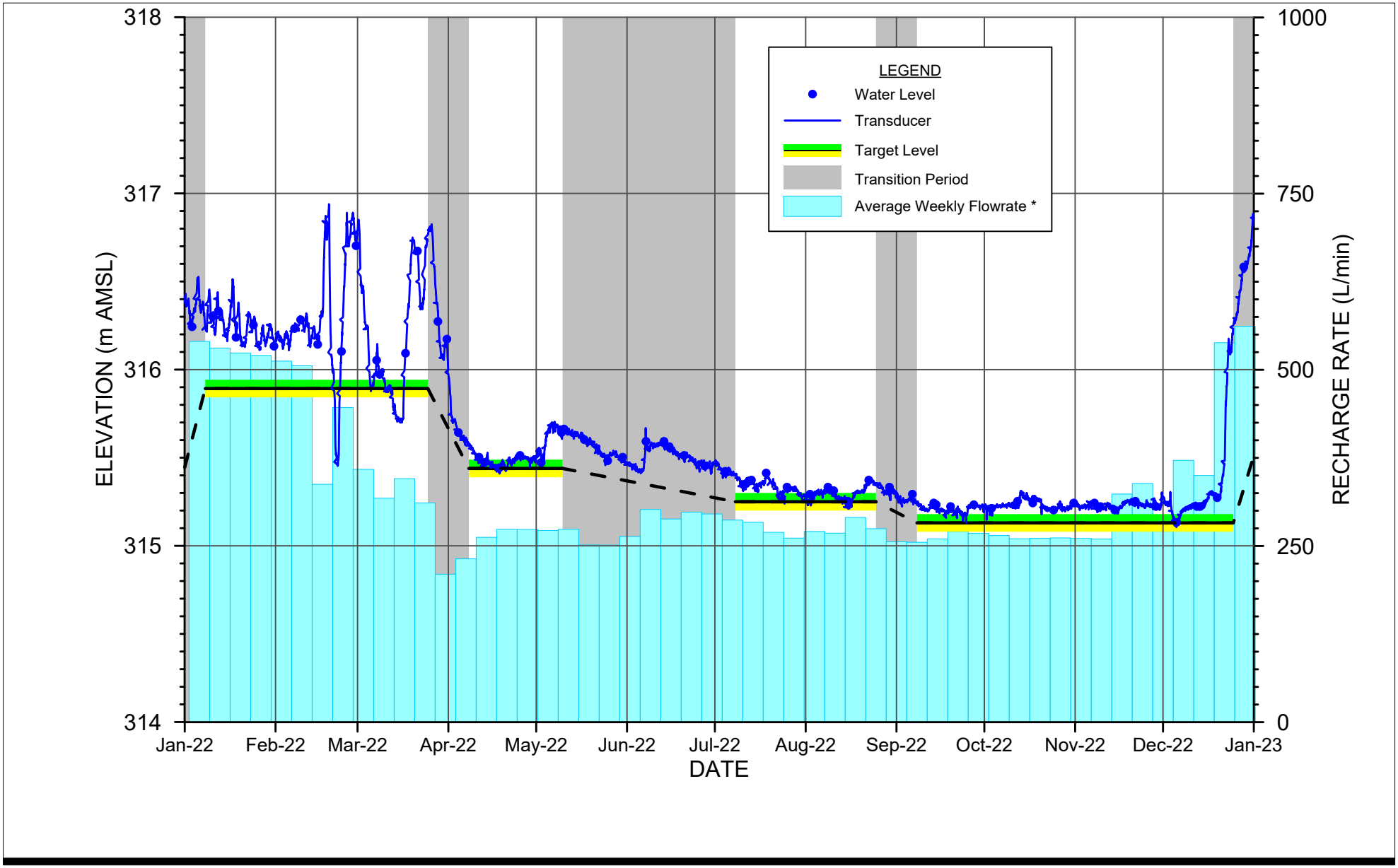


* Includes flow from RW108A-07, RW108C-15, RW108D-09, RW109A-07, RW109B-09, RW109C-07, and RW109D-07.

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**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - BH37**
**NORTH QUARRY**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.7**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\1 NQ Triggers (5.1-5.7)\BH37.grf
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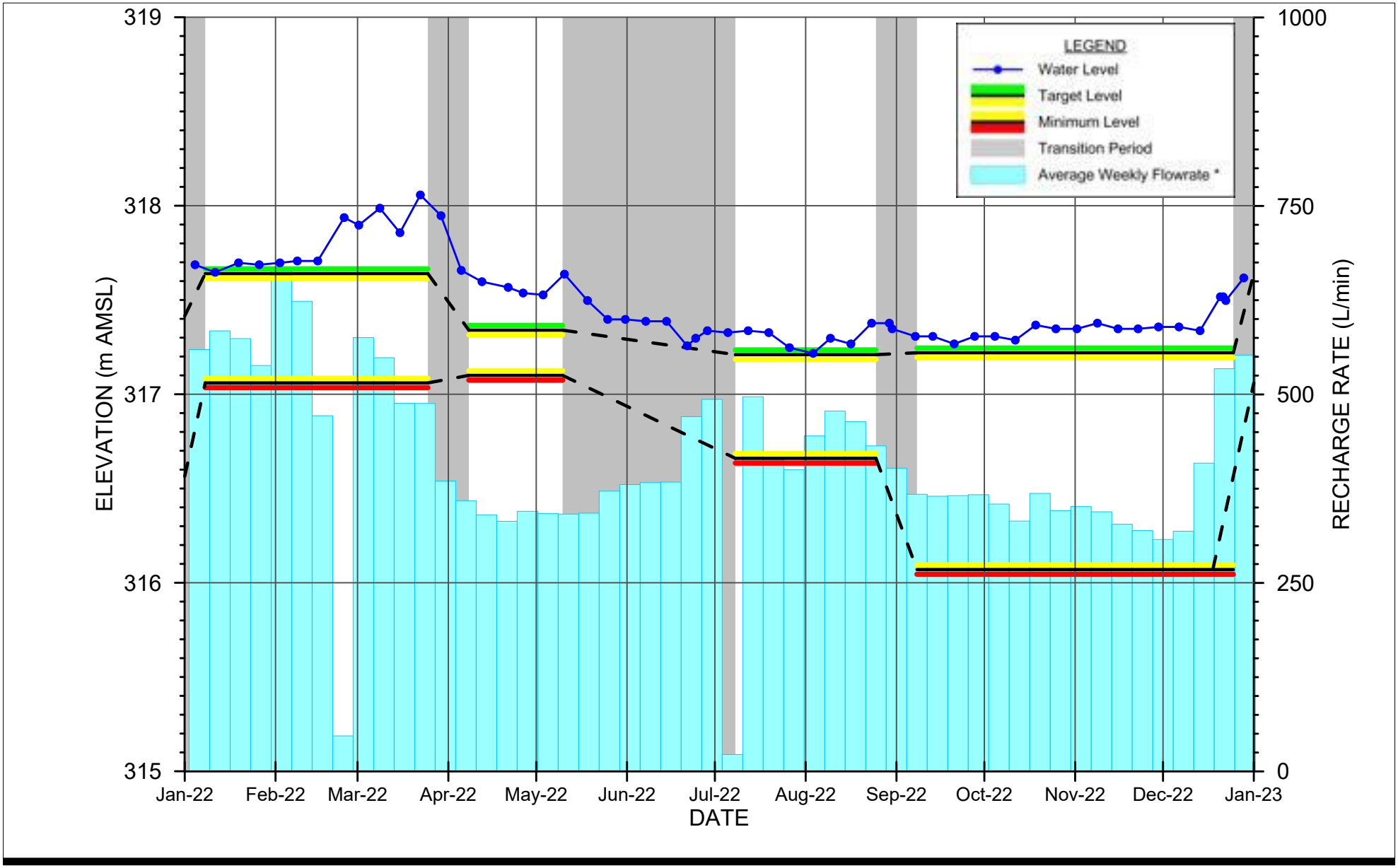


* Includes flow from MWx1-15, RW201A-09, RW201B-09, RW202A-09, RW203C-11, RW203D-11, RW204C-13, RW204D-11, and RW204D2-15.

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW27-04**
**WEST CELL EXTENSION**

**FIGURE 5.8**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW27-04.grf
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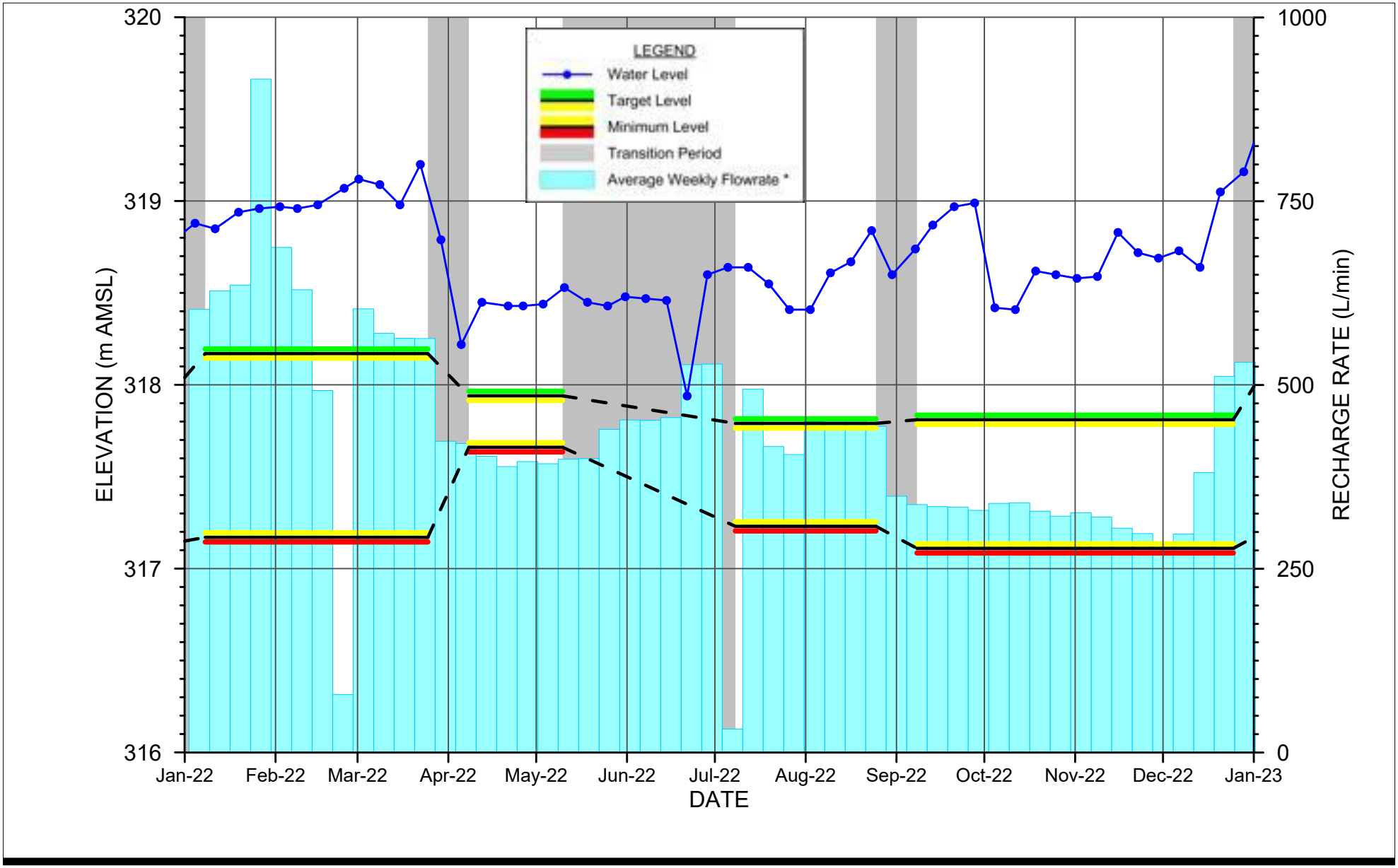


* Includes flow from RW201B-09, RW202A-09, RW203A-09, RW203C-11, RW203D-11, RW204C-13, RW204D-11, and RW204D2-15.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW28-04**
**WEST CELL EXTENSION**

**FIGURE 5.9**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW28-04.grf
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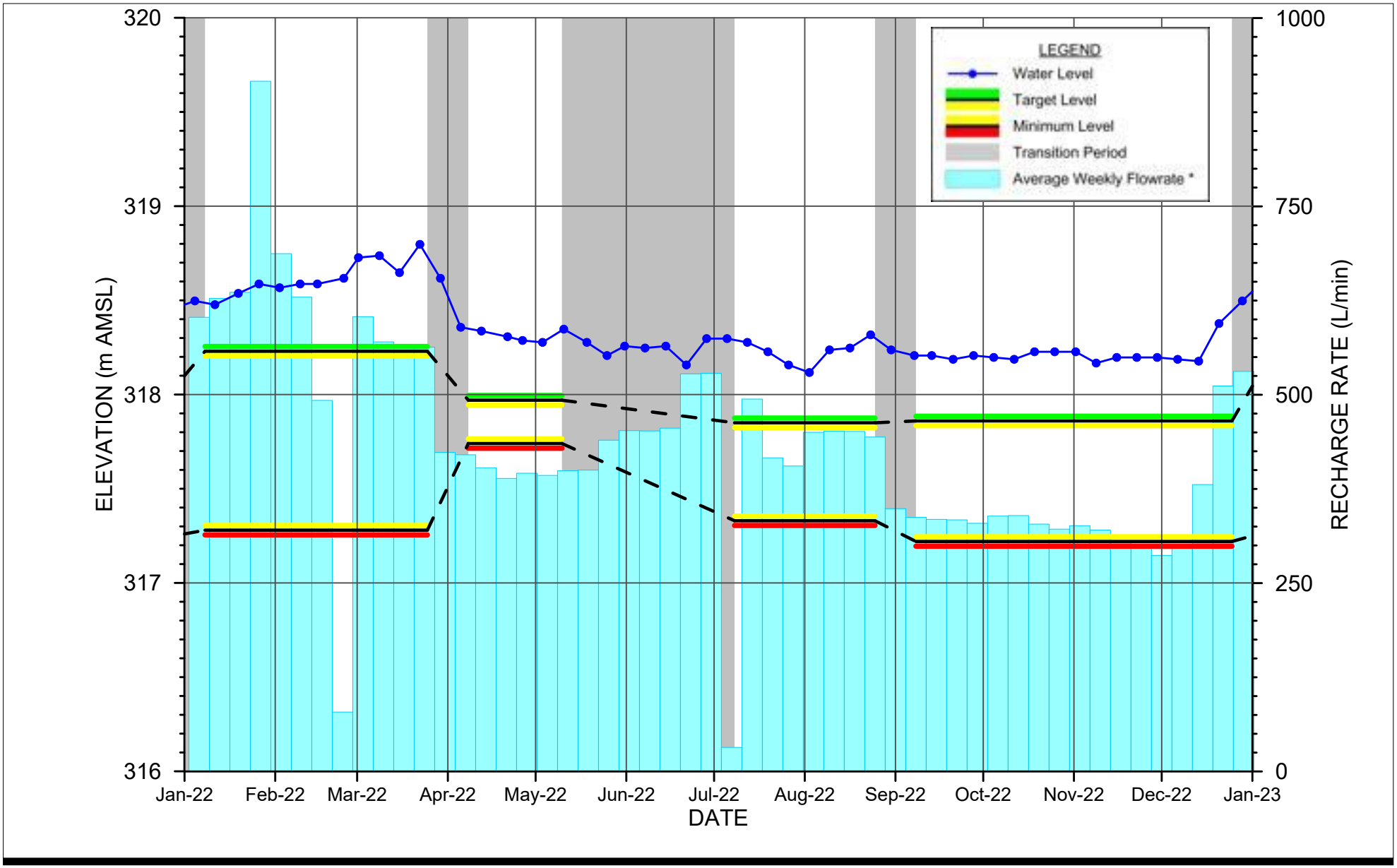


* Includes flow from RW202A-09, RW203A-09, RW203B-09, RW203C-11, RW203D-11, RW204C-13, RW204D-11, and RW204D2-15.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - OW29-04**
**WEST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.10**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW29-04.grf
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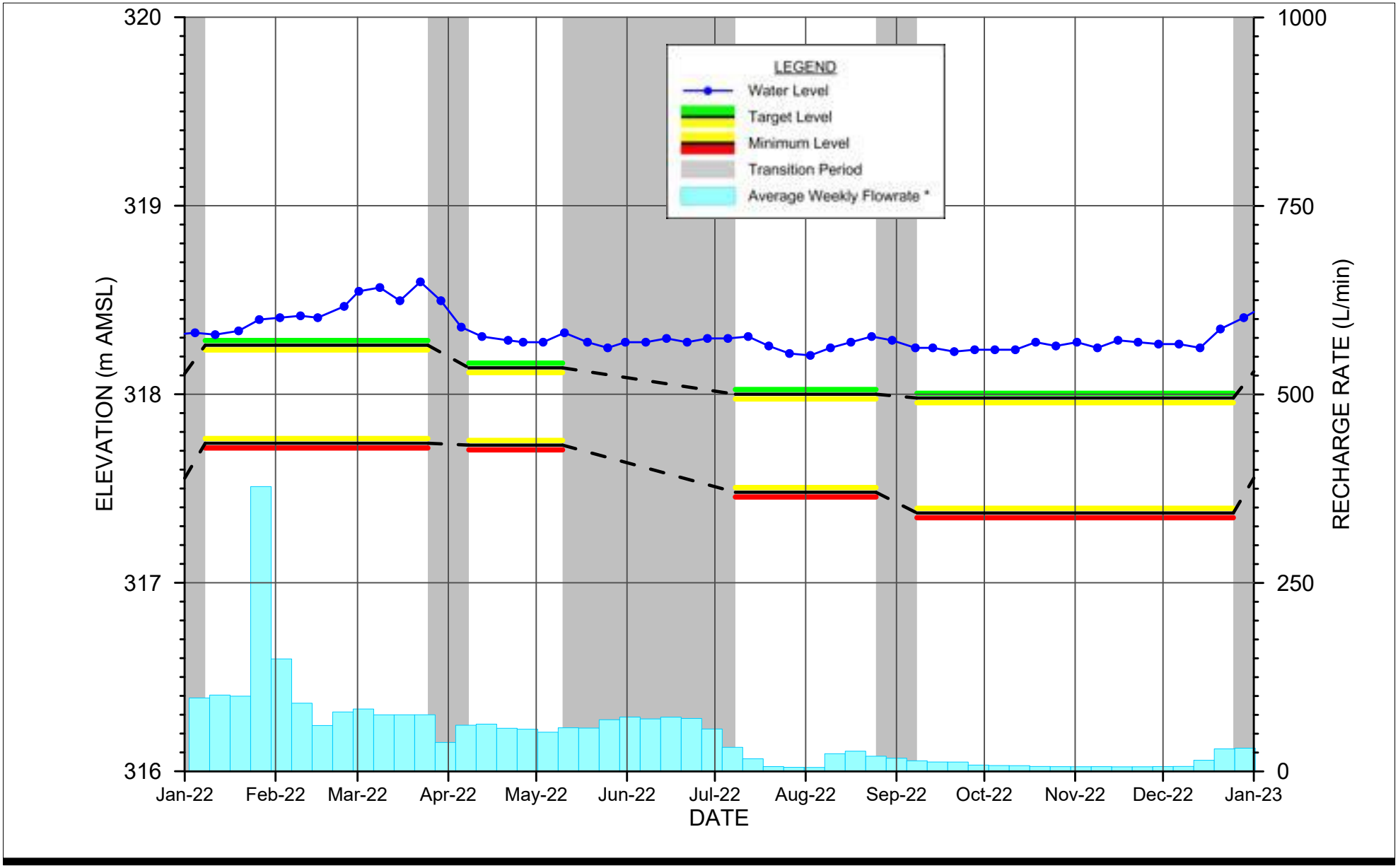


* Includes flow from RW203B-09, RW203C-11, RW204A-09, and RW204B-09.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW30-04**
**WEST CELL EXTENSION**

**FIGURE 5.11**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW30-04.grf
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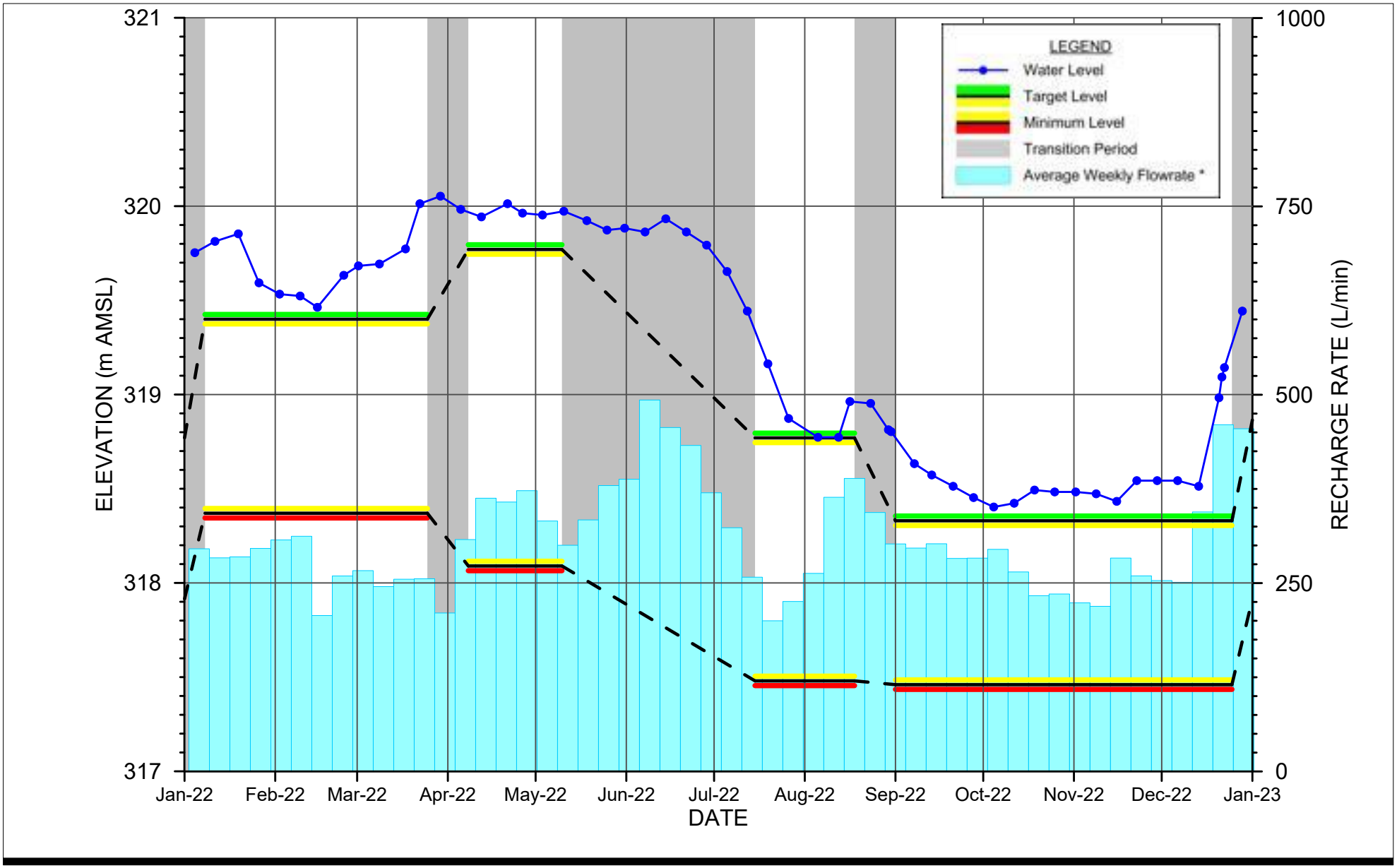


* Includes flow from RW203B-09, RW204A-09, RW204B-09, and RW205H-15.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - OW31-04**
**WEST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.12**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW31-04.grf
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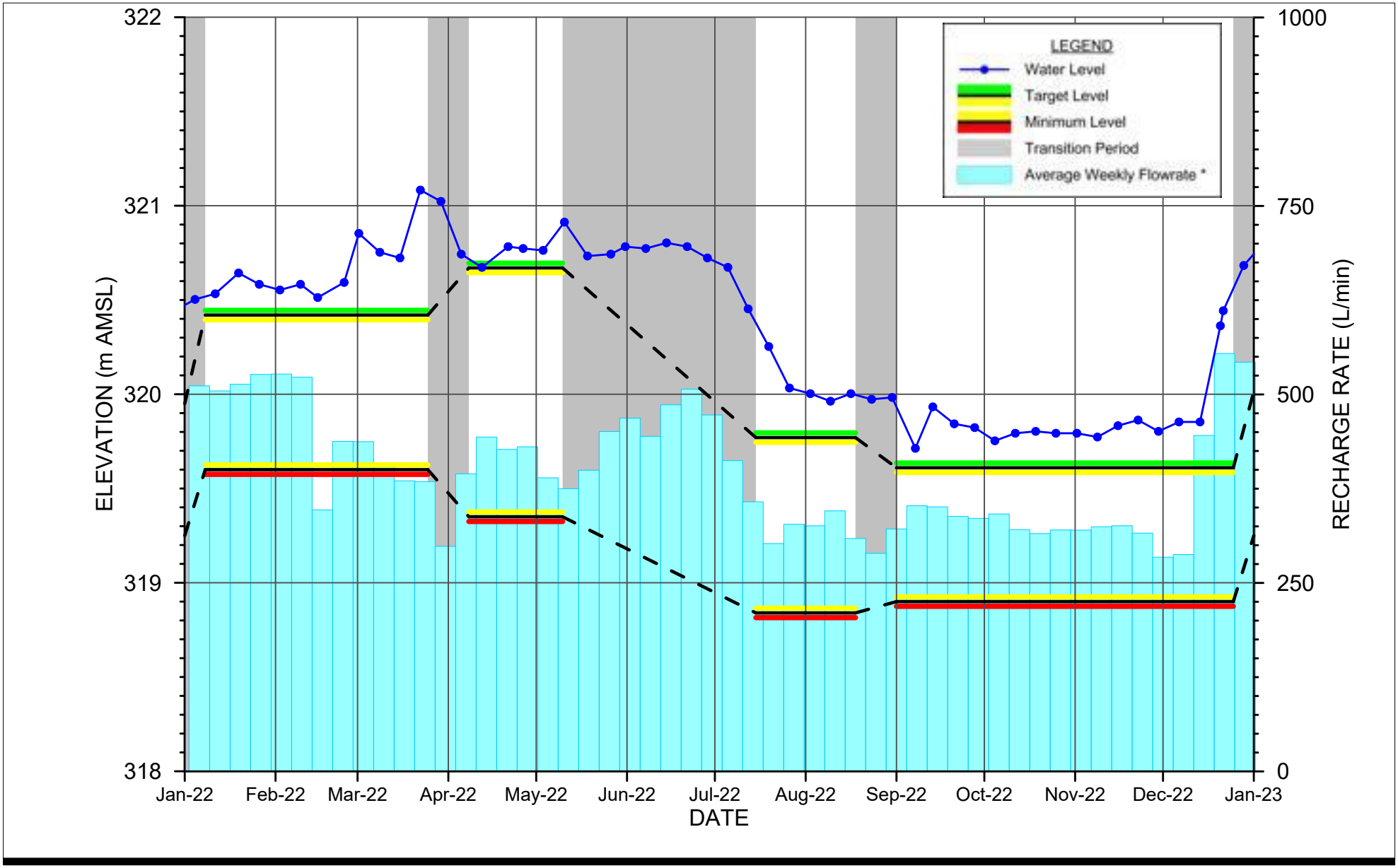


* Includes flow from RW204B-09, RW205A-09, RW205B-14, RW205C-15, RW205H-15, and RW206A-09.

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW32-04**
**WEST CELL EXTENSION**

**FIGURE 5.13**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW32-04.grf
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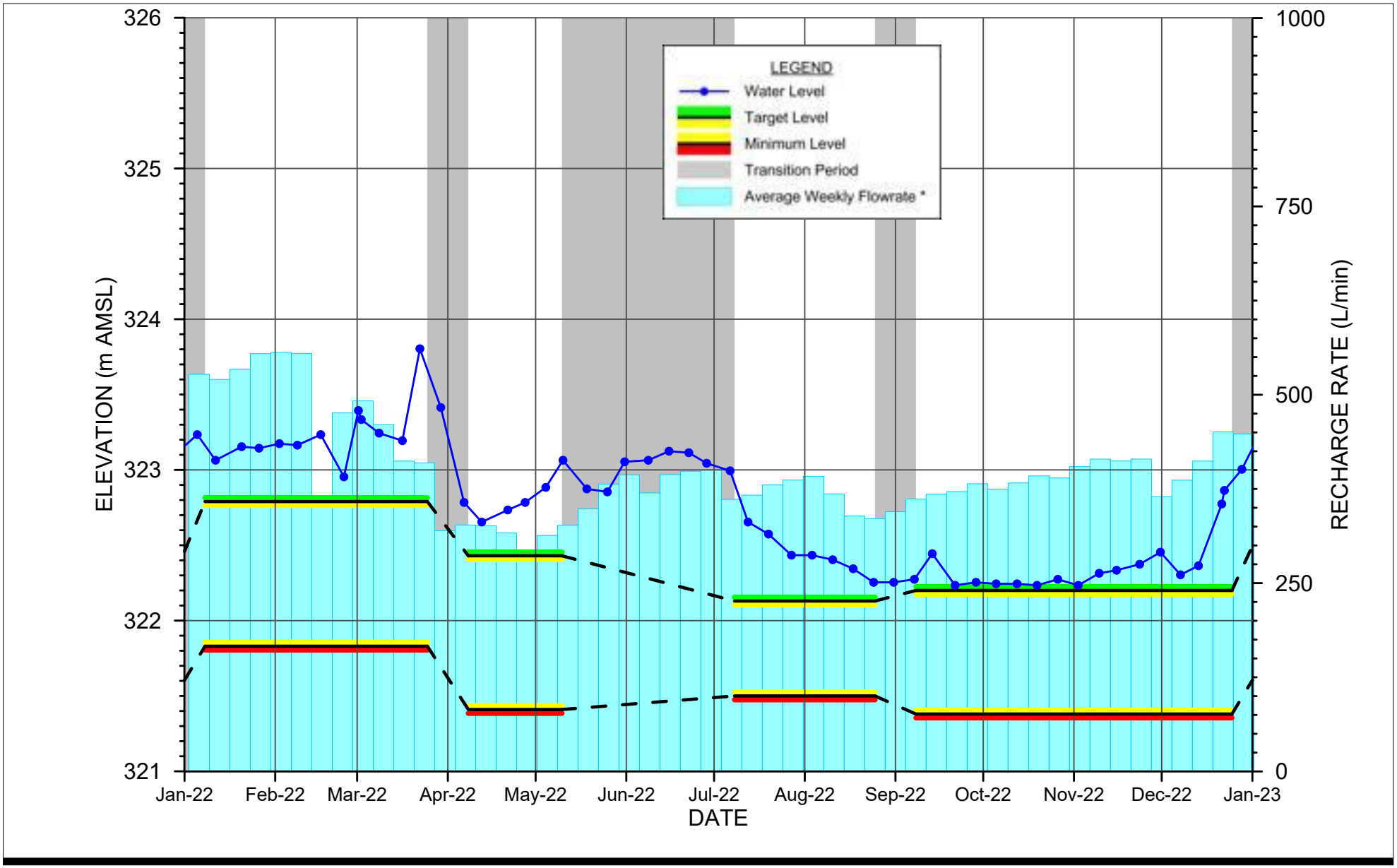



* Includes flow from RW205A-09, RW205C-15, RW206A-09, RW206B-09.

GHD

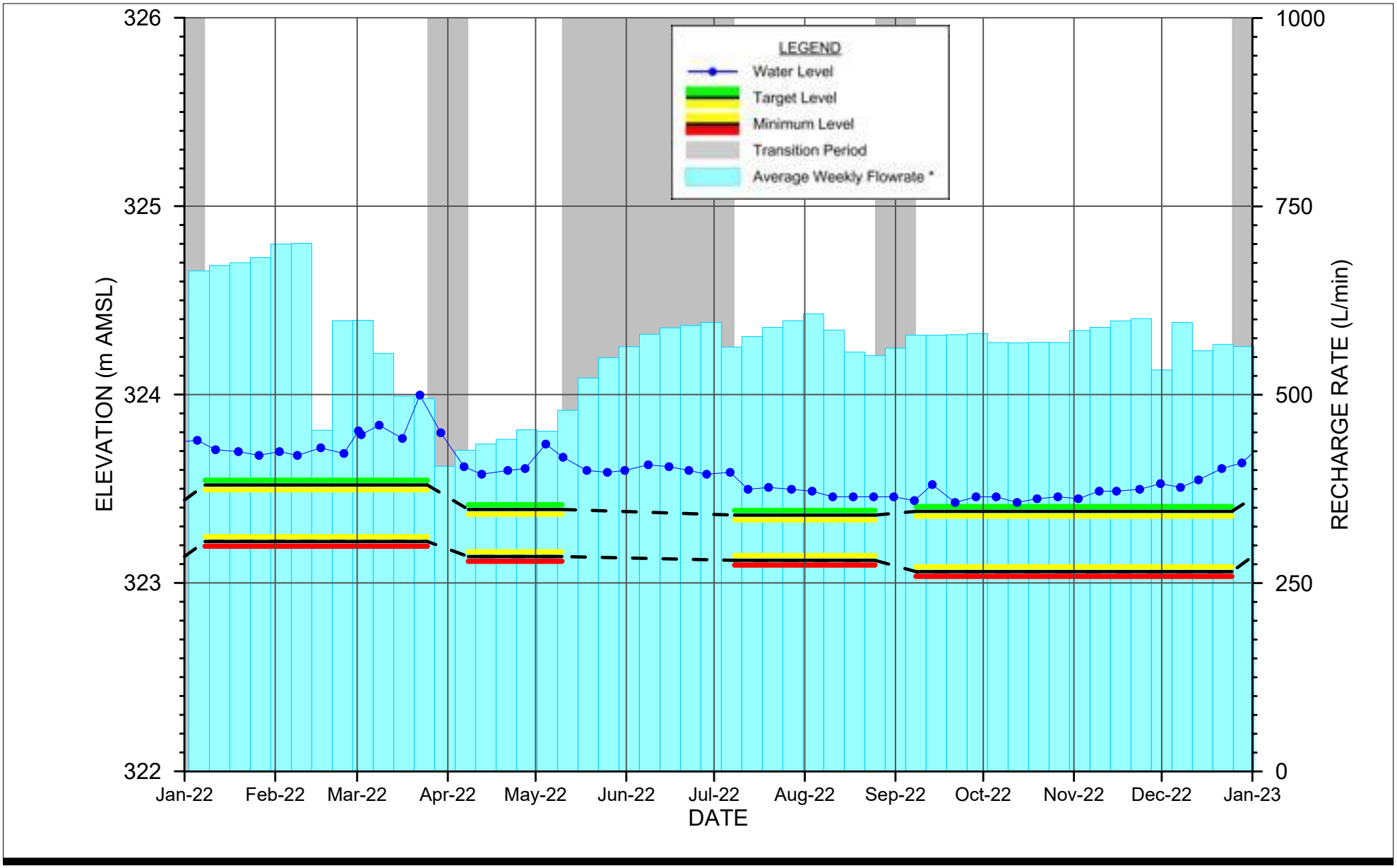
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW33-04**
**WEST CELL EXTENSION**

**FIGURE 5.14**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW33-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW205D-16, RW206A-09, and RW206B-09.

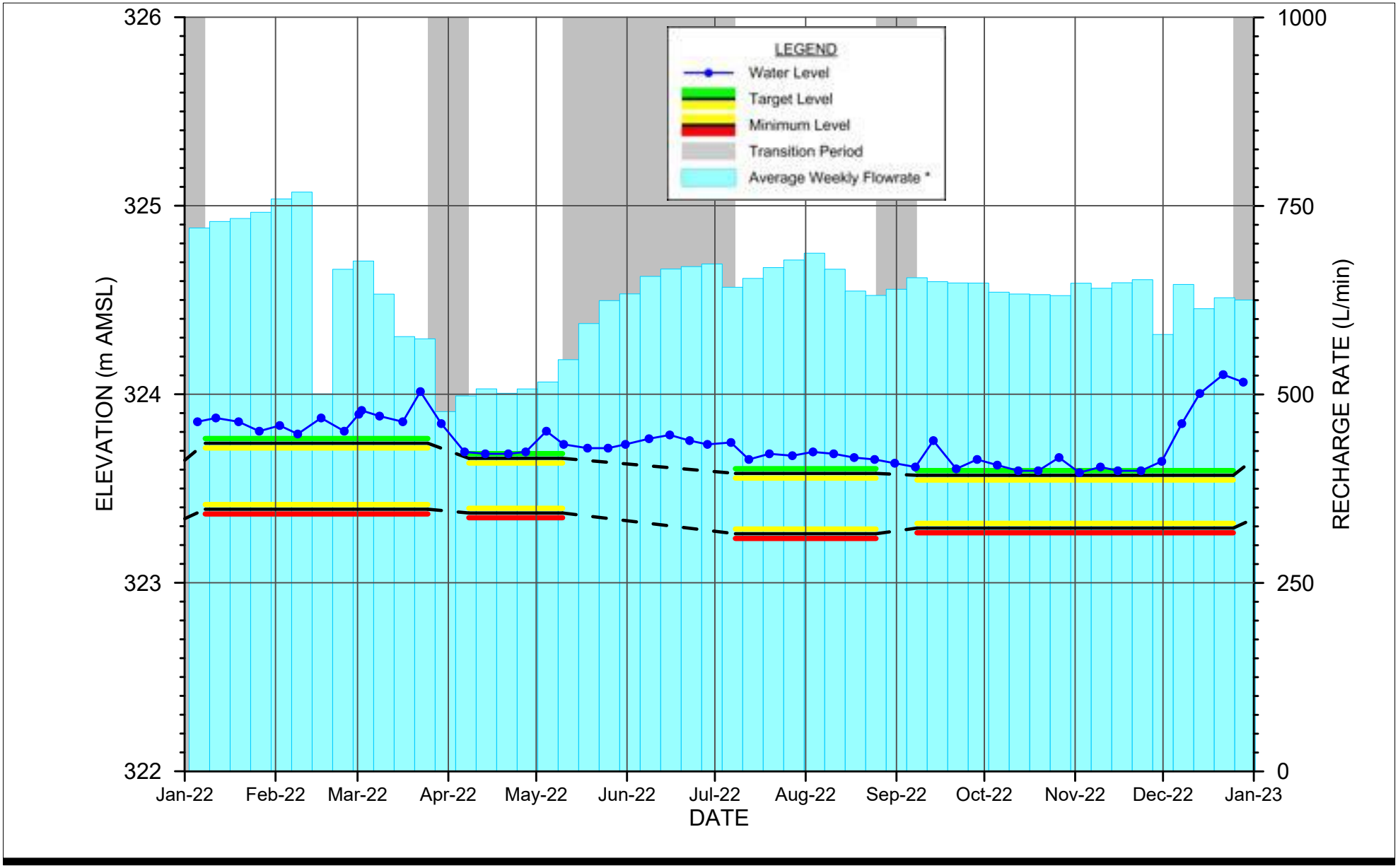
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW34-04**
**WEST CELL EXTENSION**

**FIGURE 5.15**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW34-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW205F-19, RW206A-09, RW206B-09, and RW206C-20.

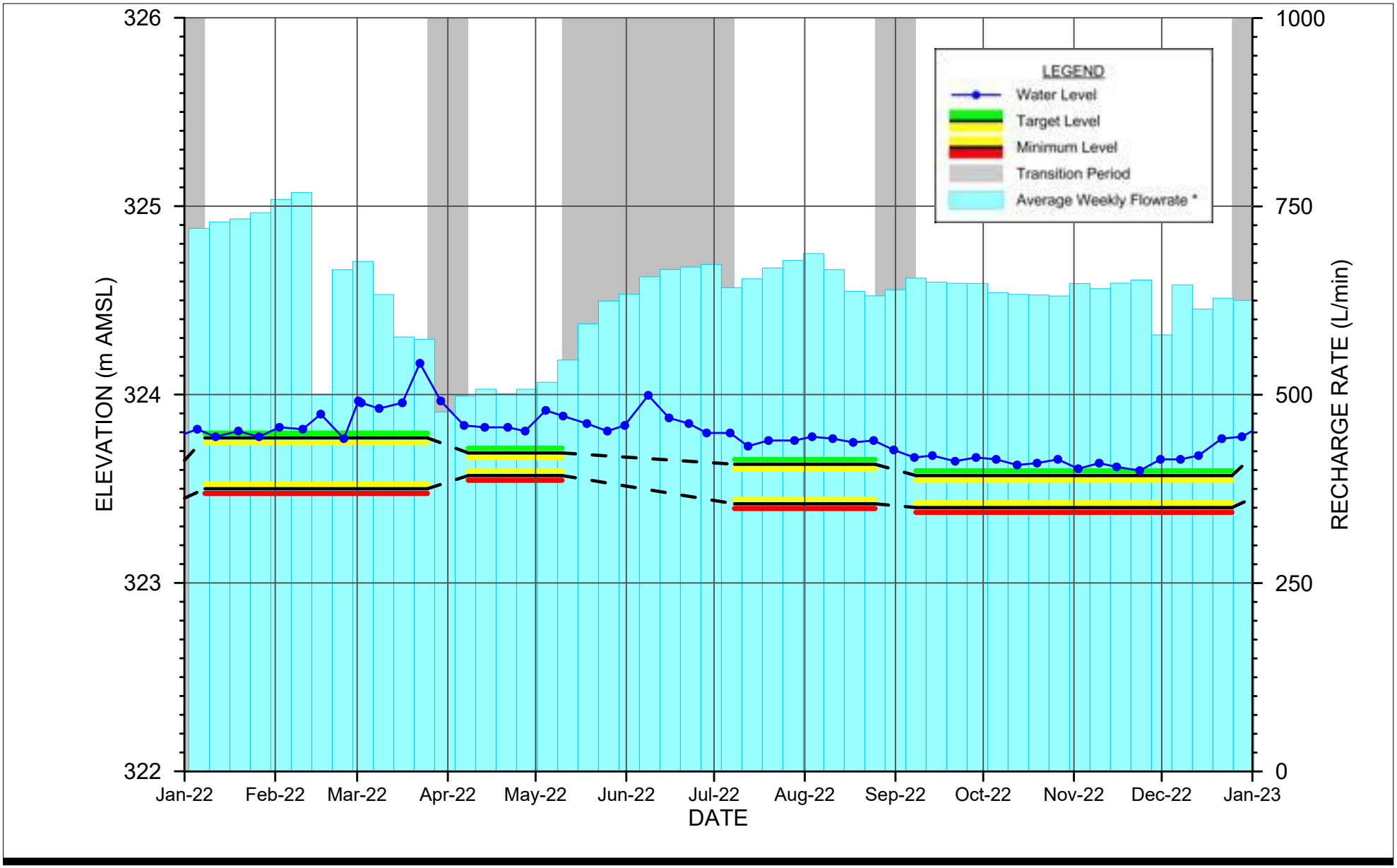
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW35-04**
**WEST CELL EXTENSION**

**FIGURE 5.16**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW35-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW206B-09, RW206C-14, RW206C-20, RW207A-09, RW207C-14, and RW208B-14.

GHD

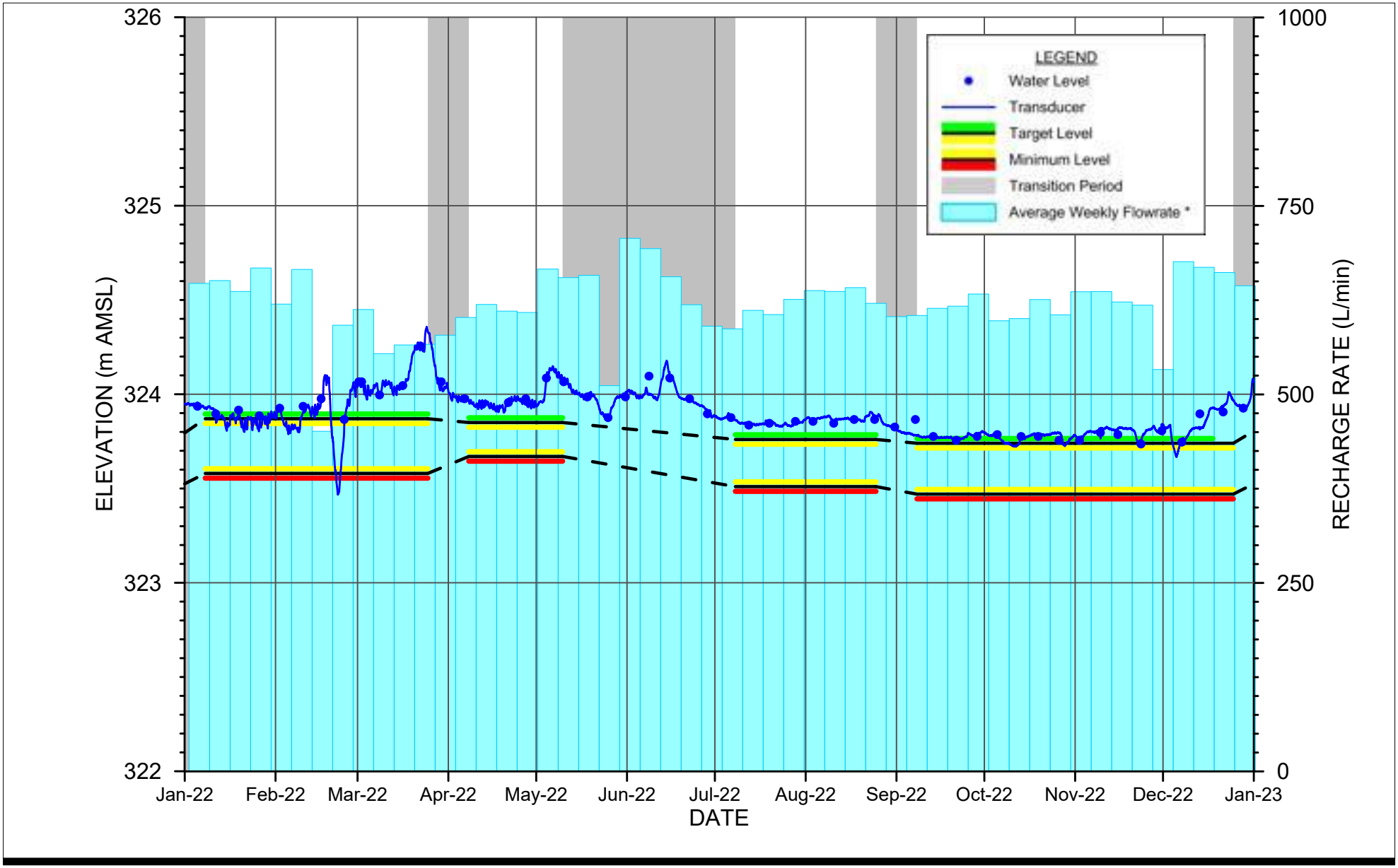
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - OW36-04**
**WEST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.17**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW36-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW207A-09, RW207B-09, RW208A-09, RW208B-14, RW208D-13, RW208F-97, RW209B-13, RW209C-13, and RW209C-16.

GHD

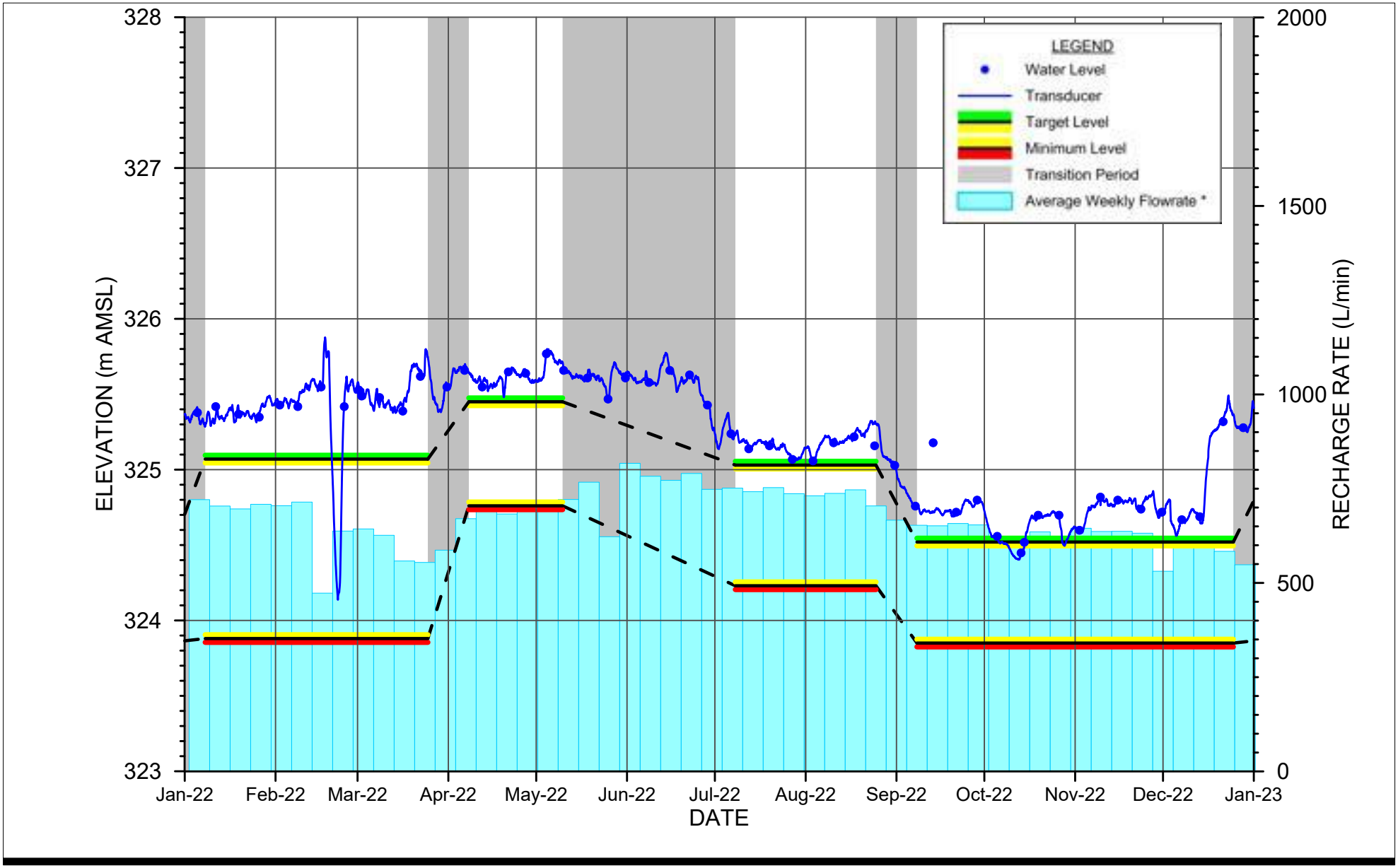
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW37-04**
**WEST CELL EXTENSION**

**FIGURE 5.18**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW37-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW208A-09, RW208B-14, RW208D-13, RW208F-97, RW208G-16, RW209A-09, RW209B-13, RW209C-13, RW209C-16, RW209D-13, and RW301B-14.

GHD

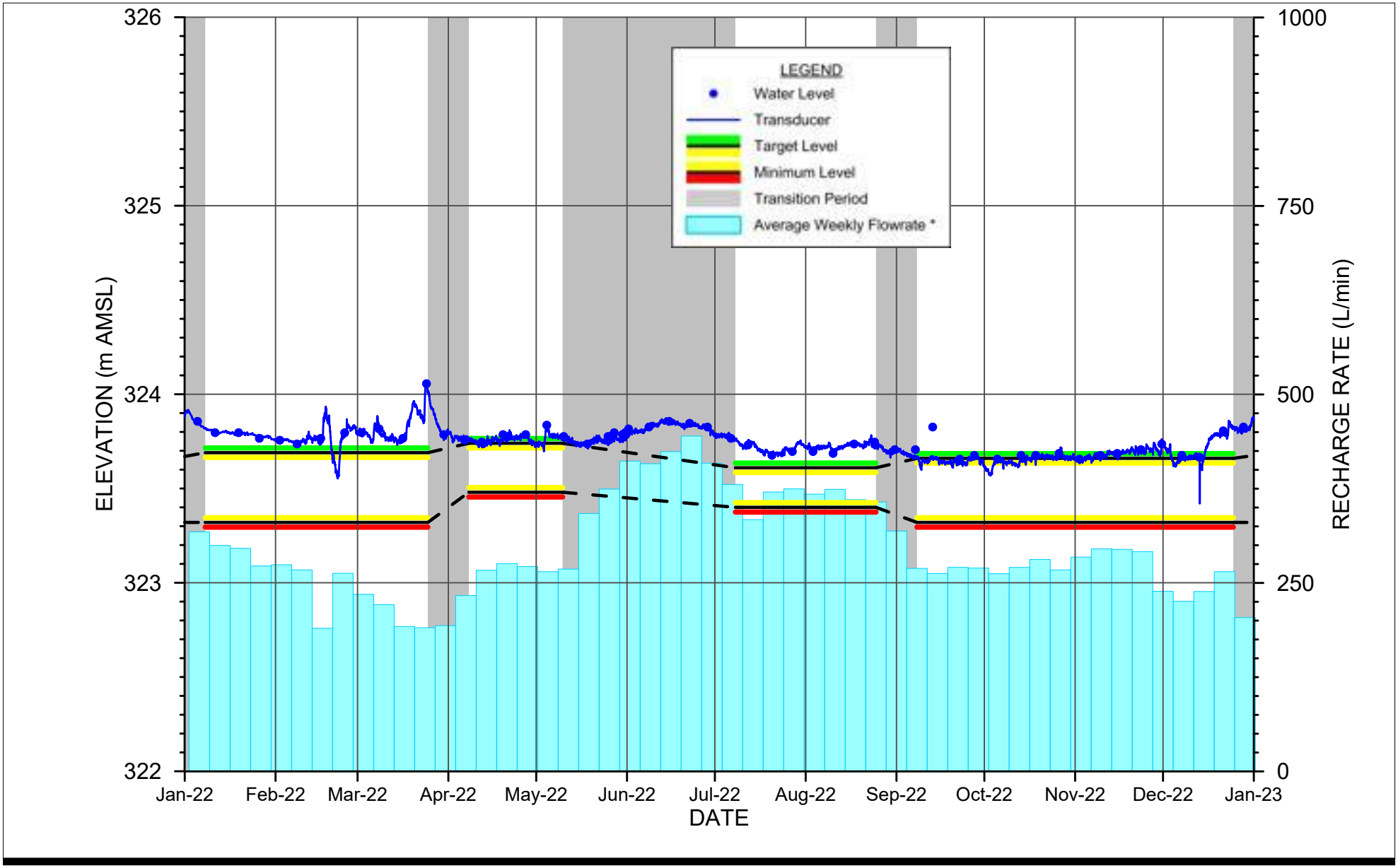
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW38-04**
**WEST CELL EXTENSION**

**FIGURE 5.19**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\2 WC Triggers (5.8-5.19)\OW38-04.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW209A-09, RW209B-13, RW209D-13, RW301A-10, RW301B-14, and RW302A-10.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW60-07**
**EAST CELL EXTENSION**

**FIGURE 5.20**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW60-07.grf
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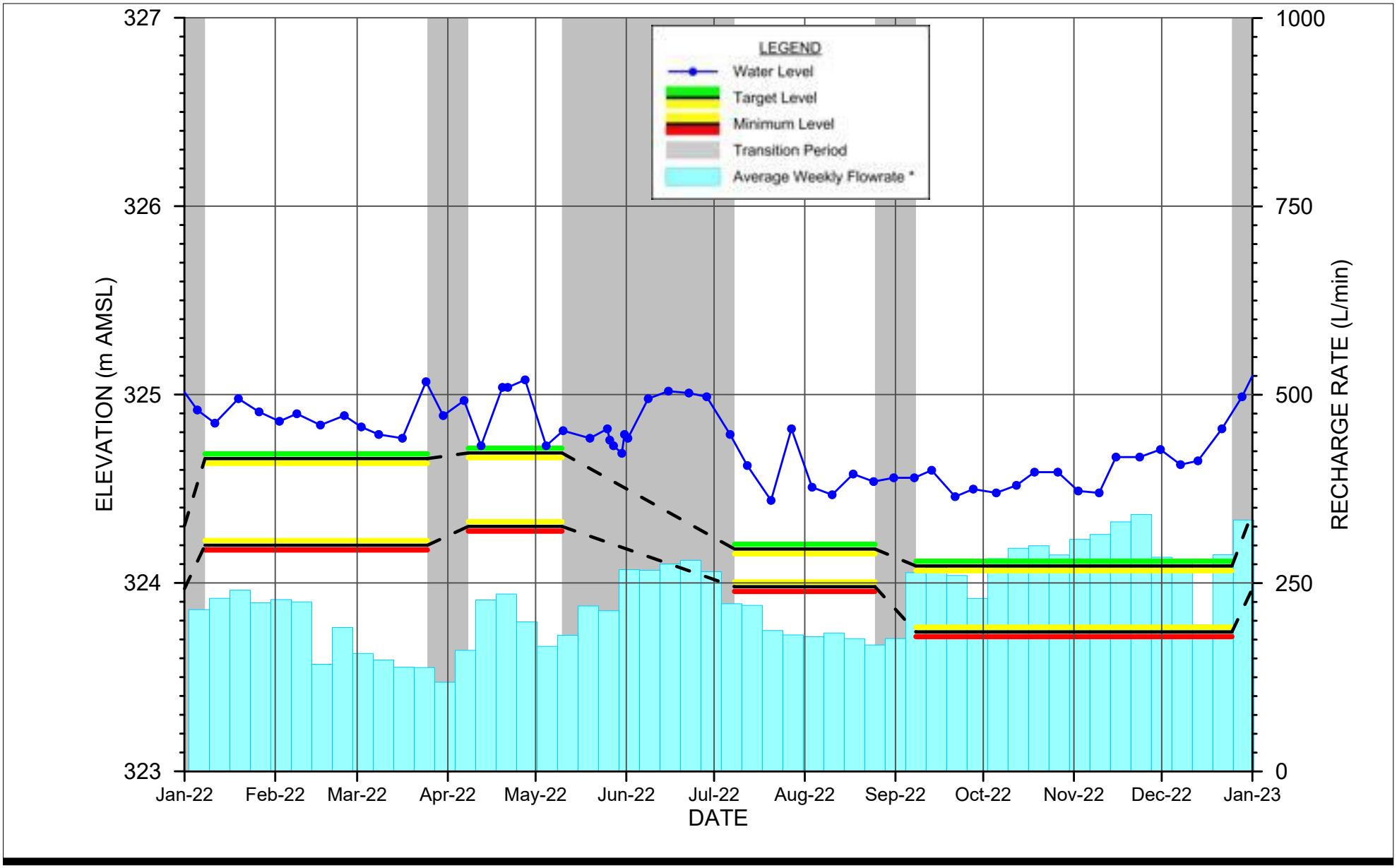



* Includes flow from RW301A-10, RW301B-14, RW302A-10, and RW302B-10.

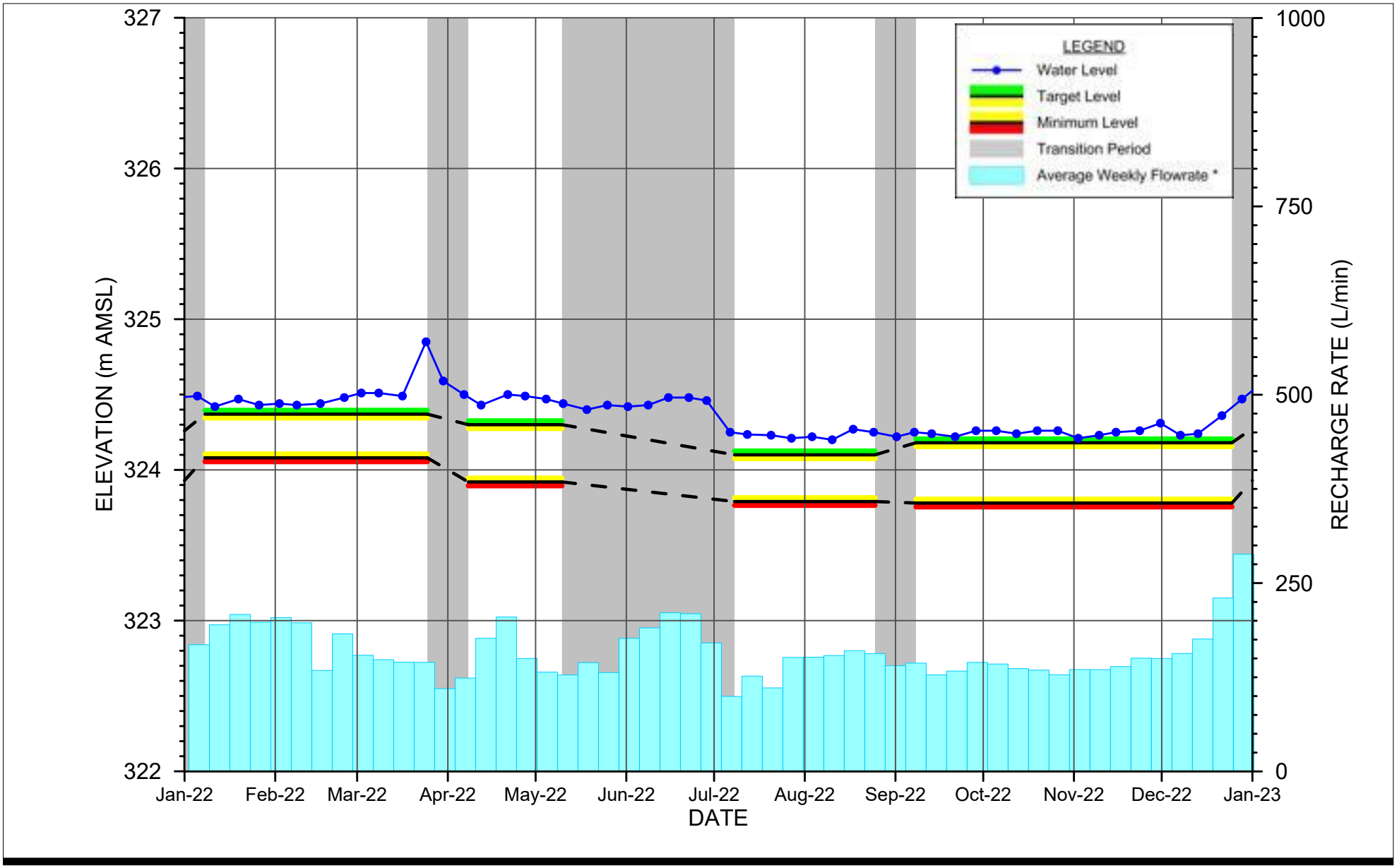
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW61-07**
**EAST CELL EXTENSION**

**FIGURE 5.21**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW61-07.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW302A-10, RW302B-10, RW302C-15, RW302D-15, RW303A-10, RW303B-10, RW304A-10, RW305A-10, and RW307A-10.

GHD

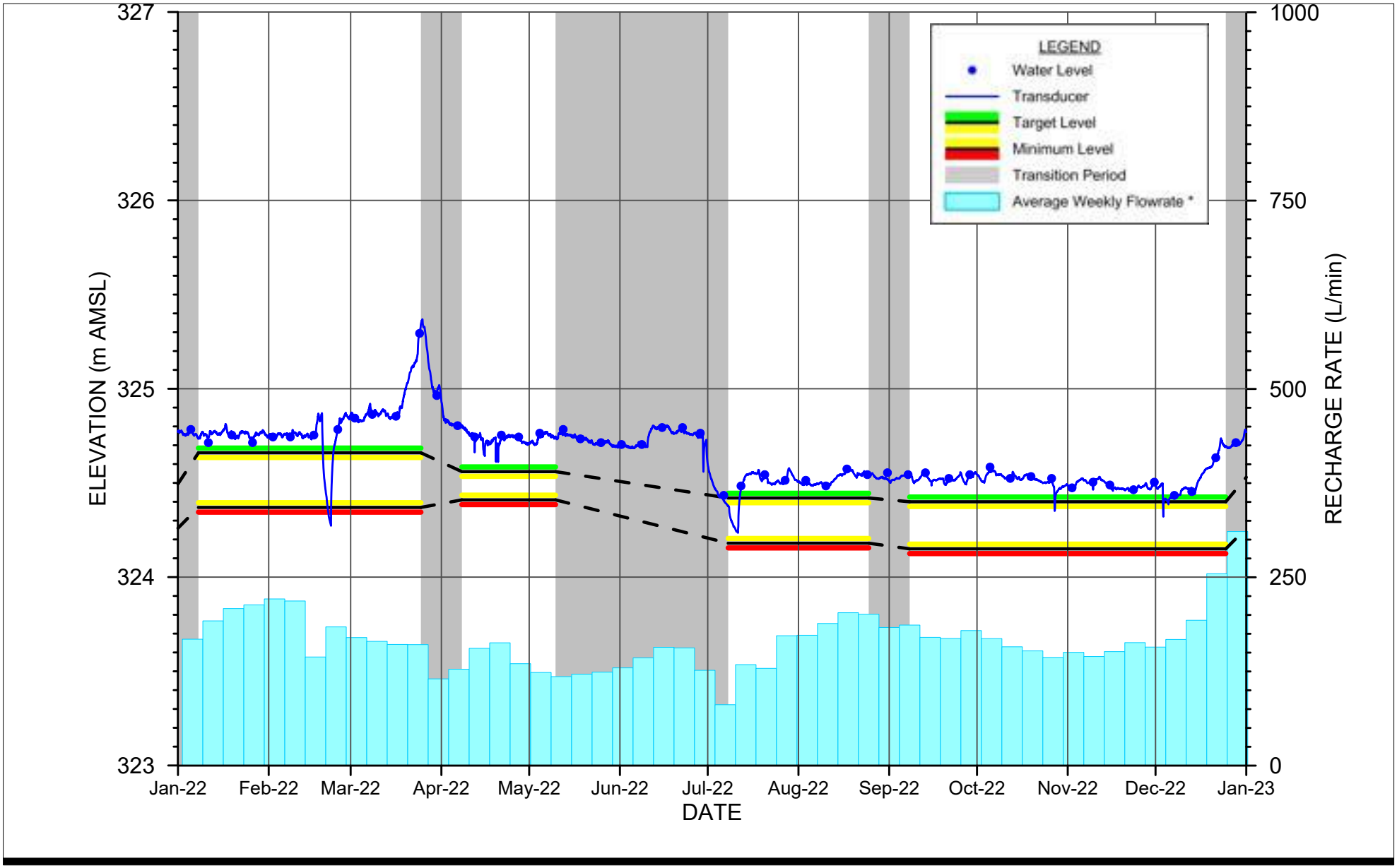
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW62-07**
**EAST CELL EXTENSION**

**FIGURE 5.22**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW62-07.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW302B-10, RW302C-15, RW302D-15, RW303A-10, RW303B-10, RW304A-10, RW305A-10, RW307A-10, and RW307B-15.

GHD

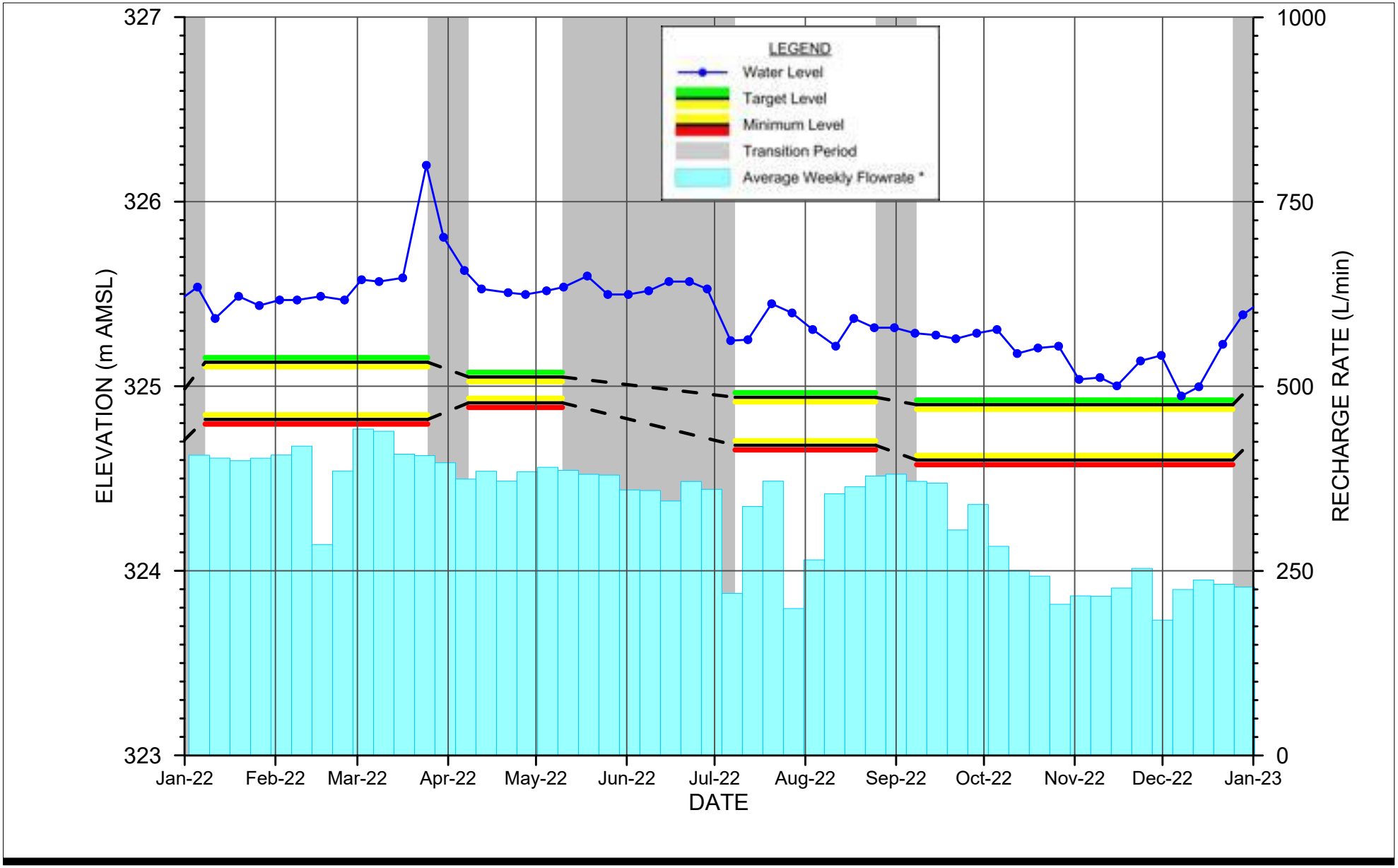
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW63-07**
**EAST CELL EXTENSION**

**FIGURE 5.23**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW63-07.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW304A-10, RW305A-10, RW307A-10, RW307B-15, and RW307D-17.

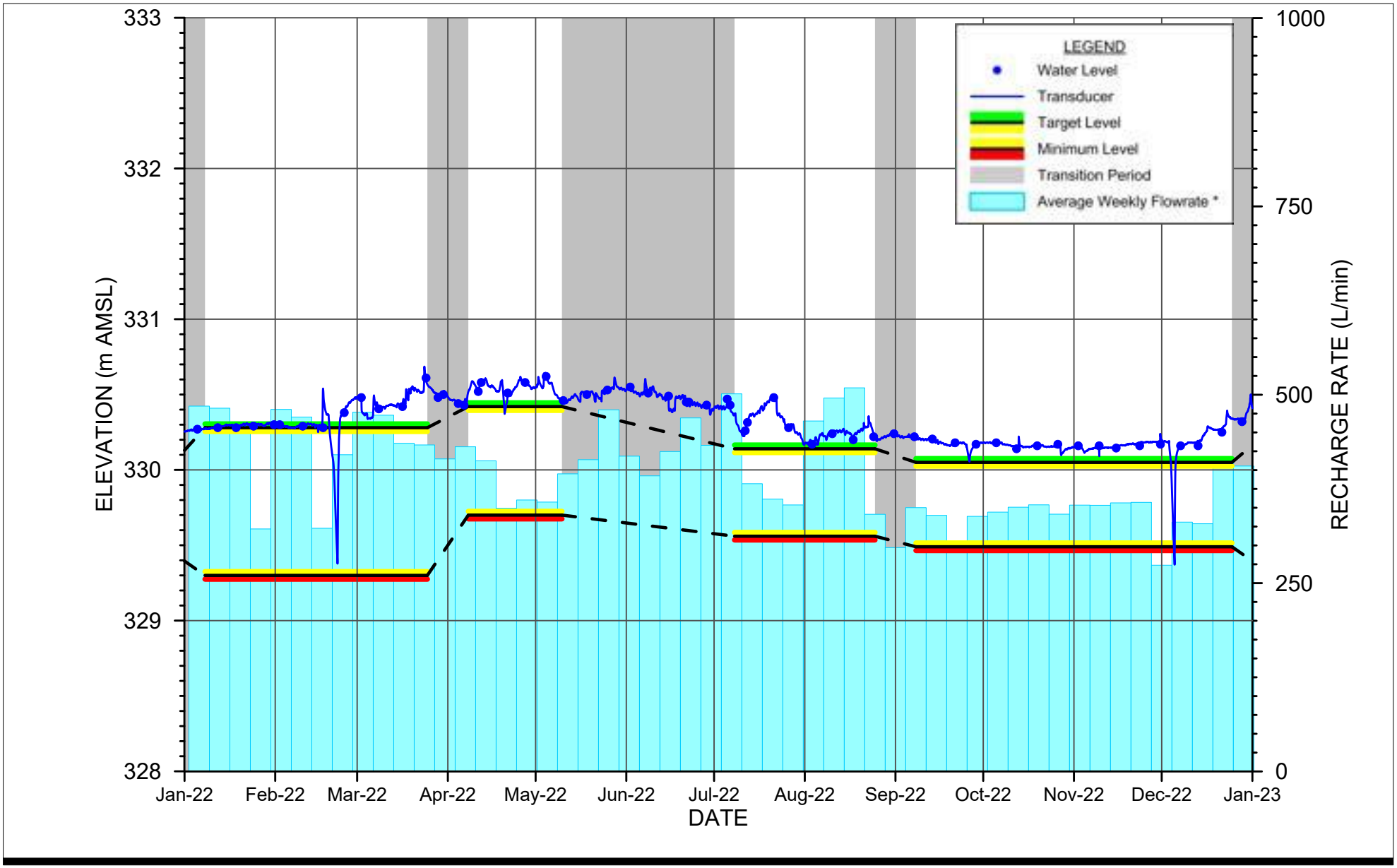
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW64-07**
**EAST CELL EXTENSION**

**FIGURE 5.24**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW64-07.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW305A-10, RW307A-10, RW308A-10, and RW308B-10.

GHD

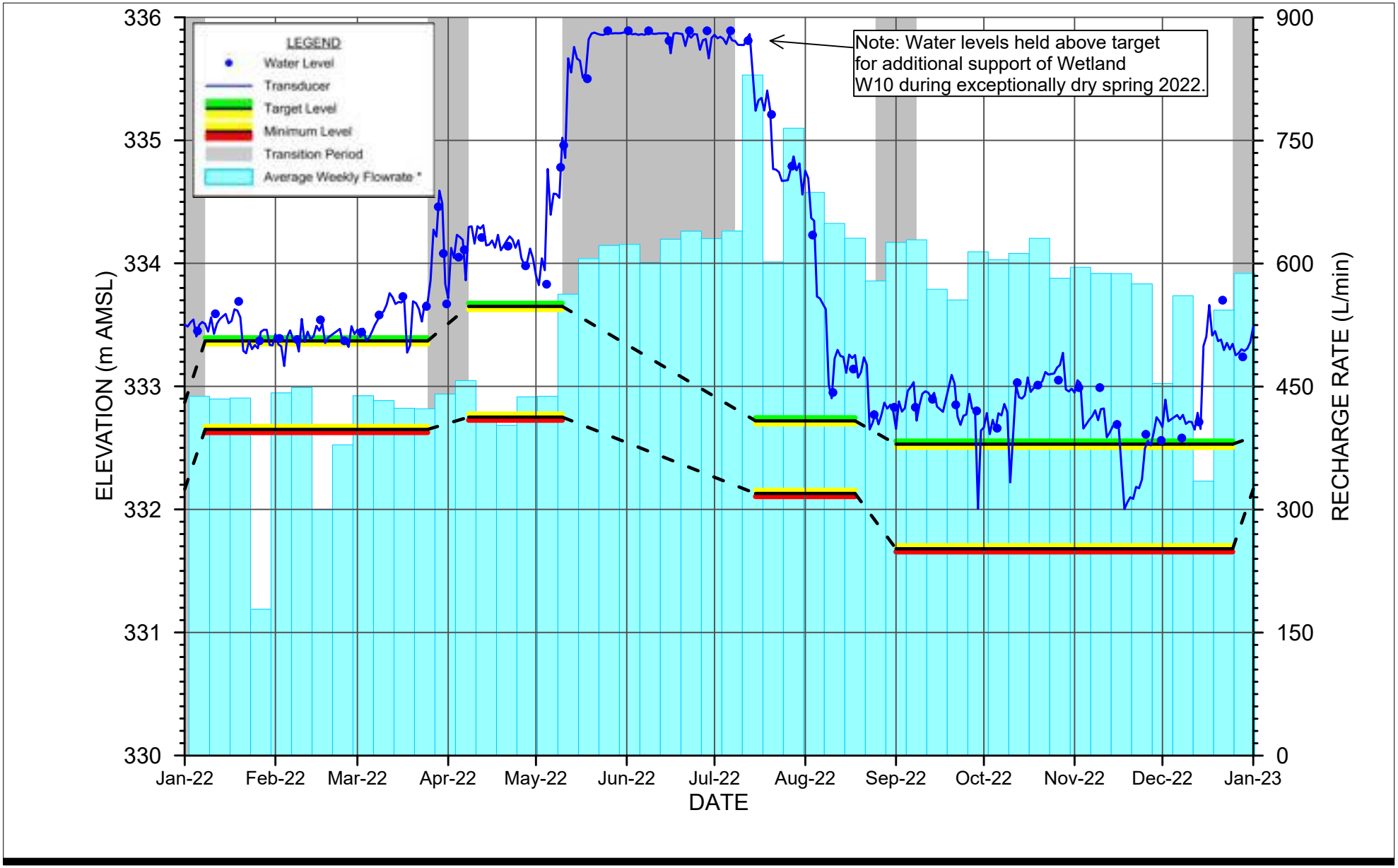
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - BH48**
**EAST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.25**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\BH48.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW308B-10, RW308E-20, RW308F-20, RW309A-10, RW309B-10, and RW309C-17.

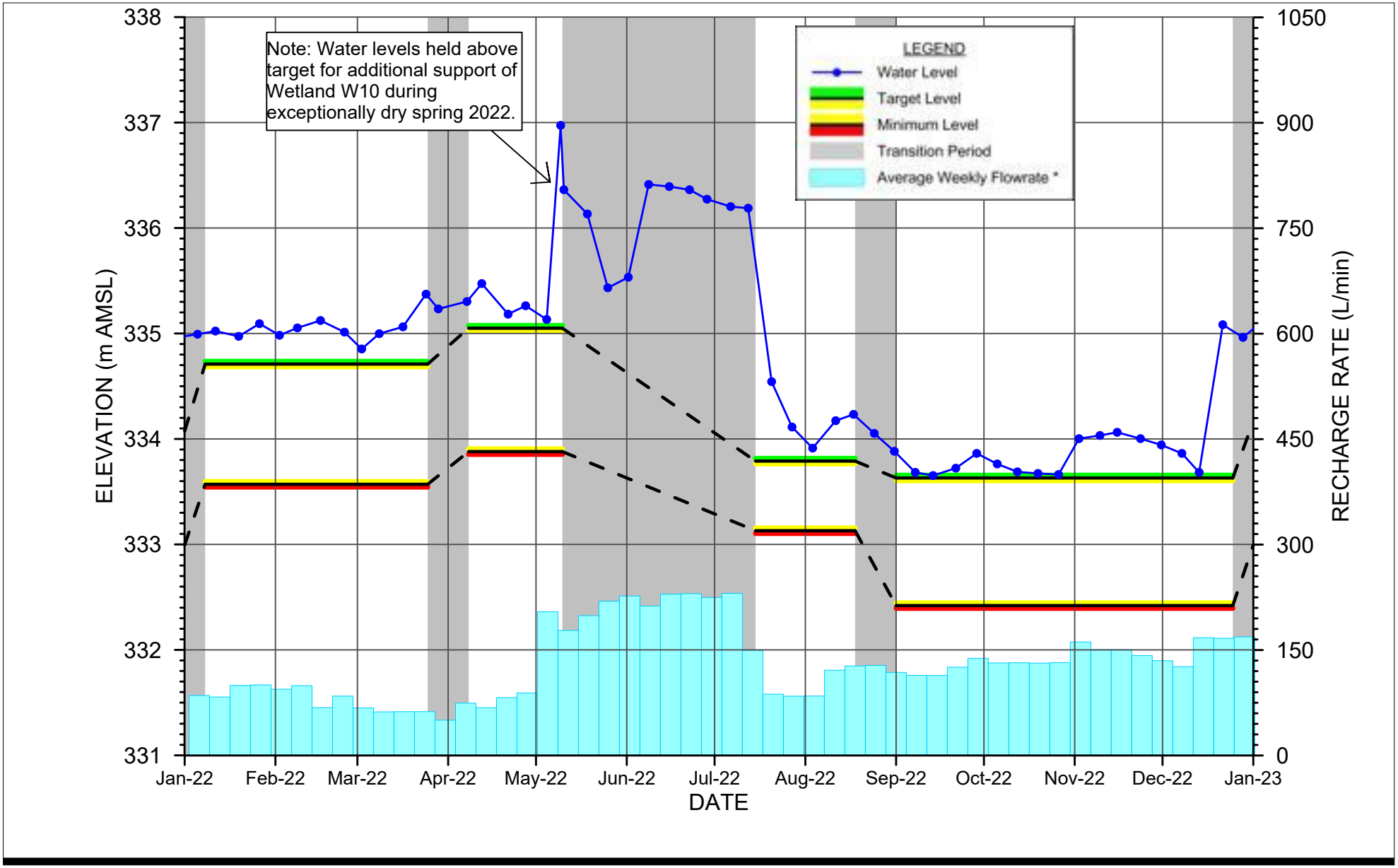
GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW65-07**
**EAST CELL EXTENSION**

**FIGURE 5.26**




* Includes flow from RW309B-10, RW310A-10, RW310B-17, and RW310C-17.

GHD

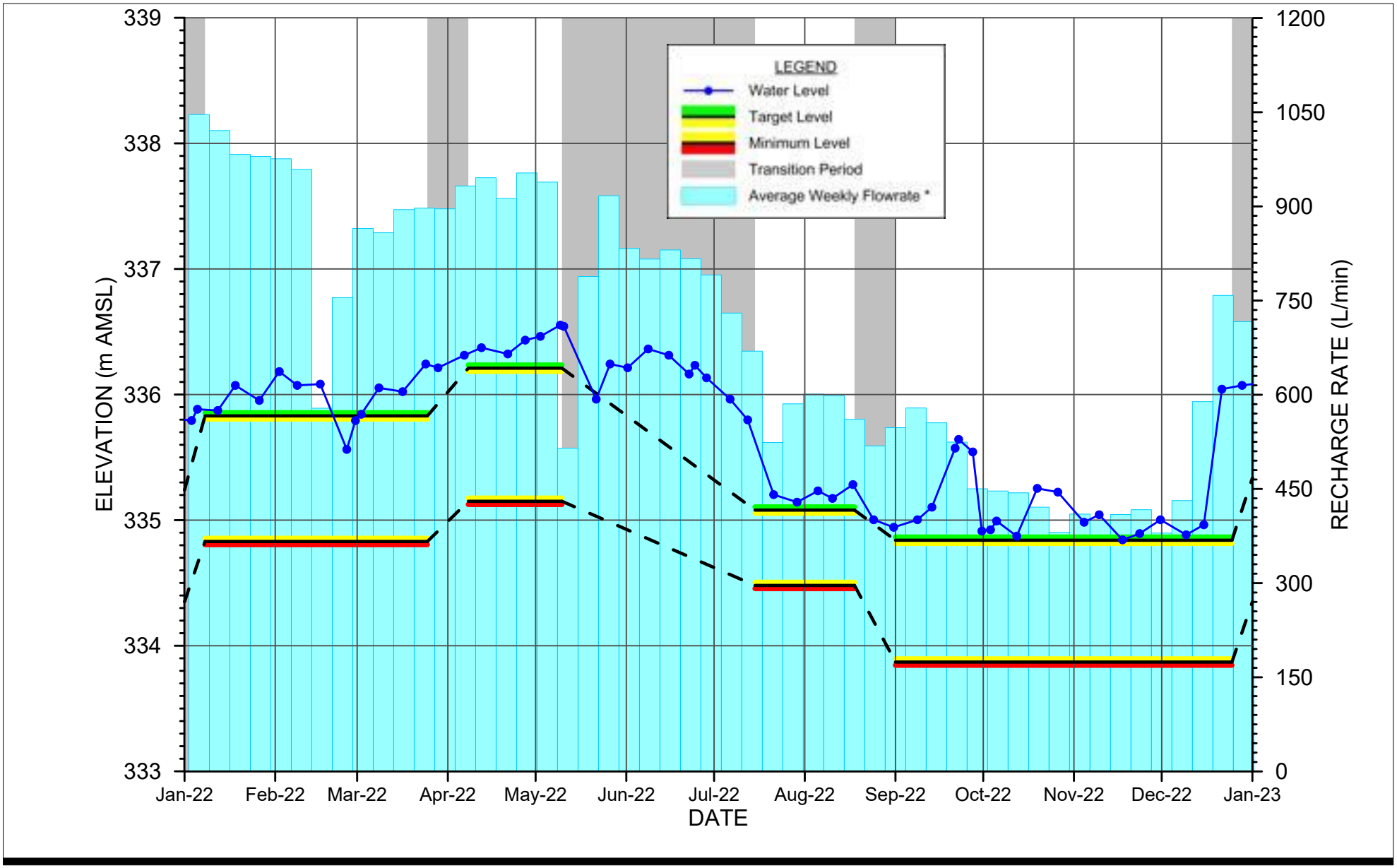
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW66-07**
**EAST CELL EXTENSION**

**FIGURE 5.27**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW66-07.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW311A-10, RW311B-18, RW311C-17, RW311D-18, RW311F-17, RW311G-17, RW311K-17, and RW312A-10.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW52-07**
**EAST CELL EXTENSION**

**FIGURE 5.28**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW52-07.grf
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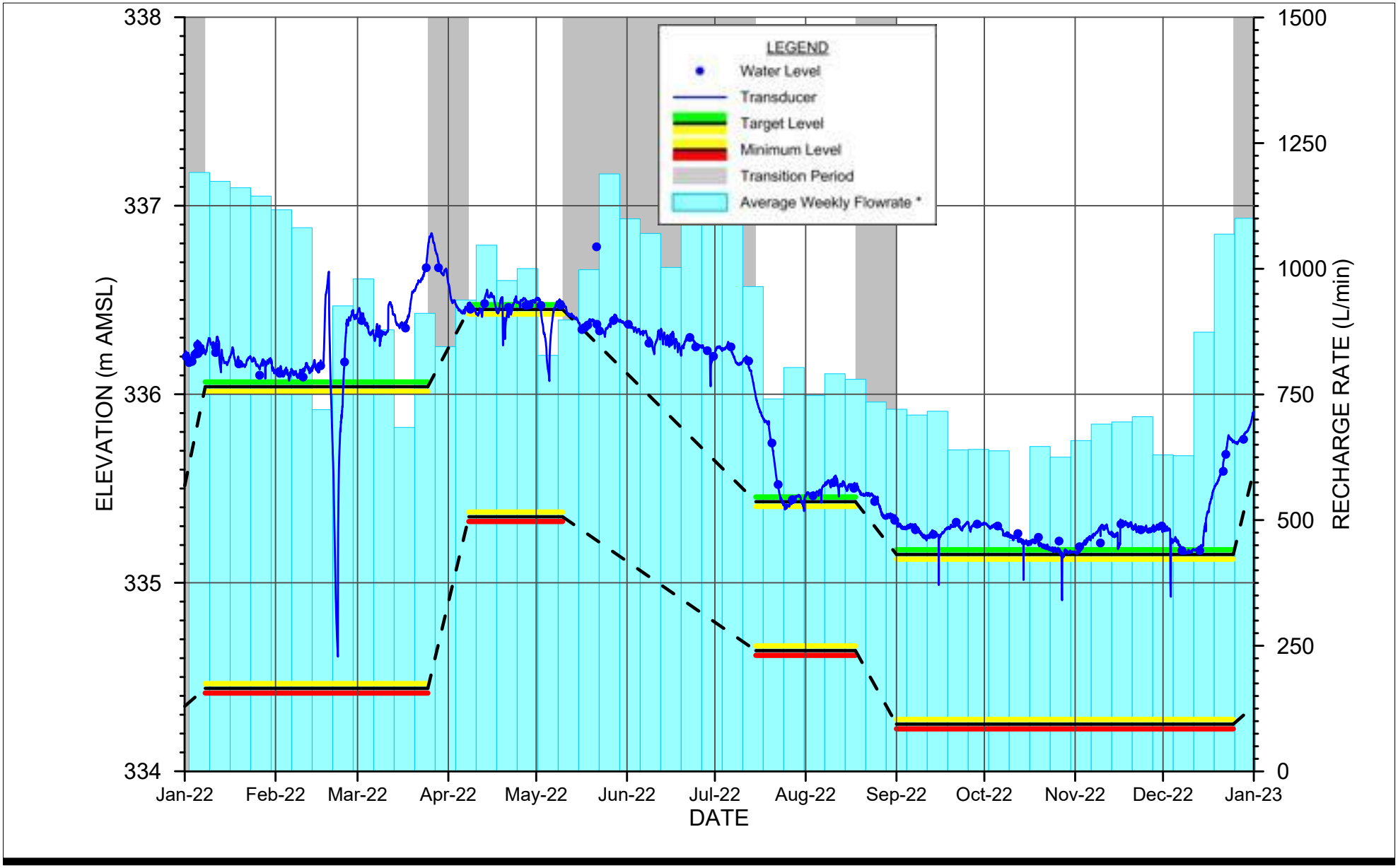



* Includes flow from RW312A-10, RW312C-17, RW312D-17, RW312E-17, RW312F-18, RW312I-17, RW313A-10, RW313B-14, RW313C-17, RW313D-17, RW313F-18, RW313G-18, RW313H-19, RW313I-19, and RW314C-17.

GHD

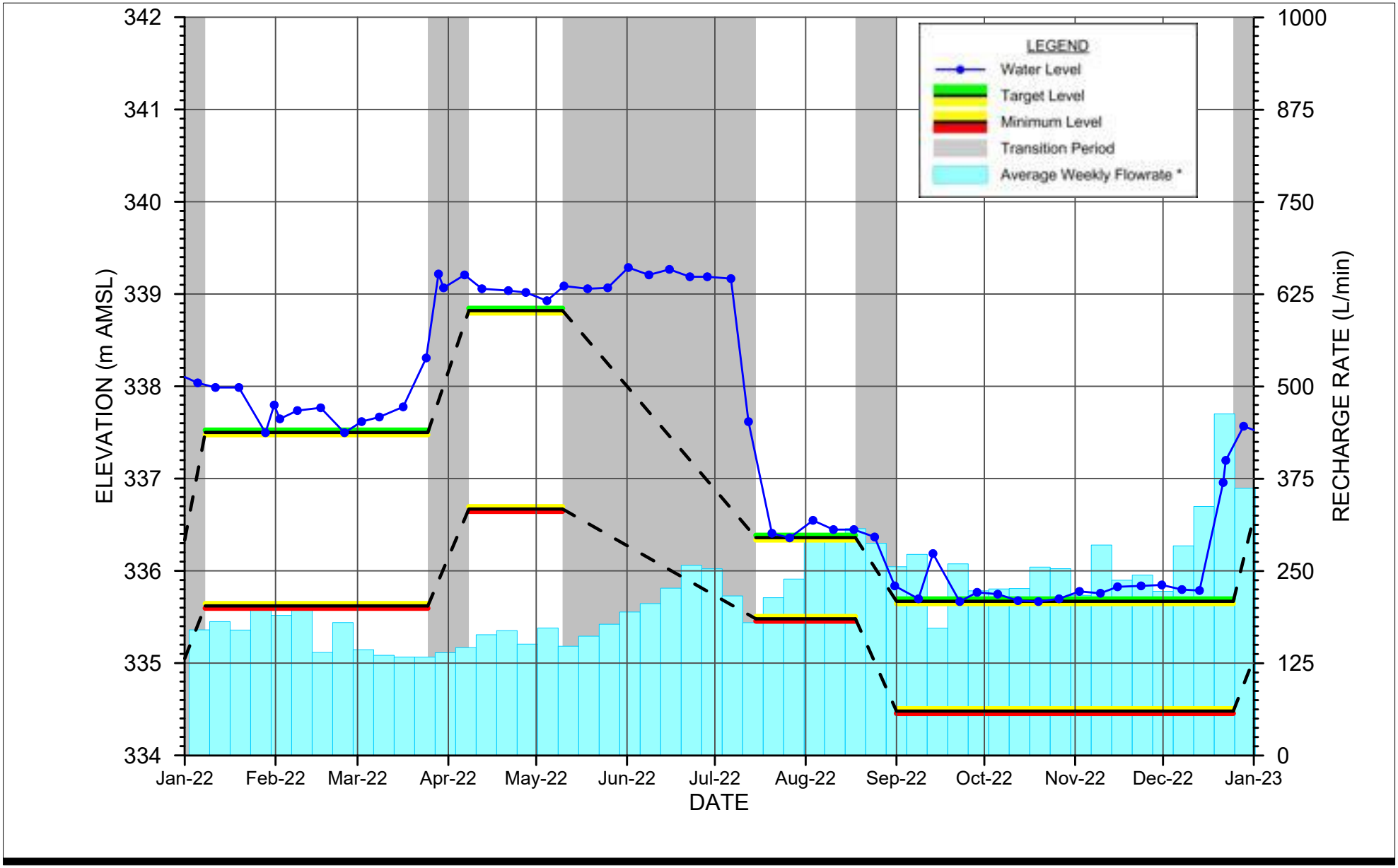
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - OW5-80**
**EAST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.29**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW5-80.grf
Plot Date: March 16 2023 9:03 PM




* Includes flow from RW316A-16, RW316C-11, RW316C1-15, RW316H-20, RW316I-20, RW317A-16, RW317C-14, RW317D-15, RW317D1-15, and RW318C-16.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**TRIGGER WELL - OW70-08**
**EAST CELL EXTENSION**

**FIGURE 5.30**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW70-08.grf
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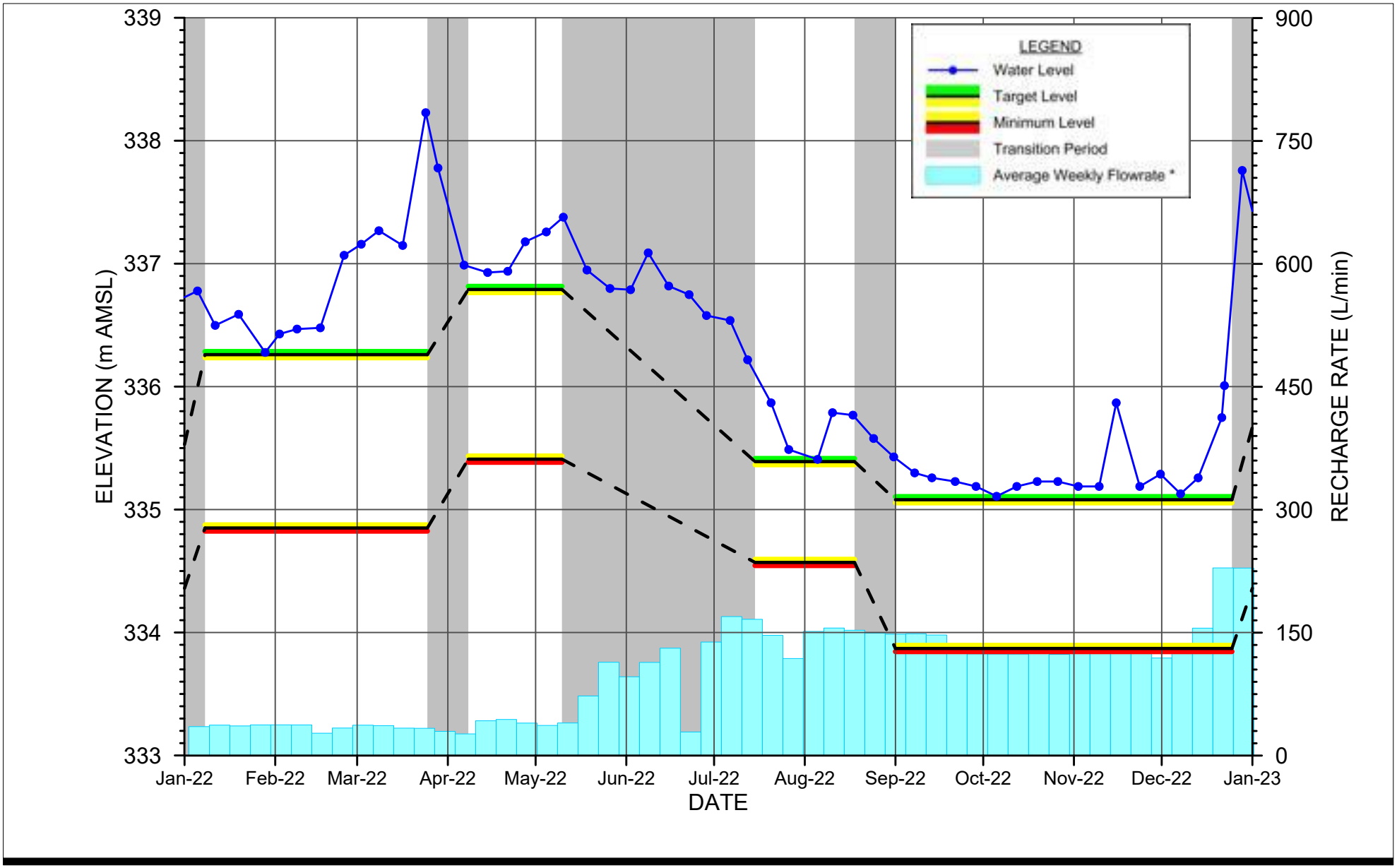


* Includes flow from RW314A-10, RW315A-10, RW316B-11, RW316B-14, and RW316D-14.

GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**TRIGGER WELL - OW71-08**
**EAST CELL EXTENSION**

Project No. **010978**
Date **March 16, 2023**

**FIGURE 5.31**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\3 EC Triggers (5.20-5.31)\OW71-08.grf
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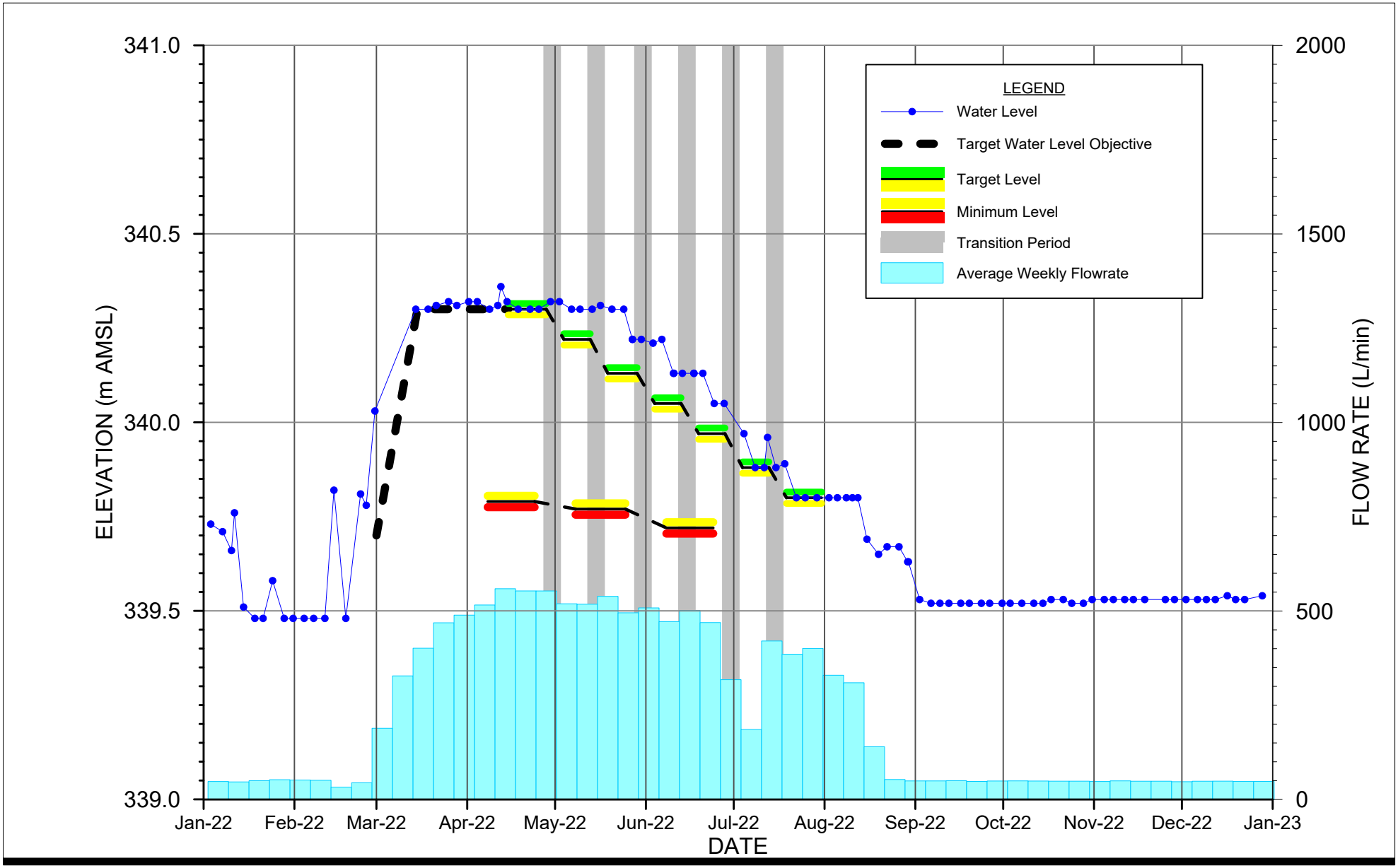


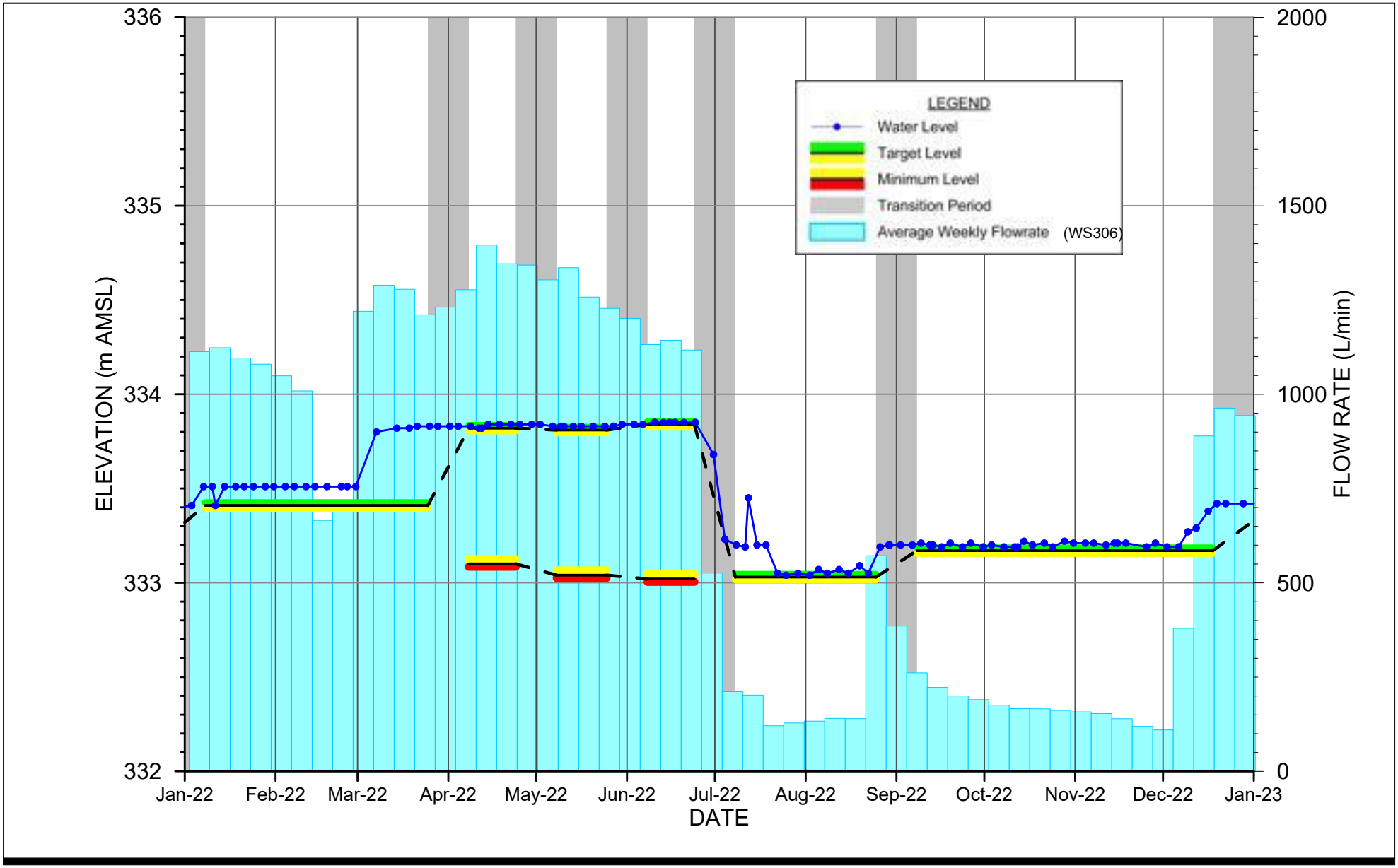

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**V2 WETLAND**
**EAST CELL EXTENSION**

**FIGURE 5.32**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\4 Wetlands (5.32-5.34)\V2 Wetland.grf
Plot Date: March 23 2023 9:03 AM




GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**W7 WETLAND**
**EAST CELL EXTENSION**

**FIGURE 5.33**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\4 Wetlands (5.32-5.34)\W7 Wetland.grf
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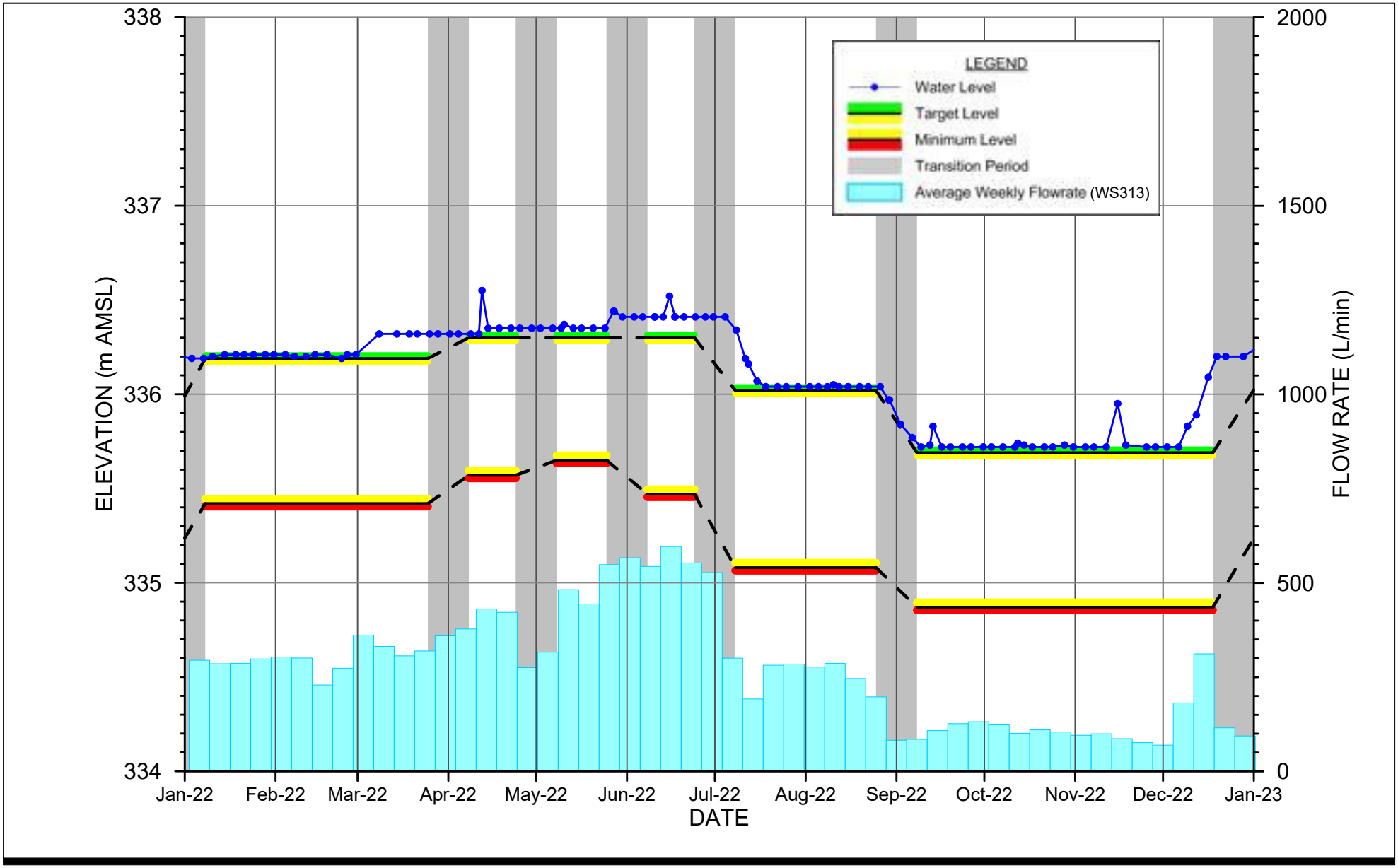


GHD

**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**W8 WETLAND**
**EAST CELL EXTENSION**

**FIGURE 5.34**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\4 Wetlands (5.32-5.34)\W8 Wetland.grf
Plot Date: March 23 2023 8:03 AM

PHASE 2
(WEST CELL)

PHASE 3
(EAST CELL)

PHASE 1 (NORTH QUARRY CELL)

PHASE 1
(NORTH QUARRY CELL)

NORTH QUARRY

ROCK PILLAR

RAMP

SIXTH LINE TRIBUTARY

FIRST LINE

BRUCE TRAIL (Side Trail)

BRUCE TRAIL (Posted on Trail)

HILTON FALLS (Side Trail)

RECHARGE PUMP STATION

DYKE 6

DYKE 2

HF-2

SPEYSIDE TRIBUTARY

Town of Halton Hills

38–1

T6–2

WEIR LOCATION

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES
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BOUNDARY INFORMATION COMPILED FROM SURVEYS AND SKETCHES PREPARED BY A.J. CUNNINGHAM, ONTARIO LANDS SURVEYORS, MILTON, ONTARIO, DECEMBER 2,1997.

LEGEND

- WATER ELEVATION MONITORING LOCATION
- 324 GROUNDWATER CONTOUR (m AMSL)
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- MUNICIPAL BOUNDARY
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- DUFFERIN LEASED
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- WATERMAIN (AS-BUILT/EXISTING)
- MAIN QUARRY LIMITS DECEMBER 2008
- EXTRACTION LIMITS - LOWER BENCH DECEMBER 2022
- EXTRACTION LIMITS - UPPER BENCH DECEMBER 2022
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

NOTE:
THE NORTH QUARRY AND EXTENSION PORTIONS OF THE GROUNDWATER RECHARGE WELL SYSTEM WERE OPERATING AT THIS TIME.

0 100 200 300m
1:10000

MW3

Dufferin Aggregates

GHD

MILTON QUARRY
REGION OF HALTON, ONTARIO

GROUNDWATER CONTOURS -
APRIL 2022
NORTH QUARRY AND EXTENSION

Project No. **10978**
Date **March 2023**

**FIGURE 5.35**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D106_WA-172.dwg
Plot Date: 24 March 2023 1:10 PM

PHASE 2
(WEST CELL)

PHASE 3
(EAST CELL)

PHASE 1 (NORTH QUARRY CELL)

NORTH QUARRY

PHASE 1
(NORTH QUARRY CELL)

ROCK PILLAR

RAMP

RECHARGE PUMP STATION

DYKE 6

SIXTH LINE TRIBUTARY

SPEYSIDE TRIBUTARY

HILTON FALLS (Side Trail)

BRUCE TRAIL (Side Trail)

BRUCE TRAIL (Forked on Trail)

FIRST LINE

TOWNLINE

Town of Halton Hills

Town of Milton

(UNOPENED ROAD ALLOWANCE)

SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE FROM THE ONTARIO MINISTRY OF NATURAL RESOURCES
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WEIR LOCATION

LEGEND

- WATER ELEVATION MONITORING LOCATION
- 324 GROUNDWATER CONTOUR (m AMSL)
- PROPERTY LINE
- LICENSED LIMIT OF EXTRACTION
- MUNICIPAL BOUNDARY
- DUFFERIN OWNED BUFFER
- DUFFERIN OWNED LICENSED
- DUFFERIN LEASED
- WETLAND IDENTIFIED AS PROVINCIALLY SIGNIFICANT
- WATERMAIN (AS-BUILT/EXISTING)
- MAIN QUARRY LIMITS DECEMBER 2008
- EXTRACTION LIMITS - LOWER BENCH DECEMBER 2022
- EXTRACTION LIMITS - UPPER BENCH DECEMBER 2022
- EXTRACTION LIMITS - FLOOR BENCH DECEMBER 2022

NOTE:
THE NORTH QUARRY AND EXTENSION PORTIONS OF THE GROUNDWATER RECHARGE WELL SYSTEM WERE OPERATING AT THIS TIME.

0 100 200 300m
1:10000

MW3

Dufferin Aggregates

GHD

MILTON QUARRY
REGION OF HALTON, ONTARIO

GROUNDWATER CONTOURS - OCTOBER 2022
NORTH QUARRY AND EXTENSION

Project No. 10978
Date March 2023

FIGURE 5.36

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D107_WA-172.dwg
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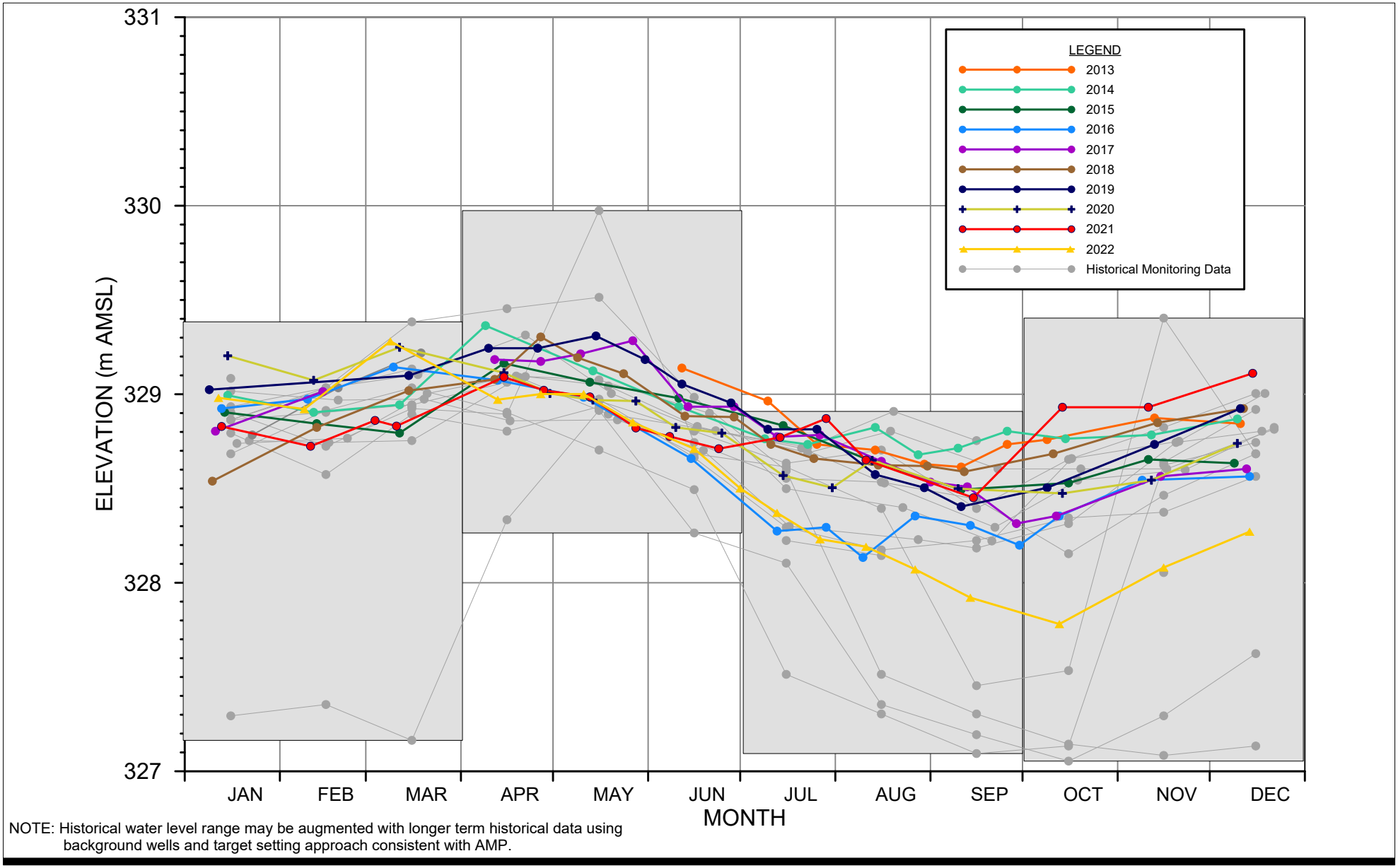



NOTE: Historical water level range may be augmented with longer term historical data using background wells and target setting approach consistent with AMP.

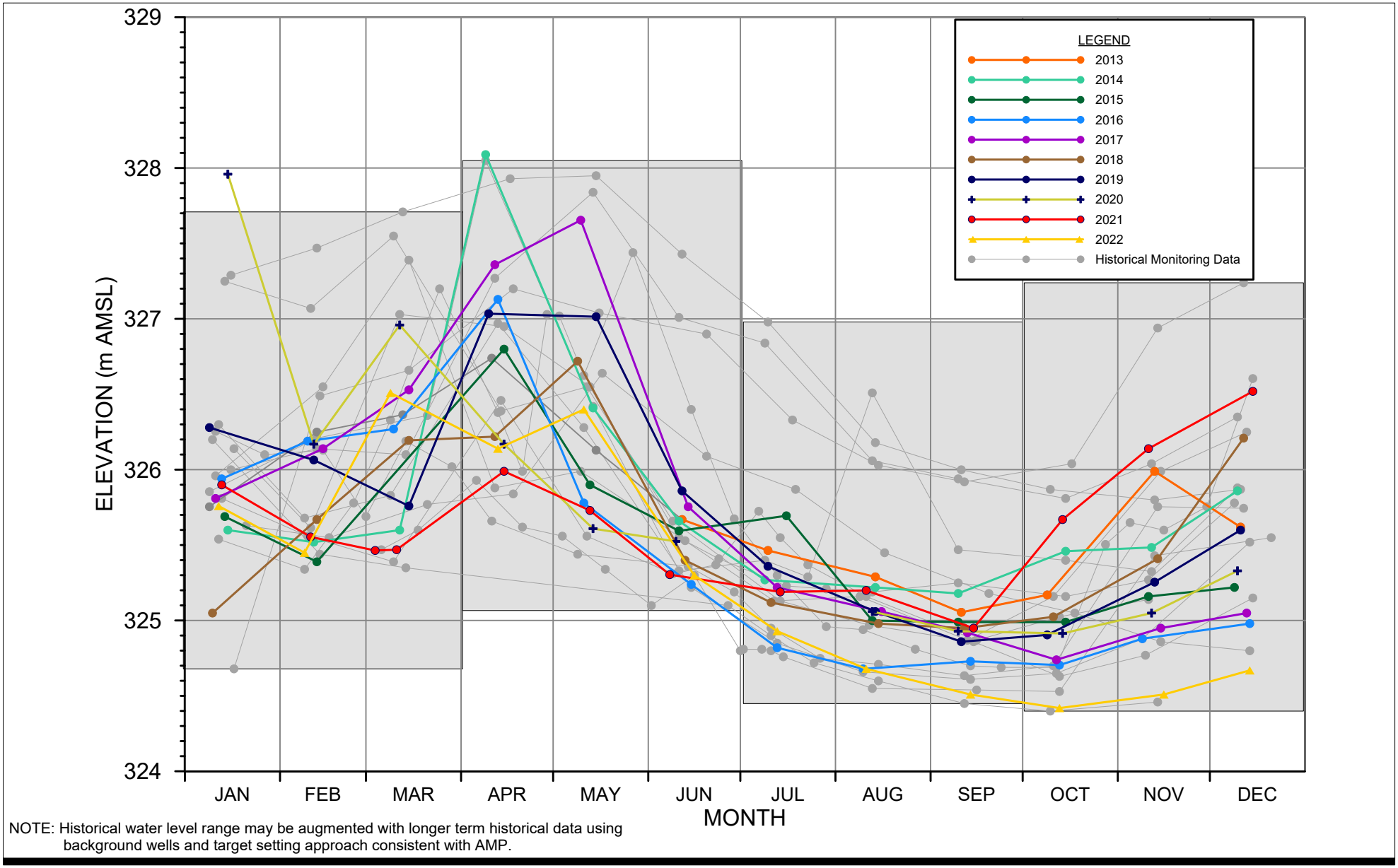
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**SUPPLEMENTAL MONITORING WELL GRAPH - BH65**

**FIGURE 5.37**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\6 Supp_Wells (5.37-5.39)\BH65.grf
Plot Date: March 17 2023 8:03 AM




NOTE: Historical water level range may be augmented with longer term historical data using background wells and target setting approach consistent with AMP.

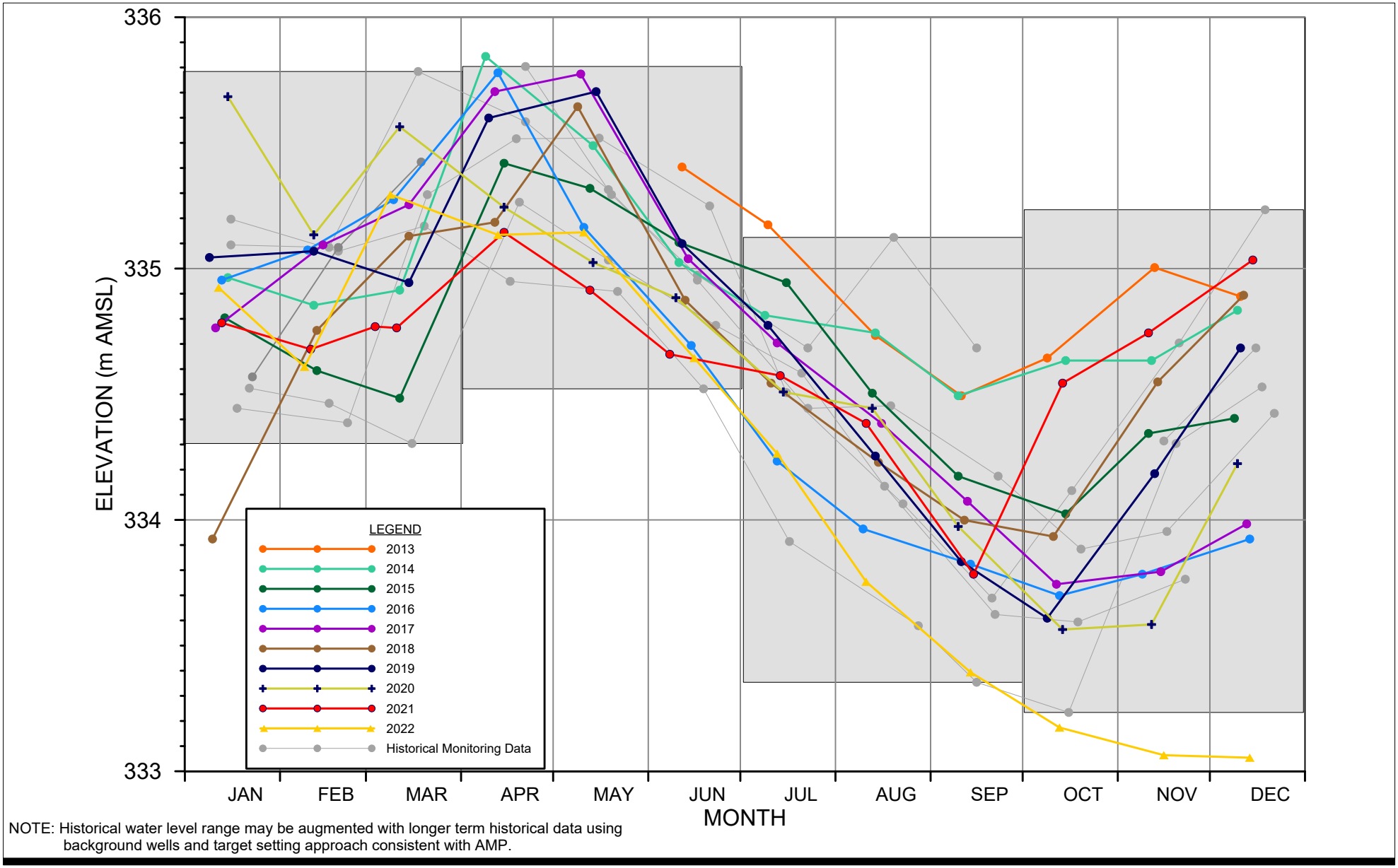
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**SUPPLEMENTAL MONITORING WELL GRAPH - BH66**

**FIGURE 5.38**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\6 Supp_Wells (5.37-5.39)\BH66.grf
Plot Date: March 17 2023 8:03 AM




NOTE: Historical water level range may be augmented with longer term historical data using background wells and target setting approach consistent with AMP.

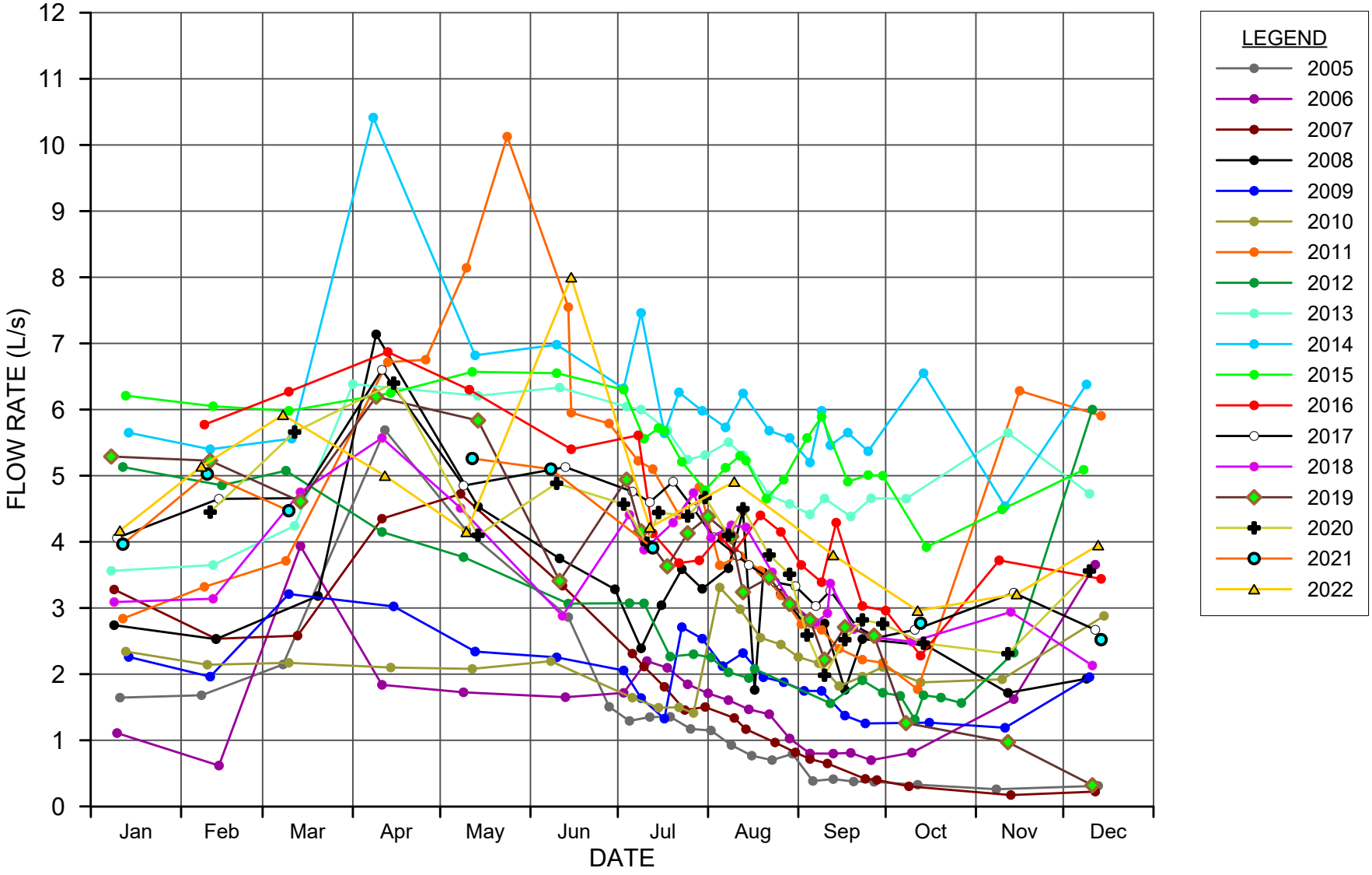
**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**SUPPLEMENTAL MONITORING WELL GRAPH - OW69-08**

**FIGURE 5.39**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\6 Supp_Wells (5.37-5.39)\OW69-08.grf
Plot Date: March 17 2023 8:03 AM




**DUFFERIN AGGREGATES - MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

Project No. **010978**
Date **March 16, 2023**

**FLOW DATA - SW4**

**FIGURE 5.40**

HEG file: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\7 Streamflow (5.40-5.41)\SW4.grf
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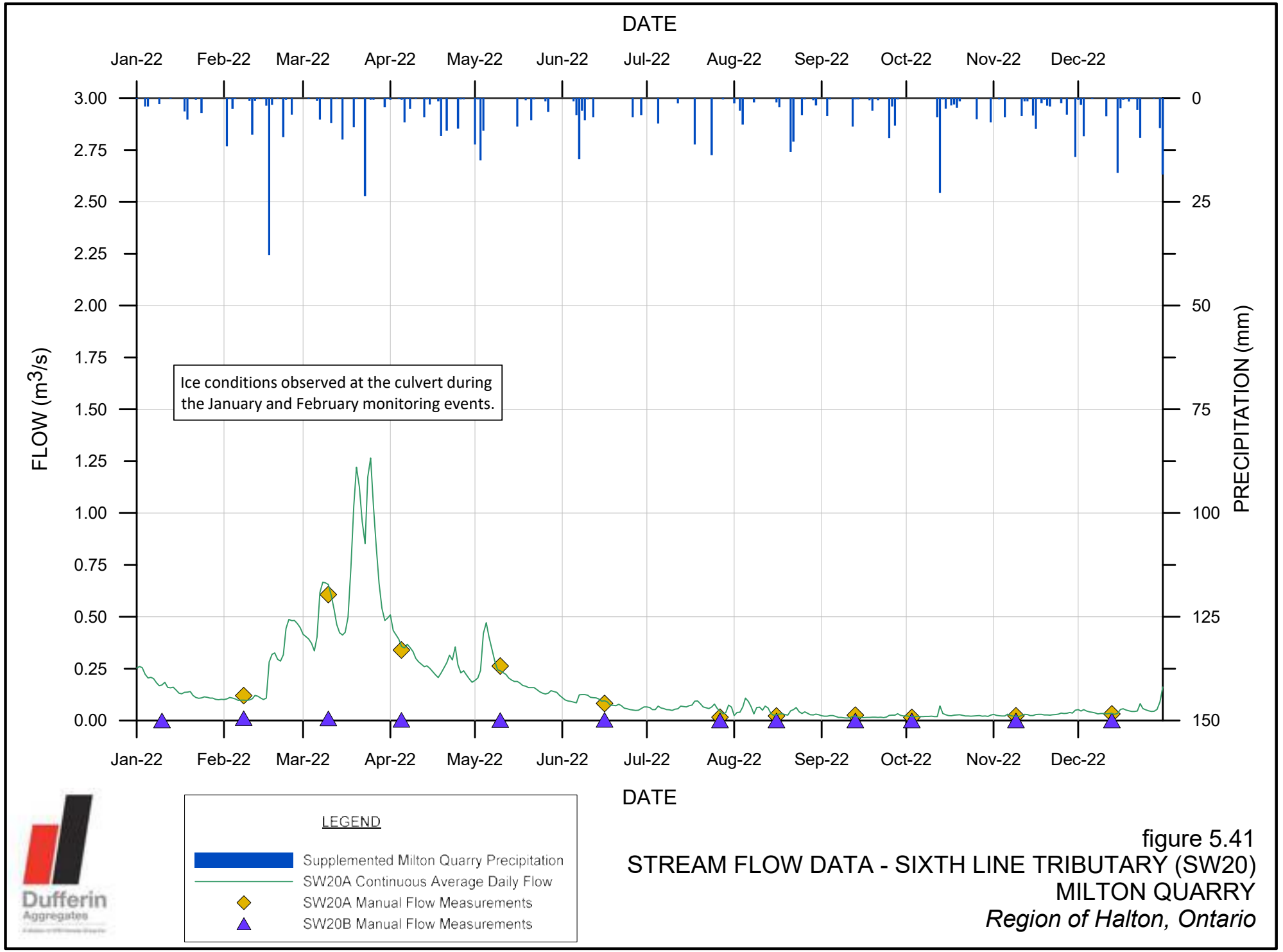
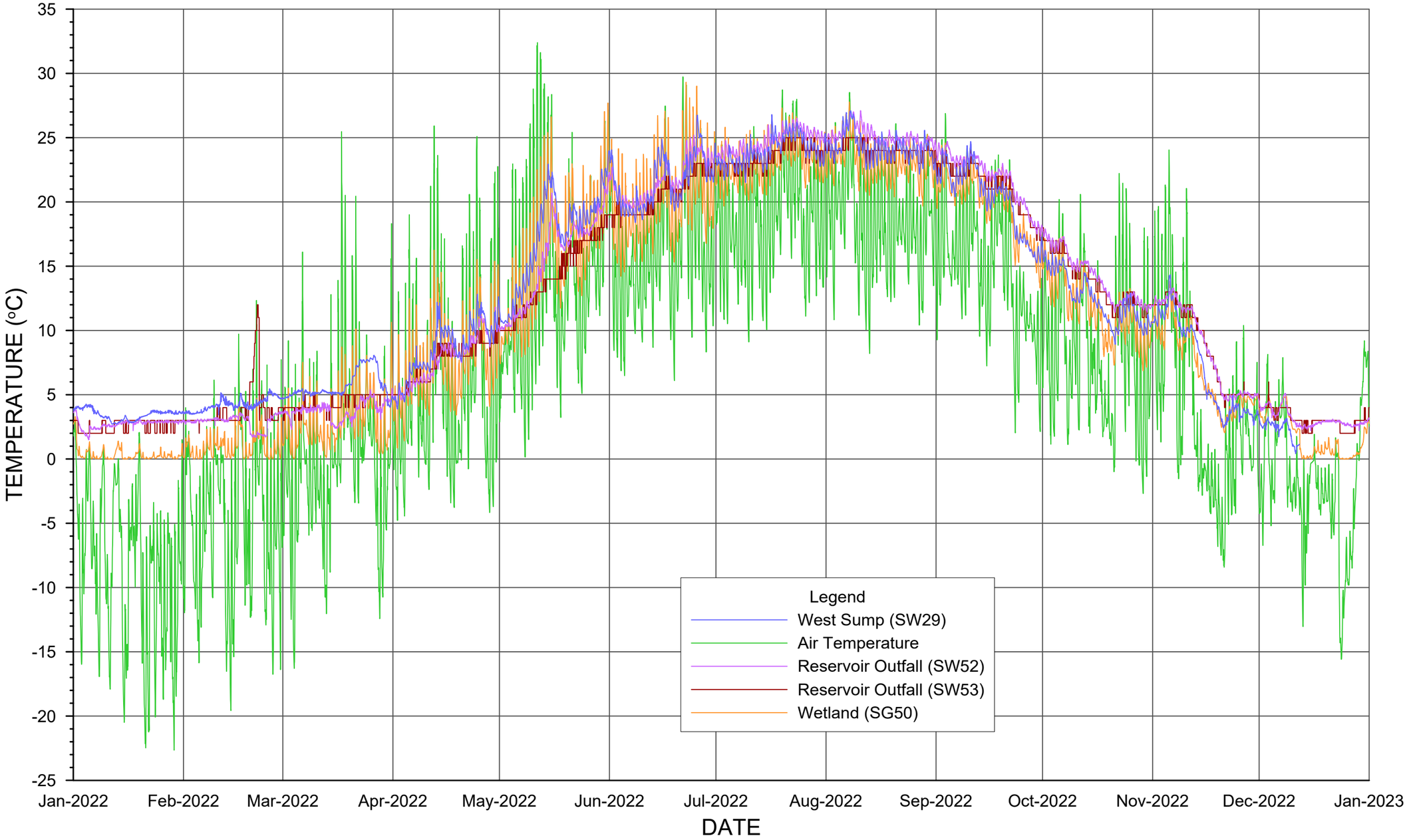



figure 5.41
STREAM FLOW DATA - SIXTH LINE TRIBUTARY (SW20)
MILTON QUARRY
*Region of Halton, Ontario*



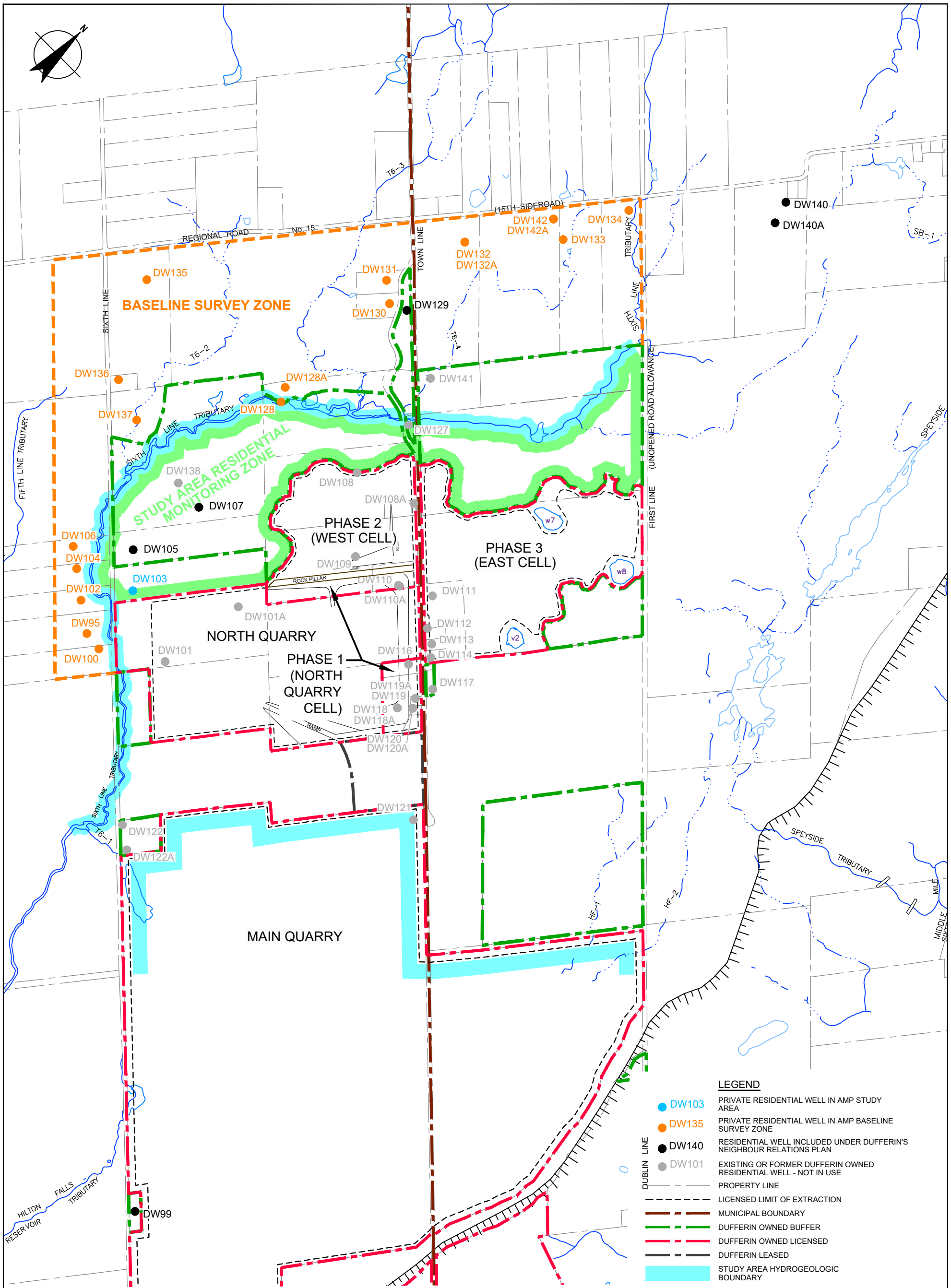

DUFFERIN AGGREGATES - MILTON QUARRY
REGION OF HALTON, ONTARIO

WATER TEMPERATURE
QUARRY DISCHARGE

Project No. **010978**
Date **March 16, 2023**

**FIGURE 7.1**

HEG file: N:\CA\Waterloo\Projects\662\010978\Grapher\AMR\2022\Main RPT\8 Quarry Discharge Temp (7.1)\Figure 7.1.grf
Plot Date: March 16 2023 9:03 PM




SOURCE:
BASE MAPPING PRODUCED BY MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED AND CONESTOGA-ROVERS & ASSOCIATES UNDER LICENCE WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES
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Dufferin Aggregates

GHD

**MILTON QUARRY**
**REGION OF HALTON, ONTARIO**

**RESIDENTIAL WELL MONITORING LOCATIONS FOR MONITORING/BASELINE SURVEY**

Project No. **10978**
Date **March 2023**

**FIGURE 8.1**

Filename: \\ghdnet\ghd\CA\Waterloo\Projects\662\010978\Digital_Design\ACAD\Figures\RPT172\010978-GHD-00-00-RPT-EN-D108_WA-172.dwg
Plot Date: 03 March 2023 11:03 AM

# Tables

**Table 2.1**

**Summary of AMP Monitoring Program**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| AMP Section Reference | Description of Requirement | Minimum Frequency | Annual Monitoring Report Reference |
|---|---|---|---|
| **Performance Monitoring/Response Program** | | | |
| 3.1 | Water level monitoring at trigger wells | Monthly - Manual Measurements<br>Daily - Automated Water Level Recorders at 5 wells | 5.2, 5.3 |
| 3.1 | Water level monitoring at trigger wells - After extraction proceeds below water table in adjacent phase | Bi-weekly - Manual Measurements | 5.2, 5.3 |
| 3.1 | Water level monitoring at trigger wells - When dewatering influence is observed at recharge alignment wells | Weekly - Manual Measurements | 5.2, 5.3 |
| 3.1 | Water level monitoring at select trigger wells - Recharge initiation/modification, response to extraction, extraction within 100m of recharge alignment | Day following extraction plus subsequent three business days<br>(formerly daily for 2 weeks - Manual Measurements) | 5.3.4 |
| 3.2 | Water Quality monitoring of reservoir | Monthly | 7.2 |
| 3.2 | Water Quality monitoring of recharge pumping station | Monthly | 7.3.1 |
| 3.2 | Water Quality monitoring of remote location on recharge system | Monthly | 7.3.2 |
| 3.2 | Water Quality monitoring of inflows to reservoir | Monthly | 7.4 |
| **Supplemental Monitoring Program** | | | |
| 4.1 | Groundwater levels at selected/new groundwater monitoring well locations | Monthly | 5.6 |
| 4.2 | Groundwater levels at minimum of four background monitoring locations beyond the study area in the general vicinity of the Milton Quarry | Monthly - Manual Measurements<br>Daily - Automated water level recorders | 5, 5.6 |
| 4.3 | Meteorological data | Milton Quarry Station - 6 Automated Readings per Day<br>Georgetown Station - As Available | 4.0 |
| 4.4 | Water levels in the reservoir at the pumping station | "Continuous" - With Automated Water Level Recorder | 5.1.1 |
| 4.4 | Water levels in the lake/wetland | Weekly | 5.1.1 |
| 4.4 | Totalized water flow at inflow/transfer/outflow points | Weekly | 6.0 |

**Table 2.1**

**Summary of AMP Monitoring Program**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| AMP Section Reference | Description of Requirement | Minimum Frequency | Annual Monitoring Report Reference |
|---|---|---|---|
| 4.5 | Surface water and groundwater levels at 5 wetland stations (W10, W15, W17, W21, and W41) plus new station at western wetland (W5) | Monthly (biweekly for April-July) | 5.6 |
| 4.5 | Photos at photographic stations in minimum of 6 wetlands (as above) | Seasonally (see Section 4.5 of AMP) | 9.2 |
| 4.5 | Jefferson Salamander egg mass and frog calling surveys in minimum of 6 wetlands (as above) | Seasonally (see Section 4.5 of AMP) | 9.2 |
| 4.5 | Wetland vegetation monitoring in 6 wetlands (as above) | Seasonally (see Section 4.5 of AMP) | 9.2 |
| 4.5 | Brook Trout redd survey in Sixth Line Tributary north of Extension Lands | Seasonally (see Section 4.5 of AMP) | 9.1.1 |
| 4.5 | Benthic monitoring at two stations upstream of Townline Road | Seasonally (see Section 4.5 of AMP) | 9.1.2 |
| 4.5 | Groundwater temperature monitoring at four trigger wells and associated creek locations and recharge system locations | Monthly - Mar, Apr, May, Jun, Oct, Nov, Dec<br>Weekly - Jan, Feb, Jul, Aug, and Sep | 7.5 |
| 4.5 | Water discharge from former pumphouse (SW4) | Monthly - Jan, Feb, Mar, Apr, May, Jun, Oct, Nov, Dec<br>Weekly - Jul, Aug, Sep | 5.6.4 |
| 4.6 | Residential wells in monitoring zone (Figure 4.1 of AMP) | Quarterly | 8.0 |
| **On-Site Wetlands Monitoring Program** | | | |
| 3.1 and Appendix C | Surface water level monitoring at on-Site wetlands | Monthly | 5.3.2 |
| Appendix C | Surface water level monitoring at on-Site wetlands - Extraction proceeds below water table | Bi-weekly | 5.3.2 |
| Appendix C | Surface water level monitoring at on-Site wetlands - Water Levels below target level | Twice Weekly | 5.3.2 |

Notes:

This monitoring program includes the monitoring required by the AMP for the pre-extraction and extraction period as extraction began in the Extension in May 2013.
There are no criteria/limits for the monitoring results during the pre-extraction period.
See Table 2.2 for monitoring requirements associated with the West Cell portion of the groundwater recharge well system.

**Table 2.2**

**Summary of Non-AMP Monitoring Requirements**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Reference to Permit or Agreement | | | | | | |
|---|---|---|---|---|---|---|
| **ECA 3406-8U6RQ5; 6124-C42GL4** | **PTTW 5256-BUUP62** | **LRIA AUR-45-03/04** | **CH Extension Quarry Agreement** | **Description of Requirement** | **Criterion/Limit** | **Annual Monitoring Report Reference** |
| 7.4.1 | NA | NA | 2.14.2 | Water quality monitoring of the Recharge Pond overflow effluent | TSS = 25 mg/L (arithmetic mean for month)<br>Oil and Grease = 15 mg/L<br>Un-ionized Ammonia = 0.02 mg/L<br>pH = 6.0 to 9.5 | NA |
| 7.4.2 | NA | NA | 2.14.2 | Water quality monitoring at upstream (SW10) and downstream (SW13) locations in the Sixth Line Tributary | Same as above | NA |
| 7.4.4 | NA | NA | 2.14.2 | Water quality monitoring of the discharge from the Recharge Pumping Station to the North Quarry Recharge System | Same as above | 7.3.1 |
| 7.4.5 | NA | F.4, F.5, F.6, F.7, and F.8 | 2.14.1(d) | Water quality monitoring from Main Quarry West Sump and/or Reservoir to the HFRT | Same as above | 7.2 |
| 7.5 | NA | NA | 2.14.2 | North Quarry Recharge Pond Overflow (flowrate and totalized flow) | NA | NA |
| NA | 3.2 | NA | 2.14.2 | North Quarry and Extension Dewatering (flowrate and totalized flow) | 45,000 L/min; 64,800,000 L/day; 1,359,000,000 L/year [(1)] | 6.2.1 |
| 9.4 | 3.2 | NA | 2.14.2 | Recharge Pumping Station (flowrate and totalized flow) | 36,000 L/min; 51,840,000 L/day; 18,921,600,000 L/year | 6.2.2 |
| 7.5 | 3.7 | NA | 2.14.1(d) | Main Quarry Discharge, Interim Conditions (flowrate and totalized flow) | 12,000 L/min; 17,280,000 L/Day; 4,464,000,000 L/year [(2)] | 6.2.3 |
| 9.4 | NA | NA | 2.14.2 | Individual Recharge Wells (flowrate and totalized flow) | NA | 6.2.2 |
| NA | 4.3 | NA | NA | Calculation of the overall Water Taking for the Milton Quarry | NA | 6.3 |
| NA | 4.4 | NA | 2.14.1(b) and (c) | Water level monitoring at MW1, MW2, MW3, MW4, MW5, BH27, OW18-03, and OW19-03 | NA | 5.1.2, 5.6 |
| NA | 4.4 | NA | 2.14.2 | Water level monitoring at BH37 and DW113A | NA | 5.2.1, 5.6 |
| 8.1 | 4.4 | NA | 2.14.2 | Water levels at Trigger Wells | NA | 5.2.1, 5.3.1 |
| 8.1 | 4.4 | NA | 2.14.2 | Water levels at Recharge Monitoring Wells | NA | 5.2.2, 5.3.3 |
| NA | 4.4 | NA | 2.14.1(e) | Water levels at Background Monitoring Wells | NA | 5, 5.6 |

**Table 2.2**

**Summary of Non-AMP Monitoring Requirements**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Reference to Permit or Agreement | | | | | | |
|---|---|---|---|---|---|---|
| **ECA 3406-8U6RQ5; 6124-C42GL4** | **PTTW 5256-BUUP62** | **LRIA AUR-45-03/04** | **CH Extension Quarry Agreement** | **Description of Requirement** | **Criterion/Limit** | **Annual Monitoring Report Reference** |
| NA | 4.4 | NA | 2.14.1(b) | Water levels at W7, W8, and V2 | NA | 5.3.2 |
| NA | 4.4 | NA | 2.14.2 | Water levels at wetlands W5, W10, W15, W17, W21, and W41 | NA | 5.6 |
| NA | 4.4 | NA | 2.14.1(e) | Water level monitoring at domestic wells DW108A, DW111, and DW116A | NA | NA (abandoned) |
| NA | 4.4 | NA | 2.14.1(b) | Surface water level and flow at the weir on the Sixth Line Tributary (SW20) | NA | 5.6.5 |
| NA | 4.4 | NA | 2.14.1(a) | Meteorological data, including air temperature, precipitation, and evaporation | NA | 4.0 |
| 9.1, 9.2, and 9.3 | NA | NA | 2.14.2 | Water quality monitoring at three Recharge Monitoring Wells (including the first and last recharge wells along the distribution header and the closest recharge well to DW103) | NA | 7.1, 7.3.2 |
| 10.0 | NA | NA | 2.14.2 | Ecological monitoring of Brook Trout spawning Sixth Line Tributary near the North Quarry | NA | 9.1.1 |
| NA | NA | NA | 2.14.1(f) | Main Quarry Ecological Monitoring | NA | 9.0 |
| 11.0 | 4.5 | NA | 2.14.1 | Performance reporting | NA | entire Annual Water Monitoring Report |

Note:

NA Not Applicable
(1) Annual limit is estimated from 2006 flow plus increased taking due to reduced evapotranspiration and capture runoff over additional extracted area of the North Quarry and Extension.
(2) The annual limit is less than expected given the relatively higher limits on the instantaneous and daily flows. The relatively lower annual limit has been found to be sufficient over many years of operation; therefore, Dufferin has not applied for a higher limit.

**2022 Monthly Air Temperature**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Measured Average Monthly Air Temperature Milton Quarry [1] ($^oC$) | Measured Milton Quarry Mean Air Temperature [2] ($^oC$) | 2022 Average Air Temperature Difference from Average ($^oC$) |
|---|---|---|---|
| January | -9.0 | -5.6 | -3.4 |
| February | -5.3 | -5.2 | -0.1 |
| March | 0.0 | -0.3 | 0.3 |
| April | 5.7 | 5.9 | -0.3 |
| May | 15.1 | 13.0 | 2.2 |
| June | 18.5 | 18.4 | 0.1 |
| July | 21.2 | 20.8 | 0.4 |
| August | 21.1 | 20.1 | 1.0 |
| September | 16.6 | 16.2 | 0.4 |
| October | 9.5 | 9.5 | 0.0 |
| November | 4.6 | 3.0 | 1.6 |
| December | -1.4 | -2.3 | 0.9 |
| ***Average*** | 8.1 | 7.8 | 0.3 |

**Notes:**

(1) The Site weather station measures air temperature every 5 seconds and records hourly average temperatures. When air temperature measurements are not available for the Site the data is supplemented with temperature data from Acton Wastewater Treatment Plant (WWTP) located approximately 9 KM from the Site.

(2) Air temperature data was collected at the quarry from 1995 to 1998 and then from 2000 to present.

**Table 4.2**

**Monthly Precipitation Data**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Measured Milton Quarry Precipitation from Weather Station [1] (mm) | Supplemented Milton Quarry Precipitation [2] (mm) | Mean Milton Quarry Precipitation [3] (mm) | Supplemented Georgetown WWTP Precipitation [4] (mm) | Mean Georgetown WWTP Precipitation [5] (mm) |
|---|---|---|---|---|---|
| January | - | 44.9 | 70.6 | 44.9 | 64.2 |
| February | - | 84.4 | 52.2 | 79.6 | 56.9 |
| March | - | 58.8 | 58.7 | 58.8 | 62.2 |
| April | 32.5 | 42.0 | 83.2 | 38.6 | 68.8 |
| May | 51.3 | 51.3 | 81.3 | 50.7 | 75.0 |
| June | 41.4 | 41.4 | 81.4 | 39.2 | 73.3 |
| July | 32.5 | 32.5 | 79.7 | 30.3 | 77.3 |
| August | 45.0 | 45.6 | 70.0 | 141.5 | 77.3 |
| September | 34.5 | 34.5 | 75.4 | 48.0 | 70.8 |
| October | 47.5 | 47.5 | 78.4 | 47.4 | 68.9 |
| November | 10.7 | 40.9 | 71.1 | 44.2 | 70.7 |
| December | - | 71.6 | 63.0 | 46.6 | 64.8 |
| ***Total:*** | 295.4 | 595.4 | 865.0 | 669.8 | 830.1 |

Notes:

(1) The Milton Quarry weather station was fitted for rainfall data collection (tipping bucket) from April 12, 2022 to November 14, 2022. The partial data collected in April and November are presented for completeness, but should not be compared to average values.

(2) Georgetown WWTP and Acton WWTP precipitation data were used to fill in data for the missing periods.
Data for Acton WWTP was obtained from Credit Valley Conservation Authority and has only undergone preliminary quality

(3) The mean is calculated for the period from 1991 onward and excluding the present year.

(4) Precipitation data was obtained for the Georgetown Wastewater Treatment Plant (WWTP). Data was ordered from the Ontario Climate Centre in January 2022.
Toronto International Airport and Oakville TWN data was utilized to supplement missing Georgetown WWTP data.
Data for Georgetown WWTP has only undergone preliminary quality checking by the OCC for January through December 2022.

(5) The mean is calculated for the period from 1882 to 2020 (140 year record).

**Table 4.3**

**Monthly Evaporation**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Measured Lake Evaporation [1] (mm) | Supplemented Lake Evaporation [2] (mm) | Average Lake Evaporation [3] (mm) | Difference Between Supplemented and Average Evaporation (mm) |
|---|---|---|---|---|
| January | - | 25.7 | 25.7 | 0.0 |
| February | - | 25.7 | 25.7 | 0.0 |
| March | - | 25.7 | 25.7 | 0.0 |
| April | 27.3 | 25.7 | 25.7 | 0.0 |
| May | 75.1 | 75.1 | 85.4 | -10.3 |
| June | 106.0 | 106.0 | 104.9 | 1.1 |
| July | 97.0 | 97.0 | 111.4 | -14.4 |
| August | 94.0 | 94.0 | 93.2 | 0.8 |
| September | 58.7 | 58.7 | 67.2 | -8.5 |
| October | 22.8 | 22.8 | 46.3 | -23.6 |
| November | 8.2 | 25.7 | 25.7 | 0.0 |
| December | - | 25.7 | 25.7 | 0.0 |
| ***Total:*** | 489.0 | 607.5 | 662.5 | -55.1 |

Notes:

(1) Measured lake evaporation is obtained by multiplying measured pan evaporation by a 0.70 correction factor.
(2) Over-winter total evaporation is estimated to be 154 mm and is added to measured lake evaporation data from May t
as per the analysis presented in the 5-Year AMP review.
(3) Lake Evaporation average does not include 1996 to 2000 (inclusive) and 2004. Average not inclusive of present year.

**Table 5.1a**

**Summary of 2023 Target Levels - Winter**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Location | Trigger Well | 2022 Target (m AMSL) | 2023 Target (m AMSL) | Difference |
|---|---|---|---|---|
| North Quarry | BH37 | 315.89 | 315.89 | 0.00 |
| North Quarry | BH55 | 313.08 | 313.08 | 0.00 |
| North Quarry | BH56 | 312.75 | 312.75 | 0.00 |
| North Quarry | BH57-III | 313.54 | 313.54 | 0.00 |
| North Quarry | BH59 | 314.00 | 314.00 | 0.00 |
| North Quarry | BH60 | 314.41 | 314.41 | 0.00 |
| North Quarry | BH61-III | 314.28 | 314.28 | 0.00 |
| West Cell | OW27-04 | 317.64 | 317.63 | -0.01 |
| West Cell | OW28-04 | 318.17 | 318.16 | -0.01 |
| West Cell | OW29-04 | 318.23 | 318.22 | -0.01 |
| West Cell | OW30-04 | 318.26 | 318.25 | -0.01 |
| West Cell | OW31-04 | 319.40 | 319.40 | 0.00 |
| West Cell | OW32-04 | 320.42 | 320.41 | -0.01 |
| West Cell | OW33-04 | 322.79 | 322.77 | -0.02 |
| West Cell | OW34-04 | 323.52 | 323.51 | -0.01 |
| West Cell | OW35-04 | 323.74 | 323.74 | 0.00 |
| West Cell | OW36-04 | 323.77 | 323.77 | 0.00 |
| West Cell | OW37-04 | 323.87 | 323.86 | -0.01 |
| West Cell | OW38-04 | 325.07 | 325.07 | 0.00 |
| East Cell | BH48 | 330.28 | 330.27 | -0.01 |
| East Cell | OW52-07 | 335.83 | 335.81 | -0.02 |
| East Cell | OW5-80 | 336.04 | 336.02 | -0.02 |
| East Cell | OW60-07 | 323.69 | 323.69 | 0.00 |
| East Cell | OW61-07 | 324.66 | 324.63 | -0.03 |
| East Cell | OW62-07 | 324.37 | 324.36 | -0.01 |
| East Cell | OW63-07 | 324.66 | 324.66 | 0.00 |
| East Cell | OW64-07 | 325.13 | 325.13 | 0.00 |
| East Cell | OW65-07 | 333.37 | 333.35 | -0.02 |
| East Cell | OW66-07 | 334.71 | 334.68 | -0.03 |
| East Cell | OW70-08 | 337.50 | 337.42 | -0.08 |
| East Cell | OW71-08 | 336.26 | 336.22 | -0.04 |
| On-Site Wetlands | W7 | 333.41 | 333.40 | -0.01 |
| On-Site Wetlands | W8 | 336.19 | 336.18 | -0.01 |
| On-Site Wetlands | V2 | -- [1]/340.30 [2] | -- [1]/340.30 [2] | 0.00[3] |

**Table 5.1b**

**Summary of 2023 Target Levels - Spring**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Location | Trigger Well | 2022 Target (m AMSL) | 2023 Target (m AMSL) | Difference |
|---|---|---|---|---|
| North Quarry | BH37 | 315.44 | 315.23 | -0.21 |
| North Quarry | BH55 | 312.80 | 312.73 | -0.07 |
| North Quarry | BH56 | 312.52 | 312.47 | -0.05 |
| North Quarry | BH57-III | 313.36 | 313.28 | -0.08 |
| North Quarry | BH59 | 313.83 | 313.75 | -0.08 |
| North Quarry | BH60 | 314.14 | 314.08 | -0.06 |
| North Quarry | BH61-III | 314.05 | 313.99 | -0.06 |
| West Cell | OW27-04 | 317.34 | 317.15 | -0.19 |
| West Cell | OW28-04 | 317.94 | 317.76 | -0.18 |
| West Cell | OW29-04 | 317.97 | 317.81 | -0.16 |
| West Cell | OW30-04 | 318.14 | 317.99 | -0.15 |
| West Cell | OW31-04 | 319.77 | 319.47 | -0.30 |
| West Cell | OW32-04 | 320.67 | 320.46 | -0.21 |
| West Cell | OW33-04 | 322.43 | 321.99 | -0.44 |
| West Cell | OW34-04 | 323.39 | 323.29 | -0.10 |
| West Cell | OW35-04 | 323.66 | 323.54 | -0.12 |
| West Cell | OW36-04 | 323.69 | 323.63 | -0.06 |
| West Cell | OW37-04 | 323.85 | 323.73 | -0.12 |
| West Cell | OW38-04 | 325.45 | 325.15 | -0.30 |
| East Cell | BH48 | 330.42 | 330.35 | -0.07 |
| East Cell | OW52-07 | 336.21 | 336.02 | -0.19 |
| East Cell | OW5-80 | 336.45 | 336.29 | -0.16 |
| East Cell | OW60-07 | 323.74 | 323.65 | -0.09 |
| East Cell | OW61-07 | 324.69 | 324.55 | -0.14 |
| East Cell | OW62-07 | 324.30 | 324.15 | -0.15 |
| East Cell | OW63-07 | 324.56 | 324.45 | -0.11 |
| East Cell | OW64-07 | 325.05 | 324.95 | -0.10 |
| East Cell | OW65-07 | 333.65 | 333.50 | -0.15 |
| East Cell | OW66-07 | 335.05 | 334.86 | -0.19 |
| East Cell | OW70-08 | 338.82 | 338.31 | -0.51 |
| East Cell | OW71-08 | 336.79 | 336.51 | -0.28 |
| On-Site Wetlands | W7 | 333.82 (April) | 333.65 (April) | -0.17 |
| On-Site Wetlands | W7 | 333.81 (May) | 333.61 (May) | -0.20 |
| On-Site Wetlands | W7 | 333.84 (June) | 333.59 (June) | -0.25 |
| On-Site Wetlands | W8 | 336.30 [7] (April) | 336.30 [7] (April) | 0.00 |
| On-Site Wetlands | W8 | 336.30 [7] (May) | 336.30 [7] (May) | 0.00 |
| On-Site Wetlands | W8 | 336.30 [7] (June) | 336.30 [7] (June) | 0.00 |
| On-Site Wetlands | V2 | 340.30 [3] (April) | 340.30 [3] (April) | 0.00 |
| On-Site Wetlands | V2 | 340.22 [4]/340.13 [5] (May) | 340.22 [4]/340.13 [5] (May) | 0.00[3] |
| On-Site Wetlands | V2 | 340.05 [4]/339.97 [5] (June) | 340.05 [4]/339.97 [5] (June) | 0.00[3] |

**Table 5.1c**

**Summary of 2023 Target Levels - Summer**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Location | Trigger Well | 2022 Target (m AMSL) | 2023 Target (m AMSL) | Difference |
|---|---|---|---|---|
| North Quarry | BH37 | 315.25 | 315.02 | -0.01 |
| North Quarry | BH55 | 312.63 | 312.56 | -0.07 |
| North Quarry | BH56 | 312.40 | 312.34 | -0.06 |
| North Quarry | BH57-III | 313.29 | 313.20 | -0.09 |
| North Quarry | BH59 | 313.77 | 313.68 | -0.09 |
| North Quarry | BH60 | 314.00 | 313.93 | -0.07 |
| North Quarry | BH61-III | 313.93 | 313.87 | -0.06 |
| West Cell | OW27-04 | 317.21 | 317.10 | -0.11 |
| West Cell | OW28-04 | 317.79 | 317.69 | -0.10 |
| West Cell | OW29-04 | 317.85 | 317.76 | -0.09 |
| West Cell | OW30-04 | 318.00 | 317.92 | -0.08 |
| West Cell | OW31-04 | 318.77 | 318.44 | -0.33 |
| West Cell | OW32-04 | 319.77 | 319.54 | -0.23 |
| West Cell | OW33-04 | 322.13 | 321.88 | -0.25 |
| West Cell | OW34-04 | 323.36 | 323.31 | -0.05 |
| West Cell | OW35-04 | 323.58 | 323.51 | -0.07 |
| West Cell | OW36-04 | 323.63 | 323.56 | -0.07 |
| West Cell | OW37-04 | 323.76 | 323.70 | -0.06 |
| West Cell | OW38-04 | 325.03 | 324.70 | -0.33 |
| East Cell | BH48 | 330.14 | 330.07 | -0.07 |
| East Cell | OW52-07 | 335.08 | 334.89 | -0.19 |
| East Cell | OW5-80 | 335.43 | 335.27 | -0.16 |
| East Cell | OW60-07 | 323.61 | 323.56 | -0.05 |
| East Cell | OW61-07 | 324.18 | 324.04 | -0.14 |
| East Cell | OW62-07 | 324.10 | 324.01 | -0.09 |
| East Cell | OW63-07 | 324.42 | 324.30 | -0.12 |
| East Cell | OW64-07 | 324.94 | 324.83 | -0.11 |
| East Cell | OW65-07 | 332.72 | 332.56 | -0.16 |
| East Cell | OW66-07 | 333.79 | 333.59 | -0.20 |
| East Cell | OW70-08 | 336.36 | 335.85 | -0.51 |
| East Cell | OW71-08 | 335.39 | 335.10 | -0.29 |
| On-Site Wetlands | W7 | 333.03 | 332.91 | -0.12 |
| On-Site Wetlands | W8 | 336.02 | 335.92 | -0.10 |
| On-Site Wetlands | V2 | 339.88 [4]/339.80 [5] (July) | 339.88 [4]/339.80 [5] (July) | 0.00[3] |
| On-Site Wetlands | V2 | -- [1] (August) | --[1] (August) | 0.00[3] |

**Table 5.1d**

**Summary of 2023 Target Levels - Fall**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Location | Trigger Well | 2022 Target (m AMSL) | 2023 Target (m AMSL) | Difference |
|---|---|---|---|---|
| North Quarry | BH37 | 315.13 | 314.88 | -0.25 |
| North Quarry | BH55 | 312.69 | 312.61 | -0.08 |
| North Quarry | BH56 | 312.44 | 312.38 | -0.06 |
| North Quarry | BH57-III | 313.24 | 313.14 | -0.10 |
| North Quarry | BH59 | 313.72 | 313.63 | -0.09 |
| North Quarry | BH60 | 314.06 | 313.99 | -0.07 |
| North Quarry | BH61-III | 313.95 | 313.88 | -0.07 |
| West Cell | OW27-04 | 317.22 | 317.10 | -0.12 |
| West Cell | OW28-04 | 317.81 | 317.69 | -0.12 |
| West Cell | OW29-04 | 317.86 | 317.76 | -0.10 |
| West Cell | OW30-04 | 317.98 | 317.89 | -0.09 |
| West Cell | OW31-04 | 318.33 | 317.97 | -0.36 |
| West Cell | OW32-04 | 319.61 | 319.36 | -0.25 |
| West Cell | OW33-04 | 322.20 | 321.91 | -0.29 |
| West Cell | OW34-04 | 323.38 | 323.31 | -0.07 |
| West Cell | OW35-04 | 323.57 | 323.49 | -0.08 |
| West Cell | OW36-04 | 323.57 | 323.50 | -0.07 |
| West Cell | OW37-04 | 323.74 | 323.66 | -0.08 |
| West Cell | OW38-04 | 324.52 | 324.17 | -0.35 |
| East Cell | BH48 | 330.05 | 329.96 | -0.09 |
| East Cell | OW52-07 | 334.84 | 334.58 | -0.26 |
| East Cell | OW5-80 | 335.15 | 334.94 | -0.21 |
| East Cell | OW60-07 | 323.66 | 323.60 | -0.06 |
| East Cell | OW61-07 | 324.09 | 323.91 | -0.18 |
| East Cell | OW62-07 | 324.18 | 324.08 | -0.10 |
| East Cell | OW63-07 | 324.40 | 324.27 | -0.13 |
| East Cell | OW64-07 | 324.90 | 324.78 | -0.12 |
| East Cell | OW65-07 | 332.53 | 332.32 | -0.21 |
| East Cell | OW66-07 | 333.63 | 333.37 | -0.26 |
| East Cell | OW70-08 | 335.67 | 335.01 | -0.66 |
| East Cell | OW71-08 | 335.08 | 334.71 | -0.37 |
| On-Site Wetlands | W7 | 333.17 (6) | 333.04 (6) | -0.13 |
| On-Site Wetlands | W8 | 335.69 | 335.56 | -0.13 |
| On-Site Wetlands | V2 | -- (1) | -- (1) | 0.00 (3) |

**Table 5.1e**

**Summary of 2023 Target Levels - Notes**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

Notes:

NA Not applicable.
(1) No target level to be implemented during this period.
(2) Target level to be implemented in anticipation of spring freshet based on short-term weather forecast (typically occurs in mid to late March).
(3) V2 target levels do not change as per Section 6.0 of The Establishment of Extension Target Levels and Minimum Levels (CRA, 2011b).
(4) Target level for first half of month.
(5) Target level for second half of month.
(6) Feature to be allowed to go dry for 1 to 2 months every 2 to 3 years [refer to "Establishment of Target Levels and Minimum Levels" (CRA, 2011b)], however, due to the presence of a snapping turtle discovered in September 2014, it is recommended by GEC to maintain water levels year round to support turtle use.
(7) The Target level cannot be higher than the maximum elevation of the edge/embankment surrounding the wetland (with an allowance for freeboard); therefore, calculated Target is replaced to match the maximum elevation.

**Table 6.1**

**2022 North Quarry and Extension Dewatering**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | To Reservoir ($m^3$) | To Operations ($m^3$) | Total Monthly Dewatering ($m^3$) |
|---|---|---|---|
| January | 480,842 | 0 | 480,842 |
| February | 438,928 | 0 | 438,928 |
| March | 537,745 | 0 | 537,745 |
| April | 389,793 | 0 | 389,793 |
| May | 355,010 | 0 | 355,010 |
| June | 366,905 | 0 | 366,905 |
| July | 273,289 | 0 | 273,289 |
| August | 347,385 | 0 | 347,385 |
| September | 311,979 | 0 | 311,979 |
| October | 311,475 | 0 | 311,475 |
| November | 210,524 | 0 | 210,524 |
| December | 205,226 | 0 | 205,226 |
| TOTAL: | 4,229,100 | 0 | 4,229,100 |

Note:

(1) Daily flow totals based on interpolation of periodic manual flowmeter readings and information on where the flow was directed (reservoir or operations) Where Dufferin has provided the date/time/flowmeter information associated with a switch in where the flow was directed this information is used to divide the flow accordingly. Where an observation of flow direction provided by Dufferin is different from the previously noted direction it is assumed that the change in direction occurred at 0:00 hrs on the day of the different observation.

**Comparison of North Quarry and Extension Discharge Quantities (2001 to 2022)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Year | Water Taking (L)[1] | Revised Water Taking[2] | Water Handling (L)[3] |
|---|---|---|---|
| 2001 | 160,324,000 | -- | 160,324,000 |
| 2002 | 441,447,000 | -- | 441,447,000 |
| 2003 | 503,697,473 | -- | 503,697,473 |
| 2004 | 623,782,118 | -- | 623,782,118 |
| 2005 | 718,895,348 | -- | 718,895,348 |
| 2006 | 735,459,903 | -- | 735,459,903 |
| 2007 | 754,046,703 | 751,411,935 | 450,934,401 |
| 2008 | 759,866,700 | 756,406,935 | 840,326,000 |
| 2009 | 781,423,204 | 774,907,749 | 1,253,041,000 |
| 2010 | 793,295,070 | 785,096,750 | 1,018,752,000 |
| 2011 | 802,654,950 | 793,129,909 | 1,368,801,000 |
| 2012 | 840,753,841 | 825,828,144 | 1,352,396,562 |
| 2013 | 867,201,020 | 848,527,089 | 2,067,246,824 |
| 2014 | 884,193,964 | 863,111,157 | 2,274,525,873 |
| 2015 | 900,673,100 | 877,254,333 | 2,861,391,838 |
| 2016 | 941,562,480 | 912,347,538 | 2,548,292,791 |
| 2017 | 956,869,837 | 925,485,054 | 2,909,817,514 |
| 2018 | 964,528,181 | 932,057,808 | 2,729,876,399 |
| 2019 | 984,852,935 | 949,501,647 | 3,389,753,863 |
| 2020 | 1,015,899,227 | 976,146,975 | 3,862,217,944 |
| 2021 | 1,032,791,871 | 990,645,129 | 4,250,870,986 |
| 2022 | 1,032,791,871 | 990,645,129 | 4,229,100,264 |
| **PTTW[4]** | 1,359,000,000 | n/a | 23,652,000,000 |

Notes:

(1) The water taking is calculated on an annual basis starting in 2007 because the North Quarry Recharge System became operational in 2007, at which time water taking and water handling are no longer the same because of the recirculation of water from the groundwater recharge well system. Prior to 2007 the water taking is based on a 1999 pump calibration by CRA.

(2) Updates completed for the 5-Year AMP Review have resulted in revised estimates for long-term average precipitation, evapotranspiration, dry quarry evaporation, infiltration, and runoff. Annual water taking has been revised using the same methodology presented in item 2 of Schedule A to the PTTW (PTTW Report).

(3) The water handling is not a taking from the environment, but rather the handling of both water taken from the environment and recharge water that recirculates back into the quarry cells.

(4) Limits of annual water taking and water handling allowed by
- PTTW No. 0117-8BHQPL effective December 16, 2010
- PTTW No. 8575-A3BKYB effective November 23, 2015
- PTTW No. 5256-BUUP62 effective November 2, 2020

**2022 Recharge System Flows**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Monthly Flow Totals at Recharge Pump Station ($m^3$) | Monthly Sum of Recharge Well and Wetland Flow Totals ($m^3$) |
|---|---|---|
| January | 471,101 | 520,250 |
| February | 367,451 | 366,911 |
| March | 416,879 | 361,925 |
| April | 432,641 | 398,379 |
| May | 467,067 | 520,677 |
| June | 488,358 | 447,224 |
| July | 399,372 | 357,921 |
| August | 384,184 | 423,663 |
| September | 329,837 | 294,253 |
| October | 326,050 | 362,100 |
| November | 314,137 | 291,663 |
| December | 400,483 | 387,296 |
| TOTAL (1) : | 4,797,560 | 4,732,261 |
| PTTW Limit: | 18,921,600 | -- |

Note:

(1) The difference between the total flow at the pump station and the total recharge well and wetland flow is less than 2%.

**Main Quarry Discharge Summary (2022)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Lake Discharge 4' Pump ($m^3$) | Reservoir Discharge ($m^3$) | Total ($m^3$) | Actual Average Flow [(1)] ($m^3/s$) |
|---|---|---|---|---|
| January | 18,258 | 6,107 | 24,365 | 0.012 |
| February | 15,787 | 15,297 | 31,084 | 0.014 |
| March | 20,416 | 16,732 | 37,148 | 0.012 |
| April | 14,181 | 21,858 | 36,039 | 0.013 |
| May | 19,956 | 23,615 | 43,571 | 0.013 |
| June | 19,270 | 20,910 | 40,180 | 0.014 |
| July | 16,296 | 119,136 | 135,432 | 0.059 |
| August | 29,070 | 118,016 | 147,086 | 0.059 |
| September | 19,570 | 126,111 | 145,681 | 0.056 |
| October | 39 | 41,222 | 41,261 | 0.013 |
| November | 57 | 29,040 | 29,097 | 0.010 |
| December | 0 | 25,080 | 25,080 | 0.007 |
| **TOTAL:** | **172,899** | **563,124** | **736,023** | -- |

Notes:

(1) Minimum annual discharge of 700,000 $m^3$ (per the October 2003 Main Qua Water Management Agreement); Minimum 464,000 $m^3$ uniformly distribute between July 1 and September 30 (i.e., approximately 0.058 $m^3/s$ average daily flows; per the April 2005 Storage and Operations Optimization Study b Philips Engineering Ltd.); Minimum 236,000 $m^3$ uniformly distributed betwee October 1 and June 30 (i.e., approximately 0.010 m 3/s average daily flows per the April 2005 Storage and Operations Optimization Study by Philips Engineering Ltd.); Not-to-exceed discharge rate of 12,000 L/min (0.2 m 3/s per Certificate of Approval No. 9119-7TSGXH and Permit to Take Water No. 0117-8BHQPL, 6445-GQZMES, 8575-A3BKYB and 5256-BUUP62).

**Table 6.5**

**Comparison of Main Quarry Discharge Quantities (1991 to 2022)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 284,292,000 | 97,864,500 | 345,666,000 | 66,144,000 | 313,852,750 | 246,171,750 | 257,659,500 | 320,597,000 | 139,284,000 | 105,122,780 | 34,988,610 |
| February | 202,658,750 | 69,324,000 | 93,969,000 | 76,320,000 | 210,489,500 | 153,673,500 | 272,049,000 | 265,106,000 | 237,645,900 | 120,730,455 | 234,412,200 |
| March | 317,311,000 | 146,598,000 | 139,694,750 | 205,198,333 | 146,240,250 | 169,838,500 | 473,184,000 | 282,596,000 | 144,644,400 | 217,760,000 | 315,862,630 |
| April | 405,927,000 | 252,306,500 | 339,769,750 | 238,924,000 | 194,006,500 | 404,933,250 | 442,020,000 | 370,894,000 | 180,324,900 | 234,693,600 | 225,026,680 |
| May | 193,079,000 | 209,681,250 | 163,452,000 | 285,603,750 | 235,094,750 | 435,554,000 | 181,074,500 | 64,395,000 | 134,119,200 | 295,458,700 | 219,863,940 |
| June | 131,837,500 | 87,238,000 | 230,709,000 | 119,647,500 | 105,562,750 | 194,377,500 | 27,599,750 | 203,149,000 | 112,897,500 | 338,757,300 | 111,169,430 |
| July | 101,004,750 | 237,864,000 | 149,062,500 | 95,691,500 | 48,044,500 | 131,161,750 | 80,136,000 | 122,218,000 | 46,350,000 | 141,425,200 | 70,322,710 |
| August | 62,049,750 | 249,047,000 | 61,201,750 | 60,552,500 | 60,658,500 | 69,204,750 | 155,078,000 | 27,030,000 | 21,801,600 | 217,525,900 | 86,470,260 |
| September | 46,467,750 | 333,264,000 | 78,387,000 | 43,208,250 | 51,555,750 | 239,825,000 | 99,189,500 | 102,290,000 | 109,076,130 | 199,620,380 | 80,469,500 |
| October | 45,725,750 | 231,875,000 | 98,553,500 | 75,843,000 | 155,886,250 | 206,753,000 | 85,934,200 | 149,725,000 | 124,748,700 | 88,253,700 | 12,908,000 |
| November | 67,985,750 | 459,801,500 | 100,488,000 | 130,552,250 | 235,386,250 | 152,560,500 | 139,819,300 | 43,513,000 | 111,363,640 | 83,422,170 | 55,071,470 |
| December | 157,449,750 | 304,591,000 | 155,051,500 | 99,799,000 | 126,193,000 | 166,340,500 | 183,364,100 | 195,093,000 | 176,643,740 | 42,174,240 | 378,883,288 |
| **Total (L)** | **2,015,788,750** | **2,679,454,750** | **1,956,004,750** | **1,497,484,083** | **1,882,970,750** | **2,570,394,000** | **2,397,107,850** | **2,146,606,000** | **1,538,899,710** | **2,084,944,425** | **1,825,448,718** |

**Table 6.5**

**Comparison of Main Quarry Discharge Quantities (1991 to 2022)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 317,925,251 | 64,239,400 | 217,825,500 | 128,987,370 | 38,266,350 | 14,346,000 | 47,546,000 | 366,850,654 | 26,638,000 | 43,204,000 | 311,865,000 |
| February | 250,571,120 | 61,125,600 | 221,380,500 | 26,877,000 | 33,111,180 | 7,709,000 | 18,131,000 | 366,081,034 | 25,148,000 | 34,269,000 | 196,619,068 |
| March | 223,426,590 | 125,526,310 | 373,956,900 | 21,726,000 | 19,836,090 | 6,972,000 | 28,374,000 | 446,768,000 | 228,249,000 | 316,223,000 | 101,448,652 |
| April | 226,518,650 | 227,154,800 | 358,357,800 | 69,204,990 | 52,002,000 | 10,547,000 | 24,587,816 | 425,298,000 | 275,476,000 | 366,292,000 | 131,075,148 |
| May | 164,961,800 | 216,571,000 | 433,116,000 | 79,021,890 | 150,270,460 | 57,375,000 | 29,020,377 | 371,337,000 | 32,091,000 | 447,546,000 | 99,278,985 |
| June | 112,964,940 | 219,146,500 | 302,220,600 | 21,921,200 | 143,594,240 | 37,920,000 | 24,871,373 | 49,161,000 | 51,017,000 | 465,104,000 | 44,635,492 |
| July | 70,893,000 | 219,216,400 | 77,334,000 | 72,760,000 | 62,041,000 | 81,265,000 | 120,670,552 | 147,548,000 | 159,706,000 | 364,827,000 | 129,648,566 |
| August | 156,273,800 | 48,751,900 | 70,319,100 | 102,080,500 | 92,949,000 | 131,565,000 | 188,255,496 | 156,152,000 | 152,345,000 | 146,771,000 | 171,263,371 |
| September | 118,369,050 | 194,385,200 | 22,827,300 | 143,058,730 | 123,422,000 | 176,423,000 | 174,145,000 | 138,366,000 | 149,670,000 | 138,648,000 | 208,081,437 |
| October | 71,687,320 | 235,523,500 | 0 | 171,914,600 | 138,923,600 | 119,461,000 | 32,686,000 | 36,363,000 | 36,801,000 | 160,946,000 | 40,247,790 |
| November | 48,097,190 | 151,477,600 | 90,775,800 | 87,839,200 | 214,885,701 | 64,070,000 | 35,226,865 | 25,896,000 | 29,128,000 | 266,943,000 | 31,815,373 |
| December | 49,654,280 | 180,956,400 | 0 | 1,537,000 | 277,212,000 | 69,996,000 | 159,780,000 | 22,090,000 | 28,875,000 | 284,039,000 | 36,161,265 |
| **Total (L)** | **1,811,342,991** | **1,944,074,610** | **2,168,113,500** | **926,928,480** | **1,346,513,621** | **777,649,000** | **883,294,479** | **2,551,910,687** | **1,195,144,000** | **3,034,812,000** | **1,502,140,146** |

**Table 6.5**

**Comparison of Main Quarry Discharge Quantities (1991 to 2022)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | Average (1991 - 2022) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 64,219,571 | 107,936,253 | 39,338,542 | 30,665,766 | 34,654,285 | 39,156,619 | 91,408,970 | 274,885,317 | 31,961,282 | 24,364,641 | 141,497,739 |
| February | 236,524,425 | 96,052,352 | 42,639,269 | 26,196,000 | 30,044,926 | 83,605,911 | 130,195,452 | 438,910,899 | 33,333,323 | 31,083,664 | 135,187,095 |
| March | 333,767,724 | 145,468,691 | 45,156,880 | 31,069,765 | 31,301,134 | 197,609,853 | 224,325,604 | 319,152,605 | 31,290,573 | 37,147,871 | 182,741,410 |
| April | 203,077,936 | 80,836,957 | 32,367,553 | 41,096,460 | 97,854,839 | 58,366,779 | 326,399,884 | 206,249,299 | 34,340,894 | 36,038,563 | 205,374,048 |
| May | 118,624,401 | 290,640,727 | 32,702,918 | 30,335,594 | 434,930,642 | 220,019,230 | 510,303,271 | 65,516,367 | 35,245,431 | 43,571,180 | 196,245,480 |
| June | 71,003,343 | 91,655,703 | 22,387,864 | 33,672,181 | 295,243,811 | 207,786,565 | 331,159,762 | 43,363,244 | 35,306,708 | 40,180,435 | 134,601,912 |
| July | 188,391,102 | 192,276,505 | 125,854,205 | 154,826,181 | 212,282,638 | 186,233,911 | 202,499,213 | 165,036,191 | 158,032,752 | 135,431,910 | 139,064,220 |
| August | 198,845,318 | 168,172,663 | 143,611,461 | 158,030,533 | 165,029,387 | 188,588,463 | 172,846,236 | 168,208,690 | 156,831,521 | 147,085,824 | 129,831,134 |
| September | 177,282,512 | 182,734,110 | 147,839,211 | 150,915,827 | 164,104,077 | 177,653,247 | 162,923,506 | 160,795,397 | 144,700,940 | 145,680,877 | 143,293,084 |
| October | 71,180,400 | 71,755,316 | 30,742,677 | 39,449,756 | 39,999,539 | 146,046,688 | 32,347,962 | 35,927,422 | 34,047,408 | 41,261,283 | 89,484,949 |
| November | 142,127,398 | 51,119,676 | 28,884,000 | 35,483,273 | 32,681,700 | 41,900,146 | 30,608,411 | 31,567,868 | 25,265,027 | 29,096,919 | 96,089,155 |
| December | 123,570,286 | 44,037,580 | 28,175,929 | 35,560,971 | 36,691,182 | 44,380,249 | 79,069,085 | 35,034,005 | 18,941,649 | 25,080,000 | 111,450,781 |
| **Total (L)** | **1,928,614,418** | **1,522,686,532** | **719,700,510** | **767,302,307** | **1,574,818,161** | **1,591,347,660** | **2,294,087,356** | **1,944,647,305** | **739,297,507** | **736,023,167** | **1,704,861,007** |

**Table 6.6**

**2022 Overall Water Taking**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Month | Main Quarry [1] Total (L) | North Quarry [3] and Extension Total (L) | Operations [4] Total (L) | Total Water Taking (L) |
|---|---|---|---|---|
| January | 24,364,641 | NA | NA | NA |
| February | 31,083,664 | NA | NA | NA |
| March | 37,147,871 | NA | NA | NA |
| April | 36,038,563 | NA | NA | NA |
| May | 43,571,180 | NA | NA | NA |
| June | 40,180,435 | NA | NA | NA |
| July | 135,431,910 | NA | NA | NA |
| August | 147,085,824 | NA | NA | NA |
| September | 145,680,877 | NA | NA | NA |
| October | 41,261,283 | NA | NA | NA |
| November | 29,096,919 | NA | NA | NA |
| December | 25,080,000 | NA | NA | NA |
| **Total** | **736,023,167** | **1,032,791,871** | **147,199,234** | **1,916,014,271** |
| **PTTW [2]** | **4,464,000,000** | **1,359,000,000** | -- | **6,417,600,000** |

Notes:

NA Not applicable.
(1) Includes discharge to the HFRT from the West Sump and the Reservoir.
(2) Limit of annual water taking allowed by the PTTW No. 8575-A3BKYB and 5256-BUUP62.
(3) This water taking is calculated on an annual basis starting in 2007 because the Groundwater Recharge Well System became operational in 2007. Monthly water takings are not available subsequent to 2006.
(4) Per Appendix J.

**Table 7.1**

**2022 Water Quality Results - West Sump Discharge to HFRT (SW15C)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Analyses | Parameters | Units | ECA Criteria | PWQO Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15[1] | n/a | 11 | 0 | 0 | -- | -- |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5[1] | n/a | 11 | 11 | 0 | 8.65 [4] | 8.35E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5[1] | n/a | 11 | 11 | 0 | 8.42 [5] | 8.14E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25[1] | n/a | 46 | 1 | 0 | 3.8 | 3.80E+00 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02[1][2] | n/a | 11 | 11 | 0 | 0.0042 | 2.26E-03 |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | n/a | - | 11 | 11 | 0 | 240 | 1.84E+02 |
| General Chemistry | Alkalinity, Carbonate | mg/L | n/a | - | 11 | 6 | 0 | 16.3 | 9.62E+00 |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | n/a | - | 11 | 11 | 0 | 240 | 1.89E+02 |
| General Chemistry | Ammonia-N | mg/L | n/a | - | 11 | 11 | 0 | 0.223 | 9.23E-02 |
| General Chemistry | Bromide | mg/L | n/a | - | 11 | 9 | 0 | 0.86 | 2.73E-01 |
| General Chemistry | Chloride | mg/L | n/a | - | 11 | 11 | 0 | 110 | 8.50E+01 |
| General Chemistry | Conductivity | umhos/cm | n/a | - | 11 | 11 | 0 | 1060 | 7.95E+02 |
| General Chemistry | Fluoride | mg/L | n/a | - | 11 | 11 | 0 | 0.169 | 1.44E-01 |
| General Chemistry | Hardness | mg/L | n/a | - | 11 | 11 | 0 | 466 | 3.04E+02 |
| General Chemistry | Nitrate (as N) | mg/L | n/a | - | 11 | 5 | 0 | 0.104 | 5.56E-02 |
| General Chemistry | Nitrite (as N) | mg/L | n/a | - | 11 | 0 | 0 | -- | -- |
| General Chemistry | Orthophosphate (dissolved) | mg/L | n/a | - | 11 | 0 | 0 | -- | -- |
| General Chemistry | Phosphorous | mg/L | n/a | 0.03[2] | 11 | 11 | 0 | 0.0158 | 8.03E-03 |
| General Chemistry | Sulphate | mg/L | n/a | - | 11 | 11 | 0 | 247 | 9.96E+01 |
| General Chemistry | Temperature, Field | Deg C | n/a | - | 11 | 11 | 0 | 24.4 | 1.43E+01 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | n/a | - | 11 | 11 | 0 | 617 | 4.29E+02 |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | n/a | - | 11 | 11 | 0 | 1.02 | 8.09E-01 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | n/a | - | 11 | 11 | 0 | 10.9 | 8.90E+00 |
| General Chemistry | Turbidity | NTU | n/a | - | 11 | 11 | 0 | 1.11 | 7.99E-01 |
| Biological | Escherichia coli | cfu/100mL | n/a | 100[2] | 11 | 7 | 0 | 36 | 7.29E+00 |
| Biological | Total Coliform Bacteria | cfu/100mL | n/a | 100[2] | 11 | 8 | 2 | 300 | 6.21E+01 |
| Metals | Aluminum | mg/L | n/a | 0.075[2] | 11 | 9 | 0 | 0.015 | 6.78E-03 |
| Metals | Antimony | mg/L | n/a | 0.02[2] | 11 | 1 | 0 | 0.00033 | 3.30E-04 |
| Metals | Arsenic | mg/L | n/a | 0.1[2]/0.005[3] | 11 | 11 | 0 | 0.00497 | 3.08E-03 |
| Metals | Barium | mg/L | n/a | - | 11 | 11 | 0 | 0.0289 | 2.38E-02 |
| Metals | Beryllium | mg/L | n/a | 1.1[2] | 11 | 0 | 0 | -- | -- |
| Metals | Bismuth | mg/L | n/a | - | 11 | 0 | 0 | -- | -- |
| Metals | Boron | mg/L | n/a | 0.2[2] | 11 | 11 | 0 | 0.157 | 7.75E-02 |
| Metals | Cadmium | mg/L | n/a | 0.0002[2]/0.0005[3] | 11 | 0 | 0 | -- | -- |
| Metals | Calcium | mg/L | n/a | - | 11 | 11 | 0 | 78 | 4.73E+01 |
| Metals | Chromium Total | mg/L | n/a | - | 11 | 0 | 0 | -- | -- |
| Metals | Cobalt | mg/L | n/a | 0.0009[2] | 11 | 10 | 0 | 0.00018 | 1.35E-04 |
| Metals | Copper | mg/L | n/a | 0.005[2] | 11 | 5 | 0 | 0.0011 | 7.54E-04 |
| Metals | Iron | mg/L | n/a | 0.3[2] | 11 | 11 | 0 | 0.126 | 6.06E-02 |
| Metals | Lead | mg/L | n/a | 0.025[2]/0.005[3] | 11 | 5 | 0 | 0.000062 | 5.60E-05 |
| Metals | Magnesium | mg/L | n/a | - | 11 | 11 | 0 | 65.8 | 4.50E+01 |
| Metals | Manganese | mg/L | n/a | - | 11 | 11 | 0 | 0.1 | 3.75E-02 |
| Metals | Molybdenum | mg/L | n/a | 0.04[2] | 11 | 11 | 0 | 0.0117 | 1.81E-03 |
| Metals | Nickel | mg/L | n/a | 0.025[2] | 11 | 11 | 0 | 0.00339 | 1.22E-03 |
| Metals | Potassium | mg/L | n/a | - | 11 | 11 | 0 | 7.88 | 7.26E+00 |
| Metals | Selenium | mg/L | n/a | 0.1[2] | 11 | 8 | 0 | 0.000068 | 5.65E-05 |
| Metals | Silicon | mg/L | n/a | - | 11 | 11 | 0 | 1.24 | 5.49E-01 |
| Metals | Silver | mg/L | n/a | 0.0001[2] | 11 | 0 | 0 | -- | -- |
| Metals | Sodium | mg/L | n/a | - | 11 | 11 | 0 | 56.4 | 4.74E+01 |
| Metals | Strontium | mg/L | n/a | - | 11 | 11 | 0 | 2.76 | 8.53E-01 |
| Metals | Thallium | mg/L | n/a | 0.0003[2] | 11 | 1 | 0 | 0.000048 | 4.80E-05 |
| Metals | Tin | mg/L | n/a | - | 11 | 0 | 0 | -- | -- |
| Metals | Titanium | mg/L | n/a | - | 11 | 2 | 0 | 0.00071 | 5.40E-04 |
| Metals | Vanadium | mg/L | n/a | 0.006[2] | 11 | 0 | 0 | -- | -- |
| Metals | Zinc | mg/L | n/a | 0.03[2]/0.02[3] | 11 | 7 | 0 | 0.0125 | 6.24E-03 |
| Volatiles | Benzene | ug/L | n/a | 100[2] | 11 | 0 | 0 | -- | -- |
| Volatiles | Ethylbenzene | ug/L | n/a | 8[2] | 11 | 0 | 0 | -- | -- |
| Volatiles | m&p-Xylenes | ug/L | n/a | - | 11 | 0 | 0 | -- | -- |
| Volatiles | o-Xylene | ug/L | n/a | 40[2] | 11 | 0 | 0 | -- | -- |
| Volatiles | Toluene | ug/L | n/a | 0.8[2] | 11 | 0 | 0 | -- | -- |
| Volatiles | Xylenes (total) | ug/L | n/a | - | 11 | 0 | 0 | -- | -- |

Notes:

Screening against Effluent Limits as per ECA requirements.
Screening against PWQOs for comparison purposes only. The ECA does not require this discharge to meet PWQOs.
n/a - Not Applicable
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - PWQO/Interim PWQO.
(4) - Minimum pH measured was 8.06.
(5) - Minimum pH measured was 7.70.

**Table 7.2**

**2022 Water Quality Results - Reservoir Outfall to HFRT (SW52B)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Analyses | Parameters | Units | ECA Criteria | PWQO Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15[1] | n/a | 12 | 0 | 0 | -- | -- |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5[1] | n/a | 12 | 12 | 0 | 8.51 [4] | 8.31E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5[1] | n/a | 12 | 12 | 0 | 8.40 [5] | 8.19E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25[1] | n/a | 52 | 2 | 1 | 28.8 | 1.66E+01 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02[1][2] | n/a | 12 | 12 | 0 | 0.0085 | 3.92E-03 |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | n/a | - | 12 | 12 | 0 | 180 | 1.39E+02 |
| General Chemistry | Alkalinity, Carbonate | mg/L | n/a | - | 12 | 8 | 0 | 11.2 | 5.56E+00 |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | n/a | - | 12 | 12 | 0 | 191 | 1.43E+02 |
| General Chemistry | Ammonia-N | mg/L | n/a | - | 12 | 12 | 0 | 0.287 | 1.38E-01 |
| General Chemistry | Bromide | mg/L | n/a | - | 12 | 10 | 0 | 1.03 | 6.76E-01 |
| General Chemistry | Chloride | mg/L | n/a | - | 12 | 12 | 0 | 120 | 1.09E+02 |
| General Chemistry | Conductivity | umhos/cm | n/a | - | 12 | 12 | 0 | 1130 | 1.04E+03 |
| General Chemistry | Fluoride | mg/L | n/a | - | 12 | 12 | 0 | 0.233 | 1.89E-01 |
| General Chemistry | Hardness | mg/L | n/a | - | 12 | 12 | 0 | 490 | 4.36E+02 |
| General Chemistry | Nitrate (as N) | mg/L | n/a | - | 12 | 9 | 0 | 0.202 | 1.30E-01 |
| General Chemistry | Nitrite (as N) | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| General Chemistry | Orthophosphate (dissolved) | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| General Chemistry | Phosphorous | mg/L | n/a | 0.03[2] | 12 | 10 | 0 | 0.0141 | 5.04E-03 |
| General Chemistry | Sulphate | mg/L | n/a | - | 12 | 12 | 0 | 273 | 2.36E+02 |
| General Chemistry | Temperature, Field | Deg C | n/a | - | 12 | 12 | 0 | 24.5 | 1.20E+01 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | n/a | - | 12 | 12 | 0 | 681 | 6.20E+02 |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | n/a | - | 12 | 12 | 0 | 0.876 | 5.11E-01 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | n/a | - | 12 | 12 | 0 | 10.3 | 4.20E+00 |
| General Chemistry | Turbidity | NTU | n/a | - | 12 | 12 | 0 | 2.79 | 8.83E-01 |
| Biological | Escherichia coli | cfu/100mL | n/a | 100[2] | 12 | 5 | 0 | 4 | 1.40E+00 |
| Biological | Total Coliform Bacteria | cfu/100mL | n/a | 100[2] | 12 | 8 | 0 | 24 | 9.88E+00 |
| Metals | Aluminum | mg/L | n/a | 0.075[2] | 12 | 12 | 1 | 0.095 | 1.80E-02 |
| Metals | Antimony | mg/L | n/a | 0.02[2] | 12 | 11 | 0 | 0.00048 | 3.87E-04 |
| Metals | Arsenic | mg/L | n/a | 0.1[2]/0.005[3] | 12 | 12 | 0 | 0.00395 | 2.31E-03 |
| Metals | Barium | mg/L | n/a | - | 12 | 12 | 0 | 0.0495 | 2.60E-02 |
| Metals | Beryllium | mg/L | n/a | 1.1[2] | 12 | 0 | 0 | -- | -- |
| Metals | Bismuth | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Boron | mg/L | n/a | 0.2[2] | 12 | 12 | 0 | 0.16 | 1.38E-01 |
| Metals | Cadmium | mg/L | n/a | 0.0002[2]/0.0005[3] | 12 | 7 | 0 | 0.0000105 | 7.81E-06 |
| Metals | Calcium | mg/L | n/a | - | 12 | 12 | 0 | 89.7 | 7.58E+01 |
| Metals | Chromium Total | mg/L | n/a | - | 12 | 1 | 0 | 0.00116 | 1.16E-03 |
| Metals | Cobalt | mg/L | n/a | 0.0009[2] | 12 | 12 | 0 | 0.00052 | 3.22E-04 |
| Metals | Copper | mg/L | n/a | 0.005[2] | 12 | 0 | 0 | -- | -- |
| Metals | Iron | mg/L | n/a | 0.3[2] | 12 | 12 | 0 | 0.218 | 4.95E-02 |
| Metals | Lead | mg/L | n/a | 0.025[2]/0.005[3] | 12 | 8 | 0 | 0.00021 | 1.08E-04 |
| Metals | Magnesium | mg/L | n/a | - | 12 | 12 | 0 | 68.8 | 5.98E+01 |
| Metals | Manganese | mg/L | n/a | - | 12 | 12 | 0 | 0.0392 | 7.54E-03 |
| Metals | Molybdenum | mg/L | n/a | 0.04[2] | 12 | 12 | 0 | 0.0131 | 1.02E-02 |
| Metals | Nickel | mg/L | n/a | 0.025[2] | 12 | 12 | 0 | 0.00516 | 3.82E-03 |
| Metals | Potassium | mg/L | n/a | - | 12 | 12 | 0 | 7.76 | 6.50E+00 |
| Metals | Selenium | mg/L | n/a | 0.1[2] | 12 | 11 | 0 | 0.000142 | 8.88E-05 |
| Metals | Silicon | mg/L | n/a | - | 12 | 12 | 0 | 1.64 | 1.06E+00 |
| Metals | Silver | mg/L | n/a | 0.0001[2] | 12 | 0 | 0 | -- | -- |
| Metals | Sodium | mg/L | n/a | - | 12 | 12 | 0 | 52.3 | 4.21E+01 |
| Metals | Strontium | mg/L | n/a | - | 12 | 12 | 0 | 2.83 | 2.28E+00 |
| Metals | Thallium | mg/L | n/a | 0.0003[2] | 12 | 11 | 0 | 0.000079 | 6.12E-05 |
| Metals | Tin | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Titanium | mg/L | n/a | - | 12 | 3 | 0 | 0.00252 | 1.06E-03 |
| Metals | Vanadium | mg/L | n/a | 0.006[2] | 12 | 0 | 0 | -- | -- |
| Metals | Zinc | mg/L | n/a | 0.03[2]/0.02[3] | 12 | 6 | 0 | 0.0096 | 5.77E-03 |
| Volatiles | Benzene | ug/L | n/a | 100[2] | 12 | 0 | 0 | -- | -- |
| Volatiles | Ethylbenzene | ug/L | n/a | 8[2] | 12 | 0 | 0 | -- | -- |
| Volatiles | m&p-Xylenes | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Volatiles | o-Xylene | ug/L | n/a | 40[2] | 12 | 0 | 0 | -- | -- |
| Volatiles | Toluene | ug/L | n/a | 0.8[2] | 12 | 0 | 0 | -- | -- |
| Volatiles | Xylenes (total) | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |

Notes:

Screening against Effluent Limits as per ECA requirements.
Screening against PWQOs for comparison purposes only. The ECA does not require this discharge to meet PWQOs.
n/a - Not Applicable
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - PWQO/Interim PWQO.
(4) - Minimum pH measured was 8.11.
(5) - Minimum pH measured was 7.32.

**Table 7.3**

**2022 Water Quality Results - Recharge System Pumping Station (SW53)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Analyses | Parameters | | ECA Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15[(1)] | 12 | 0 | 0 | -- | -- |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5[(1)] | 12 | 12 | 0 | 8.57 [(4)] | 8.29E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5[(1)] | 12 | 12 | 0 | 8.33 [(5)] | 8.08E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25[(1)] | 52 | 2 | 0 | 3.4 | 3.30E+00 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02[(1)(2)] | 12 | 12 | 0 | 0.0062 | 2.92E-03 |
| General Chemistry | Ammonia-N | mg/L | - | 12 | 12 | 0 | 0.282 | 1.31E-01 |
| General Chemistry | Temperature, Field | Deg C | - | 12 | 12 | 0 | 23.9 | 1.33E+01 |

Notes:

Screening against Effluent Limits as per ECA requirements.
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - Minimum pH measured was 8.04.
(4) - Minimum pH measured was 7.83.

**Table 7.4**

**2022 Water Quality Results - North Quarry Recharge System Wells**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Analyses | Parameters | Units | ECA Criteria | PWQO Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15[1] | n/a | 36 | 2 | 0 | 9.6 | 9.40E+00 |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5[1] | n/a | 36 | 36 | 0 | 8.46 [4] | 8.25E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5[1] | n/a | 36 | 36 | 0 | 8.78 [5] | 8.21E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25[1] | n/a | 36 | 2 | 0 | 5.8 | 4.50E+00 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02[1][2] | n/a | 36 | 36 | 0 | 0.0088 | 3.97E-03 |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | n/a | - | 36 | 36 | 0 | 162 | 1.35E+02 |
| General Chemistry | Alkalinity, Carbonate | mg/L | n/a | - | 36 | 16 | 0 | 8.2 | 5.12E+00 |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | n/a | - | 36 | 36 | 0 | 162 | 1.37E+02 |
| General Chemistry | Ammonia-N | mg/L | n/a | - | 36 | 36 | 0 | 0.283 | 1.32E-01 |
| General Chemistry | Bromide | mg/L | n/a | - | 36 | 29 | 0 | 1.1 | 7.28E-01 |
| General Chemistry | Chloride | mg/L | n/a | - | 36 | 36 | 0 | 124 | 1.11E+02 |
| General Chemistry | Conductivity | umhos/cm | n/a | - | 36 | 36 | 0 | 1150 | 1.05E+03 |
| General Chemistry | Fluoride | mg/L | n/a | - | 36 | 36 | 0 | 0.207 | 1.87E-01 |
| General Chemistry | Hardness | mg/L | n/a | - | 36 | 36 | 0 | 496 | 4.54E+02 |
| General Chemistry | Nitrate (as N) | mg/L | n/a | - | 36 | 24 | 0 | 0.219 | 1.40E-01 |
| General Chemistry | Nitrite (as N) | mg/L | n/a | - | 36 | 0 | 0 | -- | -- |
| General Chemistry | Orthophosphate (dissolved) | mg/L | n/a | - | 36 | 0 | 0 | -- | -- |
| General Chemistry | Phosphorous | mg/L | n/a | 0.03[2] | 36 | 21 | 0 | 0.0264 | 4.60E-03 |
| General Chemistry | Sulphate | mg/L | n/a | - | 36 | 36 | 0 | 284 | 2.50E+02 |
| General Chemistry | Temperature, Field | Deg C | n/a | - | 36 | 36 | 0 | 24.2 | 1.27E+01 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | n/a | - | 36 | 36 | 0 | 738 | 6.53E+02 |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | n/a | - | 36 | 36 | 0 | 0.78 | 4.39E-01 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | n/a | - | 36 | 36 | 0 | 35.2 | 4.74E+00 |
| General Chemistry | Turbidity | NTU | n/a | - | 36 | 36 | 0 | 1.76 | 5.63E-01 |
| Biological | Escherichia coli | cfu/100mL | n/a | 100[2] | 36 | 9 | 0 | 2 | 1.00E+00 |
| Biological | Total Coliform Bacteria | cfu/100mL | n/a | 100[2] | 36 | 20 | 0 | 100 | 1.70E+01 |
| Metals | Aluminum | mg/L | n/a | 0.075[2] | 36 | 35 | 0 | 0.0458 | 1.31E-02 |
| Metals | Antimony | mg/L | n/a | 0.02[2] | 36 | 36 | 0 | 0.00054 | 3.87E-04 |
| Metals | Arsenic | mg/L | n/a | 0.1[2]/0.005[3] | 36 | 36 | 0 | 0.00324 | 2.20E-03 |
| Metals | Barium | mg/L | n/a | - | 36 | 36 | 0 | 0.0503 | 2.51E-02 |
| Metals | Beryllium | mg/L | n/a | 1.1[2] | 36 | 0 | 0 | -- | -- |
| Metals | Bismuth | mg/L | n/a | - | 36 | 1 | 0 | 0.000086 | 8.60E-05 |
| Metals | Boron | mg/L | n/a | 0.2[2] | 36 | 36 | 0 | 0.165 | 1.48E-01 |
| Metals | Cadmium | mg/L | n/a | 0.0002[2]/0.0005[3] | 36 | 20 | 0 | 0.0000134 | 8.75E-06 |
| Metals | Calcium | mg/L | n/a | - | 36 | 36 | 0 | 92.5 | 7.99E+01 |
| Metals | Chromium Total | mg/L | n/a | - | 36 | 0 | 0 | -- | -- |
| Metals | Cobalt | mg/L | n/a | 0.0009[2] | 36 | 36 | 0 | 0.00042 | 2.61E-04 |
| Metals | Copper | mg/L | n/a | 0.005[2] | 36 | 2 | 0 | 0.00054 | 5.20E-04 |
| Metals | Iron | mg/L | n/a | 0.3[2] | 36 | 36 | 0 | 0.161 | 4.12E-02 |
| Metals | Lead | mg/L | n/a | 0.025[2]/0.005[3] | 36 | 25 | 0 | 0.0002 | 9.70E-05 |
| Metals | Magnesium | mg/L | n/a | - | 36 | 36 | 0 | 67.5 | 6.18E+01 |
| Metals | Manganese | mg/L | n/a | - | 36 | 36 | 0 | 0.00675 | 3.39E-03 |
| Metals | Molybdenum | mg/L | n/a | 0.04[2] | 36 | 36 | 0 | 0.0133 | 1.12E-02 |
| Metals | Nickel | mg/L | n/a | 0.025[2] | 36 | 36 | 0 | 0.00503 | 3.99E-03 |
| Metals | Potassium | mg/L | n/a | - | 36 | 36 | 0 | 7.1 | 6.43E+00 |
| Metals | Selenium | mg/L | n/a | 0.1[2] | 36 | 36 | 0 | 0.000189 | 8.70E-05 |
| Metals | Silicon | mg/L | n/a | - | 36 | 36 | 0 | 1.66 | 1.12E+00 |
| Metals | Silver | mg/L | n/a | 0.0001[2] | 36 | 2 | 0 | 0.000014 | 1.30E-05 |
| Metals | Sodium | mg/L | n/a | - | 36 | 36 | 0 | 43.9 | 4.14E+01 |
| Metals | Strontium | mg/L | n/a | - | 36 | 36 | 0 | 2.88 | 2.48E+00 |
| Metals | Thallium | mg/L | n/a | 0.0003[2] | 36 | 36 | 0 | 0.000157 | 6.30E-05 |
| Metals | Tin | mg/L | n/a | - | 36 | 1 | 0 | 0.00027 | 2.70E-04 |
| Metals | Titanium | mg/L | n/a | - | 36 | 10 | 0 | 0.00126 | 6.44E-04 |
| Metals | Vanadium | mg/L | n/a | 0.006[2] | 36 | 0 | 0 | -- | -- |
| Metals | Zinc | mg/L | n/a | 0.03[2]/0.02[3] | 36 | 18 | 0 | 0.0078 | 5.55E-03 |
| Volatiles | Benzene | ug/L | n/a | 100[2] | 36 | 0 | 0 | -- | -- |
| Volatiles | Ethylbenzene | ug/L | n/a | 8[2] | 36 | 0 | 0 | -- | -- |
| Volatiles | m&p-Xylenes | ug/L | n/a | - | 36 | 0 | 0 | -- | -- |
| Volatiles | o-Xylene | ug/L | n/a | 40[2] | 36 | 0 | 0 | -- | -- |
| Volatiles | Toluene | ug/L | n/a | 0.8[2] | 36 | 0 | 0 | -- | -- |
| Volatiles | Xylenes (total) | ug/L | n/a | - | 36 | 0 | | -- | -- |

Notes:

Screening against Effluent Limits for comparison purposes only. The ECA does not require this discharge to meet Effluent Limits.
Screening against PWQOs for comparison purposes only. The ECA does not require this discharge to meet PWQOs.
n/a - Not Applicable
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - PWQO/Interim PWQO.
(4) - Minimum pH measured was 7.98.
(5) - Minimum pH measured was 7.99.

**Table 7.5**

**2022 Water Quality Results - North Quarry Sump (SW38)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Analyses | Parameters | Units | ECA Criteria | PWQO Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15(1) | n/a | 12 | 0 | 0 | -- | -- |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5(1) | n/a | 12 | 12 | 0 | 8.42 (4) | 8.24E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5(1) | n/a | 12 | 12 | 0 | 8.31 (5) | 8.13E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25(1) | n/a | 12 | 4 | 0 | 5.3 | 4.50E+00 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02(1)(2) | n/a | 12 | 12 | 0 | 0.0029 | 1.20E-03 |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | n/a | - | 12 | 12 | 0 | 176 | 1.55E+02 |
| General Chemistry | Alkalinity, Carbonate | mg/L | n/a | - | 12 | 4 | 0 | 8.9 | 6.50E+00 |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | n/a | - | 12 | 12 | 0 | 176 | 1.57E+02 |
| General Chemistry | Ammonia-N | mg/L | n/a | - | 12 | 12 | 0 | 0.116 | 4.26E-02 |
| General Chemistry | Bromide | mg/L | n/a | - | 12 | 8 | 0 | 0.95 | 5.79E-01 |
| General Chemistry | Chloride | mg/L | n/a | - | 12 | 12 | 0 | 115 | 9.99E+01 |
| General Chemistry | Conductivity | umhos/cm | n/a | - | 12 | 12 | 0 | 1200 | 1.06E+03 |
| General Chemistry | Fluoride | mg/L | n/a | - | 12 | 12 | 0 | 0.265 | 2.06E-01 |
| General Chemistry | Hardness | mg/L | n/a | - | 12 | 12 | 0 | 553 | 4.76E+02 |
| General Chemistry | Nitrate (as N) | mg/L | n/a | - | 12 | 12 | 0 | 0.345 | 1.73E-01 |
| General Chemistry | Nitrite (as N) | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| General Chemistry | Orthophosphate (dissolved) | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| General Chemistry | Phosphorous | mg/L | n/a | 0.03(2) | 12 | 10 | 0 | 0.0262 | 5.95E-03 |
| General Chemistry | Sulphate | mg/L | n/a | - | 12 | 12 | 0 | 305 | 2.60E+02 |
| General Chemistry | Temperature, Field | Deg C | n/a | - | 12 | 12 | 0 | 23.7 | 1.26E+01 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | n/a | - | 12 | 12 | 0 | 785 | 6.59E+02 |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | n/a | - | 12 | 11 | 0 | 0.288 | 2.05E-01 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | n/a | - | 12 | 12 | 0 | 5.2 | 2.36E+00 |
| General Chemistry | Turbidity | NTU | n/a | - | 12 | 12 | 0 | 10.3 | 2.67E+00 |
| Biological | Escherichia coli | cfu/100mL | n/a | 100(2) | 12 | 9 | 0 | 30 | 1.22E+01 |
| Biological | Total Coliform Bacteria | cfu/100mL | n/a | 100(2) | 12 | 10 | 1 | 1000 | 1.15E+02 |
| Metals | Aluminum | mg/L | n/a | 0.075(2) | 12 | 12 | 4 | 0.225 | 7.65E-02 |
| Metals | Antimony | mg/L | n/a | 0.02(2) | 12 | 12 | 0 | 0.00052 | 3.84E-04 |
| Metals | Arsenic | mg/L | n/a | 0.1(2)/0.005(3) | 12 | 12 | 0 | 0.00247 | 1.58E-03 |
| Metals | Barium | mg/L | n/a | - | 12 | 12 | 0 | 0.045 | 4.07E-02 |
| Metals | Beryllium | mg/L | n/a | 1.1(2) | 12 | 0 | 0 | -- | -- |
| Metals | Bismuth | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Boron | mg/L | n/a | 0.2(2) | 12 | 12 | 2 | 0.225 | 1.70E-01 |
| Metals | Cadmium | mg/L | n/a | 0.0002(2)/0.0005( | 12 | 10 | 0 | 0.0000179 | 1.24E-05 |
| Metals | Calcium | mg/L | n/a | - | 12 | 12 | 0 | 107 | 9.31E+01 |
| Metals | Chromium Total | mg/L | n/a | - | 12 | 1 | 0 | 0.00068 | 6.80E-04 |
| Metals | Cobalt | mg/L | n/a | 0.0009(2) | 12 | 12 | 10 | 0.00304 | 1.66E-03 |
| Metals | Copper | mg/L | n/a | 0.005(2) | 12 | 9 | 0 | 0.00084 | 6.49E-04 |
| Metals | Iron | mg/L | n/a | 0.3(2) | 12 | 12 | 0 | 0.249 | 8.42E-02 |
| Metals | Lead | mg/L | n/a | 0.025(2)/0.005(3) | 12 | 12 | 0 | 0.000784 | 2.86E-04 |
| Metals | Magnesium | mg/L | n/a | - | 12 | 12 | 0 | 69.4 | 5.92E+01 |
| Metals | Manganese | mg/L | n/a | - | 12 | 12 | 0 | 0.0177 | 1.05E-02 |
| Metals | Molybdenum | mg/L | n/a | 0.04(2) | 12 | 12 | 0 | 0.0136 | 1.07E-02 |
| Metals | Nickel | mg/L | n/a | 0.025(2) | 12 | 12 | 0 | 0.00987 | 6.99E-03 |
| Metals | Potassium | mg/L | n/a | - | 12 | 12 | 0 | 7.84 | 6.49E+00 |
| Metals | Selenium | mg/L | n/a | 0.1(2) | 12 | 12 | 0 | 0.000145 | 9.50E-05 |
| Metals | Silicon | mg/L | n/a | - | 12 | 12 | 0 | 1.72 | 1.29E+00 |
| Metals | Silver | mg/L | n/a | 0.0001(2) | 12 | 0 | 0 | -- | -- |
| Metals | Sodium | mg/L | n/a | - | 12 | 12 | 0 | 43.9 | 3.74E+01 |
| Metals | Strontium | mg/L | n/a | - | 12 | 12 | 0 | 4.47 | 3.07E+00 |
| Metals | Thallium | mg/L | n/a | 0.0003(2) | 12 | 12 | 0 | 0.000121 | 7.98E-05 |
| Metals | Tin | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Titanium | mg/L | n/a | - | 12 | 7 | 0 | 0.00465 | 2.49E-03 |
| Metals | Vanadium | mg/L | n/a | 0.006(2) | 12 | 0 | 0 | -- | -- |
| Metals | Zinc | mg/L | n/a | 0.03(2)/0.02(3) | 12 | 12 | 2 | 0.0484 | 1.61E-02 |
| Volatiles | Benzene | ug/L | n/a | 100(2) | 12 | 0 | 0 | -- | -- |
| Volatiles | Ethylbenzene | ug/L | n/a | 8(2) | 12 | 0 | 0 | -- | -- |
| Volatiles | m&p-Xylenes | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Volatiles | o-Xylene | ug/L | n/a | 40(2) | 12 | 0 | 0 | -- | -- |
| Volatiles | Toluene | ug/L | n/a | 0.8(2) | 12 | 0 | 0 | -- | -- |
| Volatiles | Xylenes (total) | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |
| | | | | | 12 | 0 | 0 | -- | -- |

Notes:

Screening against Effluent Limits for comparison purposes only. The ECA does not require this discharge to meet Effluent Limits.
Screening against PWQOs for comparison purposes only. The ECA does not require this discharge to meet PWQOs.
n/a - Not Applicable
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - PWQO/Interim PWQO.
(4) - Minimum pH measured was 7.98.
(5) - Minimum pH measured was 8.00.

**Table 7.6**

**2022 Water Quality Results - Central Sump (SW51A)**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontari**

| Analyses | Parameters | Units | ECA Criteria | PWQO Criteria | Number of Samples | Number of Detections | Number of Detections Above Effluent Limit or PWQO | Maximum Detected Concentration | Average of Detected Concentrations |
|---|---|---|---|---|---|---|---|---|---|
| General Chemistry | Oil and Grease | mg/L | 15[(1)] | n/a | 12 | 1 | 0 | 13.6 | 1.36E+01 |
| General Chemistry | pH (lab) | s.u. | 6.0-9.5[(1)] | n/a | 12 | 12 | 0 | 8.45 [(4)] | 8.24E+00 |
| General Chemistry | pH Field | s.u. | 6.0-9.5[(1)] | n/a | 12 | 12 | 0 | 8.13 [(5)] | 8.04E+00 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | 25[(1)] | n/a | 12 | 4 | 0 | 7.7 | 5.20E+00 |
| General Chemistry | Un-ionized Ammonia | mg/L | 0.02[(1)(2)] | n/a | 12 | 12 | 0 | 0.00361 | 1.68E-03 |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | n/a | - | 12 | 12 | 0 | 254 | 1.97E+02 |
| General Chemistry | Alkalinity, Carbonate | mg/L | n/a | - | 12 | 5 | 0 | 12.1 | 7.64E+00 |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | n/a | - | 12 | 12 | 0 | 254 | 2.00E+02 |
| General Chemistry | Ammonia-N | mg/L | n/a | - | 12 | 12 | 0 | 0.241 | 7.86E-02 |
| General Chemistry | Bromide | mg/L | n/a | - | 12 | 12 | 0 | 3.27 | 1.56E+00 |
| General Chemistry | Chloride | mg/L | n/a | - | 12 | 12 | 0 | 389 | 2.41E+02 |
| General Chemistry | Conductivity | umhos/cm | n/a | - | 12 | 12 | 0 | 2240 | 1.63E+03 |
| General Chemistry | Fluoride | mg/L | n/a | - | 12 | 12 | 0 | 0.298 | 2.28E-01 |
| General Chemistry | Hardness | mg/L | n/a | - | 12 | 12 | 0 | 956 | 7.00E+02 |
| General Chemistry | Nitrate (as N) | mg/L | n/a | - | 12 | 10 | 0 | 1.01 | 4.92E-01 |
| General Chemistry | Nitrite (as N) | mg/L | n/a | - | 12 | 1 | 0 | 0.012 | 1.20E-02 |
| General Chemistry | Orthophosphate (dissolved) | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| General Chemistry | Phosphorous | mg/L | n/a | 0.03[(2)] | 12 | 10 | 1 | 0.0373 | 7.88E-03 |
| General Chemistry | Sulphate | mg/L | n/a | - | 12 | 12 | 0 | 424 | 3.58E+02 |
| General Chemistry | Temperature, Field | Deg C | n/a | - | 12 | 12 | 0 | 24.3 | 1.26E+01 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | n/a | - | 12 | 12 | 0 | 1490 | 1.01E+03 |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | n/a | - | 12 | 12 | 0 | 0.477 | 2.77E-01 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | n/a | - | 12 | 12 | 0 | 4 | 2.71E+00 |
| General Chemistry | Turbidity | NTU | n/a | - | 12 | 12 | 0 | 17.1 | 3.59E+00 |
| Biological | Escherichia coli | cfu/100mL | n/a | 100[(2)] | 12 | 7 | 0 | 35 | 7.71E+00 |
| Biological | Total Coliform Bacteria | cfu/100mL | n/a | 100[(2)] | 12 | 8 | 0 | 90 | 1.65E+01 |
| Metals | Aluminum | mg/L | n/a | 0.075[(2)] | 12 | 12 | 1 | 0.343 | 5.35E-02 |
| Metals | Antimony | mg/L | n/a | 0.02[(2)] | 12 | 11 | 0 | 0.00093 | 5.95E-04 |
| Metals | Arsenic | mg/L | n/a | 0.1[(2)]/0.005[(3)] | 12 | 12 | 0 | 0.00199 | 1.24E-03 |
| Metals | Barium | mg/L | n/a | - | 12 | 12 | 0 | 0.0382 | 3.17E-02 |
| Metals | Beryllium | mg/L | n/a | 1.1[(2)] | 12 | 0 | 0 | -- | -- |
| Metals | Bismuth | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Boron | mg/L | n/a | 0.2[(2)] | 12 | 12 | 4 | 0.229 | 1.73E-01 |
| Metals | Cadmium | mg/L | n/a | 0.0002[(2)]/0.0005[(3)] | 12 | 6 | 0 | 0.0000331 | 2.31E-05 |
| Metals | Calcium | mg/L | n/a | - | 12 | 12 | 0 | 132 | 1.04E+02 |
| Metals | Chromium Total | mg/L | n/a | - | 12 | 1 | 0 | 0.00051 | 5.10E-04 |
| Metals | Cobalt | mg/L | n/a | 0.0009[(2)] | 12 | 11 | 1 | 0.00105 | 3.73E-04 |
| Metals | Copper | mg/L | n/a | 0.005[(2)] | 12 | 6 | 0 | 0.0011 | 7.58E-04 |
| Metals | Iron | mg/L | n/a | 0.3[(2)] | 12 | 11 | 1 | 0.306 | 5.96E-02 |
| Metals | Lead | mg/L | n/a | 0.025[(2)]/0.005[(3)] | 12 | 11 | 0 | 0.00103 | 2.68E-04 |
| Metals | Magnesium | mg/L | n/a | - | 12 | 12 | 0 | 152 | 1.07E+02 |
| Metals | Manganese | mg/L | n/a | - | 12 | 12 | 0 | 0.0316 | 1.12E-02 |
| Metals | Molybdenum | mg/L | n/a | 0.04[(2)] | 12 | 12 | 0 | 0.0344 | 2.15E-02 |
| Metals | Nickel | mg/L | n/a | 0.025[(2)] | 12 | 11 | 0 | 0.00571 | 4.11E-03 |
| Metals | Potassium | mg/L | n/a | - | 12 | 12 | 0 | 13.6 | 1.04E+01 |
| Metals | Selenium | mg/L | n/a | 0.1[(2)] | 12 | 11 | 0 | 0.00022 | 1.39E-04 |
| Metals | Silicon | mg/L | n/a | - | 12 | 11 | 0 | 2.11 | 1.35E+00 |
| Metals | Silver | mg/L | n/a | 0.0001[(2)] | 12 | 0 | 0 | -- | -- |
| Metals | Sodium | mg/L | n/a | - | 12 | 12 | 0 | 129 | 7.84E+01 |
| Metals | Strontium | mg/L | n/a | - | 12 | 12 | 0 | 3.52 | 2.50E+00 |
| Metals | Thallium | mg/L | n/a | 0.0003[(2)] | 12 | 12 | 0 | 0.000248 | 1.79E-04 |
| Metals | Tin | mg/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Metals | Titanium | mg/L | n/a | - | 12 | 7 | 0 | 0.0101 | 2.22E-03 |
| Metals | Vanadium | mg/L | n/a | 0.006[(2)] | 12 | 1 | 0 | 0.00071 | 7.10E-04 |
| Metals | Zinc | mg/L | n/a | 0.03[(2)]/0.02[(3)] | 12 | 11 | 3 | 0.0436 | 1.83E-02 |
| Volatiles | Benzene | ug/L | n/a | 100[(2)] | 12 | 0 | 0 | -- | -- |
| Volatiles | Ethylbenzene | ug/L | n/a | 8[(2)] | 12 | 0 | 0 | -- | -- |
| Volatiles | m&p-Xylenes | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |
| Volatiles | o-Xylene | ug/L | n/a | 40[(2)] | 12 | 0 | 0 | -- | -- |
| Volatiles | Toluene | ug/L | n/a | 0.8[(2)] | 12 | 0 | 0 | -- | -- |
| Volatiles | Xylenes (total) | ug/L | n/a | - | 12 | 0 | 0 | -- | -- |

Notes:

Screening against Effluent Limits for comparison purposes only. The ECA does not require this discharge to meet Effluent Limits.
Screening against PWQOs for comparison purposes only. The ECA does not require this discharge to meet PWQOs.
n/a - Not Applicable
(1) - ECA Effluent Limit.
(2) - PWQO.
(3) - PWQO/Interim PWQO.
(4) - Minimum pH measured was 7.82.
(5) - Minimum pH measured was 7.85.

**Table 8.1**

**Residential Well Water Level Data**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| Sample Location | Sample Date | Measuring Point Elevation (m AMSL) | Depth to Water (m bref) | Water Elevation (m AMSL) | Remark |
|---|---|---|---|---|---|
| DW99 | 4/27/2022 | 312.83 | 7.74 | 305.09 | -- |
| DW99 | 6/28/2022 | 312.83 | 8.63 | 304.20 | -- |
| DW99 | 9/27/2022 | 312.83 | 9.18 | 303.65 | -- |
| DW99 | 12/5/2022 | 312.83 | 9.33 | 303.50 | -- |
| DW100 | 9/30/2022 | 319.38 | 6.15 | 313.23 | -- |
| DW100 | 11/24/2022 | 319.38 | 6.12 | 313.26 | -- |
| DW103 | 3/22/2022 | 319.35 | 2.97 | 316.38 | -- |
| DW103 | 6/27/2022 | 319.35 | 3.70 | 315.65 | -- |
| DW103 | 9/20/2022 | 319.35 | 4.12 | 315.23 | -- |
| DW103 | 10/19/2022 | 319.35 | 3.86 | 315.49 | -- |
| DW104 | 4/27/2022 | 320.67 | 4.90 | 315.77 | -- |
| DW104 | 6/28/2022 | 320.67 | 5.18 | 315.49 | -- |
| DW104 | 9/27/2022 | 320.67 | 5.43 | 315.24 | -- |
| DW104 | 12/5/2022 | 320.67 | 5.38 | 315.29 | -- |
| DW107 | 6/28/2022 | 326.77 | -- (DRY) | -- (DRY) | Dry @ 14.80m below top of casing pipe. Could not advance line any further. |
| DW107 | 9/28/2022 | 326.77 | -- (DRY) | -- (DRY) | Could not advance water level meter past 15.6m below top of casing. |
| DW130 | 4/27/2022 | 333.01 | 3.05 | 329.96 | -- |
| DW130 | 6/30/2022 | 333.01 | 4.12 | 328.89 | -- |
| DW130 | 9/27/2022 | 333.01 | 5.66 | 327.35 | -- |
| DW130 | 12/12/2022 | 333.01 | 5.48 | 327.53 | -- |
| DW133 | 6/28/2022 | 344.51 | -- | -- | Requested no water level this quarter |
| DW133 | 9/8/2022 | 344.51 | 5.60 | 338.91 | Below top of casing |
| DW136 | 4/27/2022 | 325.41 | 3.10 | 322.31 | -- |
| DW136 | 6/28/2022 | 325.41 | 3.46 | 321.95 | -- |
| DW136 | 9/27/2022 | 325.41 | 4.22 | 321.19 | -- |
| DW136 | 12/6/2022 | 325.41 | 3.96 | 321.45 | -- |
| DW137 | 4/27/2022 | 322.35 | 1.88 | 320.47 | -- |
| DW137 | 6/28/2022 | 322.35 | 3.42 | 318.93 | -- |
| DW137 | 9/30/2022 | 322.35 | 3.38 | 318.97 | -- |
| DW137 | 12/6/2022 | 322.35 | 3.38 | 318.97 | -- |
| DW140 | 4/27/2022 | 351.40 | 8.10 | 343.30 | -- |
| DW140 | 6/30/2022 | 351.40 | 9.14 | 342.26 | -- |
| DW140 | 9/28/2022 | 351.40 | 10.38 | 341.02 | -- |
| DW140 | 12/6/2022 | 351.40 | 10.67 | 340.73 | -- |
| DW140A | 4/27/2022 | 350.32 | 6.95 | 343.37 | -- |
| DW140A | 6/30/2022 | 350.32 | 8.04 | 342.28 | -- |
| DW140A | 9/28/2022 | 350.32 | 9.29 | 341.03 | -- |
| DW140A | 12/6/2022 | 350.32 | 9.62 | 340.70 | -- |
| DW142A | 4/27/2022 | 341.81 | 1.36 | 340.45 | -- |
| DW142A | 6/30/2022 | 341.81 | 2.35 | 339.46 | -- |
| DW142A | 9/28/2022 | 341.81 | 3.32 | 338.49 | -- |
| DW142A | 12/5/2022 | 341.81 | 3.37 | 338.44 | -- |

Note:

Measuring point elevations based on GHD survey data.
m bref - meters below reference elevation.

**Table 8.2**

**Residential Well Analytical Data**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| | | | Sample Location: | DW99 | DW100 | DW103 | DW103 | DW103 | DW105 | DW106 | DW106 | DW107 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | RW-10978-267-47-092722-RC102 | RW-10978-262-47-112422-RC103 | GW-10978-262-47-032222-RC105 | GW-10978-262-47-092022-RC105 | GW-10978-262-47-101922-RC105 | RW-10978-262-47-092922-RC107 | GW-10978-262-47-070722-RC108 | RW-10978-262-47-092922-RC108 | GW-10978-262-47-121922-RC109 |
| | | | Sample Date: | 9/27/2022 | 11/24/2022 | 3/22/2022 | 9/20/2022 | 10/19/2022 | 9/29/2022 | 7/7/2022 | 9/29/2022 | 12/19/2022 |
| **Analyses** | **Parameters** | **Units** | | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** |
| Metals | Aluminum | mg/L | | 0.0115 | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | 0.0031 | ND (0.0030) | 0.0051 |
| Metals | Antimony | mg/L | | 0.00012 | ND (0.00010) | 0.00010 | 0.00010 | 0.00013 | 0.00011 | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Arsenic | mg/L | | 0.00012 | ND (0.00010) | 0.00012 | 0.00011 | 0.00011 | 0.00011 | 0.00013 | 0.00012 | 0.00011 |
| Metals | Barium | mg/L | | 0.0264 | 0.00745 | 0.0256 | 0.0290 | 0.0301 | 0.0350 | 0.00621 | 0.00654 | 0.0433 |
| Metals | Beryllium | mg/L | | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) |
| Metals | Bismuth | mg/L | | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) |
| Metals | Boron | mg/L | | 0.022 | 0.022 | 0.086 | 0.115 | 0.124 | 0.122 | 0.012 | 0.014 | 0.062 |
| Metals | Cadmium | mg/L | | 0.0000535 | 0.0000449 | 0.0000506 | 0.0000430 | 0.0000850 | 0.0000542 | 0.0000532 | 0.0000483 | 0.0000576 |
| Metals | Caesium | mg/L | | 0.000013 | ND (0.000010) | ND (0.000010) | 0.000010 | 0.000011 | 0.000011 | ND (0.000010) | ND (0.000010) | ND (0.000010) |
| Metals | Calcium | mg/L | | 101 | 98.1 | 91.5 | 83.0 | 83.4 | 92.1 | 94.9 | 92.5 | 94.8 |
| Metals | Chromium Total | mg/L | | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) |
| Metals | Cobalt | mg/L | | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Copper | mg/L | | 0.00407 | 0.0162 | 0.00609 | 0.00432 | 0.00802 | 0.00498 | 0.00531 | 0.00507 | 0.00493 |
| Metals | Iron | mg/L | | 0.016 | 0.027 | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) |
| Metals | Lead | mg/L | | 0.000270 | 0.000320 | 0.000168 | 0.000122 | 0.00159 | 0.000395 | 0.000183 | 0.000206 | 0.000151 |
| Metals | Lithium | mg/L | | 0.0013 | ND (0.0010) | 0.0071 | 0.0109 | 0.0115 | 0.0113 | ND (0.0010) | ND (0.0010) | 0.0032 |
| Metals | Magnesium | mg/L | | 36.0 | 49.3 | 56.3 | 57.8 | 60.3 | 58.7 | 52.6 | 45.5 | 51.8 |
| Metals | Manganese | mg/L | | 0.00033 | 0.00072 | 0.00035 | 0.00016 | 0.00035 | 0.00410 | ND (0.00010) | ND (0.00010) | 0.00014 |
| Metals | Molybdenum | mg/L | | 0.000445 | 0.000164 | 0.00283 | 0.00299 | 0.00304 | 0.00474 | 0.000321 | 0.000326 | 0.00117 |
| Metals | Nickel | mg/L | | 0.00136 | 0.00050 | 0.00074 | 0.00060 | 0.00079 | 0.00191 | ND (0.00050) | ND (0.00050) | 0.00054 |
| Metals | Phosphorous | mg/L | | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) |
| Metals | Potassium | mg/L | | 1.99 | 0.567 | 3.88 | 5.18 | 5.46 | 4.98 | 0.595 | 0.699 | 1.74 |
| Metals | Rubidium | mg/L | | 0.00155 | 0.00057 | 0.00164 | 0.00216 | 0.00222 | 0.00278 | 0.00032 | 0.00037 | 0.00199 |
| Metals | Selenium | mg/L | | 0.000109 | 0.000123 | 0.000055 | ND (0.000050) | ND (0.000050) | ND (0.000050) | 0.000130 | 0.000128 | 0.000061 |
| Metals | Silicon | mg/L | | 2.29 | 1.92 | 1.64 | 1.32 | 1.34 | 1.54 | 1.75 | 1.95 | 2.13 |
| Metals | Silver | mg/L | | ND (0.000010) | 0.000010 | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) |
| Metals | Sodium | mg/L | | 120 | 13.2 | 26.2 | 34.2 | 36.1 | 39.9 | 35.7 | 37.8 | 28.1 |
| Metals | Strontium | mg/L | | 0.246 | 0.105 | 1.37 | 1.68 | 1.78 | 1.94 | 0.0496 | 0.0503 | 0.576 |
| Metals | Sulphur | mg/L | | 22.4 | 19.8 | 57.6 | 74.3 | 78.6 | 86.8 | 3.56 | 4.68 | 62.8 |
| Metals | Tellurium | mg/L | | ND (0.00020) | ND (0.00020) | 0.00020 | 0.00020 | 0.00022 | 0.00023 | ND (0.00020) | ND (0.00020) | ND (0.00020) |
| Metals | Thallium | mg/L | | 0.000035 | ND (0.000010) | 0.000049 | 0.000061 | 0.000064 | 0.000170 | ND (0.000010) | ND (0.000010) | 0.000073 |
| Metals | Thorium | mg/L | | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Tin | mg/L | | 0.00037 | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Titanium | mg/L | | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) |
| Metals | Tungsten | mg/L | | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Uranium | mg/L | | 0.00104 | 0.000174 | 0.000599 | 0.000564 | 0.000553 | 0.000601 | 0.000180 | 0.000187 | 0.000448 |
| Metals | Vanadium | mg/L | | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) |
| Metals | Zinc | mg/L | | 0.0280 | 0.0240 | 0.0504 | 0.0371 | 0.0687 | 0.0224 | 0.0197 | 0.0210 | 0.0469 |
| Metals | Zirconium | mg/L | | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) |
| Biological | Escherichia coli | cfu/100mL | | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) |
| Biological | Total Coliform Bacteria | cfu/100mL | | 4 | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | 3 | ND (1) |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | | 361 | 362 | 263 | 170 | 165 | 171 | 367 | 351 | 239 |
| General Chemistry | Alkalinity, Carbonate | mg/L | | ND (2.0) | ND (2.0) | ND (2.0) | 12.0 | 13.3 | 8.2 | ND (2.0) | 6.0 | ND (2.0) |
| General Chemistry | Alkalinity, Hydroxide | mg/L | | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) |
| General Chemistry | Alkalinity, Phenolphthalein | mg/L | | ND (2.0) | ND (2.0) | ND (2.0) | 6.0 | 6.6 | 4.1 | ND (2.0) | 3.0 | ND (2.0) |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | | 361 | 362 | 263 | 182 | 178 | 179 | 367 | 358 | 239 |
| General Chemistry | Ammonia-N | mg/L | | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) | ND (0.0050) |
| General Chemistry | Bromide | mg/L | | ND (0.50) DLDS | ND (0.10) | 0.37 | 0.62 | ND (0.50) DLDS | 0.86 | ND (0.10) | ND (0.10) | 0.25 |
| General Chemistry | Chloride (Dissolved) | mg/L | | 181 DLDS | 27.7 | 74.3 | 93.8 | 100 DLDS | 106 | 82.7 | 82.3 | 79.3 |
| General Chemistry | Conductivity | uS/cm | | 1340 | 849 | 957 | 988 | 1040 | 1060 | 949 | 936 | 954 |
| General Chemistry | Fluoride | mg/L | | ND (0.100) DLDS | 0.065 | 0.119 | 0.127 | 0.101 DLDS | 0.106 | 0.063 | 0.057 | 0.057 |
| General Chemistry | Hardness Calculation | mg/L | | 400 | 448 | 460 | 445 | 456 | 472 | 454 | 418 | 450 |
| General Chemistry | Nitrate (as N) | mg/L | | 1.03 DLDS | 1.02 | 0.228 | 0.217 | 0.211 DLDS | 0.100 | 1.60 | 1.52 | 0.160 |
| General Chemistry | Nitrite (as N) | mg/L | | ND (0.050) DLDS | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.050) DLDS | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) |
| General Chemistry | Orthophosphate (dissolved) | mg/L | | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | ND (0.0030) | 0.0010 |
| General Chemistry | pH (lab) | s.u. | | 8.25 | 7.69 | 7.70 | 8.43 | 8.48 | 8.36 | 7.66 | 8.29 | 8.09 |
| General Chemistry | Phosphorous | mg/L | | ND (0.0020) | 0.0020 | ND (0.0020) | ND (0.0020) | ND (0.0020) | 0.0021 | ND (0.0020) | ND (0.0020) | ND (0.0020) |
| General Chemistry | Sulphate (Dissolved) | mg/L | | 64.0 DLDS | 50.6 | 167 | 209 | 224 DLDS | 226 | 9.34 | 11.0 | 172 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | | 693 DLDS | 424 DLDS | 566 DLDS | 599 DLDS | 616 DLDS | 676 DLDS | 504 DLDS | 449 DLDS | 567 DLDS |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | | ND (0.200) | ND (0.200) | ND (0.200) | ND (0.200) | ND (0.200) | ND (0.200) | 0.325 | ND (0.200) | ND (0.200) |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | | 1.26 | 0.81 | 1.14 | 0.92 | 0.62 | 1.01 | 0.72 | 1.11 | 0.63 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) |
| General Chemistry | Turbidity | NTU | | 0.25 | 0.14 | ND (0.10) | ND (0.10) PEHT | ND (0.10) | ND (0.10) | ND (0.10) | ND (0.10) | 0.18 |

Notes:

DLDS - Detection limit raised: Dilution due to high Dissolved Solids/Electrical Conductivity.

DLHC - Detection Limit Raised: Dilution due to high concentration of test analyte(s).

HTC - Hardness calculated from Total Ca and/or Mg; may bias high (dissolved Ca/Mg unavailable).

TKNI - TKN result is likely biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

ND - Non-detect at associated value.

-- Not applicable.

**Table 8.2**

**Residential Well Analytical Data**
**2022 Annual Monitoring Report**
**Dufferin Milton Quarry**
**Region of Halton, Ontario**

| | | Sample Location: | DW128 | DW128A | DW129 | DW130 | DW133 | DW136 | DW137 | DW140 | DW140A | DW142A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | RW-10978-262-47-120922-RC114 | RW-10978-262-47-120922-RC115 | RW-10978-262-47-120522-RC116 | GW-10978-262-47-121222-RC117 | GW-10978-262-47-090722-RC121 | RW-10978-262-47-120622-RC110 | RW-10978-262-47-120622-RC111 | RW-10978-262-47-092822-RC125 | RW-10978-267-47-092822-RC126 | RW-10978-262-47-092822-RC127 |
| | | Sample Date: | 12/9/2022 | 12/9/2022 | 12/5/2022 | 12/12/2022 | 9/7/2022 | 12/6/2022 | 12/6/2022 | 9/28/2022 | 9/28/2022 | 9/28/2022 |
| **Analyses** | **Parameters** | **Units** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** | **Concentration** |
| Metals | Aluminum | mg/L | 0.0063 | 0.0036 | ND (0.0030) | ND (0.0030) | 0.0082 | 0.0067 | 0.0059 | ND (0.0030) | ND (0.0030) | 0.0049 |
| Metals | Antimony | mg/L | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | 0.00029 | 0.00010 | 0.00013 | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Arsenic | mg/L | 0.00043 | 0.00015 | 0.00014 | 0.00012 | 0.00058 | 0.00030 | 0.00035 | 0.00021 | 0.00012 | 0.0105 |
| Metals | Barium | mg/L | 0.00026 | 0.124 | 0.0228 | 0.0166 | 0.214 | 0.0857 | 0.103 | 0.0166 | 0.0209 | 0.109 |
| Metals | Beryllium | mg/L | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) | ND (0.000020) |
| Metals | Bismuth | mg/L | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) | ND (0.000050) |
| Metals | Boron | mg/L | 0.067 | 0.014 | 0.010 | 0.012 | 0.013 | 0.019 | 0.017 | 0.046 | 0.020 | ND (0.010) |
| Metals | Cadmium | mg/L | ND (0.0000050) | 0.0000110 | 0.000181 | 0.000168 | 0.000195 | 0.0000498 | 0.0000751 | 0.000312 | 0.000289 | ND (0.0000050) |
| Metals | Caesium | mg/L | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | 0.000010 | ND (0.000010) | ND (0.000010) | ND (0.000010) |
| Metals | Calcium | mg/L | 0.236 | 71.2 | 83.7 | 97.1 | 88.9 | 92.4 | 93.3 | 97.0 | 113 | 90.0 |
| Metals | Chromium Total | mg/L | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | 0.00083 | 0.00094 | ND (0.00050) | ND (0.00050) | ND (0.00050) |
| Metals | Cobalt | mg/L | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | 0.00022 | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | 0.00016 |
| Metals | Copper | mg/L | 0.00396 | 0.00586 | 0.00465 | 0.0381 | 0.144 | 0.0142 | 0.0214 | 0.00859 | 0.00504 | 0.00340 |
| Metals | Iron | mg/L | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | 0.032 | 0.232 | 0.389 | ND (0.010) | 0.010 | 2.34 |
| Metals | Lead | mg/L | 0.000295 | 0.000410 | 0.000655 | 0.00138 | 0.00168 | 0.000974 | 0.00103 | 0.000717 | 0.00172 | 0.000190 |
| Metals | Lithium | mg/L | 0.0047 | 0.0013 | ND (0.0010) | ND (0.0010) | ND (0.0010) | 0.0022 | 0.0023 | ND (0.0010) | ND (0.0010) | ND (0.0010) |
| Metals | Magnesium | mg/L | 0.115 | 32.4 | 43.4 | 45.8 | 40.0 | 38.6 | 37.6 | 32.1 | 32.5 | 39.1 |
| Metals | Manganese | mg/L | 0.00012 | 0.00466 | ND (0.00010) | ND (0.00010) | 0.00886 | 0.0105 | 0.0102 | 0.00024 | 0.00028 | 0.0425 |
| Metals | Molybdenum | mg/L | 0.00142 | 0.00121 | 0.00134 | 0.00119 | 0.00351 | 0.00152 | 0.00164 | 0.000409 | 0.000112 | 0.00375 |
| Metals | Nickel | mg/L | ND (0.00050) | ND (0.00050) | 0.00105 | 0.00165 | 0.00538 | 0.00071 | 0.00098 | 0.00228 | 0.00304 | 0.00161 |
| Metals | Phosphorous | mg/L | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) | ND (0.050) |
| Metals | Potassium | mg/L | 0.371 | 0.647 | 0.420 | 0.523 | 1.05 | 3.20 | 2.65 | 6.98 | 7.46 | 0.599 |
| Metals | Rubidium | mg/L | 0.00027 | 0.00077 | 0.00042 | 0.00072 | 0.00108 | 0.00170 | 0.00210 | 0.00091 | 0.00167 | 0.00112 |
| Metals | Selenium | mg/L | ND (0.000050) | ND (0.000050) | 0.000104 | 0.000095 | 0.000139 | 0.000226 | 0.000287 | 0.000628 | 0.000380 | ND (0.000050) |
| Metals | Silicon | mg/L | 2.61 | 3.43 | 1.85 | 2.23 | 2.48 | 4.83 | 5.07 | 3.65 | 3.68 | 3.46 |
| Metals | Silver | mg/L | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | ND (0.000010) | 0.000017 | 0.000029 | ND (0.000010) | ND (0.000010) | ND (0.000010) |
| Metals | Sodium | mg/L | 225 DLHC | 7.62 | 2.35 | 19.2 | 35.0 | 108 | 105 | 15.8 | 14.8 | 79.3 |
| Metals | Strontium | mg/L | 0.00329 | 0.569 | 0.0538 | 0.0811 | 0.0808 | 0.231 | 0.360 | 0.101 | 0.146 | 0.0824 |
| Metals | Sulphur | mg/L | 52.8 | 6.92 | 3.71 | 5.04 | 6.13 | 12.7 | 13.4 | 5.53 | 8.92 | 7.67 |
| Metals | Tellurium | mg/L | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) |
| Metals | Thallium | mg/L | ND (0.000010) | 0.000011 | 0.000021 | 0.000053 | 0.000110 | 0.000071 | 0.000098 | 0.000110 | 0.000118 | ND (0.000010) |
| Metals | Thorium | mg/L | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Tin | mg/L | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | 0.00016 | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Titanium | mg/L | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) | ND (0.00030) |
| Metals | Tungsten | mg/L | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) | ND (0.00010) |
| Metals | Uranium | mg/L | 0.000259 | 0.000150 | 0.000425 | 0.000572 | 0.000502 | 0.000664 | 0.000777 | 0.000338 | 0.000245 | 0.000101 |
| Metals | Vanadium | mg/L | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) | ND (0.00050) |
| Metals | Zinc | mg/L | ND (0.0030) | 0.0040 | 0.187 | 0.194 | 0.196 | 0.0298 | 0.0515 | 0.355 | 0.540 | 0.0253 |
| Metals | Zirconium | mg/L | 0.00039 | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | ND (0.00020) | 0.00137 |
| Biological | Escherichia coli | cfu/100mL | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) | ND (1) |
| Biological | Total Coliform Bacteria | cfu/100mL | ND (1) | ND (1) | 10 | ND (1) | ND (1) | ND (1) | 10 | ND (1) | ND (1) | ND (1) |
| General Chemistry | Alkalinity, Bicarbonate | mg/L | 210 | 284 | 373 | 386 | 325 | 303 | 316 | 366 | 387 | 360 |
| General Chemistry | Alkalinity, Carbonate | mg/L | 5.9 | ND (2.0) | ND (2.0) | ND (2.0) | 30.7 | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) |
| General Chemistry | Alkalinity, Hydroxide | mg/L | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) |
| General Chemistry | Alkalinity, Phenolphthalein | mg/L | 3.0 | ND (2.0) | ND (2.0) | ND (2.0) | 15.3 | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) | ND (2.0) |
| General Chemistry | Alkalinity, Total (As CaCO3) | mg/L | 216 | 284 | 373 | 386 | 355 | 303 | 316 | 366 | 387 | 360 |
| General Chemistry | Ammonia-N | mg/L | ND (0.0050) | 0.0368 | ND (0.0050) | ND (0.0050) | 0.0092 | ND (0.0050) | 0.0056 | ND (0.0050) | 0.0352 | 0.204 |
| General Chemistry | Bromide | mg/L | 0.33 | ND (0.10) | ND (0.10) | ND (0.10) | ND (0.10) | ND (0.50) DLDS | ND (0.50) DLDS | ND (0.10) | ND (0.10) | ND (0.10) |
| General Chemistry | Chloride (Dissolved) | mg/L | 64.0 | 11.5 | 4.14 | 30.6 | 69.1 | 187 DLDS | 180 DLDS | 23.1 | 18.3 | 134 |
| General Chemistry | Conductivity | uS/cm | 934 | 556 | 684 | 804 | 900 | 1230 | 1230 | 815 | 862 | 1080 |
| General Chemistry | Fluoride | mg/L | 0.082 | 0.059 | 0.063 | 0.050 | 0.068 | ND (0.100) DLDS | ND (0.100) DLDS | 0.068 | 0.067 | 0.071 |
| General Chemistry | Hardness Calculation | mg/L | 1.06 | 311 | 388 | 431 | 387 | 390 | 388 | 374 | 416 | 386 |
| General Chemistry | Nitrate (as N) | mg/L | 0.052 | ND (0.020) | 0.717 | 0.717 | 0.650 | 4.23 DLDS | 3.11 DLDS | 9.52 | 9.90 | ND (0.020) |
| General Chemistry | Nitrite (as N) | mg/L | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.010) | ND (0.050) DLDS | ND (0.050) DLDS | ND (0.010) | ND (0.010) | ND (0.010) |
| General Chemistry | Orthophosphate (dissolved) | mg/L | ND (0.0010) | ND (0.0010) | ND (0.0010) | 0.0021 | ND (0.0030) | ND (0.0010) | 0.0033 RRV | ND (0.0030) | ND (0.0030) | ND (0.0030) |
| General Chemistry | pH (lab) | s.u. | 8.38 | 8.28 | 7.89 | 7.90 | 8.50 | 8.11 | 8.21 | 7.83 | 7.73 | 7.91 |
| General Chemistry | Phosphorous | mg/L | ND (0.0020) | ND (0.0020) | ND (0.0020) | 0.0024 | ND (0.0020) | ND (0.0020) | ND (0.0020) | ND (0.0020) | ND (0.0020) | 0.0029 |
| General Chemistry | Sulphate (Dissolved) | mg/L | 145 | 18.1 | 8.83 | 12.1 | 15.5 | 33.7 DLDS | 35.5 DLDS | 15.1 | 25.4 | 20.8 |
| General Chemistry | Total Dissolved Solids (TDS) | mg/L | 514 DLDS | 304 DLDS | 334 DLDS | 438 DLDS | 442 DLDS | 656 DLDS | 650 DLDS | 420 DLDS | 445 DLDS | 556 DLDS |
| General Chemistry | Total Kjeldahl Nitrogen (TKN) | mg/L | ND (0.200) | ND (0.200) | 0.216 | 0.231 | ND (0.200) | 0.370 TKNI | 0.402 | 0.330 TKNI | 0.300 TKNI | 0.460 |
| General Chemistry | Total Organic Carbon (TOC) | mg/L | 0.85 | 1.43 | 0.89 | 0.84 | 2.86 | 0.78 | 1.03 | 1.32 | 1.22 | 7.99 |
| General Chemistry | Total Suspended Solids (TSS) | mg/L | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) | ND (3.0) |
| General Chemistry | Turbidity | NTU | ND (0.10) | ND (0.10) | ND (0.10) | ND (0.10) | 0.12 | 1.19 | 1.26 | 0.10 | ND (0.10) | 6.59 |

Notes:

DLDS - Detection limit raised: Dilution due to high Dissolved Solids/Electrical Conductivity.

DLHC - Detection Limit Raised: Dilution due to high concentration of test analyte(s).

HTC - Hardness calculated from Total Ca and/or Mg; may bias high (dissolved Ca/Mg unavailable).

TKNI - TKN result is likely biased low due to Nitrate interference. Nitrate-N is > 10x TKN.

ND - Non-detect at associated value.

-- Not applicable.