HARDEN ENVIRONMENTAL SERVICES LIMITED

Hydrogeological Assessment
Proposed Concrete Batch Plant
1017 & 1029 Brebeuf Road
Midland, Ontario

Prepared For:
The Sarjeant Company Limited
15 Sarjeant Drive
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Harden File No. 2361

Submission Record

Revision	Date	Description of Changes
-	August 9, 2024	Hydrogeological Assessment Report for Submission
1	October 8, 2024	Inclusion of Final Private Well Survey

Report Prepared By:

Sincerely,
Harden Environmental Services Ltd.

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Statement of Limitations

Harden Environmental Services Ltd. (HARDEN) conducted the work associated with this report in accordance with the scope of services, time and budget limitations imposed for this work. The work has been conducted according to reasonable and generally accepted local standards for an environmental consultant at the time of the work. No other warranty or representation, expressed or implied, is included or intended in this report.

It should be noted that subsurface conditions might vary at locations and depths other than those locations where borings, surveys or explorations were made by HARDEN or others. Other contaminants, not tested for in this work, may also potentially be present on the Site. Even with exhaustive investigation, it is not possible to warranty the Site will be free of other contaminants. Should conditions, not observed during the work, become apparent, HARDEN should be immediately notified to assess the situation and conduct additional work, where required. The findings of this report are based on conditions as they were observed at the time of the work. No assurance is made regarding changes in conditions subsequent to the time of the work.

Regulatory statutes are subject to interpretation. These statutes and their interpretation may change over time, thus these issues should be reviewed with appropriate legal counsel. HARDEN relied on information provided by others in this report. HARDEN cannot guarantee the accuracy, completeness and reliability of the information provided by others, although HARDEN staff attempted to seek clarification on information provided and verifies authenticity, where practical. The report and its attachments were prepared for and made available for the use of the client and their agents. HARDEN will not be responsible for any use or interpretation of the information contained in this report by any other party without the prior expressed written consent of HARDEN.

1.0 Introduction

Harden Environmental Services Ltd. (Harden) was retained by The Sarjeant Company Limited to complete a Hydrogeological Assessment for the proposed development at 1017 & 1029 Brebeuf Road, Midland, Ontario (herein referred to as the Subject Lands; Figure 1). The Subject Lands are located on the east side of Brebeuf Road, south of Heritage Drive. The subject lands are owned by Team Aggregates and are contiguous with the Team Aggregate pit (Midland Pit) located at 944 Beamish Road. The Sarjeant Company will operate the concrete batch plant.

The hydrogeological assessment is required as part of a zoning by-law amendment application with the Town of Midland. The purpose of the assessment is to characterize the existing groundwater conditions on the Site, identify potential impacts to the local groundwater regime and provide recommendations related to groundwater control/management.

1.1 Proposed Development

The proposed zoning by-law amendment is to allow use of the property as a concrete batch plant. The proposed site use will require a reduction of the ground surface elevation to match the existing elevations in the Midland Pit to the east. Access to the proposed concrete batch plant on the Subject Lands will be from the east via the existing Midland Pit with a municipal address of 944 Beamish Road. There will be no access from Brebeuf Road. The batch plant will include a small site office and employee washroom (Appendix A).

The Subject Lands are an approximately rectangular 5.4 hectare (ha) parcel including 1017 and 1029 Brebeuf Road (Figure 1). An existing aggregate extraction pit (Midland Pit; 944 Beamish Road) is located immediately east of the Subject Lands. The Subject Lands will be merged with the Midland Pit as part of the proposed development (Figure 2). A residential dwelling at 1017 Brebeuf Road is presently occupied and the residential dwelling at 1029 Brebeuf Road is abandoned (Figure 3). The remainder of the Subject Lands are undeveloped/vegetated. Surrounding land use is primarily residential/agricultural to the north, west and south.

1.2 Servicing and Environmental Approvals

Public servicing (water/sewer) is not available in the local area; as such, the development will include an onsite water supply well and private sewage disposal system.

A new water supply well will be installed to service the batch plant and washroom. Daily water use requirements are not expected to exceed 50,000 L/day; as such, a Permit To Take Water (PTTW) is not required from the Ministry of the Environment, Conservation and Parks (MECP).

The sewage disposal system will be designed according to the Ontario Building Code (OBC). Daily sewage design flows are less than 10,000 L/day; as such, an Environmental Compliance Approval (ECA) is not be required from the MECP.

The batch plant may require an ECA from the MECP for onsite discharge of process water. Process water will be managed and infiltrated on-site and no offsite discharge is anticipated.

1.3 Summary of Previous Reports

1.3.1 Preliminary Groundwater and Surface Water Impact Assessment

Harden completed a preliminary groundwater and surface water impact assessment for the Subject Lands in December 2023. The preliminary assessment identified the presence of a small drainage feature with visible groundwater discharge on an adjacent downgradient property (golf course). The Subject Lands were interpreted to contribute a portion of groundwater interflow to the downgradient drainage feature, which may potentially be impacted by the proposed development. The Subject Lands are higher in elevation than the golf course, and two shallow dug wells in the ditch adjacent to the Subject Lands indicated that groundwater resides in the upper fine grained sediments, despite being underlain by unsaturated sand and gravel. Additional investigation was required to determine if on-site groundwater can contribute to the observed downgradient groundwater discharge area and provide an estimate of loss (if any) of groundwater discharge as a result of the proposed site works.

The preliminary report was presented to the Severn Sound Environmental Association along with a scope of work for the fulsome hydrogeological investigation.

1.4 Study Objectives and Assessment Approach

The hydrogeological assessment is required as part of a zoning by-law amendment application with the Town of Midland.

The objectives of the hydrogeological assessment included:

- Characterize the local hydrogeological setting and determine groundwater conditions on the Subject Lands.
- Assess the extent of local groundwater / surface water interaction.
- Assess the potential impact of development on environmental receptors.
- Assess potential impact on the source water (quality and quantity) of nearby municipal wells and private water supply wells.
- Recommend measures to minimize any significant impacts identified.

Harden's completion of this study included the following tasks:

- Review of available environmental and geological background reports for the Subject Lands.
- Review of supporting background information sources including geological mapping from the Ontario Geological Survey (OGS), Ministry of the Environment, Conservation and Parks (MECP) Water Well Records and other relevant publications.

- Coordinating the installation of new groundwater monitoring wells on the Subject Lands to facilitate shallow groundwater monitoring. The monitoring wells were drilled and installed as part of the geotechnical investigation by SoilEng (2024).
- Installing shallow piezometers within areas with observed surface water pooling on the Subject Lands to evaluate groundwater-surface water hydraulic interactions.
- Groundwater level monitoring on four occasions from April to July 2024, including the spring freshet.
- In situ rising/falling head recovery testing of onsite monitoring wells to estimate the hydraulic conductivity of the subsurface soils.
- Water quality analysis of the shallow groundwater for general chemistry parameters.
- A 6-hour pumping test at the existing drilled supply well located in the adjacent gravel pit, including water quality analysis and water supply analysis.
- Private well survey of properties within 500 m of the Subject Lands.
- Nitrate loading assessment for the proposed septic system.
- Water balance assessment for the Subject Lands under existing and post-development conditions.
- Assessment of impacts to nearby environmental receptors and existing infrastructure.
- Preparation of a hydrogeological report including recommendations for mitigation of potential impacts.

The collected information has been summarized with analysis and interpretation by a qualified hydrogeologist (P.Eng. or P.Geo.). The report was completed in general accordance with applicable provincial legislation, Ontario Water Resources Act, Ontario Regulation 387/04, R.R.O. 1990, Regulation 903: Wells and the 2013 Conservation Authority Guidelines for Development Applications – Hydrogeological Assessment Submission.

2.0 Physical Setting

2.1 Drainage, Topography and Environmental Features

Existing topography on the Subject Lands is gently sloping to the south-southwest, with an elevation of between 221 to 230 m above mean sea level (m AMSL). The adjacent Midland Pit has been excavated into the sand and gravel unit to an existing pit floor elevation of approximately 209 m AMSL. There is a local topographical high point (knoll) just northwest of the site at an elevation of 236 m AMSL. The site is on the eastern slope of this knoll. From the knoll, the land surface decreases in southwesterly direction to the tributary of Mud Lake (at the golf course). The elevation of the tributary is approximately 200 m AMSL. Mud Lake has an elevation of

178 m AMSL and Little Lake located 1,400 metres north of site has an elevation of 198 m AMSL. Georgian Bay has an elevation of approximately 176 m AMSL.

The Subject Lands and the adjacent Midland Pit are within the Wye River subwatershed, South Georgian Bay Shoreline watershed of Lake Huron. There are no mapped wetlands on the Subject Lands or within 500 m.

There is a roadside drainage ditch along Brebeuf Road, which conveys surface drainage in a southerly direction. A defined drainage channel is mapped as originating on the southwest corner of the Subject Lands and flowing to the southwest (Figure 4). Based on field observations on the Subject Lands, the drainage channel is an intermittent feature that holds and conveys surface water during the spring and following significant precipitation events but is dry for the remainder of the year. The drainage channel crosses under Brebeuf Road via a corrugated culvert and onto the golf course property. The corrugated culvert was dry and filled with debris (predominantly dry leaves) during all site visits by Harden, including the spring 2024 when the on-site drainage channel contained surface water. Harden interprets that a portion of the surface water held within the drainage channel infiltrates and moves downgradient as interflow within the shallow soil system. Southwest of Brebeuf Road the drainage channel emerges through seepage from shallow groundwater interflow before entering the drainage system on the golf course, which includes a series of swales, ponds and subsurface drainage features that outlet to a much larger tributary of Mud Lake on the southwest side of the golf course.

An ephemeral wetland inclusion was identified on the site by Birks Natural Heritage Consultants (Birks) during initial site visits in 2023 and characterized within the Environmental Impact Study (Birks, 2024).

2.2 Regional Geology

The Subject Lands are situated within the Simcoe Uplands physiographic region and characterized by till plains and steep flat-floored valleys from the old shorelines and former islands of Lake Algonquin (Figure 6; Chapman & Putnam, 1984, 2007). Surficial geology mapping shows that the Subject Lands are covered in ice-contact stratified deposits of sand and gravel with minor silt, clay and till (Figure 7; OGS, 2010). The northwest corner of the Subject Lands is mapped as containing coarse-textured glaciofluvial outwash deposits (gravelly to sandy material).

MECP (2024b) water well records within 500 m of the Subject Lands indicate primarily sand and gravel at surface, with some records showing clayey to silty material at surface overlying the sand and gravel (Table C-2, Appendix C). The regional aquifer, also referred to as Aquifer A3 or the Lower Aquifer, is typically found at an elevation range of 120 to 200 m AMSL and includes sand and gravel overburden to the top of bedrock. The regional aquifer is about 15 to 50 m thick and varies in composition from fine sand to coarse gravel (Lake Simcoe Region Conservation Authority, 2015a).

Bedrock regionally consists of limestone with minor upper shales of the Bobcaygeon Formation, Simcoe Group. The bedrock is of Middle to Late Ordovician age and consists of primarily

limestones with some shales, ranging from 7 to 87 m thick (Singer et al., 2003). The bedrock surface is approximately 95 to 101 m below ground surface (mbgs) based on nearby MECP water well records (Table C-1, Appendix C).

A surficial fine-grained clayey to silty layer is identified on some local MECP water well records to a depth of 2 to 13 mbgs. The surficial clay/silt layer is interpreted as intermittent in the local area, below which are unsaturated sand and gravel layers with intermittent fine-grained layers, which may be up to seven metres thick. The surficial clay/silt provides opportunity for perched groundwater conditions and shallow interflow above the unsaturated sands in the vicinity of the Subject Lands.

2.3 Regional Hydrogeology

The Lower Aquifer (also known as Aquifer A3 or the regional aquifer) in the vicinity of the Subject Lands is found within the thick sequence of stratified ice contact deposits. A Town of Midland municipal well is located one kilometer northeast of the site and obtains water from this aquifer at a depth of 64 to 72 metres below grade (approximate elevation of 145 m AMSL). The aquifer is very productive with the water well record for the municipal well indicating a potential rate of 1,200 gallons per minute (4,560 Liters Per Minute). This aquifer is also targeted by the well on the Team Aggregates site where well screens are also set at approximately 140 m AMSL. Local private water wells also target this aquifer.

Regional groundwater flow is southeasterly toward Mud Lake. The groundwater potential of water in the Team Aggregate well is 190 m AMSL which is lower than that of Little Lake and higher than that of Mud Lake. With local ground surface elevations of up to 236 m AMSL, the unsaturated sediment thickness is up to 46 metres thick.

Overlying the Lower Unit is the Upper Unit, consisting of till and stratified fine-grained sediments originating from ice-contact and reworked sediments by advancing and retreating glaciers. The Upper Unit can hold water where the sediments are fine grained. Local dug wells are evidence of this. Groundwater flow in these sediments will be strongly influenced in the direction of local topographical low areas.

Figure 8 depicts a simplified geological profile of the area through the Subject Lands. Glaciolacustrine deposits identified west of the site do not occur beneath the Subject Lands. There is a relatively thick layer of unsaturated sediments underlying the area with the potentiometric surface of the lower aquifer unit shown at 190 m AMSL and the shallow water table of the upper unit shown near existing ground surface.

2.4 Groundwater Use

Municipal servicing is not available in the 500 m buffer surrounding the Subject Lands and all properties are serviced by private wells and septic systems. A search of MECP (2024b) water well records identified 17 records within 500 m of the Subject Lands (Figure 9), including 2 public supply wells, 10 domestic supply wells, 1 livestock/domestic supply well, 1 industrial supply well

(within the adjacent pit), 1 observation/monitoring well, 1 test hole and 1 well abandonment record (Table C-1, Appendix C). The water supply wells were installed between 1949 and 2016 within the sand and gravel aquifer with depths of 47 to 78 mbgs, which is interpreted as the regional unconfined sand and gravel aquifer unit. Two nearby wells were installed in the upper 2 m of limestone/dolomite bedrock with depths of 96 and 103 mbgs. Local well records recorded high yields of 10 to 50 gallons per minute. No shallow dug wells were identified in the well record search, however, a shallow aquifer is present near to the site as evidenced by on-site dug well and two dug wells in the roadside ditch.

Two existing Permits to Take Water (PTTW) are mapped within 1 km of the Subject Lands (MECP, 2024c):

- PTTW No. 2080-ABVQ6T for groundwater and surface water takings from Brooklea Golf & Country Club Well #1 and "Unnamed Stream Source 2", located approximately 650 m southwest of the Subject Lands. Groundwater takings are permitted up to 450,900 L/day for 74 days annually and surface water takings from the stream are permitted up to 1,404,000 L/day for 109 days annually. Surface water takings are from the larger tributary and not from the small drainage channel that flows from the Subject Lands to the golf course property. As such, the proposed site development is not expected to adversely impact groundwater or surface water takings by the golf course.
- PTTW No. 2406-AKPQ83 for groundwater takings from Midland Public Water Supply Wells, with 11 drilled wells for a total permitted taking of 20,763,200 L/day for 24 hours/day and 365 days/year. The Heritage Wellfield (7A and 7B) is located approximately 900 m northeast of the Subject Lands, with permitting takings of 4,924,800 L/day for Well #7A and 4,233,600 L/day from Well #7B. The Subject Lands is within the WHPA-Q2 for this supply well cluster and applicable source protection policies are discussed herein.

2.5 Source Protection

The Subject Lands are within the Severn Sound Source Protection Area of the South Georgian Bay Lake Simcoe Source Protection Region. The Subject Lands are in a wellhead protection area (WHPA)-Q2 for quantity, a highly vulnerable aquifer (HVA) and significant groundwater recharge area (SGRA) with a score of 6 (high vulnerability) and the associated source protection policies will apply (Figure 10).

The WHPA-Q2 is an area where future reduction in recharge would have significant impacts to source protection. The policy for WHPA-Q2 under the Approved Source Protection Plan for the South Georgian Bay Lake Simcoe Source Protection Region (Lake Simcoe Region Conservation Authority, 2015b) requires that groundwater recharge be maintained on the Subject Lands. The proposed site development, including grading, water takings and onsite discharge of batch plant process water will result in a net increase in recharge.

3.0 Site Investigation and Results

The site investigation included verifying the subsurface materials identified and the location of boreholes drilled by Sola (2024) and collecting groundwater data within the monitoring wells.

3.1 Site Reconnaissance Observations

Harden completed a site visit on December 6, 2023 to observe the Subject Lands and surface drainage conditions. The site was mainly undeveloped with wooded and pasture-type vegetation. An abandoned house was present in the centre of the property with a gravel driveway. A raised berm was observed on the eastern extent of the Subject Lands adjacent to the existing pit. Site topography sloped west-southwesterly from the raised berm toward Brebeuf Road and the southwestern corner of the Subject Lands. A few small ephemeral wetland inclusion areas were observed with accumulated surface water that was frozen at the time of the site visit. The on-site drainage feature was dry and lightly snow-covered. A small culvert (approximately 30 cm diameter) that conveys surface flow from the ditch on the west side of the Subject Lands across Brebeuf Road was dry with some accumulated dry leaves inside; no standing water or ice was present within the culvert.

Harden was permitted access to the golf course lands southwest of the Subject Lands to observe the downstream drainage area. The mapped drainage feature continued west-southwest from the Subject Lands, through a wooded area in the northeast corner of the golf course property and was dry until approximately 110 m downstream of the Brebeuf Road culvert. At that location, groundwater discharge was observed which flowed as surface water for about 60 m until just before it reached a fairway of the golf course. The surface flow disappeared either through infiltration or subdrainage installed by the golf course. An offline pond on the northeast corner of the golf course was observed to be ice-covered. The remaining approximately 350 m of mapped drainage feature on the golf course was observed as a small, grassed swale that was lightly snow covered with no pooled water, until about 50 m from its convergence with the larger tributary where the drainage feature became a defined valley with flow observed. Corrugated drainage pipe was observed within the tributary valley and it is interpreted that tile drainage is used on the golf course lands.

3.2 Site Stratigraphy

SoilEng advanced eight boreholes at six locations (BH1S/D, BH2S/D, BH3, BH4, BH5 and BH6) to depths between 6.1 to 20.0 metres below ground surface (mbgs) between April 11-16, 2024 (Figure 11). (Appendix B). The drilling corroborates the regional geological framework with a shallow-depth fine grained unit (Upper Unit) and a deeper sand and gravel unit (Lower Unit). The thicknesses of these units and description as seen from the drilling samples are described below.

Topsoil (0.08 to 0.25 m thick)

All boreholes were drilled through a thin layer of topsoil at surface.

Sand to Silty Sand (to 1.3-4.0 mbgs) (Reworked Glacial Sediments – Upper Unit)

Fine to medium grained sand, well graded, trace silt to silty, occasional cobbles and boulders, brown to dark brown, very loose to very dense, becoming wet between 0.5 and 2.9 mbgs. All boreholes except BH1S/D and BH6 were drilled through the upper sand to silty sand layer.

Gravelly Sand (to over 20.0 mbgs) (Ice Contact Sediments – Lower Unit)

Gravelly sand, well graded, trace to some silt, occasional cobbles and boulders, brown, loose to very dense. The gravelly sand was encountered below the Upper Unit fine grained sediments, where present, and was otherwise immediately below the topsoil in BH1S/D and BH6. The gravelly sand was noted as wet between 1.0 and 4.8 mbgs in BH1S/D, BH2S/D, BH4 and BH6. Layers of clay and/or wet silt were identified in BH1S/D, consistent with a glaciolacustrine to glaciofluvial depositional environment. The extensive gravelly sand unit was identified in all boreholes from below the topsoil and/or sand (where present) to the terminal borehole depths of 6.4 to 20.0 mbgs.

From water well record 5715926 (Team Aggregates well in the Midland Pit), the thickness of the ice contact sediments is over 70 m.

3.3 Monitoring Well and Piezometer Installations

Groundwater monitoring wells were installed by SoilEng in April 2024 at all boreholes on the Subject Lands (BH1S/D, BH2S/D, BH3, BH4, BH5 and BH6). Monitoring wells were installed with 51 mm (2”) diameter Schedule 40 PVC casings and 10-slot well screens 1.6 to 3.1 m in length. Each well annulus was backfilled with sand to 0.5-0.8 m above the top of the screen and sealed to surface with bentonite pellets. Each well stickup was completed with a lockable steel monument.

Harden installed shallow piezometers at two locations on the Subject Lands (DP1S/D and DP2). A nested pair of one shallow and one deep piezometer was installed at DP1S/D to monitor vertical gradients. The piezometers were installed as 25 mm (1”) diameter steel pipes with 0.23 m length 19 mm (0.75”) diameter stainless steel screens, which were hand-driven into the shallow sediments to depths of 0.7 to 2.0 mbgs.

One dug water well was identified on the Subject Lands as well as two dug wells within the ditch on the east side Brebeuf Road.

Table D-1 (Appendix D) provides details of the groundwater monitoring well installations compiled from the Borehole Logs (Appendix B) and field measurements.

3.4 Soil Hydraulic Conductivity

Harden completed in situ falling head recovery tests in BH6 on June 6, 2024 and in BH1S and BH2S on July 4, 2024 to estimate the hydraulic conductivity of the screened materials.

Monitoring wells were developed by purging with a Waterra™ inertial pumping system prior to conducting the field tests. The well recovery tests were conducted by adding a known volume of water to each monitor and measuring the rate of decline of the water level in the monitoring well.

An estimate of the hydraulic conductivity was determined using the following method (Hvorslev, 1951):

$$K = r^2 \ln(L/R) / 2LT_o$$

Where:

k = hydraulic conductivity (m/s)
r = radius of the well (m)
L = length of screen (m)
R = radius of borehole (m)
T_o = lag time obtained from graph (s)

The analyses are provided in Appendix E and summarized in the following table.

Table 1: Hydraulic Conductivity – In Situ Well Response Tests

Well ID	Screened Stratigraphy	Screened Interval (mbgs)	Hydraulic Conductivity (m/s)
BH1S	Gravelly Sand	1.43 – 4.48	2.3×10^{-4}
BH2S	Gravelly Sand	2.66 – 5.71	8.2×10^{-7}
BH6	Gravelly Sand	2.96 – 6.01	7.8×10^{-8}

The calculated hydraulic conductivity ranged from 7.8×10^{-8} to 2.3×10^{-4} m/s with a geometric mean of 2.5×10^{-6} m/s. The in-situ test results are generally consistent with literature ranges of 10^{-7} to 10^{-5} m/s for silty sand to fine sand material and 10^{-5} to 10^{-3} m/s for well-sorted sands and glacial outwash material (Fetter, 1994).

3.5 Groundwater Levels

Harden measured groundwater levels in the onsite monitoring wells, dug wells and piezometers using a battery-operated water level meter on six occasions between April and July 2024. Additional groundwater readings within the dug wells in the ditch were obtained in November and December 2023, and groundwater levels within pit wells MW3 and MW10(PW-1) were measured on select dates. The groundwater levels are presented in Table D-2 (Appendix D).

3.5.1 Groundwater Levels in the Upper Unit

Groundwater levels within the shallow monitoring wells (BH1S, BH2S, BH3, BH5 and BH6), with well bottom elevations between approximately 218.9 and 220.2 m AMSL, ranged from <220.2 to

226.6 m AMSL (0.3 to >7.4 mbgs), with BH3 dry during all measurements. Groundwater levels within the shallow dug wells were within the same elevation range as the shallow monitoring wells, ranging from 221.0 to 226.0 m AMSL (0.0 to 1.8 mbgs) over the monitoring period. The April 2024 readings are interpreted as the approximate seasonal groundwater high, with groundwater levels within about one metre of existing grade in some wells. The shallow groundwater table is expected to fluctuate by approximately 1 to 2 m, with the highest groundwater levels typically encountered during the spring freshet and in response to significant precipitation events.

3.5.2 Groundwater Levels in the Lower Unit

Monitoring wells BH1D, BH2D and BH4 were installed the upper unsaturated sediments of the Lower Unit, with bottom elevations between 215.4 and 215.5 m AMSL. Groundwater levels within these deeper wells were recorded at <213.6 to 216.0 m AMSL (8.7 to >11.9 mbgs), with all of the deep wells dry in July 2024. The deep monitoring wells were installed using mud rotary drilling techniques and the wells all went dry and did not recover following well development efforts.

Water levels were obtained from groundwater monitoring wells in the gravel pit MW3 and MW10 (PW-1), installed within deeper sand and gravel with well bottom elevations of 189.2 and 162.9 m AMSL, respectively. Groundwater elevations in MW3 and MW10 are approximately the same. As discussed in Section 2.2 the Lower Unit can be up to 50 m thick, and MW3 and MW10 are interpreted to be screened within the regional ice contact sediments aquifer unit. Groundwater elevations ranged from 190.2 to 190.7 m AMSL over the monitoring period.

The regional ice contact sediments aquifer is the target aquifer for the proposed concrete batch plant supply well. With a proposed final grade of 209 m AMSL at the batch plant, the permanent groundwater table within the regional aquifer will be approximately 18 m below the proposed final grade.

3.6 Groundwater Flow

3.6.1 Shallow Groundwater Flow

Figure 12 presents groundwater elevations measured from shallow groundwater monitors on June 5, 2024. Interpolated contour lines of groundwater equipotentials are also presented on Figure 12.

A shallow groundwater flow divide is interpreted across the centre of the Subject Lands, with groundwater on the west side flowing west to southwest toward Brebeuf Road and groundwater on the east side flowing east toward the existing gravel pit (Figure 12).

Given the thick unsaturated conditions in the sand and gravel underlying the surficial fine-grained sediments, we interpret this shallow groundwater to be retained within the surficial fine-grained Upper Unit. Water movement in the fine-grained Upper Unit will mainly be vertically downward.

There is no discharge of water from the Upper Unit at the exposed face in the adjacent gravel pit or in the onsite water course.

3.6.2 Recharge and Discharge Conditions

Monitoring pairs BH1S/D and BH2S/D were installed to monitor vertical gradients between the shallow stratigraphic layers containing finer grained sediments and the deeper unsaturated sand and gravel across the Subject Lands. The shallow monitors (BH1S and BH2S) were screened to base elevations of 220.2 and 218.9 m AMSL, respectively; while the deeper monitors (BH1D and BH2D) were both screened to 215.5 m AMSL. Monitoring results between April and July 2024 consistently indicated strong downward vertical gradients, with shallow groundwater levels between 0.3 and 4.1 mbgs (220.6 to 224.3 m AMSL) and deep groundwater levels between 8.7 and >9.2 mbgs (<215.5 to 216.0 m AMSL) with the deep wells dry throughout most of the monitoring period. The strong downward vertical gradients are indicative of recharge occurring from the shallow finer sediments into the underlying unsaturated sand and gravel.

Piezometers DP1S/D and DP2 were installed within locations on the Subject lands where intermittent surface water pooling was identified.

- DP1S/D was installed within the drainage feature on the southwest side of the Subject Lands. As discussed in Section 2.1, the drainage feature is an intermittent feature that holds surface water during the spring and following significant precipitation events but is dry for the remainder of the year. Groundwater levels within DP1D and DP1S were similar to surface water levels within the drainage feature in April 2024 with 0.3 m of water above grade and no significant vertical gradient. Surface conditions at DP1S/D were dry for the remainder of the monitoring period (May through July 2024), and shallow groundwater within DP1D declined significantly with water levels of 1.4 to 1.8 mbgs. Shallow groundwater elevations within DP1D were also about 1 to 2 m above groundwater elevations in nearby monitoring well MW2S, indicating a consistent downward gradient between the upper and lower fine-grained layers of the Upper Unit.
- DP2 was installed within the 0.11 ha ephemeral wetland inclusion on the north portion of the Subject Lands to monitor hydraulic differences between shallow groundwater and pooled surface water. Groundwater levels in DP2 were similar to surface water levels within the ephemeral wetland inclusion in April and May 2024, with water levels up to 10 cm above ground surface and no significant vertical gradient. The ephemeral wetland inclusion was dry at DP2 for the remainder of the monitoring period (June and July 2024). Shallow groundwater levels declined to 0.4 and 1.0 mbgs in June and July, respectively.

3.7 Groundwater Quality

3.7.1 Upper Unit Groundwater Quality

Harden collected a background shallow groundwater quality sample from BH2S on April 22, 2024. Prior to sampling a minimum of three well volumes were purged from the well to remove stagnant water and sediments from the well. Sample bottles for metals and mercury were field-filtered during groundwater collection. Groundwater samples were collected directly into laboratory-supplied containers and delivered directly to the laboratory under chain of custody documentation in a cooler packed with ice. The samples were analyzed by AGAT Laboratories in Mississauga, a Canadian Association for Laboratory Accreditation Inc. (CALA) and Standards Council of Canada (SCC) accredited laboratory. Laboratory certificates of analysis are provided in Appendix G.

The results of the shallow groundwater sample from MW2S were compared to the Ontario Drinking Water Quality Standards (ODWS). The results did not exceed the ODWS Maximum Acceptable Concentration (MAC) for any tested parameter. The shallow groundwater sample was high in hardness (176 mg/L), which exceeds the ODWS Operational Guideline of 80-100 mg/L. Turbidity and colour also exceeded the ODWS Aesthetic Objectives for Turbidity and Colour, which is common in samples collected from monitoring wells. Nitrate and nitrite were not detected within the shallow groundwater sample.

Harden did not identify any concerns regarding the background shallow groundwater quality on the Subject Lands.

3.7.2 Lower Unit Groundwater Quality

Harden collected a groundwater quality sample from the existing supply well PW-1(MW10) within the adjacent pit near the end of the 6-hour pumping test on June 5, 2024. The pit well is screened within the regional sand and gravel aquifer unit, which is the target aquifer for the proposed new supply well for the concrete batch plant. The pumping test and water quality results from PW-1 are considered representative of groundwater conditions at the proposed concrete batch plant.

The results of the deep groundwater sample from PW-1 (Appendix G) did not exceed the ODWS Maximum Acceptable Concentration (MAC) for any tested parameter. The groundwater was high in hardness (293 mg/L), which exceeds the ODWS Operational Guideline of 80-100 mg/L. Sodium (48.7 mg/L) exceeded the Medical Officer of Health Reporting Limit of 20 mg/L but was below the ODWS Aesthetic Objective of 200 mg/L. Elevated hardness (naturally occurring) and elevated sodium concentrations(from road salt) are common in groundwater in southern Ontario and are not considered a concern for the concrete batch plant water supply. Nitrate was present at 3.47 mg/L, which is below the ODWS MAC of 10 mg/L but is indicative of minor impacts from nearby agricultural use of fertilizers and/or sewage disposal from private and/or communal septic systems.

Based on the sample results from PW-1, the existing water quality within the regional sand and gravel aquifer is considered acceptable as a water supply for the proposed concrete batch plant. An additional groundwater quality sample should be collected from the batch plant supply well following installation for analysis of general water quality parameters.

4.0 Water Supply Evaluation

The proposed concrete batch plant will be serviced by a new water supply well, which will be drilled once excavation to the proposed final floor elevation is completed in the area of the new well. Water use requirements for the office building, washrooms and ready-mix plant are not expected to exceed 50,000 L/day and will not require a PTTW from the MECP.

The target aquifer for the new supply well is the regional unconfined sand and gravel aquifer unit that supplies pumping well PW-1/MW10 within the adjacent pit, as well as the nearby municipal production wells and several local private water wells. To evaluate the potential of the target aquifer to supply water of adequate quality and quantity for the batch plant, a pumping test was completed within the existing pumping well PW-1/MW10.

4.1 Pumping Test

Harden conducted a 6-hour pumping test within the existing supply well at the adjacent pit PW-1/MW10 (MECP Water Well 5715926) on June 5, 2024. PW-1 is a 6" diameter steel well screened within the regional sand and gravel aquifer, which is the target aquifer for the future batch plant well.

The pumping test results are presented in Appendix F and summarized below:

- Harden pumped PW-1 using a at 92 L/min (24.3 US gal/min) using a submersible pump for 360 minutes.
- The static water level in PW-1 was approximately 190 m AMSL (19 mbgs) before pumping, and a maximum drawdown of about 5 m was observed during the pumping test, with another 22 m of available drawdown within the well, for a total of 27 m of available drawdown (Figures F-1 and F-2, Appendix F).
- A water quality sample was collected from PW-1 during the test for general water quality analysis. The water quality results are discussed in Section 3.7.2.
- Upon shutting off the pump, PW-1 fully recovered to static levels within approximately 4 minutes (Figures F-1 and F-2, Appendix F).
- Continuous groundwater level monitoring was also completed within MW3 during the pumping test, located approximately 20 m from PW-1. No drawdown effects were observed in MW3 (Figures F-3 and F-4, Appendix F).

The results of the pumping test indicate that the sand and gravel aquifer can produce more than adequate water supply for the proposed concrete batch plant. Based on an estimated transmissivity of 33 m^2/day as indicated by the test data (Figure F-5, Appendix F), there will be less than one metre of drawdown beyond the property boundary and no significant impact on nearby private wells.

5.0 Private Well Survey

Harden provided notification letters with a well survey form (Appendix I) to each property within 500 m of the Subject Lands on July 30, 2024. Letters were hand-delivered to seven properties along Brebeuf Road (properties within 250 m of the Subject Lands) and sent by Canada Post to the remaining properties on Highway 12 and Highway 93 (properties within 500 m of the Subject Lands), for a total of 14 letters distributed. Residents were provided with the option to reply to Harden by phone, text or e-mail. Harden also completed in-person interviews with those who were available at the time of the door-to-door well survey.

The well survey details are summarized in the table below.

Table 2: Summary of Private Well Survey

Address	Well Type	Supply Aquifer	Approximate Distance from Subject Lands
926 Brebeuf Rd	drilled well 6” diameter above grade steel casing, vented, vermin-proof lid, installed ~2010, well tag A023982	Sand and Gravel Aquifer	160 m N
934 Brebeuf Rd	250’ deep drilled well 6” diameter above grade steel casing, vented, vermin-proof lid, installed ~1980s, no well tag	Sand and Gravel Aquifer	120 m N
1014 Brebeuf Rd	360’ deep drilled well, 6” diameter above grade steel casing, vented, vermin-proof lid, no well tag	Sand and Gravel Aquifer	60 m W
1024 Brebeuf Rd	Well 5709376, 228’ deep, serves two units, good quality, concerned about future water quality.	Sand and Gravel Aquifer	50 m W
1034 Brebeuf Rd	Deep drilled well, 6” diameter above grade steel casing, vented, vermin-proof lid, well tag; also old dug well by driveway with future use potential.	Sand and Gravel Aquifer	80 m W

Address	Well Type	Supply Aquifer	Approximate Distance from Subject Lands
1041 Brebeuf Rd	Drilled well, 6" diameter above grade steel casing, vented, vermin-proof lid, no well tag	Sand and Gravel Aquifer	70 m S
1053 Brebeuf Rd	Delivered letter to mailbox – response not received to date	-	160 m S
8567 Hwy 93	Sent survey by Canada Post – response not received to date	-	600 m SW
8709 Hwy 93	Sent survey by Canada Post – response not received to date	-	480 m W
16984 Hwy 12	Sent survey by Canada Post – response not received to date	-	430 m NE
17003 Hwy 12	Sent survey by Canada Post – response not received to date	-	490 m NE
17029 Hwy 12	Sent survey by Canada Post – response not received to date	-	430 m NE
17102 Hwy 12	Sent survey by Canada Post – response not received to date	-	270 m N
17111 Hwy 12	Sent survey by Canada Post – response not received to date	-	260 m N

The findings of the well survey include:

- Responses were received from 5 of the 14 properties – a 36% participation rate.
- Nearby private wells are installed within the regional sand and gravel aquifer to depths of 250 to 360 mbgs.
- No shallow dug wells were identified that were used for water supply within 500 m of the Subject Lands. One unused dug well was identified at 1034 Brebeuf Road that has most recently been used for landscaping but is proposed to be used to service future shop.

6.0 Water Balance

The objective of the water balance was to quantitatively estimate the hydrological impacts as a result of the proposed development on the Subject Lands, and to evaluate potential LID measures to mitigate hydrological impacts. Our approach uses a monthly soil-moisture balance based on Thornthwaite and Mather (1957) methodology, which accounts for surface water runoff and infiltration, under both the pre-development (existing) and post-development conditions.

6.1 Water Balance Components

A water balance is an estimation of the balance between water input (e.g., precipitation) and water output (e.g., evapotranspiration, infiltration and runoff). It is based upon climatic conditions (temperature and precipitation) and site conditions (e.g., soil, topography and vegetation).

The water balance estimates are based on the following equation:

$$P = \Delta S + ET + R + I$$

Where: P = precipitation

ΔS = change in storage

ET = evapotranspiration / evaporation

R = surface water runoff

I = infiltration

A summary of the hydrologic cycle component values based on the MECP Stormwater Management Planning and Design Manual (Table 3.1: Hydrologic Cycle Component Values) is provided in Table H-1 (Appendix H). The component calculations for each catchment area on the site are provided in Tables H-2 to H-6 (Appendix H) and discussed below.

Precipitation (P)

Long-term average precipitation data were obtained from the Environment Canada Climate database based on 1981-2010 Climate Normals for the Midland Water Pollution Control Plant (WPCP) MECP Climate Station, located approximately 4.2 km northeast of the Subject Lands at an elevation of 180 m AMSL. The average annual precipitation is 1,041 mm/year. Average monthly temperature and precipitation data were used for the water balance component calculations for each catchment in Tables H-2 to H-6 (Appendix H).

Storage (ΔS)

Storage includes soil moisture storage (i.e., the water retention capacity of the soil matrix) and surface storage (e.g., precipitation surplus stored as snow above grade when the temperature is

below -1°C). The change in storage was estimated based on Thornthwaite and Mather (1957) methodology for accumulated potential water loss and soil moisture storage.

Soil moisture storage input values were estimated using the MECP Stormwater Management Planning and Design Manual (Table 3.1: Hydrologic Cycle Component Values). Existing soils were interpreted as primarily fine sandy loam with variable cover from pasture and shrubs to mature forests, resulting in a predevelopment soil moisture storage of 150 to 300 mm, while soils in the post-development condition will be similar along berms and undisturbed areas but will also have a soil moisture storage of 50 mm in the unvegetated sand and gravel pit floor areas (Table H-1, Appendix H).

Evapotranspiration / Evaporation (ET)

Evapotranspiration and evaporation components are affected by the perviousness of the land, vegetation types and soil moisture conditions. Potential evapotranspiration (PET) estimates the water loss from a vegetated land surface assuming unlimited water inputs. Actual evapotranspiration (AET) accounts for soil moisture deficit (e.g., during dry conditions). AET is therefore often less than PET during dry summer months. The resulting annual PET for vegetated areas is 602 mm/year (Tables H-2 to H-3, Appendix H). For the gravel pit floor areas in the post-development condition a 50% reduction in PET was assumed, for a resulting annual PET in the pit floor areas of 301 mm/year (Tables H-5 and H-6, Appendix H).

For impervious surfaces, an estimated 15% of precipitation will be evaporated, with the remaining 85% as water surplus.

Water Surplus (R+ I)

The remaining water surplus following ET exists as surface runoff and/or infiltration into the surficial soil. The detailed monthly calculations for each catchment estimates a water surplus between November and May each year (Tables H-2 to H-6, Appendix H). The ratio of runoff to infiltration was estimated for each catchment using an infiltration factor based on topography, soil type and land cover based on the MECP Stormwater Management Planning and Design Manual (Table 3.1: Hydrologic Cycle Component Values).

In the case of impervious surfaces, all remaining water surplus following evaporation will be runoff (without mitigation). The water surplus (runoff) for impervious areas was estimated by assuming 15% evaporation of precipitation (156 mm/year), with the remaining 85% as runoff (885 mm/year).

6.2 Water Balance Assessment (Pre- and Post-Development)

Harden completed a water balance for the Subject Lands using Thornthwaite and Mather (1957) methodology. The analysis also includes the proposed development area for the concrete batch plant and some of the surrounding lands, as some of the surface catchments extend across the development boundary as shown on Drawings SWM-1 and SWM-2 (Appendix H).

The catchment areas for the pre- and post-development conditions are depicted on Drawing No. SWM-1 and SWM-2, in addition to the detailed breakdown of each catchment area by Jones Consulting Group Ltd. (Jones) (Appendix H). The existing lands are a mix of treed and pasture/shrub areas, with small areas of packed gravel driveways and impervious roof surfaces. In the post-development condition, the central portion of the site will become unvegetated sand and gravel (pit floor), with buffer areas of treed and pasture/shrub areas and some impervious surfaces for the new building and roadways.

Table H-7 (Appendix H) provides a summary of the water balance estimates for total runoff and infiltration for each catchment under pre-development (existing) and post-development conditions, without any infiltration augmentation measures. The proposed concrete batch plant development will result in an estimated 26% increase in surface runoff and a 13% increase in infiltration, for a total of approximately 4,730 m^3 annually of additional infiltration.

With the net increase in infiltration, infiltration augmentation measures are not proposed for the development. The additional runoff will flow downslope toward the existing sand and gravel pit floor where it will infiltrate the unvegetated sand and gravel surface.

7.0 Nitrate Impact Assessment

The proposed development will be serviced by a private onsite sewage disposal system. Harden completed a nitrate impact assessment to examine the impacts of the proposed sewage system using MECP (1996) *Procedure D-5-4: Technical Guideline for Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment*. Application of Procedure D-5-4 requires the following three steps:

1. Lot Size Considerations
2. System Isolation Considerations
3. Contaminant Attenuation Considerations

7.1 Step One: Lot Size Considerations

Procedure D-5-4 indicates that developments consisting of lots averaging at least 1 ha (with no lot less than 0.8 ha) may not require a detailed assessment provided that the area is not hydrogeologically sensitive.

The Subject Lands is an approximately 5.4 ha property and may not require a detailed assessment under the Procedure; however, we have included a full assessment for due diligence.

7.2 Step Two: System Isolation Considerations

Procedure D-5-4 indicates that developments are normally considered low risk where sewage effluent is hydrogeologically isolated from existing or potential supply aquifer(s).

The proposed batch plant on the Subject Lands will be excavated into the unconfined sand and gravel unit, which is considered to be a regional aquifer system. As such, the proposed sewage disposal system is not interpreted as hydrogeologically isolated from the supply aquifer system.

7.3 Step Three: Contaminant Attenuation Considerations

Procedure D-5-4 indicates that contaminant attenuation must be considered for lot sizes greater than 1 ha where system isolation cannot be demonstrated.

A predictive assessment (industrial/commercial developments) was completed for the Subject Lands. A predictive assessment evaluates the attenuation capacity of the property based on the sewage volume, nitrate concentration in the effluent, and dilution provided by precipitation (rain/snow) over the property. Details of each input parameter are discussed below:

- Sewage Volume: The sewage design flow of 2,360 L/day was used based on the total average daily flow presented in the FSR (Jones, 2024).
- Nitrate Concentration in Effluent: Although the property will be used for industrial/commercial purposes, the proposed sewage system will receive effluent from employee washroom and kitchen areas. As such, the estimated nitrate concentration is assumed to be equivalent to residential sewage at approximately 40 mg/L.
- Dilution by Precipitation: The amount of precipitation available for infiltration (and dilution) is based on the average annual precipitation (based on climate normal data) less the estimated evapotranspiration and runoff (based on the Thornthwaite-Mather method). As presented in Section 6.1, the annual precipitation for the Midland WPCP climate station is 1,041 mm/year. As presented in the water balance (Table H-7, Appendix H), the calculated infiltration volume in the post-development condition for Catchment 202 (the developed 5.22 ha batch plant area) is approximately 24,312 m^3 per year.

The nitrate attenuation estimate is based on the following equation:

$$C = \frac{Q_e C_e + Q_p C_p}{Q_e + Q_p}$$

Where: C = nitrate concentration after dilution (mg/L)

Q_e = volume of effluent (2,360 L/day x 365 days = 861,400 L/yr)

C_e = nitrate concentration in the sewage effluent (40 mg/L)

Q_p = volume of precipitation infiltrating the Site (24,312,000 L/yr)

C_p = nitrate concentration in the infiltrating precipitation: (assumed 0.1 mg/L)

Based on the above calculations the predicted nitrate concentration at the property boundary will be 1.5 mg/L, which is less than the MECP ODWS MAC of 10 mg/L for nitrate in drinking water.

The above nitrate attenuation calculation is considered highly conservative as it does not consider denitrification process within the unsaturated soils or dilution from sources other than precipitation infiltration (e.g., groundwater flow, greywater discharge infiltration, etc.).

8.0 Construction and Long-Term Dewatering

As discussed in Section 6.2, the proposed development will result in a net increase in infiltration on the Subject Lands. Stormwater is expected to readily infiltrate into the unsaturated sand and gravel in the post-development condition and will not require any active dewatering. During construction, removal of the upper fine grained sand to silty sand may release water as excavation progresses; however, all drainage from surface and the shallow soils will move into the existing sand and gravel pit where it will infiltrate. As such, no active construction dewatering is anticipated during construction or in the long-term post-construction condition.

9.0 Environmental Impact Discussion

9.1 Surface water

The proposed development includes significant earth movement to reduce the surface elevation of the Subject Lands from the existing 221-230 m AMSL to match the new batch plant area on the Subject Lands to the existing pit floor elevation of 209.00 on the adjacent aggregate site (Appendix A). The change in grade will result in a net loss of surface drainage (runoff) and a net increase in onsite infiltration (recharge). This is expected to be beneficial from a groundwater perspective due to the increase in recharge and a reduction in runoff from the site via the mapped drainage feature.

Watershed mapping available through the Ontario Flow Assessment Tool (OFAT) estimated the drainage area upgradient of the culvert at Brebeuf Road at 0.098 km^2, which includes the approximately 0.054 km^2 Subject Lands, and is interpreted as the area of drainage that will be altered as part of the proposed development. The OFAT drainage area upgradient of the convergence of the drainage feature with the larger tributary on the golf course property was estimated at 0.322 km^2, which includes the 0.098 km^2 area draining from the Subject Lands (Figure 13). Based on this assessment, site development and grading would result in a net loss of about 30% of the drainage area to the tributary flowing between the Subject Lands and the Wye River.

The drainage assessment work prepared by Jones Consulting Group corroborates the OFAT assessment. The entirety of the subject lands presently have the potential to contribute surface water to the mapped on-site water course. Harden has been on-site on several occasions, including specifically to observe flow in the water course on April 13, 2024 following a heavy

rainstorm. There was no flow in the drainage feature at Brebeuf Road on any occasion. Our observations are that on-site depressions capture runoff prior to entering the drainage feature.

The water balance shows that under existing conditions there is the potential for 13,115 m^3 of runoff to discharge from the site via the water course under Brebeuf Road. The proposed conditions result in a potential for 2,257 m^3 of runoff to discharge via the water course, a reduction of 10,858 m^3/year. Based on our observations, the only time water will flow through the water course is under extreme conditions, at which time additional flow from the site would only contribute to flooding conditions downstream.

9.2 Upper Unit Groundwater System

The near surface sediments beneath the site include near-shore and reworked sediments indicative of readvancements of the glacier. This results in a nonhomogeneous sediment sequence and our observations of soil samples in the upper five metres include layers of sand, sand and gravel, silt and clay. The sand and sand and gravel layers are water bearing from local, mainly onsite, infiltration of water. The three dug wells (one on-site and two in the roadside ditch) are an indication that these sediments have been used for a water supply. The presence of the two wells in the roadside ditch do, however, suggest that surface water was used to augment a precarious water supply within the Upper Unit. Our observations during the drilling are that the water bearing layers are not continuous throughout the site and these water bearing zones do not appear as seepage on the open face in the gravel pit where this layer is exposed.

The clayey and silty layers within these shallow sediments allow for the retention of water by retarding the downward progression of infiltrating precipitation. This water is truly perched within these sediments as the deeper monitoring wells (greater than eight metres depth) are all dry. The water found in this perched system is of good quality and reflects recently infiltrated water. For example, the water sample obtained from MW2S has a very low chloride concentration (1 mg/L) and no nitrate was detected. The groundwater elevations obtained from this perched system shows that the groundwater elevations are strongly correlated with the ground elevation. As the ground elevation increases, the groundwater elevation also increases.

The hydraulic conductivity of MW1S is indicative of the sandy sediments encountered in the Upper Unit.

The removal of the Upper Unit will occur to within twenty-six metres of Brebeuf Road. The isolated and non-contiguous nature of the individual water bearing layers in this shallow system will limit the area of influence that the removal of this layer will have on nearby lands offsite. The limited influence of removing the Upper Unit through extraction is already evident from the existing excavation at the eastern edge of the property. BH5 is shown on retain water at a distance of 160 m from the open face and the ephemeral wetland inclusion located at DP2 holds water seasonally.

The observed groundwater discharge on the Golf Course lands is interpreted to mainly originate in the local highland area north and west of the site. There is a significant topographical elevation

change from the height of land at 236 m AMSL to the discharge area at approximately 213 m AMSL. The site represents a limited potential source of water to the discharge area given the observed groundwater divide as shown on Figure 12. Only the western half of the site could be a source of groundwater to this seepage area. However, being a perched system, the most significant hydraulic gradient is vertically downwards. Any window of higher permeability in this upper unit will allow for the shallow groundwater to move downward.

9.3 Lower Unit Aquifer

The groundwater in the Lower Unit Aquifer has an elevation of approximately 190 m AMSL on the Subject Lands or between 30 and 40 metres below existing ground surface. The water table will not be disturbed with the proposed grading, given the proposed final grade of 209 m AMSL in the batch plant area connecting to the existing quarry floor at the same elevation.

The future source of water for the batch plant will be obtained from the Lower Unit Aquifer. This is a very productive aquifer and less than 50,000 liters per day will be needed for the plant. The pumping test conducted in the nearby well, as a surrogate for the future plant well, determined that at a discharge rate of more than 92 L/min the well could easily produce the required amount of water. Water use at the plant will not be continuous, with recovery of water levels occurring on evenings and weekends. The maximum anticipated drawdown at the well is in the order of one to two metres during daily operation with full recovery daily.

10.0 Conclusions

The findings of the hydrogeological assessment are summarized as follows:

1. Existing site topography of 221 to 230 m AMSL will undergo significant grading to a base elevation of 209 m AMSL for the batch plant to match the existing quarry floor elevation.

2. Groundwater levels within the Upper Unit ranged from <220.2 to 226.6 m AMSL (0.3 to >7.4 mbgs), between April and July 2024. The Upper Unit is a perched system.

3. Groundwater elevations within the Lower Unit ranged from 190.2 to 190.7 m AMSL over the monitoring period. Monitoring wells installed within the upper unsaturated sediments of the Lower Unit all went dry and did not recover following well development efforts.

4. Soil average hydraulic conductivity of the saturated soils within the Upper Unit ranged from 7.8×10^{-8} to 2.3×10^{-4} m/s.

5. A shallow groundwater flow divide is interpreted across the centre of the Subject Lands, with groundwater on the west side flowing west to southwest toward Brebeuf Road and groundwater on the east side flowing east toward the existing gravel pit.

6. A strong downward gradient exists between the Upper Unit and the Lower Unit, and most shallow groundwater contained within the upper fine grained sediments will infiltrate vertically downward (i.e., recharge conditions).

7. Local groundwater availability in the Lower Unit is expected to be more than adequate for the proposed development's water usage requirements. A pumping test conducted in a nearby well as a surrogate to water taking by the proposed plant shows that there will be relatively little drawdown in the well and little potential for impact off-site. Water quality within the Lower Unit is considered acceptable for the proposed batch plant and office.

8. A private well survey conducted within 500 m of the Subject Lands determined that nearby residents source water from the regional sand and gravel aquifer with well depths of approximately 250 to 360 mbgs. No shallow dug wells were identified that were used for water supply. A shallow dug well at 1034 Brebeuf Road is not used for domestic water supply but could be used in the future.

9. The proposed development will result in a decrease in runoff (offsite) and increase in recharge. The detailed water balance finds that there will be an overall increase in groundwater recharge of 4,730 m^3 annually.

10. Based on a D-5-4 calculation for the proposed onsite sewage disposal system, the predicted nitrate concentration at the property boundary will be 1.5 mg/L, which is less than the MECP ODWS MAC of 10 mg/L for nitrate in drinking water.

11. No construction or long-term dewatering will be required for the proposed development.

12. The development will alter the fate of runoff from the subject lands. Presently, all surface water has the potential to discharge off-site via a drainage feature beneath Brebeuf Road. Post development this water will mainly be directed into the adjacent aggregate pit to the east. Although there is a potential loss of runoff to the drainage feature, Harden did not observe water flowing through the culvert at Brebeuf Road on any occasion in the Spring of 2024 including following a significant rainfall event. It is our conclusion that the redirection of runoff will not affect streamflow in lower reaches of this water course under most conditions. Only during very high runoff events such as snowmelt, could there be a reduction in contribution from the subject lands, at which time additional water from the site could only contribute to flooding conditions downstream.

13. The site development will result in the removal of near-shore and reworked glacial sediment layer overlying a larger more regional sand and gravel geological unit. A perched groundwater system is developed in this upper unit and has been used locally as a water supply. The water supply comes from relatively thin sand or sand and gravel layers.

14. The removal of the perched groundwater system could result in the lowering of the water table on adjacent lands. There is expected to be a limited off-site water level change given the non homogenous nature of this deposit, that is, the deposit is not continuously stratified.

15. The elevation of the shallow water table within the perched system changes with ground elevation, an indication of the limited connectivity of the water bearing layers within this system. No groundwater discharge is observed at the existing pit face east of the site.

16. All nearby groundwater users are on private drilled wells, with no shallow dug supply wells identified in the vicinity of the Subject Lands. No impacts are anticipated to nearby groundwater users.

17. Local geological mapping and MECP water well records suggest the presence of an intermittent surficial fine-grained layer that provides the opportunity for shallow groundwater interflow above the unsaturated sand layer, which contributes to groundwater discharge observed on the nearby golf course property. The Subject Lands are within the drainage area and contributes a portion of the interflow to the downgradient tributary. An ecological assessment of the surface water features is being completed concurrently.

11.0 Recommendations

Harden provides the following recommendations:

1. The two shallow dug wells in the municipal ditch should be decommissioned.

2. Two monitoring wells should be installed along the west boundary of the subject Lands to monitor shallow groundwater levels within the Upper Unit as development progresses. There is the possibility of monitoring the dug well at 1034 Brebeuf Road in lieu of dedicated monitors. It is recommended that a four hour flow test be conducted in the dug well and it be used for monitoring, provided permission granted by homeowner.

3. We recommend that a water quality sample be obtained from the well at 1024 Brebeuf Road as a baseline for future concerns about water quality.

4. An ECA may be required from the MECP for onsite discharge of the batch plant process water.

5. As part of the development all unused wells must be decommissioned in accordance with R.R.O. 1990 Regulation 903: Wells under the Ontario Water Resources Act (OWRA).

6. Existing building(s) on the Subject Lands will be demolished as part of the proposed development. A Designated Substance Survey is required prior to building demolition

and/or renovation activities under Section 30 of the Occupational Health and Safety Act, in accordance with Ontario Regulation (O. Reg.) 490/09: Designated Substances and O. Reg. 278/05: Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations.

12.0 References

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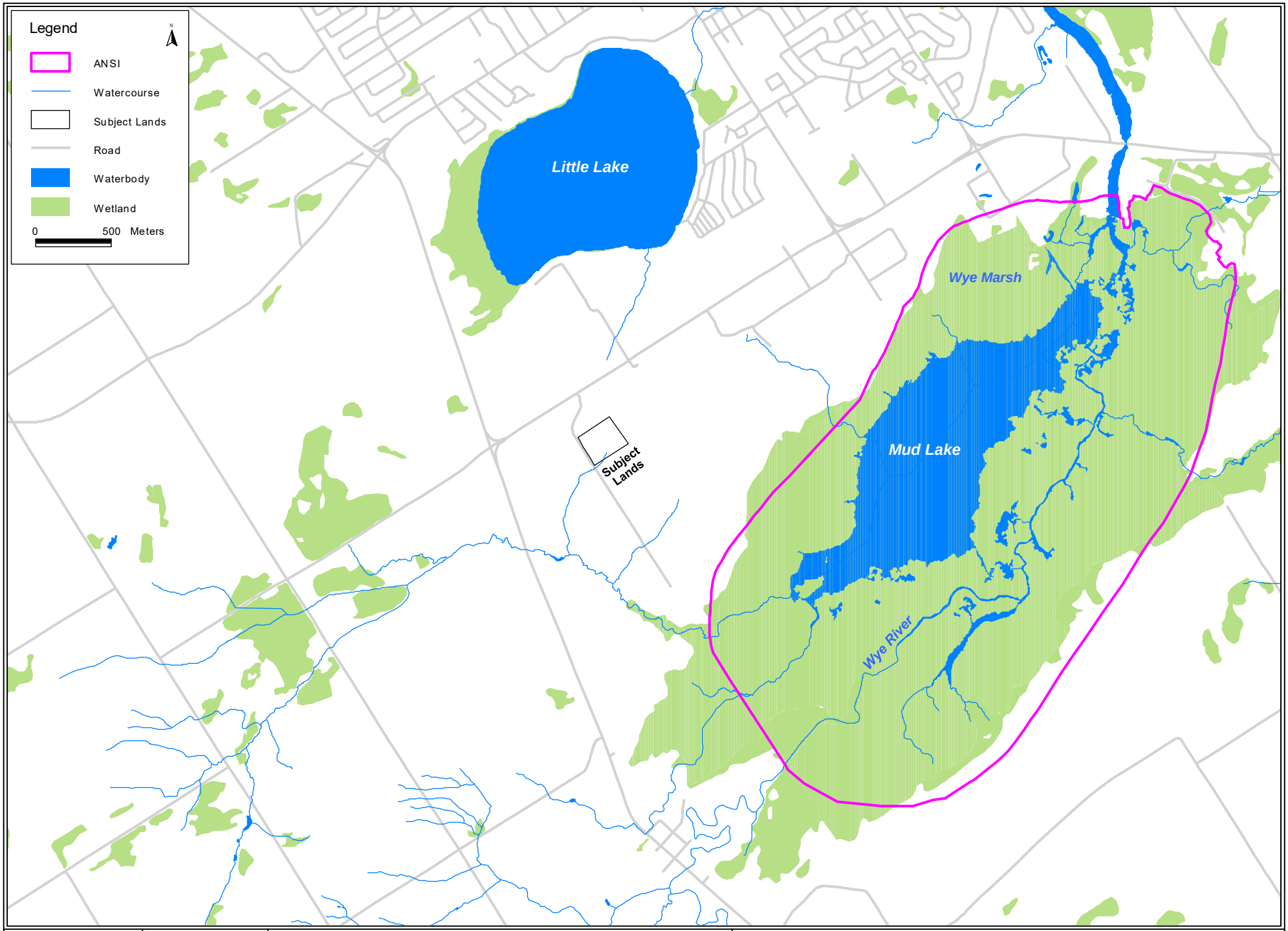
Figures

	Harden Environmental Services Ltd.	**Project No:** 2361 **Date:** Jul 2024 **Drawn By:** AR	Hydrogeological Assessment Proposed Concrete Batch Plant 1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	Figure 1: **Subject Lands**

	Harden Environmental Services Ltd.	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	Figure 2:
		Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	**Property Ownership**
		Drawn By: AR		

HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	**Figure 3: Aerial Imagery**
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	
	Drawn By: AR		



HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD
	Drawn By: AR	**Figure 4: Environmental Features**

Legend

N

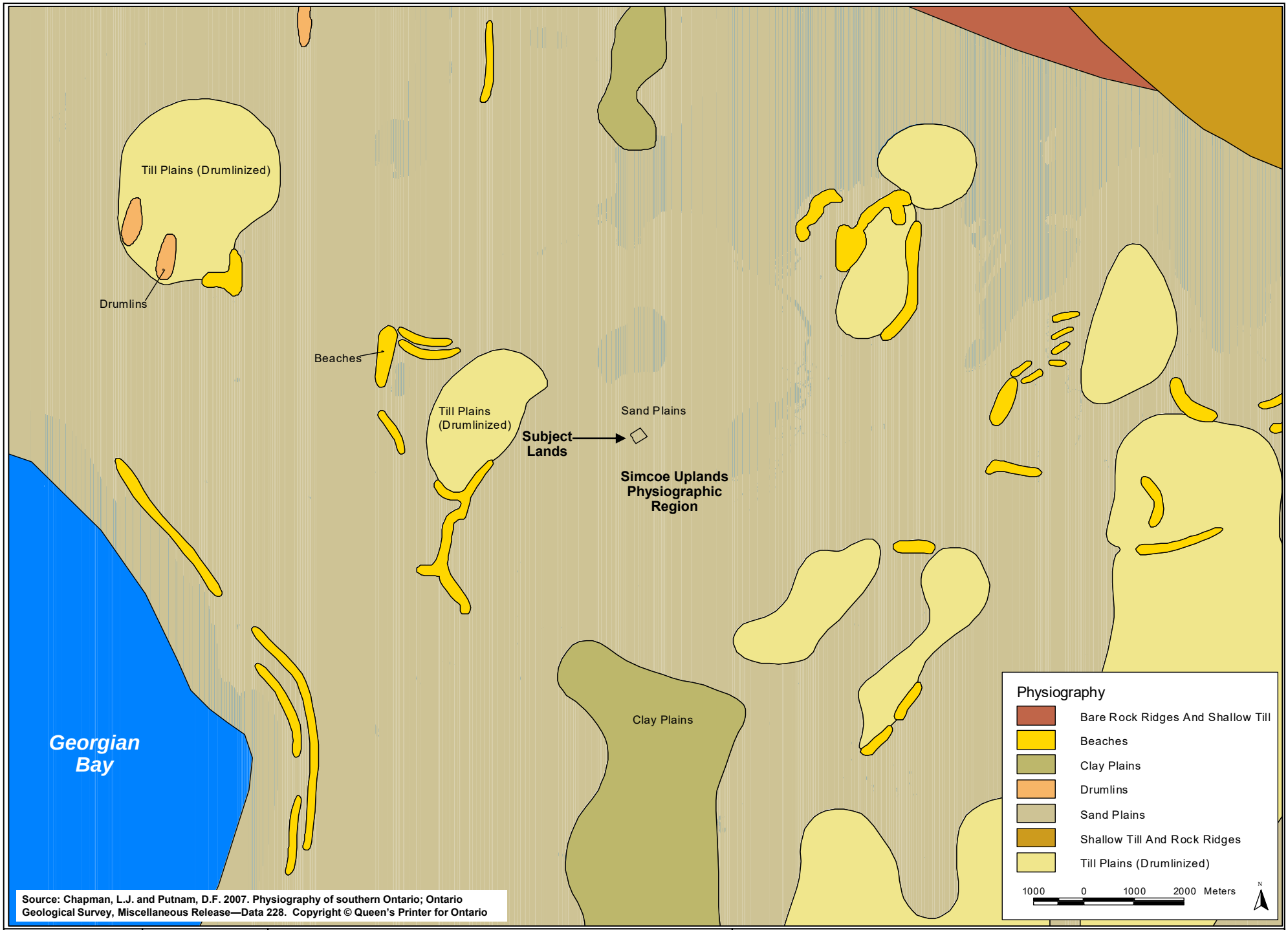
- Watercourse
- 2m Contour (mAMSL)
- Subject Lands
- Road
- Waterbody
- Wetland

100 0 100 Meters

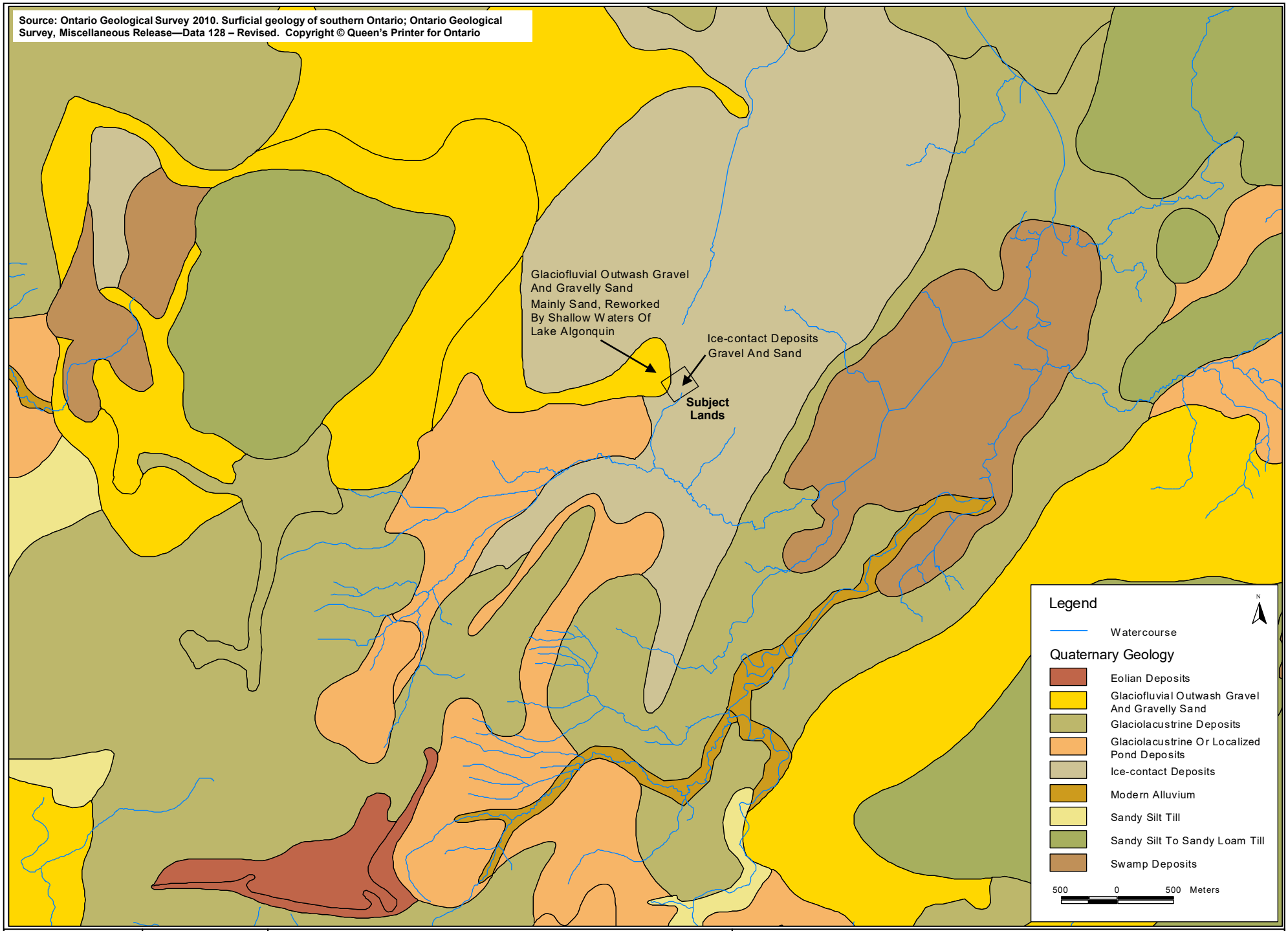
200
220
226
230
228
236
226
228
224
214
204
178
206
178

HWY 12
HWY 93
BEAMISH RD
BREBEUF RD

	Harden Environmental Services Ltd.	**Project No:** 2361 **Date:** Jul 2024 **Drawn By:** AR	Hydrogeological Assessment Proposed Concrete Batch Plant 1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	Figure 5: **Regional Topography**



HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	**Figure 6: Physiography**
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	
	Drawn By: AR		



HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD
	Drawn By: AR	**Figure 7: Quaternary Geology**

Simplified Geologiical Cross Section

Subject Lands

A

A’

Upper Unit: Reworked Sediments

Water Table

Glacial Lacustrine Sediments

Lower Unit: Ice Contact Sediments

Limestone Bedrock

Well Screens

Poteniometric Surface of Lower Unit

5704475 - Golf course

Blue Clay

Fine Sand

Med Sand

BH1SD

BH2SD

BH1D

Sand

Silty Clay

Sandy Silt

Silty Sand Till

BH3

Topsoil

Grey Clay

Silty Sand Till

Top Soil

Sand

Silty Sand Till

Clay with gravel

Sand

Sand/Gravel/cemented

Sand

Sand/Gravel

Sand

Clay/Gravel

Limestone

Gravel and stones

Topsoil

Silty Sand Till

Sand

Clay with gravel

Sand

5703887

Pre Dug

Gravel

Hardpan

Blue Clay

Dolomite

MW10(MW2)

Fill

Sand and Gravel

Sand/Silt

Sand/Gravel

Sand

Sand

Sand

Clay with gravel

Municipal Well 7A (7896)

Clay with Boulders

Clay with Gravel and Sand

Sand with Gravel and Clay

hardpan

Clay with Sand and gravel

Sand wth Gravel and Clay

Clay/Gravel/Sand

Clay/Sand/Gravel

Sand/Gravel/Clay

Clay/Gravel/Sand/Rock

Rock

250
240
230
220
210
200
190
180
170
160
150
140
130
120

0
500
1000
1500
2000
2500

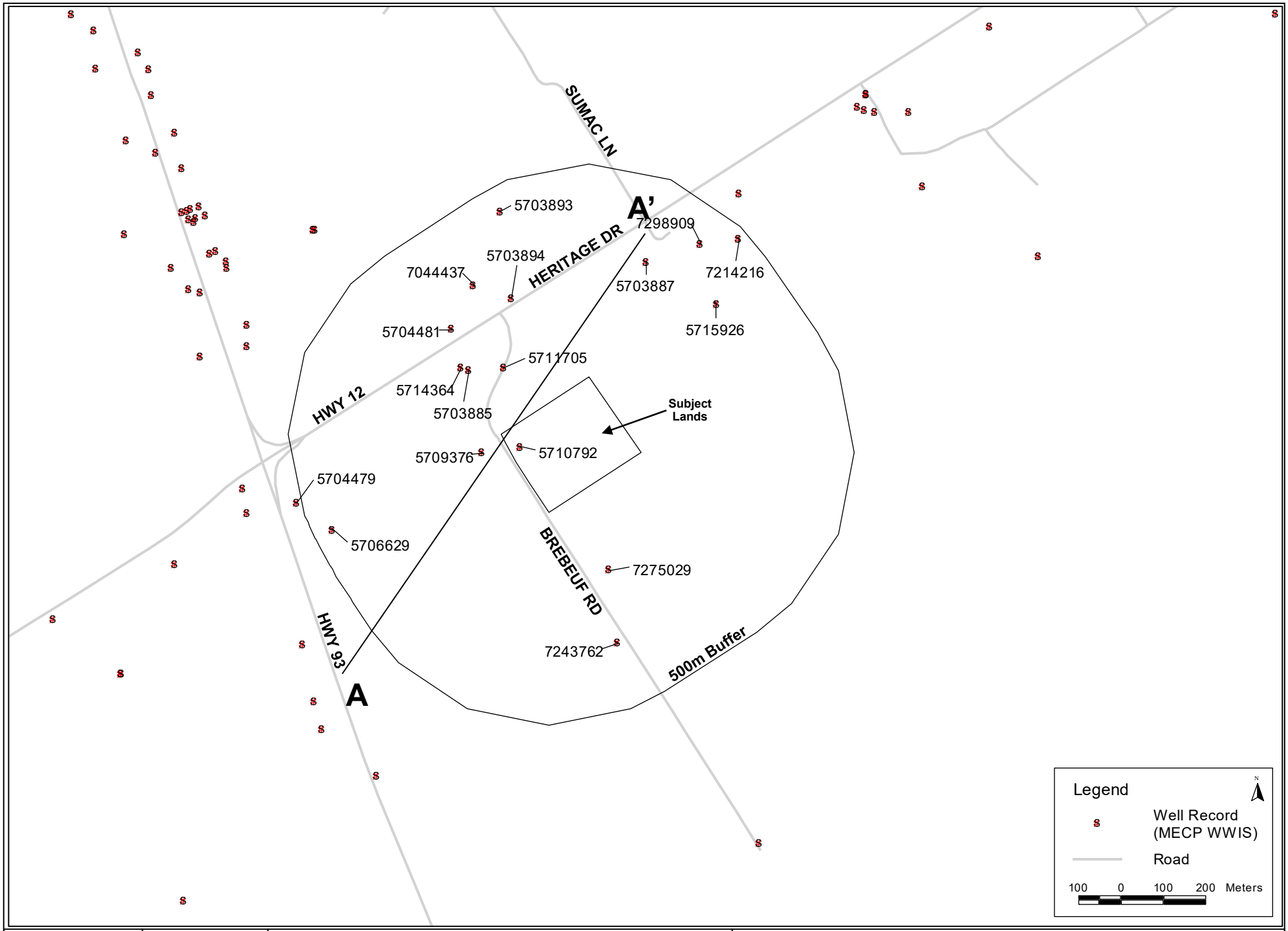
Google Earth Aerial Imagery Date April 10/2024

Harden Environmental Services Ltd.

Project No: 2361
Date: Jul 2024
Drawn By: AR

Hydrogeological Assessment
Proposed Concrete Batch Plant
1017 & 1029 Brebeuf Road, Midland, County of Simcoe
TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD

Figure 8:
Geological Cross Section



HARDEN Environmental	**Project No:** 2361 **Date:** Jul 2024 **Drawn By:** AR	Hydrogeological Assessment Proposed Concrete Batch Plant 1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD

Figure 9: Water Well Records Within 500m

Ontario **Source Protection Information Atlas**
Ministry of the Environment, Conservation and Parks

- Intake Protection Zone 1
- Intake Protection Zone 2
- Intake Protection Zone 3
- Highly Vulnerable Aquifers
- WHPA-E
- *Surface Water*
- Event Based Areas
- Intake Protection Zone Q
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2

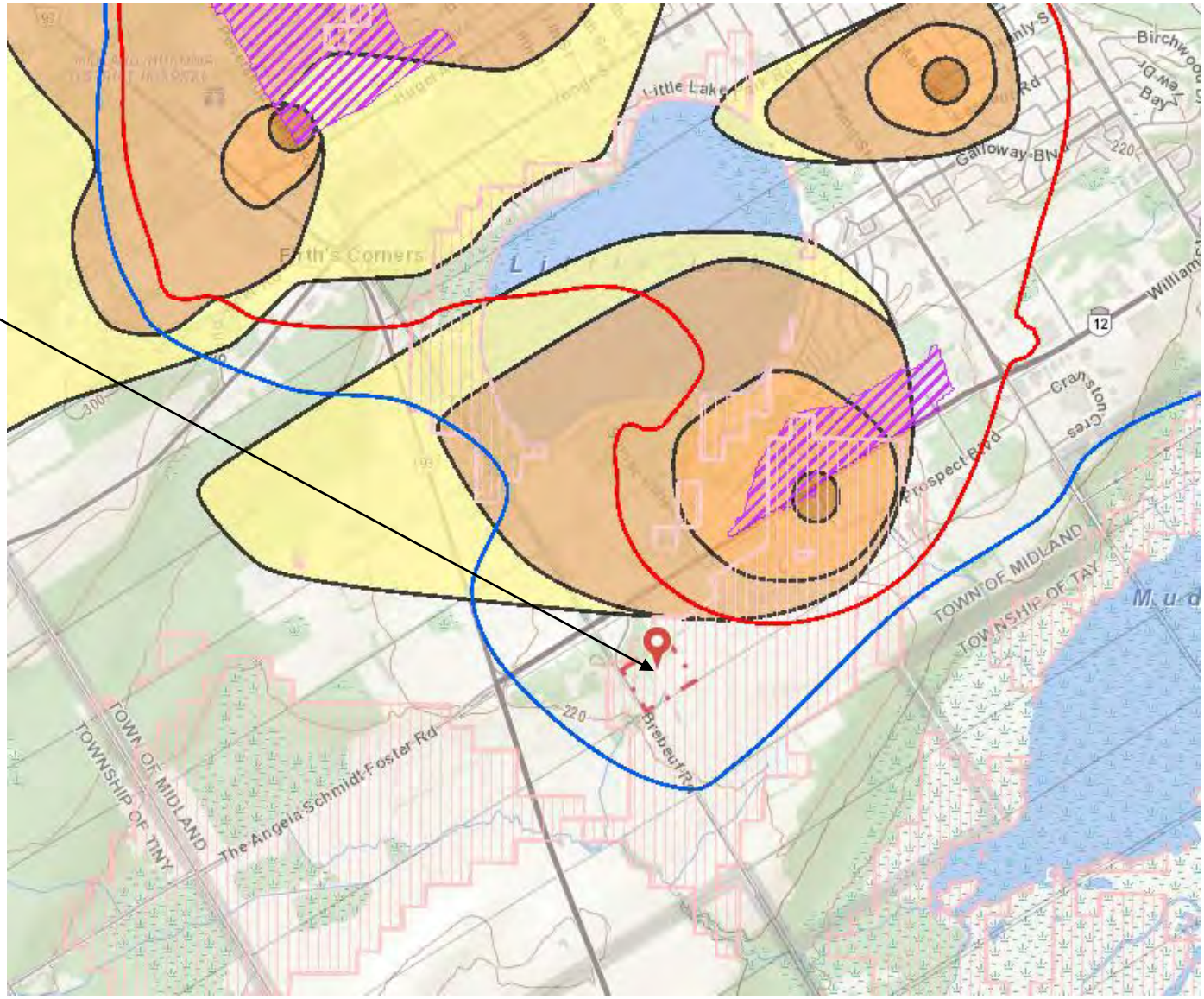
Location Information

Zoom in to confirm your location and results

Latitude: **44.71905** Longitude: **-79.88865**
UTM Zone: **17**
Easting: **588018.17** Northing: **4952341.81**
Upper Tier Municipality: **COUNTY OF SIMCOE**
Lower Tier Municipality: **TOWN OF MIDLAND**
Township Concession and Lot: **TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD**
Assessment Parcel Address: **1029 Brebeuf Road**
Assessment Roll #: **437401001143500000000**
MECP District: **Barrie**
MECP Region: **Central Region**

Source Protection Details for Location

Source Protection Area: **Severn Sound**
View Source Protection Plan
Wellhead Protection Area: **No**
Wellhead Protection Area (WHPA-E): **No**
Intake Protection Zone: **No**
Issue Contributing Area: **No**
Significant Groundwater Recharge Area: **Yes** ; score is **6**
Highly Vulnerable Aquifer: **Yes** ; score is **6**
Event Based Area: **No**
Wellhead Protection Area Q1: **No**
Wellhead Protection Area Q2: **Yes** Stress: **Moderate**
Intake Protection Zone Q: **No**
Information is current as of: **April 19, 2024**



HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	**Figure 10: Source Water Protection**
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	
	Drawn By: AR		

Google Earth Aerial Imagery Date April 10/2024

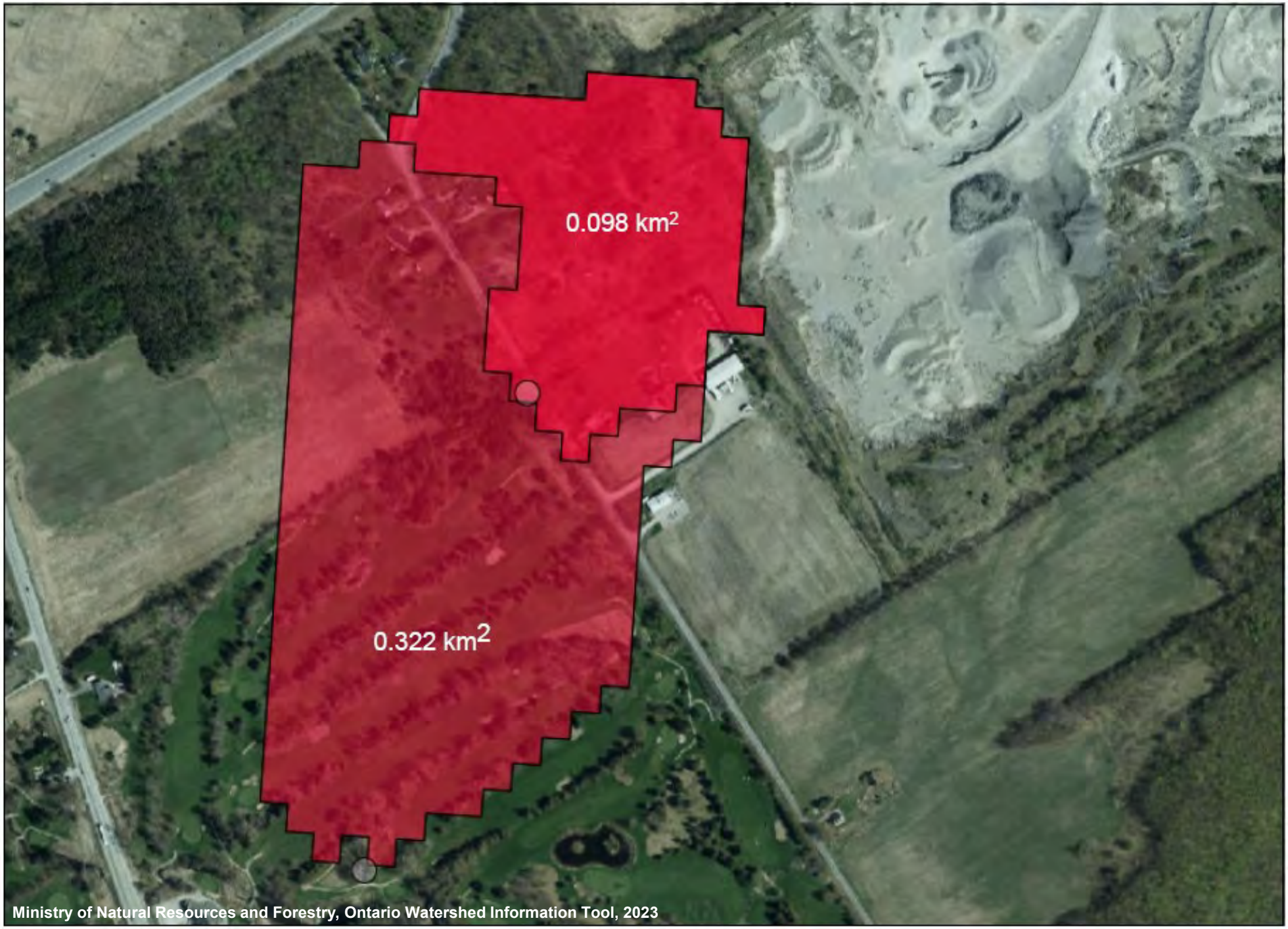
Harden Environmental Services Ltd.

Project No: 2361	Hydrogeological Assessment Proposed Concrete Batch Plant
Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD
Drawn By: AR	

Figure 11:

Monitoring Well Locations on Pit Property

HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	**Figure 12: Interpreted Shallow Groundwater Flow (June 5, 2024)**
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	
	Drawn By: AR		



HARDEN Environmental	**Project No:** 2361	Hydrogeological Assessment Proposed Concrete Batch Plant	**Figure 13: Surface Drainage Areas**
	Date: Jul 2024	1017 & 1029 Brebeuf Road, Midland, County of Simcoe TAY LOT 100 CON 1 EAST OF PENETANGUISHENE ROAD	
	Drawn By: AM		

Appendix A

Site Grading, Servicing and Stormwater Management Plans

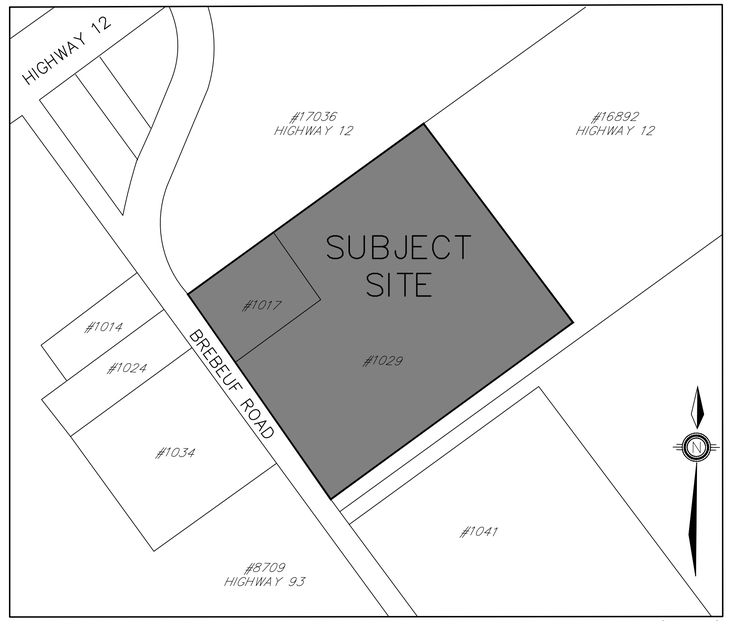
1017 & 1029 BREBEUF ROAD
CONCRETE MIXING PLANT
TOWN OF MIDLAND, ONTARIO

THE JONES CONSULTING GROUP LTD. DRAWING LIST

SG–1	SITE GRADING PLAN
SS–1	SITE SERVICING PLAN
ESC–1	EROSION AND SEDIMENT CONTROL PLAN PHASE 1 INTERIM
ESC–2	EROSION AND SEDIMENT CONTROL PLAN PHASE 2 INTERIM
ESC–3	EROSION AND SEDIMENT CONTROL PLAN PHASE 3 ULTIMATE
ESC–4	EROSION AND SEDIMENT CONTROL NOTES AND DETAILS
SWM–1	PRE–DEVELOPMENT STORMWATER MANAGEMENT PLAN
SWM–2	POST–DEVELOPMENT STORMWATER MANAGEMENT PLAN

EME ENGINEERING INC. DRAWING LIST

E–001	ELECTRICAL SPECIFICATIONS
E–002	SYMBOLS AND ABBREVIATIONS
E–101	SITE SERVICING PLAN
E–201	SITE PHOTOMETRIC PLAN
E–301	SITE DETAILS



KEYPLAN (NTS)

MUNICIPALITY:

TOWN OF MIDLAND
575 DOMINION AVENUE
MIDLAND, ON L4R 1R2
PH. 705.526.4275

CLIENT:

THE SARJEANT Co. LTD.
15 SARJEANT DRIVE
BARRIE, ONTARIO L4N 4V9

CONSULTANT:

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

PROJECT No. SAR–23058 – OPA, ZBLA & SPA SUBMISSION AUGUST 2024

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#17036 HIGHWAY 12

#1041 BREBEUF ROAD

#16892 HIGHWAY 12 (OWNED BY APPLICANT)

BREBEUF ROAD

EXISTING CULVERT TO BE REMOVED AND DITCH TO BE RE-GRADED

EX. GRAVEL DRIVEWAY (TO BE REMOVED)

EX. WELL

EXISTING CULVERT TO BE REMOVED AND DITCH TO BE RE-GRADED

EX. PROPERTY LINE

3.0m HIGH BERM AROUND PERIMETER

3:1 MAX.

2:1 MAX.

1:1 MAX.

EX. TOP OF SLOPE

EX. BOT. OF SLOPE

PROP. 0.50m DEEP TRIANGULAR DITCH WITH 2:1 (MAX) SIDE SLOPES

PROP. PARKING

PROP. JERSEY BARRIER

PROP. 6.1m WIDE RAMP/DRIVE AISLE

PROP. PRIVACY BERM AT 3:1 SIDE SLOPES WITH 3m FLAT TOP

PROP. FIRE ROUTE

WATER TANKS 9'x26' (2.75x7.92m) 12' (3.66m) dia. SILO

PROP. 7080L SEPTIC TANK

PROP. OFFICE FFE 210.03 15ft x 20ft (300 sq.ft) 4.57mx6.10m (27.87 sq.m)

STEAM BED 20'x20' (6.1mx6.1m)

PROP. 20'x20' AGGREGATE BIN (6.1mx6.1m)

60'x12' CMP

BOILER 4'x10' (1.22mx3.05m)

PROP. DRILLED WELL

EXISTING WORKSHOP (TO BE REMOVED)

EXISTING HOUSE (TO BE REMOVED)

TEAM AGGREGATE QUARRY (OWNED BY APPLICANT)

77.5m

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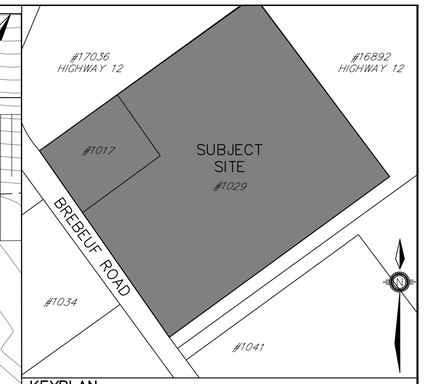
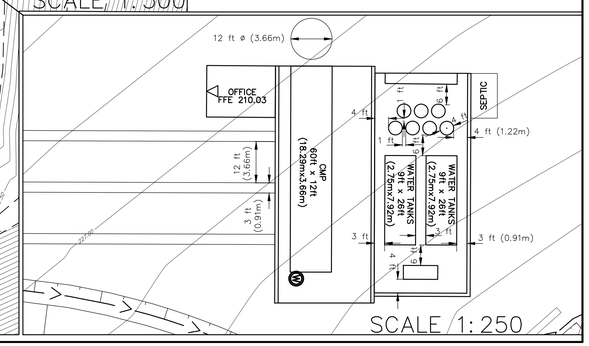


KEYPLAN
NTS

LEGEND

- EX. PROPERTY LINE
- EX. CONTOURS AND ELEVATION
- PROP. GROUND ELEVATION
- EX. GROUND ELEVATION
- PROP. GRADIENT AND FLOW DIRECTION
- PROP. DRILLED WELL
- PROP. SLOPE (AS SHOWN)
- PROP. DITCH
- EX. HYDRO POLE AND ANCHOR
- EX. WELL
- PROP. FIRE ROUTE AND DIRECTION



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BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
3	OPA, ZBLA & SPA SUBMISSION	AUG. 2024	MG
2	ISSUED FOR PRE-CONSULTATION	DEC. 2023	DR
1	ISSUED TO CLIENT	OCT. 2023	DR

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

SITE GRADING PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN DR	SCALE: AS SHOWN	DATE OCTOBER 2023	
DRAWN KS	PROJECT SAR-23058	DWG. Nº SG-1	
CHECKED DR			

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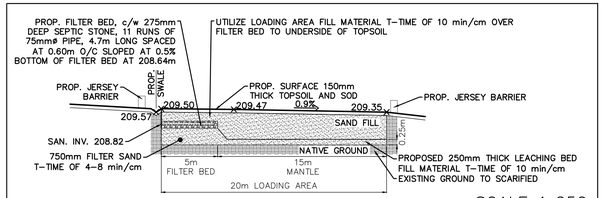

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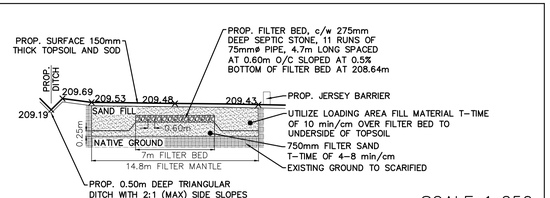

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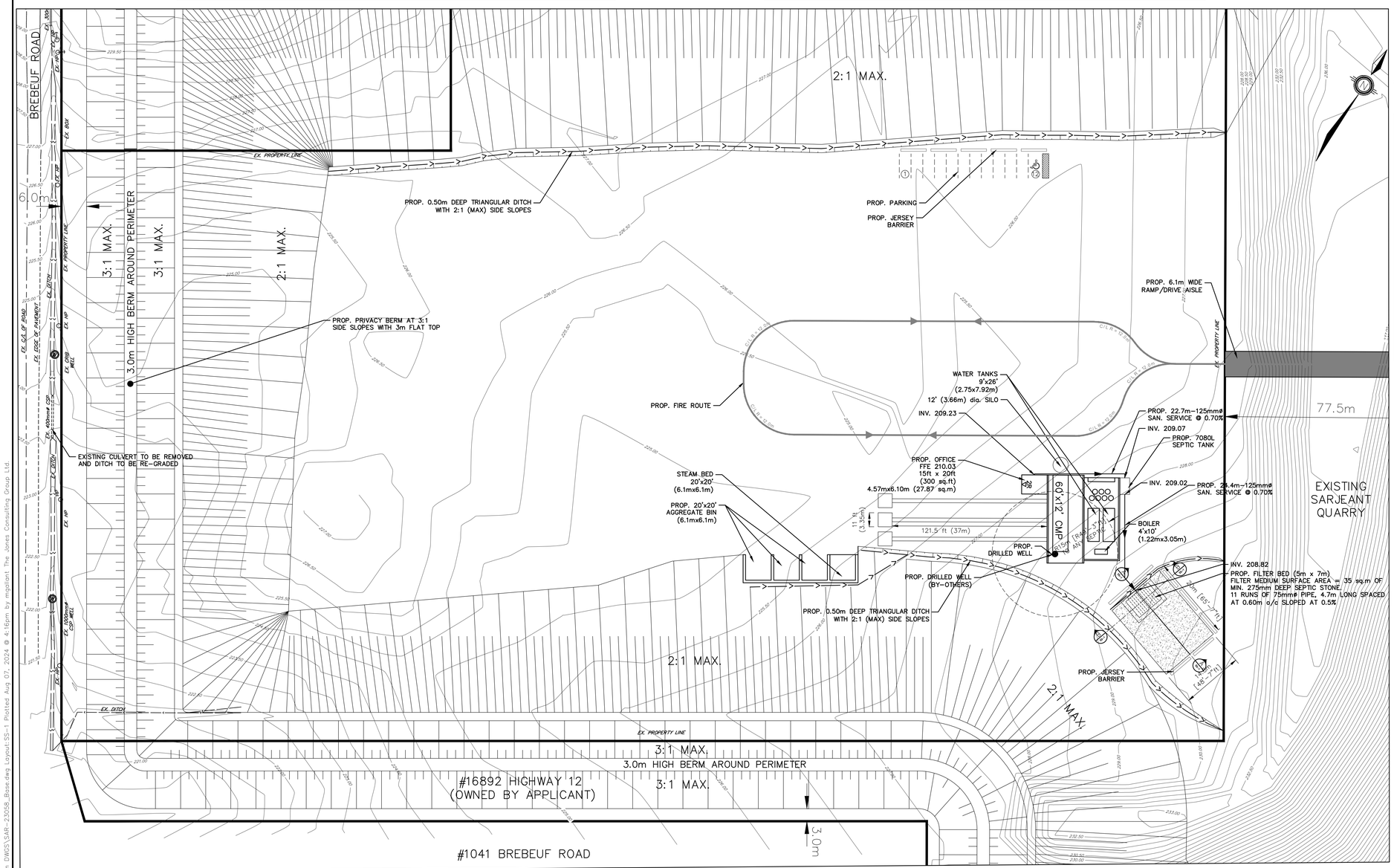

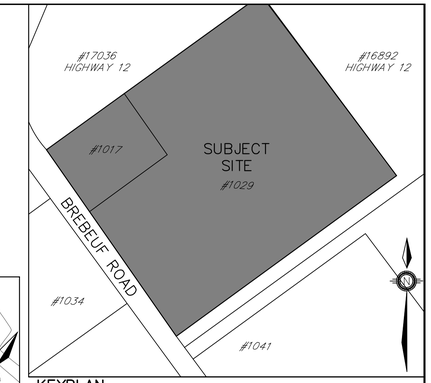

KEYPLAN
NTS

LEGEND

- EX. PROPERTY LINE
- EX. CONTOURS AND ELEVATION (218.90)
- PROP. SANITARY SEWER AND FLOW DIRECTION
- PROP. DRILLED WELL
- PROP. SLOPE (AS SHOWN)
- PROP. DITCH
- CROSS-SECTION LOCATION AND REFERENCE PLAN
- EX. HYDRO POLE AND ANCHOR
- EX. WELL
- PROP. FIRE ROUTE AND DIRECTION

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
3	OPA, ZBLA & SPA SUBMISSION	AUG. 2024	MG
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1	ISSUED TO CLIENT	OCT. 2023	DR

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100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

SITE SERVICING PLAN

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P. 705.734.2538
F. 705.734.1056

DESIGN DR	SCALE: 1:500	DATE JULY 2024	
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CHECKED DR			

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EXISTING WELL (TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE)

EXISTING CULVERT TO BE REMOVED AND DITCH TO BE RE-GRADED

EXISTING CRIB WELL TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE

EXISTING CULVERT TO BE REMOVED AND DITCH TO BE RE-GRADED

EXISTING GRAVEL DRIVEWAY TO BE REMOVED

EXISTING 1000mmø CSP WELL TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE

BREBEUF ROAD

#17036 HIGHWAY 12

#16892 HIGHWAY 12 (OWNED BY APPLICANT)

#1041 BREBEUF ROAD

TEAM AGGREGATE QUARRY (OWNED BY APPLICANT)

PROP. SILT FENCE PER OPSD 219.110

PROP. PRIVATE DRILLED WELL

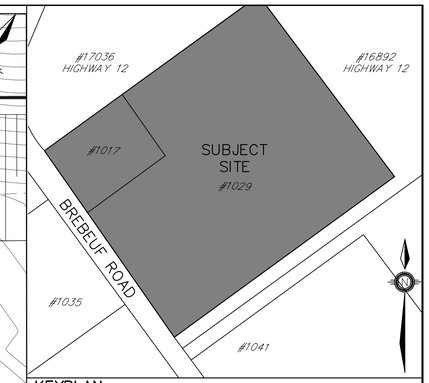
3:1 MAX.

2:1 MAX.

77.5m

20m [65'-7"]

14.8m [48'-7"]



KEYPLAN
NTS

LEGEND

- EX. PROPERTY LINE
- 218.90 EX. CONTOURS AND ELEVATION
- PROP. SLOPE (AS SHOWN)
- PROP. SILT FENCE PER OPSD 219.110
- 227.06 PROP. ELEVATION
- 227.06 EX. ELEVATION
- PROP. GRADIENT AND FLOW DIRECTION
- AREA TO REMOVED
- EX. HP EX. HYDRO POLE AND ANCHOR
- W EX. WELL

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
1	OPA, ZBLA & SPA SUBMISSION	AUG. 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

EROSION AND SEDIMENT CONTROL PLAN
PHASE 1 INTERIM

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	DR	SCALE: 1:500	DATE JULY 2024
DRAWN	KS	PROJECT SAR-23058	DWG. Nº ESC-1
CHECKED	DR		

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EXISTING WELL (TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE)

EXISTING CRIB WELL TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE

EXISTING 1000mmø CSP WELL TO BE DECOMMISSIONED AND REMOVED IN ACCORDANCE WITH MOE

EXISTING GRAVEL DRIVEWAY TO BE REMOVED

PROP. SILT FENCE PER OPSD 219.110

PROP. PRIVATE DRILLED WELL

BREBEUF ROAD

#17036 HIGHWAY 12

#16892 HIGHWAY 12 (OWNED BY APPLICANT)

#1041 BREBEUF ROAD

TEAM AGGREGATE QUARRY (OWNED BY APPLICANT)

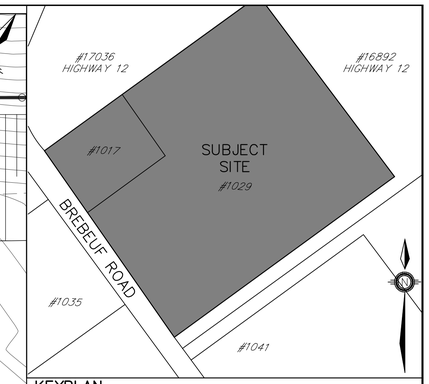
3:1 MAX.

2:1 MAX.

77.5m

20m [65'-7"]

14.8m [48'-7"]



KEYPLAN
NTS

LEGEND

- EX. PROPERTY LINE
- EX. CONTOURS AND ELEVATION (218.90)
- PROP. SLOPE (AS SHOWN)
- PROP. SILT FENCE PER OPSD 219.110
- PROP. ELEVATION (227.06)
- EX. ELEVATION (227.06)
- PROP. GRADIENT AND FLOW DIRECTION
- AREA TO REMOVED
- EX. HP — EX. HYDRO POLE AND ANCHOR
- EX. WELL

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
1	OPA, ZBLA & SPA SUBMISSION	JUL. 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

EROSION AND SEDIMENT CONTROL PLAN
PHASE 2 INTERIM

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	DR	SCALE: 1:500	DATE JULY 2024
DRAWN	KS	PROJECT SAR-23058	DWG. Nº ESC-2
CHECKED	DR		

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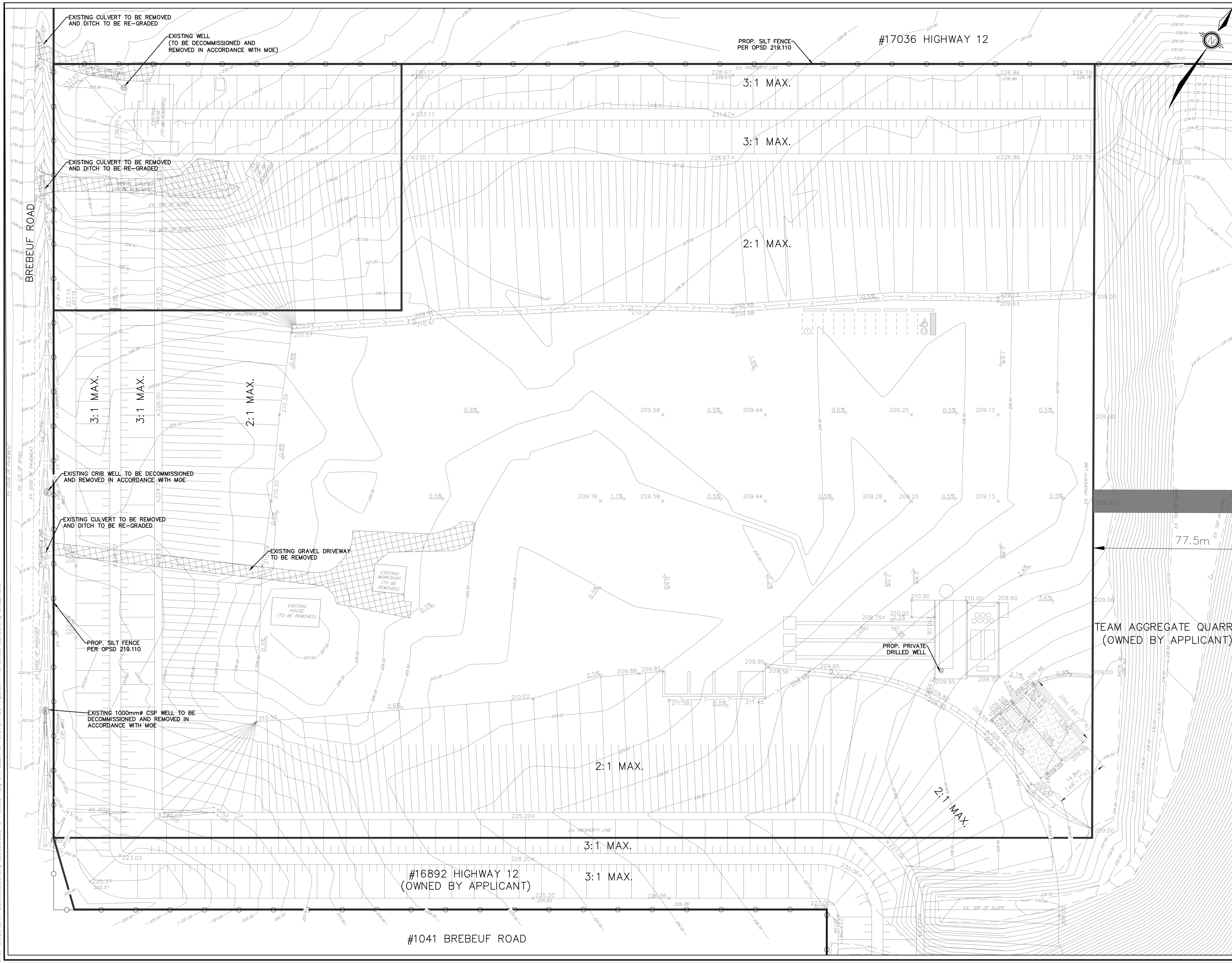

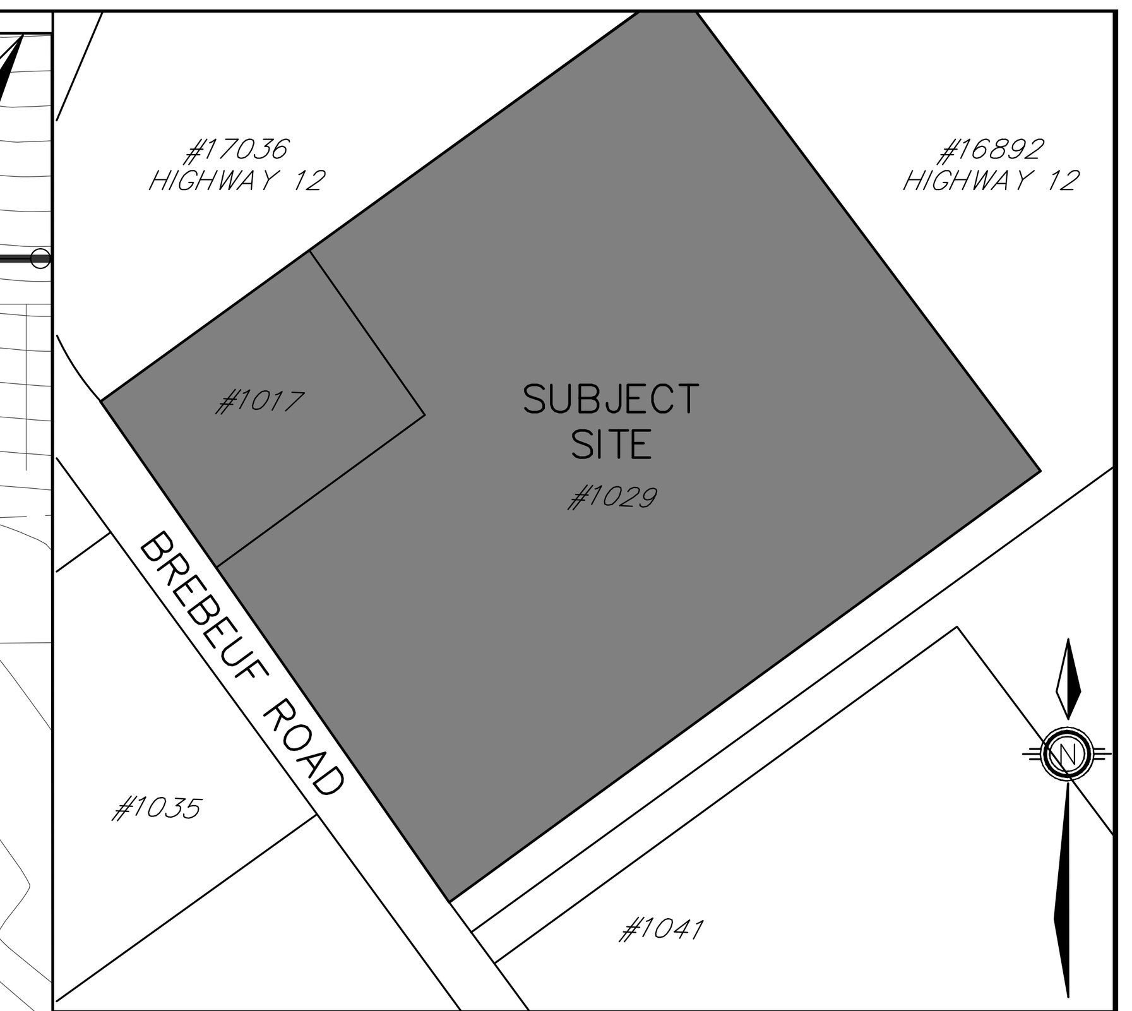

KEYPLAN
NTS

LEGEND

- EX. PROPERTY LINE
- EX. CONTOURS AND ELEVATION
- PROP. SLOPE (AS SHOWN)
- PROP. SILT FENCE PER OPSD 219.110
- 227.06 PROP. ELEVATION / 227.06 EX. ELEVATION
- PROP. GRADIENT AND FLOW DIRECTION
- AREA TO REMOVED
- EX. HYDRO POLE AND ANCHOR
- EX. WELL

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
1	OPA, ZBLA & SPA SUBMISSION	JUL. 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

EROSION AND SEDIMENT CONTROL PLAN
PHASE 3 ULTIMATE

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN DR	SCALE: 1:500	DATE JULY 2024	
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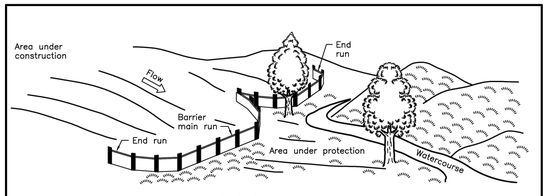
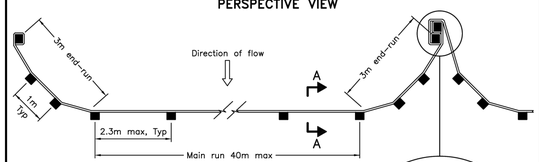
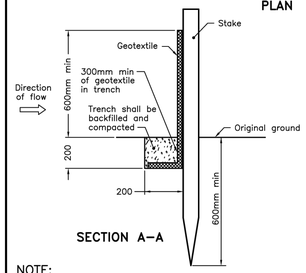
CHECKED DR			



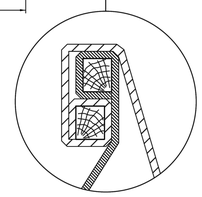
PERSPECTIVE VIEW



PLAN



SECTION A–A



JOINT DETAIL

NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING	Nov 2021	Rev	3
LIGHT–DUTY SILT FENCE BARRIER		OPSD 219.110	

EROSION CONTROL NOTES

1. THE ACCOMPANYING PLANS SET OUT THE MEASURES THAT WILL BE TAKEN BY THE DEVELOPER AND ITS CONTRACTORS TO CONTROL DOWNSTREAM SEDIMENT TO THE LOWEST LEVEL PRACTICALLY ACHIEVABLE. THE CONDITIONS AND TECHNIQUES SET OUT ARE TO BE FOLLOWED UNLESS APPROVED OTHERWISE BY THE CONTRACT ADMINISTRATOR, CONSERVATION AUTHORITY AND/OR MUNICIPALITY.
2. ALL TEMPORARY SILT CONTROL AND EROSION PROTECTION DEVICES (I.E. SILT FENCING, DRAINAGE SWALES, ROCK CHECK DAMS, SEDIMENT BASIN(S), GRAVEL ACCESS PAD, ETC.) SHALL BE CONSTRUCTED PRIOR TO COMMENCEMENT OF SITE WORKS AND SHALL REMAIN IN PLACE AND BE MAINTAINED BY THE CONTRACTOR UNTIL CONSTRUCTION IS COMPLETE AND THE GRASS HAS ESTABLISHED GROWTH, SUBJECT TO APPROVAL BY THE CITY ENGINEERING DEPARTMENT.
3. ALL SEDIMENTATION CONTROL MEASURES ARE TO BE INSPECTED REGULARLY (MINIMUM WEEKLY), AS WELL AS AFTER EVERY RAINFALL EVENT AND ANY DAMAGED SILT CONTROL AND EROSION PROTECTION DEVICES SHALL BE PROMPTLY REPAIRED OR REPLACED BY THE CONTRACTOR.
4. THE CONTRACTOR MUST USE MATERIALS, CONSTRUCTION PRACTICES, AND MITIGATION TECHNIQUES IN ORDER TO PREVENT THE UNAUTHORIZED HARMFUL ALTERATION, DISRUPTION OR DESTRUCTION OF VEGETATION OR THE IMPAIRMENT OF WATER QUALITY.
5. THE CONTRACTOR SHALL BE PREPARED FOR UNEXPECTED CONDITIONS AND ACCORDINGLY HAVE STOCKPILED MATERIALS ON SITE FOR NECESSARY REPAIRS AS A RESULT OF FAILED OR INADEQUATE CONTROL MEASURES.
6. AREAS WITHOUT STABLE GROUND COVER SHALL BE PROTECTED WITH SILTATION CONTROL FENCING, STRAW MULCH, ETC, AND MAINTAINED BY THE CONTRACTOR UNTIL VEGETATION HAS BECOME ESTABLISHED IN THE SUBSEQUENT GROWING SEASON.
7. ALL EXPOSED SOIL MUST BE GRADED TO A STABLE SLOPE AND TREATED AS QUICKLY AS POSSIBLE TO PREVENT EROSION AND SEDIMENT FROM LEAVING THE SITE. ALL AREA STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 30 DAYS SHALL BE TOPSOILED AND SEEDED AT THE DIRECTION OF THE ENGINEER.
8. ALL SITE DRAINAGE TO BE DIRECTED TO THE TEMPORARY SEDIMENT BASINS AND OTHER CHECK DAMS VIA SHEET DRAINAGE, BERMS OR SWALES (AS NECESSARY) TO FACILITATE THE COMPLETION OF GRADING WORKS. THE CONTRACTOR SHALL CONSTRUCT ANY ADDITIONAL SWALES OR BERMS THAT MAY BE NECESSARY TO DIRECT RUN–OFF IN A CONTROLLED MANNER OF SUITABLE QUALITY.
9. ALL CONSTRUCTION VEHICLES SHALL ENTER AND EXIT THE SITE FROM PROPOSED CONSTRUCTION ACCESS VIA THE GRAVEL ACCESS PAD.
10. ANY DEWATERING WASTE SHALL BE DISCHARGED TO A VEGETATED AREA AT LEAST 30m FROM ANY WATERCOURSE AND FILTERED. FILTERING METHODS MUST BE APPROVED BY THE SITE INSPECTOR.
11. TECHNIQUES FOR EROSION AND SEDIMENT CONTROLS ARE TO ADHERE TO ACCEPTED ENGINEERING PRACTICE AND MUNICIPAL, CONSERVATION AUTHORITY AND ONTARIO PROVINCIAL STANDARD SPECIFICATIONS AND DRAWINGS. THE CONTRACTOR SHALL OBTAIN A CURRENT COPY AND BECOME FAMILIAR WITH OPSS 805: CONSTRUCTION SPECIFICATION FOR TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES, AS WELL AS APPLICABLE MUNICIPAL STANDARDS AND/OR APPROVAL AGENCY STANDARDS.
12. THE CONTRACTOR MAY CONSIDER ALTERNATIVE SEDIMENT AND EROSION CONTROL MEASURES, SUCH MEASURES MUST BE PRESENTED IN WRITING FOR APPROVAL BY THE CONTRACT ADMINISTRATOR AND MUST BE APPROVED IN WRITING BY THE APPLICABLE APPROVAL AGENCIES.
13. SEDIMENT CONTROL FENCE TO USE GEOTEXTILE WITH WEAVE DENSITY OF 270R TERRAFIX OR EQUIVALENT.
14. CHECK DAMS ARE TO BE USED IN ANY TEMPORARY DRAINAGE SWALES REQUIRED DURING THE CONSTRUCTION PERIOD.
15. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES MAY BE REQUIRED AND SHALL BE DETERMINED BY THE ENGINEER OR THE TOWN OF MIDLAND.
16. ROCK CHECK DAMS ARE TO BE CLEANED OF ALL ACCUMULATED SEDIMENT AS SOON AS SEDIMENT HAS ACCUMULATED TO A DEPTH GREATER THAN 50% OF ALL UPSTREAM CHECK DAMS.
17. MATERIALS TO REPAIR DAMAGED ESC MEASURES MUST BE KEPT ON–SITE AT ALL TIMES.
18. ESC STRATEGIES ON THESE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO PREVENT SEDIMENT RELEASES. FAILED ESC MEASURES MUST BE REPAIRED IMMEDIATELY.
19. SERVICING OF CONSTRUCTION EQUIPMENT ON SITE IS PROHIBITED.
20. THE CONTRACTOR MUST CLEAN ADJACENT ROADS ON A REGULAR BASIS. THE ROAD SHALL BE, AT A MINIMUM SCRAPED DAILY AND FLUSHED (IF NECCESSARY).
21. DUST CONTROL TO BE REVIEWED DAILY. WATER TRUCK OR CALCIUM CHLORIDE IS TO BE PROVIDED ON–SITE AND HAUL ROADS/WORKING AREAS ARE TO BE TREATED AS REQUIRED TO ENSURE THAT DUST IS CONTROLLED ON–SITE.

CONSTRUCTION SEQUENCE

THE FOLLOWING CONSTRUCTION SEQUENCE IS PROVIDED FOR CONTRACTOR GUIDANCE:

1. CONSTRUCT ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES INCLUDING SILT FENCE, TREE PRESERVATION FENCE, CHECK DAMS, SWALES/BERMS, ETC.
2. STRIPPING AND REMOVAL OF TOPSOIL AND HARD SURFACES OFF–SITE.
3. PROCEED WITH EARTH EXCAVATION AND PRE–GRADING. PROCEED WITH SEEDING OF RESTORATION OF ALL DISTURBED AREAS AS DIRECTED BY ENGINEER. ALL AREAS STRIPPED OF VEGETATIVE COVER FOR LONGER THAN 15 DAYS SHALL BE HYDROSEEDED AT THE DIRECTION OF THE ENGINEER. HYDROSEED WITH FIBRETAC AT 100KG/HA. HYDROSEED MIXTURE OF 48% ANNUAL RYE GRASS, 48% FALL RYE, 4% RED CLOVER WILL NEED TO BE APPLIED TO EXPOSED AREAS FOLLOWING TOPSOIL STRIPPING.
4. PROCEED WITH SITE WORKS I.E. SITE SERVICING AND SURFACE WORKS INSTALLATIONS.
2. RESTORATION OF DISTURBED AREAS.
3. REMOVAL OF SEDIMENT AND EROSION CONTROLS.

NOTE SILTATION AND EROSION CONTROL MEASURES ARE TO BE MONITORED AND MAINTAINED THROUGHOUT CONSTRUCTION AND NECESSARY REPAIRS TO BE PROMPTLY COMPLETED AS REQUIRED.

CONTINGENCY PLAN

IF UNFORESEEN EVENTS CAUSE THE STRATEGIES SET OUT IN THIS PLAN TO BE INSUFFICIENT OR INAPPROPRIATE TO MEET THE OBJECTIVE, THE CONTRACTOR IS EXPECTED TO RESPOND IN A TIMELY MANNER WITH ALL REASONABLE MEASURES CONSISTENT WITH SAFETY, TO PREVENT, COUNTERACT OR REMEDY DOWNSTREAM SEDIMENTATION AND EROSION.

IF A SPILL OCCURS IT SHALL BE REPORTED TO THE MINISTRY OF ENVIRONMENT, CONSERVATION AND PARKS SPILLS ACTION CENTRE AT 1–800–268–6060.

IF APPROVAL AGENCIES DETERMINE THAT LONG TERM DAMAGE TO THE NATURAL ENVIRONMENT HAS OCCURRED DUE TO FAILURE OF THIS PLAN TO CONTROL SEDIMENTS, A RESTORATION PLAN WILL BE DEVELOPED BY THE CONTRACTOR IN CONSULTATION WITH AND APPROVAL FROM THE APPROPRIATE AGENCIES FOR IMPLEMENTATION BY THE CONTRACTOR.

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
1	OPA, ZBLA & SPA SUBMISSION	AUG. 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

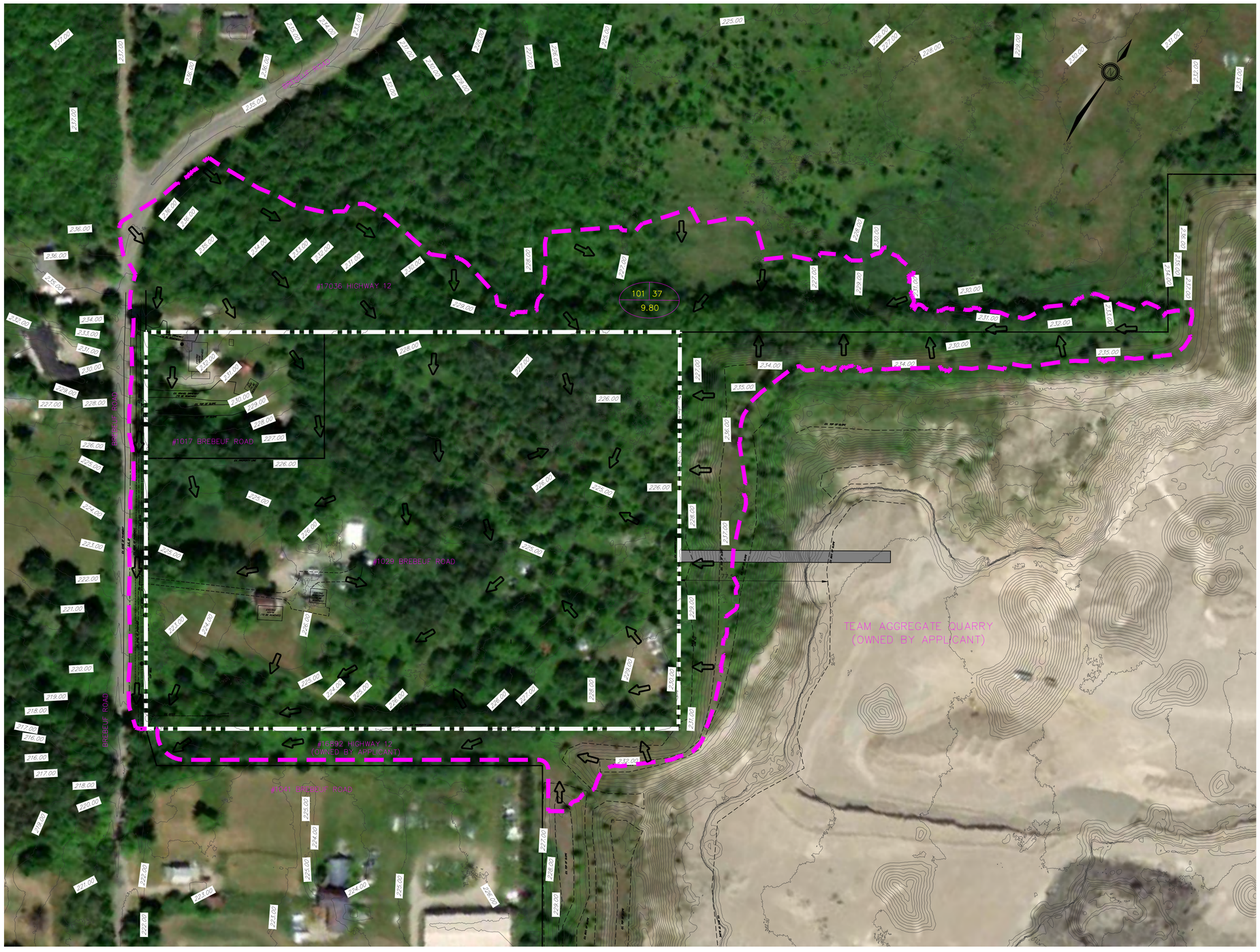
1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

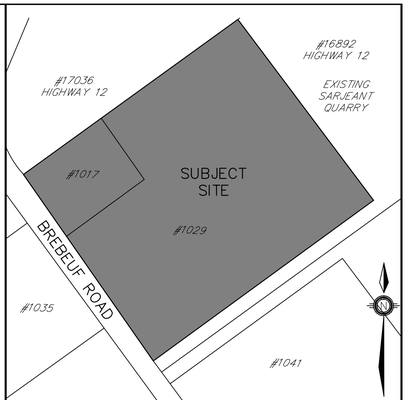
EROSION AND SEDIMENT CONTROL PLAN NOTES AND DETAILS

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN DR	SCALE: 1:500	DATE JULY 2024
DRAWN KS	PROJECT SAR–23058	DWG. Nº ESC–4
CHECKED DR		

G:\Eng_3D\SAR–23058\Production DWGS\SAR–23058_ESC.dwg Layout:ESC–4 Plotted Aug 07, 2024 @ 10:38am by mgallant The Jones Consulting Group Ltd





KEYPLAN
NTS

LEGEND

- CATCHMENT AREA BOUNDARY
- LIMIT OF DEVELOPMENT
- DIRECTION OF PRE-DEVELOPMENT OVERLAND FLOW
- 253.00 EXISTING CONTOUR AND ELEVATION
- CATCHMENT AREA ID NUMBER
- 101 | 0.40 / 41.67 — CN*(II) VALUE (OTTHYMO NASHYD) OR % IMPERVIOUS (OTTHYMO STANDHYD); AREA (ha.)

BENCHMARK:
0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO

NO.	REVISIONS	DATE	INITIAL
1.	IN SUPPORT OF OPA, ZBLA & SPA	JULY 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

PRE-DEVELOPMENT STORMWATER MANAGEMENT PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
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P. 705.734.2538
F. 705.734.1056

DESIGN	MG	SCALE: 1:1000	DATE JULY 2024
DRAWN	CG	PROJECT SAR-23058	DWG. Nº SWM-1
CHECKED	DR		

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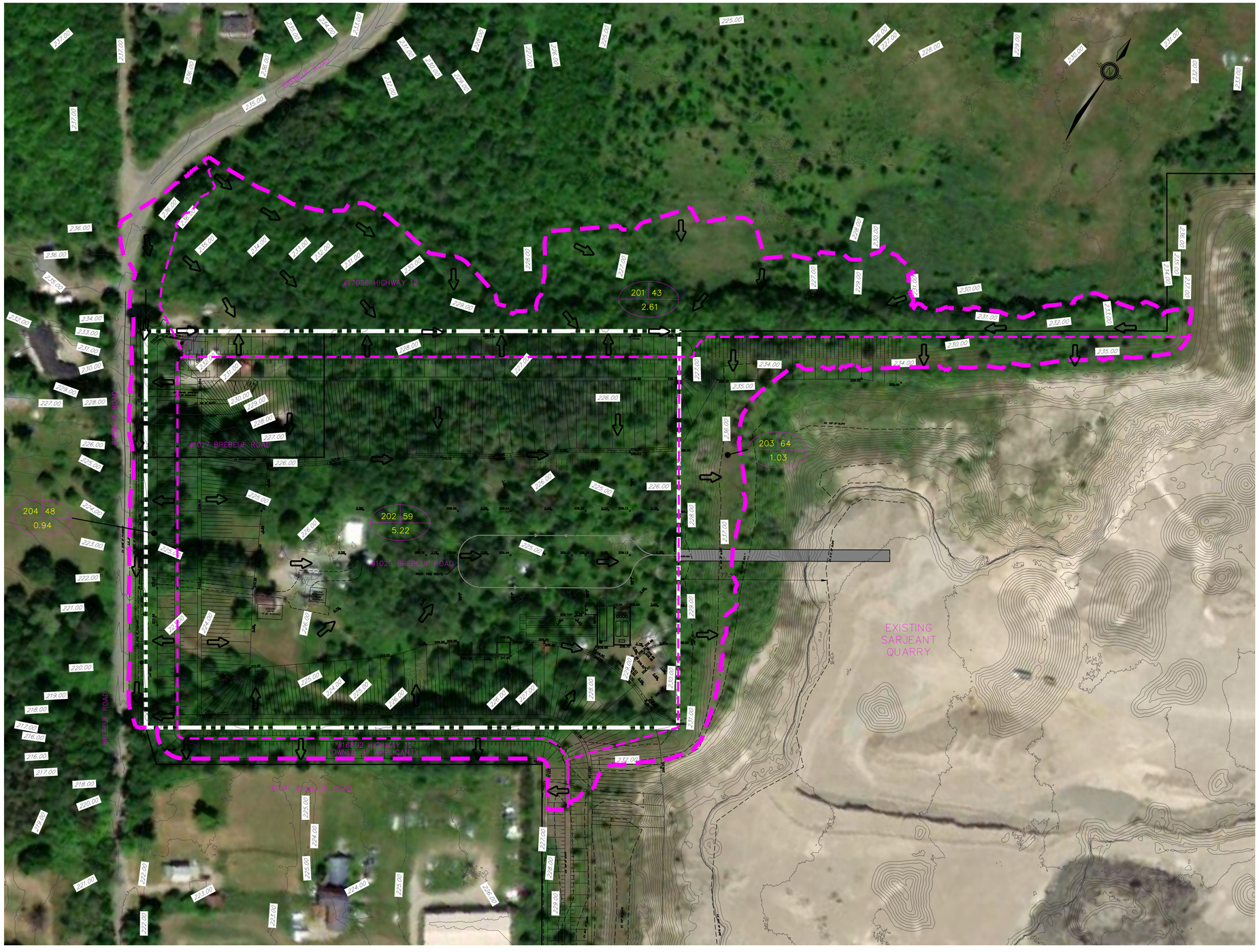

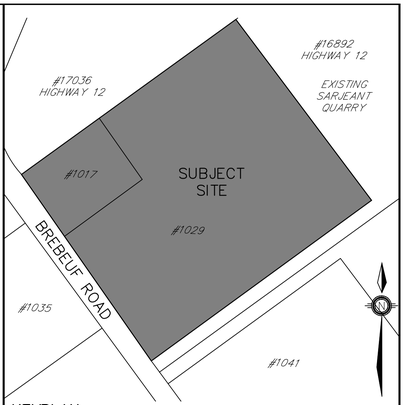

KEYPLAN
NTS

LEGEND

- OVERALL CATCHMENT AREA BOUNDARY
- MINOR CATCHMENT AREA BOUNDARY
- LIMIT OF DEVELOPMENT
- DIRECTION OF PRE-DEVELOPMENT OVERLAND FLOW
- 253.00 EXISTING CONTOUR AND ELEVATION
- CATCHMENT AREA ID NUMBER
- 101 | 0.40 / 41.67
  - CN*(II) VALUE (OTTHYMO NASHYD) OR % IMPERVIOUS (OTTHYMO STANDHYD)
  - AREA (ha.)

BENCHMARK:
0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO

NO.	REVISIONS	DATE	INITIAL
1.	IN SUPPORT OF OPA, ZBLA & SPA	JULY 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

POST-DEVELOPMENT STORMWATER MANAGEMENT PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
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P. 705.734.2538
F. 705.734.1056

DESIGN	MG	SCALE: 1:1000	DATE JULY 2024
DRAWN	CG	PROJECT SAR-23058	DWG. Nº SWM-2
CHECKED	DR		

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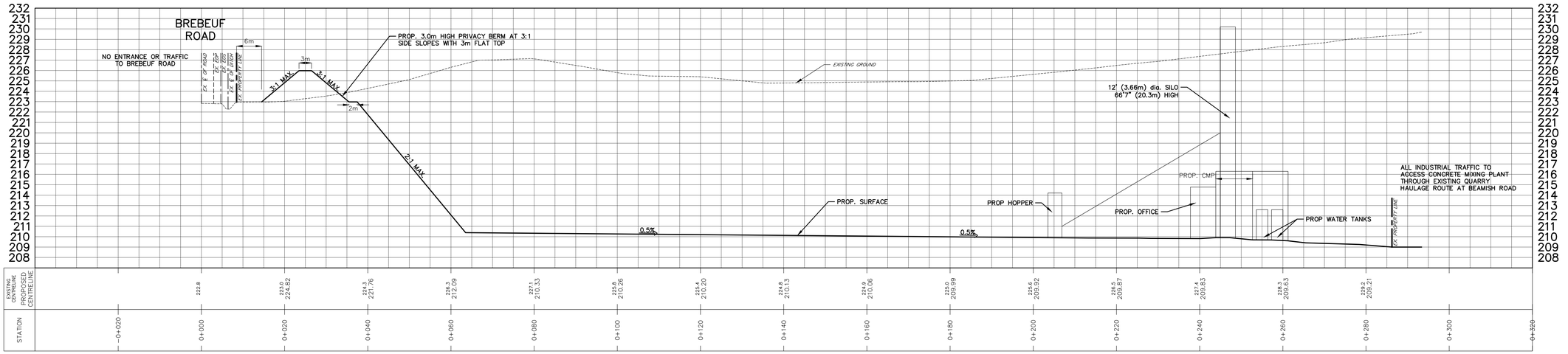
SECTION B–B



STATION	0+020	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300	0+320
EXISTING CENTRELINE		222.8																
PROPOSED CENTRELINE		223.0 224.82		224.3 221.76	228.3 212.09	227.1 210.33	226.8 210.26	225.4 210.20	224.8 210.13	224.4 210.06	225.9 209.99	225.8 209.92	226.5 209.87	227.4 209.83	228.3 209.63	229.2 209.21		

BENCHMARK:

0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

NO.	REVISIONS	DATE	INITIAL
3	OPA, ZBLA & SPA SUBMISSION	JUL. 2024	MG
2	ISSUED FOR PRE–CONSULTATION	DEC. 2023	DR
1	ISSUED TO CLIENT	OCT. 2023	DR

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

EAST WEST
CROSS SECTION

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
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F. 705.734.1056

DESIGN DR	SCALE: H 1:500 V 1:200	DATE JULY 2024
DRAWN KS	PROJECT SAR–23058	DWG. Nº CS–1
CHECKED DR		

G:\Eng_3D\SAR-23058\Production DWGS\SAR-23058_Base.dwg Layout:CS-1 Plotted Jul 22, 2024 @ 4:13pm by cgagnon The Jones Consulting Group Ltd.

Appendix B

Borehole Logs

JOB NO.: 2403-S066

LOG OF BOREHOLE: 1D

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Solid Stem Auger

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 11, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
224.7	Ground Surface							
0.0	**20 cm Topsoil**	1	DO	0	0			
0.2	weathered							
	Brown, very loose to very dense, wet clay layer	2A 2B	DO	7	1		12 40	
	GRAVELLY SAND							
	well graded occ. cobbles clay layer	3	DO	4	2		35	
	wet silt layers	4A 4B	DO	18			12 20	
		5	DO	15	3		24	
	wet silt layers				4			
		6	DO	33	5		9	
		7	DO	69	6		12	
		8	DO	47	7		8	
					8			
215.3		9	DO	50/10	9		9	
9.4	**END OF BOREHOLE**				10			
	Installed 25 mm Ø PVC monitoring well to 9.4 m with 1.6 m screen Sand backfill from 7m to 9.4 m Bentonite seal from 0.0 m to 7 m Provided with monument casing				11			
					12			

W.L. @ El. 224.1 m on completion

Soil Engineers Ltd.

JOB NO.: 2403-S066

LOG OF BOREHOLE: 1S

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Land Development

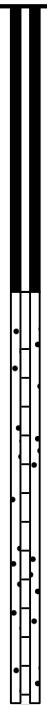
METHOD OF BORING: Solid Stem Auger

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 11, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
224.7	Ground Surface							
0.0	Straight Auger for Monitoirng Well Installation				0			
					1			
					2			
					3			
					4			
					5			
218.6					6			
6.1	**END OF BOREHOLE**							
					7			
					8			
					9			
					10			
					11			
					12			

Installed 25 mm Ø PVC monitoring well
to 6.1 m with 3.1 m screen
Sand backfill from 2.5 m to 6.1 m
Bentonite seal from 0.0 m to 2.5 m
Provided with monument casing



JOB NO.: 2403-S066

LOG OF BOREHOLE: 2D

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Hollow Stem with Mud Drilling

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 16, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
224.7 / 0.0	Ground Surface				
	8 cm Topsoil	1	DO	3	0
	Dark brown to brown, very loose to loose **SAND** fine to medium grained	2	DO	4	1
	weathered	3	DO	8	2
221.8 / 2.9		4	DO	3	
	Brown, loose to very dense, wet **GRAVEILLY SAND** well graded a trace of clay occ. cobbles and boulders	5	DO	4	3
		6	DO	6	4
		7	DO	15	5
		8	DO	50/13	6
215.4 / 9.3		9	DO	50/10	7
	END OF BOREHOLE				8
	Installed 25 mm Ø PVC monitoring well to 9.3 m with 3.1 m screen Sand backfill from 5.5m to 9.3 m Bentonite seal from 0.0 m to 5.5 m Provided with monument casing				9
					10
					11
					12

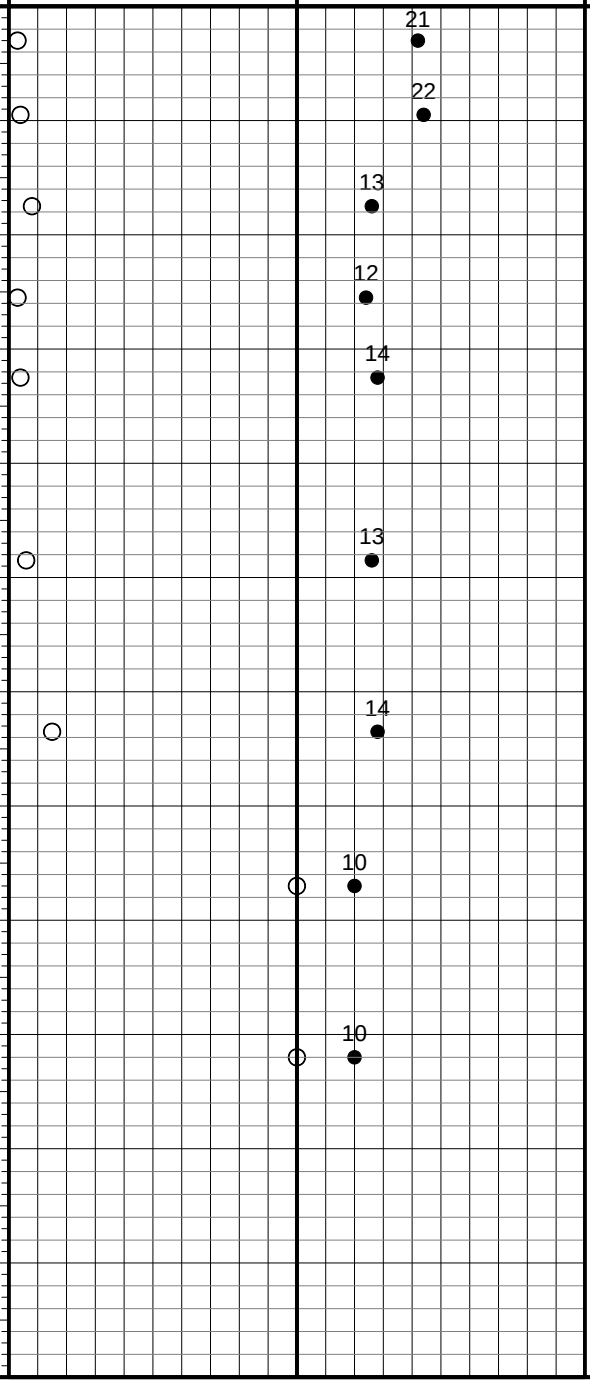
Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40



WATER LEVEL

Soil Engineers Ltd.

JOB NO.: 2403-S066

LOG OF BOREHOLE: 2S

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Solid Stem Auger

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 16, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
224.7	Ground Surface							
0.0	Straight Auger for Monitoirng Well Installation				0			
					1			
					2			
					3			
					4			
					5			
218.6					6			
6.1	**END OF BOREHOLE**							
					7			
					8			
					9			
					10			
					11			
					12			

Installed 25 mm Ø PVC monitoring well
to 6.1 m with 3.1 m screen
Sand backfill from 2.5 m to 6.1 m
Bentonite seal from 0.0 m to 2.5 m
Provided with monument casing

Soil Engineers Ltd.

JOB NO.: 2403-S066

LOG OF BOREHOLE: 3

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Hollow Stem with Mud Drilling

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 11, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
227.5 0.0	Ground Surface				
	10 cm Topsoil	1	DO	2	0
	Dark brown to brown, very loose to loose,wet — — weathered				
	SAND	2	DO	8	1
226.2 1.3	fine to medium grained some silt				
	Brown, compact to very dense	3	DO	11	2
	GRAVEILLY SAND				
	a trace of clay occ. cobbles and boulders	4	DO	27	
		5	DO	50/8	3
					4
		6	DO	64	5
					6
		7	DO	63	
219.8 7.7	**Borehole Terminated Due to Auger Refusal**	8	DO	50/10	7
					8
					9
					10
					11
					12

Dynamic Cone (blows/30 cm) 10 30 50 70 90

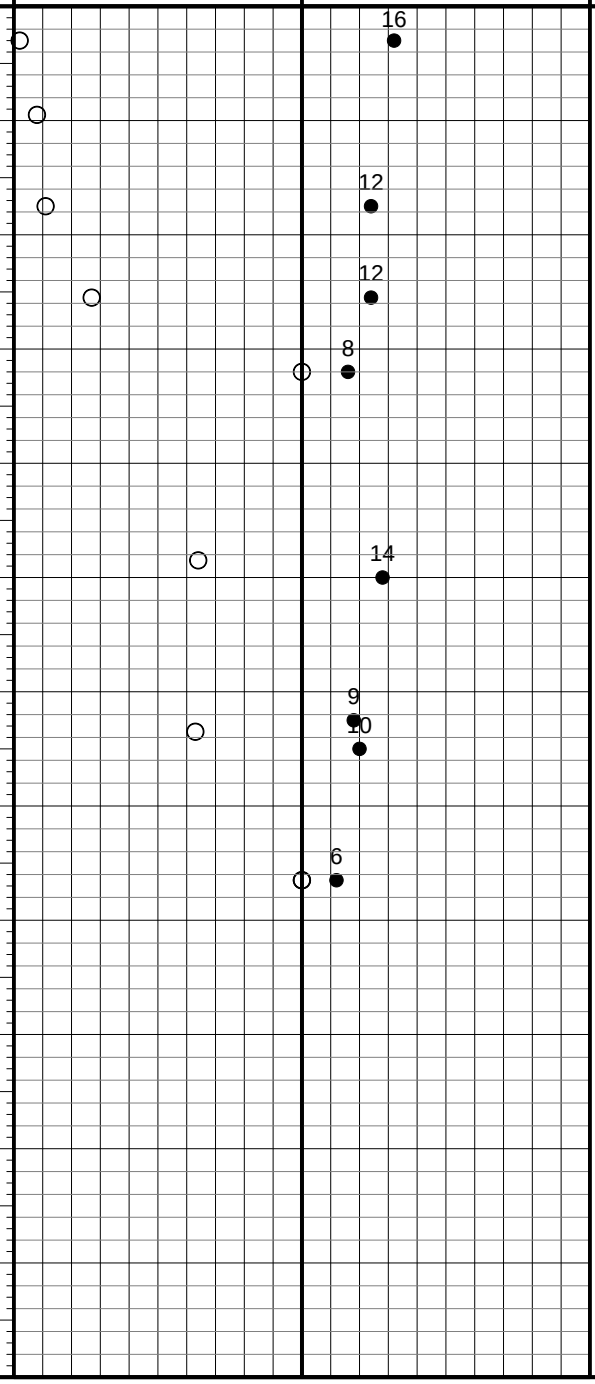
Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

WATER LEVEL



Installed 25 mm Ø PVC monitoring well
to 7.6 m with 3.1 m screen
Sand backfill from 3.9 m to 7.6 m
Bentonite seal from 0.0 m to 3.9 m
Provided with monument casing

Soil Engineers Ltd.

JOB NO.: 2403-S066

LOG OF BOREHOLE: 4

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Hollow Stem with Mud Drilling

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 12, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
225.5	Ground Surface							
0.0	**25 cm Topsoil**	1	DO	3	0		27	
	weathered							
	Dark brown to brown, very loose to compact **SAND** some silt to silty	2	DO	14	1		14	
		3	DO	2	2		14	
	wet silt layers	4	DO	10	2		19	
		5	DO	14	3		13	
221.5					4			
4.0	Brown, loose to very dense, wet **GRAVELLY SAND** well graded a trace of silt occ. cobbles and boulders	6	DO	4	5		15	
		7	DO	16	6			
		8	DO	36	7			
		9	DO	52	8		9	
		10	DO	50/10	9		11	
213.5					10			
					11			
					12			

JOB NO.: 2403-S066

LOG OF BOREHOLE: 4

FIGURE NO.: 6

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Hollow Stem with Mud Drilling

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 12, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
12.0	Brown, loose to very dense, wet **GRAVELLY SAND** well graded a trace of silt occ. cobbles and boulders	11	DO	50/8	12		13	
		12	DO	50/13	13		11	
		13	DO	50/8	14		10	
		14	DO	50/15	15		13	
		15	DO	50/13	16		12	
205.5		16	DO	50/13	17			
20.0	**END OF BOREHOLE** Installed 25 mm Ø PVC monitoring well to 12.2 m with 3.1 m screen Sand backfill from 8.5 m to 12.2 m Bentonite seal from 0.0 m to 12.2 m Provided with monument casing				18			
					19			
					20			
					21			
					22			
					23			
					24			

Soil Engineers Ltd.

JOB NO.: 2403-S066

LOG OF BOREHOLE: 5

FIGURE NO.: 7

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Solid Stem Auger

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 15, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
227.3	Ground Surface							
0.0	**8 cm Topsoil**	1	DO	3	0		13	
	weathered Brown, compact to very dense, wet							
	SAND fine to medium grained a trace of silt occ. cobbles and boulders	2	DO	23	1		11	
		3	DO	22	2		9	
		4	DO	17			10	
224.3					3			
3.0	Brown, compact to very dense	5	DO	57			18	
	GRAVEILLY SAND well graded a trace of silt occ. cobbles and boulders				4			
		6	DO	39	5		8	
		7	DO	41	7		7	
		8	DO	27	9		9	
216.6		9	DO	50/13	10		9	
10.7	**END OF BOREHOLE**				11			
	Installed 25 mm Ø PVC monitoring well to 8.8 m with 3.1 m screen Sand backfill from 5.1 m to 8.8 m Bentonite seal from 0.0 m to 5.1 m Provided with monument casing				12			W.L. @ El. 227.0 m on completion

JOB NO.: 2403-S066

LOG OF BOREHOLE: 6

FIGURE NO.: 8

PROJECT DESCRIPTION: Proposed Land Development

METHOD OF BORING: Solid Stem Auger

PROJECT LOCATION: 1029 Brebeuf Road, Town of Midland

DRILLING DATE: April 16, 2024

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
226.2	Ground Surface							
0.0	**8 cm Topsoil**	1	DO	0	0			
	weathered							
	Brown, compact to very dense **GRAVEILLY SAND** well graded trace to some silt occ. cobbles and boulders	2	DO	20	1		13	
		3	DO	20	2		11	
		4	DO	21	2		13	
		5	DO	32	3		12	
	seepage	6	DO	20	5		11	
219.8		7	DO	50/13	6		11	
6.4	**END OF BOREHOLE**							
	Installed 25 mm Ø PVC monitoring well to 6.1 m with 3.1 m screen Sand backfill from 2.5 m to 6.1 m Bentonite seal from 0.0 m to 2.5 m Provided with monument casing				7 8 9 10 11 12			W.L. @ El. 225.9 m on completion

Soil Engineers Ltd.

Appendix C

MECP Water Well Records

APPENDIX C
Table C-1: MECP Water Well Records
(within 500 m of the Site)

Well ID	Date Completed	TAG	Well Depth (m)	Depth to Bedrock (m)	Static Water Level	Final Status	Use
5703885	1949-07-10		53.3		45.1	Water Supply	Public
5703887	1950-09-16		96.0	94.5	42.7	Water Supply	Livestock / Domestic
5703893	1957-11-01		46.9		36.3	Water Supply	Domestic
5703894	1964-05-13		48.8		36.3	Water Supply	Domestic
5704479	1956-06-25		28.3			Abandoned-Supply	Not Used
5704481	1963-09-25		51.2		7.6	Water Supply	Domestic
5706629	1969-07-22		23.8		10.4	Water Supply	Domestic
5709376	1972-10-26		69.5		46.0	Water Supply	Domestic
5710792	1973-12-10		57.0		44.2	Water Supply	Domestic
5711705	1974-09-15		54.6		45.4	Water Supply	Domestic
5714364	1977-03-08		103.0	101.2	45.7	Water Supply	Domestic
5715926	1978-11-13		78.0		42.4	Water Supply	Industrial
7044437	2007-03-16	A043160	48.8		37.8	Water Supply	Domestic
7214216	2013-10-08	A152178	53.6		3.7	Water Supply	Municipal
7243762	2015-04-14	A162235	4.6			Observation Wells	Monitoring
7275029	2016-11-02	A184078	47.2		32.9	Water Supply	Domestic
7298909	2017-10-03	A232329	27.4			Test Hole	Test Hole

Well ID	Top (mbgs)	Bottom (mbgs)	Thickness (m)	Colour	Material 1	Material 2	Material 3
5703885	0.00	22.86	22.86		HARDPAN	GRANITE	BOULDERS
5703885	22.86	27.74	4.88		CLAY		
5703885	27.74	50.29	22.56		HARDPAN	GRANITE	BOULDERS
5703885	50.29	53.34	3.05		MEDIUM SAND		
5703887	0.00	29.87	29.87		PREVIOUSLY DUG		
5703887	29.87	89.00	59.13		GRAVEL	STONES	
5703887	89.00	92.05	3.05		HARDPAN		
5703887	92.05	94.49	2.44	BLUE	CLAY		
5703887	94.49	96.01	1.52		DOLOMITE		
5703893	0.00	24.69	24.69		PREVIOUSLY DUG		
5703893	24.69	46.94	22.25		MEDIUM SAND	GRAVEL	
5703894	0.00	2.44	2.44		TOPSOIL	CLAY	
5703894	2.44	36.58	34.14		MEDIUM SAND	GRAVEL	STONES
5703894	36.58	48.77	12.19		MEDIUM SAND	GRAVEL	
5704479	0.00	15.24	15.24		MEDIUM SAND	CLAY	
5704479	15.24	18.29	3.05		QUICKSAND		
5704479	18.29	28.35	10.06		BOULDERS	MEDIUM SAND	
5704481	0.00	49.68	49.68		STONES	GRAVEL	BOULDERS
5704481	49.68	51.21	1.52		GRAVEL		
5706629	0.00	4.57	4.57	YELLOW	MEDIUM SAND		
5706629	4.57	23.47	18.90		COARSE SAND	SILT	BOULDERS
5706629	23.47	23.77	0.30		GRAVEL		
5709376	0.00	0.61	0.61		TOPSOIL	DARK-COLOURED	LOOSE
5709376	0.61	1.52	0.91	RED	SAND	BOULDERS	LOOSE
5709376	1.52	28.96	27.43	YELLOW	SAND	GRAVEL	BOULDERS
5709376	28.96	39.62	10.67	YELLOW	SAND	PACKED	
5709376	39.62	69.19	29.57	GREY	GRAVEL	SAND	SILT
5709376	69.19	69.49	0.30		GRAVEL	HARD	
5710792	0.00	0.61	0.61		TOPSOIL		
5710792	0.61	5.79	5.18	RED	SAND	GRAVEL	
5710792	5.79	6.71	0.91	GREY	CLAY	SAND	GRAVEL
5710792	6.71	8.84	2.13	GREY	CLAY	BOULDERS	
5710792	8.84	24.08	15.24	GREY	GRAVEL	SILT	BOULDERS
5710792	24.08	30.78	6.71	YELLOW	FINE SAND		
5710792	30.78	50.60	19.81	GREY	GRAVEL	CLAY	SAND
5710792	50.60	56.39	5.79	GREY	GRAVEL	SILT	BOULDERS
5710792	56.39	57.00	0.61	GREY	GRAVEL		
5711705	0.00	18.29	18.29		HARDPAN	BOULDERS	
5711705	18.29	54.56	36.27		GRAVEL		

APPENDIX C

Table C-2: MECP Water Well Record Stratigraphy

(within 500 m of the Site)

Well ID	Top (mbgs)	Bottom (mbgs)	Thickness (m)	Colour	Material 1	Material 2	Material 3
5714364	0.00	1.22	1.22		SAND		
5714364	1.22	10.36	9.14		GRAVEL	STONES	
5714364	10.36	17.37	7.01	GREY	CLAY		
5714364	17.37	27.74	10.36		CLAY	GRAVEL	
5714364	27.74	32.61	4.88		SAND		
5714364	32.61	70.41	37.80		SAND	GRAVEL	CEMENTED
5714364	70.41	81.38	10.97		SAND	MEDIUM-GRAINED	
5714364	81.38	83.82	2.44		SAND	GRAVEL	LAYERED
5714364	83.82	89.00	5.18		SAND	COARSE-GRAINED	
5714364	89.00	101.19	12.19		CLAY	GRAVEL	
5714364	101.19	103.02	1.83		LIMESTONE		
5715926	0.00	31.09	31.09		SAND	GRAVEL	
5715926	31.09	51.82	20.73		COARSE SAND	MEDIUM SAND	
5715926	51.82	71.63	19.81		COARSE SAND		
5715926	71.63	78.03	6.40		CLAY	GRAVEL	
7044437	0.00	35.90	35.90	BROWN	SAND	GRAVEL	STONES
7044437	35.90	48.80	12.90	BROWN	SAND	GRAVEL	
7214216	0.00	0.30	0.30		TOPSOIL		
7214216	0.30	2.13	1.83	BROWN	SAND	GRAVEL	
7214216	2.13	2.74	0.61	BLACK	GRANITE	BOULDERS	
7214216	2.74	53.64	50.90	BROWN	SAND	GRAVEL	WATER-BEARING
7243762	0.00	3.05	3.05	BROWN	SAND		
7243762	3.05	4.57	1.52	GREY	SAND		
7275029	0.00	1.22	1.22	GREY	CLAY		SOFT
7275029	1.22	13.41	12.19	GREY	CLAY	SILT	HARD
7275029	13.41	47.24	33.83	BROWN	SAND	GRAVEL	LOOSE
7298909	0.00	3.66	3.66	BROWN	FILL		
7298909	3.66	6.10	2.44	BROWN	SAND	GRAVEL	
7298909	6.10	27.43	21.34	GREY	GRAVEL	BOULDERS	

Appendix D

Well Construction Details and Groundwater Levels

APPENDIX D
Table D-1: Well Construction Details

Location	Installation	Well Construction Details											
		Ground Surface*	Top of Well Casing	Stickup	Bottom of Well			Top of Screen			Screen Length	Well Inside Diameter	Borehole Diameter
		(masl)	(masl)	(m)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(m)	(m)	(m)
Pit Wells													
MW3	**Landshark (2017)**	209.10	209.80	0.70	20.58	19.88	189.22	17.53	16.83	192.27	3.05	0.051	0.910
MW10 (PW-1)	**Snider (1978)**	208.85	209.93	1.08	47.00	45.92	162.93	44.56	43.48	165.37	2.44	0.152	0.910
Dug Wells													
Onsite Dug Well	**Unknown**	226.30	226.70	0.40	3.90	3.50	222.80	0.90	0.50	225.80	3.00	0.910	0.910
Ditch Concrete Well	**Unknown**	223.87	224.58	0.71	4.66	3.95	219.92	0.66	-0.05	223.92	4.00	0.910	0.910
Ditch Corrugated Well	**Unknown**	221.91	223.04	1.13	3.76	2.63	219.28	0.76	-0.37	222.28	3.00	0.910	0.910
Monitoring Wells													
BH1S	**SoilEng (2024)**	224.65	225.64	0.99	5.45	4.46	220.19	2.40	1.41	223.24	3.05	0.051	0.152
BH1D	**SoilEng (2024)**	224.65	225.44	0.79	9.91	9.12	215.53	8.39	7.60	217.05	1.52	0.051	0.216
BH2S	**SoilEng (2024)**	224.64	225.68	1.04	6.90	5.86	218.78	3.85	2.81	221.83	3.05	0.051	0.152
BH2D	**SoilEng (2024)**	224.71	225.80	1.09	10.21	9.12	215.59	7.16	6.07	218.64	3.05	0.051	0.216
BH3	**SoilEng (2024)**	227.54	228.55	1.01	8.40	7.39	220.15	5.35	4.34	223.20	3.05	0.051	0.216
BH4	**SoilEng (2024)**	225.50	226.72	1.22	13.21	11.99	213.51	10.16	8.94	216.56	3.05	0.051	0.216
BH5	**SoilEng (2024)**	227.80	228.91	1.11	9.92 *(5.21)*	8.80 *(4.09)*	219.00 *(223.71)*	6.87	5.76	222.04	3.05	0.051	0.216
BH6	**SoilEng (2024)**	226.20	227.17	0.97	6.93	5.96	220.24	3.88	2.91	223.29	3.05	0.051	0.152
Piezometers													
DP1D	**Harden (2024)**	224.18	225.15	0.97	3.18	2.21	221.97	2.95	1.98	222.20	0.23	0.025	0.025
DP1S	**Harden (2024)**	224.18	224.86	0.68	1.64	0.96	223.22	1.41	0.73	223.45	0.23	0.025	0.025
DP2	**Harden (2024)**	226.22	227.17	0.95	1.96	1.01	225.21	1.73	0.78	225.44	0.23	0.025	0.025

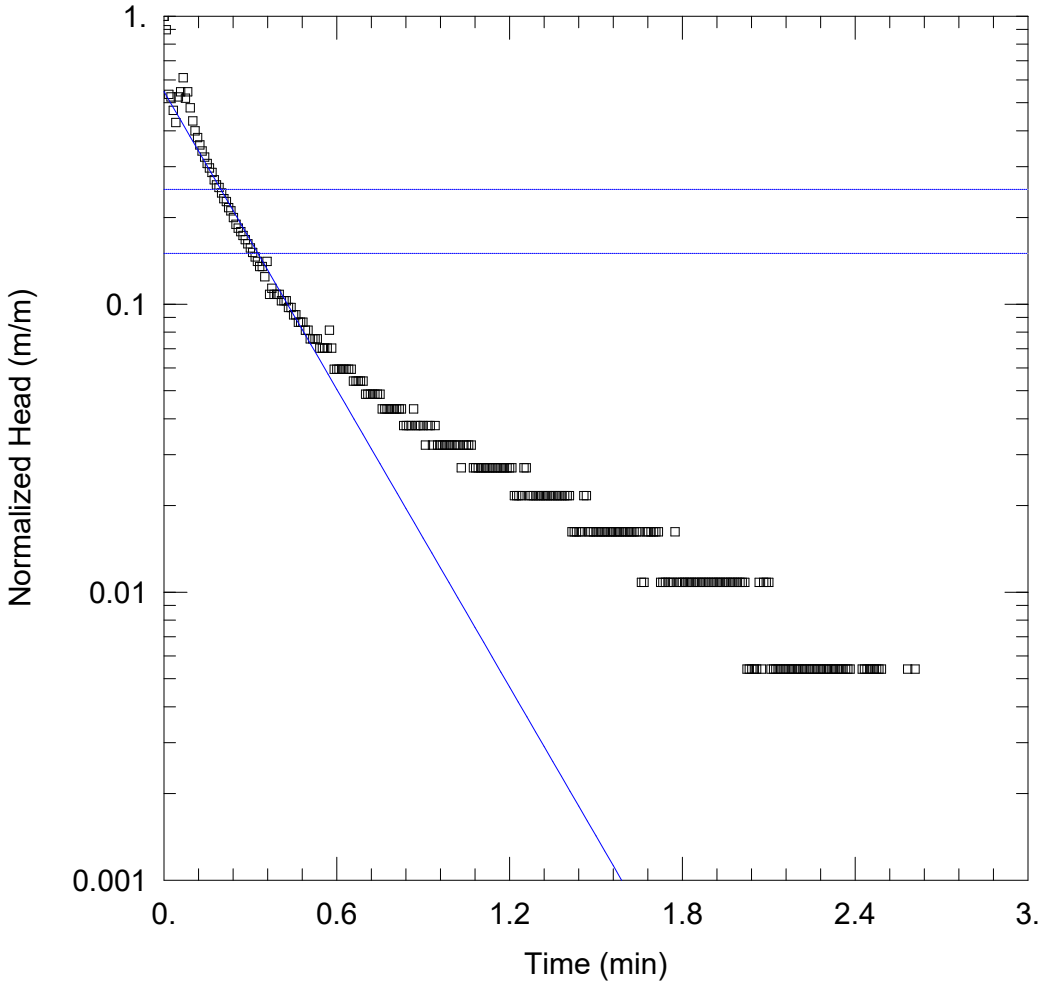
Notes:
masl = metres above mean sea level
mbgs = metres below ground surface
mbtoc = metres below top of well casing
* Ground surface elevations from SoilEng, 2024
italicized = measured well depth; MW5 presumed damaged at this depth

Location	Groundwater Levels																							
	2023-Nov-7			2023-Dec-6			2024-Apr-11			2024-Apr-22			2024-May-23			2024-Jun-05			2024-Jul-04			2024-Jul-19		
	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)	(mbtoc)	(mbgs)	(masl)
Pit Wells																								
MW3	-	-	-	19.29	18.59	190.51	-	-	-	-	-	-	-	-	-	19.17	18.47	190.63	19.11	18.41	190.69	19.07	18.37	190.73
MW10 (PW-1)	-	-	-	19.74	18.66	190.19	-	-	-	-	-	-	-	-	-	19.60	18.52	190.33	19.55	18.47	190.38	19.55	18.47	190.38
Dug Wells																								
Onsite Dug Well	-	-	-		-	-	0.93	0.53	225.77	0.67	0.27	226.03	1.11	0.71	225.59	1.33	0.93	225.37	-	-	-	1.61	1.21	225.09
Ditch Concrete Well	2.47	1.76	222.11	2.13	1.42	222.45	1.36	0.65	223.22	0.98	0.27	223.60	1.56	0.85	223.02	1.81	1.10	222.77	-	-	-	2.24	1.53	222.34
Ditch Corrugated Well	1.81	0.68	221.23	1.61	0.48	221.43	1.22	0.09	221.82	1.15	0.02	221.89	-	-	-	1.42	0.29	221.62	-	-	-	1.76	0.63	221.28
Monitoring Wells																								
BH1S	-	-	-	-	-	-	-	-	-	1.30	0.31	224.34	1.81	0.82	223.83	2.12	1.13	223.52	2.63	1.64	223.01	2.74	1.75	222.90
BH1D	-	-	-	-	-	-	-	-	-	DRY @ 9.73	DRY @ 8.94	DRY @ 215.71	DRY @ 9.88	DRY @ 9.09	DRY @ 215.56	DRY @ 9.87	DRY @ 9.08	DRY @ 215.57	DRY @ 9.87	DRY @ 9.08	DRY @ 215.57	DRY @ 9.90	DRY @ 9.11	DRY @ 215.54
BH2S	-	-	-	-	-	-	-	-	-	1.95	0.91	223.73	4.51	3.47	221.17	4.54	3.50	221.14	5.11	4.07	220.57	5.56	4.52	220.12
BH2D	-	-	-	-	-	-	-	-	-	9.78	8.69	216.02	DRY @ 10.21	DRY @ 9.17	DRY @ 215.54	DRY @ 10.21	DRY @ 9.17	DRY @ 215.54	DRY @ 10.21	DRY @ 9.17	DRY @ 215.54	DRY @ 10.16	DRY @ 9.12	DRY @ 215.59
BH3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	DRY @ 8.40	DRY @ 7.37	DRY @ 220.17	DRY @ 8.33	DRY @7.30	DRY @ 220.24	DRY @ 8.40	DRY @ 7.37	DRY @ 220.17
BH4	-	-	-	-	-	-	-	-	-	-	-	-	11.29	10.07	215.43	11.63	10.41	215.09	DRY @ 13.11	DRY @ 11.88	DRY @ 213.62	DRY @ 13.09	DRY @ 11.86	DRY @ 213.64
BH5	-	-	-	-	-	-	-	-	-	-	-	-	2.28	1.17	226.63	2.37	1.26	226.54	3.69	2.58	225.22	3.85	2.74	225.06
BH6	-	-	-	-	-	-	-	-	-	3.23	2.26	223.94	3.51	2.54	223.66	3.75	2.78	223.42	4.09	3.12	223.08	4.42	3.45	222.75
Piezometers																								
DP1D	-	-	-	-	-	-	-	-	-	0.63	-0.34	224.52	2.38	1.41	222.77	2.47	1.50	222.68	2.77	1.80	222.38	2.83	1.86	222.32
DP1D-SW	-	-	-	-	-	-	-	-	-	0.63	-0.35	224.52	DRY @ 0.97	DRY @ 0.00	DRY @ 224.18	DRY @ 0.97	DRY @ 0.00	DRY @ 224.18	DRY @ 0.97	DRY @ 0.00	DRY @ 224.18	DRY @ 0.97	DRY @ 0.00	DRY @ 224.18
DP1S	-	-	-	-	-	-	-	-	-	0.35	-0.33	224.51	-	-	-	DRY @ 1.64	DRY @ 0.96	DRY @ 223.22	DRY @ 1.64	DRY @ 0.96	DRY @ 223.22	DRY @ 1.64	DRY @ 0.96	DRY @ 223.22
DP1S-SW	-	-	-	-	-	-	-	-	-	0.36	-0.33	224.50	DRY @ 0.68	DRY @ 0.00	DRY @ 224.18	DRY @ 0.68	DRY @ 0.00	DRY @ 224.18	DRY @ 0.68	DRY @ 0.00	DRY @ 224.18	DRY @ 0.68	DRY @ 0.00	DRY @ 224.18
DP2	-	-	-	-	-	-	-	-	-	0.86	-0.10	226.32	0.94	-0.01	226.23	1.38	0.43	225.79	1.91	0.96	225.26	DRY @ 1.96	DRY @ 1.01	DRY @ 225.21
DP2-SW	-	-	-	-	-	-	-	-	-	0.87	-0.08	226.30	0.91	-0.04	226.26	DRY @ 0.95	DRY @ 0.00	DRY @ 226.22	DRY @ 0.95	DRY @ 0.00	DRY @ 226.22	DRY @ 0.95	DRY @ 0.00	DRY @ 226.22

Notes:
masl = metres above mean sea level
mbgs = metres below ground surface
mbtoc = metres below top of well casing
'-' = data not available

Appendix E

Hydraulic Conductivity Test Results



FALLING HEAD RECOVERY TEST

Data Set: C:\...\MW1-S.aqt
Date: 07/18/24 Time: 12:11:41

PROJECT INFORMATION

Company: Harden Environmental Services
Client: Sarjeant
Project: 2361
Location: Brebeuf Rd Midland
Test Well: MW1S
Test Date: 2024/07/04

AQUIFER DATA

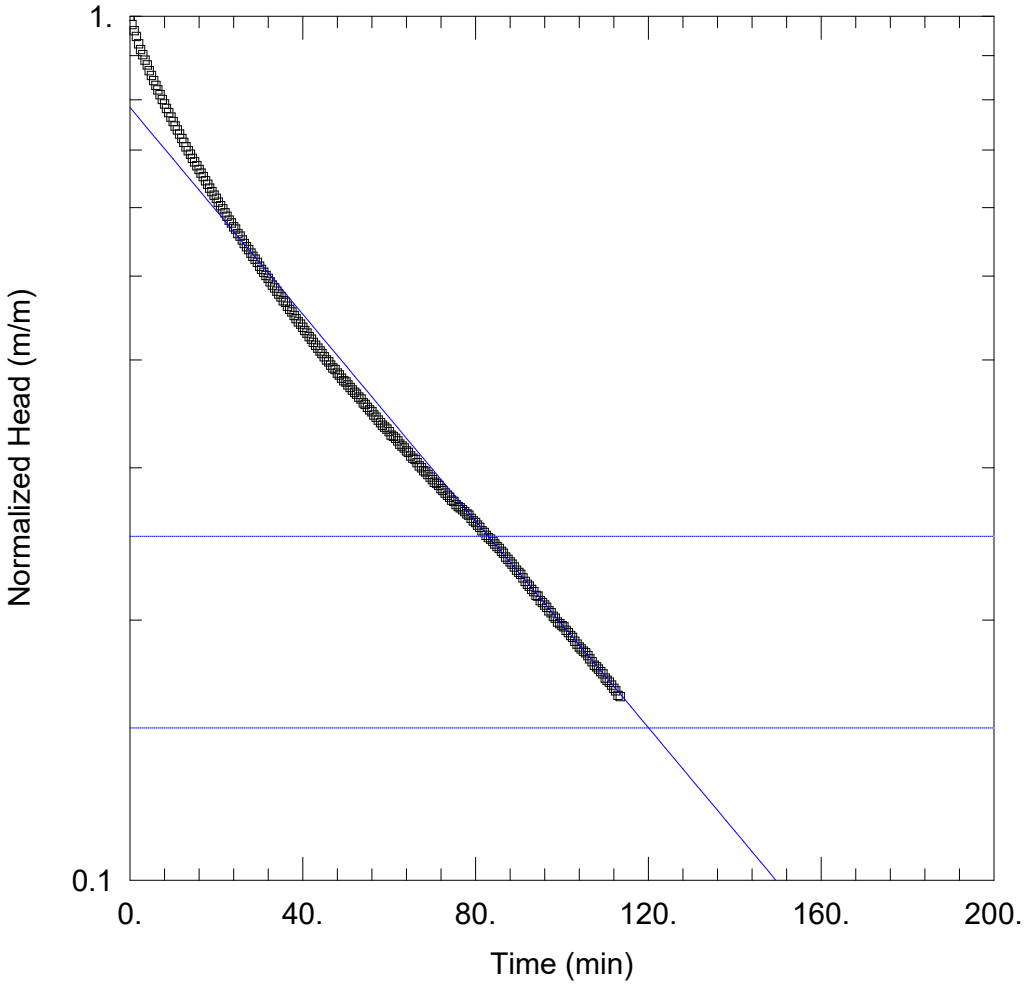
Saturated Thickness: 2.82 m
Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW1S)

Initial Displacement: 0.555 m
Total Well Penetration Depth: 2.82 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.82 m
Screen Length: 1.52 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 0.00023 m/sec
y0 = 0.3038 m



FALLING HEAD RECOVERY TEST

Data Set: C:\...\MW2-S.aqt
Date: 07/18/24 Time: 11:46:45

PROJECT INFORMATION

Company: Harden Environmental Services
Client: Sarjeant
Project: 2361
Location: Brebeuf Rd Midland
Test Well: MW2S
Test Date: 2024/07/04

AQUIFER DATA

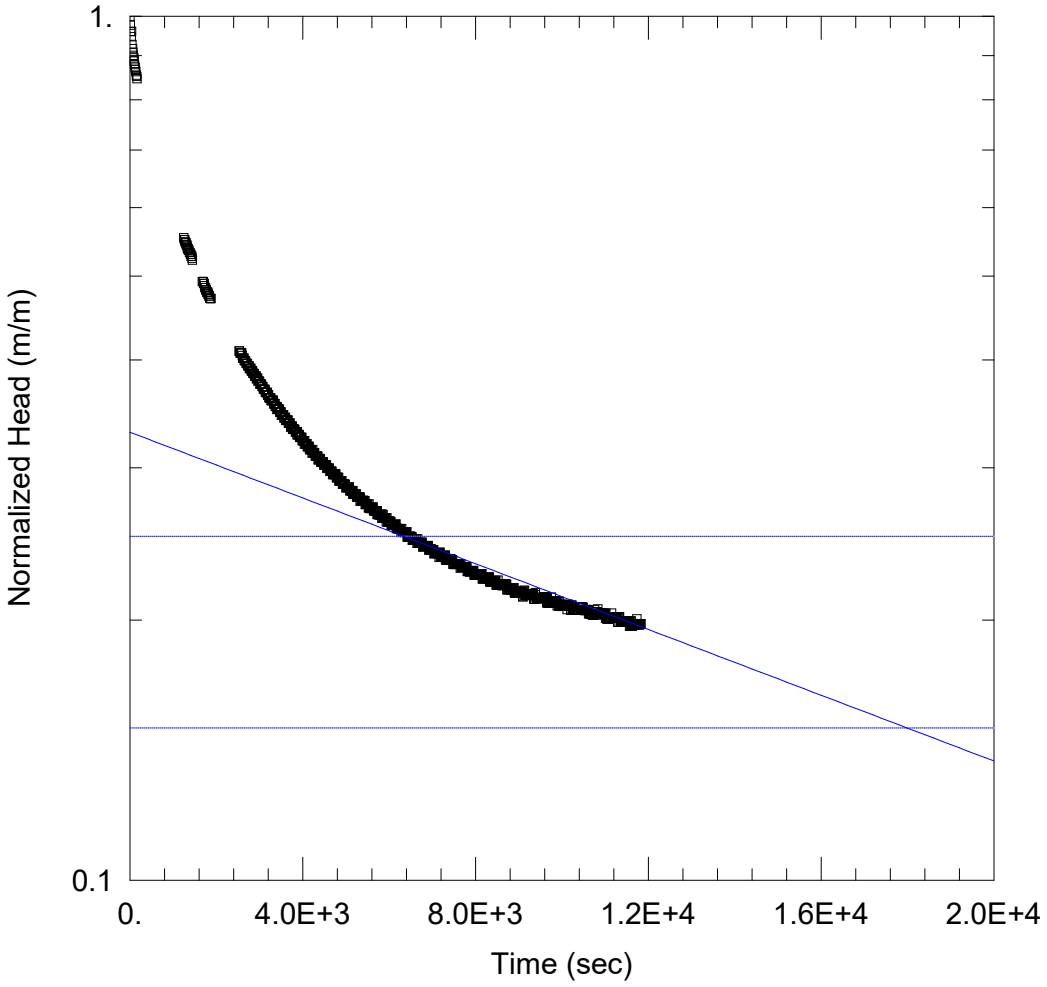
Saturated Thickness: 1.62 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW2S)

Initial Displacement: 1.365 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.62 m
Screen Length: 3.05 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev
K = 8.2E-7 m/sec y0 = 1.07 m



FALLING HEAD RECOVERY TEST

Data Set: C:\...\MW6.aqt
Date: 07/18/24 Time: 11:47:57

PROJECT INFORMATION

Company: Harden Environmental Services
Client: Sarjeant
Project: 2361
Location: Brebeuf Rd Midland
Test Well: MW6
Test Date: 2024/06/05

AQUIFER DATA

Saturated Thickness: 3.18 m Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (MW6)

Initial Displacement: 1.107 m
Total Well Penetration Depth: 3.18 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.18 m
Screen Length: 3.05 m
Well Radius: 0.076 m
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 7.6E-8 m/sec y0 = 0.3652 m

Appendix F

Pumping Test Results

Figure F-1: PW-1/MW10 Pumping Test at 24.3 US GPM (92 LPM)

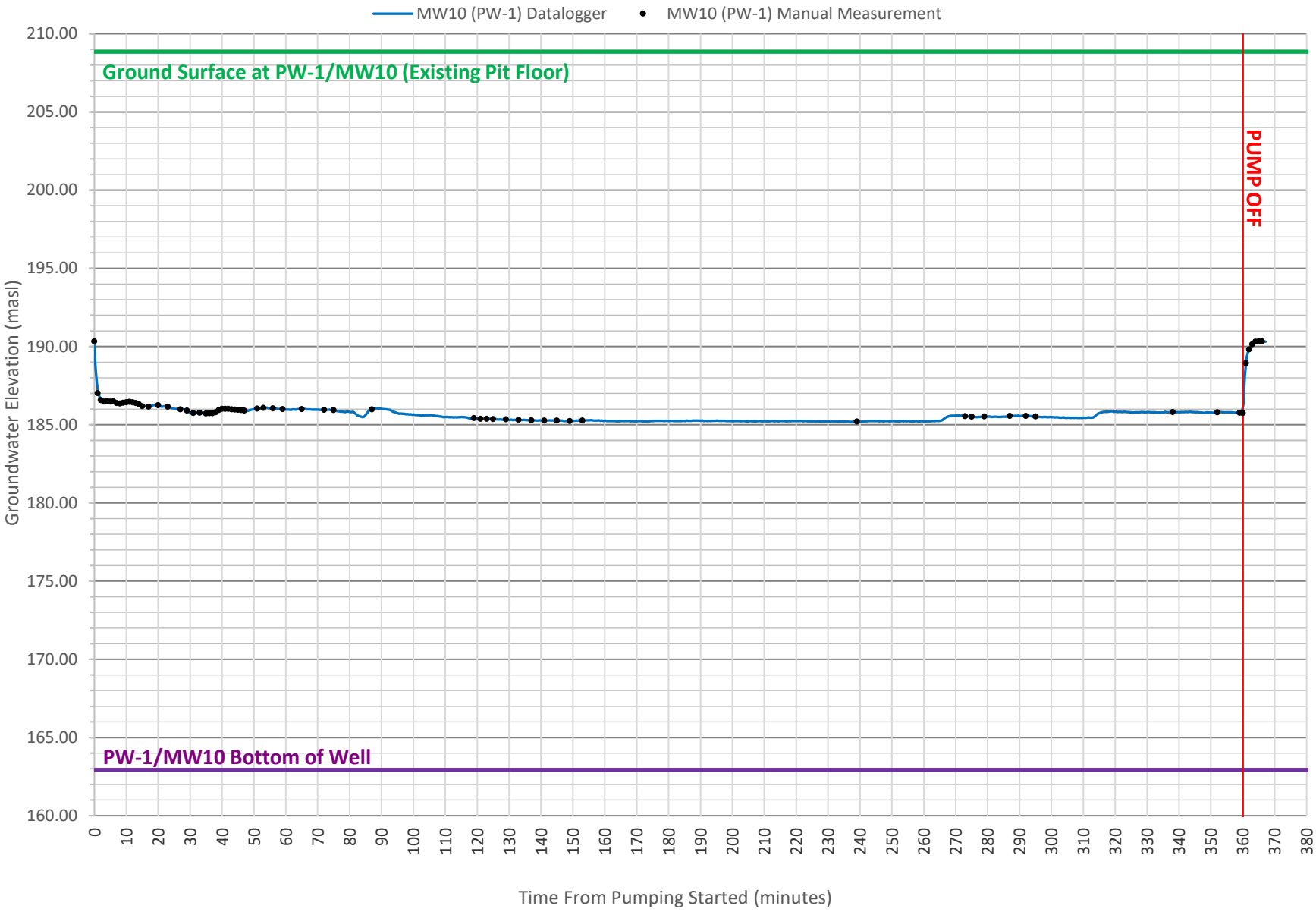


Figure F-2: PW-1/MW10 Pumping Test at 24.3 US GPM (92 LPM) - Detailed View

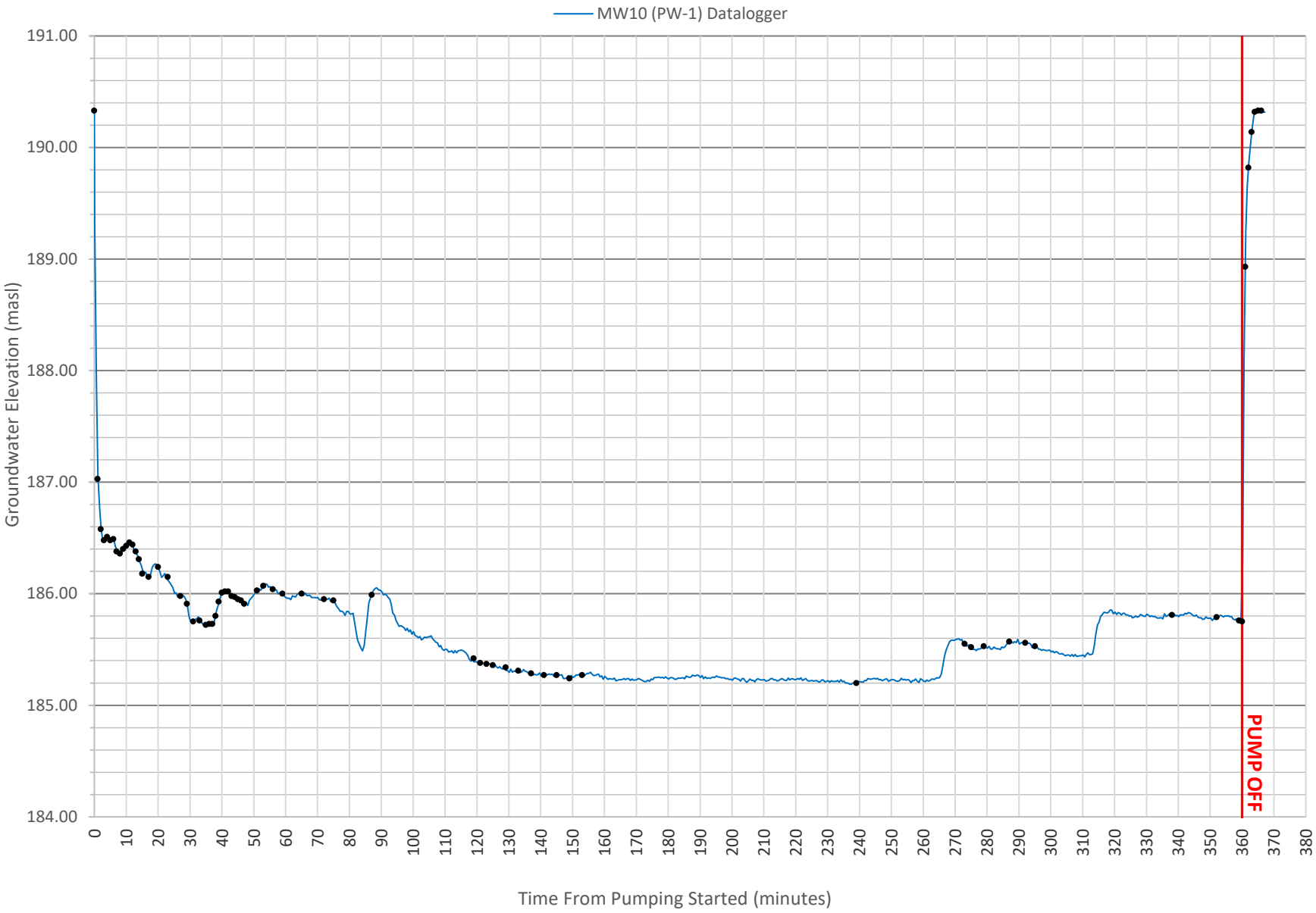


Figure F-3: MW3 Hydrograph During PW-1/MW10 Pumping Test

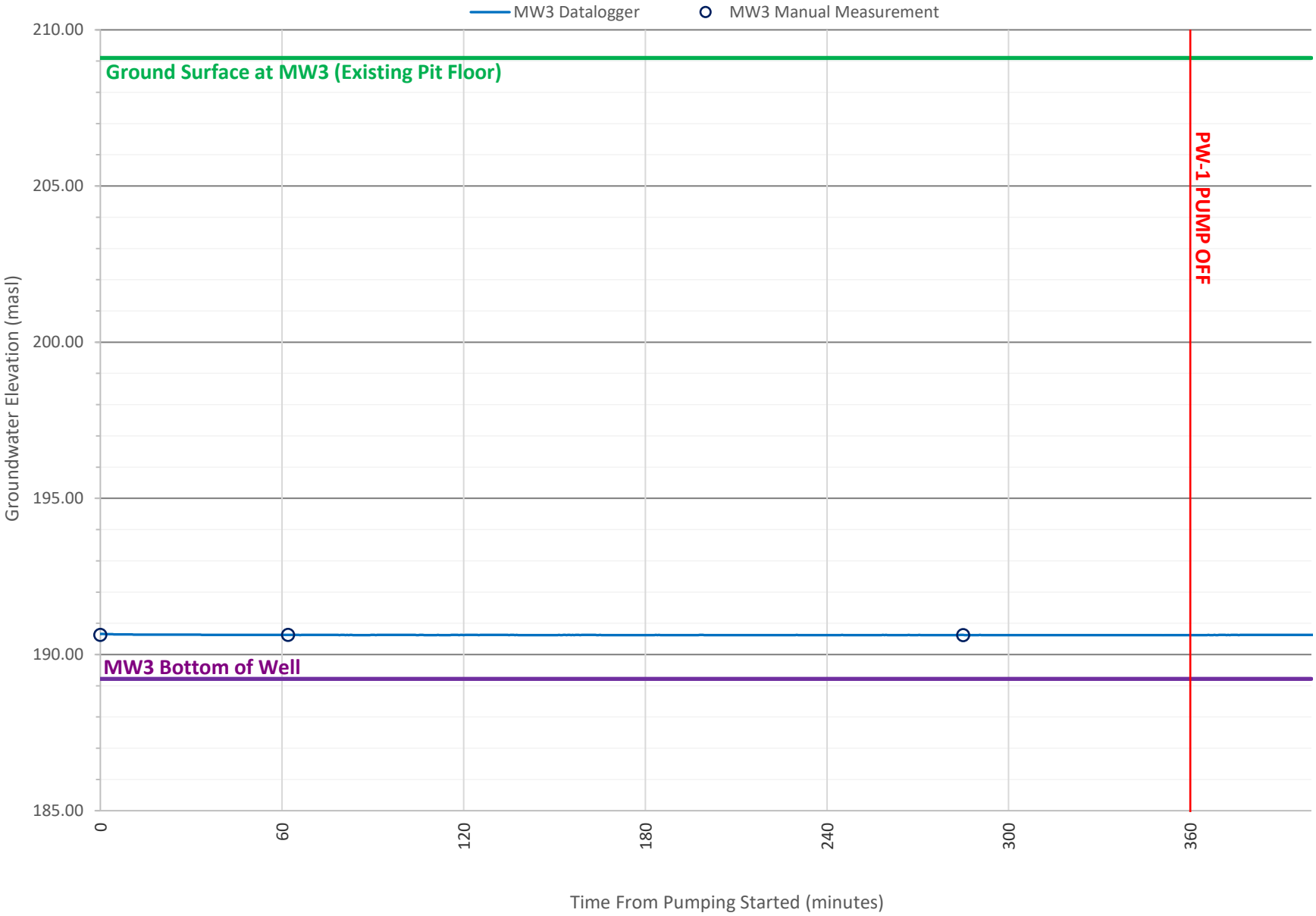


Figure F-4: MW3 Hydrograph During PW-1/MW10 Pumping Test - Detailed View

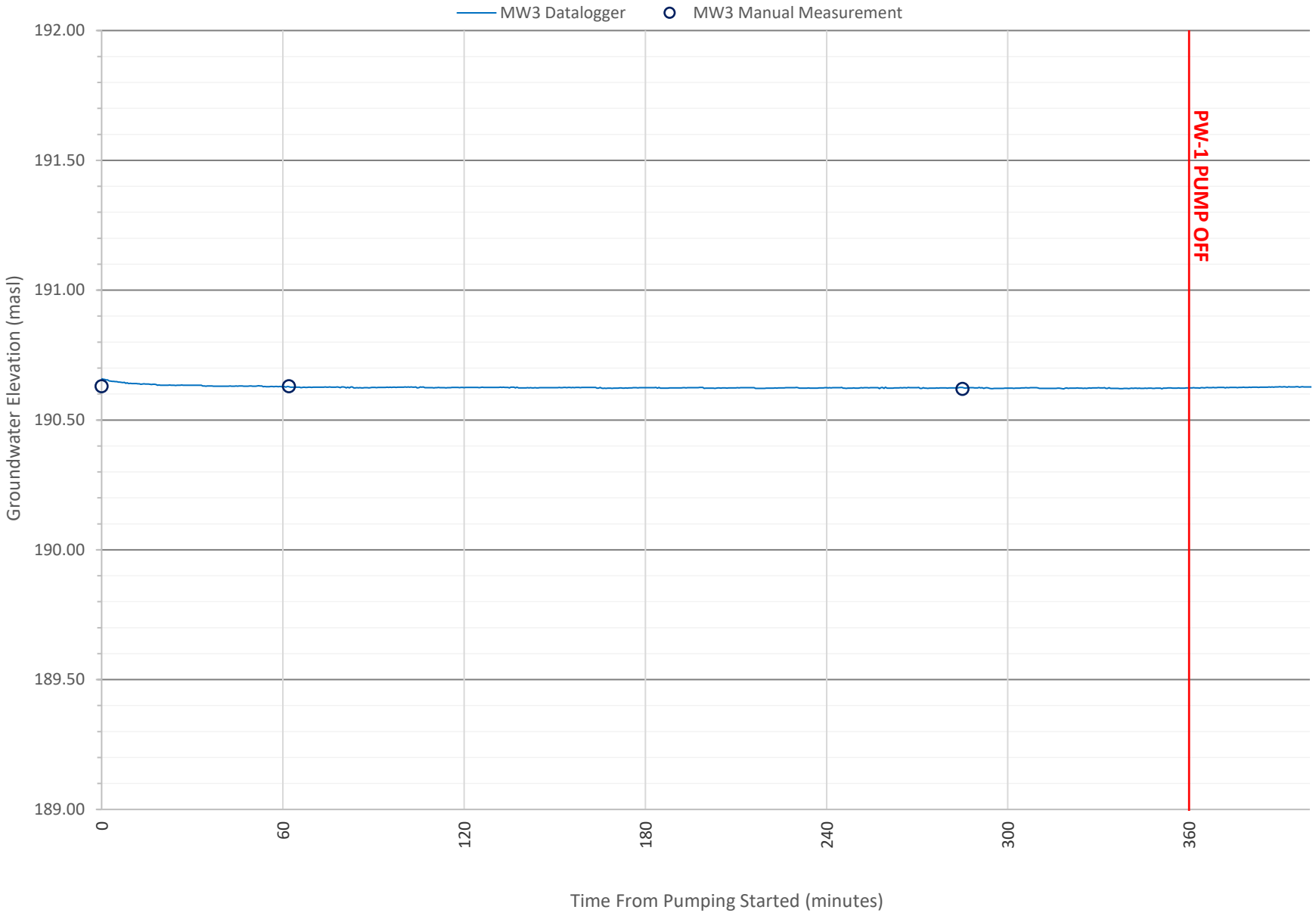
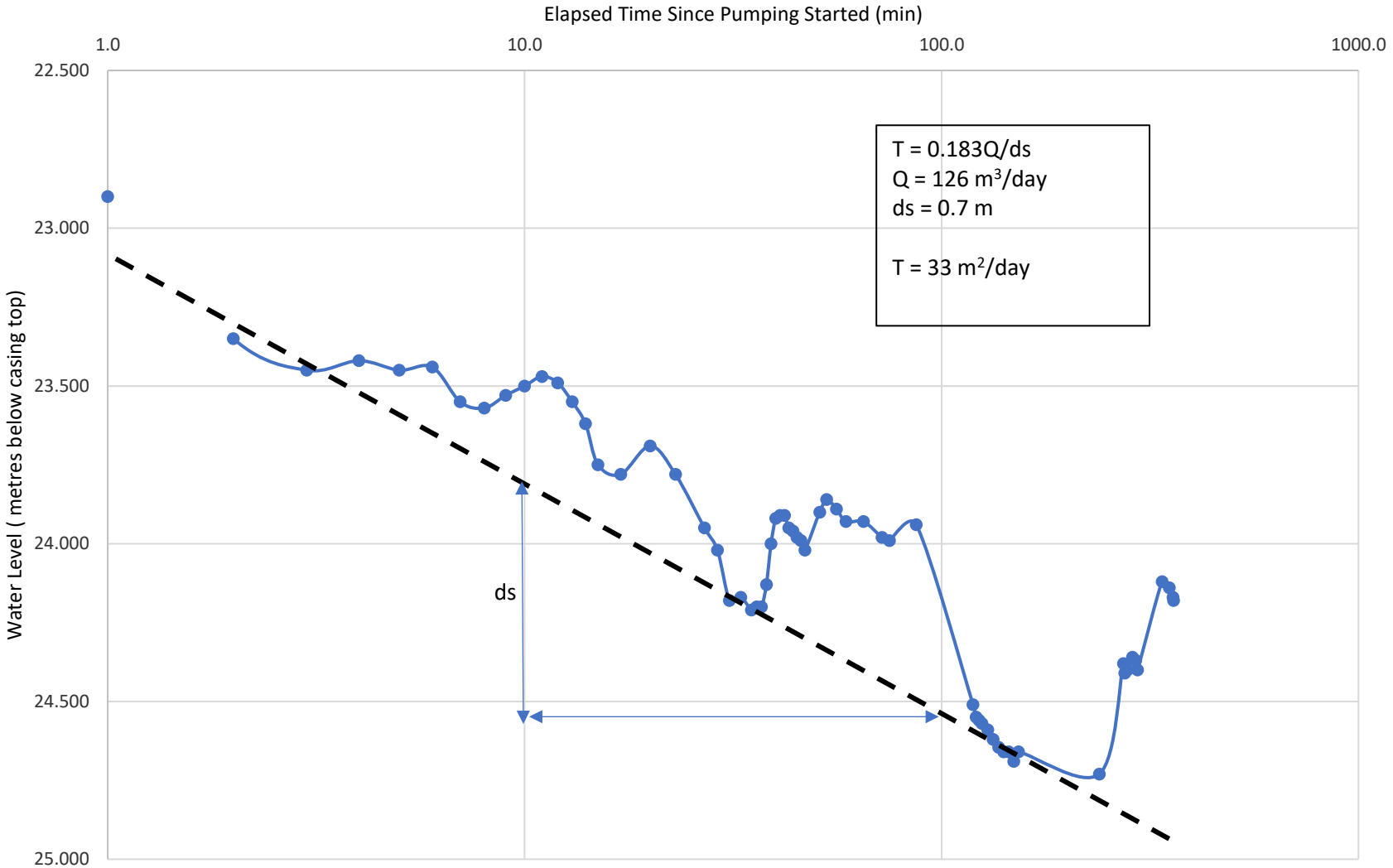


Figure F-5: PW-1 Time-Drawdown Chart



Appendix G

Laboratory Certificates of Analysis

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.
4622 NASSAGAWEYA PUSLINCH TOWNLINE
MOFFAT, ON L0P 1J0
519-826-0099

ATTENTION TO: Angela Mason

PROJECT: 2361 - Brebeuf

AGAT WORK ORDER: 24T141756

WATER ANALYSIS REVIEWED BY: Amanjot Bhela, Lab Operation Manager

DATE REPORTED: Apr 30, 2024

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*
- *For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.*

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Certificate of Analysis

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Angela Mason

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment (mg/L) Groundwater

DATE RECEIVED: 2024-04-22

DATE REPORTED: 2024-04-30

		SAMPLE DESCRIPTION:		MW2S
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2024-04-22 13:40
Parameter	**Unit**	**G / S**	**RDL**	**5812717**
Electrical Conductivity	µS/cm		2	297
pH	pH Units	6.5-8.5	NA	7.70
Saturation pH (Calculated)				7.26
Langelier Index (Calculated)				0.443
Hardness (as CaCO3) (Calculated)	mg/L	80-100	0.5	**176**
Total Dissolved Solids	mg/L	500	10	176
Alkalinity (as CaCO3)	mg/L	30-500	5	213
Bicarbonate (as CaCO3)	mg/L		5	213
Carbonate (as CaCO3)	mg/L		5	<5
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L	250	0.10	1.05
Nitrate as N	mg/L		0.05	<0.05
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L	500	0.10	1.89
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	<0.02
Total Phosphorus	mg/L		0.02	0.38
Total Organic Carbon	mg/L		0.5	6.4
True Colour	TCU	5	2.50	**5.26**
Turbidity	NTU	5	0.5	**113**
Dissolved Calcium	mg/L		0.05	59.4
Dissolved Magnesium	mg/L		0.05	6.62
Dissolved Potassium	mg/L		0.50	4.79
Dissolved Sodium	mg/L		0.05	2.61
Dissolved Aluminum	mg/L		0.004	0.212
Dissolved Antimony	mg/L		0.001	<0.001
Dissolved Arsenic	mg/L		0.001	<0.001

Certified By:

Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Angela Mason

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment (mg/L) Groundwater

DATE RECEIVED: 2024-04-22

DATE REPORTED: 2024-04-30

		SAMPLE DESCRIPTION:		MW2S
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2024-04-22 13:40
Parameter	Unit	G / S	RDL	5812717
Dissolved Barium	mg/L		0.002	0.024
Dissolved Beryllium	mg/L		0.0005	<0.0005
Dissolved Boron	mg/L		0.010	0.016
Dissolved Cadmium	mg/L		0.0001	<0.0001
Dissolved Chromium	mg/L		0.002	<0.002
Dissolved Cobalt	mg/L		0.0005	<0.0005
Dissolved Copper	mg/L		0.001	0.001
Dissolved Iron	mg/L		0.020	0.169
Dissolved Lead	mg/L		0.0005	<0.0005
Dissolved Manganese	mg/L		0.002	0.034
Dissolved Mercury	mg/L		0.0001	<0.0001
Dissolved Molybdenum	mg/L		0.002	<0.002
Dissolved Nickel	mg/L		0.001	0.002
Dissolved Selenium	mg/L		0.001	<0.001
Dissolved Silver	mg/L		0.0001	<0.0001
Dissolved Strontium	mg/L		0.005	0.085
Dissolved Thallium	mg/L		0.0003	<0.0003
Dissolved Tin	mg/L		0.002	<0.002
Dissolved Titanium	mg/L		0.003	0.010
Dissolved Tungsten	mg/L		0.010	<0.010
Dissolved Uranium	mg/L		0.0005	<0.0005
Dissolved Vanadium	mg/L		0.002	<0.002
Dissolved Zinc	mg/L		0.005	<0.005
Dissolved Zirconium	mg/L		0.004	<0.004

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg 169/03 - Ontario Drinking Water Quality Standards - Aesthetic Objectives and Operational Guidelines
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

5812717 Metals analysis completed on a filtered sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

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AGAT Laboratories

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Exceedance Summary

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Angela Mason

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
5812717	MW2S	ON 169/03 AO&OG	Water Quality Assessment (mg/L) Groundwater	Hardness (as CaCO3) (Calculated)	mg/L	80-100	176
5812717	MW2S	ON 169/03 AO&OG	Water Quality Assessment (mg/L) Groundwater	True Colour	TCU	5	5.26
5812717	MW2S	ON 169/03 AO&OG	Water Quality Assessment (mg/L) Groundwater	Turbidity	NTU	5	113

Results relate only to the items tested. Results apply to samples as received.

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Quality Assurance

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

ATTENTION TO: Angela Mason

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Apr 30, 2024

PARAMETER	Batch	Sample Id	DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
			Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Quality Assessment (mg/L) Groundwater															
Electrical Conductivity	5812272		1160	1150	0.9%	< 2	93%	90%	110%	NA			NA		
pH	5812272		7.02	7.03	0.1%	NA	99%	90%	110%	NA			NA		
Total Dissolved Solids	5814862		672	656	2.4%	< 10	98%	80%	120%	NA			NA		
Alkalinity (as CaCO3)	5812272		303	306	1.0%	< 5	97%	80%	120%	NA			NA		
Bicarbonate (as CaCO3)	5812272		303	306	1.0%	< 5	NA			NA			NA		
Carbonate (as CaCO3)	5812272		<5	<5	NA	< 5	NA			NA			NA		
Hydroxide (as CaCO3)	5812272		<5	<5	NA	< 5	NA			NA			NA		
Fluoride	5813017		0.71	0.69	2.9%	< 0.05	97%	70%	130%	97%	80%	120%	93%	70%	130%
Chloride	5813017		151	150	0.7%	< 0.10	94%	70%	130%	97%	80%	120%	NA	70%	130%
Nitrate as N	5813017		<0.05	<0.05	NA	< 0.05	93%	70%	130%	94%	80%	120%	94%	70%	130%
Nitrite as N	5813017		<0.05	<0.05	NA	< 0.05	91%	70%	130%	99%	80%	120%	97%	70%	130%
Bromide	5813017		<0.05	<0.05	NA	< 0.05	98%	70%	130%	96%	80%	120%	96%	70%	130%
Sulphate	5813017		66.7	66.2	0.8%	< 0.10	96%	70%	130%	97%	80%	120%	96%	70%	130%
Ortho Phosphate as P	5813017		<0.10	<0.10	NA	< 0.10	101%	70%	130%	105%	80%	120%	94%	70%	130%
Ammonia as N	5814862		<0.02	<0.02	NA	< 0.02	95%	70%	130%	95%	80%	120%	99%	70%	130%
Total Phosphorus	5807001		0.69	0.71	2.9%	< 0.02	104%	70%	130%	94%	80%	120%	105%	70%	130%
Total Organic Carbon	5812717	5812717	6.4	6.5	1.6%	< 0.5	104%	90%	110%	106%	90%	110%	98%	80%	120%
True Colour	5814862		<2.50	<2.50	NA	< 2.5	106%	90%	110%	NA			NA		
Turbidity	5812272		4.9	5.0	2.0%	< 0.5	92%	80%	120%	NA			NA		
Dissolved Calcium	5812717	5812717	59.4	57.8	2.7%	< 0.05	102%	70%	130%	107%	80%	120%	102%	70%	130%
Dissolved Magnesium	5812717	5812717	6.62	6.32	4.6%	< 0.05	101%	70%	130%	107%	80%	120%	95%	70%	130%
Dissolved Potassium	5812717	5812717	4.79	4.70	1.9%	< 0.50	104%	70%	130%	105%	80%	120%	101%	70%	130%
Dissolved Sodium	5812717	5812717	2.61	2.29	13.1%	< 0.05	103%	70%	130%	110%	80%	120%	99%	70%	130%
Dissolved Aluminum	5812717	5812717	0.212	0.222	4.6%	< 0.004	101%	70%	130%	110%	80%	120%	114%	70%	130%
Dissolved Antimony	5812717	5812717	<0.001	<0.001	NA	< 0.001	107%	70%	130%	109%	80%	120%	109%	70%	130%
Dissolved Arsenic	5812717	5812717	<0.001	<0.001	NA	< 0.001	100%	70%	130%	109%	80%	120%	108%	70%	130%
Dissolved Barium	5812717	5812717	0.024	0.023	4.3%	< 0.002	105%	70%	130%	108%	80%	120%	108%	70%	130%
Dissolved Beryllium	5812717	5812717	<0.0005	<0.0005	NA	< 0.0005	108%	70%	130%	114%	80%	120%	111%	70%	130%
Dissolved Boron	5812717	5812717	0.016	0.018	NA	< 0.010	110%	70%	130%	115%	80%	120%	109%	70%	130%
Dissolved Cadmium	5812717	5812717	<0.0001	<0.0001	NA	< 0.0001	100%	70%	130%	100%	80%	120%	102%	70%	130%
Dissolved Chromium	5812717	5812717	<0.002	<0.002	NA	< 0.002	100%	70%	130%	100%	80%	120%	106%	70%	130%
Dissolved Cobalt	5812717	5812717	<0.0005	<0.0005	NA	< 0.0005	100%	70%	130%	103%	80%	120%	106%	70%	130%
Dissolved Copper	5812717	5812717	0.001	0.002	NA	< 0.001	101%	70%	130%	99%	80%	120%	103%	70%	130%
Dissolved Iron	5812717	5812717	0.169	0.162	4.2%	< 0.010	106%	70%	130%	111%	80%	120%	107%	70%	130%
Dissolved Lead	5812717	5812717	<0.0005	<0.0005	NA	< 0.0005	108%	70%	130%	107%	80%	120%	107%	70%	130%
Dissolved Manganese	5812717	5812717	0.034	0.029	15.9%	< 0.002	104%	70%	130%	103%	80%	120%	105%	70%	130%
Dissolved Mercury	5812717	5812717	<0.0001	<0.0001	NA	< 0.0001	100%	70%	130%	99%	80%	120%	95%	70%	130%
Dissolved Molybdenum	5812717	5812717	<0.002	<0.002	NA	< 0.002	101%	70%	130%	103%	80%	120%	107%	70%	130%
Dissolved Nickel	5812717	5812717	0.002	0.001	NA	< 0.001	100%	70%	130%	102%	80%	120%	106%	70%	130%

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Results relate only to the items tested. Results apply to samples as received.

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Quality Assurance

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

ATTENTION TO: Angela Mason

SAMPLING SITE:

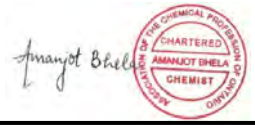
SAMPLED BY:

Water Analysis (Continued)

RPT Date: Apr 30, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Dissolved Selenium	5812717	5812717	0.001	<0.001	NA	< 0.001	104%	70%	130%	110%	80%	120%	109%	70%	130%
Dissolved Silver	5812717	5812717	<0.0001	<0.0001	NA	< 0.0001	101%	70%	130%	101%	80%	120%	100%	70%	130%
Dissolved Strontium	5812717	5812717	0.085	0.083	2.4%	< 0.005	100%	70%	130%	106%	80%	120%	104%	70%	130%
Dissolved Thallium	5812717	5812717	<0.0003	<0.0003	NA	< 0.0003	105%	70%	130%	107%	80%	120%	109%	70%	130%
Dissolved Tin	5812717	5812717	<0.002	<0.002	NA	< 0.002	103%	70%	130%	107%	80%	120%	107%	70%	130%
Dissolved Titanium	5812717	5812717	0.010	0.013	26.1%	< 0.002	100%	70%	130%	109%	80%	120%	98%	70%	130%
Dissolved Tungsten	5812717	5812717	<0.010	<0.010	NA	< 0.010	97%	70%	130%	102%	80%	120%	101%	70%	130%
Dissolved Uranium	5812717	5812717	<0.0005	<0.0005	NA	< 0.0005	106%	70%	130%	114%	80%	120%	117%	70%	130%
Dissolved Vanadium	5812717	5812717	<0.002	<0.002	NA	< 0.002	102%	70%	130%	106%	80%	120%	110%	70%	130%
Dissolved Zinc	5812717	5812717	<0.005	<0.005	NA	< 0.005	104%	70%	130%	101%	80%	120%	109%	70%	130%
Dissolved Zirconium	5812717	5812717	<0.004	<0.004	NA	< 0.004	99%	70%	130%	100%	80%	120%	102%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:



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Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

5835 COOPERS AVENUE
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Method Summary

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

ATTENTION TO: Angela Mason

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO3) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Bicarbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Carbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Total Phosphorus	INOR-93-6057	modified from LACHAT 10-115-01-3A	LACHAT FIA
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6000	modified from SM 2130 B	PC TITRATE
Dissolved Calcium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Magnesium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Dissolved Potassium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Sodium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP/MS
Dissolved Aluminum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Antimony	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Arsenic	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Barium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Beryllium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Boron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cadmium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Chromium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Cobalt	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Copper	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS

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Method Summary

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T141756

PROJECT: 2361 - Brebeuf

ATTENTION TO: Angela Mason

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Dissolved Iron	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Lead	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Manganese	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Dissolved Molybdenum	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Nickel	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Selenium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Silver	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Strontium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Thallium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Tin	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Titanium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Tungsten	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Uranium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Vanadium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zinc	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS
Dissolved Zirconium	MET-93-6103	modified from EPA 200.8 and EPA 3005A	ICP-MS

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AGAT Laboratories

Have feedback? Scan here for a quick survey!

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Ph: 905.712.5100 Fax: 905.712.5122
webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Harden Environmental Services Ltd.
Contact: Angela Mason
Address: 4622 Nassagaweya-Puslinch Townline, Moffat, ON
Phone: 519-831-9696 Fax:
Reports to be sent to:
1. Email: amason@hardenv.com
2. Email: sdenhoed@hardenv.com

Project Information:

Project: 2361 - Brebeuf
Site Location: 1029 Brebeuf Rd, Midland, ON
Sampled By: Angela Mason
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email: admin@hardenv.com

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table _____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Regulation 406
Table _____ *Indicate One*
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐ Sanitary ☐ Storm
_____ *Region*
☒ Prov. Water Quality Objectives (PWQO)
☒ Other ODWAS *Indicate One*

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☒ Yes ☐ No

Sample Matrix Legend

GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 24T141756
Cooler Quantity: 1 large
Arrival Temperatures: 5.4 | 3.9 | 3.7
Custody Seal Intact: ☐ Yes ☐ No ☑ N/A
Notes: bagged in

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered (Metals, Hg, CrVI, DOC) Y/N	O. Reg 153: Metals & Inorganics	O. Reg 153: Metals - ☐ CrVI, ☐ Hg, ☐ HWSB	O. Reg 153: BTEX, F1-F4 PHCs	VOC	PAHs	PCBs	PCBs: Aroclors ☐	O. Reg 558: Landfill Disposal Characterization TCLP: TCLP: ☐ M&I ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	O. Reg 406: Regulation 406 SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	O. Reg 406: Regulation 406 Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Corrosivity: ☐ Moisture ☐ Sulphide	4603						Potentially Hazardous or High Concentration (Y/N)
1. MW 2S	2024/04/22	1:40 AM/PM	9	GW		Y												X						
2.		AM/PM																						
3.		AM/PM																						
4.		AM/PM																						
5.		AM/PM																						
6.		AM/PM																						
7.		AM/PM																						
8.		AM/PM																						
9.		AM/PM																						
10.		AM/PM																						
11.		AM/PM																						

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Angela Mason	2024/04/22	16:22	Tiffany Persaud	Apr 22	4:24p
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time

APR22 4:24PM

Page ____ of ____

N°: T-148316

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

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AGAT Laboratories

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CANADA L4Z 1Y2
TEL (905)712-5100
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http://www.agatlabs.com

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.
4622 NASSAGAWEYA PUSLINCH TOWNLINE
MOFFAT, ON L0P 1J0
519-826-0099

ATTENTION TO: Allan Rodie

PROJECT: 2361 - Brebeuf

AGAT WORK ORDER: 24T159064

WATER ANALYSIS REVIEWED BY: Yris Verastegui, Inorganic Team Lead

DATE REPORTED: Jun 17, 2024

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Certificate of Analysis

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment (mg/L)

DATE RECEIVED: 2024-06-06

DATE REPORTED: 2024-06-17

		SAMPLE DESCRIPTION:		PW-1
		SAMPLE TYPE:		Water
		DATE SAMPLED:		2024-06-05 17:00
Parameter	Unit	G / S	RDL	5912023
Electrical Conductivity	µS/cm		2	715
pH	pH Units	6.5-8.5	NA	7.64
Saturation pH (Calculated)				7.04
Langelier Index (Calculated)				0.597
Hardness (as CaCO3) (Calculated)	mg/L	80-100	0.5	293
Total Dissolved Solids	mg/L	500	10	450
Alkalinity (as CaCO3)	mg/L	30-500	5	224
Bicarbonate (as CaCO3)	mg/L		5	224
Carbonate (as CaCO3)	mg/L		5	<5
Hydroxide (as CaCO3)	mg/L		5	<5
Fluoride	mg/L		0.05	<0.05
Chloride	mg/L	250	0.10	99.9
Nitrate as N	mg/L		0.05	3.47
Nitrite as N	mg/L		0.05	<0.05
Bromide	mg/L		0.05	<0.05
Sulphate	mg/L	500	0.10	30.0
Ortho Phosphate as P	mg/L		0.10	<0.10
Ammonia as N	mg/L		0.02	<0.02
Total Phosphorus	mg/L		0.02	<0.02
Total Organic Carbon	mg/L		0.5	0.8
True Colour	TCU	5	2.50	<2.50
Turbidity	NTU	5	0.5	2.0
Total Calcium	mg/L		0.20	78.7
Total Magnesium	mg/L		0.10	23.4
Total Potassium	mg/L		0.50	3.65
Total Sodium	mg/L	200	0.10	48.7
Total Aluminum	mg/L	0.1	0.010	0.013
Total Antimony	mg/L		0.003	<0.003
Total Arsenic	mg/L		0.003	<0.003

Certified By: Iris Verástegui

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Certificate of Analysis

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

Water Quality Assessment (mg/L)

DATE RECEIVED: 2024-06-06

DATE REPORTED: 2024-06-17

			SAMPLE DESCRIPTION:	PW-1
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2024-06-05 17:00
Parameter	Unit	G / S	RDL	5912023
Total Barium	mg/L		0.002	0.150
Total Beryllium	mg/L		0.001	<0.001
Total Boron	mg/L		0.010	0.014
Total Cadmium	mg/L		0.0001	<0.0001
Total Chromium	mg/L		0.003	<0.003
Total Cobalt	mg/L		0.0005	<0.0005
Total Copper	mg/L	1	0.002	<0.002
Total Iron	mg/L	0.3	0.050	<0.050
Total Lead	mg/L		0.0005	<0.0005
Total Manganese	mg/L	0.05	0.002	0.017
Total Mercury	mg/L		0.0001	<0.0001
Total Molybdenum	mg/L		0.002	<0.002
Total Nickel	mg/L		0.003	<0.003
Total Selenium	mg/L	0.01	0.002	<0.002
Total Silver	mg/L		0.0001	<0.0001
Total Strontium	mg/L		0.005	0.176
Total Thallium	mg/L		0.0003	<0.0003
Total Tin	mg/L		0.002	<0.002
Total Titanium	mg/L		0.010	<0.010
Total Tungsten	mg/L		0.010	<0.010
Total Uranium	mg/L		0.0005	0.0057
Total Vanadium	mg/L		0.002	<0.002
Total Zinc	mg/L	5	0.020	<0.020
Total Zirconium	mg/L		0.004	<0.004

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to O. Reg 169/03 - Ontario Drinking Water Quality Standards - Aesthetic Objectives and Operational Guidelines
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Iris Verástegui

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Exceedance Summary

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

ATTENTION TO: Allan Rodie

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
5912023	PW-1	ON 169/03 AO&OG	Water Quality Assessment (mg/L)	Hardness (as CaCO3) (Calculated)	mg/L	80-100	293

Results relate only to the items tested. Results apply to samples as received.

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Quality Assurance

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date: Jun 17, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Water Quality Assessment (mg/L)															
Electrical Conductivity	5912023	5912023	715	809	12.3%	< 2	95%	90%	110%						
pH	5912023	5912023	7.64	7.69	0.7%	NA	99%	90%	110%						
Total Dissolved Solids	5904113		312	306	1.9%	< 10	100%	80%	120%						
Alkalinity (as CaCO3)	5912023	5912023	224	224	0.0%	< 5	102%	80%	120%						
Bicarbonate (as CaCO3)	5912023	5912023	224	224	0.0%	< 5	NA								
Carbonate (as CaCO3)	5912023	5912023	<5	<5	NA	< 5	NA								
Hydroxide (as CaCO3)	5912023	5912023	<5	<5	NA	< 5	NA								
Fluoride	5911357		<0.05	<0.05	NA	< 0.05	101%	70%	130%	105%	80%	120%	98%	70%	130%
Chloride	5911357		0.48	0.48	NA	< 0.10	97%	70%	130%	101%	80%	120%	100%	70%	130%
Nitrate as N	5911357		0.36	0.34	5.7%	< 0.05	99%	70%	130%	97%	80%	120%	98%	70%	130%
Nitrite as N	5911357		<0.05	<0.05	NA	< 0.05	95%	70%	130%	97%	80%	120%	98%	70%	130%
Bromide	5911357		<0.05	<0.05	NA	< 0.05	101%	70%	130%	91%	80%	120%	98%	70%	130%
Sulphate	5911357		240	246	2.5%	< 0.10	96%	70%	130%	98%	80%	120%	NA	70%	130%
Ortho Phosphate as P	5911357		<0.10	<0.10	NA	< 0.10	105%	70%	130%	96%	80%	120%	100%	70%	130%
Ammonia as N	5912023	5912023	<0.02	<0.02	NA	< 0.02	107%	70%	130%	104%	80%	120%	98%	70%	130%
Total Phosphorus	5916266		0.12	0.13	8.0%	< 0.02	106%	70%	130%	95%	80%	120%	92%	70%	130%
Total Organic Carbon	5916515		0.8	0.9	NA	< 0.5	104%	90%	110%	101%	90%	110%	101%	80%	120%
True Colour	5913523		5.31	5.44	NA	< 2.5	98%	90%	110%						
Turbidity	5912023	5912023	2.0	1.9	NA	< 0.5	93%	80%	120%						
Total Calcium	5910163		111	102	8.5%	< 0.20	88%	70%	130%	111%	80%	120%	101%	70%	130%
Total Magnesium	5910163		16.8	17.9	6.3%	< 0.10	103%	70%	130%	101%	80%	120%	101%	70%	130%
Total Potassium	5910163		2.14	1.74	NA	< 0.50	106%	70%	130%	102%	80%	120%	95%	70%	130%
Total Sodium	5910163		127	116	9.1%	< 0.10	112%	70%	130%	109%	80%	120%	110%	70%	130%
Total Aluminum	5910163		0.081	0.071	13.2%	< 0.010	100%	70%	130%	104%	80%	120%	95%	70%	130%
Total Antimony	5910163		<0.003	<0.003	NA	< 0.003	99%	70%	130%	104%	80%	120%	107%	70%	130%
Total Arsenic	5910163		<0.003	<0.003	NA	< 0.003	95%	70%	130%	98%	80%	120%	96%	70%	130%
Total Barium	5910163		0.049	0.047	4.2%	< 0.002	95%	70%	130%	96%	80%	120%	102%	70%	130%
Total Beryllium	5910163		<0.001	<0.001	NA	< 0.001	99%	70%	130%	107%	80%	120%	107%	70%	130%
Total Boron	5910163		0.043	0.040	NA	< 0.010	102%	70%	130%	105%	80%	120%	103%	70%	130%
Total Cadmium	5910163		<0.0001	<0.0001	NA	< 0.0001	99%	70%	130%	98%	80%	120%	101%	70%	130%
Total Chromium	5910163		<0.003	<0.003	NA	< 0.003	101%	70%	130%	105%	80%	120%	103%	70%	130%
Total Cobalt	5910163		<0.0005	<0.0005	NA	< 0.0005	101%	70%	130%	105%	80%	120%	102%	70%	130%
Total Copper	5910163		0.003	0.005	NA	< 0.002	102%	70%	130%	104%	80%	120%	99%	70%	130%
Total Iron	5910163		0.183	0.162	NA	< 0.050	96%	70%	130%	99%	80%	120%	95%	70%	130%
Total Lead	5910163		<0.0005	<0.0005	NA	< 0.0005	97%	70%	130%	97%	80%	120%	93%	70%	130%
Total Manganese	5910163		0.021	0.021	0.0%	< 0.002	104%	70%	130%	104%	80%	120%	104%	70%	130%
Total Mercury	5913523		<0.0001	<0.0001	NA	< 0.0001	99%	70%	130%	106%	80%	120%	98%	70%	130%
Total Molybdenum	5910163		<0.002	<0.002	NA	< 0.002	101%	70%	130%	106%	80%	120%	98%	70%	130%
Total Nickel	5910163		0.007	<0.003	NA	< 0.003	105%	70%	130%	108%	80%	120%	102%	70%	130%

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Results relate only to the items tested. Results apply to samples as received.

AGAT Laboratories

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Quality Assurance

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

Water Analysis (Continued)

RPT Date: Jun 17, 2024			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Total Selenium	5910163		<0.002	<0.002	NA	< 0.002	94%	70%	130%	93%	80%	120%	98%	70%	130%
Total Silver	5910163		<0.0001	<0.0001	NA	< 0.0001	104%	70%	130%	103%	80%	120%	96%	70%	130%
Total Strontium	5910163		0.364	0.376	3.2%	< 0.005	103%	70%	130%	114%	80%	120%	100%	70%	130%
Total Thallium	5910163		<0.0003	<0.0003	NA	< 0.0003	95%	70%	130%	104%	80%	120%	94%	70%	130%
Total Tin	5910163		<0.002	<0.002	NA	< 0.002	103%	70%	130%	102%	80%	120%	107%	70%	130%
Total Titanium	5910163		0.011	<0.010	NA	< 0.010	96%	70%	130%	110%	80%	120%	100%	70%	130%
Total Tungsten	5910163		<0.010	<0.010	NA	< 0.010	86%	70%	130%	92%	80%	120%	92%	70%	130%
Total Uranium	5910163		0.0006	0.0006	NA	< 0.0005	90%	70%	130%	96%	80%	120%	93%	70%	130%
Total Vanadium	5910163		<0.002	<0.002	NA	< 0.002	107%	70%	130%	108%	80%	120%	111%	70%	130%
Total Zinc	5910163		<0.020	<0.020	NA	< 0.020	99%	70%	130%	106%	80%	120%	100%	70%	130%
Total Zirconium	5910163		<0.004	<0.004	NA	< 0.004	92%	70%	130%	99%	80%	120%	85%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate NA: results are under 5X the RDL and will not be calculated.
Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.

Certified By: Iris Verástegui

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Method Summary

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Water Analysis			
Electrical Conductivity	INOR-93-6000	modified from SM 2510 B	PC TITRATE
pH	INOR-93-6000	modified from SM 4500-H+ B	PC TITRATE
Saturation pH (Calculated)		SM 2320 B	CALCULATION
Langelier Index (Calculated)		SM 2330B	CALCULATION
Hardness (as CaCO3) (Calculated)	MET-93-6105	modified from EPA SW-846 6010C & 200.7 & SM 2340 B	CALCULATION
Total Dissolved Solids	INOR-93-6028	modified from EPA 1684,ON MOECC E3139,SM 2540C,D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	Modified from SM 2320 B	PC TITRATE
Bicarbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Carbonate (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Hydroxide (as CaCO3)	INOR-93-6000	modified from SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ortho Phosphate as P	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6059	modified from SM 4500-NH3 H	LACHAT FIA
Total Phosphorus	INOR-93-6057	modified from LACHAT 10-115-01-3A	LACHAT FIA
Total Organic Carbon	INOR-93-6049	modified from SM 5310 B	SHIMADZU CARBON ANALYZER
True Colour	INOR-93-6074	modified from SM 2120 B	LACHAT FIA
Turbidity	INOR-93-6000	modified from SM 2130 B	PC TITRATE
Total Calcium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Magnesium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Potassium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Sodium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP/MS
Total Aluminum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Antimony	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Arsenic	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Barium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Beryllium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Boron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cadmium	MET -93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Chromium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Cobalt	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Copper	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

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Method Summary

CLIENT NAME: HARDEN ENVIRONMENTAL SERVICES LTD.

AGAT WORK ORDER: 24T159064

PROJECT: 2361 - Brebeuf

ATTENTION TO: Allan Rodie

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Total Iron	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Lead	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Manganese	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Mercury	MET-93-6100	modified from EPA 245.2 and SM 3112 B	CVAAS
Total Molybdenum	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Nickel	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Selenium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Silver	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Strontium	INOR-93-6003	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Thallium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tin	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Titanium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Tungsten	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Uranium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Vanadium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zinc	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS
Total Zirconium	MET-93-6103	modified from EPA 200.8, 3005A, 3010A & 6020B	ICP-MS

Results relate only to the items tested. Results apply to samples as received.

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Harden Environmental Services
Contact: Allan Rodie
Address: 519-400-7113
Phone: Fax:
Reports to be sent to:
1. Email: arodie@hardenv.com
2. Email:

Project Information:

Project: 2361 - Brebeuf
Site Location:
Sampled By: AR
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☐ Regulation 153/04
Table ____ *Indicate One*
☐ Ind/Com
☐ Res/Park
☐ Agriculture
Soil Texture *(Check One)*
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table ____ *Indicate One*
☐ Regulation 558
☐ CCME

☐ Sewer Use
☐ Sanitary ☐ Storm
____ *Region*
☐ Prov. Water Quality Objectives (PWQO)
☑ Other ODWS *Indicate One*

Is this submission for a **Record of Site Condition?** ☐ Yes ☐ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☐ No

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #: 24T159064
Cooler Quantity: bag
Arrival Temperatures: 8.8 | 9.3 | 9.5
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes: chilled

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*
For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered (Y/N)
PW-1	5-6-24	500 AM/PM	9	GW		Y
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				
		AM PM				

O. Reg 153 | O. Reg 558 | O. Reg 406

Metals & Inorganics | Metals - ☐ CrVI, ☐ Hg, ☐ HWSB | BTEX, F1-F4 PHC | PAHs | PCBs | VOC | Aroclors | Landfill Disposal Characterization TCLP: ☐ M&I ☐ VOC ☐ ABNs ☐ B(a)P ☐ PCBs | Excess Soils SPLP: ☐ Metals ☐ Rainwater Leach ☐ OCs ☐ SVOCs | Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4 | Corrosivity: Inclusive ☐ Moisture ☐ Sulphide ☐ | Potentially Hazardous or High Concentration (Y/N)

W&QA ✓

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Allan Rodie / AR	6-6-24	9:15	Tiffany Pleasance		

'24 JUN 6 9:25

Page ____ of ____

N°: T-140704

Appendix H

Water Balance Calculations

Table H-1: Summary of Catchment Component Values

Existing Conditions and Post-Development

Component	PRE-DEVELOPMENT				POST-DEVELOPMENT									
	CATCHMENT 101				CATCHMENT 201		CATCHMENT 202			CATCHMENT 203		CATCHMENT 204		
	Woodland	**Pasture**	**Gravel**	**Impervious**	**Woodland**	**Pasture**	**Pasture**	**Gravel**	**Impervious**	**Pasture**	**Gravel**	**Woodland**	**Pasture**	**Impervious**
Area (ha)	7.23	2.30	0.13	0.15	1.84	0.77	2.89	2.27	0.06	0.51	0.52	0.09	0.74	0.11
Topography*	Rolling (2.5%)	Rolling (2.5%)	Rolling (2.5%)	Rolling (2.5%)	Rolling (3.1%)	Rolling (3.1%)	Flat (0.5%)	Flat (0.5%)	Flat (0.5%)	Rolling (2.0%)	Rolling (2.0%)	Rolling (5.7%)	Rolling (5.7%)	Rolling (5.7%)
	0.20	0.20	0.20	0.20	0.20	0.20	0.30	0.30	0.30	0.20	0.20	0.20	0.20	0.20
Soil*	Open Sandy Loam	Open Sandy Loam	Packed Gravel	Impervious	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam	Open Sandy Loam
	0.40	0.40	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Cover*	Woodland	Cultivated Land	n/a	n/a	Woodland	Cultivated Land	Cultivated Land	n/a	n/a	Cultivated Land	n/a	Woodland	Cultivated Land	n/a
	0.20	0.10	0.00	0.00	0.20	0.10	0.10	0.00	0.00	0.10	0.00	0.20	0.10	0.00
Total (Infiltration Factor)	**0.80**	**0.70**	**0.20**	**0.20**	**0.80**	**0.70**	**0.80**	**0.70**	**0.70**	**0.70**	**0.60**	**0.80**	**0.70**	**0.60**
Vegetation**	Mature Forests	Pasture and Shrubs	No vegetation	No vegetation	Mature Forests	Pasture and Shrubs	Pasture and Shrubs	No vegetation	No vegetation	Pasture and Shrubs	No vegetation	Mature Forests	Pasture and Shrubs	No vegetation
Soils**	Fine Sandy Loam	Fine Sandy Loam	Packed Gravel	Impervious	Fine Sandy Loam	Fine Sandy Loam	Fine Sandy Loam	Gravel (Pit Floor)	Impervious	Fine Sandy Loam	Gravel (Pit Floor)	Fine Sandy Loam	Fine Sandy Loam	Impervious
Soil Moisture Storage (mm)**	**300**	**150**	**0**	**0**	**300**	**150**	**150**	**50**	**0**	**150**	**50**	**300**	**150**	**0**

* MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.
** MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.

Table H-2: Water Balance Components (Wooded Areas, Rolling Topography, Open Sandy Loam Soils)

Pre-Development Catchment 101; Post-Development Catchments 201 and 204

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Storage of 300mm and Infiltration Factor of 0.80

Climate data from Midland WPCP Climate Station (1981 - 2010)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-8.5	-6.4	-2	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	**7.1**
Precipitation (P) [1]	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.25	3.86	7.01	8.66	8.10	5.76	2.56	0.51	0.00	**37.7**
Adjusting Factor for U (Latitude 45 N)	0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	26	58	89	103	98	77	43	13	0	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	29	74	114	135	119	80	40	11	0	**602**
P - PET	110	70	66	36	19	-25	-62	-41	19	50	93	104	439
APWL	0	0	0	0	0	-25	-87	-128	0	0	0	0	
Soil Moisture Storage max 300 mm	410	370	366	300	300	279	231	204	223	273	300	404	
Soil Moisture Deficit max 300 mm	0	0	0	0	0	25	62	41	0	0	0	0	
Change in Soil Moisture Storage	0	0	0	0	0	0	0	0	0	0	0		
Actual Evapotranspiration (AET) (mm)	0	0	0	29	74	90	73	78	80	40	11	0	**474**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	110	70	66	36	19	0	0	0	0	0	93	104	**498**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	88	56	53	29	15	0	0	0	0	0	74	84	**398**
Potential Direct Surface Water Runoff (independent of temperature)	22	14	13	7	4	0	0	0	0	0	19	21	**100**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Potential Evaporation (PE); Assume 15% (mm)	16	10	10	10	14	13	11	12	15	14	16	16	**156**
Potential Surface Water Runoff (P-PE) (mm)	93	59	56	55	79	76	62	66	84	77	88	89	**885**

*Assume January storage is 100% of Soil Moisture Storage + Surplus (Snowpack)

Soil Moisture Storage [3] - mature forests in fine sandy loam soils 300 mm

MOE SWM infiltration calculations [4]

topography - rolling land	0.2
soils - open sandy loam	0.4
cover - woodland	0.2
Infiltration factor	**0.8**

Latitude of site (or climate station) 45 ^{O} N

Notes:

1. Environment Canada Climate Normals (Midland WPCP Climate Station 1981-2010)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

Table H-3: Water Balance Components (Pasture Areas, Rolling Topography, Open Sandy Loam Soils)

Pre-Development Catchment 101; Post-Development Catchments 201, 203 and 204

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Storage of 150mm and Infiltration Factor of 0.70

Climate data from Midland WPCP Climate Station (1981 - 2010)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-8.5	-6.4	-2	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	**7.1**
Precipitation (P) [1]	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.25	3.86	7.01	8.66	8.10	5.76	2.56	0.51	0.00	**37.7**
Adjusting Factor for U (Latitude 45 N)	0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	26	58	89	103	98	77	43	13	0	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	29	74	114	135	119	80	40	11	0	**602**
P - PET	110	70	66	36	19	-25	-62	-41	19	50	93	104	439
APWL	0	0	0	0	0	-25	-87	-128	0	0	0	0	
Soil Moisture Storage max 150 mm	260	220	216	150	150	127	82	61	80	130	150	254	
Soil Moisture Deficit max 150 mm	0	0	0	0	0	25	17	21	0	0	0	0	
Change in Soil Moisture Storage	0	0	0	0	0	0	-45	-20	19	0	0		
Actual Evapotranspiration (AET) (mm)	0	0	0	29	74	90	118	98	80	40	11	0	**539**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	110	70	66	36	19	0	0	0	0	0	93	104	**498**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	77	49	46	25	13	0	0	0	0	0	65	73	**349**
Potential Direct Surface Water Runoff (independent of temperature)	33	21	20	11	6	0	0	0	0	0	28	31	**149**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Potential Evaporation (PE); Assume 15% (mm)	16	10	10	10	14	13	11	12	15	14	16	16	**156**
Potential Surface Water Runoff (P-PE) (mm)	93	59	56	55	79	76	62	66	84	77	88	89	**885**

*Assume January storage is 100% of Soil Moisture Storage + Surplus (Snowpack)

Soil Moisture Storage [3] - pasture and shrubs in fine sandy loam soils 150 mm

MOE SWM infiltration calculations [4]

topography - rolling land	0.2
soils - open sandy loam	0.4
cover - cultivated land	0.1
Infiltration factor	**0.7**

Latitude of site (or climate station) 45 ^{O} N

Notes:

1. Environment Canada Climate Normals (Midland WPCP Climate Station 1981-2010)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

Table H-4: Water Balance Components (Pasture Areas, Flat Topography, Open Sandy Loam Soils)

Post-Development Catchment 202

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Storage of 150mm and Infiltraion Factor of 0.80

Climate data from Midland WPCP Climate Station (1981 - 2010)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-8.5	-6.4	-2	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	**7.1**
Precipitation (P) [1]	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.25	3.86	7.01	8.66	8.10	5.76	2.56	0.51	0.00	**37.7**
Adjusting Factor for U (Latitude 45 N)	0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	26	58	89	103	98	77	43	13	0	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	29	74	114	135	119	80	40	11	0	**602**
P - PET	110	70	66	36	19	-25	-62	-41	19	50	93	104	439
APWL	0	0	0	0	0	-25	-87	-128	0	0	0	0	
Soil Moisture Storage max 150 mm	260	220	216	150	150	127	82	61	80	130	150	254	
Soil Moisture Deficit max 150 mm	0	0	0	0	0	25	17	21	0	0	0	0	
Change in Soil Moisture Storage	0	0	0	0	0	0	-45	-20	19	0	0		
Actual Evapotranspiration (AET) (mm)	0	0	0	29	74	90	118	98	80	40	11	0	**539**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	110	70	66	36	19	0	0	0	0	0	93	104	**498**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	88	56	53	29	15	0	0	0	0	0	74	84	**398**
Potential Direct Surface Water Runoff (independent of temperature)	22	14	13	7	4	0	0	0	0	0	19	21	**100**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Potential Evaporation (PE); Assume 15% (mm)	16	10	10	10	14	13	11	12	15	14	16	16	**156**
Potential Surface Water Runoff (P-PE) (mm)	93	59	56	55	79	76	62	66	84	77	88	89	**885**

*Assume January storage is 100% of Soil Moisture Storage + Surplus (Snowpack)

Soil Moisture Storage [3] - pasture and shrubs in fine sandy loam soils 150 mm

MOE SWM infiltration calculations [4]

topography - flat land	0.3
soils - open sandy loam	0.4
cover - cultivated land	0.1
Infiltration factor	**0.8**

Latitude of site (or climate station) 45 ^{O} N

Notes:

1. Environment Canada Climate Normals (Midland WPCP Climate Station 1981-2010)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

Table H-5: Water Balance Components (Pit Floor Gravel, Flat Topography, Open Sandy Loam Soils)

Post-Development Catchment 202 (Gravel Areas)

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Storage of 50mm and Infiltraion Factor of 0.70

Climate data from Midland WPCP Climate Station (1981 - 2010)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-8.5	-6.4	-2	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	**7.1**
Precipitation (P) [1]	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.25	3.86	7.01	8.66	8.10	5.76	2.56	0.51	0.00	**37.7**
Adjusting Factor for U (Latitude 45 N)	0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	26	58	89	103	98	77	43	13	0	
Adjusted Potential Evapotranspiration PET (mm)**	0	0	0	14	37	57	68	59	40	20	5	0	**301**
P - PET	110	70	66	51	56	32	5	18	59	70	98	104	740
APWL	0	0	0	0	0	0	0	0	0	0	0	0	
Soil Moisture Storage max 50 mm	160	120	116	50	50	50	50	50	50	50	50	154	
Soil Moisture Deficit max 50 mm	0	0	0	0	0	0	0	0	0	0	0	0	
Change in Soil Moisture Storage	0	0	0	-66	0	0	0	0	0	0	0		
Actual Evapotranspiration (AET) (mm)	0	0	0	14	37	57	68	59	40	20	5	0	**301**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	110	70	66	116	56	32	5	18	59	70	98	104	**805**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	77	49	46	81	39	23	4	13	41	49	69	73	**564**
Potential Direct Surface Water Runoff (independent of temperature)	33	21	20	35	17	10	2	6	18	21	29	31	**242**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Potential Evaporation (PE); Assume 15% (mm)	16	10	10	10	14	13	11	12	15	14	16	16	**156**
Potential Surface Water Runoff (P-PE) (mm)	93	59	56	55	79	76	62	66	84	77	88	89	**885**

*Assume January storage is 100% of Soil Moisture Storage + Surplus (Snowpack)
** Assume PET at 50% of normal within bare soil areas

Soil Moisture Storage [3] - sand and gravel pit floor, no vegetation 50 mm

MOE SWM infiltration calculations [4]

topography - flat land	0.3
soils - open sandy loam	0.4
cover - none	0
Infiltration factor	**0.7**

Latitude of site (or climate station) 45 ^{O} N

Notes:
1. Environment Canada Climate Normals (Midland WPCP Climate Station 1981-2010)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

Table H-6: Water Balance Components (Pit Floor Gravel, Rolling Topography, Open Sandy Loam Soils)

Post-Development Catchment 203 (Gravel Areas)

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Storage of 50mm and Infiltraion Factor of 0.60

Climate data from Midland WPCP Climate Station (1981 - 2010)

POTENTIAL EVAPOTRANSPIRATION CALCULATIONS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Average Temperature (Degree C) [1]	-8.5	-6.4	-2	5.8	12.2	18.1	20.8	19.9	15.9	9.3	3.2	-3.1	**7.1**
Precipitation (P) [1]	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Heat index: i = (t/5)$^{1.514}$	0.00	0.00	0	1.25	3.86	7.01	8.66	8.10	5.76	2.56	0.51	0.00	**37.7**
Adjusting Factor for U (Latitude 45 N)	0.8	0.81	1.02	1.13	1.28	1.29	1.31	1.21	1.04	0.94	0.79	0.75	
Unadjusted Daily Potential Evapotranspiration U (mm)	0	0	0	26	58	89	103	98	77	43	13	0	
Adjusted Potential Evapotranspiration PET (mm) **	0	0	0	14	37	57	68	59	40	20	5	0	**301**
P - PET	110	70	66	51	56	32	5	18	59	70	98	104	740
APWL	0	0	0	0	0	0	0	0	0	0	0	0	
Soil Moisture Storage max 50 mm	160	120	116	50	50	50	50	50	50	50	50	154	
Soil Moisture Deficit max 50 mm	0	0	0	0	0	0	0	0	0	0	0	0	
Change in Soil Moisture Storage	0	0	0	-66	0	0	0	0	0	0	0		
Actual Evapotranspiration (AET) (mm)	0	0	0	14	37	57	68	59	40	20	5	0	**301**
Surplus Water (P-AET) (mm) - for infiltraiton or runoff	110	70	66	116	56	32	5	18	59	70	98	104	**805**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	66	42	39	70	34	19	3	11	35	42	59	63	**483**
Potential Direct Surface Water Runoff (independent of temperature)	44	28	26	47	22	13	2	7	24	28	39	42	**322**
IMPERVIOUS COMPONENTS - WATER SURPLUS (RUNOFF AND EVAPORATION)													
Precipitation (P) (mm)	110	70	66	65	93	90	73	78	99	90	104	104	**1041**
Potential Evaporation (PE); Assume 15% (mm)	16	10	10	10	14	13	11	12	15	14	16	16	**156**
Potential Surface Water Runoff (P-PE) (mm)	93	59	56	55	79	76	62	66	84	77	88	89	**885**

*Assume January storage is 100% of Soil Moisture Storage + Surplus (Snowpack)
** Assume PET at 50% of normal within bare soil areas

Soil Moisture Storage [3] - sand and gravel pit floor, no vegetation 50 mm

MOE SWM infiltration calculations [4]

topography - rolling land	0.2
soils - open sandy loam	0.4
cover - none	0
Infiltration factor	**0.6**

Latitude of site (or climate station) 45 ^{O} N

Notes:
1. Environment Canada Climate Normals (Midland WPCP Climate Station 1981-2010)
2. Lorente, J.M. 1961. Pg. 206 "Adjusting Factors for U".
3. MOE SWMPDM. 2003. Table 3.1 "Water Holding Capicity" values.
4. MOE SWMPDM. 2003. Table 3.1 "Infiltration Factors" values.

TABLE H-7: Water Balance

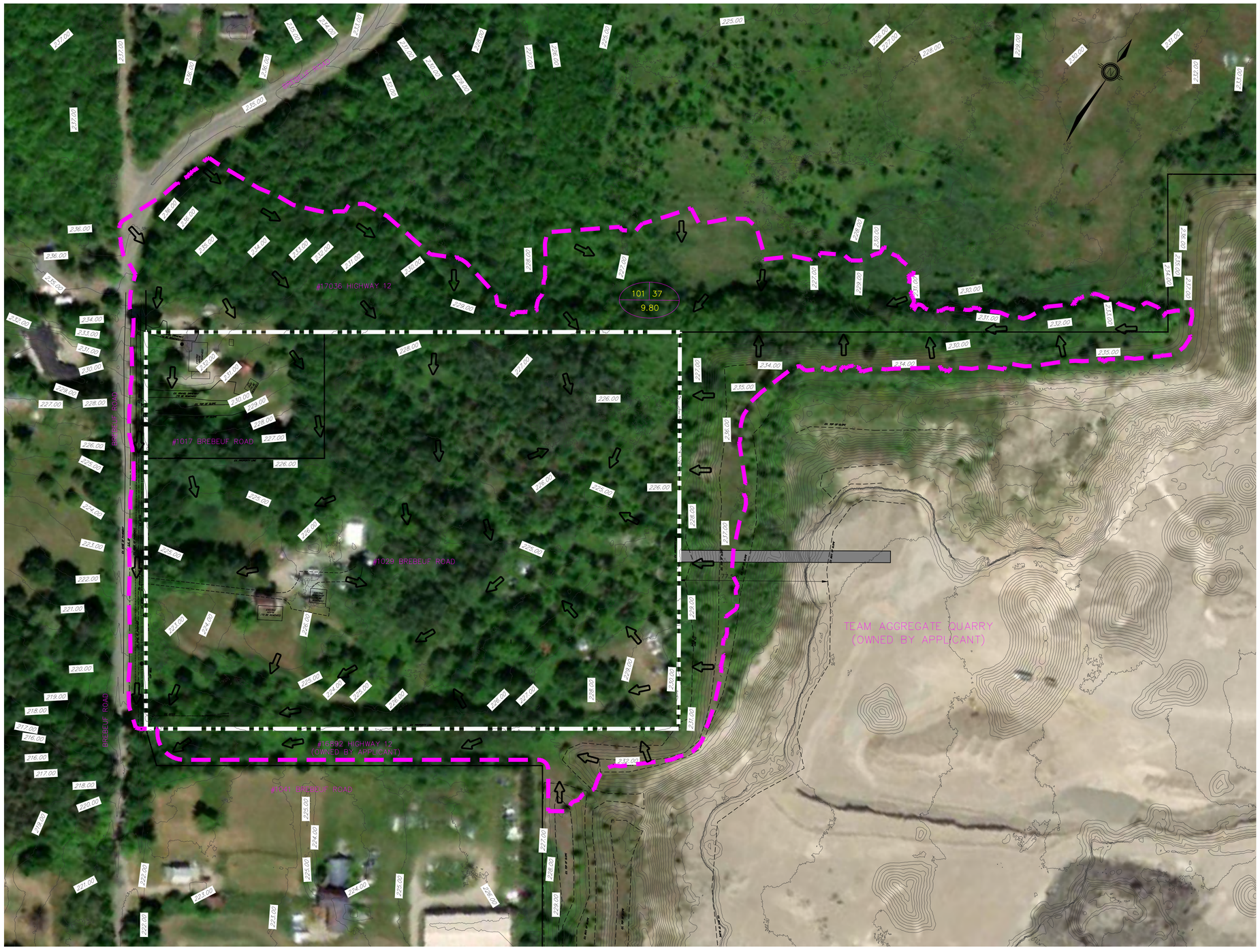
Existing Conditions and Post-Development (without Mitigation)

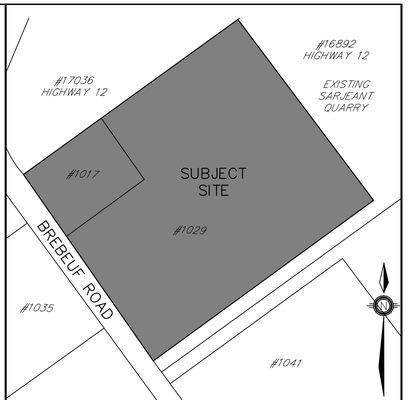
Catchment Area	Land Type	Approx. Land Area* (m^2)	Estimated Impervious Fraction for Land Use	Estimated Impervious Area (m^2)	Runoff from Impervious Area** (m/a)	Runoff Volume from Impervious Area (m^3/a)	Estimated Pervious Area (m^2)	Runoff from Pervious Area** (m/a)	Runoff Volume from Pervious Area (m^3/a)	Infiltration from Pervious Area** (m/a)	Infiltration Volume from Pervious Area (m^3/a)	Total Runoff Volume (m^3/a)	Total Infiltration Volume (m^3/a)
Existing Land Use													
CATCHMENT 101	Woodland	72,300	0.00	0	0.885	0	72,300	0.100	7,202	0.398	28,807	7,202	28,807
	Pasture	23,000	0.00	0	0.885	0	23,000	0.149	3,437	0.349	8,019	3,437	8,019
	Packed Gravel (Driveway)	1,300	1.00	1,300	0.885	1,150	0	0.149	0	0.349	0	1,150	0
	Impervious	1,500	1.00	1,500	0.885	1,327	0	0.149	0	0.349	0	1,327	0
TOTAL PRE-DEVELOPMENT		**98,100**		**2,800**		**2,477**	**95,300**		**10,638**		**36,826**	**13,115**	**36,826**
Post-Development Land Use													
CATCHMENT 201	Woodland	18,400	0.00	0	0.885	0	18,400	0.100	1,833	0.398	7,331	1,833	7,331
	Pasture	7,700	0.00	0	0.885	0	7,700	0.149	1,150	0.349	2,684	1,150	2,684
CATCHMENT 202	Pasture	28,900	0.00	0	0.885	0	28,900	0.100	2,879	0.398	11,515	2,879	11,515
	Gravel (Pit Floor)	22,700	0.00	0	0.885	0	22,700	0.242	5,484	0.564	12,797	5,484	12,797
	Impervious	600	1.00	600	0.885	531	0	0.242	0	0.564	0	531	0
CATCHMENT 203	Pasture	5,100	0.00	0	0.885	0	5,100	0.149	762	0.349	1,778	762	1,778
	Gravel (Pit Floor)	5,200	0.00	0	0.885	0	5,200	0.322	1,675	0.483	2,513	1,675	2,513
CATCHMENT 204	Woodland	900	0.00	0	0.885	0	900	0.100	90	0.398	359	90	359
	Pasture	7,400	0.00	0	0.885	0	7,400	0.149	1,106	0.349	2,580	1,106	2,580
	Impervious	1,200	1.00	1,200	0.885	1,061	0	0.149	0	0.349	0	1,061	0
TOTAL POST-DEVELOPMENT		**98,100**		**1,800**		**1,592**	**96,300**		**14,979**		**41,557**	**16,571**	**41,557**
											% Change from Pre to Post	26%	13%
											Effect of development (with no mitigation)	26% increase in runoff	13% increase in infiltration

* data provided by The Jones Consulting Group Ltd.

** figures from Tables H-2 to H-6

To balance pre- to post-,
the infiltration target (m^3/a)= **-4,731**





KEYPLAN
NTS

LEGEND

- CATCHMENT AREA BOUNDARY
- LIMIT OF DEVELOPMENT
- DIRECTION OF PRE-DEVELOPMENT OVERLAND FLOW
- 253.00 EXISTING CONTOUR AND ELEVATION
- CATCHMENT AREA ID NUMBER
- 101 | 0.40 / 41.67 — CN*(II) VALUE (OTTHYMO NASHYD) OR % IMPERVIOUS (OTTHYMO STANDHYD); AREA (ha.)

BENCHMARK:
0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO

NO.	REVISIONS	DATE	INITIAL
1.	IN SUPPORT OF OPA, ZBLA & SPA	JULY 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

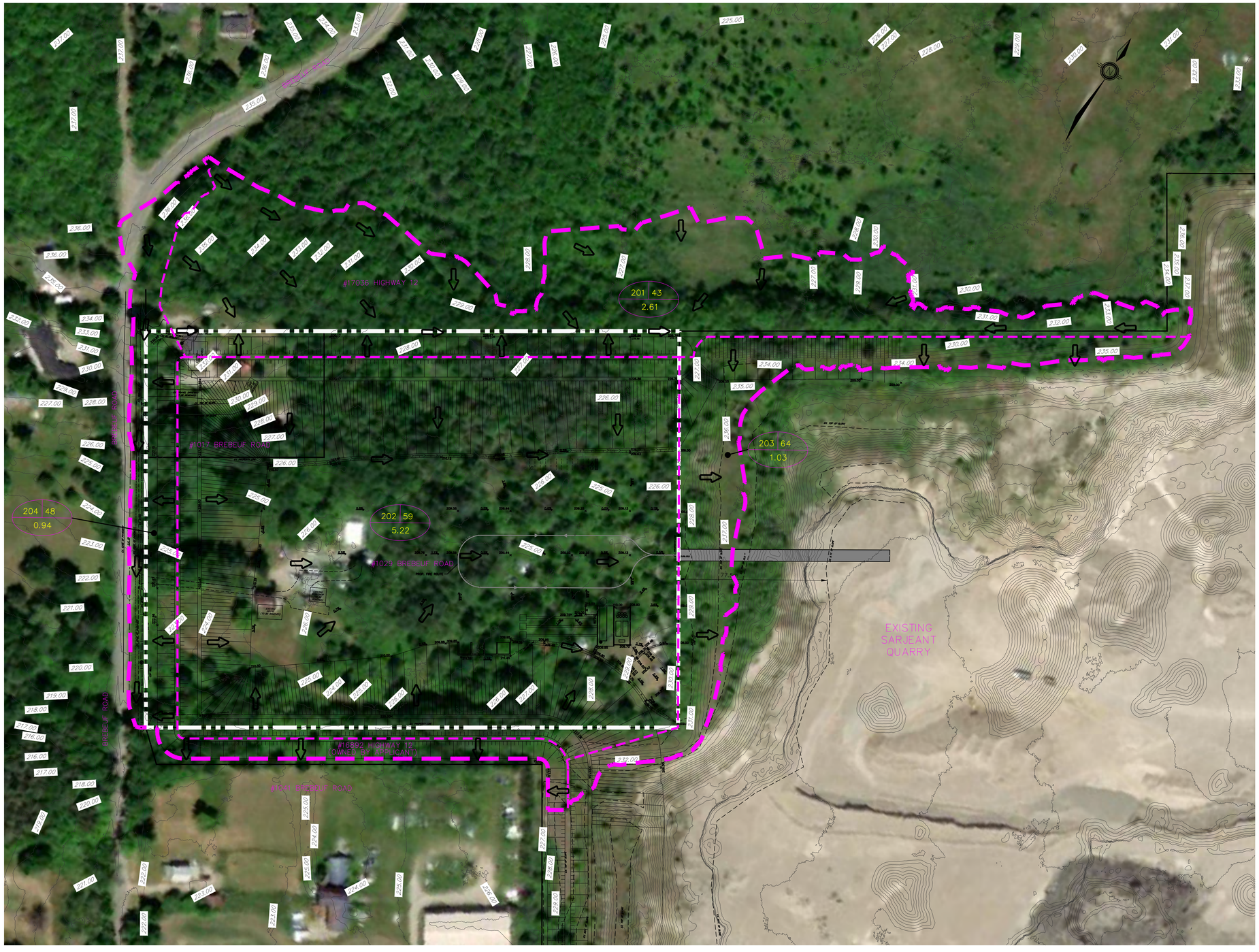
1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

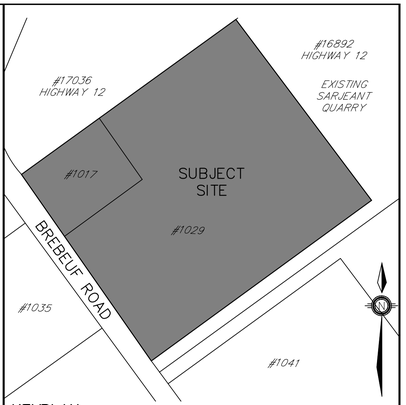
PRE-DEVELOPMENT STORMWATER MANAGEMENT PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	MG	SCALE: 1:1000	DATE JULY 2024
DRAWN	CG	PROJECT SAR-23058	DWG. Nº SWM-1
CHECKED	DR		

G:\Eng_3D\SAR-23058\Production DWGS\SAR-23058_Stormwater Management.dwg Layout: SWM-1 Plotted Aug 07, 2024 @ 4:20pm by mpellant The Jones Consulting Group Ltd





KEYPLAN
NTS

LEGEND

- OVERALL CATCHMENT AREA BOUNDARY
- MINOR CATCHMENT AREA BOUNDARY
- LIMIT OF DEVELOPMENT
- DIRECTION OF PRE-DEVELOPMENT OVERLAND FLOW
- 253.00 EXISTING CONTOUR AND ELEVATION
- CATCHMENT AREA ID NUMBER
- 101 | 0.40 / 41.67
  - CN*(II) VALUE (OTTHYMO NASHYD) OR % IMPERVIOUS (OTTHYMO STANDHYD)
  - AREA (ha.)

BENCHMARK:
0011971U523

MIDLAND – HIGHWAY NO. 12 BRIDGE OVER WYE RIVER, 4.5km SOUTHEAST OF POST OFFICE AND IMMEDIATELY WEST OF MARTYRS SHRINE, TABLET IN SOUTHWEST OUTSIDE FACE OF COPING, 1.28m BELOW TOP OF CONCRETE END POST AND 34cm NORTHWEST OF SOUTHEAST END.

VERT. ORDER: FIRST ORDER
ELEVATION: 182.460m

CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE – ONTARIO

NO.	REVISIONS	DATE	INITIAL
1.	IN SUPPORT OF OPA, ZBLA & SPA	JULY 2024	MG

LICENSED PROFESSIONAL ENGINEER
M. D. GALLANT
100535706
2024-08-07
PROVINCE OF ONTARIO

1017 & 1029 BREBEUF ROAD
TOWN OF MIDLAND

POST-DEVELOPMENT STORMWATER MANAGEMENT PLAN

JONES CONSULTING GROUP LTD.
PLANNERS & ENGINEERS
229 Mapleview Dr. E, Unit 1
Barrie, ON L4N 0W5
P. 705.734.2538
F. 705.734.1056

DESIGN	MG	SCALE: 1:1000	DATE JULY 2024
DRAWN	CG	PROJECT SAR-23058	DWG. Nº SWM-2
CHECKED	DR		

G:\Eng_30\SAR-23058\Production DWGS\SAR-23058_Stormwater Management.dwg Layout: SWM-2 Plotted Aug 07, 2024 @ 4:21pm by mgallant The Jones Consulting Group Ltd.

Weighted Curve Number Calculator

Input:

Catchment ID	101		
Hydrologic Soil Group	A & AB		
Soil Texture	Tioga Loamy Sand (Tis) & Vasey Sandy Loam (Vasl)	Weighted Curve Number	Weighted Runoff 'C'
Wetland(ha)/CN	0.00	N/A	N/A
Woods(ha)/CN	7.23	33.2	0.08
Pasture/Lawn Area(ha)/CN	2.30	44.1	0.10
Cultivated(ha)/CN	0.00	N/A	N/A
Gravel (ha)/CN	0.13	77.7	0.40
Impervious Area(ha)/CN	0.15	98.0	0.95

Calculated:

Area	9.81
Average CN	37
Average Pervious CN	36
Average Runoff 'C'	0.10

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	8.64	mm
Average Pervious IA	8.74	mm

*Curve Numbers, Runoff Coefficients and Initial Abstraction numbers were determined based on the MTO Drainage Management Manual Dated 1997. Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Catchment Max El.	237.00	m
Catchment Min. El.	220.00	m
Catchment Flow Length	668	m

Calculated:

Catchment Ave. Slope	2.5	%
Imperviousness	1%	
Directly Connected Imperviousness	0%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.10	

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.11	
50YR Rational 'C'	0.12	
100YR Rational 'C'	0.13	

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	61.78	min
Time of Concentration	1.03	hr
Time to Peak	0.69	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	25.14	min
Time of Concentration	0.42	hr
Time to Peak	0.28	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**1.03**	**hr**
Time to Peak	**0.69**	**hr**

Pre-Development Catchment 101

	Areas	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0	50	0	0.05	0
Woods "A"	32971	25	824275	0.08	2637.68
Pasture/Lawn "A"	12337	39	481143	0.10	1233.7
Cultivated "A"	0	51	0	0.22	0
Gravel "A"	885	76	67260	0.40	354
Impervious "A" (Connected)	427	98	41846	0.95	405.65
Impervious "A" (Dis-Connected)	157	98	15386	0.95	149.15
Total Area "A"	46777				
Weighted coefficients "A"			30.56866		0.102191
Wetlands "AB"	0	50	0	0.05	0
Woods "AB"	39365	40	1574600	0.08	3149.2
Pasture/Lawn "AB"	10633	50	531650	0.10	1063.3
Cultivated "AB"	0	59	0	0.22	0
Gravel "AB"	451	81	36531	0.40	180.4
Impervious "AB" (Connected)	663	98	64974	0.95	629.85
Impervious "AB" (Dis-Connected)	210	98	20580	0.95	199.5
Total Area "AB"	51322				
Weighted coefficients "AB"			43.41871		0.101755
Wetlands "B"	0	50	0	0.05	0
Woods "B"	0	55	0	0.25	0
Pasture/Lawn "B"	0	61	0	0.28	0
Cultivated "B"	0	67	0	0.35	0
Gravel "B"	0	85	0	0.50	0
Impervious "B" (Connected)	0	98	0	0.95	0
Impervious "B" (Dis-Connected)	0	98	0	0.95	0
Total Area "B"	0				
Weighted coefficients "B"			0		0
Wetlands "C"	0	50	0	0.05	0
Woods "C"	0	70	0	0.35	0
Pasture/Lawn "C"	0	74	0	0.40	0
Cultivated "C"	0	76	0	0.55	0
Gravel "C"	0	89	0	0.60	0
Impervious "C" (Connected)	0	98	0	0.95	0
Impervious "C" (Dis-Connected)	0	98	0	0.95	0
Total Area "C"	0				
Weighted coefficients "C"			0		0
Totals:	98099	Weighted CN	37.29136	Weighted "C"	0.101963
Mannings Gravel =	0.40				
Mannings Woods =	0.40		Average Pervious Mannings=		0.35
Mannings Lawn =	0.19				

Weighted Curve Number Calculator

Input:

Catchment ID	201		
Hydrologic Soil Group	AB		
Soil Texture	Vasey Sandy Loam (Vasl)	Weighted Curve Number	Weighted Runoff 'C'
Wetland(ha)/CN	0.00	N/A	N/A
Woods(ha)/CN	1.84	40.0	0.08
Pasture/Lawn Area(ha)/CN	0.77	50.0	0.10
Cultivated(ha)/CN	0.00	N/A	N/A
Gravel (ha)/CN	0.00	N/A	N/A
Impervious Area(ha)/CN	0.00	N/A	N/A

Calculated:

Area	2.61
Average CN	43
Average Pervious CN	43
Average Runoff 'C'	0.09

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	8.52	mm
Average Pervious IA	8.52	mm

*Curve Numbers, Runoff Coefficients and Initial Abstraction numbers were determined based on the MTO Drainage Management Manual Dated 1997. Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Catchment Max El.	236.00	m
Catchment Min. El.	226.79	m
Catchment Flow Length	296.92	m

Calculated:

Catchment Ave. Slope	3.1	%
Imperviousness	0%	
Directly Connected Imperviousness	0%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.09	

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.09	
50YR Rational 'C'	0.10	
100YR Rational 'C'	0.11	

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	39.21	min
Time of Concentration	0.65	hr
Time to Peak	0.44	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	12.26	min
Time of Concentration	0.20	hr
Time to Peak	0.14	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.65**	**hr**
Time to Peak	**0.44**	**hr**

Post-Development Catchment 201

	Areas	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0	50	0	0.05	0
Woods "A"	0	25	0	0.08	0
Pasture/Lawn "A"	0	39	0	0.10	0
Cultivated "A"	0	51	0	0.22	0
Gravel "A"	0	76	0	0.40	0
Impervious "A" (Connected)	0	98	0	0.95	0
Impervious "A" (Dis-Connected)	0	98	0	0.95	0
Total Area "A"	0				
Weighted coefficients "A"			0		0
Wetlands "AB"	0	50	0	0.05	0
Woods "AB"	18417	40	736680	0.08	1473.36
Pasture/Lawn "AB"	7707	50	385350	0.10	770.7
Cultivated "AB"	0	59	0	0.22	0
Gravel "AB"	0	81	0	0.40	0
Impervious "AB" (Connected)	0	98	0	0.95	0
Impervious "AB" (Dis-Connected)	0	98	0	0.95	0
Total Area "AB"	26124				
Weighted coefficients "AB"			42.95016		0.0859
Wetlands "B"	0	50	0	0.05	0
Woods "B"	0	55	0	0.25	0
Pasture/Lawn "B"	0	61	0	0.28	0
Cultivated "B"	0	67	0	0.35	0
Gravel "B"	0	85	0	0.50	0
Impervious "B" (Connected)	0	98	0	0.95	0
Impervious "B" (Dis-Connected)	0	98	0	0.95	0
Total Area "B"	0				
Weighted coefficients "B"			0		0
Wetlands "C"	0	50	0	0.05	0
Woods "C"	0	70	0	0.35	0
Pasture/Lawn "C"	0	74	0	0.40	0
Cultivated "C"	0	76	0	0.55	0
Gravel "C"	0	89	0	0.60	0
Impervious "C" (Connected)	0	98	0	0.95	0
Impervious "C" (Dis-Connected)	0	98	0	0.95	0
Total Area "C"	0				
Weighted coefficients "C"			0		0
Totals:	26124	Weighted CN	42.95016	Weighted "C"	0.0859
Mannings Gravel =	0.40				
Mannings Woods =	0.40		Average Pervious Mannings=		0.34
Mannings Lawn =	0.19				

Weighted Curve Number Calculator

Input:

Catchment ID	202		
Hydrologic Soil Group	A & AB		
Soil Texture	Tioga Loamy Sand (Tis) & Vasey Sandy Loam (Vasl)	Weighted Curve Number	Weighted Runoff 'C'
Wetland(ha)/CN	0.00	N/A	N/A
Woods(ha)/CN	0.00	N/A	N/A
Pasture/Lawn Area(ha)/CN	2.89	43.5	0.10
Cultivated(ha)/CN	0.00	N/A	N/A
Gravel (ha)/CN	2.27	76.6	0.40
Impervious Area(ha)/CN	0.06	98.0	0.95

Calculated:

Area	5.22
Average CN	59
Average Pervious CN	58
Average Runoff 'C'	0.24

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	4.96	mm
Average Pervious IA	5.00	mm

*Curve Numbers, Runoff Coefficients and Initial Abstraction numbers were determined based on the MTO Drainage Management Manual Dated 1997. Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Catchment Max El.	210.20	m
Catchment Min. El.	209.00	m
Catchment Flow Length	220	m

Calculated:

Catchment Ave. Slope	0.5	%
Imperviousness	1%	
Directly Connected Imperviousness	0%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.24

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.26
50YR Rational 'C'	0.29
100YR Rational 'C'	0.30

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	50.75	min
Time of Concentration	0.85	hr
Time to Peak	0.56	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	12.00	min
Time of Concentration	0.20	hr
Time to Peak	0.13	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.85**	**hr**
Time to Peak	**0.56**	**hr**

Post-Development Catchment 202

	Areas	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0	50	0	0.05	0
Woods "A"	0	25	0	0.08	0
Pasture/Lawn "A"	17106	39	667134	0.10	1710.6
Cultivated "A"	0	51	0	0.22	0
Gravel "A"	19925	76	1514300	0.40	7970
Impervious "A" (Connected)	0	98	0	0.95	0
Impervious "A" (Dis-Connected)	619	98	60662	0.95	588.05
Total Area "A"	37650				
Weighted coefficients "A"			59.55102		0.27274
Wetlands "AB"	0	50	0	0.05	0
Woods "AB"	0	40	0	0.08	0
Pasture/Lawn "AB"	11804	50	590200	0.10	1180.4
Cultivated "AB"	0	59	0	0.22	0
Gravel "AB"	2759	81	223479	0.40	1103.6
Impervious "AB" (Connected)	0	98	0	0.95	0
Impervious "AB" (Dis-Connected)	18	98	1764	0.95	17.1
Total Area "AB"	14581				
Weighted coefficients "AB"			55.92504		0.157815
Wetlands "B"	0	50	0	0.05	0
Woods "B"	0	55	0	0.25	0
Pasture/Lawn "B"	0	61	0	0.28	0
Cultivated "B"	0	67	0	0.35	0
Gravel "B"	0	85	0	0.50	0
Impervious "B" (Connected)	0	98	0	0.95	0
Impervious "B" (Dis-Connected)	0	98	0	0.95	0
Total Area "B"	0				
Weighted coefficients "B"			0		0
Wetlands "C"	0	50	0	0.05	0
Woods "C"	0	70	0	0.35	0
Pasture/Lawn "C"	0	74	0	0.40	0
Cultivated "C"	0	76	0	0.55	0
Gravel "C"	0	89	0	0.60	0
Impervious "C" (Connected)	0	98	0	0.95	0
Impervious "C" (Dis-Connected)	0	98	0	0.95	0
Total Area "C"	0				
Weighted coefficients "C"			0		0
Totals:	52231	Weighted CN	58.53878	Weighted "C"	0.240657
Mannings Gravel =	0.40				
Mannings Woods =	0.40		Average Pervious Mannings=		0.28
Mannings Lawn =	0.19				

Weighted Curve Number Calculator

Input:

Catchment ID	203		
Hydrologic Soil Group	A & AB		
Soil Texture	Tioga Loamy Sand (Tis) & Vasey Sandy Loam (Vasl)	Weighted Curve Number	Weighted Runoff 'C'
Wetland(ha)/CN	0.00	N/A	N/A
Woods(ha)/CN	0.00	N/A	N/A
Pasture/Lawn Area(ha)/CN	0.51	48.5	0.10
Cultivated(ha)/CN	0.00	N/A	N/A
Gravel (ha)/CN	0.52	78.9	0.40
Impervious Area(ha)/CN	0.00	N/A	N/A

Calculated:

Area	1.03
Average CN	64
Average Pervious CN	64
Average Runoff 'C'	0.25

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	5.00	mm
Average Pervious IA	5.00	mm

*Curve Numbers, Runoff Coefficients and Initial Abstraction numbers were determined based on the MTO Drainage Management Manual Dated 1997. Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Catchment Max El.	Varies	m
Catchment Min. El.	Varies	m
Catchment Flow Length	28	m

Calculated:

Catchment Ave. Slope	2.0	%
Imperviousness	0%	
Directly Connected Imperviousness	0%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.25	

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.28	
50YR Rational 'C'	0.30	
100YR Rational 'C'	0.31	

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	11.66	min
Time of Concentration	0.19	hr
Time to Peak	0.13	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	1.39	min
Time of Concentration	0.02	hr
Time to Peak	0.02	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.19**	**hr**
Time to Peak	**0.13**	**hr**

Post-Development Catchment 203

	Areas	CN	CN*A	Rational "C"	C*A
Wetlands "A"	0	50	0	0.05	0
Woods "A"	0	25	0	0.08	0
Pasture/Lawn "A"	690	39	26910	0.10	69
Cultivated "A"	0	51	0	0.22	0
Gravel "A"	2139	76	162564	0.40	855.6
Impervious "A" (Connected)	0	98	0	0.95	0
Impervious "A" (Dis-Connected)	0	98	0	0.95	0
Total Area "A"	2829				
Weighted coefficients "A"			66.97561		0.326829
Wetlands "AB"	0	50	0	0.05	0
Woods "AB"	0	40	0	0.08	0
Pasture/Lawn "AB"	4421	50	221050	0.10	442.1
Cultivated "AB"	0	59	0	0.22	0
Gravel "AB"	3016	81	244296	0.40	1206.4
Impervious "AB" (Connected)	0	98	0	0.95	0
Impervious "AB" (Dis-Connected)	0	98	0	0.95	0
Total Area "AB"	7437				
Weighted coefficients "AB"			62.57174		0.221662
Wetlands "B"	0	50	0	0.05	0
Woods "B"	0	55	0	0.25	0
Pasture/Lawn "B"	0	61	0	0.28	0
Cultivated "B"	0	67	0	0.35	0
Gravel "B"	0	85	0	0.50	0
Impervious "B" (Connected)	0	98	0	0.95	0
Impervious "B" (Dis-Connected)	0	98	0	0.95	0
Total Area "B"	0				
Weighted coefficients "B"			0		0
Wetlands "C"	0	50	0	0.05	0
Woods "C"	0	70	0	0.35	0
Pasture/Lawn "C"	0	74	0	0.40	0
Cultivated "C"	0	76	0	0.55	0
Gravel "C"	0	89	0	0.60	0
Impervious "C" (Connected)	0	98	0	0.95	0
Impervious "C" (Dis-Connected)	0	98	0	0.95	0
Total Area "C"	0				
Weighted coefficients "C"			0		0
Totals:	10266	Weighted CN	63.78531	Weighted "C"	0.250643
Mannings Gravel =	0.40				
Mannings Woods =	0.40		Average Pervious Mannings=		0.30
Mannings Lawn =	0.19				

Weighted Curve Number Calculator

Input:

Catchment ID	204		
Hydrologic Soil Group	A & AB		
Soil Texture	Tioga Loamy Sand (Tis) & Vasey Sandy Loam (Vasl)	Weighted Curve Number	Weighted Runoff 'C'
Wetland(ha)/CN	0.00	N/A	N/A
Woods(ha)/CN	0.09	40.0	0.08
Pasture/Lawn Area(ha)/CN	0.74	41.3	0.10
Cultivated(ha)/CN	0.00	N/A	N/A
Gravel (ha)/CN	0.00	N/A	N/A
Impervious Area(ha)/CN	0.11	98.0	0.95

Calculated:

Area	0.94
Average CN	48
Average Pervious CN	41
Average Runoff 'C'	0.20

Initial Abstraction Calculator

Input:

Wetland	16	mm
Woods	10	mm
Pasture/Lawns	5	mm
Cultivated	7	mm
Impervious Areas	2	mm

Calculated:

Total Average IA	5.13	mm
Average Pervious IA	5.54	mm

*Curve Numbers, Runoff Coefficients and Initial Abstraction numbers were determined based on the MTO Drainage Management Manual Dated 1997. Weighted Curve Numbers and Weighted Rational Coefficients are determined from the weighted average of the area and Curve Number or Rational Coefficient in a given soil type, i.e. Type A, B, C or D.

Time of Concentration Calculator

Input:

Catchment Max El.	236.00	m
Catchment Min. El.	220.10	m
Catchment Flow Length	280	m

Calculated:

Catchment Ave. Slope	5.7	%
Imperviousness	12%	
Directly Connected Imperviousness	0%	

Calculated: RATIONAL COEFFICIENT

5YR Rational 'C'	0.20

Calculated: MTO DRAINAGE MANUAL

25YR Rational 'C'	0.22
50YR Rational 'C'	0.24
100YR Rational 'C'	0.25

Calculated: AIRPORT METHOD (Runoff Coef <0.4)

Time of Concentration	27.77	min
Time of Concentration	0.46	hr
Time to Peak	0.31	hr

$Tc=3.26*(1.1-C)*L^{0.5}*S^{-0.33}$

Calculated: BRANSBY-WILLIAMS METHOD (Runoff Coef >=0.4)

Time of Concentration	11.35	min
Time of Concentration	0.19	hr
Time to Peak	0.13	hr

$Tc=0.057*L*S^{-0.2}*A^{-0.1}$

Use:

Time of Concentration	**0.46**	**hr**
Time to Peak	**0.31**	**hr**

Post-Development Catchment 204

	Areas		CN	CN*A	Rational "C"	C*A
Wetlands "A"	0		50	0	0.05	0
Woods "A"	0		25	0	0.08	0
Pasture/Lawn "A"	5871		39	228969	0.10	587.1
Cultivated "A"	0		51	0	0.22	0
Gravel "A"	0		76	0	0.40	0
Impervious "A" (Connected)	427		98	41846	0.95	405.65
Impervious "A" (Dis-Connected)	0		98	0	0.95	0
Total Area "A"	6298					
Weighted coefficients "A"				43.00016		0.157629
Wetlands "AB"	0		50	0	0.05	0
Woods "AB"	892		40	35680	0.08	71.36
Pasture/Lawn "AB"	1525		50	76250	0.10	152.5
Cultivated "AB"	0		59	0	0.22	0
Gravel "AB"	0		81	0	0.40	0
Impervious "AB" (Connected)	664		98	65072	0.95	630.8
Impervious "AB" (Dis-Connected)	0		98	0	0.95	0
Total Area "AB"	3081					
Weighted coefficients "AB"				57.44953		0.277397
Wetlands "B"	0		50	0	0.05	0
Woods "B"	0		55	0	0.25	0
Pasture/Lawn "B"	0		61	0	0.28	0
Cultivated "B"	0		67	0	0.35	0
Gravel "B"	0		85	0	0.50	0
Impervious "B" (Connected)	0		98	0	0.95	0
Impervious "B" (Dis-Connected)	0		98	0	0.95	0
Total Area "B"	0					
Weighted coefficients "B"				0		0
Wetlands "C"	0		50	0	0.05	0
Woods "C"	0		70	0	0.35	0
Pasture/Lawn "C"	0		74	0	0.40	0
Cultivated "C"	0		76	0	0.55	0
Gravel "C"	0		89	0	0.60	0
Impervious "C" (Connected)	0		98	0	0.95	0
Impervious "C" (Dis-Connected)	0		98	0	0.95	0
Total Area "C"	0					
Weighted coefficients "C"				0		0
Totals:	9379	Weighted CN		47.74677	Weighted "C"	0.196973
Mannings Gravel =	0.40					
Mannings Woods =	0.40			Average Pervious Mannings=		0.21
Mannings Lawn =	0.19					

Appendix I

Private Well Survey

Harden Environmental Services Ltd.
4622 Nassagaweya-Puslinch Townline
Moffat, Ontario, L0P 1J0
Phone: (519) 826-0099 Fax: (519) 826-9099

- Hydrogeological Assessment
- Permits to Take Water
- Environmental Compliance Approvals
- Phase I / II ESA
- Excess Soil Management
- Designated Substance Surveys
- Regional Flow Studies
- Contaminant Investigations
- Geochemistry
- Groundwater and Surface Water Monitoring
- Groundwater and Surface Water Impact Studies
- Groundwater Modelling
- OLT Hearings

Our File: 2361
July 30, 2024

Via: Hand Delivery
Dear Property Owner / Tenant:

Re: Private Well Survey

Harden Environmental Services Ltd. (Harden) has been retained by The Sarjeant Company Limited to complete a survey of existing private/residential water supply wells in the vicinity of the proposed zoning by-law amendment application with the Town of Midland for 1017/1029 Brebeuf Road in Midland, Ontario. The purpose of the survey is to identify the location and use of private groundwater supply wells in the area. This information is important to ensure that local water supply wells are protected as development proceeds.

The attached water well survey form asks general questions about the well location, construction, water quality and usage. Participation is voluntary and any information you provide will be kept confidential. The survey may be returned by e-mail or completed over the phone using the contact information provided below.

We would greatly appreciate your participation in this survey and receiving any information you can provide. For any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,
Harden Environmental Services Ltd.

Angie Mason, M.Sc., P.Geo., QP_{ESA}
Senior Hydrogeologist
E-mail: amason@hardenv.com
Cell: 519-831-9696

Enclosed: Private Water Well Information Survey Form

Harden Environmental Services Ltd.
Office: 519-826-0099
amason@hardenv.com

PRIVATE WATER WELL INFORMATION SURVEY FORM

Well Owner Information

Well Owner: _____ Phone: _____

E-mail: _____

Mailing Address: _____

Preferred Contact Method □ Phone □ E-mail □ Other _____

Well Information (please provide as much information as possible)

Year Installed: _____ Well Contractor: _____ Original owner:_____

Well Type: □ Drilled □ Dug □ Bored □ _____ Well Record Available: □ Yes □ No

Casing Type: □ Steel □ Concrete □ Plastic □ _____ Lid Type: _____

Casing Diameter: _____ Well Depth: _____ Pump Depth: _____

Wellhead: □ Steel cap □ Solid concrete lid □ Concrete with square access lid □ Plastic

□ Well in pit □ _____

Aquifer Material: □ Bedrock □ Deep Overburden □ Shallow Overburden □ _____

Pump Type: □ Submersible □ Single line jet □ Double line jet □ _____

Pump Intake Depth: _____ Static Water Level (and date): _____

Are there any other wells on the property? : □ No □ Yes (please provide details)

_____

Water Quality / Quantity Information

Water Use: □ Drinking □ Livestock □ Bathing □ Irrigation □ Car Washing □ Other _____

□ Well not used (explain) _____ Number of people using well water: _____

Alternate sources of water: □ Municipal Supply □ Bottled □ Cistern □ _____

Has the well ever gone dry / shortage of water? □ No □ Yes (when/how often) _____

Water quality: □ Clear □ Sediment/turbidity □ Iron staining □ Sulfur odour □ Methane gas

Other comments: _____

Frequency of testing (Health Unit): □ Monthly □ Quarterly □ Annually □ Never □ _____

Previous water quality results: _____

Treatment: □ Softener □ Filter □ Reverse Osmosis □ UV □ Chlorination □ _____

Well Monitoring

Are you interested in being contacted to have your well monitored, if applicable: □ Yes □ No

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SITE PLAN ON PAGE 2

Harden Environmental Services Ltd.
Office: 519-826-0099
amason@hardenv.com

Site Plan (sketch)

Please include property layout, north arrow, well location(s) and septic system location(s).

Additional Comments

Please let us know if you have any additional comments or concerns:

Thank you for taking the time to complete this survey.