



## REPORT

# Groundwater Mitigation System Design Report

## *CBM Caledon Pit and Quarry*

Submitted to:

**CBM Aggregates - a Division of St. Marys Cement Inc. (Canada)**

55 Industrial St.  
Toronto ON  
M4G 3W9

Submitted by:

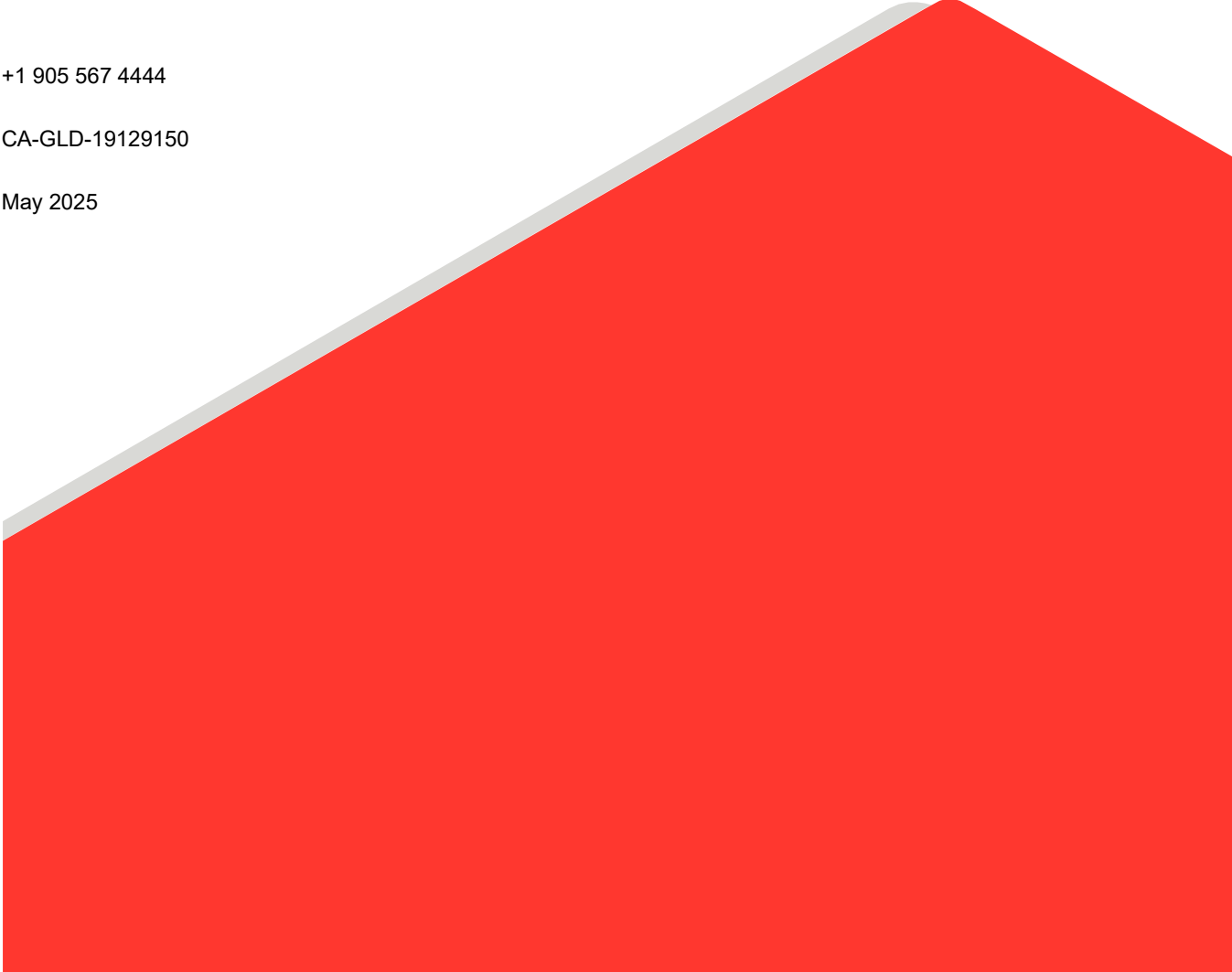
**WSP Canada Inc.**

6925 Century Avenue, Suite #600, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

CA-GLD-19129150

May 2025

A large, solid red graphic element that starts as a thin diagonal line on the left and expands into a large, irregular shape covering the bottom right portion of the page. It has a grey shadow effect on its upper-left edge.

## Distribution List

eCopy - CBM

eCopy - MHBC

eCopy - GSAI

eCopy - WSP



# Table of Contents

<b>1.0 INTRODUCTION .....</b>	<b>1</b>
1.1 Background .....	1
1.2 Objectives.....	1
1.3 Groundwater Mitigation System .....	3
1.4 Scope of Work.....	3
<b>2.0 DESKTOP REVIEW .....</b>	<b>4</b>
2.1 Site Characterization.....	4
2.2 Infiltration System Design .....	5
2.3 Construction .....	5
2.4 Operation and Maintenance.....	6
2.5 Water Quality.....	7
<b>3.0 FIELD INVESTIGATIONS.....</b>	<b>9</b>
3.1 Drilling and Monitoring Well Installation .....	11
3.2 Laboratory Testing .....	11
3.3 Groundwater Level Monitoring .....	12
3.4 Hydraulic Testing – Single Well Response Tests (SWRTs) .....	13
3.5 Groundwater Quality .....	14
<b>4.0 NUMERICAL MODELLING SIMULATIONS .....</b>	<b>14</b>
4.1 HGS Model Revisions .....	14
4.1.1 Hydrostratigraphy.....	15
4.1.2 Hydraulic Conductivity Parameterization .....	15
4.2 Model Calibration .....	15
4.2.1 Calibration Approach .....	15
4.2.2 Calibration Assessment .....	15
4.3 Updated Predictive Simulations .....	15
4.3.1 Updated Base of Grout Zones and Infiltration Trenches .....	16

4.3.2	Updated Mitigation of Quarry Inflows.....	16
4.3.3	Updated Backfill Removal Area Post- Rehabilitation.....	16
4.4	Results .....	16
4.4.1	Simulated Head and Drawdown .....	16
4.4.2	Surface Water Flows.....	17
4.4.3	Quarry Inflows.....	17
4.4.4	Final Pond Water Levels.....	17
4.4.5	Trench Flow Rates.....	17
4.5	Summary.....	17
<b>5.0</b>	<b>WATER MANAGEMENT PLAN .....</b>	<b>17</b>
5.1	Off-Site Discharge.....	17
5.2	Pit / Quarry Discharges and Flows .....	18
5.3	Summary.....	19
<b>6.0</b>	<b>UPDATED MITIGATION SYSTEM DESIGN .....</b>	<b>20</b>
6.1	General Configuration .....	20
6.2	Mitigation System Zones.....	26
6.3	Phasing of Implementation.....	27
6.4	Estimated Pit / Quarry Inflows and Trench Infiltration Rates .....	28
6.5	Sensitivity to Hydraulic Barrier Performance .....	31
6.6	Infiltration Trench Details .....	31
6.7	Hydraulic Barrier Details .....	38
6.7.1	Soil Mixing by One-Pass Trenching (OPT).....	38
6.7.2	Self-Hardening Cement-Bentonite (CB) Slurry Wall.....	39
6.7.3	Grouting the Upper Weathered Bedrock Zone .....	40
6.7.4	Summary.....	41
6.8	Water Storage and Distribution System.....	41
6.8.1	Settling Pond, Intake, and Outlets .....	41
6.8.2	Supply to Gravity Reservoirs .....	42
6.8.2.1	Flows.....	44

6.8.2.2	System Description .....	44
6.8.2.3	Process Control .....	46
6.8.3	Supply to Infiltration Vaults .....	46
6.8.3.1	Flows.....	46
6.8.3.2	System Description .....	49
6.8.3.3	Process Control .....	49
6.9	Water Quality Considerations .....	53
<b>7.0</b>	<b>DETAILED DESIGN, PERMITTING, AND CONSTRUCTION AND OPERATION .....</b>	<b>54</b>
7.1	Detailed Design .....	54
7.2	Permitting .....	54
7.3	Construction and Operation .....	55
<b>8.0</b>	<b>SUMMARY AND CONCLUSIONS .....</b>	<b>55</b>
8.1	General Overview .....	55
8.2	Scope of Work.....	55
8.3	Infiltration Technology Review .....	56
8.4	Field Investigations .....	56
8.5	Updated HGS Numerical Modelling .....	56
8.6	Updated Water Management Plan.....	57
8.7	Updated Mitigation System Design.....	57
8.8	Conclusions and Recommendations .....	58

## TABLES

Table 1: Single Well Response Test Hydraulic Conductivity by Aquifer Unit.....	13
Table 2: Water Consumption and Discharge Scenarios .....	19
Table 3: Proposed Groundwater Mitigation Zones.....	26
Table 4: Implementation Sequence of Groundwater Mitigation System Elements .....	28
Table 5: Estimated Pit / Quarry Inflows .....	28
Table 6: Estimated Recharge Required to Infiltration Trench .....	29
Table 7: Infiltration Trench Zone Details.....	31
Table 8: Anticipated Flows to the Gravity Reservoirs.....	44
Table 9: Infiltration Vault Flow Rate Summary .....	47

Table 10: Infiltration Vault Supply Pipe Length Summary .....	49
---	----

## FIGURES

Figure 1: Study Area .....	2
Figure 2: Proposed Groundwater Mitigation System consisting of six Infiltration Trench Zones and two Hydraulic Barrier Zones .....	3
Figure 3: Location of Infiltration Trench Monitoring Well Nests MW-IT-01 to MW-IT-07 .....	10
Figure 4: Continuous Core at MW-IT-01 within Proposed Infiltration Trench Zone 2 .....	11
Figure 5: Hydrographs at Well Nest MW-IT-02 (A=bedrock, B=contact aquifer, C=overburden) .....	12
Figure 6: Proposed Water Discharge from the Pit / Quarry Settling Pond to the Osprey Valley Golf Course .....	18
Figure 7: Cross-Section showing General Configuration of Proposed Groundwater Infiltration Trench and Slurry Wall .....	22
Figure 8: Cross-Section showing Proposed Infiltration Vault Detail .....	24
Figure 9: Cross-Section showing General Configuration of Proposed Typical Infiltration Trench Detail .....	25
Figure 10: Estimated Pit/Quarry Inflows and Infiltration Rates for Proposed Mitigation System .....	30
Figure 11: Trench Zone 1 .....	32
Figure 12: Trench Zone 2 .....	33
Figure 13: Trench Zone 3 .....	34
Figure 14: Trench Zone 4 .....	35
Figure 15: Trench Zone 5 .....	36
Figure 16: Trench Zone 6 .....	37
Figure 17: One-Pass Trenching Method a) Digging box. b) Stick (pivot) cylinders. c) Lift (stroke) cylinders. d) Boom. e) Water supply line. f) Digging/mixing chain. g) Drag Box. h) Cab. i) Tracks. j) Counterweight (DeWind, 2025) .....	39
Figure 18: Self-Hardening CB (Cement-Bentonite) Slurry Wall Method (Geo-Solutions, 2025) .....	40
Figure 19: Layout of Water distribution system to Supply Gravity Reservoirs .....	43
Figure 20: Layout of Water distribution system to Supply Gravity Reservoirs .....	48
Figure 21: Process Control Flow Chart - Water Supply to Gravity Reservoirs from Settling Pond .....	51
Figure 22: Process Control Flow Chart - Water Supply from Gravity Reservoir to Infiltration Vaults .....	52

## **APPENDICES**

### **APPENDIX A**

DESKTOP REVIEW OF INFILTRATION TRENCH SYSTEM TECHNOLOGIES

### **APPENDIX B**

FIELD INVESTIGATION

### **APPENDIX C**

NUMERICAL MODELLING SIMULATIONS

### **APPENDIX D**

UPDATED WATER MANAGEMENT PLAN

## 1.0 INTRODUCTION

### 1.1 Background

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), has applied to the Ministry of Natural Resources (MNR) for a Class A License (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation for the proposed CBM Caledon Pit / Quarry.

CBM controls approximately 323 hectares of land located at the northwest, northeast and southwest intersection of Regional Road 24 (Charleston Sideroad) and Regional Road 136 (Main Street). Of these lands, approximately 261.2 hectares are proposed to be licenced under the Aggregate Resources Act and designated / zoned under the Planning Act to permit the proposed CBM Caledon Pit / Quarry. The lands proposed to be licenced under the Aggregate Resources Act are referred to herein as the “Subject Site” (or “Site”) and are legally described as Part of Lots 15-18, Concession 4 WSCR and Part of Lot 16, Concession 3 WSCR (former Geographic Township of Caledon). The area located to the northwest of the intersection of Regional Road 24 and 136 is referred to as the “Main Area”. The area to the northeast of the intersection of Regional Road 24 and 136 is referred to as the “North Area”, and the area located to the southwest of the intersection of Regional Road 24 and 136 is referred to as the “South Area” (Figure 1).

Groundwater-surface water model simulations using HydroGeoSphere (HGS) undertaken as part of the revised Level 1 / 2 Water Report (Golder 2022, revised July 2023), indicated that pit / quarry dewatering during the later stages of operations (Phases 4 to 7) could result in a decline in groundwater levels in the water table aquifer that would extend southward and to the southwest of the licence area.

In order to mitigate the potential effects on natural features and groundwater users to the south of the proposed CBM Caledon Pit / Quarry during the operational phases, mitigation measures were developed by WSP (formerly Golder) to maintain groundwater levels within the range of their natural pre-extraction seasonal variations. The mitigations were then implemented in HGS modelling simulations of Operational Phase 3 to 7, to assess their effectiveness. These proposed mitigation measures are described in the Level 1 / 2 Water Report (Appendix S1), which presented a conceptual design and proposed implementation phasing of a groundwater mitigation system.

Some of the technical comments related to the Level 1/2 Water Report received from various agency / stakeholder groups between the fall of 2023 and the spring of 2024 requested additional study and further development of the mitigation system design, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system would perform as predicted.

In the spring of 2024, WSP was retained by CBM to undertake additional technical studies and advance the design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project.

### 1.2 Objectives

As noted above, this report presents the results of the additional technical studies undertaken by WSP to advance the design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system would perform as predicted.



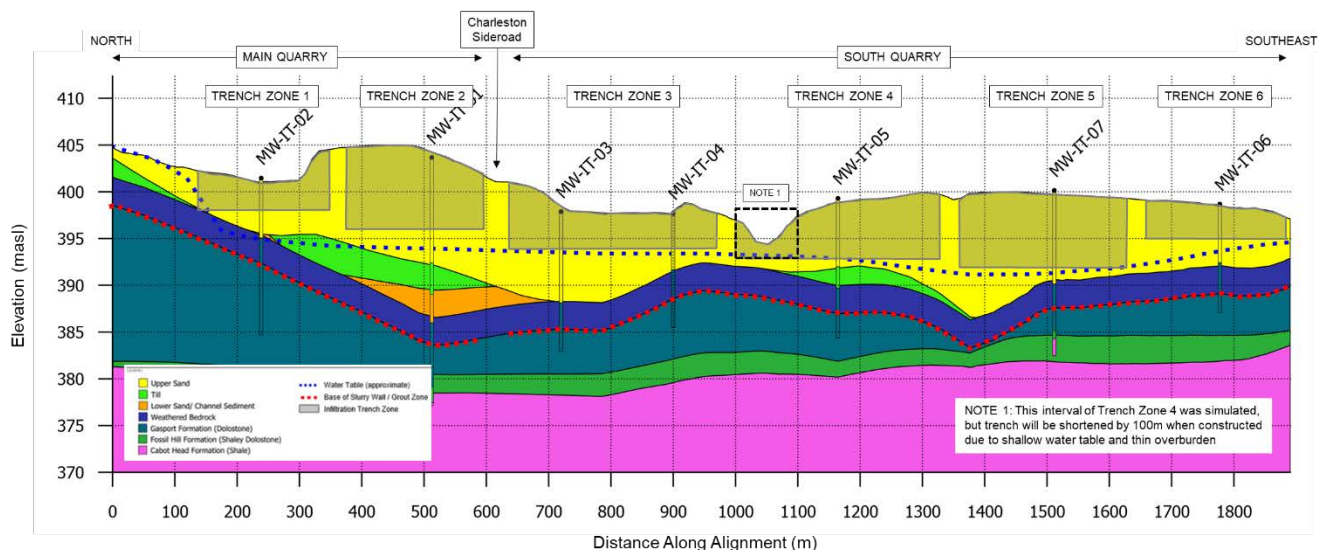




### 1.3 Groundwater Mitigation System

The proposed groundwater mitigation system will utilize a portion of the water collected during Phases 4 to 7 of operations, and direct it to a series of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction (Figure 2).

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, noting that the upper bedrock zone along the slurry wall alignments may also be grouted to reduce the permeability of this zone and further reduce the inflow of groundwater into the pit / quarry and help sustain existing groundwater levels outside of the licence area.



**Figure 2: Proposed Groundwater Mitigation System consisting of six Infiltration Trench Zones and two Hydraulic Barrier Zones**

### 1.4 Scope of Work

The work was carried out by WSP from April 2024 to March 2025, and was comprised of the following main activities.

**Desktop Review** – A desktop review of infiltration trench system technologies was completed by WSP, with a focus on reviewing recent studies / examples in the Greater Toronto Area (GTA), Ontario and other Canadian jurisdictions, to help ensure the design incorporates current industry best practices and lessons learned from other projects. The results of infiltration system technology review are presented in Appendix A and summarized in Section 2.

**Field Investigation** – A hydrogeological field investigation was carried out by WSP in the spring and summer of 2024 along the proposed infiltration trench alignment, which included continuous coring of boreholes through the overburden and bedrock, laboratory testing of soil cores, and the installation and testing of 7 new monitoring well



nesses, in order to obtain detailed site-specific information on stratigraphy, groundwater levels, groundwater gradient and hydraulic properties of the various aquifer and aquitard units. The field investigation results are presented in Appendix B and summarized in Section 3.

**Numerical Modelling Simulations** - The results of the field investigation along the proposed infiltration trench system were used to update the conceptual site model and the HGS numerical model in this area. The updated numerical model was then recalibrated to current conditions and used to update the various mitigation system simulations utilizing the refined numerical model. The numerical modelling results are presented in Appendix C and summarized in Section 4.

**Water Management Plan Update** - The updated numerical modelling simulation results were also used to update the Water Management Plan for the proposed pit and quarry operation, which is presented in Appendix D and summarised in Section 5.

**Mitigation System Design Update** – The mitigation system design was then updated, based on the desktop review, field investigation, and updated numerical modelling simulations. The updated mitigation system design is presented in Section 7. The updated design demonstrates “proof of concept” and provides assurances to CBM, agencies, stakeholder groups, that the proposed GW mitigation system will perform as predicted.

## 2.0 DESKTOP REVIEW

A desktop review of infiltration trench system technologies was completed by WSP to help ensure the mitigation system design update incorporates current industry best practices and lessons learned from other projects. The full review is presented in Appendix A, and key findings are summarized below. Guidance documents and case studies are unanimous in their consensus that infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples.

The best practices in the design and operation of infiltration systems are summarized in the following categories: site characterization, design, construction, operation and maintenance, and water quality, as presented in the following sections. References cited are provided in Appendix A.

### 2.1 Site Characterization

Site characterization is essential in the design of infiltration systems.

- Soil permeability is a critical design criterion for infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr (USEPA, 2021), however circumstantially, rates as low as 7 mm/hour (TRCA, 2013) and rates up to 210 mm/hr (Schueler, 1987) may be considered depending on the design priorities and risk to receptors.
- Lithological heterogeneities beneath infiltration systems can be potential preferential pathways for rapid recharge and therefore an elevated risk of groundwater contamination compared to an assumed homogenous aquifer. Continuous subsurface imaging, such as ground penetrating radar (GPR) in combination with boreholes, test pits, and sedimentological insight, can improve the characterization of hydrostratigraphic units in the subsurface (Chouteau and Giroux, 2008).

- Where infiltration systems are constructed above carbonate rocks, enhanced dissolution should be considered in the design of the system. Case studies used detailed site characterization and GPR to search for pre-existing karst prior to construction, and designed systems to avoid rapid localized recharge to the bedrock by ensuring sufficient overburden travel time (PDEP, 2006).

## 2.2 Infiltration System Design

**System Design** – Most resources recommend an infiltration system to be fully enclosed with a non-woven filter fabric to prevent the infiltration of fine materials from the surrounding soils, the majority of the backfill be a large diameter clear stone (often 20 to 50 mm) (MOE, 2003) (TRCA, 2013), with a vegetated topsoil cover to prevent erosion, and a filter layer 0.15 to 0.30 m thick be placed at the base of the system.

- The purpose of the filter layer is to provide filtration for fine particles, pathogens, metals, and organic compounds that will be partially removed by the filter layer. Depending on the water quality parameters of concern, the filter layer maybe composed of fine sand or peat (MOE, 2003).
- Permeable filter fabric is recommended on the base and side walls of the infiltration system, and less permeable filter fabric on top, to mitigate infiltration of fines from above the system (Schueler, 1987).

**System Sizing** – Most system sizing discussions for stormwater applications are based on a design storage volume, assuming a 40% void ratio in the backfilled volume. Infiltration systems are generally sized such that void space can accommodate the require level of water storage. Saturated depth is specified based on the infiltration rate measurement and designed to fully discharge in 48 to 72 hours (Chahar, Graillot, & Gaur, 2012). Area of the system is then calculated to achieve the required volume (MOE, 2003) (Rowe, 2019).

**Infiltration into the Unsaturated Zone** – Infiltrating water into the unsaturated zone is generally recommended to allow for some degree of aerobic water treatment to take place before the water reaches the water table and more variable conditions (MOE, 2003) (BCMOE, 2014). Recommended offsets vary from 1.5 to 7.5 m based on soil type and potential to improve water quality (MOE, 2003) (USDOT, 2024) (MPCA, 2022) (BCMOE, 2014) (USEPA, 2021). However, where source water quality is of little concern, there are successful examples of infiltration systems sited at the water table elevation (TRCA, 2013) (GHD, 2021).

The design and construction of the infiltration system should consider the primary causes of failure for infiltration systems: poor construction practices, inadequate field testing (in particular in situ testing), and lack of sediment control (Schueler, 1987).

## 2.3 Construction

Construction practices recommended to optimize infiltration system operation include (Schueler, 1987):

- Prevent heavy machinery from compacting subsoils;
- The edges of the infiltration system should be bermed and erosion of the sidewalls stabilized to prevent sediment migration into the infiltration system during construction;
- The infiltration system should be constructed using an excavator or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the infiltration system alignment should be avoided; and

- Clean stone should be placed in lightly compacted lifts. Unwashed stone contains enough sediment to risk clogging.

## 2.4 Operation and Maintenance

A primary concern in the operation and maintenance of infiltration systems is clogging. Clogging has several possible causes including (Dillon et al., 2024):

- Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;
- Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;
- Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure; and
- Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate).

Physical clogging of control structures, distribution pipes, and pore spaces caused by suspended solids in the source water is among the most commonly reported problems for infiltration systems. The primary mitigation measures are the selection of waters to infiltrate and pre-treatment (USDOT, 2024) (TRCA, 2013).

- Where there is opportunity to select water with low initial TSS to be infiltrated, this has proven to be an effective approach to designing an infiltration system. In some cases, systems have sourced very clear water, operated an infiltration system with no pre-treatment, and observed no long term clogging. Systems that received water with very low levels of suspended solids generally continued to perform well and required little maintenance (Schueler, 1987) (TRCA, 2013).
- Various pre-treatment methods to settle or otherwise attenuate suspended solids are recommended, including, use of sumps in injection control structures, oil and grit separators, prefiltration of water through filter sand, fabric, or organic material, prior to it entering the infiltration system, and reduction of suspended sediment by allowing water to gently flow through a grassy swale or filter strip prior to entering the infiltration system (Schueler, 1987) (MOE, 2003) (TRCA, 2013) (BCMOE, 2014).
- Where additional protection from clogging is needed in the design, the perforated distribution pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system (Schueler, 1987).

Maintenance activities should include (BCMOE, 2014) (USEPA, 2021) (USDOT, 2024):

- Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, animal activity, or undesirable vegetation growth;
- Minor sediment removal from easily accessed areas of the system;
- Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
- Documentation standards for all maintenance activities.

## 2.5 Water Quality

Water quality parameters potentially applicable to quarry water management and the design of infiltration systems include the following (BCMOE, 2014) (Dillon et al., 2022).

- Suspended solids from aggregate extraction and atmospheric deposition. Suspended solids are a concern because they can clog infiltration facilities, diminishing their performance.
- Inorganics (e.g. iron and manganese). These are common constituents in bedrock-derived groundwater in southern Ontario.
- Nutrients, primarily nitrogen, from blasting residuals.
- Salt from de-icing and dust suppression activities.
- Petroleum hydrocarbons, associated with vehicles and other human activities.
- Pathogens and pathogen indicators, primarily associated with natural watershed sources.
- Temperature: groundwater temperature changes may cause changes in geochemical conditions and gas release. However, thermal effects are buffered to some extent within an infiltration system due to the passage of water through the unsaturated zone.

Water quality risk and mitigation in the design of infiltration systems can be considered in the following categories: source water quality, water treatment prior to infiltration (pre-treatment), water quality improvement in the infiltration system and subsurface (intrinsic reduction), the sensitivity of the receptor, and post-treatment before use at the receptor (Dillon et al., 2022).

**Source Water Quality** - Source water quality is evaluated by consideration of known risk factors (proximity to refueling, industrial operations, etc.) and typical water quality for the source (storm water, groundwater, etc.). Source water quality monitoring is not generally conducted where the source water is considered low risk. However, source water monitoring is recommended where either the source of water is at risk of contamination or if there are sensitive receptors to the infiltrated water (BCMOE, 2014).

**Pre-Treatment** – Pre-treatment of waters for some parameters prior to infiltration (e.g. suspended solids) has a significant impact on the effectiveness and longevity of the system and its potential to have impacts on groundwater receptors.

- Pre-treatment of water to be infiltrated with an oil and grease separator has been implemented where these are risk factors in the source water (Schueler, 1987) (TRCA, 2013).
- Depending on source water quality and risk to receptors, treatment of waters for pathogens may be required (Dillon et al., 2022). For example, the Mannheim ASR system is used store water for Municipal drinking water supply, Grand River water is treated using a UV system for primary disinfection prior to entering the injection well and is chlorinated at the extraction well following recovery. In cases where there is limited risk to receptors, or there is sufficient intrinsic reduction in the system, no pre-treatment other than treatment for suspended solids is required, such as the Milton Quarry (GHD, 2021) or most stormwater applications (TRCA, 2013) (USDOT, 2024).

**Intrinsic Reduction** – Water quality has generally been found to improve between where it enters the infiltration system and when it is observed downgradient in the groundwater system, due to soil interaction, including

sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical water quality improvements include the following.

- The USDOT states typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria (2024).
- Similarly, the MPCA (2022) states that infiltration systems have a high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%).
- Potential contaminants (such as metals and oils) with low solubility generally pose a lower risk to aquifers, because they will tend to adsorb to sediments or will degrade and breakdown over time. For example, many metals may only be transported a few centimetres beneath surface infiltration facilities (BCMOE, 2014).
- To achieve water quality improvements in the infiltration system, the retention time should be less than the maximum retention time (48 to 72 hours, to allow aerobic conditions suitable for bacterial growth in the subsoil) and greater than the minimum retention time (6 hours, to allow filtration and sorption processes time to take place) (Schueler, 1987) (Chahar, Graillot, & Gaur, 2012).
- In general, where risk to water quality receptors is high and water quality enhancement in the subsurface is relied upon to mitigate risks, sampling of groundwater downgradient of the infiltration system is used to validate the effectiveness of the system in enhancing water quality (Dillon et al., 2022).
- Aquifer residence time can effectively remove pollutants, such as pathogens. An application of this principle is a California system which infiltrates wastewater into a drinking water aquifer. A standard for removal of pathogens before arrival at the drinking water receptor was established and aquifer residence time was accounted for as one order of magnitude removal per month of residence time in the aquifer (Dillon et al., 2022).

**Post-treatment** – If required, adverse water quality can be mitigated by treatment at the receptor, particularly for drinking water receptors (Dillon et al., 2022). An example of this is the Mannheim ASR system, which uses chlorination post-treatment at its extraction wells to manage pathogen risks to drinking water supplies (Stantec, 2015).

**Proximity to Receptors** - Where possible, infiltration systems should be sited at least 30 m (CalTrans, 2020) to 60 m (BCMOE, 2014) upgradient from a water supply well. Detailed characterization along the full alignment of the infiltration system, including lithology and groundwater levels with particular caution exercised in the presence of possible karst conditions (BCMOE, 2014) (USEPA, 2021).

### 3.0 FIELD INVESTIGATIONS

WSP was retained by CBM to undertake field investigations along the proposed infiltration trench alignment, to inform the design of the proposed groundwater mitigation system, install the well nests needed to establish baseline conditions and eventually monitor system performance, and at the same time respond to agency / stakeholder requests for additional information.

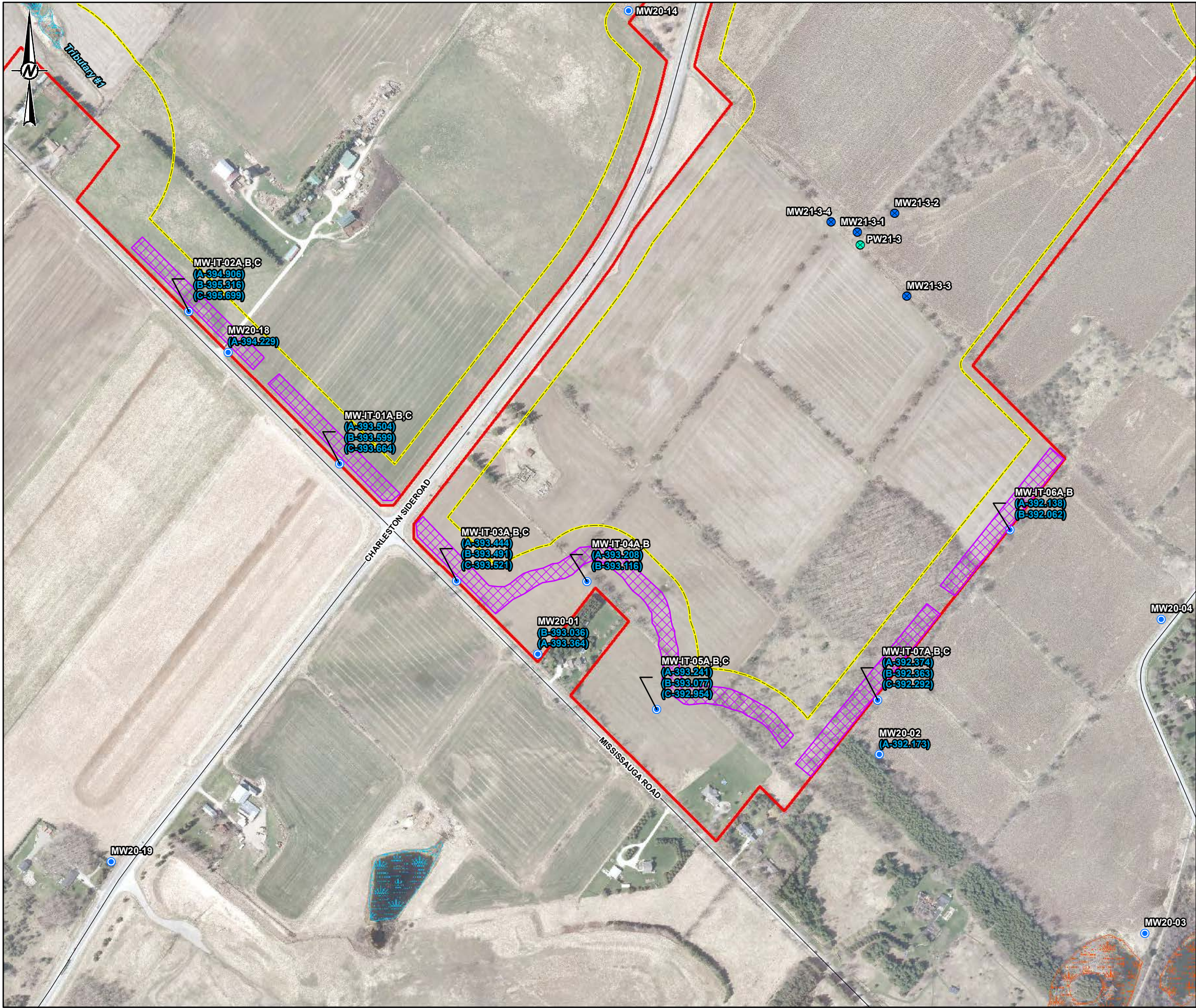
These investigations were carried out from April to June 2024 and were comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 3).

The field investigations were comprised of the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The investigation results are presented in Appendix B, and key findings are summarized below.





LEGEND

MONITORING WELL

MONITORING WELL (2021 PUMPING TEST)

TEST PUMPING WELL WELL (2021 PUMPING TEST)

GROUNDWATER ELEVATION, mASL

ROAD

PROPOSED GROUNDWATER INFILTRATION TRENCH

UNEVALUATED WETLAND

PROVINCIALY SIGNIFICANT WETLAND

PROPOSED LICENCE LIMIT

PROPOSED LIMIT OF EXTRACTION

- REFERENCE(S)
1. BASE DATA MNRF LIO OBTAINED 2020

2. WATERCOURSES OBTAINED FROM CREDIT VALLEY CONSERVATION AUTHORITY OPEN DATA PORTAL, NOVEMBER 2022 IN COMBINATION WITH SITE WATERCOURSE SURVEY PROVIDED BY FIRST BASE SOLUTIONS NOVEMBER 2021.

3. IMAGERY FIRSTBASE SOLUTIONS SPRING 2019 (15CM RESOLUTION) AND SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

4. LICENSE AND EXTRACTION LIMIT PROVIDED BY MHBC IN JUNE 2023.

5. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT

CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

PROJECT

CBM CALEDON PIT / QUARRY

TITLE

LOCATION OF INFILTRATION TRENCH MONITORING WELL NESTS MW-IT-01 TO MW-IT-07

CONSULTANT	YYYY-MM-DD	2024-06-07
	DESIGNED	CGE
	PREPARED	SA
	REVIEWED	PGM
	APPROVED	GWS

PROJECT NO.	CONTROL	REV.	FIGURE
19129150	0065	0.0	3





### 3.1 Drilling and Monitoring Well Installation

The borehole drilling and monitoring well installation was carried out over a three-week period during April 2024.

- A total of 19 monitoring wells were installed at seven well nest locations MW-IT-01 to MW-IT-07.
- Boreholes were advanced through the overburden and bedrock to the required depth with the rotasonic method, obtaining a continuous core (Figure 4).
- The overburden and rock core samples were logged, photographed, and bagged for laboratory testing.
- Each well nest generally consisted of a well installed in the bedrock, contact aquifer and overburden, where possible, with each well installed in its own borehole.
- The wells were subsequently used for groundwater level monitoring, single well response tests, and groundwater quality sampling.



**Figure 4: Continuous Core at MW-IT-01 within Proposed Infiltration Trench Zone 2**

### 3.2 Laboratory Testing

A total 171 soil samples were collected, and of those, 34 representative samples were selected for grainsize analysis (sieve).

- Four to six representative soil samples were selected for analysis from the deepest borehole at each well nest location.



- A variety of soil samples were chosen to confirm the soil descriptions prepared in the field during borehole logging.
- In addition to sieve analysis, Fineness Modulus (FM), % Wash Loss, % Crushable Stone and Stone-to-Sand Ratio was calculated for sand and gravel samples.
- The grainsize results were used to refine the field descriptions of soil types, prepare final borehole logs and subsequently used to revise the hydrostratigraphy and HGS numerical model for the site.

### 3.3 Groundwater Level Monitoring

The groundwater monitoring data to date from well nests MW-IT-01 to MW-IT-07 has helped refine hydrogeologic conditions along the proposed mitigation system alignment, including groundwater levels, flow direction and vertical hydraulic gradients.

Hydrographs from well nest MW-IT-02 are presented on Figure 5 as a representative example; a complete set of hydrographs is provided in Appendix B.

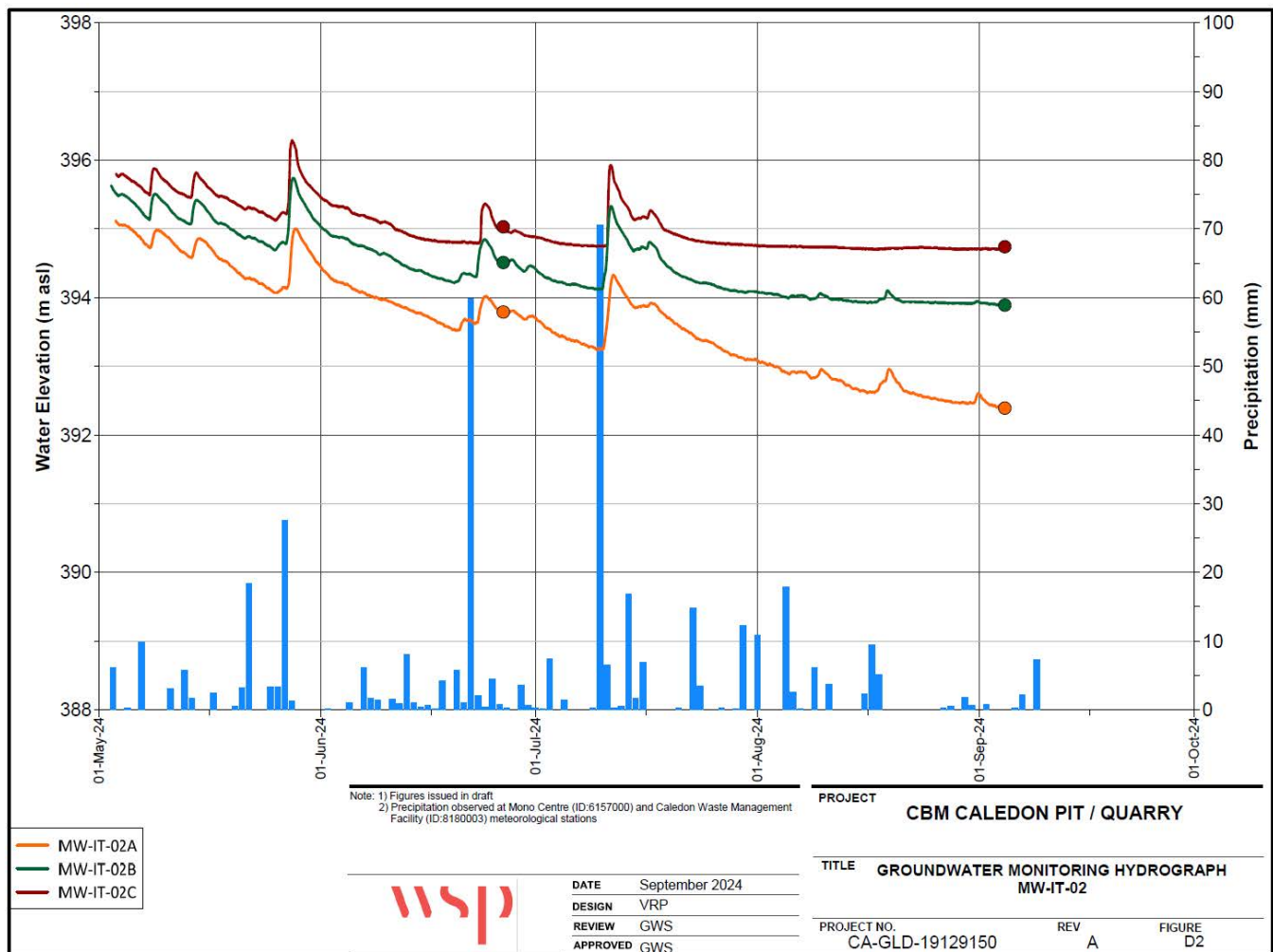


Figure 5: Hydrographs at Well Nest MW-IT-02 (A=bedrock, B=contact aquifer, C=overburden)

The hydrographs generally show the following.

- All monitoring wells show a trend of decreasing water elevation from May to September 2024, concurrent with warm weather and active plant growth. This is consistent with seasonal trends observed on the Site since 2021.
- Rapid increases in groundwater levels were observed in response to significant precipitation events at MW-IT-01A/B/C, similar to the response observed where conditions are similar.
- The vertical hydraulic gradients between the wells installed in the Gasport formation and the bedrock contact were generally upward at locations MW-IT-01, MW-IT-04, MW-IT-05 and MW-IT-06, and neutral at locations MW-IT-03 and MW-IT-07. At MW-IT-02, there was a notable downward hydraulic gradient throughout the monitoring period.
- At location MW-IT-02, two wells (-A and -B) were installed within the Gasport Formation. There was a downward hydraulic gradient between these wells throughout the monitoring period, which was observed to be increasing in magnitude over time (June and September hydraulic gradients of -0.14 and -0.30, respectively).
- The vertical hydraulic gradients between the wells installed in the bedrock contact and the overburden were generally upward at MW-IT-05, neutral at MW-IT-03 and MW-IT-07, and downward at MW-IT-01. All of the overburden wells, with the exception of MW-IT-03C, have gone dry over the course of the monitoring period.

### 3.4 Hydraulic Testing – Single Well Response Tests (SWRTs)

Single well response tests (SWRTs) were conducted in all 19 of the newly installed monitoring wells in April and May 2024, following monitoring well development. The SWRTs were analyzed to estimate the hydraulic conductivity of each subsurface interval tested. The single well response tests and results are presented in Appendix B.

A summary of results by aquifer unit is presented in the table below.

**Table 1: Single Well Response Test Hydraulic Conductivity by Aquifer Unit**

Formation / Rock Unit	Number of Observations	Minimum K (m/s)	Maximum K (m/s)	Geometric Mean K (m/s)
Overburden	4	$8 \times 10^{-6}$	$2 \times 10^{-3}$	$1 \times 10^{-4}$
Bedrock Contact	7	$1 \times 10^{-5}$	$8 \times 10^{-4}$	$2 \times 10^{-4}$
Gasport	7	$6 \times 10^{-7}$	$6 \times 10^{-4}$	$2 \times 10^{-5}$
Gasport / Shaley Dolostone	1	$2 \times 10^{-4}$		

The following observations are made with respect to the results of the SWRTs:

- The SWRTs performed on wells screened in the Gasport Formation ranged from  $6 \times 10^{-7}$  m/s to  $6 \times 10^{-4}$  m/s, which is typical of lithologies ranging from a middle value for unfractured dolostone to a middle value of

weathered dolostone (Freeze and Cherry 1979). This is consistent with the lithological observations at the Site and previously reported hydraulic conductivity ranges in the revised Water Report Level 1/2.

- The SWRT performed on the well screened in both the Gasport Formation and Shaley Dolostone fell within the range of values observed for the wells that were entirely screened within the Gasport Formation. This value is approximately an order of magnitude greater than the maximum observed in the revised Water Report.
- The results of SWRTs in the overburden were generally consistent with published hydraulic conductivities for the soil materials observed during drilling at those locations.

### 3.5 Groundwater Quality

Water quality sampling was carried out between April 26 to May 1, 2024, at the monitoring well nests MW-IT-01 to MW-IT-07. Water quality results are presented in Appendix B.

In general, water quality was in the typical range for groundwater in this hydrogeologic setting, which was similar to the results found in other monitoring wells within the study area.

- There were some exceedances of ODWS and MECP Table 2 parameters, including total dissolved solids (TDS), hardness, chloride, cobalt, manganese, sodium and PHC F3 hydrocarbons. There were also a number of occasional exceedances of PWQO parameters, notably for cobalt and BTEX (toluene).
- Several locations that exhibited one or more detections of parameters presumed to be related to anthropogenic activities, including elevated chloride and sodium (MW-IT-01C), PHC detections and detections of one or more BTEX parameters. The PHC and BTEX detections may be due to PVC cement used during well installation to extend the riser pipe at ground surface.
- The elevated sodium and chloride detections in groundwater are localized in extent and likely the result of salt application on nearby roads, and potentially from snow storage on adjacent municipal lands. Ditches along the roadsides that drain away from the proposed pit / quarry areas, and berms around the pit / quarry will help to minimize surface water run-off from entering the pit / quarry operation.

## 4.0 NUMERICAL MODELLING SIMULATIONS

Utilizing the new data collected during the 2024 field investigations at the seven new monitoring well nests MW-IT-01 to MW-IT-07, the Site conceptual understanding / hydrostratigraphic understanding / HGS numerical model for the proposed pit / quarry were updated along the proposed infiltration trench / hydraulic barrier alignment.

The updated HGS flow model was calibrated to updated current hydrogeologic conditions and then used to update predictive simulations for all operational phases and the rehabilitation phase of the proposed pit / quarry. The HGS model updates are described in Appendix D and the results are summarized below.

### 4.1 HGS Model Revisions

The HGS model domain, surface water flow, and boundary conditions were not modified. The hydrostratigraphy and the hydraulic properties of the hydrostratigraphic units were updated based on the new IT wells and the HGS model was then re-calibrated to reproduce the observed water levels at the new IT wells measured in 2024.

### 4.1.1 Hydrostratigraphy

The new IT wells provided additional hydrostratigraphic information along the proposed mitigation system alignment. The updated hydrostratigraphy is illustrated on Figure 2, along with groundwater levels under current (baseline) conditions. The horizontal discretization of the HGS model mesh remained consistent with the original HGS model but the vertical thickness of the hydrostratigraphic layers in the HGS numerical model were updated to coincide with the updated hydrostratigraphy.

### 4.1.2 Hydraulic Conductivity Parameterization

Hydraulic conductivity measurements at the IT wells were used to supplement the previously compiled hydraulic conductivity measurements. These were applied to the HGS numerical model as initial parameters for model calibration and used as references throughout the calibration process. To improve refinement within the Site Area and better fit hydraulic conductivity observations, hydraulic conductivity zonation was reevaluated. Weathered Bedrock Zone 4 was sub-divided into three new sub-zones of weathered bedrock hydraulic conductivity and each of these three sub-zones were assigned an independent, calibrated hydraulic conductivity. These sub-zones were calibrated separately from the regional hydrostratigraphic units (see Figure 2, Appendix D).

## 4.2 Model Calibration

### 4.2.1 Calibration Approach

The numerical modelling tool PEST (Doherty 2018) was again used to calibrate the hydraulic conductivity so that the simulation could reproduce current observed groundwater elevations and stream flows. PEST was run for 6 iterations before being terminated. The calibrated hydraulic conductivity values are shown on Figure 2 (Appendix D); noting that the hydraulic conductivity was refined for the following hydrostratigraphic units:

- Weathered Bedrock Zones 4A, 4B, and 4C;
- Gasport Zone 4;
- Upper Sand; and
- Local Till.

All other parameters remained unchanged from their previous values used in Golder (2023) simulations. All calibrated hydraulic conductivity values were within the range observed in the field or conceptually consistent with the observed site conditions.

### 4.2.2 Calibration Assessment

The simulated calibrated model results are presented in Appendix D. Overall, the updated HGS numerical model is considered fit for purpose based on the calibration fit, the consistency of the calibrated parameters with the hydrostratigraphic conceptualization, and the consistency of the simulation groundwater flow patterns with the conceptual groundwater flow model.

## 4.3 Updated Predictive Simulations

A total of eight model forecast simulations were completed, each representing a different phase of pit / quarry development (including rehabilitation) as shown in Appendix D. The forecast simulations were completed under steady state conditions to provide a conservative estimate of the extent of drawdown for each development phase (i.e. highest drawdown during that phase).

### 4.3.1 Updated Base of Grout Zones and Infiltration Trenches

The new hydrogeologic information obtained from the new well nests MW-IT-01 to MW-IT-07 indicates that the water table is 2 to 3 metres lower along some portions of Zones 1, 2 and 3 than was previously indicated from groundwater level data available at that time. As such, base elevation of the infiltration trenches and hydraulic barrier in Zones 1, 2, and 3 in the forecast simulations were lowered to reflect the updated water table from the updated calibrated HGS model. Trench and hydraulic barrier base elevations in Zones 4, 5, and 6 remain substantially the same in the revised forecast simulations, since predicted groundwater levels along those trenches did not substantially change as a result of the new hydrogeologic information in those areas.

### 4.3.2 Updated Mitigation of Quarry Inflows

The new hydrogeologic information (i.e. stratigraphy, water levels and hydraulic conductivity measurements) along with the updated HGS numerical model calibration to current conditions indicated that aquifer transmissivity along portions of the proposed groundwater mitigation system alignment was higher than previously inferred, particularly along Zones 1, 2 and 3, which would result in higher predicted inflows during the operational periods.

Modelling simulations were iteratively used to evaluate options to minimize higher potential inflows to optimize portion of water infiltrated which contributes to increasing aquifer levels (as opposed to re-entering the quarry). It was determined that by placing and compacting low permeability silt till backfill along the pit / quarry walls adjacent to the high transmissivity zone during Phases 5 and 6 as part of progressive rehabilitation, pit / quarry inflows could be minimized and actually reduced relative to the original (Golder 2023) predicted inflows. The timing of the progressive placement of silt till backfill in the other phases of operation otherwise remained the same in the updated forecast simulations. Note that the hydraulic conductivity of the silt till backfill was assigned as  $1 \times 10^{-6}$  m/s, which was consistent with previous simulations (Golder 2023).

The mitigation of Phase 5 required higher heads in Trench Zones 1 and 2. Trench Zones 1 and 2 are active from Phase 4 through Phase 7 but these higher heads were only required in Phase 5.

### 4.3.3 Updated Backfill Removal Area Post- Rehabilitation

The zone of silt till backfill removal upon rehabilitation in the main pit / quarry remains in the same location and has the same planned extent as previous simulations (Golder 2023). The area of backfill removal is now represented as restoring 98% of the effective hydraulic conductivity of this portion of the original pit / quarry wall prior to backfill placement, as residual silt till material is expected remain in place.

## 4.4 Results

### 4.4.1 Simulated Head and Drawdown

The general simulated groundwater flow direction across the Site in each unit remained consistent with the current conditions; groundwater flow is southeast across the Site toward the Credit River and bedrock valley.

The simulated water level drawdown is consistent with the head change in the Gasport Formation south and southwest of the Site. As in Golder 2023, in the northwest and north of the Site where fine grained material is present, the water table drawdown is less than the head change in the Gasport Formation. There is also drawdown observed in the Whirlpool / Manitoulin Formations, but this is relatively small in magnitude relative to the available drawdown in this aquifer given its depth and typical static water level. Upon rehabilitation, the residual change in groundwater heads within all aquifer units is typically less than +/- 1 m.

#### **4.4.2 Surface Water Flows**

Surface water stations SW5, SW11, SW13, SW14, and SW16 experience some simulated reduction in flows relative to current conditions. Rehabilitation, SW14, SW13, and SW5 experience some long-term reductions relative to the current conditions. SW16 experiences an increase in long-term flow upon rehabilitation.

#### **4.4.3 Quarry Inflows**

Overall, the total simulated inflow to all areas of the pit / quarry during operation ranges from 14.7 L/s to 50.9 L/s, a narrower range than the 14.3 L/s to 133.6 L/s simulated in Golder 2023. The majority of the simulated inflow is in the Main Area of the pit / quarry, with inflows up to 47.9 L/s during Phase 5 of the operation. The simulated pit / quarry inflows have decreased in Phase 5 and 6 relative to Golder 2023, primarily due to the progressive silt till backfill placement, but other changes in conductivity and model updates have resulted in changes between the other phases as well.

#### **4.4.4 Final Pond Water Levels**

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow and pipe to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated elevation of the South Pond is estimated to be 393.5 masl and will be internally contained, with no surface outflow. The simulated steady state outflow from the combined Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s, a decrease of 2 L/s from the estimation presented in Golder (2023).

#### **4.4.5 Trench Flow Rates**

Simulated infiltration trench flow rates peak in Phase 5 at 51.6 L/s. Total trench flow as a percentage of total sump inflow peaks in Phase 5 at 77% assuming the target heads are maintained in Trench Zones 1 to 6.

### **4.5 Summary**

The HGS numerical model for the proposed Caledon pit / quarry has been updated and calibrated to our improved hydrostratigraphic characterization for the Site, and the updated HGS model has been used to update the assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.

## **5.0 WATER MANAGEMENT PLAN**

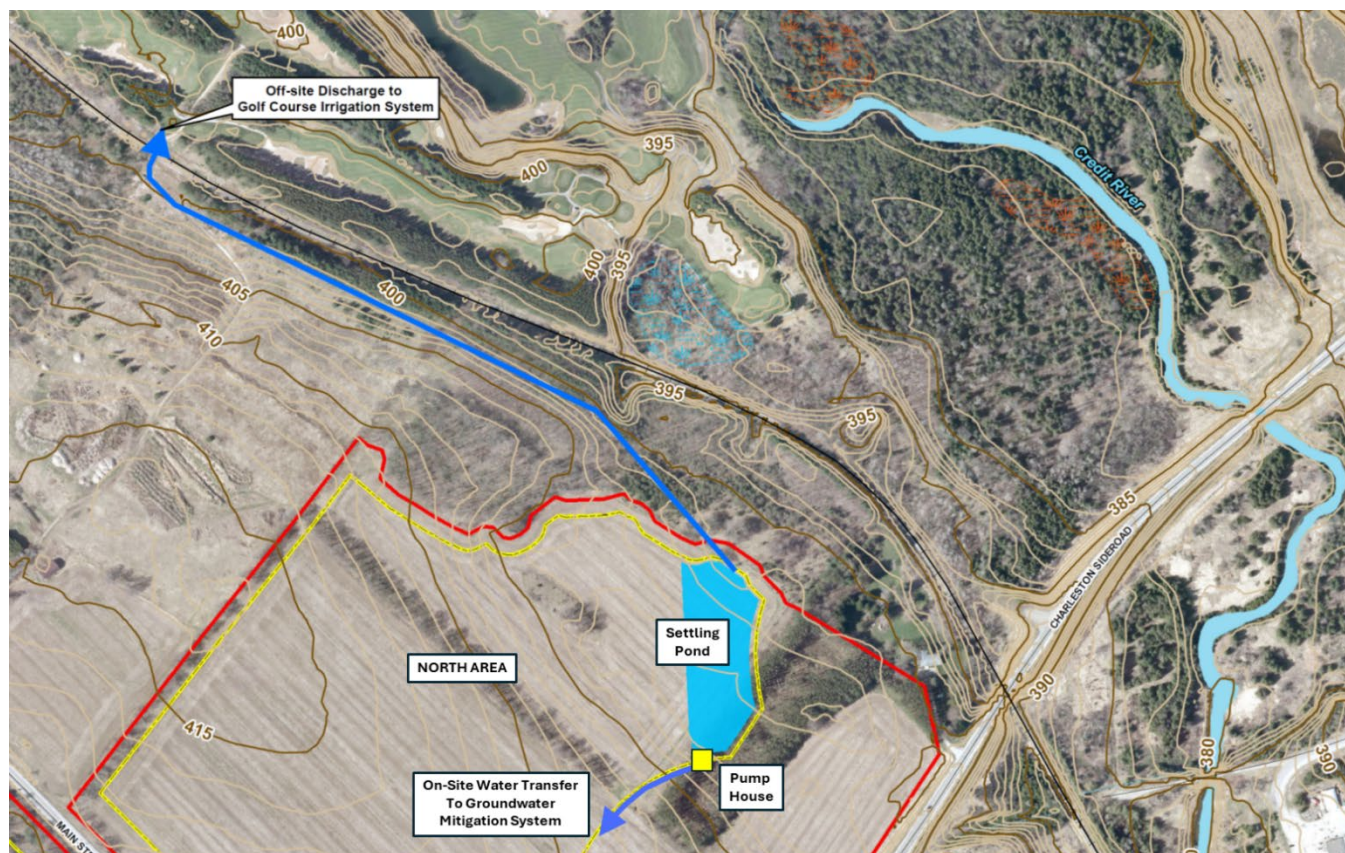
An updated year-by-year Water Management Plan has been prepared for the site (see Appendix D) and is summarized below.

### **5.1 Off-Site Discharge**

A single point of discharge has been identified for water collected from the combined land assemblages of the proposed Caledon Pit / Quarry to the Osprey Valley Golf Course irrigation system infrastructure (Figure 6), where



water will be used for irrigation when needed, with excess water stored in the golf course's existing pond system which ultimately discharges to the Credit River.



**Figure 6: Proposed Water Discharge from the Pit / Quarry Settling Pond to the Osprey Valley Golf Course**

## 5.2 Pit / Quarry Discharges and Flows

With reference to Table 2, discharges of surplus water to the Osprey Valley Golf Course irrigation system are anticipated to begin during Operational Year 1 with an annual discharge of approximately 10,000 m<sup>3</sup> that year. The rate of discharge is expected to increase annually to a maximum of approximately 587,000 m<sup>3</sup> / year in operational Year 13, and then stabilize and decline in future years.

It should be noted that additional HGS water model simulations indicated the groundwater mitigation system could be used to re-infiltrate additional groundwater, in the range of 200,000 to 400,000 m<sup>3</sup> / year, without adversely affecting groundwater levels. As such there is an option to re-infiltrate additional groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of downgradient natural heritage features.

Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

**Table 2: Water Consumption and Discharge Scenarios**

Year	Scenario 1	Water Consumed		Water Stored					Water Infiltrated by Trench							Water Discharged / Infiltrated			
	Annual Water Generated	Agg Production	Water for Agg Washing	Main Sump Storage	Wash Plant Storage	North Sump Storage	North Quarry Allowed to Fill	South Sump Storage	Trench Zone 1	Trench Zone 2	Trench Zone 3	Trench Zone 4	Trench Zone 5	Trench Zone 6	Total Infiltration Trench Zones 1-6	Total Water to Manage	Off Site Water Discharge to OVG	Water Transferred to Trench Zones 1-2	Water Transferred to Trench Zones 3-6
		0.05																	
	m3	T	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3		m3	m3	m3	m3
0	0	0	0	0	0	0	0	0							0	0	0	0	0
1	84,251	250,000	12,500	1,000	20,000	40,000	0	0							0	10,751	10,751	0	0
2	120,746	500,000	25,000	0	0	0	0	0							0	95,746	95,746	0	0
3	173,517	750,000	37,500	0	0	0	0	0							0	136,017	136,017	0	0
4	229,708	1,000,000	50,000	0	0	0	0	0							0	179,708	179,708	0	0
5	275,220	1,500,000	75,000	0	0	0	0	0							0	200,220	200,220	0	0
6	338,310	2,000,000	100,000	0	0	0	0	0							0	238,310	238,310	0	0
7	399,855	2,500,000	125,000	0	0	0	0	0							0	274,855	274,855	0	0
8	467,414	2,500,000	125,000	0	150,000	0	0	0							0	192,414	192,414	0	0
9	533,807	2,500,000	125,000	0	0	0	0	0							0	408,807	408,807	0	0
10	586,684	2,500,000	125,000	0	0	0	0	0							0	461,684	461,684	0	0
11	629,412	2,500,000	125,000	0	0	1,000	0	0							0	503,412	503,412	0	0
12	678,977	2,500,000	125,000	0	0	0	0	0							0	553,977	553,977	0	0
13	712,714	2,500,000	125,000	0	0	0	0	0							0	587,714	587,714	0	0
14	703,493	2,500,000	125,000	0	0	0	0	0							0	578,493	578,493	0	0
15	694,359	2,500,000	125,000	0	0	0	0	0							0	569,359	569,359	0	0
16	685,290	2,500,000	125,000	0	0	0	0	0							0	560,290	560,290	0	0
17	681,178	2,500,000	125,000	0	0	0	0	0	0	0					0	556,178	556,178	0	0
18	724,436	2,500,000	125,000	0	0	0	0	0	76,948	8,830					85,778	599,436	513,658	85,778	0
19	763,373	2,500,000	125,000	0	0	0	0	0	153,896	17,660					171,556	638,373	466,818	171,556	0
20	803,666	2,500,000	125,000	0	0	0	0	0	230,844	26,490					257,334	678,666	421,332	257,334	0
21	836,766	2,500,000	125,000	0	0	0	0	0	307,791	35,320					343,112	711,766	368,654	343,112	0
22	873,547	2,500,000	125,000	0	0	0	0	0	384,739	44,150					428,890	748,547	319,658	428,890	0
23	1,180,746	2,500,000	125,000	0	0	0	0	0	506,153	222,329					728,482	1,055,746	327,265	728,482	0
24	1,504,204	2,500,000	125,000	0	0	0	0	0	627,566	400,507					1,028,074	1,379,204	351,131	1,028,074	0
25	1,804,207	2,500,000	125,000	0	0	0	0	0	748,980	578,686					1,327,666	1,679,207	351,541	1,327,666	0
26	2,109,758	2,500,000	125,000	0	0	0	0	0	870,394	756,864	0	0	0	0	1,627,258	1,984,758	357,501	1,627,258	0
27	1,981,351	2,500,000	125,000	0	0	0	0	1,000	782,093	632,822	27,331	14,717	22,075	15,242	1,494,281	1,855,351	361,070	1,414,915	79,366
28	1,837,035	2,500,000	125,000	0	0	0	0	0	693,792	508,781	54,662	29,434	44,150	30,485	1,361,304	1,712,035	350,731	1,202,573	158,731
29	1,675,534	2,500,000	125,000	0	0	0	0	0	605,491	384,739	81,994	44,150	66,226	45,727	1,228,327	1,550,534	322,207	990,230	238,097
30	1,527,862	2,500,000	125,000	0	0	0	0	20,000	517,190	260,698	109,325	58,867	88,301	60,970	1,095,350	1,382,862	287,511	777,888	317,462
31	1,381,639	2,500,000	125,000	0	0	0	0	0	428,890	136,656	136,656	73,584	110,376	76,212	962,374	1,256,639	294,265	565,546	396,828
32	1,235,580	2,500,000	125,000	0	0	0	0	0	340,589	12,614	163,987	88,301	132,451	91,454	829,397	1,110,580	281,184	353,203	476,194
33	1,298,865	2,500,000	125,000	0	0	0	0	0	342,166	14,191	177,653	102,492	142,438	103,543	882,482	1,173,865	291,383	356,357	526,126
34	1,374,664	2,500,000	125,000	0	0	0	0	0	343,742	15,768	191,318	116,683	152,424	115,632	935,568	1,249,664	314,096	359,510	576,058
35	1,446,686	2,500,000	125,000	0	0	0	0	0	345,319	17,345	204,984	130,874	162,410	127,721	988,654	1,321,686	333,033	362,664	625,990
36	1,502,123	2,500,000	125,000	0	0	0	0	0	346,896	18,922	218,650	145,066	172,397	139,810	1,041,739	1,377,123	335,384	365,818	675,922
37	1,539,750	2,500,000	125,000	0	0	0	0	0	348,473	20,498	232,315	159,257	182,383	151,898	1,094,825	1,414,750	319,925	368,971	725,854
38	1,576,800	500,000	25,000	0	0	0	0	0	350,050	22,075	245,981	173,448	192,370	163,987	1,147,910	1,551,800	403,890	372,125	775,786

Max annual discharge to the Golf Course Irrigation Ponds: 587,714 m3  
 Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): 18.6 L/s  
 Average annual discharge to the Golf Course Irrigation Ponds: 345,645 m3  
 Avg discharge flow rate to the Golf Course Irrigation Ponds: 11.0 L/s

## 5.3 Summary

The following key points are noted with respect to water management at the proposed Caledon Pit / Quarry.

- The Operational Plan for the pit / quarry plans for the construction of a 40,000 m<sup>3</sup> settling pond / holding pond for managing discharge water in the North Area during Year 1, in order provide “immediate” water storage capacity.
- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.
- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 m<sup>3</sup> of capacity in that area once extraction has been completed at the end of Operational Year 14.
- The maximum annual average rate of discharge throughout pit / quarry operations to the Osprey Valley Golf Course irrigation pond system is approximately 587,000 m<sup>3</sup> / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.



- There is an option to re-infiltrate an additional 200,000 to 400,000 m<sup>3</sup> / year in Phases 4 to 7 of operations of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of downgradient natural heritage features.
- Upon rehabilitation, the combined outflow from the Main and North Ponds to the Osprey Valley Golf Course irrigation pond system is expected to be 10.0 L/s on average.

## 6.0 UPDATED MITIGATION SYSTEM DESIGN

The proposed groundwater mitigation system design presented in Golder (2023) has been updated based on the infiltration technology review, 2024 field investigations along the proposed infiltration trench and hydraulic barrier alignment, updated HGS numerical modelling simulations, and the updated water management plan. The updated system design is presented in the following subsections:

- General Configuration;
- Mitigation System Zones;
- Phasing of Implementation;
- Estimated Pit / Quarry Inflows and Trench Infiltration Rates;
- Sensitivity to Hydraulic Barrier Performance;
- Infiltration Trench Details;
- Hydraulic Barrier Details;
- Water Storage and Distribution System;
- Supply to Gravity Reservoirs;
- Supply to Infiltration Vaults; and
- Water Quality Considerations.

Supplemental design information is provided in Appendix E.

### 6.1 General Configuration

The proposed mitigation system generally consists of a groundwater infiltration trench and slurry wall / grout zone, as shown conceptually on Figure 7, which will be implemented within a 50 m wide zone of the pit / quarry setback, where it is required to sustain groundwater levels during operations.

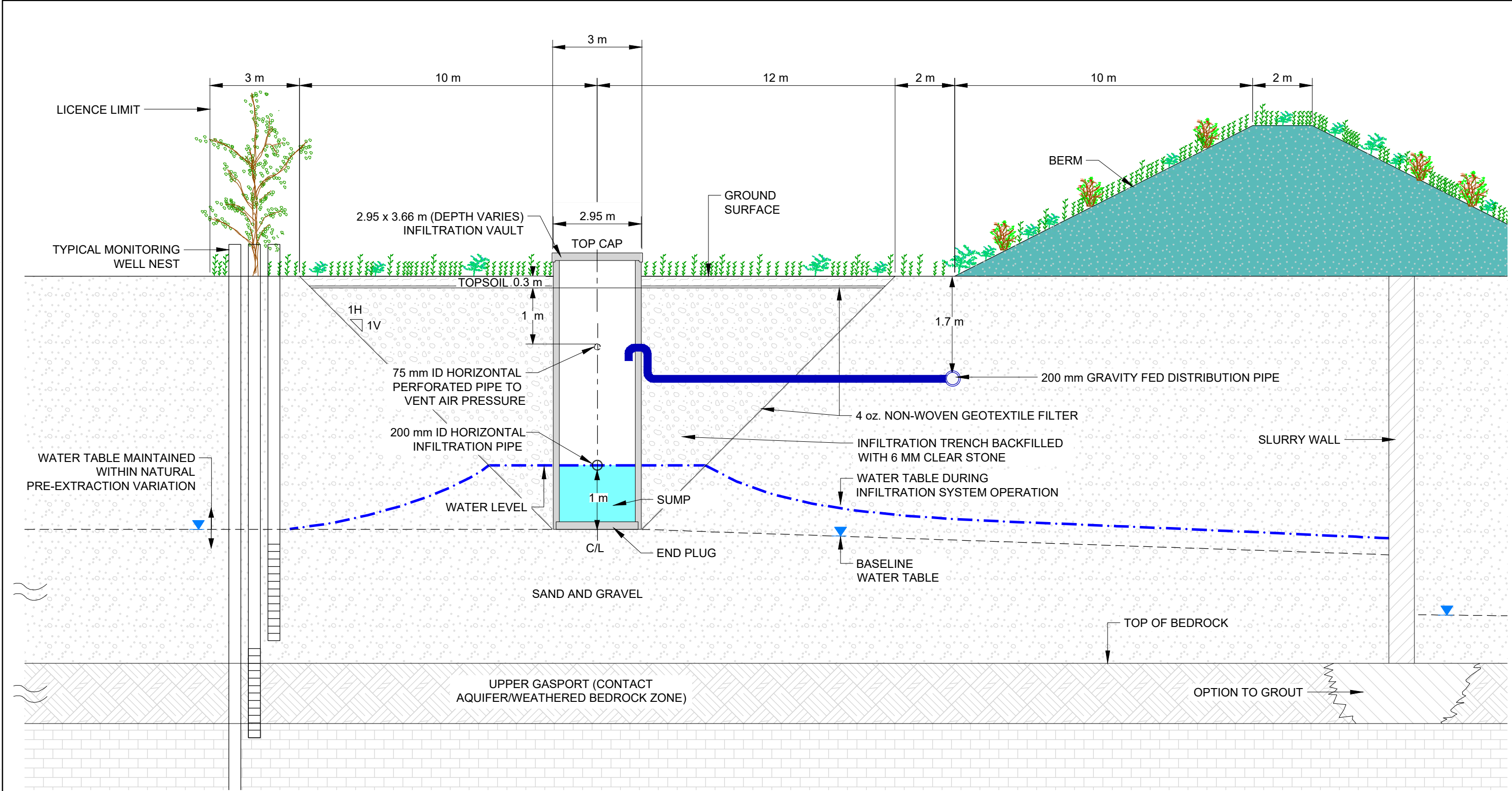
- The infiltration trench would be constructed within the setback, parallel and a minimum of 3 m from the licence limit. The trench will be excavated through the sand and gravel overburden to design depth using 1:1 sloping with a typical minimum width at the base of 3 m.
- The design depth of the trench is the shallowest of the depth to the annual average water table, top of bedrock, or a maximum depth of 8.5 m. Therefore, the trench has a maximum width of 20 m at surface. The detailed design of the Mitigation System will consider water level monitoring up to that point in the selection of design depths.
- A perforated 200 mm horizontal infiltration pipe would be placed 1 m above the base of the trench, and the trench would then be backfilled with 6 mm clear stone material, covered with a 4 oz non-woven geotextile and capped with a topsoil layer at surface, a minimum of 0.3 m thick, and up to a maximum of 0.9 m thick where the total depth of the trench permits a greater root zone.

- It is noted that many infiltration systems which receive variable inflows (such as storm water surges) conservatively select the backfill to be a large diameter clear stone (often 20 to 50 mm) to accommodate dynamic filling. In this case inflow rates are managed by the design of the system so a smaller diameter backfill material can be selected. This has the additional benefit, that in the event of a penetration of the geotextile a smaller diameter backfill may develop a natural filter pack and reduce the infiltration of fines into the trench compared to a larger backfill material.
- A thin (4 oz) non-woven geotextile is selected to reduce the risk of the geotextile becoming clogged over time and therefore improve the longevity of the system. As the material is thinner, care will be taken during construction to ensure that geotextile will not be damaged.
- The infiltration pipe would have 1.8 mm sluice perforations and have suitable strength to be buried up to design depths. It is anticipated that the sluice openings will provide sufficiently large openings to avoid chemical clogging of the infiltration pipe by the formation of precipitates (Dillon et al., 2024).
- All connections would be completed using soil tight connectors to ensure backfill materials do not clog pipes.
- Several vertical air release vent pipes to surface will be installed along the horizontal infiltration pipe to allow any entrapped air in the infiltration pipe to vent. A secondary function of the vertical vent pipes is to allow monitoring of water levels within the infiltration trench, with manual observations or with electronic water level monitoring devices. Vertical vent pipes will be placed at the end of each infiltration pipe and at the midpoint between vaults where there are multiple vaults in a zone.
- Horizontal air vents would be constructed using nominal 75 mm perforated pipe installed along the trench alignment at a depth of 1 m below the top of the backfill to vent air displaced in the backfill when water levels rise (TRCA, 2013).
- The vertical and horizontal air vents would alleviate mechanical clogging (or “back pressure”) due to air entrapment and ensure that water flows freely into the vault to the pipe to the granular material (Dillon et al., 2022).
- Water collected during pit / quarry operations would be stored and used to supply water to the infiltration trench via an infiltration vault, as may be needed to help maintain groundwater levels in the areas of potential concern at their current typical range during pit / quarry operations.
- An infiltration vault (Figure 8) would consist of prefabricated concrete “box culvert” segments, placed vertically on a prefabricated end cap with a gasket on the base of the trench, and extending to ground surface. The infiltration vault would be supplied with water via piping from the Settling Pond. Piping for the water distribution system would be installed below the frost line, where required, to facilitate year-round operation.



- The infiltration vaults will extend from above ground surface to the base of the infiltration trench, with the infiltration pipe positioned 1 m above the bottom of the sump. This placement will create an approximately 1 m sump at the base of the vault, which will provide redundant settling for particles and further reduce the likelihood of physical clogging (Dillon et al., 2024) (TRCA, 2013).
- A hydraulic barrier will also be constructed in the setback area, through the sand and gravel overburden and into the upper weather zone of the bedrock, between the infiltration trench alignment and the extraction limit, approximately 10 m from the extraction limit. The hydraulic barrier will consist of two components: grouting of fractures in the upper 3 to 5 m of the bedrock (i.e. weathered zone, if present) to reduce groundwater flow through any fractures, followed by the construction of a low permeability ~1m thick slurry wall in the overburden, keyed into the top of competent bedrock to ground surface on the same alignment.
- The target hydraulic conductivity (k) of the hydraulic barrier created by the slurry wall and grout zone within the overburden and weathered bedrock is  $1 \times 10^{-7}$  m/s, and this k value was used as the base case in the HGS numerical simulations to represent these zones in the scenarios with the mitigation system in place. It is noted that a soil slurry wall may need to be amended
- Grouting of the more permeable upper weathered bedrock zone would be performed, typically by means of pressurized injection grouting, where is it required to help create a hydraulic barrier. The slurry wall would extend from ground surface down to the top of bedrock. Given its proposed location within the setback, this hydraulic barrier would be constructed prior to the installation of the berm in that part of the setback area.
- Lastly, monitoring well nests (seven in total) have been installed in the spring of 2023 at key locations in the setback along the proposed mitigation system between the infiltration trench and the licence limit, as described in Section 0. In general, each well nest includes of a deep piezometer in the Gasport Formation, a piezometer screened across the Contact Aquifer zone, and a shallow piezometer in the overburden. Where groundwater levels were near the bedrock contact, an overburden monitoring well was omitted from the well nest. These monitoring well nests are currently being monitored to establish baseline groundwater levels along the proposed mitigation system, and will be used later to provide “feedback” on groundwater levels, to “inform” the injection rate needed to sustain groundwater levels, and to monitor the performance of the mitigation system.
- When operational, the mitigation system would be used to maintain groundwater levels within the range of their natural pre-extraction variations, as illustrated on Figure 8 (proximal to the trench vault) and Figure 9 (along other parts of the trench).

Path: \\wsp-phw-nr\CAD\CAMIS\0071\_Data\SI\CM\Clients\Volcanism\_Clients\Long\_Per\_5\_Caledon\99\_PROD\19129150\00\_PROD\0071\_Update\_GW\_Mitigation | File Name: 19129150-0071-CH-0001.dwg | Last Edited By: gld\_jesper Date: 2025-03-10 Time: 1:56:50 AM | Printed By: gld\_jesper Date: 2025-03-10 Time: 1:56:42 PM



GENERAL

1. Max trench width 20 m and depth 8.5 m will vary depending on the design depth.
2. Infiltration piping will be sized to meet required infiltration rate.
3. Minimum setback of 50 m needed.
4. Construct slurry wall/grout 10 m from extraction limit.
5. Construct infiltration trench centerline 13 m from licence limit.
6. Construct berm in setback.
7. Design features are schematic and Not to Scale.



CLIENT  
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.  
(CANADA).

CONSULTANT



YYYY-MM-DD 2025-05-07

DESIGNED GWS

PREPARED JPR

REVIEWED PM

APPROVED GWS

PROJECT  
CBM CALEDON PIT / QUARRY  
GROUNDWATER MITIGATION DESIGN REPORT

TITLE  
**CROSS-SECTION SHOWING PROPOSED INFILTRATION VAULT  
DETAIL**

PROJECT NO.  
19129150

CONTROL  
0071

REV.  
1

FIGURE  
8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3/B





## 6.2 Mitigation System Zones

To mitigate the potential decline in groundwater levels during later the stages of operations (Phases 4 to 7) due to dewatering, the proposed mitigation system would consist of six infiltration trench zones and two slurry wall / grout zones constructed along a 1,900 m alignment, as summarized in Table 3.

- North of Charleston Sideroad in the Main Area, two trench zones (Zones 1 and 2) and a 600 m long slurry wall / grout zone are proposed.
- South of Charleston Sideroad in the South Area, four trench zones (Zones 3 to 6) and a 1,250 m long slurry wall / grout zone are proposed.
- The six individual trench zones would range in length from ~220 to ~335 m and are typically separated from one another by a “gap” of 30 m, except Trenches 2 and 3, which are separated by a gap of ~43 m as they straddle Charleston Sideroad and Trenches 3 and 4 which are separated by 125 m where a topographic low area where the water table is close to ground surface, making trench operation impractical.
- Each trench zone would be assigned a “target” water level to be maintained during mitigation. For the purposes of the design and testing the feasibility of this mitigation, the steady state current condition water table from the calibrated HGS model was assumed to be the “target” water level in numerical simulations.
- The monitoring wells installed along the mitigation system alignment will observe the natural pre-extraction water table fluctuations and can be used to establish the maximum and minimum water level range associated with each trench zone.

**Table 3: Proposed Groundwater Mitigation Zones**

Mitigation		Start (m)	End (m)	Length (m)	Target Trench Water Level (masl)
Main Area	Slurry Wall	0.0	128.6	128.6	N/A
	Trench Zone 1 / Slurry Wall	128.6	348.7	220.1	396.0 - 398.0
	Trench Zone 2 / Slurry Wall	378.7	596.7	218.0	394.0 - 398.0
South Area	Trench Zone 3 / Slurry Wall	640.1	974.8	334.7	393.5
	Trench Zone 4 / Slurry Wall	1100.0	1334.9	234.9	393.0
	Trench Zone 5 / Slurry Wall	1365.8	1634.5	268.7	392.0
	Trench Zone 6 / Slurry Wall	1664.5	1890.5	226.0	394.0

- With reference to Table 3 the “average” current condition groundwater table assigned to each trench segment in the HGS model simulation varied along the alignment, from 396.0 masl at the north end in Trench Zone 1 in the Main Area, to as low as 393.0, 392.0 and 394.0 masl at the southernmost trench Zones 4, 5 and 6 in the South Area.
- Trench Zones 1 and 2 will be assigned higher target heads (398.0 masl) during Phase 5 of operation to help maintain groundwater levels in that area, and will otherwise be assigned target groundwater levels based on average current condition groundwater levels (396.0 and 394.0 masl, respectively).

- When the system is implemented, the range of operational water levels for each trench zone will be determined from baseline water level monitoring data at the monitoring well nest or nests corresponding to that trench zone. Using natural variations observed in baseline groundwater levels, the target water levels can be varied to account for observed seasonal changes in groundwater levels.
- Target water levels will be determined for each trench zone from baseline monitoring at the infiltration trench monitoring well nests, acquired for a minimum period of 2 years prior to the start of below water table extraction. Based on the water level variability observed at existing site monitoring wells MW20-01, MW20-02 and MW20-18 for the 2021 period, it is expected that target water levels for the proposed infiltration trench system will vary seasonally by 1.5 to 2 m. It is expected that it will also be necessary to periodically adjust the range of target water levels in the event that longer term changes in groundwater levels occur as a result of future climate trends.
- Because the mitigation system reinfilters a large portion of the total pit / quarry inflows into the southwestern portion of the Site, the proposed system will mitigate the impact of dewatering to the west of the Main Area and the south and west of the South Area of the proposed pit / quarry operation.
- In the event that baseline aquifer water levels are established during typical conditions, then abnormally dry conditions occur during operations, aquifer water levels to naturally decline below established target levels, through no impact of the quarry. Therefore, it is suggested that during the detailed design a maximum portion of quarry inflows (for example 90%) be required for use of the mitigation system in the event of abnormally dry conditions.

### 6.3 Phasing of Implementation

Based on numerical simulations for Operational Phases 3 to 7 as described in Section 8 and Appendix Q of the Water Report (Golder, 2023), the groundwater mitigation system elements would be implemented in the following operational sequence.

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area prior to the start of Phase 4 and 5 extraction.
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6) prior to the start of Phase 6 and 7 extraction.

The Rehabilitation scenario includes the removal of the slurry wall in the overburden in the southwest corner of the South Area (adjacent to Trench Zones 4 and 5), in order to help restore the original hydraulic connection between the South Area and the lands to the south and southwest of the Site. The other slurry walls and the infiltration trenches would remain in place. The infiltration trench vaults would be decommissioned in place, but the water distribution piping would be removed.

A summary of the mitigation system elements that were simulated and are proposed to be implemented during pit / quarry operations is presented in Table 4.



**Table 4: Implementation Sequence of Groundwater Mitigation System Elements**

Phase	Operational Year	Slurry Wall / Grout Zone	Infiltration Trench Zone / Constant Head (masl)
Phase 1	1 to 8	N/A	N/A
Phase 2	9 to 13	N/A	N/A
Phase 3	14 to 17	West side of Main Area	N/A
Phase 4	18 to 22	West side of Main Area	Trench Zone 1: 396.0 Trench Zone 2: 394.0
Phase 5	23 to 26	West side of Main Area	Trench Zone 1: 398.0 Trench Zone 2: 398.0
Phase 6	27 to 32	West side of Main Area  West and South side of South Area	Trench Zone 1: 396.0 Trench Zone 2: 394.0 Trench Zone 3: 393.5 Trench Zone 4: 393.0 Trench Zone 5: 392.0 Trench Zone 6: 394.0
Phase 7	33 to 38	West side of Main Area  West and South side of South Area	Trench Zone 1: 396.0 Trench Zone 2: 394.0 Trench Zone 3: 393.5 Trench Zone 4: 393.0 Trench Zone 5: 392.0 Trench Zone 6: 394.0
Rehabilitation	Year 39+	Slurry wall removed along Trench Zones 4 and 5	N/A

## 6.4 Estimated Pit / Quarry Inflows and Trench Infiltration Rates

Numerical simulations in HGS for each phase of pit / quarry operations with the proposed mitigation system elements in place (inflows presented in Table 5), in accordance with the implementation sequence noted above (Table 4). The estimated inflows by phase are also shown graphically on Figure 10.

**Table 5: Estimated Pit / Quarry Inflows**

Phase	Period (years)	Forecast Year	Pit / Quarry Inflow – With Mitigation Trench (L/s)			
			Main Area	North Area	South Area	Total Inflow
1	1 to 8	8	14.7	0.0	n/a	14.7
2	9 to 13	13	19.6	3.0	n/a	22.6
3	14 to 17	17	18.5	3.1	n/a	21.6
4	18 to 22	22	24.6	3.1	n/a	27.7
5	23 to 26	26	63.8	3.1	n/a	66.9
6	27 to 32	32	28.2	3.0	7.9	39.1
7	33 to 38	38	29.5	2.5	18.0	50.0

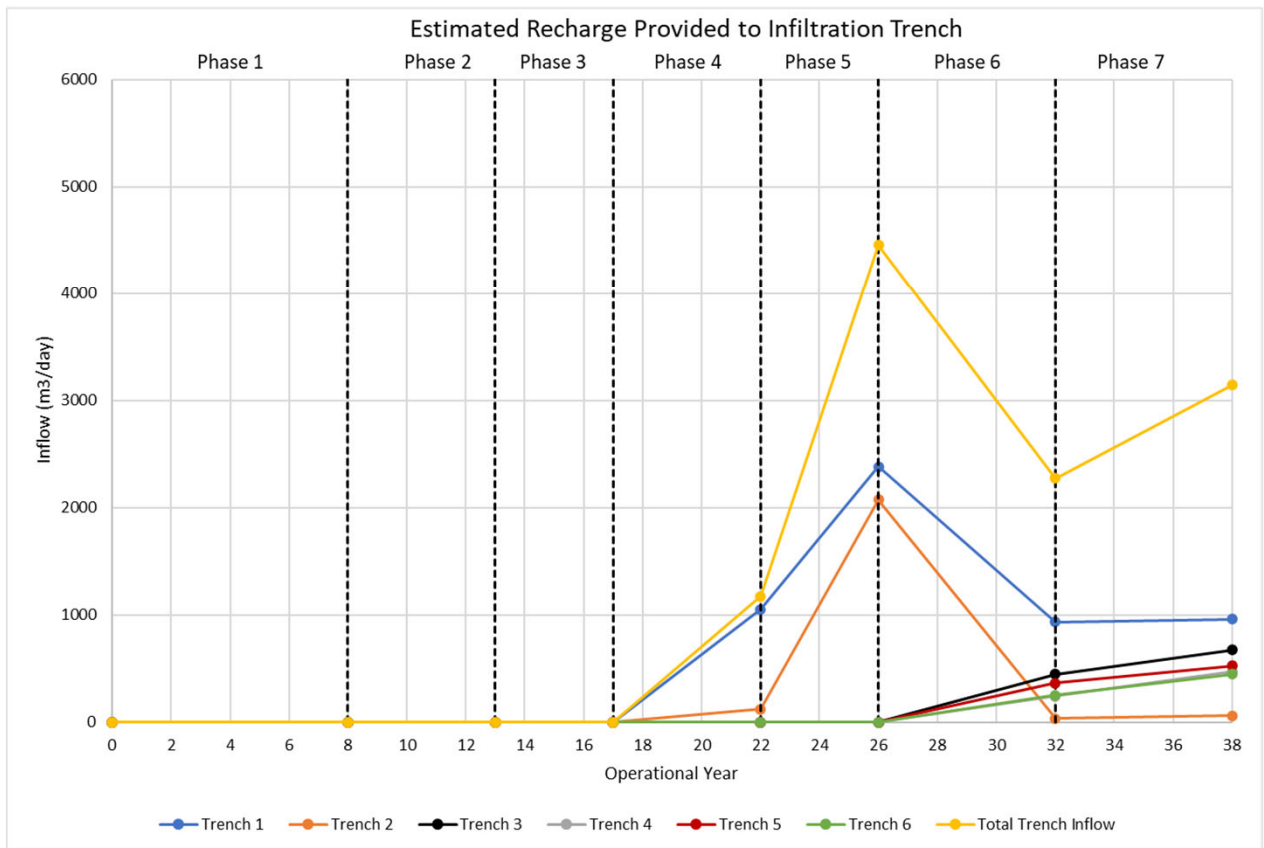
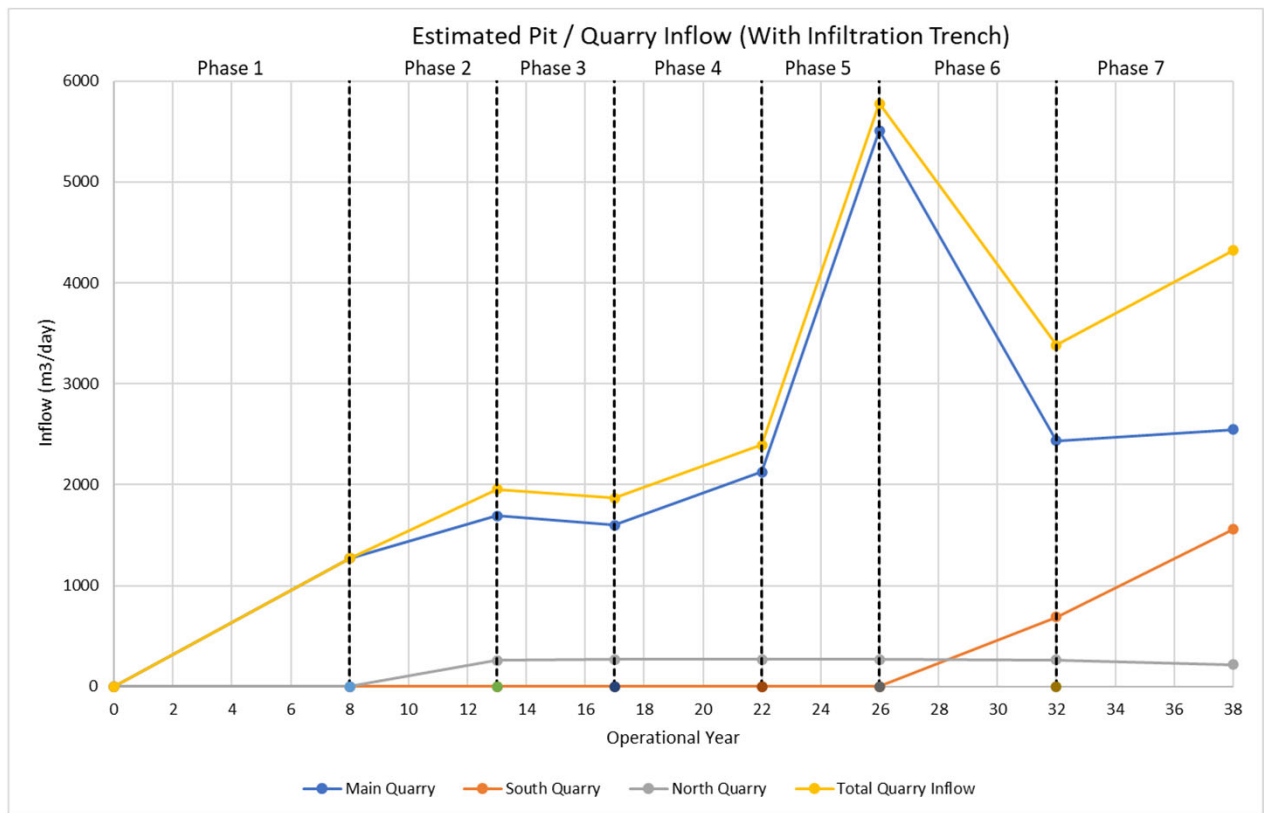
The HGS model simulations were also used to estimate the quantity of water required to maintain the groundwater tables at the target trench water levels, as summarized in Table 5, and shown graphically on Figure 10.

The simulations demonstrate that the volume of water required for the implementation of the groundwater mitigation system is less than the corresponding quarry inflows on an annual basis and the water balance presented in Appendix A of the Water Report Addendum (WSP 2025) shows that sufficient water throughout the year to operate the system, indicating that there will be sufficient water available from dewatering to operate the mitigation system throughout all phases of the pit / quarry.

Hydraulic conductivity estimates from field observations and HGS numerical simulations demonstrate that the weathered bedrock is sufficiently permeable (ranging from  $k = 1 \times 10^{-3}$  m/s to  $k = 8 \times 10^{-3}$  m/s), overlain by sand and gravel ( $k = 1 \times 10^{-4}$  m/s) to receive the proposed groundwater inflow rates, given the size of the contact area within the trench that is available for infiltration.

**Table 6: Estimated Recharge Required to Infiltration Trench**

Phase	Forecast Year	Recharge Required to Infiltration Trench (L/s)							
		Trench Zone 1	Trench Zone 2	Trench Zone 3	Trench Zone 4	Trench Zone 5	Trench Zone 6	Total Trench Recharge	Trench Flow Portion of Sump Inflow (%)
1	8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	13	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	17	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	22	12.2	1.4	n/a	n/a	n/a	n/a	13.6	49%
5	26	27.6	24.0	n/a	n/a	n/a	n/a	51.6	77%
6	32	10.8	0.4	5.2	2.8	4.2	2.9	26.3	67%
7	38	11.1	0.7	7.8	5.5	6.1	5.2	36.4	73%
Max. infiltration rate (L/s):		26.7	24.0	7.8	5.5	6.1	5.2	51.6	



CLIENT  
CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

PROJECT  
**Caledon Pit / Quarry**  
Groundwater Mitigation Design Report

CONSULTANT



YYYY-MM-DD 2025-03-17

PREPARED PGM

DESIGN PGM

REVIEW GWS

APPROVED GWS

TITLE

**ESTIMATED PIT / QUARRY INFLOWS AND INFILTRATION  
RATES FOR PROPOSED MITIGATION SYSTEM**

PROJECT No.  
**19129150**

Rev.  
**A**

FIG.  
**10**



## 6.5 Sensitivity to Hydraulic Barrier Performance

A sensitivity analysis was performed on predicted pit / quarry inflows by varying the hydraulic conductivity of the proposed hydraulic barrier by increasing and decreasing it by one order of magnitude for each of the operational phases (Appendix S, Golder 2023). The analysis showed that quarry inflows varied by <10% in response to the effective hydraulic conductivity of the barrier. With the inclusion of progressive rehabilitation in addition to the hydraulic barrier in the groundwater mitigation system, it is expected quarry inflows will be less sensitive to the performance of the hydraulic barrier.

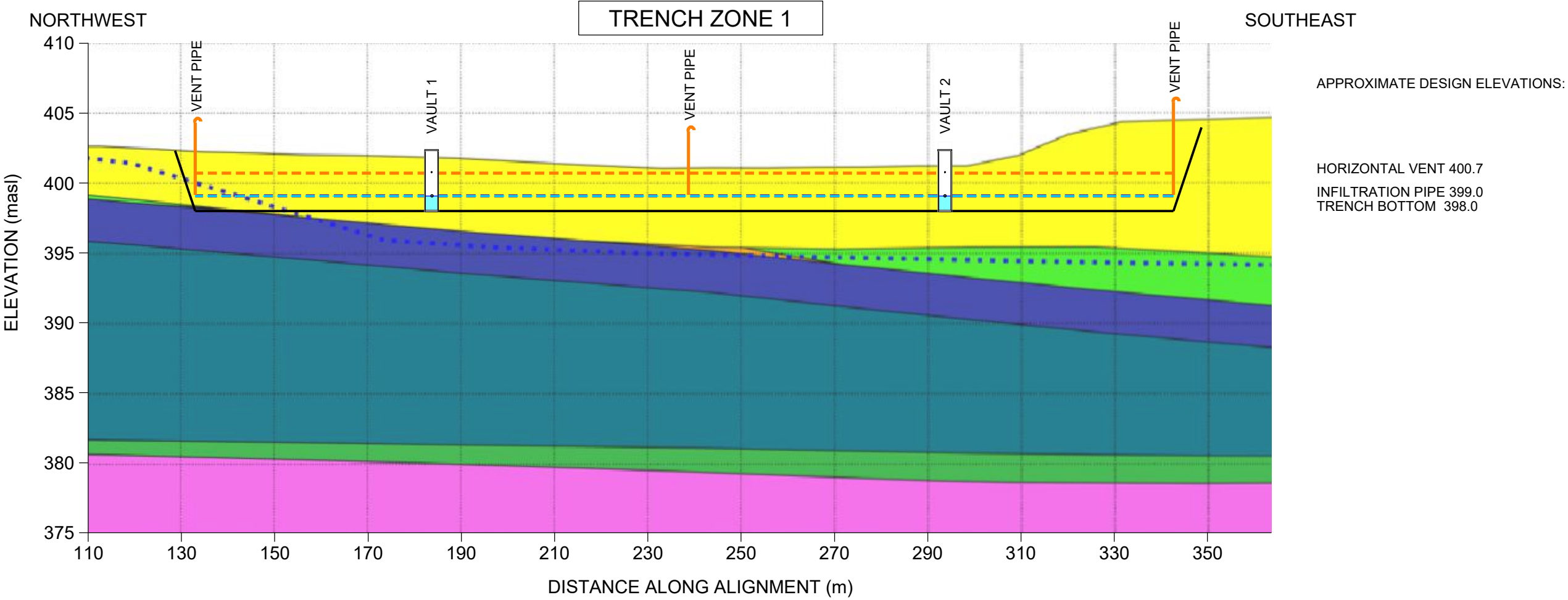
## 6.6 Infiltration Trench Details

The details of the design of each zone of the infiltration trench are summarized in Table 7 and presented in Figure 11 to Figure 16. The trench zone bottom elevations are designed by selecting the highest elevation of highest point on the typical water table elevation, top of bedrock elevation, or 8.5 m below the highest topographic point in the trench footprint, as described in Section 6.1.

**Table 7: Infiltration Trench Zone Details**

Trench Zone #	Chainage (m)	Base of Trench Design Elevation (masl)	Rationale	Trench Depth Range Below Ground Surface (m)	Trench Width Range (m)	Number of Vaults
1	128.6 to 348.7	398	Water Table and Top of Bedrock Elevation	4 to 6	11 to 15	2
2	378.7 to 596.7	396.5	Maximum Trench Depth	5.5 to 8.5	14 to 20	1
3	640.1 to 974.8	394	Water Table Elevation	3 to 6	9 to 15	1
4	1100.0 to 1334.9	393	Water Table Elevation	4 to 7	11 to 17	1
5	1365.8 to 1634.5	392	Water Table Elevation	7 to 8	17 to 19	1
6	1664.5 to 1890.5	395	Water Table Elevation	3 to 4	9 to 11	1

Path: \\wsp-pbwan-net\CAD\MIS\00\CTX\_Data\SIN\Clients\Volcanism\_Clients\Long\_Par\_5\_Caledon\99\_PROJ\19129150\40\_PROD\0071\_Update\_GW\_Mitigation | File Name: 19129150\40\_PROD\0071\_Update\_GW\_Mitigation.dwg | Last Edited By: gld\_jregier Date: 2025-03-10 Time: 11:14:11 AM | Printed By: gld\_jregier Date: 2025-03-10 Time: 11:54:40 AM



GENERAL

- Upper Sand
- Till
- Lower Sand / Channel Sediment
- Weathered Bedrock
- Gasport Formation (Dolostone)
- Fossil Hill Formation (Shaley Dolostone)
- Cabot Head Formation (Shale)



CLIENT  
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.  
(CANADA).

CONSULTANT



YYYY-MM-DD	2025-03-07
DESIGNED	GWS
PREPARED	JPR
REVIEWED	PM
APPROVED	GWS

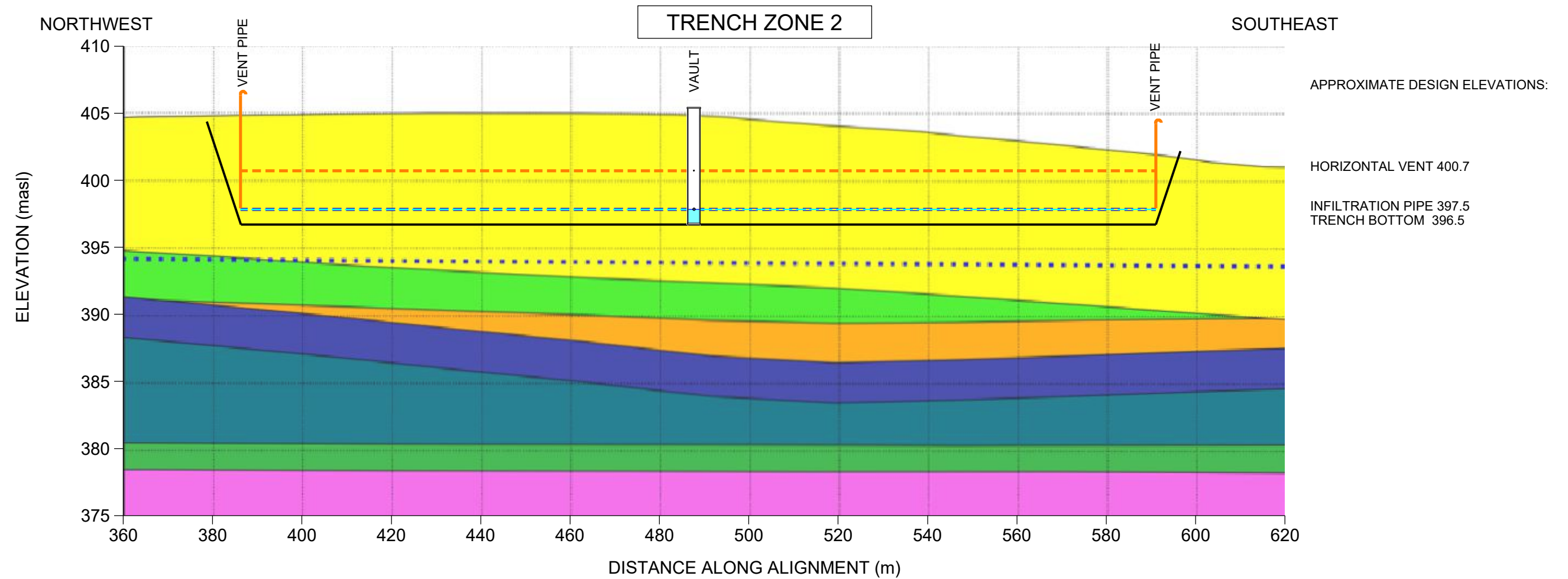
PROJECT  
CBM CALEDON PIT / QUARRY  
GROUNDWATER MITIGATION DESIGN REPORT

TITLE  
**TRENCH ZONE1**

PROJECT NO.	CONTROL	REV.	FIGURE
19129150	0071		11

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3S/B

Path: \\wsp-pbwan-net\CAD\MIS\00\CTX\_Data\SIM\Clients\Volcanism\_Clients\Long\_Par\_5\_Caledon\99\_PROJ\19129150\40\_PROD\071\_Update\_GW\_Mitigation | File Name: 19129150\40\_PROD\071\_Update\_GW\_Mitigation.dwg | Last Edited By: gld\_jregier Date: 2025-03-10 Time: 11:14:11 AM | Printed By: gld\_jregier Date: 2025-03-10 Time: 11:54:57 AM



GENERAL

- Upper Sand
- Till
- Lower Sand / Channel Sediment
- Weathered Bedrock
- Gasport Formation (Dolostone)
- Fossil Hill Formation (Shale Dolostone)
- Cabot Head Formation (Shale)



CLIENT  
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.  
(CANADA).

CONSULTANT



YYYY-MM-DD	2025-03-07
DESIGNED	GWS
PREPARED	JPR
REVIEWED	PM
APPROVED	GWS

PROJECT  
CBM CALEDON PIT / QUARRY  
GROUNDWATER MITIGATION DESIGN REPORT

TITLE  
**TRENCH ZONE2**

PROJECT NO.  
19129150

CONTROL  
0071

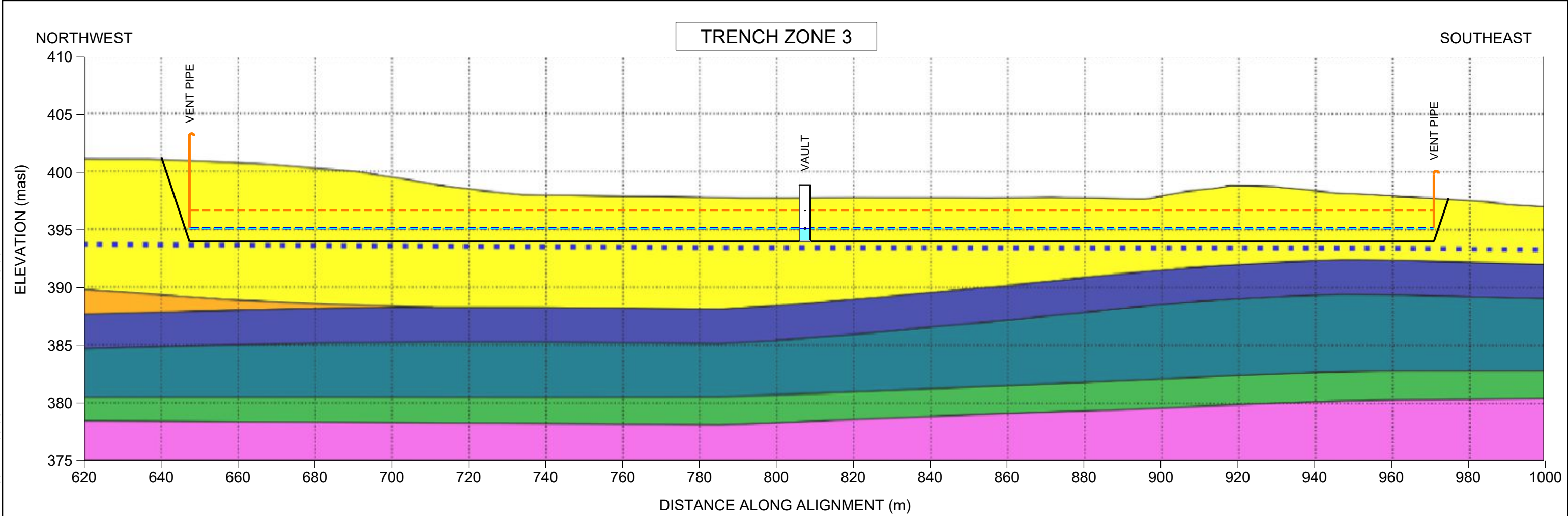
REV.  
--

FIGURE  
12

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A4S B



Path: \\wsp-pbwan-net\CAD\MIS\00\CTX\_Data\SIN\Clients\Volcanism\_Clients\Long\_Par\_5\_Caledon\99\_PROJ\19129150\40\_PROD\0071\_Update\_GW\_Mitigation | File Name: 19129150\40\_PROD\0071\_Update\_GW\_Mitigation | Date: 2025-03-10 Time: 11:14:11 AM | Printed By: gld\_jregier Date: 2025-03-10 Time: 11:55:16 AM



APPROXIMATE DESIGN ELEVATIONS:  
--- HORIZONTAL VENT 396.7  
--- INFILTRATION PIPE 395.0  
--- TRENCH BOTTOM 394.0

GENERAL

- Upper Sand
- Till
- Lower Sand / Channel Sediment
- Weathered Bedrock
- Gasport Formation (Dolostone)
- Fossil Hill Formation (Shaley Dolostone)
- Cabot Head Formation (Shale)



CLIENT  
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC.  
(CANADA).

CONSULTANT



YYYY-MM-DD	2025-03-07
DESIGNED	GWS
PREPARED	JPR
REVIEWED	PM
APPROVED	GWS

PROJECT  
CBM CALEDON PIT / QUARRY  
GROUNDWATER MITIGATION DESIGN REPORT

TITLE  
**TRENCH ZONE3**

PROJECT NO.	CONTROL	REV.	FIGURE
19129150	0071		13

25 mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM A3S/B









Trench zones vary in length from 220 m (Zone 1) to 335 m (Zone 3), in bottom depth below ground surface from 3.0 m (Zone 6) to 8.5 m (Zone 2), and correspondingly in top width from 9 to 20 m in width. Bottom elevations range from 393 masl (Zone 4) to 398 masl (Zone 1), based on the typical water table elevation (as predicted by the HGS model), except for Zone 2 where the maximum excavation depth (8.5 mbgs) was used to design the bottom elevation of the trench. The only exception to this design method occurs at the northern extent of Zone 1, where the predicted water table dips steeply (Figure 11). For Zone 1 a representative water table elevation (instead of the maximum water table elevation), which coincides with the expected top of bedrock, was selected as the designed bottom elevation of the trench zone.

Following the collection of detailed baseline groundwater level monitoring data along the mitigation system alignment, final design elevations will be established for each zone, following the same method described in Section 6.1.

Each trench zone is supplied by one Infiltration Vault placed in the center of the alignment, except for Zone 1 which is supplied by two Infiltration Vaults, due to the higher expected infiltration rates in this trench zone. As shown in Figure 11 to Figure 16, air vents are installed in the trench vertically, at the greatest distances from the infiltration vaults and horizontally at 1 m below the top of the backfill material.

## 6.7 Hydraulic Barrier Details

As initially described in Golder (2023) Appendix S, a hydraulic barrier will be constructed in the setback area through the sand and gravel overburden and into the upper weathered zone of the bedrock. The barrier will be constructed between the infiltration trench alignment and the extraction limit, approximately 10 m from the extraction limit, and approximately 27 m from the centerline of the infiltration trench, as shown on Figure 7. The hydraulic barrier will consist of two components: constructing a slurry wall through the overburden and keyed into competent bedrock and (if required) grouting the weathered zone in the upper bedrock on the same alignment.

The target hydraulic conductivity ( $k$ ) of the hydraulic barrier created by the slurry wall and grout zone within the overburden and weathered bedrock is  $1 \times 10^{-7}$  m/s. This  $k$  value was used for HGS numerical simulations to represent the hydraulic barrier zones in operational scenarios with the groundwater mitigation system in place.

A number of construction methods were initially evaluated and from that, two slurry wall construction technologies emerged as the most suitable for the proposed hydraulic barrier at the site: in-situ soil mixing by one-pass trenching (OPT) to create a soil-bentonite (SB) barrier; and a self-hardening cement-bentonite (CB) slurry wall constructed by traditional excavation methods.

### 6.7.1 Soil Mixing by One-Pass Trenching (OPT)

One-Pass Trenching (OPT) technology is an in-situ soil mixing technique (DeWind, 2025). OPT soil mixing implements a high-speed, high-torque mixing chain to homogenize in-situ soils with a prescribed proportion of bentonite (Figure 17). The resultant soil-bentonite barrier wall can be constructed to meet the hydraulic conductivity objective of the project.

If this approach is selected, the hydraulic barrier wall would be installed with a DeWind MT1600 One-Pass Trencher, capable of reaching a maximum 22 m depth and operating with 2,000 horsepower. This trencher produces 800,000 lb-ft of torque and has digging chain speeds of up to 4 m/s. The process typically uses a maximum operational vertical boom stroke of 3 m, depending on the length of the boom and the amount of leverage the trencher exerts on the boom (DeWind, 2025).



**Figure 17: One-Pass Trenching Method a) Digging box. b) Stick (pivot) cylinders. c) Lift (stroke) cylinders. d) Boom. e) Water supply line. f) Digging/mixing chain. g) Drag Box. h) Cab. i) Tracks. j) Counterweight (DeWind, 2025).**

The OPT method also has the potential to reduce the permeability of the weathered upper bedrock zone without the need for additional grouting of the bedrock. Because it does not require the use of slurry to hold the trench walls open, an in-situ soil-bentonite mixture is constantly maintained within a 10 to 20 cm “slump”. This low-slump mixture enables slurry loss into bedrock fractures to be gradual, allowing time to place more trenching spoils on the working pad to “top off” the trench volume as soil-bentonite mixture slowly fills in top-of-rock fracture pathways. The soil-bentonite mixture will typically fill in fractures due to the weight/pressure of the 6 to 18 m of soil-bentonite mixture above them, which is an intrinsic benefit of selecting the barrier wall installation method in these circumstances.

### **6.7.2 Self-Hardening Cement-Bentonite (CB) Slurry Wall**

First constructed in the 1970's, self-hardening CB (Cement-bentonite) slurry walls are a common barrier wall choice in North America, Europe and other international locales (Geo-Solutions, 2025). In this method, the wall is excavated through a slurry that typically consists of water, bentonite, cement, and occasionally other additives (Figure 18). The trench slurry hardens in place, normally overnight. The hardened CB slurry serves as the final barrier wall. Cement-bentonite installations do not require a separate backfilling operation and it's for this reason that this technique is sometimes referred to as one-step slurry wall construction.





**Figure 18: Self-Hardening CB (Cement-Bentonite) Slurry Wall Method (Geo-Solutions, 2025)**

The CB wall method is advantageous over conventional slurry walls where there is limited access or narrow work zones because of the smaller equipment footprint. Since CB slurry is heavier than bentonite slurry and self-hardens, this method can provide improved trench stability and more easily overcome weaker ground conditions, and variable topography. Since the slurry sets after ~1 day, overlapping segments can be constructed in any direction or order to form a continuous barrier. Segments can be used to traverse up or down moderate slopes (5 to 15%) with minimal earthwork construction. Cement-bentonite walls can also be readily constructed through relatively permeable ground.

The CB walls are excavated using a hydraulic excavator and/or clamshell excavation equipment, the same equipment used for other slurry walls. At the slurry plant, cement, or some other setting agent, is added to the bentonite slurry. The viscosity of the mixed slurry is designed to be in the fluid range during the excavation process. The slurry is then pumped from the mix plant to the excavation. Once the excavation is to full depth, the bottom is “cleaned”, and the process moves on. The slurry stays in the trench and is allowed to set. Typical CB slurry will attain a butter-like consistency overnight and a clay-like consistency after fully curing.

Cement-bentonite walls typically pair well with underlying bedrock grouting from an installation standpoint. With a CB wall approach, the slurry wall can be installed first, which allows for a full profiling along the entire trench of the bedrock interface so when bedrock grouting begins, the start and stop depths are already defined. Secondly, if the CB wall is already in place prior to grouting, when the grouting holes are drilled, it's possible to drill them uncased through the CB wall, which saves significant grouting costs. Most importantly, the CB wall installation may also eliminate the need for additional grouting, as a portion of the CB slurry is expected to enter into and seal some fractures in the upper bedrock zone when it is initially emplaced in the excavation.

### **6.7.3 Grouting the Upper Weathered Bedrock Zone**

Based on the hydrogeologic and geologic data obtained in the spring of 2024, the results of previous site investigations along the proposed hydraulic barrier alignment, and opinions provided by expert contractors (DeWinde 2025; Geo-Solutions, 2025), grouting of the upper weathered bedrock zone, while practical, is a costly approach to treating a relatively small zone of weathered rock.

As noted above, both the OPT SB slurry wall and the traditional CB slurry wall can be constructed in a manner that inherently reduces the permeability of the upper bedrock and both are likely to achieve the intended result of reducing water inflows, without the need for additional grouting. It is therefore recommended that the decision to perform additional grouting of the bedrock be made once the slurry walls have been constructed, as the slurry wall



construction in itself will provide additional information on subsurface conditions and further inform the decision-making process. If ground conditions are conducive to the hydraulic barrier being keyed into competent bedrock, grouting can be omitted from the construction of the mitigation system. If grouting is selected, it would typically be carried out in the following general steps.

- Drilling through the completed SB or CB wall (2 m min, 16 m max, 8.4 m average), through the "weathered" rock (about 3 m in thickness) and into the underlying bedrock about 1.5 m.
- Drill primary and secondary boring pairs on a 3 m spacing for a final spacing of 1.5 m. A 25% allowance should be made for higher-order borings, to be located based on observed grout takes in the field (to provide additional treatment to "problem" areas).
- Upstage grouting with traditional balanced / stable cementitious grouts. Grouts can be varied in viscosity to suit the rock condition and observed takes.
- Packer grout in ~3 m stages. Grout each stage to effective refusal.
- Option to conduct water pressure testing and / or coring to verify grouting placement / performance.

#### 6.7.4 Summary

The hydrogeologic and geologic data obtained in the spring of 2024 from the drilling and testing of monitoring wells nests MW-IT-01 to MW-IT-07 and the results of previous site investigations along the proposed hydraulic barrier alignment, indicates that both the OPT SB wall and one-step CB wall construction methods are viable for the slurry wall / hydraulic barrier at the proposed pit / quarry, and are also both likely to reduce the permeability of the weathered upper bedrock zone sufficiently to negate the need for additional grouting.

### 6.8 Water Storage and Distribution System

Water collected from pit / quarry sumps during operational Phases 1 to 7 will be conveyed to the Settling Pond (described in Section 6.8.1) located in the North Area, where it will be stored until it is needed to supply the proposed groundwater mitigation system or surplus water is discharged off-site to the Golf Course irrigation system. The mitigation system will distribute water in two main phases: supplying water from the Settling Pond to the Gravity Reservoirs (described in Section 6.8.2) and from the Gravity Reservoirs to the Infiltration Vaults (described in Section 6.8.3).

#### 6.8.1 Settling Pond, Intake, and Outlets

The proposed Settling Pond (Figure 6) is approximately 8,900 m<sup>2</sup> in size and rectangular in shape (180 m x 540 m) with an average depth of 4.5 m, and a planned water storage capacity of approximately 40,000 m<sup>3</sup>. Run-off and groundwater seepage collected in the pit / quarry sumps will be collected and discharged to the Settling Pond via an inlet structure located on the west side of the pond. Both a submerged and non-submerged inlet structure will be evaluated at the detailed design stage, and the preferred intake option selected for implementation. Suspended particles will be allowed to settle in the forebay of the pond, before exiting the forebay via conveyance pipes and entering the main area of the pond. The main area of the pond comprises a permanent pool (lower portion of the water column) and an active storage zone (upper portion of the water column).

The design of the Settling Pond will be consistent in the approach recommended in the Stormwater Management Planning and Design Manual (MOE, 2003). The forebay's length-to-width ratio will be optimized to maximize the settling of particles, the forebay will be sized to ensure non-erosive velocities exit the forebay, and the forebay's

size will not exceed 33% of the size and 20% of the volume of the permanent pool. If required, the main area of the pond may be constructed with low flow berming to extend the flow path of the water through the pond. The large size and volume of the settling pond, together with the use of berming (if needed) in its detailed design will ensure that a minimum detention time of at least 24 hours can be met for inflow rates that will readily accommodate anticipated maximum steady flows rates predicted for Phase 5 of operation (i.e. 66.9 L/s, Table 5), as well as higher short term peak inflows associated with spring melt and storm events.

Water to supply the groundwater mitigation system will be drawn from an outlet at the south end of the pond through a submerged woven wire mesh screen into a pipe connected to a concrete chamber beneath the pump house, from which it will be pumped to the mitigation system as needed. The screen area and outlet pipe diameter will be sized to meet the maximum inflow rate needed to supply water to the pump house for distribution to the groundwater mitigation system.

Water to be directed off-site to the golf course will be drawn from a second outlet at the north end of the pond using a reverse sloped pipe outlet configuration, passing through a submerged woven wire mesh screen into a pipe which will convey water to a concrete chamber and then by gravity through a buried pipeline to the golf course. The screen area and outlet pipe diameter will be sized to ensure the unfettered flow of water by gravity to the golf course irrigation system both during pit / quarry operation, and upon rehabilitation. As this outlet will remain operational upon rehabilitation when the settling pond will be naturalized, the screen will be sized to meet Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO, 1995).

### **6.8.2 Supply to Gravity Reservoirs**

Water to supply the proposed groundwater mitigation system, when needed, will be pumped from the Settling Pond via buried pipelines to two reservoirs (Gravity Reservoir #1 in the Main Area and Gravity Reservoir #2 in the South Area) located proximal to the infiltration trench system (Trench Zones 1 – 2 in the Main Area and Trench Zones 3 – 6 in the South Area). The overall distance of conveyance from the Pump House to each gravity reservoir is approximately 2,500 m and 3,300 m, respectively, as shown on Figure 19.



#### LEGEND

- Pump House Building
- Gravity Reservoir
- Main (North) Supply Pipe
- South Supply Pipe
- Ground Elevation (masl)
- Valve Box
- Air Release / Vacuum Break Valve
- Pumped Flow Direction

#### NOTES

1. This figure is to be read in conjunction with the accompanying report.
2. Base drawing prepared by MHBC Planning [8816AF – Site Plan.dwg].
3. Ground elevations and locations are approximate.
4. Road crossings of the supply pipe will be constructed by directional drilling.

CLIENT  
CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

CONSULTANT



YYYY-MM-DD 2025-03-08

PREPARED GWS

DESIGN PGM / LS / GWS

REVIEW LS

APPROVED FSB

PROJECT  
**Caledon Pit / Quarry**  
Groundwater Mitigation System Design Report

TITLE  
**LAYOUT OF WATER DISTRIBUTION SYSTEM TO SUPPLY  
PROPOSED GRAVITY RESERVOIRS**

PROJECT No.  
19129150

Rev.  
A

FIG.  
19

### 6.8.2.1 Flows

The anticipated flows to be pumped from the settling pond to each of the gravity reservoirs are summarized below in Table 8. Flows from the Settling Pond to Gravity Reservoir 1 peak during Phase 5 of operations, with an average anticipated flow of 4,458 m<sup>3</sup>, prior to the construction of Gravity Reservoir 2. Peak flow from the Settling Pond to Gravity Reservoir 2 occurs during Phase 7, with an anticipated average rate of 2,125 m<sup>3</sup> in a 24-hour period, while Gravity Reservoir 1 simultaneously receives 1,020 m<sup>3</sup>. Design calculations considered operational flexibility and seasonal variations to estimate the maximum flow rates that may be required, as high as 6,687 m<sup>3</sup> per 24-hour period, for Gravity Reservoir 1 and 3,188 m<sup>3</sup> per 24-hour period, for Gravity Reservoir 2.

**Table 8: Anticipated Flows to the Gravity Reservoirs**

Flow Consideration	Gravity Reservoir #1 (m <sup>3</sup> /24 hrs)	Gravity Reservoir #2 (m <sup>3</sup> /24 hrs)
Average	1,905	1,715
Maximum	6,687	3,188
Minimum	484	652

### 6.8.2.2 System Description

Overall, the system will include the following main components:

- Pumping station;
- Piping; and
- Gravity reservoir.

Each of the above is described separately in the sections that follow.

#### **Pumping Station**

The pumping station is envisioned to be a small building (~10 x 10 m in size) which houses the mechanical, electrical and instrumentation equipment required to transfer water from the settling pond and direct it through the conveyance pipe.

The pump station is anticipated to include:

- Intake piping with screen;
- Pump system and controls; and
- Pre-treatment as may be required.

#### Intake pipe with screen

The intake pipe will draw water from the settling pond. The pipe will project into the pond and be supported through its length. The pipe will be sized to ensure peak flows can reach the pipes with minimal pressure loss through the pipe. At the intake to the pipe a mechanical screening system will be provided to ensure large debris is not directed to the pumps.



### Pump system and controls

Two pumps with Variable Frequency Drives (VFDs) will be provided. The pumps will be operated in a duty/standby configuration and will alternate which pump is duty. The VFDs will allow flow discharged to the gravity reservoirs to vary as needed by operations. The discharge from the pumps will be monitored using a magnetic flow meter. Pressure indicator and pressure transmitter on the pump discharge will be provided to monitor the pressure and provide alarms should the pressure be higher (blockage) or lower (line leak) than typical.

### Pre-treatment as required

Depending on water quality results from the settling pond, additional treatment may be provided prior to or following the pump system. Treatment systems may include particulate removal and/or disinfection. This is discussed further in Section 6.9.

## **Piping**

The force main to supply the Gravity Reservoirs will be composed of 300 mm HDPE, as depicted in Figure 7. The piping to Gravity Reservoir #1 and Gravity Reservoir #2 will have a main common pipe (North Pipe) for approximately 2,300 m and then a valve box will be provided where flow can be directed to one or both of the gravity reservoirs. The distance of pipe from the valve box to Gravity Reservoir #1 is approximately 200m and the distance from the valve box to Gravity Reservoir #2 (South Pipe) is approximately 800m.

The pipe will be buried below the frost depth (typically 1.7 mbgs) and hence no piping insulation will be required. To minimize pressure losses through the pipe, all bends will use as large a radius as possible. At two points along the piping route, directional drilling will be used to have the pipe go under public roads. With the exception of these two locations, the pipe will be buried at the toe of the berm on the inside property slope of the berm. A permitter access road will allow for pipe installation and maintenance.

Figure 19 provides a surface elevation profile for the Main (North) pipe to Gravity Reservoir #1 and the South pipe to Gravity Reservoir #2. The profile can be flattened to a certain degree based on how the pipe is placed in the ground; however, it is noted that there will still be high and low points within the piping layout. To prevent air pockets from inhibiting flow and potentially siphoning of water to occur at the discharge, air release and/or vacuum break valves will be provided as required. A number of potential locations for these valves and hence the chambers in which they will be contained are indicated in Figure 19. The perimeter access road will be used for the monitoring and maintaining of these valves. The number and exact location of the valves will be determined when transient analysis is done on the pumping and piping system. A transient analysis is a modelling exercise that can determine and then minimize the pressure waves (water hammer) generated by pumping starting/stopping, valves opening/closing and where air or vacuums may be generated.

The valve box located at the junction of Main pipe and South pipe will include electrically actuated valves that will direct flow to one or both of the gravity reservoirs.

## **Gravity Reservoirs**

Discharge from the piping system into the gravity reservoirs will be through an open discharge pipe. To optimize the number of pump cycles and the duration of pump cycles, Gravity Reservoir 1 will be a minimum of 100 m<sup>3</sup> and Gravity Reservoir 2 will be minimum of 50 m<sup>3</sup>. To prevent siphoning of water from pipe when the pumps are turned off, the reservoirs will be raised and/or discharges into the reservoirs will be elevated. Floats within the

reservoirs will be used to indicate low and high levels and will provide indications to the control system when flow to the reservoir can begin and when it should stop.

### **6.8.2.3 Process Control**

A control system is required to determine when:

- The duty pump should start and stop;
- The duty pump should switch to standby;
- The pump VFD setting should change; and
- Which valve(s) in the valve box should be open.

It is noted that the control system will permit the above features be done manually or done automatically using a control logic program.

In addition to the above, the control system will provide operators an indication of when a system has gone into a warning or alarm state and attention is needed.

In general, pumping will start, when:

- One or both of the Gravity Reservoirs low level floats indicate water should be directed to the reservoir; and
- The appropriate valves in the valve box are open.

The duration of the pumping cycle is controlled by either:

- High level float position in the reservoir (filled / not filled); or
- Volume of water directed to the reservoir(s).

Typically, the high level float in the reservoir will stop the pump; however, should the volume to the reservoir be higher than anticipated as calculated by the pump discharge flow meter, the pump may turn off. This would be a safety feature in the case of float failure.

By changing the speed of the pump motor, the VFD can trim flows to account for the difference in pumping to Gravity Reservoir #1 versus pumping to Gravity Reservoir #2 and to accommodate the flow requirements during minimum flow and maximum flow conditions. In addition, through the use of the VFD, it will ensure that the number of pump starts and stops per hour do not exceed pump specifications.

## **6.8.3 Supply to Infiltration Vaults**

A distribution system will supply the infiltration vaults from the gravity reservoirs, as shown on Figure 20.

### **6.8.3.1 Flows**

Flows directed to each infiltration trench zone during each operational phase are described in Section 6.4 and summarized in Table 5. Table 9 includes a summary of the flow rates to each infiltration vault. The typical flows to each infiltration vault are designed based on these estimates averaged over the service life of each vault. To design the water supply system (principally pipe sizing) a flow equal to 150% of the maximum flow rate (for any operational phase described in Section 6.4) was considered to ensure operational flexibility of the system. (For

example, if more water than anticipated is required the distribution system will be capable of meeting the requirement.)

**Table 9: Infiltration Vault Flow Rate Summary**

Trench #	Vault #	Ground Surface (masl)	Vault Chainage (m)	Typical Designed Flow (m <sup>3</sup> /24 hrs)	Max Designed Flow (m <sup>3</sup> /24 hrs)	Supplied by Gravity Reservoir #
1	1	401.5	184	666	1,788	1
1	2	401.5	294	666	1,788	1
2	1	404	488	572	3,110	1
3	1	398	807	562	1,011	2
4	1	399	1,217	359	713	2
5	1	400	1,500	445	791	2
6	1	399	1,778	350	674	2





### 6.8.3.2 System Description

#### Gravity Reservoirs

Gravity reservoirs, as described in Section 6.8.2.2, receive and store water pumped from the Settling Pond and supply it to the infiltration vaults. The gravity reservoirs will have dedicated outlets for each supply pipe to each infiltration vault approximately 1 m above ground surface at each location (Gravity Reservoir 1 at 405.5 masl and Gravity Reservoir 2 at 401 masl). The hydraulic head at the gravity reservoirs will pressurize the system when operating to distribute water without pumping from the gravity reservoirs to the infiltration vaults.

#### Piping

The gravity fed distribution system will include a dedicated 200 mm HDPE pipe for each infiltration vault from a gravity reservoir. The pipe to supply the infiltration vault will be buried below the frost depth (typically 1.7 mbgs) and hence no piping insulation will be required. To minimize pressure losses through the pipe, all bends will use as large a radius as practical. The distribution pipe will be constructed with appropriately spaced clean-outs and pressure flushing ports to allow maintenance on the pipe, as needed. The elevation head at each end of the pipe and the length of pipe to supply each infiltration vault are summarized in Table 10.

**Table 10: Infiltration Vault Supply Pipe Length Summary**

Supplied by Gravity Reservoir #	Gravity Reservoir Outlet Elevation (masl)	Trench #	Vault #	Outfall Elevation (masl)	Pipe Length (m)
1	405.5	1	1	400.5	204
1	405.5	1	2	400.5	94
1	405.5	2	1	403.0	148
2	401.0	3	1	397.0	567
2	401.0	4	1	398.0	157
2	401.0	5	1	399.0	174
2	401.0	6	1	398.0	451

#### Infiltration Vaults

The water discharged to the infiltration vaults would be supplied by the distribution pipe, enter the infiltration vault, and free fall to the sump in the vault, as shown in Figure 8. When water levels in the sump reach the level of infiltration pipes, water then flows out into the infiltration pipe, out of the perforations in the pipe and into the infiltration trench.

### 6.8.3.3 Process Control

A control system is required to:

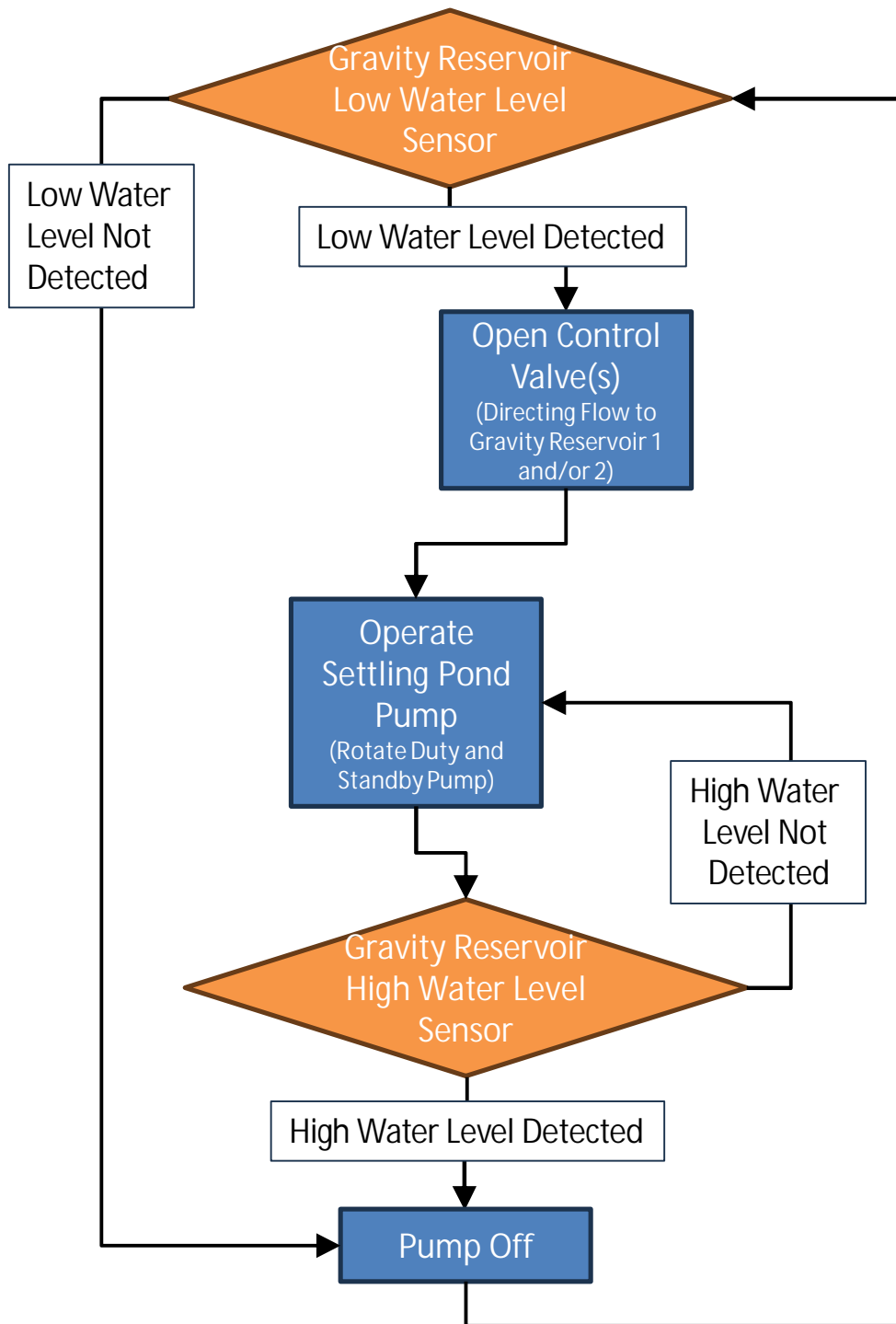
- Document volume of water supplied to each infiltration vault;
- Ensure maximum elevations are not exceeded in each infiltration vault; and

- Operate which valve(s) should be open.

Schematics flow charts of the process controls for supply to the gravity reservoirs is shown on Figure 21 and for supply to the infiltration vaults on Figure 22. In general, the gravity reservoirs will be supplied from the pump station at the settling pond, when a low water level is observed in a gravity reservoir and stopped when a high level is detected. The gravity distribution system will operate using inline flow meters installed in each pipe feeding an infiltration vault to provide a specified quantity of water to each infiltration vault each day with a high-water level sensor to ensure vaults are not overfilled. Once the specified volume of water has been supplied to the infiltration vault, the isolation gate will remain closed until the following day.

The quantity of water will initially be specified based on the expected amount of recharge required to maintain groundwater levels within their natural pre-extraction variations and adjusted based on observed water levels in the monitoring wells. These adjustments can be made using manual water level measurements and logger downloads at the monitoring wells or using a real-time water level monitoring system to inform system operation. Each infiltration vault will be equipped with a high-level float to indicate water supply to the infiltration vault should be stopped.

It is noted that the control system will permit the above features be done manually or done automatically using a control logic program (e.g. SCADA system). In addition to the above, the control system will provide operators an indication of when the system has gone into a warning or alarm state and attention is needed.



**Notes:**

Figure to be read with accompanying report.

Control logic presented is applied simultaneously at Gravity Reservoir 1 and 2 and at 7 infiltration vaults.

Control system to evaluate Gravity Reservoir Low Water Level Float and Infiltration Vault Flow Totalizer Volume at specified frequency to initiate control logic.

**CLIENT**

CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

**PROJECT**

**Caledon Pit / Quarry**  
Groundwater Mitigation Design Report

**CONSULTANT**



YYYY-MM-DD 2025-05-08

PREPARED PGM

DESIGN PGM

REVIEW GWS

APPROVED GWS

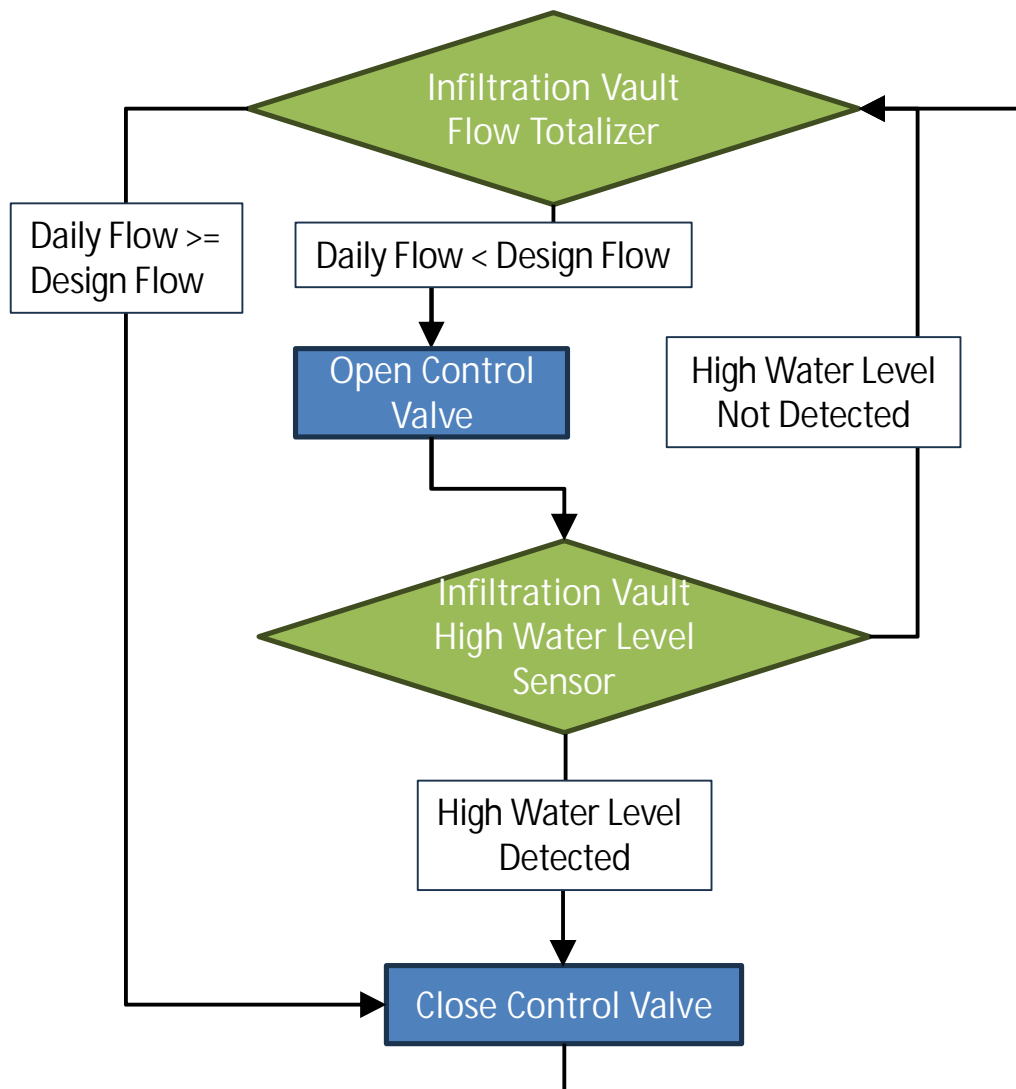
**TITLE**

**Process Control Flow Chart – Water Supply to Gravity Reservoirs from Settling Pond**

PROJECT No.  
**19129150**

Rev.  
**A**

FIG.  
**21**



**Notes:**

Figure to be read with accompanying report.

Control logic presented is applied simultaneously at Gravity Reservoir 1 and 2 and at 7 infiltration vaults.

Control system to evaluate Gravity Reservoir Low Water Level Float and Infiltration Vault Flow Totalizer Volume at specified frequency to initiate control logic.

CLIENT  
CBM Aggregates, a division of St. Marys Cement Inc. (Canada)

PROJECT  
**Caledon Pit / Quarry**  
Groundwater Mitigation Design Report

CONSULTANT



YYYY-MM-DD 2025-05-08

PREPARED PGM

DESIGN PGM

REVIEW GWS

APPROVED GWS

TITLE

**Process Control Flow Chart – Water Supply from Gravity Reservoir to Infiltration Vaults**

PROJECT No.  
**19129150**

Rev.  
**A**

FIG.  
**22**



## 6.9 Water Quality Considerations

As noted in the Water Report (Golder, revised July 2023), any water discharged from the Settling Pond must first meet all necessary water quality discharge criteria specified in the PTTW and ECA, which will be obtained by CBM prior to any off-Site water discharge. This condition will ensure that all water discharged from the Site will meet water quality criteria before it is re-infiltrated into the ground through the mitigation system (or be discharged off-Site for use in golf course irrigation).

Groundwater quality at the Site is generally good and within the typical range expected for groundwater in this hydrogeologic setting for most parameters tested (Golder, revised July 2023) and (WSP, 2025). These reports and the desktop review of infiltration systems (Appendix A) identified the following potential contaminants of concern that may be present in future at the proposed pit / quarry during operations:

- Suspended solids;
- Petroleum hydrocarbons (PHC);
- Road salt;
- Nitrogen-based residuals from blasting activities; and
- Pathogens

The issue of suspended solids in the source water can be readily addressed by allowing adequate resident time in the Settling Pond, positioning of the water intake for the mitigation system at an appropriate level in the water column, and filtration at the pump intake. The sumps located at the base of each infiltration trench vaults also provide an opportunity for particles to settle before entering the groundwater system, and there is additional filtering provided by the filter fabric at the infiltration trench / soil interface.

Additional pre-treatment of the source water at the Settling Pond prior to conveyance of water into the mitigation may be required to meet water quality regulatory requirements for some parameters (e.g. pathogens), if present. To address this issue, water quality in the Settling Pond will need to be monitored and assessed to determine if treatment is needed prior to operation of the mitigation system.

As there will be approximately 10 to 15 years between the commissioning of the Settling Pond and the operation of the Groundwater Mitigation system, there will be adequate time to assess in situ water quality and develop suitable treatment options, if treatment is required. Additionally, treatment technologies will continue to evolve beyond the technologies of today, such that any future treatment method proposed will utilize the best available technology of the day. Depending on the potential contaminants of concern, intrinsic treatment with validation (e.g. nitrogen) and post-treatment (e.g. pathogens) approaches can also be considered, where they are applicable.

Overall, it is expected that the proposed pit / quarry will not have any impact on water quality receptors, as aggregate operations will follow all applicable environmental standards, employ current industry best practices, implement mitigations discussed above as needed, and confirm water quality with sampling.

## 7.0 DETAILED DESIGN, PERMITTING, AND CONSTRUCTION AND OPERATION

### 7.1 Detailed Design

This report provides an updated design for the proposed groundwater mitigation system at the Caledon Pit / Quarry for the purposes of supporting this ARA licence application, and in response to review comments provided by various agency / stakeholder groups.

The additional studies and updated system design presented in this report demonstrate “proof of concept” and provides a technical basis from which a Detailed Design and Associated Refinements can be prepared at an appropriate time in the life-cycle of the Project.

### 7.2 Permitting

Prior to implementation of the proposed groundwater mitigation system, CBM would be required to obtain and operate in accordance with a Permit To Take Water and Industrial Sewage Works (ISW) Environmental Compliance Approval (ECA) under the Ontario Water Resources Act to permit the water management activities needed to operate this system.

The PTTW and ECA Permit would be a part of the overall approvals required to operate the pit / quarry, which would include:

- Pumping, collection, storage and discharge of pit / quarry water;
- Operation of the groundwater mitigation system (i.e., infiltration trench system); and
- Construction and operation of an aggregate wash plant.

Regarding the operation of the proposed groundwater mitigation system, the PTTW and ECA Permit would typically need to specifically include and/or address the following key elements (many of which have already been addressed by technical studies to date):

- A description of the groundwater mitigation system, including a functional (process flow) diagram of the system;
- Target groundwater levels (see Note 1 below);
- Water handling requirements (i.e., water collection, temporary storage, settling, filtration, pumping and re-infiltration);
- Water level and water quality monitoring requirements;
- System operation and maintenance requirements; and
- Reporting requirements.

Note 1: The target water level for each trench zone will be determined from baseline water level monitoring data at the monitoring wells nest or nests corresponding to that zone, and will account for seasonal variability and climate variability, as much as possible.

## 7.3 Construction and Operation

Construction of the various elements of the proposed groundwater mitigation system would be integrated into the overall planned schedule for pit / quarry operations, generally as follows:

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area, including pilot-scale testing, prior to the start of Phase 4 and 5 extraction. This stage of implementation would include pilot test of the system prior to its full implementation
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6), including pilot-scale testing, prior to the start of Phase 6 and 7 extraction.

The construction of the proposed mitigation system would be carried out concurrently with other operation activities in a manner that would not adversely impact the overall operational schedule. Further recommendations on construction methods and operational practices are discussed in Sections 2.3 and 2.4.

## 8.0 SUMMARY AND CONCLUSIONS

This report presents the results of additional technical studies and provides an updated design for the groundwater mitigation system proposed for the CBM Caledon Pit and quarry project.

### 8.1 General Overview

The proposed groundwater mitigation system will utilize a portion of the water collected during Phases 4 to 7 of operations, and direct it to a series of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction (Figure 2).

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, with the option to grout the upper bedrock zone if required.

### 8.2 Scope of Work

The scope of work undertaken and presented in this report includes the following:

**Desktop Review** – A desktop review of infiltration trench system technologies to help ensure the updated trench design incorporates current industry best practices and lessons learned from other projects.

**Field Investigation** – A hydrogeological field investigation along the proposed mitigation system alignment to obtain detailed site-specific information.

**Numerical Modelling Simulations** - The results of the field investigation were used to update the conceptual site model and the HGS numerical model in this area, which was used to update mitigation system simulations.

**Water Management Plan Update** - The updated numerical modelling simulation results were also used to update the Water Management Plan for the proposed pit and quarry operation.

**Mitigation System Design Update** – The mitigation system design was then updated, based on the desktop review, field investigations, updated numerical modelling simulations, and the updated water management plan.

### 8.3 Infiltration Technology Review

A desktop review of infiltration trench system technologies was completed to help ensure the mitigation system design update incorporates current industry best practices and lessons learned from other projects. Guidance documents and case studies are unanimous in their consensus that infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples.

Best practices reaffirmed the importance of obtaining detailed site data and were used to update key aspects of the proposed mitigation system including trench design, construction, operation and maintenance, and identified potential water quality issues for future design consideration.

### 8.4 Field Investigations

Extensive hydrogeological field investigations were carried out from April to June 2024, comprising the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 3). The field investigations included the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The investigation results provided additional detailed site-specific information on stratigraphy, groundwater levels, groundwater gradients and hydraulic properties of the various aquifer and aquitard units.

### 8.5 Updated HGS Numerical Modelling

The HGS numerical model for the proposed Caledon pit / quarry has been updated and calibrated to the refined hydrostratigraphy for the Site, and the updated HGS model has been used to update the assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.



## 8.6 Updated Water Management Plan

The Water Management Plan for the site has been updated to incorporate new hydrogeologic data and inflow predictions for the pit / quarry, noting the following.

- The construction of a 40,000 m<sup>3</sup> settling pond / holding pond is planned for Year 1 in the North Area in order to provide “immediate” on-site water storage capacity.
- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.
- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 m<sup>3</sup> of capacity in that area once extraction has been completed at the end of Operational Year 14.
- The maximum annual average rate of discharge throughout pit / quarry operations is approximately 587,000 m<sup>3</sup> / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.
- There is an option to re-infiltrate an additional 200,000 to 400,000 m<sup>3</sup> / year of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.

## 8.7 Updated Mitigation System Design

The proposed groundwater mitigation system design presented in Golder (2023) has been updated based on the infiltration technology review, 2024 field investigations along the proposed infiltration trench and hydraulic barrier alignment, updated HGS numerical modelling simulations, and the updated water management plan.

The updated system design included a review of and update to the following key system elements, where required.

- General configuration of the groundwater mitigation system has been updated to reflect more detailed subsurface stratigraphy and refined groundwater levels along the alignment.
- Mitigation system zones were unchanged from the initial design concept.
- Phasing of implementation was unchanged from the initial design concept.
- Estimated pit / quarry inflows and trench infiltration rates have been updated based on new HGS modelling.
- Infiltration trench design details have been refined to incorporate best practice features wherever possible and provide additional specific design details.
- The hydraulic barrier design concept has been updated, and two viable construction technologies have been identified that fit the needs of this project.
- A general design has been developed for the water storage and distribution system to supply water to the infiltration trenches, including the conveyance of water from the Settling Pond to Gravity Reservoirs, and ultimately to the Infiltration Vaults and Infiltration Trenches.
- The potential for water quality issues have been identified and options to ensure mitigation have been discussed.

## 8.8 Conclusions and Recommendations

The additional technical studies and groundwater mitigation system design presented in this report for the proposed CBM Caledon Pit / Quarry project demonstrates proof of concept, and provides assurance to CBM, as well as agencies and stakeholder groups, that the proposed groundwater mitigation system will perform as predicted to protect groundwater and surface water resources.

WSP recommends that the ARA Site Plan for the proposed pit /quarry be updated (Sheets 2 and 3) to show a minor change to the proposed groundwater infiltration trench system. The northern end of Infiltration Trench 4 as originally proposed will be truncated by 100 m, as shown in the cross-section presented on Figure 14. This reduction in the length of the trench will not affect its ability to maintain groundwater levels in this area during operations.

WSP also recommends that the ARA Site Plan be updated (Sheet 3) to include the revised “typical infiltration trench detail” shown on Figure 9 of this report.

## Signature Page

### WSP Canada Inc.



Paul Menkveld, M.Sc., P.Eng.  
*Hydrogeological Engineer*



Craig DeVito, B.Sc., P.Eng.  
*Senior Water Resources Engineer*



George Schneider, M.Sc., P.Geo.  
*Senior Geoscientist*



Frank Barone, Ph.D., P.Eng.  
*Senior Geo-Environmental Engineer*

VP/RS/LS/PGM/GWS/CDV/FSB/

[https://wsponline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/11 final report may2025/07 final version r2d 27may2025/cbm caledon - mitigation system design report 27may2025.docx](https://wsponline.sharepoint.com/sites/gld-114392/project%20files/5%20technical%20work/ph%202300-hydrogeology/45%20mitigation%20system%20design%202025/11%20final%20report%20may2025/07%20final%20version%20r2d%2027may2025/cbm%20caledon%20-%20mitigation%20system%20design%20report%2027may2025.docx)

**APPENDIX A**

**DESKTOP REVIEW OF  
INFILTRATION TRENCH SYSTEM  
TECHNOLOGIES**





## TECHNICAL MEMORANDUM

**DATE** March 10, 2025

**Project No.** 19129150

**TO** David Hanratty, Mike LeBreton  
CBM Aggregates

**CC** George Schneider, Frank Barone, Greg Padusenko - WSP

**FROM** Paul Menkveld

**EMAIL** paul.menkveld@wsp.com

### INFILTRATION SYSTEM TECHNOLOGY REVIEW - PROPOSED CBM CALEDON PIT / QUARRY

#### 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada), submitted an application in 2022 to the Ministry of Natural Resources and Forestry (MNRF) for a Class A License (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation for the proposed CBM Caledon Pit / Quarry. CBM controls approximately 323 hectares of land located at the northwest, northeast and southwest intersection of Regional Road 24 (Charleston Sideroad) and Regional Road 136 (Main Street). Of these lands, approximately 261.2 hectares are proposed to be licenced under the Aggregate Resources Act referred to as the "Site".

#### 1.1 Background

Initial review of the HydroGeoSphere (HGS) groundwater-surface water model simulations undertaken as part of the Water Report (Golder, 2023) indicated that pit / quarry dewatering during later the stages of operations (Phases 4 to 7) would likely result in a decline in groundwater levels in the water table aquifer that would extend southward and to the southwest of the licence area. If so, these predicted changes in groundwater levels could potentially effect natural features, groundwater users, and influence groundwater levels beneath existing aggregate pit #6525 (Lafarge Pit #3) that is currently licenced to extract sand and gravel above the water table.

In order to mitigate the potential effects of these predicted changes in groundwater levels during the operational phases of the proposed CBM Caledon Pit / Quarry, groundwater mitigation measures, including a series of infiltration trenches and a hydraulic barrier (i.e. slurry wall / optional bedrock grouting), were developed by Golder and then implemented in the HGS modelling simulations for Operational Phase 3 to 7, to assess their effectiveness, as described in the Water Report (Golder, 2023). The Water Report presented the conceptual design of the mitigation system and recommended the completion of detailed design following licencing.

Technical comments related to the Level 1/2 Water Report have been received from agency and stakeholder groups, which requested additional study and further development of the mitigation system design, in order to demonstrate proof of concept, and to provide assurance to those agencies and stakeholder groups that the proposed infiltration trench system will perform as predicted.

## 1.2 Objectives

The objective of this Technical Memorandum is to review existing infiltration system guidance, best management practices (BMP), (Section 2.0) and case studies (Section 3.0), and summarize findings (Section 4.0),.

## 2.0 REVIEW OF DESIGN GUIDANCE AND BMP

To assess and refine the conceptual design of the proposed CBM Caledon Pit / Quarry infiltration trench system, a review of 21 relevant papers, design guides, and other publications is summarized in this section. The design guidelines are grouped by region, Ontario (and other selected Canadian guidance documents), the United States, and International.

### 2.1 Ontario (and selected Canadian Guidance)

#### Evaluation of Underground Stormwater Infiltration Systems - Toronto Region Conservation Authority (2013)

- Infiltration systems are well suited to clean water, such as roof run-off. However, when pre-treatment is provided through hydrodynamic separators (i.e., oil and grit separators), in-line filters or grassed swales they may also be applied successfully to treat run-off from parking lots and low traffic roads, which typically generate higher loads of sediment and other pollutants than roofs.
- The document summarizes eight infiltration system case studies (with detailed descriptions of three) including their design, context, and monitored performance.
- Two residential neighborhoods constructed in 1993 in Nepean, Ontario, were equipped with perforated pipe systems to manage storm water run-off volumes. The two systems infiltrated 70% and 94% of the water received, with little reduction in performance in the 20 year monitoring period.
- Two perforated pipe systems in Etobicoke and North York, Ontario, that receive roof and road run-off were also examined as an infiltration system to manage storm water. The systems were observed to infiltrate 89% and 95% of all run-off from storms greater than 5 millimetres (mm), over the two years of monitoring.
- An infiltration trench installed on the campus of Villanova University in Pennsylvania, received untreated run-off from a heavily used parking lot. Infiltration rates were observed to decrease exponentially during the first and second years after installation, with the decreased infiltration rate attributed to high loads of suspended sediments.
- The Elgin Mills Cross Infiltration System is designed to receive stormwater from the roofs of a large commercial plaza. The infiltration system was constructed near the water table to take advantage of a sand lens within the silty sand aquifer and maintain groundwater discharge to a nearby surface water feature. The infiltration system was generally effective and durable.
- The Mayfield Industrial Park Infiltration Trench System, constructed in Bolton Ontario, is designed to infiltrate roof run-off using a system of four infiltration trenches. Water levels are managed using manholes with weir plates, connecting to perforated pipes at the top and bottom of the infiltration trench, backfilled with gravel, and wrapped in filter fabric. Pre-treatment occurs in a manhole equipped with a Goss trap to remove floating debris. During operations, silt infiltrating the system clogged several distribution pipes, accumulated in

manholes, and reduced the effective storage capacity of one of the trenches by 30%. Recommendations included cautious management of suspended solids, consideration of maintenance, and the inclusion of sumps in manholes as a silt management contingency.

- The Bamport Infiltration System in Brampton, Ontario, receives roof, road, and parking lot run-off which is directed to a system of infiltration chambers in a gravel bed, controlled with a series of orifices. Water quality concerns, including suspended solids, were addressed using a sump in the control manhole and an inline oil and grit separator. The design relied on a permeability estimate derived from grain size distributions for the sandy silty clay till. Operational monitoring showed “very little or no infiltration” into the till, due to an overestimate in the hydraulic conductivity of the material during design.

### **Stormwater Management Planning and Design Manual – Ministry of the Environment (2003)**

- Infiltration is a preferred method of stormwater control, as compared to direct surface water discharge, because it maintains groundwater levels, and therefore protects baseflow, aquifer filtration mitigates surface water quality and temperature impacts.
- Design recommendations for infiltration systems includes:
  - Use of 50 mm clear stone and filter fabric, fully enclosing the subsurface infiltration system;
  - Depth of design should consider freezing conditions and potential for frost heave;
  - Inclusion of a 150 to 300 mm thick filter layer at the base of the infiltration system to enhance infiltrated water quality. Recommended sands for a filter layer include 0.25 mm and a coefficient of uniformity less than or equal to 3.5 or an effective size of 2.5 mm and a coefficient of uniformity less than or equal to 1.5;
  - Alternatively, peat can be mixed into the filter layer to improve removal of metals, hydrocarbons, and nutrients;
  - To permit aerobic processes to improve water quality in the subsurface, the infiltration system should be sited more than 1 m above the water table or bedrock surface;
  - To improve storage characteristics of the storage media (generally gravel), compaction during construction should be minimized; and
  - To improve infiltration rates, smearing of excavation faces during construction should be minimized.

### **Proper Sizing of Infiltration Trenches and Bioretention Cells for Urban Stormwater Management Purposes – Rowe (2019)**

- Rowe (2019) summarized typical sizing approaches in Canadian stormwater management. The depth is determined by use of a site measured or literature value infiltration rates to determine and sizing the system to fully discharge in 48 hours. The volume (and therefore area) of the system is determined based on the design storm, typically a 100-year storm.
- The publication argues that in many marginally economical cases this is too onerous and leads to overdesign. A probabilistic approach is developed to optimize the sizing of the system relative to annual run-off volumes.

## **Underground Stormwater Infiltration: Best Practices for the Protection of Groundwater in British Columbia – BCMOE (2014)**

- The design of an infiltration system should rely on a detailed hydrogeological assessment including lithology, groundwater levels, groundwater flow system, infiltration capacity, seasonal variability, source water analysis, and impact assessment.
- Common water quality considerations in the design of an infiltration system include:
  - Total suspended sediments or solids (TSS);
  - Trace metals, primarily copper, lead, zinc, and cadmium;
  - Nutrients, primarily total nitrogen (TN) and total phosphorus (TP);
  - Petroleum hydrocarbons (PHC) associated with vehicles and other human activities;
  - Pesticides, herbicides and fungicides;
  - Salts used for roadway de-icing;
  - Pathogens and pathogen indicators associated with human waste, animal waste, and natural watershed sources. Pathogen transport in the subsurface varies significantly depending on the capacity of the soil to absorb them and therefore the risks posed can be difficult to assess;
  - Many pollutants (such as metals and oils) have low solubility in water. Such pollutants will tend to adsorb to sediments or will degrade and breakdown over time. Consequently, they tend to be filtered and attenuate to varying levels as infiltrating water percolates through the soil pores. For example, many metals may only be transported a few centimetres beneath infiltration facilities. Pollutants with low solubility generally pose a lower risk to aquifers; and
  - Depending on the risk associated with the operation of the system, source water monitoring or sampling may be necessary.
- Where a drinking water aquifer receives water from an infiltration system, it is recommended that:
  - Any facility specifically designed to convey water to the saturated zone of a drinking water aquifer requires a high level of design, regulatory approval, and ongoing oversight;
  - The drinking water well is set back 60 m or more from the infiltration system;
  - The vulnerability assessment considers groundwater flow direction, flow speed, and aquifer vulnerability; and
  - A private well survey be conducted.
- Design recommendations include:
  - To achieve some aerobic water quality enhancement, different offsets distances between the infiltration system and the maximum water table elevation are recommended, ranging from 1.5 m in fine grained materials (such as sandy silt), to 3.0 m in medium grained materials (such as sand), to 7.5 m in coarse grained materials (such as gravel);



- An access road to support maintenance and serviceability, in particular to allow vac trucks to access all manholes for sediment removal;
- Manholes should be a minimum of 0.75 m in diameter to allow for maintenance activities; and
- Monitoring wells and observation ports should be included in the installation to allow for monitoring of system performance.
- Maintenance activities should include:
  - Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, and animal activity;
  - Minor sediment removal from easily accessed areas of the system;
  - Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
  - Documentation standards for all maintenance activities.
- Monitoring of the performance of an infiltration system includes monitoring of groundwater levels, water levels in the system, and, ideally, flow rate monitoring, although this is often difficult to measure accurately depending on system design. Monitoring should include a start up phase, where monitoring is performed more frequently until the system's performance is better understood.

## 2.2 United States of America

Infiltration systems are a familiar and widely adopted technology in the United States, with many recommendations and guidelines for their design and implementation.

### Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring – United States Department of Transportation (2024)

- Infiltration systems are beneficial for maintaining groundwater levels where development has increased impervious surface area and enhance surface water quantity, however their costs generally limit application to stormwater management to ultra-urban high density situations.
- Pre-treatment of infiltration water to mitigate suspended solids is essential to effective performance and longevity of infiltration systems. Common pre-treatments include vegetated filter strips and grassed swales.
- Soil interaction with the infiltrating water includes sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria.
- Infiltration systems should be designed using site specific in situ testing to determine hydraulic properties of subsurface materials and be sited in materials with a minimum infiltration rate of 7 mm/hour.
- To allow for aerobic water quality improvement processes, infiltration systems should be constructed at a minimum 1.22 m above bedrock and the seasonally high water table.

- For systems with inadequate suspended sediment removal, major sediment removal may be required within five years, while systems with effective pre-treatment may last as long as 10 to 15 years without major maintenance.

### **Best Management Practices for Stormwater Infiltration - Minnesota Pollution Control Agency (2022)**

- Infiltration systems are a valuable tool in water management to minimize the impacts of development on the hydrological system.
- Various infiltration system configurations are considered including: infiltration trenches, infiltration basins, dry wells, permeable pavements, bio infiltration systems, and dry swales with check dams.
- For infiltration trench systems, the following design features are recommended:
  - The bottom of the trench be constructed a minimum of 0.9 m above the water table;
  - Consider maintenance methods explicitly in the design; and
  - Conduct a source water risk assessment.
- For infiltration trench systems, the improvement to water quality is characterized by high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%).

### **The American Society of Civil Engineers / Environmental and Water Resource Institute Standard Guidelines for Managed Aquifer Recharge – McCurry et al. (2023)**

- These conference proceedings provide an overview of the standards for managed aquifer recharge (MAR) systems, highlight the environmental benefits of maintaining predevelopment levels of recharge to support to environment features and overviews cases studies of MAR.
- The guideline includes a scoring system to evaluate potential MAR sites, which considers factors including hydrogeological suitability, environmental considerations (benefits and potential of adverse impacts), and implementation considerations.
- Several design recommendations are featured, including use of pilot testing in system design, high frequency start up monitoring, and detailed design of electrical, control, and sensor systems.

### **Best Management Practices for Infiltration Trenches – USEPA (2021)**

- Soil permeability is a “strongly limited factor” in the siting of infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr.
- Other design recommendations include:
  - Pre-treatment including use of settling basins to reduce clogging;
  - Maintain a 1.2 m offset from the seasonally high water table;

- Not using infiltration systems in areas with karst topography due to the potential for sinkhole formation and the risk of rapid groundwater contamination, should the source water quality be compromised; and
- Design in cold climates should consider minimum depths to saturated materials to avoid frost heave.
- Regular inspections, pre-treatment, control structures and maintenance to remove sediment.
- Typical water quality improvements attributed to infiltration systems include 90% reduction in TSS, 60% reduction in TP, due to soil adsorption, and 10 to 55% reduction in TN, due to inorganic soils generally do not filtering or absorbing nitrogen well.

### **Infiltration Trench Design Guidance – CalTrans (2020)**

- Design recommendations include: design of vertical or slopes side walls of infiltration trenches, lined with filter fabric, pre-treatment to remove sediment (such as forebays, bioswales, or vegetation strips), and consideration of sensitive receptors (requiring infiltration systems to be set back a minimum of 30 m upgradient of a private well).
- Alternative trench backfill materials are considered, including either a sand or a mixture of perlite, dolomite, gypsum, and crushed rock, to provided treatment via filtering, adsorption, and ion exchange within the trench.

### **Pennsylvania Stormwater Best Management Practices Manual - Pennsylvania Department of Environmental Protection (2006)**

- Pennsylvania (PA) Department of Environmental Protection (PDEP) presents two case studies of the design of infiltration systems and highlights design considerations.
- At the Flying J. Truck Plaza for Welsh Oil of Indiana Truck Refueling Terminal, Cumberland County, PA (constructed in 1993) stormwater from a large parking area is managed using extensive pre-treatment, including a vegetated settling unit, filtration system, and in line sand filter (within the control manholes) and subsurface infiltration beds. The risk of dissolution of carbonate rock beneath the infiltration beds, and the possible formation of sink holes, was evaluated using ground penetrating radar, to establish that the rock mass did not contain any large solution enhanced features prior to construction.
- Infiltration systems were designed as part of the construction of the Penn State University - Centre County Visitor Center, Centre County, PA. The lithology of the site is characterized by a thin layer of overburden (approximately 2 m) over weathered carbonate bedrock, which are the drinking water aquifer for several supply wells 800 m downgradient of the infiltration system. The system was designed based on detailed site characterization and percolation testing in test pits. Moderate clay content in the overburden was observed to prevent rapid infiltration into the bedrock and is expected to enhance water quality through soil absorption. Sinkhole risk was assessed to be low based on the detailed investigation and further mitigated by carefully maintaining an offset from the top of weathered bedrock.

### **Effects of Stormwater Infiltration on Quality of Groundwater Beneath Retention and Detention Basins - Fischer, Emmanuel, and Baehr (2003)**

- This study performed sampling of groundwater in wells designed to monitor the performance of storm water infiltration systems and wells observing background groundwater conditions. In general, facilities with poorly controlled source water quality varied in performance, and showed variable groundwater quality with elevated levels of contaminants commonly found in surface water, such as elevated benzene or toluene.

- In areas where background groundwater quality contained some contamination, such as chlorinated solvents, increased recharge diluted the undesirable water quality and enhanced groundwater quality.

### **Sizing Stormwater Infiltration Structures - Aken (2002)**

- This paper presents a mathematical approach, simultaneously solving the Green-Ampt equation and the equation for storage in an infiltration structure, to predicting capacity of a system and its time to fully discharge based on known hydrogeological parameters and the time and flow rate the system receives.

### **Controlling Urban Run-off - Schueler (1987)**

- Infiltration systems are generally seen as a beneficial development practice as they maintain natural recharge patterns, groundwater levels, and mitigate water quality risks.
- Design and site selection should consider factors such as infiltration rates greater than 13 mm/hr (and up to 210 mm/hr), a minimum of 0.6 m above the seasonally high water table, 1.2 m above top of rock, and at least 30 m upgradient of drinking water supplies and foundations.
- Primary causes of failure for infiltration systems are poor construction practices, inadequate field testing, and lack of sediment control.
- Detailed design guidance includes:
  - In general, infiltration systems should be graded to have a flat bottom of excavation, with permeable filter fabric and/or a layer of filter sand at the base (0.15 to 0.30 m), permeable filter fabric side walls, and impermeable filter fabric on top (to mitigate infiltration of fines from above the system), with seams in the fabric overlapped generously, perforated distribution pipes, backfilled with washed clear stone (25 to 76 mm), and with at least one observation well per infiltration trench;
  - Schueler describes several configurations of pre-treatment chambers and intakes to reduce sediment, oil and grease, and floating debris, in source water before directing it to the infiltration system; and
  - Where pre-treatment is expected to remove a high level of sediment, perforated pipe can be used to distribute water in the infiltration system. Where additional protection from clogging is needed in the design, the perforated pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system.
- Recommended construction practices to optimize infiltration systems include:
  - Prevent heavy machinery from compacting subsoils;
  - The edges of the trench should be bermed and erosion of the trench walls stabilized to prevent sediment migration into the trench during construction;
  - Trench should be constructed using a backhoe or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the trench alignment should be avoided; and
  - Clean stone should be placed in lightly compacted in lifts. Unwashed stone contains enough sediment to risk clogging.



- Infiltration systems are noted to provide significant enhancement to water quality, removing 80 to 100% TSS, 60 to 100% biological oxygen demand (BOD) and bacteria, 40 to 80% TP and TN, when operated as recommended.
- To provide effective water quality treatment in the infiltration system, a minimum and maximum drainage time are established:
  - Maximum drainage time: the system should fully drain in 48 hours or less to maintain aerobic conditions in the underlying soil, which favor bacteria which aid in pollutant removal.
  - Minimum drainage time: poor pollutant removal was observed in systems which hold water for less than 6 hours.

### **A study of Infiltration Trenches in Unsaturated Soils – Kim (1986)**

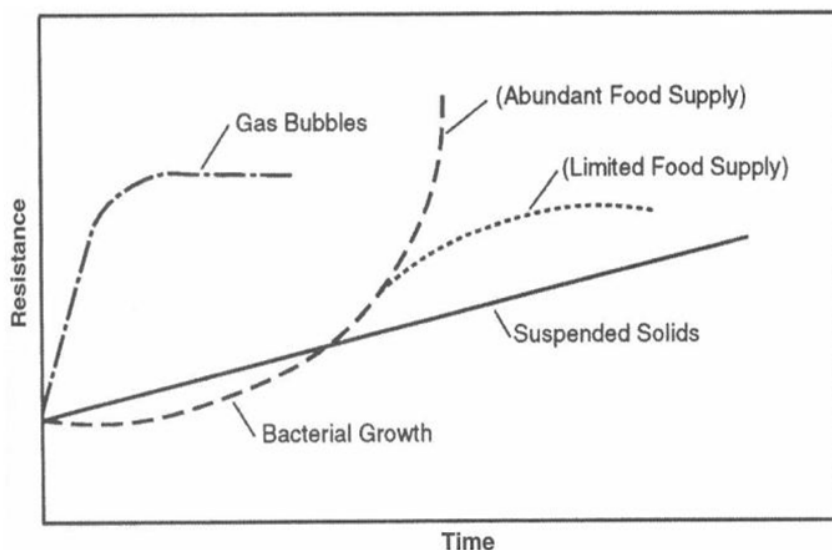
- This paper developed a numerical solution to solve Fok's model of unsaturated groundwater flow using a finite difference method. The numerical simulations showed that infiltration rates were predominantly a function of hydraulic conductivity of the subsoils, with little impact from porosity, capillary potential, or surface infiltration.
- The study also showed that long narrow infiltration trenches were more effective than near square infiltration systems.

## **2.3 International**

### **Managed Aquifer Recharge: Overview and Governance – Dillon et al. (2022)**

- The International Association of Hydrogeologists Commission on Managed Aquifer Recharge (MAR) prepared this publication to support the development of standards and applications of MAR, including guidance on design, management, and monitoring of infiltration systems.
- Risks associated with water quality can be considered based on source water quality, water treatment prior to infiltration, the sensitivity of the receptor, and post treatment before use at the receptor. Dillon et al. provide generalized guidance is included for each stage of MAR, for example, generally water sourced from another aquifer needs little or no pre-treatment before being recharged and infiltrated water with the end use of drinking water, requires disinfection post treatment.
  - It is recommended that sampling criteria and frequency be developed based on an assessment of risk of the source, the receptor, and treatment.
- Water quality hazards include:
  - Pathogens: Preventative measures to manage pathogen hazards include natural treatment in the aquifer (which requires validation), source control, pre-treatment of source water prior to recharge or on recovery (e.g., disinfection), and measures to reduce exposure during use of the recovered water. An example of a regulation to mitigate pathogen risks to drinking water supplies is a standard developed in California, which requires log 12 removal of viruses from waste water to be indirectly reused as drinking water, assuming 1 log removal per month retained in the aquifer, and any additional required removal being achieved with pre-treatment methods (FYI: Ontario requires log 4 removal of viruses for SW and GUDI sources, and higher removal may be needed in the presence of sewage);

- Inorganic chemicals: including iron, manganese, arsenic, and trace metals. Where geochemical changes result from the infiltration system, it is possible to mobilize inorganic substances in the subsurface, such as arsenic. A geochemical assessment is recommended to evaluate these risks;
- Salinity: either as a result of source water quality, or as a result of mixing stratified water qualities within the aquifer;
- Nutrients: nitrogen, phosphorus and organic carbon, can impact human health but are usually of greater concern in relation to the environment. Preventative measures to manage nutrient hazards include natural treatment in the subsurface (which requires validation), source control, selective recharge/diversion of continuously monitored source water that is outside specified water quality criteria (e.g., color) and pre- or post-treatment;
- Organic chemicals: include contaminants of emerging concern (e.g., per- and polyfluoroalkyl substances) as well as herbicides, pesticides, hydrocarbons, industrial chemicals, algal toxins, pharmaceuticals, personal care products and disinfection byproducts;
- Radionuclides: In general, elevated radionuclide concentrations can be found in granitic, fractured rock aquifers; and
- Temperature: in well-based MAR systems groundwater temperature can be affected, leading changes in geochemical conditions and gas release, however, in infiltration systems thermal effects are buffered to some extent during the passage of water through the unsaturated zone.
- Clogging has several possible causes including:
  - Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;



**Figure 1: Typical Resistance to Infiltration for Different Clogging Mechanisms (Dillon et al., 2022)**

- Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;

- Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure;
- Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate);
- Preventative measures to reduce the impact of clogging include source control, selective recharge (for example diverting water which fails to meet a continuously measured water quality parameter, such as turbidity), and treatment of source water prior to recharge; and
- Figure 1 shows generalized trends in resistance to infiltration over time, due to different clogging mechanisms.

### **Artificial Recharge of Groundwater – Malu (2017)**

- Infiltration systems generally improve groundwater quantity and quality. Siting considerations include: source water quantity and quality, aquifer properties, where groundwater levels are in decline due to overuse, and where groundwater quality is poor. In this context infiltration systems are generally seen as a mitigation for adversely affected groundwater quantity and quality by anthropogenic activity.
- Recommended studies include, source water studies (water quality and hydrometeorological as applicable), hydrogeological, and geophysical (as applicable).
- Design guidance emphasizes effective groundwater recharge in large quantities, including use of percolation tanks and spreading basins, where “highly fractured and weathered” rock formations can be exposed, injection of source water into dug wells, and the construction of vertical and horizontal shafts into aquifer materials to inject source water.

### **Influence of Applying Infiltration and Retention Objects to the Rainwater Run-off on a Plot and Catchment Scale – Case Study of Służewiecki Stream Subcatchment in Warsaw - Barszcz (2015)**

- This study simulated the impacts of different low impact development (LID) strategies, including infiltration systems, on plot and subwatershed scale. The study showed that infiltration systems provided meaningful reductions in run-off from impervious areas and in peak storm responses. Infiltration systems were the most effective LID for recharging groundwater in the study.

### **Storm-water management through Infiltration trenches - Chahar, Grailot, & Gaur (2012)**

- This study develops a numerical approach to simulate 2D groundwater flow beneath infiltration systems, with an emphasis on the calculation of infiltration rates, effects of multiple soil layers, and lateral effects of the trench above the water table, to support decisions on spacing of multiple trenches.
- To examine the applicability of the numerical method to physical installations, the approximately 100 infiltration systems in Lyon, France, were considered. Many of these systems have been operated for 10 to 21 years and continue to perform well, which is generally attributed to the highly permeable fluvial and glaciofluvial strata beneath them.
- The Django-Reinhardt infiltration basin was compared in detail by comparison to the numerical approach. That system pretreats with a large subsurface settling facility, then water is pumped to a trapezoidal infiltration

trench 1 m deep. The subsoil has variable hydraulic conductivity, overlying a permeable layer at 10 m below ground surface (bgs) and the water table at 18 m bgs. Numerical and field studies found that:

- The trench effectively saturates the soils beneath it;
- Infiltration can be considered 2D where the length of a trench is ten times its width;
- Clogging and groundwater contamination must be considered in the design of infiltration systems; and
- Drainage time should be limited to 72 hours to maintain aerobic conditions for microbes beneath the infiltration system.

### **Hydrostratigraphic Characterization of Glaciofluvial Deposits Underlying an Infiltration Basin Using Ground Penetrating Radar - Chouteau (2008)**

- This study focuses on heterogeneities beneath infiltration systems in fluvial and glaciofluvial sedimentary environments as a potential preferential pathway for rapid recharge and an elevated risk of groundwater contamination compared to an assumed homogenous aquifer.
- These heterogeneities are too small in scale for widely spaced boreholes to observe and too small for pumping tests to directly observe. Geophysics, and ground penetrating radar (GPR) in particular, offers an opportunity to collect continuous 2D and 3D data for comparison to boreholes, test pits, and sedimentological insight. In combination, these data sets offer the opportunity to map hydrogeological units in the subsurface.
- The study applied these methods to characterize the Django-Reinhardt Infiltration Basin in Lyon, France, to map and predict subsurface conditions with a very high degree of accuracy.
- The study installed time domain reflectometry (TDR) probes below the infiltration trench to measure in situ water content and monitor the effect of the overlying silty sand above a gravel unit in the vadose zone. The gravel unit allowed rapid recharge when the infiltration basin was operating and acted as a capillary barrier in dry conditions.

### **Case study: design, operation, maintenance and water quality management of sustainable storm water ponds for roof run-off – Scholz (2005)**

- Evaluated the performance of a stormwater pond with a silt trap, which receives roof run-off coupled to a dry pond intended to infiltrate water following settling in the stormwater pond. While the system achieved some of its water quality objectives, the infiltration basin failed due to inadequate site characterization.

### **A Review of Sustainable Drainage Systems: A Soft Option for Hard Drainage Questions? - Charlesworth, Harker & Rickard (2003)**

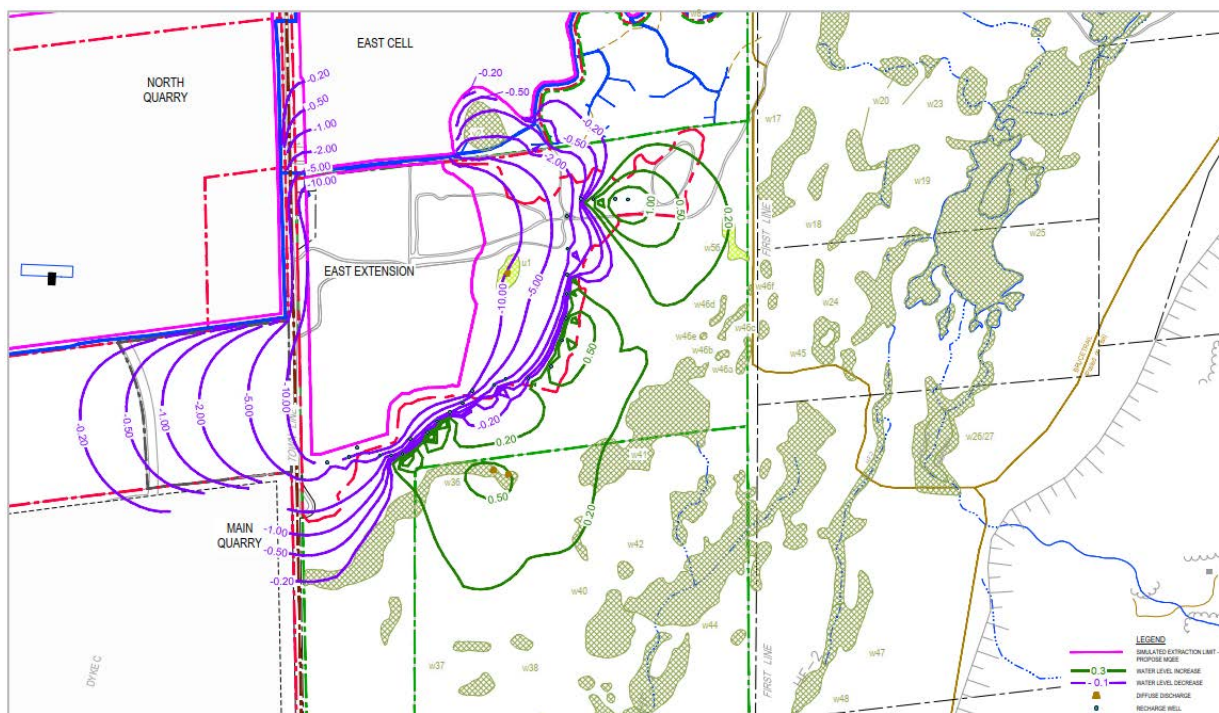
- This publication highlights the importance of LID practices in development, including infiltration systems. It is argued that successful infiltration systems including infiltration trenches, basins, and soakaways, have been applied widely including in the Sweden, Australia, the United States, and the United Kingdom, and should be broadly accepted and applied in the interests of sustainable development.





- The recharge wells are completed by casing through the overburden and advancing open holes through the Lockport Formation. Recharge wells are supplied with water at a rate to maintain groundwater levels at or slightly above baseline conditions; and
- Monitoring wells, identified as “Target Monitoring Locations”, are placed at receptors to monitor water levels and identify any adverse impact. If water levels decline below specified levels at Target Monitoring Locations, injection rates in nearby wells can be adjusted to mitigate the impact.

In 2021, Dufferin Aggregates applied for an extension to the East Quarry and proposed an extension of the MAR system to mitigate potential impacts. The configuration of 15 recharge wells, water mains, and seven Target Monitoring Locations, are presented on Figure 2, and water level changes in the Lockport Formation associated with the quarry extension and recharge system is presented on Figure 3.



**Figure 3: Milton Quarry East Extension Groundwater Level Change in the Lockport Formation**

The water management plan indicates recharge wells will be operated continuously throughout the life of the quarry to maintain water levels at or slightly above the established baseline level. Upon rehabilitation, the MAR system will continue during the filling of the quarry and will be decommissioned when the quarry lakes have reached their final levels (GHD and GEC, 2021).

The Milton Quarry East Extension demonstrates that MAR can effectively mitigate impacts of aggregate extraction on groundwater levels and downgradient groundwater users.



## 3.2 Elgin Mills Stormwater Infiltration System

In Richmond Hill, Ontario, an infiltration system was constructed in 2008 at a commercial plaza as a part of a stormwater management system. Its design, operation, and medium-term operation are described the TRCA's report entitled: "Evaluation of Underground Stormwater Infiltration Systems" (2013).

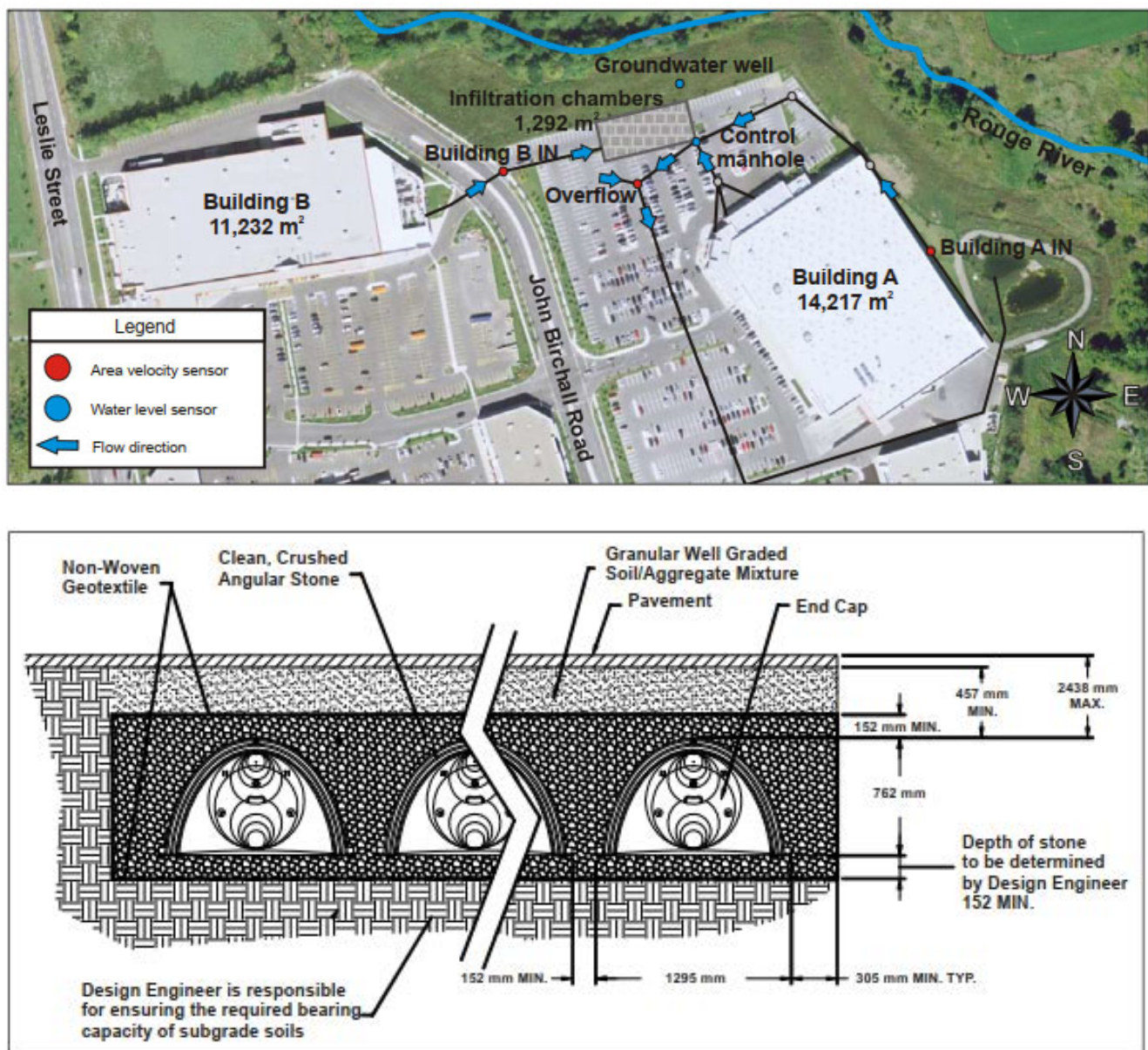


Figure 4: Elgin Mills Stormwater Infiltration System Plan and Cross Section

Source water for the infiltration system is obtained from the roofs of two large commercial buildings. The source water was assessed to pose little risk to groundwater quality and was likely to contain very low levels of suspended sediments. Based on these assessments, no pre-treatment or source water sampling was required.

The infiltration system is 1,292 m<sup>2</sup> and approximately 1 m deep. It uses infiltration chambers, 20 to 50 mm crushed clear stone backfill, and a control manhole with weir plates to manage inflows. The system was designed to accommodate up to 840 m<sup>3</sup> and expected to discharge fully in 62 hours, based on an infiltration rate of 11 mm/hr, and therefore a system discharge rate of 3.8 L/s. The infiltration system layout and a cross section are presented in Figure 4.

This site is located immediately to the south of the Rouge River, which is a cold-water aquatic habitat. Groundwater discharge rate, quality, and temperature are important factors in maintaining predevelopment habitat functions in the river. By infiltrating a portion of the water captured on impervious surfaces in the development, ecological functions are maintained.

The hydrogeological characterization of the site showed a shallow unconfined aquifer in a sandy silt material, which flows to the north and discharges to the Rouge River immediately north of the site. The water table is typically located 2 to 3 m below ground surface and with a seasonally high water table of 230.6 masl. A sand lens, believed to be connected the Rouge River, was observed between elevations of 230 and 231 masl in boreholes near the infiltration system. A bottom depth of 230.50 masl was selected for the infiltration system to connect to the sand lens, infiltrate water more quickly, and maintain groundwater discharge to the river. This design decision means that during seasonally high conditions, the water table will be at or near the base of the infiltration system and that the sand lens has the potential to transport infiltrating water quickly into the subsurface and to the receptor.

Operational monitoring was conducted following completion of the system in September 2008 to July 2011. Precipitation, water levels in the system, and groundwater were monitored during this period, with the following key findings:

- Performance of the system varied between observed infiltration rates of 1.0 to 13.5 mm/hour depending on if a recent storm event had partially filled the storage system and increased the water table elevation;
- No decline in performance was noted over the first three years of operation. A contributing factor in this reliable performance is the low levels of suspended solids;
- Groundwater elevations downgradient of the infiltration system increased in response to the operation of the system; and
- Observed infiltration rates were generally less than those estimated in the design of the system, based on literature values, highlighting the value of site specific, in situ testing.

Overall, the Elgin Mills Crossing Site serves as a successful example of how underground stormwater infiltration systems can be implemented to promote sustainable water management and mitigate the impacts on local hydrology.

### 3.3 Mannheim ASR

In 2005 the Region of Waterloo commissioned a managed aquifer recharge (MAR) system to take advantage of flows in the Grand River significantly exceeding demand from water users in the fall, winter, and spring, to address periods in the summer when flows in the Grand River are lower and water demand is high (Camilleri, 2019). To this end, water from the Grand River is used in an aquifer storage and recovery system (ASR). Injection

wells directly recharge a sand and gravel aquifer in the Waterloo Moraine throughout the year, then recover the water during periods of low flow and high demand, as shown on Figure 5 (Stantec, 2015).

The ASR system contains four wells used for both injection and recovery and two recovery wells to the east and west of the injection of the system. The system has operated effectively and provides 231 L/s in sustainable peaking capacity to the Region of Waterloo's water supply system, which corresponds to 10% of the Region's peak day water demand in 2010 (Stantec, 2015).

Water quality in the system is managed using water treatment prior to injection and following recovery (Grand River Watershed Water Management Plan, 2014). Prior to injection, water is treated using an ultraviolet (UV) system to provide primary disinfection. Following recovery, the water is chlorinated prior to distribution (Stantec, 2015).



**Figure 5: Mannheim Aquifer Storage and Recovery System Conceptual Configuration (Camilleri, 2019)**

The Mannheim ASR serves as an example of a well managed ASR system to meet the needs of the Region of Waterloo as it grows and to limit environmental impact of water use.

## 4.0 SUMMARY OF BEST PRACTICES

Guidance documents and case studies are unanimous in their consensus that, in general, infiltration systems are a beneficial management practice to mitigate the impacts of development. The technology is well known and supported by a body of literature, design guidance, and successful examples. The best practices in the design and operation of infiltration systems are summarized in the following categories: site characterization, design, construction, operation and maintenance, and water quality.



## 4.1 Site Characterization

Site characterization is essential in the design of infiltration systems.

- Soil permeability is a critical design criterion for infiltration systems. In soils which are not sufficiently permeable, the system will be ineffective at discharging water, and soils which are too permeable may not provide sufficient treatment. It is recommended that the field measured infiltration rates are between 13 to 76 mm/hr (USEPA, 2021), however circumstantially, rates as low as 7 mm/hour (TRCA, 2013) and rates up to 210 mm/hr (Schueler, 1987) may be considered depending on the design priorities and risk to receptors.
- Lithological heterogeneities beneath infiltration systems can be potential preferential pathways for rapid recharge and therefore an elevated risk of groundwater contamination compared to an assumed homogenous aquifer. Continuous subsurface imaging, such as ground penetrating radar (GPR) in combination with boreholes, test pits, and sedimentological insight, can improve the characterization of hydrostratigraphic units in the subsurface (Chouteau and Giroux, 2008).
- Where infiltration systems are constructed above carbonate rocks, enhanced dissolution should be considered in the design of the system. Case studies used detailed site characterization and GPR to search for pre-existing karst prior to construction, and designed systems to avoid rapid localized recharge to the bedrock by ensuring sufficient overburden travel time (PDEP, 2006).

## 4.2 Infiltration System Design

**System Design** – Most resources recommend an infiltration system to be full enclosed with a non-woven filter fabric to prevent the infiltration of fine materials from the surrounding soils, the majority of the backfill be a large diameter clear stone (often 20 to 50 mm) (MOE, 2003) (TRCA, 2013), with a vegetated topsoil cover to prevent erosion, and a filter layer 0.15 to 0.30 m thick be placed at the base of the system.

- The purpose of the filter layer is to provide filtration for fine particles, pathogens, metals, and organic compounds that will be partially removed by the filter layer. Depending on the water quality parameters of concern, the filter layer maybe composed of fine sand or peat (MOE, 2003).
- Permeable filter fabric is recommended on the base and side walls of the infiltration system, and less permeable filter fabric on top, to mitigate infiltration of fines from above the system (Schueler, 1987).

**System Sizing** – Most system sizing discussions for stormwater applications are based on a design storage volume, assuming a 40% void ratio in the backfilled volume. Infiltration systems are generally sized such that void space can accommodate the require level of water storage. Saturated depth is specified based on the infiltration rate measurement and designed to fully discharge in 48 to 72 hours (Chahar, Graillet, & Gaur, 2012). Area of the system is then calculated to achieve the required volume (MOE, 2003) (Rowe, 2019).

**Infiltration into the Unsaturated Zone** – Infiltrating water into the unsaturated zone is generally recommended to allow for some degree of aerobic water treatment to take place before the water reaches the water table and more variable conditions (MOE, 2003) (BCMOE, 2014). Recommended offsets vary from 1.5 to 7.5 m based on soil type and potential to improve water quality (MOE, 2003) (USDOT, 2024) (MPCA, 2022) (BCMOE, 2014) (USEPA, 2021). However, where source water quality is of little concern, there are successful examples of infiltration systems sited at the water table elevation (TRCA, 2013) (GHD, 2021).

The design and construction of the infiltration system should consider the primary causes of failure for infiltration systems: poor construction practices, inadequate field testing (in particular in situ testing), and lack of sediment control (through measures discussed in Section 4.4) (Schueler, 1987).

### 4.3 Construction

Construction practices recommended to optimize infiltration system operation include (Schueler, 1987):

- Prevent heavy machinery from compacting subsoils;
- The edges of the infiltration system should be bermed and erosion of the sidewalls stabilized to prevent sediment migration into the infiltration system during construction;
- The infiltration system should be constructed using a backhoe or trencher, equipped with tracks or oversized tires to avoid soil compaction. Use of bulldozers and front-end loaders within the infiltration system alignment should be avoided; and
- Clean stone should be placed in lightly compacted lifts. Unwashed stone contains enough sediment to risk clogging.

### 4.4 Operation and Maintenance

A primary concern in the operation and maintenance of infiltration systems is clogging. Clogging has several possible causes including (Dillon et al., 2024):

- Physical Clogging: Caused by the filtration of suspended solids present in the recharge water or the swelling/mobilization of clays;
- Biological Clogging: Resulting from bacterial growth due to dissolved nutrients in the source water;
- Mechanical Clogging: Caused by air entrainment, gas binding, or formation failure; and
- Chemical Clogging: Due to the precipitation of minerals (for example calcium carbonate).

Physical clogging of control structures, distribution pipes, and pore spaces caused by suspended solids in the source water is among the most commonly reported problems for infiltration systems. The primary mitigation measures are the selection of waters to infiltrate and pre-treatment (USDOT, 2024) (TRCA, 2013).

- Where there is opportunity to select water with low initial TSS to be infiltrated, this has proven to be an effective approach to designing an infiltration system. In some cases, systems have sourced very clear water, operated an infiltration system with no pre-treatment, and observed no long term clogging. Systems that received water with very low levels of suspended solids generally continued to perform well and required little maintenance (Schueler, 1987) (TRCA, 2013).
- Various pre-treatment methods to settle or otherwise attenuate suspended solids are recommended, including, use of sumps in injection control structures, oil and grit separators, prefiltration of water through filter sand, fabric, or organic material, prior to it entering the infiltration system, and reduction of suspended sediment by allowing water to gently flow through a grassy swale or filter strip prior to entering the infiltration system (Schueler, 1987) (MOE, 2003) (TRCA, 2013) (BCMOE, 2014).

- Where additional protection from clogging is needed in the design, the perforated distribution pipe can be oversized and wrapped in filter fabric to act as an additional layer of sediment control in the system (Schueler, 1987).

Maintenance activities should include (BCMOE, 2014) (USEPA, 2021) (USDOT, 2024):

- Regular inspections for sediment accumulation or other clogging, any structural problems, such as cracking or settlement, animal activity, or undesirable vegetation growth;
- Minor sediment removal from easily accessed areas of the system;
- Major sediment removal with the use of flushing and vac trucks to remove sediment from subsurface facilities; and
- Documentation standards for all maintenance activities.

## 4.5 Water Quality

Water quality parameters often considered in the design of infiltration systems include the following (BCMOE, 2014) (Dillon et al., 2022).

- Suspended solids from numerous sources including un-stabilized soils, human activities and atmospheric deposition. Suspended sediments are a concern for all sites, because other pollutants can adhere to particulates, and because they can clog infiltration facilities, diminishing their performance.
- Inorganics including iron, manganese, arsenic, and trace metals (primarily copper, lead, zinc, and cadmium). Where geochemical conditions are affected by the infiltration system, it is possible to mobilize inorganic substances in the subsurface. Where this risk is identified a geochemical assessment is recommended.
- Organics including contaminants of emerging concern (e.g., per- and polyfluoroalkyl substances) as well as herbicides, pesticides, hydrocarbons, industrial chemicals, algal toxins, pharmaceuticals, personal care products and disinfection byproducts.
- Nutrients, primarily nitrogen and phosphorus, from landscaping activities, automobile exhaust and atmospheric fallout.
- A wide variety of petroleum hydrocarbons associated with vehicles and other human activities.
- Salts used for roadway de-icing.
- Pathogens and pathogen indicators associated with human waste, animal waste, and natural watershed sources. Preventative measures to manage pathogen hazards include natural treatment in the aquifer (which requires validation), source control, pre-treatment of source water prior to recharge, and treatment on recovered water (e.g., disinfection).
- Radionuclides: elevated radionuclide concentrations may be found in granitic, fractured rock aquifers.
- Temperature: groundwater temperature changes may cause changes in geochemical conditions and gas release, however, in infiltration systems thermal effects are buffered to some extent during the passage of water through the unsaturated zone.

Water quality risk and mitigation in the design of infiltration systems can be considered in the following categories: source water quality, water treatment prior to infiltration (pre-treatment), water quality improvement in the infiltration system and subsurface (intrinsic reduction), the sensitivity of the receptor, and post-treatment before use at the receptor (Dillon et al., 2022).

**Source Water Quality** - Source water quality is evaluated by consideration of known risk factors (proximity to refueling, industrial operations, etc.) and typical water quality for the source (storm water, groundwater, etc.). Source water quality monitoring is not generally conducted where the source water is considered low risk. However, source water monitoring is recommended where either the source of water is at risk of contamination or if there are sensitive receptors to the infiltrated water (BCMOE, 2014).

**Pre-Treatment** – Pre-treatment of waters for some parameters prior to infiltration (e.g. suspended solids) has a significant impact on the effectiveness and longevity of the system and its potential to have impacts on groundwater receptors.

- Pre-treatment of water to be infiltrated with an oil and grease separator has been implemented where these are risk factors in the source water (Schueler, 1987) (TRCA, 2013).
- Depending on source water quality and risk to receptors, treatment of waters for pathogens may be required (Dillon et al., 2022). For example, the Mannheim ASR system is used store water for Municipal drinking water supply, Grand River water is treated using a UV system for primary disinfection prior to entering the injection well and is chlorinated at the extraction well following recovery. In cases where there is limited risk to receptors, or there is sufficient intrinsic reduction in the system, no pre-treatment other than treatment for suspended solids is required, such as the Milton Quarry (GHD, 2021) or most stormwater applications (TRCA, 2013) (USDOT, 2024).

**Intrinsic Reduction** – Water quality has generally been found to improve between where it enters the infiltration system and when it is observed downgradient in the groundwater system, due to soil interaction, including sorption, precipitation, trapping, filtering, and bacterial degradation. The effectiveness of these processes in improving water quality are dependent on soil type and site specific conditions. Typical water quality improvements include the following.

- The USDOT states typical reduction of contaminant levels by infiltration systems include: 60% in nutrient loads, 85% in metals, 90% in total suspended solids, and 90% in bacteria (2024).
- Similarly, the MPCA states that infiltration systems have a high capacity to treat (65 to 100% improvement) of TSS, metals, oils and grease, and pathogens, a medium capacity to treat dissolved nutrients (~65% reduction), and a low capacity to treat chloride (<30%) (2022).
- Potential contaminants (such as metals and oils) with low solubility generally pose a lower risk to aquifers, because they will tend to adsorb to sediments or will degrade and breakdown over time. For example, many metals may only be transported a few centimetres beneath surface infiltration facilities (BCMOE, 2014).
- To achieve water quality improvements in the infiltration system, the retention time should be less than the maximum retention time (48 to 72 hours, to allow aerobic conditions suitable for bacterial growth in the subsoil) and greater than the minimum retention time (6 hours, to allow filtration and sorption processes time to take place) (Schueler, 1987) (Chahar, Graillot, & Gaur, 2012).



- In general, where risk to water quality receptors is high and water quality enhancement in the subsurface is relied upon to mitigate risks, sampling of groundwater downgradient of the infiltration system is used to validate the effectiveness of the system in enhancing groundwater quality (Dillon et al., 2022).
- Alternative infiltration system backfill materials can be considered to provide enhanced treatment via filtering, adsorption, and ion exchange within the infiltration system, including either a sand or a mixture of perlite, dolomite, gypsum, and crushed rock (CalTrans, 2020).
- Aquifer residence time can effectively remove pollutants, such as pathogens. An application of this principle is a California system which infiltrates wastewater into a drinking water aquifer. A standard for log removal of pathogens before arrival at the drinking water receptor was established and aquifer residence time was accounted for as one log removal per month of residence time in the aquifer (Dillon et al., 2022).

**Post-treatment** – If required, adverse water quality can be mitigated by treatment at the receptor, particularly for drinking water receptors (Dillon et al., 2022). An example of this is the Mannheim ASR system, which uses chlorination post-treatment at its extraction wells to manage pathogen risks to drinking water supplies (Stantec, 2015).

- **Proximity to Receptors** - Where possible, infiltration systems should be sited at least 30 m (CalTrans, 2020) to 60 m (BCMOE, 2014) upgradient from a water supply well. Detailed characterization along the full alignment of the infiltration system, including lithology and groundwater levels with particular caution exercised in the presence of possible karst conditions (BCMOE, 2014) (USEPA, 2021).

## 5.0 REFERENCES

- Akan, Osman A., 2002. Sizing Stormwater Infiltration Structures. *Journal of Hydraulic Engineering*, Vol 128, No.5, ASCE, ISSN 0733-9429/2002/5-534–537
- Barszcz, M. P. 2015. Influence of Applying Infiltration and Retention Objects to the Rainwater Run-off on a Plot and Catchment Scale – Case Study of Służewiecki Stream Subcatchment in Warsaw. *Polish Journal of Environmental Studies*, 24(1), 57-65. <https://doi.org/10.15244/pjoes/29197>
- B.C. Ministry of Environment, 2014. Underground Stormwater Infiltration: Best Practices for the Protection of Groundwater in British Columbia. Water Protection and Sustainability Branch. ISBN 978-0-7726-6855-4.
- CalTrans, 2020. Caltrans Stormwater Quality Handbooks - Infiltration Trench Design Guidance. California Department of Transportation HQ Division of Design. Dated December 2020.
- Chahar, B.R., Graillot, D., & Gaur, S. 2012. Storm-water management through Infiltration trenches. *Journal of Irrigation and Drainage Engineering-asce*, 138, 274-281.
- Camilleri, C., 2019. Managed aquifer recharge. Retrieved from <https://www.groundwatercanada.com/managed-aquifer-recharge-4785/> on February 13, 2025.
- Charlesworth, S. & Harker, E. & Rickard, S. 2003. A Review of Sustainable Drainage Systems (SuDS): A Soft Option for Hard Drainage Questions?. *Geography*. 88. 99-107. 10.1080/20436564.2003.12219866.

- Chouteau, B. M., Giroux B. 2008. Hydrostratigraphic Characterization of Glaciofluvial Deposits Underlying an Infiltration Basin Using Ground Penetrating Radar. *Vadose Zone Journal* 2008; 7 (1): 194–207. doi: <https://doi.org/10.2136/vzj2007.0003>
- Dillon, P., W. Alley, Y. Zheng, and J. Vanderzalm (editors), 2022. *Managed Aquifer Recharge: Overview and Governance*. IAH Special Publication. <https://recharge.iah.org/> ISBN 978-1-3999-2814-4
- Fischer, David & Charles, Emmanuel & Baehr, Arthur, 2003. Effects of Stormwater Infiltration on Quality of Groundwater Beneath Retention and Detention Basins. *Journal of Environmental Engineering-asce - J ENVIRON ENG-ASCE*. 129. 10.1061/(ASCE)0733-9372(2003)129:5(464).
- Golder, 2023. CBM Caledon Pit / Quarry infiltration trench system. Revised Report dated July 2023.
- GHD, 2021. *Geology and Water Resources Assessment Report, Dufferin Aggregates, Milton Quarry East Extension, Region of Halton*. Report dated December 2021.
- GHD and GEC, 2021. Addendum to Updated Adaptive Environmental Management and Protection Plan (AMP) Milton Quarry East Extension (MQEE) Town of Halton Hills, Ontario. Report dated December 2021.
- Grand River Watershed Water Management Plan, 2014. Prepared by the Project Team, Water Management Plan. Grand River Conservation Authority, Cambridge, ON. 137p.
- Kim, Joonghoon, 1986. A study of Infiltration Trenches in Unsaturated Soils. Master of Science Thesis, Virginia Polytechnic Institute and State University, Blacksburg, Virginia.
- Malu, Shubham, 2017. Artificial Recharge of Groundwater. Retrieved from <https://www.engineeringcivil.com/artificial-recharge-of-groundwater.html> on February 11, 2025.
- McCurry, G., Barkmann, P., Stanin, P., Willardson, B., Sheng, Z., Bartlett, D., McGrane, D., Dillon, P., Moore, S., Hutchinson, A., Woodside, G., Brand, C., Galloway, D., & Pyne, D., 2022. *The ASCE/EWRI Standard Guidelines for Managed Aquifer Recharge*. McCurry Hydrology, LLC.
- MHBC, 2021. *Planning Justification Report & Aggregate Resources Act Summary Statement Milton Quarry East Extension*. Report dated December 2021.
- Ministry of the Environment, 2003. *Stormwater Management Planning and Design Manual*. Queen's Printer for Ontario. ISBN 0-7794-2969-9. Dated March 2003.
- Minnesota Pollution Control Agency, 2022. *BMPs for Stormwater Infiltration*. Minnesota Stormwater Manual. Retrieved from <https://stormwater.pca.state.mn.us>, on August 15, 2022.
- Pennsylvania Department of Environmental Protection, 2006. *Pennsylvania Stormwater Best Management Practices Manual*. Retrieved from [https://www.stormwaterpa.org/assets/media/BMP\\_manual/07\\_Chapter\\_6.pdf](https://www.stormwaterpa.org/assets/media/BMP_manual/07_Chapter_6.pdf) on February 10, 2025.
- Rowe, E., 2019. Proper Sizing of Infiltration Trenches and Bioretention Cells for Urban Stormwater Management Purposes. Master of Applied Science Thesis, McMaster University, Hamilton, Ontario.
- Scholz, Miklas, 2005. Case study: design, operation, maintenance and water quality management of sustainable storm water ponds for roof run-off. *Bioresource technology*. 95. 269-79. 10.1016/j.biortech.2003.07.015.

Schueler, Thomas R., 1987. Controlling Urban Run-off. Metropolitan Washington Council of Governments. Dated July 1987.

Stantec, 2015. Water Supply Master Plan Update Final Report. Prepared for the Regional Municipality of Waterloo. Dated March 2015.

U.S. Department of Transportation (USDOT), 2024. Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring. Federal Highway Administration.

U.S. Environmental Protection Agency, Office of Water, 2021. Best Management Practices for Infiltration Trenches. Document number: EPA-832-F-21-031C. Dated December 2021.

Young, D., Van Seters, T., & Graham, C., 2013. Evaluation of Underground Stormwater Infiltration Systems. Toronto and Region Conservation Authority. Toronto, Ontario. Dated February 2013.

## CLOSURE

We trust that this Technical Memorandum meets your current needs. If you have any questions or require clarification, please contact WSP at your earliest convenience.

### WSP Canada Inc.



Paul Menkveld, M.Sc., P.Eng.  
*Hydrogeological Engineer*

EP/PGM/

Attachments: None

[https://wsonline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/02 mitigation desktop review \(see technical work 40\)/19129150 caledon trench technology review mar2025 r1.docx](https://wsonline.sharepoint.com/sites/gld-114392/project%20files/5%20technical%20work/ph%202300-hydrogeology/45%20mitigation%20system%20design%202025/02%20mitigation%20desktop%20review%20(see%20technical%20work%2040)/19129150%20caledon%20trench%20technology%20review%20mar2025%20r1.docx)



**APPENDIX B**

**FIELD INVESTIGATION**



## TECHNICAL MEMORANDUM

**DATE** November 20, 2024

**Project No.** CA-GLD-19129150

**TO** David Hanratty; Mike Le Breton  
CBM Aggregates

**CC** Paul Menkveld; Greg Padusenko; Heather Melcher

**FROM** George Schneider; Victoria Propp

**EMAIL** [george.schneider@wsp.com](mailto:george.schneider@wsp.com)

### FIELD INVESTIGATION RESULTS - GROUNDWATER MITIGATION SYSTEM FOR THE PROPOSED CBM CALEDON PIT / QUARRY

#### 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) has applied to the Ministry of Natural Resources (MNR) for a Class A Licence (Pit and Quarry Below Water) under the Aggregate Resources Act (ARA) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation. To support the application process, WSP Canada Inc. (WSP), formerly Golder Associates Ltd. (Golder), was retained by CBM beginning in 2019 to carry out technical studies and prepare a Level 1/2 Water Report (Golder December 2022, revised July 2023).

In order to maintain groundwater levels on the west and south sides of the Main and South Quarry areas, the revised Water Report proposed that a groundwater mitigation system, consisting mainly of a series of infiltration trenches (Figure 1) be constructed during pit / quarry operations, to help maintain groundwater levels west and south of the site within their normal seasonal range, and thereby mitigate the temporary effects of pit / quarry dewatering on water users and ecological features.

As part of the application process, CBM received review comments on the revised Water Report from nine agency / stakeholder groups. Five of the nine agencies / groups requested additional information regarding the proposed groundwater mitigation system, in order demonstrate that the system will perform as predicted and mitigate potential impacts to groundwater during the operation of the pit / quarry.

The investigation results are being used to update the Hydrogeosphere (HGS) groundwater-surface water numerical model for the site, update hydrogeologic predictions during pit / quarry operations, and help advance the detailed design of the mitigation system, building on the conceptual design initially presented in the revised Water Report (Golder July 2023).

#### 2.0 FIELD INVESTIGATIONS

In the spring of 2024, WSP was retained by CBM to undertake field investigations along the proposed infiltration trench alignment, to inform the design of the proposed groundwater mitigation system, install the well nests needed to establish baseline conditions and eventually monitor system performance, and at the same time respond to agency / stakeholder requests for additional information. This technical memorandum presents the

results of these field investigations, which were carried out by WSP from April to June 2024 and were comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 1).

The field investigations were comprised of the following main activities:

- Borehole drilling and monitoring well nest installation;
- Laboratory testing of overburden soils;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

These investigations are described in the sections below.

## 2.1 Drilling and Monitoring Well Installation

The borehole drilling and monitoring well installation was carried out by Choice Sonic Drilling Ltd. (CSD) of Brighton, Ontario under WSP supervision over a three-week period during April 2024. Monitoring well locations are shown on Figure 1.

A total of 19 monitoring wells were installed at seven well nest locations MW-IT-01 to MW-IT-07, generally as follows.

- All locations were cleared for underground utilities using public and private locating services, prior to the start of drilling.
- The boreholes were drilled using a track-mounted Sonic SDC 550 drill rig and support equipment including 4x4 pickup trucks, a skid-steer, and a utility trailer equipped with low-impact tires.
- The borehole was advanced through the overburden and bedrock to the required depth with the rotasonic method, obtaining a continuous 114 mm diameter (4 ½") soil rock core and leaving a 124 mm (4-7/8") open borehole in the rock.
- The overburden and rock core samples were logged, photographed, and bagged for future laboratory testing.
- The well installation was completed using 51 mm (2") SCH40 PVC well screen and riser pipe. Each well nest generally consisted of a well installed in the bedrock, contact aquifer and overburden, where possible, with each well installed in its own borehole. Well screens were backfilled with a sand pack and then sealed up to surface using bentonite pellets.
- Each well nest installation was then completed at surface with a lockable protective well casing.
- The monitoring wells were later developed by purging, using a 13 mm inner diameter Waterra tubing with an inertial foot valve. Development was considered complete based on one of the following conditions being met: ten times the volume of water in the monitoring well had been pumped or the well was pumped dry, allowed to recover (fully or partially depending on recovery speed) and pumped dry again.

All boreholes and monitoring wells were later surveyed by Delph and Jenkins North Ltd. of Aurora, Ontario and the results provided to WSP via CBM.

All monitoring and pumping wells were tagged and registered with the MECP Water Well Information System. The well records were submitted to the MECP by CSD on behalf of CBM, the owner of the wells.

A summary of the borehole observations and monitoring well installation details are provided in Table 1. Record of Borehole and Monitoring Well Logs are provided in Appendix A. Core photographs of the deepest borehole at each well nest location are provided in Appendix B. The wells were subsequently used for groundwater level monitoring, single well response tests, and groundwater quality sampling, as discussed in later subsections.

## 2.2 Laboratory Testing

Of the 19 wells drilled on or proximal to the Site, a total 171 soil samples were collected, and of those, 34 representative samples were selected for grainsize analysis (sieve only). Four to six representative soil samples were selected for analysis from the deepest borehole at each well nest location. A variety of soil samples were chosen to confirm the soil descriptions prepared in the field during borehole logging.

The soil core samples were transported to WSP's Materials Testing Laboratory in Cambridge, which is accredited for Aggregate Testing by the Canadian Council of Independent Laboratories (CCIL) and the Ministry of Transportation Ontario (MTO). In addition to sieve analysis, Fineness Modulus (FM), % Wash Loss, % Crushable Stone and Stone-to-Sand Ratio was calculated for sand and gravel samples.

The grainsize distribution curves are presented in Appendix C and the results are summarized in Table 2. The grainsize results were used to refine the field descriptions of soil types, prepare the final borehole logs presented in Appendix A, and were subsequently used to revise the hydrostratigraphy and HGS numerical model for the site.

## 2.3 Groundwater Level Monitoring

The newly installed groundwater monitoring well nests MW-IT-01 to MW-IT-07 will be added to the groundwater monitoring program at the proposed Caledon Pit / Quarry. These new well nests will help establish baseline groundwater conditions, including groundwater flow direction and vertical hydraulic gradients, and later to monitor groundwater levels adjacent to the proposed infiltration trench system during future pit / quarry operations.

Each monitoring well was equipped with a Van Essen TD-Diver pressure transducer / logger following well development. The loggers were generally installed in the screened interval, each with a range suitable for the range of water levels that may be encountered and programmed to record water levels on a 15-minute interval.

Manual water levels were also measured on May 6, June 26, and September 4, 2024, using an electric water level measuring tape. Groundwater levels were converted to elevations using the surveyed elevation (Delph and Jenkins North Ltd. of Aurora, Ontario) of the ground surface at each monument and the field measured stickup.

The groundwater head elevations monitored as part of this investigation are presented as hydrographs in Appendix D. The figures present data collected between the start of May 2024 up to September 5, 2024. A hydrograph showing the seasonal fluctuation in groundwater head elevations for nearby previously installed monitoring wells (MW20-01A/B, MW20-02 and MW20-18) is also presented in Figure D8. Figure D8 presents data collected between April 2023 up to September 5, 2024. Precipitation data included on these figures was measured at Environment Canada Meteorology Mono Centre Station (Station ID: 6157000).

With reference to the above noted hydrographs presented in Appendix D, the following is noted:

- All monitoring wells show a trend of decreasing water elevation from May to September 2024, concurrent with warm weather and active plant growth, which presumably reduces the water available for infiltration and recharge. This is consistent with seasonal trends observed on the Site since 2021.
- Rapid increases in groundwater levels were observed in response to significant precipitation events at MW-IT-02A/B/C, similar to the response observed at MW20-18.
- The vertical hydraulic gradients between the wells installed in the Gasport formation and the bedrock contact were generally upward at locations MW-IT-01, MW-IT-04, MW-IT-05 and MW-IT-06, and neutral at locations MW-IT-03 and MW-IT-07. At MW-IT-02, there was a notable downward hydraulic gradient throughout the monitoring period.
- At location MW-IT-02, two wells (-A and -B) were installed within the Gasport Formation. There was a downward hydraulic gradient between these wells throughout the monitoring period, which was observed to be increasing in magnitude over time (June and September hydraulic gradients of -0.14 and -0.30, respectively).
- The vertical hydraulic gradients between the wells installed in the bedrock contact and the overburden were generally upward at MW-IT-05, neutral at MW-IT-03 and MW-IT-07, and downward at MW-IT-01. All of the overburden wells, with the exception of MW-IT-03C, have gone dry over the course of the monitoring period.

## 2.4 Hydraulic Testing – Single Well Response Tests (SWRTs)

Single well response tests (SWRTs) were conducted by WSP in all 19 of the newly installed monitoring wells in April and May 2024, following monitoring well development. The SWRTs were analyzed to estimate the hydraulic conductivity of each subsurface interval tested.

### SWRT Methodology

Single well response testing method selection was informed by speed of water level recovery during well development. In monitoring wells with an intermediate recovery speed, a Waterra purge rising head test, bailer test, or a physical slug test were performed as described below.

- Waterra purge rising head test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high recording frequency, to optimize the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. The Waterra pump was then used to rapidly purge the well. The volume purged from the well was measured in a graduated bucket. The Waterra pump was then removed from the monitoring well and recovery was monitored using the logger and manual water levels. The logger was downloaded, and the test considered completed when recovery exceeded 95%.
- Bailer test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high reading frequency, to allow for the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. A bailer was then lowered into the well and allowed to fill with water. The bailer was then rapidly removed from the well and the volume of water removed was recorded. A rising head test was



monitored using the logger and manual water level measurements until 95% recovery was exceeded. Where there was uncertainty if the logger had shifted during the insertion and removal of the bailer, the test was repeated.

- Physical slug test: The monitoring well was allowed to recover following development. Static water levels were confirmed prior the test by measuring manual water levels until the water level had stabilized for 5 minutes. A logger was then placed below the water level and set to a high reading frequency, to allow for the collection of data for a period of minutes or hours. The static water level was monitored for several minutes to observe any minor water level trends. A slug of known volume was then lowered quickly to displace the water in the well and a falling head test was monitored using the logger and manual water level measurements. Typically, when recovery exceeded 95%, the slug was rapidly removed from the well and recovery was monitored until 95% was exceeded. Where there was uncertainty if the logger had shifted during the insertion and removal of the slug, the test was repeated.

Where rapid recovery from well development was identified, a pneumatic displacement rising head test was performed.

- A pneumatic displacement rising head test was conducted by sealing the top of the riser pipe off with the test apparatus, and then using air pressure to displace groundwater in the riser pipe out through the well screen.
- The pressure in the system is monitored using pressure transducers at two locations in the riser pipe: in the water column at a known depth, and in the air space above the water column.
- Typically, pressure in the riser pipe was allowed to equilibrate for 5 minutes. Air pressure is then suddenly released, and the transient response is observed as a rising head test.

This test method provided more instantaneous displacement and a better fit with theoretical displacement than traditional tests using a physical slug to displace the water in fast recovering wells. Implementing a pneumatic method is consistent with the Butler's recommendation for testing high k aquifers (1998).

In some cases, where the monitoring well recovered rapidly, the well head geometry or a water level in the well screen made it impossible complete a pneumatic rising head test. In these cases, a physical slug test, bailer test, or a Waterra purge rising head test were conducted.

## SWRT Analysis

Analysis of the single well response tests was performed using the following methodology.

- Monitoring well details were confirmed based construction details to establish the screen length, well diameter, borehole diameter, sand pack length, stick up, and materials used in well construction.
- Field notes and logger files were reviewed, and a test hydrograph was plotted.
- A conceptual model of the well was developed, including identifying if the well was confined or unconfined, determining aquifer thickness, and estimating well penetration, based on a review of the borehole log and downhole geophysical data.
- It was assumed that the tested interval was homogenous, isotropic, and no borehole skin affected the test.

- An effective radius correction was applied if the water level entered the sand pack during the test and if the water level was in the well screen interval during the majority of the test.
- These parameters were entered into AQTESOLV (Version 4.50) and an analytical solution was applied to calculate a hydraulic conductivity for the test.
  - Where test results were overdamped (displacement consistently fell toward the static level), the Bouwer Rice (1976) (confined or unconfined, depending on well model) solution was applied.
  - Where test results were underdamped (displacement oscillated around the static level), Springer-Gelhar (1991) solution was applied for unconfined wells and the Butler (1998) solution for confined wells.

## SWRT Results

The single well response tests and results are presented in Table 3 and Appendix E (Figures E1 to E19). A summary of results by aquifer unit is presented below.

### Single Well Response Test Hydraulic Conductivity by Aquifer Unit

Formation / Rock Unit	Number of Observations	Minimum K (m/s)	Maximum K (m/s)	Geometric Mean K (m/s)
Overburden	4	$8 \times 10^{-06}$	$2 \times 10^{-03}$	$1 \times 10^{-04}$
Bedrock Contact	7	$1 \times 10^{-05}$	$8 \times 10^{-04}$	$2 \times 10^{-04}$
Gasport	7	$6 \times 10^{-07}$	$6 \times 10^{-04}$	$2 \times 10^{-05}$
Gasport / Shaley Dolostone	1	$2 \times 10^{-04}$		

The following observations are made with respect to the results of the SWRTs:

- The SWRTs performed on wells screened in the Gasport Formation ranged from  $6 \times 10^{-07}$  m/s to  $6 \times 10^{-04}$  m/s, which is typical of lithologies ranging from a middle value for unfractured dolostone to a middle value of weathered dolostone (Freeze and Cherry 1979). This is consistent with the lithological observations at the Site and previously reported hydraulic conductivity ranges in the revised Water Report Level 1/2.
- The SWRT performed on the well screened in both the Gasport Formation and Shaley Dolostone fell within the range of values observed for the wells that were entirely screened within the Gasport Formation. This value is approximately an order of magnitude greater than the maximum observed in the revised Water Report.
- The results of SWRTs in the overburden were generally consistent with published hydraulic conductivities for the soil materials observed during drilling at those locations.

## 2.5 Groundwater Quality

Water quality sampling was carried out by WSP field personnel between April 26 to May 1, 2024, at the monitoring well nests MW-IT-01 to MW-IT-07 shown on Figure 1. The sampling methodology was generally as follows.

- All monitoring wells installed were developed and completed with dedicated groundwater water sampling equipment (tubing and Waterra foot-valves).
- Each well was purged and then sampled. Field parameters (including pH, electrical conductivity, and temperature) were recorded after each purge volume, to ensure water chemistry had stabilized prior to sampling.
- The water samples were collected in pre-supplied laboratory bottles, placed in ice-packed coolers, and delivered to the Bureau Veritas (BV) Labs in Mississauga following standard Chain of Custody protocols.
- The samples were analyzed at BV Labs for the RCAP groundwater suite (which includes general chemistry, nutrients, inorganics and metals), as well as benzene, toluene, ethylbenzene and xylene (BTEX) and petroleum hydrocarbons (PHC) F1 to F4.
- Analytical results were compared to:
  - Table 2: Full Depth Generic Site Condition Standards [SCS] in a Potable Groundwater Condition - Coarse Grained Sediments - Residential / Parkland / Institutional Use from the MECP *Soil, ground water and sediment standards for use under Part XV.1 of the Environmental Protection Act*, dated July 1, 2011;
  - Ontario Drinking Water Quality Standards (ODWS) from the MECP *Safe Drinking Water Act*, dated January 1, 2020; and
  - Provincial Water Quality Objectives (PWQO) from *Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of Environment and Energy*, reprinted February, 1999.

Water quality results are summarized in Table 4 and are presented with MECP Table 2, ODWS and PWQO criteria presented alongside the data for comparison purposes. A full set of analytical results from the laboratory, including chain of custody and certificates of analysis, are provided in Appendix F. The groundwater samples were analyzed for dissolved metals (not total metals) for comparison to MECP Table 2 and ODWS, and as such, the groundwater samples for metals were field filtered. It should be noted that the PWQO are intended to be compared to total metal concentrations, which may be higher than dissolved metal concentrations. The comparison to the PWQO is nonetheless considered to be helpful in understanding the potential quality of excess water collected during pit / quarry operations that may be discharged from the Site to the Osprey Valley Golf Course irrigation pond system.

In general, the water quality was in the typical range for groundwater in this hydrogeologic setting.

There were some exceedances of ODWS and MECP Table 2 parameters, including total dissolved solids (TDS), hardness, chloride, cobalt, manganese, sodium and PHC F3 hydrocarbons. There were also a number of occasional exceedances of PWQO parameters, notably for cobalt and BTEX (toluene).

Several locations that exhibited one or more detections of parameters presumed to be related to anthropogenic activities, including elevated chloride and sodium (MW-IT-01C), elevated PHCs and detections of one or more BTEX parameters. Elevated PHC and BTEX concentrations may be due to the PVC cement used during well installation to extend the riser pipe at ground surface.

### 3.0 CLOSURE

We trust that this memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

**WSP Canada Inc.**



Victoria Propp, MSc  
*Hydrogeologist-in-training*



George Schneider, MSc, PGeo  
*Senior Geoscientist*



VRP/PGM/GWS/

Attachments: Table 1 – Borehole and Monitoring Well Details for MW-IT Wells  
Table 2 – Summary of Grainsize Results for MW-IT Wells  
Table 3 – Summary of Single Well Response Tests for MW-IT Wells  
Table 4 – Summary of Water Quality Results for MW-IT Wells  
Figure 1 – Location of Infiltration Trench Monitoring Well Nests MW-IT-01 to MW-IT-07  
Appendix A – Borehole Logs and Well Installation Details  
Appendix B – Core Photographs  
Appendix C – Grainsize Test Results  
Appendix D – Hydrographs  
Appendix E – Single Well Response Tests  
Appendix F – Water Quality Results

[https://wsonline.sharepoint.com/sites/gld-114392/project files/6 deliverables/ph 2300-hydrogeology/501 mitigation system investigation tm/19129150-tm gwms mw-it investigation nov2024f.docx](https://wsonline.sharepoint.com/sites/gld-114392/project%20files/6%20deliverables/ph%202300-hydrogeology/501%20mitigation%20system%20investigation%20tm/19129150-tm%20gwms%20mw-it%20investigation%20nov2024f.docx)

**Table 1**  
**Borehole and Monitoring Well Details for MW-IT Wells**  
**CBM Caledon Pit / Quarry**

Well ID	Date Drilled	Easting (m) UTM 17T	Northing (m) UTM 17T	Ground Surface Elevation (masl)	Standpipe	Total Hole Depth (mbgs)	Depth to Bedrock (mbgs)	Stick Up (m)	Formation Screened	Screen from (m)	Screen to (m)	Screen length (m)
MW-IT-01A	April 15, 2024	577201	4852516	403.67	2" PVC	26.52	17.68	0.930	Gasport Fm	21.64	23.16	1.52
MW-IT-01B	April 16, 2024	577202	4852514	403.63	2" PVC	19.51	17.98	0.830	Contact Aquifer	16.71	18.84	2.13
MW-IT-01C	April 16, 2024	577204	4852513	403.58	2" PVC	11.96	-	0.896	Overburden	10.44	11.96	1.52
MW-IT-02A	April 16, 2024	577009	4852710	401.46	2" PVC	16.76	6.1	0.861	Gasport Fm	14.64	16.16	1.52
MW-IT-02B	April 17, 2024	577007	4852712	401.49	2" PVC	12.50	6.4	0.912	Gasport Fm	8.84	11.89	3.05
MW-IT-02C	April 17, 2024	577006	4852713	401.47	2" PVC	7.01	-	0.822	Contact Aquifer	5.18	6.71	1.52
MW-IT-03A	April 18, 2024	577352	4852364	397.88	2" PVC	14.94	9.75	0.895	Gasport Fm	13.29	14.81	1.52
MW-IT-03B	April 18, 2024	577354	4852363	397.76	2" PVC	12.04	9.75	0.929	Contact Aquifer	9.60	11.43	1.83
MW-IT-03C	April 18, 2024	577355	4852362	397.74	2" PVC	7.92	-	0.910	Overburden	5.79	7.32	1.52
MW-IT-04A	April 19, 2024	577521	4852364	397.68	2" PVC	12.19	6.55	0.837	Gasport Fm	10.21	11.73	1.52
MW-IT-04B	April 22, 2024	577522	4852363	397.69	2" PVC	9.14	5.49	0.869	Contact Aquifer	5.33	8.38	3.05
MW-IT-05A	April 22, 2024	577614	4852195	399.30	2" PVC	14.94	9.14	0.871	Gasport Fm	11.39	14.44	3.05
MW-IT-05B	April 23, 2024	577612	4852197	399.23	2" PVC	10.36	10.06	0.865	Contact Aquifer	8.71	10.23	1.52
MW-IT-05C	April 23, 2024	577611	4852199	399.18	2" PVC	7.62	-	0.888	Overburden	5.79	7.32	1.52
MW-IT-06A	April 24, 2024	578068	4852428	398.67	2" PVC	11.58	6.25	0.861	Gasport Fm	9.75	11.28	1.52
MW-IT-06B	April 25, 2024	578069	4852429	398.62	2" PVC	9.14	6.10	0.834	Contact Aquifer	6.00	9.04	3.05
MW-IT-07A	April 26, 2024	577897	4852208	400.14	2" PVC	17.68	10.21	0.946	Gasport Fm and Shaley Dolostone	13.72	15.24	1.52
MW-IT-07B	April 29, 2024	577898	4852209	400.19	2" PVC	12.95	9.75	0.901	Contact Aquifer	9.61	12.66	3.05
MW-IT-07C	April 29, 2024	577899	4852211	400.14	2" PVC	9.30	-	1.003	Overburden	7.48	9.00	1.52



**Table 2**  
**Summary of Grainsize Results for MW-IT Wells**  
**CBM Caledon Pit / Quarry**

Well ID	Sample ID	Run Depth (ft)				Percent Gravel (%)	Percent Sand (%)	Percent Silt (%)	Full FM Value	Sand Portion FM Value	Wash Loss (%)	Crushable Stone (%)
		Top		Bottom								
		(ft)	(m)	(ft)	(m)							
MW-IT-01A	7	12.5	3.81	17.5	5.33	42	39	19	5.43	3.92	18.7	20.37
MW-IT-01A	9	22.0	6.71	26.0	7.92	46	39	15	5.62	4.32	15.0	17.44
MW-IT-01A	12	32.0	9.75	36.0	10.97	55	35	10	6.64	4.88	10.4	25.44
MW-IT-01A	13	38.0	11.58	43.0	13.11	0	10	90	0.04	0.04	90.4	0.00
MW-IT-01A	17	51.5	15.70	56.0	17.07	67	28	5	7.47	5.65	4.5	30.99
MW-IT-02A	3	3.5	1.07	8.0	2.44	21	62	17	3.23	3.02	16.8	0.51
MW-IT-02A	5	10.0	3.05	11.5	3.51	30	40	30	3.59	3.06	30.2	8.12
MW-IT-02A	6	11.5	3.51	14.0	4.27	64	27	9	7.54	5.28	9.3	32.65
MW-IT-02A	7	16.5	5.03	18.0	5.49	56	27	17	6.17	4.59	16.8	25.14
MW-IT-03A	3	4.0	1.22	8.0	2.44	49	40	11	5.56	4.48	11.1	16.25
MW-IT-03A	4	9.0	2.74	11.5	3.51	2	22	76	0.38	0.38	75.9	0.00
MW-IT-03A	7	15.0	4.57	17.5	5.33	63	24	13	7.32	5.11	13.4	35.21
MW-IT-03A	9	21.0	6.40	25.5	7.77	70	20	10	8.39	5.43	9.6	42.10
MW-IT-03A	10	29.0	8.84	31.0	9.45	57	20	23	6.30	4.51	22.7	29.28
MW-IT-04A	2	6.0	1.83	9.0	2.74	47	40	13	5.59	4.47	12.6	18.79
MW-IT-04A	4	9.0	2.74	10.0	3.05	59	22	19	4.39	3.78	18.8	8.22
MW-IT-04A	6	13.0	3.96	15.5	4.72	0	65	35	0.28	0.28	34.8	0.00
MW-IT-04A	7	15.5	4.72	17.0	5.18	0	30	70	0.03	0.03	70.4	0.00
MW-IT-04A	9	19.0	5.79	21.5	6.55	52	27	21	6.13	4.36	20.7	26.28
MW-IT-05A	2	3.0	0.91	8.0	2.44	47	38	15	5.85	4.26	14.6	20.14
MW-IT-05A	3	8.0	2.44	13.0	3.96	46	41	13	5.57	4.33	12.7	18.04
MW-IT-05A	4	13.0	3.96	18.0	5.49	40	43	17	4.65	3.77	16.6	14.75
MW-IT-05A	5	18.0	5.49	23.0	7.01	0	87	13	1.19	1.19	13.0	0.00
MW-IT-05A	6	23.0	7.01	28.0	8.53	0	33	67	0.08	0.08	67.0	0.00
MW-IT-06A	1	0.0	0.00	3.0	0.91	38	38	24	4.85	3.67	23.5	18.54
MW-IT-06A	2	3.0	0.91	8.0	2.44	44	40	16	5.40	4.21	15.9	17.72
MW-IT-06A	3	8.0	2.44	13.0	3.96	60	29	11	7.39	5.01	10.8	33.95
MW-IT-06A	4	13.0	3.96	18.0	5.49	44	42	14	5.43	4.28	14.2	14.30
MW-IT-06A	5	18.0	5.49	23.0	7.01	68	21	11	7.57	5.41	10.7	32.68
MW-IT-07A	2	4.0	1.22	8.0	2.44	35	48	17	4.40	3.85	17.1	6.76
MW-IT-07A	3	8.0	2.44	11.0	3.35	53	40	7	6.25	4.99	7.2	19.71
MW-IT-07A	5	18.0	5.49	21.0	6.40	40	56	4	5.61	4.60	4.1	12.55
MW-IT-07A	6	21.0	6.40	28.0	8.53	44	49	7	5.56	4.68	6.8	11.85
MW-IT-07A	7	28.0	8.53	33.0	10.06	30	58	12	3.87	3.37	12.4	6.10

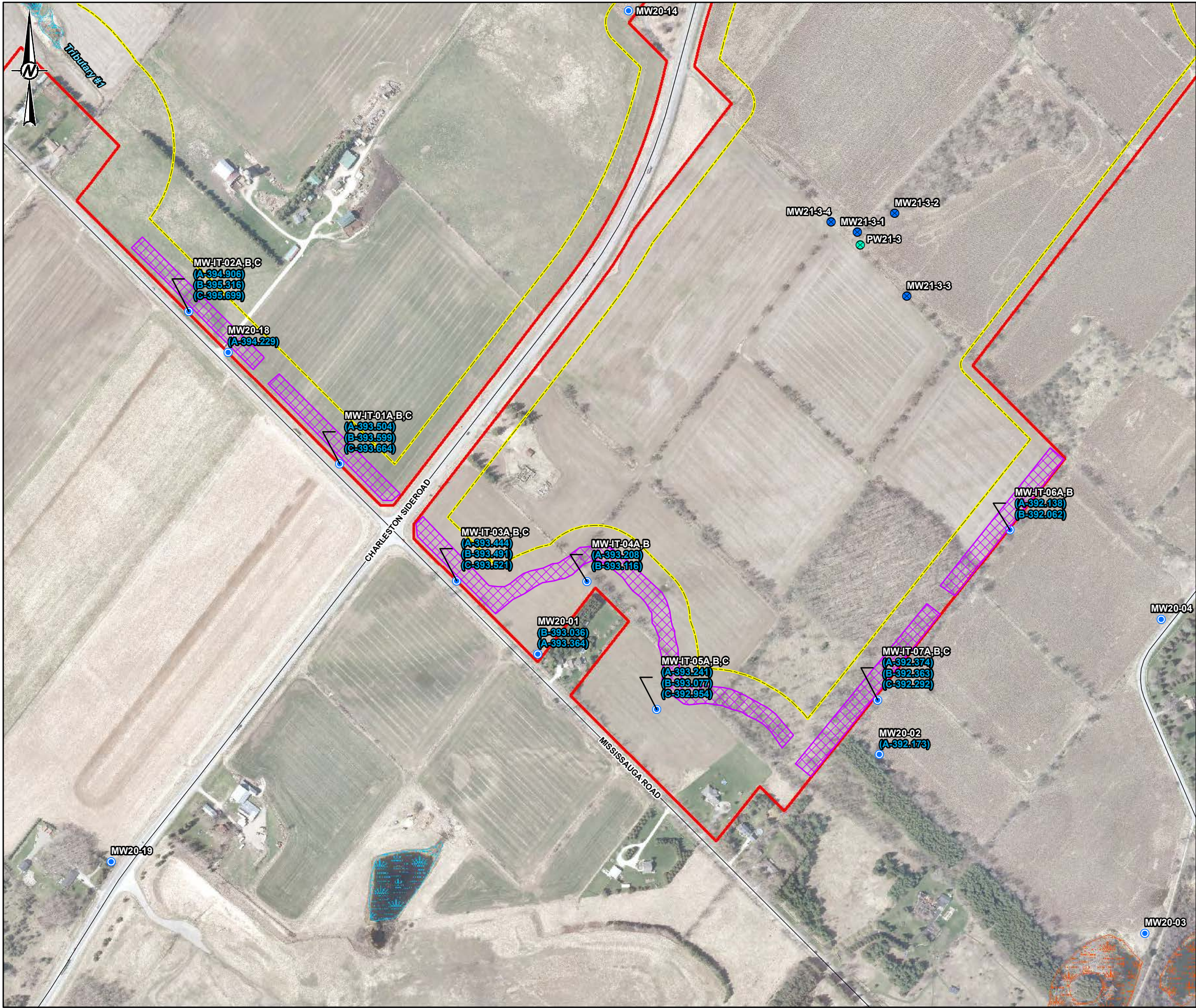
**Table 3**  
**Summary of Single Well Response Tests for MW-IT Wells**  
**CBM Caledon Pit / Quarry**

MW ID	Figure Number	Top of test interval (mbgs)	Bottom of test interval (mbgs)	Depth of Test (center point mbgs)	Ground Surface Elevation (masl)	Depth of Test (center point masl)	Aquifer Model	Screened Formation	Final k (m/s)
MW-IT-01A	D01	21.64	23.16	22.40	403.67	381.27	Confined	Gasport Fm	9.E-05
MW-IT-01B	D02	16.71	18.84	17.78	403.63	385.85	Confined	BR Contact	8.E-04
MW-IT-01C	D03	10.44	11.96	11.20	403.58	392.38	Unconfined	Overburden	5.E-05
MW-IT-02A	D04	14.64	16.16	15.40	401.46	386.06	Unconfined	Gasport Fm	6.E-07
MW-IT-02B	D05	8.84	11.89	10.37	401.49	391.12	Unconfined	Gasport Fm	3.E-06
MW-IT-02C	D06	5.18	6.71	5.95	401.47	395.53	Unconfined	BR Contact	2.E-05
MW-IT-03A	D07	13.29	14.81	14.05	397.88	383.83	Unconfined	Gasport Fm	1.E-06
MW-IT-03B	D08	9.6	11.43	10.52	397.76	387.25	Unconfined	BR Contact	1.E-04
MW-IT-03C	D09	5.79	7.32	6.56	397.74	391.18	Unconfined	Overburden	2.E-03
MW-IT-04A	D10	10.21	11.73	10.97	397.68	386.71	Unconfined	Gasport Fm	1.E-04
MW-IT-04B	D11	5.33	8.38	6.86	397.69	390.83	Unconfined	BR Contact	7.E-04
MW-IT-05A	D12	11.39	14.44	12.92	399.30	386.38	Confined	Gasport Fm	6.E-04
MW-IT-05B	D13	8.71	10.23	9.47	399.23	389.76	Confined	BR Contact	1.E-05
MW-IT-05C	D14	5.79	7.32	6.56	399.18	392.62	Unconfined	Overburden	8.E-06
MW-IT-06A	D15	9.75	11.28	10.52	398.67	388.16	Unconfined	Gasport Fm	1.E-04
MW-IT-06B	D16	6	9.04	7.52	398.62	391.10	Unconfined	BR Contact	6.E-04
MW-IT-07A	D17	13.72	15.24	14.48	400.14	385.66	Unconfined	Gasport Fm and Shaley Dolostone	2.E-04
MW-IT-07B	D18	9.61	12.66	11.14	400.19	389.05	Unconfined	BR Contact	8.E-04
MW-IT-07C	D19	7.48	9	8.24	400.14	391.90	Unconfined	Overburden	3.E-04

Table 4  
Summary of Water Quality Results for MW-IT Wells  
CBM Caledon Pit / Quarry

	Units	PWQO	Criteria, ODWS				MECP Table 2	MW-IT-01A	MW-IT-01B	MW-IT-01C	MW-IT-02A	MW-IT-02B	DUP2	MW-IT-02C	MW-IT-03A	MW-IT-03B	MW-IT-03C	MW-IT-04A	MW-IT-04B	DUP1	MW-IT-05A	MW-IT-05B	MW-IT-05C	MW-IT-06A	MW-IT-06B	MW-IT-07A	MW-IT-07B	MW-IT-07C
			30-Apr-24	30-Apr-24	30-Apr-24	30-Apr-24		30-Apr-24	30-Apr-24	30-Apr-24	30-Apr-24	29-Apr-24	29-Apr-24	29-Apr-24	26-Apr-24	26-Apr-24	26-Apr-24	26-Apr-24	26-Apr-24	26-Apr-24	26-Apr-24	29-Apr-24	29-Apr-24	1-May-24	1-May-24	1-May-24		
			Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm		Gasport Fm	Gasport Fm	Gasport Fm / Overburden	Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm	Gasport Fm / Overburden	Overburden	Gasport Fm	Gasport Fm / Overburden	Gasport Fm / Shaley Dolostone or Cabot Head Fm
Physical Tests (Water)																												
Anion Sum	me/L						6.18	6.85	17.4	5.92	5.48	5.53	5.3	4.51	6.03	6.23	6.55	6.95	6.97	6.15	6.35	5.21	5.76	6.02	6.35	6.2	5.63	
Bicarb. Alkalinity (calc. as CaCO3)	mg/L						220	210	250	230	210	220	220	170	220	210	220	220	220	210	210	170	180	210	210	220		
Calculated TDS	mg/L			500			330	370	1000	310	280	280	270	260	320	340	350	380	380	330	340	300	340	350	350	340	310	
Carb. Alkalinity (calc. as CaCO3)	mg/L						3.1	2.3	1.5	2.6	3.6	3	3.9	2.3	3.3	1.9	2	2.7	2.5	2.8	2.4	1.7	1.9	2	2.7	2.6	2.2	
Cation Sum	me/L						6.18	7.37	19.7	5.86	5.31	5.54	5.31	5.48	6.35	6.81	6.82	7.48	7.38	6.45	6.53	5.73	6.67	6.59	6.74	6.63	6.45	
Hardness (CaCO3)	mg/L					80-100	280	280	470	280	230	240	240	260	260	260	250	280	280	260	260	260	290	280	270	270	290	
Ion Balance (% Difference)	%						0.06	3.71	6.19	0.5	1.57	0.08	0.1	9.72	2.6	4.45	1.98	3.65	2.84	2.42	1.39	4.67	7.3	4.5	2.91	3.38	6.76	
Langelier Index (@ 20C)	N/A						0.964	0.855	0.827	0.883	0.996	0.931	1.05	0.814	0.967	0.757	0.779	0.942	0.895	0.919	0.837	0.775	0.804	0.821	0.913	0.898	0.896	
Langelier Index (@ 4C)	N/A						0.715	0.606	0.581	0.634	0.746	0.682	0.799	0.564	0.718	0.508	0.53	0.693	0.647	0.67	0.588	0.526	0.555	0.572	0.665	0.65	0.647	
Saturation pH (@ 20C)	N/A						7.21	7.21	6.98	7.2	7.27	7.24	7.23	7.33	7.24	7.23	7.22	7.17	7.18	7.23	7.24	7.26	7.28	7.24	7.22	7.22	7.12	
Saturation pH (@ 4C)	N/A						7.45	7.46	7.22	7.45	7.52	7.49	7.48	7.58	7.49	7.48	7.47	7.42	7.42	7.48	7.49	7.51	7.53	7.49	7.46	7.46	7.37	
Inorganics																												
Total Ammonia-N	mg/L						0.051	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Unionized Ammonia	mg/L	0.02					<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
Conductivity	umho/cm						590	720	2000	540	530	530	500	420	590	640	660	710	710	600	620	510	570	600	630	610	540	
Dissolved Organic Carbon	mg/L			5			1.3	2.1	1.4	3.7	3.8	3.8	4	0.45	2	2.2	1.7	1.8	1.8	1.8	2.8	2.2	0.99	1.1	1.6	1.7	2.5	
Orthophosphate (P)	mg/L						<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
pH	pH	6.5-8.5				6.5-8.5	8.17	8.07	7.8	8.08	8.26	8.17	8.28	8.14	8.21	7.99	8	8.11	8.07	8.15	8.08	8.03	8.08	8.06	8.13	8.11	8.01	
Dissolved Sulphate (SO4)	mg/L				500		41	13	19	49	13	12	8.6	43	15	14	15	16	16	13	17	33	17	13	14	14	10	
Alkalinity (Total as CaCO3)	mg/L	not decreased by >25% of natural concentration				30-500		220	210	250	240	210	220	220	170	220	210	220	230	230	210	210	170	170	190	210	210	230
Dissolved Chloride (Cl-)	mg/L				250	790	28	78	410	7	31	30	24	5	43	57	60	67	67	54	56	29	44	45	54	49	25	
Nitrite (N)	mg/L		1.0				<0.010	<0.010	0.06	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	
Nitrate (N)	mg/L		10.0				1.17	1.8	5.29	<0.10	0.95	0.94	0.59	<0.10	1.65	1.73	2.44	2.74	2.75	2.66	2.73	4.54	10.5	10.6	3.75	4.11	2.32	
Nitrate + Nitrite (N)	mg/L						1.17	1.8	5.35	<0.10	0.95	0.94	0.59	<0.10	1.65	1.73	2.44	2.74	2.75	2.66	2.73	4.54	10.5	10.6	3.75	4.11	2.32	
Metals																												
Dissolved Aluminum (Al)	ug/L	75				100	6	<4.9	<4.9	5.2	9.9	5.1	7	69	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	11	
Dissolved Antimony (Sb)	ug/L	20		6			6	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	
Dissolved Arsenic (As)	ug/L	100		10			25	<1.0	<1.0	<1.0	5.6	<1.0	<1.0	<1.0	3.7	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
Dissolved Barium (Ba)	ug/L		1000			1000	29	51	330	91	35	37	17	84	41	30	38	39	38	35	48	39	22	28	38	36	72	
Dissolved Beryllium (Be)	ug/L	1100					4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	
Dissolved Boron (B)	ug/L	200		5000		5000	31	<10	14	17	12	<10	11	17	12	<10	<10	<10	<10	<10	15	16	<10	<10	<10	<10	12	
Dissolved Cadmium (Cd)	ug/L	0	5				3	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	<0.090	
Dissolved Calcium (Ca)	ug/L						75000	79000	150000	71000	65000	69000	68000	68000	70000	75000	75000	82000	81000	75000	73000	86000	83000	83000	77000	77000	89000	
Dissolved Chromium (Cr)	ug/L	1 CrVI or 8.9 CrIII	50				50	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
Dissolved Cobalt (Co)	ug/L	1					4	0.74	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.77	10						





**LEGEND**

- MONITORING WELL
- MONITORING WELL (2021 PUMPING TEST)
- TEST PUMPING WELL WELL (2021 PUMPING TEST)
- GROUNDWATER ELEVATION, mASL
- ROAD
- PROPOSED GROUNDWATER INFILTRATION TRENCH
- UNEVALUATED WETLAND
- PROVINCIALY SIGNIFICANT WETLAND
- PROPOSED LICENCE LIMIT
- PROPOSED LIMIT OF EXTRACTION

**REFERENCE(S)**

- BASE DATA MNRF LIO OBTAINED 2020
- WATERCOURSES OBTAINED FROM CREDIT VALLEY CONSERVATION AUTHORITY OPEN DATA PORTAL, NOVEMBER 2022 IN COMBINATION WITH SITE WATERCOURSE SURVEY PROVIDED BY FIRST BASE SOLUTIONS NOVEMBER 2021.
- IMAGERY FIRSTBASE SOLUTIONS SPRING 2019 (15CM RESOLUTION) AND SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
- LICENSE AND EXTRACTION LIMIT PROVIDED BY MHBC IN JUNE 2023.
- PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

**CLIENT**  
CBM AGGREGATES, A DIVISION OF ST. MARYS CEMENT INC. (CANADA).

**PROJECT**  
CBM CALEDON PIT / QUARRY

**TITLE**  
LOCATION OF INFILTRATION TRENCH MONITORING WELL NESTS MW-IT-01 TO MW-IT-07

CONSULTANT	YYYY-MM-DD	2024-06-07
DESIGNED	CGE	
PREPARED	SA	
REVIEWED	PGM	
APPROVED	GWS	



PROJECT NO. 19129150 CONTROL 0065 REV. 0.0

FIGURE 1

PATH: S:\Client\Voice\trf\_Crean\trf\eng\_Prv\_5\_Caledon\09\_PROJ\19129150\00\_PROJ\0005\_Hydrogeol\19129150-005-CH-0002.mxd PRINTED ON: 2024-06-07 AT: 11:07:39 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B 25mm



---

**APPENDIX A**

**Borehole Logs and Well Installation  
Details**



SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Choice Sonic Drilling

STA-RCK 004 S:\CLIENTS\VOTORANTIM CIMENTOS\LONG PAR 5 CALEDON\02 DATA\GINT\LONG PAR 5 CALEDON.GPJ GAL-MISS.GDT 6/13/24

CHECKED: GWS

[illegible]

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-01C (CAL)

SHEET 1 OF 1

LOCATION: N 4852513.2 ;E 577203.7

DRILLING DATE: April 16, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate	BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage	PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular	PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break	BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
															RECOVERY		R.Q.D. %	FRACT INDEX PER 0.25 m	B Angle	DIP W/L CORE AXIS	DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
															TOTAL CORE %	SOLID CORE %					TYPE AND SURFACE DESCRIPTION	Jr	Ja				Jn																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
															80 60 40 20 0	80 60 40 20 0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
0		GROUND SURFACE		403.58																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON\GPI GAL-MISS.GDT 6/13/24



SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Choice Sonic Drilling

STA-RCK 004 S:\CLIENTS\VOTORANTIM CIMENTOS\LONG PAR 5 CALEDON\GPJ GAL-MISS.GDT 6/13/24

CHECKED: GWS

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-02B (CAL)

SHEET 1 OF 1

LOCATION: N 4852711.8 ;E 577007.4

DRILLING DATE: April 17, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate																BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage																PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular																PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break																BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																														
									RECOVERY				R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA								HYDRAULIC CONDUCTIVITY K, cm/sec								Diametral Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																									
									TOTAL CORE %	SOLID CORE %	R.O.C.	R.O.C.			R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.			R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.				R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.	R.O.C.</

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON02 DATA\GINT\LONG\_PAR\_5 CALEDON.GPJ GAL-MISS.GDT 6/13/24

DEPTH SCALE

1 : 150



LOGGED: VRP

CHECKED: GWS



PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-02C (CAL)

SHEET 1 OF 1

LOCATION: N 4852712.8 ;E 577005.9

DRILLING DATE: April 17, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate										BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage										PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular										PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break										BR - Broken Rock	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
									RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY K, cm/sec				Diameter Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
									TOTAL CORE %	SOLID CORE %			B Angle		DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION		Jr	Ja	Jn			1 0 1 0 1 0		1 0 1 0 1 0																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
0		GROUND SURFACE		401.47																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON\02 DATA\GINT\LONG\_PAR\_5 CALEDON.GPJ GAL-MISS.GDT 6/13/24



PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-03A (CAL)

SHEET 1 OF 1

LOCATION: N 4852364.4 ;E 577352.1

DRILLING DATE: April 18, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate										BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage										PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular										PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break										BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
									RECOVERY		R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA					HYDRAULIC CONDUCTIVITY K, cm/sec					Diameter Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
									TOTAL CORE %	SOLID CORE %			B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	Q	C	Q																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
0		GROUND SURFACE		397.88																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											

May 06, 2024

Bentonite

Sand

Screen

Sand

DEPTH SCALE

1 : 150



LOGGED: VRP

CHECKED: GWS

[illegible]

[illegible]

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-04A (CAL)

SHEET 1 OF 1

LOCATION: N 4852363.9 ;E 577521.0

DRILLING DATE: April 19, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate															BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage															PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular															PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break															BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
									RECOVERY					R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY K, cm/sec					Diameter Point Load Index (MPa)	RMC -Q' AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
									TOTAL CORE %	SOLID CORE %	B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION			Jr	Ja	Jn	C	O	S	I	R	M	B																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
0		GROUND SURFACE		397.68																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				</

DEPTH SCALE

1 : 150



LOGGED: VRP

CHECKED: GWS



PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-04B (CAL)

SHEET 1 OF 1

LOCATION: N 4852362.5 ;E 577522.1

DRILLING DATE: April 22, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate	BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break	BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION													
																RECOVERY		R.Q.D. %	FRACT INDEX PER 0.25 m	B Angle	DIP w.r.t CORE AXIS	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY K, cm/sec	Diametral Point Load Index (MPa)	RMC -Q' AVG.
																TOTAL CORE %	SOLID CORE %					Type and Surface Description	Jr	Ja	Jn			
																80 60 40 20 0	80 60 40 20 0											
0		GROUND SURFACE		397.69																								
	Sonic	(ML) SANDY SILT, some clay; dark brown, organic matter, no odors, no staining, cohesive, w<PL (TOPSOIL)		0.00 0.30																								
2		(CL) SILTY CLAY, trace gravel; rounded, brown, grey gravel, no odor, no staining, cohesive, w~PL		395.86 1.83																								
		(SM/GP) SILTY SAND and GRAVEL; some cobbles, rounded, brown, grey gravel, no odors, no staining, non-cohesive, dry		394.64 3.05																								
4		(SM) SILTY SAND; brown, no odors, no staining, non-cohesive, moist		393.42 4.27																								
		(ML) SANDY SILT; brown, no odors, no staining, cohesive, w~PL		392.51 5.18																								
6		(GM) sandy SILTY GRAVEL; sub-rounded to sub-angular, reddish brown, grey gravel, non-cohesive, wet, gravel % increases with depth		5.49																								
		DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION)																										
8		-highly weathered, gravel and cobble sized pieces of dolostone, beige to grey, coral features from 6.71 to 8.38 m		388.55																								
10		BOTTOM OF HOLE		9.14																								
12																												
14																												
16																												
18																												
20																												
22																												
24																												
26																												
28																												
30																												

Bentonite

Sand

Screen

Natural Backfil

May 06, 2024

Bentonite

Sand

Screen

Natural Backfill

May 06, 2024

DEPTH SCALE

1 : 150



LOGGED: VRP

CHECKED: GWS

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-05A (CAL)

SHEET 1 OF 1

LOCATION: N 4852195.3 ;E 577613.7

DRILLING DATE: April 22, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate																BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage																PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular																PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break																BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
									RECOVERY				R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA								HYDRAULIC CONDUCTIVITY K, cm/sec				Diameter Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
									TOTAL CORE %	SOLID CORE %	B Angle	DIP w/L CORE AXIS			TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	O	T	P	C	C																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
0		GROUND SURFACE		399.30																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

Bentonite

May 06, 2024

Sand

Screen

Sand

DEPTH SCALE

1 : 150



LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-05B (CAL)

SHEET 1 OF 1

LOCATION: N 4852196.9 ;E 577612.3

DRILLING DATE: April 23, 2024

DATUM: Geodetic

INCLINATION: -90°      AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break BR - Broken Rock																NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
									RECOVERY				R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA						HYDRAULIC CONDUCTIVITY K, cm/sec						Diameter Point Load Index (MPa)	RMC -Q' AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
									TOTAL CORE %	SOLID CORE %	B Angle	DIP w/L CORE AXIS			TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	O	T	P																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
0		GROUND SURFACE		399.23																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

Bentonite

May 06, 2024

Sand

Screen

Sand

DEPTH SCALE

1 : 150



LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-05C (CAL)

SHEET 1 OF 1

LOCATION: N 4852198.7 ;E 577610.6


DRILLING DATE: April 23, 2024

DATUM: Geodetic

INCLINATION: -90°      AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate	BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage	PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular	PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break	BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																
																RECOVERY		R.Q.D. %	FRACT INDEX PER 0.25 m	DISCONTINUITY DATA				HYDRAULIC CONDUCTIVITY K, cm/sec				Diametral Point Load Index (MPa)	RMC -Q' AVG.		
																TOTAL CORE %	SOLID CORE %			B Angle	DIP w/L CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	O			O	O
																80 60 40 20	80 60 40 20														
0		GROUND SURFACE		399.18																											
	Sonic	(SM) SILTY SAND, some clay; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL)		0.00																											
				398.57																											
					0.61																										
2		(SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry																													
4																															
6		(SM) SILTY SAND; reddish brown to brown, no odors, no staining, non-cohesive, wet		394.00																											
				5.18																											
8		BOTTOM OF HOLE		391.56																											
				7.62																											
10																															
12																															
14																															
16																															
18																															
20																															
22																															
24																															
26																															
28																															
30																															

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON\GPJ GAL-MISS.GDT 6/13/24



PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-06A (CAL)

SHEET 1 OF 1

LOCATION: N 4852427.6 ;E 578067.9

DRILLING DATE: April 24, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate															BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage															PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular															PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break															BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
									RECOVERY					R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA										HYDRAULIC CONDUCTIVITY K, cm/sec					Diameter Point Load Index (MPa)	RMC -Q AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
									TOTAL CORE %	SOLID CORE %	R.O.D. %	B Angle	DIP w/L CORE AXIS			TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	Q	C	Q	C																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
0		GROUND SURFACE		398.67																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									</

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON\GPJ GAL-MISS.GDT 6/13/24





PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-06B (CAL)

SHEET 1 OF 1

LOCATION: N 4852429.0 ;E 578069.2

DRILLING DATE: April 25, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate										BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage										PL - Planar CU- Curved UN- Undulating ST - Stepped IR - Irregular										PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break										BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
									RECOVERY		R.Q.D. %	FRACT INDEX PER 0.25 m	DISCONTINUITY DATA					HYDRAULIC CONDUCTIVITY K, cm/sec					Diameter Point Load Index (MPa)	RMC -Q' AVG.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
									TOTAL CORE %	SOLID CORE %			B Angle	DIP W/L CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	O	C	C																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
																									80 60 40 20 0	80 60 40 20 0	0 180 270	0 90 45 315																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
0		GROUND SURFACE		398.62																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									

Bentonite

Sand

Screen

Sand

May 06, 2024

DEPTH SCALE

1 : 150



LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

RECORD OF DRILLHOLE: MW-IT-07A (CAL)

SHEET 1 OF 1

LOCATION: N 4852207.9 ;E 577897.1

DRILLING DATE: April 26, 2024

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR - Shear VN - Vein CJ - Conjugate BD - Bedding FO - Foliation CO - Contact OR - Orthogonal CL - Cleavage PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular PO - Polished K - Slickensided SM - Smooth Ro - Rough MB - Mechanical Break BR - Broken Rock															NOTES WATER LEVELS INSTRUMENTATION	
									RECOVERY			R.Q.D. %	FRACT. INDEX PER 0.25 m	DISCONTINUITY DATA					HYDRAULIC CONDUCTIVITY K, cm/sec			Diameter Point Load Index (MPa)	RMC -Q AVG.		
									TOTAL CORE %	SOLID CORE %	B Angle			DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jn	C	O	C				O
									0.00 0.0																

Bentonite

May 06, 2024

Sand

Screen

Sand

Bentonite

Natural Backfill

DEPTH SCALE

1 : 150



LOGGED: RN

CHECKED: GWS

PROJECT: 19129150

LOCATION: N 4852209.1 ;E 577898.0

INCLINATION: -90°      AZIMUTH: ---

RECORD OF DRILLHOLE:    MW-IT-07B (CAL)

SHEET 1 OF 1

DRILLING DATE: April 29, 2024

DRILL RIG: Sonic

DRILLING CONTRACTOR: Choice Sonic Drilling

DATUM: Geodetic

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	PENETRATION RATE min/(m)	FLUSH	COLOUR % RETURN	JN - Joint FLT - Fault SHR- Shear VN - Vein CJ - Conjugate	BD- Bedding FO- Foliation CO- Contact OR- Orthogonal CL - Cleavage	PL - Planar CU - Curved UN - Undulating ST - Stepped IR - Irregular	PO- Polished K - Slickensided SM- Smooth Ro - Rough MB- Mechanical Break	BR - Broken Rock	NOTE: For additional abbreviations refer to list of abbreviations & symbols.	NOTES WATER LEVELS INSTRUMENTATION																
																RECOVERY			DISCONTINUITY DATA			HYDRAULIC CONDUCTIVITY			Diameter Point Load Index (MPa)	RMC -Q AVG.					
																TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACT. INDEX PER 0.25 m	B Angle	DIP w.r.t CORE AXIS	TYPE AND SURFACE DESCRIPTION	Jr	Ja			Jn	K, cm/sec	C	T	P
																0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00			0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00	0.00 0.25 0.50 0.75 1.00
0		GROUND SURFACE		400.19																											
		(ML) CLAYEY SILT, some sand; dark brown, organic matter, no odors, no staining, non-cohesive, moist (TOPSOIL)		0.00 399.58 0.61																											
2		(SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry		397.75																											
		(GP/SP) GRAVEL and SAND; some silt and cobbles, brown, grey gravel, no odors, no staining, non-cohesive, moist		2.44																											
4																															
6																															
8		-wet																													
		(SM/GP) SILTY SAND and GRAVEL; some cobbles, brown, grey gravel, no odors, no staining, non-cohesive, dry		391.66 8.53																											
		(CL) CLAY, trace silt, brown, no odors, no staining, cohesive, w~PL		390.59																											
10		DOLOSTONE, highly weathered to fresh, bedded dolostone, beige to grey (GASPORT FORMATION)		9.75																											
12																															
				387.24 12.95																											
14		BOTTOM OF HOLE																													
16																															
18																															
20																															
22																															
24																															
26																															
28																															
30																															

GTA-RCK 004 S:\CLIENTS\VOTORANTIM\_CIMENTOS\LONG\_PAR\_5 CALEDON\GPJ GAL-MISS.GDT 6/13/24



SHEET 1 OF 1

DATUM: Geodetic

DRILLING CONTRACTOR: Choice Sonic Drilling

STA-RCK 004 S:\CLIENTS\VOTORANTIM CIMENTOS\LONG PAR 5 CALEDON\02 DATA\GINT\LONG PAR 5 CALEDON.GPJ GAL-MISS.GDT 6/13/24

CHECKED: GWS

---

**APPENDIX B**

**Core Photographs**





























19129150  
CBM Caledon  
MW-IT-01  
Run 9 (76-87')

04/15/24

















04/16/24  
19129150  
CBM Caledon  
MW-IT-02  
Run 6 (49-855')

















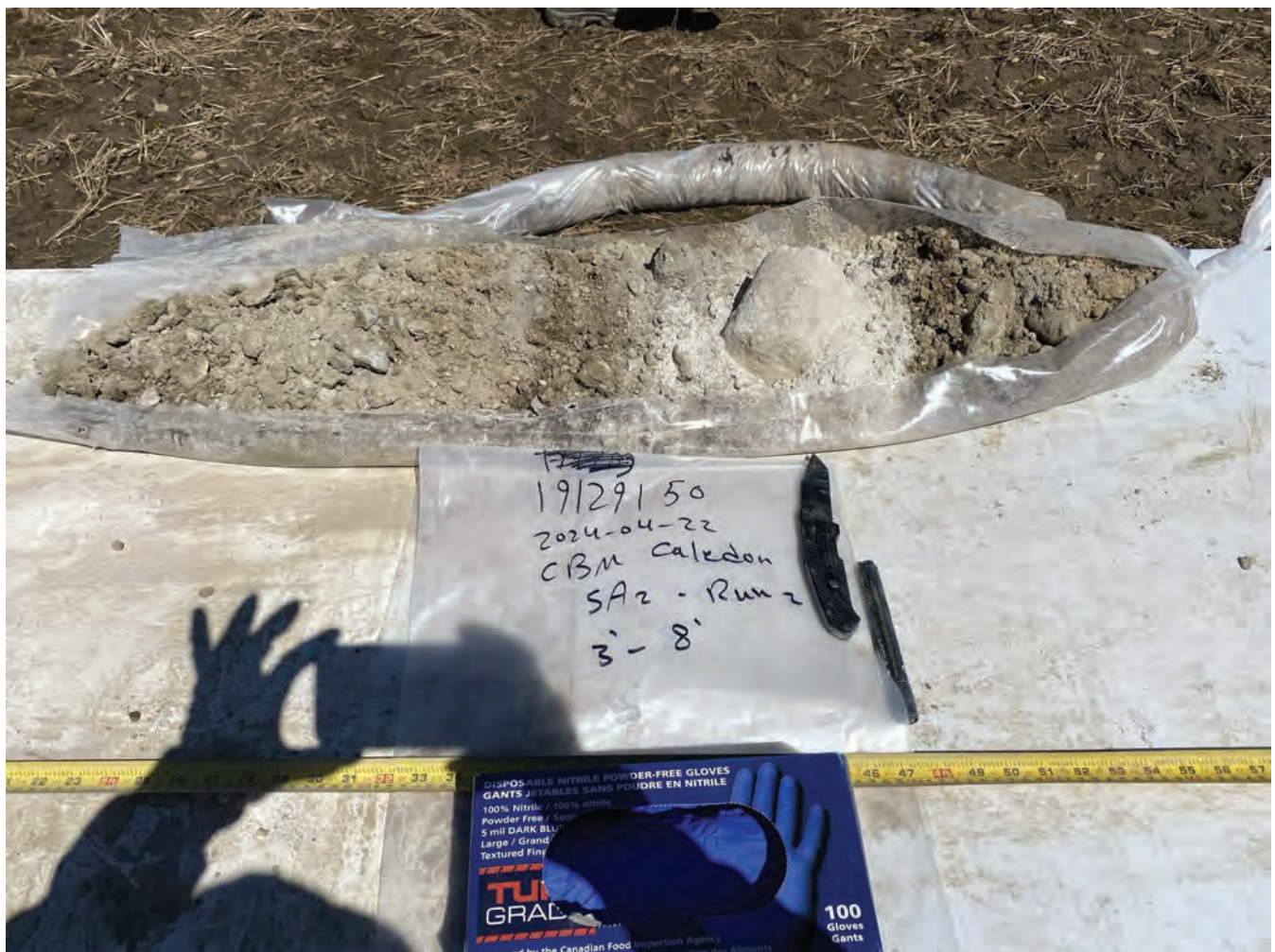












































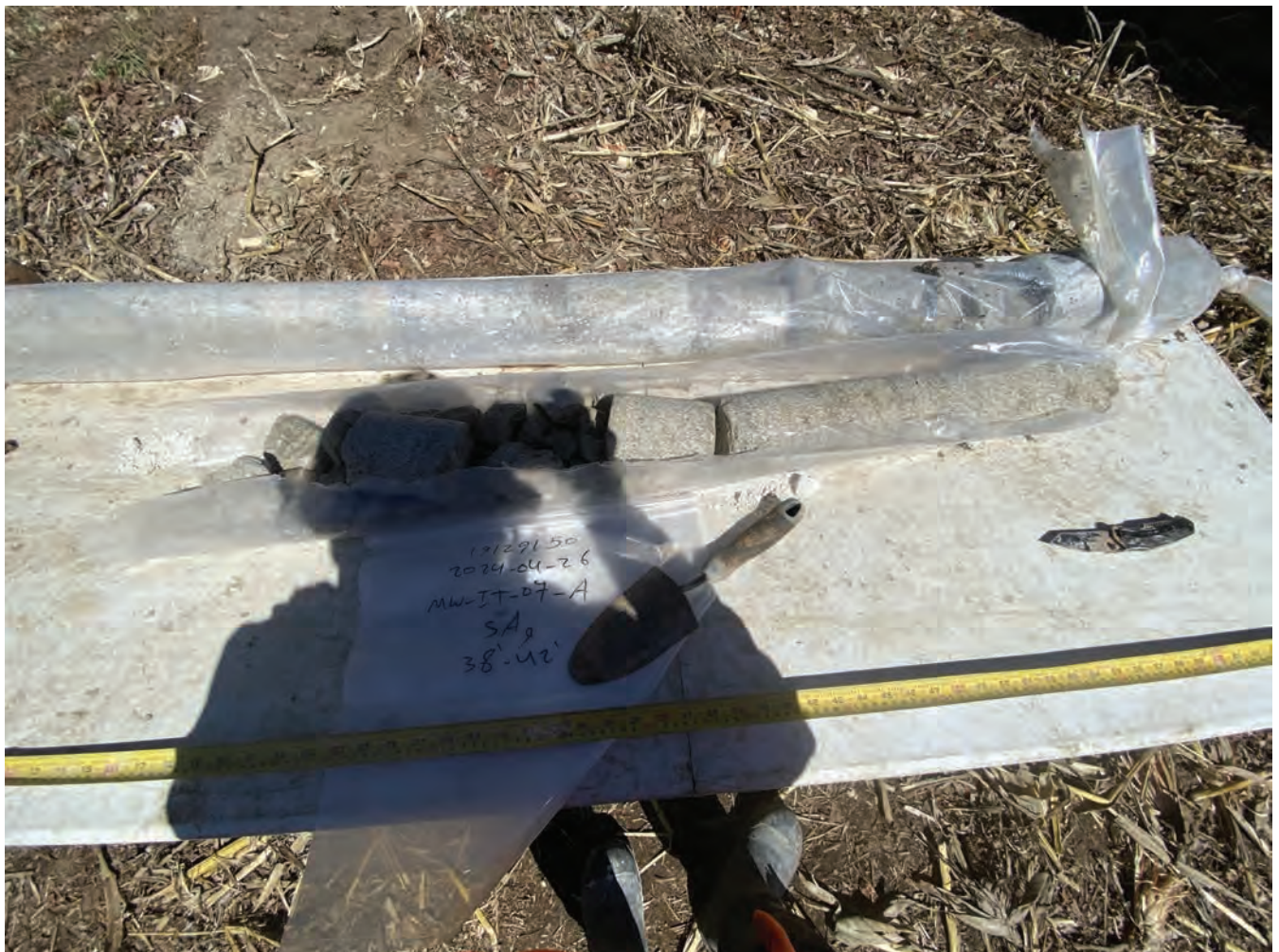


















---

**APPENDIX C**

**Grainsize Test Results**

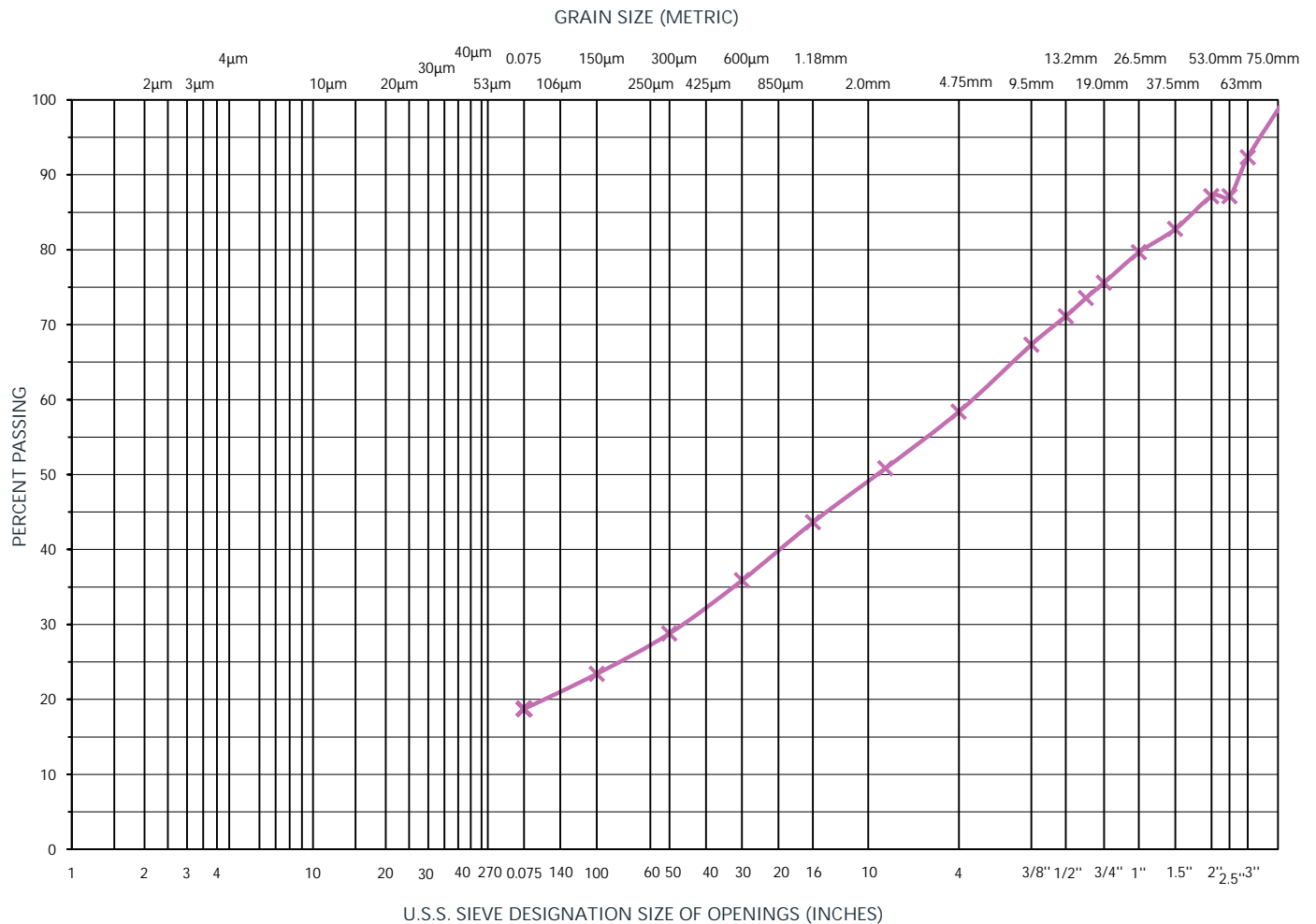




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-01A	SA7	3.81-5.33	42	39	19

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-01A SA7

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

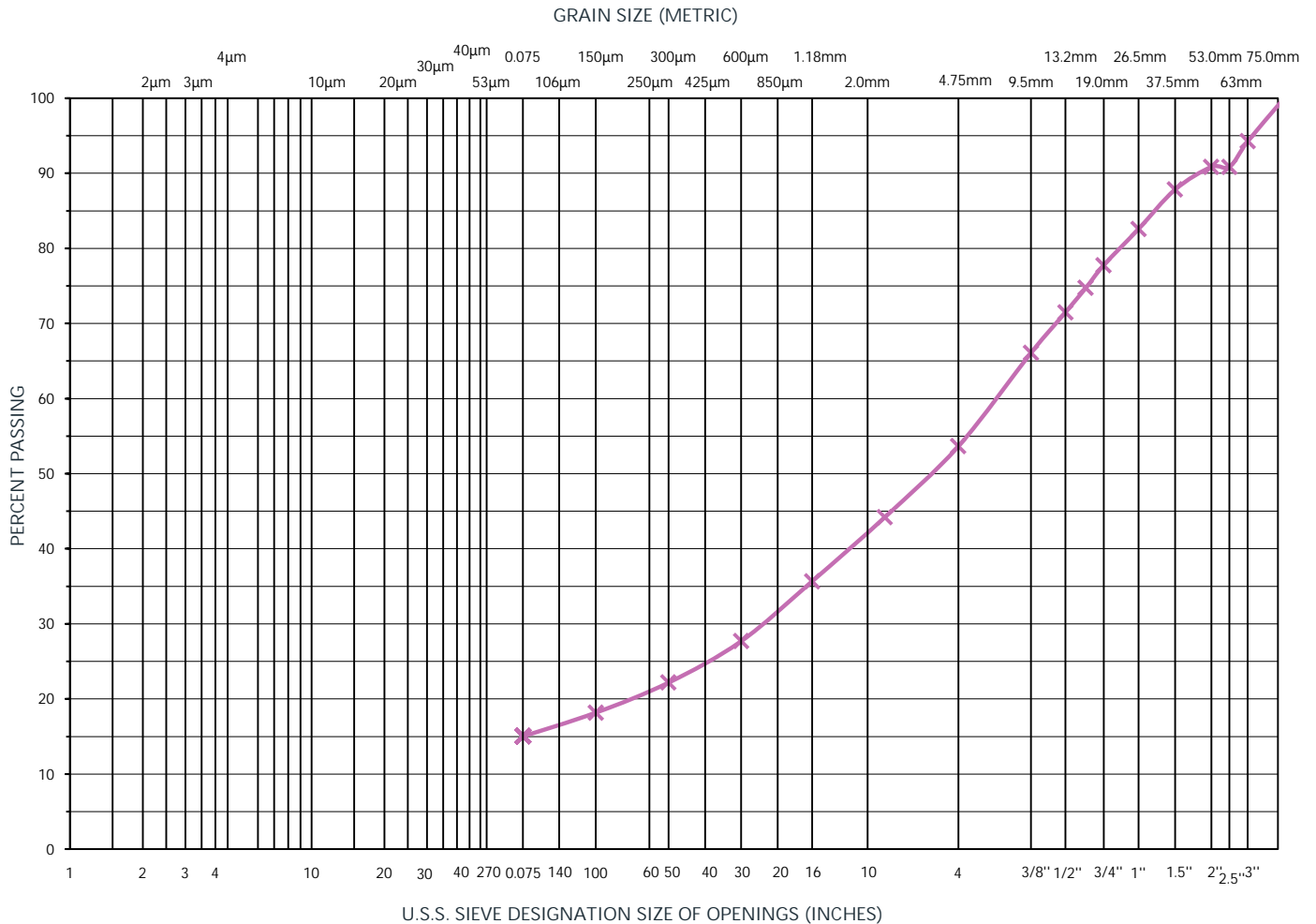
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-01A	SA9	6.71-7.92	46	39	15

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-01A SA9

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

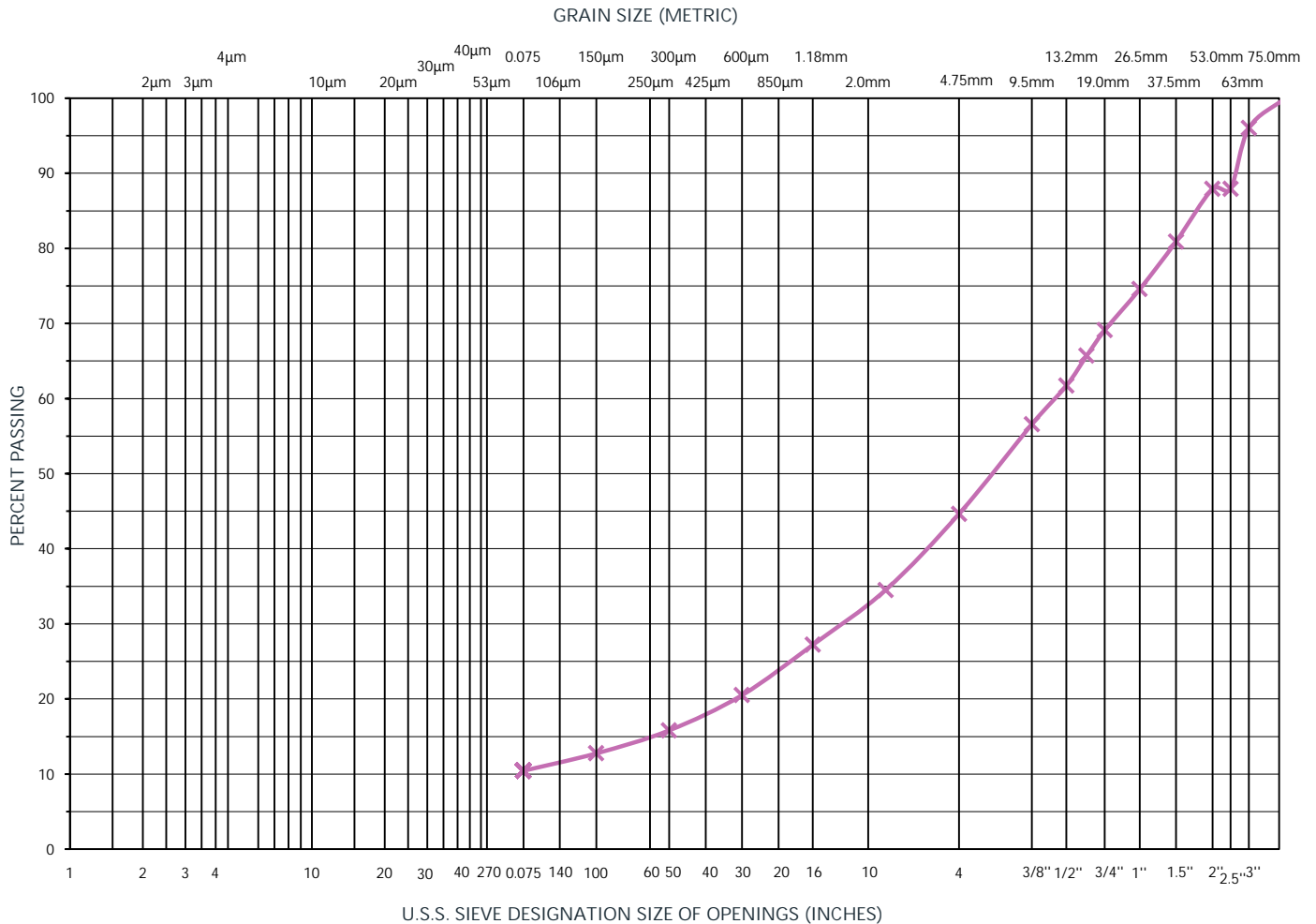
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-01A	SA12	9.75-10.97	55	35	10

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-01A SA12

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

Report Date: Apr 20, 2024

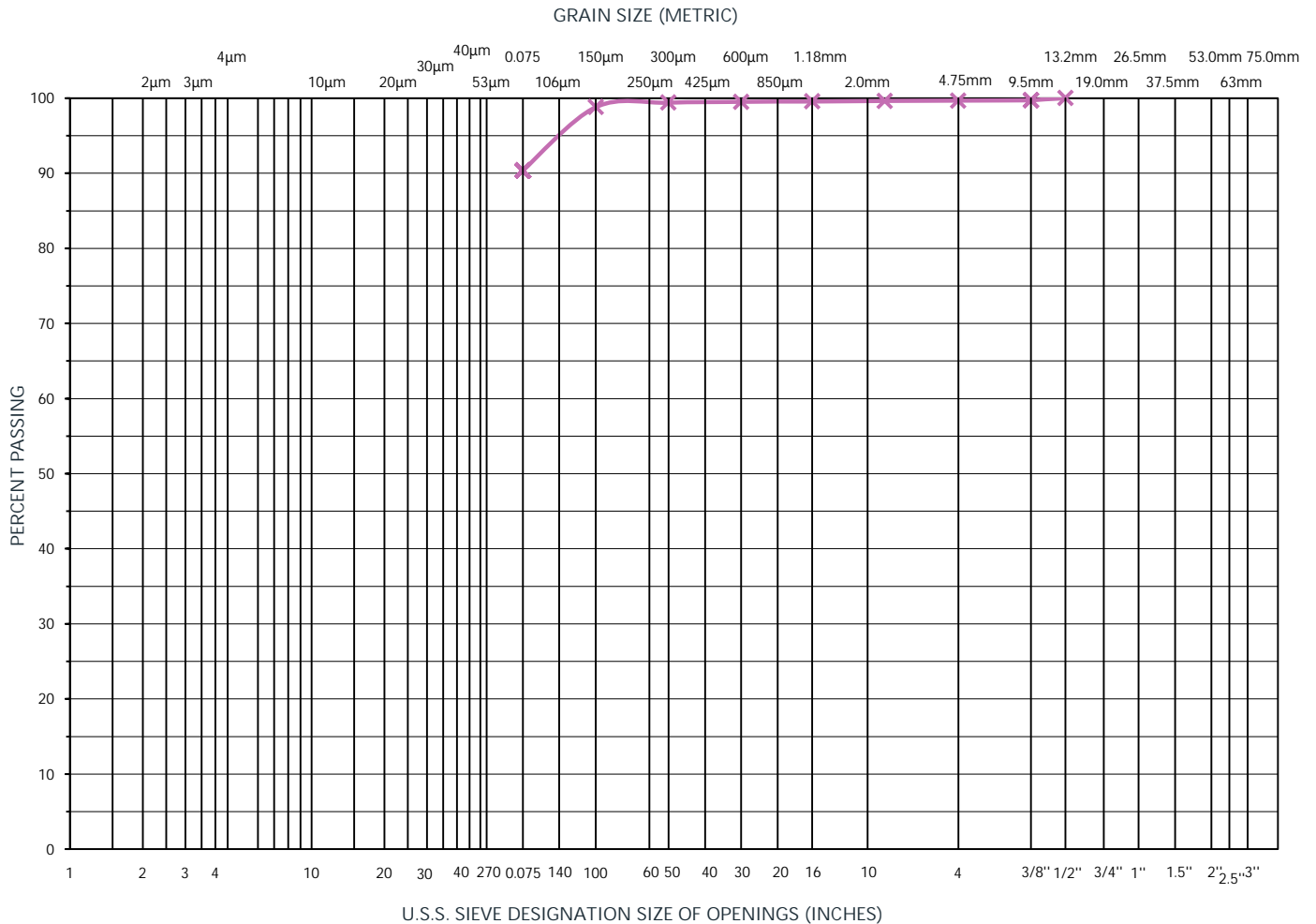




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-01A	SA13	11.58-13.11	0	10	90

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-01A SA13

Project No.: CA-GLD-19129150

Date Rec'd: Apr 2, 2024 Tested By: D. Dion

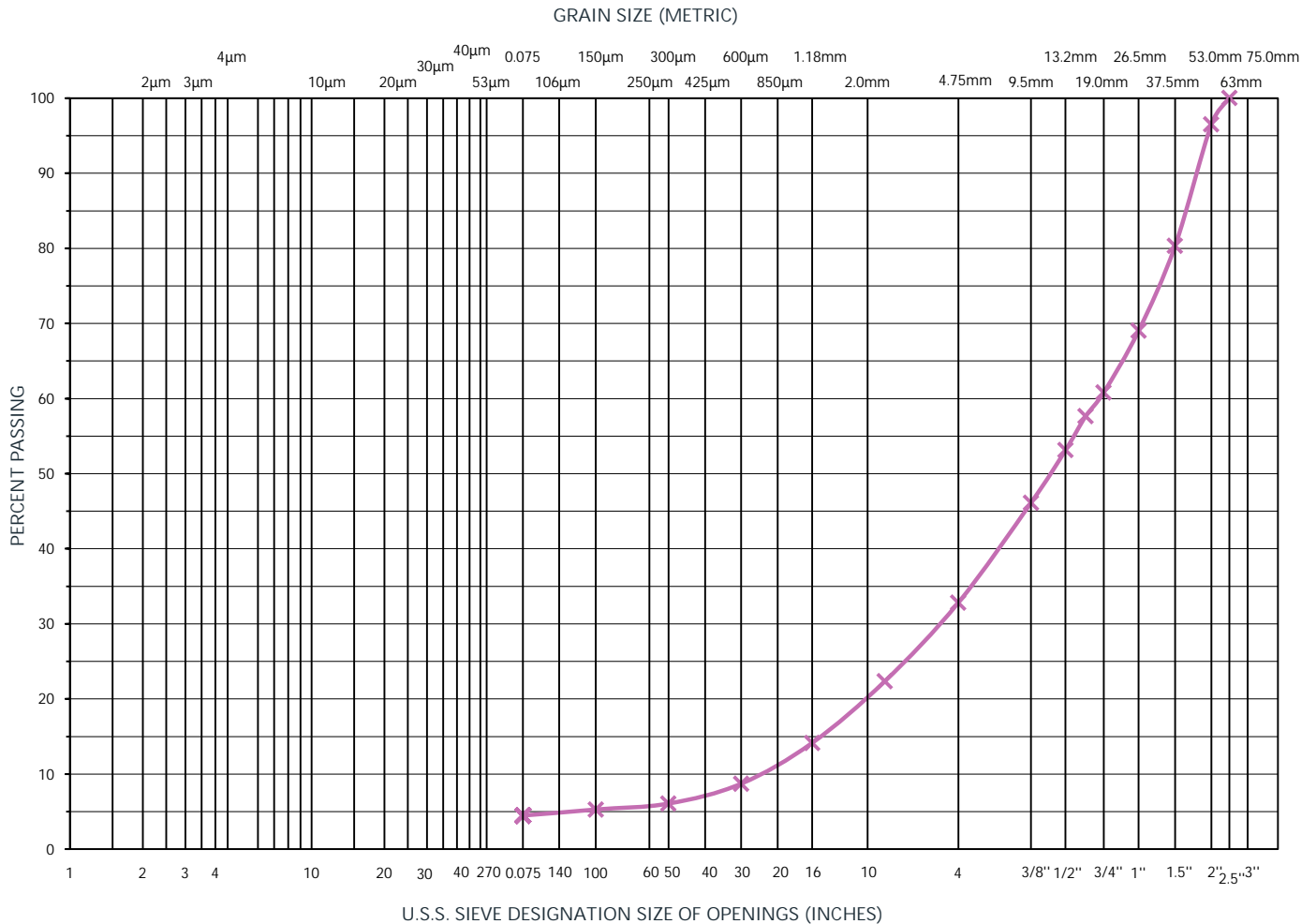
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	W-IT-01A	SA17	15.7-17.07	67	28	5

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-01A SA17

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

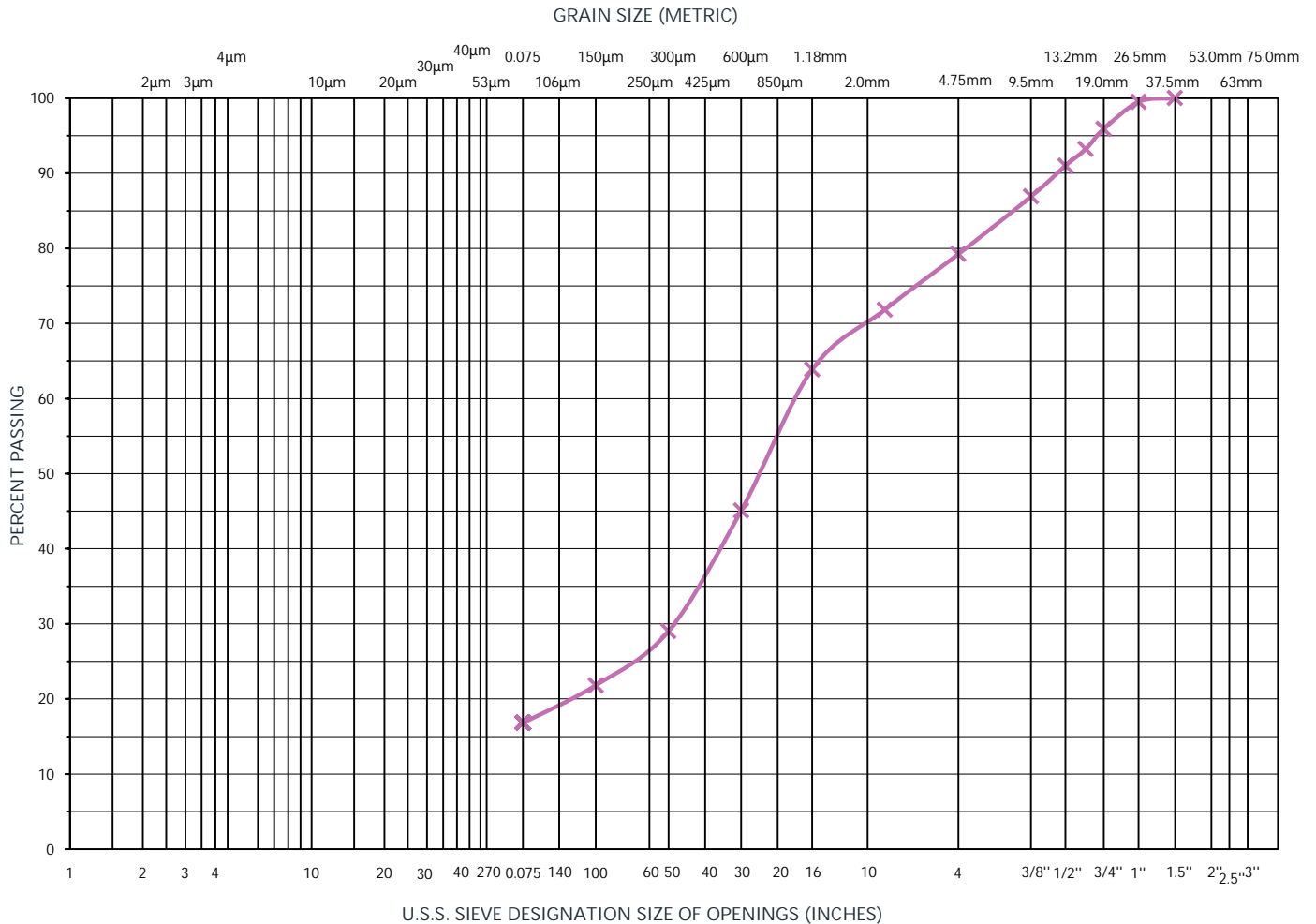
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-02A	SA3	1.07-2.44	21	62	17

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-02A SA3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

Report Date: Apr 20, 2024

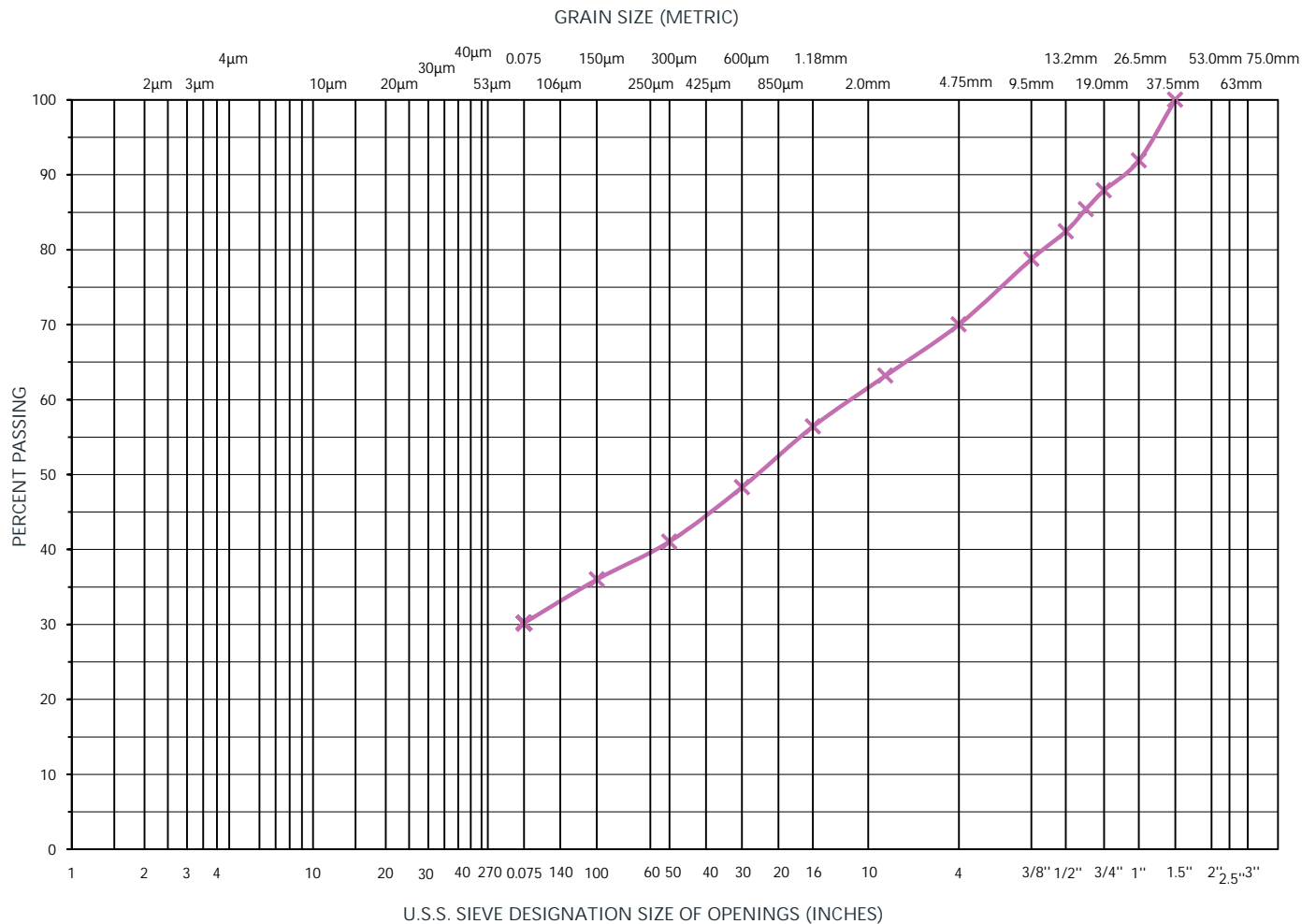




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-02A	SA5	3.05-3.51	30	40	30

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-02A SA5

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

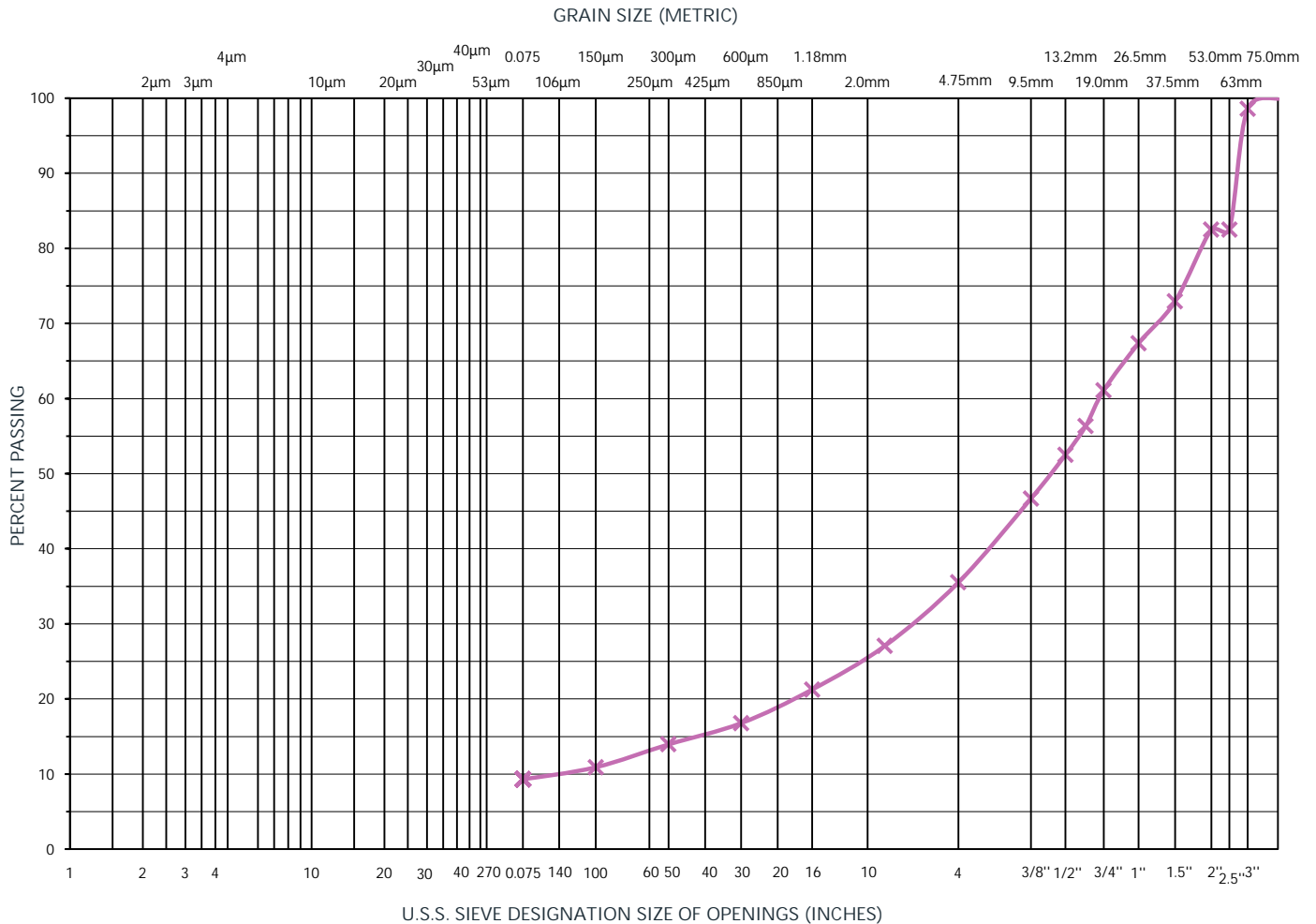
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	W-IT-02A	SA6	3.51-4.27	64	27	9

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-02A SA6

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

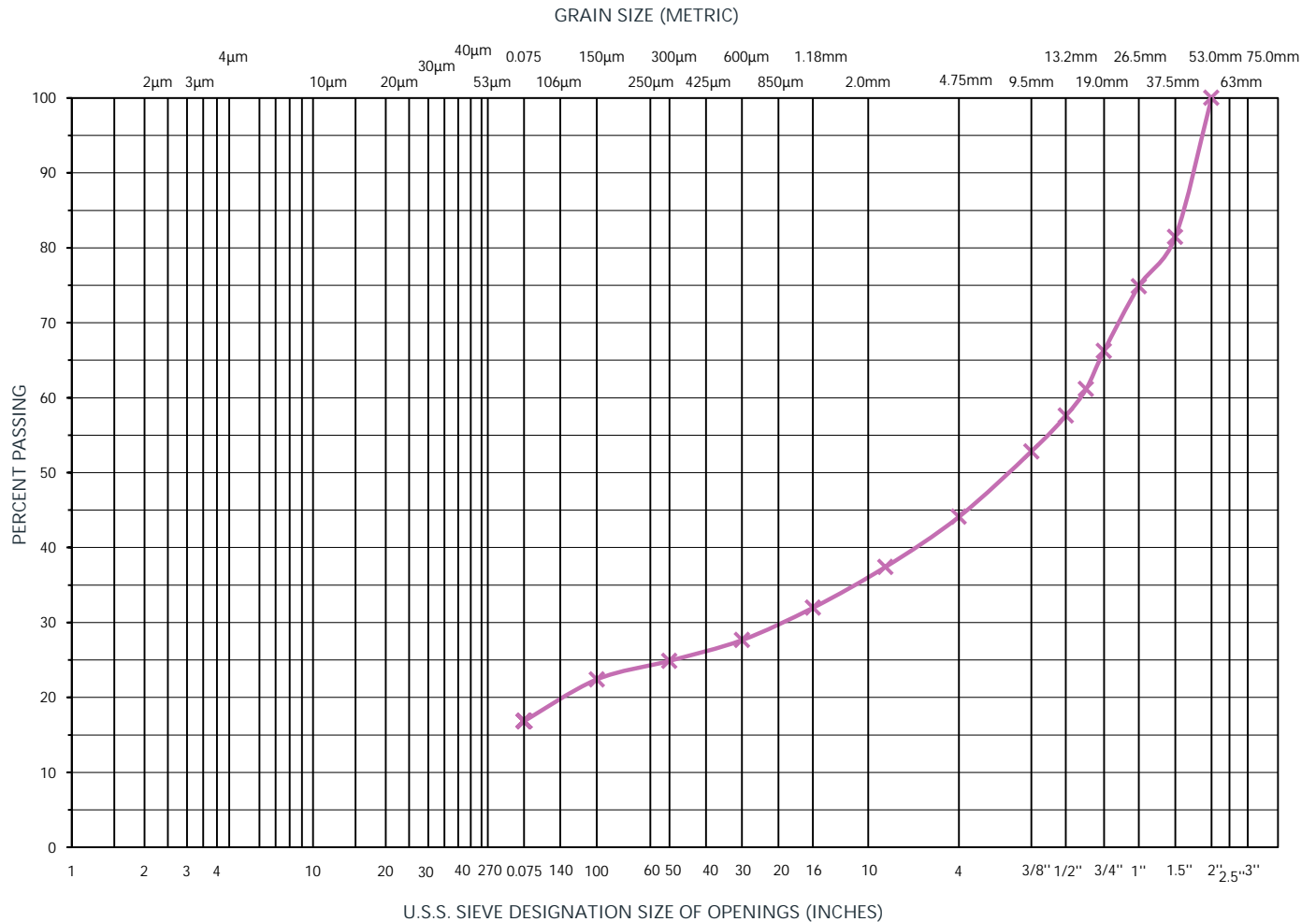
Report Date: Apr 20, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-02A	SA7	4.42-5.49	56	27	17

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-02A SA7

Project No.: CA-GLD-19129150

Date Rec'd: Apr 16, 2024 Tested By: D. Dion

Report Date: Apr 20, 2024

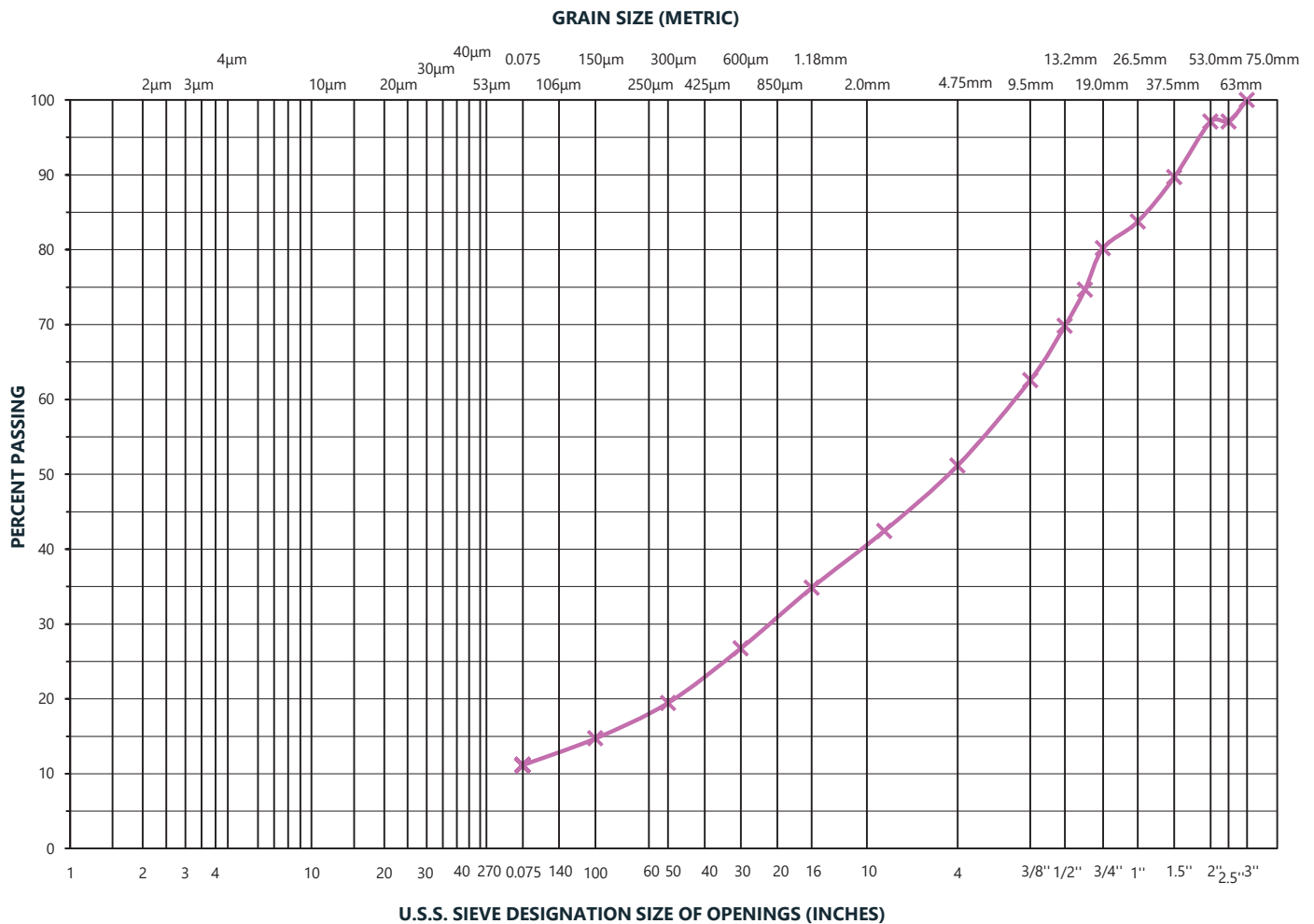




## GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



### LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-03	SA3 RUN 1		49	40	11

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

#### GRAIN SIZE DISTRIBUTION

#### MW-IT-03 SA3 RUN 1

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

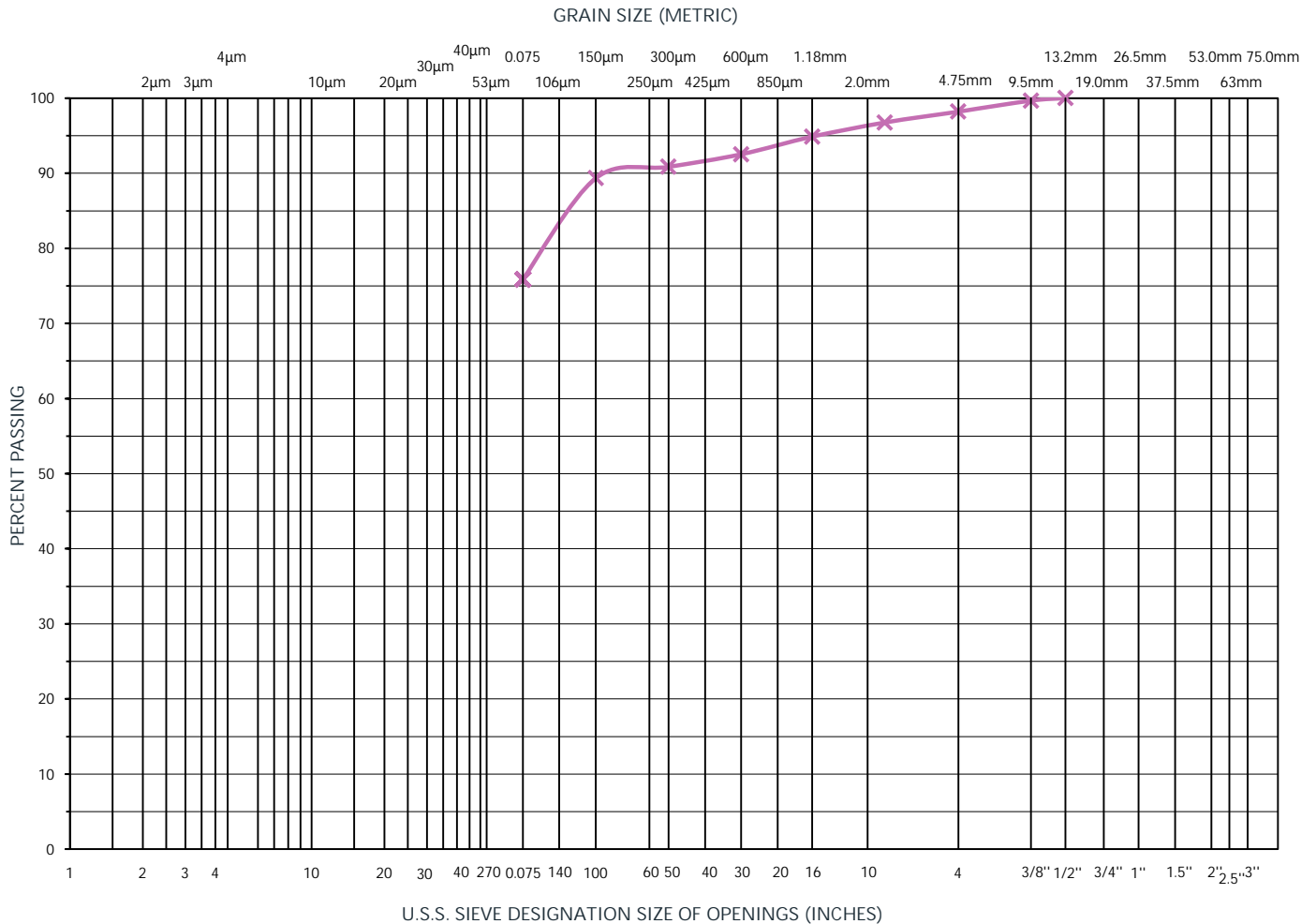
Report Date: May 16, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-03	SA4 RUN 2		2	22	76

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-03 SA4 RUN 2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

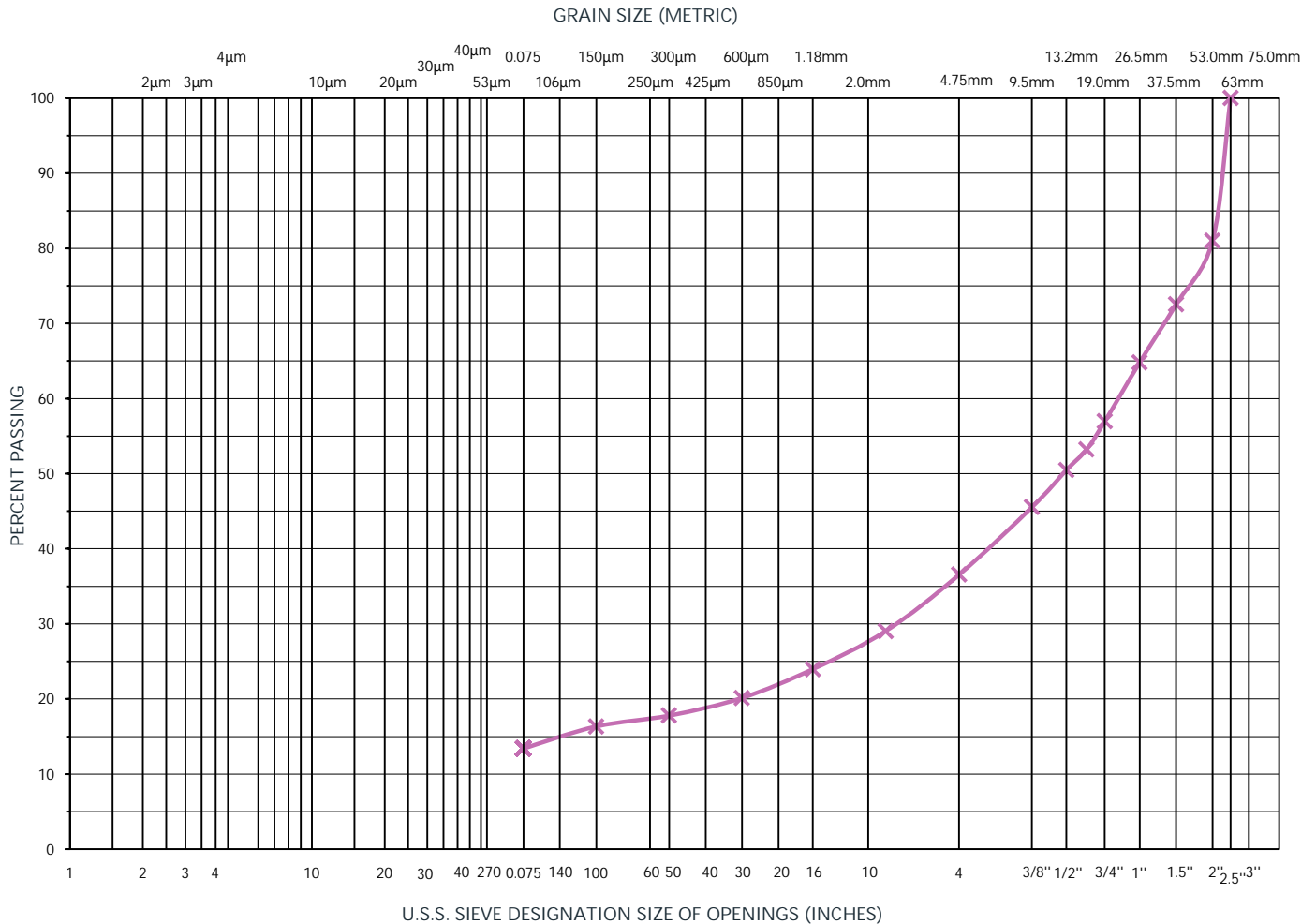
Report Date:



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-03	SA7 RUN 2		63	24	13

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-03 SA7 RUN 2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

Report Date:

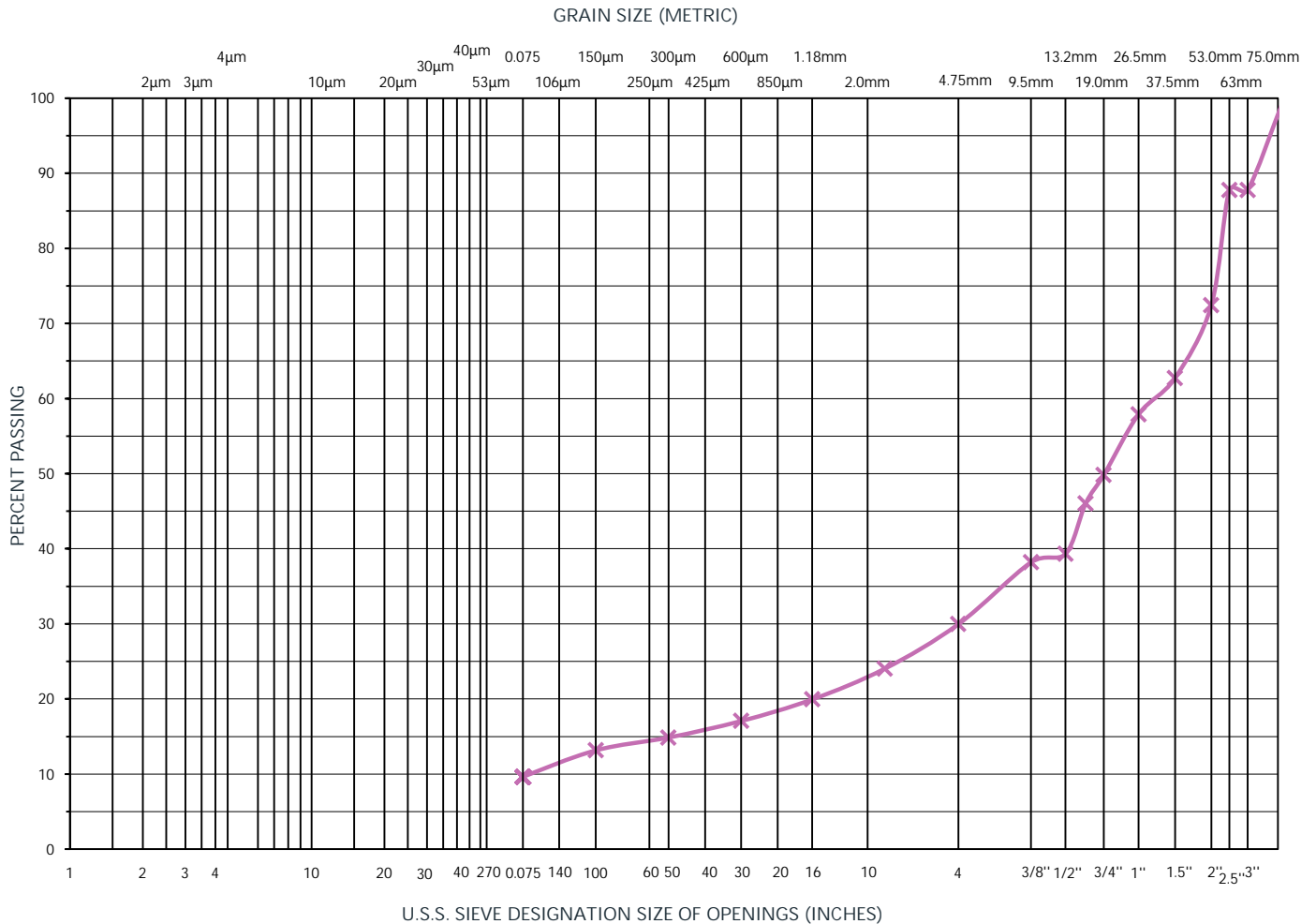




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-03	SA9 RUN 3		70	20	10

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-03 SA9 RUN 3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

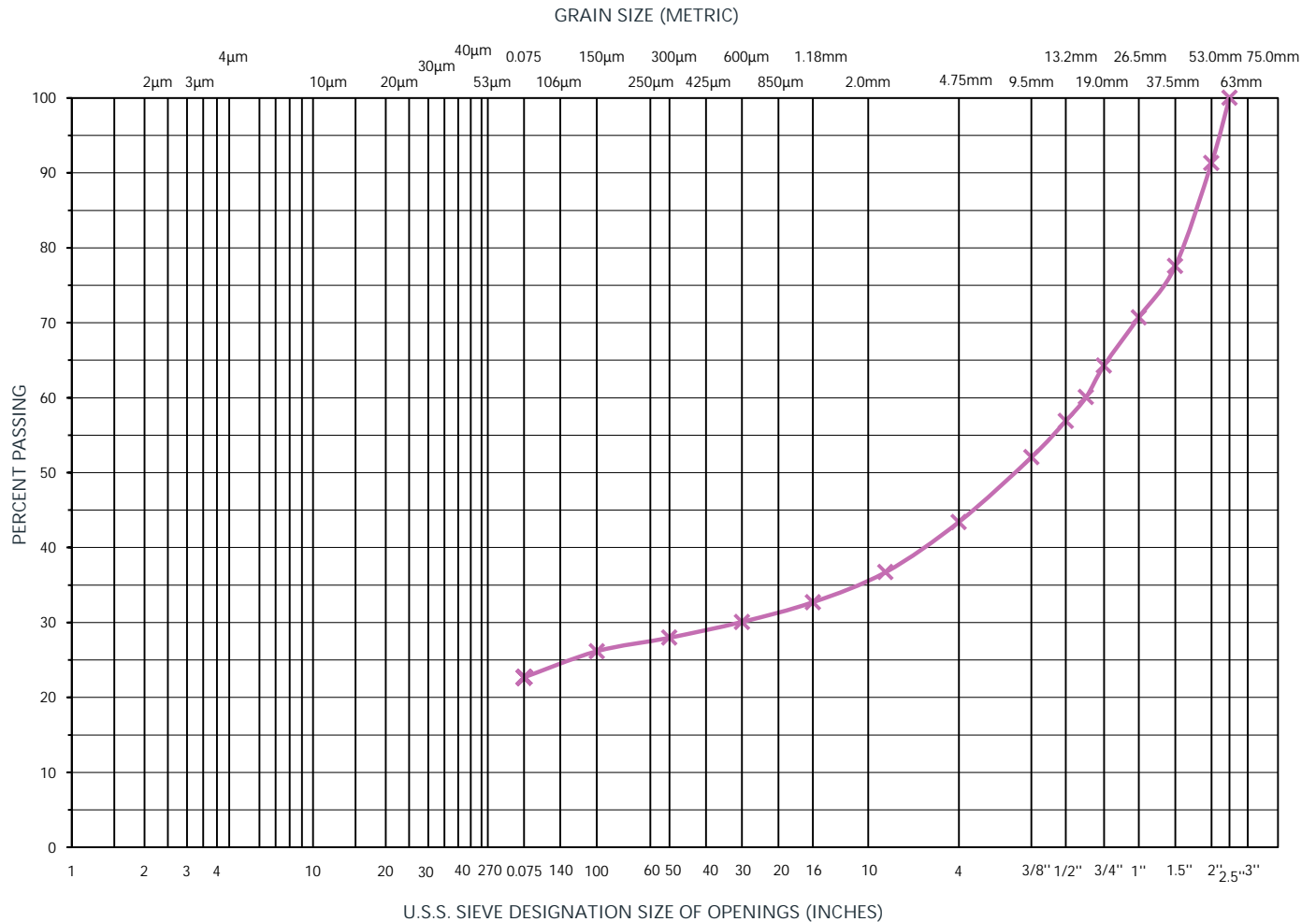
Report Date:



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-03	SA10 RUN 4		57	20	23

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-03 SA10 RUN 4

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

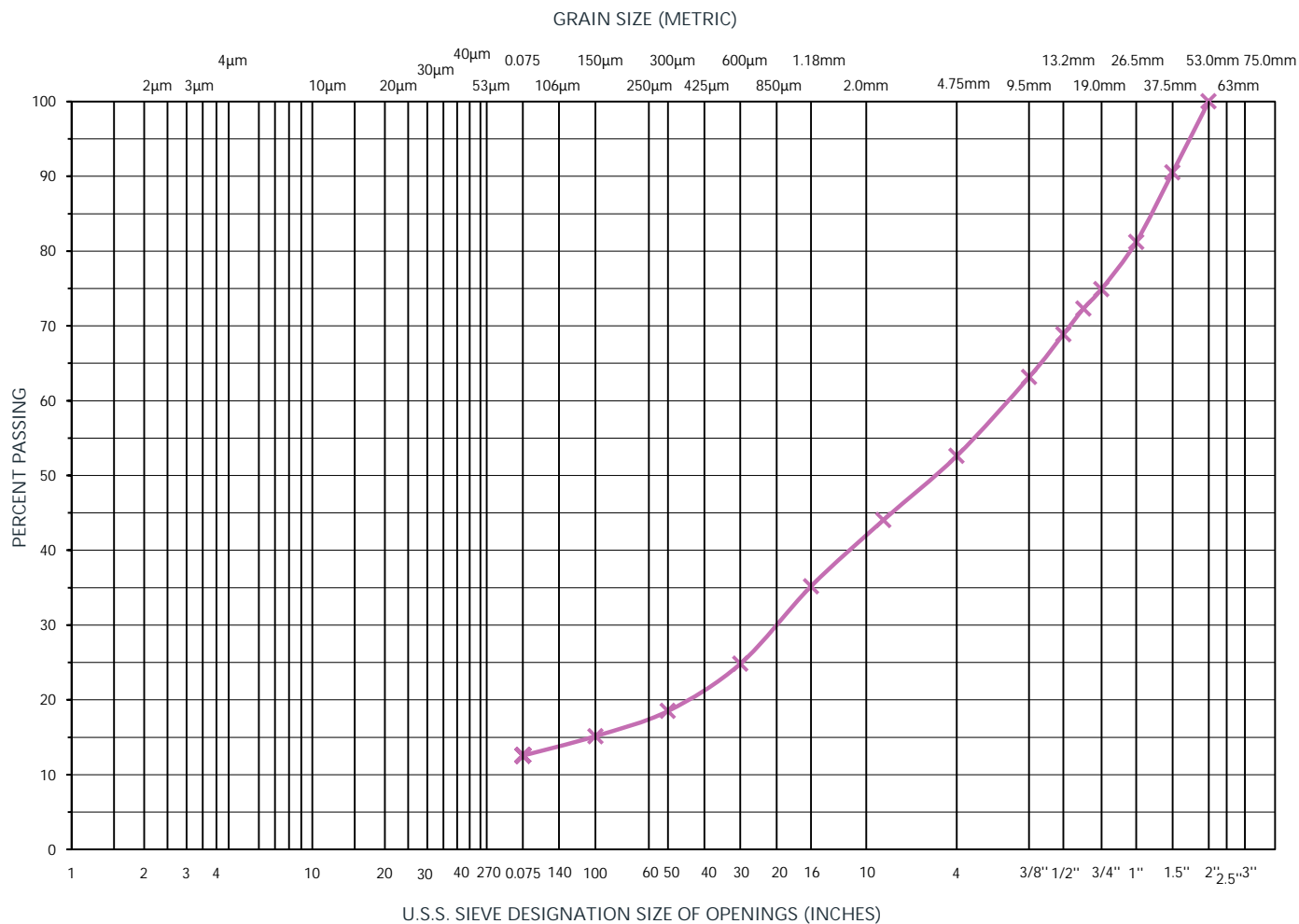
Report Date:



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-04	SA2 RUN 1		47	40	13

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-04 SA2 RUN 1

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

Report Date:

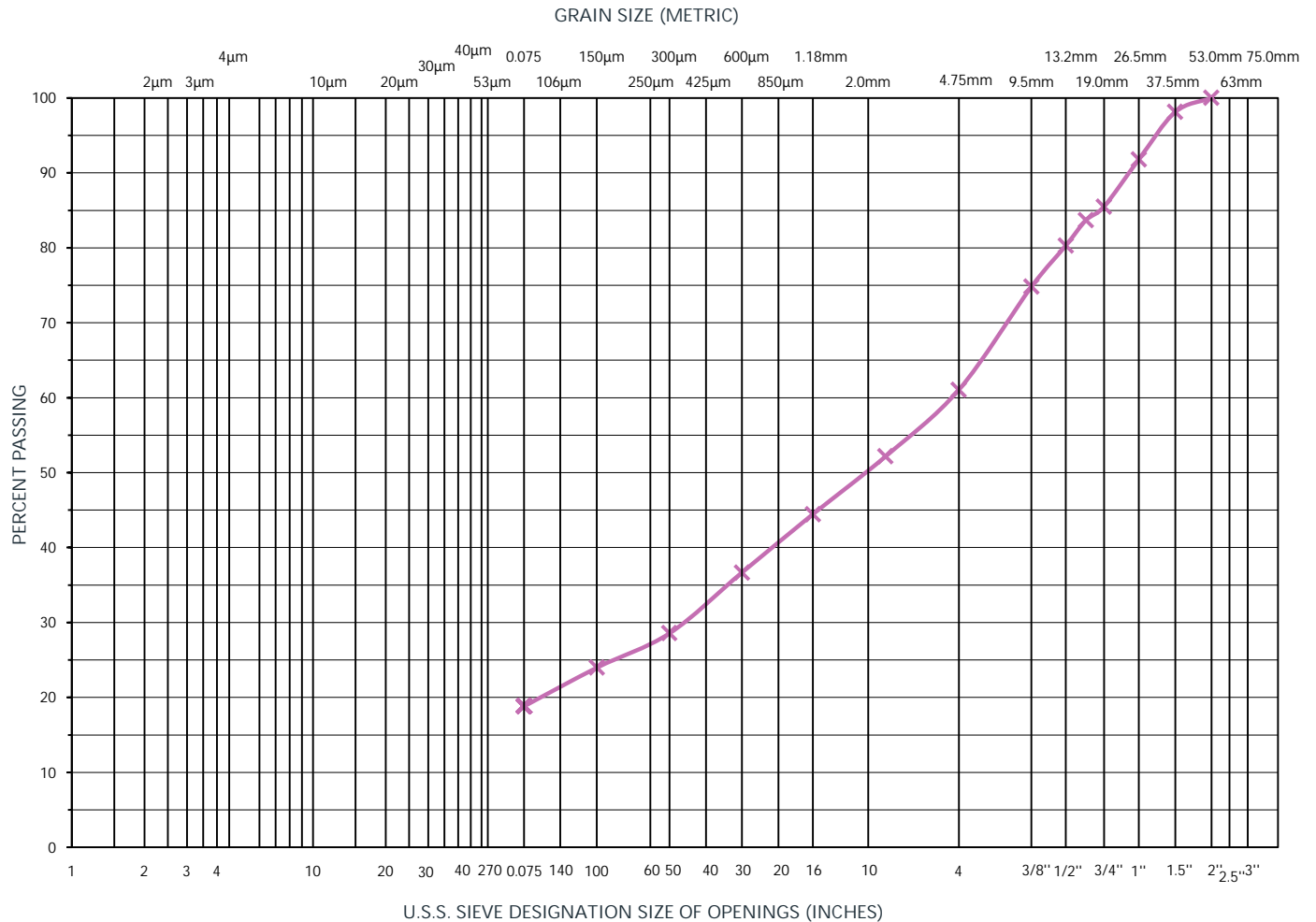




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-04	SA4 RUN 2		59	22	19

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-04 SA4 RUN 2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 2, 2024 Tested By: D. Dion

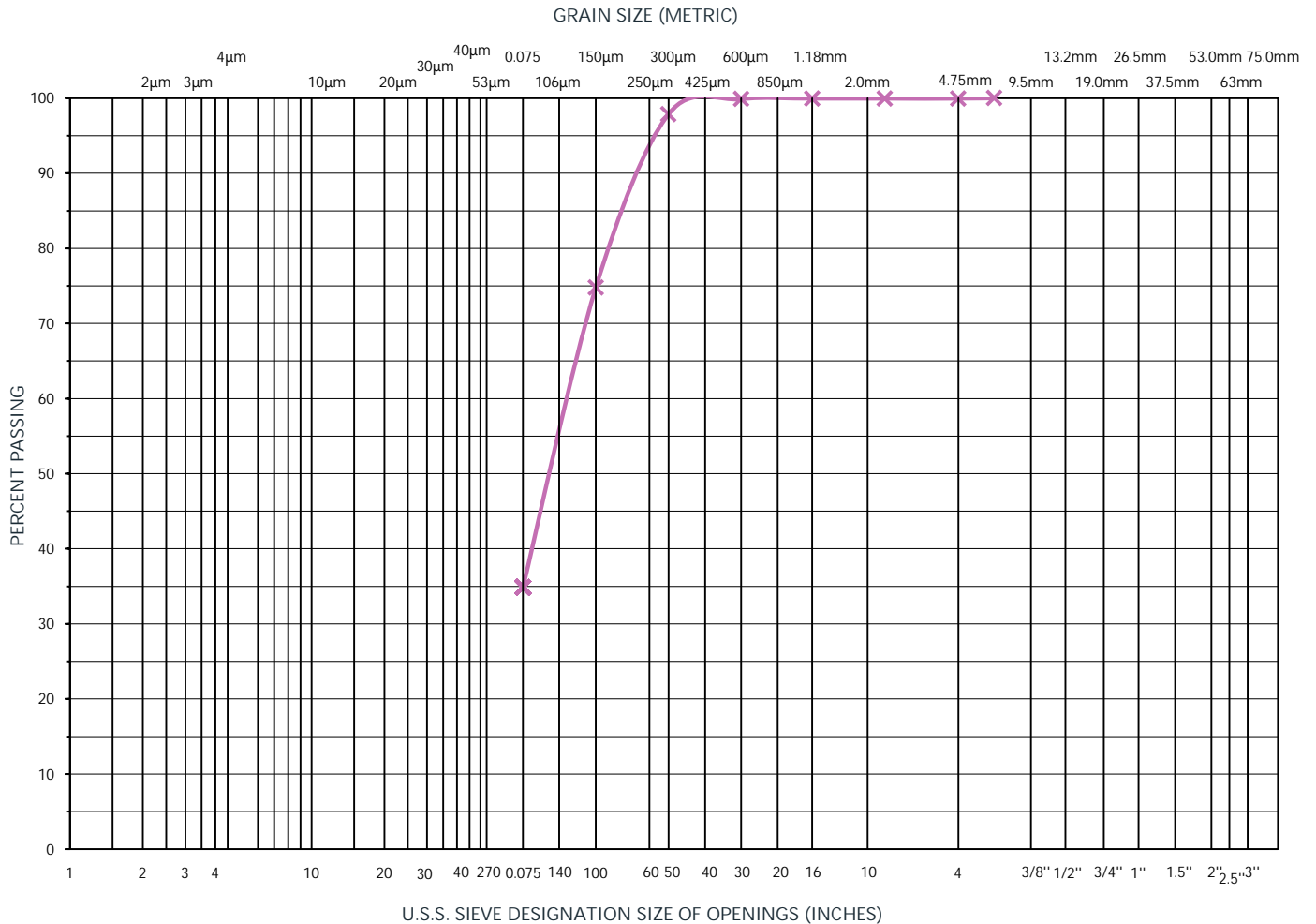
Report Date: May 16, 2024



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-04	SA6 RUN 2		0	65	35

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-04 SA6 RUN 2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

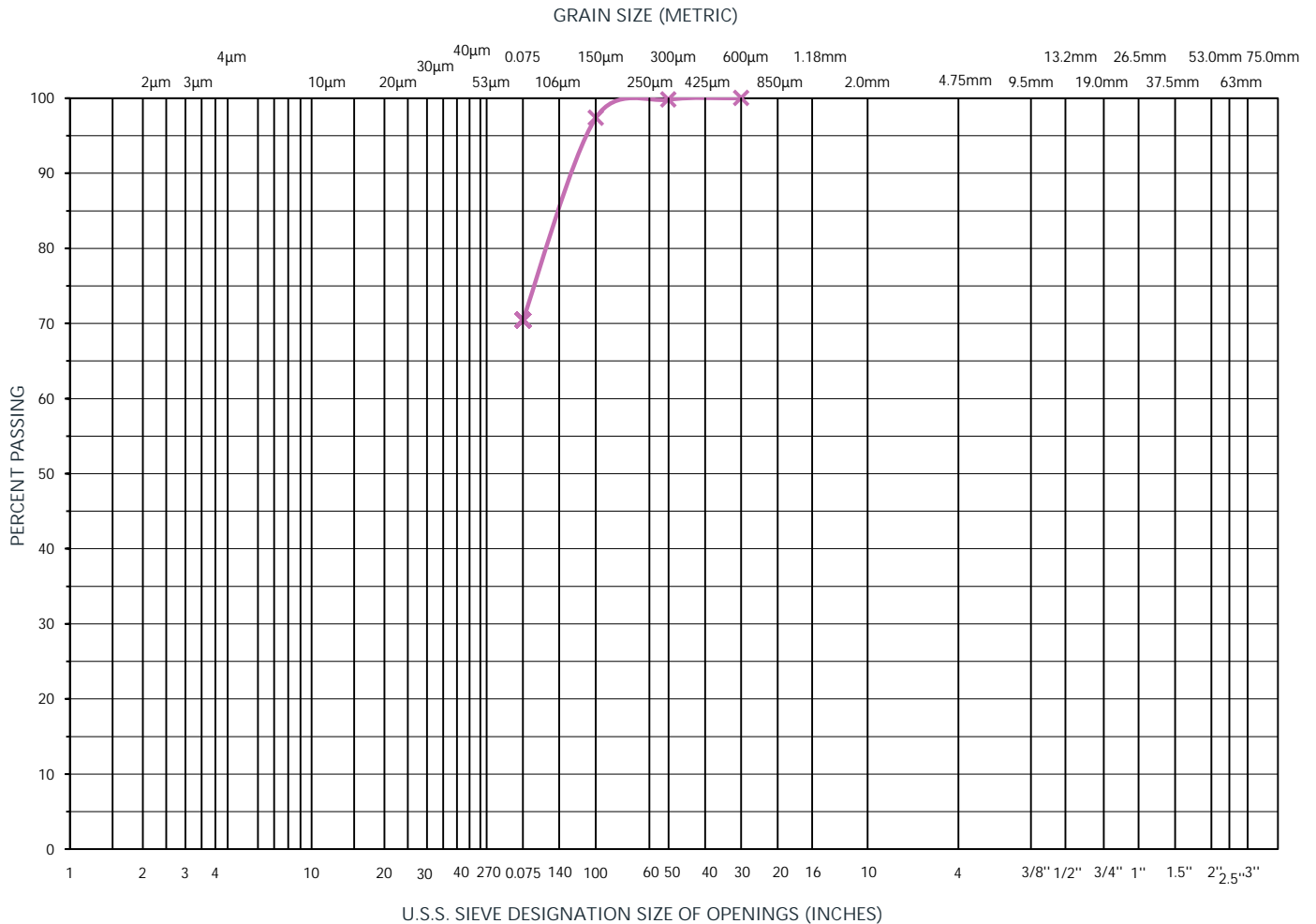
Report Date:



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-04	SA7 RUN 2		0	30	70

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-04 SA7 RUN 2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

Report Date:

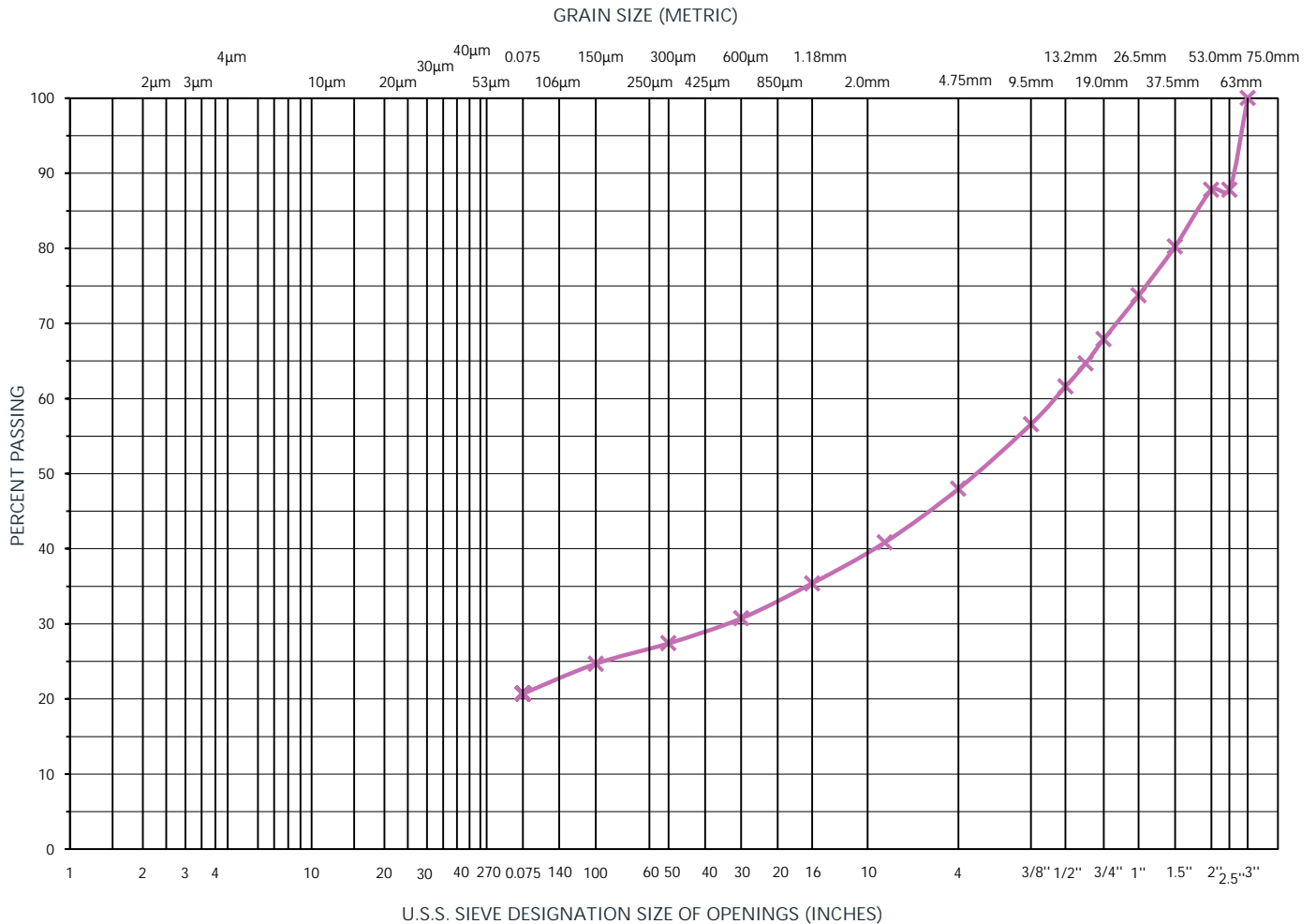




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-04	SA9 RUN 3		52	27	21

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-04 SA9 RUN 3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 19, 2024 Tested By: D. Dion

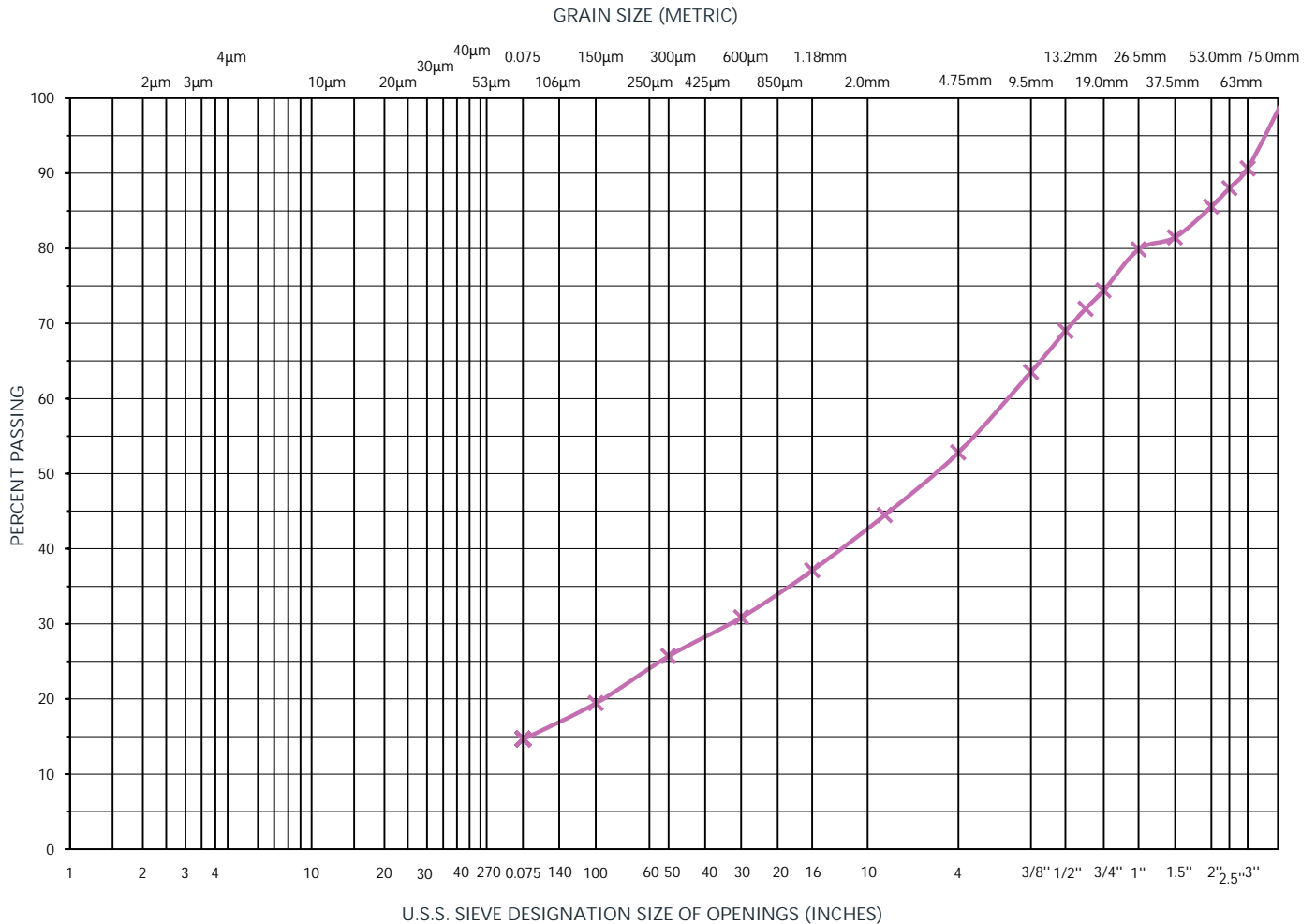
Report Date:



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-05A	SA2		47	38	15

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: D. Dion

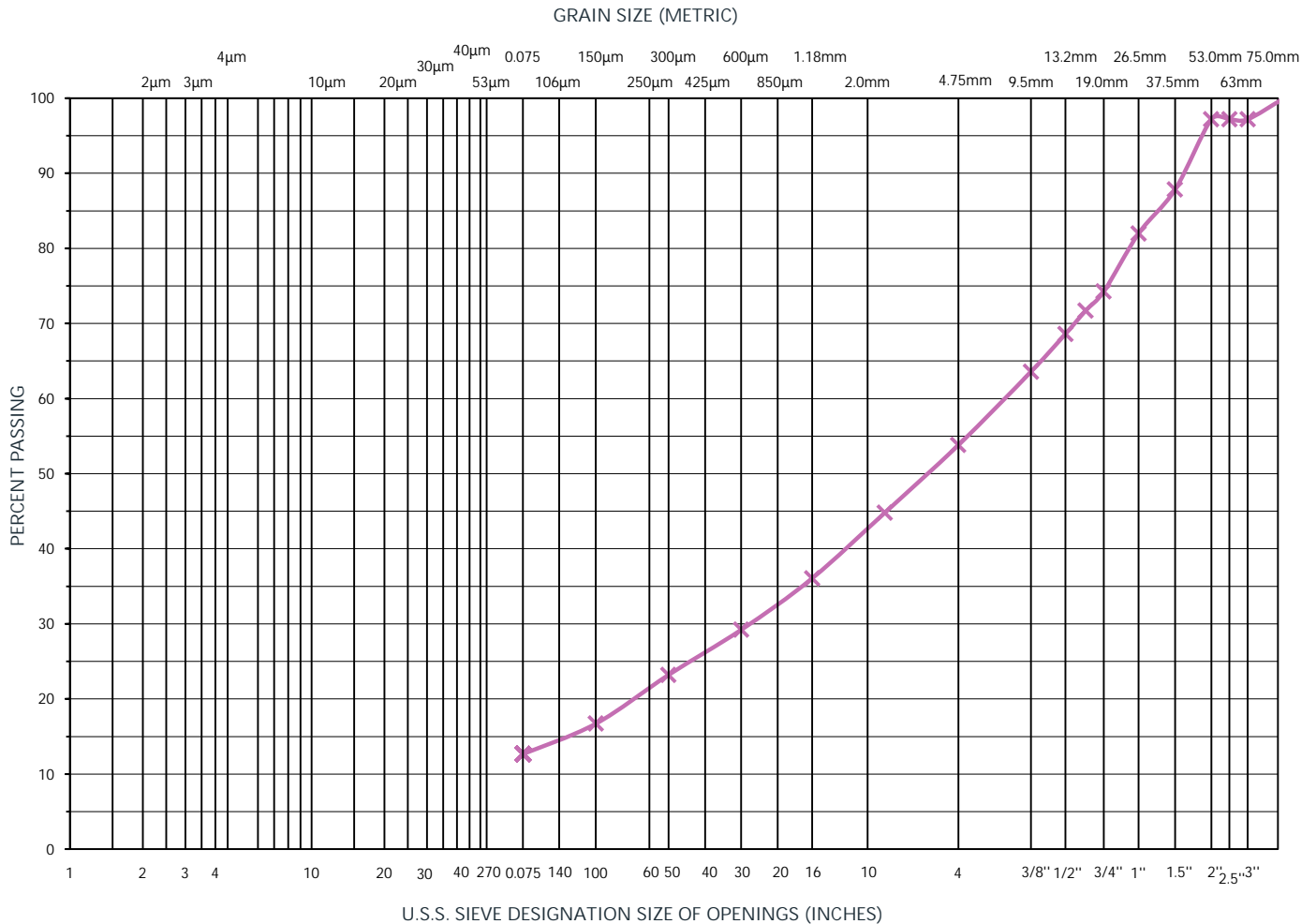
Report Date: May 4, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-05A	SA3		46	41	13

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: D. Dion

Report Date: May 4, 2024

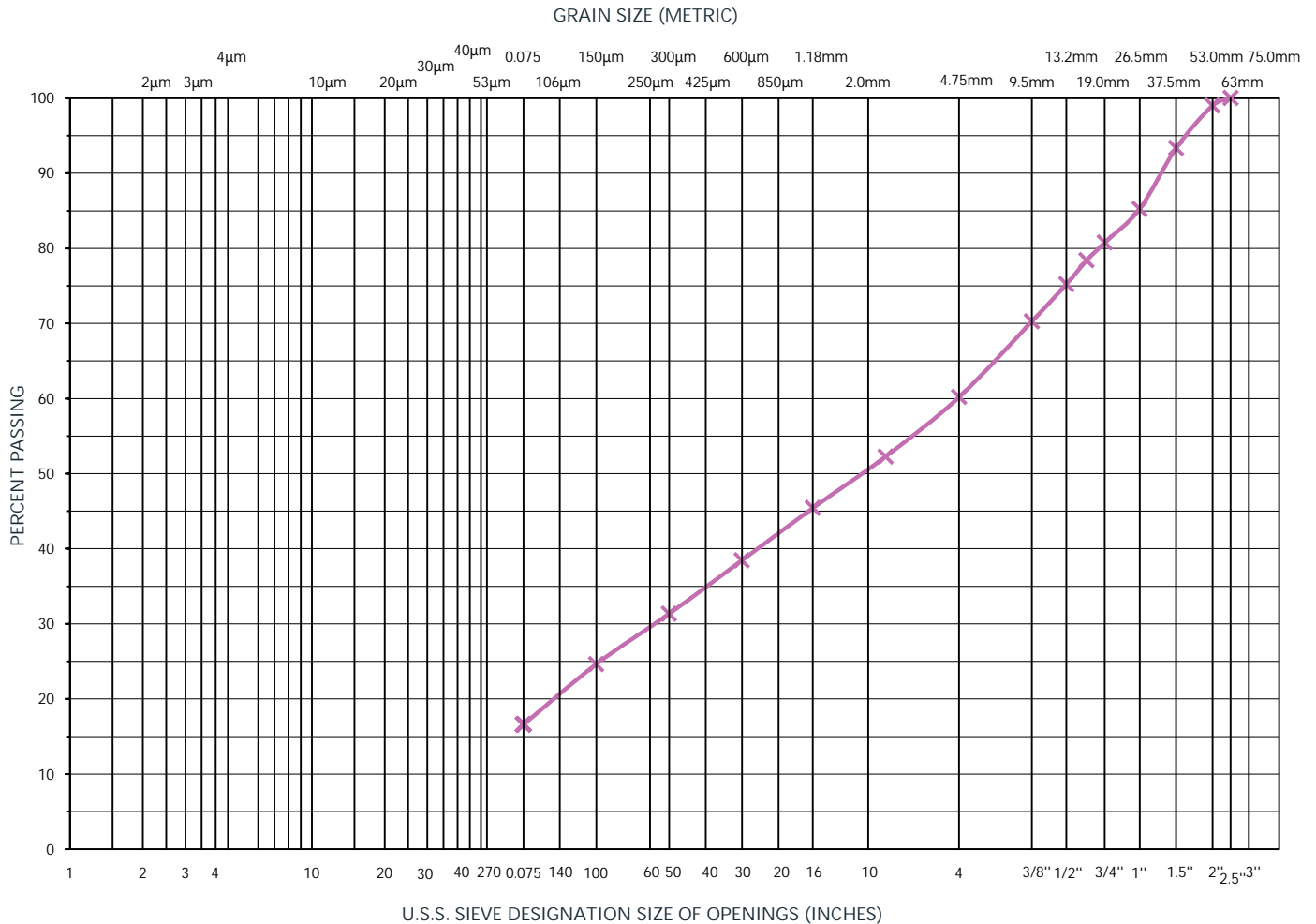




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-05A	SA4		40	43	17

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA4

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: D. Dion

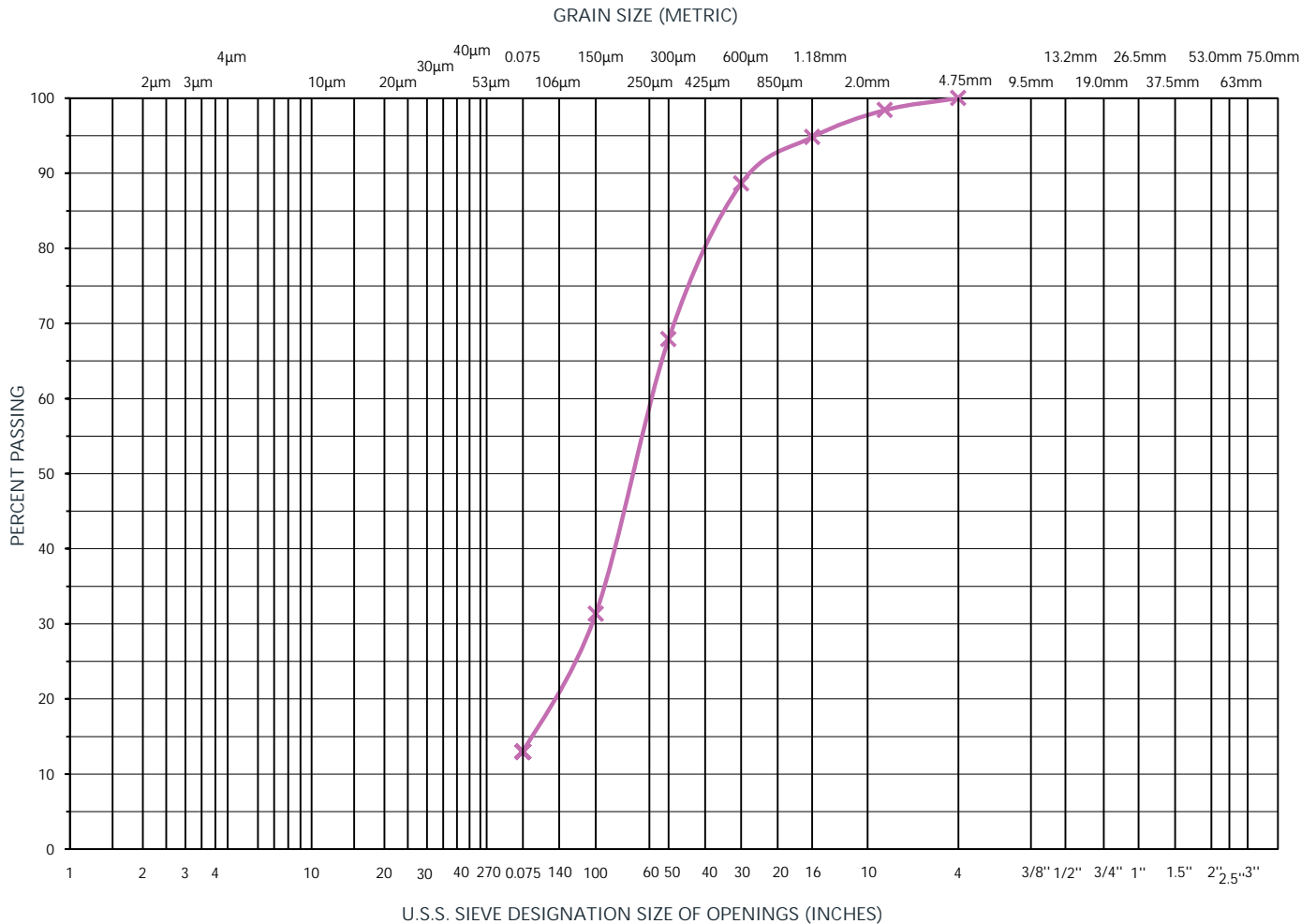
Report Date: May 4, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-05A	SA5		0	87	13

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA5

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: D. Dion

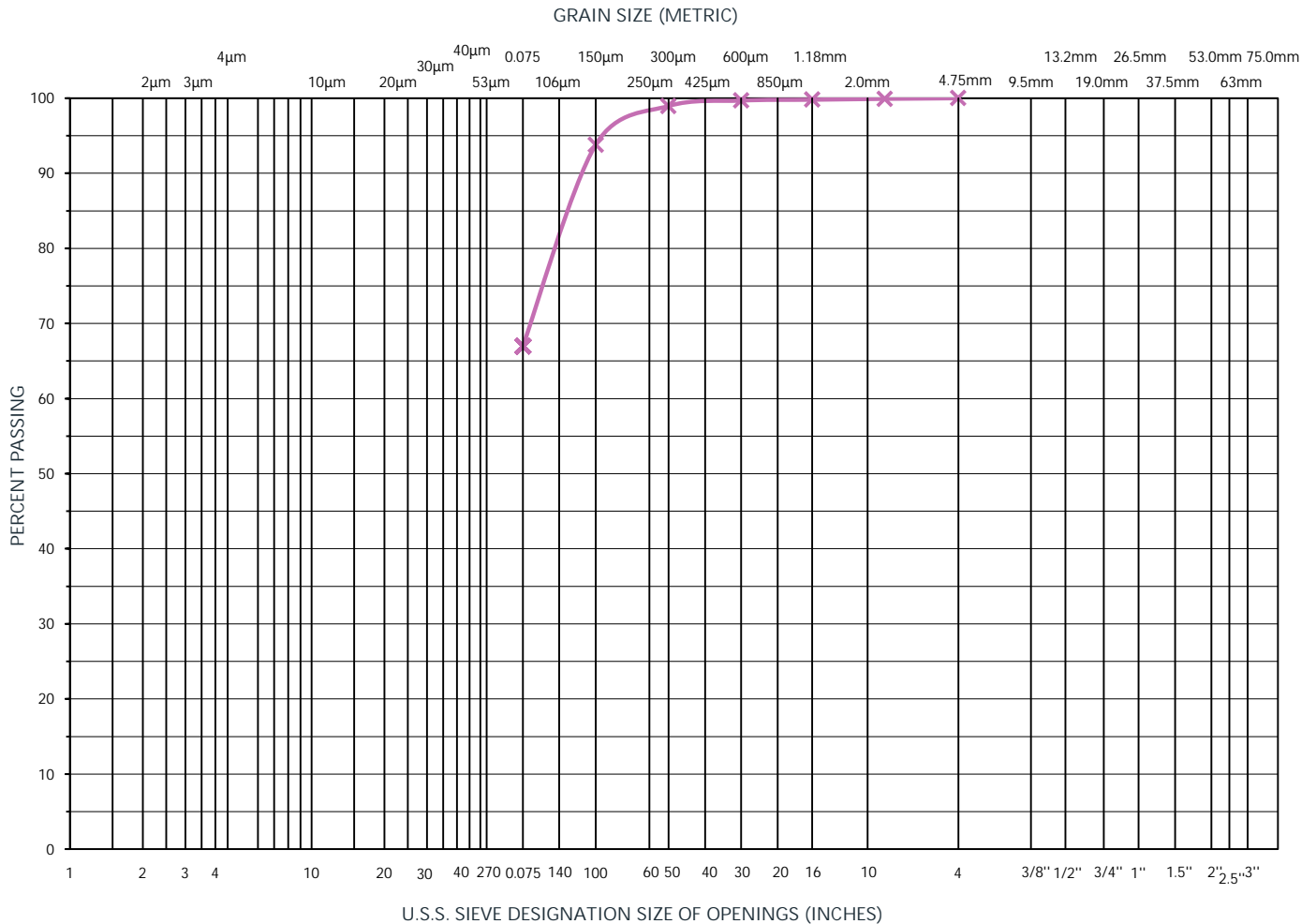
Report Date: May 4, 2024



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-05A	SA6		0	33	67

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-05A, SA6

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: D. Dion

Report Date: May 4, 2024

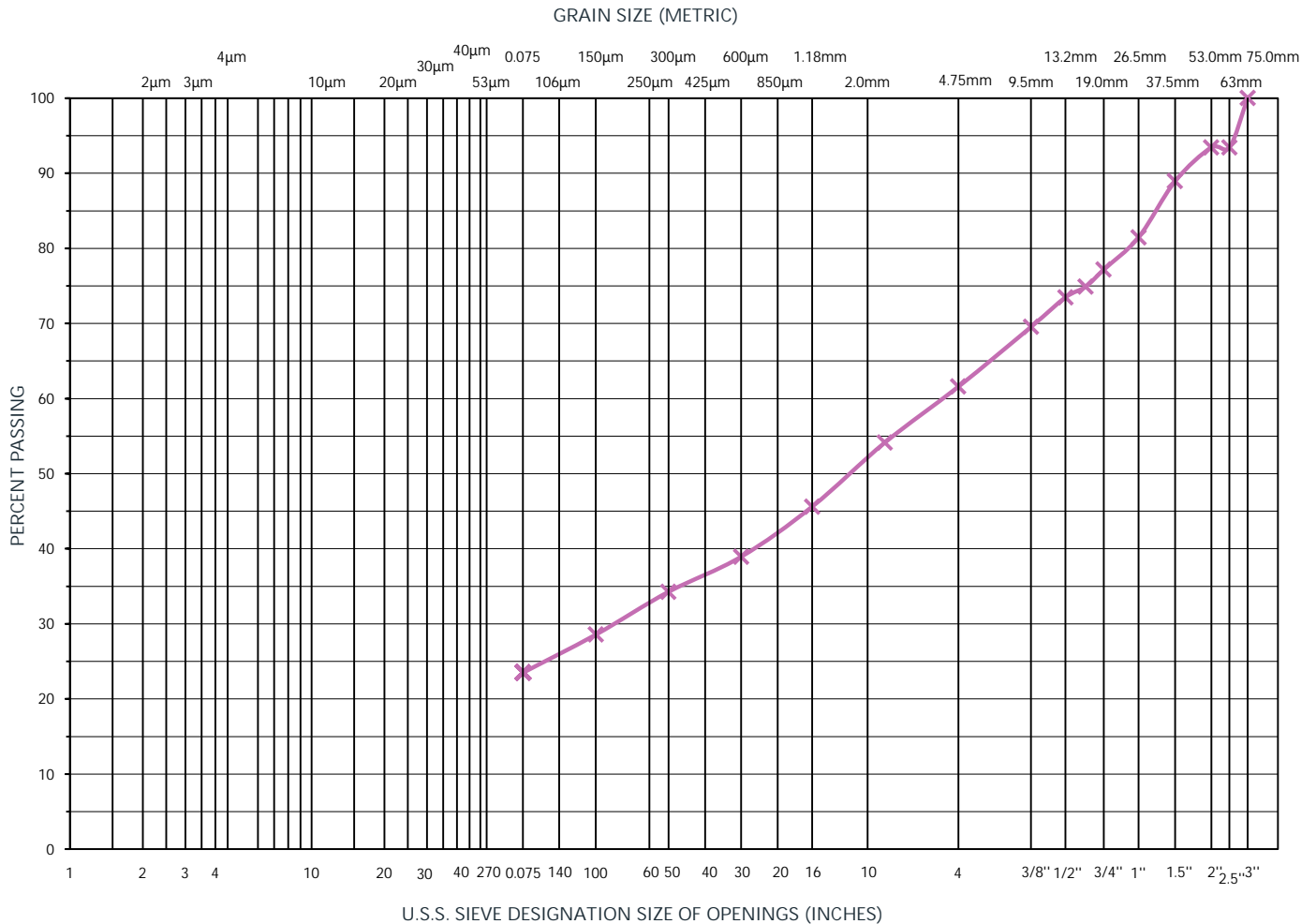




# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-06A	SA1		38	38	24

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-06A SA1

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

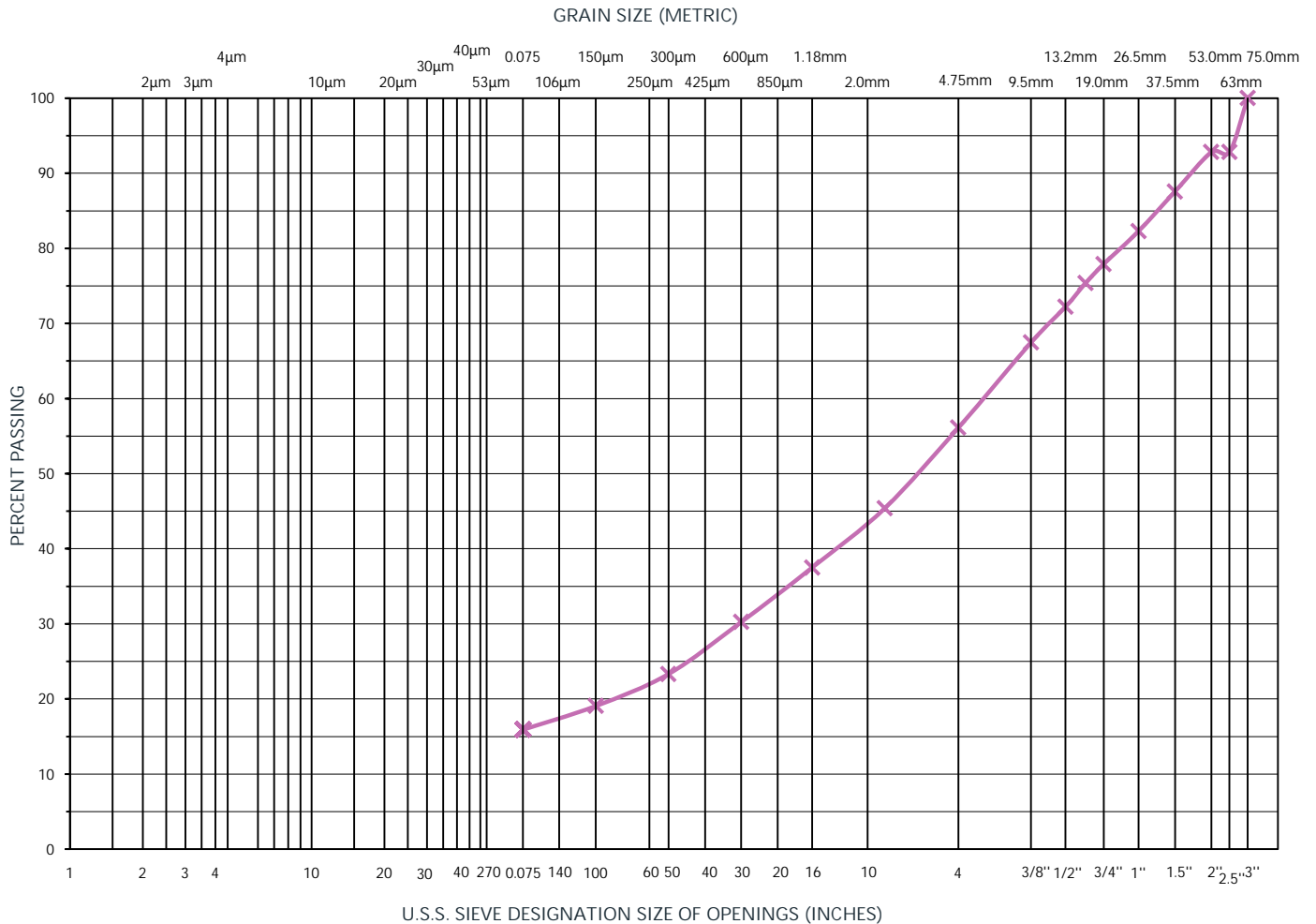
Report Date: May 4, 2024



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-06A	SA2		44	40	16

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-06A SA2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

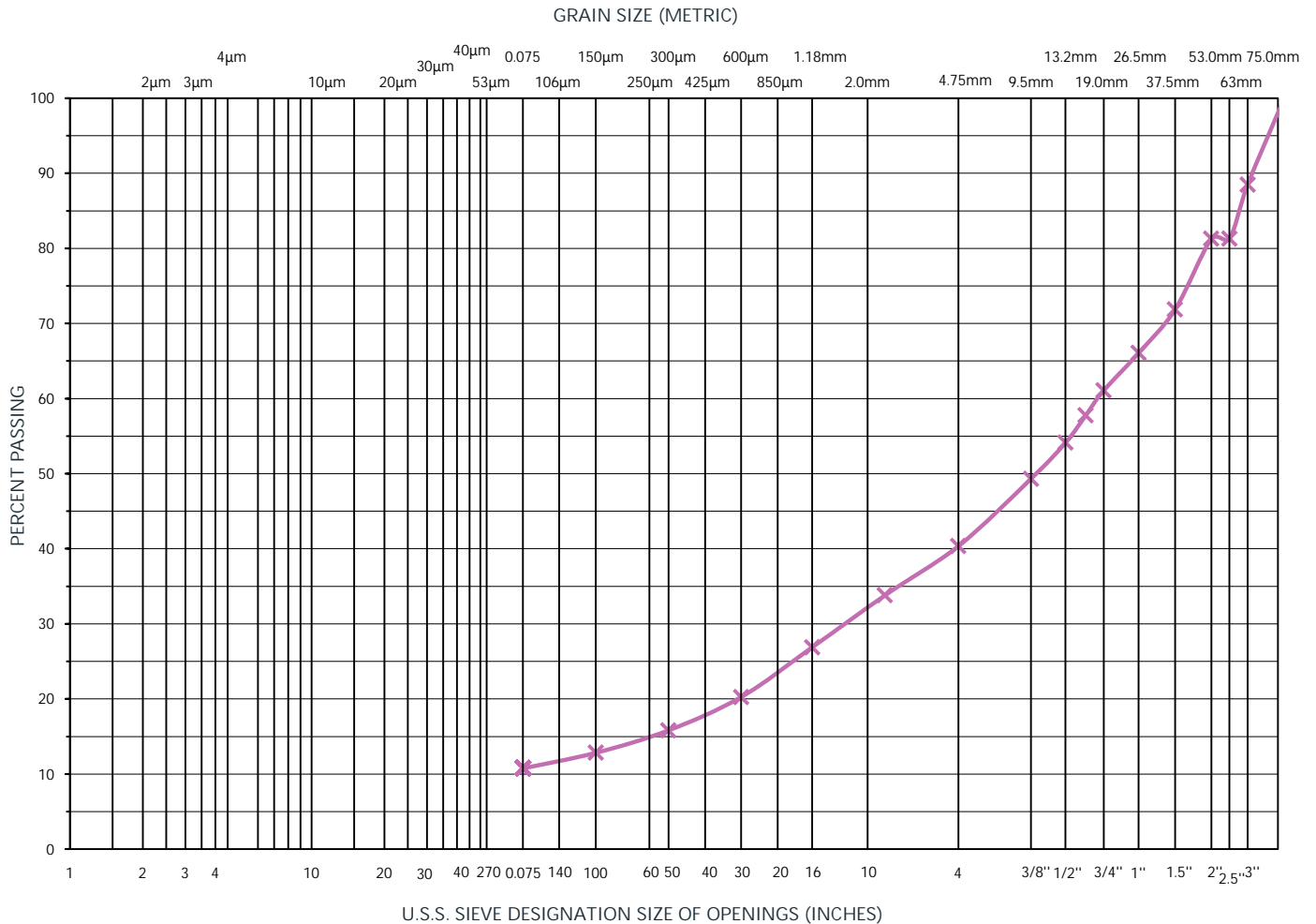
Report Date: May 4, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-06A	SA3		60	29	11

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-06A SA3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

Report Date: May 4, 2024

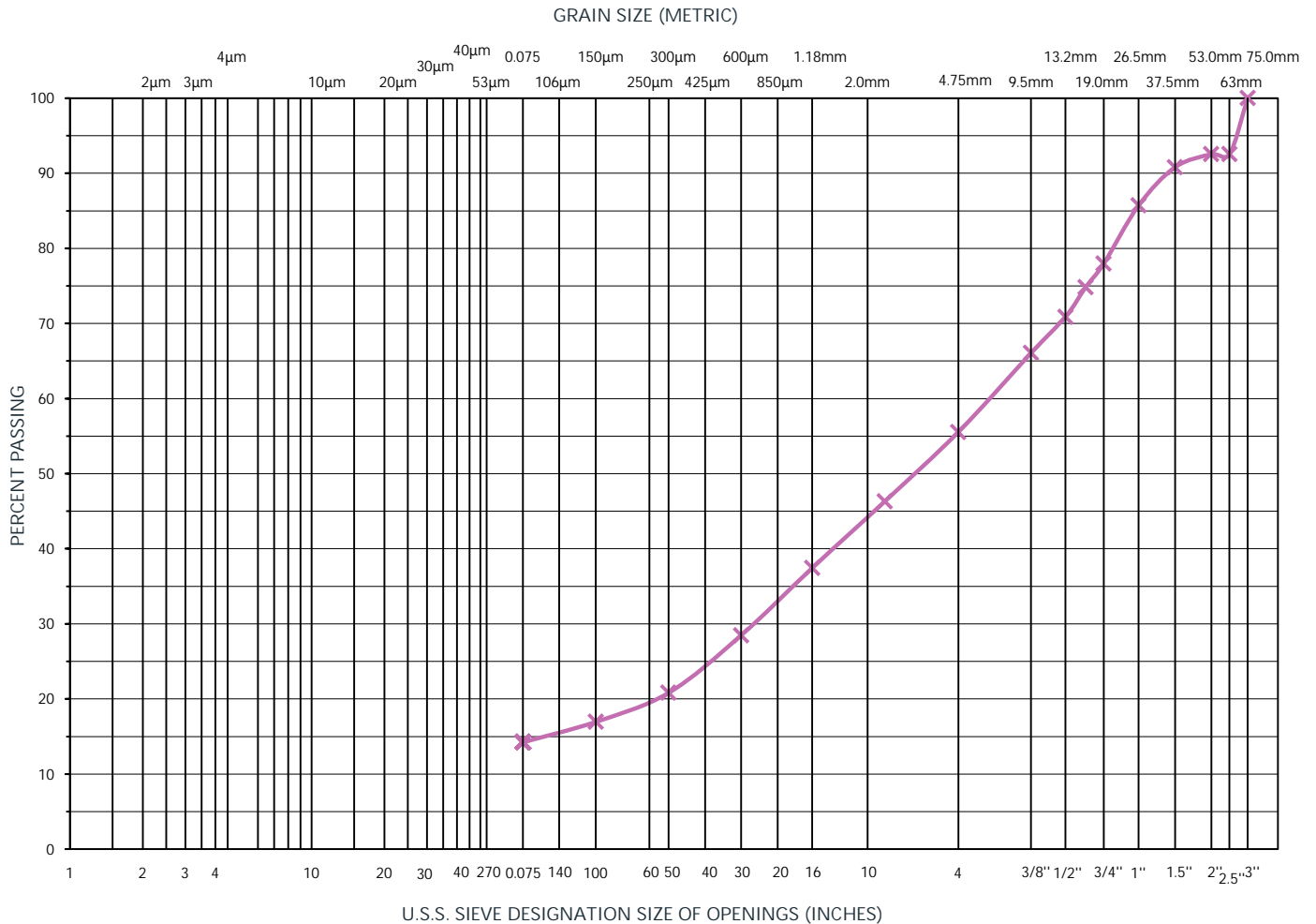




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-06A	SA4		44	42	14

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-06A SA4

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

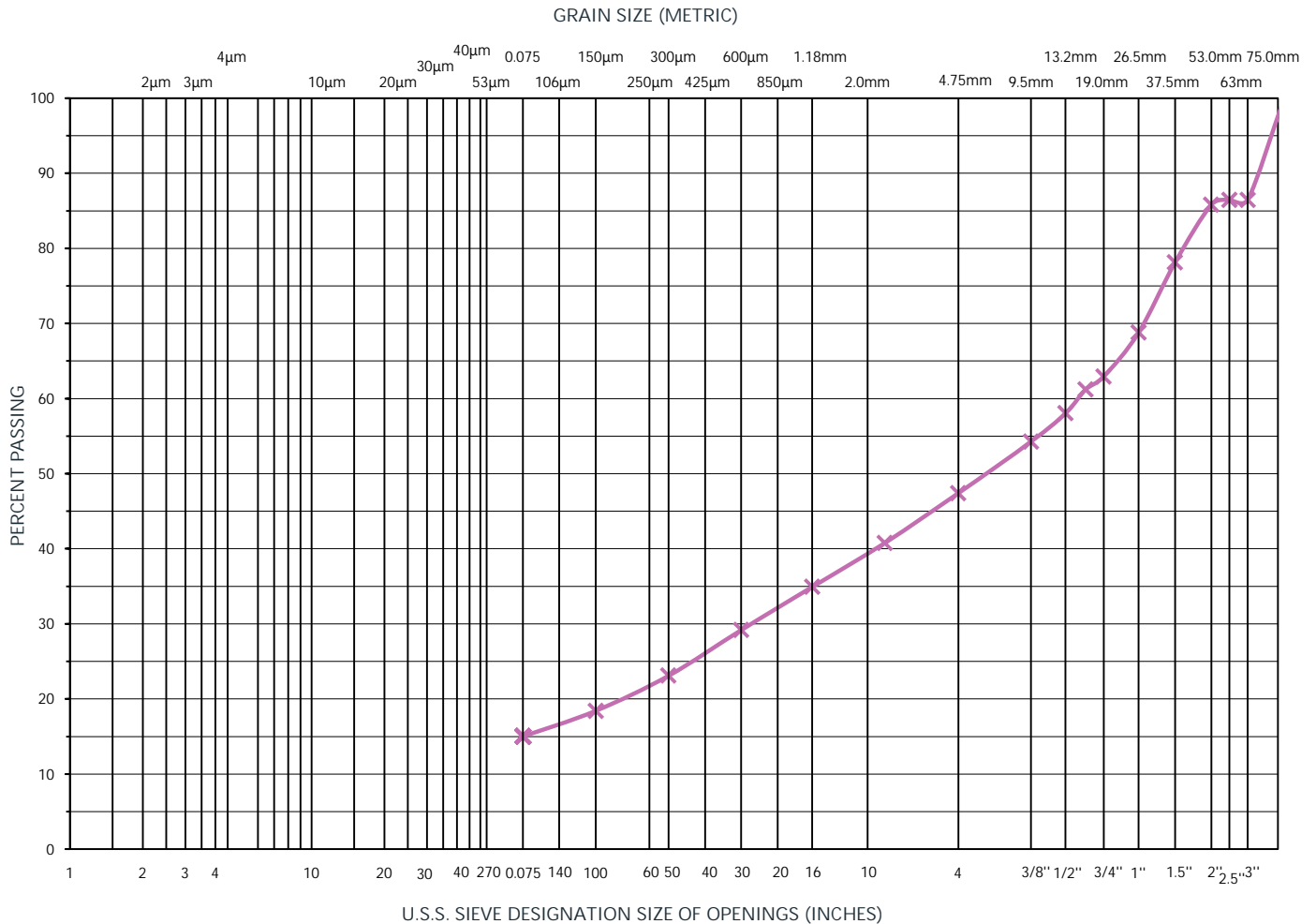
Report Date: May 4, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-06A	SA5		53	29	18

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-06A SA5

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

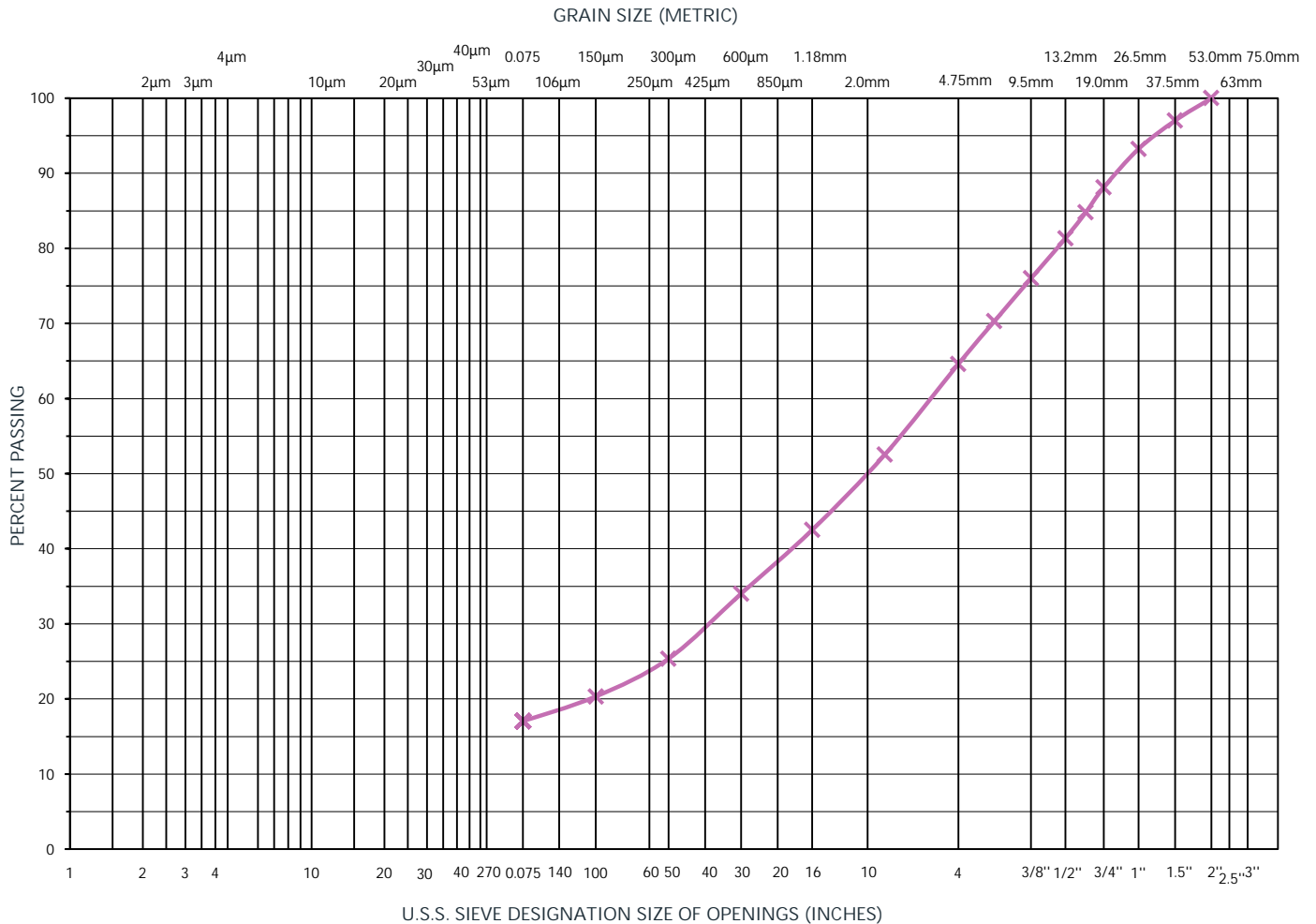
Report Date: May 4, 2024



# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-07A	SA2		35	48	17

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA2

Project No.: CA-GLD-19129150

Date Rec'd: Apr 29, 2024 Tested By: H. Desai

Report Date: May 4, 2024

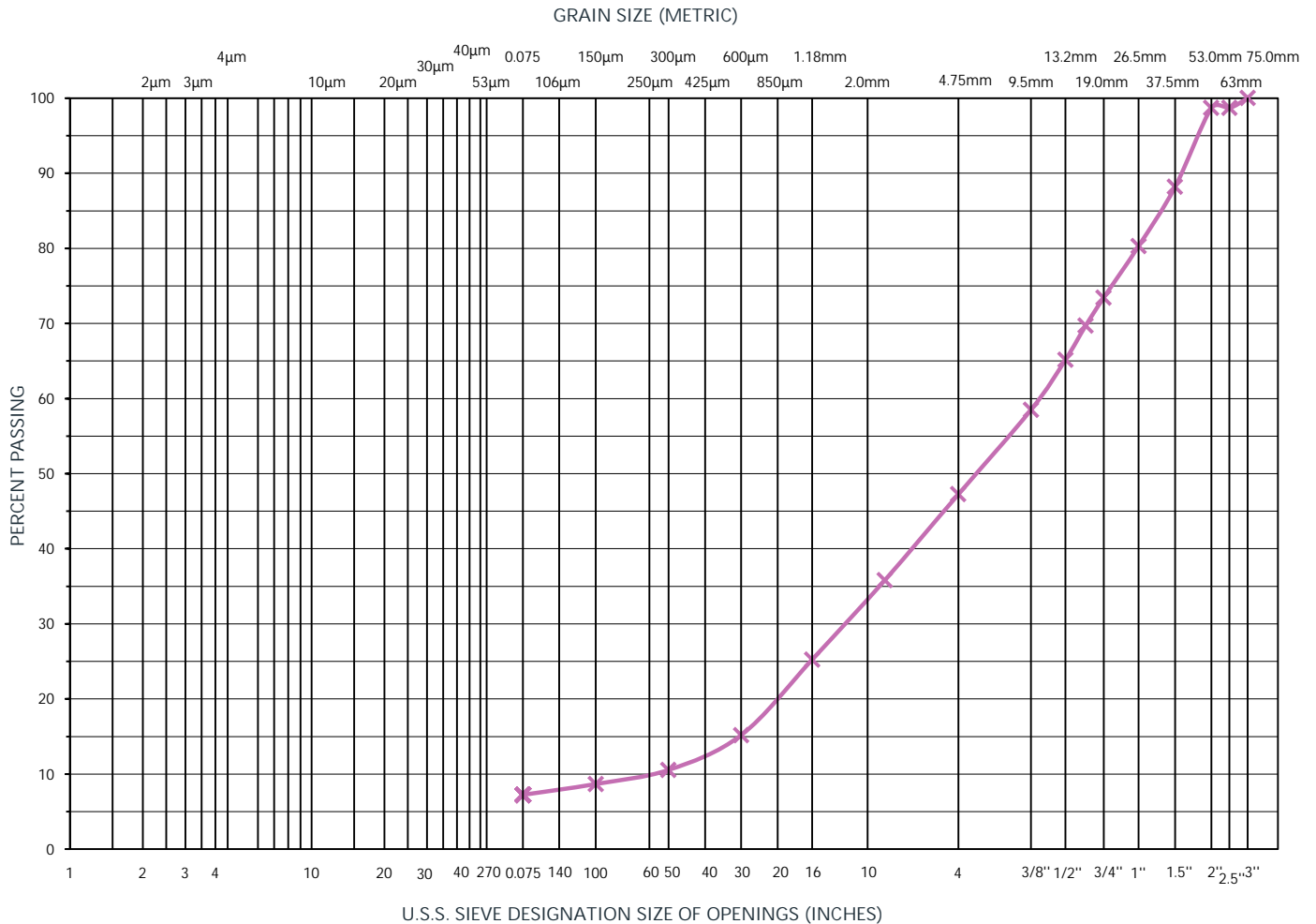




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-07A	SA3		53	40	7

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA3

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

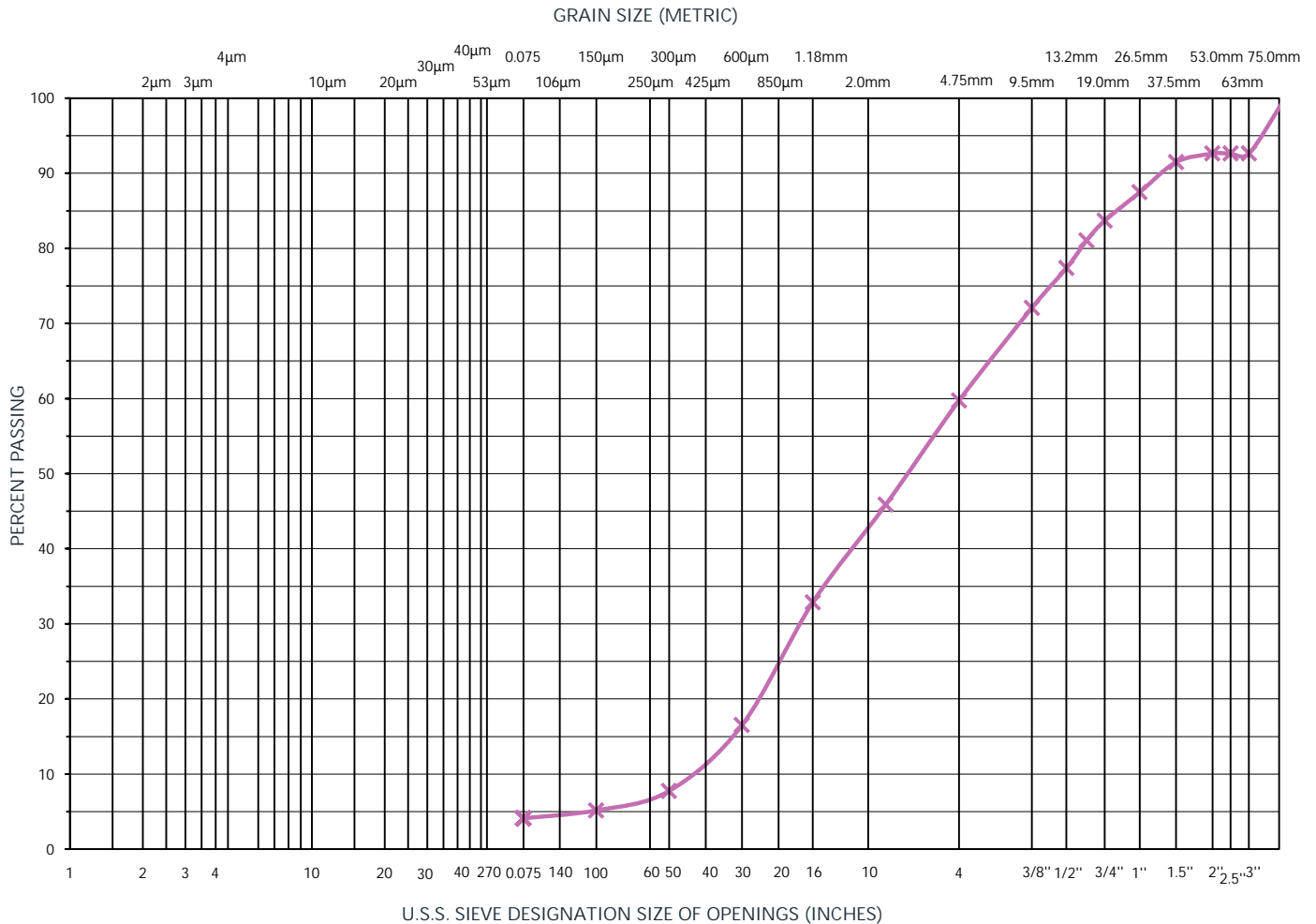
Report Date: May 4, 2024



# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse

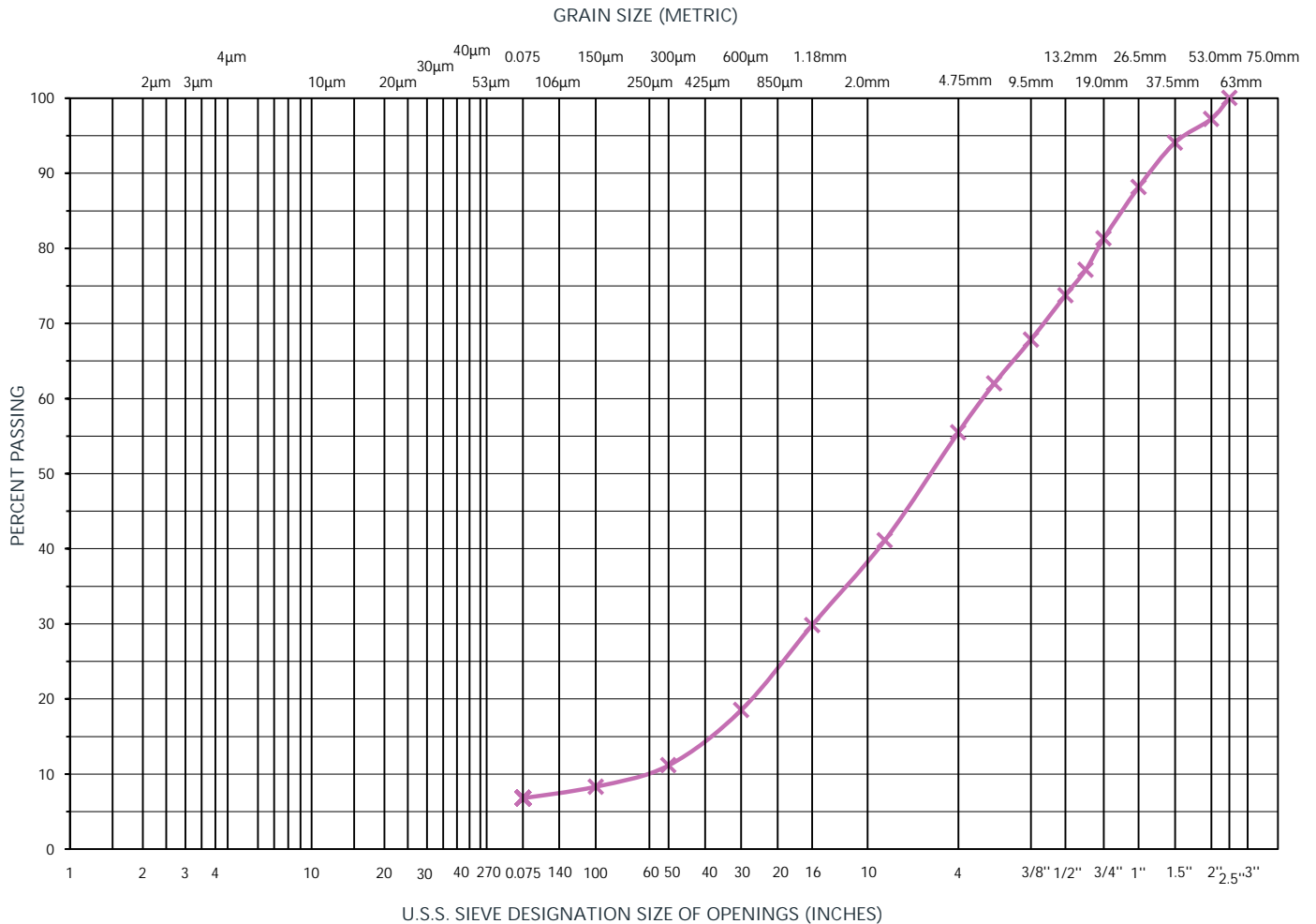




# GRAIN SIZE DISTRUBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-07A	SA6		44	49	7

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

## GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA6

Project No.: CA-GLD-19129150

Date Rec'd: Apr 26, 2024 Tested By: H. Desai

Report Date: May 4, 2024

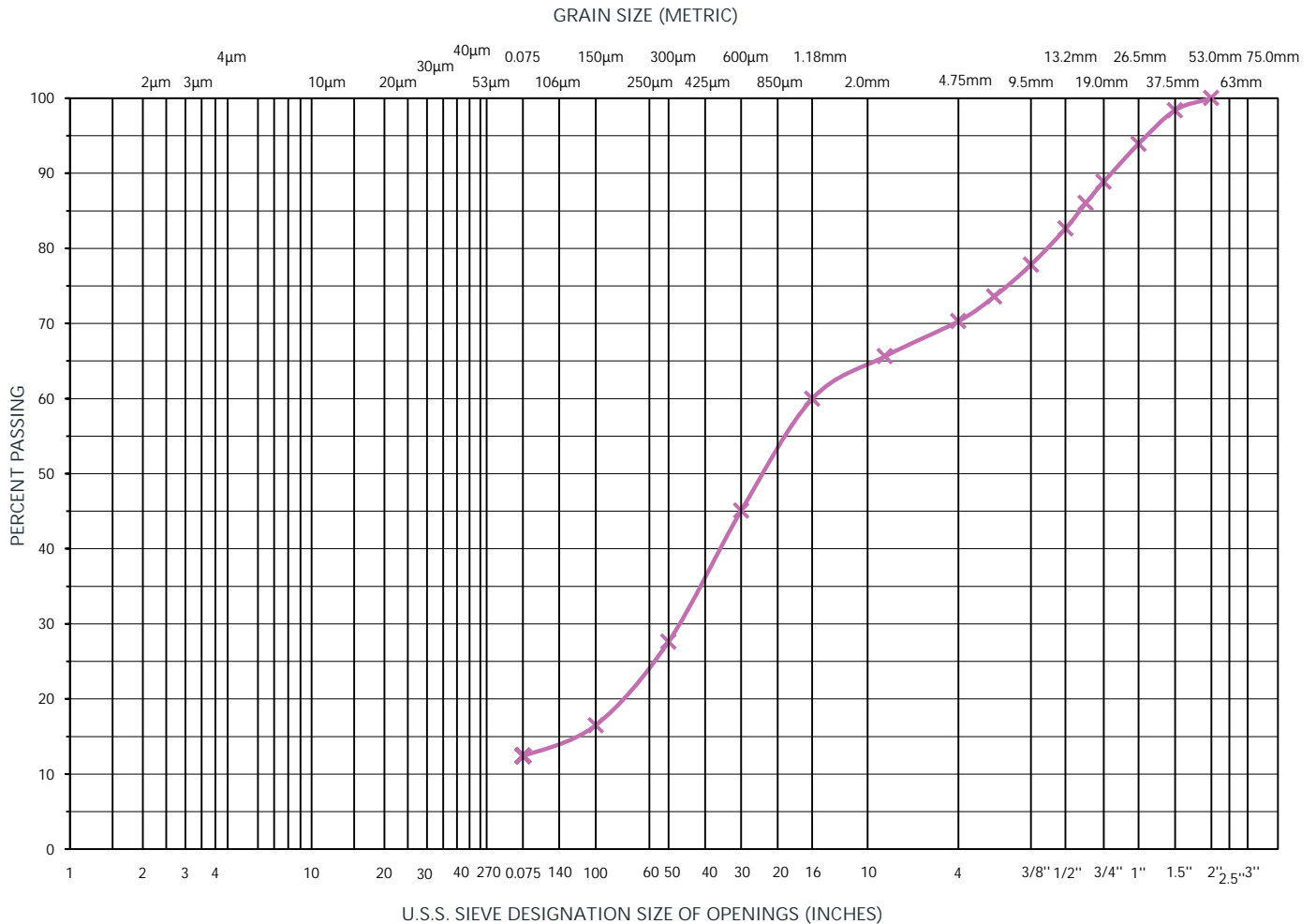




# GRAIN SIZE DISTRIBUTION

CBM Caledon Pit Laboratory Testing

FINE GRAINED (SILT & CLAY) SIZE	SAND SIZE			GRAVEL SIZE	
	Fine	Medium	Coarse	Fine	Coarse



## LEGEND

SYMBOL	BOREHOLE	SAMPLE	DEPTH (m)	GRAVEL (%)	SAND (%)	SILT (%)
X	MW-IT-07A	SA7		30	58	12

WSP Canada Inc  
900 Maple Grove Road, Unit 10  
Cambridge, ON N3H 4R7  
www.wsp.com

### GRAIN SIZE DISTRIBUTION

MW-IT-07A, SA7

Project No.: CA-GLD-19129150

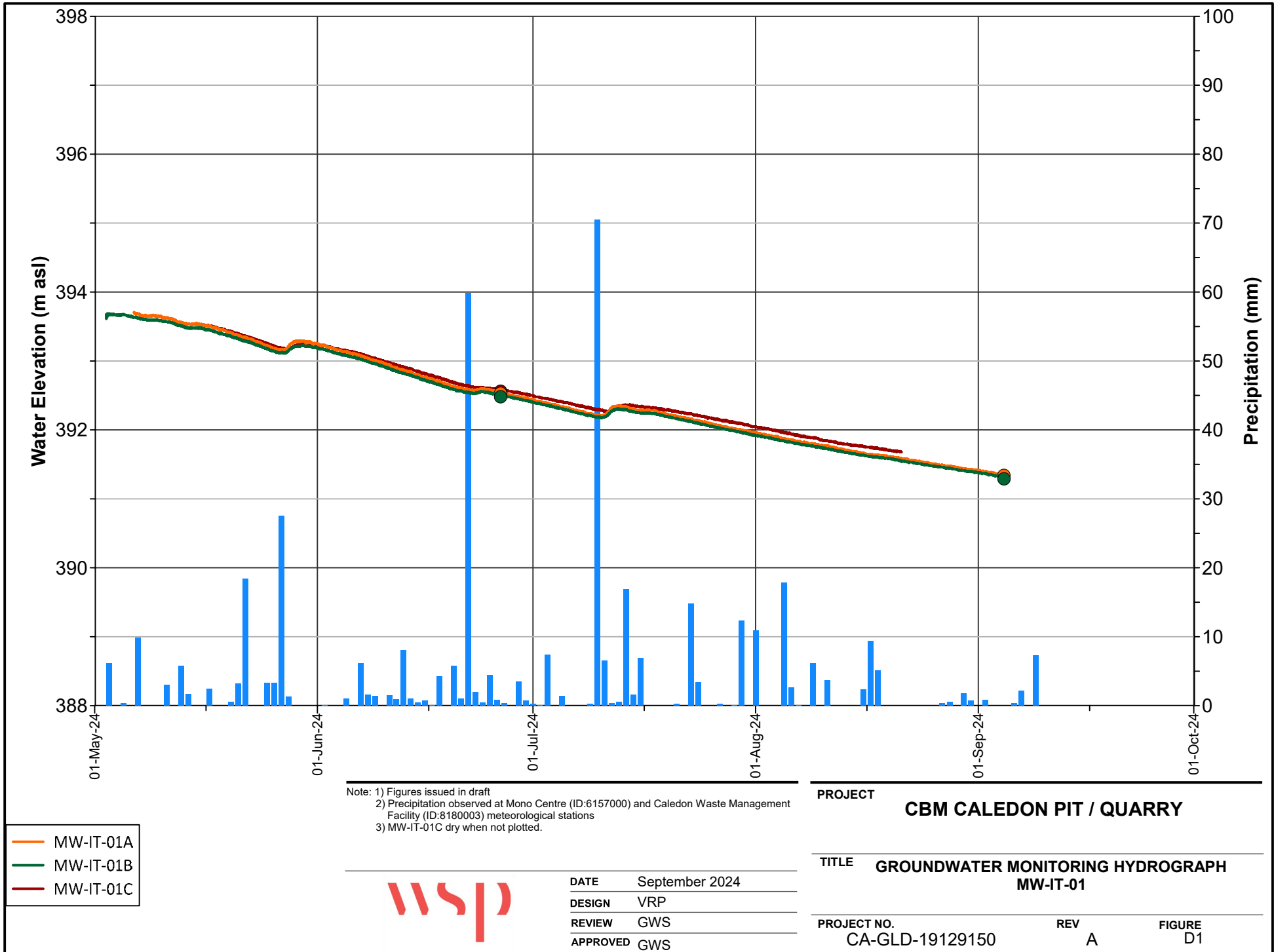
Date Rec'd: Apr 26, 2024 Tested By: H. Desai

Report Date: May 4, 2024

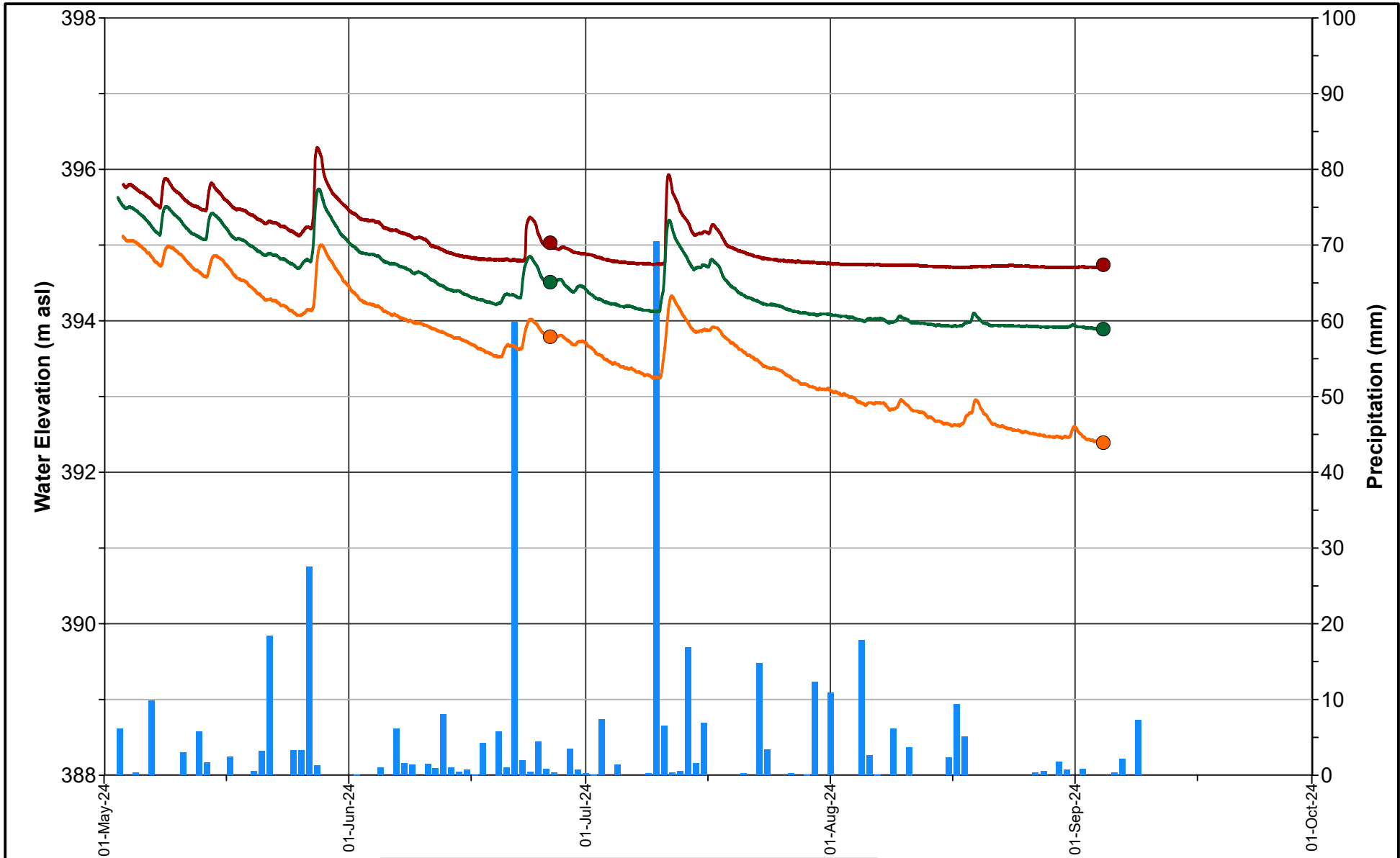
---

**APPENDIX D**

**Hydrographs**







Note: 1) Figures issued in draft  
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

MW-IT-02A  
MW-IT-02B  
MW-IT-02C



DATE September 2024  
DESIGN VRP  
REVIEW GWS  
APPROVED GWS

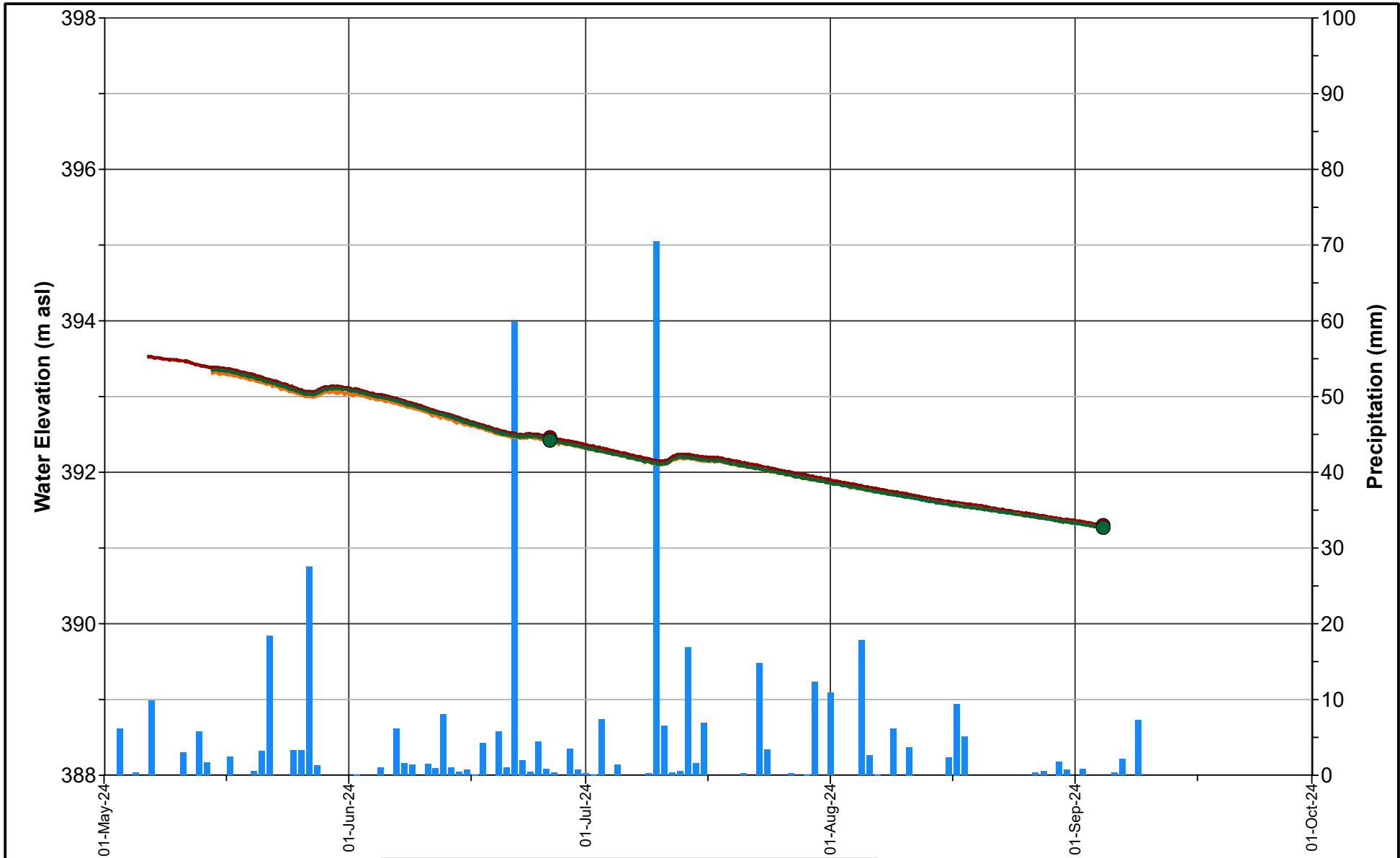
PROJECT **CBM CALEDON PIT / QUARRY**

TITLE **GROUNDWATER MONITORING HYDROGRAPH  
MW-IT-02**

PROJECT NO.  
CA-GLD-19129150

REV  
A

FIGURE  
D2



Note: 1) Figures issued in draft  
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

MW-IT-03A  
MW-IT-03B  
MW-IT-03C



DATE September 2024  
DESIGN VRP  
REVIEW GWS  
APPROVED GWS

PROJECT

CBM CALEDON PIT / QUARRY

TITLE

GROUNDWATER MONITORING HYDROGRAPH  
MW-IT-03

PROJECT NO.

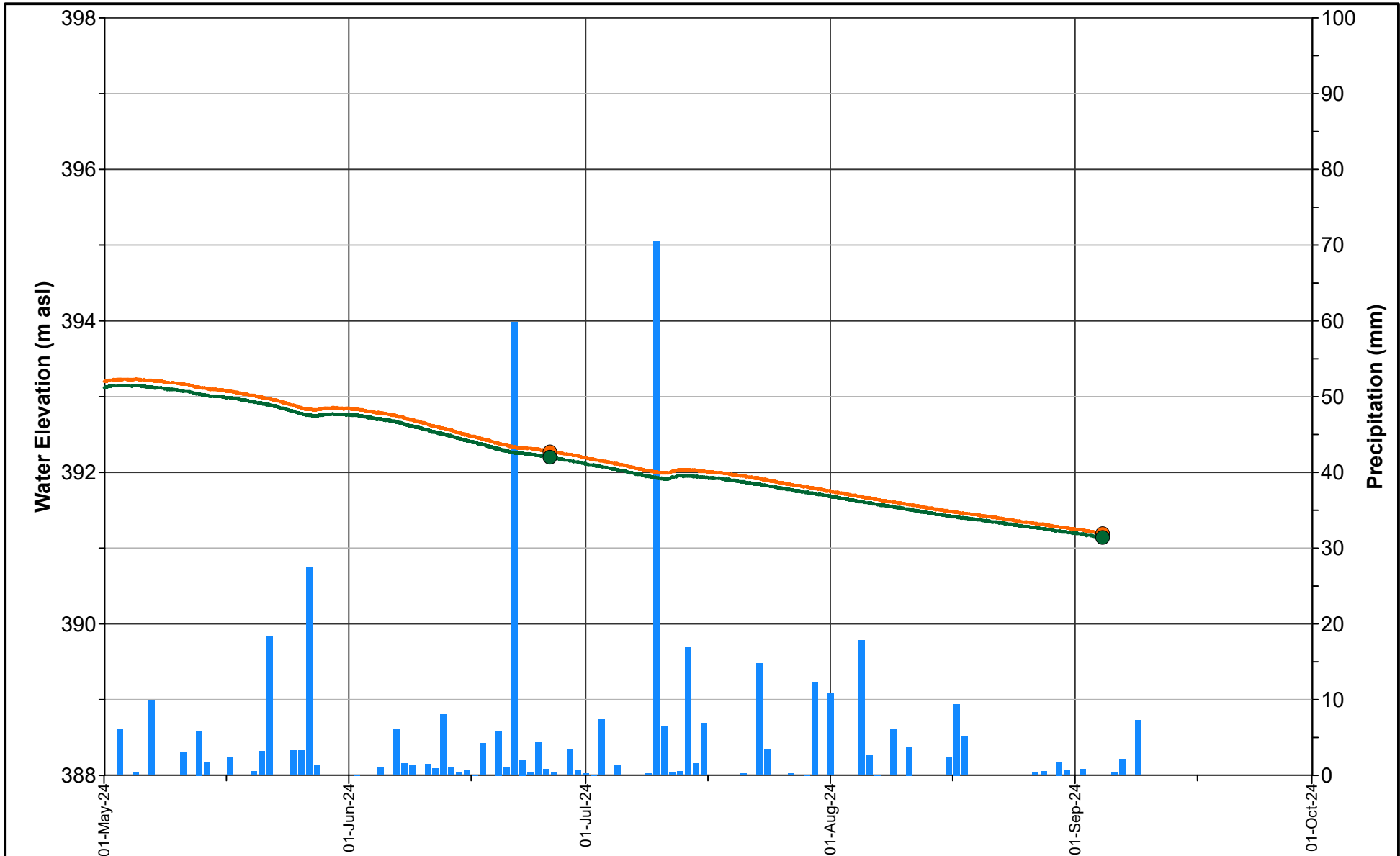
CA-GLD-19129150

REV

A

FIGURE

D3



Note: 1) Figures issued in draft  
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

MW-IT-04A  
MW-IT-04B



DATE September 2024  
DESIGN VRP  
REVIEW GWS  
APPROVED GWS

PROJECT

**CBM CALEDON PIT / QUARRY**

TITLE

**GROUNDWATER MONITORING HYDROGRAPH  
MW-IT-04**

PROJECT NO.

CA-GLD-19129150

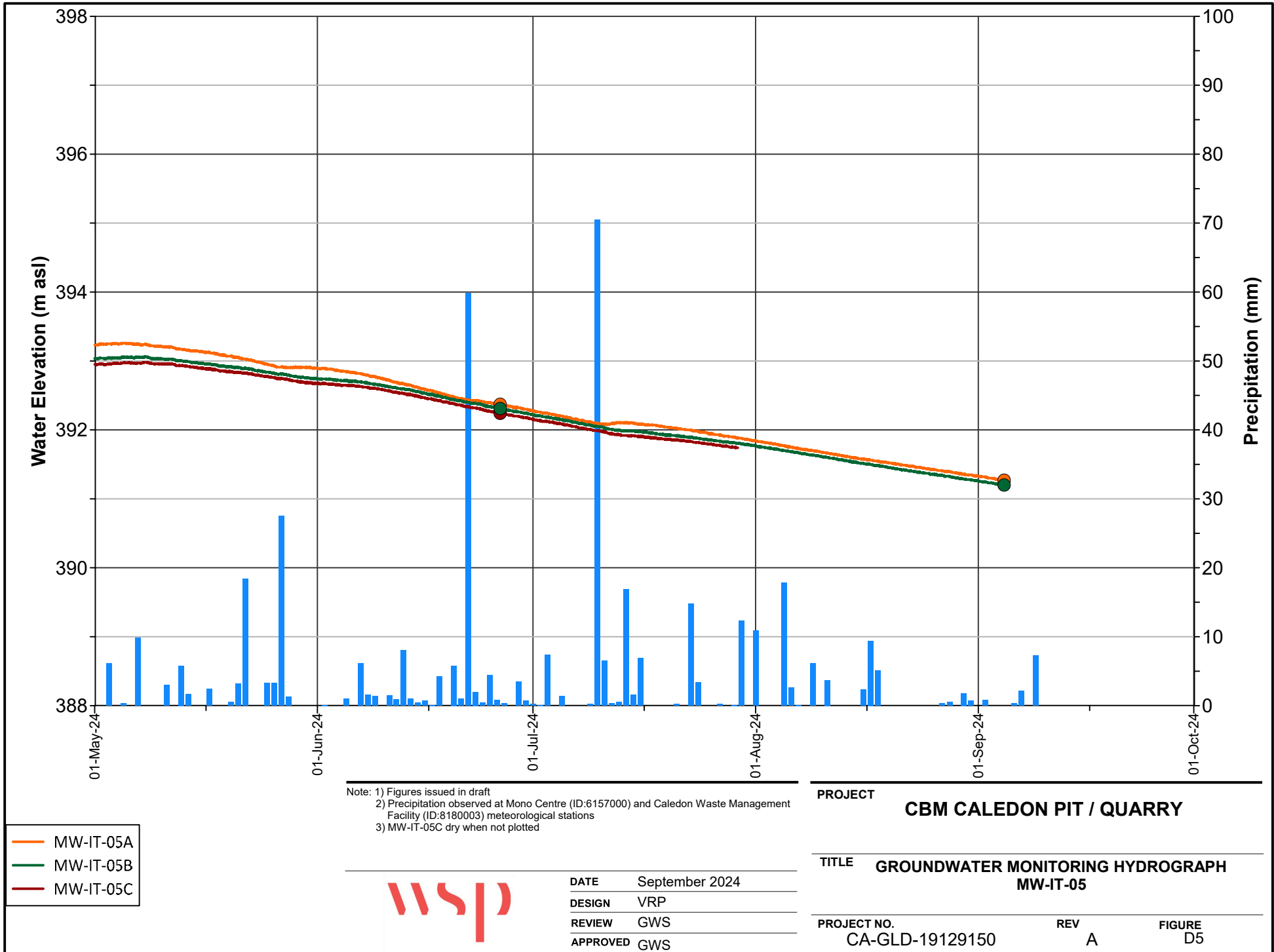
REV

A

FIGURE

D4



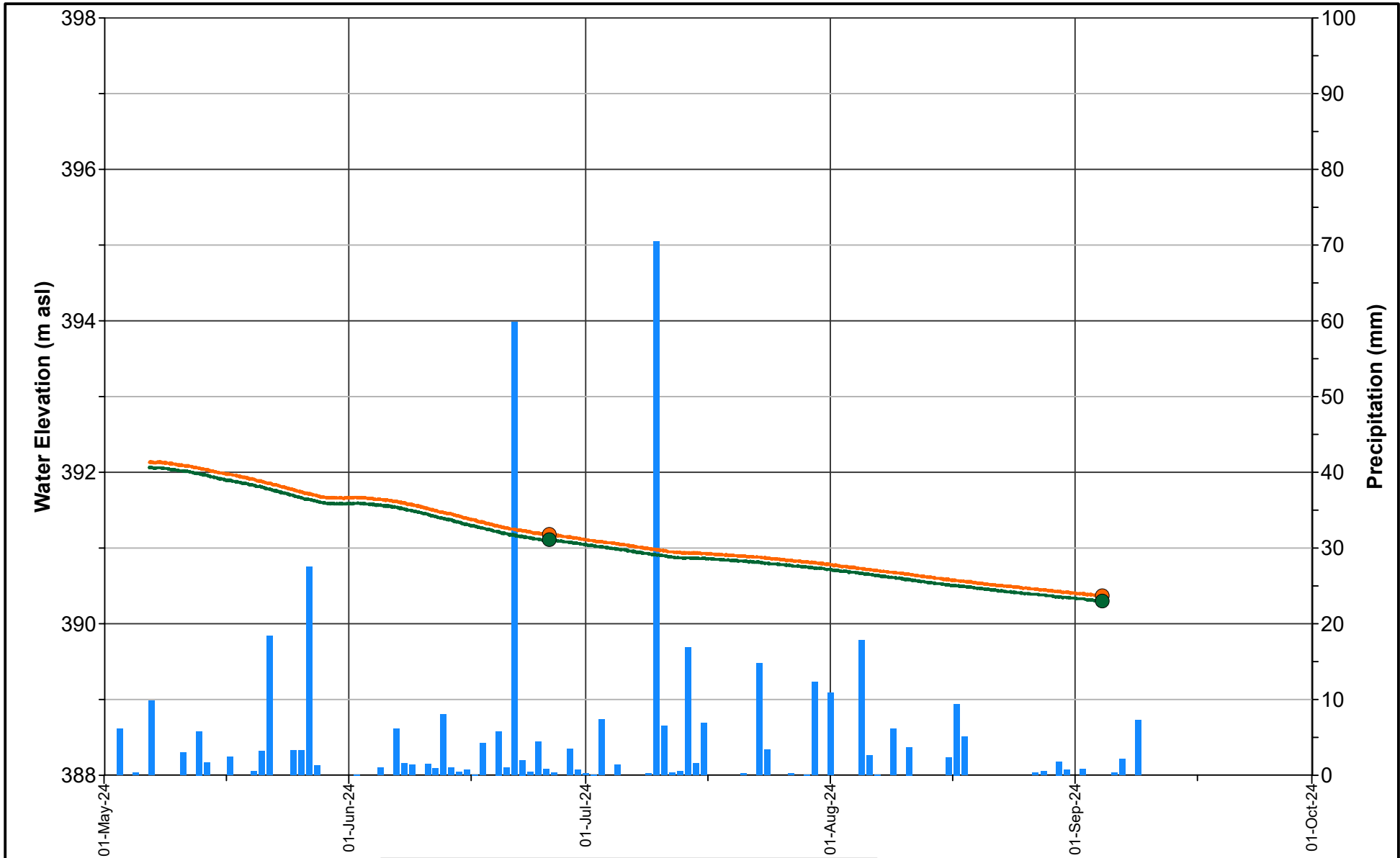


Note: 1) Figures issued in draft  
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations  
3) MW-IT-05C dry when not plotted



DATE	September 2024
DESIGN	VRP
REVIEW	GWS
APPROVED	GWS

PROJECT	CBM CALEDON PIT / QUARRY		
TITLE	GROUNDWATER MONITORING HYDROGRAPH MW-IT-05		
PROJECT NO.	CA-GLD-19129150	REV	FIGURE
		A	D5



Note: 1) Figures issued in draft  
2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations  
3) MW-IT-07C dry when not plotted

MW-IT-06A  
MW-IT-06B



DATE September 2024  
DESIGN VRP  
REVIEW GWS  
APPROVED GWS

PROJECT

CBM CALEDON PIT / QUARRY

TITLE

GROUNDWATER MONITORING HYDROGRAPH  
MW-IT-06

PROJECT NO.

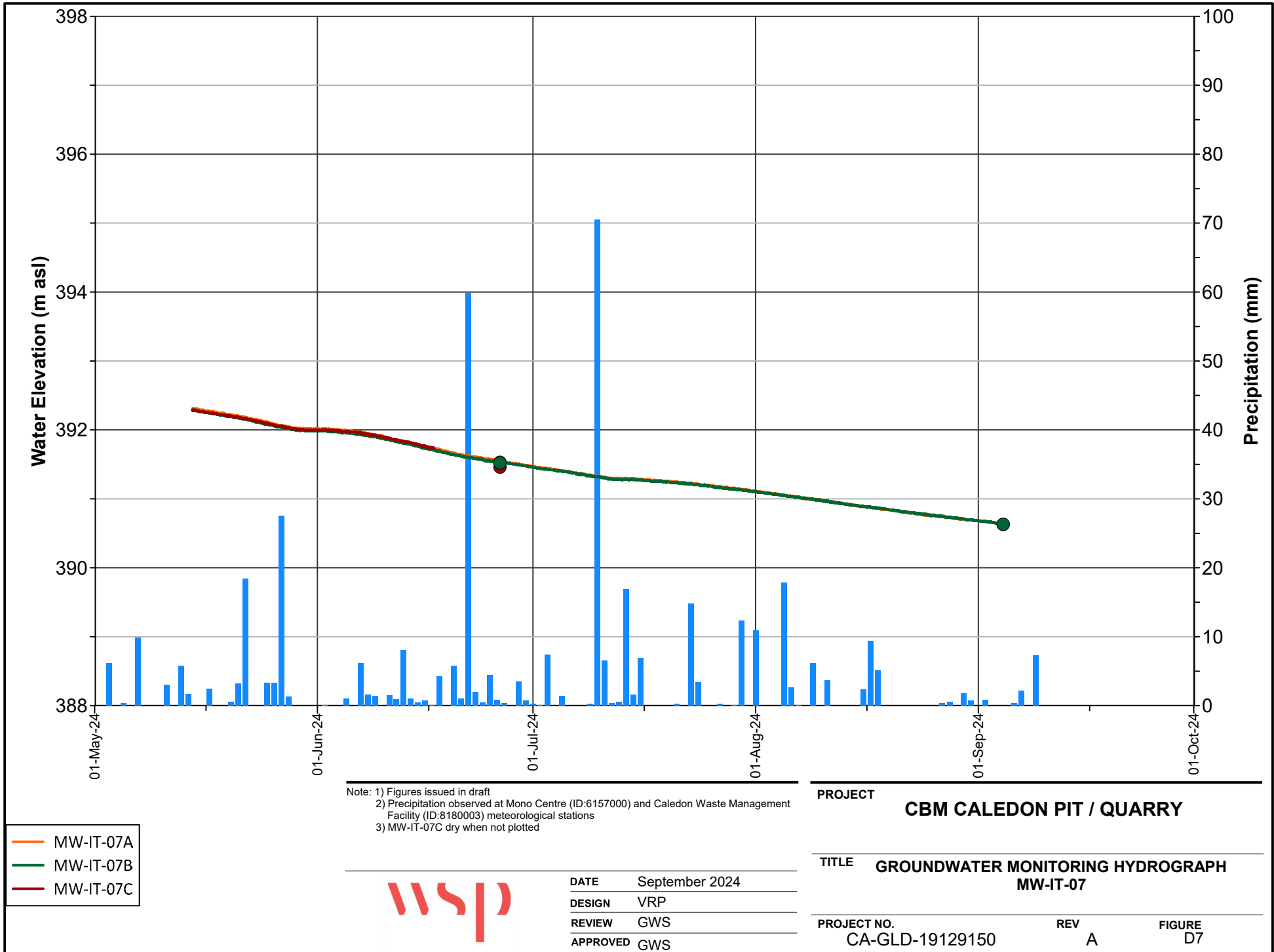
CA-GLD-19129150

REV

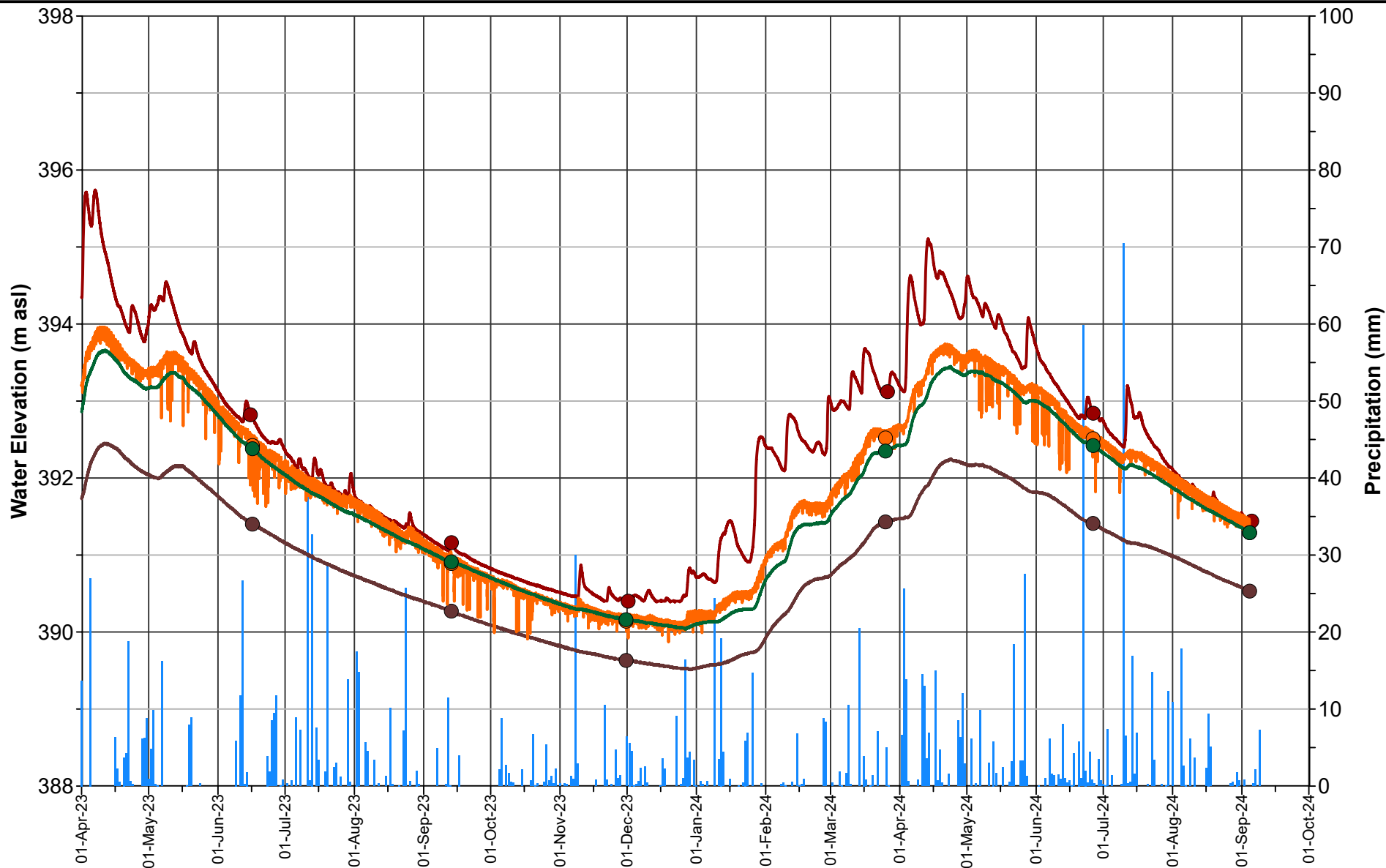
A

FIGURE

D6







Note: 1) Figures issued in draft  
 2) Precipitation observed at Mono Centre (ID:6157000) and Caledon Waste Management Facility (ID:8180003) meteorological stations

- MW20-01A
- MW20-01B
- MW20-02
- MW20-18



DATE September 2024  
 DESIGN VRP  
 REVIEW PGM  
 APPROVED GWS

PROJECT

**CBM CALEDON PIT / QUARRY**

TITLE

**GROUNDWATER MONITORING HYDROGRAPH  
 MW20-01A/B, MW20-02 AND MW20-18**

PROJECT NO.

CA-GLD-19129150

REV

A

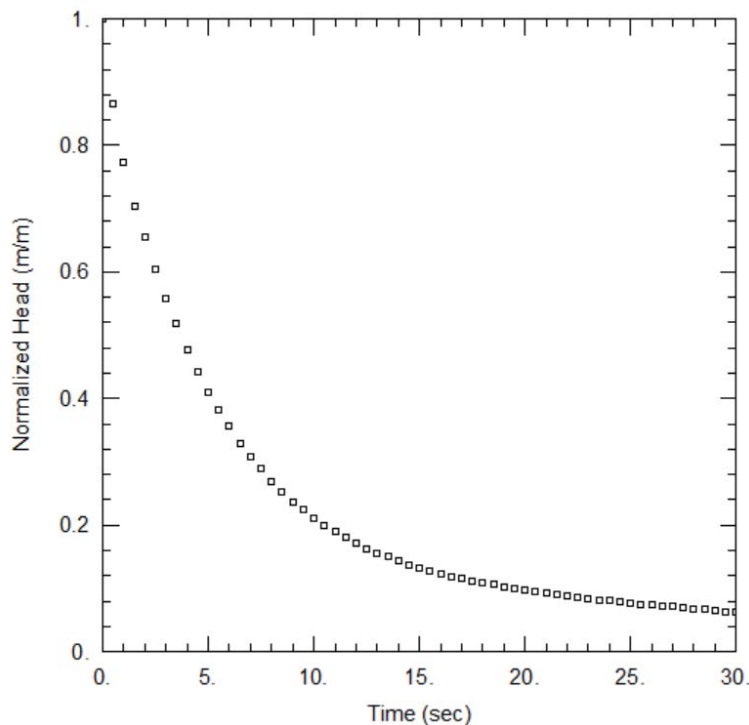
FIGURE

D8

---

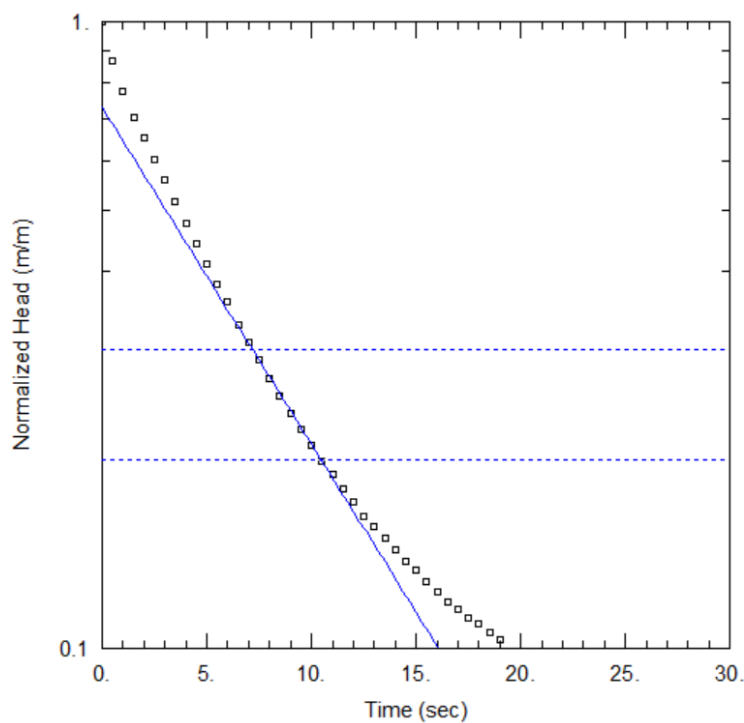
**APPENDIX E**

**Single Well Response Tests**



#### TEST INFORMATION:

Test Well: MW-IT-01A  
 Date of Test: May 02, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test  
  
 Static Water Level: 9.92 mbgs  
 Initial Displacement: 3.47 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 21.64 m to 23.16 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Confined

Hydraulic Conductivity (K) =

$$9 \times 10^{-5} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-01A

PROJECT No.  
19129150

PHASE  
2300

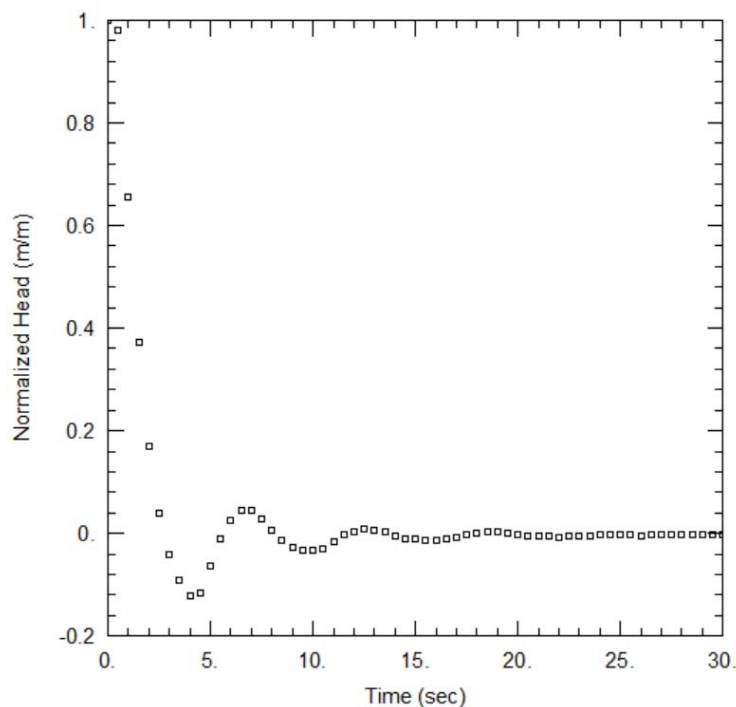
Rev.  
A

FIGURE  
E01

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

1 in



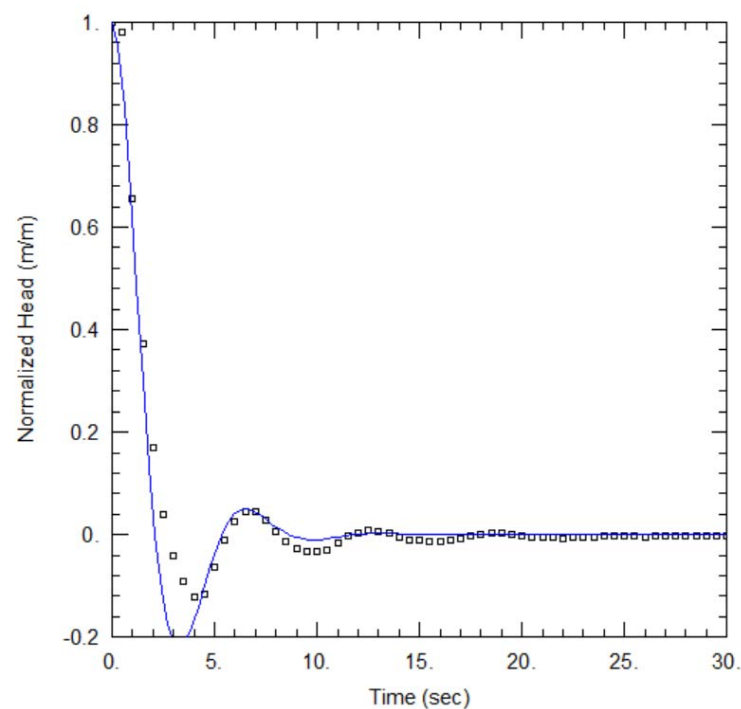


#### TEST INFORMATION:

Test Well: MW-IT-01B  
 Date of Test: May 02, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test

Static Water Level: 9.97 mbgs  
 Initial Displacement: 1.23 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 16.71 m to 18.84 m  
 Geology: (GP/GM) – SANDY SILTY GRAVEL  
 & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Butler  
 Solution Type: Inertial  
 Aquifer Model: Confined

Hydraulic Conductivity (K) =

$$8 \times 10^{-4} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

**CBM Aggregates**

PROJECT

**CALEDON PIT / QUARRY**

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

**SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-01B**

PROJECT No.  
**19129150**

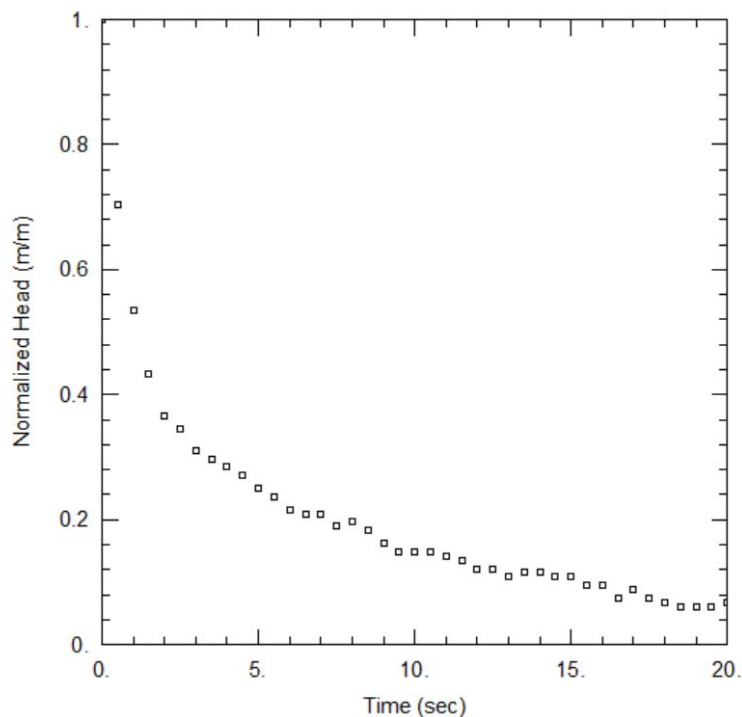
PHASE  
**2300**

Rev.  
**A**

FIGURE  
**E02**

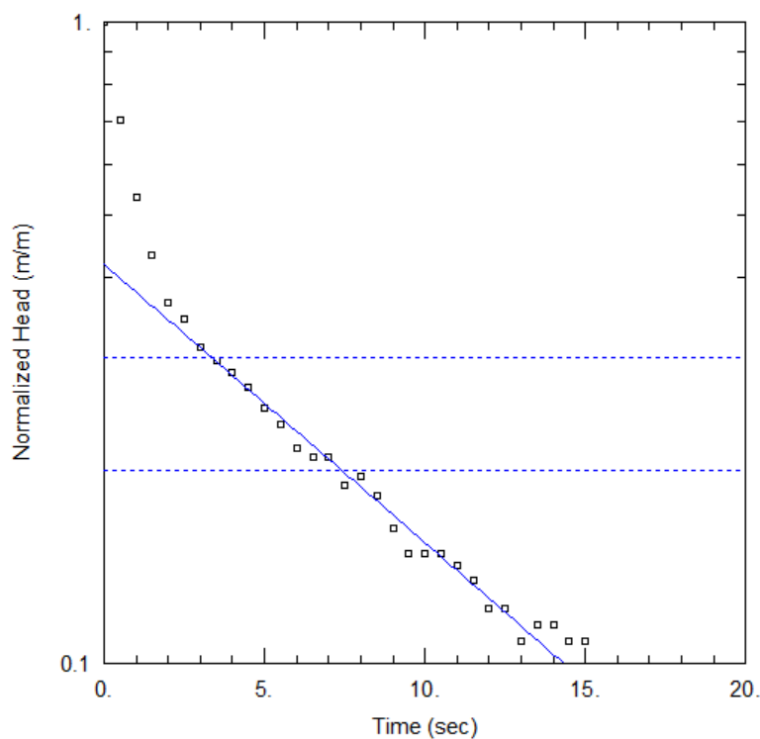
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

1 in



#### TEST INFORMATION:

Test Well: MW-IT-01C  
 Date of Test: May 14, 2024  
 Test Type: Rising Head Test  
 Test Method: Waterra Purge  
  
 Static Water Level: 10.07 mbgs  
 Initial Displacement: 0.15 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 10.44 m to 11.96 m  
 Geology: (SM/GP) SILTY SAND and GRAVEL



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$5 \times 10^{-5} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-01C

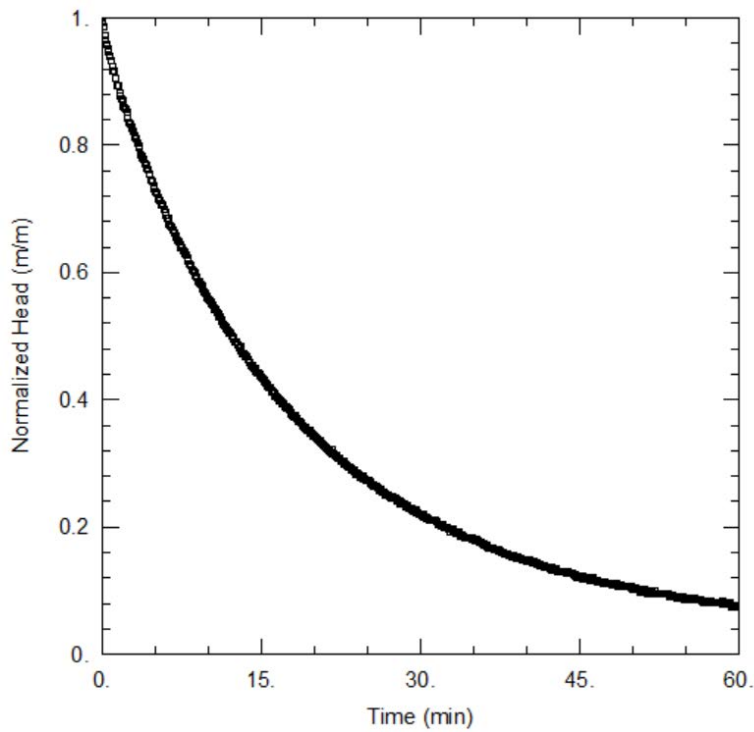
PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

FIGURE  
E03

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

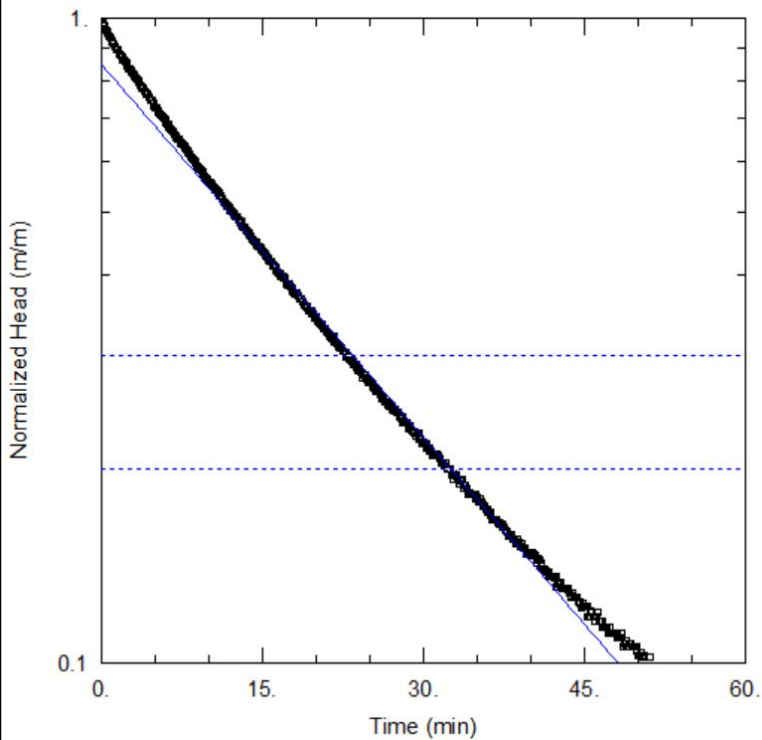


#### TEST INFORMATION:

Test Well: MW-IT-02A  
 Date of Test: May 02, 2024  
 Test Type: Rising Head Test  
 Test Method: Bailer

Static Water Level: 6.21 mbgs  
 Initial Displacement: 1.23 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 14.64 m to 16.16 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$6 \times 10^{-7} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-02A

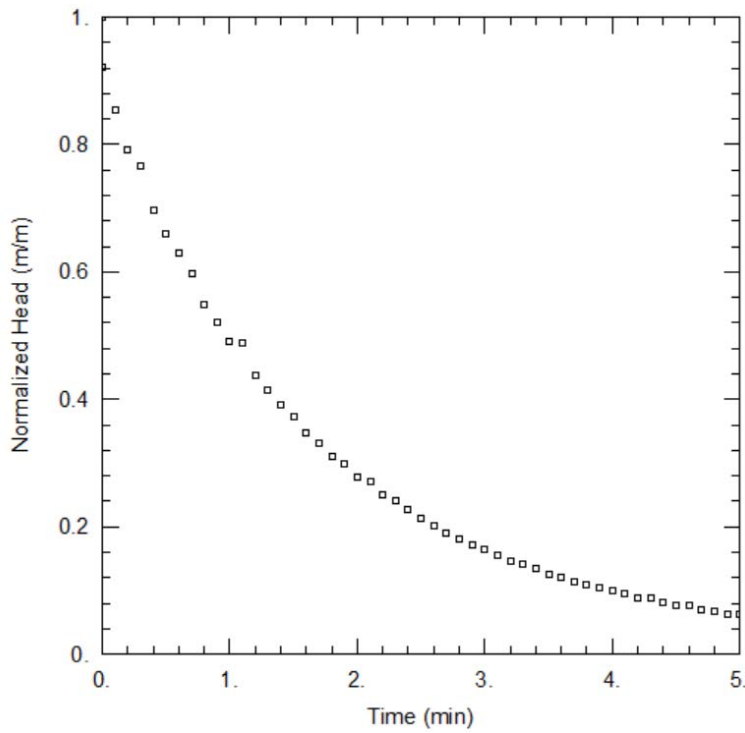
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E04



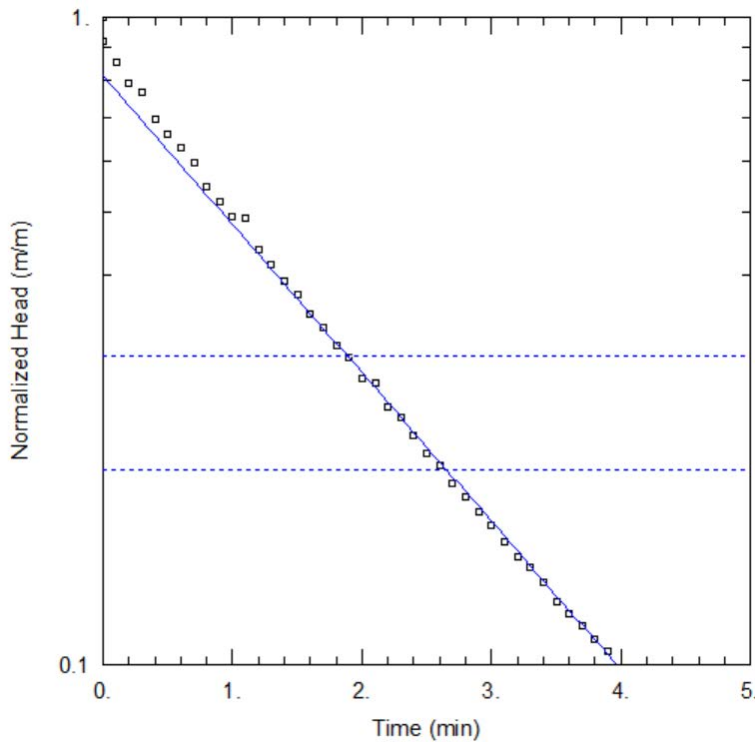


#### TEST INFORMATION:

Test Well: MW-IT-02B  
 Date of Test: May 02, 2024  
 Test Type: Rising Head Test  
 Test Method: Bailer

Static Water Level: 5.85 mbgs  
 Initial Displacement: 0.94 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 8.84 m to 11.89 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$3 \times 10^{-6} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-02B

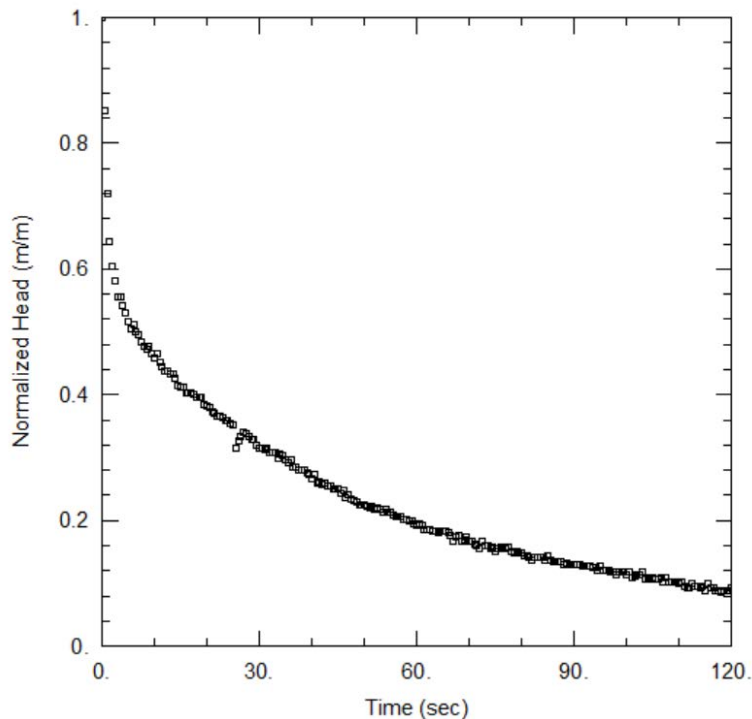
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E05

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

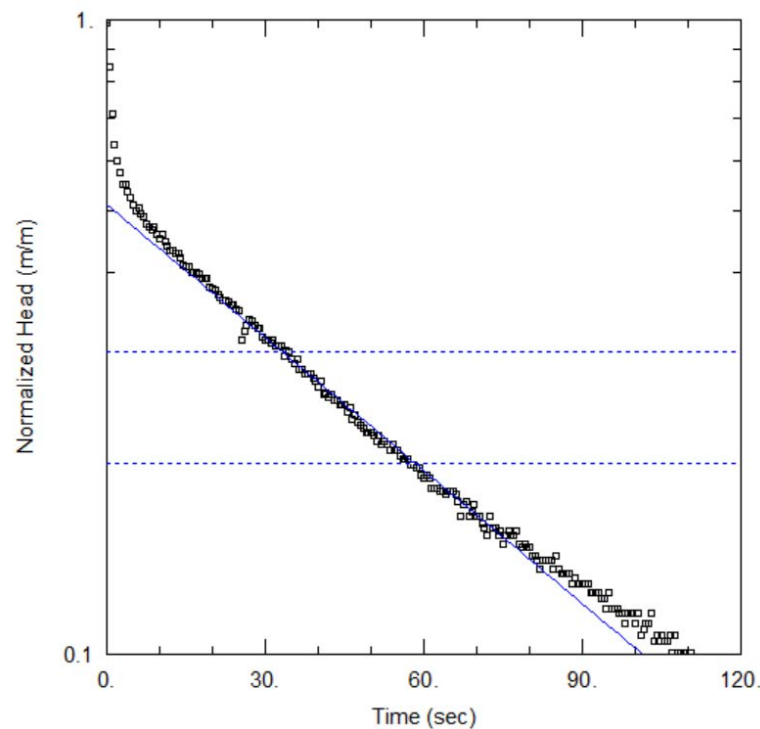


#### TEST INFORMATION:

Test Well: MW-IT-02C  
 Date of Test: May 03, 2024  
 Test Type: Rising Head Test  
 Test Method: Bailer

Static Water Level: 5.60 mbgs  
 Initial Displacement: 0.44 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 5.18 m to 6.71 m  
 Geology: (GP/GM) – SANDY SILTY GRAVEL  
 & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$2 \times 10^{-5} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-02C

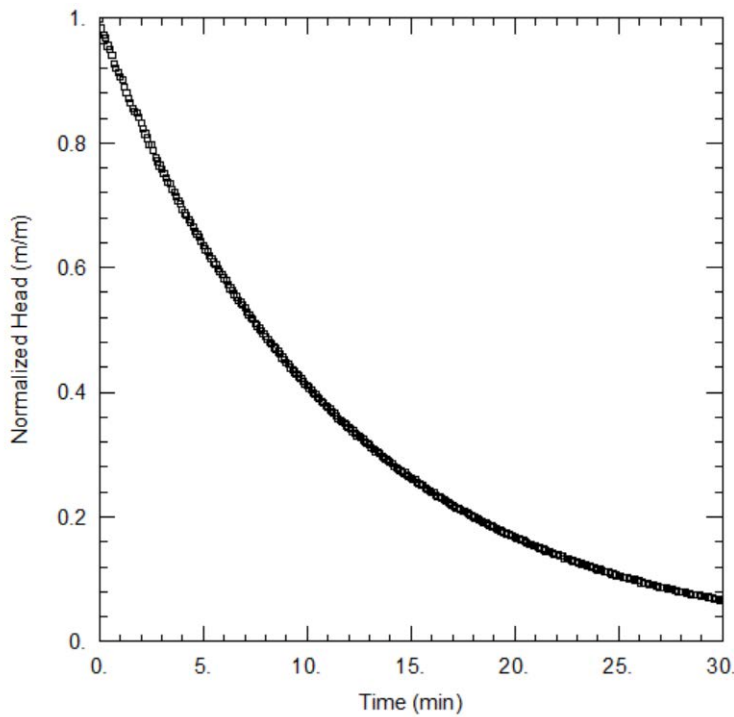
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E06

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

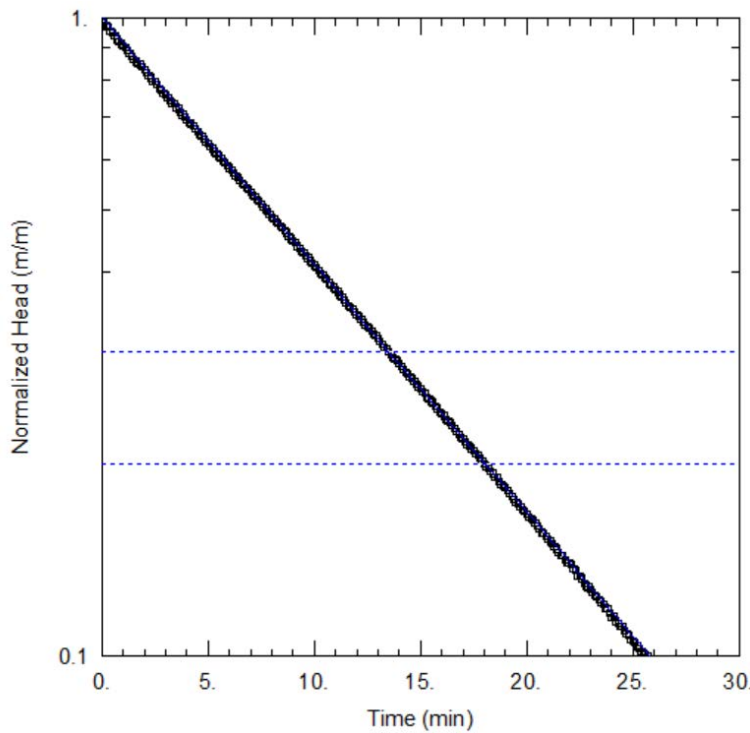


#### TEST INFORMATION:

Test Well: MW-IT-03A  
 Date of Test: May 14, 2024  
 Test Type: Rising Head Test  
 Test Method: Waterra Purge

Static Water Level: 4.59 mbgs  
 Initial Displacement: 3.04 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 13.29 m to 14.81 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$1 \times 10^{-6} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-03A

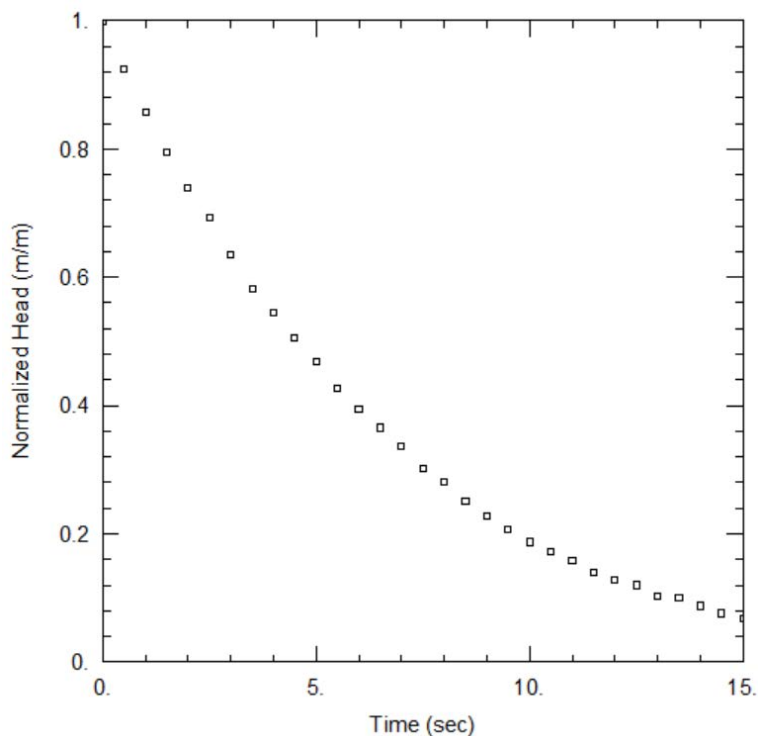
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E07



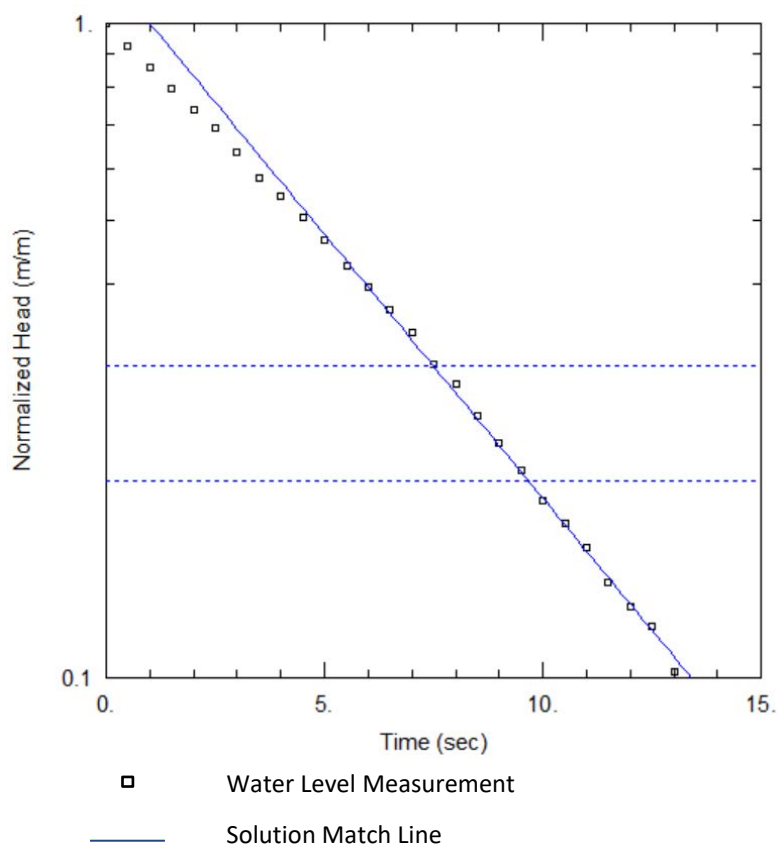


#### TEST INFORMATION:

Test Well: MW-IT-03B  
 Date of Test: May 06, 2024  
 Test Type: Rising Head Test  
 Test Method: Physical Slug

Static Water Level: 4.27 mbgs  
 Initial Displacement: 0.34 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 9.60 m to 11.43 m  
 Geology: (GP) – GRAVEL & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$1 \times 10^{-4} \text{ m/s}$$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-03B

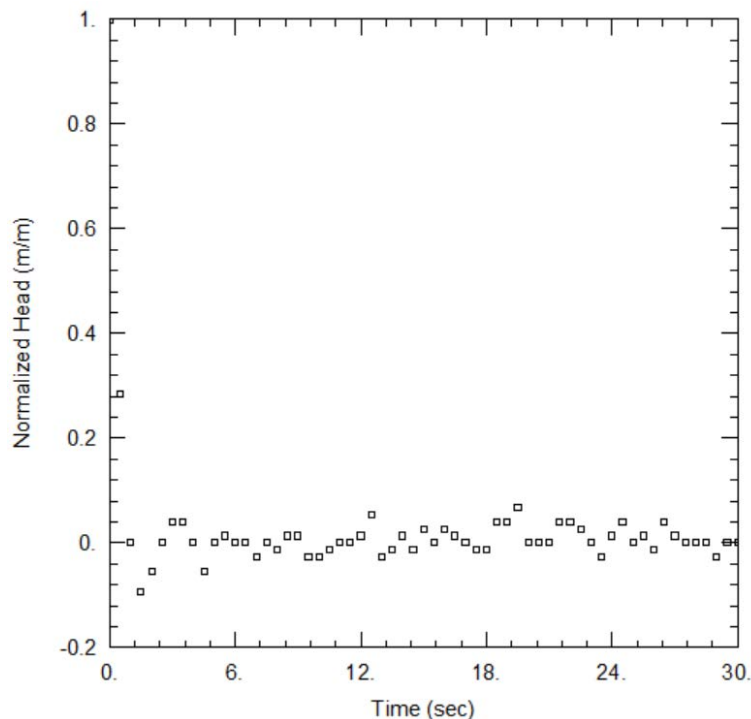
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

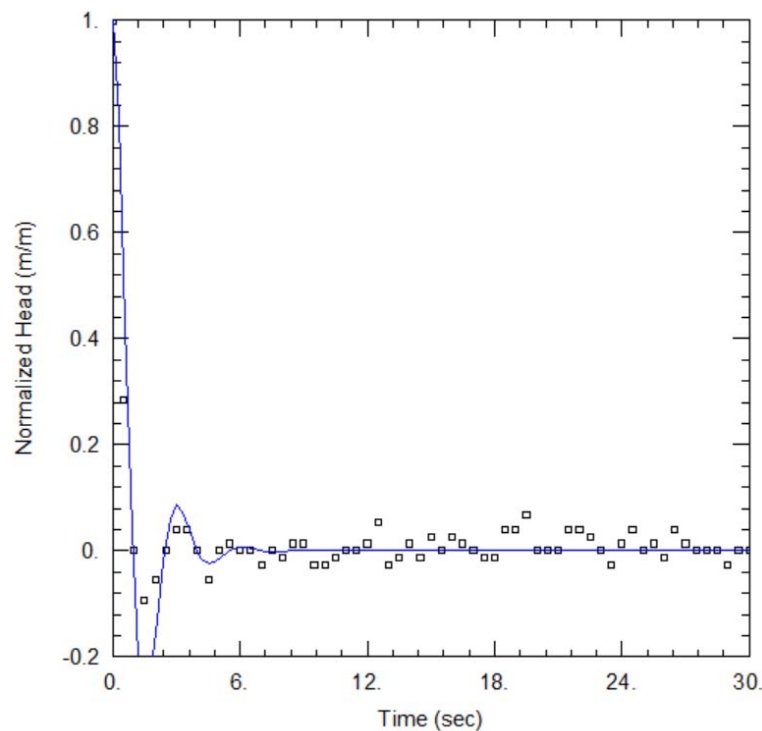
FIGURE  
 E08

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



#### TEST INFORMATION:

Test Well: MW-IT-03C  
 Date of Test: May 06, 2024  
 Test Type: Rising Head Test  
 Test Method: Physical Slug  
 Static Water Level: 4.21 mbgs  
 Initial Displacement: 0.07 m  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 5.79 m to 7.32 m  
 Geology: (GP/GM) – SANDY SILTY GRAVEL



#### SOLUTION:

Solution Method: Springer-Gelhar  
 Solution Type: Inertial  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$2 \times 10^{-3} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

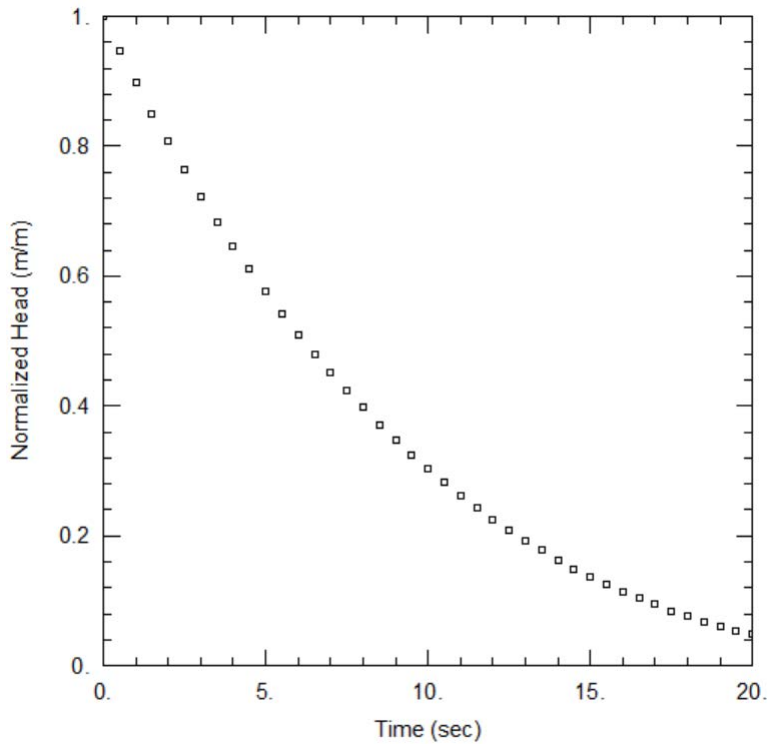
SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-03C

PROJECT No.  
19129150

PHASE  
2300

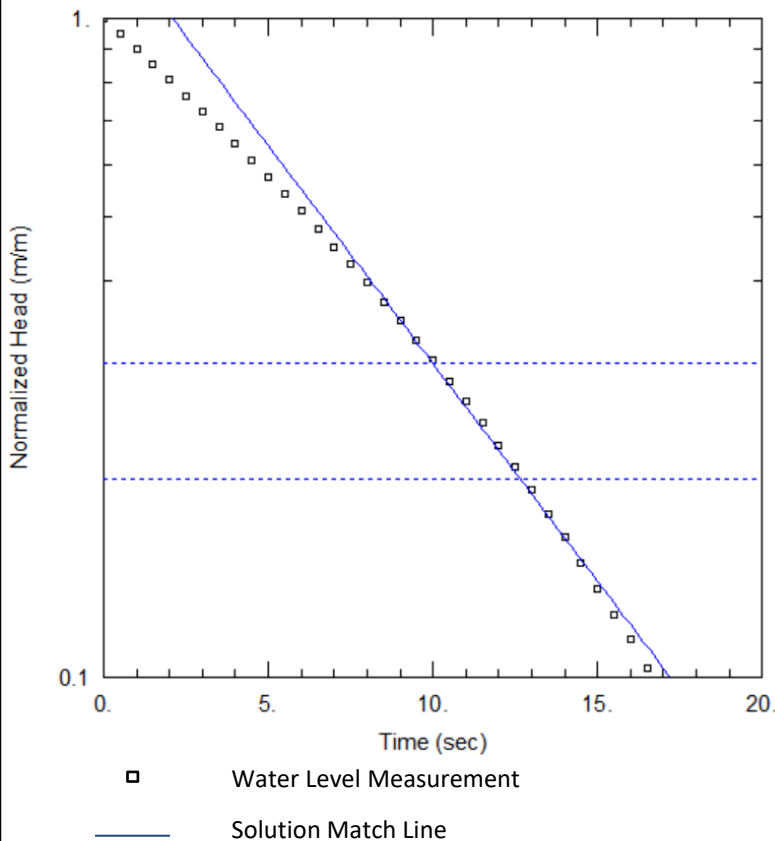
Rev.  
A

FIGURE  
E09



#### TEST INFORMATION:

Test Well: MW-IT-04A  
 Date of Test: April 29, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test  
 Static Water Level: 4.49 mbgs  
 Initial Displacement: 3.58 m  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 10.21 m to 11.73 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$1 \times 10^{-4} \text{ m/s}$$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-04A

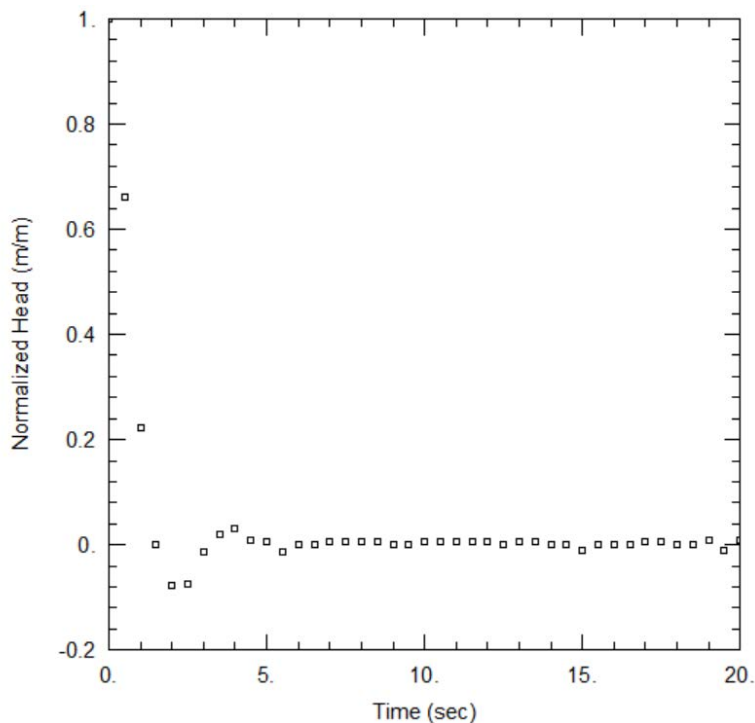
PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

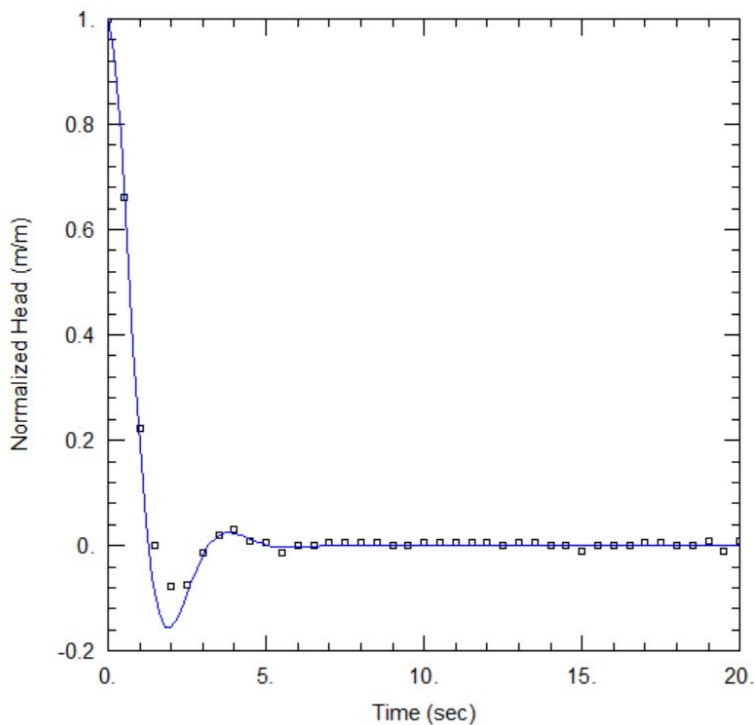
FIGURE  
E10





#### TEST INFORMATION:

Test Well: MW-IT-04B  
 Date of Test: April 29, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test  
  
 Static Water Level: 4.58 mbgs  
 Initial Displacement: 0.20 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 5.33 m to 8.38 m  
 Geology: (GP/GM) – SANDY SILTY GRAVEL  
 & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Springer-Gelhar  
 Solution Type: Inertial  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$7 \times 10^{-4} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-04B

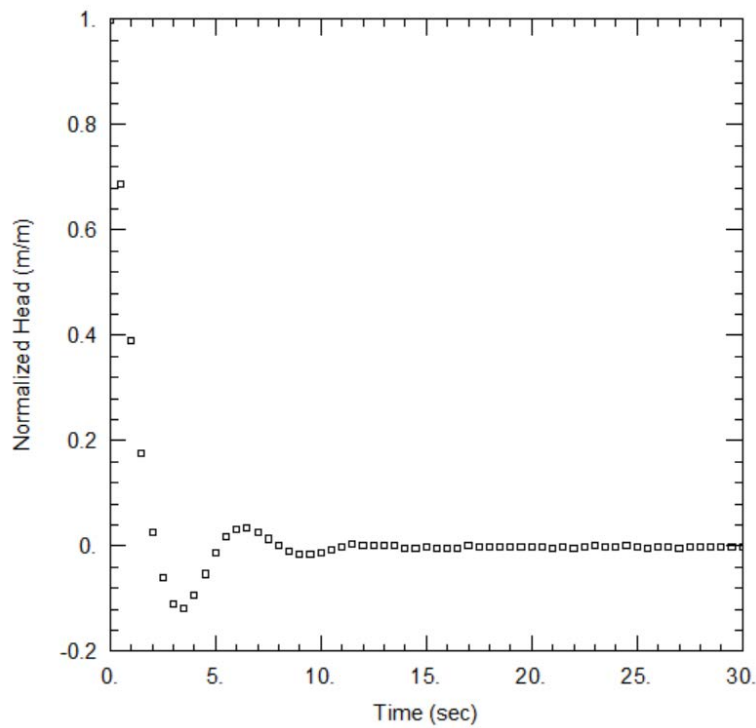
PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

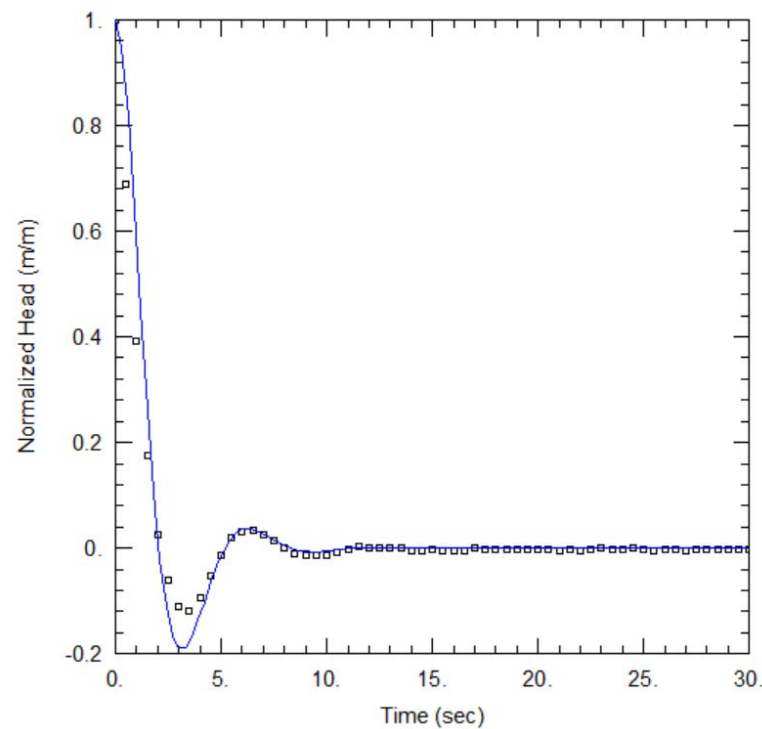
FIGURE  
E11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



#### TEST INFORMATION:

Test Well: MW-IT-05A  
 Date of Test: April 30, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test  
  
 Static Water Level: 6.06 mbgs  
 Initial Displacement: 1.02 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 11.39 m to 14.44 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Butler  
 Solution Type: Inertial  
 Aquifer Model: Confined

Hydraulic Conductivity (K) =

$$6 \times 10^{-4} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

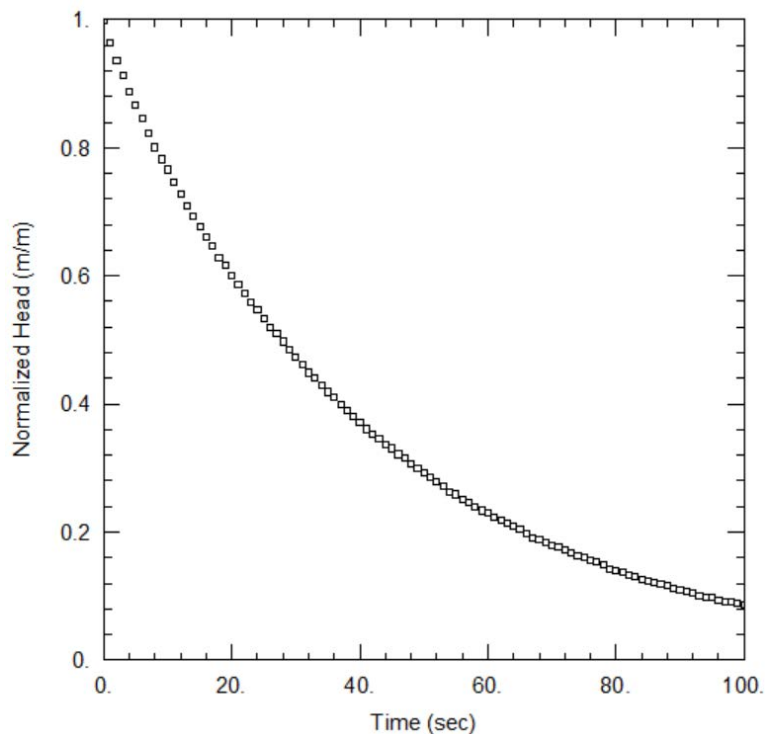
SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-05A

PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

FIGURE  
E12

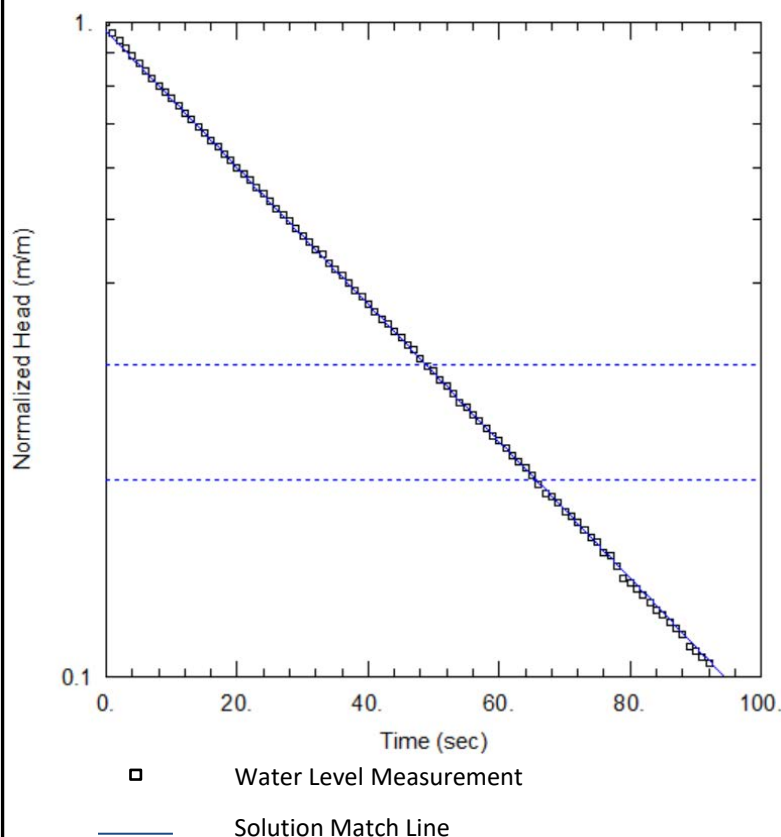


#### TEST INFORMATION:

Test Well: MW-IT-05B  
 Date of Test: April 30, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test

Static Water Level: 6.20 mbgs  
 Initial Displacement: 1.40 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 8.71 m to 10.23 m  
 Geology: (ML) SANDY SILT & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Confined

Hydraulic Conductivity (K) =

$$1 \times 10^{-5} \text{ m/s}$$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-05B

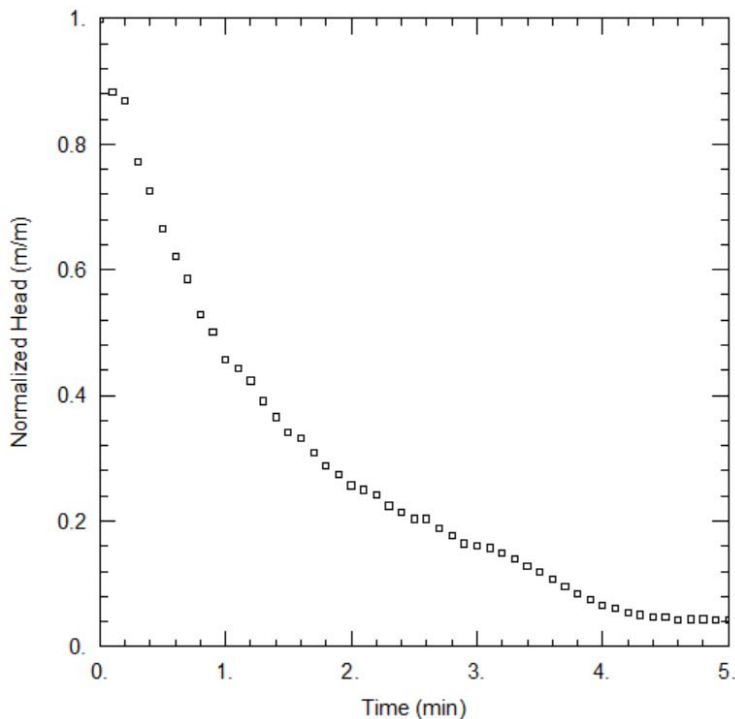
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E13



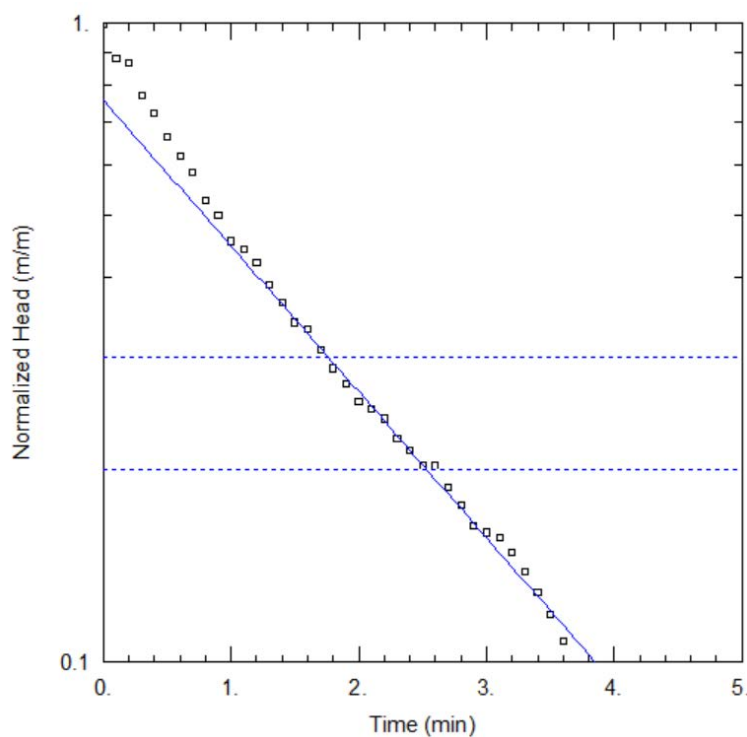


#### TEST INFORMATION:

Test Well: MW-IT-05C  
 Date of Test: April 30, 2024  
 Test Type: Rising Head Test  
 Test Method: Waterra Purge

Static Water Level: 6.23 mbgs  
 Initial Displacement: 0.71 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 5.79 m to 7.32 m  
 Geology: (SM) SILTY SAND



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$8 \times 10^{-6} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-05C

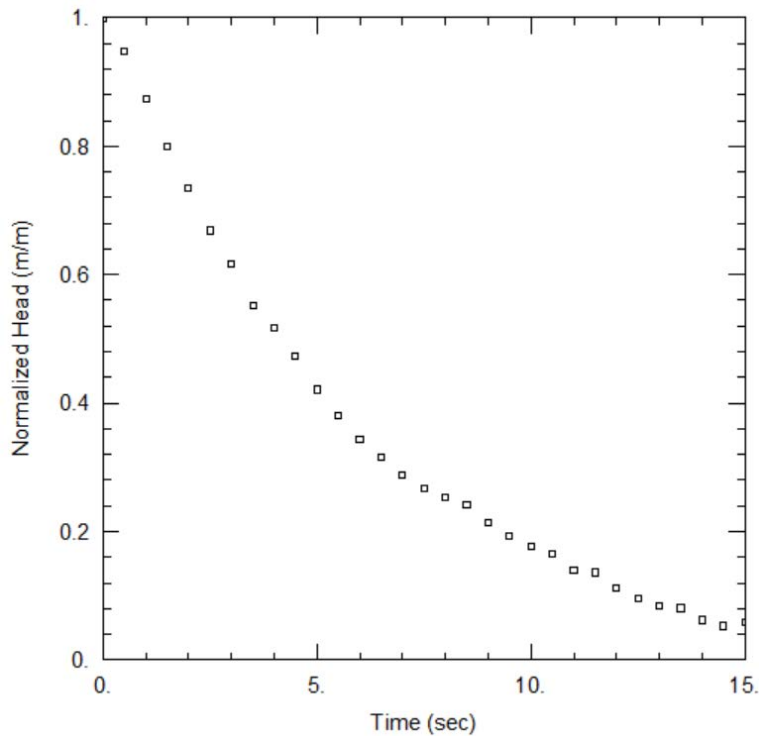
PROJECT No.  
 19129150

PHASE  
 2300

Rev.  
 A

FIGURE  
 E14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

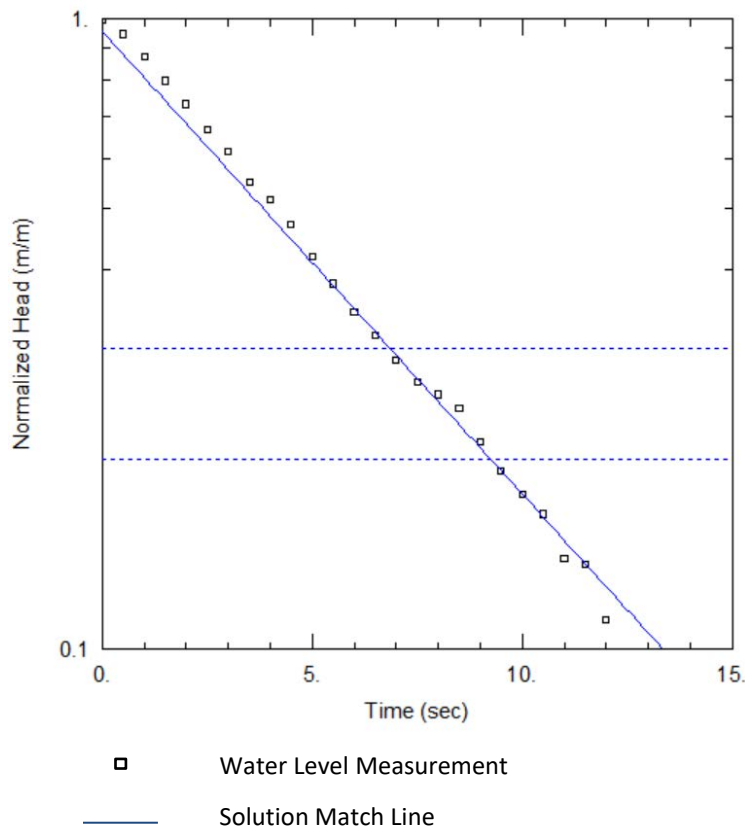


#### TEST INFORMATION:

Test Well: MW-IT-06A  
 Date of Test: May 06, 2024  
 Test Type: Rising Head Test  
 Test Method: Physical Slug

Static Water Level: 6.54 mbgs  
 Initial Displacement: 0.32 m

Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 9.75 m to 11.28 m  
 Geology: Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$1 \times 10^{-4} \text{ m/s}$$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

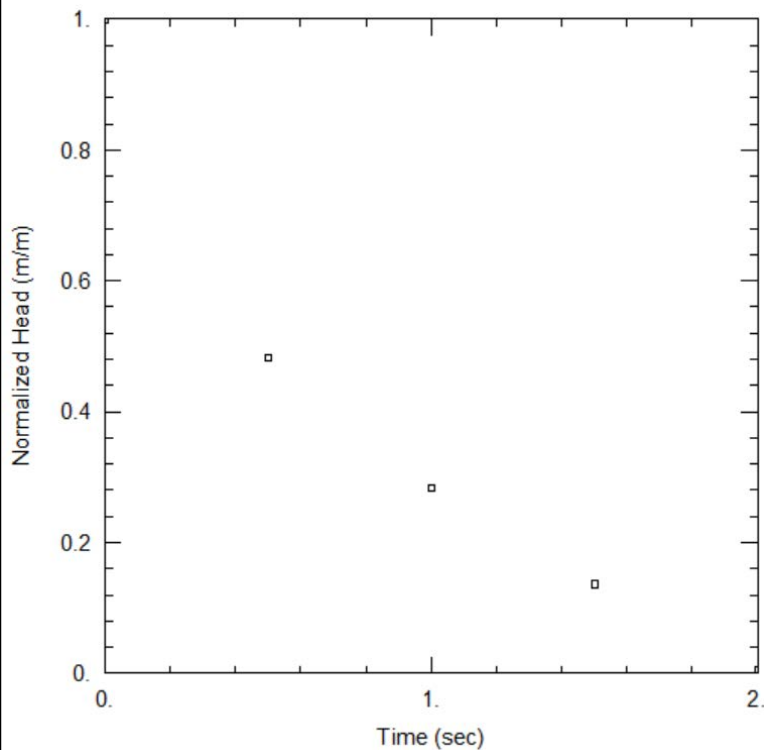
SINGLE WELL RESPONSE TEST ANALYSIS  
 MONITORING WELL MW-IT-06A

PROJECT No.  
19129150

PHASE  
2300

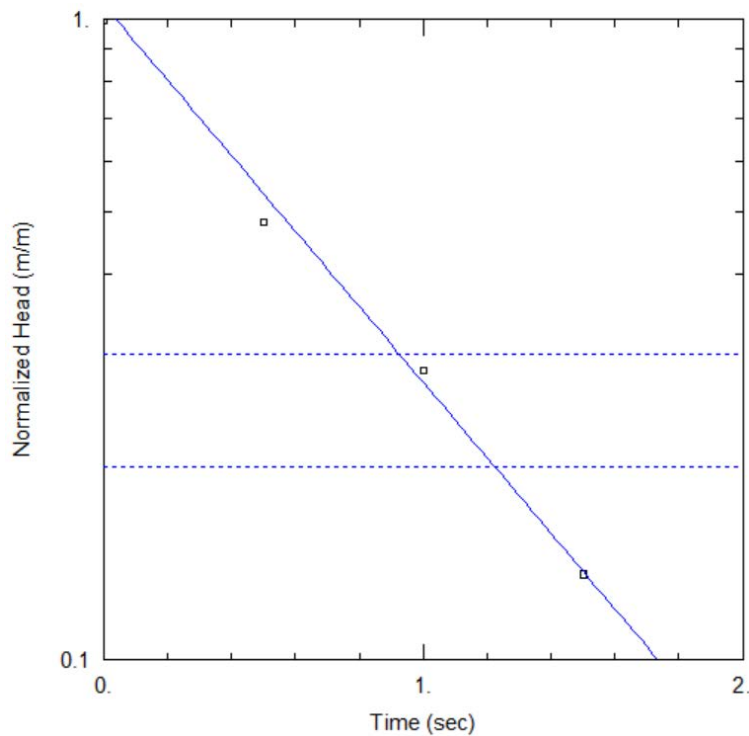
Rev.  
A

FIGURE  
E15



#### TEST INFORMATION:

Test Well: MW-IT-06B  
 Date of Test: May 06, 2024  
 Test Type: Rising Head Test  
 Test Method: Physical Slug  
  
 Static Water Level: 6.55 mbgs  
 Initial Displacement: 0.19 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 6.00 m to 9.04 m  
 Geology: (SM/GP) SILTY SAND and GRAVEL & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$6 \times 10^{-4} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-06B

PROJECT No.  
19129150

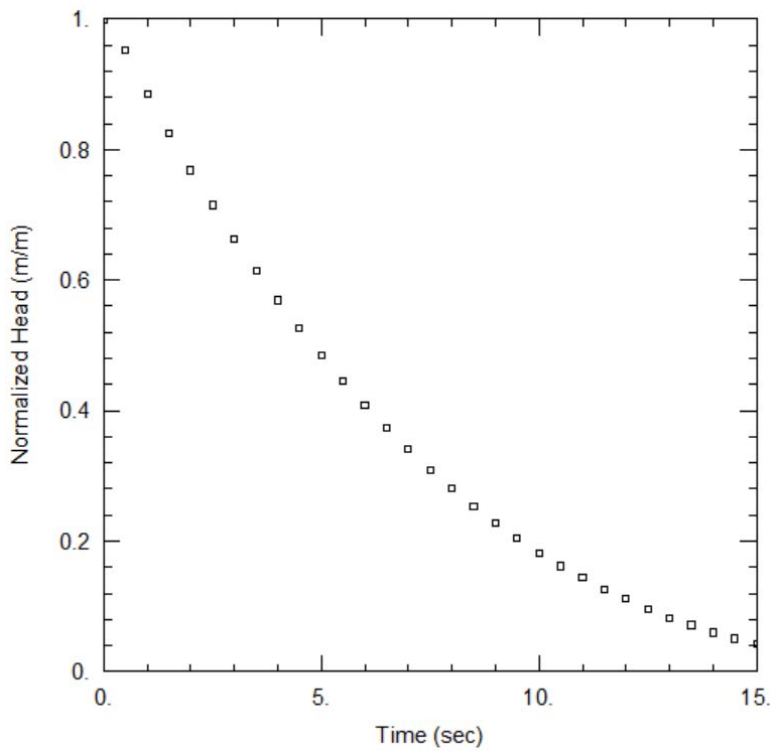
PHASE  
2300

Rev.  
A

FIGURE  
E16

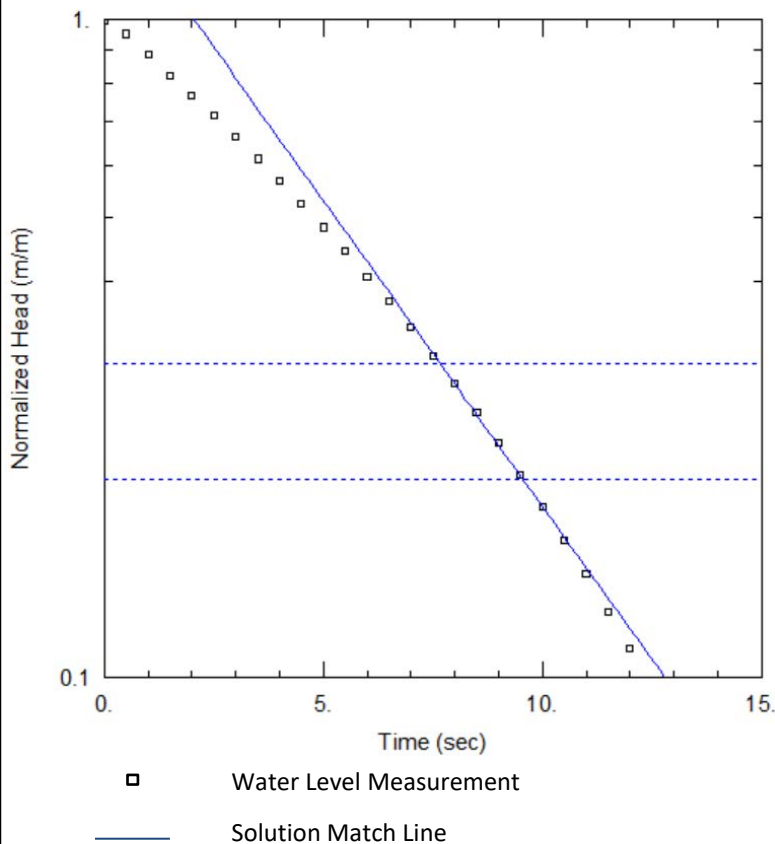
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A





#### TEST INFORMATION:

Test Well: MW-IT-07A  
 Date of Test: May 14, 2024  
 Test Type: Rising Head Test  
 Test Method: Pneumatic Rising Head Test  
 Static Water Level: 7.86 mbgs  
 Initial Displacement: 2.39 m  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 13.72 m to 15.24 m  
 Geology: Dolostone, Gasport Fm & Shaley Dolostone



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$2 \times 10^{-4} \text{ m/s}$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-07A

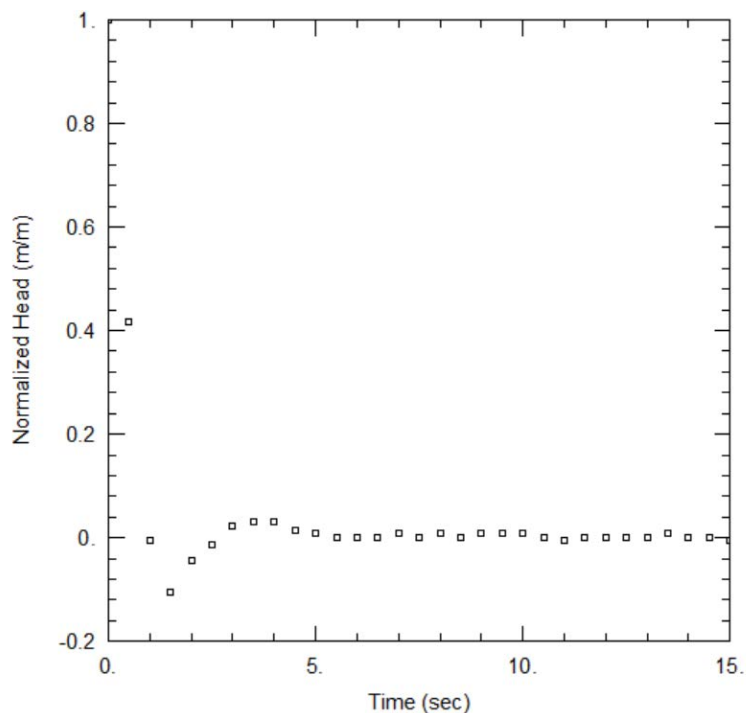
PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

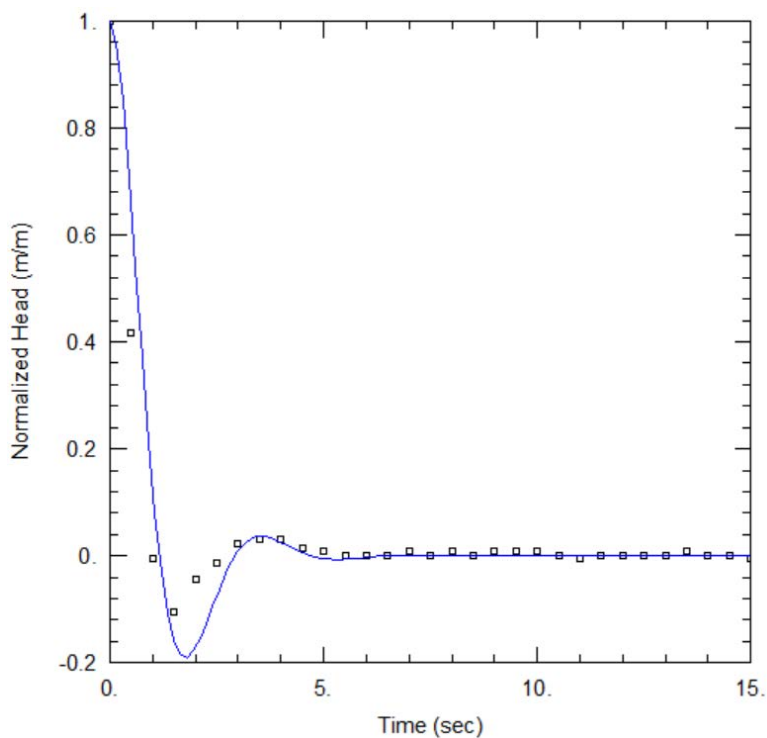
FIGURE  
E17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



#### TEST INFORMATION:

Test Well: MW-IT-07B  
 Date of Test: May 06, 2024  
 Test Type: Falling Head Test  
 Test Method: Physical Slug  
  
 Static Water Level: 7.82 mbgs  
 Initial Displacement: 0.23 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.062 m  
 Well Screen Interval: 9.61 m to 12.66 m  
 Geology: (CL) CLAY & Dolostone, Gasport Fm



#### SOLUTION:

Solution Method: Springer-Gelhar  
 Solution Type: Inertial  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$$8 \times 10^{-4} \text{ m/s}$$

□ Water Level Measurement  
 — Solution Match Line

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-07B

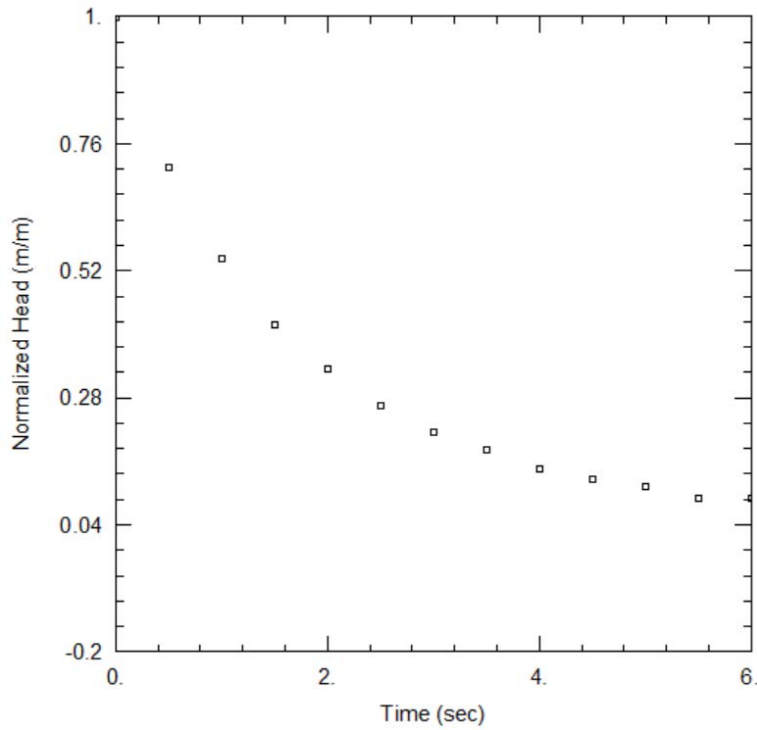
PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

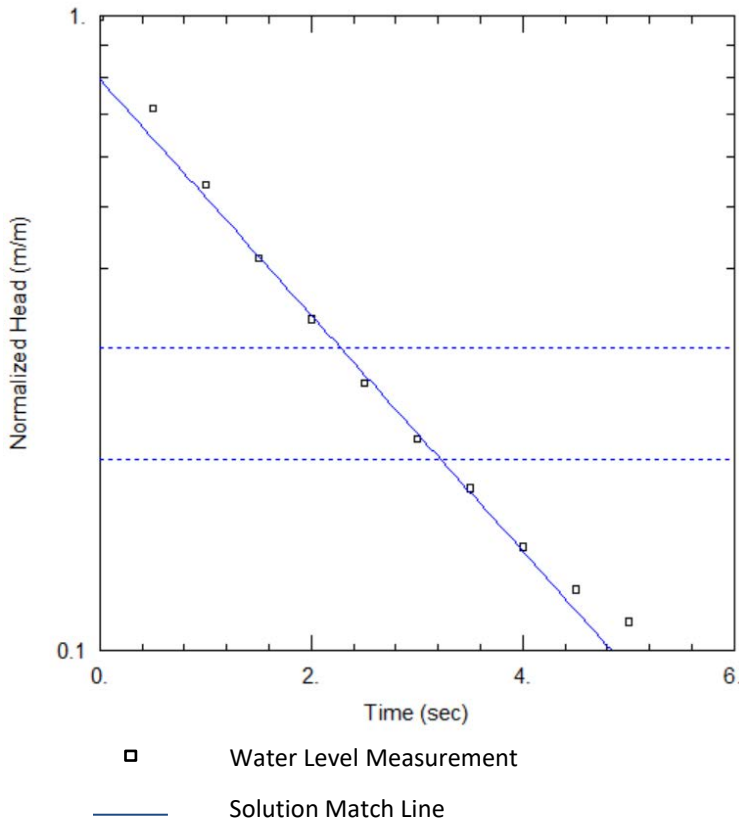
FIGURE  
E18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



#### TEST INFORMATION:

Test Well: MW-IT-07C  
 Date of Test: May 01, 2024  
 Test Type: Rising Head Test  
 Test Method: Physical Slug  
  
 Static Water Level: 7.85 mbgs  
 Initial Displacement: 0.14 m  
  
 Casing Radius: 0.026 m  
 Borehole Radius: 0.089 m  
 Well Screen Interval: 7.48 m to 9.00 m  
 Geology: (GP/SP) GRAVEL and SAND & (SM/GP) SILTY SAND and GRAVEL



#### SOLUTION:

Solution Method: Bouwer-Rice  
 Solution Type: Zero Storage  
 Aquifer Model: Unconfined

Hydraulic Conductivity (K) =

$3 \times 10^{-4} \text{ m/s}$

CLIENT

CBM Aggregates

PROJECT

CALEDON PIT / QUARRY

CONSULTANT



YYYY-MM-DD 2024-06-05

PREPARED VRP

DESIGN VRP

REVIEW PM/MY

APPROVED GWS

TITLE

SINGLE WELL RESPONSE TEST ANALYSIS  
MONITORING WELL MW-IT-07C

PROJECT No.  
19129150

PHASE  
2300

Rev.  
A

FIGURE  
E19

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



---

**APPENDIX F**

**Water Quality Results**



Your Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/06**  
Report #: R8137184  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C5873**

**Received: 2024/04/26, 19:08**

Sample Matrix: Water  
# Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2024/04/30	CAM SOP-00448	SM 24 2320 B m
Alkalinity	5	N/A	2024/05/04	CAM SOP-00448	SM 24 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2024/05/01	CAM SOP-00102	APHA 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	5	N/A	2024/05/04	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	6	N/A	2024/05/01	CAM SOP-00463	SM 24 4500-Cl E m
Conductivity	1	N/A	2024/04/30	CAM SOP-00414	SM 24 2510 m
Conductivity	5	N/A	2024/05/04	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	6	N/A	2024/04/29	CAM SOP-00446	SM 24 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	3	N/A	2024/04/29	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydro. CCME F1 & BTEX in Water	4	N/A	2024/04/30	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	6	2024/04/29	2024/04/30	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	6	N/A	2024/05/01	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	6	N/A	2024/04/30	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2024/05/01		
Ion Balance (% Difference)	2	N/A	2024/05/04		
Ion Balance (% Difference)	3	N/A	2024/05/06		
Anion and Cation Sum	1	N/A	2024/05/01		
Anion and Cation Sum	5	N/A	2024/05/04		
Total Ammonia-N	6	N/A	2024/05/02	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	6	N/A	2024/05/01	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (4)	5	2024/04/29	2024/05/04	CAM SOP-00413	SM 24th - 4500H+ B
pH (4)	1	2024/04/30	2024/04/30	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate	6	N/A	2024/05/01	CAM SOP-00461	SM 24 4500-P E
Sat. pH and Langelier Index (@ 20C)	1	N/A	2024/05/01		Auto Calc
Sat. pH and Langelier Index (@ 20C)	2	N/A	2024/05/04		Auto Calc
Sat. pH and Langelier Index (@ 20C)	3	N/A	2024/05/06		Auto Calc
Sat. pH and Langelier Index (@ 4C)	1	N/A	2024/05/01		Auto Calc
Sat. pH and Langelier Index (@ 4C)	2	N/A	2024/05/04		Auto Calc
Sat. pH and Langelier Index (@ 4C)	3	N/A	2024/05/06		Auto Calc
Sulphate by Automated Turbidimetry	6	N/A	2024/05/01	CAM SOP-00464	SM 24 4500-SO42- E m



Your Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/06**  
Report #: R8137184  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C5873**

**Received: 2024/04/26, 19:08**

Sample Matrix: Water  
# Samples Received: 7

Analyses	Date		Date Analyzed	Laboratory Method	Analytical Method
	Quantity	Extracted			
Total Dissolved Solids (TDS calc)	1	N/A	2024/05/01		Auto Calc
Total Dissolved Solids (TDS calc)	2	N/A	2024/05/04		Auto Calc
Total Dissolved Solids (TDS calc)	3	N/A	2024/05/06		Auto Calc

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(4) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."





Your Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Your C.O.C. #: C#987335-02-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/06**  
Report #: R8137184  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C5873**

**Received: 2024/04/26, 19:08**

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAC561		ZAC562	ZAC563		
Sampling Date		2024/04/26 13:00		2024/04/26 15:00	2024/04/26 16:00		
COC Number		C#987335-02-01		C#987335-02-01	C#987335-02-01		
	UNITS	MW-IT-04B	RDL	MW-IT-05A	MW-IT-05B	RDL	QC Batch
<b>Calculated Parameters</b>							
Anion Sum	me/L	6.95	N/A	6.15	6.35	N/A	9360238
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	220	1.0	210	210	1.0	9360243
Calculated TDS	mg/L	380	1.0	330	340	1.0	9360236
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	2.7	1.0	2.8	2.4	1.0	9360243
Cation Sum	me/L	7.48	N/A	6.45	6.53	N/A	9360238
Hardness (CaCO <sub>3</sub> )	mg/L	280	1.0	260	260	1.0	9360155
Ion Balance (% Difference)	%	3.65	N/A	2.42	1.39	N/A	9360237
Langelier Index (@ 20C)	N/A	0.942		0.919	0.837		9360233
Langelier Index (@ 4C)	N/A	0.693		0.670	0.588		9360234
Saturation pH (@ 20C)	N/A	7.17		7.23	7.24		9360233
Saturation pH (@ 4C)	N/A	7.42		7.48	7.49		9360234
<b>Inorganics</b>							
Total Ammonia-N	mg/L	<0.050	0.050	<0.050	<0.050	0.050	9366492
Conductivity	umho/cm	710	1.0	600	620	1.0	9362336
Dissolved Organic Carbon	mg/L	1.8	0.40	1.8	2.8	0.40	9362351
Orthophosphate (P)	mg/L	<0.010	0.010	<0.010	<0.010	0.010	9362439
pH	pH	8.11		8.15	8.08		9362332
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	16	1.0	13	17	1.0	9362440
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	230	1.0	210	210	1.0	9362320
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	67	1.0	54	56	2.0	9362431
Nitrite (N)	mg/L	<0.010	0.010	<0.010	<0.010	0.010	9363815
Nitrate (N)	mg/L	2.74	0.10	2.66	2.73	0.10	9363815
Nitrate + Nitrite (N)	mg/L	2.74	0.10	2.66	2.73	0.10	9363815
<b>Metals</b>							
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	<4.9	<4.9	4.9	9362177
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	<0.50	<0.50	0.50	9362177
Dissolved Arsenic (As)	ug/L	<1.0	1.0	<1.0	<1.0	1.0	9362177
Dissolved Barium (Ba)	ug/L	39	2.0	35	48	2.0	9362177
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	<0.40	<0.40	0.40	9362177
Dissolved Boron (B)	ug/L	<10	10	<10	15	10	9362177
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable							



BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAC561		ZAC562	ZAC563		
Sampling Date		2024/04/26 13:00		2024/04/26 15:00	2024/04/26 16:00		
COC Number		C#987335-02-01		C#987335-02-01	C#987335-02-01		
	UNITS	MW-IT-04B	RDL	MW-IT-05A	MW-IT-05B	RDL	QC Batch
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	<0.090	<0.090	0.090	9362177
Dissolved Calcium (Ca)	ug/L	82000	200	75000	73000	200	9362177
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	<5.0	<5.0	5.0	9362177
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	<0.50	0.77	0.50	9362177
Dissolved Copper (Cu)	ug/L	<0.90	0.90	<0.90	<0.90	0.90	9362177
Dissolved Iron (Fe)	ug/L	<100	100	<100	<100	100	9362177
Dissolved Lead (Pb)	ug/L	<0.50	0.50	<0.50	<0.50	0.50	9362177
Dissolved Magnesium (Mg)	ug/L	18000	50	17000	18000	50	9362177
Dissolved Manganese (Mn)	ug/L	2.2	2.0	<2.0	65	2.0	9362177
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	<0.50	4.2	0.50	9362177
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	<1.0	1.7	1.0	9362177
Dissolved Phosphorus (P)	ug/L	<100	100	<100	<100	100	9362177
Dissolved Potassium (K)	ug/L	1400	200	1300	1500	200	9362177
Dissolved Selenium (Se)	ug/L	<2.0	2.0	<2.0	<2.0	2.0	9362177
Dissolved Silicon (Si)	ug/L	2900	50	2600	3100	50	9362177
Dissolved Silver (Ag)	ug/L	<0.090	0.090	<0.090	<0.090	0.090	9362177
Dissolved Sodium (Na)	ug/L	43000	100	29000	31000	100	9362177
Dissolved Strontium (Sr)	ug/L	140	1.0	130	150	1.0	9362177
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	<0.050	<0.050	0.050	9362177
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	<5.0	<5.0	5.0	9362177
Dissolved Uranium (U)	ug/L	0.24	0.10	0.24	0.33	0.10	9362177
Dissolved Vanadium (V)	ug/L	<0.50	0.50	<0.50	<0.50	0.50	9362177
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	<5.0	<5.0	5.0	9362177
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							





BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAC563			ZAC564		ZAC565		
Sampling Date		2024/04/26 16:00			2024/04/26 16:30		2024/04/26 12:00		
COC Number		C#987335-02-01			C#987335-02-01		C#987335-02-01		
	UNITS	MW-IT-05B Lab-Dup	RDL	QC Batch	MW-IT-05C	QC Batch	MW-IT-04A	RDL	QC Batch

Calculated Parameters									
Anion Sum	me/L				5.21	9360238	6.55	N/A	9360238
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				170	9360243	220	1.0	9360243
Calculated TDS	mg/L				300	9360236	350	1.0	9360236
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				1.7	9360243	2.0	1.0	9360243
Cation Sum	me/L				5.73	9360238	6.82	N/A	9360238
Hardness (CaCO <sub>3</sub> )	mg/L				260	9360155	250	1.0	9360155
Ion Balance (% Difference)	%				4.67	9360237	1.98	N/A	9360237
Langelier Index (@ 20C)	N/A				0.775	9360233	0.779		9360233
Langelier Index (@ 4C)	N/A				0.526	9360234	0.530		9360234
Saturation pH (@ 20C)	N/A				7.26	9360233	7.22		9360233
Saturation pH (@ 4C)	N/A				7.51	9360234	7.47		9360234

Inorganics									
Total Ammonia-N	mg/L				<0.050	9366492	<0.050	0.050	9366492
Conductivity	umho/cm				510	9362336	660	1.0	9363678
Dissolved Organic Carbon	mg/L				2.2	9362351	1.7	0.40	9362351
Orthophosphate (P)	mg/L	<0.010	0.010	9362439	<0.010	9362439	<0.010	0.010	9362439
pH	pH				8.03	9362332	8.00		9363674
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	17	1.0	9362440	33	9362440	15	1.0	9362440
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L				170	9362320	220	1.0	9363644
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	56	2.0	9362431	29	9362431	60	1.0	9362431
Nitrite (N)	mg/L				<0.010	9363815	<0.010	0.010	9363815
Nitrate (N)	mg/L				4.54	9363815	2.44	0.10	9363815
Nitrate + Nitrite (N)	mg/L				4.54	9363815	2.44	0.10	9363815

Metals									
Dissolved Aluminum (Al)	ug/L				<4.9	9362177	<4.9	4.9	9362177
Dissolved Antimony (Sb)	ug/L				<0.50	9362177	<0.50	0.50	9362177
Dissolved Arsenic (As)	ug/L				<1.0	9362177	<1.0	1.0	9362177
Dissolved Barium (Ba)	ug/L				39	9362177	38	2.0	9362177
Dissolved Beryllium (Be)	ug/L				<0.40	9362177	<0.40	0.40	9362177

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable



BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAC563			ZAC564		ZAC565		
Sampling Date		2024/04/26 16:00			2024/04/26 16:30		2024/04/26 12:00		
COC Number		C#987335-02-01			C#987335-02-01		C#987335-02-01		
	UNITS	MW-IT-05B Lab-Dup	RDL	QC Batch	MW-IT-05C	QC Batch	MW-IT-04A	RDL	QC Batch
Dissolved Boron (B)	ug/L				16	9362177	<10	10	9362177
Dissolved Cadmium (Cd)	ug/L				<0.090	9362177	<0.090	0.090	9362177
Dissolved Calcium (Ca)	ug/L				86000	9362177	75000	200	9362177
Dissolved Chromium (Cr)	ug/L				<5.0	9362177	<5.0	5.0	9362177
Dissolved Cobalt (Co)	ug/L				10	9362177	<0.50	0.50	9362177
Dissolved Copper (Cu)	ug/L				<0.90	9362177	<0.90	0.90	9362177
Dissolved Iron (Fe)	ug/L				<100	9362177	<100	100	9362177
Dissolved Lead (Pb)	ug/L				<0.50	9362177	<0.50	0.50	9362177
Dissolved Magnesium (Mg)	ug/L				11000	9362177	16000	50	9362177
Dissolved Manganese (Mn)	ug/L				210	9362177	<2.0	2.0	9362177
Dissolved Molybdenum (Mo)	ug/L				5.9	9362177	<0.50	0.50	9362177
Dissolved Nickel (Ni)	ug/L				9.5	9362177	<1.0	1.0	9362177
Dissolved Phosphorus (P)	ug/L				<100	9362177	<100	100	9362177
Dissolved Potassium (K)	ug/L				1000	9362177	1200	200	9362177
Dissolved Selenium (Se)	ug/L				<2.0	9362177	<2.0	2.0	9362177
Dissolved Silicon (Si)	ug/L				3300	9362177	2600	50	9362177
Dissolved Silver (Ag)	ug/L				<0.090	9362177	<0.090	0.090	9362177
Dissolved Sodium (Na)	ug/L				12000	9362177	39000	100	9362177
Dissolved Strontium (Sr)	ug/L				190	9362177	130	1.0	9362177
Dissolved Thallium (Tl)	ug/L				<0.050	9362177	<0.050	0.050	9362177
Dissolved Titanium (Ti)	ug/L				<5.0	9362177	<5.0	5.0	9362177
Dissolved Uranium (U)	ug/L				0.47	9362177	0.27	0.10	9362177
Dissolved Vanadium (V)	ug/L				<0.50	9362177	<0.50	0.50	9362177
Dissolved Zinc (Zn)	ug/L				<5.0	9362177	<5.0	5.0	9362177
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate									



Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

<b>Bureau Veritas ID</b>		ZAC565			ZAC566		
<b>Sampling Date</b>		2024/04/26 12:00			2024/04/26		
<b>COC Number</b>		C#987335-02-01			C#987335-02-01		
	<b>UNITS</b>	<b>MW-IT-04A Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>DUP1</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	me/L				6.97	N/A	9360238
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				220	1.0	9360243
Calculated TDS	mg/L				380	1.0	9360236
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				2.5	1.0	9360243
Cation Sum	me/L				7.38	N/A	9360238
Hardness (CaCO <sub>3</sub> )	mg/L				280	1.0	9360155
Ion Balance (% Difference)	%				2.84	N/A	9360237
Langelier Index (@ 20C)	N/A				0.895		9360233
Langelier Index (@ 4C)	N/A				0.647		9360234
Saturation pH (@ 20C)	N/A				7.18		9360233
Saturation pH (@ 4C)	N/A				7.42		9360234
<b>Inorganics</b>							
Total Ammonia-N	mg/L				<0.050	0.050	9366492
Conductivity	umho/cm				710	1.0	9362336
Dissolved Organic Carbon	mg/L				1.8	0.40	9362351
Orthophosphate (P)	mg/L				<0.010	0.010	9362439
pH	pH				8.07		9362332
Dissolved Sulphate (SO <sub>4</sub> )	mg/L				16	1.0	9362440
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L				230	1.0	9362320
Dissolved Chloride (Cl <sup>-</sup> )	mg/L				67	1.0	9362431
Nitrite (N)	mg/L				<0.010	0.010	9363815
Nitrate (N)	mg/L				2.75	0.10	9363815
Nitrate + Nitrite (N)	mg/L				2.75	0.10	9363815
<b>Metals</b>							
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	9362177	<4.9	4.9	9362177
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	9362177	<0.50	0.50	9362177
Dissolved Arsenic (As)	ug/L	<1.0	1.0	9362177	<1.0	1.0	9362177
Dissolved Barium (Ba)	ug/L	38	2.0	9362177	38	2.0	9362177
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	9362177	<0.40	0.40	9362177
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							





Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAC565			ZAC566		
Sampling Date		2024/04/26 12:00			2024/04/26		
COC Number		C#987335-02-01			C#987335-02-01		
	UNITS	MW-IT-04A Lab-Dup	RDL	QC Batch	DUP1	RDL	QC Batch
Dissolved Boron (B)	ug/L	<10	10	9362177	<10	10	9362177
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	9362177	<0.090	0.090	9362177
Dissolved Calcium (Ca)	ug/L	77000	200	9362177	81000	200	9362177
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	9362177	<5.0	5.0	9362177
Dissolved Cobalt (Co)	ug/L	<0.50	0.50	9362177	<0.50	0.50	9362177
Dissolved Copper (Cu)	ug/L	<0.90	0.90	9362177	<0.90	0.90	9362177
Dissolved Iron (Fe)	ug/L	<100	100	9362177	<100	100	9362177
Dissolved Lead (Pb)	ug/L	<0.50	0.50	9362177	<0.50	0.50	9362177
Dissolved Magnesium (Mg)	ug/L	16000	50	9362177	18000	50	9362177
Dissolved Manganese (Mn)	ug/L	<2.0	2.0	9362177	2.3	2.0	9362177
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	9362177	<0.50	0.50	9362177
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	9362177	<1.0	1.0	9362177
Dissolved Phosphorus (P)	ug/L	<100	100	9362177	<100	100	9362177
Dissolved Potassium (K)	ug/L	1200	200	9362177	1300	200	9362177
Dissolved Selenium (Se)	ug/L	<2.0	2.0	9362177	<2.0	2.0	9362177
Dissolved Silicon (Si)	ug/L	2600	50	9362177	2800	50	9362177
Dissolved Silver (Ag)	ug/L	<0.090	0.090	9362177	<0.090	0.090	9362177
Dissolved Sodium (Na)	ug/L	39000	100	9362177	42000	100	9362177
Dissolved Strontium (Sr)	ug/L	130	1.0	9362177	140	1.0	9362177
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	9362177	<0.050	0.050	9362177
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	9362177	<5.0	5.0	9362177
Dissolved Uranium (U)	ug/L	0.27	0.10	9362177	0.24	0.10	9362177
Dissolved Vanadium (V)	ug/L	<0.50	0.50	9362177	<0.50	0.50	9362177
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	9362177	<5.0	5.0	9362177
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							



### PETROLEUM HYDROCARBONS (CCME)

<b>Bureau Veritas ID</b>		ZAC567		
<b>Sampling Date</b>		2024/04/26		
<b>COC Number</b>		C#987335-02-01		
	<b>UNITS</b>	<b>TRIPBLANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>BTEX &amp; F1 Hydrocarbons</b>				
Benzene	ug/L	<0.20	0.20	9362790
Toluene	ug/L	<0.20	0.20	9362790
Ethylbenzene	ug/L	<0.20	0.20	9362790
o-Xylene	ug/L	<0.20	0.20	9362790
p+m-Xylene	ug/L	<0.40	0.40	9362790
Total Xylenes	ug/L	<0.40	0.40	9362790
F1 (C6-C10)	ug/L	<25	25	9362790
F1 (C6-C10) - BTEX	ug/L	<25	25	9362790
<b>Surrogate Recovery (%)</b>				
1,4-Difluorobenzene	%	92		9362790
4-Bromofluorobenzene	%	100		9362790
D10-o-Xylene	%	91		9362790
D4-1,2-Dichloroethane	%	92		9362790
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

### O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		ZAC561			ZAC561			ZAC562		
Sampling Date		2024/04/26 13:00			2024/04/26 13:00			2024/04/26 15:00		
COC Number		C#987335-02-01			C#987335-02-01			C#987335-02-01		
	UNITS	MW-IT-04B	RDL	QC Batch	MW-IT-04B Lab-Dup	RDL	QC Batch	MW-IT-05A	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>										
Benzene	ug/L	<0.20	0.20	9362790	<0.20	0.20	9362790	<0.20	0.20	9362790
Toluene	ug/L	0.27	0.20	9362790	0.22	0.20	9362790	<0.20	0.20	9362790
Ethylbenzene	ug/L	<0.20	0.20	9362790	<0.20	0.20	9362790	<0.20	0.20	9362790
o-Xylene	ug/L	<0.20	0.20	9362790	<0.20	0.20	9362790	<0.20	0.20	9362790
p+m-Xylene	ug/L	<0.40	0.40	9362790	<0.40	0.40	9362790	<0.40	0.40	9362790
Total Xylenes	ug/L	<0.40	0.40	9362790	<0.40	0.40	9362790	<0.40	0.40	9362790
F1 (C6-C10)	ug/L	<25	25	9362790	<25	25	9362790	<25	25	9362790
F1 (C6-C10) - BTEX	ug/L	<25	25	9362790	<25	25	9362790	<25	25	9362790
<b>F2-F4 Hydrocarbons</b>										
F2 (C10-C16 Hydrocarbons)	ug/L	<100	100	9362318				<100	100	9362318
F3 (C16-C34 Hydrocarbons)	ug/L	<200	200	9362318				<200	200	9362318
F4 (C34-C50 Hydrocarbons)	ug/L	<200	200	9362318				<200	200	9362318
Reached Baseline at C50	ug/L	Yes		9362318				Yes		9362318
<b>Surrogate Recovery (%)</b>										
1,4-Difluorobenzene	%	96		9362790	91		9362790	95		9362790
4-Bromofluorobenzene	%	99		9362790	102		9362790	99		9362790
D10-o-Xylene	%	102		9362790	86		9362790	91		9362790
D4-1,2-Dichloroethane	%	95		9362790	101		9362790	90		9362790
o-Terphenyl	%	98		9362318				95		9362318
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

**O.REG 153 PHCS, BTEX/F1-F4 (WATER)**

Bureau Veritas ID		ZAC563	ZAC564	ZAC565	ZAC566		
Sampling Date		2024/04/26 16:00	2024/04/26 16:30	2024/04/26 12:00	2024/04/26		
COC Number		C#987335-02-01	C#987335-02-01	C#987335-02-01	C#987335-02-01		
	UNITS	MW-IT-05B	MW-IT-05C	MW-IT-04A	DUP1	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>							
Benzene	ug/L	0.21	<0.20	<0.20	<0.20	0.20	9362790
Toluene	ug/L	2.7	1.5	<0.20	0.24	0.20	9362790
Ethylbenzene	ug/L	0.35	<0.20	<0.20	<0.20	0.20	9362790
o-Xylene	ug/L	0.56	<0.20	<0.20	<0.20	0.20	9362790
p+m-Xylene	ug/L	1.2	<0.40	<0.40	<0.40	0.40	9362790
Total Xylenes	ug/L	1.8	<0.40	<0.40	<0.40	0.40	9362790
F1 (C6-C10)	ug/L	100	85	<25	<25	25	9362790
F1 (C6-C10) - BTEX	ug/L	95	84	<25	<25	25	9362790
<b>F2-F4 Hydrocarbons</b>							
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	100	9362318
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	380	<200	200	9362318
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	200	9362318
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes		9362318
<b>Surrogate Recovery (%)</b>							
1,4-Difluorobenzene	%	92	92	93	92		9362790
4-Bromofluorobenzene	%	100	100	101	100		9362790
D10-o-Xylene	%	94	90	87	91		9362790
D4-1,2-Dichloroethane	%	92	95	93	87		9362790
o-Terphenyl	%	94	98	95	99		9362318
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							





Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAC561  
**Sample ID:** MW-IT-04B  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9362320	N/A	2024/05/04	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/04	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9362336	N/A	2024/05/04	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/30	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO <sub>3</sub> )		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/04	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9366492	N/A	2024/05/02	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9362332	2024/04/29	2024/05/04	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAC561 Dup  
**Sample ID:** MW-IT-04B  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/30	Georgeta Rusu

**Bureau Veritas ID:** ZAC562  
**Sample ID:** MW-IT-05A  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9362320	N/A	2024/05/04	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/04	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9362336	N/A	2024/05/04	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/29	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO <sub>3</sub> )		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/04	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/04	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9366492	N/A	2024/05/02	Yogesh Patel



Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAC562  
**Sample ID:** MW-IT-05A  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9362332	2024/04/29	2024/05/04	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/04	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/04	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/04	Automated Statchk

**Bureau Veritas ID:** ZAC563  
**Sample ID:** MW-IT-05B  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9362320	N/A	2024/05/04	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/04	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9362336	N/A	2024/05/04	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/29	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO3)		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/04	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/04	Automated Statchk
Total Ammonia-N	LACH/NH4	9366492	N/A	2024/05/02	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9362332	2024/04/29	2024/05/04	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/04	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/04	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/04	Automated Statchk

**Bureau Veritas ID:** ZAC563 Dup  
**Sample ID:** MW-IT-05B  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan



Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAC564  
**Sample ID:** MW-IT-05C  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9362320	N/A	2024/05/04	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/04	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9362336	N/A	2024/05/04	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/30	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO <sub>3</sub> )		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/04	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9366492	N/A	2024/05/02	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9362332	2024/04/29	2024/05/04	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAC565  
**Sample ID:** MW-IT-04A  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9363644	N/A	2024/04/30	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/01	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9363678	N/A	2024/04/30	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/30	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO <sub>3</sub> )		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/01	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/01	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9366492	N/A	2024/05/02	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9363674	2024/04/30	2024/04/30	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/01	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/01	Automated Statchk



Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAC565 Dup  
**Sample ID:** MW-IT-04A  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen

**Bureau Veritas ID:** ZAC566  
**Sample ID:** DUP1  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9362320	N/A	2024/05/04	Nachiketa Gohil
Carbonate, Bicarbonate and Hydroxide	CALC	9360243	N/A	2024/05/04	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9362431	N/A	2024/05/01	Massarat Jan
Conductivity	AT	9362336	N/A	2024/05/04	Nachiketa Gohil
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9362351	N/A	2024/04/29	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/30	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9362318	2024/04/29	2024/04/30	Mohammed Abdul Nafay Shoeb
Hardness (calculated as CaCO3)		9360155	N/A	2024/05/01	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9362177	N/A	2024/04/30	Thuy Linh Nguyen
Ion Balance (% Difference)	CALC	9360237	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9360238	N/A	2024/05/04	Automated Statchk
Total Ammonia-N	LACH/NH4	9366492	N/A	2024/05/02	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9363815	N/A	2024/05/01	Jinal Chavda
pH	AT	9362332	2024/04/29	2024/05/04	Nachiketa Gohil
Orthophosphate	KONE	9362439	N/A	2024/05/01	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9360233	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9360234	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9362440	N/A	2024/05/01	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9360236	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAC567  
**Sample ID:** TRIPBLANK  
**Matrix:** Water

**Collected:** 2024/04/26  
**Shipped:**  
**Received:** 2024/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9362790	N/A	2024/04/29	Georgeta Rusu





Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location:   CBM CALEDON QUARRY  
Sampler Initials: VP

**GENERAL COMMENTS**

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	1.7°C
-----------	-------

**Results relate only to the items tested.**

BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9362318	o-Terphenyl	2024/04/29	103	60 - 130	104	60 - 130	101	%		
9362790	1,4-Difluorobenzene	2024/04/29	92	70 - 130	94	70 - 130	97	%		
9362790	4-Bromofluorobenzene	2024/04/29	105	70 - 130	105	70 - 130	103	%		
9362790	D10-o-Xylene	2024/04/29	93	70 - 130	102	70 - 130	90	%		
9362790	D4-1,2-Dichloroethane	2024/04/29	94	70 - 130	94	70 - 130	107	%		
9362177	Dissolved Aluminum (Al)	2024/04/30	103	80 - 120	97	80 - 120	<4.9	ug/L	NC	20
9362177	Dissolved Antimony (Sb)	2024/04/30	113	80 - 120	105	80 - 120	<0.50	ug/L	NC	20
9362177	Dissolved Arsenic (As)	2024/04/30	104	80 - 120	101	80 - 120	<1.0	ug/L	NC	20
9362177	Dissolved Barium (Ba)	2024/04/30	104	80 - 120	99	80 - 120	<2.0	ug/L	1.2	20
9362177	Dissolved Beryllium (Be)	2024/04/30	109	80 - 120	104	80 - 120	<0.40	ug/L	NC	20
9362177	Dissolved Boron (B)	2024/04/30	101	80 - 120	98	80 - 120	<10	ug/L	NC	20
9362177	Dissolved Cadmium (Cd)	2024/04/30	104	80 - 120	99	80 - 120	<0.090	ug/L	NC	20
9362177	Dissolved Calcium (Ca)	2024/04/30	NC	80 - 120	101	80 - 120	<200	ug/L	1.7	20
9362177	Dissolved Chromium (Cr)	2024/04/30	105	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
9362177	Dissolved Cobalt (Co)	2024/04/30	103	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
9362177	Dissolved Copper (Cu)	2024/04/30	105	80 - 120	104	80 - 120	<0.90	ug/L	NC	20
9362177	Dissolved Iron (Fe)	2024/04/30	104	80 - 120	102	80 - 120	<100	ug/L	NC	20
9362177	Dissolved Lead (Pb)	2024/04/30	104	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
9362177	Dissolved Magnesium (Mg)	2024/04/30	100	80 - 120	101	80 - 120	<50	ug/L	0.20	20
9362177	Dissolved Manganese (Mn)	2024/04/30	101	80 - 120	99	80 - 120	<2.0	ug/L	NC	20
9362177	Dissolved Molybdenum (Mo)	2024/04/30	110	80 - 120	104	80 - 120	<0.50	ug/L	NC	20
9362177	Dissolved Nickel (Ni)	2024/04/30	97	80 - 120	96	80 - 120	<1.0	ug/L	NC	20
9362177	Dissolved Phosphorus (P)	2024/04/30	108	80 - 120	101	80 - 120	<100	ug/L	NC	20
9362177	Dissolved Potassium (K)	2024/04/30	109	80 - 120	106	80 - 120	<200	ug/L	0.35	20
9362177	Dissolved Selenium (Se)	2024/04/30	102	80 - 120	97	80 - 120	<2.0	ug/L	NC	20
9362177	Dissolved Silicon (Si)	2024/04/30	106	80 - 120	100	80 - 120	<50	ug/L	2.0	20
9362177	Dissolved Silver (Ag)	2024/04/30	106	80 - 120	102	80 - 120	<0.090	ug/L	NC	20
9362177	Dissolved Sodium (Na)	2024/04/30	NC	80 - 120	102	80 - 120	<100	ug/L	0.17	20
9362177	Dissolved Strontium (Sr)	2024/04/30	101	80 - 120	99	80 - 120	<1.0	ug/L	1.1	20
9362177	Dissolved Thallium (Tl)	2024/04/30	103	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
9362177	Dissolved Titanium (Ti)	2024/04/30	106	80 - 120	100	80 - 120	<5.0	ug/L	NC	20

BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9362177	Dissolved Uranium (U)	2024/04/30	103	80 - 120	99	80 - 120	<0.10	ug/L	1.1	20
9362177	Dissolved Vanadium (V)	2024/04/30	104	80 - 120	99	80 - 120	<0.50	ug/L	NC	20
9362177	Dissolved Zinc (Zn)	2024/04/30	100	80 - 120	99	80 - 120	<5.0	ug/L	NC	20
9362318	F2 (C10-C16 Hydrocarbons)	2024/04/30	96	60 - 130	98	60 - 130	<100	ug/L	16	30
9362318	F3 (C16-C34 Hydrocarbons)	2024/04/30	105	60 - 130	108	60 - 130	<200	ug/L	9.5	30
9362318	F4 (C34-C50 Hydrocarbons)	2024/04/30	99	60 - 130	103	60 - 130	<200	ug/L	NC	30
9362320	Alkalinity (Total as CaCO <sub>3</sub> )	2024/05/04			100	85 - 115	<1.0	mg/L	1.5	20
9362332	pH	2024/05/04			101	98 - 103			2.0	N/A
9362336	Conductivity	2024/05/04			102	85 - 115	<1.0	umho/cm	0.95	10
9362351	Dissolved Organic Carbon	2024/04/29	94	80 - 120	95	80 - 120	<0.40	mg/L	0.63	20
9362431	Dissolved Chloride (Cl <sup>-</sup> )	2024/05/01	NC	80 - 120	99	80 - 120	<1.0	mg/L	0.85	20
9362439	Orthophosphate (P)	2024/05/01	92	75 - 125	91	80 - 120	<0.010	mg/L	NC	20
9362440	Dissolved Sulphate (SO <sub>4</sub> )	2024/05/01	97	75 - 125	96	80 - 120	<1.0	mg/L	0.36	20
9362790	Benzene	2024/04/30	90	50 - 140	91	50 - 140	<0.20	ug/L	NC	30
9362790	Ethylbenzene	2024/04/30	93	50 - 140	96	50 - 140	<0.20	ug/L	NC	30
9362790	F1 (C6-C10) - BTEX	2024/04/30					<25	ug/L	NC	30
9362790	F1 (C6-C10)	2024/04/30	97	60 - 140	99	60 - 140	<25	ug/L	NC	30
9362790	o-Xylene	2024/04/30	92	50 - 140	93	50 - 140	<0.20	ug/L	NC	30
9362790	p+m-Xylene	2024/04/30	89	50 - 140	91	50 - 140	<0.40	ug/L	NC	30
9362790	Toluene	2024/04/30	86	50 - 140	88	50 - 140	<0.20	ug/L	20	30
9362790	Total Xylenes	2024/04/30					<0.40	ug/L	NC	30
9363644	Alkalinity (Total as CaCO <sub>3</sub> )	2024/04/30			101	85 - 115	<1.0	mg/L	1.9	20
9363674	pH	2024/04/30			102	98 - 103			0.27	N/A
9363678	Conductivity	2024/04/30			102	85 - 115	<1.0	umho/cm	0.16	10
9363815	Nitrate (N)	2024/05/01	89	80 - 120	97	80 - 120	<0.10	mg/L	NC	20
9363815	Nitrite (N)	2024/05/01	97	80 - 120	102	80 - 120	<0.010	mg/L	3.4	20



BUREAU  
VERITAS

Bureau Veritas Job #: C4C5873

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON QUARRY

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9366492	Total Ammonia-N	2024/05/02	NC	75 - 125	98	80 - 120	<0.050	mg/L	0.57	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference  $\leq 2 \times \text{RDL}$ ).





Bureau Veritas Job #: C4C5873  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON QUARRY  
Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

---

Cristina Carriere, Senior Scientific Specialist

---




Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



**NONT-2024-04-2749**

Page 2 of 3

i 84

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:				NOV-1-2024-04-2749	
Company Name: #21375 WSP Canada Inc.		Company Name: Paul Menkveld		Quotation #: C41059				Title Order #:	
Attention: George Schneider		Attention: Paul Menkveld		P.O. #:					
Address: 210 Sheldon Drive		Address:		Project: CA-GLD-19129150 (2300)				987335	
Cambridge ON N1T 1A8				Project Name: CBM Caledon Quarry		COC #:		Project Manager:	
Tel: (519) 620-8182		Tel: (519) 620-8182		Site #:				Ankita Bhalla	
Fax: George_Schneider@golder.com		Fax: paul.menkveld@wsp.com		Sampled By: Victoria Propp		C#987335-02-01			

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE  
SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)				Other Regulations		Special Instructions
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/Fine		<input type="checkbox"/> CCME	<input type="checkbox"/> Sanitary Sewer Bylaw	
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse		<input type="checkbox"/> Reg 55B	<input type="checkbox"/> Storm Sewer Bylaw	
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC		<input type="checkbox"/> MISA	Municipality _____	
<input type="checkbox"/> Table _____				<input type="checkbox"/> PWQO	<input type="checkbox"/> Reg 406 Table _____	
				<input type="checkbox"/> Other _____		

**Include Criteria on Certificate of Analysis (Y/N)?**

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix
1		MW-IT-04B	24/04/26	13:00	GW
2		<del>MW-IT-04C</del>			
3		MW-IT-05A		15:00	
4		MW-IT-05B		16:00	
5		MW-IT-05C		16:30	
6		MW-IT-06A 04A		12:00	
7		MW-IT-06B Dup 1	↓	—	↓
8		MW-IT-06C TRIP BLANK	—	—	—
9		MW-IT-07A			
10		MW-IT-07B			

(Metals) / Hg / Cr VI

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

[illegible]

Turnaround Time (TAT) Required:

Please provide advance notice for rush projects

Regular (Standard) TAT:

Standard TAT = 5-7 Working days for most tests.

Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)	
---	--

Date Required: \_\_\_\_\_ Time Required: \_\_\_\_\_

Rush Confirmation Number: \_\_\_\_\_

(call lab for #)

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
V. Propp	24/04/26	19:00	Ashitha Subramaniam	2024/04/26	19:08		Time Sensitive	Temperature (°C) on Receipt	Custody Seal Present	Yes	No
								11/19.3			

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT [WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS](http://WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS).

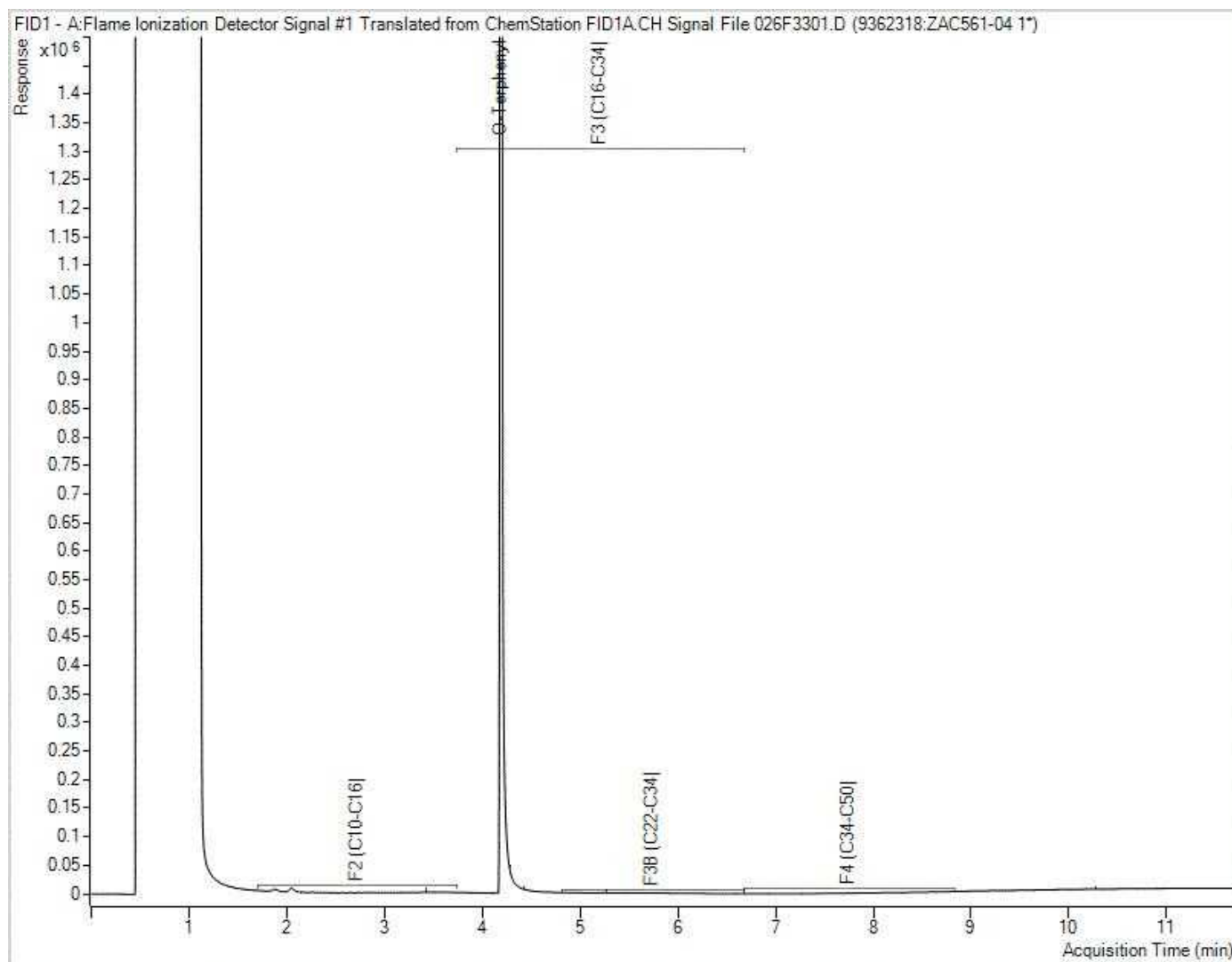
\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT [WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS](http://WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCS)

SAMPLES MUST BE KEPT COOL ( < 10° C ) FROM TIME OF SAMPLING  
UNTIL DELIVERY TO BUREAU VERITAS

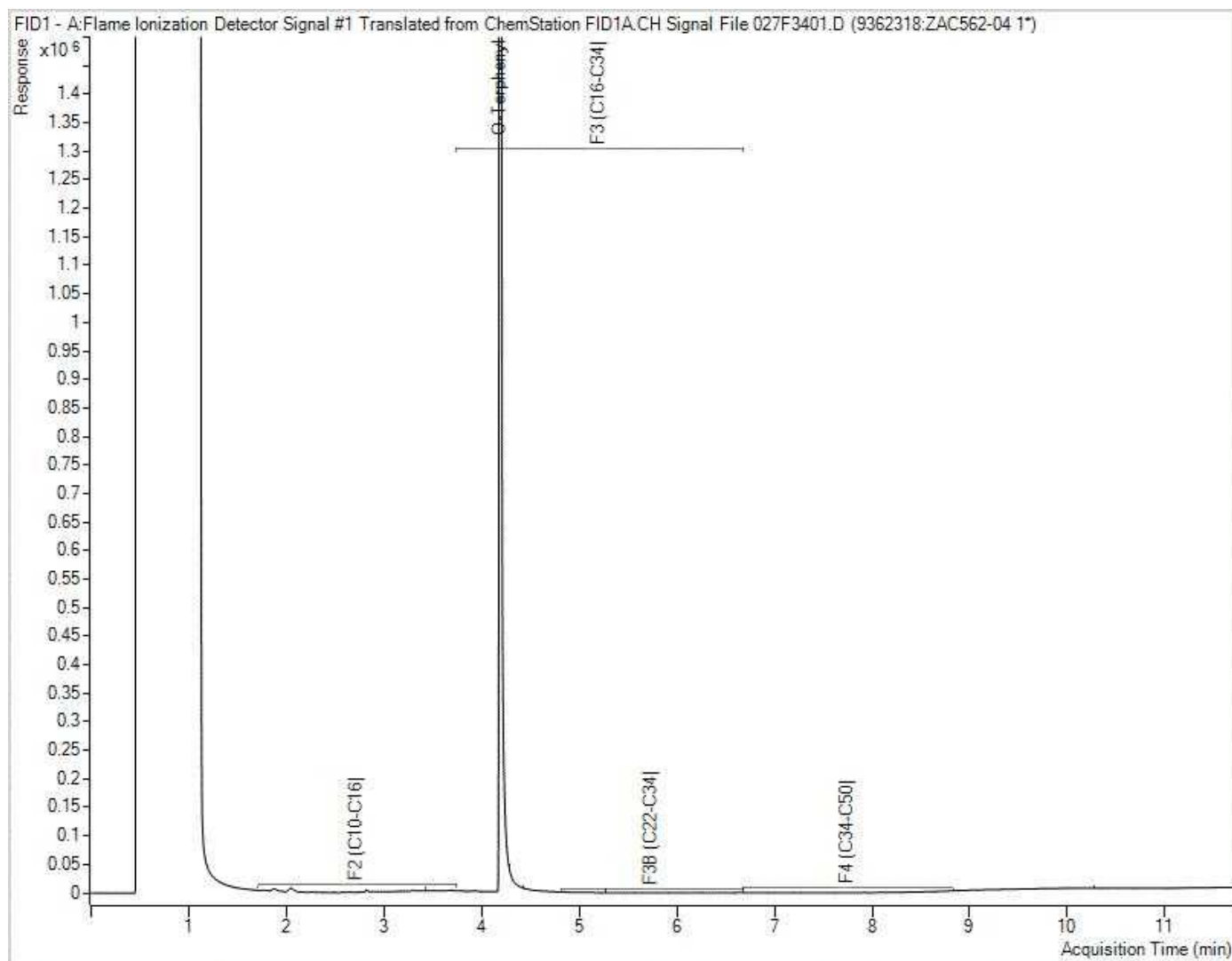
White: Bureau Veritas Yellow: Client

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

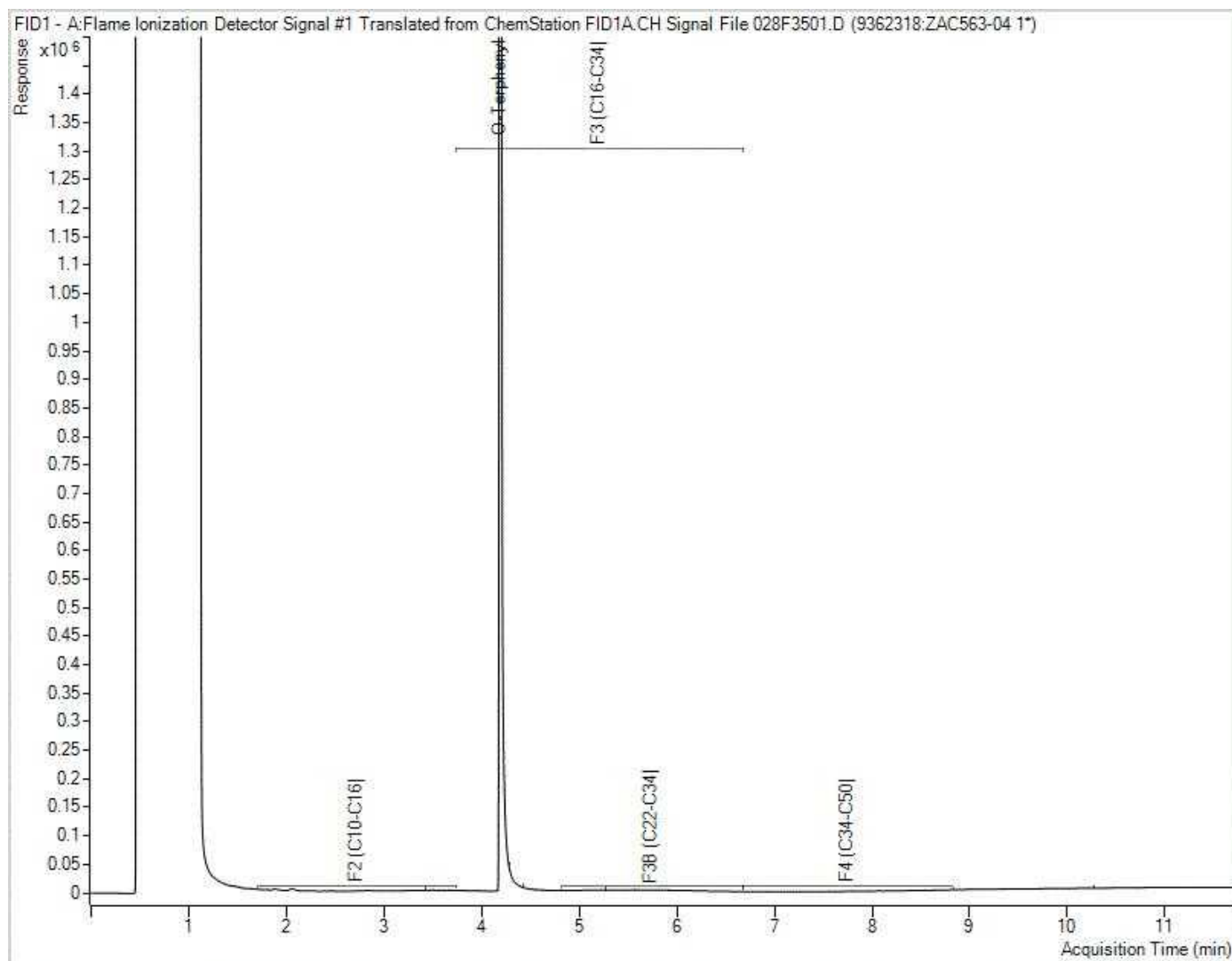
**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

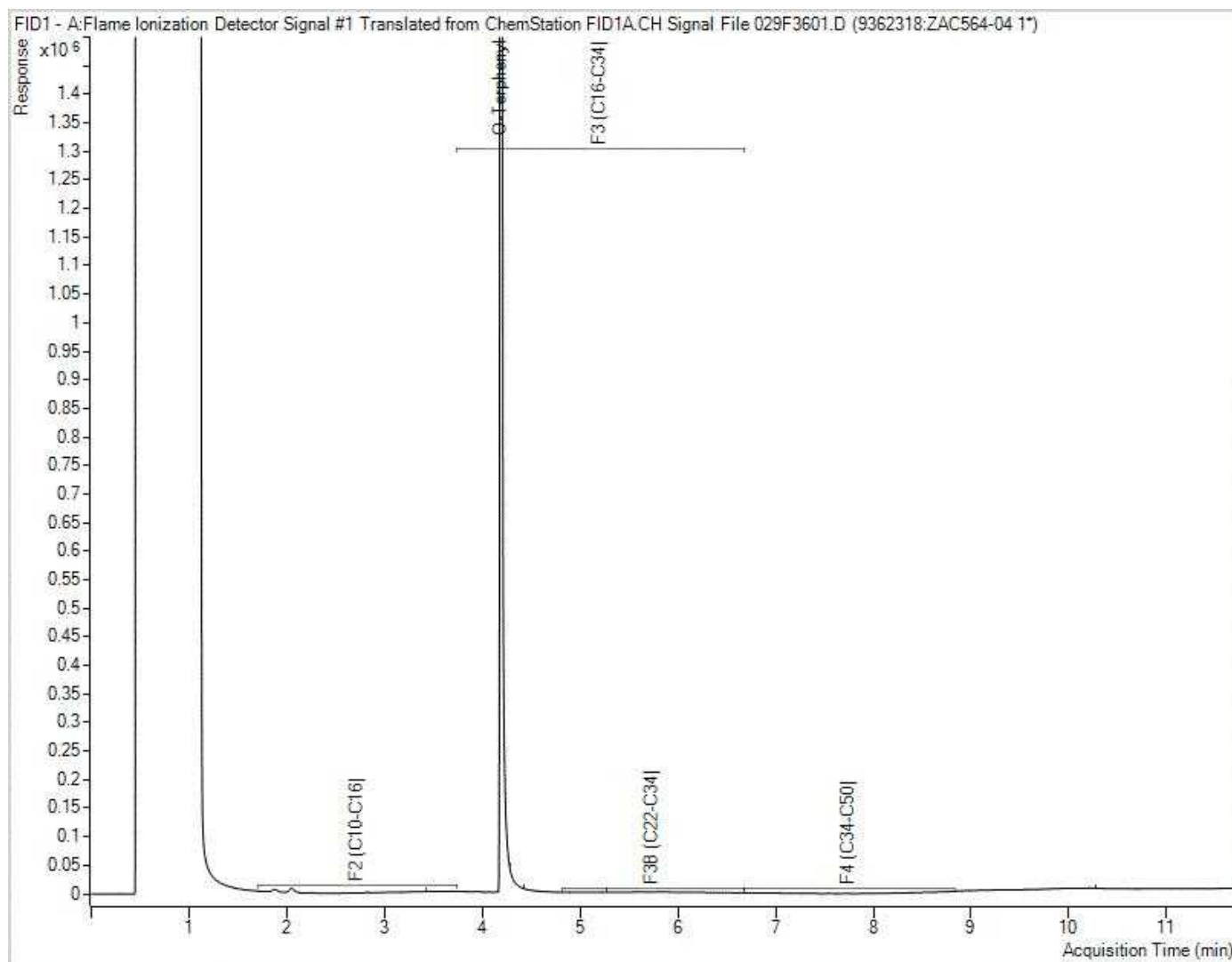


**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



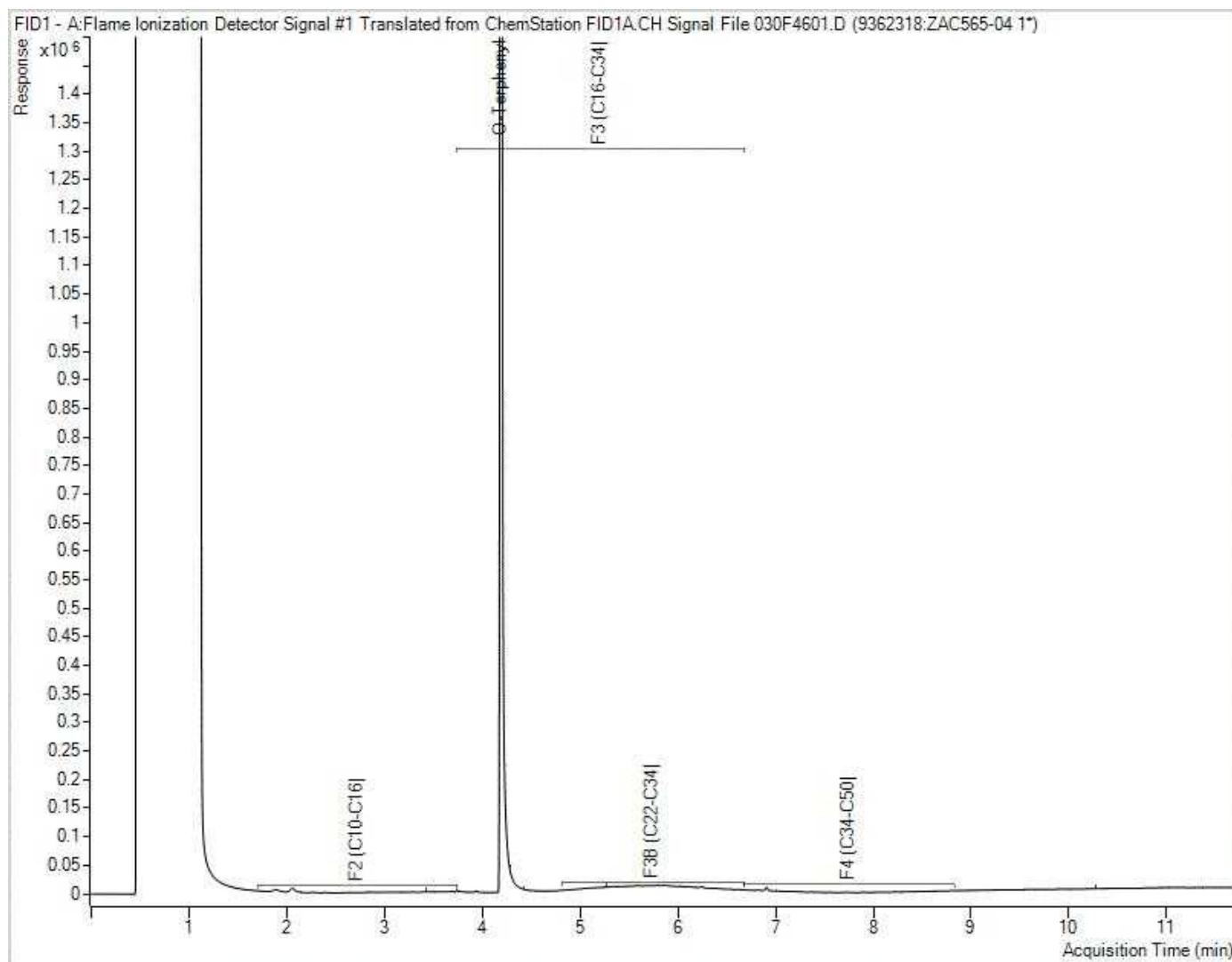
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



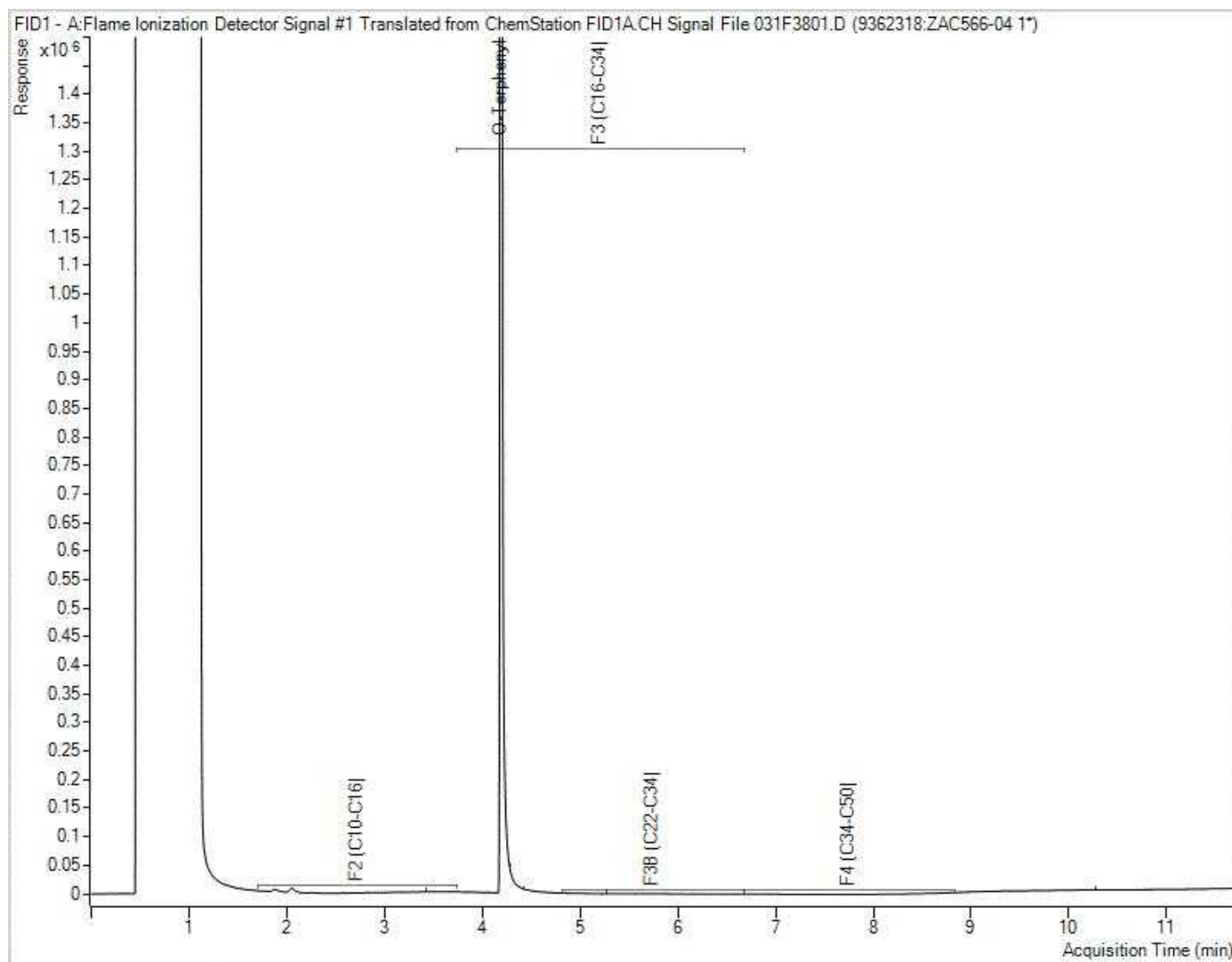
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.





Your Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Your C.O.C. #: 987335-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/06**  
Report #: R8137528  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C8240**

**Received: 2024/04/29, 18:30**

Sample Matrix: Water  
# Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2024/05/05	CAM SOP-00448	SM 24 2320 B m
Alkalinity	4	N/A	2024/05/06	CAM SOP-00448	SM 24 2320 B m
Carbonate, Bicarbonate and Hydroxide	5	N/A	2024/05/06	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	5	N/A	2024/05/02	CAM SOP-00463	SM 24 4500-Cl E m
Conductivity	1	N/A	2024/05/05	CAM SOP-00414	SM 24 2510 m
Conductivity	4	N/A	2024/05/06	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2024/05/02	CAM SOP-00446	SM 24 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	5	N/A	2024/05/01	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	5	2024/05/01	2024/05/01	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	5	N/A	2024/05/03	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	5	N/A	2024/05/03	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	5	N/A	2024/05/06		
Anion and Cation Sum	5	N/A	2024/05/06		
Total Ammonia-N	5	N/A	2024/05/05	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	5	N/A	2024/05/01	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (4)	1	2024/05/01	2024/05/05	CAM SOP-00413	SM 24th - 4500H+ B
pH (4)	4	2024/05/01	2024/05/06	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate	5	N/A	2024/05/02	CAM SOP-00461	SM 24 4500-P E
Sat. pH and Langelier Index (@ 20C)	5	N/A	2024/05/06		Auto Calc
Sat. pH and Langelier Index (@ 4C)	5	N/A	2024/05/06		Auto Calc
Sulphate by Automated Turbidimetry	5	N/A	2024/05/02	CAM SOP-00464	SM 24 4500-SO42- E m
Total Dissolved Solids (TDS calc)	5	N/A	2024/05/06		Auto Calc

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement



Your Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Your C.O.C. #: 987335-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/06**  
Report #: R8137528  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C8240**

**Received: 2024/04/29, 18:30**

Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(4) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAP561			ZAP561			ZAP562		
Sampling Date		2024/04/29 14:00			2024/04/29 14:00			2024/04/29 15:00		
COC Number		987335-01-01			987335-01-01			987335-01-01		
	UNITS	MW-IT-06A	RDL	QC Batch	MW-IT-06A Lab-Dup	RDL	QC Batch	MW-IT-06B	RDL	QC Batch

Calculated Parameters										
Anion Sum	me/L	5.76	N/A	9364795				6.02	N/A	9364796
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	170	1.0	9364792				180	1.0	9364792
Calculated TDS	mg/L	340	1.0	9364802				350	1.0	9364802
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	1.9	1.0	9364792				2.0	1.0	9364792
Cation Sum	me/L	6.67	N/A	9364795				6.59	N/A	9364796
Hardness (CaCO <sub>3</sub> )	mg/L	290	1.0	9363516				280	1.0	9363516
Ion Balance (% Difference)	%	7.30	N/A	9364794				4.50	N/A	9364794
Langelier Index (@ 20C)	N/A	0.804		9364797				0.821		9364797
Langelier Index (@ 4C)	N/A	0.555		9364799				0.572		9364800
Saturation pH (@ 20C)	N/A	7.28		9364797				7.24		9364797
Saturation pH (@ 4C)	N/A	7.53		9364799				7.49		9364800

Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	9368749				<0.050	0.050	9368749
Conductivity	umho/cm	570	1.0	9367304				600	1.0	9367304
Dissolved Organic Carbon	mg/L	0.99	0.40	9367022				1.1	0.40	9367022
Orthophosphate (P)	mg/L	<0.010	0.010	9367923				<0.010	0.010	9367923
pH	pH	8.08		9367314				8.06		9367314
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	17	1.0	9367913				13	1.0	9367913
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	170	1.0	9367272				190	1.0	9367272
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	44	1.0	9367906				45	1.0	9367906
Nitrite (N)	mg/L	<0.010	0.010	9366685				<0.010	0.010	9366685
Nitrate (N)	mg/L	10.5	0.10	9366685				10.6	0.10	9366685
Nitrate + Nitrite (N)	mg/L	10.5	0.10	9366685				10.6	0.10	9366685

Metals										
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	9371442	<4.9	4.9	9371442	<4.9	4.9	9371442
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	9371442	<0.50	0.50	9371442	<0.50	0.50	9371442
Dissolved Arsenic (As)	ug/L	<1.0	1.0	9371442	<1.0	1.0	9371442	<1.0	1.0	9371442
Dissolved Barium (Ba)	ug/L	22	2.0	9371442	22	2.0	9371442	28	2.0	9371442
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	9371442	<0.40	0.40	9371442	<0.40	0.40	9371442

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate  
N/A = Not Applicable

BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

**RCAP - COMPREHENSIVE (WATER)**

Bureau Veritas ID		ZAP561			ZAP561			ZAP562		
Sampling Date		2024/04/29 14:00			2024/04/29 14:00			2024/04/29 15:00		
COC Number		987335-01-01			987335-01-01			987335-01-01		
	UNITS	MW-IT-06A	RDL	QC Batch	MW-IT-06A Lab-Dup	RDL	QC Batch	MW-IT-06B	RDL	QC Batch
Dissolved Boron (B)	ug/L	<10	10	9371442	<10	10	9371442	<10	10	9371442
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	9371442	<0.090	0.090	9371442	<0.090	0.090	9371442
Dissolved Calcium (Ca)	ug/L	83000	200	9371442	80000	200	9371442	83000	200	9371442
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	9371442	<5.0	5.0	9371442	<5.0	5.0	9371442
Dissolved Cobalt (Co)	ug/L	2.4	0.50	9371442	2.3	0.50	9371442	1.8	0.50	9371442
Dissolved Copper (Cu)	ug/L	<0.90	0.90	9371442	<0.90	0.90	9371442	<0.90	0.90	9371442
Dissolved Iron (Fe)	ug/L	<100	100	9371442	<100	100	9371442	<100	100	9371442
Dissolved Lead (Pb)	ug/L	<0.50	0.50	9371442	<0.50	0.50	9371442	<0.50	0.50	9371442
Dissolved Magnesium (Mg)	ug/L	19000	50	9371442	19000	50	9371442	17000	50	9371442
Dissolved Manganese (Mn)	ug/L	5.9	2.0	9371442	5.8	2.0	9371442	15	2.0	9371442
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	9371442	<0.50	0.50	9371442	<0.50	0.50	9371442
Dissolved Nickel (Ni)	ug/L	2.6	1.0	9371442	2.6	1.0	9371442	1.7	1.0	9371442
Dissolved Phosphorus (P)	ug/L	<100	100	9371442	<100	100	9371442	<100	100	9371442
Dissolved Potassium (K)	ug/L	1000	200	9371442	1000	200	9371442	940	200	9371442
Dissolved Selenium (Se)	ug/L	<2.0	2.0	9371442	<2.0	2.0	9371442	<2.0	2.0	9371442
Dissolved Silicon (Si)	ug/L	2500	50	9371442	2400	50	9371442	2500	50	9371442
Dissolved Silver (Ag)	ug/L	<0.090	0.090	9371442	<0.090	0.090	9371442	<0.090	0.090	9371442
Dissolved Sodium (Na)	ug/L	22000	100	9371442	22000	100	9371442	23000	100	9371442
Dissolved Strontium (Sr)	ug/L	130	1.0	9371442	130	1.0	9371442	120	1.0	9371442
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	9371442	<0.050	0.050	9371442	<0.050	0.050	9371442
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	9371442	<5.0	5.0	9371442	<5.0	5.0	9371442
Dissolved Uranium (U)	ug/L	0.15	0.10	9371442	0.14	0.10	9371442	0.17	0.10	9371442
Dissolved Vanadium (V)	ug/L	<0.50	0.50	9371442	<0.50	0.50	9371442	<0.50	0.50	9371442
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	9371442	<5.0	5.0	9371442	<5.0	5.0	9371442
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate										





BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAP563		ZAP564		ZAP565		
Sampling Date		2024/04/29 11:15		2024/04/29 12:00		2024/04/29 12:30		
COC Number		987335-01-01		987335-01-01		987335-01-01		
	UNITS	MW-IT-03A	QC Batch	MW-IT-03B	QC Batch	MW-IT-03C	RDL	QC Batch
<b>Calculated Parameters</b>								
Anion Sum	me/L	4.51	9364795	6.03	9364796	6.23	N/A	9364796
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	170	9364792	220	9364792	210	1.0	9364792
Calculated TDS	mg/L	260	9364802	320	9364802	340	1.0	9364802
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	2.3	9364792	3.3	9364792	1.9	1.0	9364792
Cation Sum	me/L	5.48	9364795	6.35	9364796	6.81	N/A	9364796
Hardness (CaCO <sub>3</sub> )	mg/L	260	9363516	260	9363516	260	1.0	9363516
Ion Balance (% Difference)	%	9.72	9364794	2.60	9364794	4.45	N/A	9364794
Langelier Index (@ 20C)	N/A	0.814	9364797	0.967	9364797	0.757		9364797
Langelier Index (@ 4C)	N/A	0.564	9364800	0.718	9364800	0.508		9364800
Saturation pH (@ 20C)	N/A	7.33	9364797	7.24	9364797	7.23		9364797
Saturation pH (@ 4C)	N/A	7.58	9364800	7.49	9364800	7.48		9364800
<b>Inorganics</b>								
Total Ammonia-N	mg/L	<0.050	9368749	<0.050	9368749	<0.050	0.050	9368749
Conductivity	umho/cm	420	9367304	590	9367304	640	1.0	9367187
Dissolved Organic Carbon	mg/L	0.45	9367022	2.0	9367022	2.2	0.40	9367022
Orthophosphate (P)	mg/L	<0.010	9367923	<0.010	9367923	<0.010	0.010	9367923
pH	pH	8.14	9367314	8.21	9367314	7.99		9367182
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	43	9367913	15	9367913	14	1.0	9367913
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	170	9367272	220	9367272	210	1.0	9367165
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	5.0	9367906	43	9367906	57	1.0	9367906
Nitrite (N)	mg/L	<0.010	9366685	<0.010	9366685	<0.010	0.010	9366685
Nitrate (N)	mg/L	<0.10	9366685	1.65	9366685	1.73	0.10	9366685
Nitrate + Nitrite (N)	mg/L	<0.10	9366685	1.65	9366685	1.73	0.10	9366685
<b>Metals</b>								
Dissolved Aluminum (Al)	ug/L	69	9371442	<4.9	9371442	<4.9	4.9	9371442
Dissolved Antimony (Sb)	ug/L	<0.50	9371442	<0.50	9371442	<0.50	0.50	9371442
Dissolved Arsenic (As)	ug/L	3.7	9371442	<1.0	9371442	<1.0	1.0	9371442
Dissolved Barium (Ba)	ug/L	84	9371442	41	9371442	30	2.0	9371442
Dissolved Beryllium (Be)	ug/L	<0.40	9371442	<0.40	9371442	<0.40	0.40	9371442
Dissolved Boron (B)	ug/L	17	9371442	12	9371442	<10	10	9371442
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
N/A = Not Applicable								



BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAP563		ZAP564		ZAP565		
Sampling Date		2024/04/29 11:15		2024/04/29 12:00		2024/04/29 12:30		
COC Number		987335-01-01		987335-01-01		987335-01-01		
	UNITS	MW-IT-03A	QC Batch	MW-IT-03B	QC Batch	MW-IT-03C	RDL	QC Batch
Dissolved Cadmium (Cd)	ug/L	<0.090	9371442	<0.090	9371442	<0.090	0.090	9371442
Dissolved Calcium (Ca)	ug/L	68000	9371442	70000	9371442	75000	200	9371442
Dissolved Chromium (Cr)	ug/L	<5.0	9371442	<5.0	9371442	<5.0	5.0	9371442
Dissolved Cobalt (Co)	ug/L	<0.50	9371442	<0.50	9371442	<0.50	0.50	9371442
Dissolved Copper (Cu)	ug/L	0.91	9371442	1.1	9371442	0.97	0.90	9371442
Dissolved Iron (Fe)	ug/L	<100	9371442	<100	9371442	<100	100	9371442
Dissolved Lead (Pb)	ug/L	<0.50	9371442	<0.50	9371442	<0.50	0.50	9371442
Dissolved Magnesium (Mg)	ug/L	23000	9371442	20000	9371442	17000	50	9371442
Dissolved Manganese (Mn)	ug/L	29	9371442	10	9371442	<2.0	2.0	9371442
Dissolved Molybdenum (Mo)	ug/L	2.1	9371442	5.8	9371442	<0.50	0.50	9371442
Dissolved Nickel (Ni)	ug/L	1.4	9371442	<1.0	9371442	<1.0	1.0	9371442
Dissolved Phosphorus (P)	ug/L	<100	9371442	<100	9371442	<100	100	9371442
Dissolved Potassium (K)	ug/L	1100	9371442	1300	9371442	1300	200	9371442
Dissolved Selenium (Se)	ug/L	<2.0	9371442	<2.0	9371442	<2.0	2.0	9371442
Dissolved Silicon (Si)	ug/L	3900	9371442	2600	9371442	2600	50	9371442
Dissolved Silver (Ag)	ug/L	<0.090	9371442	<0.090	9371442	<0.090	0.090	9371442
Dissolved Sodium (Na)	ug/L	3600	9371442	28000	9371442	38000	100	9371442
Dissolved Strontium (Sr)	ug/L	690	9371442	140	9371442	140	1.0	9371442
Dissolved Thallium (Tl)	ug/L	<0.050	9371442	<0.050	9371442	<0.050	0.050	9371442
Dissolved Titanium (Ti)	ug/L	<5.0	9371442	<5.0	9371442	<5.0	5.0	9371442
Dissolved Uranium (U)	ug/L	0.57	9371442	0.47	9371442	0.27	0.10	9371442
Dissolved Vanadium (V)	ug/L	<0.50	9371442	<0.50	9371442	<0.50	0.50	9371442
Dissolved Zinc (Zn)	ug/L	<5.0	9371442	<5.0	9371442	<5.0	5.0	9371442
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								



Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAP565		
Sampling Date		2024/04/29 12:30		
COC Number		987335-01-01		
	UNITS	MW-IT-03C Lab-Dup	RDL	QC Batch
Inorganics				
Conductivity	umho/cm	640	1.0	9367187
Orthophosphate (P)	mg/L	<0.010	0.010	9367923
pH	pH	8.11		9367182
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	14	1.0	9367913
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	210	1.0	9367165
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	56	1.0	9367906
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate				



BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

### O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		ZAP561	ZAP562			ZAP562			ZAP563		
Sampling Date		2024/04/29 14:00	2024/04/29 15:00			2024/04/29 15:00			2024/04/29 11:15		
COC Number		987335-01-01	987335-01-01			987335-01-01			987335-01-01		
	UNITS	MW-IT-06A	MW-IT-06B	RDL	QC Batch	MW-IT-06B Lab-Dup	RDL	QC Batch	MW-IT-03A	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>											
Benzene	ug/L	<0.20	<0.20	0.20	9365952	<0.20	0.20	9365952	<0.20	0.20	9365952
Toluene	ug/L	0.97	<0.20	0.20	9365952	<0.20	0.20	9365952	8.1	0.20	9365952
Ethylbenzene	ug/L	<0.20	<0.20	0.20	9365952	<0.20	0.20	9365952	<0.20	0.20	9365952
o-Xylene	ug/L	<0.20	<0.20	0.20	9365952	<0.20	0.20	9365952	<0.20	0.20	9365952
p+m-Xylene	ug/L	<0.40	<0.40	0.40	9365952	<0.40	0.40	9365952	<0.40	0.40	9365952
Total Xylenes	ug/L	<0.40	<0.40	0.40	9365952	<0.40	0.40	9365952	<0.40	0.40	9365952
F1 (C6-C10)	ug/L	<25	<25	25	9365952	<25	25	9365952	25	25	9365952
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	9365952	<25	25	9365952	<25	25	9365952
<b>F2-F4 Hydrocarbons</b>											
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	9365911				<100	100	9365911
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	9365911				<200	200	9365911
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	9365911				<200	200	9365911
Reached Baseline at C50	ug/L	Yes	Yes		9365911				Yes		9365911
<b>Surrogate Recovery (%)</b>											
1,4-Difluorobenzene	%	102	104		9365952	104		9365952	103		9365952
4-Bromofluorobenzene	%	96	100		9365952	100		9365952	96		9365952
D10-o-Xylene	%	99	102		9365952	104		9365952	103		9365952
D4-1,2-Dichloroethane	%	114	112		9365952	113		9365952	114		9365952
o-Terphenyl	%	95	93		9365911				98		9365911
RDL = Reportable Detection Limit											
QC Batch = Quality Control Batch											
Lab-Dup = Laboratory Initiated Duplicate											





**O.REG 153 PHCS, BTEX/F1-F4 (WATER)**

<b>Bureau Veritas ID</b>		ZAP564	ZAP565		
<b>Sampling Date</b>		2024/04/29 12:00	2024/04/29 12:30		
<b>COC Number</b>		987335-01-01	987335-01-01		
	<b>UNITS</b>	<b>MW-IT-03B</b>	<b>MW-IT-03C</b>	<b>RDL</b>	<b>QC Batch</b>
<b>BTEX &amp; F1 Hydrocarbons</b>					
Benzene	ug/L	<0.20	<0.20	0.20	9365952
Toluene	ug/L	<0.20	<0.20	0.20	9365952
Ethylbenzene	ug/L	<0.20	<0.20	0.20	9365952
o-Xylene	ug/L	<0.20	<0.20	0.20	9365952
p+m-Xylene	ug/L	<0.40	<0.40	0.40	9365952
Total Xylenes	ug/L	<0.40	<0.40	0.40	9365952
F1 (C6-C10)	ug/L	<25	<25	25	9365952
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	9365952
<b>F2-F4 Hydrocarbons</b>					
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	9365911
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	9365911
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	9365911
Reached Baseline at C50	ug/L	Yes	Yes		9365911
<b>Surrogate Recovery (%)</b>					
1,4-Difluorobenzene	%	103	104		9365952
4-Bromofluorobenzene	%	96	99		9365952
D10-o-Xylene	%	100	102		9365952
D4-1,2-Dichloroethane	%	115	111		9365952
o-Terphenyl	%	94	96		9365911
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAP561  
**Sample ID:** MW-IT-06A  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367272	N/A	2024/05/06	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9364792	N/A	2024/05/06	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367304	N/A	2024/05/06	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9367022	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9365911	2024/05/01	2024/05/01	Jeevaraj Jeevaratnam
Hardness (calculated as CaCO <sub>3</sub> )		9363516	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9364794	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9364795	N/A	2024/05/06	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9368749	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9366685	N/A	2024/05/01	Samuel Law
pH	AT	9367314	2024/05/01	2024/05/06	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9364797	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9364799	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9364802	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAP561 Dup  
**Sample ID:** MW-IT-06A  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti

**Bureau Veritas ID:** ZAP562  
**Sample ID:** MW-IT-06B  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367272	N/A	2024/05/06	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9364792	N/A	2024/05/06	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367304	N/A	2024/05/06	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9367022	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9365911	2024/05/01	2024/05/01	Jeevaraj Jeevaratnam
Hardness (calculated as CaCO <sub>3</sub> )		9363516	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9364794	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9364796	N/A	2024/05/06	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9368749	N/A	2024/05/05	Yogesh Patel



Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAP562  
**Sample ID:** MW-IT-06B  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	9366685	N/A	2024/05/01	Samuel Law
pH	AT	9367314	2024/05/01	2024/05/06	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9364797	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9364800	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9364802	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAP562 Dup  
**Sample ID:** MW-IT-06B  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu

**Bureau Veritas ID:** ZAP563  
**Sample ID:** MW-IT-03A  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367272	N/A	2024/05/06	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9364792	N/A	2024/05/06	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367304	N/A	2024/05/06	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9367022	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9365911	2024/05/01	2024/05/01	Jeevaraj Jeevaratnam
Hardness (calculated as CaCO <sub>3</sub> )		9363516	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9364794	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9364795	N/A	2024/05/06	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9368749	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9366685	N/A	2024/05/01	Samuel Law
pH	AT	9367314	2024/05/01	2024/05/06	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9364797	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9364800	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9364802	N/A	2024/05/06	Automated Statchk



Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAP564  
**Sample ID:** MW-IT-03B  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367272	N/A	2024/05/06	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9364792	N/A	2024/05/06	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367304	N/A	2024/05/06	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9367022	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9365911	2024/05/01	2024/05/01	Jeevaraj Jeevaratnam
Hardness (calculated as CaCO <sub>3</sub> )		9363516	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9364794	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9364796	N/A	2024/05/06	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9368749	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9366685	N/A	2024/05/01	Samuel Law
pH	AT	9367314	2024/05/01	2024/05/06	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9364797	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9364800	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9364802	N/A	2024/05/06	Automated Statchk

**Bureau Veritas ID:** ZAP565  
**Sample ID:** MW-IT-03C  
**Matrix:** Water

**Collected:** 2024/04/29  
**Shipped:**  
**Received:** 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367165	N/A	2024/05/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9364792	N/A	2024/05/06	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367187	N/A	2024/05/05	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9367022	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9365952	N/A	2024/05/01	Haibin Wu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9365911	2024/05/01	2024/05/01	Jeevaraj Jeevaratnam
Hardness (calculated as CaCO <sub>3</sub> )		9363516	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9364794	N/A	2024/05/06	Automated Statchk
Anion and Cation Sum	CALC	9364796	N/A	2024/05/06	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9368749	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9366685	N/A	2024/05/01	Samuel Law
pH	AT	9367182	2024/05/01	2024/05/05	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9364797	N/A	2024/05/06	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9364800	N/A	2024/05/06	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9364802	N/A	2024/05/06	Automated Statchk





Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

TEST SUMMARY

Bureau Veritas ID: ZAP565 Dup  
Sample ID: MW-IT-03C  
Matrix: Water

Collected: 2024/04/29  
Shipped:  
Received: 2024/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9367165	N/A	2024/05/05	Surinder Rai
Chloride by Automated Colourimetry	SKAL	9367906	N/A	2024/05/02	Massarat Jan
Conductivity	AT	9367187	N/A	2024/05/05	Surinder Rai
pH	AT	9367182	2024/05/01	2024/05/05	Surinder Rai
Orthophosphate	KONE	9367923	N/A	2024/05/02	Massarat Jan
Sulphate by Automated Turbidimetry	SKAL	9367913	N/A	2024/05/02	Massarat Jan



Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	5.3°C
-----------	-------

Results relate only to the items tested.

BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9365911	o-Terphenyl	2024/05/01	98	60 - 130	98	60 - 130	101	%		
9365952	1,4-Difluorobenzene	2024/05/01	98	70 - 130	100	70 - 130	102	%		
9365952	4-Bromofluorobenzene	2024/05/01	105	70 - 130	103	70 - 130	100	%		
9365952	D10-o-Xylene	2024/05/01	101	70 - 130	111	70 - 130	101	%		
9365952	D4-1,2-Dichloroethane	2024/05/01	110	70 - 130	109	70 - 130	113	%		
9365911	F2 (C10-C16 Hydrocarbons)	2024/05/01	95	60 - 130	93	60 - 130	<100	ug/L	NC	30
9365911	F3 (C16-C34 Hydrocarbons)	2024/05/01	96	60 - 130	98	60 - 130	<200	ug/L	NC	30
9365911	F4 (C34-C50 Hydrocarbons)	2024/05/01	89	60 - 130	89	60 - 130	<200	ug/L	NC	30
9365952	Benzene	2024/05/01	94	50 - 140	104	50 - 140	<0.20	ug/L	NC	30
9365952	Ethylbenzene	2024/05/01	89	50 - 140	99	50 - 140	<0.20	ug/L	NC	30
9365952	F1 (C6-C10) - BTEX	2024/05/01					<25	ug/L	NC	30
9365952	F1 (C6-C10)	2024/05/01	100	60 - 140	112	60 - 140	<25	ug/L	NC	30
9365952	o-Xylene	2024/05/01	92	50 - 140	101	50 - 140	<0.20	ug/L	NC	30
9365952	p+m-Xylene	2024/05/01	87	50 - 140	96	50 - 140	<0.40	ug/L	NC	30
9365952	Toluene	2024/05/01	85	50 - 140	93	50 - 140	<0.20	ug/L	NC	30
9365952	Total Xylenes	2024/05/01					<0.40	ug/L	NC	30
9366685	Nitrate (N)	2024/05/01	NC	80 - 120	98	80 - 120	<0.10	mg/L	2.6	20
9366685	Nitrite (N)	2024/05/01	NC	80 - 120	102	80 - 120	<0.010	mg/L	0.075	20
9367022	Dissolved Organic Carbon	2024/05/02	96	80 - 120	100	80 - 120	<0.40	mg/L	1.4	20
9367165	Alkalinity (Total as CaCO3)	2024/05/05			100	85 - 115	<1.0	mg/L	1.8	20
9367182	pH	2024/05/05			102	98 - 103			1.6	N/A
9367187	Conductivity	2024/05/05			101	85 - 115	<1.0	umho/cm	0.49	10
9367272	Alkalinity (Total as CaCO3)	2024/05/06			103	85 - 115	<1.0	mg/L	1.5	20
9367304	Conductivity	2024/05/06			101	85 - 115	<1.0	umho/cm	0.95	10
9367314	pH	2024/05/06			102	98 - 103			1.3	N/A
9367906	Dissolved Chloride (Cl-)	2024/05/02	NC	80 - 120	100	80 - 120	<1.0	mg/L	1.3	20
9367913	Dissolved Sulphate (SO4)	2024/05/02	96	75 - 125	99	80 - 120	<1.0	mg/L	0.37	20
9367923	Orthophosphate (P)	2024/05/02	97	75 - 125	98	80 - 120	<0.010	mg/L	NC	20
9368749	Total Ammonia-N	2024/05/05	NC	75 - 125	103	80 - 120	<0.050	mg/L	0.75	20
9371442	Dissolved Aluminum (Al)	2024/05/03	105	80 - 120	101	80 - 120	<4.9	ug/L	NC	20
9371442	Dissolved Antimony (Sb)	2024/05/03	110	80 - 120	105	80 - 120	<0.50	ug/L	NC	20

BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9371442	Dissolved Arsenic (As)	2024/05/03	106	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
9371442	Dissolved Barium (Ba)	2024/05/03	104	80 - 120	100	80 - 120	<2.0	ug/L	0.43	20
9371442	Dissolved Beryllium (Be)	2024/05/03	107	80 - 120	99	80 - 120	<0.40	ug/L	NC	20
9371442	Dissolved Boron (B)	2024/05/03	104	80 - 120	96	80 - 120	<10	ug/L	NC	20
9371442	Dissolved Cadmium (Cd)	2024/05/03	106	80 - 120	101	80 - 120	<0.090	ug/L	NC	20
9371442	Dissolved Calcium (Ca)	2024/05/03	NC	80 - 120	103	80 - 120	<200	ug/L	3.5	20
9371442	Dissolved Chromium (Cr)	2024/05/03	105	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
9371442	Dissolved Cobalt (Co)	2024/05/03	104	80 - 120	100	80 - 120	<0.50	ug/L	2.6	20
9371442	Dissolved Copper (Cu)	2024/05/03	107	80 - 120	103	80 - 120	<0.90	ug/L	NC	20
9371442	Dissolved Iron (Fe)	2024/05/03	107	80 - 120	103	80 - 120	<100	ug/L	NC	20
9371442	Dissolved Lead (Pb)	2024/05/03	104	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Magnesium (Mg)	2024/05/03	104	80 - 120	101	80 - 120	<50	ug/L	1.0	20
9371442	Dissolved Manganese (Mn)	2024/05/03	105	80 - 120	100	80 - 120	<2.0	ug/L	1.8	20
9371442	Dissolved Molybdenum (Mo)	2024/05/03	111	80 - 120	106	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Nickel (Ni)	2024/05/03	104	80 - 120	100	80 - 120	<1.0	ug/L	0.11	20
9371442	Dissolved Phosphorus (P)	2024/05/03	110	80 - 120	101	80 - 120	<100	ug/L	NC	20
9371442	Dissolved Potassium (K)	2024/05/03	108	80 - 120	103	80 - 120	<200	ug/L	0.45	20
9371442	Dissolved Selenium (Se)	2024/05/03	106	80 - 120	102	80 - 120	<2.0	ug/L	NC	20
9371442	Dissolved Silicon (Si)	2024/05/03	106	80 - 120	102	80 - 120	<50	ug/L	2.6	20
9371442	Dissolved Silver (Ag)	2024/05/03	107	80 - 120	104	80 - 120	<0.090	ug/L	NC	20
9371442	Dissolved Sodium (Na)	2024/05/03	105	80 - 120	102	80 - 120	<100	ug/L	0.47	20
9371442	Dissolved Strontium (Sr)	2024/05/03	106	80 - 120	101	80 - 120	<1.0	ug/L	0.51	20
9371442	Dissolved Thallium (Tl)	2024/05/03	105	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
9371442	Dissolved Titanium (Ti)	2024/05/03	104	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
9371442	Dissolved Uranium (U)	2024/05/03	105	80 - 120	102	80 - 120	<0.10	ug/L	5.6	20
9371442	Dissolved Vanadium (V)	2024/05/03	107	80 - 120	101	80 - 120	<0.50	ug/L	NC	20





BUREAU  
VERITAS

Bureau Veritas Job #: C4C8240

Report Date: 2024/05/06

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150 (2300)

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9371442	Dissolved Zinc (Zn)	2024/05/03	106	80 - 120	101	80 - 120	<5.0	ug/L	NC	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference  $\leq 2 \times \text{RDL}$ ).



Bureau Veritas Job #: C4C8240  
Report Date: 2024/05/06

WSP Canada Inc.  
Client Project #: CA-GLD-19129150 (2300)  
Site Location: CBM CALEDON  
Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

---

Cristina Carriere, Senior Scientific Specialist

---

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



Bureau Veritas  
6740 Campbell Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com



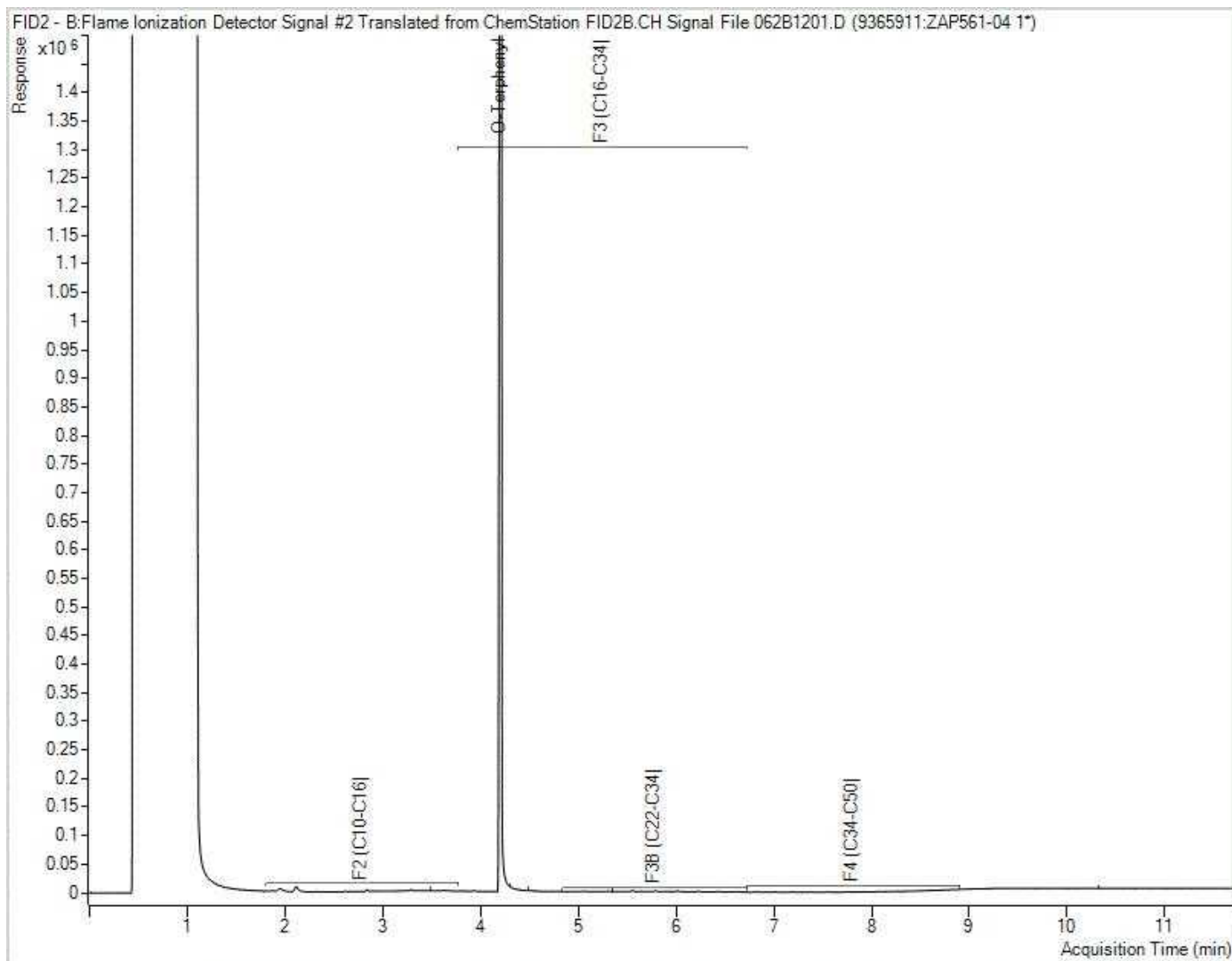
NONT-2024-04-2918

Page 1 of 3

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Bottle Order #:	
Company Name:	#21375 WSP Canada Inc.	Company Name:	Paul Menkveld	Quotation #:	C41059		
Attention:	George Schneider	Attention:	Paul Menkveld	P.O. #:			
Address:	210 Sheldon Drive	Address:		Project:	CA-GLD-19129150 (2300)		
	Cambridge ON N1T 1A8			Project Name:	CBM Caledon		
Tel:	(519) 620-8182	Tel:		Site #:	VP/BN		
Email:	George_Schneider@golder.com	Email:	paul.menkveld@wsp.com	Sampled By:			
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY				ANALYSIS REQUESTED (PLEASE BE SPECIFIC)			
Regulation 153 (2011)		Other Regulations		Special Instructions			
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw					
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> Reg 559 <input type="checkbox"/> Storm Sewer Bylaw					
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC		<input type="checkbox"/> MISA Municipality					
<input type="checkbox"/> Table		<input type="checkbox"/> PWGO <input type="checkbox"/> Reg 406 Table					
<input type="checkbox"/> Other							
Include Criteria on Certificate of Analysis (Y/N)? <u>Y</u>							
Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals Hg / Cr VI	RCAP - Comprehensive	O.Reg 153 PHC, MTES/ST-154
1	MW-IT-07A MW-IT-06A	24/04/24	14:00	GW	✓	✓	✓
2	MW-IT-07B MW-IT-06B	24/04/24	15:00	GW	✓	✓	✓
3	MW-IT-07C						
4	MW-IT-07A						
5	MW-IT-07B						
6	MW-IT-07C						
7	MW-IT-03A	24/04/24	11:15	GW	✓	✓	✓
8	MW-IT-03B	24/04/24	12:00	GW	✓	✓	✓
9	MW-IT-03C	24/04/24	12:30	GW	✓	✓	✓
10	MW-IT-04A						
* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time
Ramin Niknam		24/4/29	18:30	SUCAR SALVAR		2024/04/29	18:50
# Jars used and not submitted		Laboratory Use Only		Time Sensitive		Temperature (°C) on Recel	Custody Seal Present
						1 / 5 / 7	Yes
							No
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS.				SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS			
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.				White: Bureau Veritas Yellow: Client			
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCs.				ON ICE			

Bureau Veritas Canada (2019) Inc.

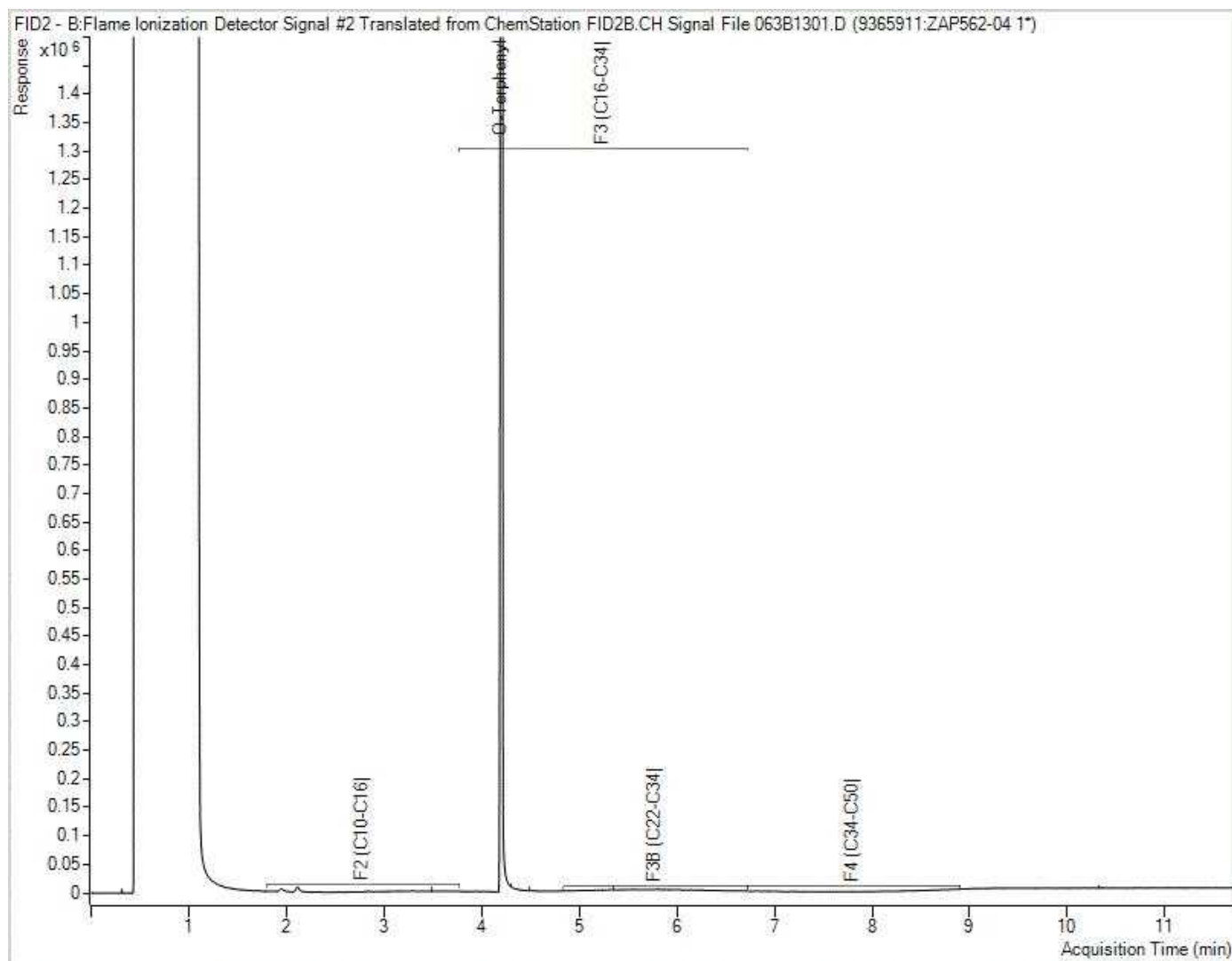
Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

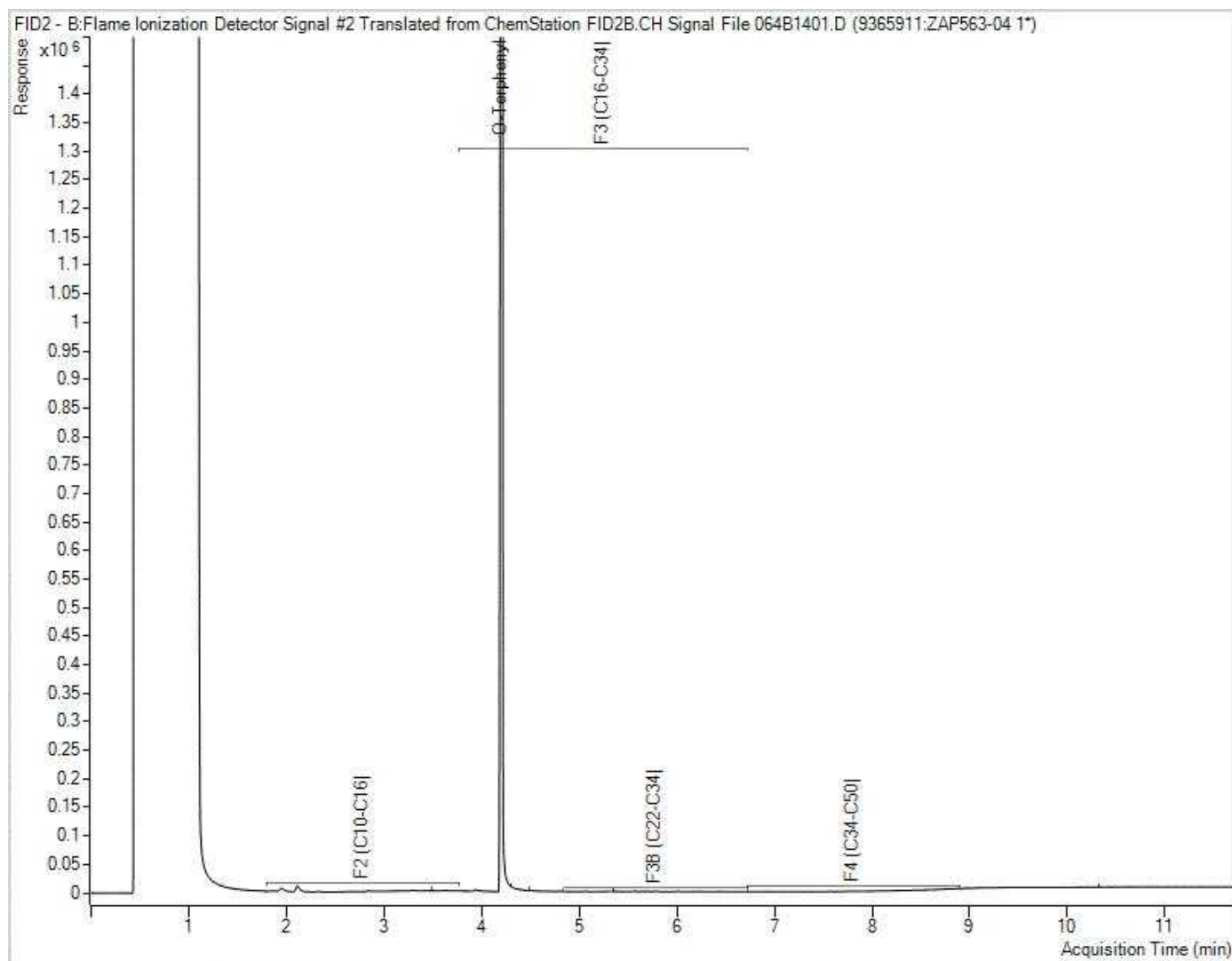


Petroleum Hydrocarbons F2-F4 in Water Chromatogram



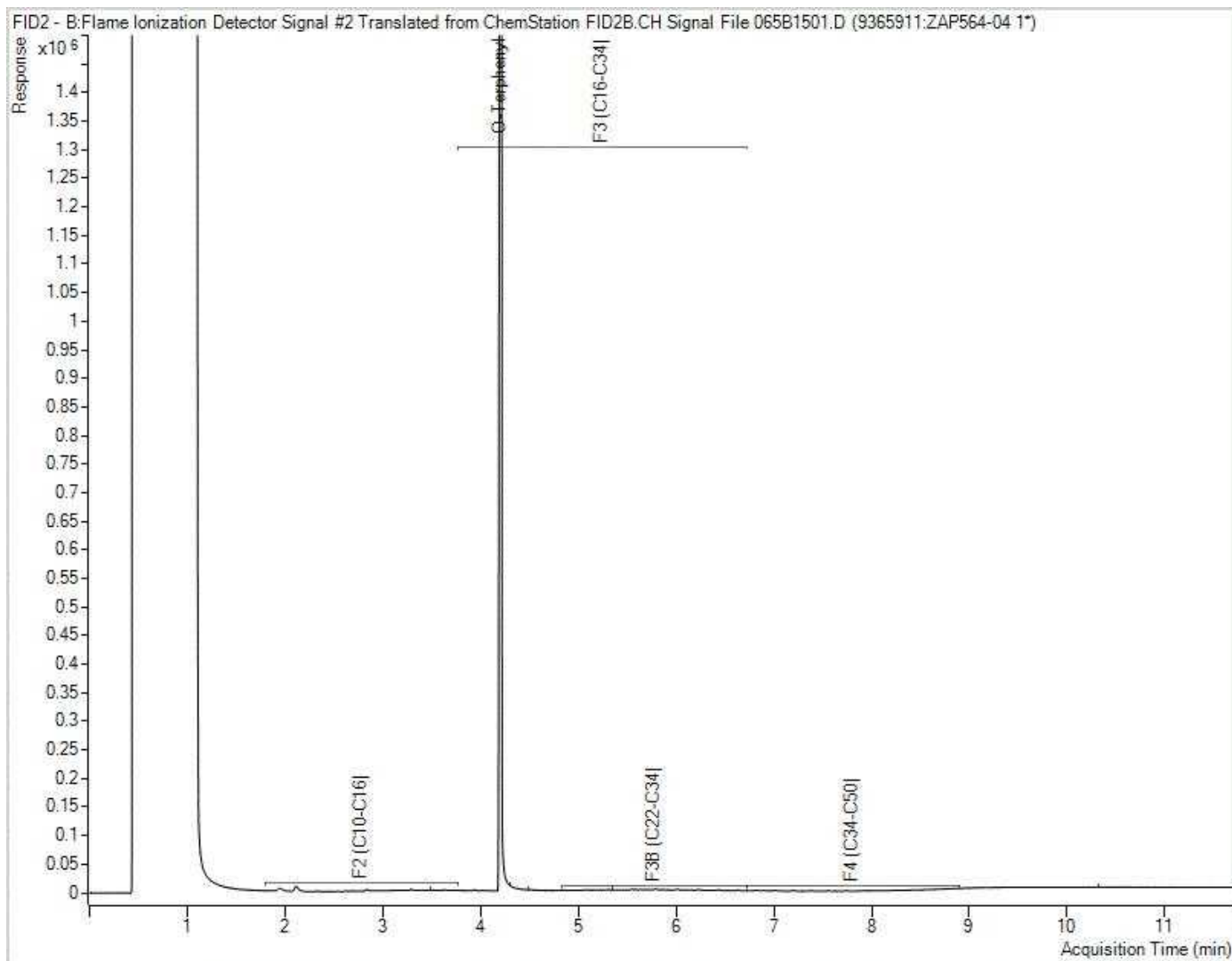
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



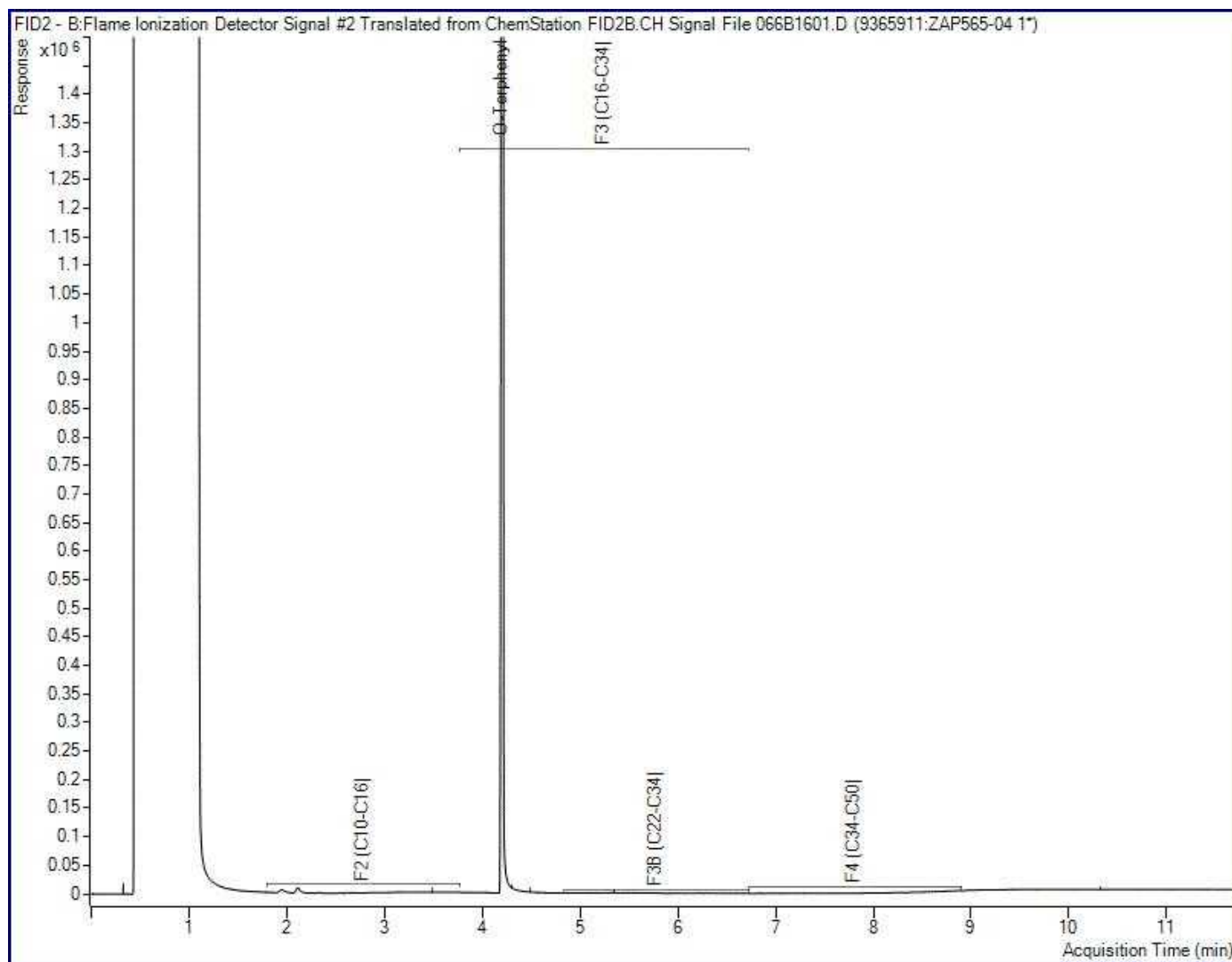
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.





Your Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Your C.O.C. #: C#984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/07**  
Report #: R8138664  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C9366**

**Received: 2024/04/30, 19:05**

Sample Matrix: Water  
# Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	1	N/A	2024/05/06	CAM SOP-00448	SM 24 2320 B m
Alkalinity	6	N/A	2024/05/07	CAM SOP-00448	SM 24 2320 B m
Carbonate, Bicarbonate and Hydroxide	7	N/A	2024/05/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	7	N/A	2024/05/03	CAM SOP-00463	SM 24 4500-Cl E m
Conductivity	1	N/A	2024/05/06	CAM SOP-00414	SM 24 2510 m
Conductivity	6	N/A	2024/05/07	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	5	N/A	2024/05/02	CAM SOP-00446	SM 24 5310 B m
Dissolved Organic Carbon (DOC) (1)	2	N/A	2024/05/03	CAM SOP-00446	SM 24 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	8	N/A	2024/05/02	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	7	2024/05/03	2024/05/03	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	7	N/A	2024/05/02	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	7	N/A	2024/05/02	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	7	N/A	2024/05/07		
Anion and Cation Sum	7	N/A	2024/05/07		
Total Ammonia-N	7	N/A	2024/05/05	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	7	N/A	2024/05/03	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (4)	1	2024/05/02	2024/05/06	CAM SOP-00413	SM 24th - 4500H+ B
pH (4)	6	2024/05/02	2024/05/07	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate	7	N/A	2024/05/03	CAM SOP-00461	SM 24 4500-P E
Sat. pH and Langelier Index (@ 20C)	7	N/A	2024/05/07		Auto Calc
Sat. pH and Langelier Index (@ 4C)	7	N/A	2024/05/07		Auto Calc
Sulphate by Automated Turbidimetry	7	N/A	2024/05/03	CAM SOP-00464	SM 24 4500-SO42- E m
Total Dissolved Solids (TDS calc)	7	N/A	2024/05/07		Auto Calc

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are



Your Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Your C.O.C. #: C#984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/07**  
Report #: R8138664  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4C9366**

**Received: 2024/04/30, 19:05**

reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(4) "The CCME method and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg. 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2  
Page 2 of 30

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW282			ZAW282			ZAW283		
Sampling Date		2024/04/30 11:45			2024/04/30 11:45			2024/04/30 12:45		
COC Number		C#984504-01-01			C#984504-01-01			C#984504-01-01		
	UNITS	MW-IT-01 A	RDL	QC Batch	MW-IT-01 A Lab-Dup	RDL	QC Batch	MW-IT-01 B	RDL	QC Batch

#### Calculated Parameters

Anion Sum	me/L	6.18	N/A	9366859				6.85	N/A	9366859
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	220	1.0	9366736				210	1.0	9366736
Calculated TDS	mg/L	330	1.0	9366865				370	1.0	9366865
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	3.1	1.0	9366736				2.3	1.0	9366736
Cation Sum	me/L	6.18	N/A	9366859				7.37	N/A	9366859
Hardness (CaCO <sub>3</sub> )	mg/L	280	1.0	9366619				280	1.0	9366619
Ion Balance (% Difference)	%	0.0600	N/A	9366858				3.71	N/A	9366858
Langelier Index (@ 20C)	N/A	0.964		9366860				0.855		9366861
Langelier Index (@ 4C)	N/A	0.715		9366863				0.606		9366864
Saturation pH (@ 20C)	N/A	7.21		9366860				7.21		9366861
Saturation pH (@ 4C)	N/A	7.45		9366863				7.46		9366864

#### Inorganics

Total Ammonia-N	mg/L	0.051	0.050	9369317				<0.050	0.050	9369317
Conductivity	umho/cm	590	1.0	9369695				720	1.0	9370043
Dissolved Organic Carbon	mg/L	1.3	0.40	9370893				2.1	0.40	9369779
Orthophosphate (P)	mg/L	<0.010	0.010	9370991	<0.010	0.010	9370991	<0.010	0.010	9370991
pH	pH	8.17		9369696				8.07		9370055
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	41	1.0	9370990	41	1.0	9370990	13	1.0	9370990
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	220	1.0	9369684				210	1.0	9370036
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	28	1.0	9370984	28	1.0	9370984	78	1.0	9370984
Nitrite (N)	mg/L	<0.010	0.010	9369705				<0.010	0.010	9369705
Nitrate (N)	mg/L	1.17	0.10	9369705				1.80	0.10	9369705
Nitrate + Nitrite (N)	mg/L	1.17	0.10	9369705				1.80	0.10	9369705

#### Metals

Dissolved Aluminum (Al)	ug/L	6.0	4.9	9369366				<4.9	4.9	9369366
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	9369366				<0.50	0.50	9369366
Dissolved Arsenic (As)	ug/L	<1.0	1.0	9369366				<1.0	1.0	9369366
Dissolved Barium (Ba)	ug/L	29	2.0	9369366				51	2.0	9369366

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate  
N/A = Not Applicable



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW282			ZAW282			ZAW283		
Sampling Date		2024/04/30 11:45			2024/04/30 11:45			2024/04/30 12:45		
COC Number		C#984504-01-01			C#984504-01-01			C#984504-01-01		
	UNITS	MW-IT-01 A	RDL	QC Batch	MW-IT-01 A Lab-Dup	RDL	QC Batch	MW-IT-01 B	RDL	QC Batch
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	9369366				<0.40	0.40	9369366
Dissolved Boron (B)	ug/L	31	10	9369366				<10	10	9369366
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	9369366				<0.090	0.090	9369366
Dissolved Calcium (Ca)	ug/L	75000	200	9369366				79000	200	9369366
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	9369366				<5.0	5.0	9369366
Dissolved Cobalt (Co)	ug/L	0.74	0.50	9369366				<0.50	0.50	9369366
Dissolved Copper (Cu)	ug/L	<0.90	0.90	9369366				0.95	0.90	9369366
Dissolved Iron (Fe)	ug/L	<100	100	9369366				<100	100	9369366
Dissolved Lead (Pb)	ug/L	<0.50	0.50	9369366				<0.50	0.50	9369366
Dissolved Magnesium (Mg)	ug/L	22000	50	9369366				19000	50	9369366
Dissolved Manganese (Mn)	ug/L	9.1	2.0	9369366				26	2.0	9369366
Dissolved Molybdenum (Mo)	ug/L	1.4	0.50	9369366				<0.50	0.50	9369366
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	9369366				<1.0	1.0	9369366
Dissolved Phosphorus (P)	ug/L	<100	100	9369366				<100	100	9369366
Dissolved Potassium (K)	ug/L	2000	200	9369366				1400	200	9369366
Dissolved Selenium (Se)	ug/L	<2.0	2.0	9369366				<2.0	2.0	9369366
Dissolved Silicon (Si)	ug/L	2500	50	9369366				2500	50	9369366
Dissolved Silver (Ag)	ug/L	<0.090	0.090	9369366				<0.090	0.090	9369366
Dissolved Sodium (Na)	ug/L	14000	100	9369366				42000	100	9369366
Dissolved Strontium (Sr)	ug/L	1300	1.0	9369366				140	1.0	9369366
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	9369366				<0.050	0.050	9369366
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	9369366				<5.0	5.0	9369366
Dissolved Uranium (U)	ug/L	0.30	0.10	9369366				0.34	0.10	9369366
Dissolved Vanadium (V)	ug/L	<0.50	0.50	9369366				<0.50	0.50	9369366
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	9369366				<5.0	5.0	9369366
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate										





BUREAU  
VERITAS

Bureau Veritas Job #: C4C9366

Report Date: 2024/05/07

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW283			ZAW284			ZAW285		
Sampling Date		2024/04/30 12:45			2024/04/30 11:30			2024/04/30 17:00		
COC Number		C#984504-01-01			C#984504-01-01			C#984504-01-01		
	UNITS	MW-IT-01 B Lab-Dup	RDL	QC Batch	MW-IT-01 C	RDL	QC Batch	MW-IT-02A	RDL	QC Batch

Calculated Parameters										
Anion Sum	me/L				17.4	N/A	9366859	5.92	N/A	9366859
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				250	1.0	9366736	230	1.0	9366736
Calculated TDS	mg/L				1000	1.0	9366865	310	1.0	9366865
Carb. Alkalinity (calc. as CaCO3)	mg/L				1.5	1.0	9366736	2.6	1.0	9366736
Cation Sum	me/L				19.7	N/A	9366859	5.86	N/A	9366859
Hardness (CaCO3)	mg/L				470	1.0	9366619	280	1.0	9366619
Ion Balance (% Difference)	%				6.19	N/A	9366858	0.500	N/A	9366858
Langelier Index (@ 20C)	N/A				0.827		9366861	0.883		9366861
Langelier Index (@ 4C)	N/A				0.581		9366864	0.634		9366864
Saturation pH (@ 20C)	N/A				6.98		9366861	7.20		9366861
Saturation pH (@ 4C)	N/A				7.22		9366864	7.45		9366864

Inorganics										
Total Ammonia-N	mg/L				<0.050	0.050	9369317	<0.050	0.050	9369317
Conductivity	umho/cm	720	1.0	9370043	2000	1.0	9369695	540	1.0	9370043
Dissolved Organic Carbon	mg/L				1.4	0.40	9370893	3.7	0.40	9369779
Orthophosphate (P)	mg/L				<0.010	0.010	9370991	<0.010	0.010	9370991
pH	pH	8.03		9370055	7.80		9369696	8.08		9370055
Dissolved Sulphate (SO4)	mg/L				19	1.0	9370990	49	1.0	9370990
Alkalinity (Total as CaCO3)	mg/L	210	1.0	9370036	250	1.0	9369684	240	1.0	9370036
Dissolved Chloride (Cl-)	mg/L				410	5.0	9370984	7.0	1.0	9370984
Nitrite (N)	mg/L				0.060	0.010	9369708	<0.010	0.010	9369705
Nitrate (N)	mg/L				5.29	0.10	9369708	<0.10	0.10	9369705
Nitrate + Nitrite (N)	mg/L				5.35	0.10	9369708	<0.10	0.10	9369705

Metals										
Dissolved Aluminum (Al)	ug/L				<4.9	4.9	9369366	5.2	4.9	9369366
Dissolved Antimony (Sb)	ug/L				<0.50	0.50	9369366	<0.50	0.50	9369366
Dissolved Arsenic (As)	ug/L				<1.0	1.0	9369366	5.6	1.0	9369366
Dissolved Barium (Ba)	ug/L				330	2.0	9369366	91	2.0	9369366

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable



BUREAU  
VERITAS

Bureau Veritas Job #: C4C9366

Report Date: 2024/05/07

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW283			ZAW284			ZAW285		
Sampling Date		2024/04/30 12:45			2024/04/30 11:30			2024/04/30 17:00		
COC Number		C#984504-01-01			C#984504-01-01			C#984504-01-01		
	UNITS	MW-IT-01 B Lab-Dup	RDL	QC Batch	MW-IT-01 C	RDL	QC Batch	MW-IT-02A	RDL	QC Batch
Dissolved Beryllium (Be)	ug/L				<0.40	0.40	9369366	<0.40	0.40	9369366
Dissolved Boron (B)	ug/L				14	10	9369366	17	10	9369366
Dissolved Cadmium (Cd)	ug/L				<0.090	0.090	9369366	<0.090	0.090	9369366
Dissolved Calcium (Ca)	ug/L				150000	200	9369366	71000	200	9369366
Dissolved Chromium (Cr)	ug/L				<5.0	5.0	9369366	<5.0	5.0	9369366
Dissolved Cobalt (Co)	ug/L				<0.50	0.50	9369366	<0.50	0.50	9369366
Dissolved Copper (Cu)	ug/L				<0.90	0.90	9369366	<0.90	0.90	9369366
Dissolved Iron (Fe)	ug/L				<100	100	9369366	<100	100	9369366
Dissolved Lead (Pb)	ug/L				<0.50	0.50	9369366	<0.50	0.50	9369366
Dissolved Magnesium (Mg)	ug/L				22000	50	9369366	25000	50	9369366
Dissolved Manganese (Mn)	ug/L				66	2.0	9369366	47	2.0	9369366
Dissolved Molybdenum (Mo)	ug/L				1.2	0.50	9369366	3.1	0.50	9369366
Dissolved Nickel (Ni)	ug/L				<1.0	1.0	9369366	<1.0	1.0	9369366
Dissolved Phosphorus (P)	ug/L				<100	100	9369366	<100	100	9369366
Dissolved Potassium (K)	ug/L				2800	200	9369366	780	200	9369366
Dissolved Selenium (Se)	ug/L				<2.0	2.0	9369366	<2.0	2.0	9369366
Dissolved Silicon (Si)	ug/L				3800	50	9369366	3100	50	9369366
Dissolved Silver (Ag)	ug/L				<0.090	0.090	9369366	<0.090	0.090	9369366
Dissolved Sodium (Na)	ug/L				240000	100	9369366	5000	100	9369366
Dissolved Strontium (Sr)	ug/L				310	1.0	9369366	310	1.0	9369366
Dissolved Thallium (Tl)	ug/L				<0.050	0.050	9369366	<0.050	0.050	9369366
Dissolved Titanium (Ti)	ug/L				<5.0	5.0	9369366	<5.0	5.0	9369366
Dissolved Uranium (U)	ug/L				0.26	0.10	9369366	0.15	0.10	9369366
Dissolved Vanadium (V)	ug/L				<0.50	0.50	9369366	<0.50	0.50	9369366
Dissolved Zinc (Zn)	ug/L				<5.0	5.0	9369366	<5.0	5.0	9369366

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate



### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW286	ZAW287	ZAW288		
Sampling Date		2024/04/30 17:30	2024/04/30 16:15	2024/04/30		
COC Number		C#984504-01-01	C#984504-01-01	C#984504-01-01		
	UNITS	MW-IT-02B	MW-IT-02C	DUP2	RDL	QC Batch
<b>Calculated Parameters</b>						
Anion Sum	me/L	5.48	5.30	5.53	N/A	9366859
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	210	220	220	1.0	9366736
Calculated TDS	mg/L	280	270	280	1.0	9366865
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	3.6	3.9	3.0	1.0	9366736
Cation Sum	me/L	5.31	5.31	5.54	N/A	9366859
Hardness (CaCO <sub>3</sub> )	mg/L	230	240	240	1.0	9366619
Ion Balance (% Difference)	%	1.57	0.100	0.0800	N/A	9366858
Langelier Index (@ 20C)	N/A	0.996	1.05	0.931		9366861
Langelier Index (@ 4C)	N/A	0.746	0.799	0.682		9366864
Saturation pH (@ 20C)	N/A	7.27	7.23	7.24		9366861
Saturation pH (@ 4C)	N/A	7.52	7.48	7.49		9366864
<b>Inorganics</b>						
Total Ammonia-N	mg/L	<0.050	<0.050	<0.050	0.050	9369317
Conductivity	umho/cm	530	500	530	1.0	9369695
Dissolved Organic Carbon	mg/L	3.8	4.0	3.8	0.40	9369779
Orthophosphate (P)	mg/L	<0.010	<0.010	<0.010	0.010	9370991
pH	pH	8.26	8.28	8.17		9369696
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	13	8.6	12	1.0	9370990
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	210	220	220	1.0	9369684
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	31	24	30	1.0	9370984
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	0.010	9369708
Nitrate (N)	mg/L	0.95	0.59	0.94	0.10	9369708
Nitrate + Nitrite (N)	mg/L	0.95	0.59	0.94	0.10	9369708
<b>Metals</b>						
Dissolved Aluminum (Al)	ug/L	9.9	7.0	5.1	4.9	9369366
Dissolved Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	0.50	9369366
Dissolved Arsenic (As)	ug/L	<1.0	<1.0	<1.0	1.0	9369366
Dissolved Barium (Ba)	ug/L	35	17	37	2.0	9369366
Dissolved Beryllium (Be)	ug/L	<0.40	<0.40	<0.40	0.40	9369366
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable						



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZAW286	ZAW287	ZAW288		
Sampling Date		2024/04/30 17:30	2024/04/30 16:15	2024/04/30		
COC Number		C#984504-01-01	C#984504-01-01	C#984504-01-01		
	UNITS	MW-IT-02B	MW-IT-02C	DUP2	RDL	QC Batch
Dissolved Boron (B)	ug/L	12	11	<10	10	9369366
Dissolved Cadmium (Cd)	ug/L	<0.090	<0.090	<0.090	0.090	9369366
Dissolved Calcium (Ca)	ug/L	65000	68000	69000	200	9369366
Dissolved Chromium (Cr)	ug/L	<5.0	<5.0	<5.0	5.0	9369366
Dissolved Cobalt (Co)	ug/L	<0.50	<0.50	<0.50	0.50	9369366
Dissolved Copper (Cu)	ug/L	1.4	1.6	1.2	0.90	9369366
Dissolved Iron (Fe)	ug/L	<100	<100	<100	100	9369366
Dissolved Lead (Pb)	ug/L	<0.50	<0.50	<0.50	0.50	9369366
Dissolved Magnesium (Mg)	ug/L	17000	16000	18000	50	9369366
Dissolved Manganese (Mn)	ug/L	6.4	14	6.4	2.0	9369366
Dissolved Molybdenum (Mo)	ug/L	<0.50	<0.50	<0.50	0.50	9369366
Dissolved Nickel (Ni)	ug/L	<1.0	<1.0	<1.0	1.0	9369366
Dissolved Phosphorus (P)	ug/L	<100	<100	<100	100	9369366
Dissolved Potassium (K)	ug/L	1100	1300	1200	200	9369366
Dissolved Selenium (Se)	ug/L	<2.0	<2.0	<2.0	2.0	9369366
Dissolved Silicon (Si)	ug/L	2200	2300	2200	50	9369366
Dissolved Silver (Ag)	ug/L	<0.090	<0.090	<0.090	0.090	9369366
Dissolved Sodium (Na)	ug/L	15000	12000	15000	100	9369366
Dissolved Strontium (Sr)	ug/L	120	110	120	1.0	9369366
Dissolved Thallium (Tl)	ug/L	<0.050	<0.050	<0.050	0.050	9369366
Dissolved Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	5.0	9369366
Dissolved Uranium (U)	ug/L	0.45	0.32	0.42	0.10	9369366
Dissolved Vanadium (V)	ug/L	<0.50	<0.50	<0.50	0.50	9369366
Dissolved Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	5.0	9369366
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						





Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### PETROLEUM HYDROCARBONS (CCME)

<b>Bureau Veritas ID</b>		ZAW289		
<b>Sampling Date</b>		2024/04/30		
<b>COC Number</b>		C#984504-01-01		
	<b>UNITS</b>	<b>TRIP BLANK</b>	<b>RDL</b>	<b>QC Batch</b>
<b>BTEX &amp; F1 Hydrocarbons</b>				
Benzene	ug/L	<0.20	0.20	9367992
Toluene	ug/L	<0.20	0.20	9367992
Ethylbenzene	ug/L	<0.20	0.20	9367992
o-Xylene	ug/L	<0.20	0.20	9367992
p+m-Xylene	ug/L	<0.40	0.40	9367992
Total Xylenes	ug/L	<0.40	0.40	9367992
F1 (C6-C10)	ug/L	<25	25	9367992
F1 (C6-C10) - BTEX	ug/L	<25	25	9367992
<b>Surrogate Recovery (%)</b>				
1,4-Difluorobenzene	%	106		9367992
4-Bromofluorobenzene	%	93		9367992
D10-o-Xylene	%	86		9367992
D4-1,2-Dichloroethane	%	102		9367992
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		ZAW282	ZAW283	ZAW283	ZAW284	ZAW285		
Sampling Date		2024/04/30 11:45	2024/04/30 12:45	2024/04/30 12:45	2024/04/30 11:30	2024/04/30 17:00		
COC Number		C#984504-01-01	C#984504-01-01	C#984504-01-01	C#984504-01-01	C#984504-01-01		
	UNITS	MW-IT-01 A	MW-IT-01 B	MW-IT-01 B Lab-Dup	MW-IT-01 C	MW-IT-02A	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>								
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9367992
Toluene	ug/L	<0.20	<0.20	<0.20	0.37	1.3	0.20	9367992
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9367992
o-Xylene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	9367992
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	9367992
Total Xylenes	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	9367992
F1 (C6-C10)	ug/L	<25	<25	<25	47	200	25	9367992
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	47	200	25	9367992
<b>F2-F4 Hydrocarbons</b>								
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	<100	100	9371300
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	600	200	9371300
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	200	9371300
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes	Yes		9371300
<b>Surrogate Recovery (%)</b>								
1,4-Difluorobenzene	%	105	104	102	104	104		9367992
4-Bromofluorobenzene	%	92	91	89	94	91		9367992
D10-o-Xylene	%	86	91	84	87	87		9367992
D4-1,2-Dichloroethane	%	104	107	104	105	104		9367992
o-Terphenyl	%	99	98	99	98	99		9371300
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
Lab-Dup = Laboratory Initiated Duplicate								



**O.REG 153 PHCS, BTEX/F1-F4 (WATER)**

Bureau Veritas ID		ZAW286	ZAW287	ZAW288		
Sampling Date		2024/04/30 17:30	2024/04/30 16:15	2024/04/30		
COC Number		C#984504-01-01	C#984504-01-01	C#984504-01-01		
	UNITS	MW-IT-02B	MW-IT-02C	DUP2	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>						
Benzene	ug/L	<0.20	<0.20	<0.20	0.20	9367992
Toluene	ug/L	<0.20	<0.20	<0.20	0.20	9367992
Ethylbenzene	ug/L	<0.20	<0.20	<0.20	0.20	9367992
o-Xylene	ug/L	<0.20	<0.20	<0.20	0.20	9367992
p+m-Xylene	ug/L	<0.40	<0.40	<0.40	0.40	9367992
Total Xylenes	ug/L	<0.40	<0.40	<0.40	0.40	9367992
F1 (C6-C10)	ug/L	<25	<25	<25	25	9367992
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	25	9367992
<b>F2-F4 Hydrocarbons</b>						
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	100	9371300
F3 (C16-C34 Hydrocarbons)	ug/L	<200	320	<200	200	9371300
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	200	9371300
Reached Baseline at C50	ug/L	Yes	Yes	Yes		9371300
<b>Surrogate Recovery (%)</b>						
1,4-Difluorobenzene	%	105	103	104		9367992
4-Bromofluorobenzene	%	93	92	94		9367992
D10-o-Xylene	%	84	86	88		9367992
D4-1,2-Dichloroethane	%	103	107	107		9367992
o-Terphenyl	%	98	100	99		9371300
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAW282  
**Sample ID:** MW-IT-01 A  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9369684	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9369695	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9370893	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO <sub>3</sub> )		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369705	N/A	2024/05/03	Jinal Chavda
pH	AT	9369696	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366860	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366863	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW282 Dup  
**Sample ID:** MW-IT-01 A  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan

**Bureau Veritas ID:** ZAW283  
**Sample ID:** MW-IT-01 B  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/06	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9370043	N/A	2024/05/06	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9369779	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO <sub>3</sub> )		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk





Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAW283  
**Sample ID:** MW-IT-01 B  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369705	N/A	2024/05/03	Jinal Chavda
pH	AT	9370055	2024/05/02	2024/05/06	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW283 Dup  
**Sample ID:** MW-IT-01 B  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/06	Surinder Rai
Conductivity	AT	9370043	N/A	2024/05/06	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
pH	AT	9370055	2024/05/02	2024/05/06	Surinder Rai

**Bureau Veritas ID:** ZAW284  
**Sample ID:** MW-IT-01 C  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9369684	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9369695	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9370893	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO3)		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369708	N/A	2024/05/03	Jinal Chavda
pH	AT	9369696	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAW284  
**Sample ID:** MW-IT-01 C  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW285  
**Sample ID:** MW-IT-02A  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9370043	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9369779	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO3)		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369705	N/A	2024/05/03	Jinal Chavda
pH	AT	9370055	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW286  
**Sample ID:** MW-IT-02B  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9369684	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9369695	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9369779	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO3)		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

## TEST SUMMARY

**Bureau Veritas ID:** ZAW286  
**Sample ID:** MW-IT-02B  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	9369708	N/A	2024/05/03	Jinal Chavda
pH	AT	9369696	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW287  
**Sample ID:** MW-IT-02C  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9369684	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9369695	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9369779	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO3)		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369708	N/A	2024/05/03	Jinal Chavda
pH	AT	9369696	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZAW288  
**Sample ID:** DUP2  
**Matrix:** Water

**Collected:** 2024/04/30  
**Shipped:**  
**Received:** 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9369684	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9366736	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9369695	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9369779	N/A	2024/05/02	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

TEST SUMMARY

Bureau Veritas ID: ZAW288  
Sample ID: DUP2  
Matrix: Water

Collected: 2024/04/30  
Shipped:  
Received: 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9371300	2024/05/03	2024/05/03	(Kent) Maolin Li
Hardness (calculated as CaCO3)		9366619	N/A	2024/05/02	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9369366	N/A	2024/05/02	Indira HarryPaul
Ion Balance (% Difference)	CALC	9366858	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9366859	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9369317	N/A	2024/05/05	Yogesh Patel
Nitrate & Nitrite as Nitrogen in Water	LACH	9369708	N/A	2024/05/03	Jinal Chavda
pH	AT	9369696	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9366861	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9366864	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9366865	N/A	2024/05/07	Automated Statchk

Bureau Veritas ID: ZAW289  
Sample ID: TRIP BLANK  
Matrix: Water

Collected: 2024/04/30  
Shipped:  
Received: 2024/04/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9367992	N/A	2024/05/02	Ravinder Gaidhu





Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	8.7°C
-----------	-------

Results relate only to the items tested.

BUREAU  
VERITAS

Bureau Veritas Job #: C4C9366

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9367992	1,4-Difluorobenzene	2024/05/02	97	70 - 130	97	70 - 130	102	%		
9367992	4-Bromofluorobenzene	2024/05/02	98	70 - 130	98	70 - 130	95	%		
9367992	D10-o-Xylene	2024/05/02	95	70 - 130	90	70 - 130	84	%		
9367992	D4-1,2-Dichloroethane	2024/05/02	98	70 - 130	98	70 - 130	102	%		
9371300	o-Terphenyl	2024/05/03	103	60 - 130	99	60 - 130	100	%		
9367992	Benzene	2024/05/02	92	50 - 140	89	50 - 140	<0.20	ug/L	NC	30
9367992	Ethylbenzene	2024/05/02	93	50 - 140	93	50 - 140	<0.20	ug/L	NC	30
9367992	F1 (C6-C10) - BTEX	2024/05/02					<25	ug/L	NC	30
9367992	F1 (C6-C10)	2024/05/02	99	60 - 140	104	60 - 140	<25	ug/L	NC	30
9367992	o-Xylene	2024/05/02	94	50 - 140	91	50 - 140	<0.20	ug/L	NC	30
9367992	p+m-Xylene	2024/05/02	90	50 - 140	87	50 - 140	<0.40	ug/L	NC	30
9367992	Toluene	2024/05/02	89	50 - 140	86	50 - 140	<0.20	ug/L	NC	30
9367992	Total Xylenes	2024/05/02					<0.40	ug/L	NC	30
9369317	Total Ammonia-N	2024/05/05	95	75 - 125	104	80 - 120	<0.050	mg/L	1.7	20
9369366	Dissolved Aluminum (Al)	2024/05/02	101	80 - 120	94	80 - 120	<4.9	ug/L	NC	20
9369366	Dissolved Antimony (Sb)	2024/05/02	107	80 - 120	98	80 - 120	<0.50	ug/L		
9369366	Dissolved Arsenic (As)	2024/05/02	103	80 - 120	98	80 - 120	<1.0	ug/L	NC	20
9369366	Dissolved Barium (Ba)	2024/05/02	99	80 - 120	97	80 - 120	<2.0	ug/L	0.32	20
9369366	Dissolved Beryllium (Be)	2024/05/02	98	80 - 120	95	80 - 120	<0.40	ug/L	NC	20
9369366	Dissolved Boron (B)	2024/05/02	NC	80 - 120	96	80 - 120	<10	ug/L	4.3	20
9369366	Dissolved Cadmium (Cd)	2024/05/02	102	80 - 120	95	80 - 120	<0.090	ug/L	7.4	20
9369366	Dissolved Calcium (Ca)	2024/05/02	NC	80 - 120	96	80 - 120	<200	ug/L	4.6	20
9369366	Dissolved Chromium (Cr)	2024/05/02	96	80 - 120	93	80 - 120	<5.0	ug/L	NC	20
9369366	Dissolved Cobalt (Co)	2024/05/02	97	80 - 120	95	80 - 120	<0.50	ug/L	0.062	20
9369366	Dissolved Copper (Cu)	2024/05/02	104	80 - 120	96	80 - 120	<0.90	ug/L	1.3	20
9369366	Dissolved Iron (Fe)	2024/05/02	101	80 - 120	97	80 - 120	<100	ug/L	NC	20
9369366	Dissolved Lead (Pb)	2024/05/02	100	80 - 120	94	80 - 120	<0.50	ug/L	NC	20
9369366	Dissolved Magnesium (Mg)	2024/05/02	NC	80 - 120	99	80 - 120	<50	ug/L	3.2	20
9369366	Dissolved Manganese (Mn)	2024/05/02	NC	80 - 120	95	80 - 120	<2.0	ug/L	0.74	20
9369366	Dissolved Molybdenum (Mo)	2024/05/02	104	80 - 120	98	80 - 120	<0.50	ug/L	0.43	20
9369366	Dissolved Nickel (Ni)	2024/05/02	95	80 - 120	93	80 - 120	<1.0	ug/L	2.5	20

BUREAU  
VERITAS

Bureau Veritas Job #: C4C9366

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9369366	Dissolved Phosphorus (P)	2024/05/02	109	80 - 120	98	80 - 120	<100	ug/L		
9369366	Dissolved Potassium (K)	2024/05/02	NC	80 - 120	102	80 - 120	<200	ug/L	1.4	20
9369366	Dissolved Selenium (Se)	2024/05/02	103	80 - 120	97	80 - 120	<2.0	ug/L		
9369366	Dissolved Silicon (Si)	2024/05/02	98	80 - 120	93	80 - 120	<50	ug/L	3.8	20
9369366	Dissolved Silver (Ag)	2024/05/02	62 (1)	80 - 120	93	80 - 120	<0.090	ug/L	NC	20
9369366	Dissolved Sodium (Na)	2024/05/02	NC	80 - 120	98	80 - 120	<100	ug/L	3.5	20
9369366	Dissolved Strontium (Sr)	2024/05/02	NC	80 - 120	95	80 - 120	<1.0	ug/L	1.7	20
9369366	Dissolved Thallium (Tl)	2024/05/02	103	80 - 120	98	80 - 120	<0.050	ug/L	2.1	20
9369366	Dissolved Titanium (Ti)	2024/05/02	101	80 - 120	96	80 - 120	<5.0	ug/L	NC	20
9369366	Dissolved Uranium (U)	2024/05/02	96	80 - 120	92	80 - 120	<0.10	ug/L		
9369366	Dissolved Vanadium (V)	2024/05/02	102	80 - 120	95	80 - 120	<0.50	ug/L	NC	20
9369366	Dissolved Zinc (Zn)	2024/05/02	98	80 - 120	96	80 - 120	<5.0	ug/L	1.6	20
9369684	Alkalinity (Total as CaCO <sub>3</sub> )	2024/05/07			102	85 - 115	<1.0	mg/L	0.15	20
9369695	Conductivity	2024/05/07			102	85 - 115	<1.0	umho/cm	0.58	10
9369696	pH	2024/05/07			102	98 - 103			0.83	N/A
9369705	Nitrate (N)	2024/05/03	NC	80 - 120	98	80 - 120	<0.10	mg/L	0.79	20
9369705	Nitrite (N)	2024/05/03	93	80 - 120	94	80 - 120	<0.010	mg/L	1.7	20
9369708	Nitrate (N)	2024/05/03	92	80 - 120	94	80 - 120	<0.10	mg/L	1.8	20
9369708	Nitrite (N)	2024/05/03	95	80 - 120	92	80 - 120	<0.010	mg/L	NC	20
9369779	Dissolved Organic Carbon	2024/05/02	93	80 - 120	97	80 - 120	<0.40	mg/L	3.4	20
9370036	Alkalinity (Total as CaCO <sub>3</sub> )	2024/05/06			102	85 - 115	<1.0	mg/L	1.4	20
9370043	Conductivity	2024/05/06			101	85 - 115	<1.0	umho/cm	0.29	10
9370055	pH	2024/05/06			102	98 - 103			0.51	N/A
9370893	Dissolved Organic Carbon	2024/05/03	96	80 - 120	98	80 - 120	<0.40	mg/L	1.5	20
9370984	Dissolved Chloride (Cl <sup>-</sup> )	2024/05/03	NC	80 - 120	99	80 - 120	<1.0	mg/L	0.36	20
9370990	Dissolved Sulphate (SO <sub>4</sub> )	2024/05/03	NC	75 - 125	97	80 - 120	<1.0	mg/L	0.77	20
9370991	Orthophosphate (P)	2024/05/03	95	75 - 125	95	80 - 120	<0.010	mg/L	NC	20
9371300	F2 (C10-C16 Hydrocarbons)	2024/05/03	97	60 - 130	91	60 - 130	<100	ug/L	NC	30
9371300	F3 (C16-C34 Hydrocarbons)	2024/05/03	104	60 - 130	101	60 - 130	<200	ug/L	NC	30



BUREAU  
VERITAS

Bureau Veritas Job #: C4C9366

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: VP

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9371300	F4 (C34-C50 Hydrocarbons)	2024/05/03	97	60 - 130	94	60 - 130	<200	ug/L	NC	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference  $\leq 2 \times \text{RDL}$ ).

(1) Matrix Spike exceeds acceptance limits, probable matrix interference





Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: VP

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

---

Cristina Carriere, Senior Scientific Specialist

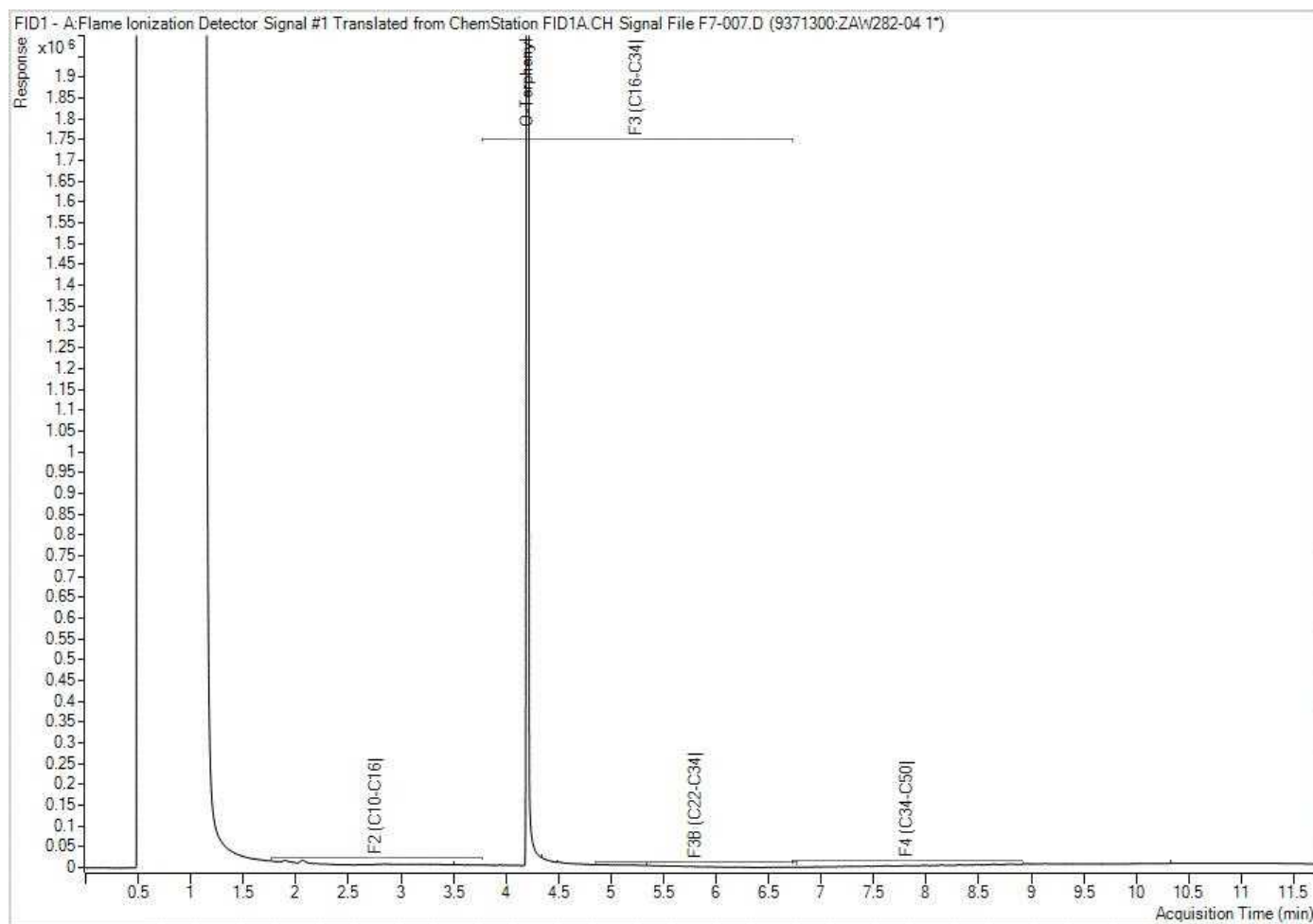
---

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.



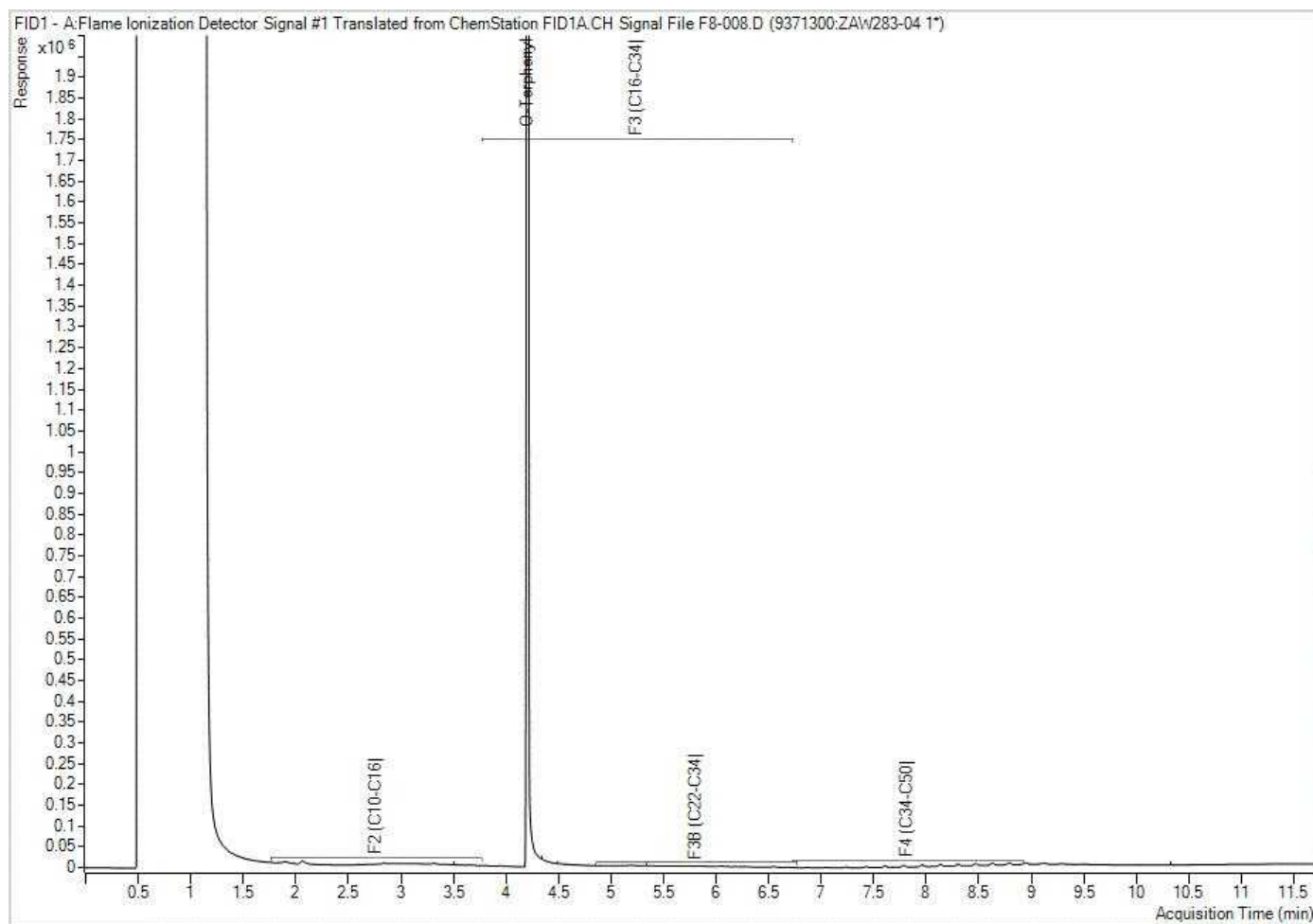
INVOICE TO:			REPORT TO:			PROJECT INFORMATION:			Only:																										
Company Name: #21375 WSP Canada Inc.			Company Name:			Quotation #: C41059			Bottle Order #:																										
Attention: George Schneider			Attention: Paul Menkveld			P.O. #:			984504																										
Address: 210 Sheldon Drive			Address:			Project: CA-GLD-19129150			Project Manager:																										
Cambridge ON N1T 1A8						Project Name: CBM Caledon			Ankita Bhalla																										
Tel: (519) 620-8182			Tel:			Site #: VP/AN			COC #:																										
Email: George_Schneider@golder.com			Email: paul.menkveld@wsp.com			Sampled By:			C#984504-01-01																										
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY																																			
Regulation 153 (2011)			Other Regulations			Special Instructions			Turnaround Time (TAT) Required:																										
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine			<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw						Regular (Standard) TAT:																										
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse			<input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw						(will be applied if Rush TAT is not specified);																										
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC			<input type="checkbox"/> MISA Municipality						Standard TAT = 5-7 Working days for most tests.																										
<input type="checkbox"/> Table			<input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table						Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.																										
<input type="checkbox"/> Other									Job Specific Rush TAT (if applies to entire submission)																										
Include Criteria on Certificate of Analysis (Y/N)?									Date Required: Time Required:																										
									Rush Confirmation Number: (call lab for #)																										
Sample Barcode Label			Sample (Location) Identification			Date Sampled			Time Sampled			Matrix			Field Filtered (please circle):			RCap - Comprehensive			O Reg 153 PHCs, BTEX/F+V			# of Bottles			Comments								
1			MW-IT-01A			24/04/30			11:45			GW			✓			✓			✓			8											
2			MW-IT-01B			↓			12:45			↓			✓			✓			✓			8											
3			MW-IT-01C			↓			11:30			↓			✓			✓			✓			8											
4			MW-IT-02A			↓			17:00			↓			✓			✓			✓			8											
5			MW-IT-02B			↓			17:30			↓			✓			✓			✓			8											
6			MW-IT-02C			↓			16:15			↓			✓			✓			✓			8											
7			DUP2			↓			—			↓			✓			✓			✓			8											
8			Trip Blank			—			—			—						✓						2											
9																																			
10																																			
* RELINQUISHED BY: (Signature/Print)			Date: (YY/MM/DD)			Time			RECEIVED BY: (Signature/Print)			Date: (YY/MM/DD)			Time			# jars used and not submitted			Laboratory Use Only														
✓ Prop ✓ PM			24/04/30			19:00			✓ ✓			20/04/30			19:05						Time Sensitive			Temperature (°C) on Recl			Custody Seal			Yes			No		
																								12/7/7			Present								
																											Intact								
* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COC-TERMS-AND-CONDITIONS.												White: Bureau Veritas Yellow: Client																							
* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.												SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS																							
** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COCs.																																			

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



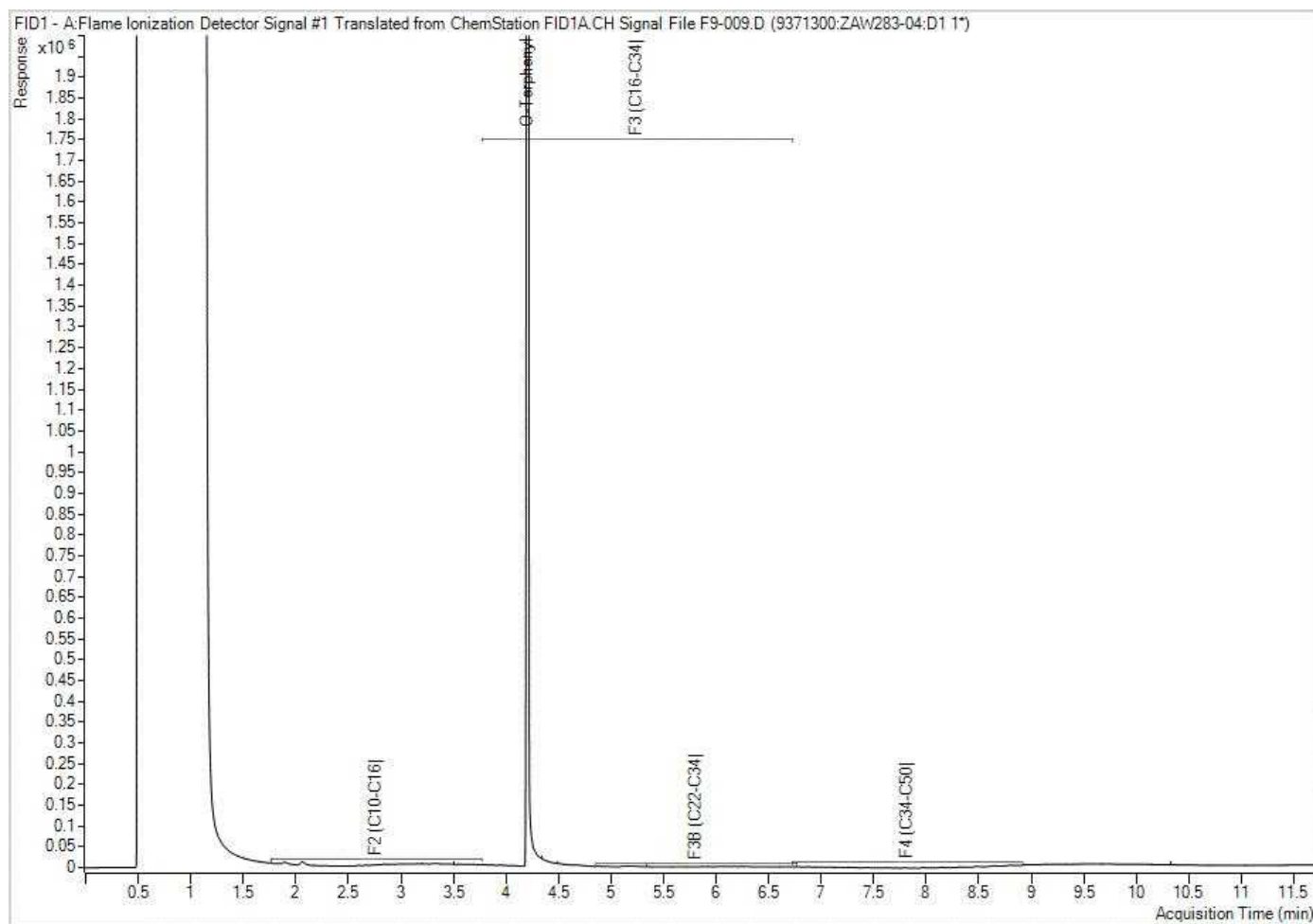
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



Bureau Veritas Job #: C4C9366  
Report Date: 2024/05/07  
Bureau Veritas Sample: ZAW283 Lab-Dup

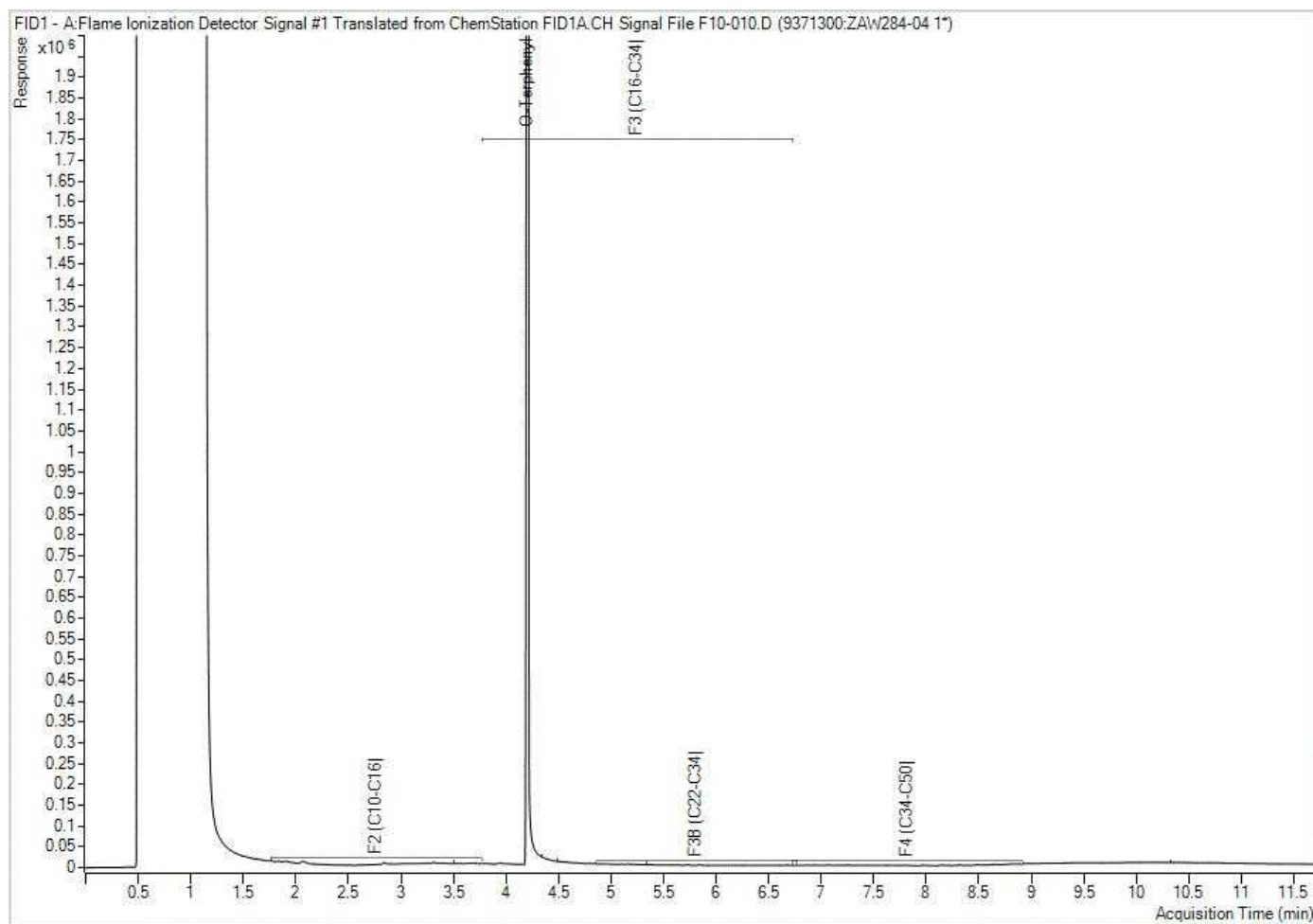
WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Project name: CBM CALEDON  
Client ID: MW-IT-01 B

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



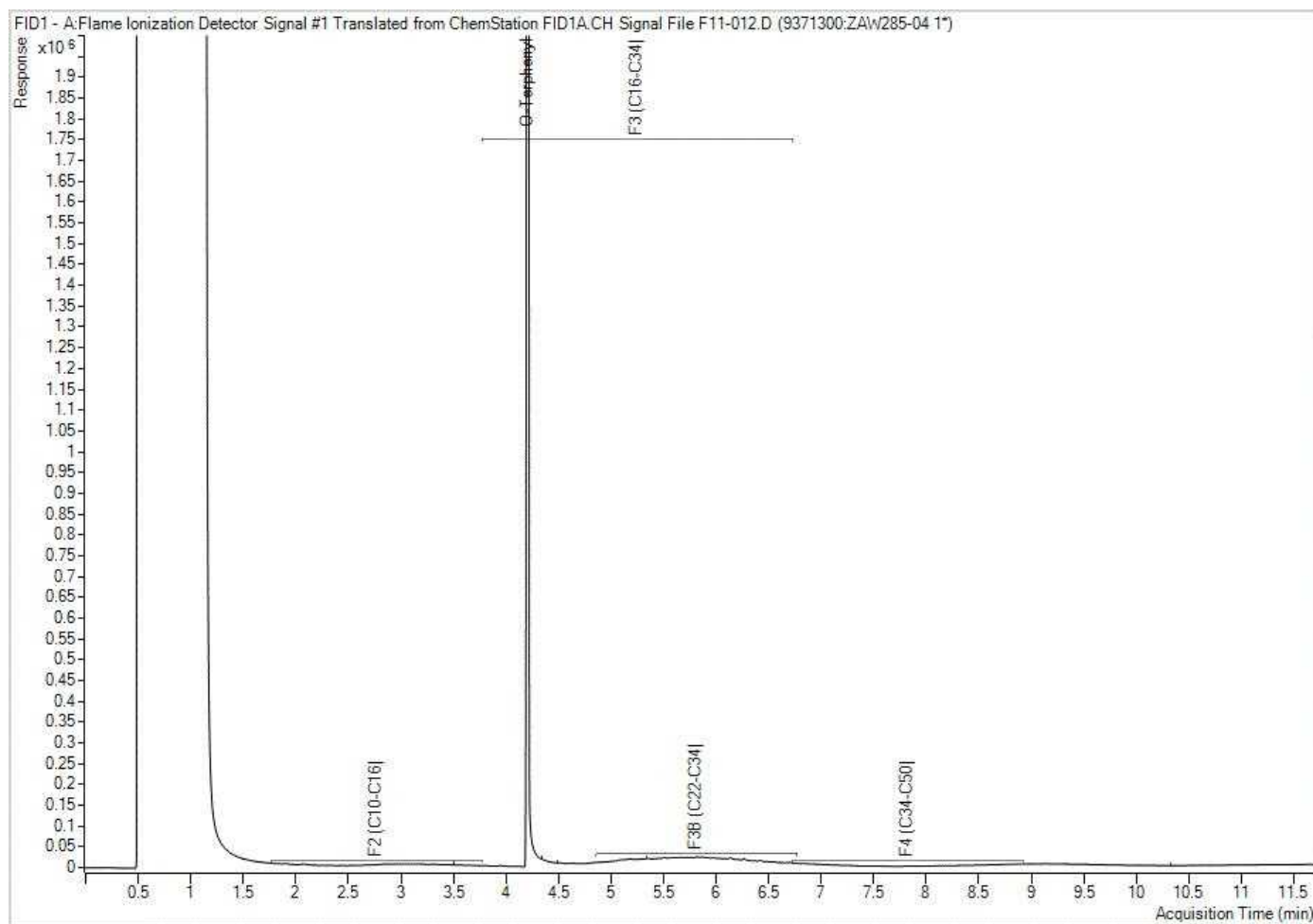
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



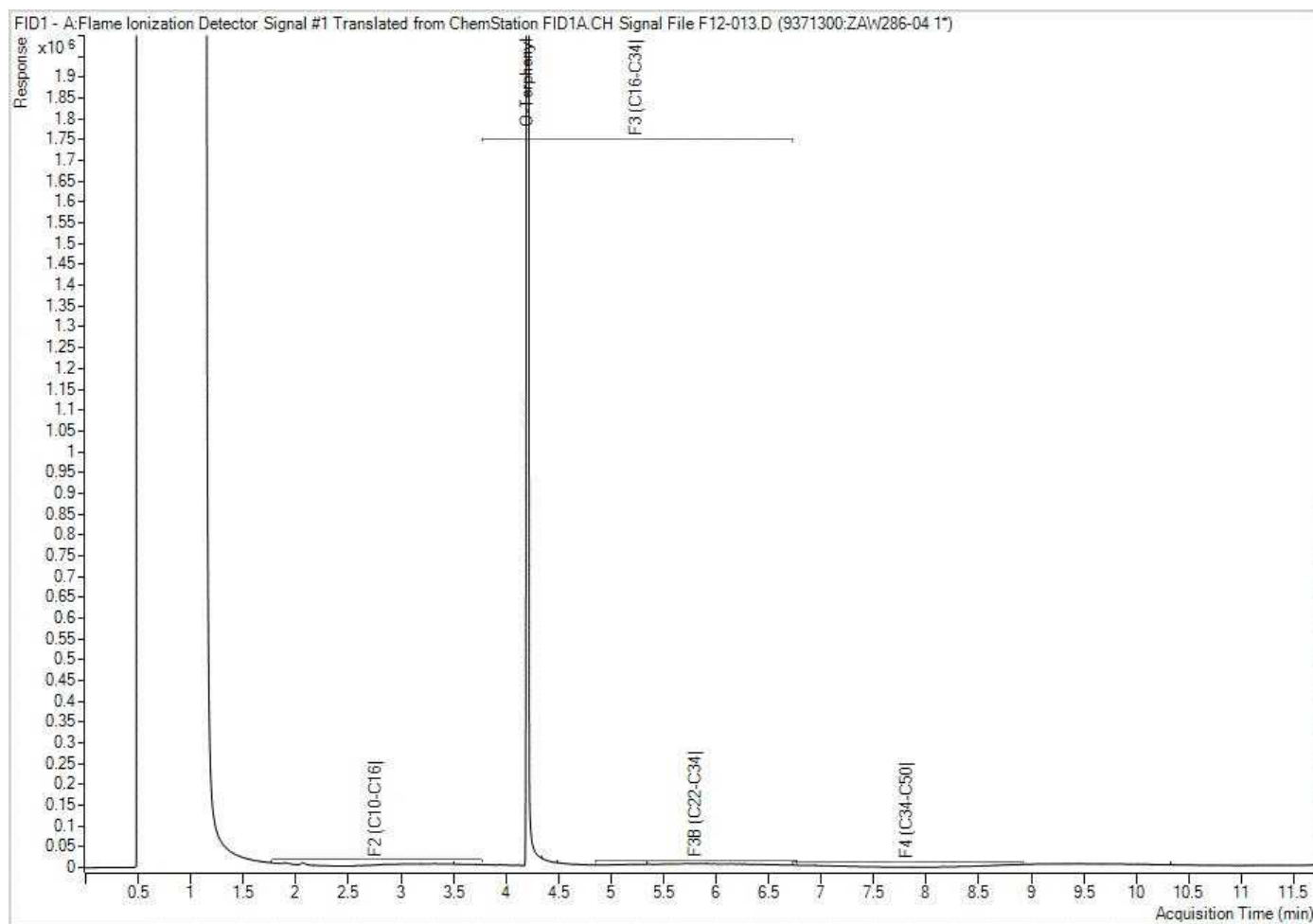
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

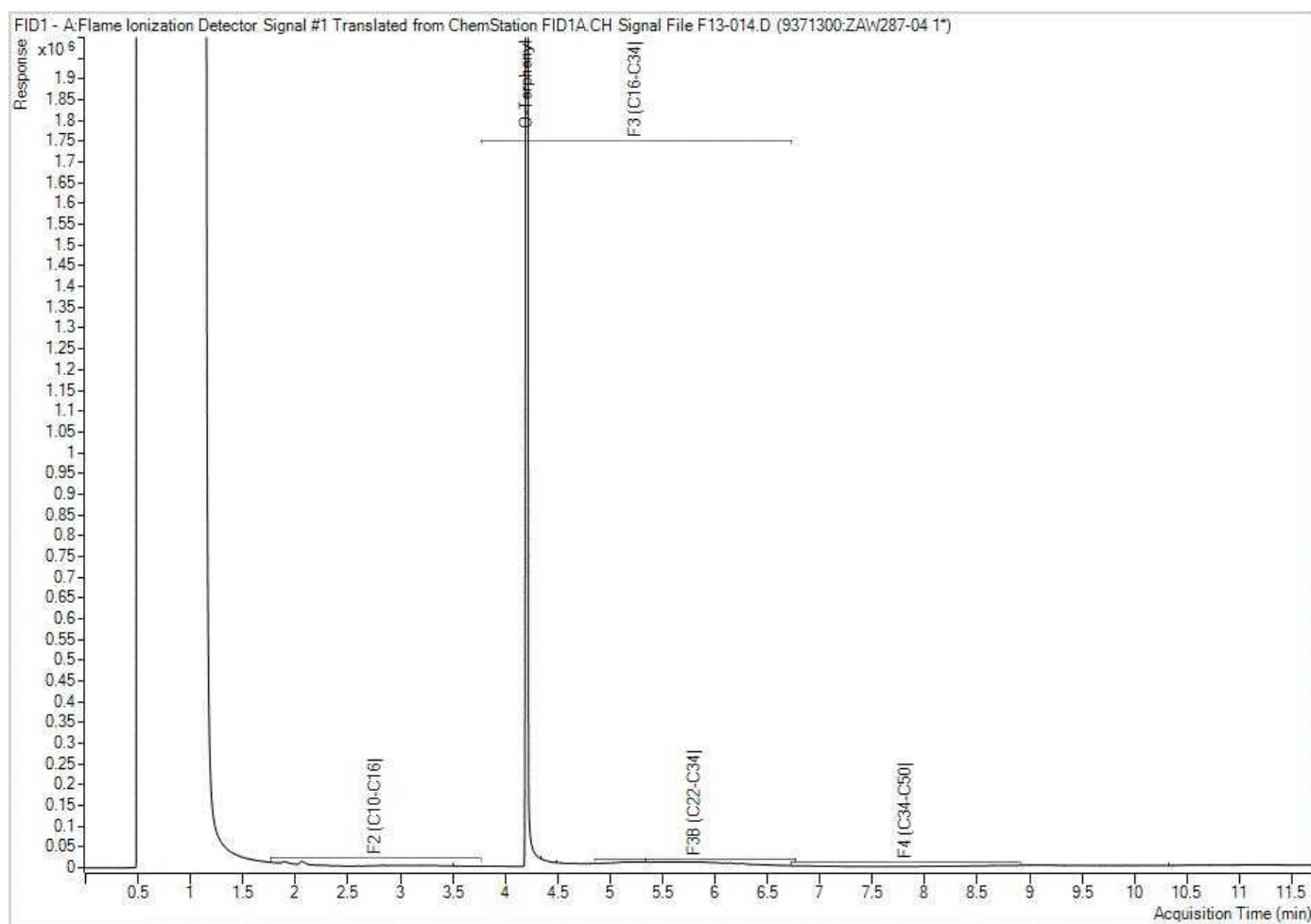
**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

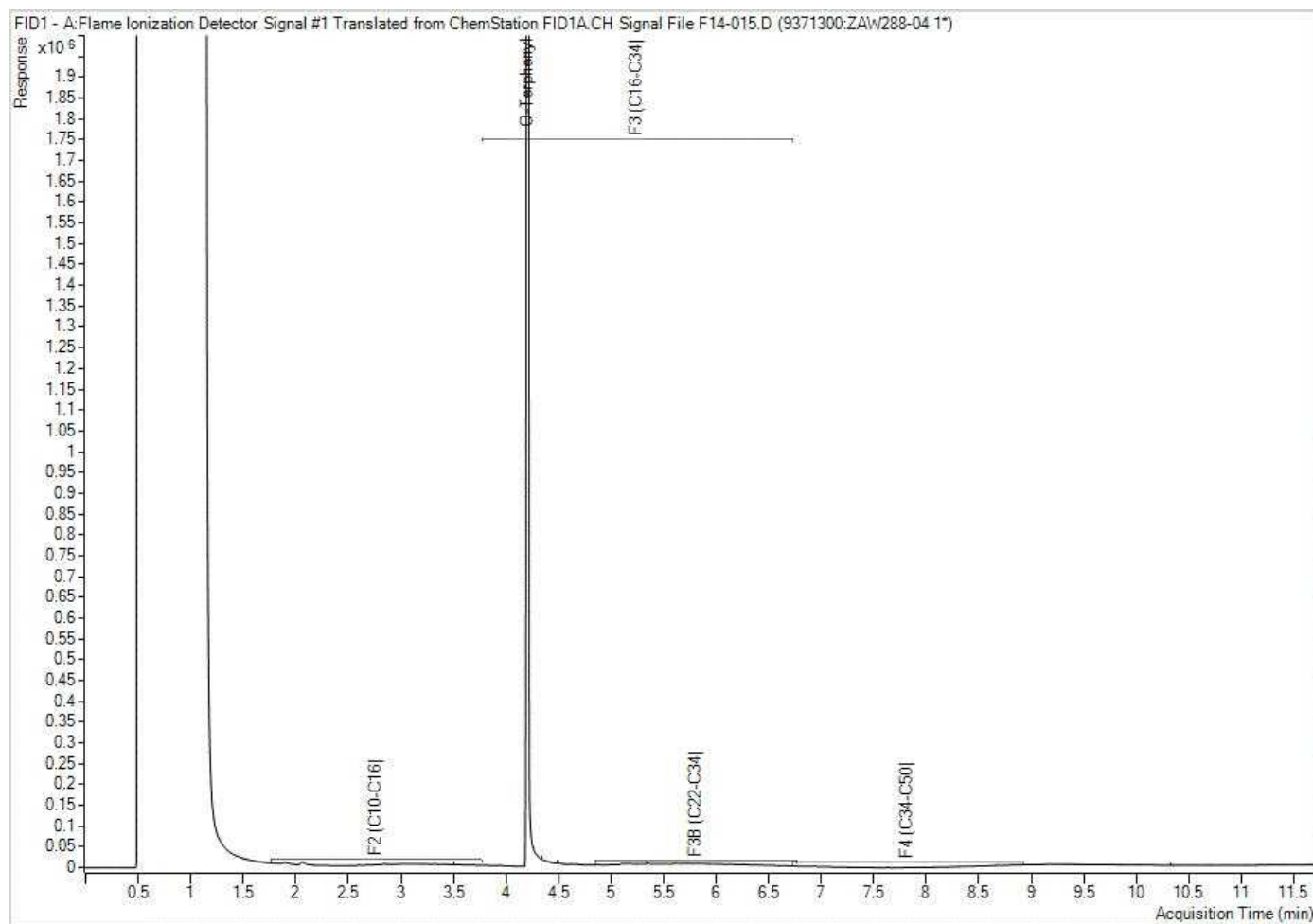


**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



Your Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Your C.O.C. #: 984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/07**  
Report #: R8138514  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4D0350**

**Received: 2024/05/01, 15:31**

Sample Matrix: Water  
# Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity	3	N/A	2024/05/07	CAM SOP-00448	SM 24 2320 B m
Carbonate, Bicarbonate and Hydroxide	3	N/A	2024/05/07	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	3	N/A	2024/05/03	CAM SOP-00463	SM 24 4500-Cl E m
Conductivity	3	N/A	2024/05/07	CAM SOP-00414	SM 24 2510 m
Dissolved Organic Carbon (DOC) (1)	3	N/A	2024/05/03	CAM SOP-00446	SM 24 5310 B m
Petroleum Hydro. CCME F1 & BTEX in Water	3	N/A	2024/05/02	CAM SOP-00315	CCME PHC-CWS m
Petroleum Hydrocarbons F2-F4 in Water (2)	3	2024/05/03	2024/05/04	CAM SOP-00316	CCME PHC-CWS m
Hardness (calculated as CaCO3)	3	N/A	2024/05/03	CAM SOP 00102/00408/00447	SM 2340 B
Dissolved Metals by ICPMS	3	N/A	2024/05/03	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	3	N/A	2024/05/07		
Anion and Cation Sum	3	N/A	2024/05/07		
Total Ammonia-N	3	N/A	2024/05/03	CAM SOP-00441	USGS I-2522-90 m
Nitrate & Nitrite as Nitrogen in Water (3)	3	N/A	2024/05/03	CAM SOP-00440	SM 24 4500-NO3I/NO2B
pH (4)	3	2024/05/02	2024/05/07	CAM SOP-00413	SM 24th - 4500H+ B
Orthophosphate	3	N/A	2024/05/03	CAM SOP-00461	SM 24 4500-P E
Sat. pH and Langelier Index (@ 20C)	3	N/A	2024/05/07		Auto Calc
Sat. pH and Langelier Index (@ 4C)	3	N/A	2024/05/07		Auto Calc
Sulphate by Automated Turbidimetry	3	N/A	2024/05/03	CAM SOP-00464	SM 24 4500-SO42- E m
Total Dissolved Solids (TDS calc)	3	N/A	2024/05/07		Auto Calc

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or



Your Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Your C.O.C. #: 984504-01-01

**Attention: Paul Menkveld**

WSP Canada Inc.  
210 Sheldon Drive  
Cambridge, ON  
CANADA N1T 1A8

**Report Date: 2024/05/07**  
Report #: R8138514  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C4D0350**

**Received: 2024/05/01, 15:31**

implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Bureau Veritas conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

(3) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

(4) "The CCME method and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) requires pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the CCME and Analytical Protocol (O. Reg 153/04, O. Reg. 406/19) holding time. Bureau Veritas endeavors to analyze samples as soon as possible after receipt."

**Encryption Key**

Please direct all questions regarding this Certificate of Analysis to:

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.





Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZBB544			ZBB544			ZBB545		
Sampling Date		2024/05/01 10:35			2024/05/01 10:35			2024/05/01 11:40		
COC Number		984504-01-01			984504-01-01			984504-01-01		
	UNITS	MW-IT-07-A	RDL	QC Batch	MW-IT-07-A Lab-Dup	RDL	QC Batch	MW-IT-07-B	RDL	QC Batch

Calculated Parameters										
Anion Sum	me/L	6.35	N/A	9369503				6.20	N/A	9369503
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	210	1.0	9369498				210	1.0	9369498
Calculated TDS	mg/L	350	1.0	9369497				340	1.0	9369497
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L	2.7	1.0	9369498				2.6	1.0	9369498
Cation Sum	me/L	6.74	N/A	9369503				6.63	N/A	9369503
Hardness (CaCO <sub>3</sub> )	mg/L	270	1.0	9369500				270	1.0	9369500
Ion Balance (% Difference)	%	2.91	N/A	9369502				3.38	N/A	9369502
Langelier Index (@ 20C)	N/A	0.913		9369505				0.898		9369505
Langelier Index (@ 4C)	N/A	0.665		9369506				0.650		9369506
Saturation pH (@ 20C)	N/A	7.22		9369505				7.22		9369505
Saturation pH (@ 4C)	N/A	7.46		9369506				7.46		9369506

Inorganics										
Total Ammonia-N	mg/L	<0.050	0.050	9370616	<0.050	0.050	9370616	<0.050	0.050	9370616
Conductivity	umho/cm	630	1.0	9370043				610	1.0	9370043
Dissolved Organic Carbon	mg/L	1.6	0.40	9371968				1.7	0.40	9371968
Orthophosphate (P)	mg/L	<0.010	0.010	9370991				<0.010	0.010	9370991
pH	pH	8.13		9370055				8.11		9370055
Dissolved Sulphate (SO <sub>4</sub> )	mg/L	14	1.0	9370990				14	1.0	9370990
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L	210	1.0	9370036				210	1.0	9370036
Dissolved Chloride (Cl <sup>-</sup> )	mg/L	54	2.0	9370984				49	1.0	9370984
Nitrite (N)	mg/L	<0.010	0.010	9371000				<0.010	0.010	9371000
Nitrate (N)	mg/L	3.75	0.10	9371000				4.11	0.10	9371000
Nitrate + Nitrite (N)	mg/L	3.75	0.10	9371000				4.11	0.10	9371000

Metals										
Dissolved Aluminum (Al)	ug/L	<4.9	4.9	9371442				<4.9	4.9	9371442
Dissolved Antimony (Sb)	ug/L	<0.50	0.50	9371442				<0.50	0.50	9371442
Dissolved Arsenic (As)	ug/L	<1.0	1.0	9371442				<1.0	1.0	9371442
Dissolved Barium (Ba)	ug/L	38	2.0	9371442				36	2.0	9371442
Dissolved Beryllium (Be)	ug/L	<0.40	0.40	9371442				<0.40	0.40	9371442

RDL = Reportable Detection Limit  
QC Batch = Quality Control Batch  
Lab-Dup = Laboratory Initiated Duplicate  
N/A = Not Applicable

BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350

Report Date: 2024/05/07

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: RT

## RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZBB544			ZBB544			ZBB545		
Sampling Date		2024/05/01 10:35			2024/05/01 10:35			2024/05/01 11:40		
COC Number		984504-01-01			984504-01-01			984504-01-01		
	UNITS	MW-IT-07-A	RDL	QC Batch	MW-IT-07-A Lab-Dup	RDL	QC Batch	MW-IT-07-B	RDL	QC Batch
Dissolved Boron (B)	ug/L	<10	10	9371442				<10	10	9371442
Dissolved Cadmium (Cd)	ug/L	<0.090	0.090	9371442				<0.090	0.090	9371442
Dissolved Calcium (Ca)	ug/L	77000	200	9371442				77000	200	9371442
Dissolved Chromium (Cr)	ug/L	<5.0	5.0	9371442				<5.0	5.0	9371442
Dissolved Cobalt (Co)	ug/L	0.69	0.50	9371442				0.65	0.50	9371442
Dissolved Copper (Cu)	ug/L	<0.90	0.90	9371442				0.92	0.90	9371442
Dissolved Iron (Fe)	ug/L	<100	100	9371442				<100	100	9371442
Dissolved Lead (Pb)	ug/L	<0.50	0.50	9371442				<0.50	0.50	9371442
Dissolved Magnesium (Mg)	ug/L	18000	50	9371442				18000	50	9371442
Dissolved Manganese (Mn)	ug/L	5.8	2.0	9371442				<2.0	2.0	9371442
Dissolved Molybdenum (Mo)	ug/L	<0.50	0.50	9371442				<0.50	0.50	9371442
Dissolved Nickel (Ni)	ug/L	<1.0	1.0	9371442				<1.0	1.0	9371442
Dissolved Phosphorus (P)	ug/L	<100	100	9371442				<100	100	9371442
Dissolved Potassium (K)	ug/L	2100	200	9371442				2200	200	9371442
Dissolved Selenium (Se)	ug/L	<2.0	2.0	9371442				<2.0	2.0	9371442
Dissolved Silicon (Si)	ug/L	2900	50	9371442				2800	50	9371442
Dissolved Silver (Ag)	ug/L	<0.090	0.090	9371442				<0.090	0.090	9371442
Dissolved Sodium (Na)	ug/L	30000	100	9371442				28000	100	9371442
Dissolved Strontium (Sr)	ug/L	130	1.0	9371442				120	1.0	9371442
Dissolved Thallium (Tl)	ug/L	<0.050	0.050	9371442				<0.050	0.050	9371442
Dissolved Titanium (Ti)	ug/L	<5.0	5.0	9371442				<5.0	5.0	9371442
Dissolved Uranium (U)	ug/L	0.24	0.10	9371442				0.24	0.10	9371442
Dissolved Vanadium (V)	ug/L	<0.50	0.50	9371442				<0.50	0.50	9371442
Dissolved Zinc (Zn)	ug/L	<5.0	5.0	9371442				<5.0	5.0	9371442
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

### RCAP - COMPREHENSIVE (WATER)

<b>Bureau Veritas ID</b>		ZBB545			ZBB546		
<b>Sampling Date</b>		2024/05/01 11:40			2024/05/01 10:15		
<b>COC Number</b>		984504-01-01			984504-01-01		
	<b>UNITS</b>	<b>MW-IT-07-B Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>	<b>MW-IT-07-C</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Anion Sum	me/L				5.63	N/A	9369503
Bicarb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				220	1.0	9369498
Calculated TDS	mg/L				310	1.0	9369497
Carb. Alkalinity (calc. as CaCO <sub>3</sub> )	mg/L				2.2	1.0	9369498
Cation Sum	me/L				6.45	N/A	9369503
Hardness (CaCO <sub>3</sub> )	mg/L				290	1.0	9369500
Ion Balance (% Difference)	%				6.76	N/A	9369502
Langelier Index (@ 20C)	N/A				0.896		9369505
Langelier Index (@ 4C)	N/A				0.647		9369506
Saturation pH (@ 20C)	N/A				7.12		9369505
Saturation pH (@ 4C)	N/A				7.37		9369506
<b>Inorganics</b>							
Total Ammonia-N	mg/L				<0.050	0.050	9370616
Conductivity	umho/cm				540	1.0	9370043
Dissolved Organic Carbon	mg/L	1.6	0.40	9371968	2.5	0.40	9370893
Orthophosphate (P)	mg/L				<0.010	0.010	9370991
pH	pH				8.01		9370055
Dissolved Sulphate (SO <sub>4</sub> )	mg/L				10	1.0	9370990
Alkalinity (Total as CaCO <sub>3</sub> )	mg/L				230	1.0	9370036
Dissolved Chloride (Cl <sup>-</sup> )	mg/L				25	1.0	9370984
Nitrite (N)	mg/L				<0.010	0.010	9371000
Nitrate (N)	mg/L				2.32	0.10	9371000
Nitrate + Nitrite (N)	mg/L				2.32	0.10	9371000
<b>Metals</b>							
Dissolved Aluminum (Al)	ug/L				11	4.9	9371442
Dissolved Antimony (Sb)	ug/L				<0.50	0.50	9371442
Dissolved Arsenic (As)	ug/L				<1.0	1.0	9371442
Dissolved Barium (Ba)	ug/L				72	2.0	9371442
Dissolved Beryllium (Be)	ug/L				<0.40	0.40	9371442
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable							



Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

### RCAP - COMPREHENSIVE (WATER)

Bureau Veritas ID		ZBB545			ZBB546		
Sampling Date		2024/05/01 11:40			2024/05/01 10:15		
COC Number		984504-01-01			984504-01-01		
	UNITS	MW-IT-07-B Lab-Dup	RDL	QC Batch	MW-IT-07-C	RDL	QC Batch
Dissolved Boron (B)	ug/L				12	10	9371442
Dissolved Cadmium (Cd)	ug/L				<0.090	0.090	9371442
Dissolved Calcium (Ca)	ug/L				89000	200	9371442
Dissolved Chromium (Cr)	ug/L				<5.0	5.0	9371442
Dissolved Cobalt (Co)	ug/L				3.0	0.50	9371442
Dissolved Copper (Cu)	ug/L				1.0	0.90	9371442
Dissolved Iron (Fe)	ug/L				<100	100	9371442
Dissolved Lead (Pb)	ug/L				<0.50	0.50	9371442
Dissolved Magnesium (Mg)	ug/L				16000	50	9371442
Dissolved Manganese (Mn)	ug/L				51	2.0	9371442
Dissolved Molybdenum (Mo)	ug/L				1.0	0.50	9371442
Dissolved Nickel (Ni)	ug/L				5.8	1.0	9371442
Dissolved Phosphorus (P)	ug/L				<100	100	9371442
Dissolved Potassium (K)	ug/L				1700	200	9371442
Dissolved Selenium (Se)	ug/L				<2.0	2.0	9371442
Dissolved Silicon (Si)	ug/L				3600	50	9371442
Dissolved Silver (Ag)	ug/L				<0.090	0.090	9371442
Dissolved Sodium (Na)	ug/L				16000	100	9371442
Dissolved Strontium (Sr)	ug/L				160	1.0	9371442
Dissolved Thallium (Tl)	ug/L				<0.050	0.050	9371442
Dissolved Titanium (Ti)	ug/L				<5.0	5.0	9371442
Dissolved Uranium (U)	ug/L				0.28	0.10	9371442
Dissolved Vanadium (V)	ug/L				<0.50	0.50	9371442
Dissolved Zinc (Zn)	ug/L				<5.0	5.0	9371442
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate							





BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350

Report Date: 2024/05/07

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: RT

### O.REG 153 PHCS, BTEX/F1-F4 (WATER)

Bureau Veritas ID		ZBB544	ZBB545			ZBB545			ZBB546		
Sampling Date		2024/05/01 10:35	2024/05/01 11:40			2024/05/01 11:40			2024/05/01 10:15		
COC Number		984504-01-01	984504-01-01			984504-01-01			984504-01-01		
	UNITS	MW-IT-07-A	MW-IT-07-B	RDL	QC Batch	MW-IT-07-B Lab-Dup	RDL	QC Batch	MW-IT-07-C	RDL	QC Batch
<b>BTEX &amp; F1 Hydrocarbons</b>											
Benzene	ug/L	<0.20	<0.20	0.20	9370734				<0.20	0.20	9370734
Toluene	ug/L	0.32	<0.20	0.20	9370734				1.9	0.20	9370734
Ethylbenzene	ug/L	<0.20	<0.20	0.20	9370734				<0.20	0.20	9370734
o-Xylene	ug/L	<0.20	<0.20	0.20	9370734				<0.20	0.20	9370734
p+m-Xylene	ug/L	<0.40	<0.40	0.40	9370734				<0.40	0.40	9370734
Total Xylenes	ug/L	<0.40	<0.40	0.40	9370734				<0.40	0.40	9370734
F1 (C6-C10)	ug/L	<25	<25	25	9370734				110	25	9370734
F1 (C6-C10) - BTEX	ug/L	<25	<25	25	9370734				100	25	9370734
<b>F2-F4 Hydrocarbons</b>											
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	100	9372441	<100	100	9372441	<100	100	9372441
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	200	9372441	<200	200	9372441	390	200	9372441
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	200	9372441	<200	200	9372441	<200	200	9372441
Reached Baseline at C50	ug/L	Yes	Yes		9372441	Yes		9372441	Yes		9372441
<b>Surrogate Recovery (%)</b>											
1,4-Difluorobenzene	%	99	100		9370734				99		9370734
4-Bromofluorobenzene	%	99	99		9370734				100		9370734
D10-o-Xylene	%	90	90		9370734				94		9370734
D4-1,2-Dichloroethane	%	100	99		9370734				100		9370734
o-Terphenyl	%	99	101		9372441	100		9372441	102		9372441
RDL = Reportable Detection Limit											
QC Batch = Quality Control Batch											
Lab-Dup = Laboratory Initiated Duplicate											



Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

## TEST SUMMARY

**Bureau Veritas ID:** ZBB544  
**Sample ID:** MW-IT-07-A  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9369498	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9370043	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9371968	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9370734	N/A	2024/05/02	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9372441	2024/05/03	2024/05/04	Dennis Ngundu
Hardness (calculated as CaCO <sub>3</sub> )		9369500	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9369502	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9369503	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9370616	N/A	2024/05/03	Massarat Jan
Nitrate & Nitrite as Nitrogen in Water	LACH	9371000	N/A	2024/05/03	Jinal Chavda
pH	AT	9370055	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9369505	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9369506	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9369497	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZBB544 Dup  
**Sample ID:** MW-IT-07-A  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH <sub>4</sub>	9370616	N/A	2024/05/03	Massarat Jan

**Bureau Veritas ID:** ZBB545  
**Sample ID:** MW-IT-07-B  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9369498	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9370043	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9371968	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9370734	N/A	2024/05/02	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9372441	2024/05/03	2024/05/04	Dennis Ngundu
Hardness (calculated as CaCO <sub>3</sub> )		9369500	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9369502	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9369503	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH <sub>4</sub>	9370616	N/A	2024/05/03	Massarat Jan



Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

## TEST SUMMARY

**Bureau Veritas ID:** ZBB545  
**Sample ID:** MW-IT-07-B  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate & Nitrite as Nitrogen in Water	LACH	9371000	N/A	2024/05/03	Jinal Chavda
pH	AT	9370055	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9369505	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9369506	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9369497	N/A	2024/05/07	Automated Statchk

**Bureau Veritas ID:** ZBB545 Dup  
**Sample ID:** MW-IT-07-B  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9371968	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9372441	2024/05/03	2024/05/04	Dennis Ngundu

**Bureau Veritas ID:** ZBB546  
**Sample ID:** MW-IT-07-C  
**Matrix:** Water

**Collected:** 2024/05/01  
**Shipped:**  
**Received:** 2024/05/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	9370036	N/A	2024/05/07	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	9369498	N/A	2024/05/07	Automated Statchk
Chloride by Automated Colourimetry	SKAL	9370984	N/A	2024/05/03	Massarat Jan
Conductivity	AT	9370043	N/A	2024/05/07	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	9370893	N/A	2024/05/03	Gyulshen Idriz
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	9370734	N/A	2024/05/02	Georgeta Rusu
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	9372441	2024/05/03	2024/05/04	Dennis Ngundu
Hardness (calculated as CaCO3)		9369500	N/A	2024/05/03	Automated Statchk
Dissolved Metals by ICPMS	ICP/MS	9371442	N/A	2024/05/03	Prempal Bhatti
Ion Balance (% Difference)	CALC	9369502	N/A	2024/05/07	Automated Statchk
Anion and Cation Sum	CALC	9369503	N/A	2024/05/07	Automated Statchk
Total Ammonia-N	LACH/NH4	9370616	N/A	2024/05/03	Massarat Jan
Nitrate & Nitrite as Nitrogen in Water	LACH	9371000	N/A	2024/05/03	Jinal Chavda
pH	AT	9370055	2024/05/02	2024/05/07	Surinder Rai
Orthophosphate	KONE	9370991	N/A	2024/05/03	Massarat Jan
Sat. pH and Langelier Index (@ 20C)	CALC	9369505	N/A	2024/05/07	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	9369506	N/A	2024/05/07	Automated Statchk
Sulphate by Automated Turbidimetry	SKAL	9370990	N/A	2024/05/03	Massarat Jan
Total Dissolved Solids (TDS calc)	CALC	9369497	N/A	2024/05/07	Automated Statchk



Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

### GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	15.0°C
-----------	--------

Results relate only to the items tested.



BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: RT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9370734	1,4-Difluorobenzene	2024/05/02	96	70 - 130	97	70 - 130	102	%		
9370734	4-Bromofluorobenzene	2024/05/02	101	70 - 130	102	70 - 130	97	%		
9370734	D10-o-Xylene	2024/05/02	103	70 - 130	102	70 - 130	87	%		
9370734	D4-1,2-Dichloroethane	2024/05/02	97	70 - 130	96	70 - 130	103	%		
9372441	o-Terphenyl	2024/05/04	102	60 - 130	102	60 - 130	105	%		
9370036	Alkalinity (Total as CaCO3)	2024/05/06			102	85 - 115	<1.0	mg/L	1.4	20
9370043	Conductivity	2024/05/06			101	85 - 115	<1.0	umho/cm	0.29	10
9370055	pH	2024/05/06			102	98 - 103			0.51	N/A
9370616	Total Ammonia-N	2024/05/03	93	75 - 125	98	80 - 120	<0.050	mg/L	NC	20
9370734	Benzene	2024/05/02	85	50 - 140	86	50 - 140	<0.20	ug/L	NC	30
9370734	Ethylbenzene	2024/05/02	92	50 - 140	89	50 - 140	<0.20	ug/L	NC	30
9370734	F1 (C6-C10) - BTEX	2024/05/02					<25	ug/L	NC	30
9370734	F1 (C6-C10)	2024/05/02	96	60 - 140	96	60 - 140	<25	ug/L	NC	30
9370734	o-Xylene	2024/05/02	91	50 - 140	94	50 - 140	<0.20	ug/L	NC	30
9370734	p+m-Xylene	2024/05/02	86	50 - 140	88	50 - 140	<0.40	ug/L	NC	30
9370734	Toluene	2024/05/02	83	50 - 140	85	50 - 140	<0.20	ug/L	NC	30
9370734	Total Xylenes	2024/05/02					<0.40	ug/L	NC	30
9370893	Dissolved Organic Carbon	2024/05/03	96	80 - 120	98	80 - 120	<0.40	mg/L	1.5	20
9370984	Dissolved Chloride (Cl-)	2024/05/03	NC	80 - 120	99	80 - 120	<1.0	mg/L	0.36	20
9370990	Dissolved Sulphate (SO4)	2024/05/03	NC	75 - 125	97	80 - 120	<1.0	mg/L	0.77	20
9370991	Orthophosphate (P)	2024/05/03	95	75 - 125	95	80 - 120	<0.010	mg/L	NC	20
9371000	Nitrate (N)	2024/05/03	93	80 - 120	94	80 - 120	<0.10	mg/L	NC	20
9371000	Nitrite (N)	2024/05/03	97	80 - 120	96	80 - 120	<0.010	mg/L	NC	20
9371442	Dissolved Aluminum (Al)	2024/05/03	105	80 - 120	101	80 - 120	<4.9	ug/L	NC	20
9371442	Dissolved Antimony (Sb)	2024/05/03	110	80 - 120	105	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Arsenic (As)	2024/05/03	106	80 - 120	100	80 - 120	<1.0	ug/L	NC	20
9371442	Dissolved Barium (Ba)	2024/05/03	104	80 - 120	100	80 - 120	<2.0	ug/L	0.43	20
9371442	Dissolved Beryllium (Be)	2024/05/03	107	80 - 120	99	80 - 120	<0.40	ug/L	NC	20
9371442	Dissolved Boron (B)	2024/05/03	104	80 - 120	96	80 - 120	<10	ug/L	NC	20
9371442	Dissolved Cadmium (Cd)	2024/05/03	106	80 - 120	101	80 - 120	<0.090	ug/L	NC	20
9371442	Dissolved Calcium (Ca)	2024/05/03	NC	80 - 120	103	80 - 120	<200	ug/L	3.5	20

BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: RT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9371442	Dissolved Chromium (Cr)	2024/05/03	105	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
9371442	Dissolved Cobalt (Co)	2024/05/03	104	80 - 120	100	80 - 120	<0.50	ug/L	2.6	20
9371442	Dissolved Copper (Cu)	2024/05/03	107	80 - 120	103	80 - 120	<0.90	ug/L	NC	20
9371442	Dissolved Iron (Fe)	2024/05/03	107	80 - 120	103	80 - 120	<100	ug/L	NC	20
9371442	Dissolved Lead (Pb)	2024/05/03	104	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Magnesium (Mg)	2024/05/03	104	80 - 120	101	80 - 120	<50	ug/L	1.0	20
9371442	Dissolved Manganese (Mn)	2024/05/03	105	80 - 120	100	80 - 120	<2.0	ug/L	1.8	20
9371442	Dissolved Molybdenum (Mo)	2024/05/03	111	80 - 120	106	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Nickel (Ni)	2024/05/03	104	80 - 120	100	80 - 120	<1.0	ug/L	0.11	20
9371442	Dissolved Phosphorus (P)	2024/05/03	110	80 - 120	101	80 - 120	<100	ug/L	NC	20
9371442	Dissolved Potassium (K)	2024/05/03	108	80 - 120	103	80 - 120	<200	ug/L	0.45	20
9371442	Dissolved Selenium (Se)	2024/05/03	106	80 - 120	102	80 - 120	<2.0	ug/L	NC	20
9371442	Dissolved Silicon (Si)	2024/05/03	106	80 - 120	102	80 - 120	<50	ug/L	2.6	20
9371442	Dissolved Silver (Ag)	2024/05/03	107	80 - 120	104	80 - 120	<0.090	ug/L	NC	20
9371442	Dissolved Sodium (Na)	2024/05/03	105	80 - 120	102	80 - 120	<100	ug/L	0.47	20
9371442	Dissolved Strontium (Sr)	2024/05/03	106	80 - 120	101	80 - 120	<1.0	ug/L	0.51	20
9371442	Dissolved Thallium (Tl)	2024/05/03	105	80 - 120	102	80 - 120	<0.050	ug/L	NC	20
9371442	Dissolved Titanium (Ti)	2024/05/03	104	80 - 120	100	80 - 120	<5.0	ug/L	NC	20
9371442	Dissolved Uranium (U)	2024/05/03	105	80 - 120	102	80 - 120	<0.10	ug/L	5.6	20
9371442	Dissolved Vanadium (V)	2024/05/03	107	80 - 120	101	80 - 120	<0.50	ug/L	NC	20
9371442	Dissolved Zinc (Zn)	2024/05/03	106	80 - 120	101	80 - 120	<5.0	ug/L	NC	20
9371968	Dissolved Organic Carbon	2024/05/03	96	80 - 120	98	80 - 120	<0.40	mg/L	0.79	20
9372441	F2 (C10-C16 Hydrocarbons)	2024/05/04	94	60 - 130	96	60 - 130	<100	ug/L	NC	30
9372441	F3 (C16-C34 Hydrocarbons)	2024/05/04	104	60 - 130	108	60 - 130	<200	ug/L	NC	30



BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350

Report Date: 2024/05/07

## QUALITY ASSURANCE REPORT(CONT'D)

WSP Canada Inc.

Client Project #: CA-GLD-19129150

Site Location: CBM CALEDON

Sampler Initials: RT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9372441	F4 (C34-C50 Hydrocarbons)	2024/05/04	100	60 - 130	106	60 - 130	<200	ug/L	NC	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference  $\leq 2 \times \text{RDL}$ ).



BUREAU  
VERITAS

Bureau Veritas Job #: C4D0350  
Report Date: 2024/05/07

WSP Canada Inc.  
Client Project #: CA-GLD-19129150  
Site Location: CBM CALEDON  
Sampler Initials: RT

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

---

Cristina Carriere, Senior Scientific Specialist

---

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.





Bureau Veritas  
8740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6256 Fax:(905) 817-5777 www.bvna.com



NONT-2024-05-151

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#21375 WSP Canada Inc.	Company Name:	WSP	Quotation #:	C41059
Attention:	George Schneider	Attention:	Paul Menkveld	P.O. #:	
Address:	210 Sheldon Drive	Address:		Project:	CA-GLD-19129150
	Cambridge ON N1T 1A8			Project Name:	CBM Collection
Tel:	(519) 620-8182	Tel:		Site #:	
Email:	George_Schneider@golder.com	Email:	paul.menkveld@wsp.com	Sampled By:	Ramen Dolo

Bottle Order #:



984504

Project Manager:

Ankita Bhatta

COC #:



C#984504-01-01

MCE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)										Turnaround Time (TAT) Required:				
Regulation 163 (2011)			Other Regulations			Special Instructions			Field Filtered (please circle):										Please provide advance notice for rush projects	
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/Fine	<input type="checkbox"/> CCME	<input type="checkbox"/> Sanitary Sewer Bylaw		Metals/ Hg / Cr VI	RCAp - Comprehensive	O.Reg 153 PHCa, BTEX/PCP-54											Regular (Standard) TAT:	
<input type="checkbox"/> Table 2	<input type="checkbox"/> Ind/Comm	<input type="checkbox"/> Coarse	<input type="checkbox"/> Reg 558	<input type="checkbox"/> Storm Sewer Bylaw											(will be applied if Rush TAT is not specified):					
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC	<input type="checkbox"/> MISA	<input type="checkbox"/> Municipality											Standard TAT = 5-7 Working days for most tests.					
<input type="checkbox"/> Table			<input type="checkbox"/> PWQO	<input type="checkbox"/> Reg 406 Table											Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.					
Include Criteria on Certificate of Analysis (Y/N)?																Job Specific Rush TAT (if applies to entire submission)				
																Date Required: Time Required:				
																Rush Confirmation Number: (call lab for #)				
																# of Bottles				
																Comments				
1		MW-IT-07-A	2024-05-01	10:35	GW											8				
2		MW-IT-07-B		11:40												8				
3		MW-IT-07-C		10:15												8				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)		Time		RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)		Time		# jars used and not submitted		Laboratory Use Only			
Ramen Dolo		2024-05-01		3:32 PM		[Signature]		2024-05-01		15:31				Time Sensitive			
														Temperature (°C) on Receipt			
														19/15/16			
														Custody Seal Present			
														Intact			
														Yes			
														No			

\* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/COG-TERMS-AND-CONDITIONS.

\*\* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

\*\* SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/ENVIRONMENTAL-LABORATORIES/RESOURCES/CHAIN-CUSTODY-FORMS-COGS.

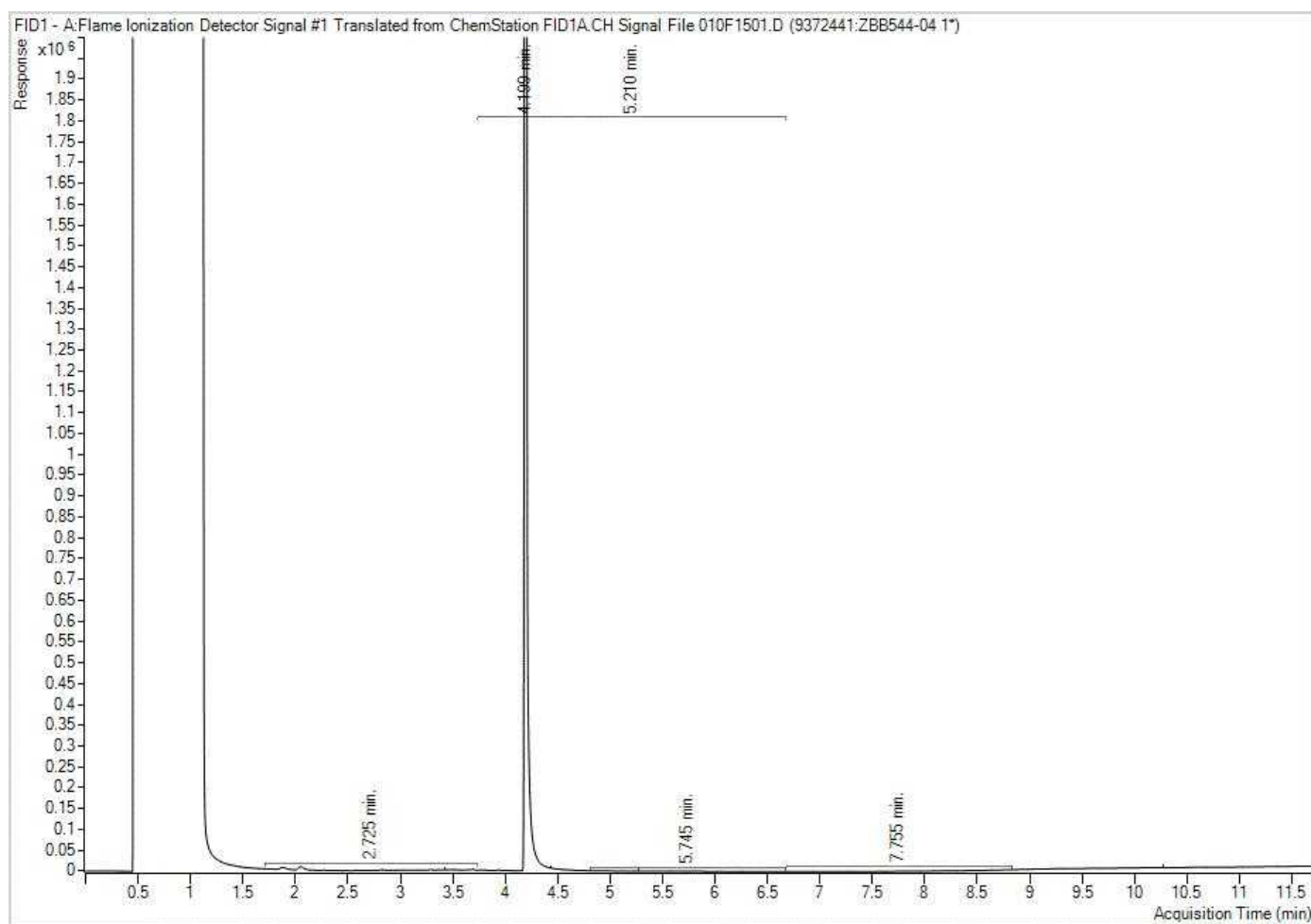
SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

White: Bureau Veritas Yellow: Client

orle

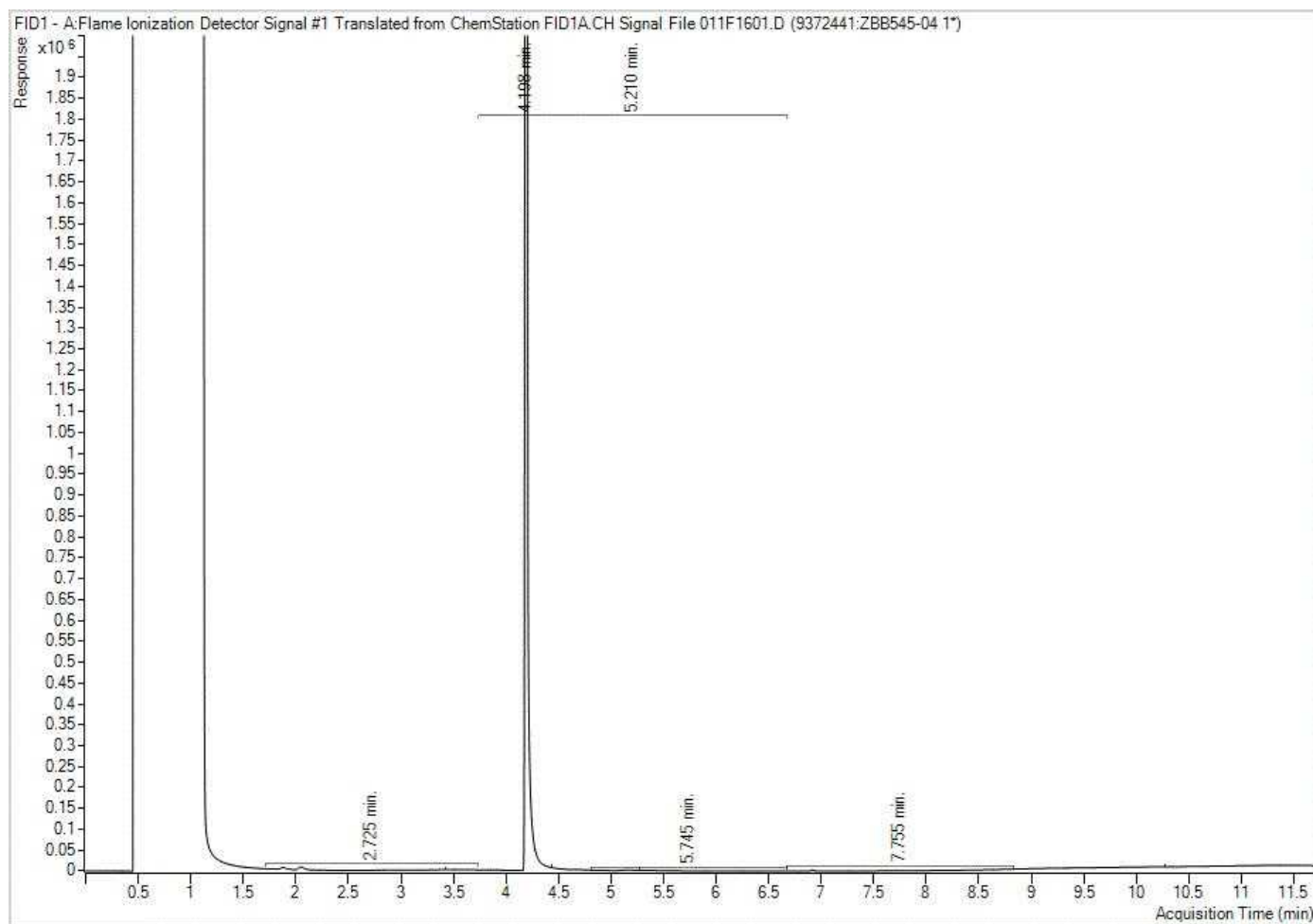
Bureau Veritas Canada (2019) Inc.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



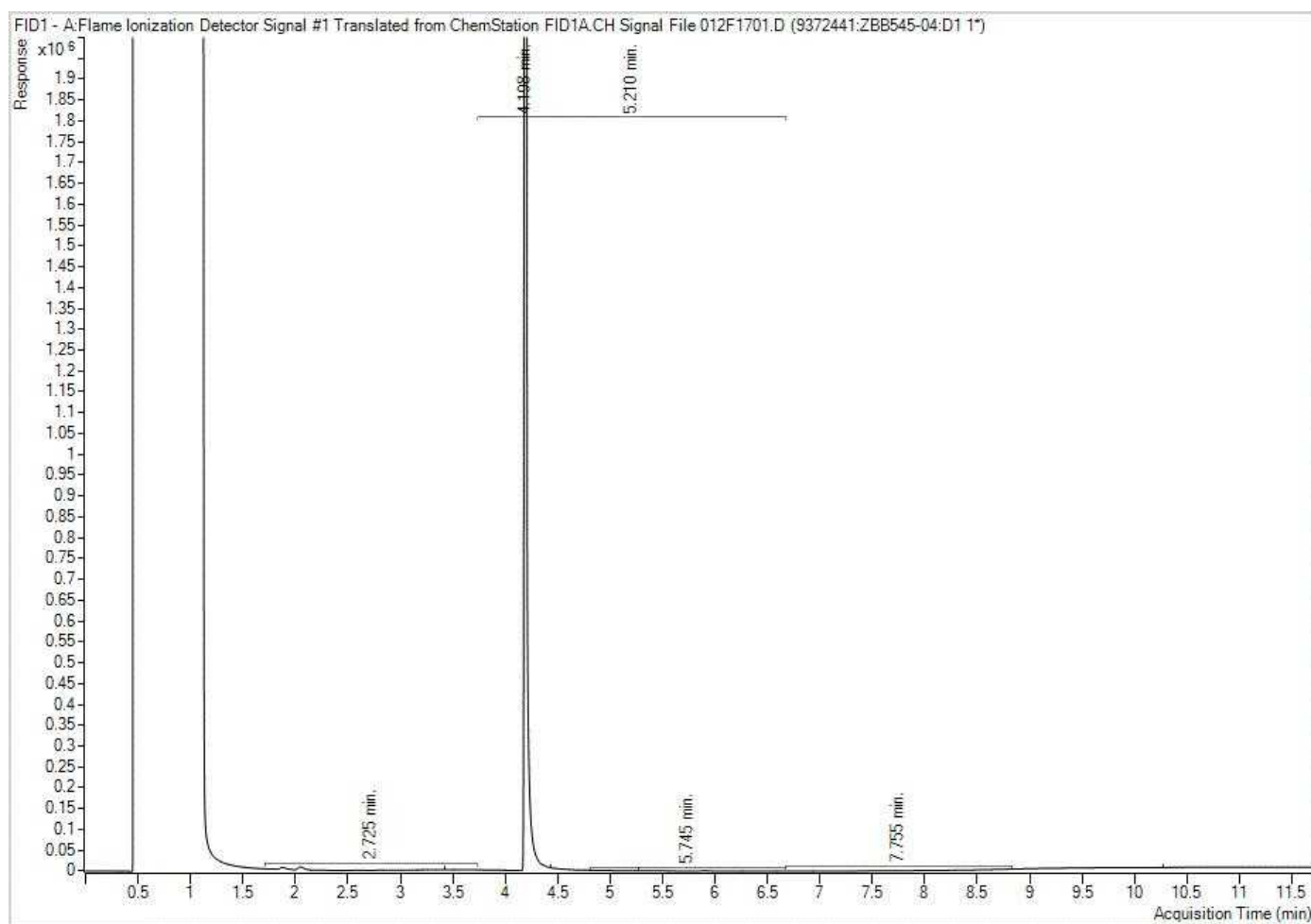
**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

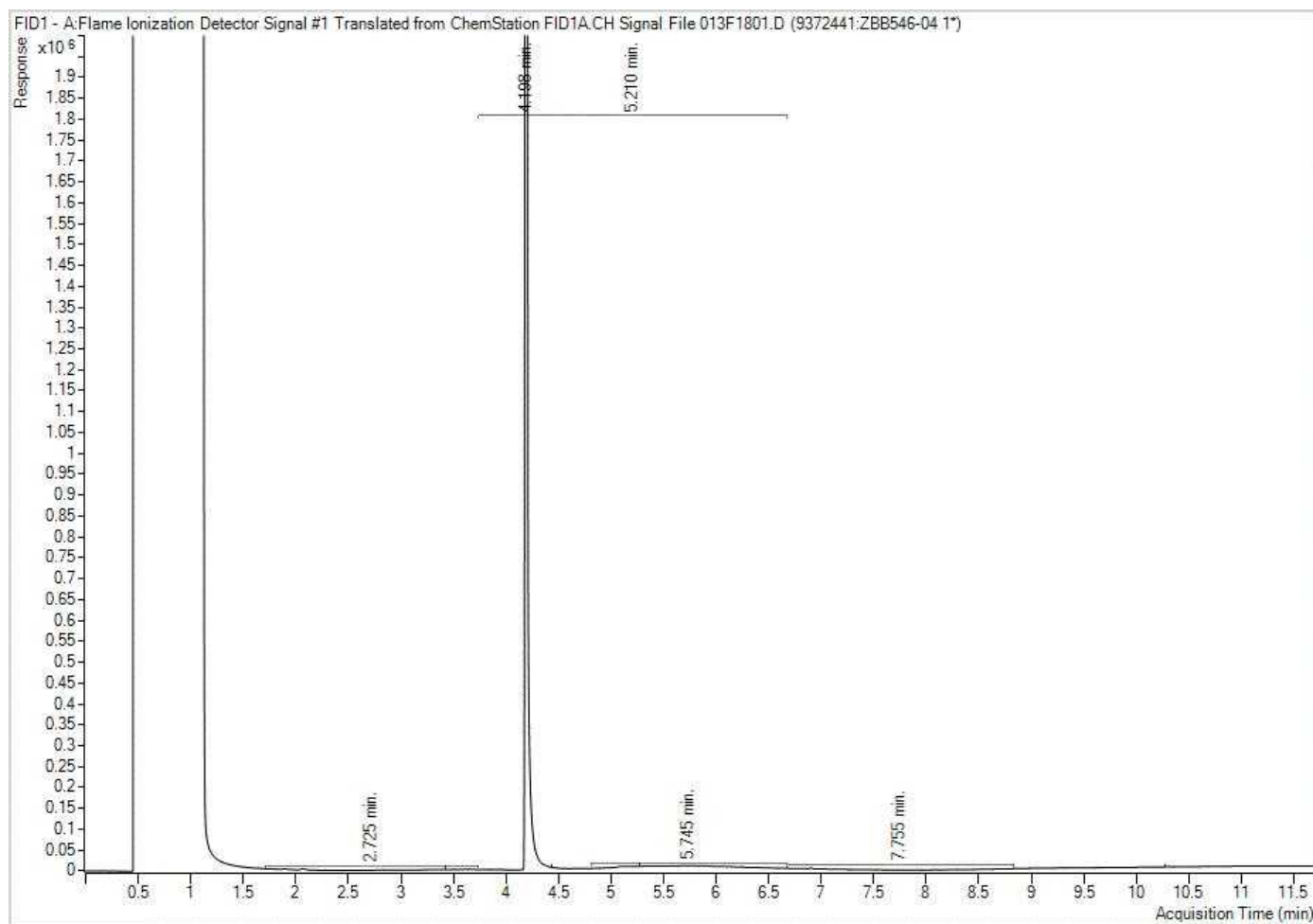
**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.



**Petroleum Hydrocarbons F2-F4 in Water Chromatogram**



**Note:** This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

**APPENDIX C**

**NUMERICAL MODELLING  
SIMULATIONS**



## TECHNICAL MEMORANDUM

**DATE** May 9, 2025

**Project No.** CA-GLD-19129150

**TO** Mike LeBreton; Bill Marquardt  
CBM Aggregates

**CC** Paul Menkveld; Greg Padusenko; Daniel Eusebi

**FROM** George Schneider; Richard Simms; Tori  
Grootjen

**EMAIL** george.schneider@wsp.com

### GROUNDWATER MITIGATION SYSTEM NUMERICAL MODELLING – PROPOSED CBM CALEDON PIT / QUARRY

#### 1.0 INTRODUCTION

CBM Aggregates (CBM), a division of St. Marys Cement Inc. (Canada) applied to the Ministry of Natural Resources (MNR) for a Class A Licence (Pit and Quarry Below Water) and to the Town of Caledon for an Official Plan Amendment and Zoning By-law Amendment to permit a mineral aggregate operation. Previously, WSP Canada Inc. (WSP, formerly Golder Associates) completed numerical modelling of the groundwater mitigation system for the proposed CBM Caledon Pit / Quarry presented in the revised Water Report Level 1/2 dated July 2023 (Golder 2023).

Technical comments related to the Level 1/2 Water Report have been received from agency / stakeholder groups in 2023 and 2024. A number of these groups requested additional studies be undertaken to further the development of the mitigation system design, to demonstrate proof of concept, and to provide further assurance to those agencies and stakeholder groups that the proposed infiltration trench system will perform as predicted. In response to these comments, WSP developed a work plan comprised of the following tasks, which was approved by CBM and initiated by WSP in April of 2024:

- **Desktop Review** – Undertake a desktop review of infiltration systems, with a focus on reviewing recent studies / examples in the Greater Toronto Area (GTA), Ontario and other Canadian jurisdictions.
- **Field Investigations** – Conduct geotechnical / hydrogeological field investigations along the proposed infiltration trench alignment, including the installation of 7 monitoring well nests that will be used to establish background groundwater levels / gradients / water quality and monitor the future performance of the infiltration trench system.
- **Numerical Modelling Update** - Utilizing the new data collected during the field investigations, update the hydrostratigraphic model for the proposed Caledon Pit / quarry along the proposed infiltration trench, update and optimize calibration of the baseline HydroGeoSphere (HGS) numerical groundwater-surface water flow model, update the proposed trench configuration and target water levels (as required), and run updated HGS simulations for all Operational Phases and the post-rehabilitation phase of the proposed pit / quarry.

- Preliminary Mitigation System Design - Based on the results of the tasks described above, update the conceptual mitigation system design to a preliminary design level that is sufficiently advanced to demonstrate proof of concept.

This technical memorandum presents the results of the HGS numerical model updates for the proposed Caledon Pit / Quarry, utilizing the new hydrogeologic information collected during the field investigations carried out by WSP.

## 2.0 FIELD INVESTIGATION RESULTS

The 2024 field investigation along the proposed infiltration trench system alignment was comprised mainly of the drilling and testing of seven groundwater monitoring well nests, MW-IT-01 to MW-IT-07 (Figure 1), and included the following tasks:

- Borehole drilling (continuous coring) and monitoring well nest installation;
- Laboratory testing of overburden soils for grainsize distribution;
- Groundwater level monitoring;
- Hydraulic testing - single well response tests (SWRT); and
- Well development and water quality sampling.

The field investigation results are presented in a Technical Memorandum dated November 20, 2024 (WSP 2024 - draft). Well installation details, groundwater levels and aquifer testing results are summarized in Table 1 and hydraulic conductivity (k) estimates from SWRTs are summarized by hydrostratigraphic unit in Table 2.

The new hydrogeologic information obtained during the field investigations was used to update the hydrostratigraphic model and the HGS numerical model in the vicinity of the proposed infiltration trench mitigation system (Figure 2 and Figure 3). The groundwater level and hydraulic conductivity data were used to update the HGS model calibration to current (baseline) conditions.



**Table 1: New Infiltration Trench Monitoring Wells**

Well ID	Easting (m)	Northing (m)	Ground Surface Elevation (masl)	Total Hole Depth (mbgs)	Depth to Bedrock (mbgs)	Stick Up (m)	Aquifer Unit Screened	Screen from (m)	Screen to (m)	Screen Length (m)	Static Water Level (masl)	Hydraulic Conductivity <sup>1</sup> (m/s)	SWRT Field Method	SWRT Solution Method
MW-IT-01A	577201	4852516	403.67	26.52	17.68	0.930	Gasport Fm	21.64	23.16	1.52	393.50	9E-05	Pneumatic Rising Head Test	Bouwer-Rice
MW-IT-01B	577202	4852514	403.63	19.51	17.98	0.830	Contact Aquifer	16.71	18.84	2.13	393.60	8E-04	Pneumatic Rising Head Test	Butler
MW-IT-01C	577204	4852513	403.58	11.96	-	0.896	Overburden	10.44	11.96	1.52	393.66	5E-05	Waterra Purge	Bouwer-Rice
MW-IT-02A	577009	4852710	401.46	16.76	6.1	0.861	Gasport Fm	14.64	16.16	1.52	394.91	6E-07	Bailer	Bouwer-Rice
MW-IT-02B	577007	4852712	401.49	12.50	6.4	0.912	Gasport Fm	8.84	11.89	3.05	395.32	3E-06	Bailer	Bouwer-Rice
MW-IT-02C	577006	4852713	401.47	7.01	-	0.822	Contact Aquifer	5.18	6.71	1.52	395.70	2E-05	Bailer	Bouwer-Rice
MW-IT-03A	577352	4852364	397.88	14.94	9.75	0.895	Gasport Fm	13.29	14.81	1.52	393.44	1E-06	Waterra Purge	Bouwer-Rice
MW-IT-03B	577354	4852363	397.76	12.04	9.75	0.929	Contact Aquifer	9.60	11.43	1.83	393.49	1E-04	Physical Slug	Bouwer-Rice
MW-IT-03C	577355	4852362	397.74	7.92	-	0.910	Overburden	5.79	7.32	1.52	393.52	2E-03	Physical Slug	Springer-Gelhar
MW-IT-04A	577521	4852364	397.68	12.19	6.55	0.837	Gasport Fm	10.21	11.73	1.52	393.21	1E-04	Pneumatic Rising Head Test	Bouwer-Rice
MW-IT-04B	577522	4852363	397.69	9.14	5.49	0.869	Contact Aquifer	5.33	8.38	3.05	393.12	7E-04	Pneumatic Rising Head Test	Springer-Gelhar
MW-IT-05A	577614	4852195	399.30	14.94	9.14	0.871	Gasport Fm	11.39	14.44	3.05	393.24	6E-04	Pneumatic Rising Head Test	Butler
MW-IT-05B	577612	4852197	399.23	10.36	10.06	0.865	Contact Aquifer	8.71	10.23	1.52	393.08	1E-05	Pneumatic Rising Head Test	Bouwer-Rice
MW-IT-05C	577611	4852199	399.18	7.62	-	0.888	Overburden	5.79	7.32	1.52	392.95	8E-06	Waterra Purge	Bouwer-Rice
MW-IT-06A	578068	4852428	398.67	11.58	6.25	0.861	Gasport Fm	9.75	11.28	1.52	392.14	1E-04	Physical Slug	Bouwer-Rice
MW-IT-06B	578069	4852429	398.62	9.14	6.10	0.834	Contact Aquifer	6.00	9.04	3.05	392.06	6E-04	Physical Slug	Bouwer-Rice
MW-IT-07A	577897	4852208	400.14	17.68	10.21	0.946	Gasport Fm and Shaley Dolostone	13.72	15.24	1.52	392.37	2E-04	Pneumatic Rising Head Test	Bouwer-Rice
MW-IT-07B	577898	4852209	400.19	12.95	9.75	0.901	Contact Aquifer	9.61	12.66	3.05	392.36	8E-04	Physical Slug	Springer-Gelhar
MW-IT-07C	577899	4852211	400.14	9.30	-	1.003	Overburden	7.48	9.00	1.52	392.29	3E-04	Physical Slug	Bouwer-Rice

**Abbreviations and Notes:**

m – metres; masl - metres above sea level; mbgs - metres below ground surface; Fm – Formation; SWRT – Single Well Response Test; m/s – metres / second

1 - Water levels measured on May 6, 2024

**Table 2: Hydraulic Conductivity from SWRTs by Hydrostratigraphic Unit**

Hydrostratigraphic Unit	Number of Observations	Minimum K (m/s)	Maximum K (m/s)	Geometric Mean K (m/s)
Overburden	4	8E-06	2E-03	1E-04
Bedrock Contact Aquifer	7	1E-05	8E-04	2E-04
Gasport Formation	7	6E-07	6E-04	2E-05
Gasport Formation and Shaley Dolostone	1	2E-04	-	-

**Abbreviations:**

K – hydraulic conductivity; m/s – metres per second

**3.0 HGS MODEL AND BASELINE CALIBRATION**

**3.1 Approach**

The objective of the HGS hydrogeological modelling is to assess the potential impact of the proposed Caledon Pit / Quarry on local and regional groundwater and surface water conditions, and to help develop and evaluate the performance of the proposed groundwater (infiltration trench) mitigation system. This includes evaluating potential changes in water levels and flows in nearby surface water features relative to background conditions. Given the emphasis on both groundwater and surface water impacts, a coupled surface water/groundwater (SW/GW) modelling approach was applied. As part of the Water Report Level 1/2 (Golder 2023), a 3D numerical model of the proposed pit / quarry and surrounding regional groundwater flow system was constructed, with the addition of a 2D grid that represents the surface flow domain (which is coincident with the top of the 3D model domain) in HydroGeoSphere (HGS, Aquanty 2015) (Golder 2023).

The initial 3D model was constructed based on the hydrogeologic conceptual model presented in the Water Report Level 1/2 (Section 2.0 of Golder 2023), which has now been updated to include the new hydrogeologic data collected in 2024 along the proposed infiltration trench system. The HGS numerical model was re-calibrated to observed groundwater elevations and surface water flows under steady state conditions. This calibrated numerical model was then used as the basis for forecast simulations of the proposed pit / quarry development during operational phases and post-rehabilitation.

**3.2 Model Revisions**

The initial model was described in the Water Report Level 1/2 (Golder 2023). The model domain, surface water flow, and boundary conditions were not modified. The hydrostratigraphy and the hydraulic properties of the hydrostratigraphic units have been updated based on the new IT wells and the HGS model has been re-calibrated to reproduce the observed water levels at the new IT wells. Modifications to the HGS model are described below.

**3.2.1 Hydrostratigraphy**

The hydrostratigraphic units used in the HGS model are described in Section 2.4 of the Water Report Level 1/2 (Golder 2023). The new IT wells provided additional hydrostratigraphic information along the proposed mitigation system alignment, on the west side of the Main Area and along the west and southwest sides of the South Area of the proposed pit / quarry. The updated hydrostratigraphy along the proposed mitigation system alignment is illustrated on Figure 3, along with groundwater levels under current (baseline) conditions. Note that the cross-

section follows the grout wall alignment, and the IT wells are projected onto that alignment. The horizontal discretization of the HGS model mesh remained consistent with the original HGS model but the vertical thickness of the hydrostratigraphic layers in the HGS numerical model were updated to coincide with the updated stratigraphy.

### 3.2.2 Hydraulic Conductivity Parameterization

The hydraulic conductivity measurements at the IT wells (Section 2) were used to supplement the previously compiled hydraulic conductivity measurements. These were applied to the HGS numerical model as initial parameters for model calibration and used as references throughout the calibration process. To improve refinement within the Site Area and better fit hydraulic conductivity observations, hydraulic conductivity zonation was reevaluated. Weathered Bedrock Zone 4 was sub-divided into three new sub-zones of weathered bedrock hydraulic conductivity and each of these three sub-zones were assigned an independent, calibrated hydraulic conductivity. These sub-zones were calibrated separately from the regional hydrostratigraphic units (Figure 2).

## 3.3 Model Calibration

### 3.3.1 Calibration Approach

Three additional Weathered Bedrock hydrostratigraphic units were added to account for greater heterogeneity of the top of bedrock representation and more flexibility with hydraulic conductivity assignment with the intention of improving calibration fit within the Site and Study Areas. As in Golder 2023, PEST (Doherty 2018) was used to calibrate the hydraulic conductivity so that the simulation could reproduce observed groundwater elevations and stream flows within the Site and Study Area. PEST (Doherty 2018) is a model-independent parameter estimation tool that automates the calibration process by adjusting model parameters to better match observed data. PEST was run for 6 iterations before being terminated. The calibrated hydraulic conductivity values are shown on Figure 2. The following calibration measures were used in the assessment:

- Average groundwater levels at 88 groundwater monitoring well locations across the Site Area, over the period of record for each location. The monitoring locations include 24 sets of nested monitoring wells. Average head differences between each nested pair of monitoring wells are also considered as part of the calibration process.
- Average streamflow measurements in 16 surface water monitoring stations in the Site Area, over the period of record for each location.
- Groundwater level measurements from 1,857 water well records in the MECP WWR database, located within the model domain (MECP, 2020).
- Single well response test results from the new IT wells (described in Section 2.0) provided additional information about the hydraulic conductivity along the proposed infiltration trench (Table 2). These new IT wells also provided additional water level data for calibration.

PEST was used to refine the hydraulic conductivity for the following hydrostratigraphic units:

- Weathered Bedrock Zones 4A, 4B, and 4C;
- Gasport Zone 4;
- Upper Sand; and
- Local Till.

All other parameters remained unchanged from their values used in Golder 2023. A comparison of the calibrated parameters to the previously used parameters in Golder 2023 is provided in Table 4. Note that all calibrated

hydraulic conductivity values were within the range observed in the field or conceptually consistent with the observed site conditions.

### 3.3.2 Calibration Assessment

The simulated calibrated model results are shown on Figures 4 and 5 and in Table 3, and summarized as follows:

- Plan view maps of the simulated hydraulic head distribution and groundwater flow direction in the overburden, Gasport Formation, and Manitoulin / Whirlpool Formation (Figure 4) are generally consistent with the conceptual understanding of the groundwater flow system in the Credit River Watershed and remain mostly unchanged from Golder 2023. West of the Credit River Valley, shallow groundwater flow follows topographic relief, and generally flows from northwest to southeast, towards the valley. Closer to the Credit River Valley, the water table declines significantly, following the ground surface topography. The simulated hydraulic head distribution and groundwater flow direction in the Gasport Formation is consistent with observed data at the Site (Figures 5-2 to 5-6 of Golder 2023).
- A scatter plot of the regional simulated hydraulic head versus the average head for the target observation points (both MECP WWR measurements, additional water level information from consultant reports (CRA 1990, 1994, 2012, and Harden 2016) and Site monitoring wells, (2043 total water levels) shows the simulated points generally close to the 45-degree line and in reasonable agreement with the observed values (Figure 4). Regionally, the mean residual is calculated to be 3.1 m, while the normalized root mean square error (NRMSE) is 3.8%, which is the same NRMSE from Golder 2023. Looking at the Site data only (128 total average water level measurements), the mean residual is calculated to be 0.5 m (an increase from Golder 2023), while the NRMSE is 3.5% (a decrease from 3.8% in Golder 2023). Looking at the new IT wells only (19 wells at 7 locations), the mean residual is calculated to be 0.7 m.
- A plot of the observed and simulated head differences at nested monitoring locations (Figure 4) generally shows good agreement between the two datasets, with more upward gradients to the west of the Site transitioning to neutral / slight downward gradients to the east, and downward gradient to the north. The observed head difference values used for comparison represent the averages over the period of record, though it is recognized that there could be variability in the magnitude (and direction) of the gradient throughout the year.
- A plot of the unit yield for each surface water station (Figure 5) shows that the updated model results remain consistent with the conceptual hydrogeologic behaviour in the Site Area. These updated model results show that the model performance is comparable to those of the initial model (Golder 2023).
- In Golder 2023, the Weathered Bedrock Zone 4 (WB4) had a hydraulic conductivity of 1E-03 m/s (isotropic). In this assessment, WB4 was divided into sub-zones WB4A, WB4B, and WB4C. The sub-zones were calibrated independently and were assumed to have 10:1 horizontal to vertical anisotropy. The WB4A horizontal hydraulic conductivity is 8.15E-03 m/s, representing an 8.15x increase. The WB4B horizontal hydraulic conductivity is 1.91E-03 m/s, representing a 1.91x increase. The WB4C horizontal hydraulic conductivity is 1.34E-03 m/s, representing a 1.34x increase.
- This results in a higher transmissivity in the areas of the infiltration trenches. For example, at the midpoint of Trench Zone 3 the effective transmissivity is  $2.6 \times 10^{-2} \text{ m}^2/\text{s}$  which is an increase from Golder 2023 that had a transmissivity  $3.7 \times 10^{-3} \text{ m}^2/\text{s}$ , an increase in transmissivity of 7x in this location.

Overall, the updated HGS numerical model is considered fit for purpose based on the calibration fit, the consistency of the calibrated parameters with the hydrostratigraphic conceptualization, and the consistency with the simulation groundwater flow patterns with the conceptual groundwater flow model.



**Table 3: Comparison of Steady State Simulated and Average Measured Groundwater Elevation at Site Well Locations**

Well ID	Average Measured Water Level (masl) <sup>a</sup>	Simulated Water Level (masl)	Residual (m) <sup>b</sup>
JHL_BH1	405.9	406.6	0.7
JHL_BH16	400.7	399.3	-1.4
JHL_BH17	400.8	399.0	-1.8
JHL_BH18	396.7	394.7	-2.0
JHL_BH19	402.1	401.9	-0.2
JHL_BH2	411.3	410.6	-0.6
JHL_BH3	405.1	404.7	-0.4
JHL_BH7	402.7	402.2	-0.5
MW20-01A	391.0	393.2	2.2
MW20-01B	390.9	393.2	2.4
MW20-02	390.2	390.6	0.4
MW20-03	384.9	387.1	2.2
MW20-04	389.4	387.9	-1.5
MW20-05A	393.2	395.3	2.0
MW20-06A	396.8	397.7	1.0
MW20-06B	397.0	397.7	0.8
MW20-07A	402.3	398.5	-3.8
MW20-07B	402.4	399.4	-2.9
MW20-08A	404.4	401.6	-2.7
MW20-08B	404.4	402.0	-2.4
MW20-09	396.3	392.5	-3.9
MW20-10A	400.6	397.2	-3.4
MW20-10B	400.6	397.5	-3.0
MW20-11A	405.7	404.6	-1.1
MW20-11B	405.7	405.0	-0.7
MW20-12A	406.5	405.7	-0.8
MW20-12B	406.5	406.3	-0.3
MW20-13A	411.1	410.8	-0.3
MW20-13B	411.2	410.8	-0.4
MW20-13C	412.8	411.2	-1.7
MW20-14A	402.1	402.1	0.0
MW20-14B	402.1	402.1	0.0
MW20-15A	415.8	416.6	0.8
MW20-15B	415.7	417.1	1.4
MW20-15C	415.5	417.2	1.7
MW20-16A	419.6	418.6	-1.0
MW20-16B	419.6	418.7	-0.9
MW20-17A	402.7	406.4	3.7
MW20-17B	402.5	406.6	4.1
MW20-18	391.6	394.4	2.8
MW20-19A	390.7	393.7	3.0
MW20-19B	390.7	393.7	3.0
MW20-20A	405.4	403.1	-2.3
MW20-20B	405.5	403.1	-2.4
MW20-20C	401.4	403.1	1.7
MW20-21A	413.9	414.5	0.6
MW20-21B	414.2	414.7	0.6
MW20-22A	396.4	400.2	3.8
MW20-22B	395.3	399.5	4.1
MW20-23A	391.8	395.3	3.5
MW20-23B	391.6	395.2	3.7
MW20-23C	391.5	395.2	3.7
MW20-24A	433.7	434.4	0.7
MW20-24B	434.1	435.3	1.2
MW20-25A	419.9	420.0	0.2
MW20-25B	419.2	419.5	0.3
MW20-26A	433.7	433.5	-0.2
MW20-26B	433.9	433.5	-0.4
MW20-26C	436.1	433.9	-2.3
MW20-27A	423.7	423.7	-0.1
MW20-27B	423.7	423.9	0.2
MW20-28A	418.4	416.4	-2.0
MW20-28B	418.5	416.3	-2.1
MW22-01	418.8	418.9	0.1
MW22-02A	418.4	420.5	2.0
OVG-MW18-20	389.6	390.2	0.7
OVG-MW19-20	391.1	391.3	0.2
OVG-MW24-20	400.3	396.9	-3.4
OVG-MW25-20	397.4	397.0	-0.4
OVG-MW5-20	387.1	388.7	1.6
OVG-MW6-20	392.7	388.4	-4.4
OVG-MW7-20	387.0	388.5	1.5
OVG-MW8-20	386.5	387.6	1.1
OVG-MW9-20	388.8	393.6	4.8
OW10B-90	388.3	388.3	0.1
OW11B-90	388.7	389.7	1.0
OW12-90	392.1	393.0	0.8
OW13-90	390.3	391.6	1.3
OW14-90	389.1	389.8	0.7
OW15-90	388.4	388.2	-0.2
OW16-90	387.7	388.8	1.1
OW17-90	392.6	393.4	0.8
OW18-90	388.2	390.0	1.8
OW19-94	389.2	391.1	1.9
OW20-94	387.8	388.1	0.3
OW21-94	388.4	390.1	1.7
OW22-94	387.1	387.7	0.6
OW23-94	385.1	386.8	1.7
OW3B-90	391.5	392.5	1.0
P-1	379.9	383.1	3.2
P-2	386.5	387.2	0.7
P-3	384.5	386.2	1.8
P-4	385.3	386.5	1.2
P-6	385.7	386.4	0.7
P-7	385.7	385.7	0.0
P-8	383.1	385.2	2.1
P-9	386.7	387.2	0.5
P-10	382.6	384.7	2.1
P-12	378.8	384.1	5.2
POND1	388.5	389.6	1.2
POND2	388.6	389.4	0.8
POND3	389.0	389.7	0.8
POND4	388.3	388.4	0.1
PW21-1	416.8	414.8	-2.0
PW21-2	407.8	407.6	-0.2
PW21-3	395.9	398.8	2.8
PW21-4	402.7	402.3	-0.4
PW22-01	416.2	417.0	0.7
TH1-89	388.8	389.3	0.5
TH2-89	391.1	392.1	1.0
TH3-89	391.5	392.5	1.0
TH4-89	391.5	391.1	-0.4
TH5-89	387.7	388.1	0.5
TH6-89	389.0	390.7	1.7
TH7-89	388.2	391.8	3.6
TH8-89	388.1	390.4	2.3
TH9-89	389.6	391.1	1.5
TH10-89	388.2	388.2	0.0
TH11-89	388.6	389.6	1.0
MW-IT-01A	393.5	393.9	0.4
MW-IT-01B	393.6	393.9	0.3
MW-IT-01C	393.7	393.9	0.2
MW-IT-02A	394.9	394.9	0.0
MW-IT-02B	395.3	394.9	-0.4
MW-IT-02C	395.7	395.0	-0.8
MW-IT-03A	393.4	393.5	0.1
MW-IT-03B	393.5	393.5	0.0
MW-IT-03C	393.5	393.5	0.0
MW-IT-04A	393.2	393.3	0.1
MW-IT-04B	393.1	393.3	0.2

Well ID	Average Measured Water Level (masl) <sup>a</sup>	Simulated Water Level (masl)	Residual (m) <sup>b</sup>
MW22-02B	418.6	420.2	1.6
MW22-02C	418.3	420.1	1.8
MW22-03A	420.6	422.2	1.7
MW22-03B	419.8	421.8	2.1
OVG-MW10-20	388.5	393.4	4.9
OVG-MW11-20	392.1	392.9	0.8
OVG-MW12-20	393.9	393.2	-0.7
OVG-MW13-20	394.7	392.7	-2.0
OVG-MW16-20	392.4	391.9	-0.5

Well ID	Average Measured Water Level (masl) <sup>a</sup>	Simulated Water Level (masl)	Residual (m) <sup>b</sup>
MW-IT-05A	393.2	392.8	-0.5
MW-IT-05B	393.1	392.8	-0.3
MW-IT-05C	393.0	392.9	0.0
MW-IT-06A	392.1	393.4	1.2
MW-IT-06B	392.1	393.4	1.3
MW-IT-07A	392.4	391.1	-1.3
MW-IT-07B	392.4	391.1	-1.3
MW-IT-07C	392.3	391.1	-1.2

**Abbreviations and Notes:**

m - metres, masl - metres above sea level

a. Average measured water level represents the average water level over the period of record for each location.

b. Residual is calculated by subtracting the measured water level from the simulated water level.

**Table 4: Comparison of Calibrated Parameters: 2023 (Revised) Model vs Updated 2024 Model**

Unit	Kh (m/s)		Kv (m/s)		Porosity <sup>a</sup>		Specific Storage (1/m)	
	Golder 2023	2024 Update	Golder 2023	2024 Update	Golder 2023	2024 Update	Golder 2023	2024 Update
Regional Till	1.E-06	1.E-06	1.E-06	1.E-06	0.3	0.3	1.E-04	1.E-04
Local Till	1.E-08	8.35E-09	5.E-09	8.35E-10	0.3	0.3	1.E-04	1.E-04
Upper Sand	1.E-04	1.44E-04	1.E-04	1.44E-05	0.3	0.3	1.E-04	1.E-04
Lower Sand	1.E-04	1.E-04	1.E-04	1.E-04	0.3	0.3	1.E-04	1.E-04
Till (Valley Skin) Zone 1	4.E-06	4.E-06	4.E-06	4.E-06	0.3	0.3	1.E-04	1.E-04
Till (Valley Skin) Zone 2	1.E-06	1.E-06	1.E-06	1.E-06	0.3	0.3	1.E-04	1.E-04
Till (Valley Skin) Zone 3	5.E-06	5.E-06	5.E-06	5.E-06	0.3	0.3	1.E-04	1.E-04
Till (Valley Skin) Zone 4	2.E-04	2.E-04	2.E-04	2.E-04	0.3	0.3	1.E-04	1.E-04
Weathered Bedrock (Regional)	2.E-04	2.E-04	5.E-06	5.E-06	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 1	5.E-06	5.E-06	5.E-07	5.E-07	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 2	4.E-06	4.E-06	4.E-06	4.E-06	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 3	4.E-06	5.E-06	4.E-06	5.E-06	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 4A	1.E-03	8.15E-03	1.E-03	8.15E-04	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 4B	1.E-03	1.91E-03	1.E-03	1.91E-04	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 4C	1.E-03	1.34E-03	1.E-03	1.34E-03	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 5	5.E-05	5.E-05	5.E-06	5.E-06	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 6	5.E-04	5.E-04	5.E-04	5.E-04	0.01	0.01	5.E-06	5.E-06
Weathered Bedrock Zone 7	5.E-06	5.E-06	5.E-07	5.E-07	0.01	0.01	5.E-06	5.E-06
Guelph Formation	5.E-05	5.E-05	5.E-06	5.E-06	0.01	0.01	5.E-06	5.E-06
Eramosa Formation	9.E-08	9.E-08	9.E-09	9.E-09	0.01	0.01	5.E-06	5.E-06
Goat Island Formation	1.E-06	1.E-06	1.E-07	1.E-07	0.01	0.01	5.E-06	5.E-06
Gasport Formation Regional	1.E-06	1.E-06	1.E-07	1.E-07	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 1	5.E-06	5.E-06	5.E-07	5.E-07	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 2	5.E-07	5.5E-07	5.E-08	5.5E-08	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 3	1.E-06	1.E-06	1.E-07	1.E-07	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 4	1.E-05	8.67E-06	1.E-06	8.67E-07	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 5	1.E-05	1.E-05	1.E-06	1.E-06	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 6	1.E-07	1.E-07	1.E-08	1.E-08	0.01	0.01	5.E-06	5.E-06
Gasport Formation Zone 7	5.E-06	5.E-06	5.E-07	5.E-07	0.01	0.01	5.E-06	5.E-06
Shaley Dolostone Unit	1.E-07	1.E-07	2.E-09	2.E-09	0.01	0.01	5.E-06	5.E-06
Cabot Head Formation	1.E-08	1.E-08	1.E-09	1.E-09	0.01	0.01	5.E-06	5.E-06
Manitoulin Formation	1.E-05	1.E-05	1.E-06	1.E-06	0.01	0.01	5.E-06	5.E-06
Whirlpool Formation	1.E-06	1.15E-06	1.E-07	1.15E-07	0.01	0.01	5.E-06	5.E-06
Queenston Formation	1.E-08	1.E-08	1.E-09	1.E-09	0.01	0.01	5.E-06	5.E-06

**Abbreviations and Notes:**

m - metres, m/s - metres per second, n/a - new unit added to 2024 model, Kh – horizontal hydraulic conductivity, Kv – vertical hydraulic conductivity

a: porosity is equivalent to specific yield

## 4.0 FORECAST SIMULATIONS

### 4.1 Approach

The approach used for the forecast simulations in this HGS model update was consistent with Section 3.1 of Golder 2023. A total of eight model forecast simulations were completed, each representing a different phase of pit / quarry development (including post-rehabilitation) as shown in Figure 6. The forecast simulations were completed under steady state conditions to provide a conservative estimate of the extent of drawdown for each development phase (i.e. highest drawdown during that phase).

Model parameterization is described in Section 3.2 of Golder (2023). Due to a change in the hydrostratigraphy of the overburden and weathered bedrock, the depth of the infiltration trench and grout wall were updated to align with the updated hydrostratigraphy. As per the previous approach, the base of the infiltration trench will be aligned with the water table, where possible, and the grout wall will extend from ground surface, through the overburden and into the weathered bedrock zone.

Groundwater elevations, water level drawdown relative to current conditions, and reduction in surface water flows at surface water monitoring stations were again simulated through each phase.

#### 4.1.1 Updated Base of Grout Zones and Infiltration Trenches

The new hydrogeologic information obtained from the new well nests MW-IT-01 to MW-IT-07 indicates that the water table is 2 to 3 metres lower along some portions of Zones 1, 2 and 3 than was previously indicated from groundwater level data. As such, base elevation of the infiltration trenches and grout wall in Zones 1, 2, and 3 in the forecast simulations were lowered to reflect the updated water table from the updated calibrated HGS model (see Figure 3 for trench and grout zone depths). Trench and grout wall base elevations in Zones 4, 5, and 6 remain substantially the same in the revised forecast simulations, since predicted groundwater levels along those trenches did not substantially change as a result of the new hydrogeologic information in those areas.

#### 4.1.2 Updated Mitigation of Quarry Inflows

The new hydrogeologic information (i.e. stratigraphy, water levels and hydraulic conductivity measurements) along with the updated HGS numerical model calibration to current conditions indicated that aquifer transmissivity along portions of the proposed groundwater mitigation system alignment was higher than previously inferred, particularly along Zones 1, 2 and 3, which would result in higher predicted inflows during the operational periods.

Modelling simulations were iteratively used to evaluate options to minimize higher potential inflows to optimize portion of water infiltrated which contributes to increasing aquifer levels (as opposed to re-entering the quarry). It was determined that by placing and compacting low permeability silt till backfill along the pit / quarry walls adjacent to the high transmissivity zone during Phases 5 and 6 as part of progressive rehabilitation, pit / quarry inflows could be minimized and actually reduced relative to the original (Golder 2023) predicted inflows. The timing of the progressive placement of silt till backfill in the other phases of operation otherwise remained the same in the updated forecast simulations. Note that the hydraulic conductivity of the silt till backfill was assigned as  $1 \times 10^{-6}$  m/s, which was consistent with previous simulations (Golder 2023).

The mitigation of Phase 5 required higher heads in Trench Zones 1 and 2. Trench Zones 1 and 2 are active from Phase 4 through Phase 7 but these higher heads were only required in Phase 5. See Section 4.2.5 for a sensitivity assessment of Trench Zone 1 and 2 heads on Phase 5 drawdown propagation, which provided the basis for assigning higher target heads to Zones 1 and 2 during Phase 5 in the final simulations.

### 4.1.3 Updated Backfill Removal Area Post-Rehabilitation

The zone of silt till backfill removal upon rehabilitation in the main pit / quarry remains in the same location and has the same planned extent as previous simulations (Golder 2023). The area of backfill removal is now represented as restoring 98% of the effective hydraulic conductivity of this portion of the original pit / quarry wall prior to backfill placement, as residual silt till material is expected remain in place.

## 4.2 Results

### 4.2.1 Simulated Head and Drawdown

The simulated hydraulic head, drawdown of the water table, and head change within the Gasport Formation, and the Whirlpool / Manitoulin Formations for Phases 1 to 7 and the post-Rehabilitation phase are shown on Figures 7A-H (hydraulic head) and Figures 8A-H (drawdown and head change).

The general simulated groundwater flow direction across the Site in each unit remained consistent with the current conditions; groundwater flow is southeast across the Site toward the Credit River and bedrock valley.

The simulated water level drawdown is consistent with the head change in the Gasport Formation south and southwest of the Site. During operation, the extent of drawdown in this area is the largest during Phase 3, prior to the implementation of the infiltration trench mitigation system in the Main Area. Phase 5 is simulated to have less drawdown than in Golder 2023 due to the combination of the progressive silt till backfill placement and the implementation of the mitigation systems.

As in Golder 2023, in the northwest and north of the Site where fine grained material is present the water table drawdown is less than the head change in the Gasport Formation. The finer grained, lower hydraulic conductivity materials provide a significant degree of hydraulic isolation between the shallow overburden and the underlying Gasport Formation layers, where dewatering mainly occurs during operations. The progressive rehabilitation of the pit / quarry walls during operation provides further hydraulic isolation between the pit / quarry operation and the surrounding environment, helping to minimize drawdown and dewatering requirements.

There is also drawdown observed in the Whirlpool / Manitoulin Formations, but this is relatively small in magnitude relative to the available drawdown in this aquifer given its depth and typical static water level. The drawdown beyond the Site in these deep aquifers is predicted to reach a maximum of approximately 3 m, which represents a small fraction of the available water column in wells screened in that aquifer, as discussed in Section 9.3.1 of Golder (2023). Upon rehabilitation, the residual change in groundwater heads within all aquifer units is typically less than +/- 1 m.

### 4.2.2 Surface Water Flows

A summary of the simulated changes in surface water flow at the surface water monitoring stations SW1 to SW16 for Operational Phases 1 to 7 and post-Rehabilitation is presented on Figure 9. Surface water stations SW5, SW11, SW13, SW14, and SW16 experience some simulated reduction in flows relative to current conditions. Post-rehabilitation, SW14, SW13, and SW5 experience some long-term reductions relative to the current conditions. SW16 experiences an increase in long-term flow upon rehabilitation.

### 4.2.3 Quarry Inflows

The steady state simulated groundwater inflow during Operational Phases 1 to 7 for each area (Main, North, South) is summarized in Table 5 below. The forecast results from Golder (2023) are included for reference.



**Table 5: Simulated Quarry Inflow at Each Phase of Development**

Phase	Main Area Simulated Inflow (L/s)			North Area Simulated Inflow (L/s)			South Area Simulated Inflow (L/s)			Total Inflow (L/s)		
	Golder 2023 <sup>a</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	Golder 2023 <sup>a</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	Golder 2023 <sup>a</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	Golder 2023 <sup>a</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>
1	14.3	14.7	4.5	0.0	0.0	0.1	n/a	n/a	n/a	14.3	14.7	4.7
2	18.0	19.6	6.9	2.8	3.0	1.7	n/a	n/a	n/a	20.8	22.6	8.7
3	17.4	18.5	8.6	2.9	3.1	1.7	n/a	n/a	n/a	20.3	21.6	10.4
4	25.3	24.6	11.2	2.9	3.1	1.7	n/a	n/a	n/a	28.2	27.7	12.9
5	70.8	63.8	13.7	2.9	3.1	1.7	n/a	n/a	n/a	73.7	66.9	15.5
6	81.3	28.2	14.4	2.9	3.0	1.7	7.7	7.9	3.5	91.9	39.2	19.6
7	53.6	29.5	14.5	2.5	2.5	1.8	77.5	18.0	6.7	133.6	50.0	22.9

**Abbreviations and Notes:**

n/a – no sump installed, L/s – litres per second

a. The inflows include the net surplus applied to the pit and quarry area.

b. Calculated based on the quarry area and a net surplus of 364 mm/year.

Overall, the total simulated inflow to all areas of the pit / quarry during operation ranges from 14.7 L/s to 66.9 L/s, a narrower range than the 14.3 L/s to 133.6 L/s simulated in Golder 2023 Appendix Q. The majority of the simulated inflow is in the Main Area of the pit / quarry, with inflows up to 66.9 L/s during Phase 5 of the operation. The simulated pit / quarry inflows have decreased in Phase 5 and 6 relative to Golder 2023, primarily due to the progressive silt till backfill placement, but other changes in conductivity and model updates have resulted in changes between the other phases as well.

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow and pipe to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated elevation of the South Pond is estimated to be 393.5 masl and will be internally contained, with no surface outflow. The simulated steady state outflow from the Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s, a decrease of 2 L/s from the estimation presented in Golder (2023).

#### 4.2.4 Trench Flow Rates

Simulated infiltration trench flow rates are shown in Table 6. Total trench flow rates peak in Phase 5 at 51.6 L/s. Total trench flow as a percentage of total sump inflow peaks in Phase 5 at 77% assuming the target heads are maintained in Trench Zones 1 to 6.

**Table 6: Trench Flow Rates**

Phase	Trench Zone 1 (L/s)	Trench Zone 2 (L/s)	Trench Zone 3 (L/s)	Trench Zone 4 (L/s)	Trench Zone 5 (L/s)	Trench Zone 6 (L/s)	Total Trench Flow (L/s)	Total Trench Flow as Percent of Total Sump Inflow (%)
1	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
4	12.2	1.4	n/a	n/a	n/a	n/a	13.6	49%
5	27.6	24.0	n/a	n/a	n/a	n/a	51.6	77%
6	10.8	0.4	5.2	2.8	4.2	2.9	26.3	67%
7	11.1	0.7	7.8	5.5	6.1	5.2	36.4	73%

**Abbreviations and Notes:**

n/a – trench not installed, L/s – litres per second

#### 4.2.5 Phase 5 Infiltration Head Sensitivity Check

Phase 5 sensitivity to infiltration trench heads in Trench Zones 1 and 2 was assessed and the results are presented on Figure 10. The planned operational case from this 2024 update was used as a base case and three scenarios where the infiltration trench heads are increased were simulated. When the heads were increased, the drawdown south of the Site property boundary was reduced. Increasing the infiltration trench heads also increased the net outflow to the surrounding aquifer. Note that head increases above the pre-development water table results in a slight rise in the water table proximal to the trench zones during Operational phases when the infiltration trench heads are maintained at a higher level (e.g., Scenario 5B in Figure 10).

### 4.3 Summary

The HGS numerical model for the proposed Caledon pit / quarry has been updated, utilizing new hydrogeologic information collected during the field investigations along the proposed mitigation system alignment along the west side of the Main Area and southwest sides of the South Area of the pit / quarry. This new hydrogeologic information has improved our understanding of the hydrostratigraphy of the Site, and the updated HGS model has been used to provide an updated assessment of potential impacts to groundwater and surface water due to the proposed pit / quarry operations.

The HGS model simulations demonstrate that the proposed mitigation system can maintain groundwater levels within their current typical range during the later stages of pit / quarry operations, and that proactive rehabilitation during Phases 5 and 6 of the pit / quarry operations can reduce groundwater inflows into the pit / quarry relative to earlier simulations, thereby optimizing water management during future operations.

## **5.0 LIMITATIONS**

### **5.1 Use of This Report**

This report has been prepared by WSP for use by CBM Aggregates (CBM) and its agents. The factual information, descriptions, interpretations, comments, results, conclusions and electronic files contained herein are specific to the project described in this report. Information used in this report should be restricted to that specified in the scope of work unless otherwise mutually agreed upon by CBM and WSP. This report should be read in its entirety as some sections could be falsely interpreted when taken individually or out-of-context. WSP is not responsible for any use of this report and its content by a third party, and/or for its use for purposes other than those intended.

WSP is not responsible for any damages that may result from unpredictable or unknown underground conditions, from erroneous information provided by and/or obtained from sources other than WSP, and from ulterior changes in the site conditions unless WSP has been notified of any occurrence, activity, information or discovery, past or future, susceptible of modifying the underground conditions described herein, and have had the opportunity of revising its interpretations. In addition, WSP is not responsible for any decrease of a property's value or any failure to complete a transaction as a consequence of this report.

### **5.2 Groundwater Modelling General Limitations**

Hydrogeological investigations and groundwater modelling are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time and the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that field data provides a fraction of information for the site or model domain; as such a truly complete, comprehensive characterization of the groundwater system is not possible. Therefore, every groundwater model is, by necessity, a simplification of a reality.

The professional groundwater modelling services described in this report are conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions. The results of previous or simultaneous work provided by sources other than WSP and quoted and/or used herein are considered as having been obtained according to recognized and accepted professional rules and practices, and therefore deemed valid.

The model presented herein provides a predictive scientific tool to evaluate the impacts of specified hydrological stressors on a real groundwater system and to compare various scenarios in support of a decision-making process. The model's accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, express or implied, is made.

## 6.0 REFERENCES

Aquanty, 2015. HGS Reference Manual.

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, *Water Resources Research*, vol. 12, no. 3, pp. 423-428.

Butler, J.J., Jr., 1998. *The Design, Performance, and Analysis of Slug Tests*, Lewis Publishers, New York, 252p.

Conestoga-Rovers & Associates (CRA), 2012. *Surface Water and Groundwater Levels – Aecon-Pinchin Pit 2012 Annual Monitoring Report*. Prepared for the Town of Caledon Ref No 3083.

Conestoga-Rovers & Associates (CRA), 1994. *Reply Evidence – Proposed Armbrö-Pinchin Pit*. Prepared for the Town of Caledon Ref No 3083.

Conestoga-Rovers & Associates (CRA), 1990. *Water Resource Evaluation – Proposed Armbrö-Pinchin Pit*. Prepared for the Town of Caledon Ref No 3083.

Credit Valley Conservation (CVC), 2021. Credit Valley Conservation Authority Subwatersheds (map) [https://cvc.ca/wp-content/uploads/2021/11/dta\\_Subwatersheds\\_Nov2021.pdf](https://cvc.ca/wp-content/uploads/2021/11/dta_Subwatersheds_Nov2021.pdf) (cvc.ca).

Doherty J. 2018. *PEST, Model-independent parameter estimation – User manual* (7th ed., with slight additions). Brisbane, Australia. Watermark Numerical Computing.

Golder Associates Limited (Golder), 2023. *Water Report Level 1/2: Proposed Caledon Pit / Quarry*. December 2022, revised: July 2023. Prepared for CBM Aggregates (CBM) a Division of St. Marys Cement Inc. (Canada). Numerical Modelling section is in Appendix Q.

Harden Environmental Services Limited (Harden), 2016. *Hydrogeological Impact Assessment, Aggregate Licence Application, Lots 11-13, Concession 6 West Side, Town of Caledon, Regional Municipality of Peel*. Prepared for: James Dick Construction Report No. 0019 dated December 16, 2016.

Springer, R.K. and L.W. Gelhar, 1991. Characterization of large-scale aquifer heterogeneity in glacial outwash by analysis of slug tests with oscillatory response, Cape Cod, Massachusetts, U.S. Geol. Surv. Water Res. Invest. Rep. 91-4034, pp. 36-40.

WSP Canada Inc. (WSP), 2024. *Field Investigation Results - Groundwater Mitigation System for the Proposed CBM Caledon Pit / Quarry*. Draft Technical memorandum. November 20, 2024, 230 p.



## 7.0 CLOSURE

We trust that this memorandum meets your current needs. If you have any questions or require clarification, please contact the undersigned at your earliest convenience.

**WSP Canada Inc.**



Tori Grootjen, M.Sc.  
Groundwater Modeller



Richard Simms, M.Sc., P.Geo.  
Senior Hydrogeologist



George Schneider, M.Sc., P.Geo.  
Senior Geoscientist

TG/WAQ/RS/PGM/GRP/GWS/

Attachments: Figures 1 to 10

[https://wsonline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/11 hgs numerical model/16 june 2024 mitigation system design modelling/04\\_2025 final draft report may 2025/ca-gld-19129150-tm hgs update may2025.docx](https://wsonline.sharepoint.com/sites/gld-114392/project%20files/5%20technical%20work/ph%202300-hydrogeology/11%20hgs%20numerical%20model/16%20june%202024%20mitigation%20system%20design%20modelling/04_2025%20final%20draft%20report%20may%202025/ca-gld-19129150-tm%20hgs%20update%20may2025.docx)

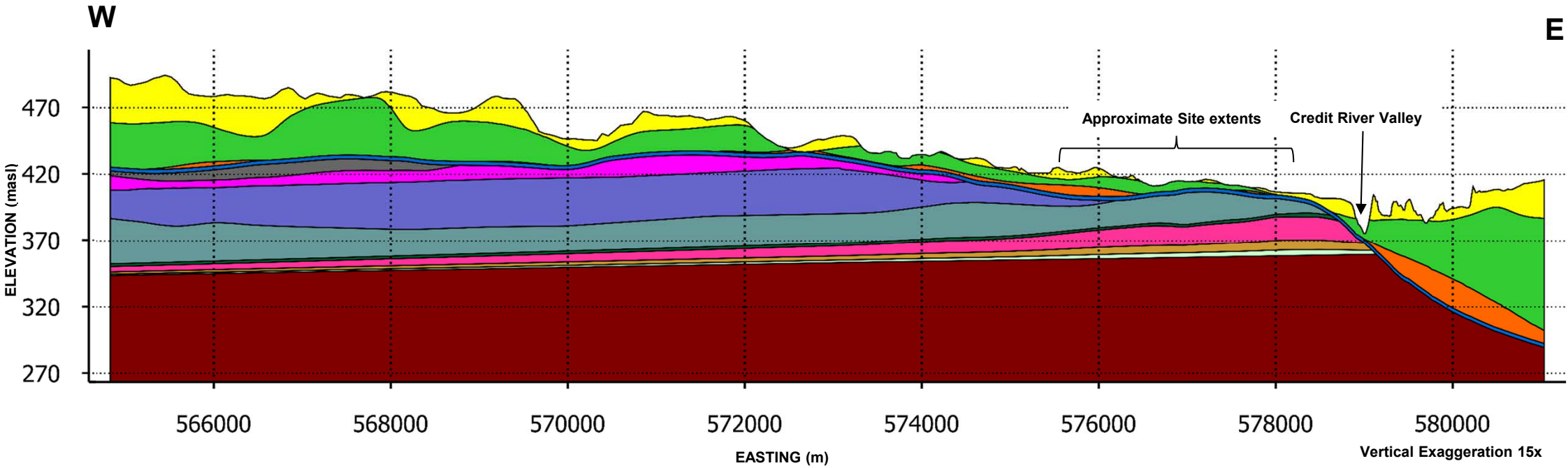
## FIGURES





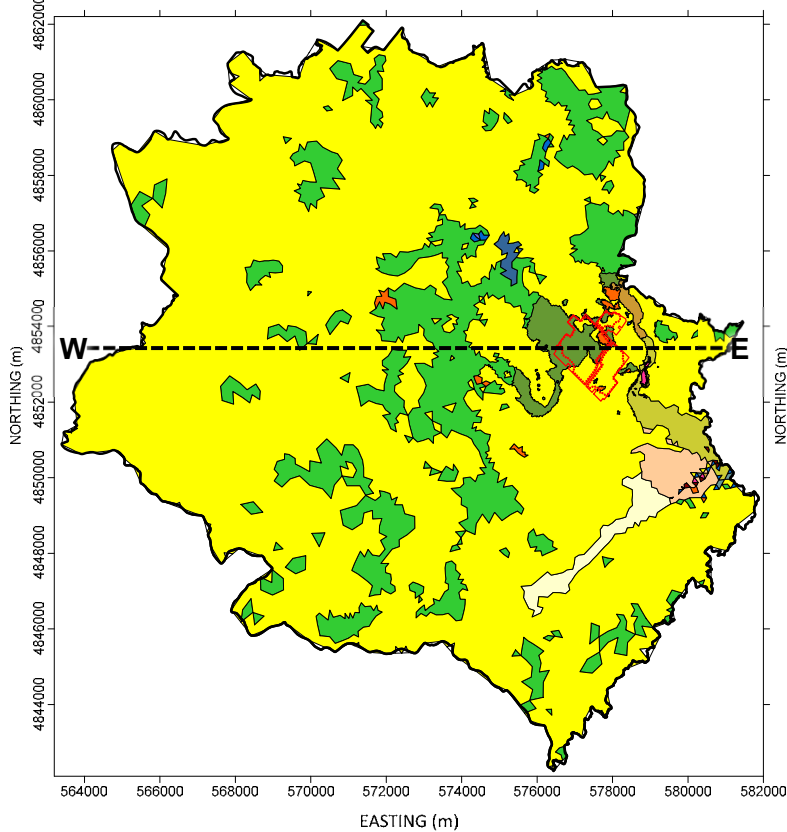


CROSS SECTION: GENERAL MODEL HYDROSTRATIGRAPHY

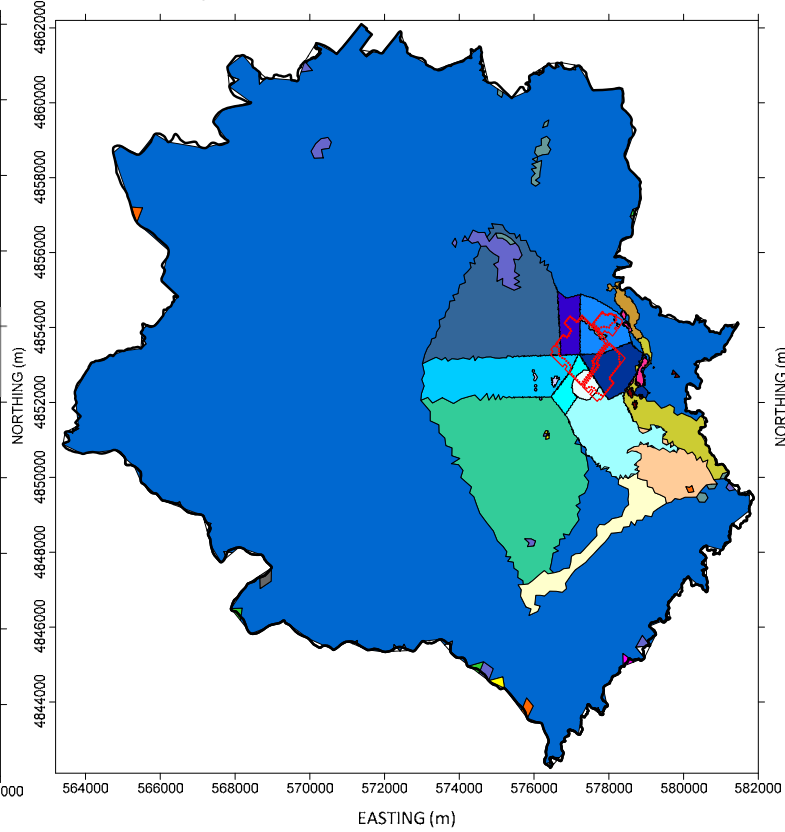


PLAN VIEW: MODEL UNIT SUB-ZONES WITHIN PARENT UNITS

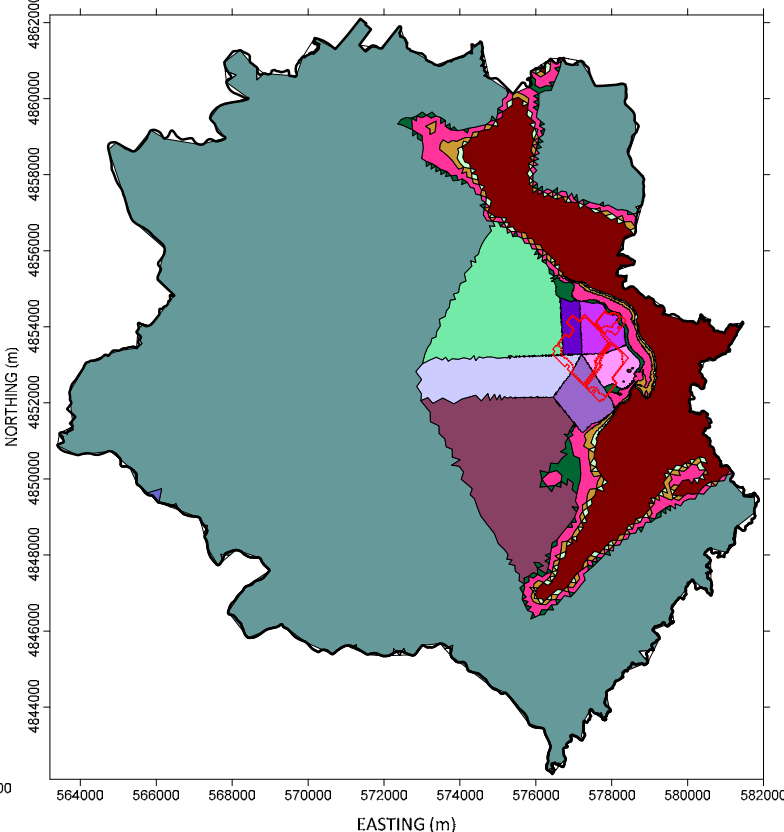
1. Model Layer 1: Overburden Sub-Zones



2. Model Layer 12: Weathered Bedrock Sub-Zones



3. Model Layer 16: Gasport Formation Sub-Zones



- LEGEND
- SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENT
  - MODEL DOMAIN

- NOTES
- Quarry license and limit of extraction provided by MHBC (2022)
  - Only parent units are shown in cross section view (not sub-zones)
  - Figure 1 shows the sub-zones within the modelled overburden layers, which are assigned from model layer 1-11. Layer 1 is shown as an example of the hydraulic conductivity distribution.
  - Figure 2 shows the weathered bedrock unit sub-zones, which are assigned primarily to model layer 12
  - Figure 3 shows the Gasport Formation sub-zones, which are assigned to model layers 16-21.

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

YYYY-MM-DD 2024-12-09

PREPARED HW

DESIGN WA

REVIEW RS

APPROVED GS

PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
MODEL PARAMETERIZATION

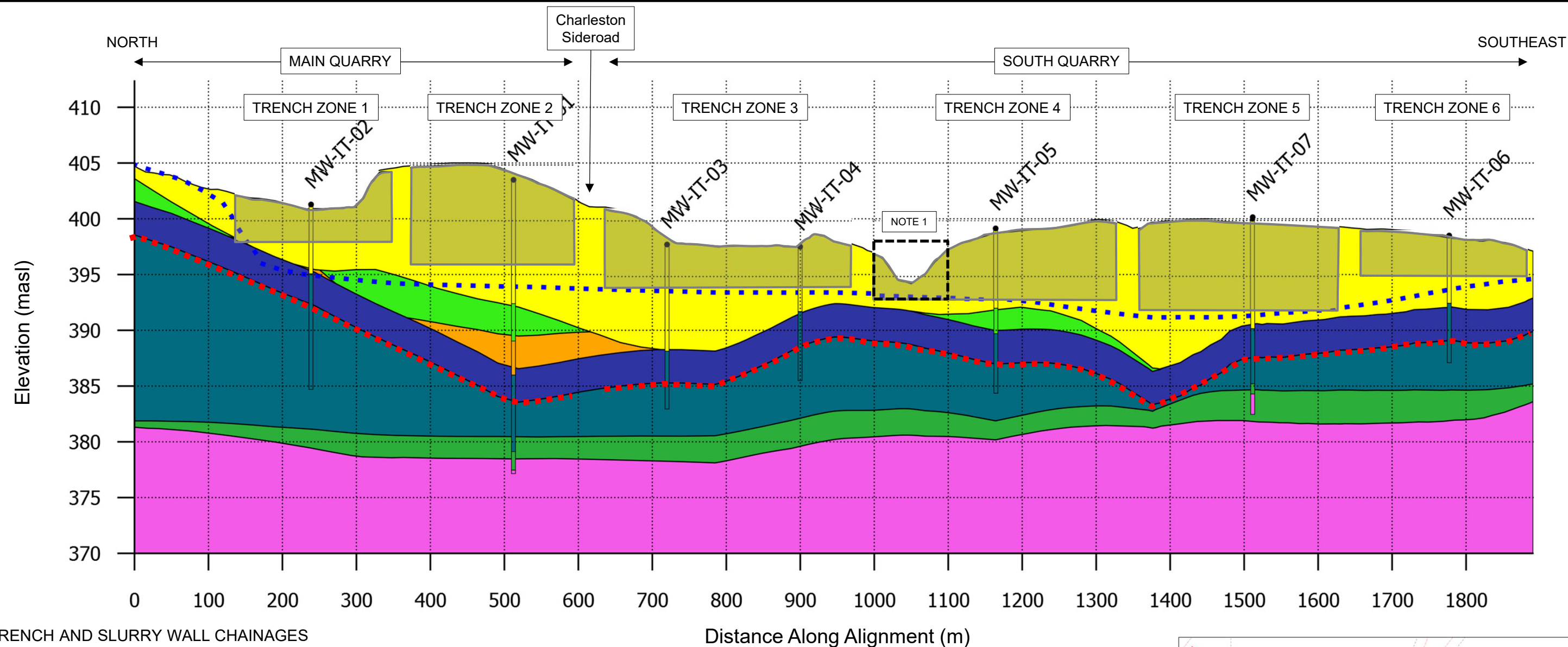
PROJECT No. 19129150

Rev. 0

FIGURE 2

	Unit	Kh (m/s)	Kv (m/s)	Porosity	Specific Storage (1/m)
	Regional Till	1.E-06	1.E-06	0.3	1.E-04
	Local Till	8.4E-09	8.4E-10	0.3	1.E-04
	Upper Sand	1.4E-04	1.4E-05	0.3	1.E-04
	Lower Sand	1.E-04	1.E-05	0.3	1.E-04
	Till (Valley Skin) Zone 1	4.E-06	4.E-06	0.3	1.E-04
	Till (Valley Skin) Zone 2	1.E-06	1.E-06	0.3	1.E-04
	Till (Valley Skin) Zone 3	5.E-06	5.E-06	0.3	1.E-04
	Till (Valley Skin) Zone 4	2.E-04	2.E-04	0.3	1.E-04
	Weathered Bedrock (Regional)	2.E-04	5.E-06	0.01	5.E-06
	Weathered Bedrock Zone 1	5.E-06	5.E-07	0.01	5.E-06
	Weathered Bedrock Zone 2	4.E-06	4.E-06	0.01	5.E-06
	Weathered Bedrock Zone 3	5.E-06	5.E-06	0.01	5.E-06
	Weathered Bedrock Zone 4A	8.2E-03	8.2E-04	0.01	5.E-06
	Weathered Bedrock Zone 4B	1.9E-03	1.9E-04	0.01	5.E-06
	Weathered Bedrock Zone 4C	1.3E-03	1.3E-04	0.01	5.E-06
	Weathered Bedrock Zone 5	5.E-05	5.E-06	0.01	5.E-06
	Weathered Bedrock Zone 6	5.E-04	5.E-04	0.01	5.E-06
	Weathered Bedrock Zone 7	5.E-06	5.E-07	0.01	5.E-06
	Guelph Formation	5.E-05	5.E-06	0.01	5.E-06
	Eramosa Formation	9.E-08	9.E-09	0.01	5.E-06
	Goat Island Formation	1.E-06	1.E-07	0.01	5.E-06
	Gasport Formation Regional	1.E-06	1.E-07	0.01	5.E-06
	Gasport Formation Zone 1	5.E-06	5.E-07	0.01	5.E-06
	Gasport Formation Zone 2	5.E-07	5.E-08	0.01	5.E-06
	Gasport Formation Zone 3	1.E-06	1.E-07	0.01	5.E-06
	Gasport Formation Zone 4	8.7E-03	8.7E-04	0.01	5.E-06
	Gasport Formation Zone 5	1.E-05	1.E-06	0.01	5.E-06
	Gasport Formation Zone 6	1.E-07	1.E-08	0.01	5.E-06
	Gasport Formation Zone 7	5.E-06	5.E-07	0.01	5.E-06
	Shaley Dolostone Unit	1.E-07	2.E-09	0.01	5.E-06
	Cabot Head Formation	1.E-08	1.E-09	0.01	5.E-06
	Manitoulin Formation	1.E-05	1.E-06	0.01	5.E-06
	Whirlpool Formation	1.E-06	1.E-07	0.01	5.E-06
	Queenston Formation	1.E-08	1.E-09	0.01	5.E-06





TRENCH AND SLURRY WALL CHAINAGES

	Start (m)	End (m)	Trench Length (m)	Target WL (masl)
Slurry wall only	0.0	128.6	N/A	N/A
Trench Zone 1	128.6	348.7	220.1	396.0 (398.0 <sup>a</sup> )
Trench Zone 2	378.7	596.7	218.0	394.0 (398.0 <sup>a</sup> )
Trench Zone 3	640.1	974.8	334.7	393.5
Trench Zone 4	1004.8	1334.9	330.2	393.0
Trench Zone 5	1365.8	1634.5	268.7	392.0
Trench Zone 6	1664.5	1890.5	226.0	394.0

a. Target WL during Phase 5 is 398.0 masl.

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

Distance Along Alignment (m)

LEGEND

- Upper Sand
- Till
- Lower Sand/ Channel Sediment
- Weathered Bedrock
- Gasport Formation (Dolostone)
- Fossil Hill Formation (Shaley Dolostone)
- Cabot Head Formation (Shale)

- Water Table (approximate)
- Base of Slurry Wall / Grout Zone
- Infiltration Trench Zone

NOTES

- This interval of Trench Zone 4 was simulated, but trench will be shortened by 100m when constructed due to shallow water table and thin overburden
- m = metres, masl = metres above sea level
- WL = water level, N/A = not applicable
- Vertical exaggeration: 15x

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	WSP
PREPARED	TG
DESIGN	HW/GWS
REVIEW	RS
APPROVED	GS

PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

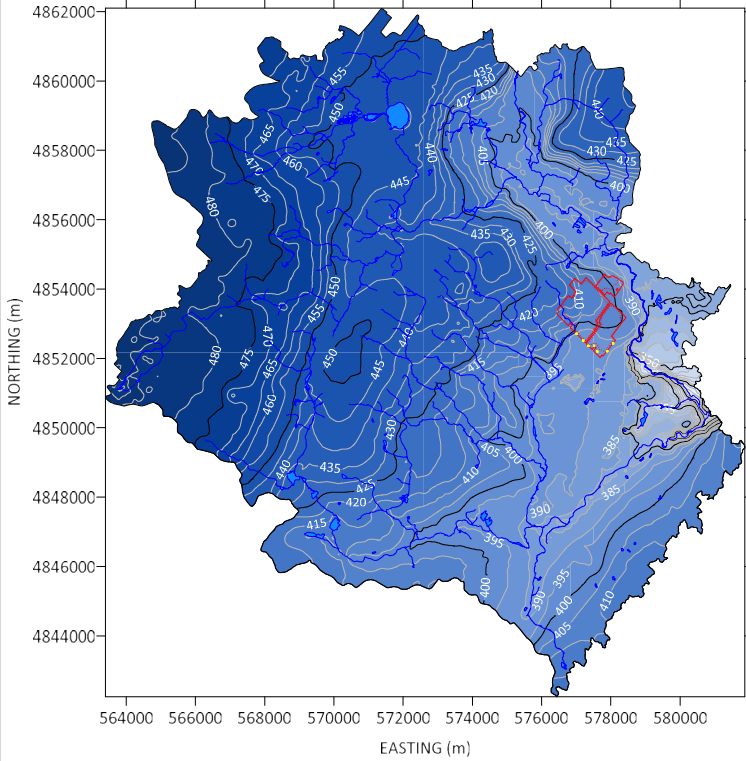
TITLE  
HYDROSTRATIGRAPHIC CROSS-SECTION ALONG SLURRY WALL ALIGNMENT

PROJECT No. 19129150  
Rev. 0

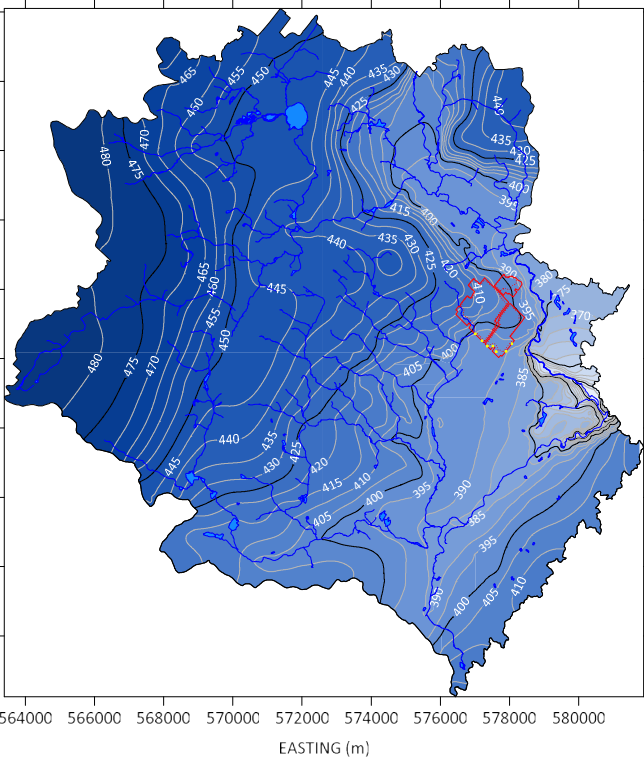


SIMULATED HYDAULIC HEAD: REGIONAL (masl)

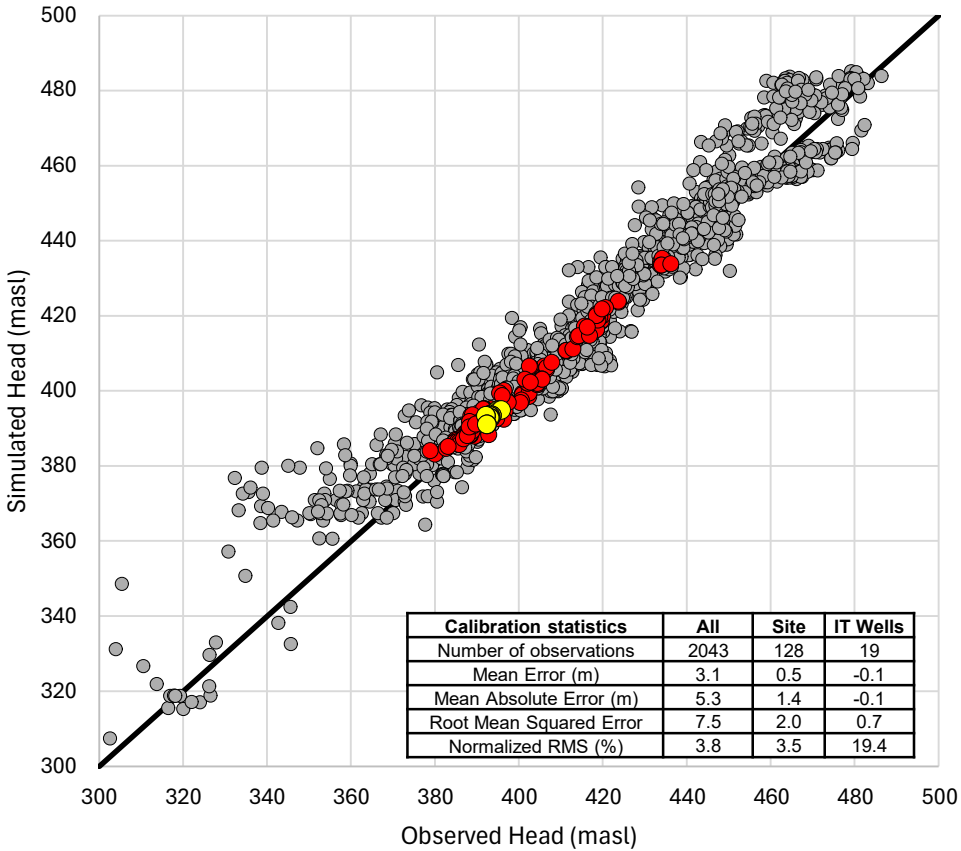
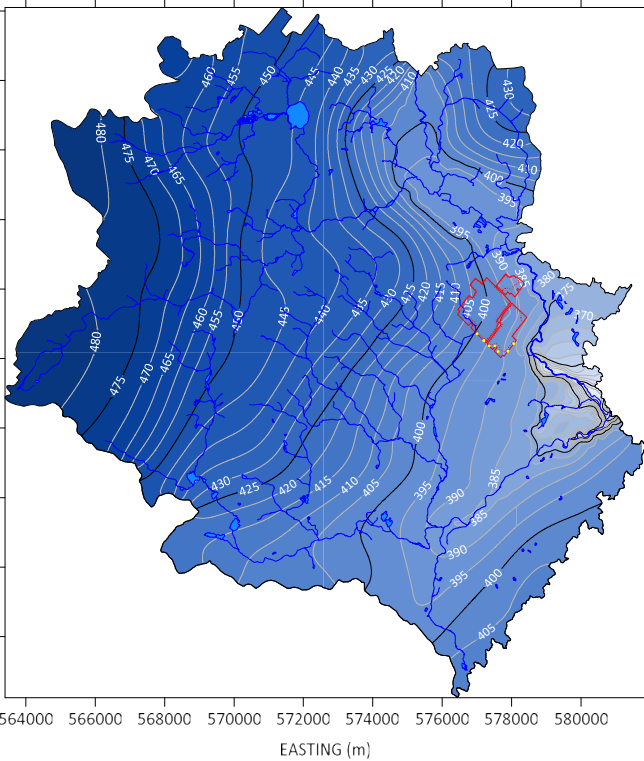
1. Simulated Water Table Elevation



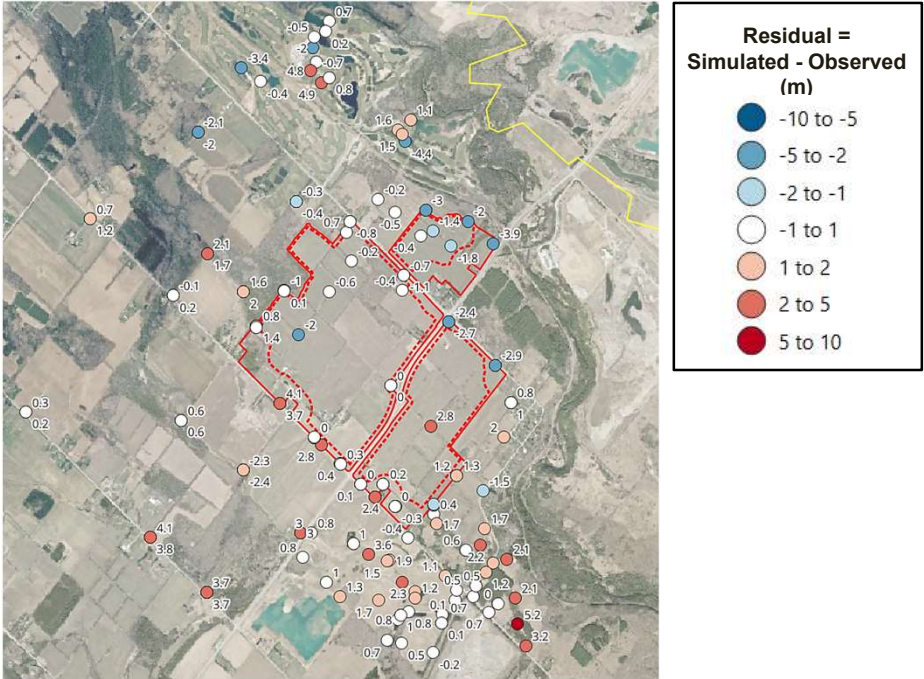
2. Gasport Formation (Model Slice 22)



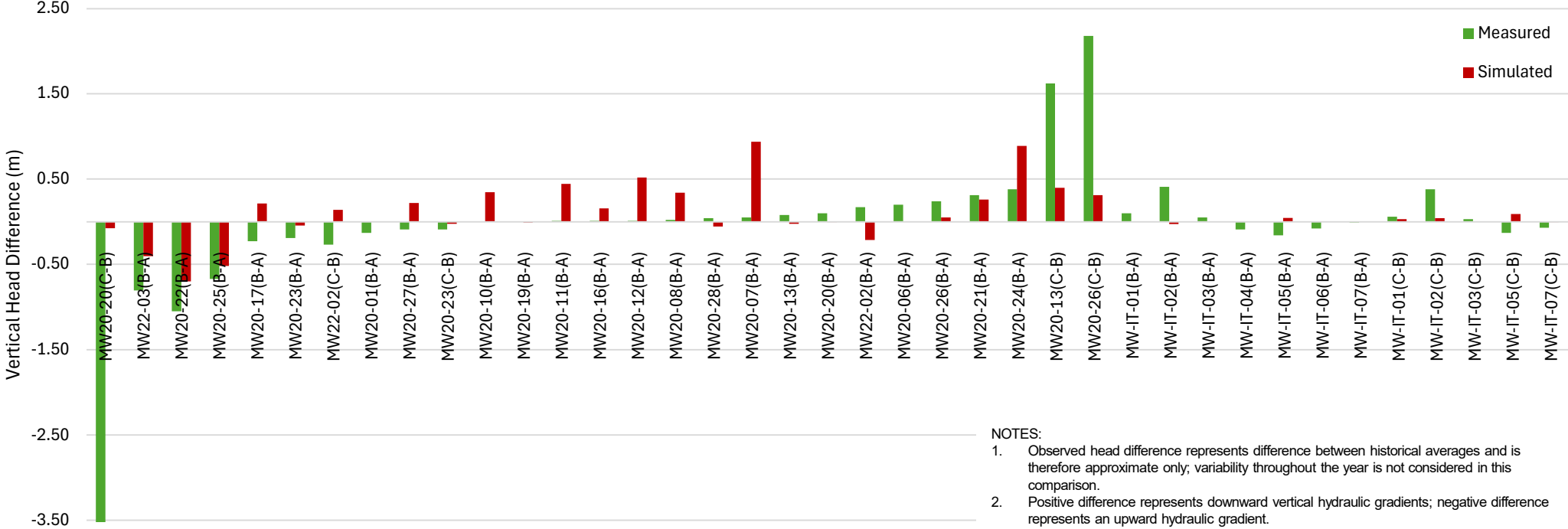
3. Manitoulin/ Whirlpool Formation (Model Slice 25)



SIMULATED VS. OBSERVED HYDAULIC HEAD: SITE



SIMULATED VS. OBSERVED HYDRAULIC HEAD DIFFERENCE IN NESTED MONITORING WELLS



- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - WETLAND
  - MODEL DOMAIN
  - NEW IT WELLS
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - MECP WWR WELL LOCATION
  - SITE GROUNDWATER MONITORING LOCATION
  - SITE SURFACE WATER MONITORING LOCATION

- NOTES
- Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  - Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNR) Southwestern Ontario Orthophotography (SWOOP) 2019
  - Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
  - Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2020).
  - Quarry license and limit of extraction provided by MHBC (2022)

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT  
wsp

YYYY-MM-DD  
2024-12-17

PREPARED  
WA

DESIGN  
HW

REVIEW  
RS

APPROVED  
GS

PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
CURRENT CONDITIONS SIMULATED HYDRAULIC HEAD

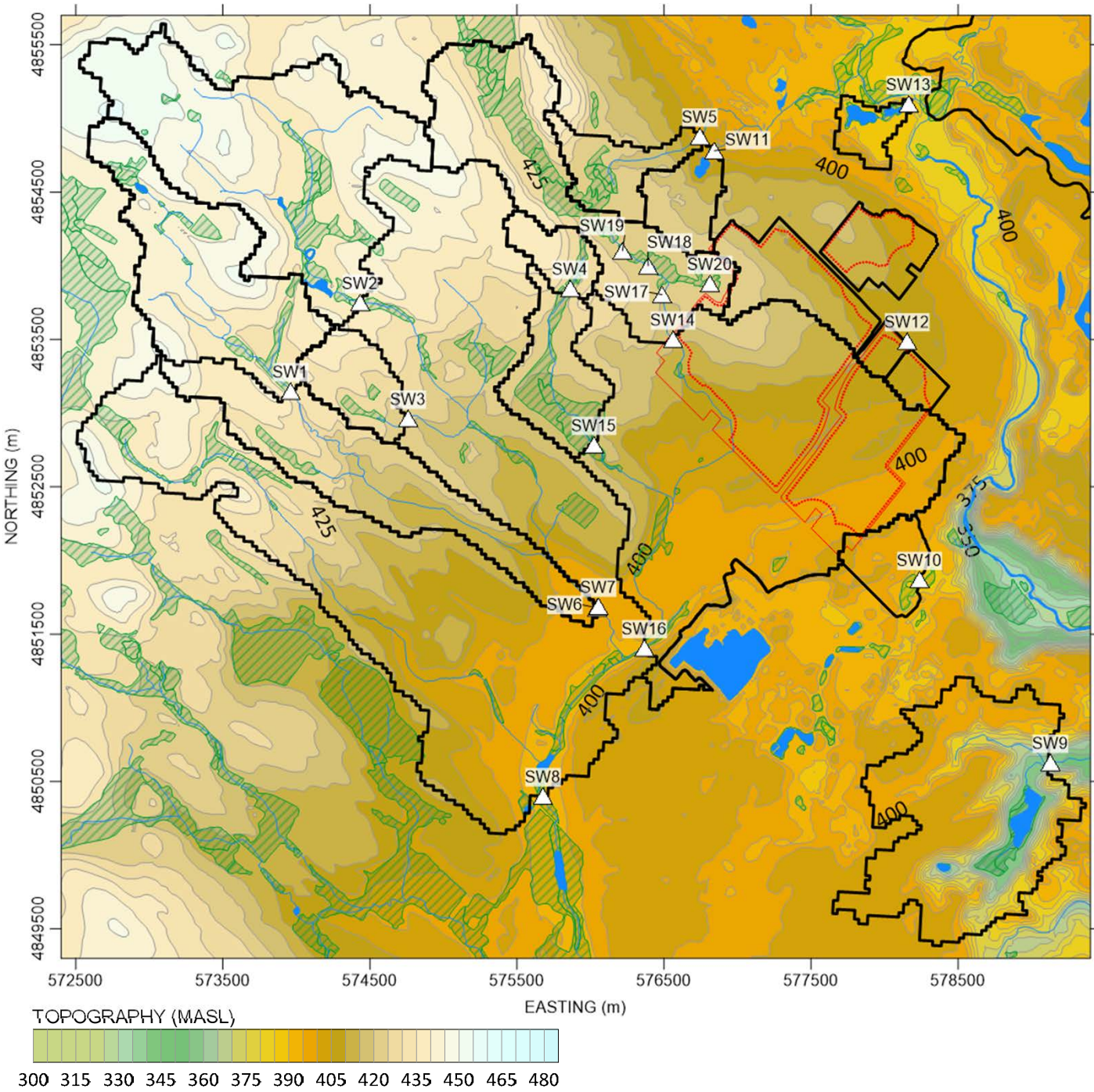
PROJECT No.  
19129150

Rev.  
0

FIGURE  
4



SURFACE WATER MONTIORING STATIONS AND CATCHMENT AREAS

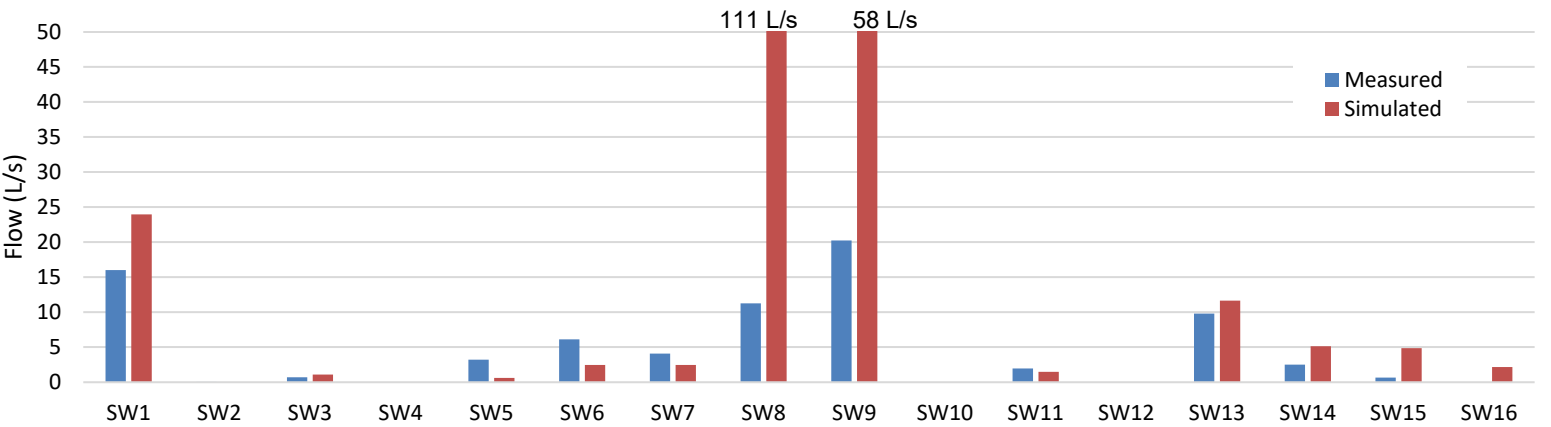


- NOTES:
1. Average measured surface water flows represent the average over the period of record for each station (approximately May 2020 to December 2021). There may be considerable variability in flows as a results of short-term climate events, which is shown in the hydrograph figures in the main report.
  2. Several surface water stations have an average flow of 0.00 L/s (SW4, SW10, SW12, and SW16).
  3. The 'unit yield' for both average measured and simulated surface water flow represents the average measured flow and model simulated flow for each surface water monitoring station divided by the catchment area.
  4. The 'unit yield' surplus value represents the surplus value of 364 mm/yr applied to the top surface of the model (surface water domain), normalized by area.

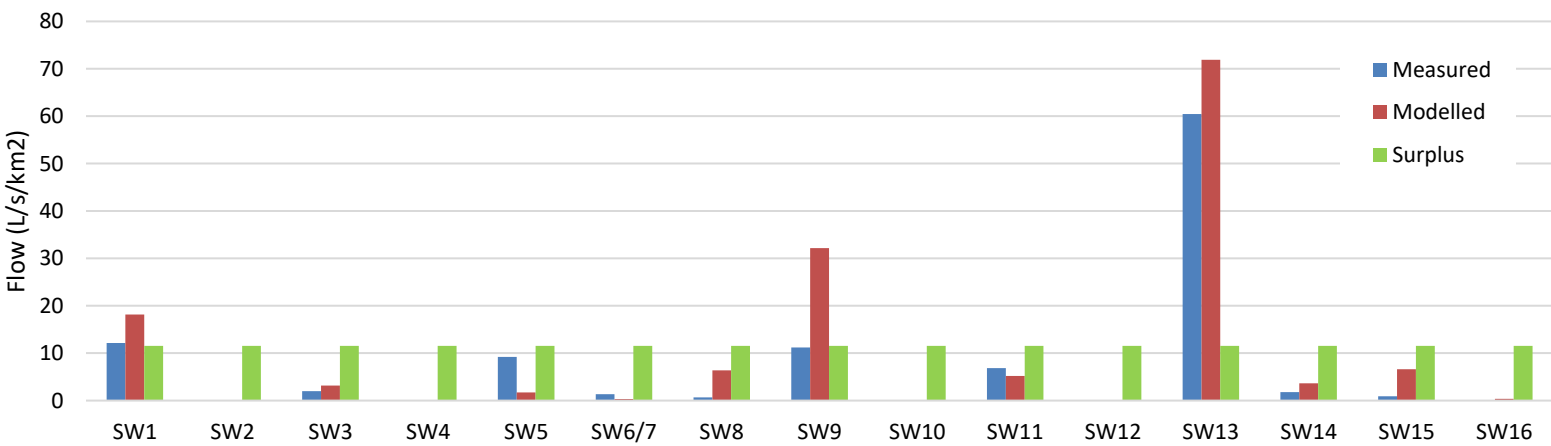
- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - WETLAND
  - CATCHMENT AREA
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - SURFACE WATER MONITORING STATION

- ADDITIONAL MAP NOTES
5. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNRF, 2018)
  6. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNRF) Southwestern Ontario Orthophotography (SWOOP) 2019
  7. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
  8. Quarry license and limit of extraction provided by MHBC (2022)

AVERAGE MEASURED AND SIMULATED FLOW (L/s)



AVERAGE MEASURED AND SIMULATED UNIT YIELD (L/s/km²)



Stations	Catchment Area (km²)	Flow (L/s)		Unit Yield (L/s/km²)		
		Average Measured	Model Simulated	Average Measured	Model Simulated	Surplus
SW1	1.32	16.00	23.95	12.12	18.14	11.54
SW2	2.21	0.03	0.00	0.01	0.00	11.54
SW3	0.35	0.68	1.09	1.98	3.15	11.54
SW4	0.22	0.00	0.00	0.00	0.00	11.54
SW5	0.35	3.20	0.59	9.20	1.71	11.54
SW6/7	7.73	10.17	2.44	1.32	0.32	11.54
SW8	17.40	11.25	110.69	0.65	6.36	11.54
SW9	1.81	20.23	58.12	11.19	32.14	11.54
SW10	0.26	0.00	0.00	0.00	0.00	11.54
SW11	0.28	1.94	1.47	6.83	5.19	11.54
SW12	0.06	0.00	0.00	0.02	0.00	11.54
SW13	0.16	9.79	11.64	60.44	71.88	11.54
SW14	1.41	2.50	5.12	1.77	3.62	11.54
SW15	0.73	0.65	4.84	0.89	6.60	11.54
SW16	5.94	0.00	2.15	0.00	0.36	11.54

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2024-12-17
	PREPARED	WA
	DESIGN	HW
	REVIEW	RS
	APPROVED	GS



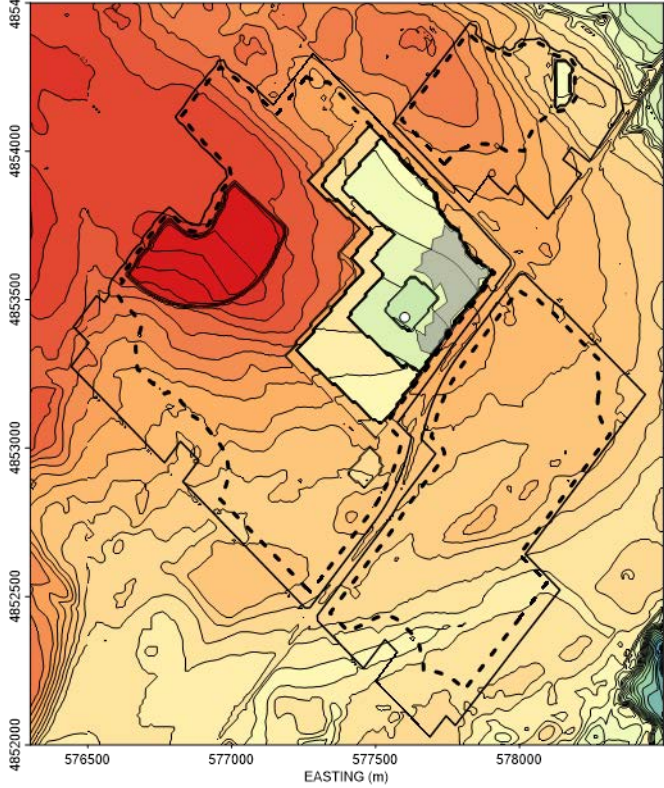
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
CURRENT CONDITIONS SIMULATED SURFACE WATER FLOW

PROJECT No. 19129150  
Rev. 0  
FIGURE 5



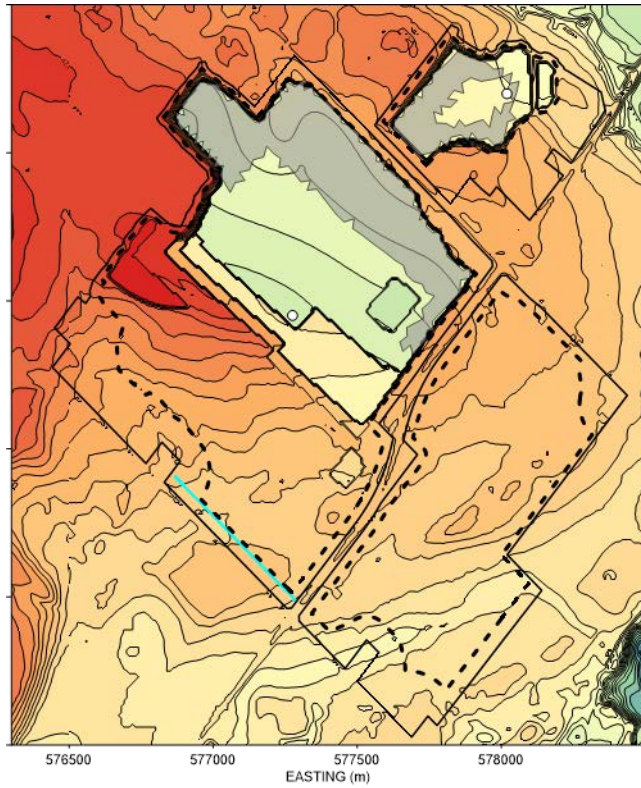
PHASE 1



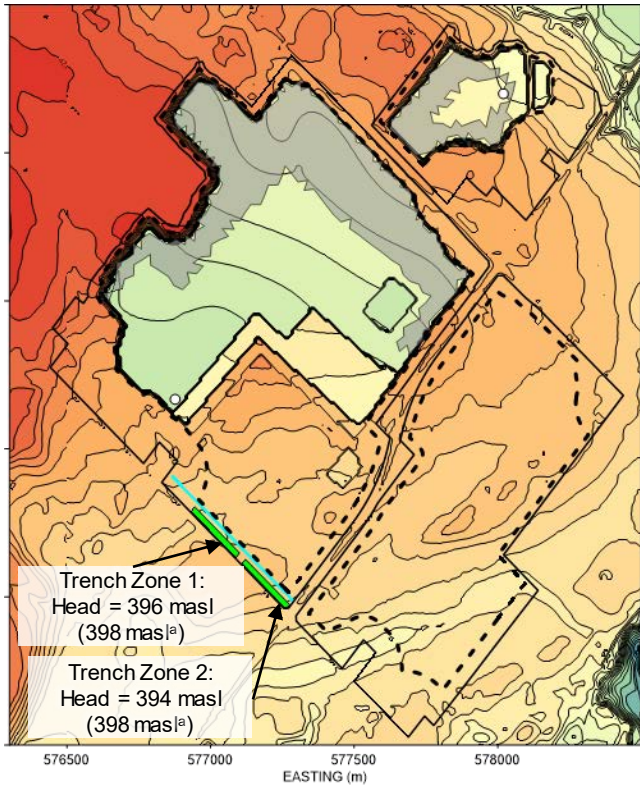
PHASE 2



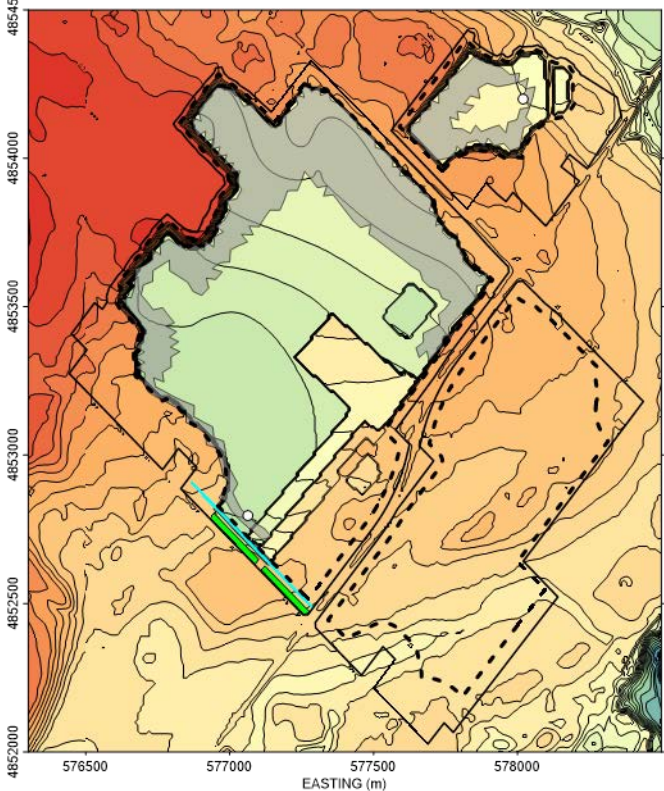
PHASE 3



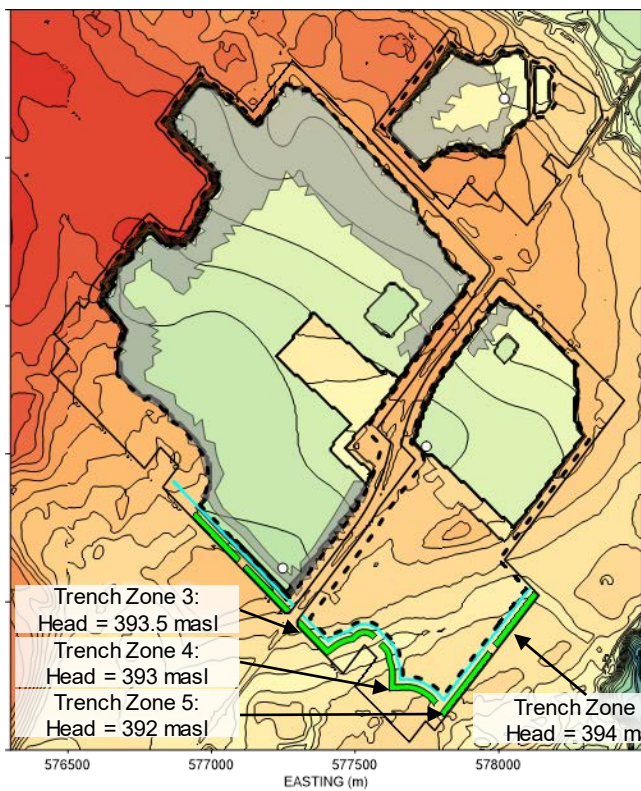
PHASE 4



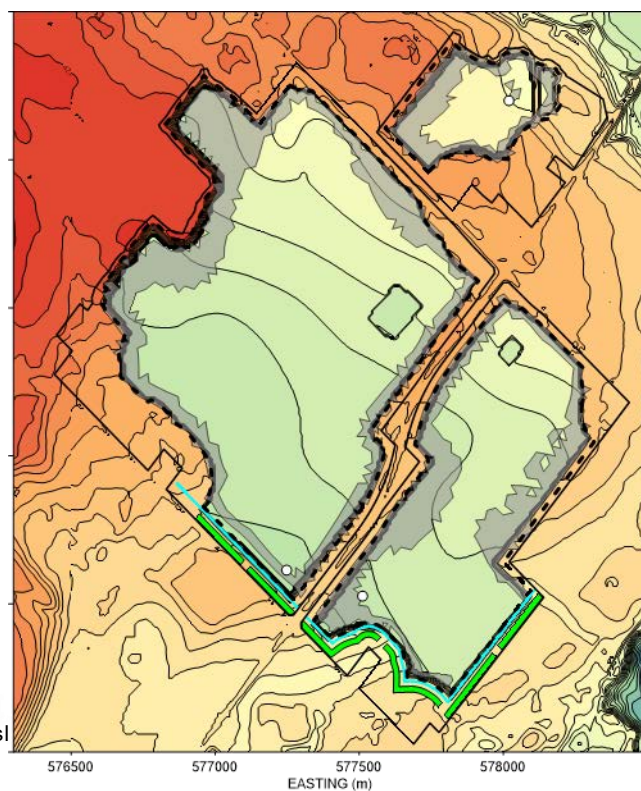
PHASE 5



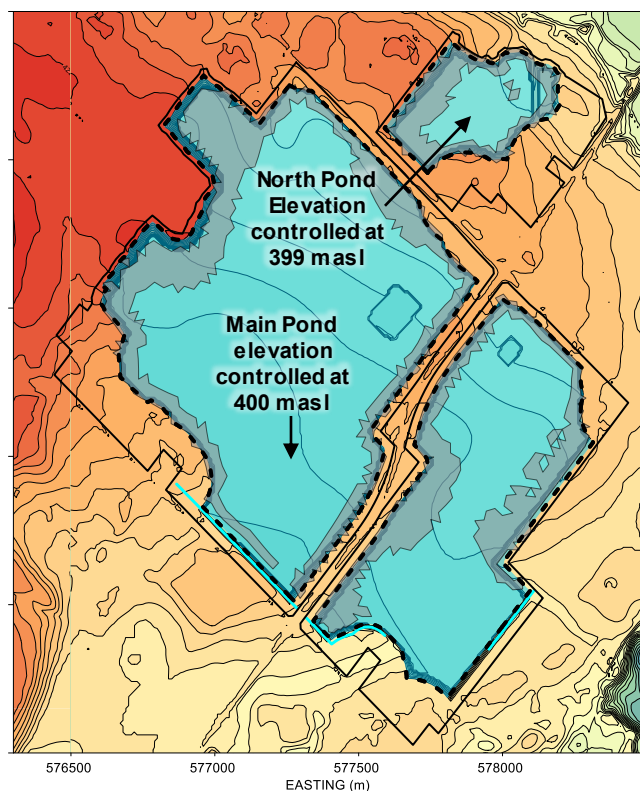
PHASE 6



PHASE 7



REHABILITATION



TIMELINE OF QUARRY DEVELOPMENT

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

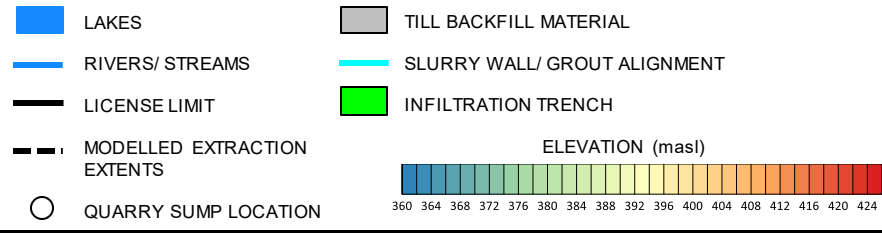
QUARRY SUMP ELEVATIONS

Phase of Operation	Main Area	North Area	South Area
1	385.1	-	-
2	385.1	394.0	-
3	385.3	394.0	-
4	382.5	394.0	-
5	382.1	394.0	-
6	381.2	394.0	385.2
7	381.2	394.0	383.4

NOTES ON MODEL SETUP:

1. Quarry area is simulated as a high hydraulic conductivity zone ( $K = 1 \text{ m/s}$ )
2. Till backfill has an assumed value of  $1\text{E-}6 \text{ m/s}$ . The till backfill is progressively placed to help limit quarry inflows. The modelled till backfill extents are shown for model layer 21.
3. Infiltration trench zones are simulated as constant head boundaries.
4. Slurry wall and grout alignment is modelled as a hydraulic conductivity zone with  $K = 1\text{E-}7 \text{ m/s}$ . Slurry wall is removed along trench zones 4 and 5 during the rehabilitation phase.
5. Sump locations are set in the South Quarry, Main Quarry, and North Quarry as they are developed. These sump nodes discharge to the Credit River directly to the east of the Main Quarry.

LEGEND



ADDITIONAL MAP NOTES

1. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
2. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNR) Southwestern Ontario Orthophotography (SWOOP) 2019
3. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
4. Quarry license and ultimate modelled limit of extraction provided by MHBC (May 2023)
- a. Trench target head during Phase 5 is 398 masl.

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT



YYYY-MM-DD

2025-03-11
TG
HW
RS
GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

MODELLER QUARRY DEVELOPMENT PHASES AND MITIGATION

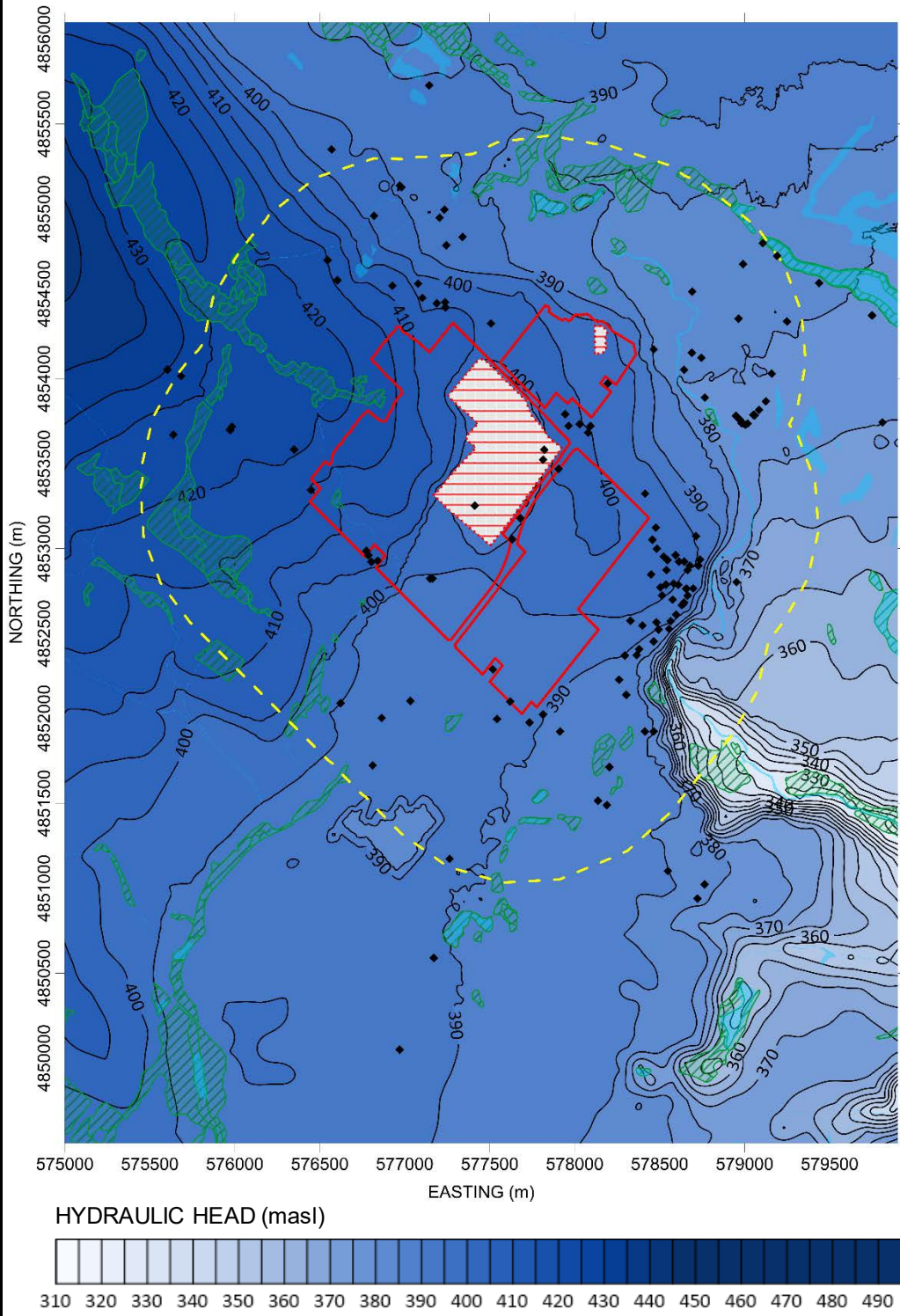
PROJECT No. 19129150

Rev. 0

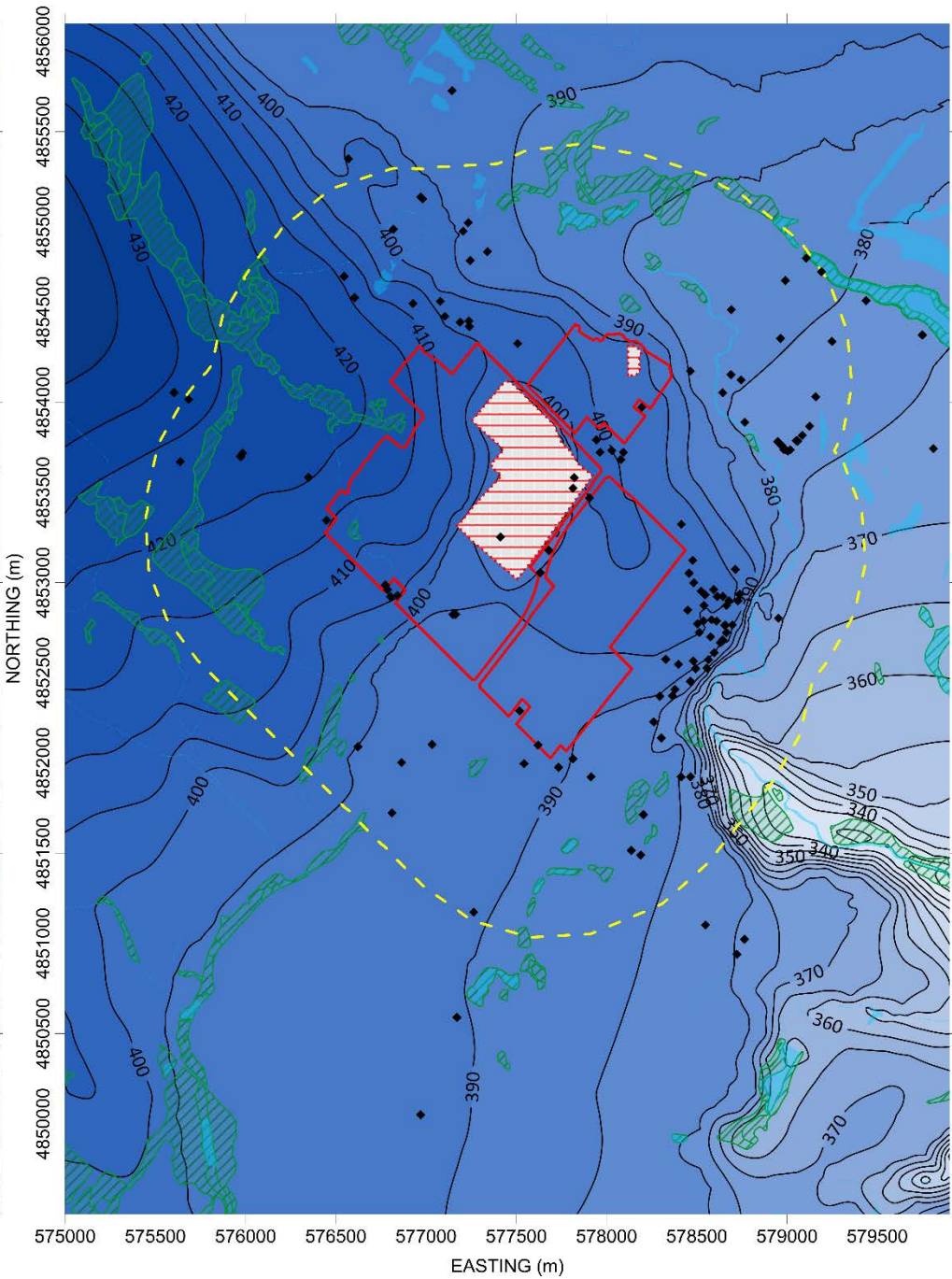
FIGURE 6



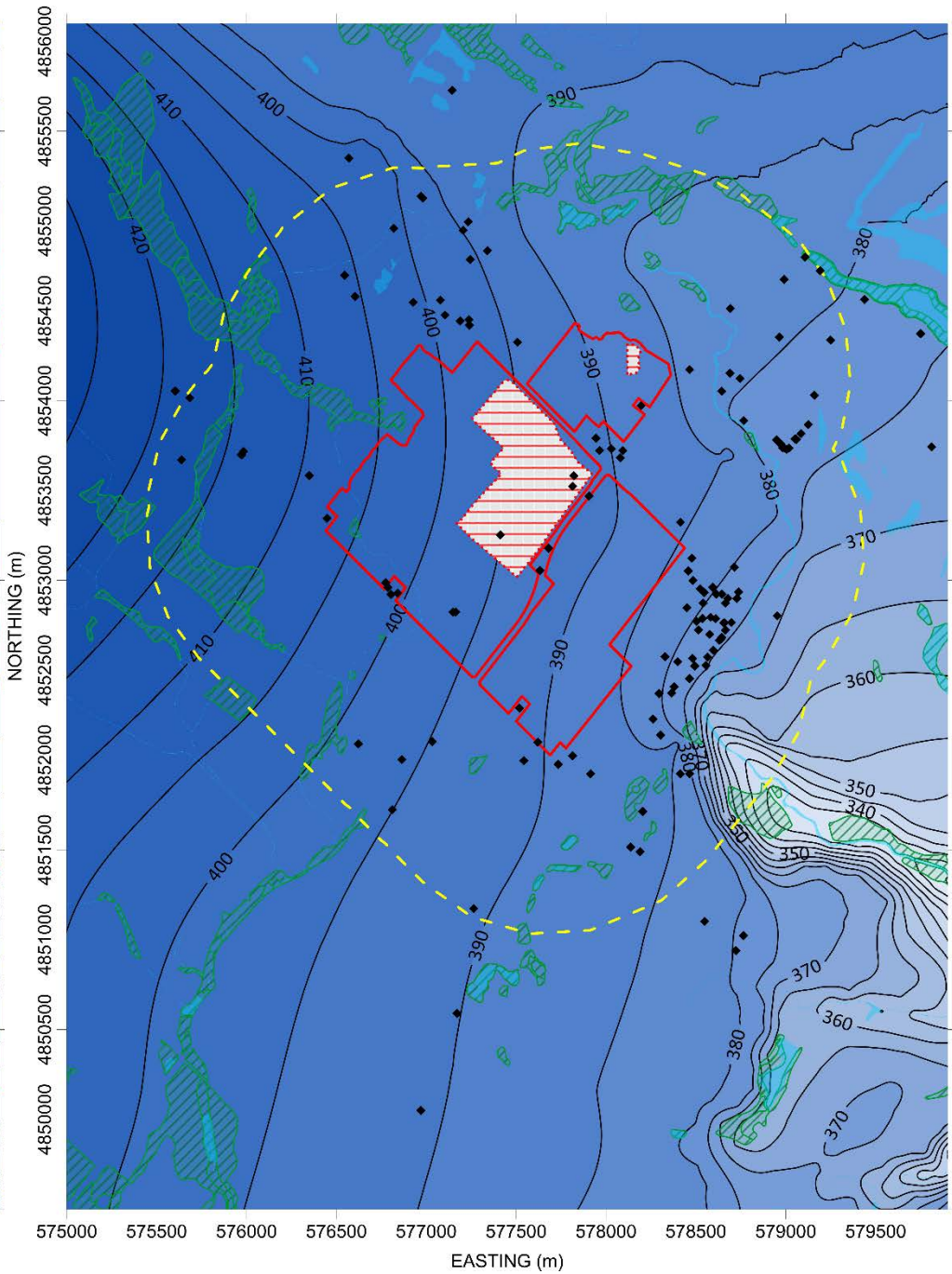
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - WETLAND
  - 1KM BUFFER AROUND PROPERTY
  - MECP PRIVATE WELL LOCATION

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

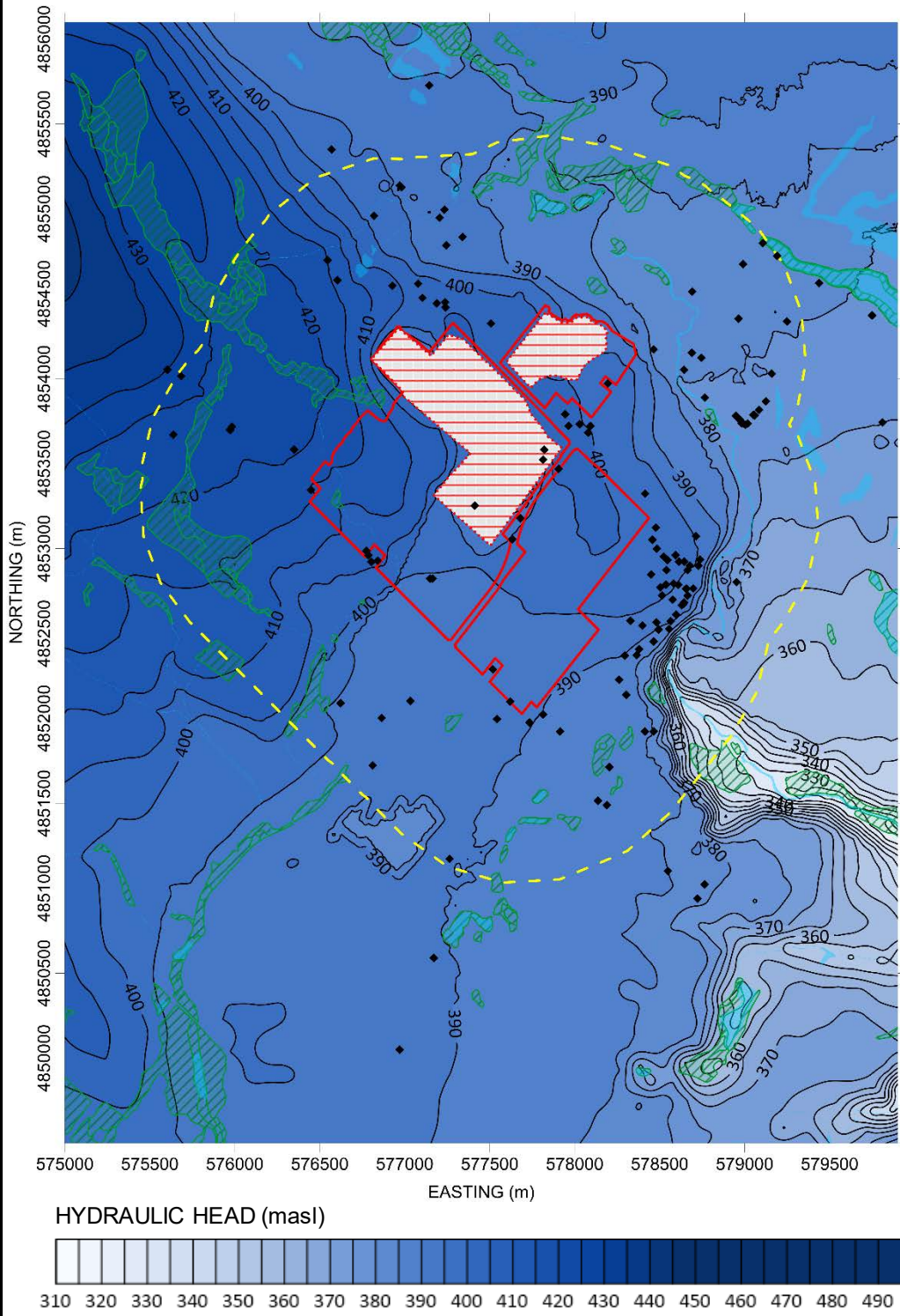
- NOTES
- Simulated hydraulic head is shown at a contour interval of 5m
  - Gasport formation head extracted from model slice 22 (base of Gasport)
  - Manitoulin/ Whirlpool formation head extracted from model slice 25
  - Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  - Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)		
CONSULTANT		
YYYY-MM-DD	2024-12-17	
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	

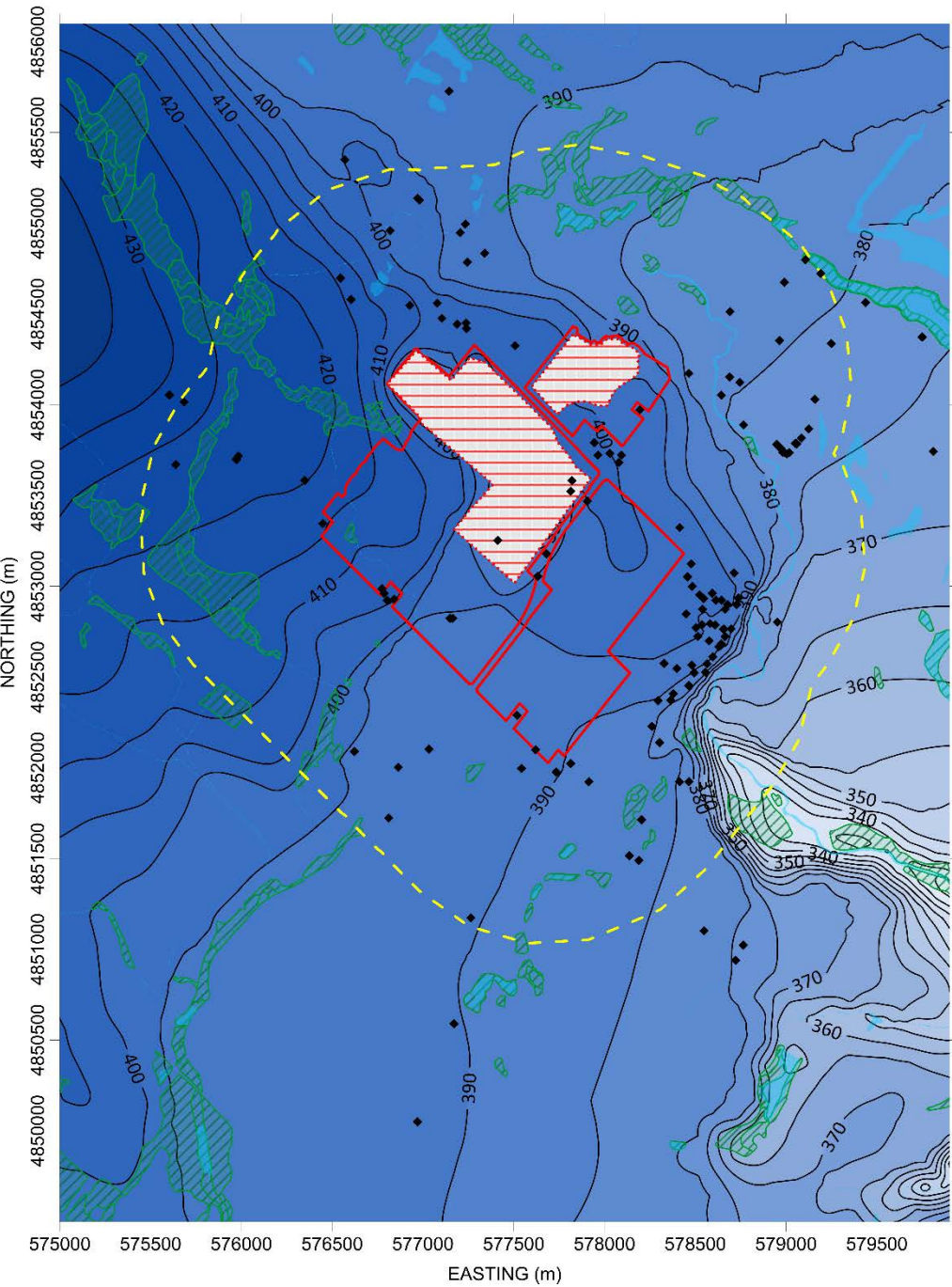
PROJECT CALEDON PIT AND QUARRY NUMERICAL MODELLING		
TITLE PHASE 1 SIMULATED HYDRAULIC HEAD		
PROJECT No. 19129150	Rev. 0	FIGURE 7A



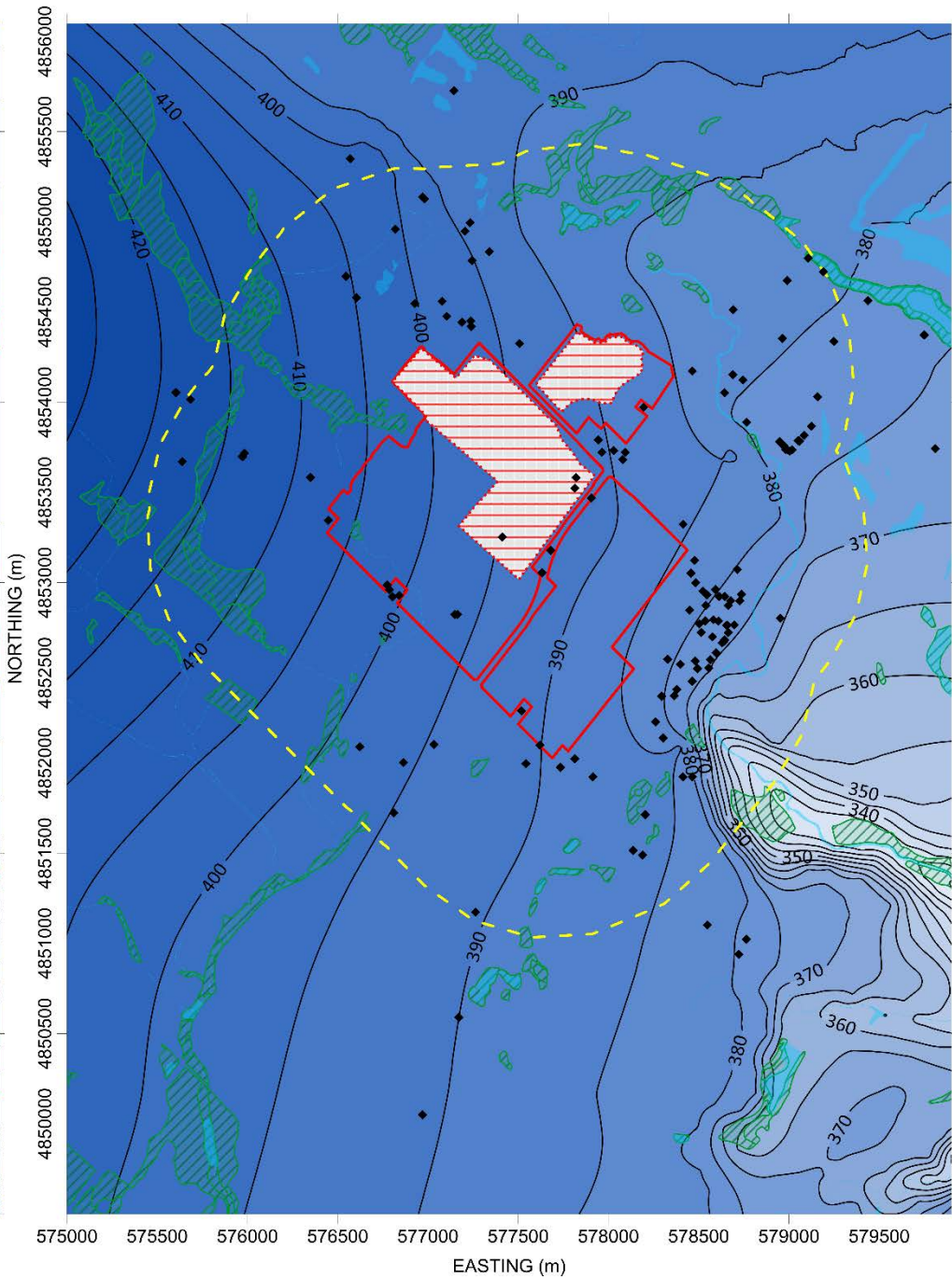
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - WETLAND
  - 1KM BUFFER AROUND PROPERTY
  - MECP PRIVATE WELL LOCATION

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

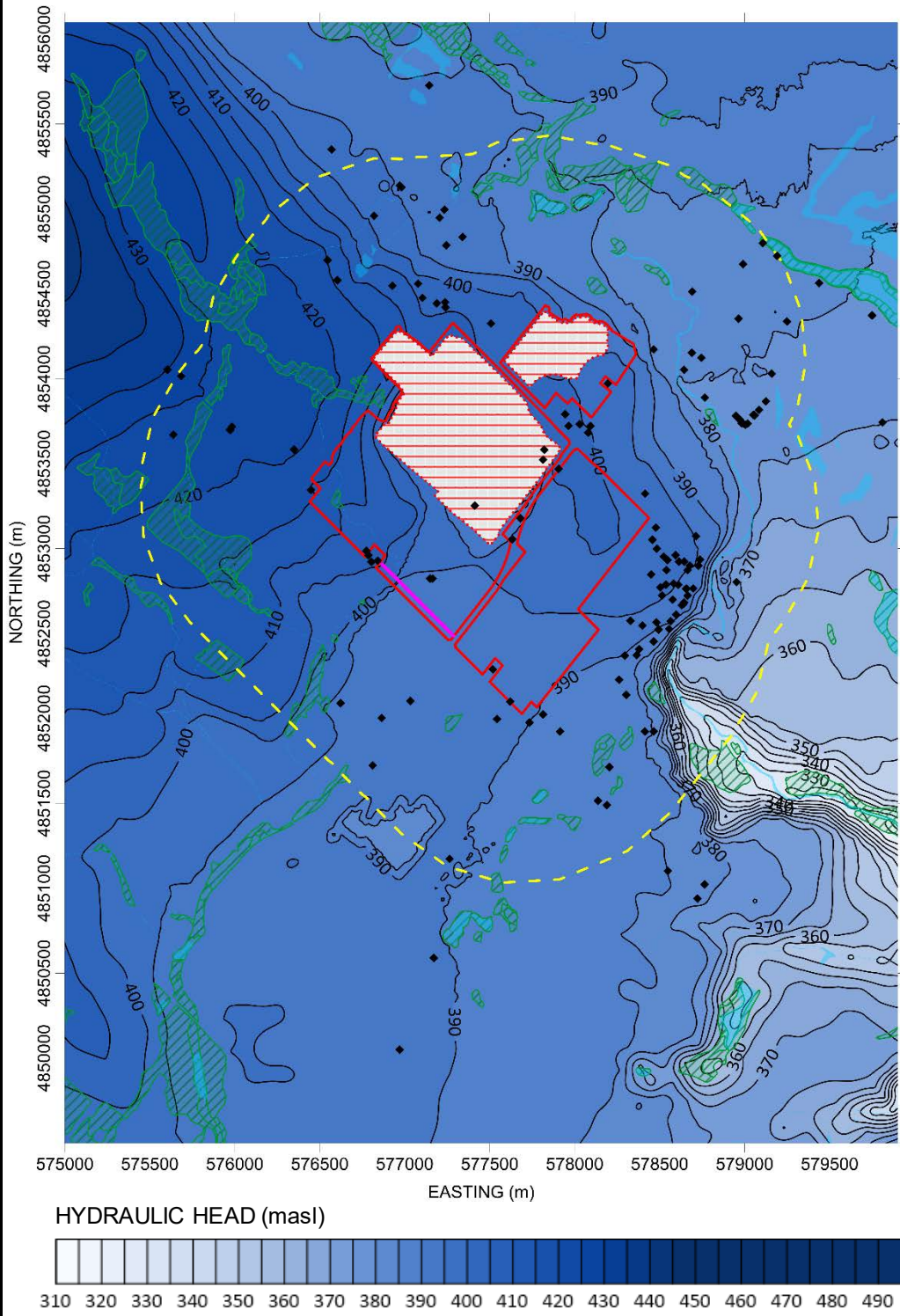
- NOTES
1. Simulated hydraulic head is shown at a contour interval of 5m
  2. Gasport formation head extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation head extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)		
CONSULTANT		
YYYY-MM-DD	2024-12-17	
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	

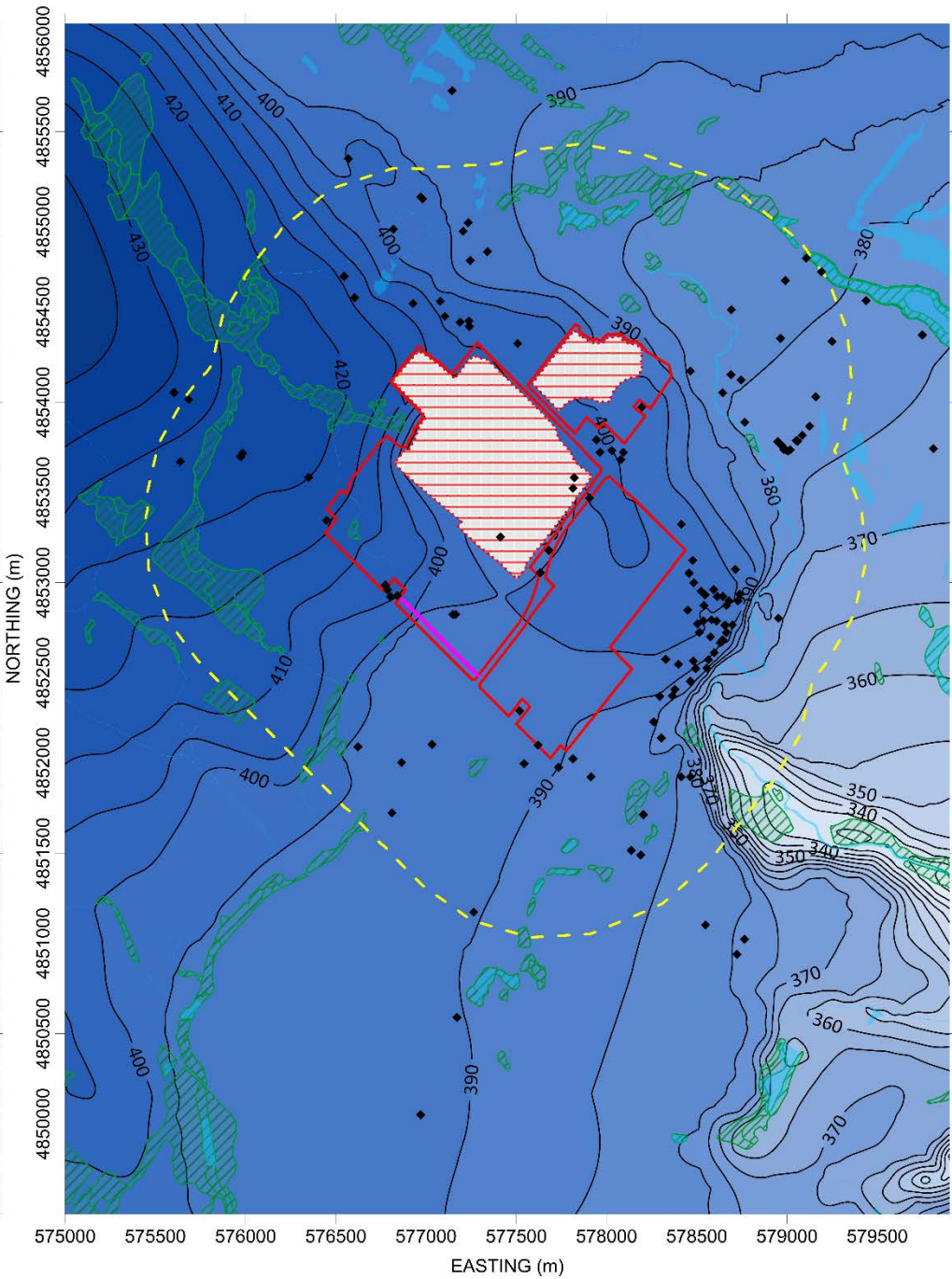
PROJECT CALEDON PIT AND QUARRY NUMERICAL MODELLING		
TITLE PHASE 2 SIMULATED HYDRAULIC HEAD		
PROJECT No. 19129150	Rev. 0	FIGURE 7B



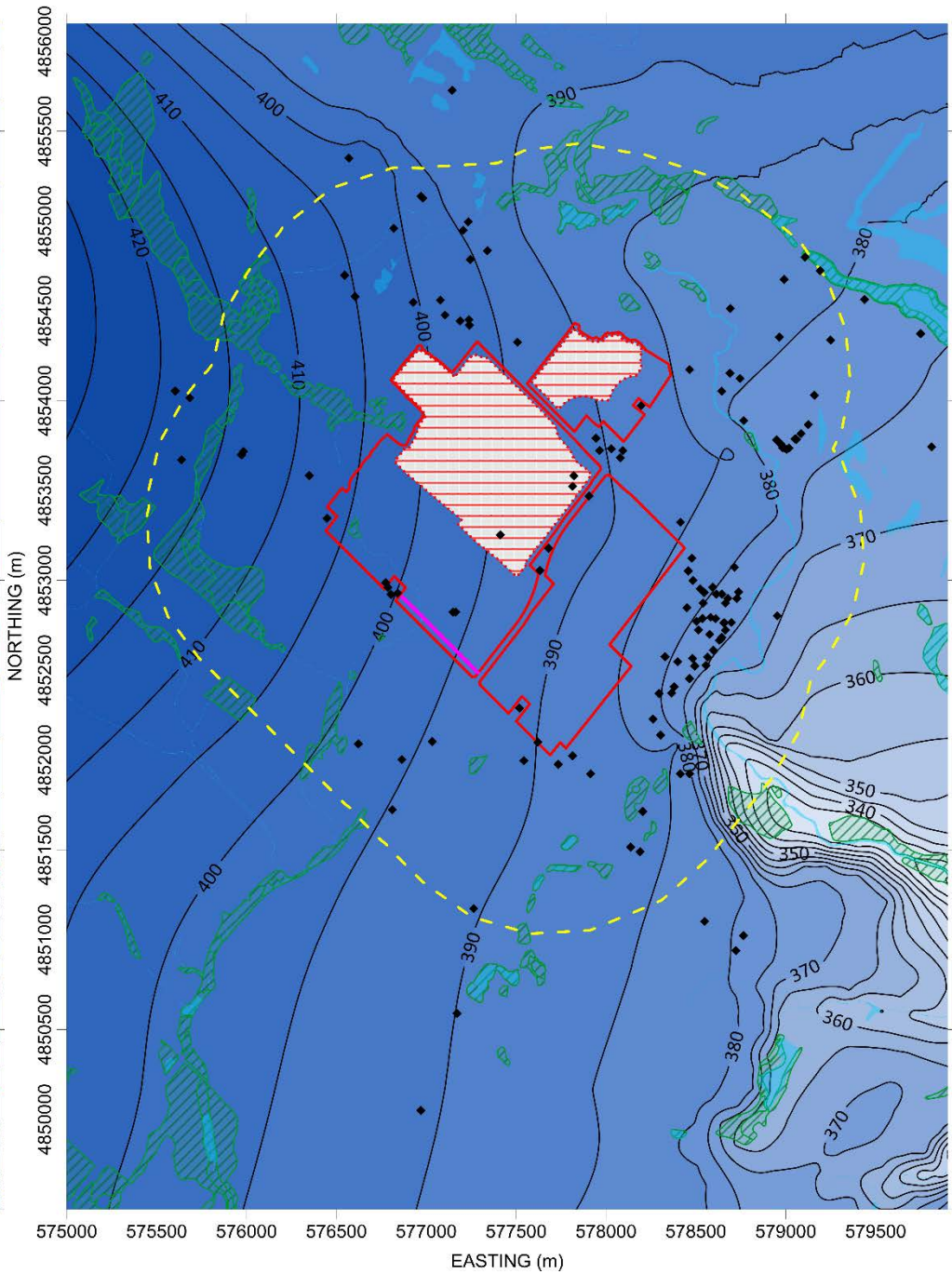
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES
- RIVERS/ STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2024-12-17
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



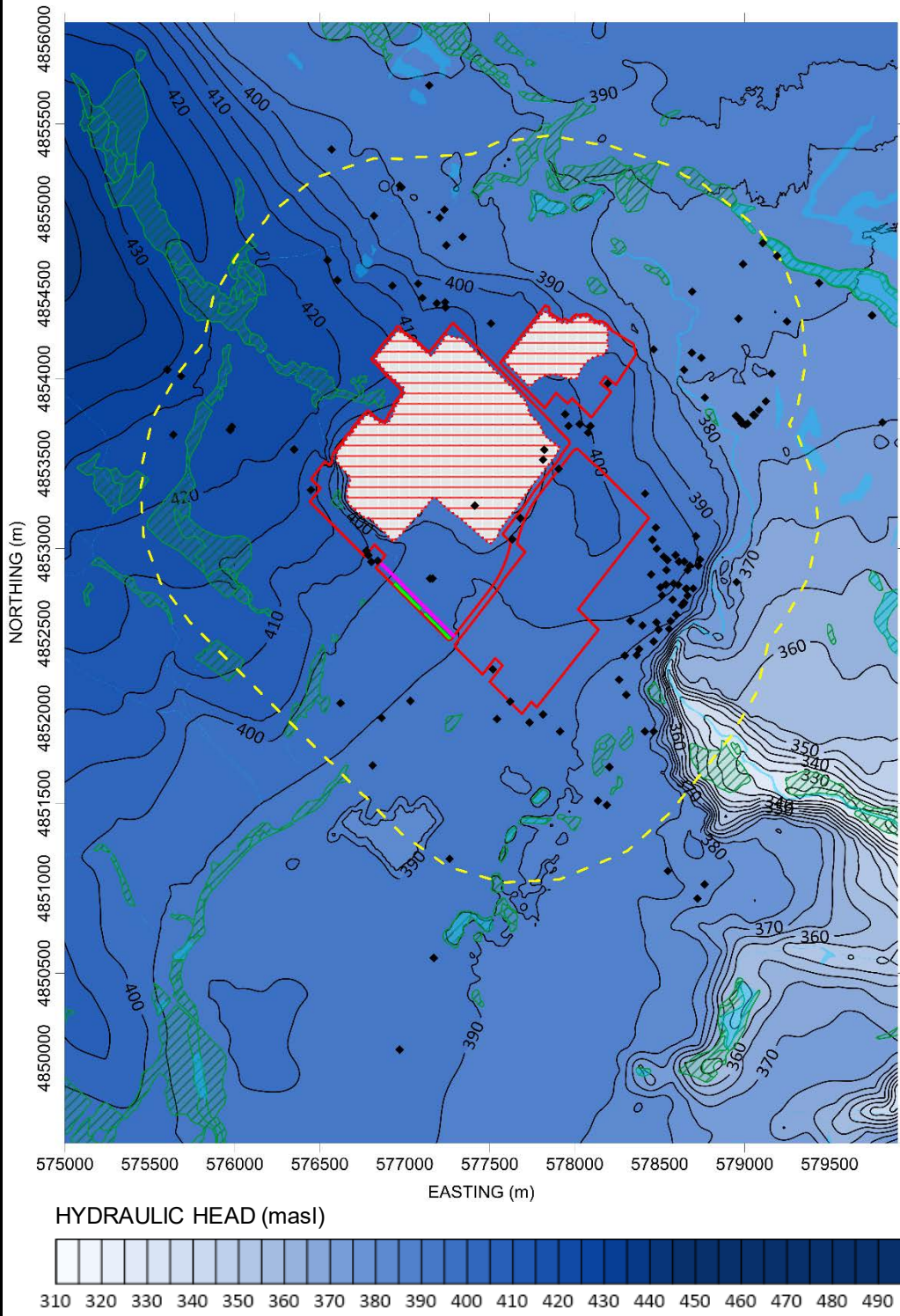
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 3 SIMULATED HYDRAULIC HEAD

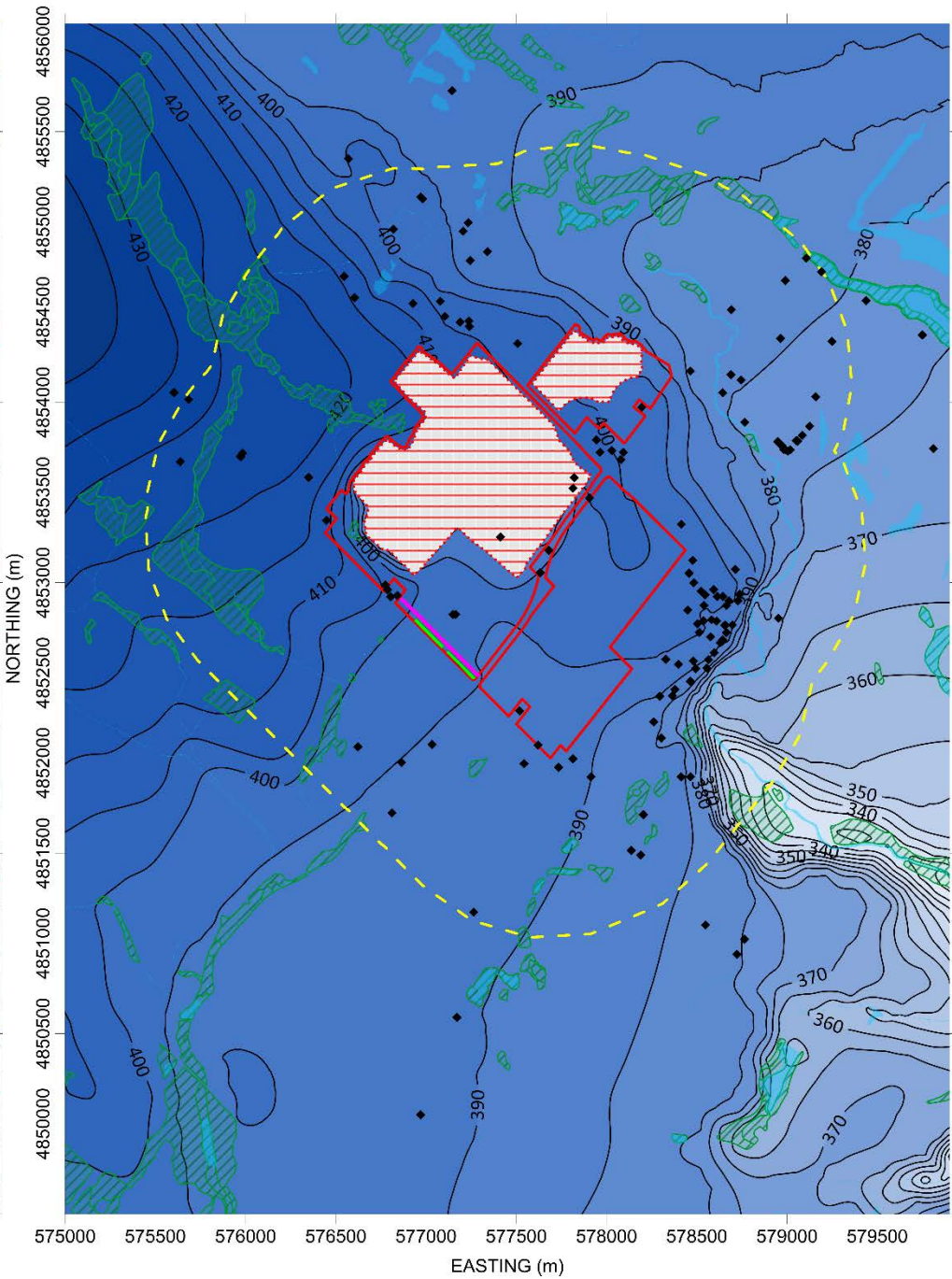
PROJECT No. 19129150 Rev. 0 FIGURE 7C



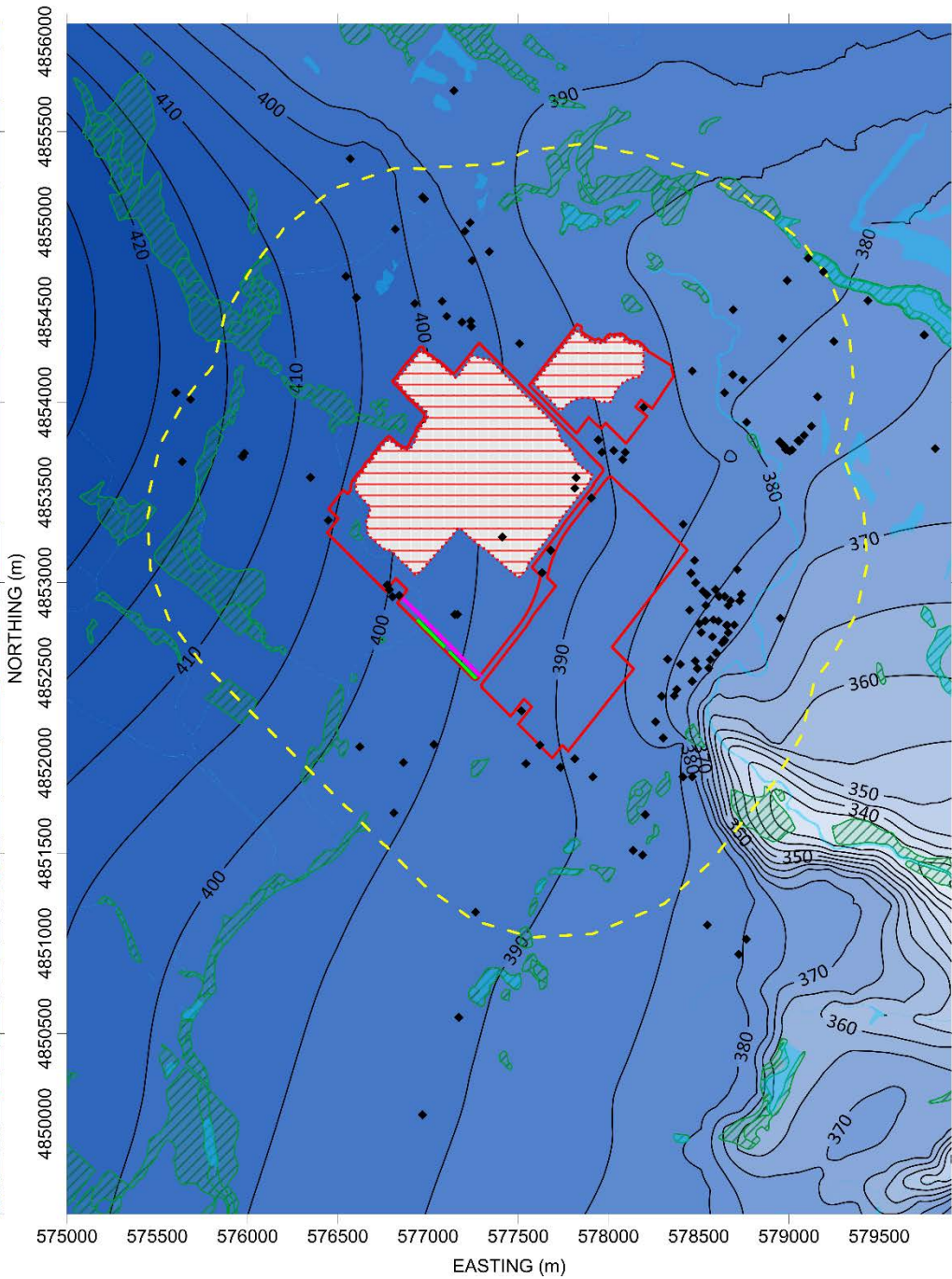
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES
- RIVERS/ STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT
- INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

- Simulated hydraulic head is shown at a contour interval of 5m
- Gasport formation head extracted from model slice 22 (base of Gasport)
- Manitoulin/ Whirlpool formation head extracted from model slice 25
- Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
- Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2024-12-17
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



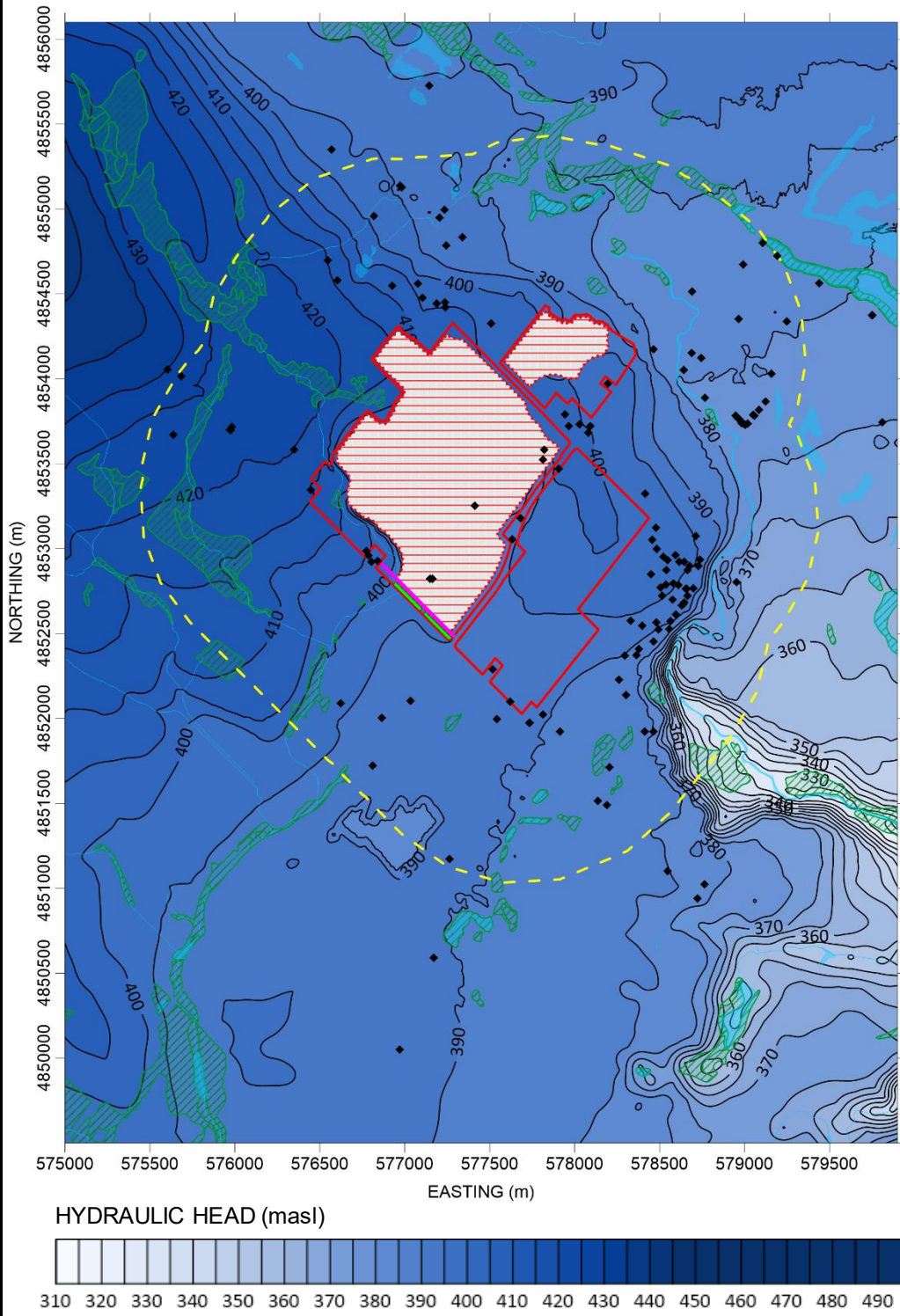
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 4 SIMULATED HYDRAULIC HEAD

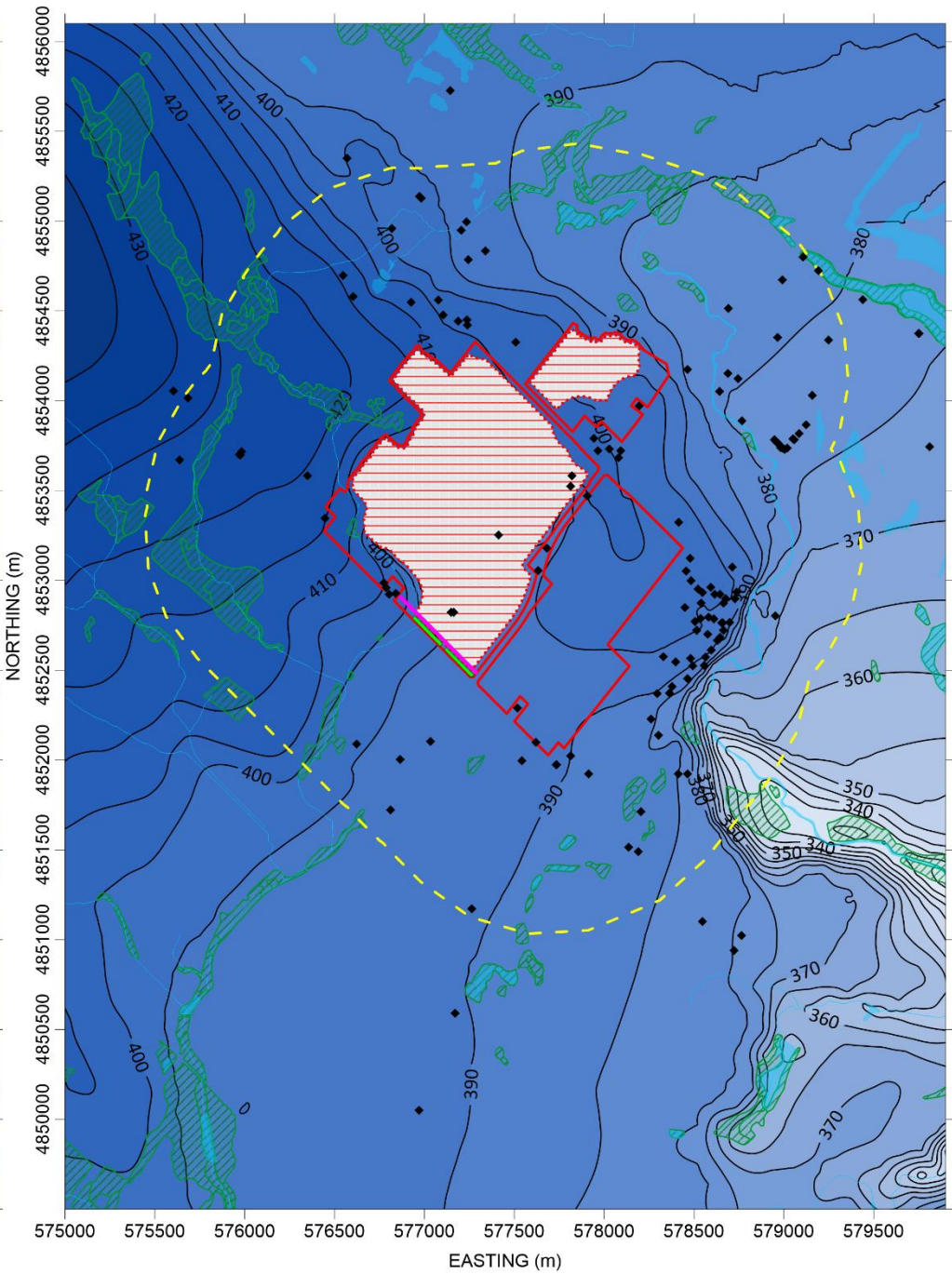
PROJECT No. 19129150 Rev. 0 FIGURE 7D



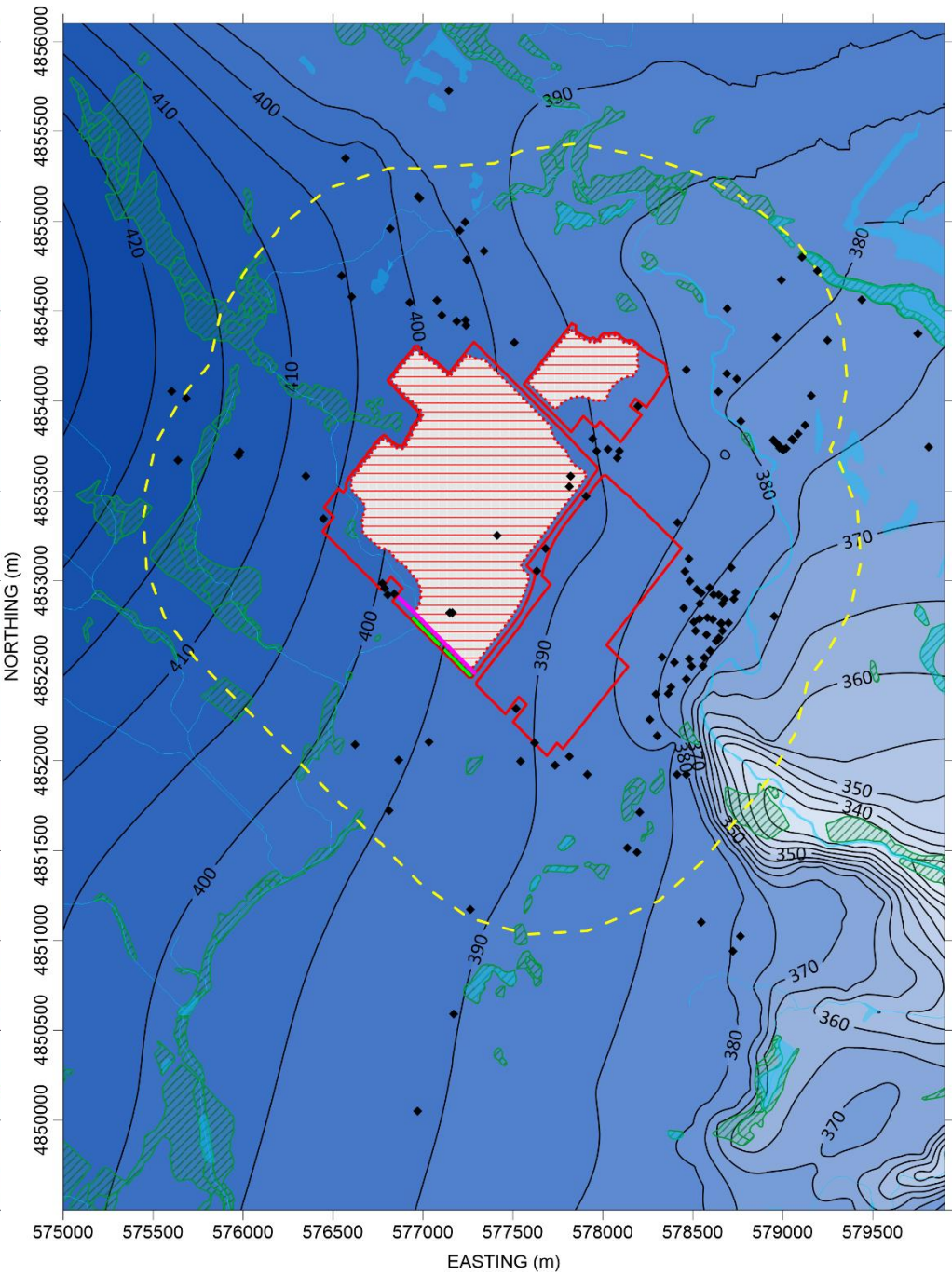
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES
- RIVERS/ STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT
- INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2025-03-10
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



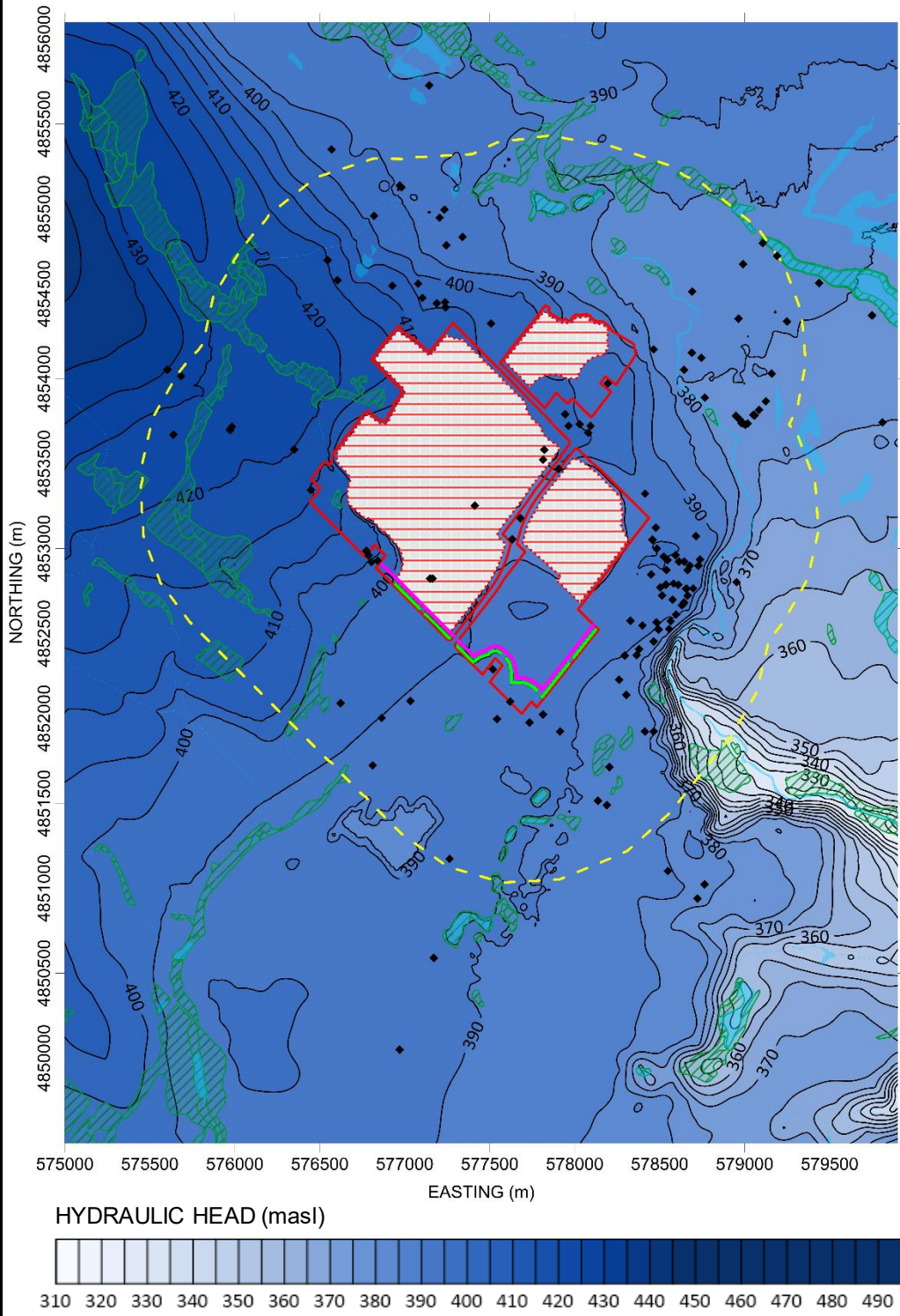
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 5 SIMULATED HYDRAULIC HEAD

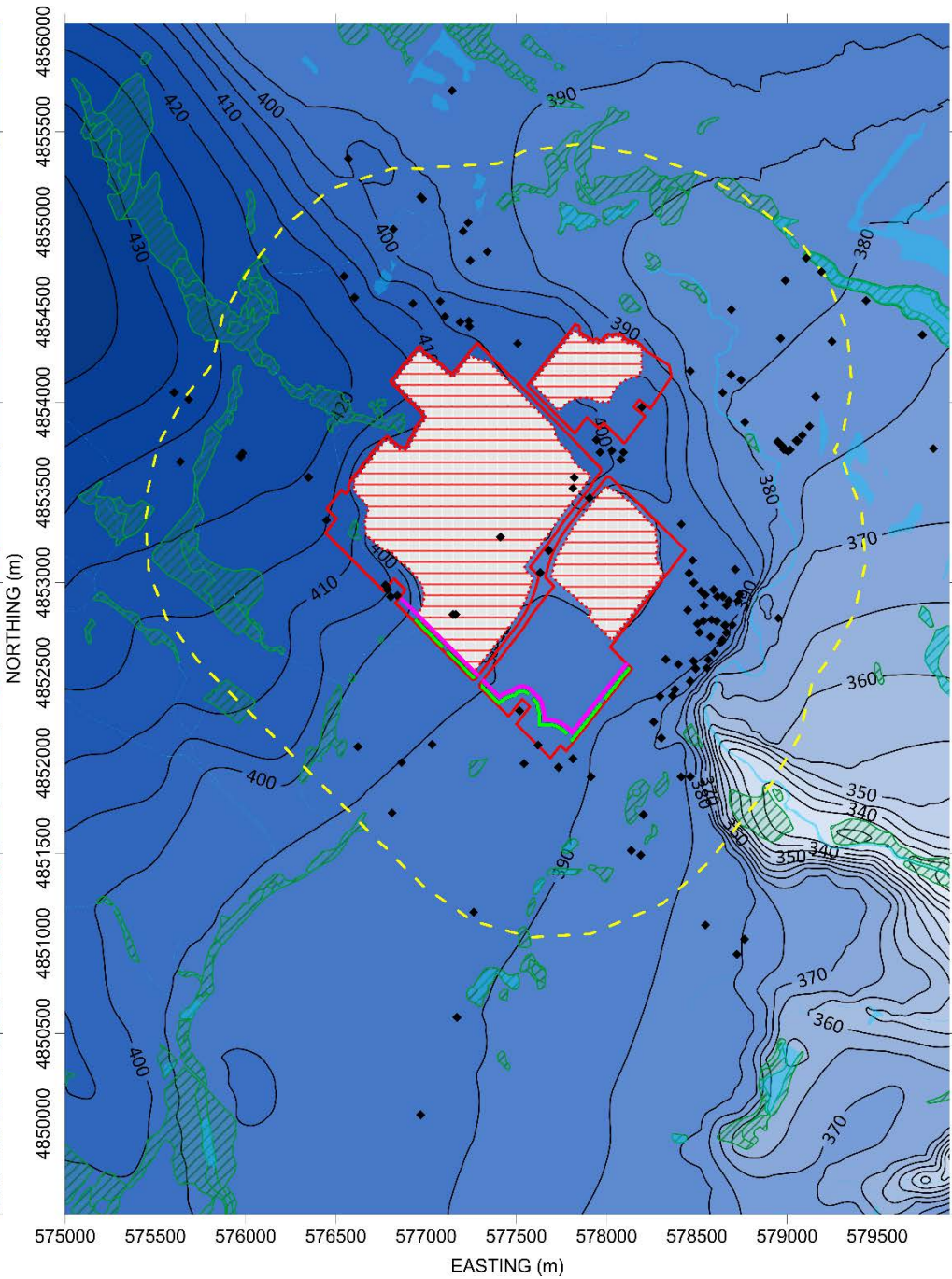
PROJECT No. 19129150  
Rev. 0  
FIGURE 7E



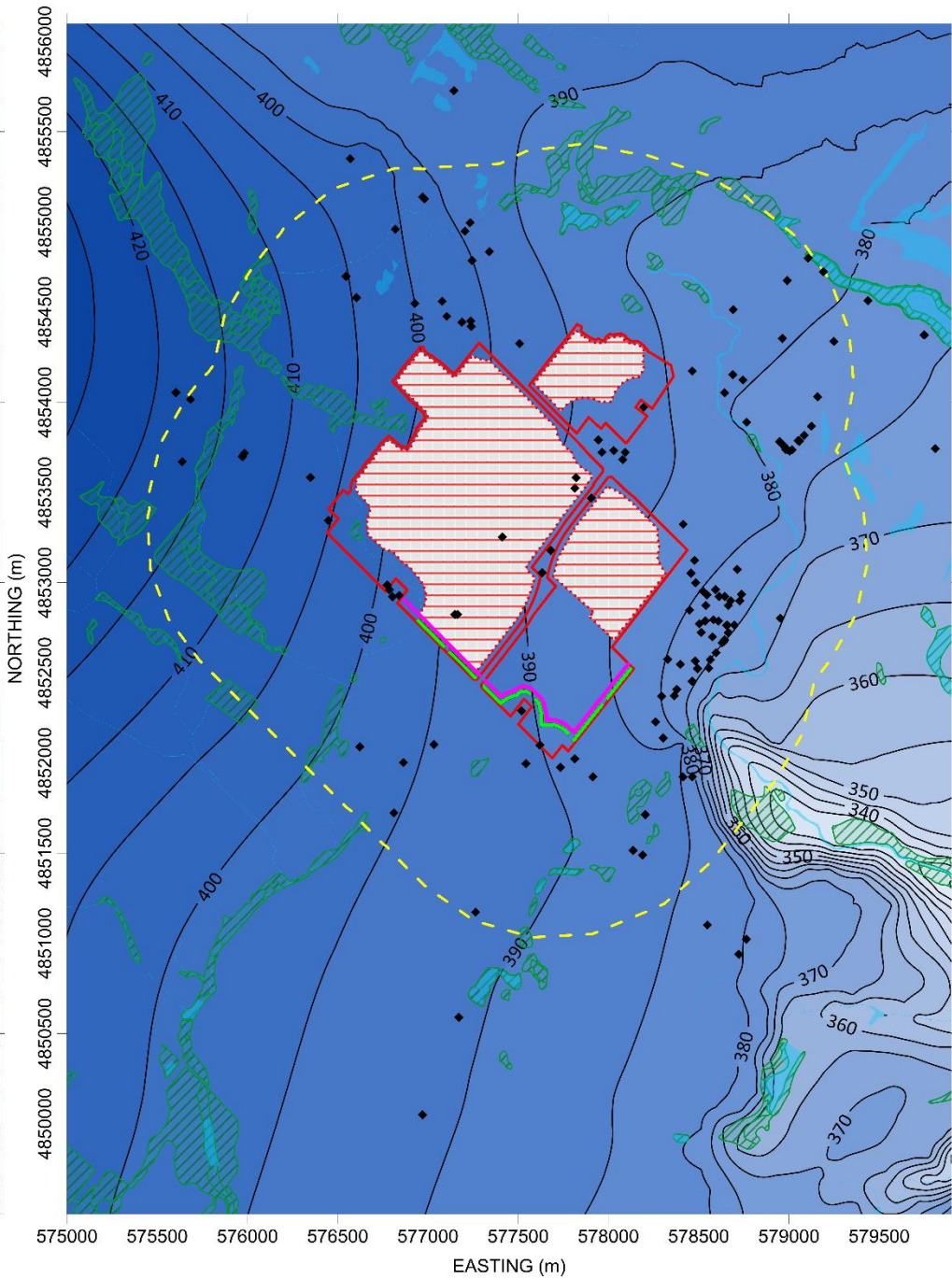
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES
- RIVERS/ STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT
- INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

- Simulated hydraulic head is shown at a contour interval of 5m
- Gasport formation head extracted from model slice 22 (base of Gasport)
- Manitoulin/ Whirlpool formation head extracted from model slice 25
- Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
- Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2024-12-17
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



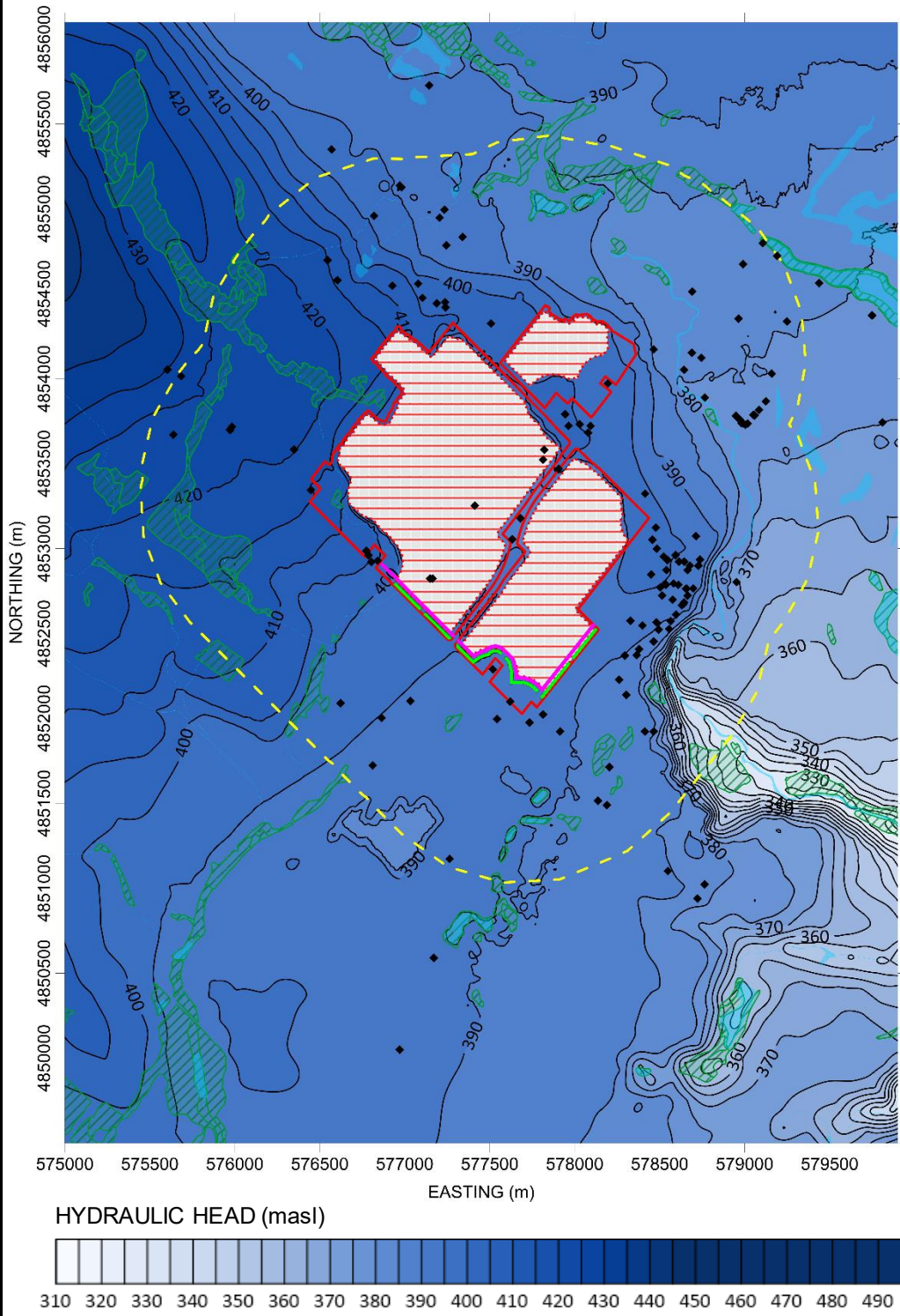
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 6 SIMULATED HYDRAULIC HEAD

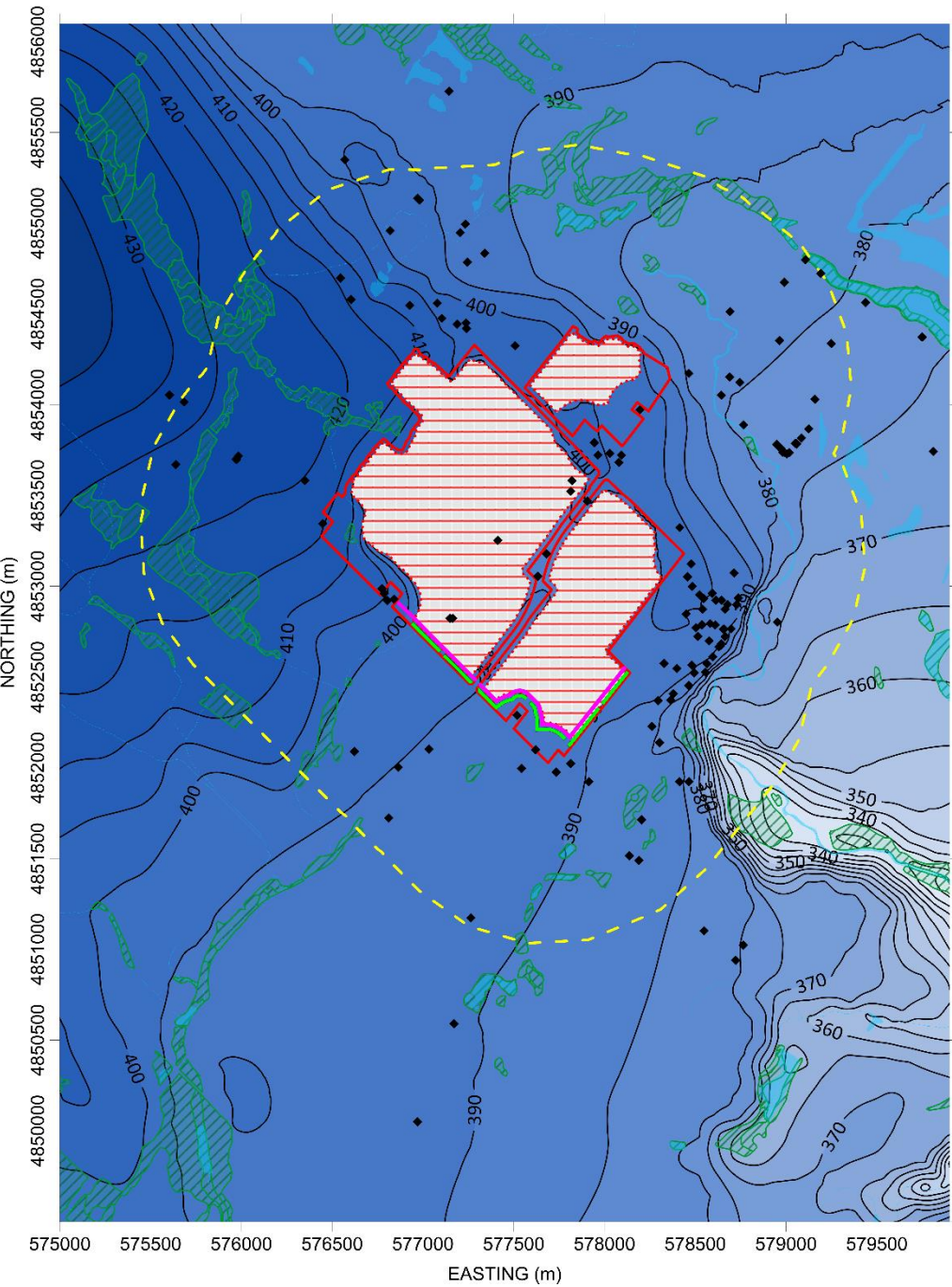
PROJECT No. 19129150 Rev. 0 FIGURE 7F



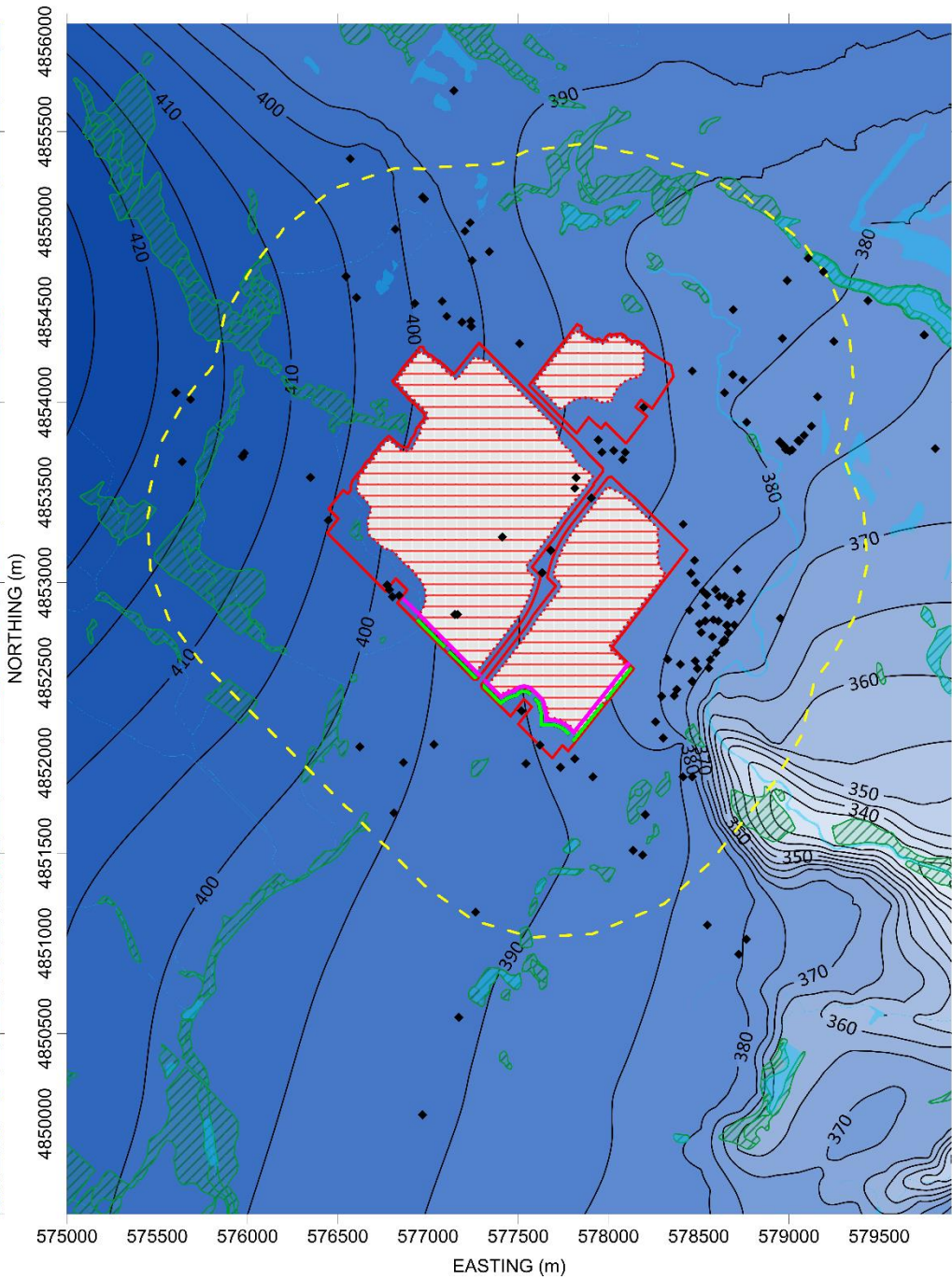
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES

RIVERS/ STREAMS

SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

WETLAND

1KM BUFFER AROUND PROPERTY

MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT

INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2024-12-17
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



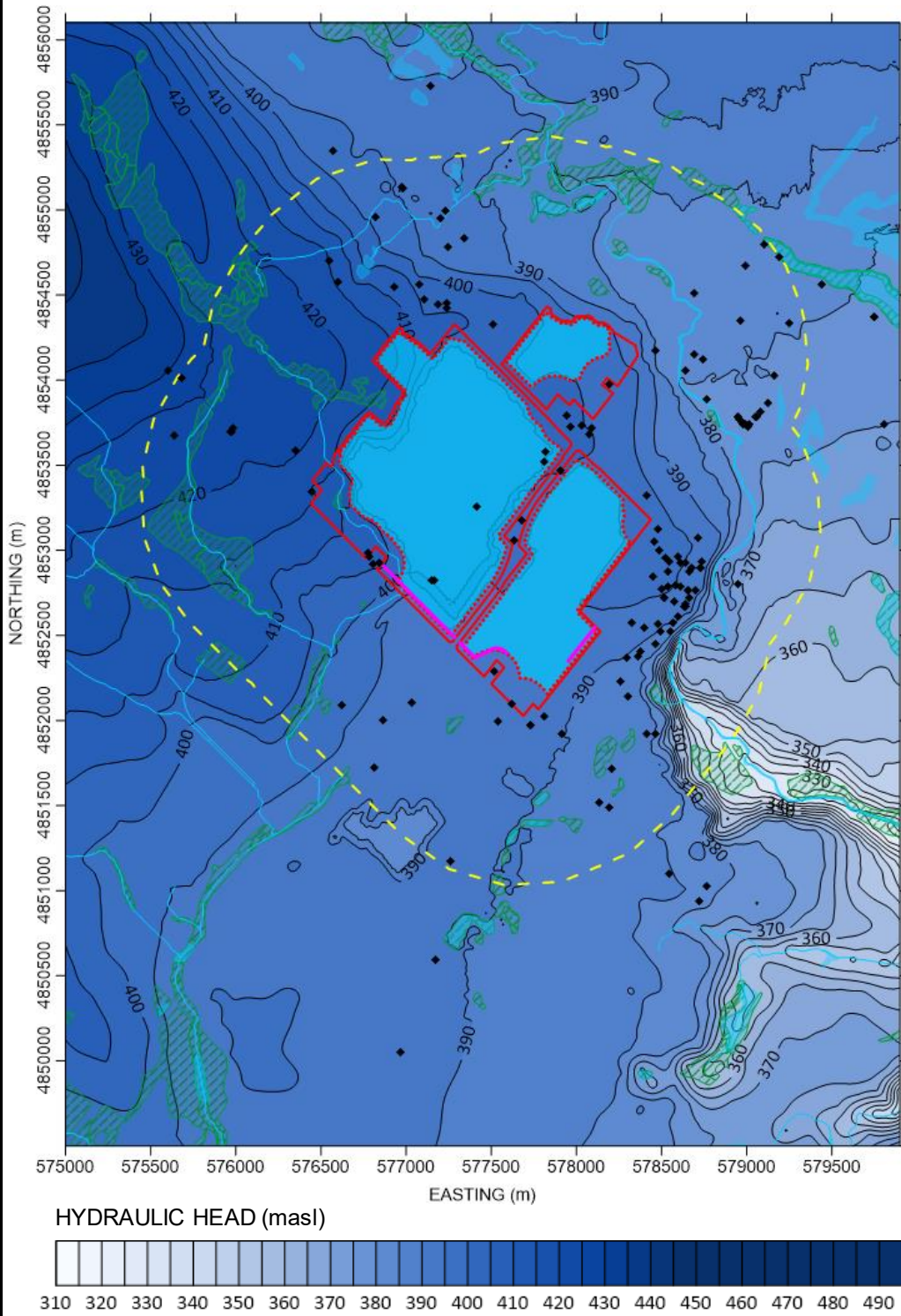
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 7 SIMULATED HYDRAULIC HEAD

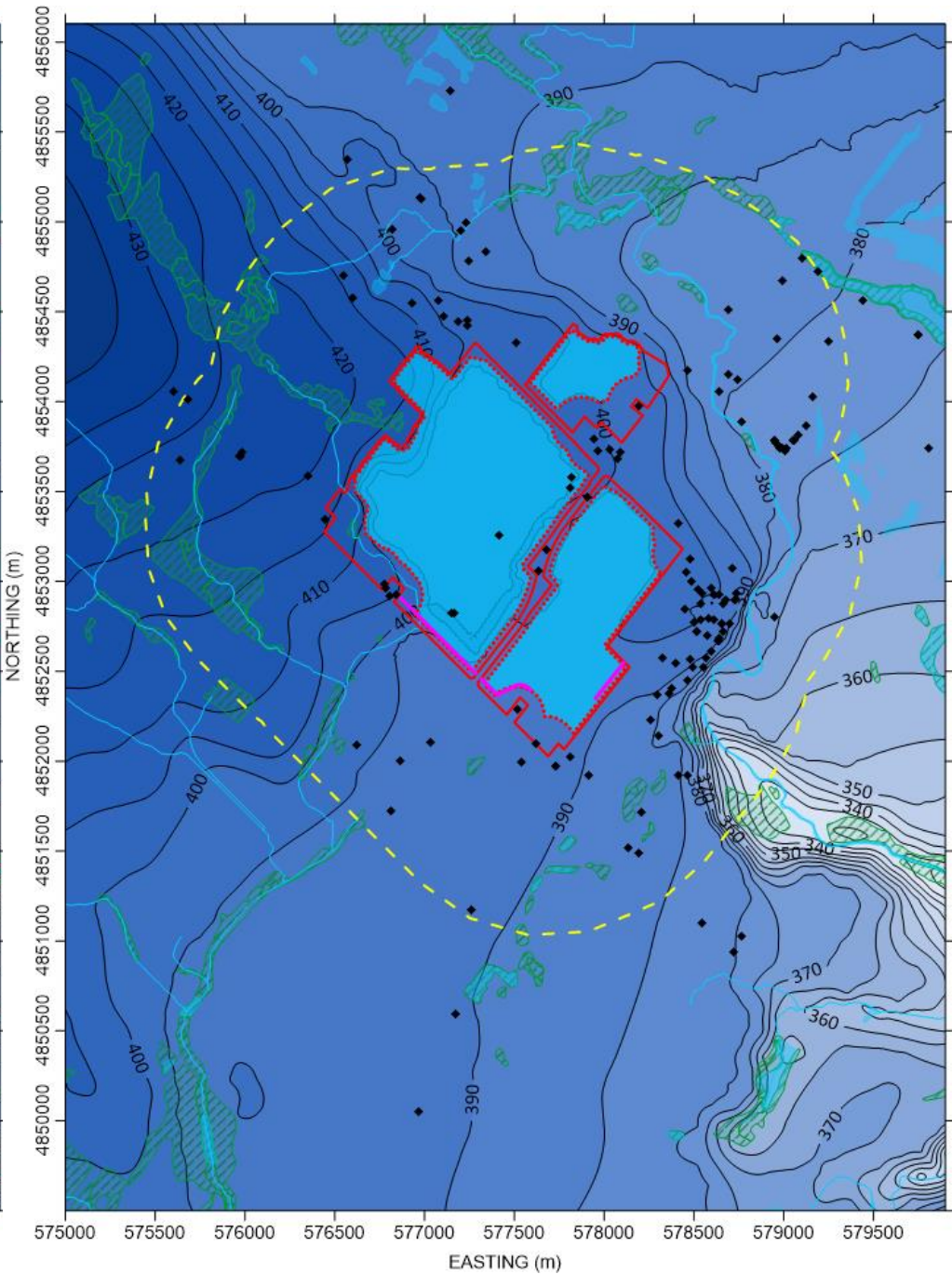
PROJECT No. 19129150 Rev. 0 FIGURE 7G



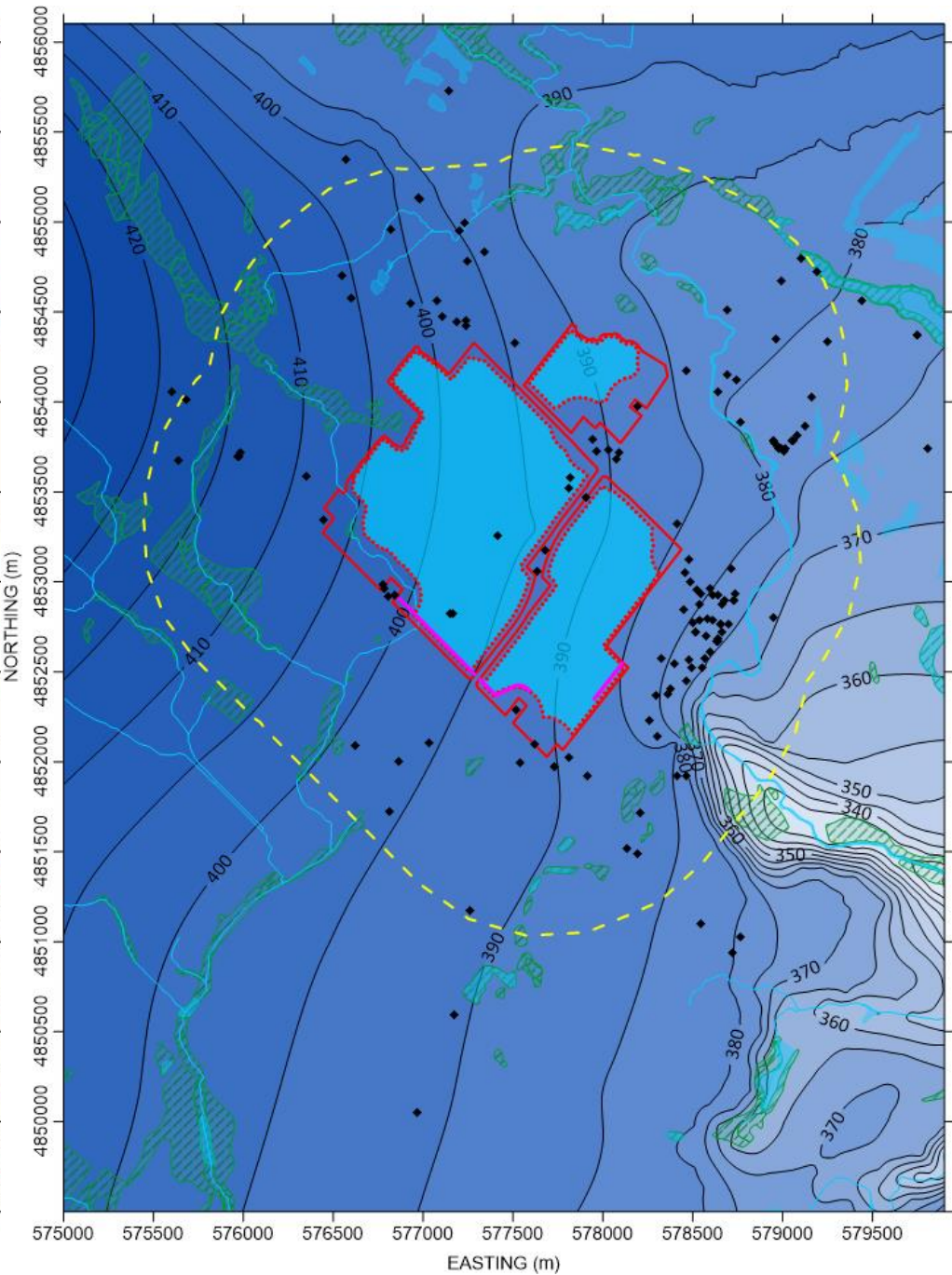
1. SIMULATED WATER TABLE ELEVATION (masl)



2. SIMULATED GASPORT FORMATION HEAD (masl)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION HEAD (masl)



LEGEND

- LAKES
- RIVERS/ STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL/ GROUT ALIGNMENT
- INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

NOTES

1. Simulated hydraulic head is shown at a contour interval of 5m
2. Gasport formation head extracted from model slice 22 (base of Gasport)
3. Manitoulin/ Whirlpool formation head extracted from model slice 25
4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2025-05-09
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	



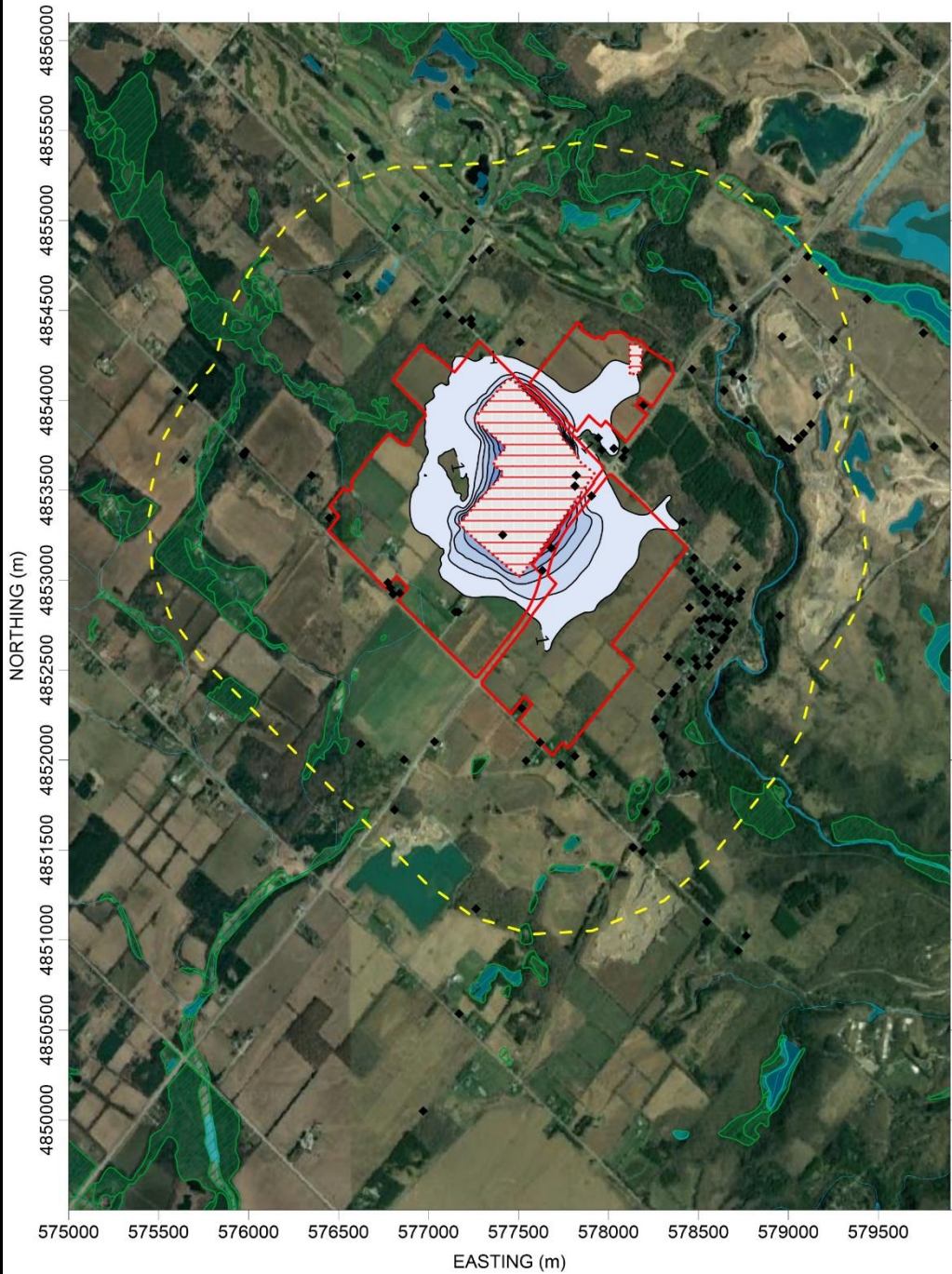
PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
REHABILITATION SIMULATED HYDRAULIC HEAD

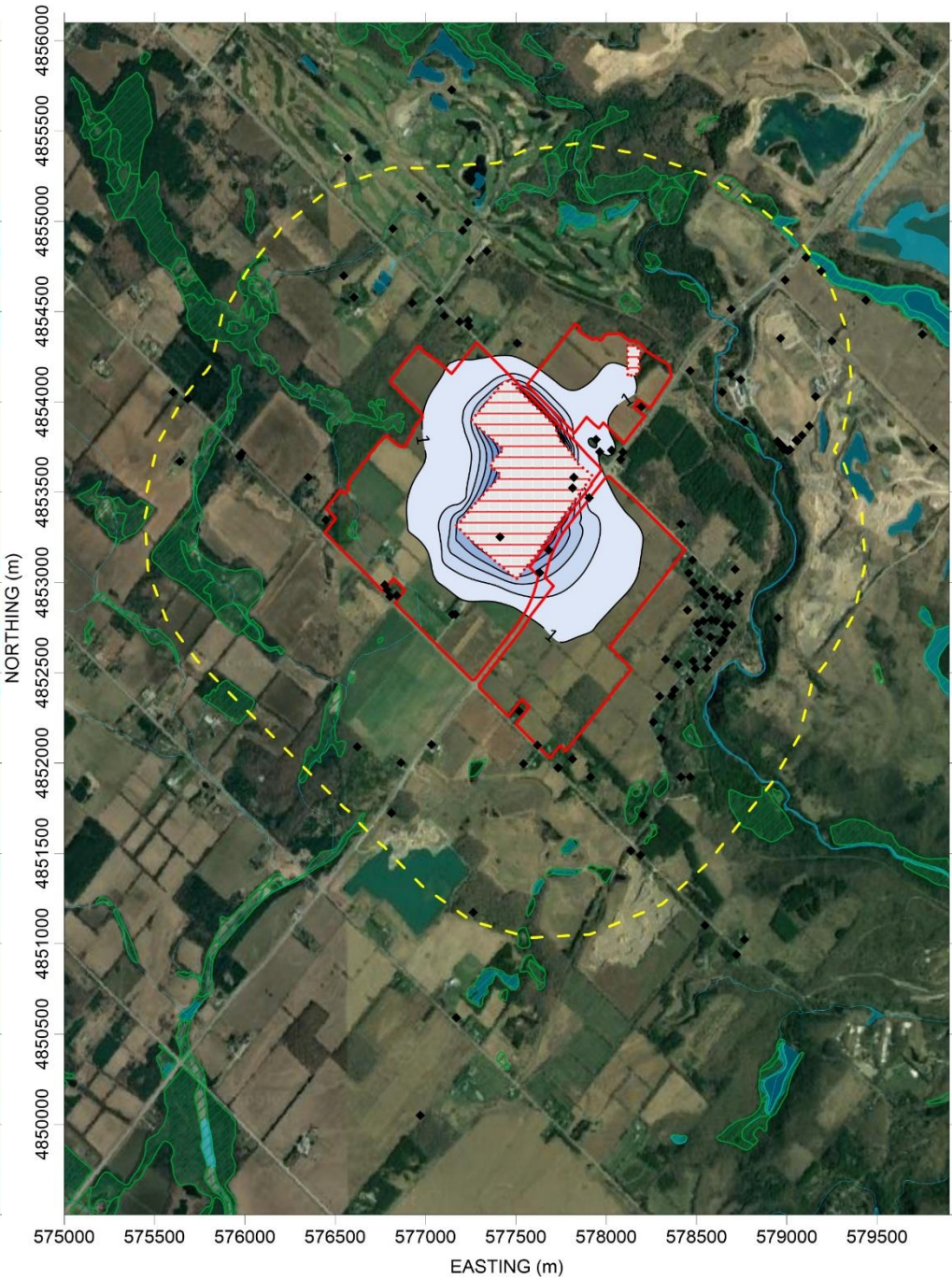
PROJECT No. 19129150 Rev. 0 FIGURE 7H



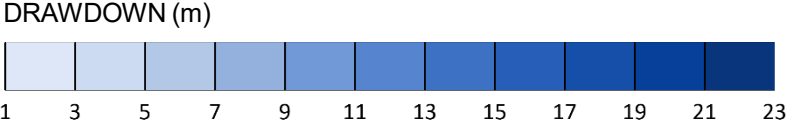
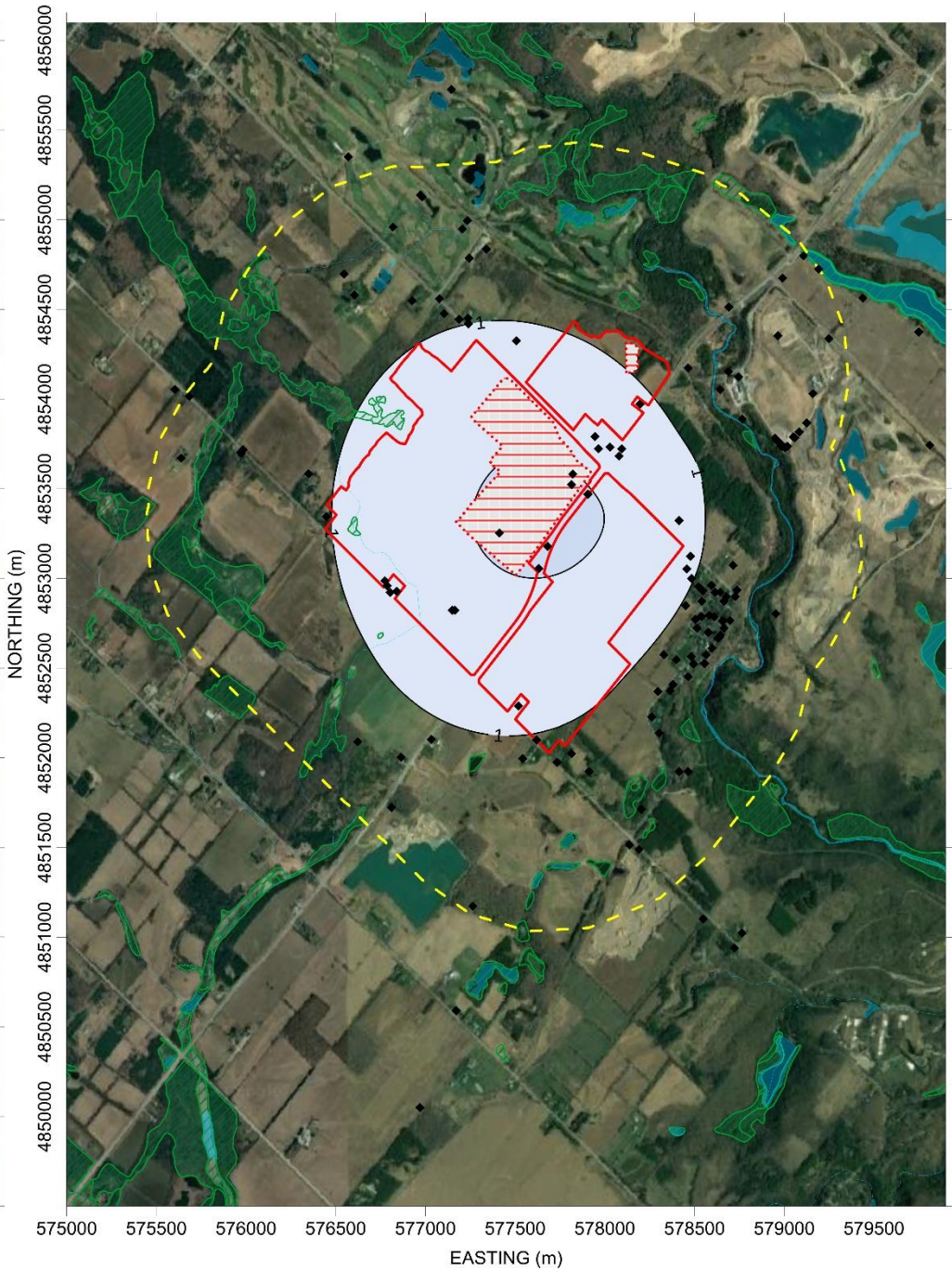
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - WETLAND
  - 1KM BUFFER AROUND PROPERTY
  - MECP PRIVATE WELL LOCATION

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

WSP

YYYY-MM-DD	2024-12-17
PREPARED	TG
DESIGN	HW
REVIEW	RS
APPROVED	GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

PHASE 1 SIMULATED DRAWDOWN

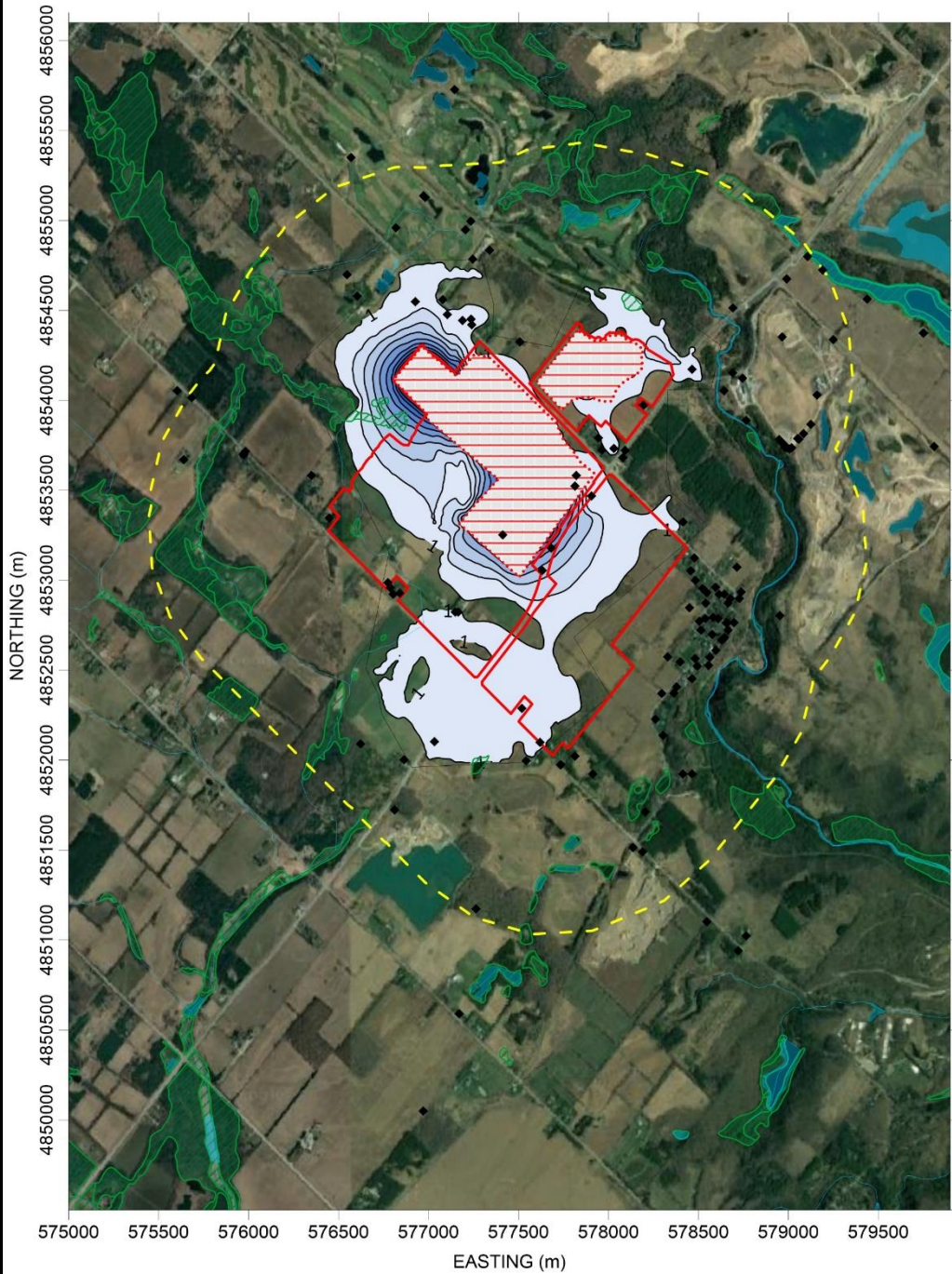
PROJECT No.	19129150	Rev.	0
-------------	----------	------	---

FIGURE

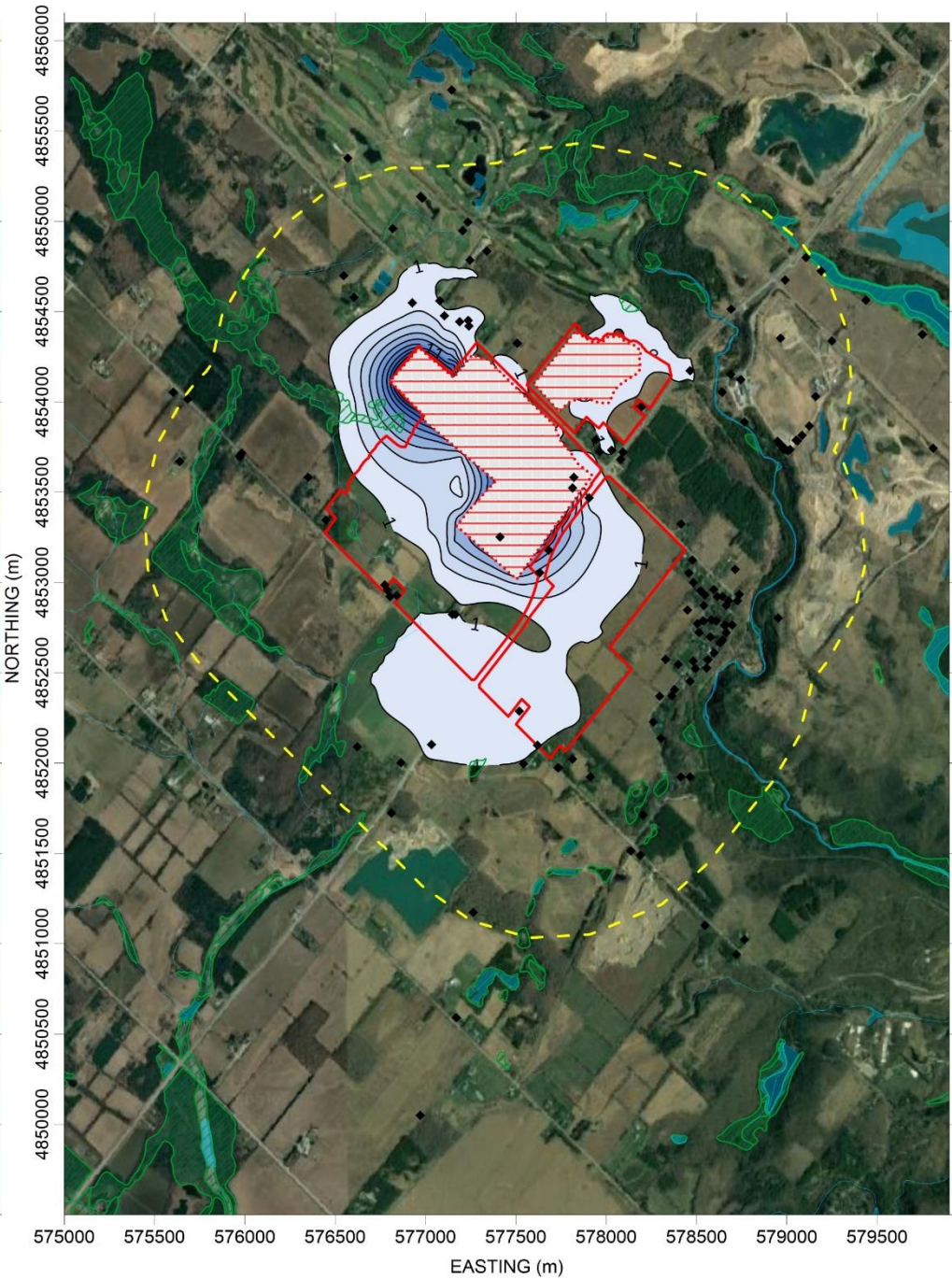
8A



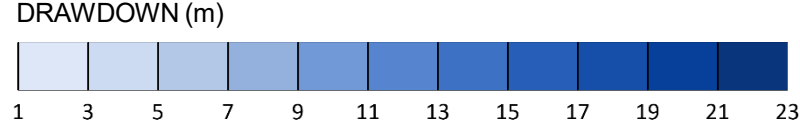
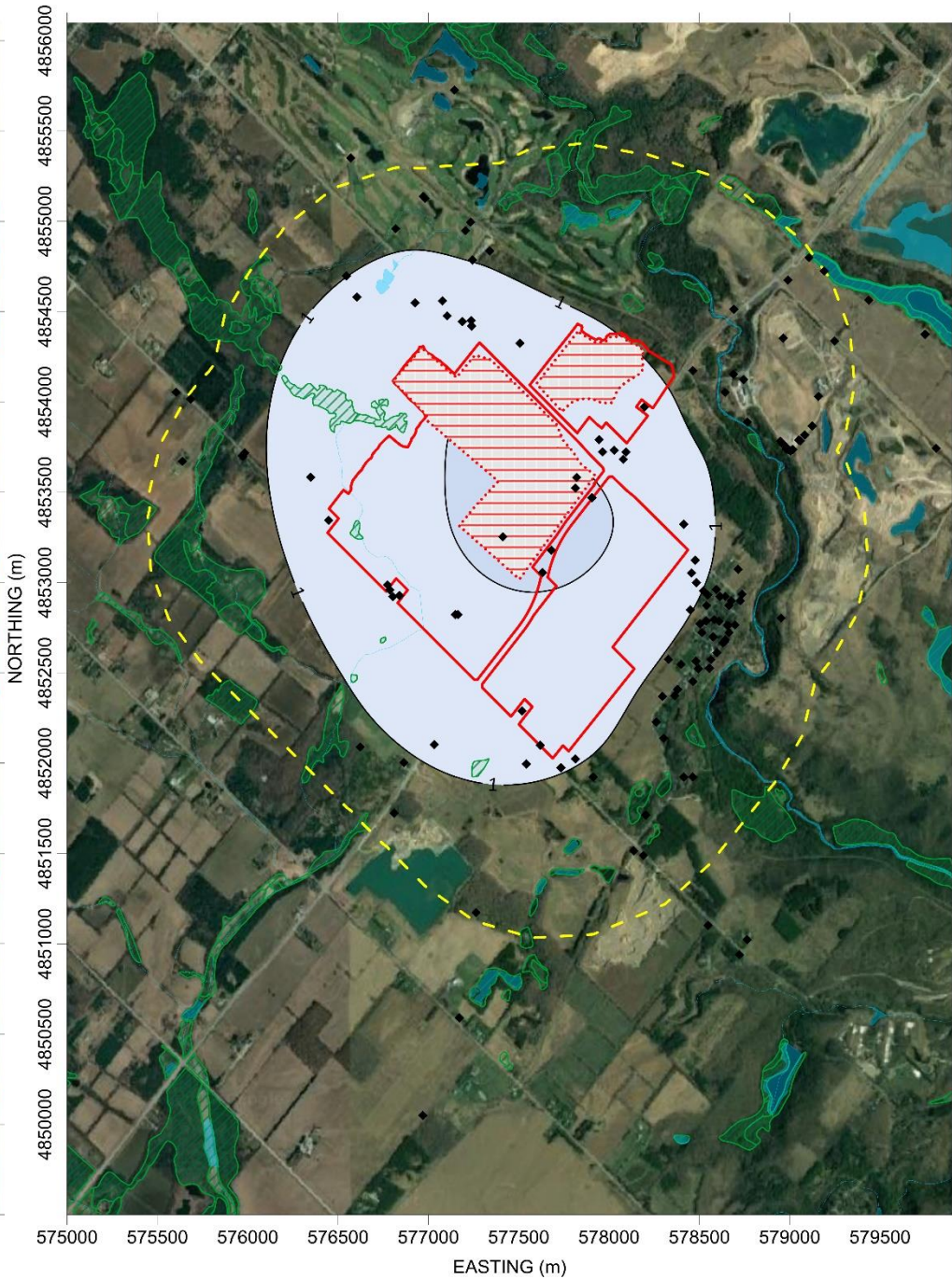
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



- LEGEND
- LAKES
  - RIVERS/ STREAMS
  - SITE PROPERTY BOUNDARY
  - EXTRACTION EXTENTS
  - WETLAND
  - 1KM BUFFER AROUND PROPERTY
  - MECP PRIVATE WELL LOCATION

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT



YYYY-MM-DD

2024-12-17

PREPARED

TG

DESIGN

HW

REVIEW

RS

APPROVED

GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

PHASE 2 SIMULATED DRAWDOWN

PROJECT No.

19129150

Rev.

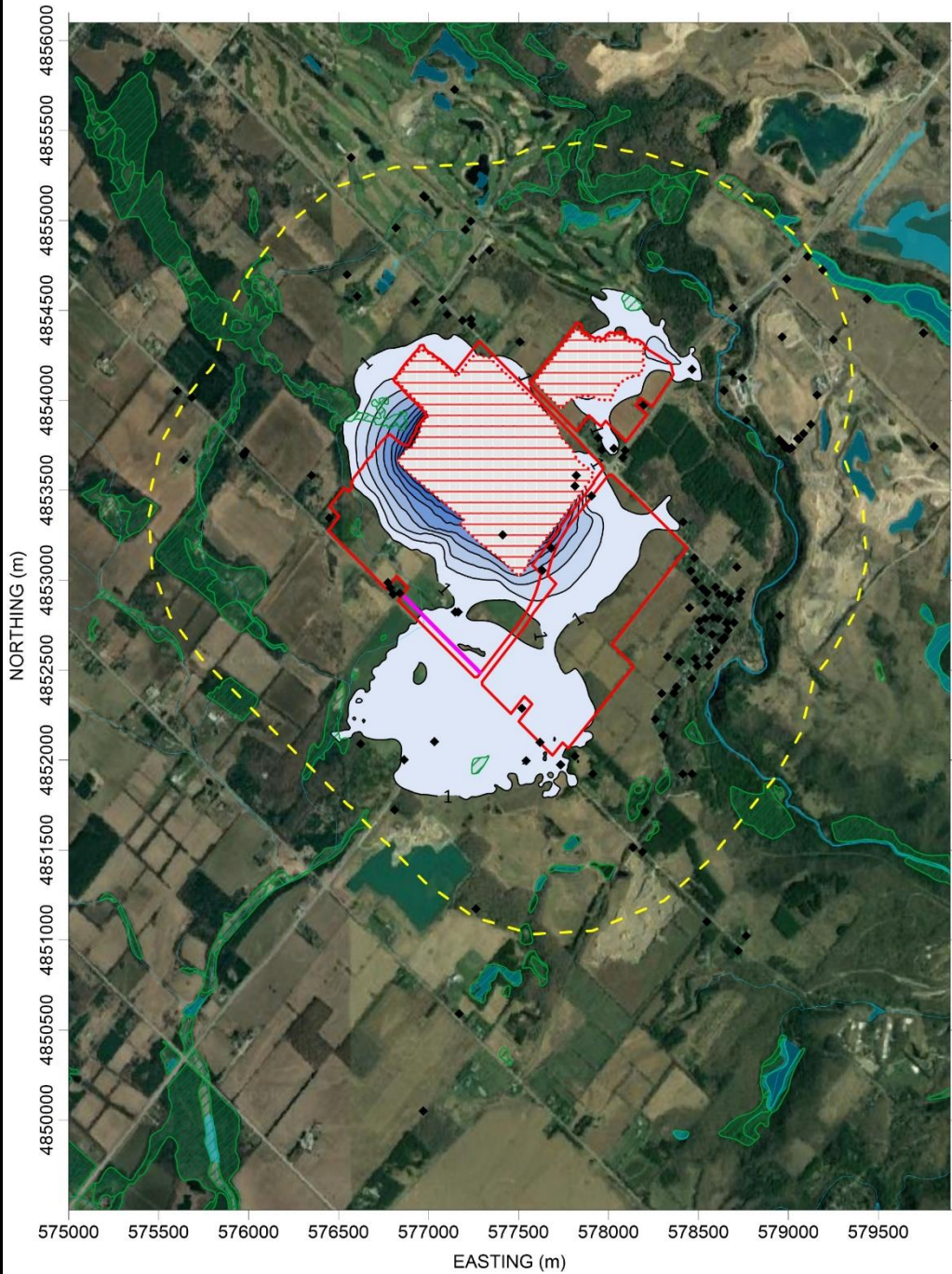
0

FIGURE

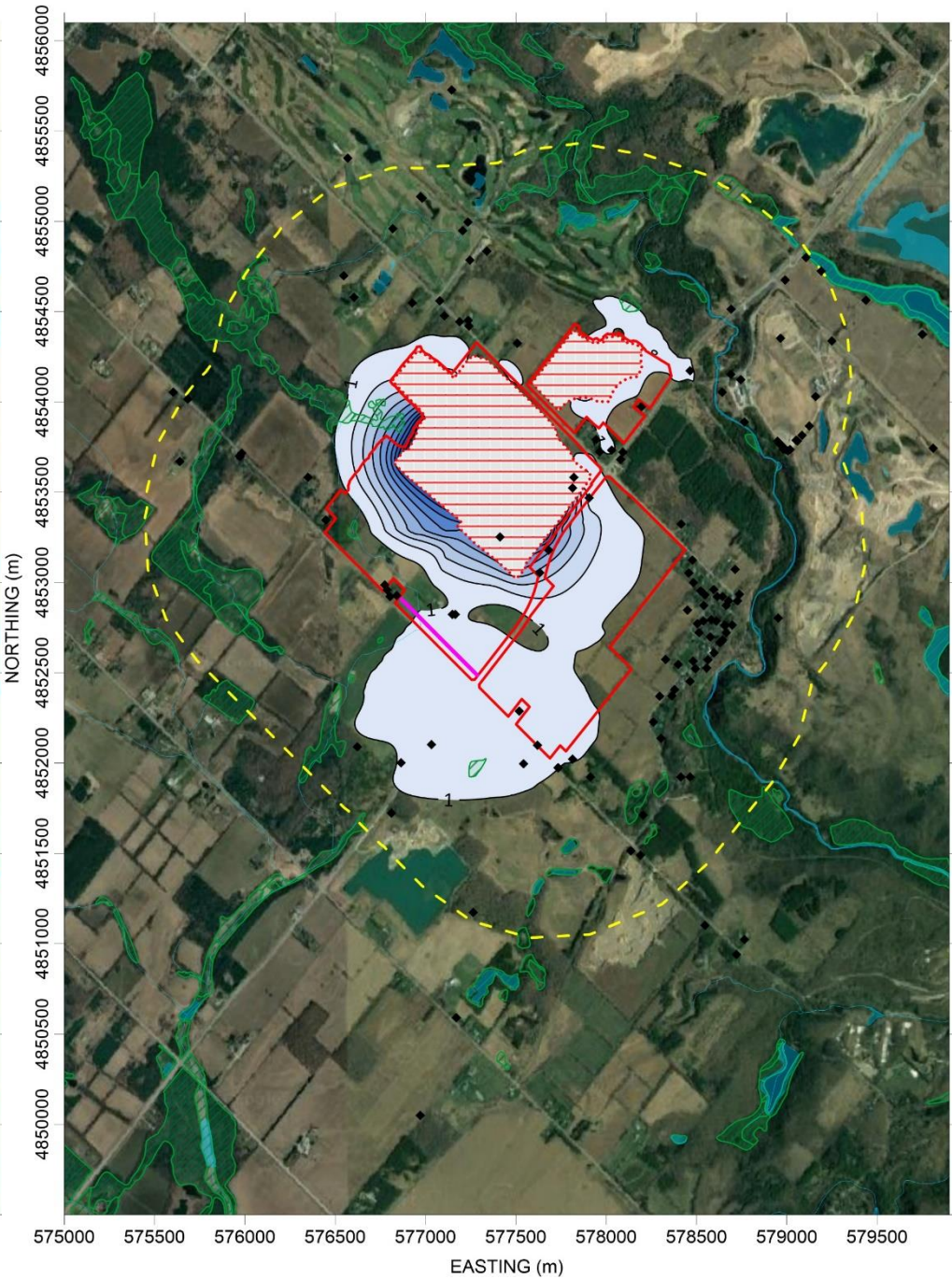
8B



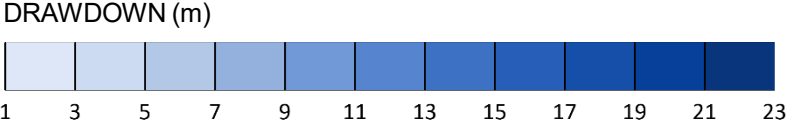
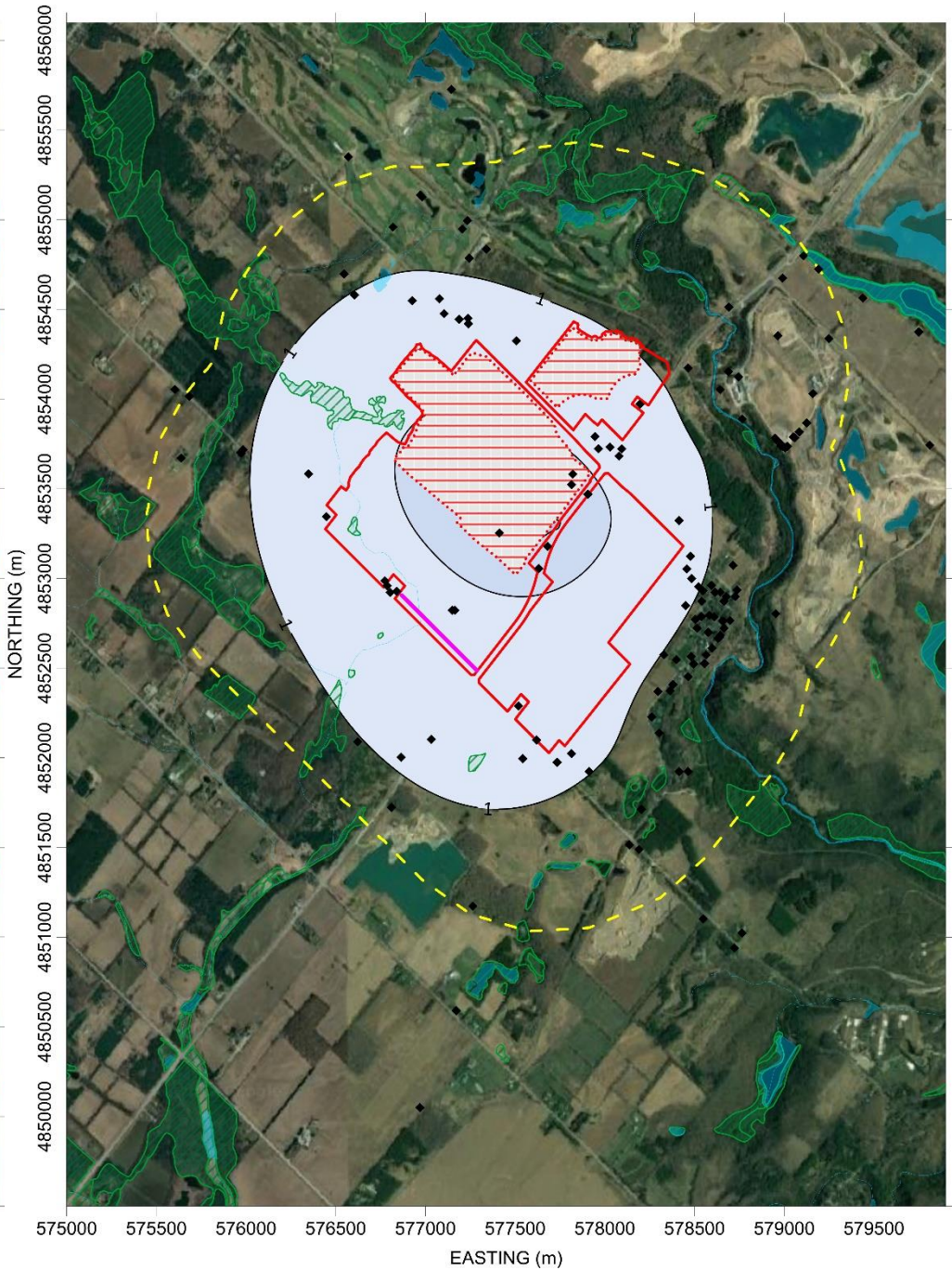
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



LEGEND

LAKES

RIVERS/ STREAMS

SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

WETLAND

1KM BUFFER AROUND PROPERTY

MECP PRIVATE WELL LOCATION

SLURRY WALL/ GROUT ALIGNMENT

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

YYYY-MM-DD

2024-12-17

PREPARED

TG

DESIGN

HW

REVIEW

RS

APPROVED

GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

PHASE 3 SIMULATED DRAWDOWN

PROJECT No.

19129150

Rev.

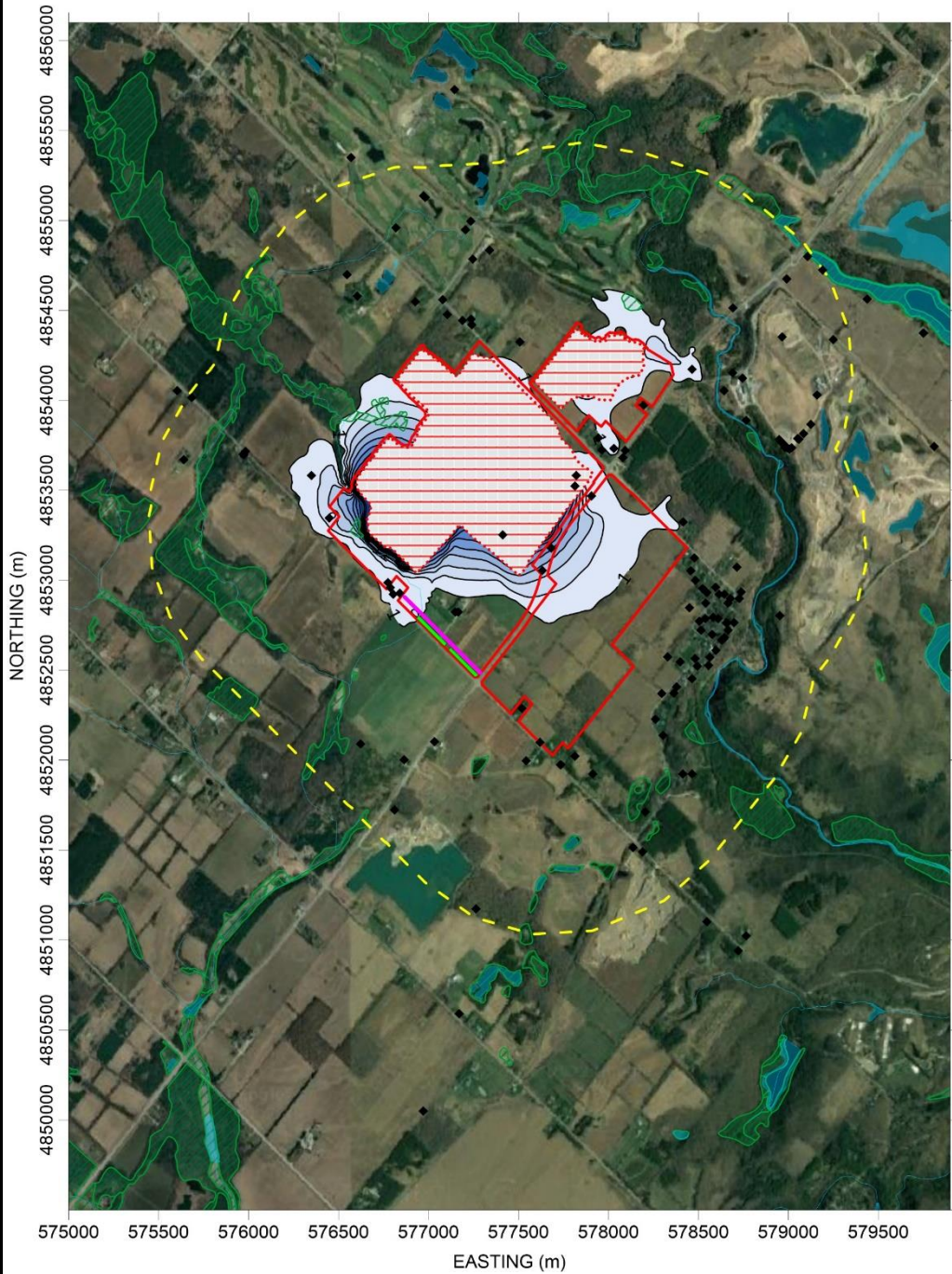
0

FIGURE

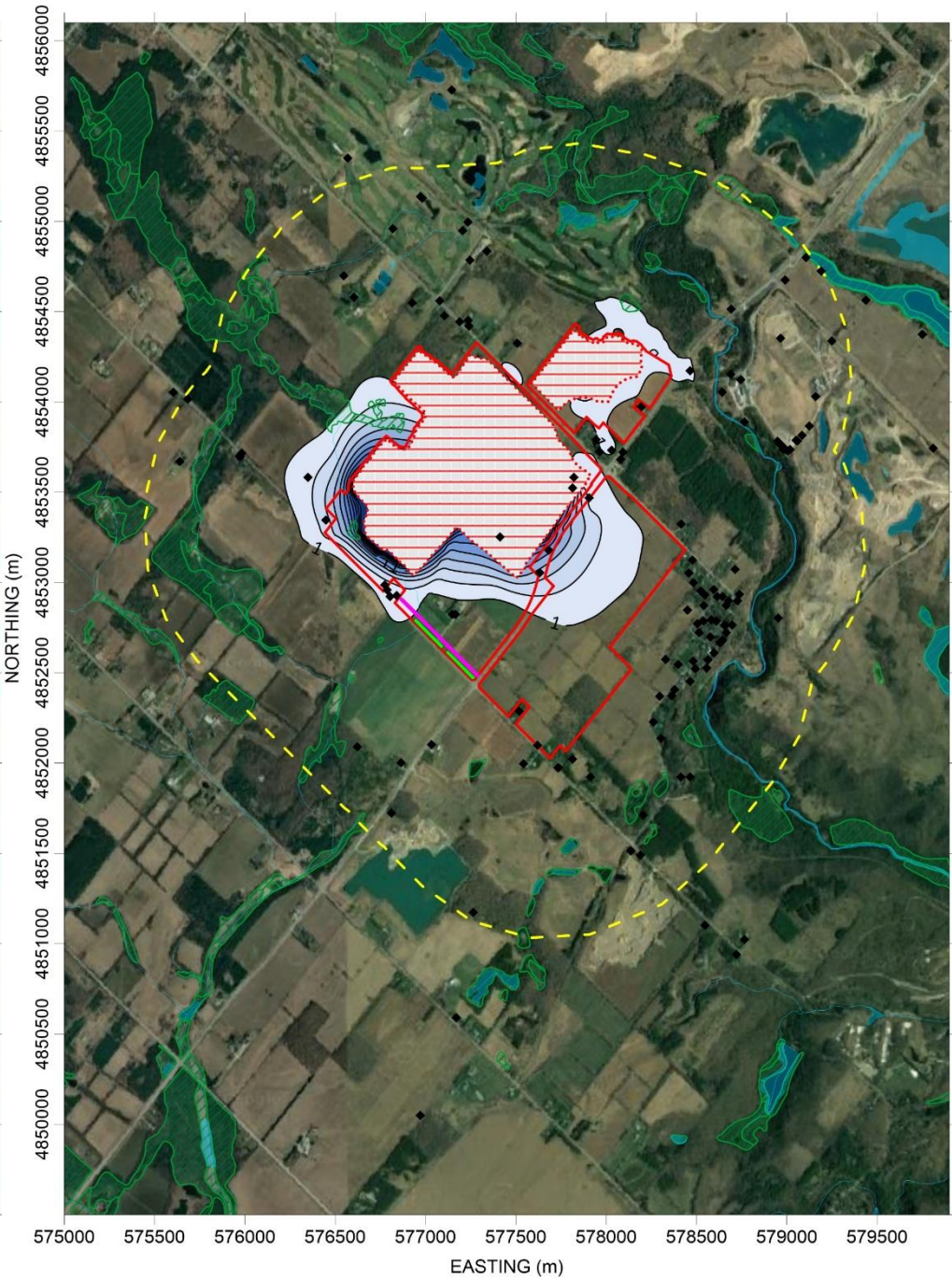
8C



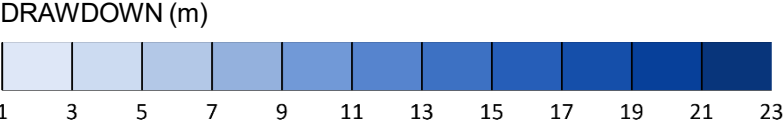
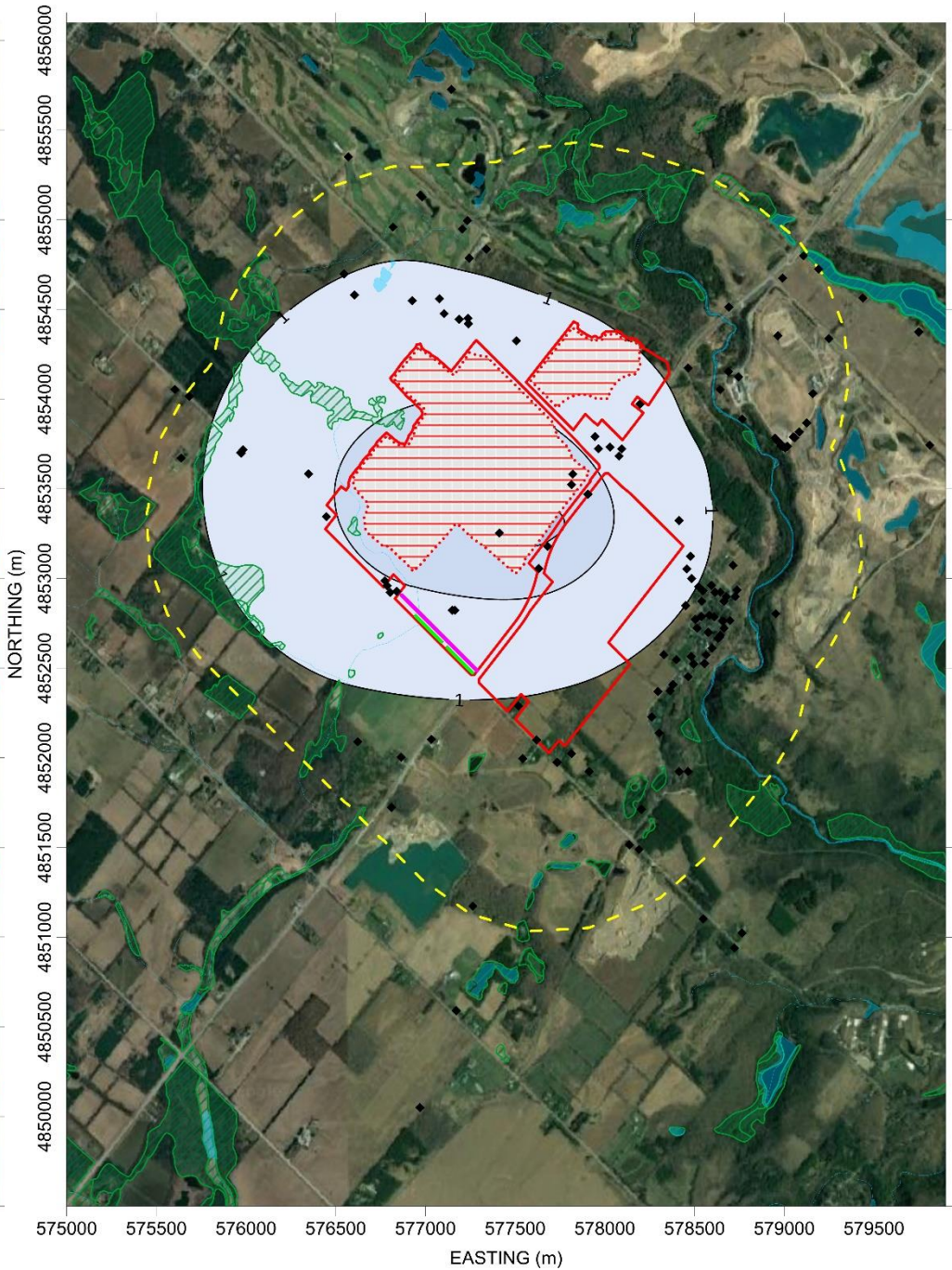
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



LEGEND

LAKES

RIVERS/ STREAMS

SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

WETLAND

1KM BUFFER AROUND PROPERTY

MECP PRIVATE WELL LOCATION

SLURRY WALL/ GROUT ALIGNMENT

INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

YYYY-MM-DD

2024-12-17

PREPARED

TG

DESIGN

HW

REVIEW

RS

APPROVED

GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

PHASE 4 SIMULATED DRAWDOWN

PROJECT No.

19129150

Rev.

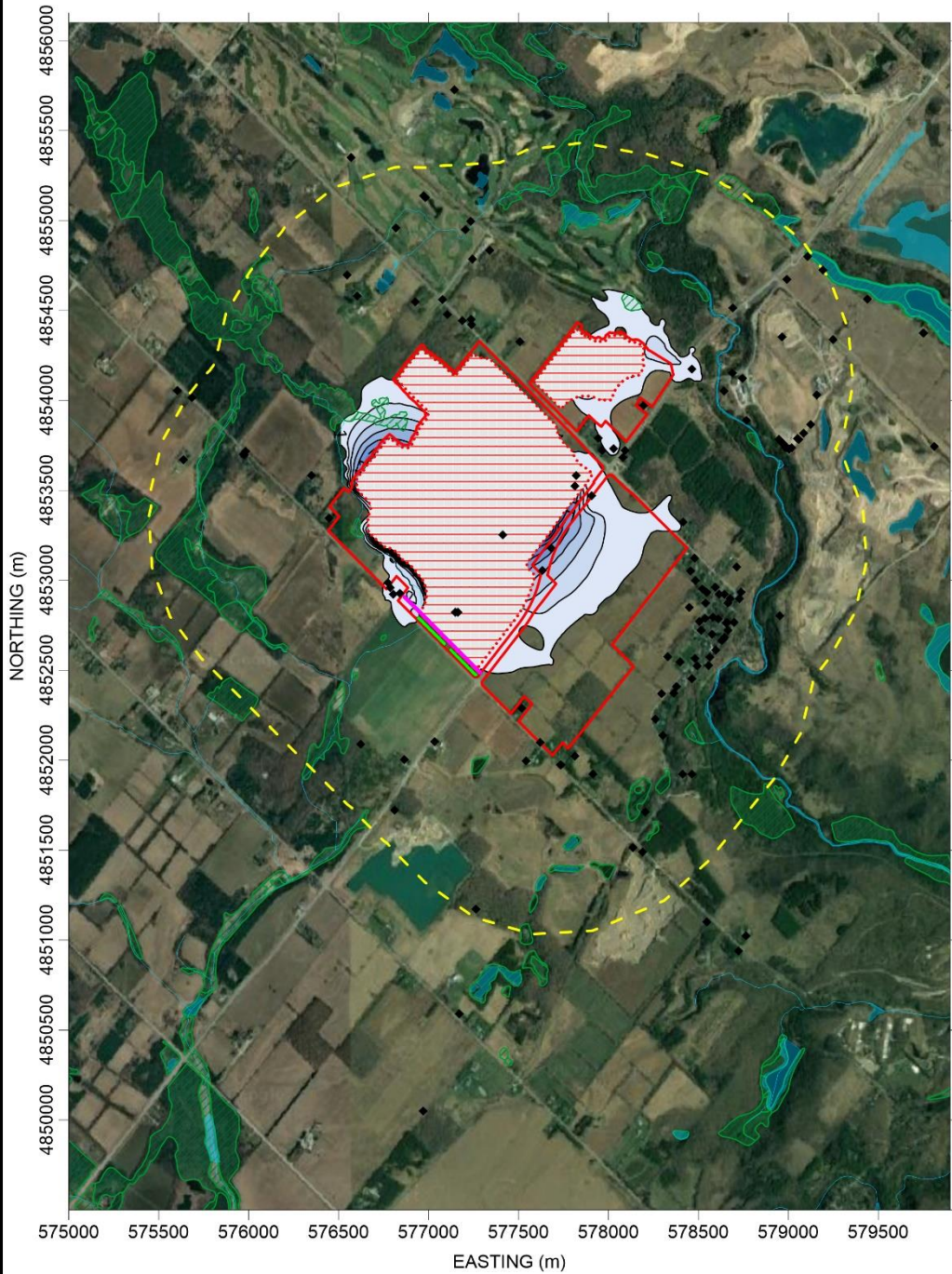
0

FIGURE

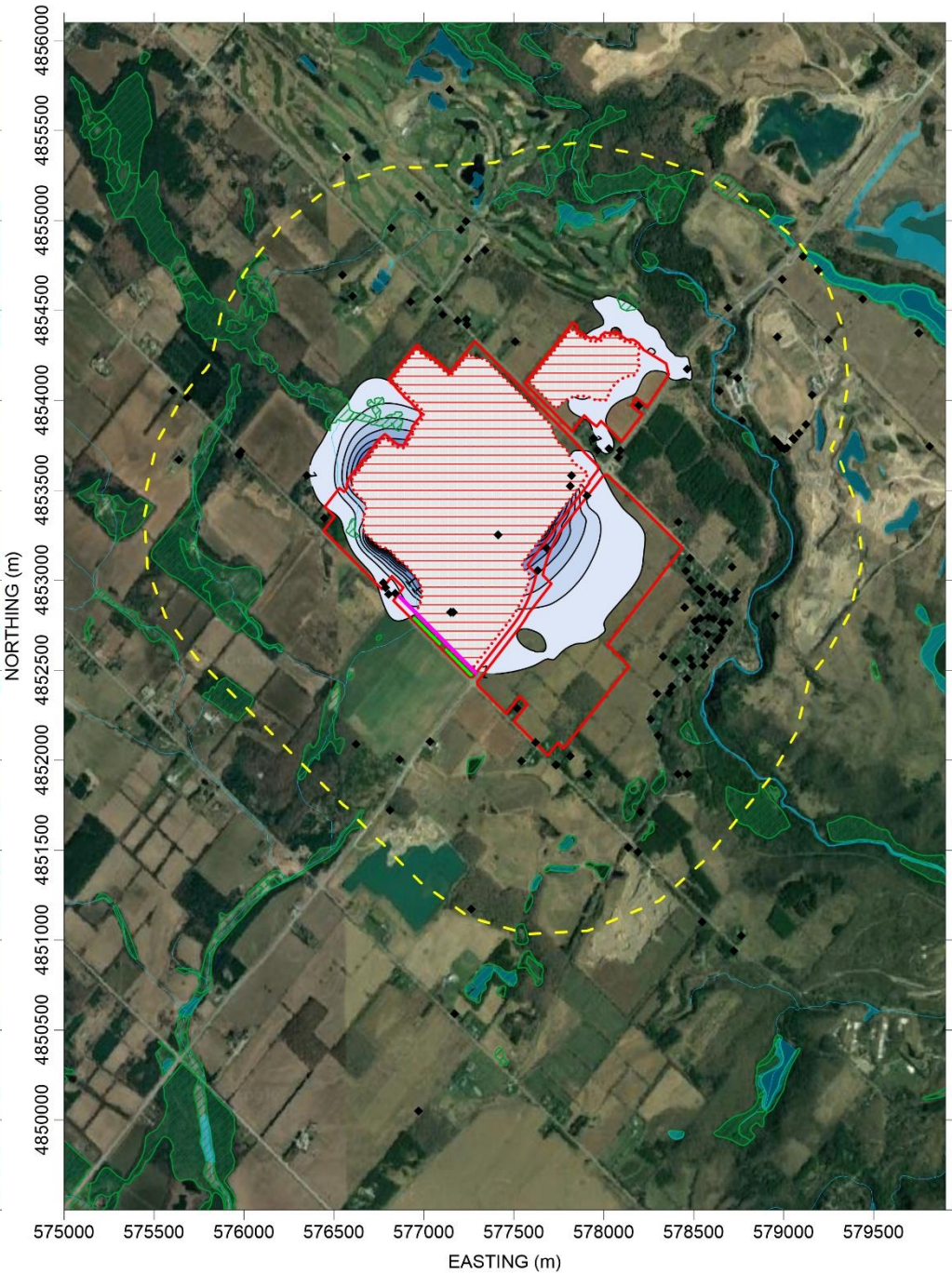
8D



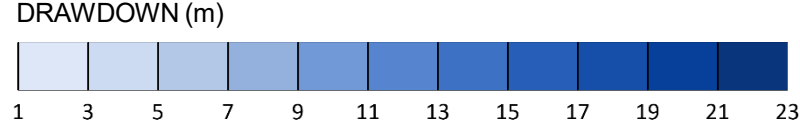
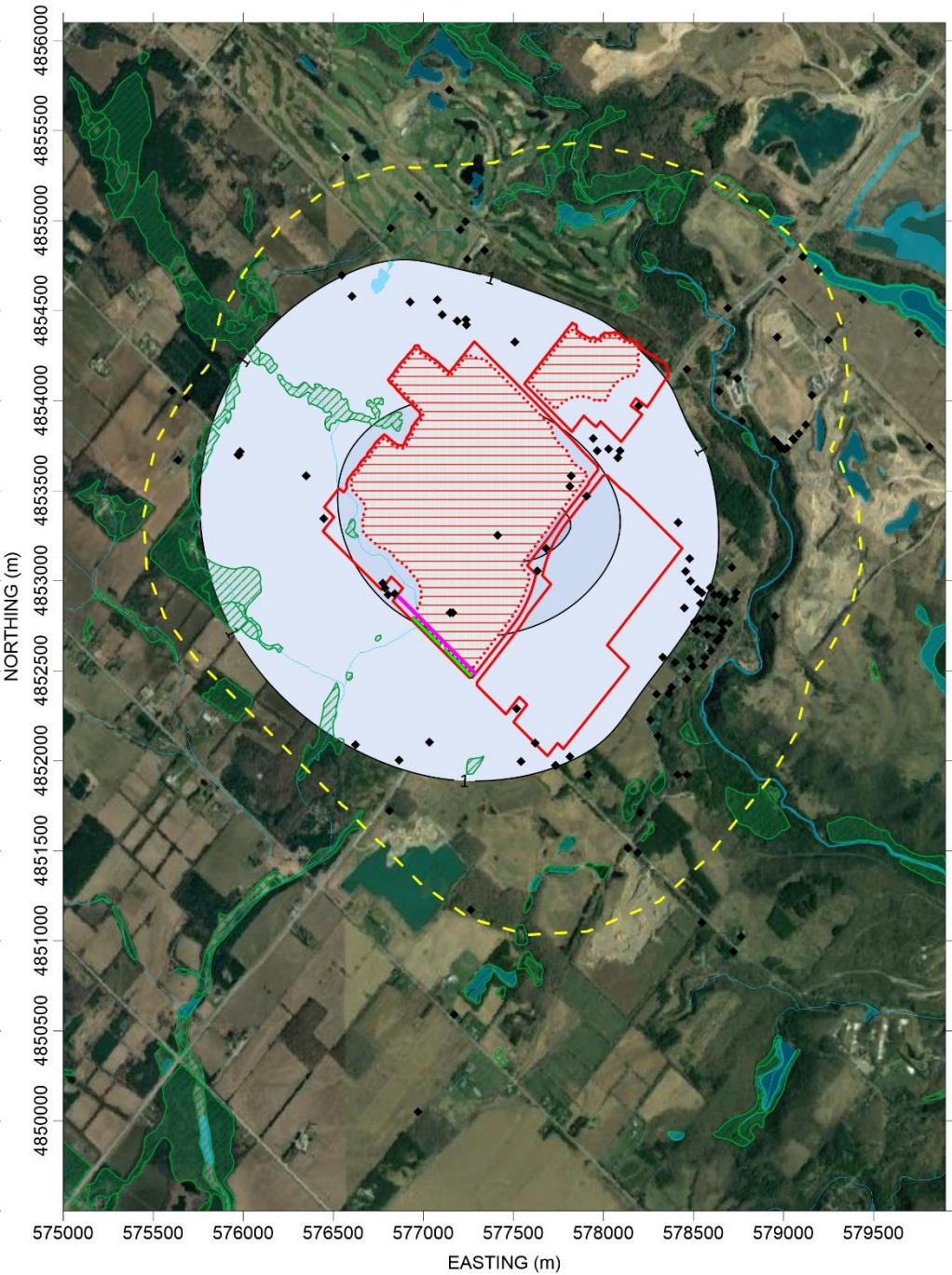
1. SIMULATED WATER TABLE DRAWDOWN (m)












2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)




LEGEND

	LAKES		SLURRY WALL/ GROUT ALIGNMENT
	RIVERS/ STREAMS		INFILTRATION TRENCH
	SITE PROPERTY BOUNDARY		
	EXTRACTION EXTENTS		
	WETLAND		
	1KM BUFFER AROUND PROPERTY		
	MECP PRIVATE WELL LOCATION		

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

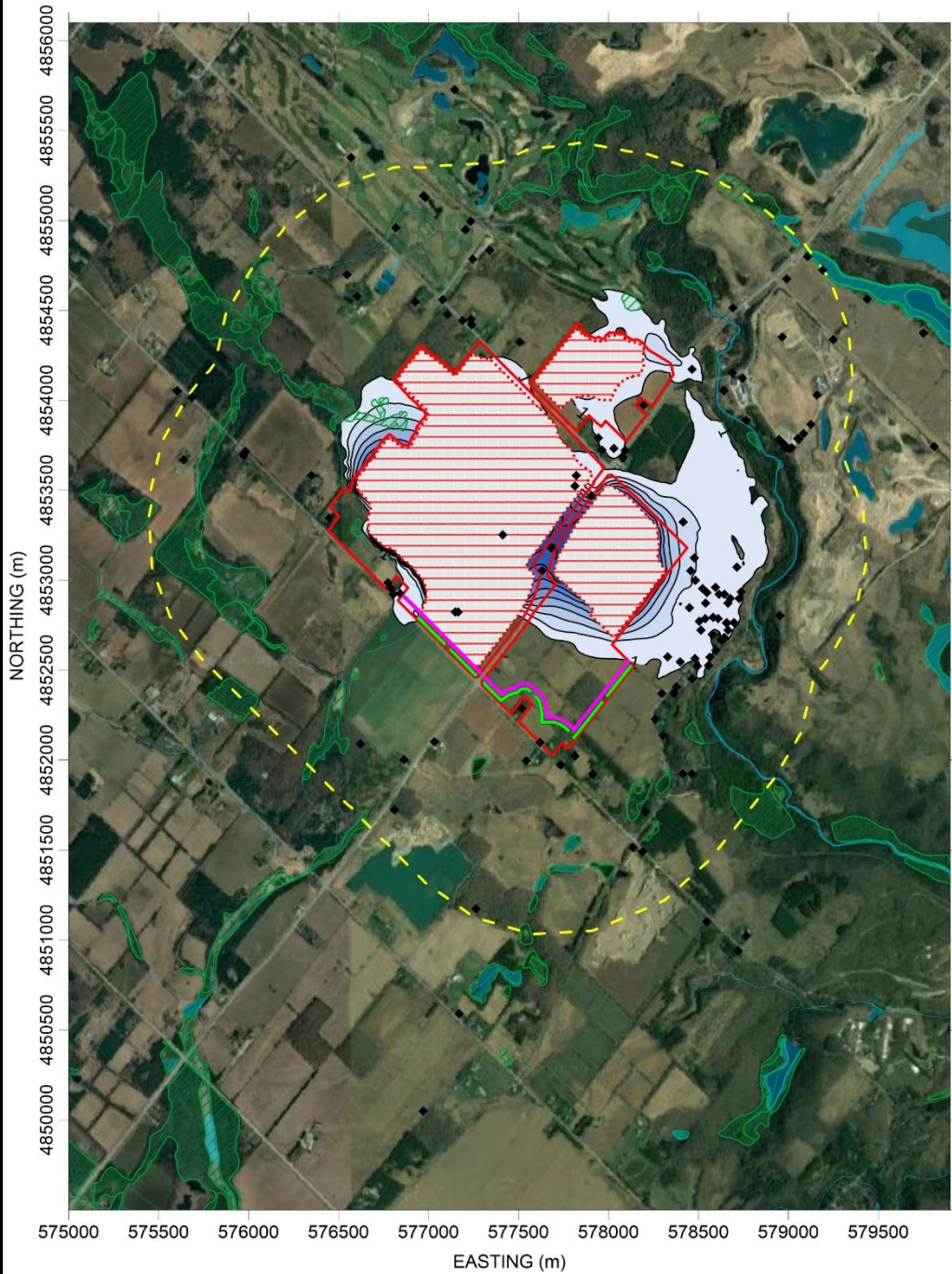
CLIENT	CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)	
CONSULTANT		
YYYY-MM-DD	2025-03-10	
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	

PROJECT	CALEDON PIT AND QUARRY NUMERICAL MODELLING	
TITLE	PHASE 5 SIMULATED DRAWDOWN	
PROJECT No.	19129150	Rev. 0

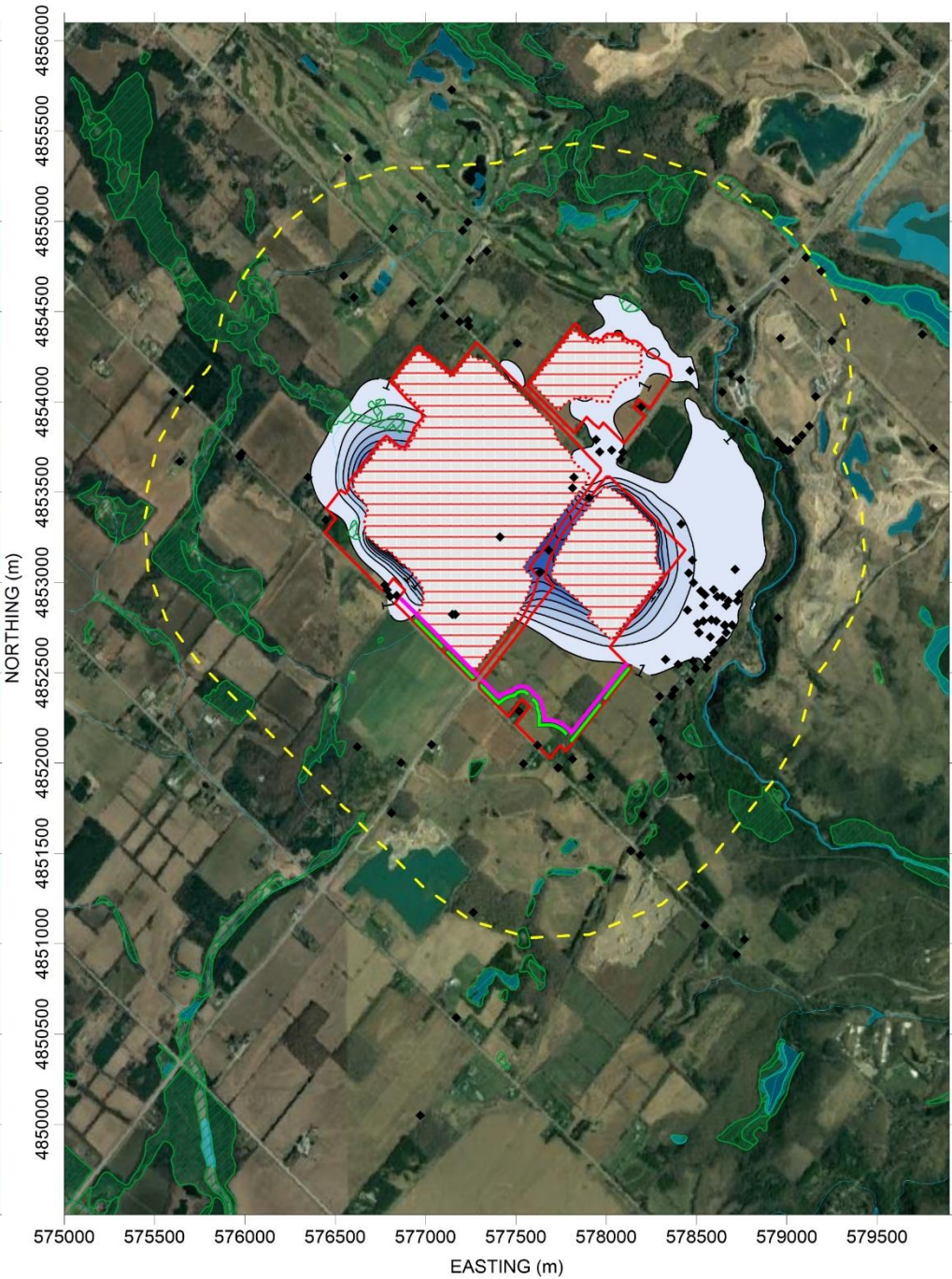
FIGURE 8E



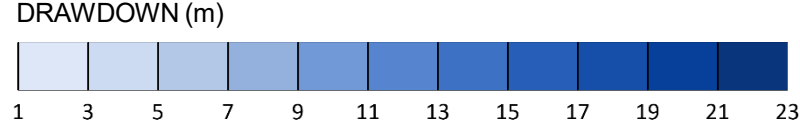
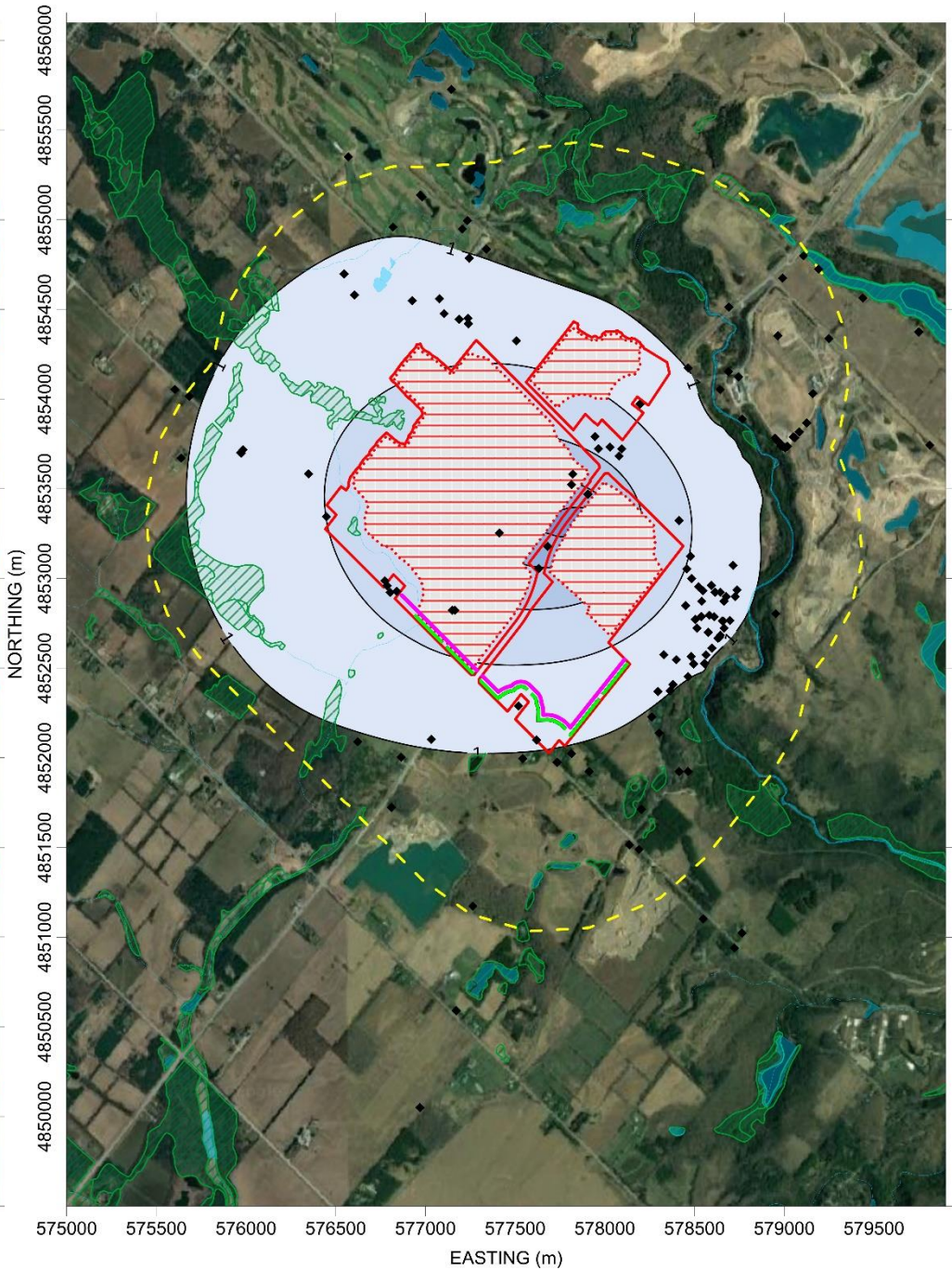
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



LEGEND

LAKES

RIVERS/ STREAMS

SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

WETLAND

1KM BUFFER AROUND PROPERTY

MECP PRIVATE WELL LOCATION

SLURRY WALL/ GROUT ALIGNMENT

INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

YYYY-MM-DD

2024-12-17

PREPARED

TG

DESIGN

HW

REVIEW

RS

APPROVED

GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

PHASE 6 SIMULATED DRAWDOWN

PROJECT No.

19129150

Rev.

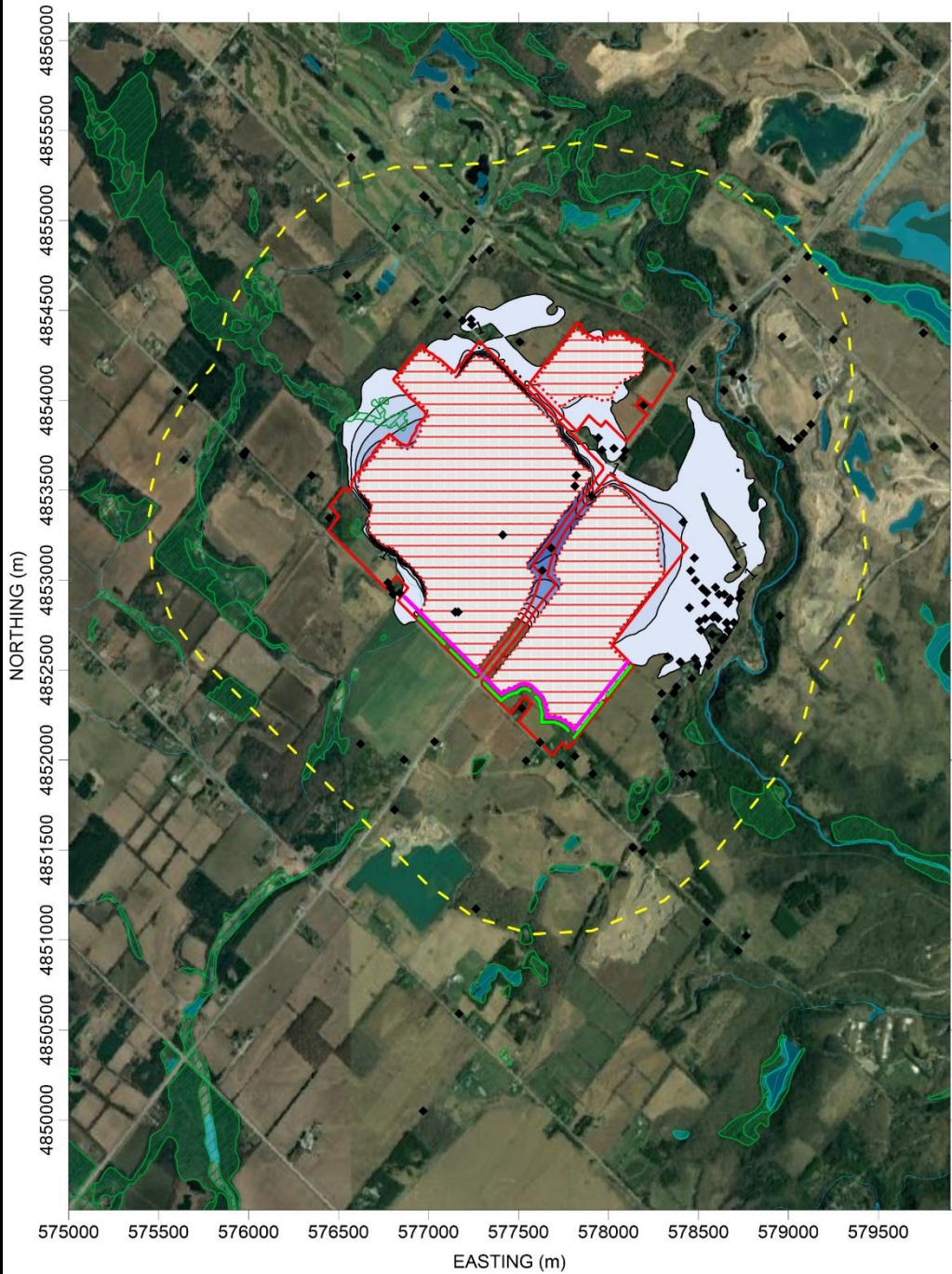
0

FIGURE

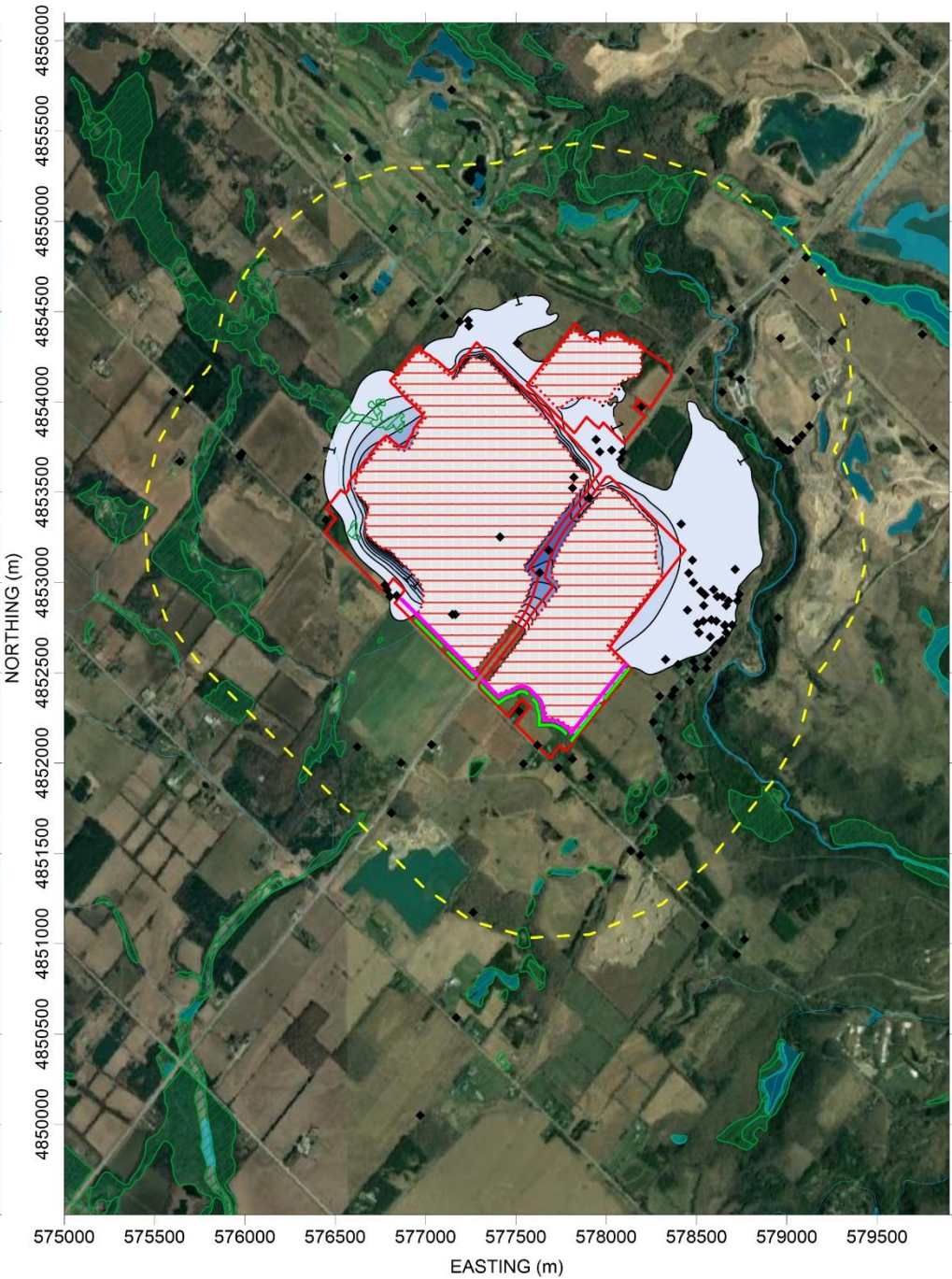
8F



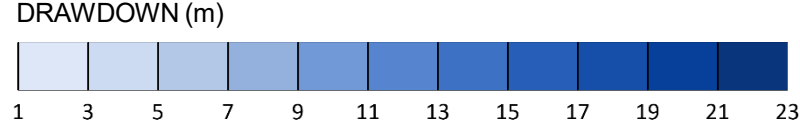
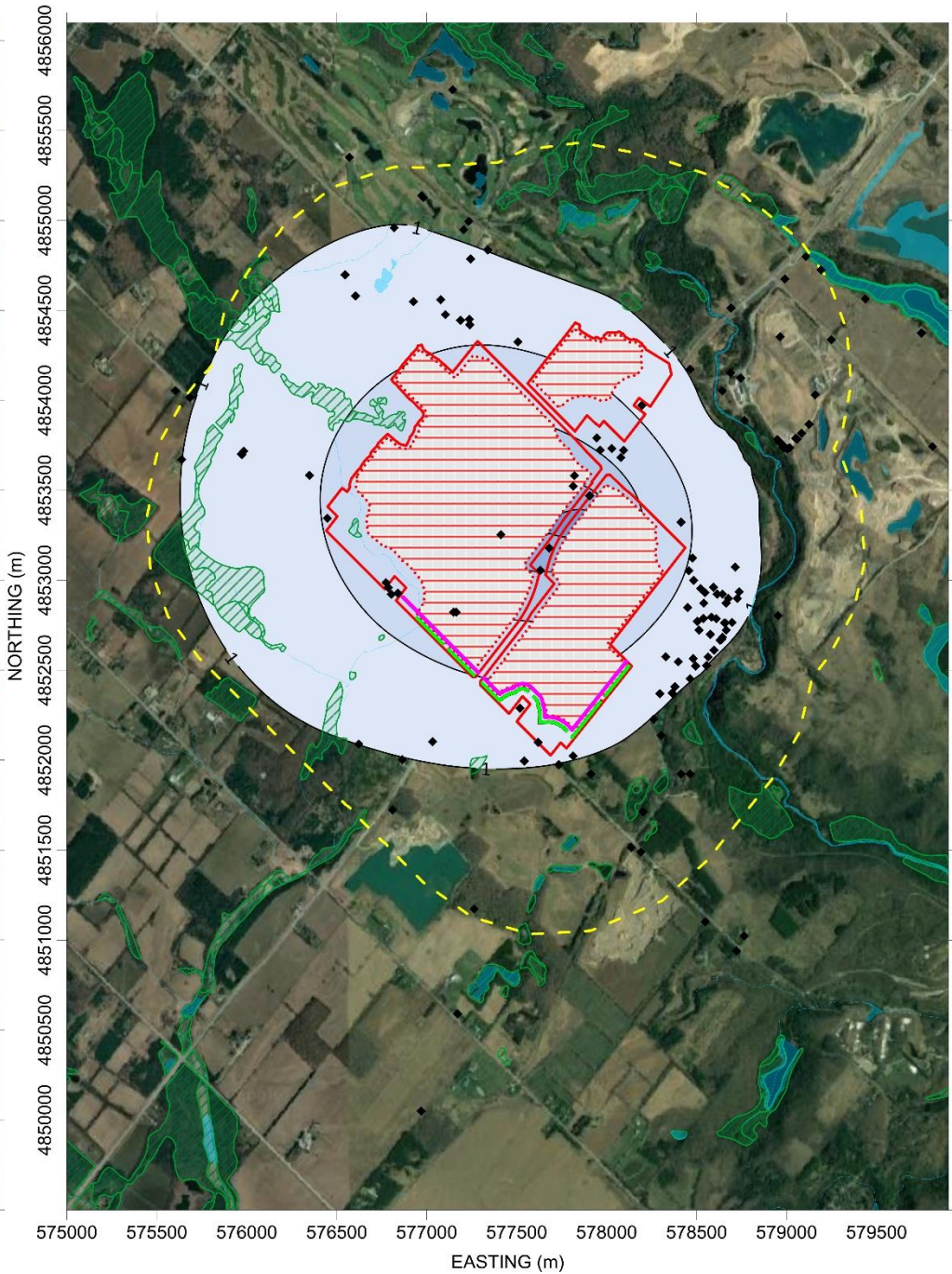
1. SIMULATED WATER TABLE DRAWDOWN (m)











2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)




LEGEND

 LAKES	 SLURRY WALL/ GROUT ALIGNMENT
 RIVERS/ STREAMS	 INFILTRATION TRENCH
 SITE PROPERTY BOUNDARY	
 EXTRACTION EXTENTS	
 WETLAND	
 1KM BUFFER AROUND PROPERTY	
 MECP PRIVATE WELL LOCATION	

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

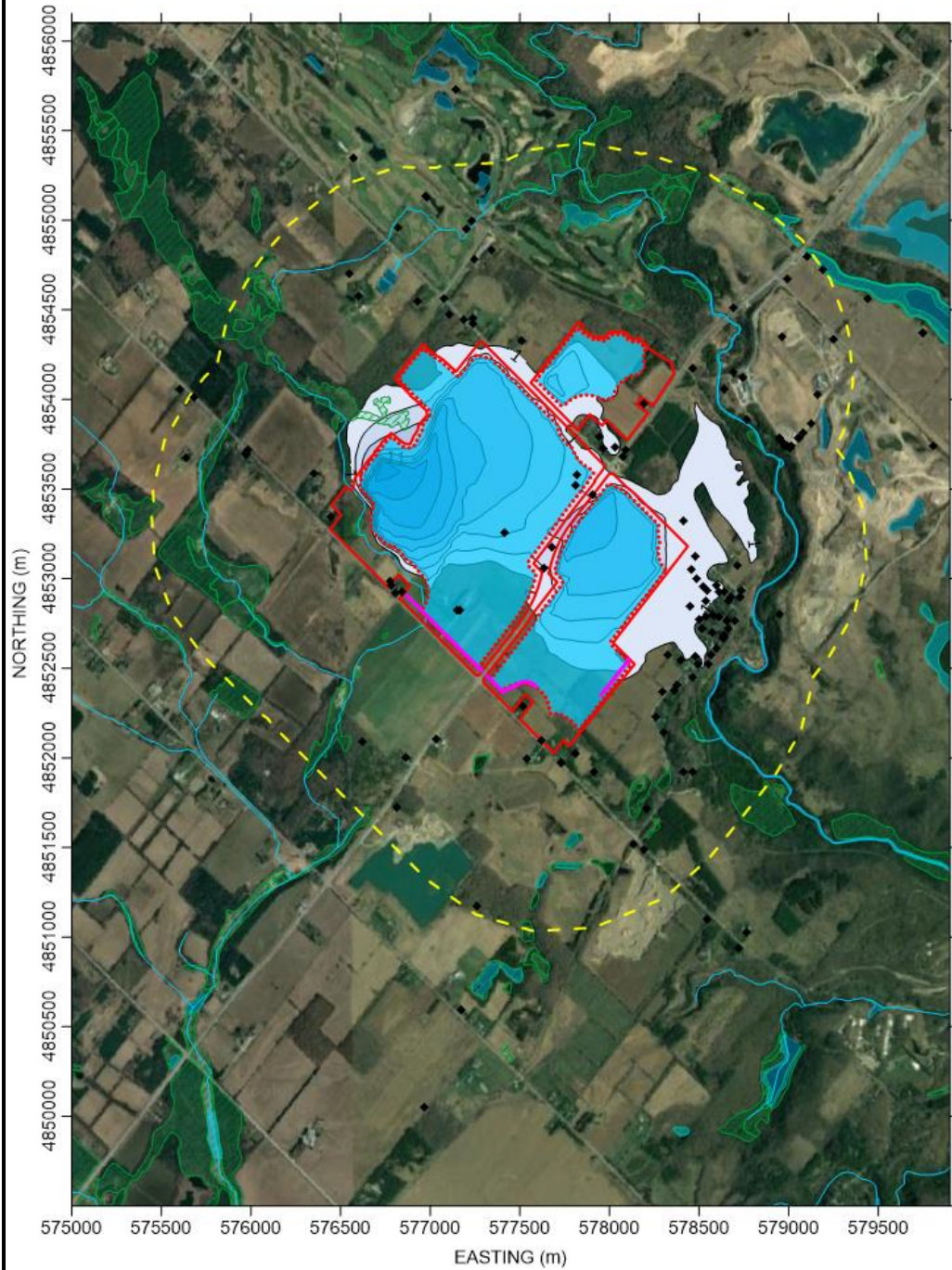
- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT	CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)	
CONSULTANT		
YYYY-MM-DD	2024-12-17	
PREPARED	TG	
DESIGN	HW	
REVIEW	RS	
APPROVED	GS	

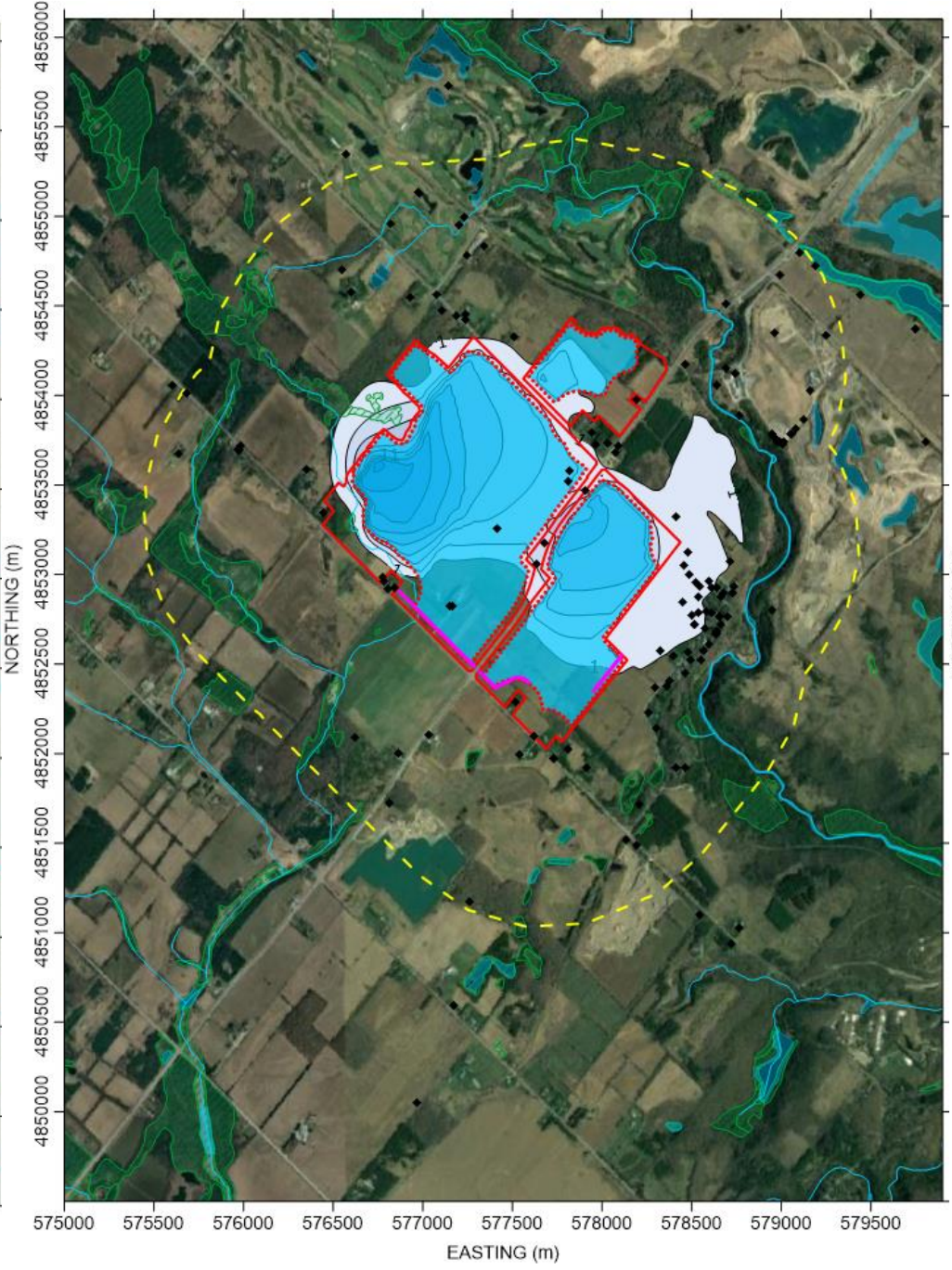
PROJECT	CALEDON PIT AND QUARRY NUMERICAL MODELLING	
TITLE	PHASE 7 SIMULATED DRAWDOWN	
PROJECT No.	19129150	Rev. 0
FIGURE	8G	



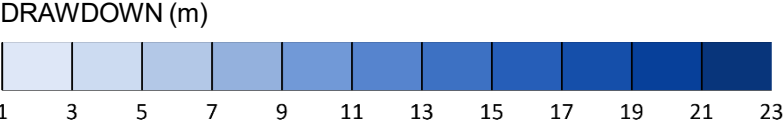
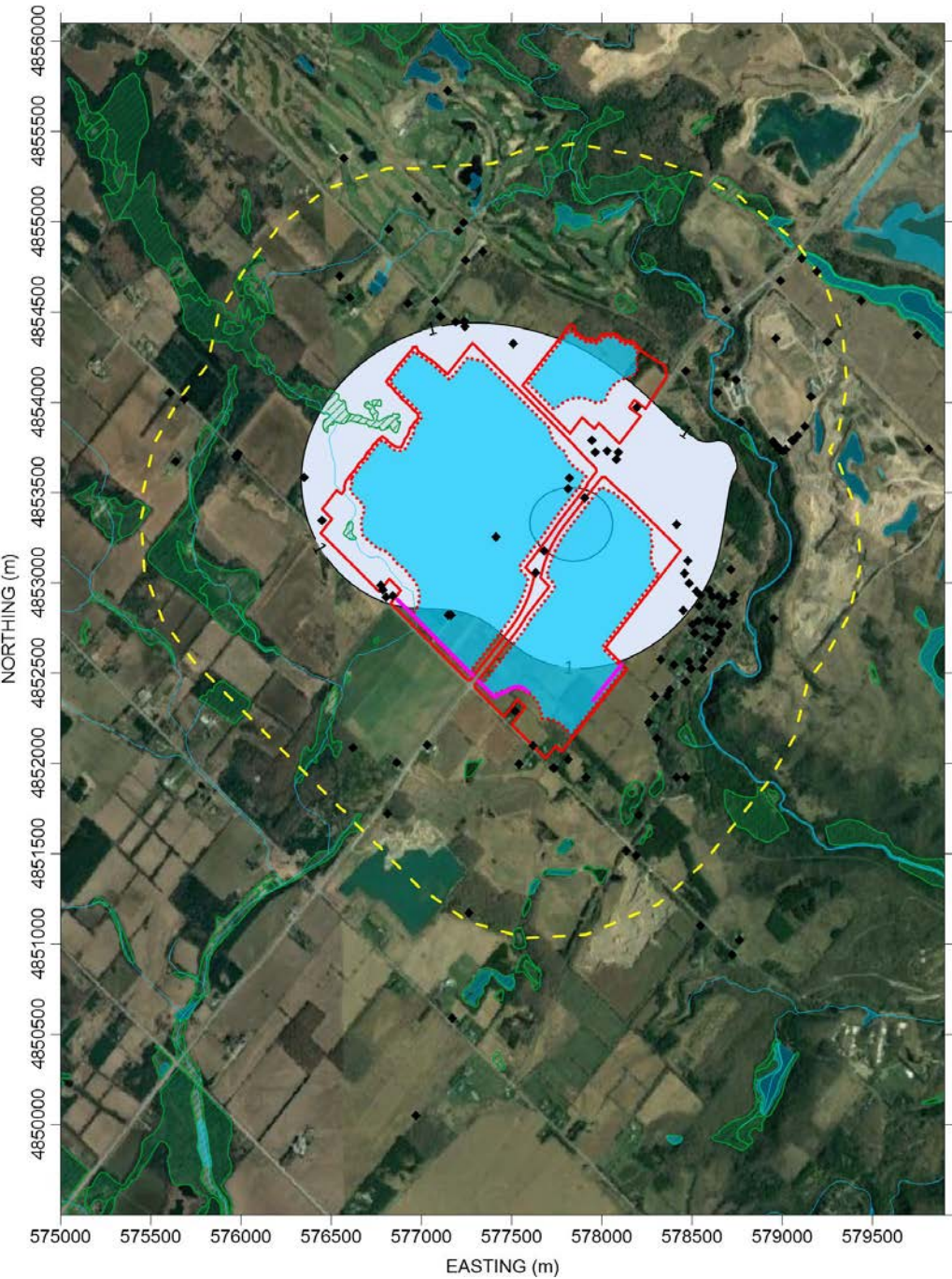
1. SIMULATED WATER TABLE DRAWDOWN (m)



2. SIMULATED GASPORT FORMATION DRAWDOWN (m)



3. SIMULATED MANITOULIN/ WHIRLPOOL FORMATION DRAWDOWN (m)



LEGEND

LAKES

RIVERS/ STREAMS

SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

WETLAND

1KM BUFFER AROUND PROPERTY

MECP PRIVATE WELL LOCATION

SLURRY WALL/ GROUT ALIGNMENT

INFILTRATION TRENCH

Phase of Operation	Years
1	1 to 8
2	9 to 13
3	14 to 17
4	18 to 22
5	23 to 26
6	27 to 32
7	33 to 38

- NOTES
1. Simulated drawdown is shown at a contour interval of 2m
  2. Gasport formation drawdown extracted from model slice 22 (base of Gasport)
  3. Manitoulin/ Whirlpool formation drawdown extracted from model slice 25
  4. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
  5. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT

YYYY-MM-DD

2025-05-09

PREPARED

TG

DESIGN

HW

REVIEW

RS

APPROVED

GS

PROJECT

CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE

REHABILITATION SIMULATED DRAWDOWN

PROJECT No.

19129150

Rev.

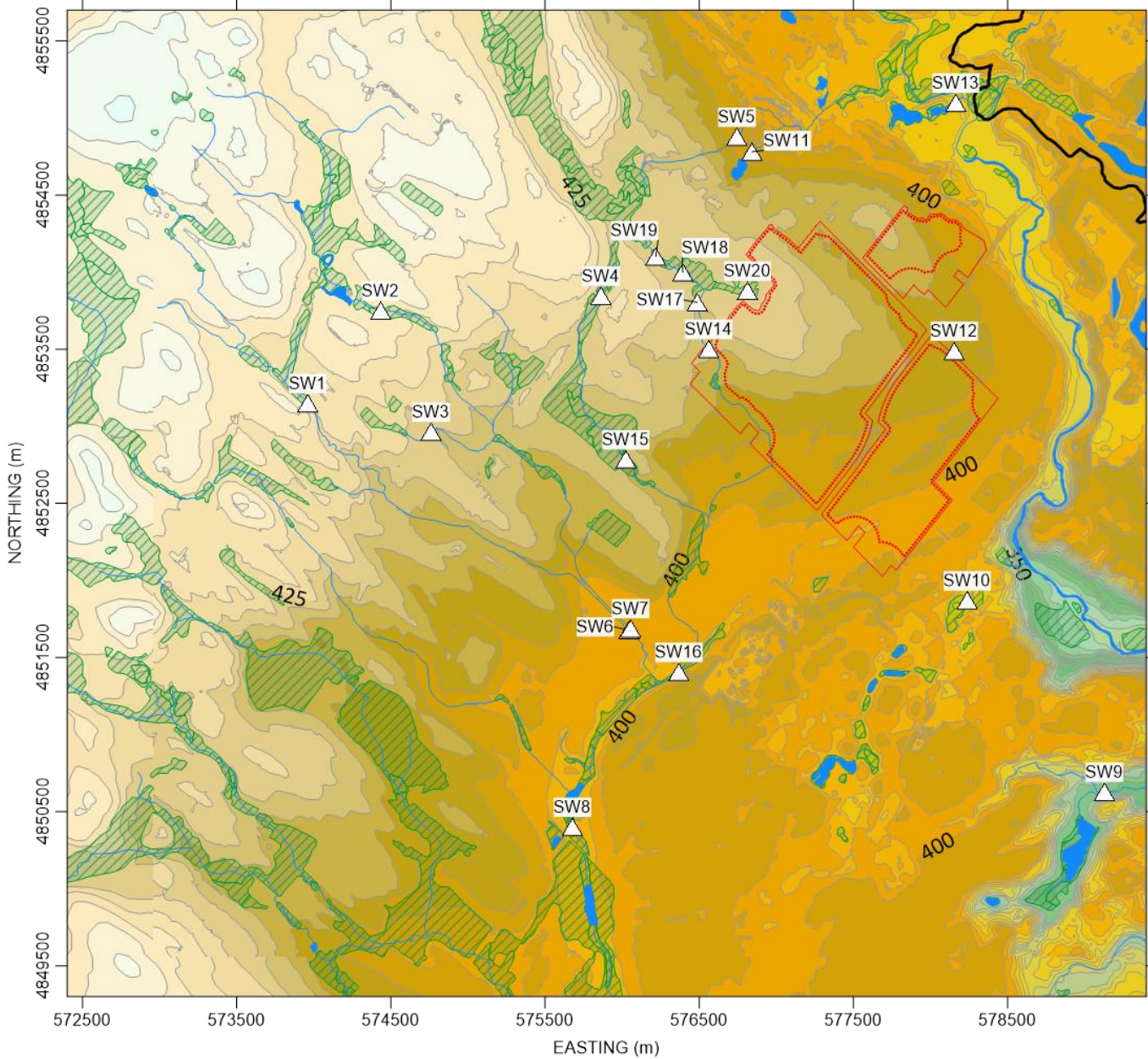
0

FIGURE

8H



SURFACE WATER MONITORING STATIONS



CURRENT CONDITIONS TOPOGRAPHY (MASL)



300 315 330 345 360 375 390 405 420 435 450 465 480

NOTES:

1. Simulated surface water flows for phases 1-7 and rehabilitation represent long term average (steady state) values
2. Several surface water stations have a current conditions simulated flow of 0.00 L/s (SW2, SW4, SW5, SW10, SW11, SW12, SW15 and SW16), and continue to have a simulated flow of 0.00 L/s throughout quarry operation and rehabilitation

LEGEND

- LAKES

RIVERS/ STREAMS

WETLAND
- SITE PROPERTY BOUNDARY

EXTRACTION EXTENTS

SURFACE WATER MONITORING STATION

ADDITIONAL MAP NOTES

3. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
4. Source of Regional Topography dataset Ontario Ministry of Natural Resources and Forestry (MNR) Southwestern Ontario Orthophotography (SWOOP) 2019
5. Source of Site Topography dataset provided by Firstbase Solutions (Spring 2021)
6. Quarry license and limit of extraction provided by MHBC (2022)

CLIENT

CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT



YYYY-MM-DD 2025-05-09

PREPARED TG

DESIGN HW

REVIEW RS

APPROVED GS

PROJECT

CALEDON PIT AND QUARRY

TITLE

SIMULATED CHANGE IN SURFACE WATER FLOW AT MONITORING STATIONS

PROJECT No.  
19129150

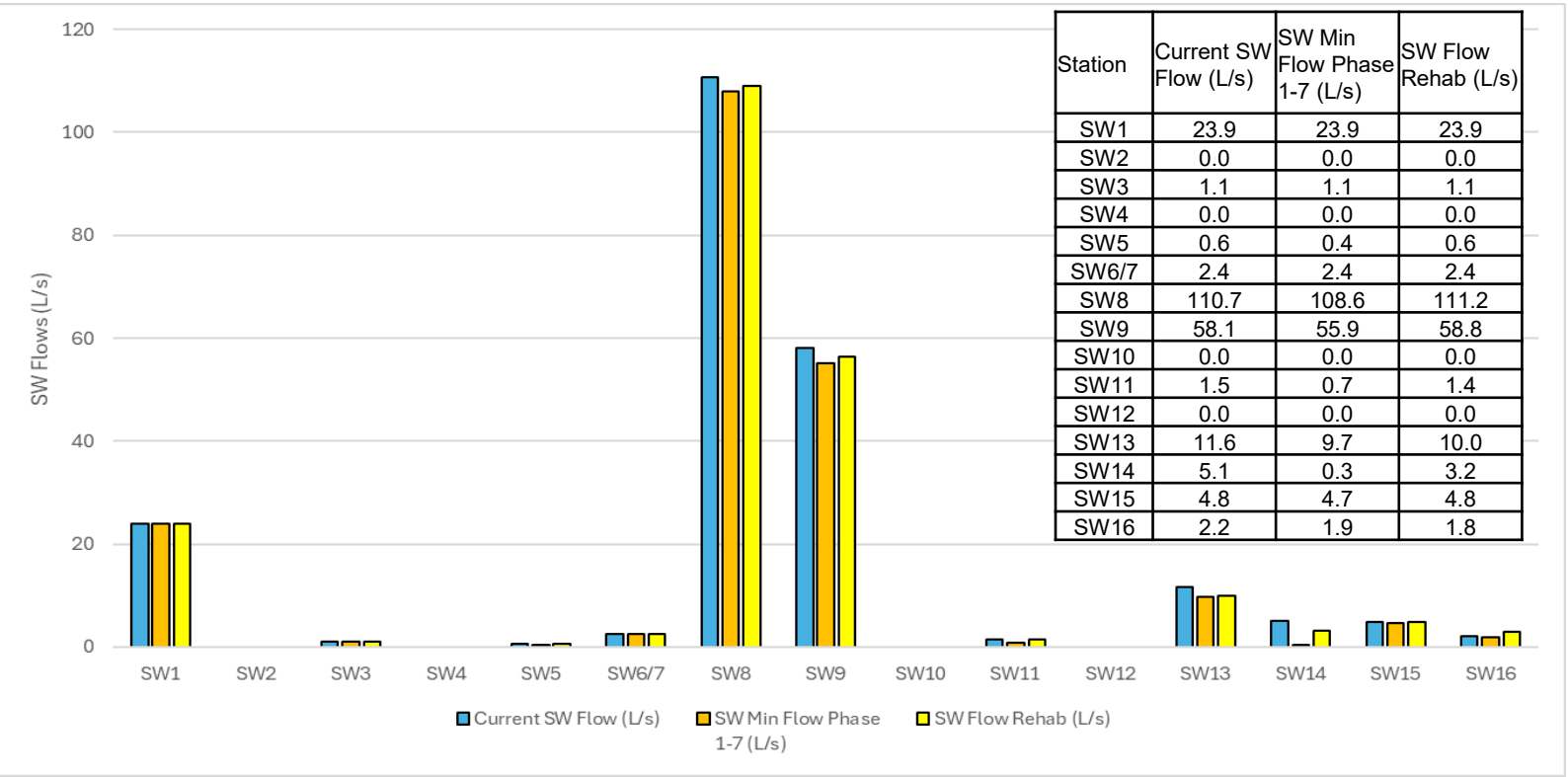
Rev.  
0

FIGURE  
9

SIMULATED REDUCTION IN SURFACE WATER FLOW THROUGH QUARRY PHASES

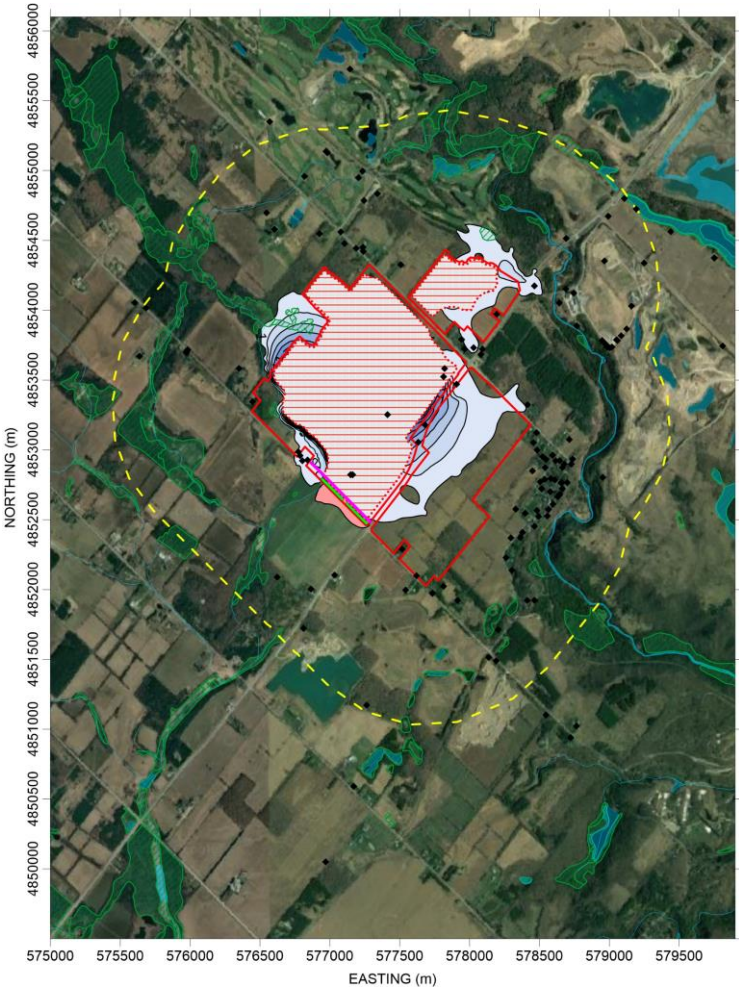
SW Station	Current Conditions (L/s)	Phase 1 (L/s)		Phase 2 (L/s)		Phase 3 (L/s)		Phase 4 (L/s)		Phase 5 (L/s)		Phase 6 (L/s)		Phase 7 (L/s)		Rehab (L/s)	
	Flow	Flow	Reduction	Flow	Reduction	Flow	Reduction	Flow	Reduction	Flow	Reduction	Flow	Reduction	Flow	Reduction	Flow	Reduction
SW1	23.9	23.9	0.0	23.9	0.0	23.9	0.0	23.9	0.0	23.9	0.0	23.9	0.0	23.9	0.0	23.9	0.0
SW2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW3	1.1	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.1	0.0
SW4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW5	0.6	0.6	0.0	0.4	0.2	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.5	0.1	0.6	0.0
SW6/7	2.4	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0	2.4	0.0
SW8	110.7	109.4	1.3	108.9	1.8	108.6	2.1	110.1	0.6	109.9	0.8	110.9	-0.2	110.7	0.0	111.2	-0.5
SW9	58.1	56.7	1.4	56.2	2.0	55.9	2.3	57.6	0.5	57.2	0.9	58.7	-0.6	58.5	-0.4	58.8	-0.7
SW10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW11	1.5	1.4	0.0	0.7	0.7	1.3	0.2	1.4	0.1	1.4	0.1	1.4	0.1	1.3	0.1	1.4	0.1
SW12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SW13	11.6	10.4	1.3	9.7	2.0	10.1	1.6	10.2	1.4	10.2	1.4	10.2	1.4	9.7	2.0	10.0	1.7
SW14	5.1	5.0	0.2	3.1	2.1	3.1	2.0	0.3	4.8	1.7	3.4	1.7	3.4	2.5	2.6	3.2	1.9
SW15	4.8	4.8	0.0	4.8	0.0	4.8	0.0	4.7	0.2	4.8	0.1	4.8	0.1	4.8	0.1	4.8	0.0
SW16	2.2	2.8	-0.7	3.1	-0.9	3.2	-1.1	2.4	-0.2	2.5	-0.4	1.9	0.2	2.0	0.1	1.8	0.3

SIMULATED SURFACE WATER FLOW: CURRENT CONDITIONS, MINIMUM DURING OPERATION, AND REHAB

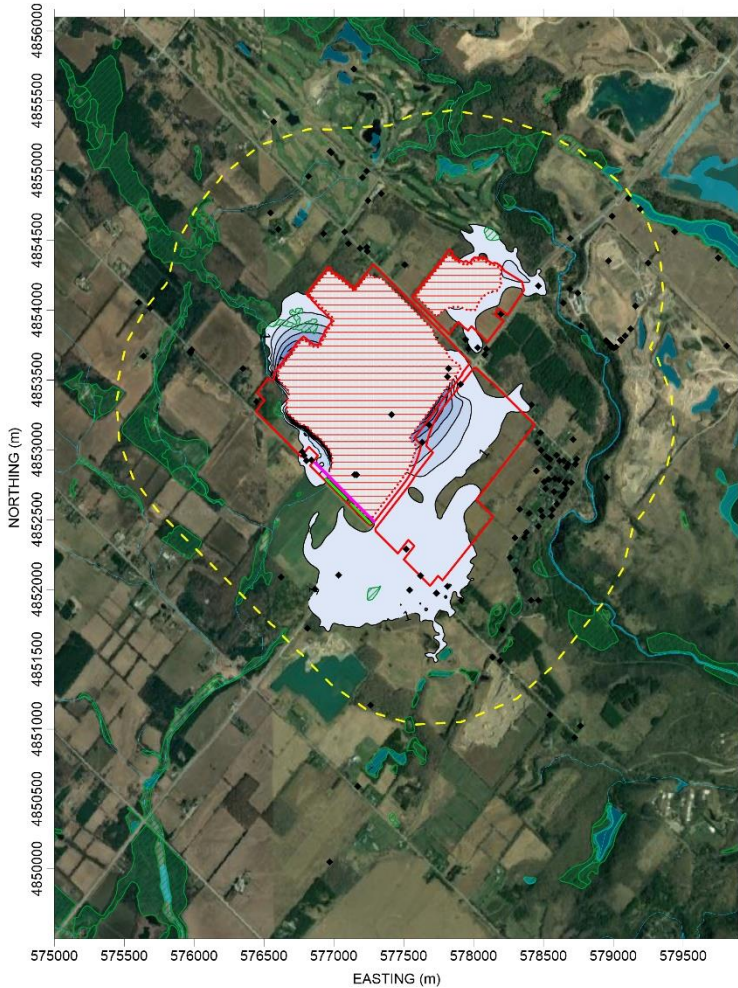




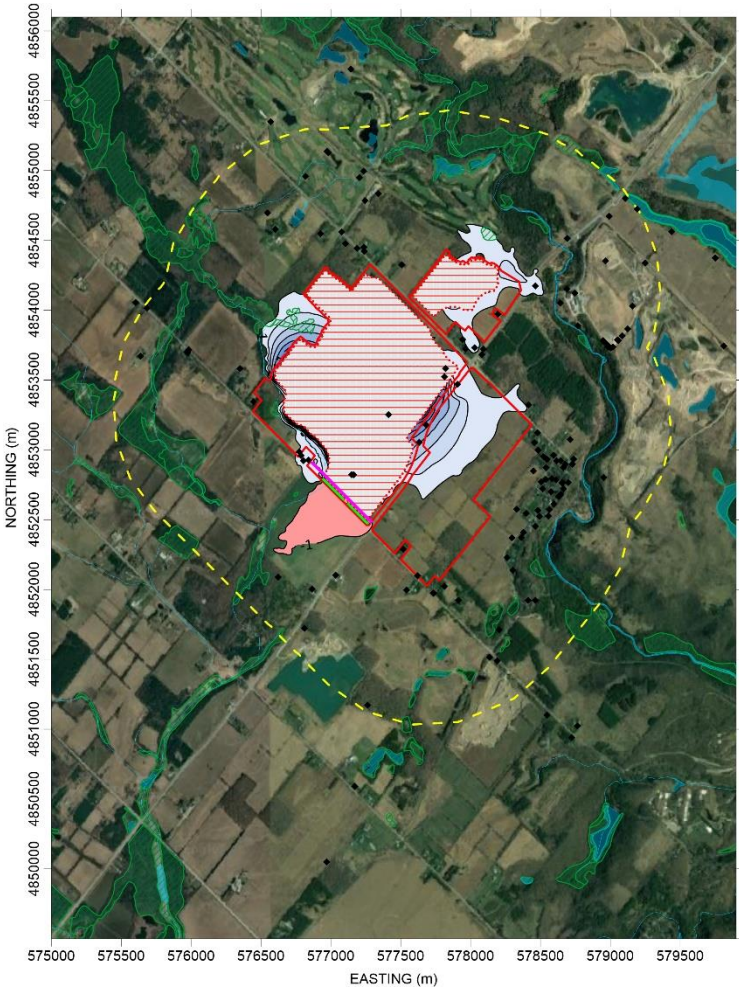
2024 UPDATE: WATER TABLE DRAWDOWN



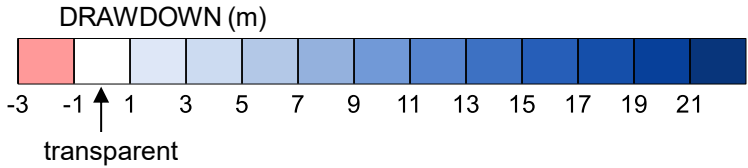
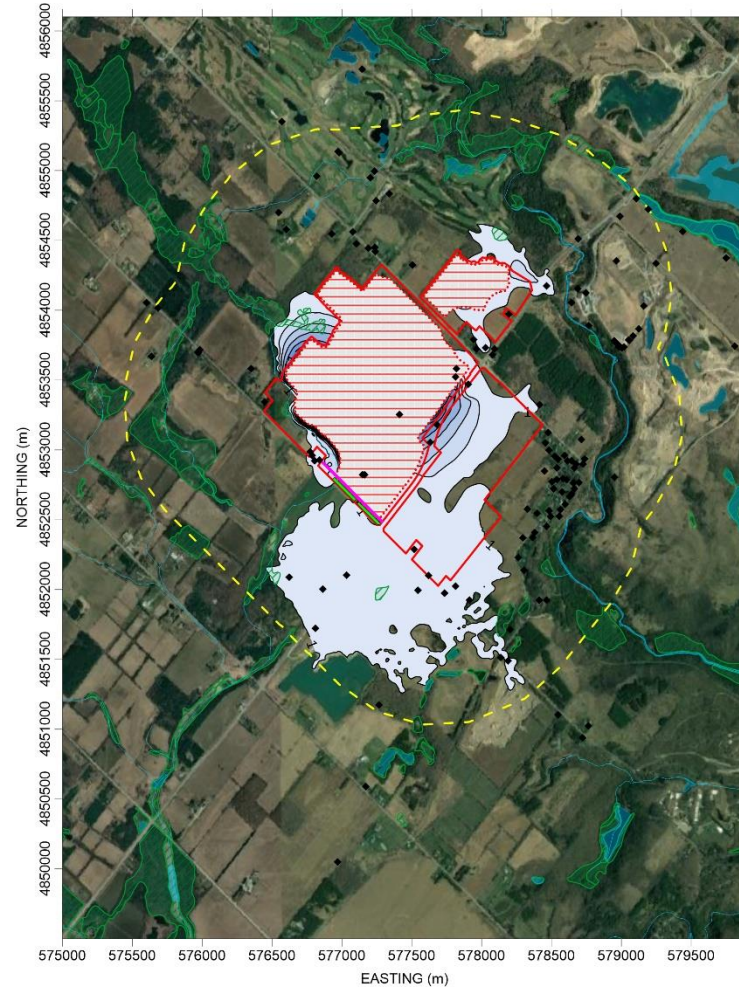
SCENARIO 5A: WATER TABLE DRAWDOWN



SCENARIO 5B: WATER TABLE DRAWDOWN



SCENARIO 5C: WATER TABLE DRAWDOWN



Phase - Scenario	Model Boundary Conditions – Phase 5		Main Area Simulated Inflow (L/s)		North Area Simulated Inflow (L/s)		Total Inflow (L/s)		Trench Flow (L/s)			Total Trench Flow as Percent of Total Sump Inflow (%)
	Trench Zone 1 Head (masl)	Trench Zone 2 Head (masl)	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	2024 Update <sup>a</sup>	Net Surplus <sup>b</sup>	Trench Zone 1	Trench Zone 2	Total Trench	
5 – 2024 Update	398	398	63.8	13.7	3.1	1.7	66.9	15.5	27.6	24.0	51.6	77%
5 – Sc 5A	396	396	52.6	13.7	3.1	1.7	55.7	15.5	17.7	16.4	34.1	61%
5 – Sc 5B	400	400	73.8	13.7	3.1	1.7	76.9	15.5	36.2	31.8	68.0	88%
5 – Sc 5C	396	394	47.9	13.7	3.1	1.7	50.9	15.5	20.0	6.4	26.3	52%

LEGEND

- LAKES
- RIVERS / STREAMS
- SITE PROPERTY BOUNDARY
- EXTRACTION EXTENTS
- WETLAND
- 1 KM BUFFER AROUND PROPERTY
- MECP PRIVATE WELL LOCATION
- SLURRY WALL / GROUT ALIGNMENT
- INFILTRATION TRENCH

NOTES

1. Simulated drawdown is shown at a contour interval of 2 m
2. m = metres, masl = metres above sea level, L/s = litres per second, Sc = scenario
3. Water table drawdown extracted from model slice 1
4. South Area Sump is excluded from the table because it is inactive during Phase 5.
5. Source of spatial mapping of watercourses, waterbodies, and wetlands: Land Information Ontario (MNR, 2018)
6. Private wells shown are from the Ministry of Environment Conservation and Parks (MECP) Water Well Information System Database (MECP, 2021).
- a. The inflows include the net surplus applied to the pit and quarry area.
- b. Calculated based on the quarry area and a net surplus of 364 millimetres/year.

CLIENT  
CBM AGGREGATES (CBM), A DIVISION OF ST. MARYS CEMENT INC. (CANADA)

CONSULTANT	YYYY-MM-DD	2025-03-11
PREPARED	TG	
DESIGN	TG	
REVIEW	RS	
APPROVED	GS	



PROJECT  
CALEDON PIT AND QUARRY NUMERICAL MODELLING

TITLE  
PHASE 5 SIMULATED DRAWDOWN - SENSITIVITY ASSESSMENT

PROJECT No. 19129150  
Rev. 0  
FIGURE 10

**APPENDIX D**

**UPDATED WATER  
MANAGEMENT PLAN**





## TECHNICAL MEMORANDUM

**DATE** May 9, 2025

**Project No.** 19129150

**TO** David Hanratty, Mike LeBreton  
CBM Aggregates

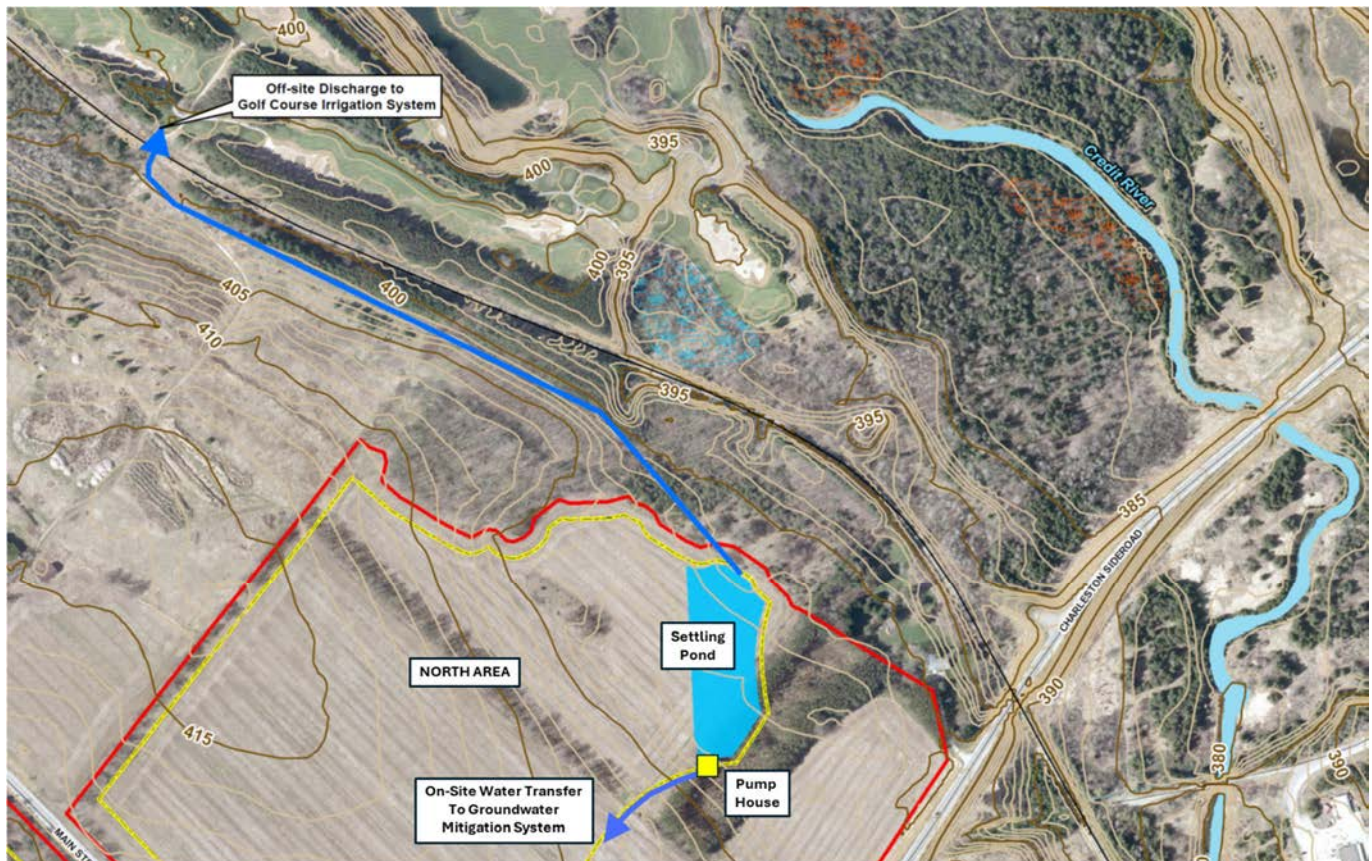
**CC** Greg Padusenko, Dan Eusebi - WSP

**FROM** George Schneider, Craig DeVito, Richard  
Simms, Paul Menkveld

**EMAIL** [george.schneider@wsp.com](mailto:george.schneider@wsp.com)

### WATER MANAGEMENT AND DISCHARGE PLAN – PROPOSED CBM CALEDON PIT / QUARRY

This technical memorandum provides an overview of the water management and discharge plan for the proposed CBM Caledon Pit / Quarry project.



**Figure 1: Proposed Water Discharge from the Pit / Quarry Settling Pond to the Osprey Valley Golf Course**



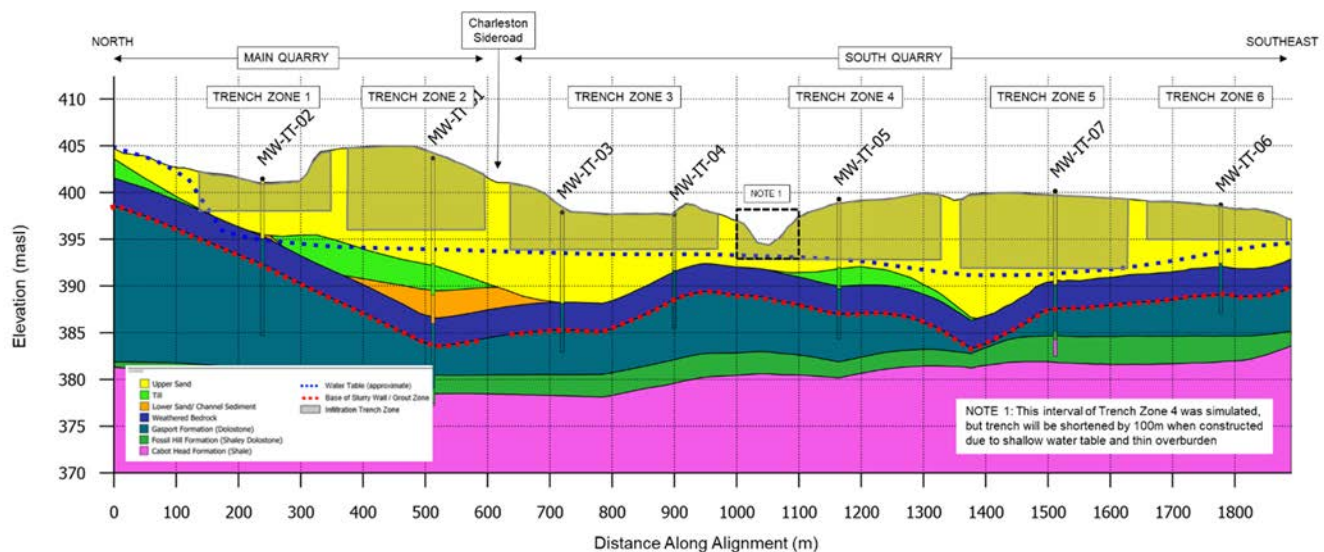
## OFF-SITE DISCHARGE

A single point of discharge has been identified for water collected from the combined land assemblages of the proposed Caledon Pit / Quarry to the Osprey Valley Golf Course irrigation system infrastructure (Figure 1), where water will be used for irrigation when needed, with excess water stored in the golf course's existing pond system which ultimately discharges to the Credit River.

## PROPOSED GROUNDWATER MITIGATION SYSTEM

A groundwater mitigation system is proposed for Phases 3 to 7 of pit / quarry operation, and a portion of the water collected during those phases of operations is expected to be directed to the infiltration trenches that form part of the mitigation system to mitigate impacts of pit / quarry dewatering (Figure 2). The mitigation measures consist of the installation and operation of six infiltration trench zones along a 1,900 m alignment along the west side of the Main Area and the west and south side of the South Area, in the setback area between the licence limit and the limit of extraction.

Water collected in the pit / quarry from dewatering will be reintroduced into the groundwater system through these infiltration trench zones to maintain the groundwater levels west and south of the licence area to levels within their current typical range. Additionally, two hydraulic barrier zones will be installed between the infiltration trenches and the extraction limit, in order to minimize the flow of groundwater back into the pit / quarry from the infiltration trenches. The hydraulic barrier will primarily consist of two slurry wall zones in the overburden, noting that the upper bedrock zone along the slurry wall alignments may also be grouted to reduce the permeability of this zone and further reduce the inflow of groundwater into the pit / quarry and help sustain existing groundwater levels outside of the licence area.



**Figure 2: The Proposed Groundwater Mitigation System consisting of six Infiltration Trench Zones and two Hydraulic Barrier Zones**

If required, the proposed groundwater mitigation system would be implemented in the following stages of pit / quarry operation:

- Phase 3 – Implementation of the slurry wall / grouting of the weathered bedrock zone on the west side of the Main Area prior to the start of Phase 3 extraction.
- Phases 4 and 5 – Implementation of the infiltration trench system (Trench Zones 1 and 2) on the west side of the Main Area prior to the start of Phase 4 and 5 extraction.
- Phase 6 and 7 – Implementation of the second slurry wall / grouting of the weathered bedrock zone and the second phase of the infiltration trench system (Trench Zones 4 to 6) prior to the start of Phase 6 and 7 extraction.

The post-Rehabilitation scenario includes the removal of the slurry wall in the overburden in the southwest corner of the South Area (adjacent to Trench Zones 4 and 5) to partially reinstate the original hydraulic connection in the overburden between the South Area and the lands to the south and southwest of the Site.

## **WATER INFLOW PREDICTIONS AND WATER MANAGEMENT STRATEGY**

Water balance calculations were performed for the pit / quarry areas, at one-year increments, for each year of operation as proposed in the Caledon Pit / Quarry Mining Plan (Mining Plan) dated 12 December 2022, in order to help predict water inflows to the quarry and inform a water management strategy. The calculations estimated how much water will be generated by pit / quarry operations each year and evaluated options to best manage the water. The water balance calculation was performed as follows, with the calculations and results presented in Tables 1 and 2.

- The net annual water surplus was calculated for each of the pit / quarry areas, year by year, for each operational year, based on plan view “snapshots” presented in the Mining Plan.
- These annual snapshots were used to calculate the spatial size of vegetated, till, rock and open water areas, and along with water surplus factors unique to each of the land surface types, a net annual water surplus was calculated for each quarry parcel. It was assumed that the surplus water from exposed till, exposed rock and ponded water areas was captured within the quarry, while surplus water from the undisturbed vegetated areas was not.
- Groundwater seepage was inferred by subtracting the annual water surplus from the total water inflow predicted by recently updated HydroGeoSphere (HGS) simulations (WSP Modeling TM, March 2025) at key time steps during pit / quarry operations.
- The annual water surplus from each area including the estimated seepage contributions were summed to estimate the total water generated by quarry operation each year.
- A portion of the pit / quarry water generated each year will be used for aggregate washing, and while washing is largely non-consumptive, it is estimated that 0.05 m<sup>3</sup> of water would be lost for every tonne of aggregate washed.
- The net water surplus for each year was then allocated to storage, used in the proposed groundwater mitigation system or discharged to the Osprey Valley Golf Course irrigation pond system, depending on the operational needs for that year. Key water management milestones are highlighted in the table below.

**Table 1**  
**Water Generation Estimate - CBM Caledon Pit / Quarry**

Year	Main Quarry						HGS Inflow Prediction			Annual Water Generated
	Total area	Veg area	Open Rock area	Till / Rehab area	Pond area	Site Surplus Inflow	Total Model Inflow	Total Model Inflow	GW Seepage (by HGS)	
	mm/yr	342	446	365	234					
	m2	m2	m2	m2	m2	m3/yr	m3/d	m3/yr	m3/yr	m3
0	1,245,747	1,245,747	0	0	0	0	0	0	0	0
1	1,245,747	1,130,547	70,475	44,725	0	47,756	159	57,947	36,495	84,251
2	1,245,747	1,130,547	70,475	44,725	0	47,756	318	115,895	72,989	120,746
3	1,245,747	1,093,797	105,825	46,125	0	64,034	476	173,842	109,484	173,517
4	1,245,747	1,047,647	141,025	57,075	0	83,730	635	231,790	145,978	229,708
5	1,245,747	1,026,847	158,625	60,275	0	92,747	794	289,737	182,473	275,220
6	1,245,747	966,372	214,450	64,925	0	119,342	953	347,684	218,968	338,310
7	1,245,747	907,172	256,950	81,625	0	144,393	1,111	405,632	255,462	399,855
8	1,245,747	835,072	298,950	92,725	19,000	171,622	1,270	463,579	291,957	463,579
9	1,245,747	776,672	317,500	132,575	19,000	194,441	1,355	494,484	303,006	497,447
10	1,245,747	769,972	318,900	137,875	19,000	197,000	1,439	525,390	314,055	511,055
11	1,245,747	708,797	378,500	139,450	19,000	224,156	1,524	556,295	325,104	549,260
12	1,245,747	626,447	395,975	204,325	19,000	255,629	1,609	587,200	336,153	591,782
13	1,245,747	589,572	418,382	218,792	19,000	270,904	1,693	618,106	347,202	618,106
14	1,245,747	550,872	427,161	248,714	19,000	285,740	1,670	609,433	322,356	608,097
15	1,245,747	514,122	445,796	266,829	19,000	300,664	1,646	600,761	297,511	598,174
16	1,245,747	476,072	459,375	291,300	19,000	315,652	1,622	592,088	272,665	588,317
17	1,245,747	426,072	480,300	320,375	19,000	335,597	1,598	583,416	247,819	583,416
18	1,245,747	369,297	509,800	347,650	19,000	358,709	1,704	621,890	267,965	626,674
19	1,245,747	323,772	536,660	366,315	19,000	377,501	1,809	660,364	288,110	665,612
20	1,245,747	276,697	573,262	376,788	19,000	397,648	1,915	698,838	308,256	705,904
21	1,245,747	248,497	606,117	372,133	19,000	410,603	2,020	737,312	328,402	739,004
22	1,245,747	208,397	630,800	387,550	19,000	427,239	2,125	775,786	348,547	775,786
23	1,245,747	170,597	654,100	402,050	19,000	442,923	2,972	1,084,838	640,062	1,082,985
24	1,245,747	94,447	705,313	426,987	19,000	474,866	3,819	1,393,891	931,577	1,406,443
25	1,245,747	74,147	718,620	433,980	19,000	483,353	4,666	1,702,944	1,223,092	1,706,445
26	1,245,747	41,622	745,352	439,773	19,000	497,390	5,512	2,011,997	1,514,607	2,011,997
27	1,245,747	3,722	775,925	447,100	19,000	513,700	5,000	1,824,883	1,324,110	1,837,810
28	1,245,747	0	799,950	426,797	19,000	517,005	4,487	1,637,770	1,133,613	1,650,617
29	1,245,747	0	811,650	415,097	19,000	517,952	3,974	1,450,656	943,116	1,461,068
30	1,245,747	0	808,419	418,328	19,000	517,691	3,462	1,263,542	752,619	1,270,309
31	1,245,747	0	808,419	418,328	19,000	517,691	2,949	1,076,429	562,122	1,079,812
32	1,245,747	0	808,419	418,328	19,000	517,691	2,436	889,315	371,625	889,315
33	1,245,747	0	808,419	418,328	19,000	517,691	2,455	896,148	378,384	896,075
34	1,245,747	0	808,419	418,328	19,000	517,691	2,474	902,981	385,144	902,835
35	1,245,747	0	808,419	418,328	19,000	517,691	2,493	909,814	391,904	909,595
36	1,245,747	0	808,419	418,328	19,000	517,691	2,511	916,646	398,664	916,355
37	1,245,747	0	813,819	412,928	19,000	518,128	2,530	923,479	405,424	923,552
38	1,245,747	0	813,819	412,928	19,000	518,128	2,549	930,312	412,184	930,312

**Table 1**  
**Water Generation Estimate - CBM Caledon Pit / Quarry**

Year	North Quarry - Scenario 1 - No Flooding Immediately Post-Rehab						HGS Inflow Prediction			
	Total area	Veg area	Rock area	Till area	Pond area	Site Surplus	Total Model Inflow	Total Model Inflow	GW Seepage (by HGS)	Annual Water Generated
	m/yr	342	446	365	234					
	m2	m2	m2	m2	m2	m3	m3/d	m3/yr	m3/yr	m3
0	149,350	149,350	0	0	0	0	0	0	0	0
1	149,350	135,650	0	4,800	8,900	3,835				
2	149,350	135,650	0	4,800	8,900	3,835				
3	149,350	135,650	0	4,800	8,900	3,835				
4	149,350	135,650	0	4,800	8,900	3,835				
5	149,350	135,650	0	4,800	8,900	3,835				
6	149,350	135,650	0	4,800	8,900	3,835				
7	149,350	135,650	0	4,800	8,900	3,835				
8	149,350	135,650	0	4,800	8,900	3,835	0	0	0	3,835
9	149,350	77,950	50,025	12,475	8,900	28,947	52	18,922	7,413	36,360
10	149,350	0	92,056	48,394	8,900	60,803	104	37,843	14,826	75,630
11	149,350	0	56,369	84,081	8,900	57,913	156	56,765	22,239	80,152
12	149,350	0	51,800	88,650	8,900	57,543	207	75,686	29,652	87,195
13	149,350	0	51,800	88,650	8,900	57,543	259	94,608	37,065	94,608
14	149,350	0	51,800	88,650	8,900	57,543	261	95,396	37,854	95,396
15	149,350	0	51,800	88,650	8,900	57,543	264	96,185	38,642	96,185
16	149,350	0	51,800	88,650	8,900	57,543	266	96,973	39,431	96,973
17	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
18	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
19	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
20	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
21	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
22	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
23	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
24	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
25	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
26	149,350	0	51,800	88,650	8,900	57,543	268	97,762	40,219	97,762
27	149,350	0	51,800	88,650	8,900	57,543	267	97,446	39,904	97,446
28	149,350	0	51,800	88,650	8,900	57,543	266	97,131	39,588	97,131
29	149,350	0	51,800	88,650	8,900	57,543	265	96,816	39,273	96,816
30	149,350	0	51,800	88,650	8,900	57,543	264	96,500	38,958	96,500
31	149,350	0	51,800	88,650	8,900	57,543	264	96,185	38,642	96,185
32	149,350	0	51,800	88,650	8,900	57,543	263	95,869	38,327	95,869
33	149,350	0	51,800	88,650	8,900	57,543	255	93,031	35,489	93,031
34	149,350	0	51,800	88,650	8,900	57,543	247	90,193	32,650	90,193
35	149,350	0	51,800	88,650	8,900	57,543	239	87,355	29,812	87,355
36	149,350	0	51,800	88,650	8,900	57,543	232	84,516	26,974	84,516
37	149,350	0	51,800	88,650	8,900	57,543	224	81,678	24,136	81,678
38	149,350	0	51,800	88,650	8,900	57,543	216	78,840	21,297	78,840



**Table 1**  
**Water Generation Estimate - CBM Caledon Pit / Quarry**

Year	North Quarry - Scenario 2 - Flooding Immediately Post-Rehab						HGS Inflow Prediction			
	Total area	Veg area	Rock area	Till area	Pond area	Site Surplus	Total Model Inflow	Total Model Inflow	GW Seepage (by HGS)	Annual Water Generated
	m/yr	342	446	365	234					
	m2	m2	m2	m2	m2	m3	m3/d	m3/yr	m3/yr	m3
0	149,350	149,350	0	0	0	0				
1	149,350	135,650	0	4,800	8,900	3,835				
2	149,350	135,650	0	4,800	8,900	3,835				
3	149,350	135,650	0	4,800	8,900	3,835				
4	149,350	135,650	0	4,800	8,900	3,835				
5	149,350	135,650	0	4,800	8,900	3,835				
6	149,350	135,650	0	4,800	8,900	3,835				
7	149,350	135,650	0	4,800	8,900	3,835				
8	149,350	135,650	0	4,800	8,900	3,835	0	0	0	3,835
9	149,350	77,950	50,025	12,475	8,900	28,947	52	18,922	7,413	36,360
10	149,350	0	92,056	48,394	8,900	60,803	104	37,843	14,826	75,630
11	149,350	0	56,369	84,081	8,900	57,913	156	56,765	22,239	80,152
12	149,350	0	51,800	88,650	8,900	57,543	207	75,686	29,652	87,195
13	131,175	0	51,800	88,650	8,900	57,543	259	94,608	37,065	94,608
14	131,175	0	0	0	131,175	30,695				30,695
15	131,175	0	0	0	131,175	30,695				30,695
16	131,175	0	0	0	131,175	30,695				30,695
17	131,175	0	0	0	131,175	30,695				30,695
18	131,175	0	0	0	131,175	30,695				30,695
19	131,175	0	0	0	131,175	30,695				30,695
20	131,175	0	0	0	131,175	30,695				30,695
21	131,175	0	0	0	131,175	30,695				30,695
22	131,175	0	0	0	131,175	30,695				30,695
23	131,175	0	0	0	131,175	30,695				30,695
24	131,175	0	0	0	131,175	30,695				30,695
25	131,175	0	0	0	131,175	30,695				30,695
26	131,175	0	0	0	131,175	30,695				30,695
27	131,175	0	0	0	131,175	30,695				30,695
28	131,175	0	0	0	131,175	30,695				30,695
29	131,175	0	0	0	131,175	30,695				30,695
30	131,175	0	0	0	131,175	30,695				30,695
31	131,175	0	0	0	131,175	30,695				30,695
32	131,175	0	0	0	131,175	30,695				30,695
33	131,175	0	0	0	131,175	30,695				30,695
34	131,175	0	0	0	131,175	30,695				30,695
35	131,175	0	0	0	131,175	30,695				30,695
36	131,175	0	0	0	131,175	30,695				30,695
37	131,175	0	0	0	131,175	30,695				30,695
38	131,175	0	0	0	131,175	30,695				30,695

**Table 1**  
**Water Generation Estimate - CBM Caledon Pit / Quarry**

Year	South Quarry						HGS Inflow Prediction			
	Total area	Veg area	Open Rock area	Till / Rehab area	Pond area	Site Surplus	Total Model Inflow	Total Model Inflow	GW Seepage (by HGS)	Annual Water Generated
	m/yr	342	446	365	234					
	m2	m2	m2	m2	m2	m3	m3/d	m3/yr	m3/yr	m3
0	581,534	581,534	0	0	0	0				
1	581,534	581,534	0	0	0	0				
2	581,534	581,534	0	0	0	0				
3	581,534	581,534	0	0	0	0				
4	581,534	581,534	0	0	0	0				
5	581,534	581,534	0	0	0	0				
6	581,534	581,534	0	0	0	0				
7	581,534	581,534	0	0	0	0				
8	581,534	581,534	0	0	0	0				
9	581,534	581,534	0	0	0	0				
10	581,534	581,534	0	0	0	0				
11	581,534	581,534	0	0	0	0				
12	581,534	581,534	0	0	0	0				
13	581,534	581,534	0	0	0	0				
14	581,534	581,534	0	0	0	0				
15	581,534	581,534	0	0	0	0				
16	581,534	581,534	0	0	0	0				
17	581,534	581,534	0	0	0	0				
18	581,534	581,534	0	0	0	0				
19	581,534	581,534	0	0	0	0				
20	581,534	581,534	0	0	0	0				
21	581,534	581,534	0	0	0	0				
22	581,534	581,534	0	0	0	0				
23	581,534	581,534	0	0	0	0				
24	581,534	581,534	0	0	0	0				
25	581,534	581,534	0	0	0	0				
26	581,534	581,534	0	0	0	0	0	0	0	0
27	581,534	517,109	43,075	21,350	0	27,004	114	41,733	19,090	46,095
28	581,534	461,384	89,525	30,625	0	51,106	229	83,465	38,181	89,287
29	581,534	437,809	97,775	45,950	0	60,379	343	125,198	57,271	117,651
30	581,534	376,734	130,380	69,670	4,750	84,691	457	166,931	76,362	161,052
31	581,534	314,784	166,025	95,975	4,750	110,190	572	208,663	95,452	205,642
32	581,534	259,984	235,925	80,875	4,750	135,853	686	250,396	114,542	250,396
33	581,534	196,759	274,792	105,233	4,750	162,079	831	303,271	147,680	309,759
34	581,534	110,609	364,850	101,325	4,750	200,818	976	356,147	180,818	381,636
35	581,534	33,584	449,400	93,800	4,750	235,781	1,121	409,022	213,956	449,737
36	581,534	0	524,944	51,840	4,750	254,158	1,265	461,897	247,094	501,252
37	581,534	0	526,550	50,234	4,750	254,288	1,410	514,773	280,231	534,520
38	581,534	0	526,435	50,349	4,750	254,279	1,555	567,648	313,369	567,648

**Table 2**  
**Water Consumption and Discharge Scenarios - CBM Caledon Pit / Quarry**

Year	Scenario 1	Water Consumed		Water Stored					Water Infiltrated by Trench							Water Discharged / Infiltrated			
	Annual Water Generated	Agg Prod-uction	Water for Agg Washing	Main Sump Storage	Wash Plant Storage	North Sump Storage	North Quarry Allowed to Fill	South Sump Storage	Trench Zone 1	Trench Zone 2	Trench Zone 3	Trench Zone 4	Trench Zone 5	Trench Zone 6	Total Infiltration Trench Zones 1-6	Total Water to Manage	Off Site Water Discharge to OVGC	Water Transferred to Trench Zones 1-2	Water Transferred to Trench Zones 3-6
	m3	T	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3		m3	m3	m3	m3
	0	0	0	0	0	0	0	0							0	0	0	0	0
1	84,251	250,000	12,500	1,000	20,000	40,000	0	0							0	10,751	10,751	0	0
2	120,746	500,000	25,000	0	0	0	0	0							0	95,746	95,746	0	0
3	173,517	750,000	37,500	0	0	0	0	0							0	136,017	136,017	0	0
4	229,708	1,000,000	50,000	0	0	0	0	0							0	179,708	179,708	0	0
5	275,220	1,500,000	75,000	0	0	0	0	0							0	200,220	200,220	0	0
6	338,310	2,000,000	100,000	0	0	0	0	0							0	238,310	238,310	0	0
7	399,855	2,500,000	125,000	0	0	0	0	0							0	274,855	274,855	0	0
8	467,414	2,500,000	125,000	0	150,000	0	0	0							0	192,414	192,414	0	0
9	533,807	2,500,000	125,000	0	0	0	0	0							0	408,807	408,807	0	0
10	586,684	2,500,000	125,000	0	0	0	0	0							0	461,684	461,684	0	0
11	629,412	2,500,000	125,000	0	0	1,000	0	0							0	503,412	503,412	0	0
12	678,977	2,500,000	125,000	0	0	0	0	0							0	553,977	553,977	0	0
13	712,714	2,500,000	125,000	0	0	0	0	0							0	587,714	587,714	0	0
14	703,493	2,500,000	125,000	0	0	0	0	0							0	578,493	578,493	0	0
15	694,359	2,500,000	125,000	0	0	0	0	0							0	569,359	569,359	0	0
16	685,290	2,500,000	125,000	0	0	0	0	0							0	560,290	560,290	0	0
17	681,178	2,500,000	125,000	0	0	0	0	0	0	0					0	556,178	556,178	0	0
18	724,436	2,500,000	125,000	0	0	0	0	0	76,948	8,830					85,778	599,436	513,658	85,778	0
19	763,373	2,500,000	125,000	0	0	0	0	0	153,896	17,660					171,556	638,373	466,818	171,556	0
20	803,666	2,500,000	125,000	0	0	0	0	0	230,844	26,490					257,334	678,666	421,332	257,334	0
21	836,766	2,500,000	125,000	0	0	0	0	0	307,791	35,320					343,112	711,766	368,654	343,112	0
22	873,547	2,500,000	125,000	0	0	0	0	0	384,739	44,150					428,890	748,547	319,658	428,890	0
23	1,180,746	2,500,000	125,000	0	0	0	0	0	506,153	222,329					728,482	1,055,746	327,265	728,482	0
24	1,504,204	2,500,000	125,000	0	0	0	0	0	627,566	400,507					1,028,074	1,379,204	351,131	1,028,074	0
25	1,804,207	2,500,000	125,000	0	0	0	0	0	748,980	578,686					1,327,666	1,679,207	351,541	1,327,666	0
26	2,109,758	2,500,000	125,000	0	0	0	0	0	870,394	756,864	0	0	0	0	1,627,258	1,984,758	357,501	1,627,258	0
27	1,981,351	2,500,000	125,000	0	0	0	0	1,000	782,093	632,822	27,331	14,717	22,075	15,242	1,494,281	1,855,351	361,070	1,414,915	79,366
28	1,837,035	2,500,000	125,000	0	0	0	0	0	693,792	508,781	54,662	29,434	44,150	30,485	1,361,304	1,712,035	350,731	1,202,573	158,731
29	1,675,534	2,500,000	125,000	0	0	0	0	0	605,491	384,739	81,994	44,150	66,226	45,727	1,228,327	1,550,534	322,207	990,230	238,097
30	1,527,862	2,500,000	125,000	0	0	0	0	20,000	517,190	260,698	109,325	58,867	88,301	60,970	1,095,350	1,382,862	287,511	777,888	317,462
31	1,381,639	2,500,000	125,000	0	0	0	0	0	428,890	136,656	136,656	73,584	110,376	76,212	962,374	1,256,639	294,265	565,546	396,828
32	1,235,580	2,500,000	125,000	0	0	0	0	0	340,589	12,614	163,987	88,301	132,451	91,454	829,397	1,110,580	281,184	353,203	476,194
33	1,298,865	2,500,000	125,000	0	0	0	0	0	342,166	14,191	177,653	102,492	142,438	103,543	882,482	1,173,865	291,383	356,357	526,126
34	1,374,664	2,500,000	125,000	0	0	0	0	0	343,742	15,768	191,318	116,683	152,424	115,632	935,568	1,249,664	314,096	359,510	576,058
35	1,446,686	2,500,000	125,000	0	0	0	0	0	345,319	17,345	204,984	130,874	162,410	127,721	988,654	1,321,686	333,033	362,664	625,990
36	1,502,123	2,500,000	125,000	0	0	0	0	0	346,896	18,922	218,650	145,066	172,397	139,810	1,041,739	1,377,123	335,384	365,818	675,922
37	1,539,750	2,500,000	125,000	0	0	0	0	0	348,473	20,498	232,315	159,257	182,383	151,898	1,094,825	1,414,750	319,925	368,971	725,854
38	1,576,800	500,000	25,000	0	0	0	0	0	350,050	22,075	245,981	173,448	192,370	163,987	1,147,910	1,551,800	403,890	372,125	775,786

Max annual discharge to the Golf Course Irrigation Ponds: 587,714 m3  
Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): 18.6 L/s

Average annual discharge to the Golf Course Irrigation Ponds: 345,645 m3  
Avg discharge flow rate to the Golf Course Irrigation Ponds: 11.0 L/s



**Table 2**  
**Water Consumption and Discharge Scenarios - CBM Caledon Pit / Quarry**

Year	Scenario 2	Water Consumed		Water Stored					Water Infiltrated by Trench							Water Discharged / Infiltrated			
	Annual Water Generated	Agg Prod-uction	Water for Agg Washing	Main Sump Storage	Wash Plant Storage	North Sump Storage	North Quarry Allowed to Fill	South Sump Storage	Trench Zone 1	Trench Zone 2	Trench Zone 3	Trench Zone 4	Trench Zone 5	Trench Zone 6	Total Infiltration Trench Zones 1-6	Total Water to Manage	Off Site Water Discharge to OVGC	Water Transferred to Trench Zones 1-2	Water Transferred to Trench Zones 3-6
	m3	T	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3	m3		m3	m3	m3	m3
	0	0	0	0	0	0	0	0							0	0	0	0	0
1	84,251	250,000	12,500	1,000	20,000	40,000	0	0							0	10,751	10,751	0	0
2	120,746	500,000	25,000	0	0	0	0	0							0	95,746	95,746	0	0
3	173,517	750,000	37,500	0	0	0	0	0							0	136,017	136,017	0	0
4	229,708	1,000,000	50,000	0	0	0	0	0							0	179,708	179,708	0	0
5	275,220	1,500,000	75,000	0	0	0	0	0							0	200,220	200,220	0	0
6	338,310	2,000,000	100,000	0	0	0	0	0							0	238,310	238,310	0	0
7	399,855	2,500,000	125,000	0	0	0	0	0							0	274,855	274,855	0	0
8	467,414	2,500,000	125,000	0	150,000	0	0	0							0	192,414	192,414	0	0
9	533,807	2,500,000	125,000	0	0	0	0	0							0	408,807	408,807	0	0
10	586,684	2,500,000	125,000	0	0	0	0	0							0	461,684	461,684	0	0
11	629,412	2,500,000	125,000	0	0	1,000	0	0							0	503,412	503,412	0	0
12	678,977	2,500,000	125,000	0	0	0	0	0							0	553,977	553,977	0	0
13	712,714	2,500,000	125,000	0	0	0	376,000	0							0	211,714	211,714	0	0
14	638,791	2,500,000	125,000	0	0	0	0	0							0	513,791	513,791	0	0
15	628,869	2,500,000	125,000	0	0	0	0	0							0	503,869	503,869	0	0
16	619,012	2,500,000	125,000	0	0	0	0	0							0	494,012	494,012	0	0
17	614,111	2,500,000	125,000	0	0	0	0	0	0	0					0	489,111	489,111	0	0
18	657,369	2,500,000	125,000	0	0	0	0	0	76,948	8,830					85,778	532,369	446,591	85,778	0
19	696,307	2,500,000	125,000	0	0	0	0	0	153,896	17,660					171,556	571,307	399,751	171,556	0
20	736,599	2,500,000	125,000	0	0	0	0	0	230,844	26,490					257,334	611,599	354,266	257,334	0
21	769,699	2,500,000	125,000	0	0	0	0	0	307,791	35,320					343,112	644,699	301,588	343,112	0
22	806,481	2,500,000	125,000	0	0	0	0	0	384,739	44,150					428,890	681,481	252,591	428,890	0
23	1,113,680	2,500,000	125,000	0	0	0	0	0	506,153	222,329					728,482	988,680	260,198	728,482	0
24	1,437,138	2,500,000	125,000	0	0	0	0	0	627,566	400,507					1,028,074	1,312,138	284,064	1,028,074	0
25	1,737,140	2,500,000	125,000	0	0	0	0	0	748,980	578,686					1,327,666	1,612,140	284,474	1,327,666	0
26	2,042,692	2,500,000	125,000	0	0	0	0	0	870,394	756,864	0	0	0	0	1,627,258	1,917,692	290,434	1,627,258	0
27	1,914,599	2,500,000	125,000	0	0	0	0	1,000	782,093	632,822	27,331	14,717	22,075	15,242	1,494,281	1,788,599	294,318	1,414,915	79,366
28	1,770,599	2,500,000	125,000	0	0	0	0	0	693,792	508,781	54,662	29,434	44,150	30,485	1,361,304	1,645,599	284,295	1,202,573	158,731
29	1,609,413	2,500,000	125,000	0	0	0	0	0	605,491	384,739	81,994	44,150	66,226	45,727	1,228,327	1,484,413	256,086	990,230	238,097
30	1,462,056	2,500,000	125,000	0	0	0	0	20,000	517,190	260,698	109,325	58,867	88,301	60,970	1,095,350	1,317,056	221,706	777,888	317,462
31	1,316,149	2,500,000	125,000	0	0	0	0	0	428,890	136,656	136,656	73,584	110,376	76,212	962,374	1,191,149	228,775	565,546	396,828
32	1,170,406	2,500,000	125,000	0	0	0	0	0	340,589	12,614	163,987	88,301	132,451	91,454	829,397	1,045,406	216,009	353,203	476,194
33	1,236,529	2,500,000	125,000	0	0	0	0	0	342,166	14,191	177,653	102,492	142,438	103,543	882,482	1,111,529	229,047	356,357	526,126
34	1,315,166	2,500,000	125,000	0	0	0	0	0	343,742	15,768	191,318	116,683	152,424	115,632	935,568	1,190,166	254,598	359,510	576,058
35	1,390,027	2,500,000	125,000	0	0	0	0	0	345,319	17,345	204,984	130,874	162,410	127,721	988,654	1,265,027	276,373	362,664	625,990
36	1,448,301	2,500,000	125,000	0	0	0	0	0	346,896	18,922	218,650	145,066	172,397	139,810	1,041,739	1,323,301	281,562	365,818	675,922
37	1,488,767	2,500,000	125,000	0	0	0	0	0	348,473	20,498	232,315	159,257	182,383	151,898	1,094,825	1,363,767	268,942	368,971	725,854
38	1,528,655	500,000	25,000	0	0	0	0	0	350,050	22,075	245,981	173,448	192,370	163,987	1,147,910	1,503,655	355,745	372,125	775,786

Max annual discharge to the Golf Course Irrigation Ponds: 553,977 m3  
Avg discharge flow rate to the Golf Course Irrigation Ponds (max year): 17.6 L/s

Average annual discharge to the Golf Course Irrigation Ponds: 295,123 m3  
Avg discharge flow rate to the Golf Course Irrigation Ponds: 9.4 L/s

The water balance calculation presented in this section differs from the site-wide surface water balance presented in Section 7 of the Water Report in the following notable ways.

- The site-wide surface water balance in the Water Report follows the Thornthwaite water balance accounting model.
- The water balance presented in this section includes additional water balance elements in comparison to the site-wide surface water balance, namely, quarry inflows due to dewatering, water used in aggregate washing operations and water used in the proposed groundwater mitigation system.
- The site-wide surface water balance presented in the Water Report was calculated for the final year of each operational phase and post-rehabilitation, whereas water balance was calculated for each year of operation.

### Water Management Milestones - Caledon Pit / Quarry

Key water management milestones during pit / quarry operations are summarized in the table below.

**Table 3: Water Management Milestones**

Year	Milestone / Operational Note
1	Establish Main Area sump with 1,000 m <sup>3</sup> storage in low point. Establish 0.5 Ha temporary wash pond with 20,000 m <sup>3</sup> storage. Establish 0.89 Ha settling pond in North Area with 40,000 m <sup>3</sup> storage.
8	Establish permanent 1.9 Ha wash ponds in the Main Area with 150,000 m <sup>3</sup> storage. May decommission temporary wash pond.
10	Establish North Area sump with 1,000 m <sup>3</sup> storage in low point.
13	North Area extraction complete. Assume CBM will continue to dewater it, but CBM could possibly use it for additional water storage capacity, if needed. There is in excess of 300,000 m <sup>3</sup> of additional water storage capacity in the North Area.
17	<b>Initiate discharge to groundwater infiltration Trench Zones 1 and 2 in the Main Area.</b> Additional water storage to operate the infiltration trench system, if needed, could be accommodated in the Main Area or the North Area (preferred). Storage of this water is not formally accounted, but there is sufficient water generated to supply the mitigation system.
26	Establish South Area sump with 1,000 m <sup>3</sup> storage in low point. Establish 0.47 Ha sump in South Area with 20,000 m <sup>3</sup> storage. <b>Initiate discharge to groundwater infiltration Trench Zones 3 to 6 in the South Area.</b>
38	Last year of scheduled dewatering / water discharge. Discharge of water will cease once the Site has been rehabilitated and the excavated and rehabbed areas are allowed to naturally flood.

### QUARRY SUMP(S)

Figure 3 below shows elevation contours for the base of the Gasport Formation, which is the lower limit of extraction and approximately represents the pit / quarry floor surface. As extraction proceeds, it is assumed that at any given time the pit / quarry sump(s) will be located proximal to the low point of the excavation floor.

## TRANSFER OF WATER BETWEEN QUARRY PARCELS

During operational phases, it will be necessary to transfer excess pit / quarry water from the South and Main Areas to the North Area, in order to store and convey excess quarry water to the golf course irrigation system at the proposed point of discharge. This will require pumping, and piping would need to be constructed to cross the roadways, either by cut and fill, or directional drilling.

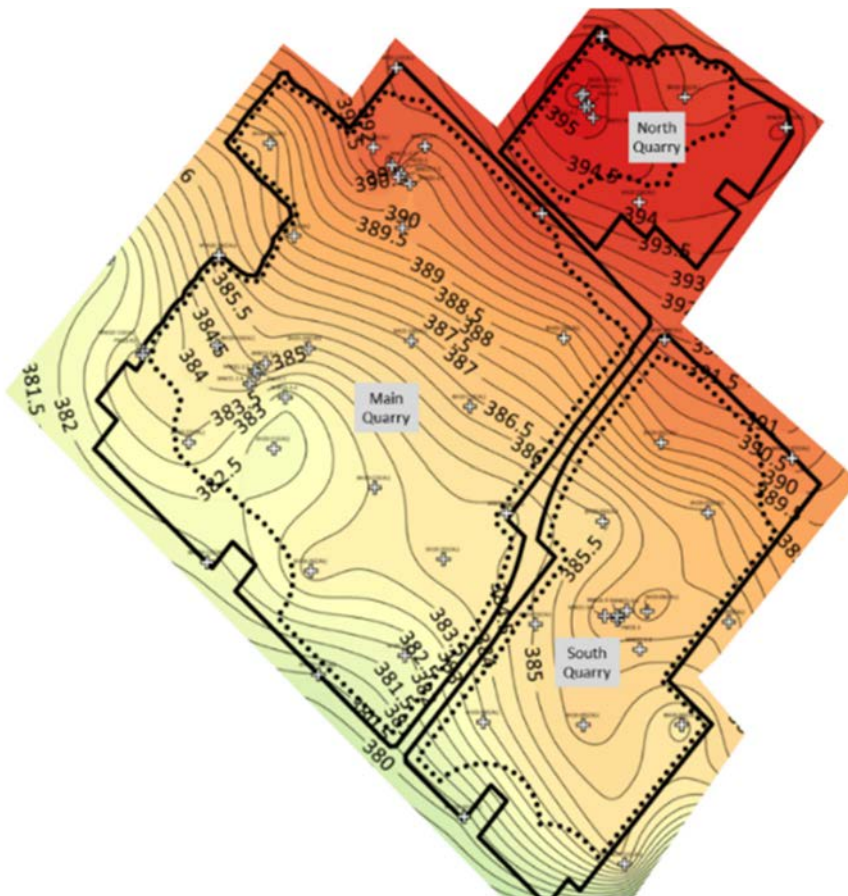


Figure 3: Elevation of the Base of the Gasport Formation (masl)

## QUARRY WATER DISCHARGE AND FLOWS

With reference to Table 2, discharges of surplus water to the Osprey Valley Golf Course irrigation system are anticipated to begin during Operational Year 1 with an annual discharge of approximately 10,000 m<sup>3</sup> that year. The rate of discharge is expected to increase annually to a maximum of approximately 587,000 m<sup>3</sup> / year in operational Year 13 and then stabilize and decline in future years. The highest annual average water discharge (Year 13) is expected to be approximately 18.6 L/s. Operational Scenario 2 (North Quarry allowed to fill in Year 13) has lower discharges and flows than Scenario 1 (North Quarry remains dry until rehab), owing to the additional water loss due to evaporation in the flooded North Quarry.

It should be noted that additional HGS water model simulations indicated the groundwater mitigation system could be used to re-infiltrate additional groundwater, in the range of 200,000 to 400,000 m<sup>3</sup> / year, without adversely affecting groundwater levels. As such there is an option to re-infiltrate additional groundwater if needed to reduce



the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.

Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

## FINAL POND WATER LEVELS

Upon rehabilitation, the maximum water level in the Main Pond will be controlled by an outflow to the North Pond at an approximate elevation of 400 masl, and the maximum water level in the North Pond will be controlled by an outflow to the Osprey Valley Golf Course irrigation system at an approximate elevation of 399 masl. The simulated post-rehabilitation water level in the South Pond is predicted to be 393.5 masl and will be internally contained, with no outflow. Post-rehabilitation the simulated steady state outflow from the combined Main and North Ponds to the golf course irrigation system is estimated to be approximately 10 L/s.

**Table 4: Final Pond Capacities and Water Levels Post-Rehabilitation**

Parameter	Units	Main	South	North (Scenario 1)
Base of Gasport (range)	masl	381 - 392.5	383.5 - 390.5	394 - 395
Base of Gasport (average)	masl	386	386	394.5
Pit Shell Area	m2	1,245,747	581,534	149,350
Current High Water Table (range)	masl	406 - 420	392 - 405	398 - 406
<b>Final Pond Water Level</b>	<b>masl</b>	<b>400</b>	<b>393.5</b>	<b>399</b>
Pond Capacity Post-Rehab	m3	13,599,000	3,055,000	376,000
Average post-rehab inflow rate (50% of initial post-rehab inflow rate)	m3/yr	465,156	283,824	39,420
Time required to fill ponds (average inflow rate)	yr	29.2	10.8	9.5

**Notes**

1. Main Pond overflow would be directed via a culvert to the North Pond - invert at ~400 masl.
2. North Pond overflow would be directed via main outlet to the Osprey Valley Golf Course Irrigation System - invert at ~399 masl.
3. South Pond does not have an outlet.

With reference to Table 4, it is anticipated that it will require approximately 29.2, 10.8 and 9.5 years for the ponds in the Main, North and South Areas to reach their final water levels, assuming that 50% of the steady state inflow rate for the final operational year is maintained, on average, as the ponds fill post-rehabilitation.

## SUMMARY

In summary, we note the following key points with respect to water management at the proposed Caledon Pit / Quarry:

- The Operational Plan for the pit / quarry plans for the construction of a 40,000 m<sup>3</sup> settling pond / holding pond for managing discharge water in the North Area during Year 1, in order provide “immediate” water storage capacity.
- Based on water inflow predictions and mitigation water needs from numerical simulations during operations, enough water will be generated during Years 17 to 38 of operation to supply the water needed for the proposed groundwater mitigation system.
- Additional water storage to operate the groundwater mitigation system, if needed, could be accommodated in the Main Area or the North Area (preferred). If needed, the North Area could be used to store additional water, as there is in excess of 300,000 m<sup>3</sup> of capacity in that area once extraction has been completed at the end of Operational Year 14.
- The maximum annual average rate of discharge throughout pit / quarry operations is approximately 587,000 m<sup>3</sup> / year in Operational Year 13. The peak average annual water discharge rate (in Year 13) is expected to be approximately 18.6 L/s.
- There is an option to re-infiltrate an additional 200,000 to 400,000 m<sup>3</sup> / year of groundwater if needed to reduce the quantity of water discharged to the Osprey Valley Golf Course irrigation pond system, or to increase groundwater levels southwest of the Site to benefit the function of the natural heritage features to the southwest.
- Because no water will be discharged from the proposed pit / quarry directly to the Credit River, there are no significant changes expected to flow or thermal characteristics of the Credit River.

## CLOSURE

We trust that this Technical Memorandum meets your current needs. If you have any questions or require clarification, please contact WSP at your earliest convenience.

**WSP Canada Inc.**



George Schneider, M.Sc., P.Geo.  
*Senior Geoscientist*

RS/CDV/PGM/GWS/

Attachments: None

[https://wsonline.sharepoint.com/sites/gld-114392/project files/5 technical work/ph 2300-hydrogeology/45 mitigation system design 2025/05a updated water management plan/19129150 caledon wmp update may2025 r3.docx](https://wsonline.sharepoint.com/sites/gld-114392/project%20files/5%20technical%20work/ph%202300-hydrogeology/45%20mitigation%20system%20design%202025/05a%20updated%20water%20management%20plan/19129150%20caledon%20wmp%20update%20may2025%20r3.docx)

