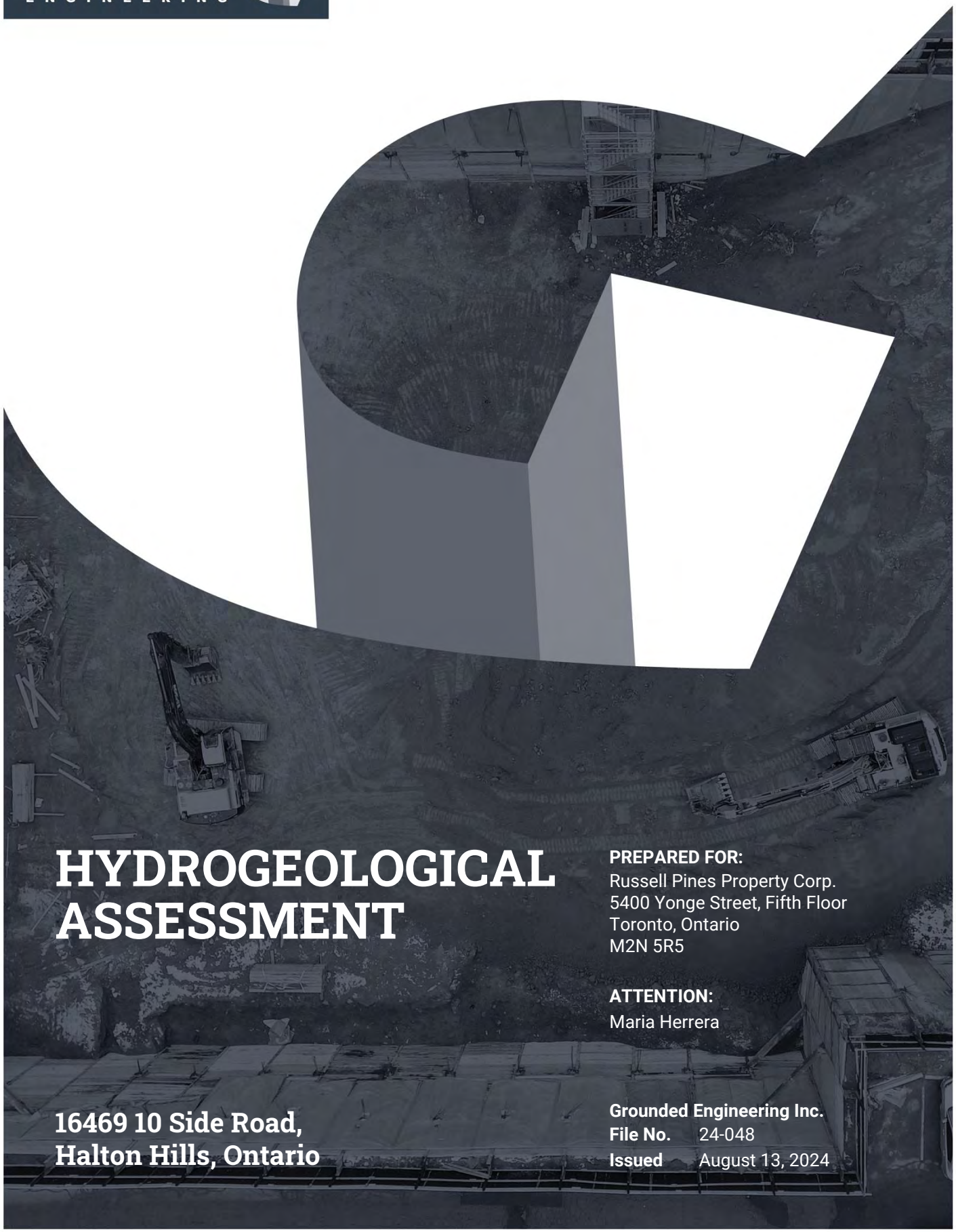

HYDROGEOLOGICAL ASSESSMENT

PREPARED FOR:
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ATTENTION:
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File No. 24-048
Issued August 13, 2024

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1 Introduction

1.1 Background

Russell Pines Property Corp. retained Grounded Engineering Inc. ("Grounded"), to complete a Hydrogeological Assessment for the property located at the municipal address of 16469 10 Side Road, Halton Hills, Ontario (the Site). The site location is presented in Figure 1.

Based on the draft plan of subdivision dated February 20, 2024 (reference below), it is understood that the proposed development will be a new residential subdivision comprised of townhouses and single detached houses at the Site. Included in the development are stormwater management (SWM) ponds, a park, and a future area for mixed uses. The northern boundary of the Site will remain as natural area (Greenbelt Lands). The hydrogeological assessment has been prepared for Site Plan Application as per the requirement of The Region of Halton and Credit Valley Conservation. The draft plan of subdivision is provided in Appendix A.

The hydrogeological assessment was undertaken to evaluate the hydrogeological conditions with respect to the proposed development on the Property, and to develop a plan to manage potential groundwater impacts associated with activities related to the proposed land use.

Grounded has been provided with the following reports and drawings to assist in our scope of work:

- Site survey, prepared by J.D. Barnes, dated March 6, 2020.
- Draft Plan of Subdivision, prepared by GSAI Glen Schnarr & Associates Inc., dated February 20, 2024.
- Hydrogeological Investigation, prepared by WSP Canada Inc., dated January 7, 2022.

1.2 Scope of Work

A summary of the scope of work is provided below:

- Background Information Review: Review of available background geologic and hydrogeological information for the Site and surrounding areas. This included a review of the Ministry of the Environment, Conservation and Parks (MECP) well records, watershed information by the Credit Valley Conservation Authority (CVC), and results of previous studies and subsurface investigations.
- Private Well Survey: A private well survey was conducted for properties within a 500 m radius of the Site.
- Groundwater Level Monitoring: Groundwater level monitoring was conducted in order to determine the stabilized groundwater elevation(s) across the site, and to assess the

groundwater flow conditions. Groundwater monitoring, including continuous water level measurements with dataloggers, will continue at the Site for a period of one (1) year.

- Hydraulic Conductivity Testing: In-situ hydraulic conductivity tests were conducted in select monitoring wells to assess hydraulic conductivity of the subsurface strata for the purpose of determining potential dewatering requirements.
- Water Balance: A preliminary water balance for existing (pre-development) and post-development conditions was completed to determine the feasibility of the proposed development with respect to groundwater recharge due to precipitation.

2 Physical and Hydrogeological Setting

2.1 Site Location and Description

The Site is irregular in shape, with a total area of 53.28 ha. The Site presently consists of undeveloped land, agricultural land, two residential homes, and a former barn and associated structures. The existing site conditions are presented in Figure 3.

The Site and the immediate neighboring areas are serviced with municipal piped water and sewage services.

2.2 Regional Physiography

From a regional perspective, the Site is predominantly situated within the South Slope physiographic region. The South Slope is bounded in the north by the Oak Ridges and in the south by the Iroquois Plain, and consists of a variety of soils developed upon tills which are sandier in the east and clayey in the west. Drumlins are present throughout the South Slope Till Plains, which are long and narrow mounds pointing upslope formed from glacial debris. Fast-flowing streams in this area have carved sharp valleys through the glacial till, resulting in an accumulation of unsorted, unstratified mixtures of clay, silt, sand, gravel and boulders across this large physiographic region. The Peel Plain is present in the east portion of the Site and extends across the contact of the grey and red shales of the Georgian Bay and Queenston Formations. The Peel Plain is a level to undulating tract of clay soils (Singer et. Al., 2003) and the clay soil of the Peel Plain southwest of the Credit River is reddish compared to in the east of the Peel Plain (Chapman and Putnam, 2007).

2.3 Topography & Drainage

The Ministry of Natural Resources and Forestry (MNRF) and Ministry of Energy, Northern Development and Mines (MENDM) database were searched to obtain topographic and geological maps of Ontario for review. The maps are provided as Appendices C and D. The information obtained is summarized below:

Records	Information
Topographic Maps	Based on the topographic data provided by the MNRF (2023) and the site survey by J.D. Barnes (2020), the ground surface at the Site ranges from approximately Elev. 230± masl in the south and southwest sloping to 223± masl in the east and northeast. The northern boundary of Site is a severe slope with top of slope at Elev. 220± masl decreasing to Elev. 205± masl.
Hydrology	The northwestern limit of the Site abuts the valley of the Credit River West Branch. The West Branch continues to flow east where it meets the Credit River, approximately 300 m north of the Site. The Credit River continues to flow east (MECP, 2023). A drainage swale is present across the southern portion of Site; however, during Grounded's site visits in May and June (2024), no flow was observed. The soil appeared to be moist with discrete areas of pooled water. It is possible that this tributary is ephemeral with surface water drainage. A drainage swale was also observed by Grounded staff on the east boundary of the Site, however, there was no water observed during the above noted site visits. The Site is located within a CVC regulated area (CVC, 2024). The Site is situated within the Sixteen Mile-Credit River watershed (MECP, 2023). The Credit River originates above the Niagara Escarpment and empties into Lake Ontario at Port Credit, approximately 25 km southeast of the Site (Singer et. al., 2003). Groundwater at the Site and within the Study Area is anticipated to flow north and northeast towards the West Branch of the Credit River and the Credit River.
Run Offs	Stormwater at the Site is expected to infiltrate or drain towards the on-Site drainage swales, present along the southern and eastern portions of the Site. No catchbasins are located on or adjacent to the Site.

2.4 Regional Climate

The following climate data were compiled from Environment Canada's Toronto Pearson Airport weather station for the period of 1991-2020 (Government of Canada, 2024).

Mean annual precipitation (mm/yr.)	806.8
Mean annual evapotranspiration (mm/yr.)	365 *
Average daily temperature (C)	8.6
Mean annual water surplus (mm/yr.)	441.8 mm

**Mean evapotranspiration value is from the LID Stormwater Management Planning and Design Guide for Agricultural land cover (CVC, TRCA, 2010).*

It is noted that the above are average values, which are representative in a regional context. There will be seasonal and annual variations in these values. However, the average values will govern long-term groundwater recharge and discharge rates. Therefore, average values are considered appropriate for the assessment of general hydrogeologic conditions at the site.

2.5 Regional Geology and Soils

Based on published information available through the Ontario Geological Survey, the regional geology is described as below.

Records	Information
Geological Maps	Overburden (OGS, 2010): • Fine-textured glaciolacustrine deposits of silt and clay, minor sand and gravel; interbedded silt and clay and gritty, pebbly flow till and rainout deposits (west to central portions of the Site) • Coarse-textured glaciolacustrine deposits of sand and gravel, minor silt and clay (forseshore and basinal deposits; north to east portions of the Site). • Clay to silt textured till (derived from glaciolacustrine deposits or shale; south and north portions of the Site). • Bedrock outcrops and older alluvial deposits of clay, silt, sand and gravel are present to the north along the Credit River. Bedrock (Armstrong and Dodge, 2007): • Shale of the Queenston Formation Depth to Bedrock (Gao et. Al., 2006): • Depth to bedrock varies across the Site and Study Area. Available MECP water well records indicate bedrock outcrops are present to the north of the Site. In the remaining Study Area, records indicate bedrock as shallow as 1.48 mbgs while other records did not encounter bedrock at depths greater than 35 mbgs.

It should be noted that the subsurface soil and bedrock conditions described above represent generalized conditions only and should not be considered site specific. The information is presented in Appendix D.

2.6 Regional Hydrogeology

The Credit River Watershed is located in the central part of southern Ontario on the north side of Lake Ontario and is managed by the Credit Valley Conservation Authority (“CVC”). The CVC area includes the Credit River watershed and a number of small watercourses that flow into Lake Ontario. The Credit River originates above Elev. 415.0 and 480.0 masl above the Niagara Escarpment and empties into Lake Ontario at Port Credit. The Credit River consists of two main branches: the Credit River in the area of Orangeville, Acton and Cataract, and the West Credit River in the area of Hillsburgh, Erin and Belfountain (Singer et al., 2003). The bedrock topography is similar to present-day topography, with three bedrock valleys established in the area. One valley extends from Orangeville down the current Credit River Valley to the Escarpment, the second extends along the current Shaw’s Creek Valley, and the third extends from Erin to Belfountain. Below the Escarpment, the bedrock surface slopes gently towards Lake Ontario. A bedrock valley appears to be slightly to the north and east of the present-day Credit River valley from Credit Fork to Cheltenham, however, from Cheltenham to Port Credit the bedrock valley appears to follow closely the present-day Credit River Valley (Singer et al., 2003).

Most of the area below the Escarpment has an overburden thickness ranging from 10± to 20± m and can reach up to 50± m in areas. In places where bedrock is close to the surface, the thickness of the overburden ranges from less than one meter to a few meters. The overburden consists of Pleistocene aged glacial, glaciofluvial, and glaciolacustrine deposits and recent age fluvial and organic deposits. The glacial deposits consist of five tills: the Newmarket Till, Wentworth Till, Port

Stanley Till, Tavistock Till and Halton Till. The Newmarket, Wentworth and Port Stanley tills are sandy silt tills; the Tavistock and Halton Tills are silt to clay silt tills. Along most of the flood plain of the Credit River there are deposits consisting of a mixture of gravel, sand, silt and clay. Shallow depressions and meltwater channels contain black muck and/or peat (Singer et al., 2003).

Two regionally significant groundwater aquifers exist within the Credit River Watershed: the Guelph/Amabel Formation (west of the Niagara Escarpment) and buried bedrock valleys (filled with coarse-grained glacial overburden deposits) found throughout the CVC (Credit River Watershed and ROP NAI, 2011):

The Orangeville Aquifer Complex is present along the northwest boundary of the CVC, and consists of gravel, sand and some silt. The gravel is glaciofluvial in origin and constitutes a lower unit of the Orangeville Moraine. The sand and silt are glaciolacustrine in origin and constitute an upper unit of the moraine. Well records show sand and gravel deposits overlain by clay and silt deposits. The specific capacities of wells are between 1.0 and more than 50.0 L/min/m (Singer et al., 2003).

The Meltwater Channel Hydrogeologic Unit is comprised of five meltwater channels that act as aquifers. One channel is known as the Hillsburgh Channel, consisting of outwash gravel, and it extends from the south of Caledon Lakes to Hillsburgh along the southern limb of the Orangeville Moraine. The second channel was formed from Orangeville to Alton, and eventually to Cataract following further ice retreat. The deposits vary from sand and silty gravel to clean, uniform, stratified gravel with a thickness ranging from less than 8.0 m to more than 15.0 m. The deposits are contiguous with the Caledon outwash deposits at Cataract. A third channel is known as the Caledon Meltwater Channel. Within the CVC this channel traverses the Escarpment past Caledon and Cataract to Erin. The channel forms a broad valley which has a flat floor and is underlain by gravel and well-sorted fine to medium sand. A fourth channel system is present along the Black River and the Silver Creek and extends to Georgetown. A fifth channel is the Caledon East Meltwater Channel. It extends from Albion to Inglewood. Below Inglewood the channel disappears until Terra Cotta where it then appears again and continues to Glen Williams. The channel floor is relatively flat and is underlain by fine to medium sand. Wells constructed in this hydrogeologic unit indicate the presence of gravel, coarse, medium, and fine sand, and some silt and clay of variable thickness, resulting in highly variable well yields. This unit is considered one of the best overburden aquifers in the CVC and can serve as an important source for domestic and municipal water supply. The specific capacity for 134 wells in this unit ranges from 0.1 to 2,993.0 L/min/m (Singer et al., 2003).

The Lake Peel Deltaic Aquifer is located in the lower part of the CVC and extends from Highway 7 to Churchville. The aquifer consists of fine sand and silt deposits that were laid down at an early stage of Lake Peel. Its composition and limited areal extent result in it being a minor aquifer with a specific capacity ranging from 0.6 to 100.0 L/min/m (Singer et al., 2003).

Within the CVC, the City of Mississauga obtains its water from Lake Ontario; however, in the rest of the CVC, groundwater is used to meet the municipal and private water needs (Singer et al., 2003). Data related to short-term pumping tests were reviewed and of the 890 wells tested, 30.8% have specific capacities ranging from 1.0 to 5.0 L/min/m, 10.1% have specific capacities between 25.0 and 50.0 L/min/m, and the remaining 20.0 % have specific capacities larger than 50.0 L/min/m (Singer et al., 2003).

Shales of the Queenston Formation within the Credit River watershed have relatively poor interconnections of pore spaces in the compact, dense shale. The unit does not readily fracture or dissolve, limiting its effective porosity. The top three to five meters are weathered and may provide sufficient water supply to meet domestic needs. Specific capacity for wells constructed in the Queenston Formation within the Credit River watershed ranges from less than 0.5 to 20.0 L/min/m (Singer et al., 2003).

It is also noted that the 65% of the Credit River's flow comes from groundwater (Credit River Watershed and ROP NAI, 2011).

2.7 Groundwater Resources

Private well records from the MECP well record database were reviewed for wells located within a 500 m radius of the Site. A total of 127 well records were retrieved from the well record database. The MECP well records are presented in Appendix F. Well record locations are presented in plan on Figure 2 and in profile on Figures 5 and 6. A summary of the data obtained is presented in the following table.

Total Number of Wells	**127**
Wells completed in Overburden	45 (35.4%)
Wells completed in Bedrock	61 (48.0%)
Wells not specified	21 (16.5%)
Depth Ranges	
50 ft. or less	55
51 ft. to 100 ft.	33
101 to 200 ft.	18
No depth information provided	21

Water Use	
Monitoring/Test Holes	11 (8.7%)
Commercial/Industrial	5 (3.9%)
Water Supply (domestic/public/livestock)	86 (67.7%)
Cooling and A/C	1 (0.8%)
Irrigation	1 (0.8%)
Not Used	8 (6.3%)
Not Specified	15 (11.8%)

2.7.1 Source Water Protection

The Site is part of the Credit Valley – Toronto and Region – Central Lake Ontario (CTC) Source Protection Ara. The Site is located within a regulated area of Credit Valley Conservation Authority (Credit Valley Conservation, 2024). The Site is located within a Highly Vulnerable Aquifer (score of 6) and Significant Groundwater Recharge Area (MECP, 2023). The source protection area is presented in Appendix B.

Based on the soil encountered at the Site during the subsurface investigation and the results of the in-situ hydraulic conductivity tests, the predominant surficial soils within the Site and Study Area are low permeability glacial tills. While the larger, regional area is classified as a Highly Vulnerable Aquifer, the surficial soils of the Site and Study Areas do not behave as a Highly Vulnerable Aquifer.

2.8 Private Well Survey

A house-to-house water well survey within 500 m of the Site was completed on June 3, 2024 to characterize the groundwater resources of the area. Based on the private well survey, it was concluded that there are properties within a 500 m radius of the Site that rely on private well water. Areas to the north and west of the Site are located in a developed area of Halton Hills, and all properties are municipally serviced. Properties to the south and east are rural residential and anticipated to be on private water. Only one (1) property responded to Grounded's solicitation attempt to confirm private water well use east of the Site. The location of the wells surveyed are presented in Figure 2.

2.9 Results of Subsurface Investigation

2.9.1 Drilling

A subsurface investigation was conducted by Grounded at the Site on May 9 – 17, 2024. The field investigation is as below. Borehole logs are presented in Appendix G. The borehole and monitoring well locations are shown on Figures 3 and 4. A cross section is shown in Figure 7.

Boreholes	BH101 to 119
Monitoring Wells	BH101 to 104, 106, 107, 109, 112, 114, 115, 117 to 119
Date of Work	May 9 – 17, 2024
Name of the Contractor	3D Drilling
Equipment Used	Track mounted drill equipped with hollow stem augers and mud rotary drilling equipment

2.9.2 Site Soil Profile

The stratigraphy beneath the investigated areas of the Site generally consists of the following:

Geological Units	Description
Surficial and Disturbed Native Earth Fill	Surficial topsoil thicknesses were observed in individual borehole locations through the top of the open borehole. Thicknesses may vary between and beyond each borehole location. Boreholes 101, 102 and 104 to 119 encountered 100 – 250 mm of topsoil at ground surface. Underlying the surficial materials, the boreholes observed a layer of disturbed native earth fill that extends to depths of 0.8 to 2.3 meters below grade (Elev. 230.5 to 223.9 meters). The earth fill varies in composition but generally consists of sand, some silt, trace clay to sandy silt, clayey with trace gravel, and trace rootlets. The earth fill is typically brown to dark brown, and moist to wet.
Sands	Underlying the topsoil or disturbed native earth fill, Boreholes 105, 106, 109, 110, 112, 113 and 118 encountered a stratum of undisturbed native cohesionless sand, trace silt to silty sand at depths of 0.2 to 1.5 m below grade (Elev. 230.4 to 222.7 m) extending down to depths of 1.7 to 2.6 m below grade (Elev. 228.9 to 221.8 m). This unit contains trace clay, trace to some gravel, and is generally brown with orange to brown, and wet.
Native Glacial Till	Glacial till was encountered at all boreholes and generally consisted of clayey silt, some sand, and trace to some gravel. This unit was generally grey and wet to moist. At BH104 the glacial till consisted of silt and clay, some sand, trace gravel and at BH113 the till consisted of silty sand, some gravel, some clay. The till was encountered at depths of 0.8 to 2.6 mbgs (Elev. 229.7 to 221.8 m) and extended to the maximum drilling depth of 3.7 to 20.3 (Elev. 224.3 to 204.4 m) at BH104, BH105, BH106, BH107, BH108, BH109, BH110, BH111, BH122, BH113, BH114, BH115, BH116, BH117, BH118, BH119.

Geological Units	Description
Bedrock	Bedrock was inferred in Boreholes 101 to 103 underlying the silt and clay to clayey silt till at depths of 4.6 to 13.7 m below grade (Elev. 225.4 to 212.8 m). Rock coring was not included in this scope. The bedrock was inferred from observations of auger and split spoon resistance and limited sample recovery in the split spoons to depths of 6.2 to 15.3 below grade (Elev. 223.8 to 211.2 m), at which depths Boreholes 101 to 103 were terminated. The bedrock beneath the site is known to consist of reddish brown shale of the Queenston Formation, which typically has a weathered zone at the surface of the bedrock, which transitions to unweathered (sound) bedrock. Sound bedrock elevations were not determined in the boreholes, as this was not part of this scope of work.

2.10 Groundwater Level Monitoring

2.10.1 Monitoring Well Installation

A total of thirteen (13) monitoring wells were installed on the Site at BH101 to 104, 106, 107, 109, 112, 114, 115, 117 to 119. BH104 and BH106 were installed as nests with a both a shallow and deep well installed in close proximity in order to assess the vertical hydraulic gradient at the Site. A detailed table of monitoring well information is appended.

The monitoring wells were constructed using 51 mm Schedule 40 PVC risers and included 3 m well screens (slot 10) with the exception of BH106, which used a 1.5 m screen at both the shallow and deep well. Sand packs were placed in the annular space within the boreholes around the well screens from the bottom of the wells to approximately 0.3 m above the well screens. Bentonite hole plug was placed above the sand pack.

2.10.2 Groundwater Elevations and Flow

Groundwater elevations were recorded on May 27, 2024 and June 3, 2024 and are included on Table 1 (appended). These groundwater level measurements do not include seasonal fluctuations. Groundwater monitoring will continue over a 12-month period to capture seasonal variations at the Site. Pressure transducer dataloggers were installed at BH102, BH104-S and BH104-D to assess groundwater levels over a one-year period. The data loggers were installed in June and programmed to record a level every 12-hours. Hydrographs will be prepared following the 12-month groundwater monitoring period.

Groundwater levels fluctuate with time depending on the amount of precipitation and surface runoff and may be influenced by known or unknown dewatering activities at nearby sites.

Based on the groundwater elevations provided in Figure 8, shallow groundwater flow is directed as follows:

- In the north portion of the Site, groundwater flow is east with a horizontal hydraulic gradient in the glacial till (between BH114 and BH102) of approximately 0.018 m/m.
- In the central portion of the Site, groundwater flow is north with a horizontal gradient in the glacial till (between BH109 and BH104S) of approximately 0.008 m/m.
- In the southern portion of the Site, groundwater flow is east with a horizontal hydraulic gradient in the glacial till (between BH109 and BH106D) of approximately 0.01 m/m.

Based on the water levels in the nested monitoring wells, the following vertical hydraulic gradients were observed at the Site:

- 1.31 m/m downward at BH104
- 0.27 m/m downward at BH106

Both nested well locations showed a downward hydraulic gradient. Groundwater will continue to be monitored to determine if the gradient remains the same direction in both the dry and wet seasons. Additionally, the vertical gradient at BH104 is higher than anticipated in a glacial till. It is possible that the water level at BH104D has not yet stabilized. Upon further groundwater monitoring, updated hydraulic gradients will be calculated to confirm.

2.11 Groundwater Quality

A groundwater sample was obtained from a monitoring well on-site (BH109; sample ID *BH109-SW*) and submitted for laboratory analysis on May 27, 2024. The monitoring well was screened in clayey silt (glacial till). The sample was analyzed with respect to the Regional Municipality of Halton By-Law No. 2-03, Table 1 – Limits for Sanitary Sewers and Combined Sewers Discharge, the Ontario Drinking Water Standards (ODWS), and the Provincial Water Quality Objectives (PWQO). The results of the groundwater testing are presented in Appendix H and summarized below.

Criteria	Exceedance
Region of Halton Sewer By-Law, Table 1 – Limits for Sanitary Sewers and Combined Sewers Discharge Criteria	None
ODWS – Aesthetic Objective (AO)	Temperature (Limit 15 C, Result 18.9 C) Colour (Limit 5 CU, Result 350 CU) Hardness (Limit 80 – 100 mg/L, Result 400 mg/L) Turbidity (Limit 5 NTU, Result 83.2 NTU) Aluminum, total (Limit 0.1 mg/L, Result 17.7 mg/L), Iron, total (Limit 0.3 mg/L, Result 37.6 mg/L) Manganese, total (Limit 0.05 mg/L, Result 1.23 mg/L)

Criteria	Exceedance
ODWS – Maximum Acceptable Concentration (MAC)	E. coli (Limit 1 CFU/100 mL, Result 2 CFU/100 mL) Arsenic, total (Limit 0.01 mg/L, Result 0.0108 mg/L) Lead, total (Limit 0.01 mg/L, Result 0.0115 mg/L)
PWQO	Phosphorus, total (Limit 0.01 mg/L, Result 0.206 mg/L) Aluminum, total (Limit 0.075 mg/L, Result 17.7 mg/L) Arsenic, total (Limit 0.005 mg/L, Result 0.0108 mg/L) [1] Cobalt, total (Limit 0.0009 mg/L, Result 0.0154 mg/L) Copper, total (Limit 0.005 mg/L, Result 0.0649 mg/L) [2] Iron, total (Limit 0.3 mg/L, Result 37.6 mg/L) Lead, total (Limit 0.005 mg/L, Result 0.0115 mg/L) [3] Nickel, total (Limit 0.025 mg/L, Result 0.0348 mg/L) Vanadium, total (Limit 0.006 mg/L, Result 0.0328 mg/L) Zinc, total (Limit 0.02 mg/L, Result 0.0917 mg/L) [4] Cadmium, dissolved (Limit 0.0005 mg/L, Result 0.000234 mg/L) [5] Phenols, total (4AAP; Limit 0.001 mg/L, Result 0.0013 mg/L)

[1] Indicates the more stringent Interim PWQO has been applied. The PWQO limit of 0.01 mg/L for arsenic, total is not exceeded.

[2] Indicates interim PWQO criteria when hardness > 200 mg/L.

[3] Indicates interim PWQO criteria when hardness > 100 mg/L

[4] Indicates the more stringent Interim PWQO has been applied. The PWQO limit of 0.03 mg/L for zinc, total is also exceeded.

[5] As there is no criteria for cadmium, dissolved the most stringent criteria for cadmium, total has been applied. It is noted that since hardness > 100 mg/L, the criteria for cadmium, total is 0.0005 mg/L and is not exceeded by the result of 0.000191 mg/L for cadmium, total

There were no exceedances of the Halton Region sewer by-law. No additional treatment will be required prior to discharge to the sewer. To discharge to the natural environment, additional treatment will be required prior to discharge. Treatment can include (but is not limited to) settlement tanks and filtration systems.

2.12 Hydraulic Conductivity

2.12.1 In Situ Permeability Test (Single Well Response Test)

In situ single well response tests (SWRT) were conducted in select monitoring wells to assess the hydraulic conductivity of the underlying soil. Data from the SWRT were analyzed using the Bouwer and Rice method (1976). The table below summarizes the results of the hydraulic conductivity testing. The analyses are presented in Appendix I.

The hydraulic properties of the strata applicable to the site are as follows:

Well ID	Well Screen Elevation (masl)	Screened Geological Unit	Hydraulic Conductivity (m/s)
BH102	225.2 - 222.2	Clayey Silt (Glacial Till)	4.0×10^{-7}

Well ID	Well Screen Elevation (masl)	Screened Geological Unit	Hydraulic Conductivity (m/s)
BH103	217.3 - 214.3	Clayey Silt (Glacial Till) to Silt and Clay	3.35×10^{-8}
BH104-S	220.2 - 217.1	Silt and Clay (Glacial Till)	1.77×10^{-7}
BH104-D	208.0 – 204.9	Silt and Clay (Glacial Till)	3.20×10^{-8}
BH106-S	223.2 - 221.7	Sand	1.38×10^{-7}
BH106-D	219.6 - 218.1	Clayey Silt (Glacial Till)	8.36×10^{-8}
BH107	222.8 - 219.7	Clayey Silt (Glacial Till)	7.39×10^{-8}
BH109	226.1 - 223.0	Clayey Silt (Glacial Till)	5.44×10^{-8}
BH112	225.7 - 222.7	Clayey Silt (Glacial Till) to Clayey Silt	1.59×10^{-7}
BH114	228.9 - 225.8	Clayey Silt (Glacial Till) to Silt and Clay	1.17×10^{-7}

The hydraulic conductivity of the glacial till is on the order of 10^{-7} to 10^{-8} m/s (indicating an aquitard). There would generally be very limited production of water from any trenches or foundations within this unit. A discontinuous silty sand was identified at a few locations. The sand was in a moist to wet condition. The hydraulic conductivity measured at BH106S was about 10^{-7} m/s. The water in the sand appears to be perched and based on the hydraulic conductivity would generally have low rates of groundwater flow.

2.12.2 Grain Size Analysis

Grain size analyses were conducted on representative soil samples through sieve and hydrometer analysis. The analysis is summarized below and presented in Appendix J.

The hydraulic conductivities of various soil types can also be estimated from grain size analyses. An assessment of the grain sizes was conducted using the excel-based tool, HydrogeoSieve XL (*HydrogeoSieve XL ver.2.2, J.F. Devlin, University of Kansas, 2015*). HydrogeoSieve XL compares the results of the grain size analyses against fifteen (15) different analytical methods.

Given our experience in the area as well as published literature, some of the geometric means provided for the soil were biased low by one or more methods. In these instances, the values determined by these methods were excluded from the mean. The table below illustrates the hydraulic conductivity values estimated from the mean of the analytical methods where the soil met the applicable analysis criteria.

Sample ID	Soil Description	Applicable Analysis Methods	Hydraulic Conductivity (m/s)
BH102 SS5	Clayey Silt (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen	5.1×10^{-9}

Sample ID	Soil Description	Applicable Analysis Methods	Hydraulic Conductivity (m/s)
BH103 SS8	Silt and Clay	Sauerbrei, Barr, Alyamani and Sen	6.6×10^{-10}
BH103 SS9	Clayey Silt (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen	4.5×10^{-9}
BH104 SS6	Silt and Clay (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen	2.6×10^{-9}
BH104 S16	Silt and Clay (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen	4.3×10^{-10}
BH106 SS3	Sand	Beyer, Sauerbrei, USBR, Barr, Alyamani and Sen, Krumbein and Monk	7.2×10^{-5}
BH112 SS6	Clayey Silt	Sauerbrei, Barr, Alyamani and Sen	1.7×10^{-9}
BH113 SS4	Silty Sand (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen, Krumbein and Monk	4.1×10^{-7}
BH113 SS5	Silty Sand (Glacial Till)	Sauerbrei, Barr, Alyamani and Sen	2.1×10^{-8}

Based on the in situ testing and grain size analysis, the Site consists of low permeability soils and is not considered to be significant in terms of groundwater recharge.

2.12.3 Literature

According to Freeze and Cherry (1979), the typical hydraulic conductivity of the strata investigated at the site are:

Stratum/Formation	Hydraulic Conductivity (m/s)
Silts	10^{-5} to 10^{-9}
Glacial Tills	10^{-6} to 10^{-12}
Clays	10^{-9} to 10^{-12}
Bedrock (Shale)	10^{-6} to 10^{-13}

2.13 Infiltration Testing

Infiltration testing will be conducted at a later stage of design.

2.14 Surface Water Features

A site inspection was conducted to assess the presence of surface water features on or immediately adjacent to the Site. The inspection includes the following:

- Inspection of surface and groundwater interactions and associated features
- Inspection of areas of actual and potential groundwater discharge
- Inspection of swales and drainage courses

- Evidence of phreatophytic vegetation, which may indicate seasonally high groundwater levels and/or groundwater discharge and seepage

The site inspection was conducted on June 10, 2024. It is noted that there is a change in elevation between the northern and southern boundary of the Site decreasing approximately 6 m in elevation. The northern boundary of the Site has a steep decline in topography of approximately 20 m. Notable features are summarized as follows:

- Ground cover was an agricultural field, with no vegetation growth at present.
- A drainage swale was present at the east boundary of the site. No water (flowing or pooled) was observed during the site inspection. Surface water flow is anticipated intermittently in this swale.
- Online mapping shows a north-south orientated drainage swale located in the field in the west of the Site (MECP, 2023). During the site inspection, the soil in this area was observed to be wet with discrete areas of pooled water, however, there was no channelized flow observed. Surface water flow is anticipated intermittently.
- A small, poorly drained depression was observed in the central portion of the west field, where surface water pools. It was characterized by cattails, reeds, and standing water. The perimeter of soil around this area was moist. No flow was observed.
- The West Branch of the Credit River was also observed during the site inspection. The river valley appeared to be steep in some areas with other locations observed to have flood plains of moderate relief. Bedrock outcrops were present along the valley walls and river bed. During the site inspection, no seepage was observed along the bedrock walls. Flow was north to east towards the Credit River.

3 Discussion and Analysis

3.1 Proposed Development Plan

The proposed development plan is presented in Appendix A.

The Draft Plan of Subdivision dated February 20, 2024 proposed a new residential subdivision comprised of townhouses and single detached houses at the site. Included in the development are SWM ponds, a park, and a future area for mixed uses. The northern boundary of the site will remain as natural area (Greenbelt Lands). Detailed design plans are not available at this time.

3.2 Summary of Hydrogeologic Conditions

The results of the study indicate that the Site hydrogeological characteristic can be summarized as follows:

- Generally, the Site stratigraphy consists of surficial deposits of low permeability native glacial till soils (clayey silt). Discontinuous sand was found overlying the glacial till along the central to south side of Site. Bedrock was inferred at three locations at depths of 4.6 mbgs to 13.7 mbgs.
- The hydraulic conductivity of clayey glacial tills is on the order of 10^{-7} to 10^{-8} m/s. The glacial till is an aquitard with very low groundwater flow rates and limited groundwater transmission.
- The hydraulic conductivity of the surficial silty sand was measured to be 10^{-7} m/s. The hydraulic conductivity of the sand may be higher in areas where it contains less silt. This unit was discontinuous and in a moist to wet condition. As such, it doesn't represent a significant groundwater transmission zone or aquifer.
- The unconfined water table was measured between 0.4 mbgs and 18.17 mbgs (Elev. 229.89 to 206.41 masl) across the Site. There appears to be seasonally perched water within the surficial sand.
- Based on the groundwater levels recorded at the Site, shallow groundwater flow is generally directed to the east.
- There is a downward vertical gradient at BH104 and BH106 at the Site. The horizontal gradient within the overburden at the Site was between 0.008 and 0.018 m/m.

3.3 Water Budget

The surficial deposits of low permeability soils at the Site allows little groundwater recharge into the shallow groundwater system. One of the overall objectives during development should be to ensure that the overall volume of groundwater recharge is not significantly impacted. A preliminary water budget for the Site was prepared to assess the distribution of rainfall, runoff, and infiltration for existing (pre-development) conditions. This model is based on the climate data presented in Section 2.4 of this report. The Thornthwaite method was used to calculate the relative balance between rainfall, evaporation, and evapotranspiration in a shallow soil zone. In summary, the total shallow groundwater recharge component for the site is approximately 125 mm/a.

The Thornthwaite method was used to evaluate the relative balance between rainfall, evaporation and evapotranspiration in the shallow soil zones. The water balance for pre-and post-development conditions is summarized below:

Pre- and Post-Development Water Balance

	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	518,600	418,406	189,289	64,825	164,292
Post-Development	518,600	418,406	84,136	28,814	306,164
Change	N/A	N/A	105,153	36,011	-141,872

There will be an infiltration deficit following development of the site without mitigation measures. These calculations will be updated following the design of mitigation measures for the Site.

The post-development water balance accounts for hard surfaced areas created by buildings and pavements. The Draft Plan of Subdivision dated February 20, 2024 was referenced to determine high level proposed land use statistic information for a preliminary post-development water balance. It is important to note that these calculations will be revised at the detail design stage. The following assumptions were made for impervious and pervious land cover:

Land Use	Assumed Impervious Area
Detached Homes	50%
Townhomes	70%
Mixed Use	50%
Park	10%
Open Space/Greenbelt lands	0%
Walkway/Servicing/Roads/Grading Area	100%
SWM Pond	80%

**The land to be severed at the north of the Site was not included as part of this water balance*

3.4 Excavations and Groundwater Control

Shallow excavations (i.e., 2 to 3 mbgs) are anticipated for basements within the residential areas and will be below the groundwater level. Seepage from the glacial till is expected to be minimal such that groundwater flow into basements may be controlled using localized sumps and pumps.

Consideration should be given to raising site grades if minor base flow in foundation drains is undesirable.

Groundwater flow may occur into the open shallow excavations if more permeable deposits (such as sand or gravel) are encountered; however, based on the results of the subsurface investigation, active groundwater control (such as from wells or well points) is not anticipated during construction. Localized groundwater flow into shallow excavations can be controlled by utilizing localized sumps and pumps at the base of the excavations. In addition to this, it is recommended that any excavations should be staged or constructed in such a manner to avoid the collection of overland drainage.

Excavations will not extend to bedrock; dewatering of the bedrock is not required.

A Permit to Take Water (PTTW) or an Environmental Activity and Sector Registry (EASR) may be required if water takings are anticipated to exceed 50,000 L/day. It is unlikely that a PTTW will be required for groundwater control activities. Given the low permeability of the soils, it is expected that limited volumes of water would seep into excavations. Minor seepage may occur from discontinuous sand seams found within the glacial till. An EASR may be needed for control of seepage from perched groundwater depending upon construction approach, staging, and timing.

If necessary, construction dewatering would consist of pumping from strategically placed sumps. A groundwater control system would need to be designed and operated by an experienced contractor. The details of the dewatering system and construction details of the sewers are not known at this time; however, a dewatering system would likely be unnecessary if limited excavations are left open, as is normal site servicing practice. As such, the required water taking rates and volumes cannot be determined at this time. They will be a function of the design of the dewatering system and the contractor's approach, the proposed method of dewatering, and the use of other construction methods to control the flow of groundwater (such as the implementation of flow barriers).

Once the details of the servicing program are known, it is recommended that a dewatering plan be developed at the detailed design stage.

It is also recommended that the grading plans be reviewed to determine where basements might intersect the water table and if so, it is recommended to conduct a test pit investigation program in areas where the basement excavations will intersect the shallow groundwater to confirm the limited potential for groundwater inflows at these locations.

3.5 Assessment of Low Impact Development (LID) Measures

It is understood that the proposed development will be a new residential subdivision comprised of townhouses, single detached houses, SWM pond, a park, a future area for mixed uses, and natural area (Greenbelt Lands). The Property will be serviced with municipal piped water, storm

and sanitary sewers. The proposed nature of the development does not pose any significant concern with respect to potential impact to groundwater quality in the area.

3.5.1 Mitigation Measures to Maintain Hydrogeologic Functions

3.5.1.1 Maintenance of Groundwater Recharge

The existing groundwater recharge rates at the Site are approximately 125 mm/a. This recharge occurs in a broad diffuse manner over the entire Site. The currently proposed development concept will result in a decrease in groundwater recharge at the Site, mostly due to the construction of impermeable surfaces (i.e., pavement, buildings, roofs, driveways, etc.). The impervious surfaces tend to reduce groundwater recharge and increase surface water runoff.

There is a surplus of water available following development to maintain groundwater recharge and function. Given the low permeability of the soil at the site, engineered infiltration systems (such as galleries, trenches, and soak away pits) are not recommended. In order to maintain groundwater recharge for the Site, passive LID methods should be implemented. LID techniques should focus on a best management practice approach. These measures may include increased topsoil thickness to promote storage in near surface soils, bioretention and naturalized areas, and the promotion of residential stormwater landscaping, including rainwater harvesting, green roofs and permeable pavement. Mitigation measures are available to maintain recharge rates; however, as noted previously, engineered infiltration measures (such as soak away pits, infiltration trenches, etc.) are not recommended for the Site.

3.5.1.2 Maintenance of Groundwater Transmission Pathways

As previously indicated, the soils present on the Property are of low permeabilities. No significant groundwater flow or transmission zones were encountered on the Property; however, the overall continuity of the groundwater flow at the Site should be maintained, where practical. Generally, the groundwater transmission pathways can be maintained through the following means:

- Bedding materials beneath underground services may serve as a subdrain to collect and convey groundwater. To prevent drainage of groundwater along bedding materials, clay trench plugs should be provided at all manhole locations in order to cut off the granular bedding.
- The excavation of any underground services or utilities across permeable layers may interrupt the groundwater flow. It is recommended that trench backfilling be carried out with materials that are similar to the materials that have been excavated.

4 Summary and Conclusions

- The subsurface investigation conducted at the Site indicates that the stratigraphy consists of surficial deposits of low permeability native glacial till soils. Surficial

discontinuous sand was found overlying the glacial till at some borehole locations. Bedrock was inferred at three locations at depths of 4.6 to 13.78 mbgs (Elev. 225.4 to 212.8 masl).

- Hydrogeologic features noted on the Site include the West Branch of the Credit River north of the Site and an ephemeral drainage swale along the southern portion of the west field.
- Shallow groundwater levels within the overburden at the Site indicate that the general direction of groundwater flow is to the east. The rate of shallow groundwater flow at the Site will be very low within the glacial till.
- The results of the water budget indicate that there is an infiltration deficit without mitigation measures. Engineered infiltration measures are not recommended. Passive LID measures are more appropriate for this Site, such as increased topsoil thickness, bioretention, and promotion of stormwater landscaping, due to the high groundwater levels and low hydraulic conductivity.
- Based on the shallow groundwater depths at the Site, most shallow excavations (i.e., 2-3 mbgs) will be below the observed shallow groundwater level. Seepage is expected to be limited as a result of the low permeability glacial till. Localized groundwater flow into shallow excavations is anticipated to be able to be controlled using localized sumps and pumps at the base of the excavations. Raising site grades to maintain the excavations above the observed shallow groundwater level may be considered but, given the low conductivity of the soil and the anticipated minimal influx of groundwater, likely is unnecessary.
- Groundwater controls may be required during the construction of the storm and sanitary sewers, as the excavation floor will be below the observed shallow groundwater levels. While groundwater inflows are expected to be small, further detailed assessment and a dewatering plan are recommended at the design stage.
- In general, Site design measures should incorporate the following: carrying out excavation or trench backfilling operations with materials that are similar to the materials that have been excavated. The provision of trench plugs to cut off granular bedding at manhole locations when the utilities are installed below the observed shallow groundwater level. The use of trench plugs should be determined based on field conditions.
- The monitoring wells installed at the Site need to be maintained in accordance with the Ontario Water Resources Act, O.Reg. 903. Once the wells are no longer required for monitoring or sampling purposes, these wells will need to be appropriately decommissioned by a licensed well contractor as required by O.Reg. 903.

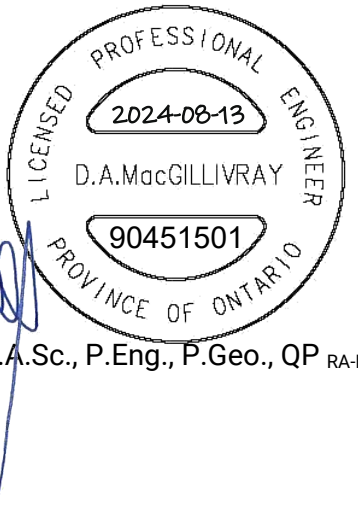
4.1 Signatures

The Hydrogeological Assessment was conducted by Haley Gazo, M.Sc., P.Geo. under the supervision of David MacGillivray, M.A.Sc, P.Eng., P.Geo., QP $_{\text{RA-ESA}}$.

We trust that this report meets your requirements at present.

For and on behalf of our team,

GROUNDED ENGINEERING



Haley Gazo, M.Sc., P.Geo.
Project Geoscientist

David MacGillivray, M.A.Sc., P.Eng., P.Geo., QP RA-ESA
Associate

5 References

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6 Limitations and Restrictions

The assessment should not be considered a comprehensive investigation that eliminates all risks of encountering environmental problems. The information presented in this report is based on information collected during the completion of the Hydrogeological Assessment by Grounded Engineering Inc. It was based on the conditions on the Hydrogeological Assessment at the time of the site inspection supplemented by a review of historical information to assess the environmental conditions regarding the Site.

There is no warranty expressed or implied by this report regarding the hydrogeologic conditions of the Site. Professional judgement was exercised in gathering and analysing information collected by our staff, as well as that submitted by others. The conclusions presented are the product of professional care and competence and cannot be construed as an absolute guarantee.

If new information regarding the hydrogeological condition of the Site is identified during future work, or outstanding responses from regulatory agencies indicate outstanding issues on file with respect to the Site, Grounded Engineering Inc. should be notified so that we may re-evaluate the findings of this assessment and provide amendments.

7 Report Use

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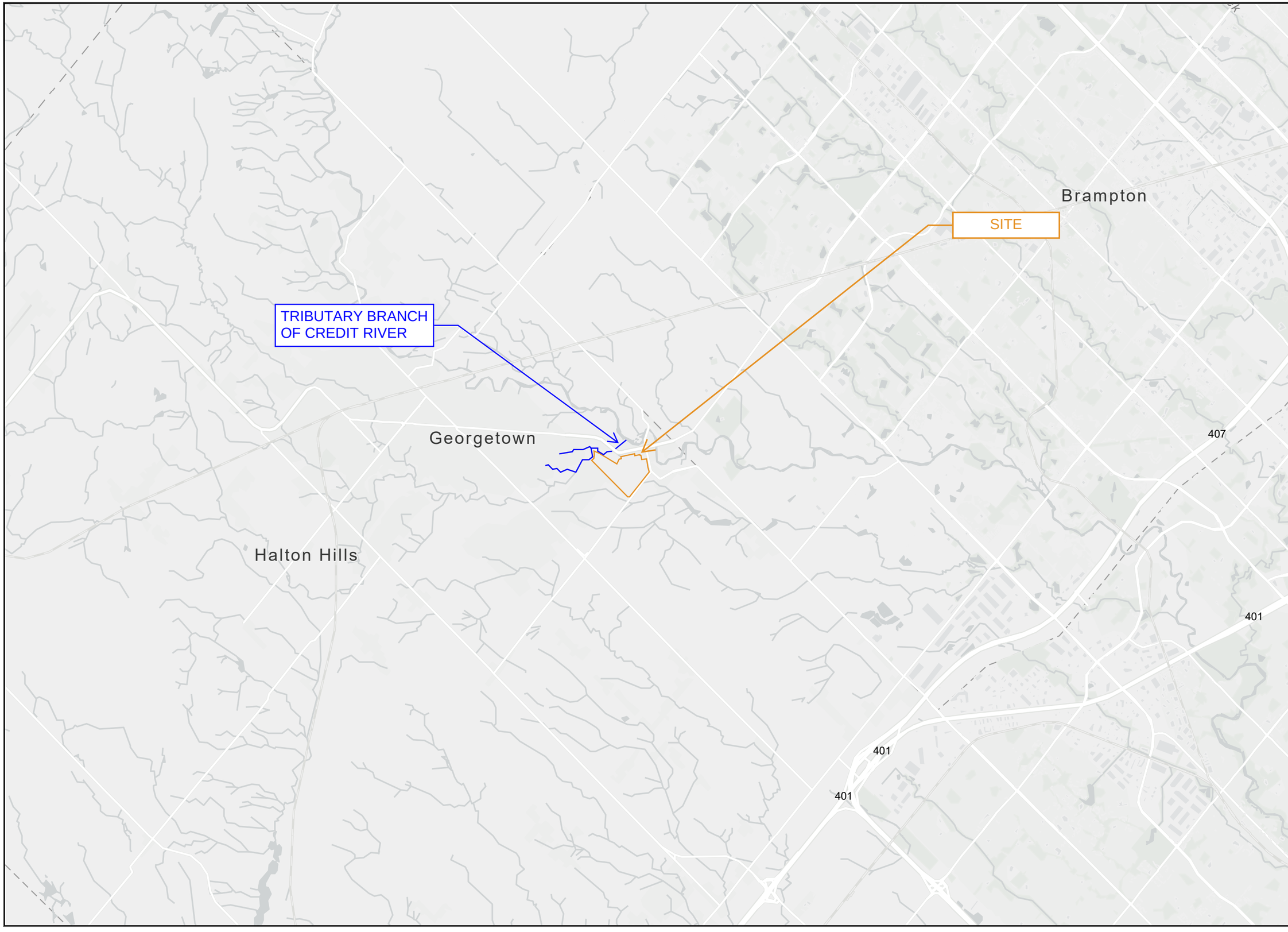
FIGURES



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1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- WATER BODY

Note

Reference

ArcGIS Online 2024

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

SITE LOCATION PLAN

North

TRUE
PROJECT

Date

AUGUST 2024

Scale

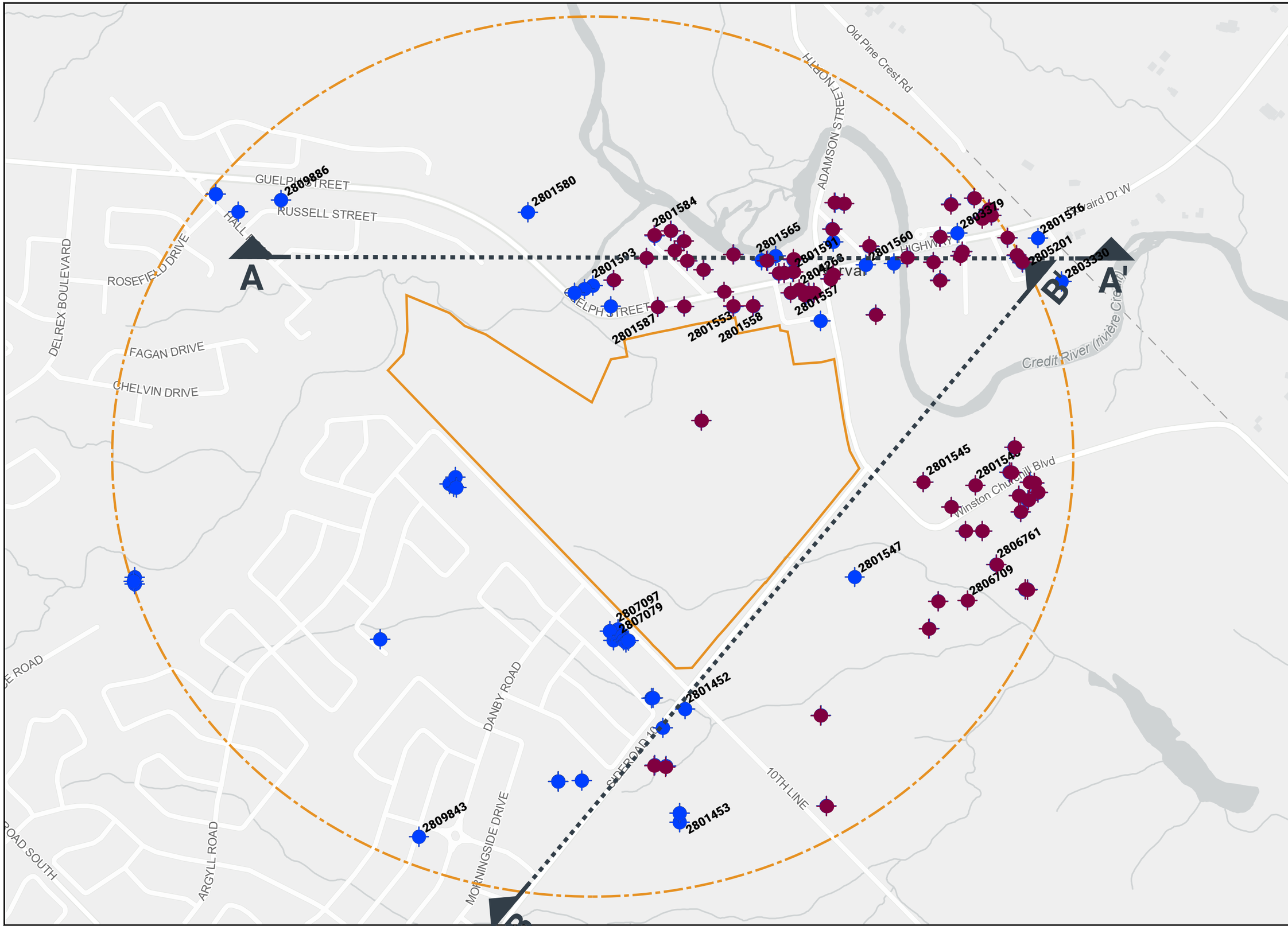
0m 1000m 2000m

Job No

24-048

Figure No

FIGURE 1



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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- STUDY AREA (500 m RADIUS)
- MECP WELL LOCATION
- MECP WELL LOCATION INCLUDE IN PRIVATE WELL SURVEY
- 1234567 WELL TAG NUMBER
- CROSS SECTION LINE

Note

Reference

ArcGIS Online 2024

Ontario Map :Well Records

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

STUDY AREA MAP

North

TRUE PROJECT

Date

AUGUST 2024

Scale

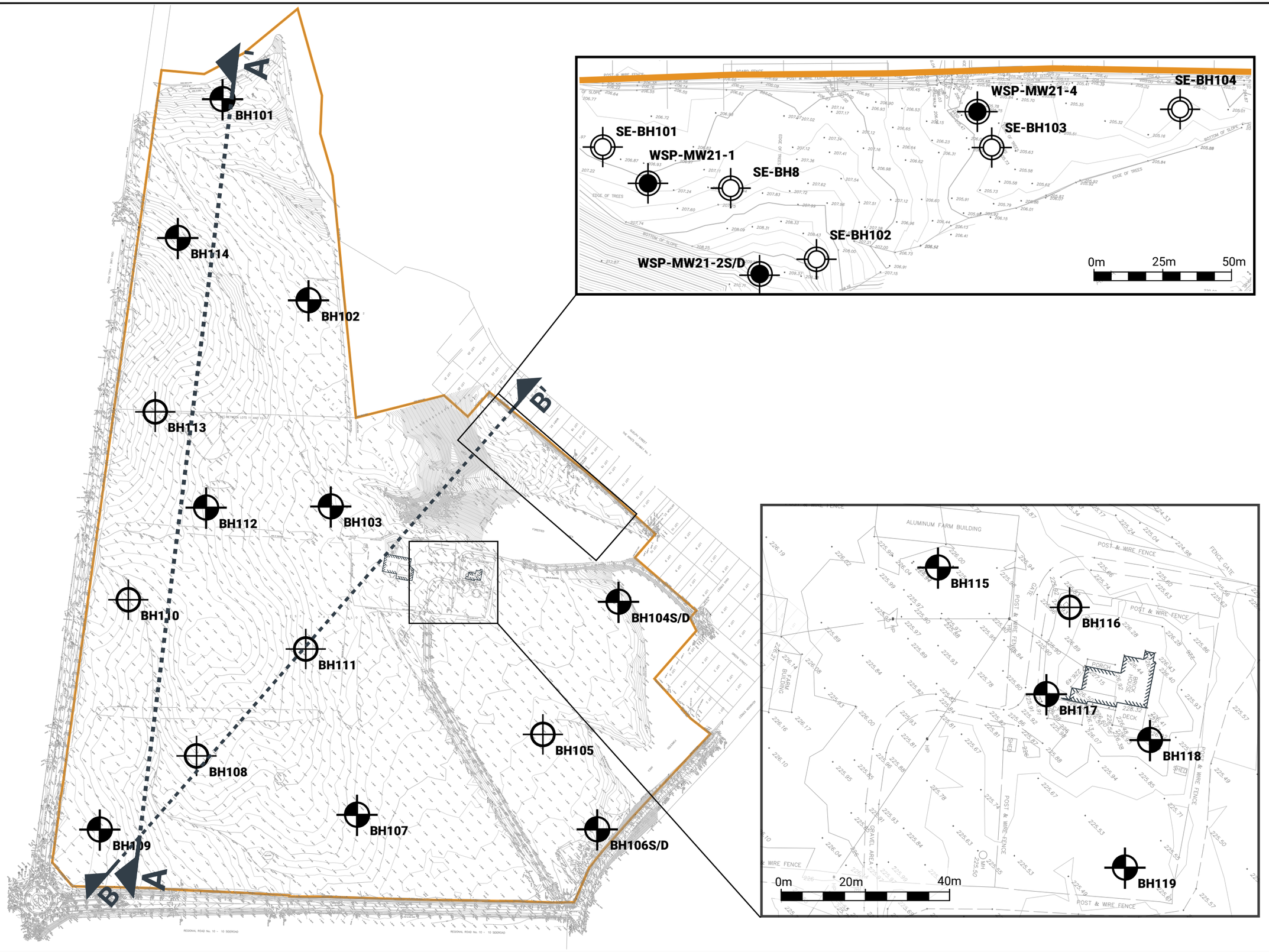
0m 100m 200m

Job No

24-048

Figure No

FIGURE 2



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LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING STRUCTURE
- MONITORING WELL/BOREHOLE BY GROUNDED
- CROSS SECTION LINE

Note

Reference

Survey Drawing job no.
15-30-736-00-2020Topo
Dated March 06, 2020
Prepared by J.D.BARNES LTD.
Received on May 07, 2024.

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN - EXISTING SITE CONDITIONS

North

TRUE
PROJECT

Date

AUGUST 2023

Scale

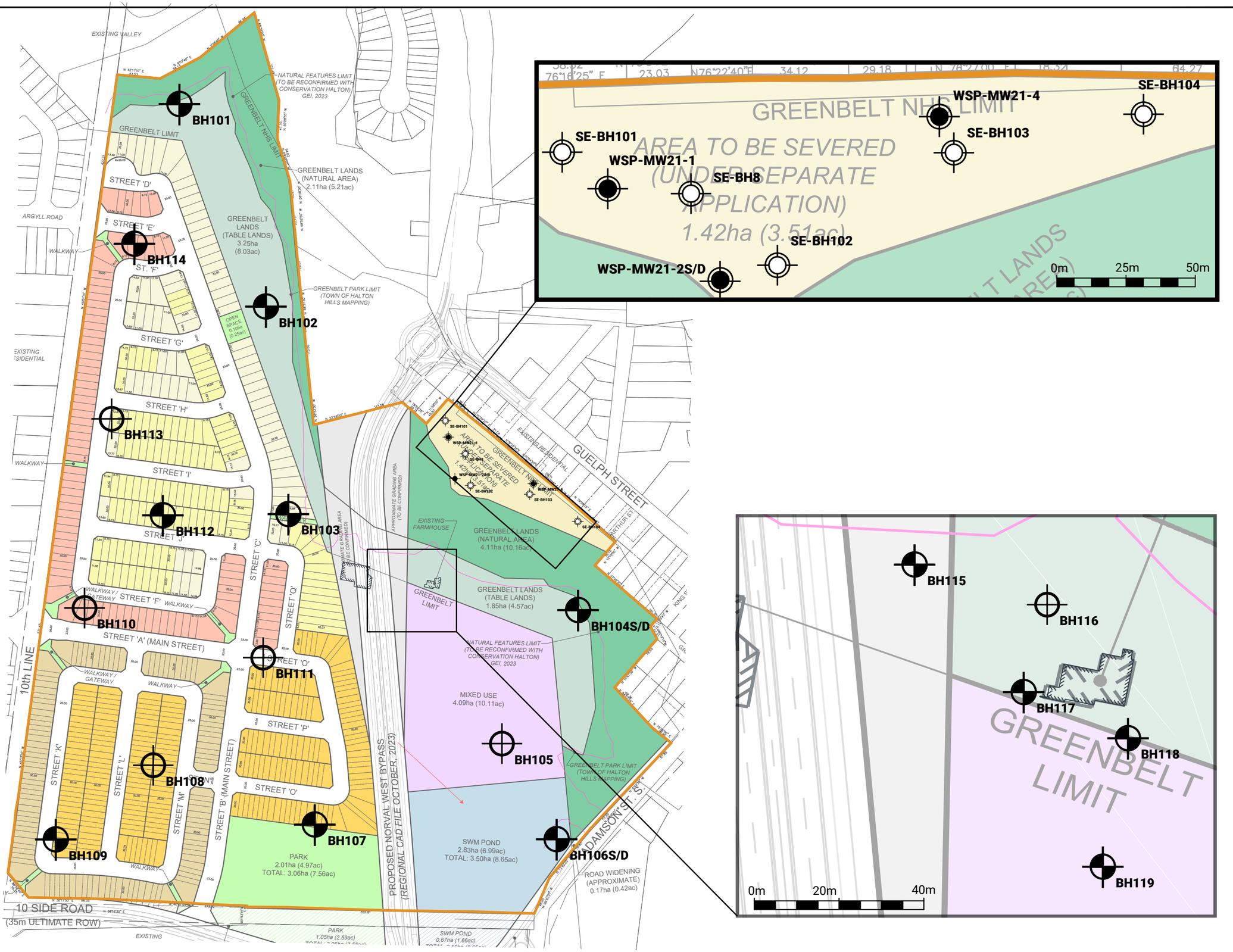
0m 50m 100m

Job No

24-048

Figure No

FIGURE 3



GROUNDED ENGINEERING

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www.groundedeng.ca

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING STRUCTURE
- MONITORING WELL/BOREHOLE BY GROUNDED

Note

Reference

DRAFT PLAN OF SUBDIVISION
Dated February 20, 2024
Prepared by Glen Schnarr and Associates Inc.
Received on March 14, 2024.

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

BOREHOLE LOCATION PLAN - PROPOSED SITE CONDITIONS

North

TRUE PROJECT

Date

AUGUST 2024

Scale

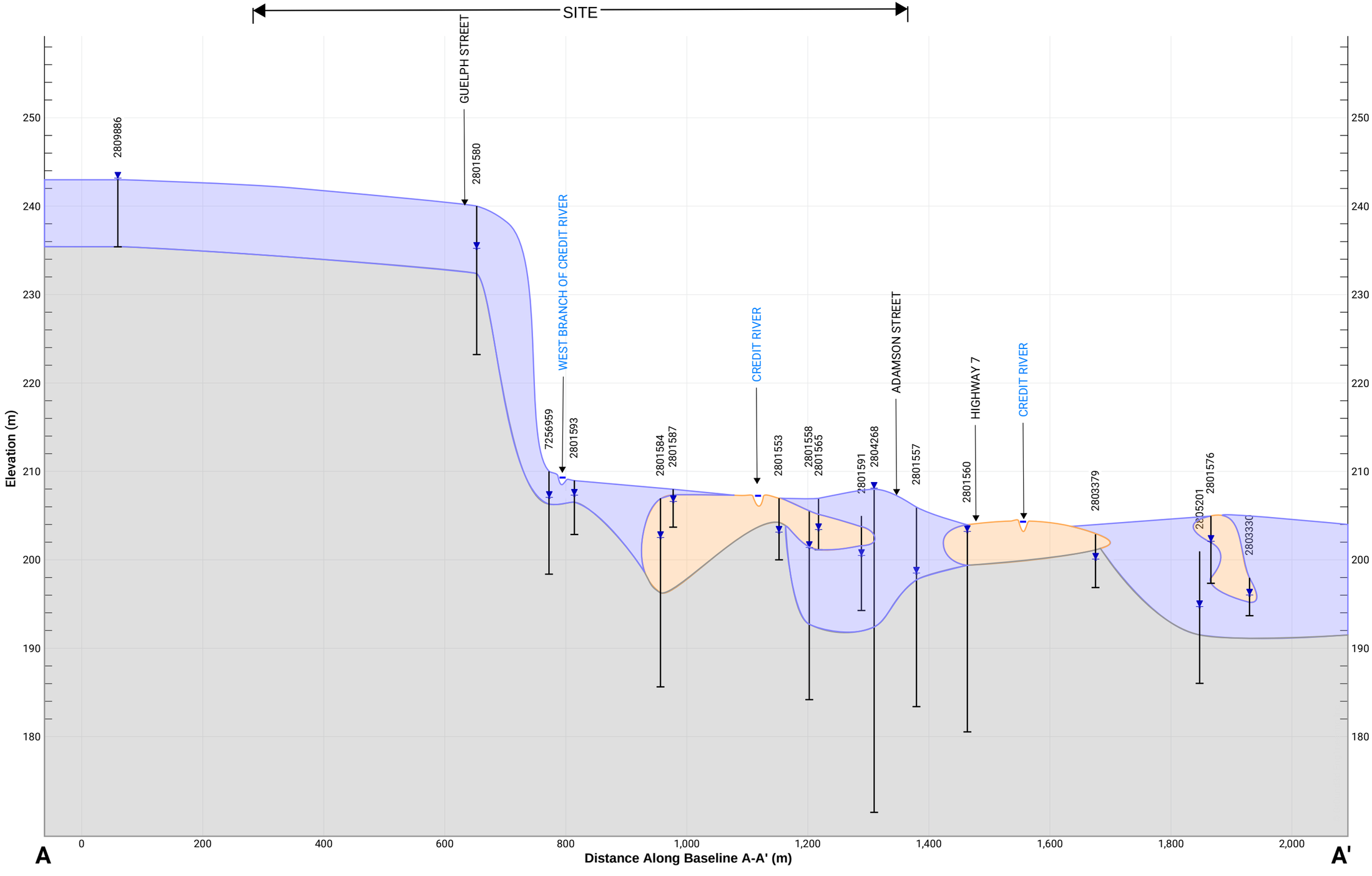
0m 50m 100m

Job No

24-048

Figure No

FIGURE 4



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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- WATER BODY
- SANDS
- GRAVELS
- GLACIAL TILL
- BEDROCK
- water level, stabilized
- 2803330 MECP WELL RECORD IDENTIFIER

Note

Reference

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

MECP CROSS-SECTION A-A'

North

Date

AUGUST 2024

Scale

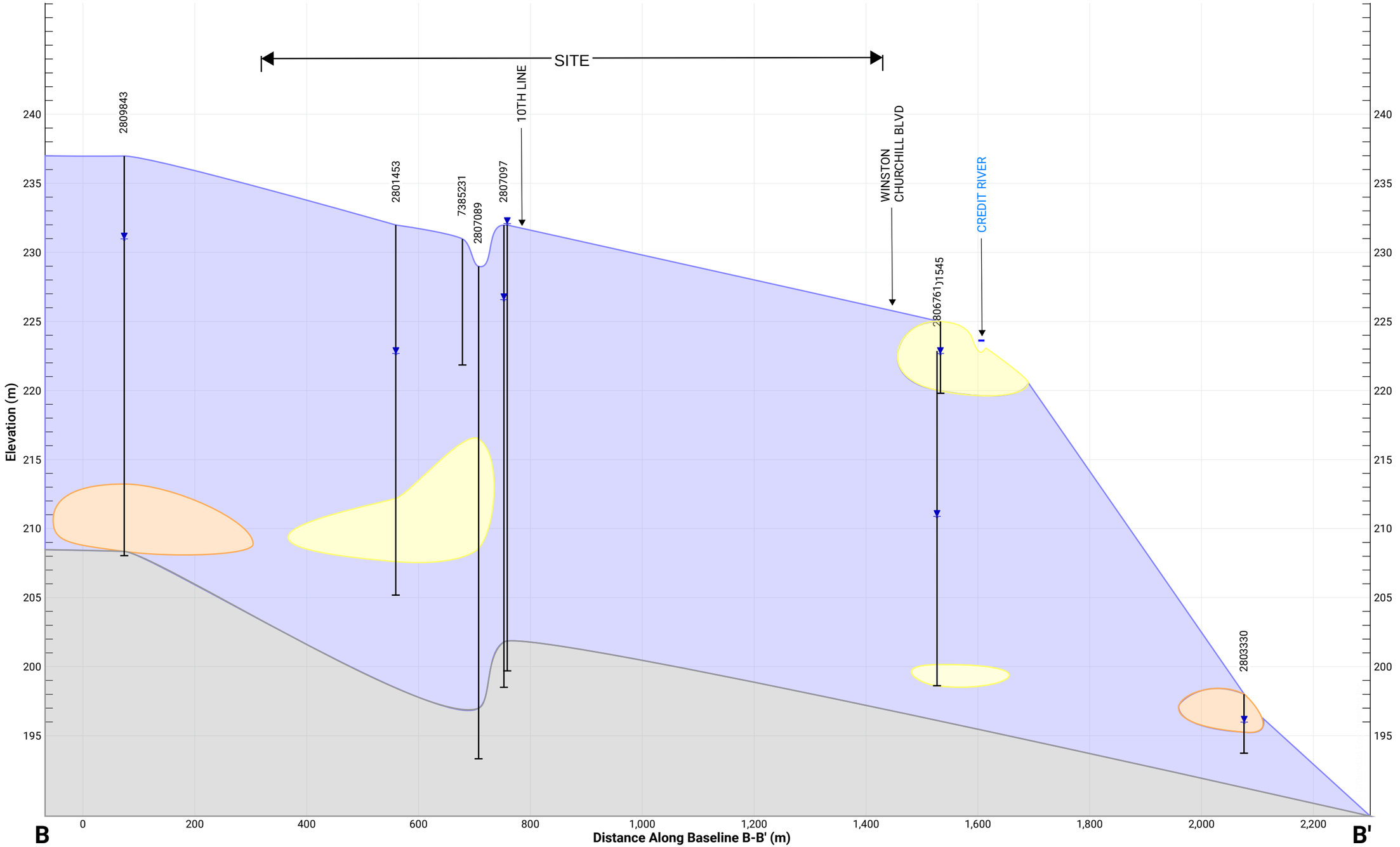
AS INDICATED

Job No

24-048

Figure No

FIGURE 5



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LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- WATER BODY
- SANDS
- GRAVELS
- GLACIAL TILL
- BEDROCK
- water level, stabilized

Note

Reference

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

MECP CROSS-SECTION B-B'

North

Date

AUGUST 2024

Scale

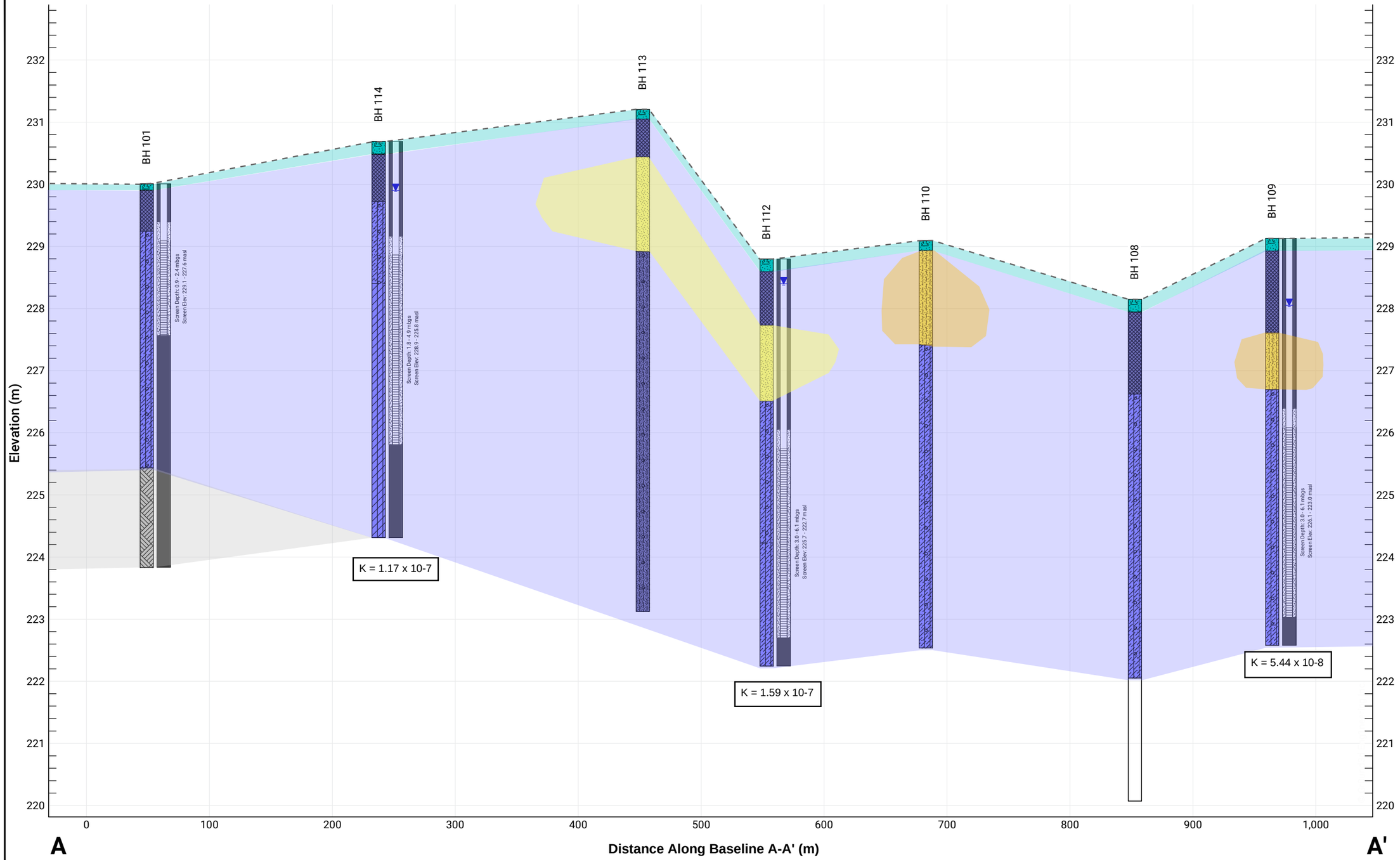
AS INDICATED

Job No

24-048

Figure No

FIGURE 6



GROUNDED ENGINEERING
1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
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LEGEND

- TOPSOIL
- SANDS
- SILTY SAND
- GLACIAL TILL
- BEDROCK
- water level, stabilized

Note

K = 1.77 x 10-7

Indicates hydraulic conductivity value (m/s) determined through single well response tests.

Reference

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

HYDROGEOLOGIC CROSS-SECTION A-A'

North

Date

AUGUST 2024

Scale

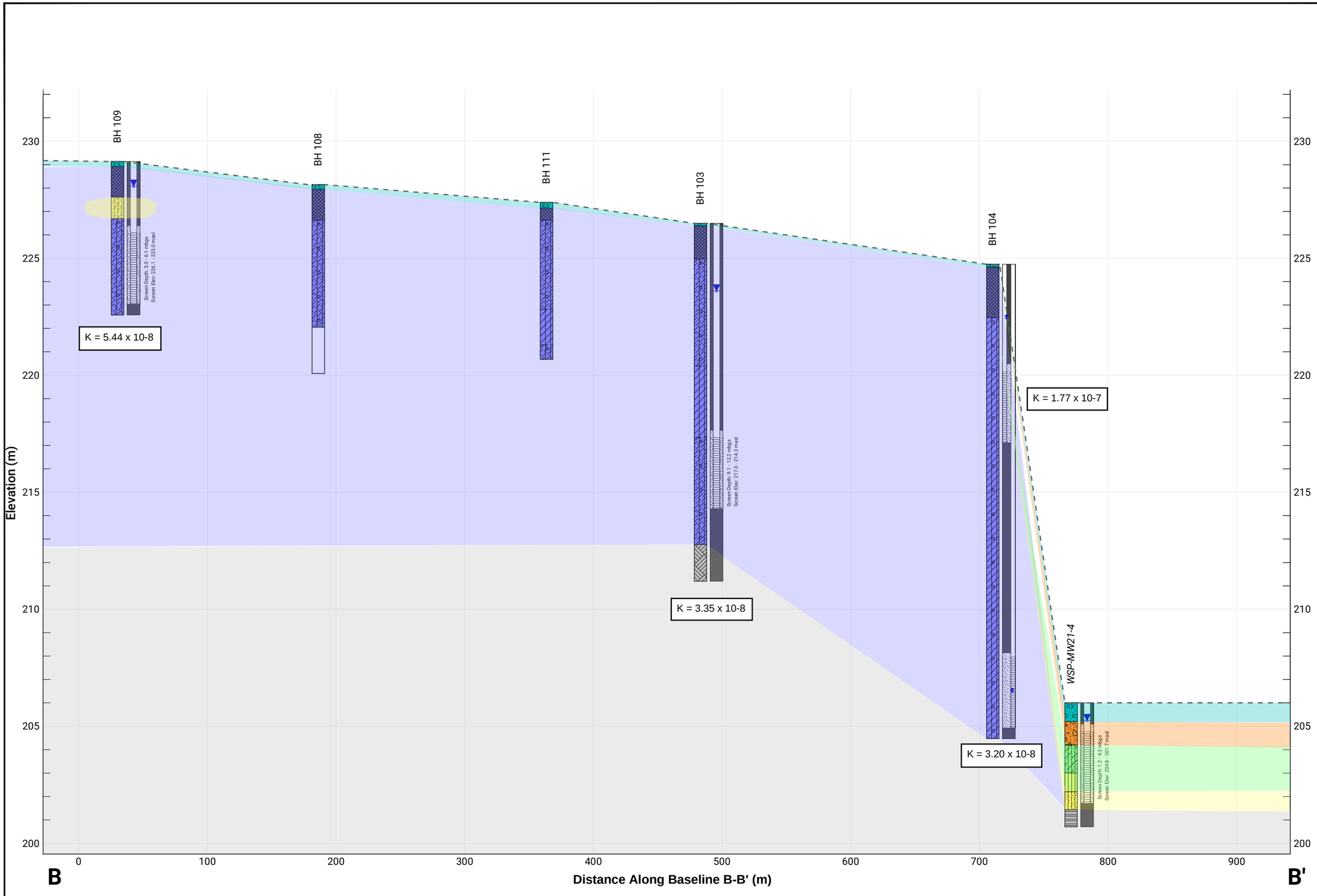
AS INDICATED

Job No

24-048

Figure No

FIGURE 7



GROUNDED ENGINEERING

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LEGEND

- TOPSOIL
- GRAVELS
- SANDS
- SILTS
- GLACIAL TILL
- BEDROCK
- water level, stabilized

Note

K = 1.77 x 10-7

Indicates hydraulic conductivity value (m/s) determined through single well response tests.

Reference

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

HYDROGEOLOGIC CROSS-SECTION B-B'

North

Date

AUGUST 2024

Scale

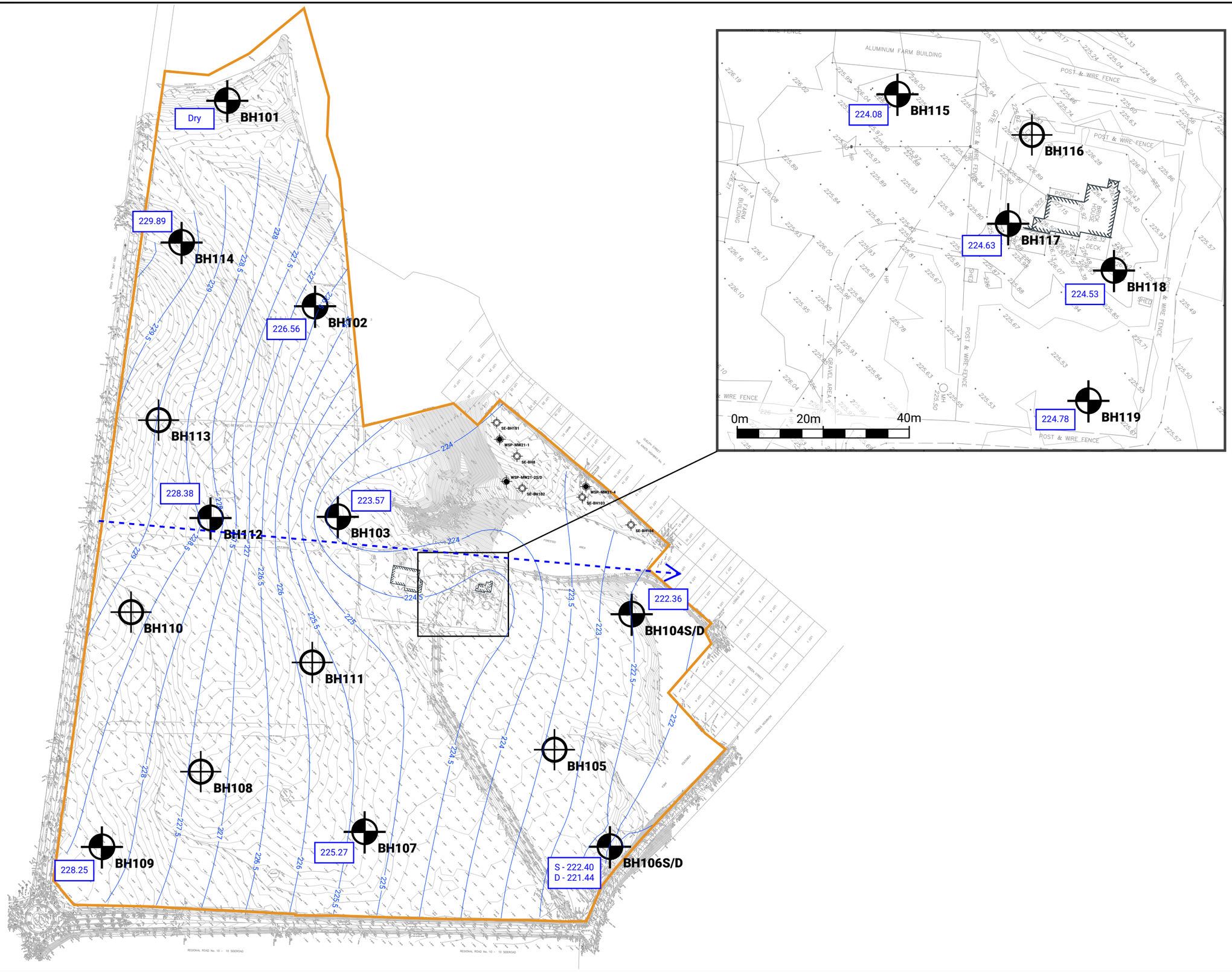
AS INDICATED

Job No

24-048

Figure No

FIGURE 8



GROUNDED ENGINEERING

1 BANIGAN DRIVE, TORONTO, ONT., M4H 1G3
www.groundedeng.ca

LEGEND

- PROPERTY BOUNDARY
- EXISTING BUILDING STRUCTURE
- MONITORING WELL/BOREHOLE BY GROUNDED
- 119.45 GROUNDWATER ELEVATIONS (masl)
- 119.4 GROUNDWATER CONTOURS (masl)
- APPROXIMATE GROUNDWATER FLOW DIRECTION

Note

Groundwater elevation data used was collected during the June 3, 2024 monitoring event.

Reference

Survey Drawing job no.
15-30-736-00-2020Topo
Dated March 06, 2020
Prepared by J.D.BARNES LTD.
Received on May 07, 2024.

Project

16469 10 SIDE ROAD, NORVAL, ONTARIO

Figure Title

GROUNDWATER ELEVATIONS AND FLOW

North

TRUE
PROJECT

Date

AUGUST 2023

Scale

0m 50m 100m

Job No

24-048

Figure No

FIGURE 9

TABLES

Table 1: Groundwater Monitoring Data

Monitoring Well ID	Ground Surface Elevation (maSL)	Screened Interval (maSL)	Strata Screened	Date (mm/dd/yy)	Depth to Groundwater (mbgs)	Groundwater Elevation (maSL)
101	230	229.1 - 227.6	Sandy silt (Glacial Till)	2024-05-27	Dry	Dry
				2024-06-03	Dry	Dry
102	227.4	225.2 - 222.2	Sandy silt to silt (Glacial Till)	2024-05-27	0.9	226.50
				2024-06-03	0.84	226.56
103	226.5	217.3 - 214.3	Sandy silt (Glaciall Till) to Clayey silt	2024-05-27	2.85	223.65
				2024-06-03	2.93	223.57
104-S	224.7	220.2 - 217.1	Sandy silt (Glacial till)	2024-05-27	2.42	222.28
				2024-06-03	2.3	222.36
104-D	224.7	208.0 - 204.9	Sandy silt (Glacial till)	2024-05-27	18.17	206.53
				2024-06-03	18.3	206.41
106-S	224.2	223.2 - 221.7	Sand	2024-05-27	1.55	222.65
				2024-06-03	1.8	222.40
106-D	224.2	219.6 - 218.1	Sandy silt (Glacial Till)	2024-05-27	2.93	221.27
				2024-06-03	2.76	221.44
107	225.8	222.8 - 219.7	Sandy silt (Glacial Till)	2024-05-27	0.6	225.19
				2024-06-03	0.5	225.27
109	229.1	226.1 - 223.0	Sandy silt (Glacial Till)	2024-05-27	1.1	228.00
				2024-06-03	0.85	228.25
112	228.8	225.7 - 222.7	Clayey Silt to Sandy silt (Glacial Till)	2024-05-27	0.4	228.40
				2024-06-03	0.42	228.38
114	230.7	228.9 - 225.8	Clayey Silt to Sandy silt (Glacial Till)	2024-05-27	2.2	228.50
				2024-06-03	0.8	229.89
115	226	224.5 - 221.4	Sandy silt (Glacial till)	2024-05-27	1.96	224.04
				2024-06-03	1.9	224.08
117	226	224.5 - 221.4	Sandy silt (Glaciall Till) to Silt	2024-05-27	1.6	224.37
				2024-06-03	1.4	224.63
118	226.1	224.6 - 221.5	Sandy silt (Glaciall Till) to Sand	2024-05-27	1.6	224.54
				2024-06-03	1.6	224.53
119	225.4	223.9 - 220.8	Silt (Glacial Till)	2024-05-27	0.5	224.86
				2024-06-03	0.6	224.78

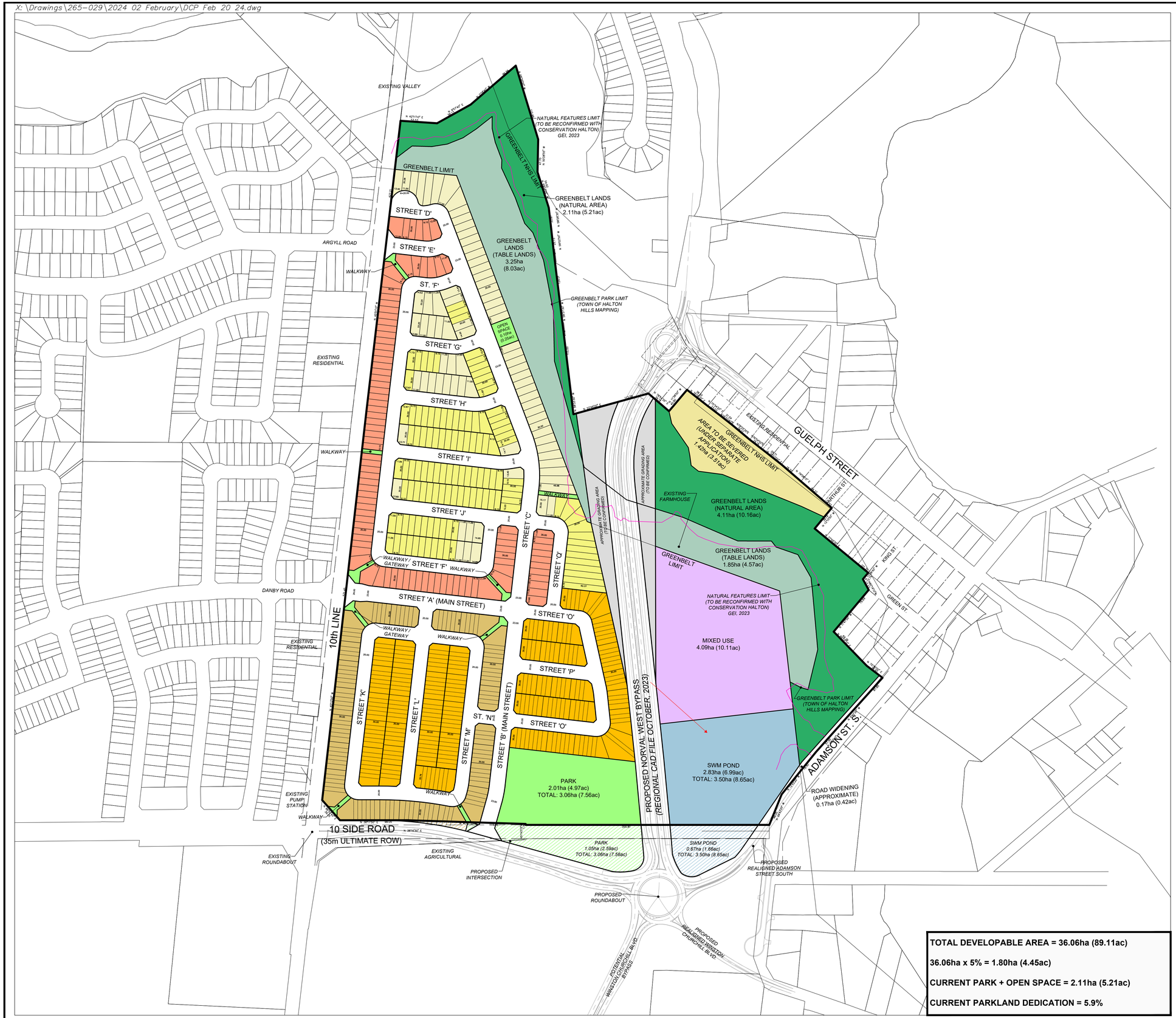
Notes:

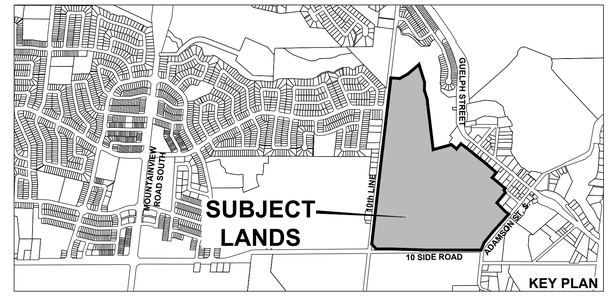
maSL = metres above sea level

mbgs = metres below ground surface

APPENDIX A

X:\Drawings\265-029\2024 02 February\DCP Feb 20 24.dwg





DRAFT PLAN OF SUBDIVISION

FILE # _____

OWNERSHIP

PART OF LOTS 11 & 12, CONCESSION 11,
(GEOGRAPHIC TOWNSHIP OF ESQUESING)
FORMERLY THE VILLAGE OF NORVAL, NOW IN THE
TOWN OF HALTON HILLS
REGIONAL MUNICIPALITY OF HALTON

OWNERS CERTIFICATE

I HEREBY AUTHORIZE GLEN SCHNARR & ASSOCIATES INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE TOWN OF HALTON HILLS FOR APPROVAL.

SIGNED _____ DATE _____

_____
OWNERSHIP

SURVEYORS CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LANDS TO BE SUBDIVIDED AS SHOWN ON THIS PLAN AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE CORRECTLY AND ACCURATELY SHOWN.

SIGNED _____ DATE _____

_____, **O.L.S.**
JD BARNES LIMITED
LAND INFORMATION SPECIALISTS

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT) INFORMATION REQUIRED BY CLAUSES A,B,C,D,E,F,G, J & L ARE SHOWN ON THE DRAFT AND KEY PLANS.

H) MUNICIPAL AND PIPED WATER TO BE PROVIDED
I) SANDY LOAM AND CLAY LOAM
K) SANITARY AND STORM SEWERS TO BE PROVIDED

LAND USE SCHEDULE

LAND USE	LOTS / BLOCKS	AREA (ha)	AREA (ac)	UNITS	DENSITY (UPHA)
DETACHED - 9.15m (30')		3.73	9.22	122	
DETACHED - 11.00m (36')		3.09	7.64	79	
DF DETACHED - 9.15m (30')		2.96	7.31	94	
DF TOWNHOUSES - 6.10m (20')		2.64	6.52	116	
ST. TOWNHOUSES - 6.10m (20')		5.13	12.68	236	
MIXED USE		4.09	10.11		
PARK		2.01	4.97		
OPEN SPACE		0.10	0.25		
WALKWAY / SERVICING		0.27	0.67		
SWM POND		2.83	6.99		
GREENBELT LANDS		6.22	15.37		
TABLE LAND GREENBELT		5.09	12.58		
GRADING AREA		1.67	4.13		
AREA TO BE SEVERED		1.42	3.51		
ROAD WIDENING		0.17	0.42		
20.0m LOCAL ROW (3,123m)		6.38	15.77		
23.0m COLECTOR ROW (1,211m)		2.83	6.99		
42.0m NORVAL BYPASS		2.65	6.55		
TOTAL		**53.28**	**131.66**	**647**	

NOTES

- LOCAL TO LOCAL DAYLIGHT TRIANGLES = 4.5m x 4.5m
- LOCAL OR COLLECTOR TO COLLECTOR DAYLIGHT TRIANGLES = 7.0m x 7.0m
- COLLECTOR TO ARTERIAL DAYLIGHT TRIANGLES = 15.0m x 15.0m

TOTAL DEVELOPABLE AREA = 36.06ha (89.11ac)

36.06ha x 5% = 1.80ha (4.45ac)

CURRENT PARK + OPEN SPACE = 2.11ha (5.21ac)

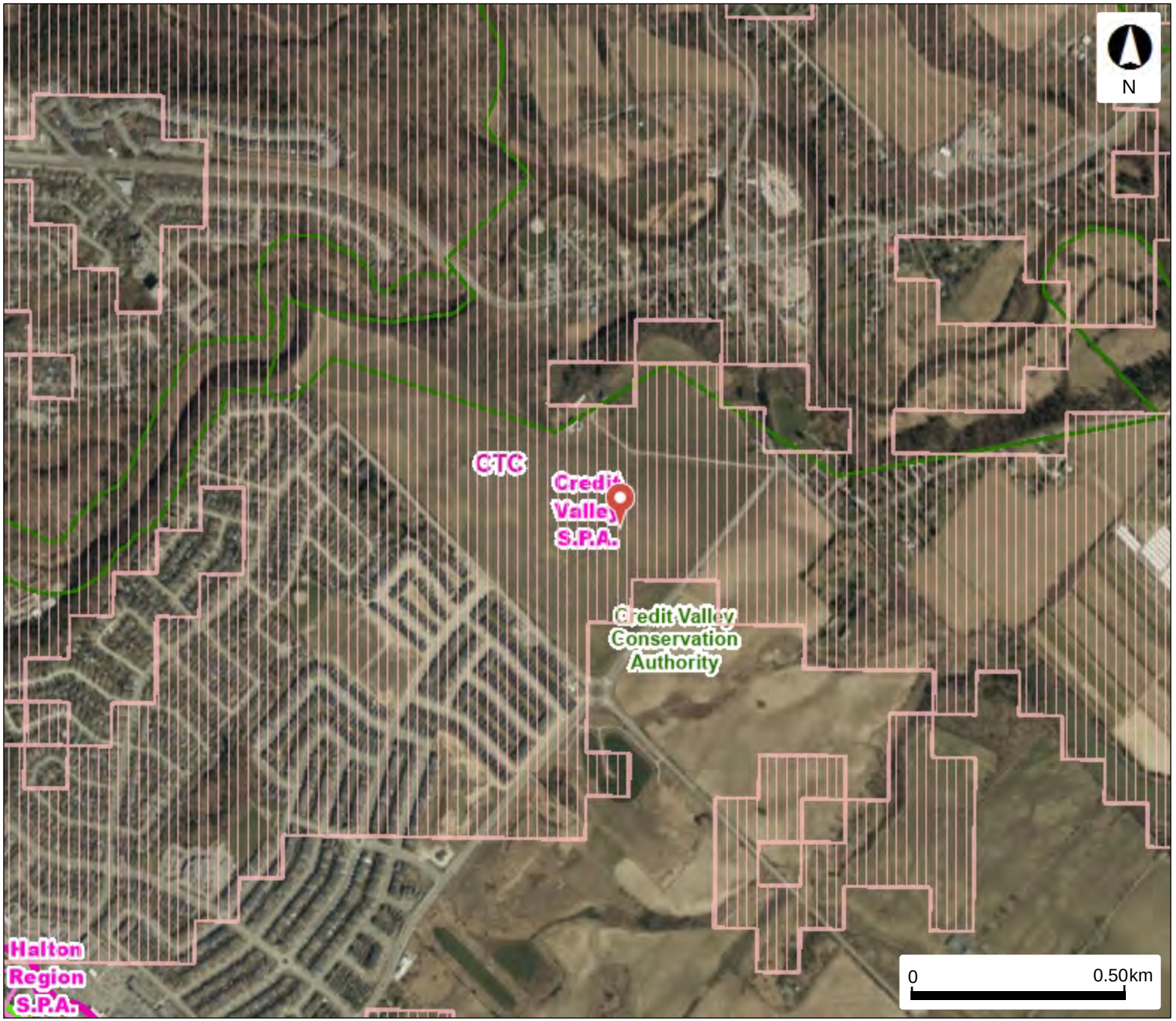
CURRENT PARKLAND DEDICATION = 5.9%

SCALE: 1:2500
(24 x 36)
FEBRUARY 20, 2024

GSAI
Glen Schnarr & Associates Inc.

APPENDIX B

Source Water Protection Map



Legend

- Intake Protection Zone Q
- Wellhead Protection Area Q1
- Wellhead Protection Area Q2
- Issue Contributing Areas
- Highly Vulnerable Aquifers
- WHPA-E
- Wellhead Protection Area
  - A
  - B
  - C
  - C1
  - D
  - F
- Intake Protection Zone 1
- Event Based Areas
- Intake Protection Zone 2
- Niagara Escarpment Plan (NEI
- Greenbelt
- Oak Ridges Moraine
- Source Protection Areas
- Source Protection Regions
- Conservation Authority

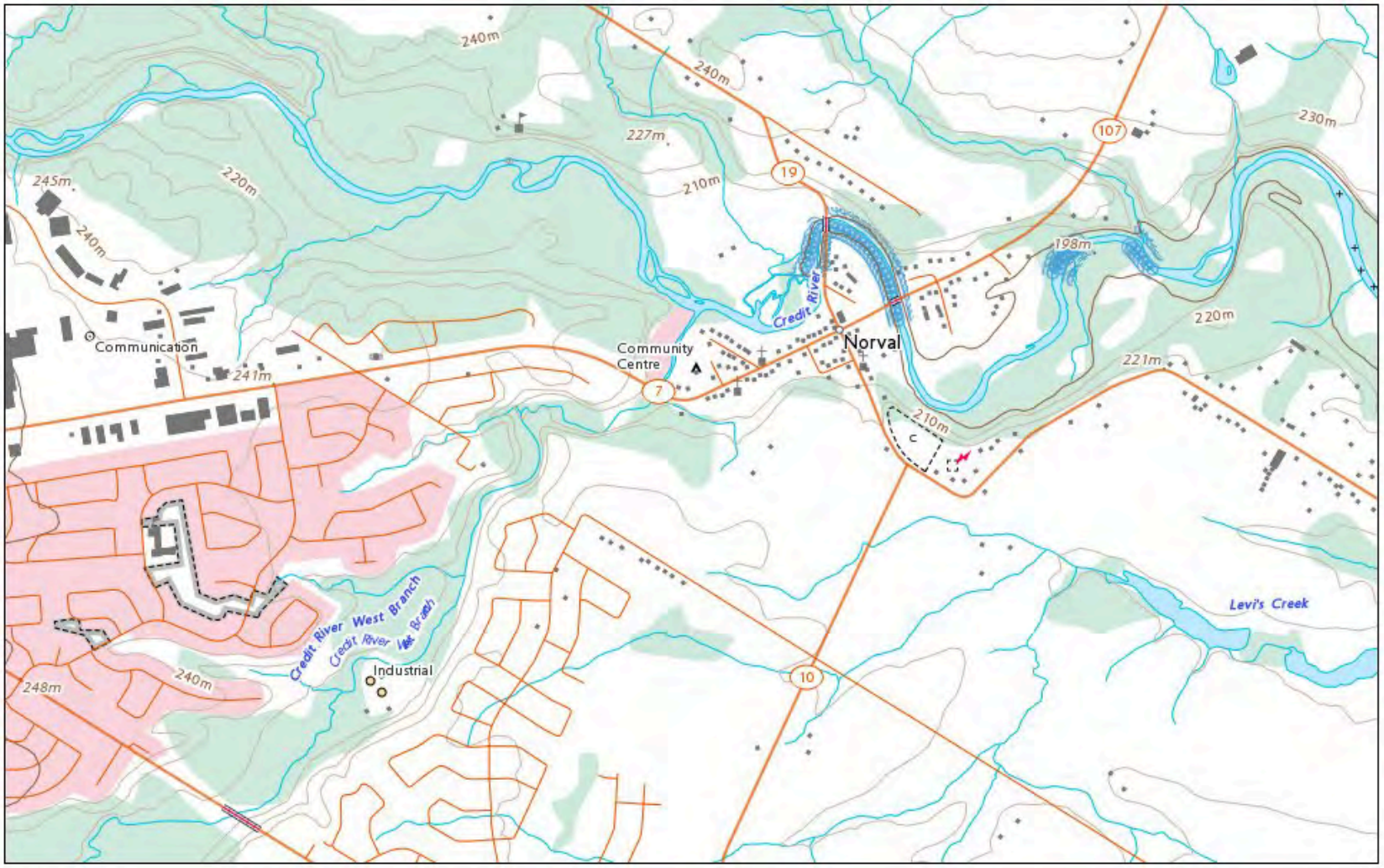
This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 6/7/2024
Map Center: 43.64165 N, -79.86296 W

APPENDIX C

Toporama



June 7, 2024

1:17,500

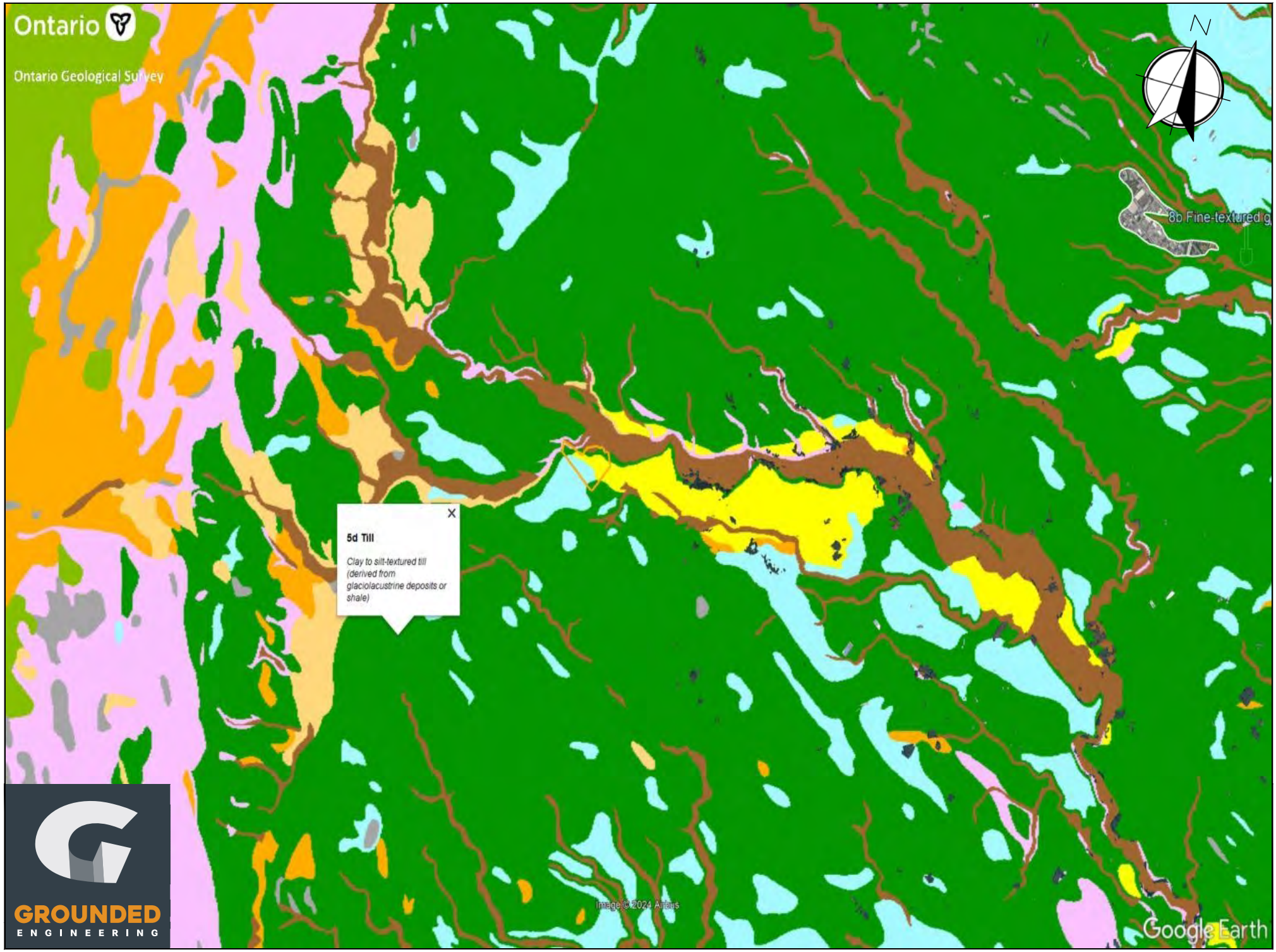
0 0.15 0.3 0.6 mi

0 0.225 0.45 0.9 km

APPENDIX D

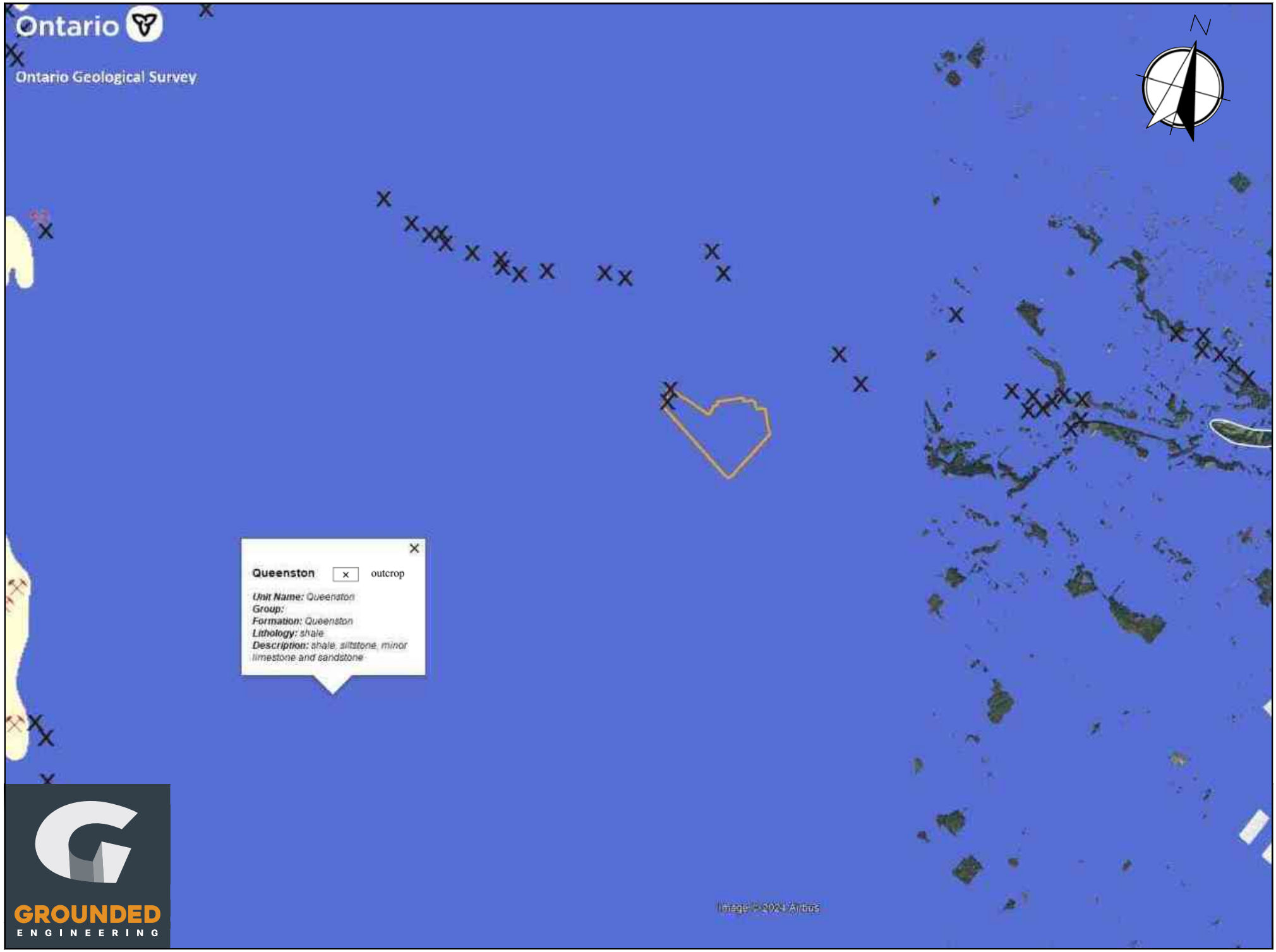

Ontario
Ontario Geological Survey
8b Fine-textured glaciolacustrine deposits
silt and clay, minor sand and gravel
Interbedded silt and clay and gritty, pebbly flow till and rainout deposits
Image © 2024 Airbus
Google Earth
GROUNDED
ENGINEERING

GROUNDED ENGINEERING


Ontario
Ontario Geological Survey
N
8b Fine-textured g
5d Till
Clay to silt-textured till (derived from glaciolacustrine deposits or shale)
Image © 2024 Airbus
Google Earth

GROUNDED ENGINEERING


Ontario
Ontario Geological Survey
3 Paleozoic bedrock
N
Image © 2024 Airbus
Google Earth
GROUNDED
ENGINEERING


Ontario
Ontario Geological Survey
N
Queenston
outcrop
Unit Name: Queenston
Group:
Formation: Queenston
Lithology: shale
Description: shale, siltstone, minor limestone and sandstone
Image © 2024 Airbus
GROUNDED
ENGINEERING

APPENDIX E

Table 1.4.1 Ecosystem responses to urbanization

Results of Increased Imperviousness	Resulting Impacts					
	Flooding and Altered Stream Flows	Habitat Loss	Erosion and Sedimentation	Channel Widening	Streambed Alteration	Water Quality
Increased Flow Volume	✓	✓	✓	✓	✓	✓
Increased Peak Flow	✓	✓	✓	✓	✓	✓
Increased Peak Duration	✓	✓	✓	✓	✓	✓
Increased Stream Temperature		✓				✓
Decreased Base Flow	✓	✓				✓
Sediment Loading Changes	✓	✓	✓	✓	✓	✓

CVC's Credit River Water Management Strategy Update study showed that conventional stormwater best management practices have only limited benefits in restoring predevelopment runoff rates and represent only a small improvement over uncontrolled urban growth (Table 1.4.2; Figure 1.4.5). Only by implementing state of the science, treatment-train stormwater management technologies, did a significant reduction in runoff occur.

Table 1.4.2 Summary of water balance characteristics for different land uses, soil types and stormwater management strategies

Land Use	Soil Type	Scenario	Annual (mm)			
			Rainfall	Runoff	Infiltration	Evapo-transpiration
Agriculture - Pasture	Sandy Soils	Existing conditions	804	77	418	365
Medium Density Residential	Sandy Soils	No SWM*	804	291	264	289
Medium Density Residential	Sandy Soils	Business-as-usual management approach**	804	259	291	284
Medium Density Residential	Sandy Soils	"Ecotopia" management approach***	804	183	363	303

*SWM – Stormwater management;
** Business-as-usual (BAU) management approach assumes implementation of traditional stormwater management practices, such as detention ponds;
*** "Ecotopia" (ECO) management approach assumes implementation of a full treatment train of stormwater management practices, including lot level and conveyance controls and wetland treatment systems.

Source: CVC, 2007b

APPENDIX F

Water Well Records

May 14, 2024
1:00:15 PM

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
BRAMPTON CITY (CHING	17 592543 4832538 W	2018-07 7556	6.11	UT 0194	101/152/20/1:0	DO		7322810 (Z267360) A232193	BRWN SAND 0030 GREY CLAY 0145 BRWN CLAY GRVL 0155 BRWN CLAY 0175 BRWN CLAY GRVL 0180 GREY GRVL 0194
BRAMPTON CITY (CHING HS W 011	17 592378 4833329 W	1987-06 1660	6 6	FR 0062 FR 0084	22//3/1:0	DO		4906633 (15837)	BRWN LOAM SOFT 0001 BRWN CLAY SOFT 0003 RED SHLE ROCK SOFT 0011 RED SHLE ROCK HARD 0035 RED SHLE HARD 0041 RED SHLE HARD 0090
BRAMPTON CITY (CHING HS W 06 010	17 592604 4833398 W	1958-07 1430	5	FR 0014	7/11/4/1:0	DO	0014 2	4902091 ()	PRDG 0012 HPAN 0014 GRVL MSND 0016
BRAMPTON CITY (CHING HS W 06 011	17 592593 4833361 W	2015-10 7407	5			DO		7252734 (Z216880) A136263	
HALTON HILLS TOWN (A 11 010	17 592332 4832506 W	2008-05 6946	2.04	UT 0007		NU	0010 5	7105960 (Z86663) A069340	BRWN SAND SLTY FILL 0002 BRWN MSND FILL FILL 0005 BRWN MSND FILL GREY SILT SAND 0009 BRWN SAND SLTY WBRG 0010 GREY FSND SILT WBRG 0015 GREY SILT 0019
HALTON HILLS TOWN (E	17 591474 4833227 W	2017-12 6974						7306800 (Z17403) P	
HALTON HILLS TOWN (E	17 592142 4833489 W	2006-03 3030	36 36	0045		DO		2810529 (Z40620) A036690	BRWN LOAM 0001 BRWN CLAY SNDY 0007 BRWN GRVL 0008 GREY CLAY 0045 BRWN SAND 0055 BRWN SAND GRVL 0057
HALTON HILLS TOWN (E	17 590649 4833404 W	2011-10 6809						7179395 (C15751) A113631 P	
HALTON HILLS TOWN (E	17 592042 4833157 W	2013-06 1455						7217408 (Z169437) A	
HALTON HILLS TOWN (E	17 591684 4832103 W	2014-05 7247	2	UT		MT		7221922 (Z179651) A161563	BRWN LOAM LOOS 0001 BRWN SAND SAND HARD 0019 GREY SAND SILT DNSE 0022
HALTON HILLS TOWN (E	17 591456 4833221 W	2015-12 7484	2	UT 0010		MO	0028 10	7256959 (Z220685) A136411	BRWN GRVL FILL SAND 0007 BRWN CLAY GRVL SILT 0012 RED SHLE WTHD 0017 RED SHLE DRY 0038
HALTON HILLS TOWN (E	17 591540 4833187 W	2015-08 7523	36		12///:			7271755 (Z211195) A	
HALTON HILLS TOWN (E	17 591662 4832109 W	2016-05 6809						7284237 (C33814) A161563 P	
HALTON HILLS TOWN (E	17 592018 4833227 W	2021-05 7268			///:			7389235 (Z360793) A	

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E	17 591719 4833188 W	2021-05 7464						7395544 (C52302) A292275 P	
HALTON HILLS TOWN (E	17 592029 4833226 W	2021-05 7268			///:			7389236 (Z360794) A	
HALTON HILLS TOWN (E	17 591764 4833277 W	2016-08 7557						7273587 (Z218755) A	
HALTON HILLS TOWN (E CON 10 010	17 591722 4831979 W	1962-05 4813	7	FR 0085	31/38/10/4:0	ST DO	0084 4	2801453 ()	BRWN CLAY 0016 BRWN CLAY MSND 0055 BRWN CLAY 0065 QSND 0080 HPAN 0085 MSND 0088
HALTON HILLS TOWN (E CON 10 010	17 591722 4831994 W	1962-06 4813	7	FR 0084	30/55/12/8:0	ST DO	0098 4	2801454 ()	PRDR 0088 MSND CLAY 0097 GRVL 0102
HALTON HILLS TOWN (E CON 10 010	17 591730 4832244 W	1949-10 4805	4 4	FR 0035	35//1/:	DO		2801452 ()	PRDG 0022 CLAY GRVL SHLE 0052 RED SHLE 0070
HALTON HILLS TOWN (E CON 10 010	17 591678 4832198 W	2021-03 7472	2		///:	MO	0020 10	7385231 (HNFORXRP) A315156	BRWN FILL LOOS 0005 GREY CLAY SILT PCKD 0025 GREY SAND SILT PCKD 0030
HALTON HILLS TOWN (E CON 10 010	17 592072 4832017 W	1988-11 1660	6 6	FR 0050	18/55/10/1:0	DO		2807182 (43017)	BRWN SAND GRVL BLDR 0019 RED SHLE ROCK 0060
HALTON HILLS TOWN (E CON 10 011	17 591562 4832431 W	1987-10 2801	6		18/42/190/0:48	NU	0087 10	2807097 (23820)	LOAM 0001 BRWN CLAY 0006 GREY CLAY 0021 GREY CLAY SNDY GRVL 0057 GREY CLAY SLTY SOFT 0078 GRVL SAND LOOS 0081 GREY GRVL SLTY CLAY 0084 GREY CLAY SNDY GRVL 0086 SAND GRVL CLAY 0098 RED CLAY SHLE 0106
HALTON HILLS TOWN (E CON 10 011	17 591553 4832428 W	2005-07 2801						2810327 (Z11299) A	
HALTON HILLS TOWN (E CON 10 011	17 591562 4832411 W	1987-09 2801	6		19///:	NU		2807096 (23819)	LOAM 0001 BRWN CLAY GRVL 0009 GREY CLAY GRVL 0050 GREY CLAY SLTY GRVL 0079 GRVL SAND CLAY 0081 GRVL SAND CLAY 0085 GRVL SAND CLAY 0092 GRVL CLAY SHLE 0095 GRVL SHLE CLAY 0099 RED CLAY SHLE 0111
HALTON HILLS TOWN (E CON 10 011	17 591099 4831931 L	1990-04 2801	20 10		20/29/200/8:0	MN	0088 8	2809843 (267448)	BRWN CLAY 0007 SAND 0008 BRWN CLAY 0021 BLUE CLAY 0045 BLUE CLAY SAND STNS 0050 GRVL SAND CLAY 0056 CLAY SNDY SILT 0078 GRVL CLAY 0081 RED GRVL CLAY 0084 GRVL SAND CLAY 0094 SHLE 0095
HALTON HILLS TOWN (E CON 10 011	17 591432 4832067 W	2003-11 4868				ST		2809838 (Z03971) A	
HALTON HILLS TOWN (E CON 10 011	17 591581 4832418 W	2005-07 2801						2810329 (Z33242) A	
HALTON HILLS TOWN (E CON 10 011	17 591580 4832417 W	2005-07 2801						2810328 (Z11300) A	
HALTON HILLS TOWN (E CON 10 011	17 591555 4832427 W	2005-07 2801						2810330 (Z11298) A	

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 10 011	17 591652 4832268 W	1987-07 2801	1				0063 9	2807089 (23774)	BRWN CLAY GRNT 0009 GREY CLAY GRVL STKY 0024 FSND SILT GRVL 0027 GREY CLAY GRVL 0033 RED CLAY GRVL 0041 FSND SLTY 0067 FSND SLTY GRVL 0073 RED CLAY GRVL CLAY 0098 RED CLAY GRVL SHLE 0105 RED SHLE 0117
HALTON HILLS TOWN (E CON 10 011	17 591099 4831931 L	2003-09 4868				ST		2809824 (261625) A	
HALTON HILLS TOWN (E CON 10 011	17 591576 4832418 W	1987-09 2801	2			NU	0088 5	2807079 (23826)	LOAM 0001 BRWN CLAY GRVL 0010 GREY CLAY SNDY GRVL 0066 CLAY SLTY GRVL 0086 GRVL SAND 0091 GRVL SAND CLAY 0094 RED GRVL CLAY 0097 RED CLAY SHLE 0101
HALTON HILLS TOWN (E CON 10 011	17 591304 4831725 W	2021-03 7472	2		///:	MO	0005 10	7385238 (MY4M25Q7) A315163	BRWN FILL LOOS 0005 GREY CLAY SILT PCKD 0015
HALTON HILLS TOWN (E CON 10 011	17 591576 4832418 W	1987-09 2801	2 1		18///:	NU	0088 10	2807085 (23825)	WHIT LOAM 0001 BRWN CLAY 0010 GREY CLAY GRVL 0035 SAND GRVL 0037 GREY CLAY GRVL 0061 CLAY SLTY STKY 0087 GRVL SAND 0091 GRVL SAND SHLE 0099 RED SHLE 0110
HALTON HILLS TOWN (E CON 10 012	17 591164 4832773 W	1976-10 3349	6 6	FR 0072	34/66/10/1:0	DO		2804893 ()	BLCK LOAM LOOS 0001 BRWN CLAY STNS 0022 GREY SAND 0048 RED SHLE 0076
HALTON HILLS TOWN (E CON 10 012	17 591174 4832783 W	1979-09 3349	6 6	FR 0065	16/68/10/2:0	DO		2805740 ()	BRWN FILL 0002 GREY CLAY 0025 RED SHLE 0070
HALTON HILLS TOWN (E CON 10 012	17 591168 4832769 W	1973-03 3637	30	FR 0005 FR 0047	10/21/7/1:0	DO		2804448 ()	BRWN OBDN 0002 BRWN SAND CLAY 0005 BRWN CLAY 0009 BLUE CLAY 0012 GREY CLAY SAND STNS 0014 RED SAND STNS 0018 GREY CLAY SAND SILT 0032 BLUE CLAY SILT 0044 RED SAND STNS GRVL 0050 RED SHLE 0051
HALTON HILLS TOWN (E CON 10 012	17 591002 4832399 W	1953-09 3514	4	FR 0065	30/30/4/:	ST		2801456 ()	PRDG 0025 BLUE CLAY 0060 GRVL 0065
HALTON HILLS TOWN (E CON 11 002	17 592324 4833616 W	2001-12 4868				DO		2809532 (207048) A	
HALTON HILLS TOWN (E CON 11 002	17 592509 4832876 W	2005-07 7219	6		87///:	NU		2810446 (Z34166) A031532 A	
HALTON HILLS TOWN (E CON 11 010	17 592394 4832678 W	1985-03 3637	30 32 21	FR 0012 FR 0018	8//6/1:0	DO		2806286 ()	BRWN LOAM 0001 BRWN CSND LOOS 0012 BLUE CLAY SAND LYRD 0023
HALTON HILLS TOWN (E CON 11 010	17 592614 4833243 W	1968-04 1308	30	FR 0008	7/12/15/3:0	DO		2803330 ()	LOAM 0001 HPAN BLDR 0007 GRVL 0009 BLUE CLAY 0014
HALTON HILLS TOWN (E CON 11 010	17 592530 4832725 W	2021-04 7523	6.25 6.25	FR 0151	96/128/5/1:	DO		7388492 (4BB4GUNZ) A312164	BLCK LOAM 0003 BRWN SAND 0017 GREY SILT GRVL 0037 GREY CLAY GRVL 0152 RED CLAY SAND 0158 RED SHLE 0172
HALTON HILLS TOWN (E CON 11 010	17 592559 4832793 W	2023-02 7732	1.97	UT 0013	///:	MO	0010 5	7442924 (KHJGUDXD) A364464	BRWN FILL 0005 BRWN SILT SAND 0015

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 11 010	17 592434 4832678 W	1982-10 3637	30 32	FR 0010 FR 0018	8/23/8/1:0	DO		2806007 ()	BRWN LOAM 0001 BLCK SAND GRVL STNS 0005 BRWN SAND LOOS 0007 BRWN SAND PCKD 0010 BLUE CLAY SAND LYRD 0018 GREN SAND GRVL 0021 BLUE CLAY STNS 0023
HALTON HILLS TOWN (E CON 11 010	17 592130 4832564 W	1966-03 1325	30	FR 0018	6/16/2/0:30	DO		2801547 ()	GRVL BLDR 0003 BRWN HPAN 0008 RED SHLE 0018
HALTON HILLS TOWN (E CON 11 010	17 592416 4832785 W	1966-05 1307	36	FR 0048	20//2/:	DO		2801546 ()	BRWN LOAM CLAY 0015 RED CLAY 0040 RED SHLE 0048
HALTON HILLS TOWN (E CON 11 010	17 592292 4832791 W	1965-12 1307	30	FR 0008	8//1/:	DO		2801545 ()	BRWN LOAM MSND 0003 CSND 0008 BRWN CSND 0016 GREY CLAY 0017
HALTON HILLS TOWN (E CON 11 010	17 592402 4832512 W	1987-05 3349	6 6		46/140/7/1:0	DO		2806709 (16635)	BLCK LOAM 0002 BRWN CLAY BLDR 0030 GREY SAND 0035 GREY CLAY SOFT 0050 GREY SAND GRVL 0117 RED SHLE 0140
HALTON HILLS TOWN (E CON 11 010	17 592470 4832596 W	1987-07 4919	30	UK 0010 UK 0075	40/76//1:0	DO		2806761 (05059)	BRWN LOAM HARD 0002 BRWN SAND SOFT 0010 GREY CLAY HARD 0075 GREY SAND SOFT 0080
HALTON HILLS TOWN (E CON 11 010	17 592554 4832792 W	1994-03 4868	36 30 42	FR 0019	19/26/5/1:30	DO		2808231 (133902)	BRWN LOAM 0002 BRWN CSND GRVL FSND 0017 BLCK SILT FSND 0019 BRWN CSND GRVL LOOS 0020 GREY CLAY STNS HARD 0037
HALTON HILLS TOWN (E CON 11 010	17 592358 4832735 W	1965-12 1307	30	FR 0020	10//4/:	DO		2801544 ()	BRWN CLAY MSND 0003 BRWN CSND 0010 BRWN MSND 0016 GREY CLAY 0018 CSND GRVL 0020 GREY CLAY 0021
HALTON HILLS TOWN (E CON 11 010	17 592501 4832815 W	1994-03 4868	30 5			DO		2808230 (133903) A	FILL 0004 BSLT 0006 UNKN CMTD 0010 STNS 0040
HALTON HILLS TOWN (E CON 11 010	17 592568 4832774 W	2023-02 7732	1.97	UT 0013	///:	MO	0010 5	7442923 (ZAE2J9ZP) A364463	BRWN FILL 0005 BRWN SILT SAND 0015
HALTON HILLS TOWN (E CON 11 010	17 592542 4832754 W	2023-02 7732	1.97	UT 0013	///:	MO	0010 5	7442922 (QAB8EACF) A364462	BRWN FILL 0005 BRWN SILT SAND 0015
HALTON HILLS TOWN (E CON 11 010	17 592527 4832761 W	2023-02 7732	1.97	UT 0013	///:	MO	0010 5	7442921 (5NKRGI87) A364461	BRWN FILL 0005 BRWN SILT SAND 0015
HALTON HILLS TOWN (E CON 11 011	17 591884 4833193 W	1954-07 3514	4 4	FR 0078	22/70/6/:	DO		2801558 ()	STNS GRVL 0008 BLUE CLAY 0050 RED SHLE 0078
HALTON HILLS TOWN (E CON 11 011	17 592534 4833303 W	1977-09 3349	6	FR 0045	21/21/10/1:0	DO		2805201 ()	BLCK LOAM 0001 BRWN CLAY 0031 RED SHLE 0049
HALTON HILLS TOWN (E CON 11 011	17 591974 4833303 W	1961-10 1307	30	FR 0029	20//1/:	DO		2801571 ()	BRWN LOAM 0005 GRVL 0010 GREY CLAY 0027 GRVL 0029
HALTON HILLS TOWN (E CON 11 011	17 592324 4833363 W	1963-11 1309	7 7	FR 0038	12/40/2/2:0	DO		2801577 ()	RED FILL CLAY MSND 0003 BRWN CLAY BLDR 0011 RED SHLE 0045

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 11 011	17 592150 4833298 W	1956-01 4838	7 7	FR 0025 FR 0048 FR 0063 FR 0075	3/15/20/2:0	AC		2801560 ()	GRVL CLAY 0015 RED SHLE 0077
HALTON HILLS TOWN (E CON 11 011	17 592154 4833338 W	1956-10 1430	4 4	FR 0060	20/60/1/:	DO		2801561 ()	GRVL BLDR 0027 RED SHLE 0060
HALTON HILLS TOWN (E CON 11 011	17 592074 4833443 W	1965-07 1309	7 7	FR 0019 SU 0038	13/32/4/4:30	DO		2801579 ()	LOAM 0001 GRVL BLDR 0004 GRVL SHLE 0008 RED SHLE 0047
HALTON HILLS TOWN (E CON 11 011	17 592064 4833263 W	1954-03 4838	7 7	MN 0072	25/74/1/0:30	DO		2801557 ()	CLAY GRVL 0027 RED SHLE 0074
HALTON HILLS TOWN (E CON 11 011	17 592450 4833423 W	1954-03 3514	4 4	FR 0040	18/35/4/:	DO		2801556 ()	LOAM 0005 BLDR 0015 RED SHLE 0040
HALTON HILLS TOWN (E CON 11 011	17 591914 4833303 W	1966-04 1613	5 5	FR 0084	24/30/1/2:0	CO		2801578 ()	LOAM 0002 CLAY GRVL BLDR 0017 MSND GRVL CLAY 0065 RED SHLE 0088
HALTON HILLS TOWN (E CON 11 011	17 592170 4833178 W	1954-12 3514	4 4	FR 0052	16/30/6/4:0	DO		2801559 ()	GRVL BLDR 0010 RED CLAY 0015 RED SHLE 0054
HALTON HILLS TOWN (E CON 11 011	17 592554 4833368 W	1962-11 1307	30	FR 0025	10//10/:	CO		2801576 ()	BRWN LOAM 0004 GRVL 0010 RED CLAY 0023 GRVL 0025
HALTON HILLS TOWN (E CON 11 011	17 592374 4833323 W	1960-08 1430	7	FR 0026	16/16/10/4:0	DO		2801569 ()	RED SHLE 0010 GRVL 0026
HALTON HILLS TOWN (E CON 11 011	17 592254 4833403 W	1962-11 1309	7 5	FR 0054	15/45/2/8:0	DO		2801572 ()	BLCK LOAM 0002 CLAY GRVL BLDR 0008 RED SHLE 0057
HALTON HILLS TOWN (E CON 11 011	17 591974 4833228 W	1962-10 1307	30	FR 0031	10//10/:	DO		2801570 ()	BRWN LOAM CLAY 0006 GRVL 0010 GREY CLAY 0030 MSND 0031
HALTON HILLS TOWN (E CON 11 011	17 592430 4833413 W	1957-09 1430	6 6	FR 0033	10/12/4/1:0	DO		2801563 ()	PRDG 0014 PRDR 0019 RED SHLE 0033
HALTON HILLS TOWN (E CON 11 011	17 591934 4833313 W	1953-11 4838	7 7	FR 0035	10/15/15/1:0	PS		2801555 ()	STNS CLAY 0005 RED SHLE 0051
HALTON HILLS TOWN (E CON 11 011	17 591940 4833273 W	1972-11 1815	6	FR 0085 FR 0121	15/154/1/2:0	DO		2803969 ()	LOAM 0003 BRWN CLAY STNS 0012 BLUE CLAY GRVL 0030 BLUE CLAY STNS 0048 SILT 0059 RED SHLE 0137 BLUE SHLE 0157
HALTON HILLS TOWN (E CON 11 011	17 592510 4833323 W	1960-06 1430	5 5	FR 0040	8/40/2/15:0	DO		2801568 ()	BRWN CLAY 0003 GRVL BLDR 0016 RED SHLE 0050
HALTON HILLS TOWN (E CON 11 011	17 592070 4833383 W	1959-05 1430	5 5	FR 0030	10/65/5/3:0	PS		2801564 ()	LOAM 0001 GRVL BLDR 0020 RED SHLE 0075
HALTON HILLS TOWN (E CON 11 011	17 592350 4833443 W	1960-05 1430	5 5	FR 0030	10/15/12/6:0	DO		2801567 ()	BRWN CLAY 0004 RED SHLE 0035
HALTON HILLS TOWN (E CON 11 011	17 591904 4833303 W	1959-07 1307	30	FR 0012	12//10/:	CO		2801565 ()	GRVL CLAY 0006 GRVL 0019
HALTON HILLS TOWN (E CON 11 011	17 592554 4833388 W	1959-12 1430	5 5	FR 0048	6/48/2/6:0	DO		2801566 ()	PRDG 0018 RED SHLE 0053

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 11 011	17 592530 4833318 W	1962-11 1307	30	FR 0024	12//6/:	DO		2801573 ()	BRWN LOAM 0004 GRVL 0012 RED CLAY 0022 CSND 0024
HALTON HILLS TOWN (E CON 11 011	17 592054 4832233 W	1973-01 3349	5					2804251 () A	BRWN CLAY BLDR 0035 BRWN FSND 0048 GREY CLAY SAND 0051 RED SHLE 0056
HALTON HILLS TOWN (E CON 11 011	17 592294 4833588 W	1991-10 4868	36 30 24	FR 0084	83//4/1:0	DO		2807891 (103906)	BRWN LOAM LOOS 0004 BRWN CLAY HARD 0013 BRWN CLAY SAND HARD 0019 BRWN SAND GRVL DRY 0034 BRWN GRVL SPST DRY 0043 BRWN STNS GRVL DRY 0046 BRWN FSND DRY HARD 0061 BRWN CLAY SILT HARD 0072 BRWN FSND DRY HARD 0084 BRWN SILT WBRG LOOS 0088 BRWN FSND LOOS 0093 GREY MSND LOOS 0097
HALTON HILLS TOWN (E CON 11 011	17 592323 4833613 W	2003-11 4868				DO		2809875 (Z03974) A003883 A	
HALTON HILLS TOWN (E CON 11 011	17 592593 4833361 W	2015-10 7407	36			DO		7252733 (Z216879) A	
HALTON HILLS TOWN (E CON 11 011	17 591813 4833227 W	2015-12 2663	6.25 6.11	UT 0105	15/15/30/1:	DO		7256088 (Z226362) A191507	BRWN GRVL CLAY 0020 BRWN CLAY 0075 WHIT LMSN 0105
HALTON HILLS TOWN (E CON 11 011	17 592246 4833633 W	1987-02 4868	30 16	FR 0010	10/16/6/2:0	DO		2806583 (07726)	BRWN LOAM SOFT 0001 BRWN CLAY SAND HARD 0008 BRWN GRVL SAND BLDR 0012 GREY CLAY SILT BLDR 0032
HALTON HILLS TOWN (E CON 11 011	17 592404 4833458 W	1948-08 1532	6 6	FR	15//5/:	DO		2801548 ()	CLAY 0015 RED SHLE 0055
HALTON HILLS TOWN (E CON 11 011	17 592249 4833314 W	2020-11 7472	0.75		///:	MO	0007 10	7375705 (AOUPG5LU) A308323	GREY CLAY PCKD 0008 RED SHLE HARD 0017
HALTON HILLS TOWN (E CON 11 011	17 592216 4833297 W	2020-11 7472	2		///:	MO	0007 10	7375706 (5JJN64KF) A308349	GREY CLAY PCKD 0008 RED SHLE HARD 0017
HALTON HILLS TOWN (E CON 11 011	17 591762 4832929 W	1973-09 3637	30	FR 0025 FR 0042	7/49/0/:	ST DO		2804377 ()	BRWN LOAM 0001 BRWN CLAY 0003 BRWN CSND GRVL 0005 BRWN CLAY 0006 BLUE CLAY SILT SAND 0049
HALTON HILLS TOWN (E CON 11 011	17 592364 4833373 W	1970-06 1307	30	FR 0020	10/19/2/1:0	DO		2803379 ()	LOAM 0001 GRVL 0006 RED SHLE 0020
HALTON HILLS TOWN (E CON 11 011	17 591994 4833233 W	1972-12 3349	5 5			DO		2804268 () A	BRWN CLAY STNS 0034 BRWN FSND 0048 GREY CLAY 0051 RED SHLE 0118 BLUE SHLE 0120
HALTON HILLS TOWN (E CON 11 011	17 592070 4833268 W	1953-09 4838	7 7	FR 0054	28/61/1/2:0	DO		2801554 ()	GRVL STNS CLAY 0030 RED SHLE 0061
HALTON HILLS TOWN (E CON 11 011	17 592014 4833223 W	1973-03 3413	30	FR	23/28/6/2:0	DO		2804227 ()	BRWN CLAY 0020 GRVL 0023 BLUE CLAY 0040
HALTON HILLS TOWN (E CON 11 011	17 592500 4833363 W	1972-03 2643	7	FR 0022	10/18/20/1:0	NU		2804081 ()	CLAY GRVL 0022

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 11 011	17 592310 4833303 W	1971-06 1660	6	FR 0017 FR 0022	5/14/10/1:0	IR		2803716 ()	BRWN LOAM 0001 BRWN CLAY 0005 RED SHLE 0025
HALTON HILLS TOWN (E CON 11 011	17 592444 4833433 W	1957-08 1430	4	FR 0048	15/40/4/1:0	CO		2801562 ()	GRVL STNS 0033 HPAN 0047 GRVL 0048
HALTON HILLS TOWN (E CON 11 011	17 592094 4833443 W	1950-05 4838	4 4	FR 0063	15//2/:	DO		2801549 ()	CLAY STNS 0028 RED SHLE 0063
HALTON HILLS TOWN (E CON 11 011	17 592070 4833348 W	1950-09 4838	5 5	FR 0047	12/12/20/:	DO		2801550 ()	GRVL CLAY 0011 RED SHLE 0047
HALTON HILLS TOWN (E CON 11 011	17 592014 4833223 W	1951-01 4838	4 4	FR 0080	30/50/1/:	DO		2801551 ()	CLAY MSND 0061 RED SHLE 0080
HALTON HILLS TOWN (E CON 11 011	17 592324 4833263 W	1952-06 4527	5 5	FR 0100	8/76/5/0:30	DO		2801552 ()	LOAM MSND BLDR 0018 RED SHLE 0100
HALTON HILLS TOWN (E CON 11 011	17 591834 4833193 W	1952-11 3514	4 4	FR 0023	13/13/4/4:0	DO		2801553 ()	GRVL 0009 RED SHLE 0023
HALTON HILLS TOWN (E CON 11 011	17 591974 4833273 W	1972-12 3349	5			DO		2804269 () A	BRWN CLAY STNS 0035 BRWN SAND 0048 GREY CLAY SAND 0051 RED SHLE 0115
HALTON HILLS TOWN (E CON 11 012	17 591544 4833247 W	1959-10 1430	5 5	FR 0028	6/6/12/5:0	DO		2801586 ()	BRWN CLAY 0007 RED SHLE 0030
HALTON HILLS TOWN (E CON 11 012	17 591974 4833273 W	1962-02 1307	30	FR 0035	15//1/:	DO		2801591 ()	BRWN LOAM 0004 GRVL BLDR 0011 BRWN CLAY 0016 GREY CLAY 0030 GREY MSND GRVL 0035
HALTON HILLS TOWN (E CON 11 012	17 592210 4833629 W	1987-12 1660	6		///:	DO		2806844 (16459)	BRWN LOAM 0001 BRWN SAND CLAY 0022 GREY CLAY 0051 BRWN GRVL SAND HARD 0090
HALTON HILLS TOWN (E CON 11 012	17 592200 4833650 W	1987-04 4868	30 24	FR 0008	6/7/6/1:0	DO		2806624 (07732)	BRWN LOAM SOFT 0006 BRWN SAND BLDR HARD 0008 BRWN GRVL PORS 0009 GREY CLAY SILT BLDR 0024
HALTON HILLS TOWN (E CON 11 012	17 592192 4833652 W	1987-02 4868	30 16	FR 0010	///:	DO		2806582 (07725)	BRWN LOAM SOFT 0001 BRWN CLAY SAND HARD 0008 BRWN GRVL SAND BLDR 0010 GREY CLAY SILT BLDR 0030
HALTON HILLS TOWN (E CON 11 012	17 592174 4833705 W	1987-02 4868	30 12	FR 0007	17/22/5/2:0	DO		2806581 (07723)	BRWN LOAM 0001 BRWN CLAY SAND HARD 0005 BRWN GRVL SAND BLDR 0009 GREY CLAY SILT BLDR 0028
HALTON HILLS TOWN (E CON 11 012	17 592186 4833680 W	1987-01 4868	30 16	FR 0008	18/20/4/0:15	DO		2806580 (07724)	BRWN LOAM SOFT 0001 BRWN CLAY SAND HARD 0006 BRWN GRVL SAND BLDR 0010 GREY CLAY SILT BLDR 0032
HALTON HILLS TOWN (E CON 11 012	17 591644 4833358 W	1957-07 1409	4 4	FR 0070	15/20/8/1:0	DO		2801584 ()	GRVL MSND 0035 RED SHLE 0070
HALTON HILLS TOWN (E CON 11 012	17 591692 4833323 W	1965-07 1613	5 5	FR 0072	15/40/5/1:30	DO		2801592 ()	LOAM 0002 STNS GRVL 0022 BLUE CLAY 0035 MSND CLAY 0060 RED SHLE 0076
HALTON HILLS TOWN (E CON 11 012	17 591342 4833412 W	1948-09 1532	6 6	FR	16//6/:	DO		2801580 ()	CLAY GRVL 0025 RED SHLE 0055

TOWNSHIP CON L	UTM	DATE CN	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
HALTON HILLS TOWN (E CON 11 012	17 591950 4833273 W	1962-02 1307	30	FR 0020	20//1/:	DO		2801590 ()	BRWN LOAM 0003 GRVL BLDR 0010 BRWN CLAY 0020 CSND 0031
HALTON HILLS TOWN (E CON 11 012	17 591714 4833346 W	1961-12 4101	6 6	FR 0045 FR 0100	18/90/2/8:0	DO		2801589 ()	BRWN CLAY 0010 GREY MSND 0032 RED SHLE 0124
HALTON HILLS TOWN (E CON 11 012	17 591724 4833297 W	1961-10 4101	5 5	FR 0035	12/15/12/12:0	DO		2801588 ()	PRDG 0010 RED SHLE 0038
HALTON HILLS TOWN (E CON 11 012	17 591660 4833189 W	1961-09 1308	30	FR 0005	5//3/8:0	DO		2801587 ()	BRWN CLAY MSND STNS 0002 GRVL STNS 0006 RED SHLE 0014
HALTON HILLS TOWN (E CON 11 012	17 592401 4833520 W	2003-08 7154	6	FR 0102	85/90/8/2:0	DO	0102 3	2809805 (264278)	BRWN CLAY 0013 BRWN GRVL 0014 GREY CLAY 0023 BRWN SILT 0098 GREY FSND 0102 GREY CSND 0105
HALTON HILLS TOWN (E CON 11 012	17 591836 4833315 W	1958-11 2904	6 6	FR 0110	14/109/2/5:0	CO		2801585 ()	PRDG 0011 CLAY 0014 GREY CLAY 0019 CLAY MSND 0022 CLAY STNS 0029 GREY MSND SILT 0054 CSND CLAY 0057 RED SHLE 0110
HALTON HILLS TOWN (E CON 11 012	17 591684 4833371 W	1955-05 3514	4	FR 0103	20/20/6/:	DO		2801583 ()	GRVL STNS 0012 BLUE CLAY 0095 GRVL 0103
HALTON HILLS TOWN (E CON 11 012	17 592420 4833503 W	1951-05 4501	5 5	FR 0035	35///:	DO		2801582 ()	LOAM MSND 0020 CLAY GRVL 0035 SHLE 0125
HALTON HILLS TOWN (E CON 11 012	17 591626 4833303 W	1960-09 4101	7 7	FR 0019	0/0/3/4:0	DO		2801581 ()	PRDG 0006 RED SHLE 0054
HALTON HILLS TOWN (E CON 11 012	17 591498 4833236 W	1965-12 1325	30	FR 0018	6/18/1/0:30	DO		2801593 ()	LOAM 0001 BRWN CLAY BLDR 0008 RED SHLE 0020
HALTON HILLS TOWN (E CON 11 090	17 592310 4832442 W	1990-12 4919	39	UK 0060	60/74/5/1:0	DO		2807787 (77218)	BRWN LOAM HARD 0001 BRWN CLAY HARD 0020 GREY CLAY HARD 0060 GREY SAND LOOS 0080
HALTON HILLS TOWN (G	17 590750 4833440 W	2004-03 6607	1.97	FR 0020		NU	0015 10	2809886 (Z10243) A010197	FILL 0005 BRWN SILT TILL 0020 GREY SILT CLAY 0025
HALTON HILLS TOWN (G 10 011	17 591488 4832071 W	2004-01 4868				DO		2809867 (Z03981) A	

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only

1. Core Material and Descriptive te

rms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

APPENDIX G

OTHER CONSULTANTS

LOG OF BOREHOLE MW21-1

PROJECT: Phase Two Environmental Site Assessment and Hydrogeological Assessment | REF. NO.: 211-03319-00

CLIENT: Russell Pines Property Corp. | Method: Split spoons + hollow stem augers | ENCL NO.:

PROJECT LOCATION: 16469 10 Sideroad, Halton Hills | Diameter: 0.2m | ORIGINATED BY HS

DATUM: NAD 83 UTM ZONE 17T | Date: May/21/2021 to May/21/2021 | COMPILED BY AP/CN

BH LOCATION: N 4833087.354 E 591604.675 | Equipment: Landshark Diedrich D-70 | CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	MONITORING WELL CONSTRUCTION	CHEMICAL ANALYSIS	Soil Head Space Vapours PID (ppm) 20 40 60 80	CGD (ppm) 20 40 60 80	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT w_P w w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.0	Ground Surface											
	TOPSOIL: Brown, silty sand, trace organics, trace gravel, loose, moist, no staining, no odour.		1	SS	5							
206.2												
0.8	**SILTY SAND:** Light brown, trace gravel, trace cobbles loose, moist, no staining, no odour.		2	SS	5							
1												
205.4												
1.5	**SAND AND GRAVEL:** Dark brown, trace cobbles, trace silt, compact, moist to saturated, no staining, no odour.		3	SS	14		Bentonite					
							W. L. 205.4 m					
							W. L. 205.3 m					
2												
204.7												
2.3	**SILT:** Dark brown, trace sand, trace oxidation, compact, saturated, no staining, no odour.		4	SS	23							
3	Grey, trace gravel.		5	SS	27							
4			6A	SS	27		Sand					
202.9												
4.1	**SANDY SILT:** Grey, trace clay, trace gravel, very stiff, WTPL, no staining, no odour.		6B	SS			Screen					1 27 64 8
			7A	SS	61							
5			7B	SS								
	Shale fragments											
201.6												
5.3	**WEATHERED SHALE:** Grey to red, very dense, damp.		8	SS	85		Bentonite					
201.1												
5.9	END OF BOREHOLE AT 5.9 mbgs											

1st ▽ Water level upon completion of drilling on May 21, 2021 (205.4 mASL)

2nd ▼ Water level on Oct 4, 2021 (205.3 mASL)

LOG OF BOREHOLE MW21-2D

PROJECT: Phase Two Environmental Site Assessment and Hydrogeological Assessment
REF. NO.: 211-03319-00
CLIENT: Russell Pines Property Corp.
Method: Split spoons + hollow stem augers
ENCL NO.:
PROJECT LOCATION: 16469 10 Sideroad, Halton Hills
Diameter: 0.2m
ORIGINATED BY HS
DATUM: NAD 83 UTM ZONE 17T
Date: May/20/2021 to May/20/2021
COMPILED BY AP/CN
BH LOCATION: N 4833069.214 E 591658.476
Equipment: Landshark Diedrich D-70
CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	MONITORING WELL CONSTRUCTION	CHEMICAL ANALYSIS	PID (ppm) 20 40 60 80	CGD (ppm) 20 40 60 80	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	POCKET PEN. (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
209.1	Ground Surface											
208.8 / 0.3	**TOPSOIL:** Brown, silty sand, trace organics, loose, moist, no staining, no odour		1A	SS	4							
	SANDY SILT: Light brown, some clay, trace gravel, trace organics, soft, WTPL, no staining, no odour.		1B	SS								
1			2	SS	4							1 32 53 14
2			3	SS	3							
	Firm.		4	SS	7							
3			5	SS	4		Bentonite					
205.3 / 3.8	Grey, trace cobbels, soft, WTPL.											
4	**SILTY SAND:** Reddish brown, some clay, some gravel, some cobbles, saturated, compact, no staining, no odour		6	SS	16		W. L. 204.9 m W. L. 205.0 m					14 46 29 11
5			7	SS	54							
203.8 / 5.3	**SILT:** Brown to grey, hard, WTPL, no staining, no odour.		8	SS	34							
6 / 203.0 / 6.1	**GRAVEL:** Grey, trace cobbles, dense, saturated, no staining, no odour.		9	SS	39							
202.2 / 6.9	**SILT:** Grey, some clay, trace sand, very stiff, WTPL, no staining, no odour.		10	SS	30							0 2 91 7
7			11A	SS	55		Sand Screen					
201.2 / 7.9	**WEATHERED SHALE:** Red, very dense, moist, no staining, no odour.		11B	SS								
8 / 200.8 / 8.3	END OF BOREHOLE AT 8.3 mbgs											

1st ▽ Water level upon completion of drilling on May 21, 2021 (204.9 mASL)

2nd ▼ Water level on Oct 4, 2021 (205.0 mASL)

LOG OF BOREHOLE MW21-2S

PROJECT: Phase Two Environmental Site Assessment and Hydrogeological Assessment
REF. NO.: 211-03319-00
CLIENT: Russell Pines Property Corp.
Method: Split spoons + hollow stem augers
ENCL NO.:
PROJECT LOCATION: 16469 10 Sideroad, Halton Hills
Diameter: 0.2m
ORIGINATED BY HS
DATUM: NAD 83 UTM ZONE 17T
Date: May/20/2021 to May/20/2021
COMPILED BY AP/CN
BH LOCATION: N 4833069.795 E 591659.257
Equipment: Landshark Diedrich D-70
CHECKED BY

ELEV (m) / DEPTH	DESCRIPTION	SAMPLE NUMBER	TYPE	"N" BLOWS/0.3 m	MONITORING WELL CONSTRUCTION / CHEMICAL ANALYSIS	PID (ppm)	CGD (ppm)
209.2	Ground Surface						
208.9 / 0.3	**TOPSOIL:** Brown, silty sand, trace organics, loose, moist, no staining, no odour	1A	SS	4		plotted	plotted
	SANDY SILT: Light brown, some clay, trace gravel, trace organics, soft, WTPL, no staining, no odour.	1B	SS				
		2	SS	4		plotted	plotted
		3	SS	3	Bentonite	plotted	plotted
	Firm.	4	SS	7		plotted	plotted
	Grey, trace cobbels, soft, WTPL.	5	SS	4		plotted	plotted
205.4 / 3.8	**SILTY SAND:** Reddish brown, some clay, some gravel, some cobbles, saturated, compact, no staining, no odour	6	SS	16	W. L. 205.2 m; W. L. 205.1 m; Sand; Screen	plotted	plotted
		7	SS	54		plotted	plotted
203.9 / 5.3	END OF BOREHOLE AT 5.3 mbgs						

Soil Head Space Vapours: PID (ppm) scale 20 40 60 80; CGD (ppm) scale 20 40 60 80. Plastic limit / Natural moisture content / Liquid limit (w_P, w, w_L), Water content (%) 10 20 30. Pocket Pen. (kPa). Remarks and grain size distribution (%): GR SA SI CL.

1st Water level upon completion of drilling on May 21, 2021 (205.1 mASL)

2nd Water level on Oct 4, 2021 (205.2 mASL)

LOG OF BOREHOLE MW21-3

PROJECT: Phase Two Environmental Site Assessment and Hydrogeological Assessment
REF. NO.: 211-03319-00
CLIENT: Russell Pines Property Corp.
Method: Split spoons + hollow stem augers
ENCL NO.:
PROJECT LOCATION: 16469 10 Sideroad, Halton Hills
Diameter: 0.2m
ORIGINATED BY HS
DATUM: NAD 83 UTM ZONE 17T
Date: May/21/2021 to May/21/2021
COMPILED BY AP/CN
BH LOCATION: N 4833102.081 E 591714.821
Equipment: Landshark Diedrich D-70
CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	MONITORING WELL CONSTRUCTION	CHEMICAL ANALYSIS	PID (ppm) 20 40 60 80	CGD (ppm) 20 40 60 80	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	POCKET PEN. (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
206.0	Ground Surface											
	TOPSOIL: Brown, silty sand, trace organics, trace gravel, loose, moist, no staining, no odour		1	SS	4							
205.1			2A	SS	7							
1 0.9	**SILTY SAND:** Light brown, trace gravel, trace roots, loose, moist. Dark brown, some gravel, trace clay, firm, APL, no staining, no odour.		2B	SS			Bentonite					15 60 20 5
204.2			3A	SS			W. L. 204.6 m					
1.8	**SILTY CLAY:** Light brown, trace gravel, trace orange oxidation, stiff, APL, no staining, no odour.		3B	SS	15		W. L. 204.2 m					
2	Trace sand, trace cobbles, very stiff, WTPL.		4	SS	24							
3 203.0	Approx. 50 mm sand seam at 2.6 mbgs											
3.0	**SILT:** Dark brown to red, some sand, trace clay, trace gravel, very stiff, WTPL, no staining, no odour. Cobbles.		5	SS	23		Sand Screen					0 15 80 5
4			6	SS	92							
201.4	Shale fragments. Hard.											
4.6	**WEATHERED SHALE:** Red, dense to very dense, damp, no staining, no odour.		7	SS	78							
5 200.7												
5.3	END OF BOREHOLE AT 5.3 mbgs											

1st ▽ Water level upon completion of drilling on May 21, 2021 (204.6 mASL)

2nd ▼ Water level on Oct 4, 2021 (204.2 mASL)

LOG OF BOREHOLE MW21-4

PROJECT: Phase Two Environmental Site Assessment and Hydrogeological Assessment
REF. NO.: 211-03319-00
CLIENT: Russell Pines Property Corp.
Method: Split spoons + hollow stem augers
ENCL NO.:
PROJECT LOCATION: 16469 10 Sideroad, Halton Hills
Diameter: 0.2m
ORIGINATED BY HS
DATUM: NAD 83 UTM ZONE 17T
Date: May/20/2021 to May/20/2021
COMPILED BY AP/CN
BH LOCATION: N 4833138.27 E 591724.735
Equipment: Landshark Diedrich D-70
CHECKED BY

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	MONITORING WELL CONSTRUCTION	CHEMICAL ANALYSIS	PID (ppm) 20 40 60 80	CGD (ppm) 20 40 60 80	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 10 20 30	POCKET PEN. (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
206.0	Ground Surface											
	TOPSOIL: Brown, silty sand, trace organics, trace gravel, loose, moist, no staining, no odour.		1	SS	7		Bentonite					
205.3												
0.8	**SAND AND GRAVEL:** Light to dark brown, trace cobbles, trace silt, compact, moist, no staining, no odour.		2	SS	23		W. L. 205.2 m TCLP W. L. 205.0 m					
1												
			3A	SS	15		TCLP					
204.2												
1.8	**SANDY CLAYEY SILT:** Light to medium brown, trace gravel, trace orange oxidation, stiff, APL, no staining, no odour.		3B	SS			TCLP					
2	Grey, stiff, WTPL.		4	SS			TCLP Screen Sand					6 25 46 23
3 203.0												
3.0	**SILT:** Grey, some clay, trace sand, trace gravel, stiff, WTPL, no staining, no odour.		5	SS	8		TCLP					
202.2												
3.8	**SAND AND SILT:** Grey, trace clay, trace gravel, very stiff, WTPL, no staining, no odour.		6	SS	16		TCLP					8 43 45 4
4 201.4												
4.6	**WEATHERED SHALE:** Red, dense to very dense, no staining, no odour.		7	SS	71		TCLP Bentonite					
5												
200.5			8	SS	50		TCLP					
5.5	END OF BOREHOLE AT 5.5 mbgs											

1st ▽ Water level upon completion of drilling on May 21, 2021 (205.0 mASL)

2nd ▼ Water level on Oct 4, 2021 (205.2 mASL)

GROUNDED ENGINEERING

BOREHOLE LOG TERMINOLOGY

GROUNDED ENGINEERING

SAMPLING/TESTING METHODS

SS: split spoon sample

AS: auger sample

GS: grab sample

FV: shear vane

DP: direct push

PMT: pressuremeter test

ST: shelby tube

CORE: soil coring

RUN: rock coring

SYMBOLS & ABBREVIATIONS

MC: moisture content

LL: liquid limit

PL: plastic limit

PI: plasticity index

γ: soil unit weight (bulk)

G_s: specific gravity

S_u: undrained shear strength

▽ unstabilized water level

▼ 1st water level measurement

▼ 2nd water level measurement most recent

▼ water level measurement

ENVIRONMENTAL SAMPLES

M&I: metals and inorganic parameters

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

VOC: volatile organic compound

PHC: petroleum hydrocarbon

BTEX: benzene, toluene, ethylbenzene and xylene

PPM: parts per million

FIELD MOISTURE (based on tactile inspection)

DRY: no observable pore water

MOIST: inferred pore water, not observable (i.e. grey, cool, etc.)

WET: visible pore water

COHESIONLESS

Relative Density	N-Value
Very Loose	<4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	>50

COHESIVE

Consistency	N-Value	Su (kPa)
Very Soft	<2	<12
Soft	2 - 4	12 - 25
Firm	4 - 8	25 - 50
Stiff	8 - 15	50 - 100
Very Stiff	15 - 30	100 - 200
Hard	>30	>200

COMPOSITION

Term	% by weight
trace silt	<10
some silt	10 - 20
silt***y***	20 - 35
sand ***and*** silt	>35

ASTM STANDARDS

ASTM D1586 Standard Penetration Test (SPT)
Driving a 51 mm O.D. split-barrel sampler ("split spoon") into soil with a 63.5 kg weight free falling 760 mm. The blows required to drive the split spoon 300 mm ("bpf") after an initial penetration of 150 mm is referred to as the N-Value.

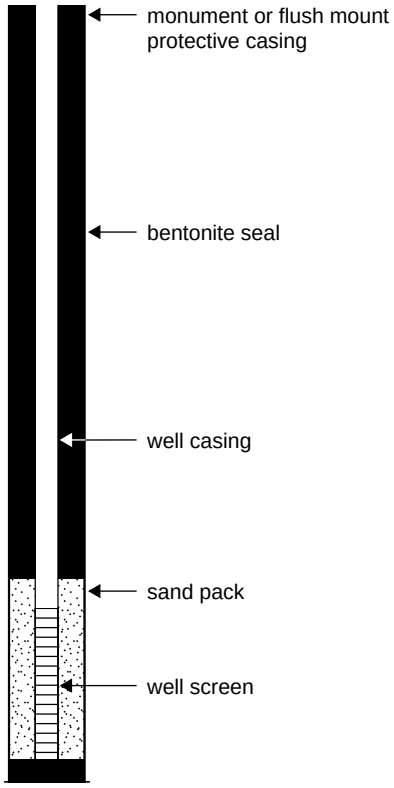
ASTM D3441 Cone Penetration Test (CPT)
Pushing an internal still rod with a outer hollow rod ("sleeve") tipped with a cone with an apex angle of 60° and a cross-sectional area of 1000 mm^2 into soil. The resistance is measured in the sleeve and at the tip to determine the skin friction and the tip resistance.

ASTM D2573 Field Vane Test (FVT)
Pushing a four blade vane into soil and rotating it from the surface to determine the torque required to shear a cylindrical surface with the vane. The torque is converted to the shear strength of the soil using a limit equilibrium analysis.

ASTM D1587 Shelby Tubes (ST)
Pushing a thin-walled metal tube into the in-situ soil at the bottom of a borehole, removing the tube and sealing the ends to prevent soil movement or changes in moisture content for the purposes of extracting a relatively undisturbed sample.

ASTM D4719 Pressuremeter Test (PMT)
Place an inflatable cylindrical probe into a pre-drilled hole and expanding it while measuring the change in volume and pressure in the probe. It is inflated under either equal pressure increments or equal volume increments. This provides the stress-strain response of the soil.

WELL LEGEND



ROCK CORE TERMINOLOGY (MTO SHALE)

TCR **Total Core Recovery** the total length of recovery (soil or rock) per run, as a percentage of the drilled length
SCR **Solid Core Recovery** the total length of sound full-diameter rock core pieces per run, as a percentage of the drilled length
RQD **Rock Quality Designation** the sum of all pieces of sound rock core in a run which are 10 cm or greater in length, as a percentage of the drilled length

Natural Fracture Frequency (typically per 0.3 m) The number of natural discontinuities (joints, faults, etc.) which are present per 0.3m. Ignores mechanical or drill-induced breaks, and closed discontinuities (e.g. bedding planes).

LOGGING DISCONTINUITIES

Discontinuity Type

BP bedding parting
CL cleavage
CS crushed seam
FZ fracture zone
MB mechanical break
IS infilled seam
JT Joint
SS shear surface
SZ shear zone
VN vein
VO void

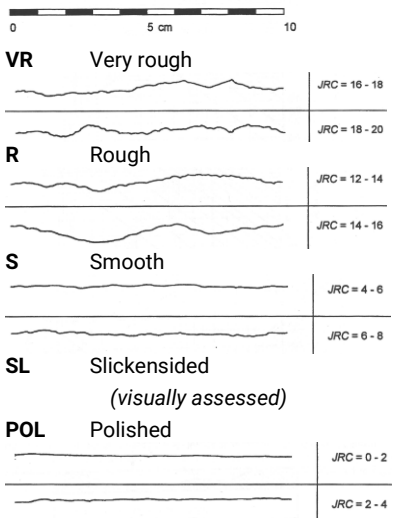
Coating

CN Clean
SN Stained
OX Oxidized
VN Veneer
CT Coating (>1 mm)

Dip Inclination

H	horizontal/flat	0 - 20°
D	dipping	20 - 50°
SV	sub-vertical	50 - 90°
V	vertical	90±°

Roughness (Barton et al.)



Spacing in Discontinuity Sets (*ISRM 1981*)

VC	very close	< 60 mm
C	close	60 – 200 mm
M	mod. close	0.2 to 0.6 m
W	wide	0.6 to 2 m
VW	very wide	> 2 m

Aperture Size

T	closed / tight	< 0.5 mm
GA	gapped	0.5 to 10 mm
OP	open	> 10 mm

Planarity

PR	Planar
UN	Undulating
ST	Stepped
IR	Irregular
DIS	Discontinuous
CU	Curved

GENERAL

Degree of Weathering (*after MTO, RR229 Evaluation of Shales for Construction Projects*)

Zone	Degree	Description
Z1	unweathered	shale, regular jointing
Z2	partially weathered	angular blocks of unweathered shale, no matrix, with chemically weathered but intact shale
Z3		soil-like matrix with frequent angular shale fragments < 25mm diameter
Z4a		soil-like matrix with occasional shale fragments < 3mm diameter
Z4b	fully weathered	soil-like matrix only

Strength classification (*after Marinos and Hoek, 2001; ISRM 1981b*)

Grade		UCS (MPa)	Field Estimate (Description)
R6	extremely strong	> 250	can only be chipped by geological hammer
R5	very strong	100 - 250	requires many blows from geological hammer
R4	strong	50 - 100	requires more than one blow from geological hammer
R3	medium strong	25 - 50	can't be scraped, breaks under one blow from geological hammer
R2	weak	5 - 25	can be peeled / scraped with knife with difficulty
R1	very weak	1 - 5	easily scraped / peeled, crumbles under firm blow of geo. hammer
R0	extremely weak	< 1	indented by thumbnail

Bedding Thickness (*Q. J. Eng. Geology, Vol 3, 1970*)

Very thickly bedded	> 2 m
Thickly bedded	0.6 – 2m
Medium bedded	200 – 600mm
Thinly bedded	60 – 200mm
Very thinly bedded	20 – 60mm
Laminated	6 – 20mm
Thinly Laminated	< 6mm

GROUNDED ENGINEERING

Date Started : May 15, 2024
Position : E: 591085, N: 4833066 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 101

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
230.0	**GROUND SURFACE**				
	100mm **TOPSOIL**		1	SS	5
229.2 / 0.8	**SANDY SILT**, clayey, trace rootlets, trace gravel, natural organic odour, firm, brown, moist (REWORKED)		2	SS	17
	CLAYEY SILT, some sand, trace gravel, very stiff to hard, brown, moist (GLACIAL TILL)		3	SS	29
	...at 1.5 m, trace shale fragments, trace rock fragments		4	SS	77 / 150mm
225.4	...at 2.3 m, some shale, reddish brown		5	SS	50 / 125mm
4.6	**INFERRED BEDROCK**, shale and limestone fragments, reddish brown		6	SS	50 / 100mm
223.8 / 6.2			7	SS	50 / 75mm

depth scale (m): 0, 1, 2, 3, 4, 5, 6
elevation (m): 230, 229, 228, 227, 226, 225, 224

well details

undrained shear strength (kPa)
■ unconfined + field vane
● pocket penetrometer ○ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene △ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

3.0m: auger grinding

4.6m: auger grinding

END OF BOREHOLE

Borehole was dry and caved to 5.2 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	dry	n/a
Jun 3, 2024	dry	n/a

BOREHOLE LOG 102

Date Started : May 16, 2024
Position : E: 591347, N: 4832990 (UTM 17T)
Elev. Datum : Geodetic

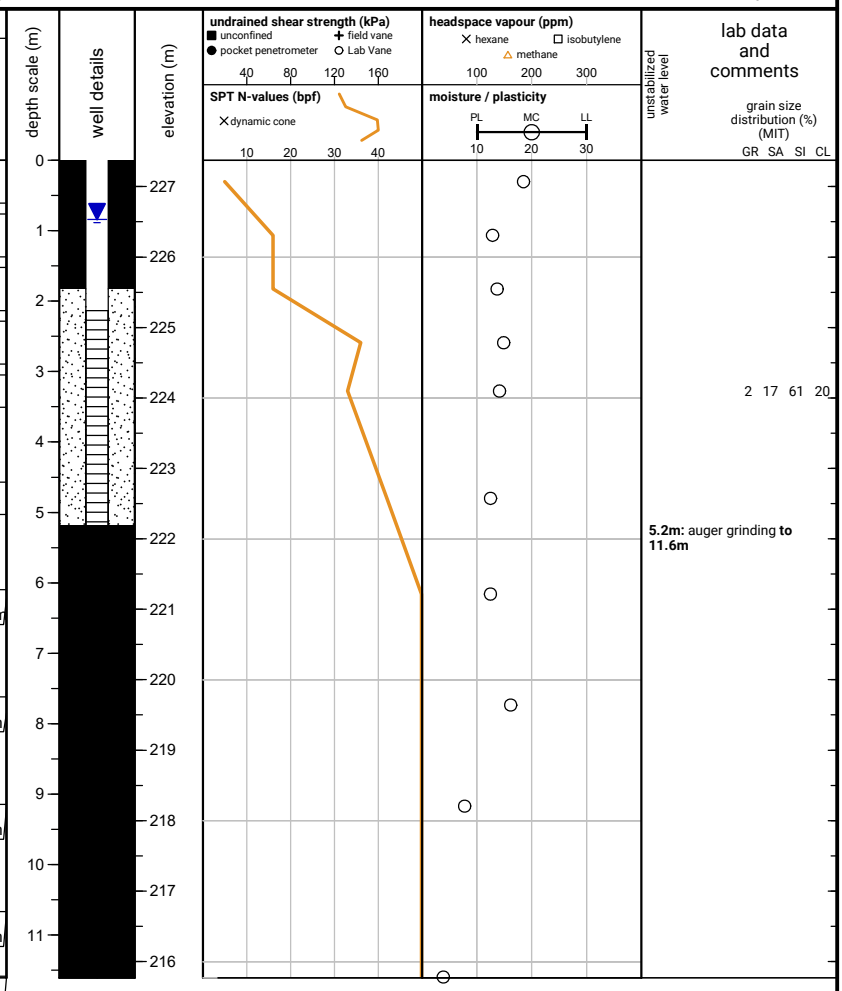
File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method	elev depth (m)	description	number	type	SPT N-value
	227.4	**GROUND SURFACE**			
hollow stem augers OD=215 mm		150mm **TOPSOIL**	1	SS	5
	226.6	**SANDY SILT**, trace clay, trace gravel, trace rootlets, loose, dark brown, moist (REWORKED)			
	0.8		2	SS	16
		CLAYEY SILT, some sand, trace to some gravel, very stiff, brown, moist to wet (GLACIAL TILL)	3	SS	16
		...at 2.3 m, trace sand, hard, brownish grey, wet	4	SS	36
			5	SS	33
mud rotary Ig OD=135 mm		...at 4.6 m, sand seams	6	SS	42
		...at 6.1 m, some shale fragments, trace rock fragments, very dense, redish brown, wet	7	SS	50 / 125mm
	219.8				
	7.6	**INFERRED BEDROCK**, shale and limestone fragments, reddish brown	8	SS	50 / 75mm
			9	SS	50 / 50mm
			10	SS	50 / 25mm
	215.8				
	11.6	...at 11.6 m, grey	11	SS	75 / 25mm

END OF BOREHOLE

Contained drill water upon completion of drilling. Unstabilized water level not measured. Borehole was open.

50 mm dia. monitoring well installed.
No. 10 screen



GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	1.0	226.4
Jun 3, 2024	0.8	226.6

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

BOREHOLE LOG 103

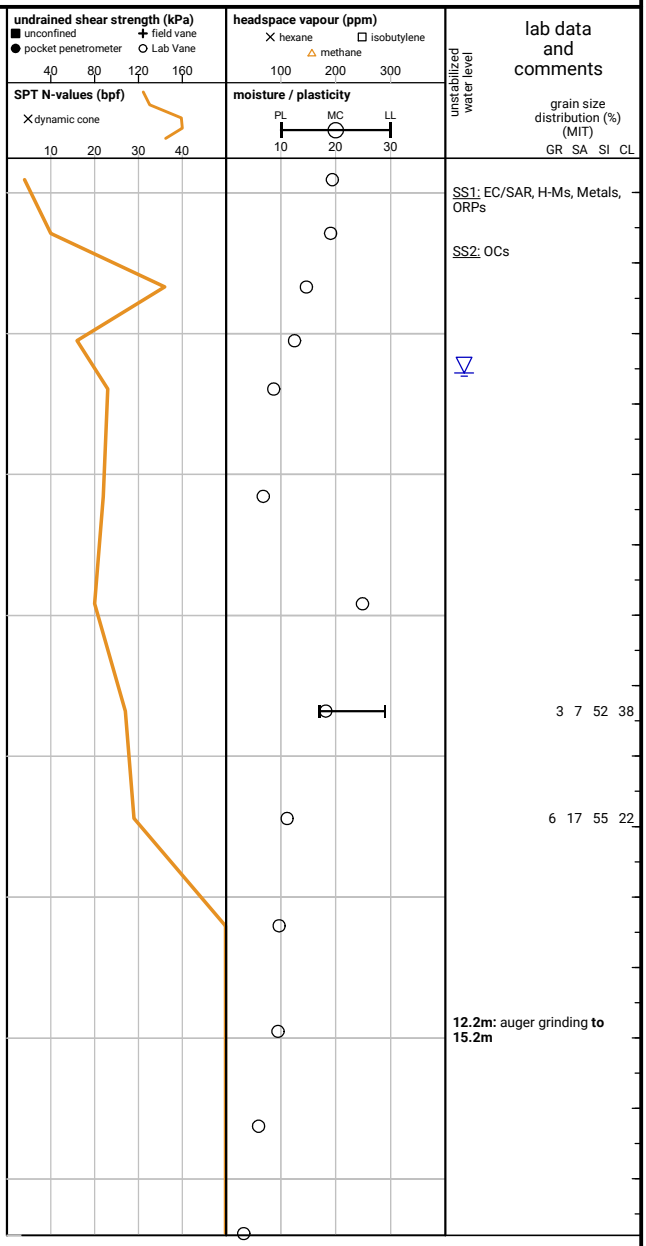
Date Started : May 16, 2024
Position : E: 591562, N: 4832858 (UTM 17T)
Elev. Datum : Geodetic

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
226.5	**GROUND SURFACE**				
	100mm **TOPSOIL**		1	SS	4
	SILTY SAND, some clay, some gravel, loose, brown, moist (REWORKED)		2	SS	10
225.0 / 1.5	**CLAYEY SILT**, some sand, trace gravel, hard, greyish brown, moist (GLACIAL TILL)		3	SS	36
	...at 2.3 m, very stiff, grey		4	SS	16
			5	SS	23
			6	SS	22
220.4 / 6.1	**SILT AND CLAY**, trace sand, very stiff, grey, moist		7	SS	20
	...at 7.6 m, trace gravel		8	SS	27
217.4 / 9.1	**CLAYEY SILT**, some sand, trace gravel, very stiff to hard, grey, moist (GLACIAL TILL)		9	SS	29
			10	SS	68
	...at 12.2 m, sandy silt, some clay, trace shale fragements, trace rock fragments, very dense		11	SS	80 / 250mm
212.8 / 13.7	**INFERRED BEDROCK**, shale and limestone fragments, reddish brown		12	SS	75 / 50mm
211.2 / 15.3	**END OF BOREHOLE**		13	SS	100 / 50mm

depth scale (m) | well details | elevation (m)



GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	2.9	223.6
Jun 3, 2024	2.9	223.6

Unstabilized water level measured at 3.0 m below ground surface; caved to 11.6 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

Date Started : May 17, 2024
Position : E: 591871, N: 4833070 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 104

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
224.7	**GROUND SURFACE**				
	125mm **TOPSOIL**		1	SS	3
	SILTY SAND, trace clay, trace gravel, trace rootlets, very loose to loose, brown, moist (REWORKED)		2	SS	9
	...at 0.8 m, some silt				
	...at 1.5 m, silty, some clay, compact		3	SS	15
222.4 / 2.3	**SILT AND CLAY**, some sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		4	SS	16
	...at 3.0 m, clayey silt, sandy, grey		5	SS	20
			6	SS	18
	...at 6.1 m, hard to very stiff		7	SS	41
			8	SS	25
	...at 9.1 m, some sand		9	SS	23
	...at 10.7 m, trace rock fragments to 12.2 m		10	SS	27
			11	SS	20
	...at 12.8 m, sand seams to 13.7 m		12	SS	23
	...at 13.7 m, sandy		13	SS	20
	...at 15.2 m, sand seams to 16.8 m		14	SS	30
	...at 16.8 m, silt and clay, trace sand		15	SS	20
	...at 18.3 m, stiff		16	SS	8
				FV	
204.4 / 20.3	...at 19.8 m, clayey silt		17	SS	29

depth scale (m) 0–20; well details: S, D; elevation (m) 224–205

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane; 40 80 120 160
SPT N-values (bpf): dynamic cone; 10 20 30 40
headspace vapour (ppm): hexane, isobutylene, methane; 100 200 300
moisture / plasticity: PL MC LL; 10 20 30
unstabilized water level

lab data and comments

SS1: H-Ms, Metals, ORPs

SS2: OCs

grain size distribution (%) (MIT)

GR	SA	SI	CL
6	24	42	28
3	8	46	43

END OF BOREHOLE

Borehole was dry and caved to 18.6 m below ground surface upon completion of drilling.

S: 50 mm dia. monitoring well installed.
D: 50 mm dia. monitoring well installed.
No. 10 screen

104-S GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	2.4	222.3
Jun 3, 2024	2.3	222.4

104-D GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	18.2	206.5
Jun 3, 2024	18.3	206.4

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 9, 2024
Position : E: 591943, N: 4832901 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 105

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
224.6	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	6
223.8 / 0.8	**SAND**, some silt, trace clay, trace gravel, loose, brown, moist (REWORKED)		2	SS	11
	SAND, trace silt, trace clay, trace gravel, compact, brown, wet ...at 1.7 m, silt, some sand, trace clay, moist		3A 3B	SS	10
222.3 / 2.3	**CLAYEY SILT**, some sand, trace gravel, stiff to very stiff, grey, moist (GLACIAL TILL) ...at 3.0 m, natural organic odour to 6.1 m		4	SS	9
			5	SS	14
			6	SS	21
			7	SS	23
217.9 / 6.7	**END OF BOREHOLE**				

depth scale (m): 0 1 2 3 4 5 6

well details

elevation (m): 224 223 222 221 220 219 218

undrained shear strength (kPa): ■ unconfined ● pocket penetrometer + field vane ○ Lab Vane; 40 80 120 160

SPT N-values (bpf): × dynamic cone; 10 20 30 40

headspace vapour (ppm): × hexane □ isobutylene △ methane; 100 200 300

moisture / plasticity: PL MC LL; 10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT): GR SA SI CL

Unstabilized water level measured at 0.9 m below ground surface; caved to 4.6 m below ground surface upon completion of drilling.

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

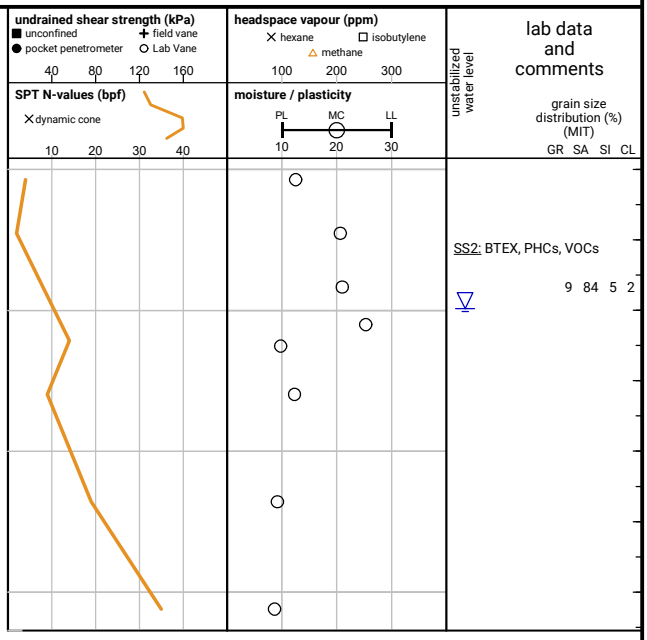
Date Started : May 9, 2024
Position : E: 592079, N: 4832884 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 106

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
224.2	**GROUND SURFACE**				
	250mm **TOPSOIL**		1	SS	4
	SAND, some silt, trace clay, trace gravel, very loose, brown, moist to wet (REWORKED)		2	SS	2
222.7 / 1.5	**SAND**, trace silt, trace clay, trace gravel, loose, brown, wet		3	SS	8
221.8 / 2.4	...at 2.3 m, silt, some sand, trace clay		4A / 4B	SS	14
	CLAYEY SILT, some sand, trace gravel, stiff to very stiff, grey, moist (GLACIAL TILL)		5	SS	9
			6	SS	19
	...at 6.1 m, hard		7	SS	35
217.5 / 6.7					



END OF BOREHOLE

Unstabilized water level measured at 2.1 m below ground surface; open upon completion of drilling.

S: 50 mm dia. monitoring well installed.
D: 50 mm dia. monitoring well installed.
No. 10 screen

106-S GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	1.6	222.6
Jun 3, 2024	1.8	222.4

106-D GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	2.9	221.3
Jun 3, 2024	2.8	221.4

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

BOREHOLE LOG 107

Date Started : May 13, 2024
Position : E: 591884, N: 4832659 (UTM 17T)
Elev. Datum : Geodetic

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
225.8	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	5
	SANDY SILT, some clay, trace gravel, trace rootlets, loose, brown, moist (REWORKED)		2	SS	8
224.3 / 1.5	**CLAYEY SILT**, some sand to sandy, very stiff, brown with black, moist (GLACIAL TILL)		3	SS	22
	...at 1.8 m, natural organic odour		4	SS	26
			5	SS	25
			6	SS	15
219.2 / 6.6	...at 6.1 m, trace shale fragments		7	SS	23

depth scale (m): 0, 1, 2, 3, 4, 5, 6
elevation (m): 225, 224, 223, 222, 221, 220

undrained shear strength (kPa): unconfined, pocket penetrometer, field vane, Lab Vane; 40, 80, 120, 160
SPT N-values (bpf): dynamic cone; 10, 20, 30, 40
headspace vapour (ppm): hexane, isobutylene, methane; 100, 200, 300
moisture / plasticity: PL, MC, LL; 10, 20, 30
unstabilized water level
lab data and comments
grain size distribution (%) (MIT): GR SA SI CL

SS1: OCs

SS2: H-Ms, Metals, ORPs

END OF BOREHOLE

Dry and open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	0.6	225.2
Jun 3, 2024	0.5	225.3

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

BOREHOLE LOG 108

Date Started : May 13, 2024
Position : E: 591714, N: 4832553 (UTM 17T)
Elev. Datum : Geodetic

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
228.1	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	3
	SANDY SILT, some clay, trace gravel, very loose to compact, brown, moist (REWORKED)		2	SS	11
226.6 / 1.5	**CLAYEY SILT**, some sand, trace gravel, very stiff, brown with black, moist (GLACIAL TILL)		3	SS	16
			4	SS	21
	...at 3.0 m, grey with orange		5	SS	29
222.0 / 6.1	No split spoon sample recovery, inferred clayey silt glacial till, hard		6	SS	25
			7	SS	50 / 100mm
			8	SS	44
220.0 / 8.1			9	SS	37

depth scale (m): 0 1 2 3 4 5 6 7 8

well details

elevation (m): 228 227 226 225 224 223 222 221

undrained shear strength (kPa)
■ unconfined + field vane
● pocket penetrometer ○ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene △ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

6.1m: no recovery, auger cuttings are consistent with the above soils

6.9m: no recovery, auger cuttings are consistent with the above soils

7.6m: no recovery, auger cuttings are consistent with the above soils

END OF BOREHOLE

Unstabilized water level measured at 3.0 m below ground surface; caved to 5.2 m below ground surface upon completion of drilling.

GROUNDED ENGINEERING

Date Started : May 14, 2024
Position : E: 591710, N: 4832397 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 109

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
229.1	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	4
	SANDY SILT, some clay, trace gravel, trace rootlets, loose, brown, moist (REWORKED)		2A 2B	SS	4
227.6 1.5	...at 0.8 m, brown with orange ...at 1.0 m, wet		3	SS	13
	SILTY SAND, compact, brown, wet				
226.7 2.4	...at 2.3 m, sand and silt, some clay, trace gravel		4A 4B	SS	14
	CLAYEY SILT, some sand, trace gravel, stiff to very stiff, grey, moist (GLACIAL TILL)		5	SS	12
			6	SS	14
			7	SS	21
222.5 6.6					

depth scale (m): 0 1 2 3 4 5 6
well details
elevation (m): 229 228 227 226 225 224 223

undrained shear strength (kPa): ■ unconfined ● pocket penetrometer + field vane ○ Lab Vane; 40 80 120 160
SPT N-values (bpf): × dynamic cone; 10 20 30 40
headspace vapour (ppm): × hexane □ isobutylene △ methane; 100 200 300
moisture / plasticity: PL MC LL; 10 20 30
unstabilized water level
lab data and comments
grain size distribution (%) (MIT): GR SA SI CL

END OF BOREHOLE

Unstabilized water level measured at 2.1 m below ground surface; caved to 4.6 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	0.9	228.2
Jun 3, 2024	1.1	228.0

Tech : BJW | **PM** : SB/LL | **Rev** : KB

file: gint 24-048 - hg rev.gpj

GROUNDED ENGINEERING

Date Started : May 14, 2024
Position : E: 591508, N: 4832594 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 110

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
229.1	**GROUND SURFACE**				
	150mm **TOPSOIL**		1	SS	5
	SILTY SAND, trace clay, loose, brown with orange, wet (REWORKED)		2	SS	8
227.4	...at 1.5 m, compact		3A		
1.7	**CLAYEY SILT**, some sand, trace gravel, very stiff, grey with orange, moist (GLACIAL TILL) ...at 1.8 m, natural organic odour		3B	SS	19
			4	SS	17
			5	SS	19
			6	SS	24
	...at 6.1 m, sand seams		7	SS	23
222.5					
6.6	**END OF BOREHOLE**				

depth scale (m): 0 1 2 3 4 5 6

well details

elevation (m): 229 228 227 226 225 224 223

undrained shear strength (kPa)
■ unconfined + field vane
● pocket penetrometer ○ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene △ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS1: H-Ms, Metals, ORPs

SS2: OCs

Borehole was dry and caved to 5.5 m below ground surface upon completion of drilling.

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 13, 2024
Position : E: 591686, N: 4832732 (UTM 17T)
Elev. Datum : Geodetic

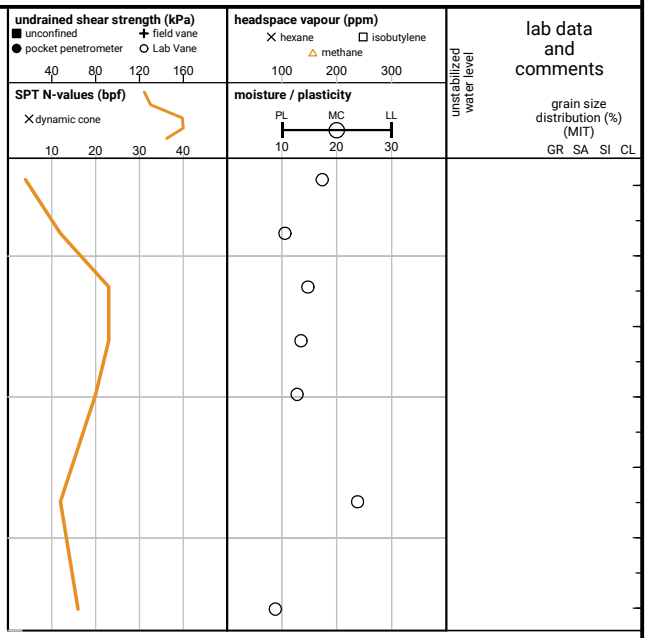
BOREHOLE LOG 111

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
227.4	**GROUND SURFACE**				
	250mm **TOPSOIL**		1	SS	4
226.6 / 0.8	**SANDY SILT**, trace clay, trace gravel, trace rootlets, loose, brown, moist (REWORKED)		2	SS	12
	CLAYEY SILT, some sand, trace gravel, trace light grey silt partings, stiff to very stiff, brown, moist (GLACIAL TILL)		3	SS	23
	...at 2.3 m, brown with orange		4	SS	23
	...at 3.0 m, grey, natural organic odour, sand seams		5	SS	20
222.8 / 4.6	**SILT AND CLAY**, trace sand, stiff, grey, moist		6	SS	12
221.3 / 6.1	**CLAYEY SILT**, some sand, trace gravel, very stiff, grey, moist (GLACIAL TILL)		7	SS	16
220.7 / 6.7	**END OF BOREHOLE**				

Borehole was dry and caved to 5.8 m below ground surface upon completion of drilling.



file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

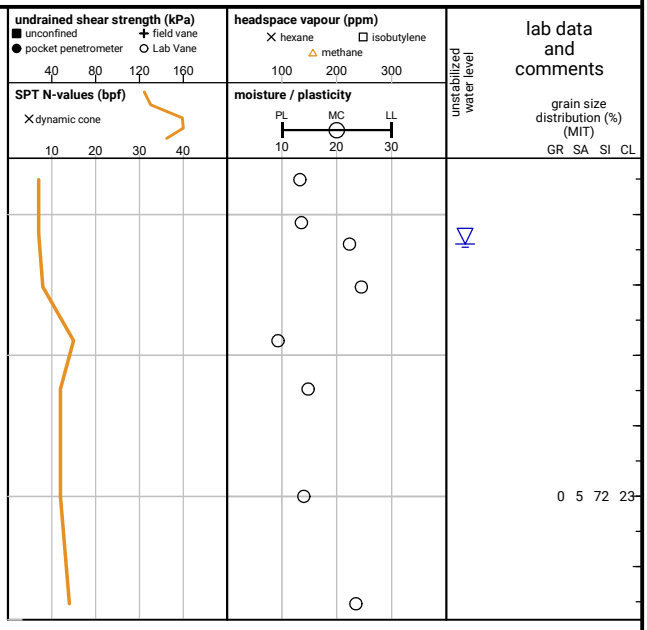
Date Started : May 15, 2024
Position : E: 591474, N: 4832739 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 112

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
228.8	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	7
227.7 / 1.1	**GRAVELLY SAND**, some silt, trace clay, loose, brown, moist (REWORKED)		2A / 2B	SS	7
	SAND, trace silt, trace clay, loose, brown, wet		3	SS	8
226.5 / 2.3	...at 1.5 m, silt, some sand				
	CLAYEY SILT, some sand, trace gravel, very stiff to stiff, grey, moist (GLACIAL TILL)		4	SS	15
	...at 3.0 m, silt and clay		5	SS	12
224.2 / 4.6	**CLAYEY SILT**, trace sand, stiff, grey, moist		6	SS	12
	...at 6.1 m, silt and clay, trace gravel, stiff		7	SS	14
222.2 / 6.6	**END OF BOREHOLE**				



Unstabilized water level measured at 1.2 m below ground surface; caved to 4.9 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	0.4	228.4
Jun 3, 2024	0.4	228.4

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 15, 2024
Position : E: 591342, N: 4832754 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 113

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
231.2	**GROUND SURFACE**				
	150mm **TOPSOIL**		1	SS	4
230.4 / 0.8	**SILTY SAND**, trace gravel, trace clay, loose, brown, moist (REWORKED)		2	SS	9
	SAND, some gravel, trace silt, trace clay, loose, brown, wet		3A / 3B	SS	9
228.9 / 2.3	...at 1.5 m, trace gravel ...at 1.7 m, silty sand		4	SS	11
	SILTY SAND, some gravel, some clay, compact, grey, wet (GLACIAL TILL)		5	SS	18
	...at 3.0 m, sandy silt, moist		6	SS	19
			7	SS	18
	...at 7.6 m, some sand, some clay, wet		8	SS	27
223.1 / 8.1	**END OF BOREHOLE**				

depth scale (m): 0 1 2 3 4 5 6 7 8

well details

elevation (m): 231 230 229 228 227 226 225 224

undrained shear strength (kPa)
■ unconfined + field vane
● pocket penetrometer ○ Lab Vane
40 80 120 160

SPT N-values (bpf)
× dynamic cone
10 20 30 40

headspace vapour (ppm)
× hexane □ isobutylene △ methane
100 200 300

moisture / plasticity
PL MC LL
10 20 30

unstabilized water level

lab data and comments

grain size distribution (%) (MIT)

GR	SA	SI	CL
16	44	33	7
12	34	38	16

Unstabilized water level measured at 1.5 m below ground surface; caved to 4.9 m below ground surface upon completion of drilling.

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

BOREHOLE LOG 114

Date Started : May 15, 2024
Position : E: 591191, N: 4832907 (UTM 17T)
Elev. Datum : Geodetic

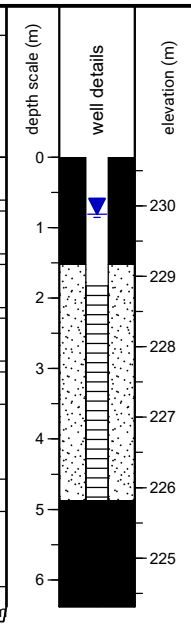
File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

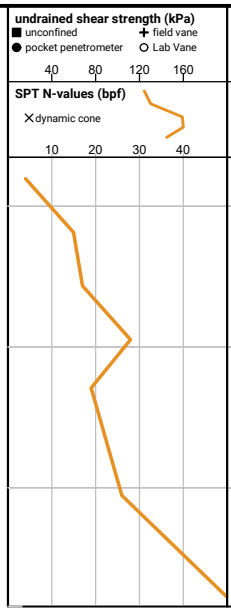
drill method : hollow stem augers OD=215 mm

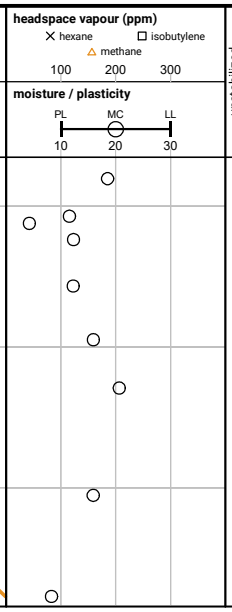
elev depth (m)	description	graphic log	number	type	SPT N-value
230.7	**GROUND SURFACE**				
	200mm **TOPSOIL**		1	SS	4
229.7 / 1.0	**SANDY SILT**, clayey, trace gravel, trace rootlets, loose, brown, moist (REWORKED)		2A 2B 2C	SS	15
	...at 0.8 m, some clay, compact				
	...at 0.9 m, black sand seam		3	SS	17
228.4 / 2.3	**CLAYEY SILT**, some sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		4	SS	28
	...at 1.5 m, trace shale fragments, brown with black		5	SS	19
	SILT AND CLAY, trace to some sand, trace gravel, very stiff, brown with orange, moist				
	...at 4.6 m, grey		6	SS	26
224.3 / 6.4	...at 6.1 m, silty sand, trace clay, trace rock fragments, very dense		7	SS	50 / 125mm

END OF BOREHOLE

Borehole was dry and caved to 5.5 m below ground surface upon completion of drilling.







unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS1: H-Ms, Metals, ORPs

2A: OCs

2C: PAHs

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	2.2	228.5
Jun 3, 2024	0.8	229.9

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 10, 2024
Position : E: 591694, N: 4832947 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 115

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
226.0	**GROUND SURFACE**				
	150mm **TOPSOIL**		1	SS	3
225.2 / 0.8	**FILL**, silty sand, some clay, trace gravel, very loose, dark brown, moist		2	SS	14
	CLAYEY SILT, some sand, trace gravel, stiff to very stiff, brown, moist (GLACIAL TILL)		3	SS	23
	...at 1.5 m, wet				
	...at 2.4 m, grey, moist		4A/4B	SS	24
			5	SS	23
			6	SS	20
220.8 / 5.2					

depth scale (m): 0, 1, 2, 3, 4, 5
elevation (m): 225, 224, 223, 222, 221

undrained shear strength (kPa): unconfined, pocket penetrometer, field vane, Lab Vane; 40, 80, 120, 160
SPT N-values (bpf): dynamic cone; 10, 20, 30, 40
headspace vapour (ppm): hexane, isobutylene, methane; 100, 200, 300
moisture / plasticity: PL, MC, LL; 10, 20, 30
unstabilized water level

lab data and comments
grain size distribution (%) (MIT) GR SA SI CL

SS2: H-Ms, Metals, ORPs
SS3: BTEX, PHCs, VOCs

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface; open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	2.0	224.0
Jun 3, 2024	1.9	224.1

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 10, 2024
Position : E: 591721, N: 4832962 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 116

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method	elev / depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	225.8	**GROUND SURFACE**				
hollow stem augers OD=215 mm		200mm **TOPSOIL**		1	SS	2
		FILL, silty sand, trace clay, trace gravel, very loose, brown, moist ...at 0.8 m, some silt, some gravel, loose		2	SS	6
		...at 1.5 m, compact		3A	SS	10
	223.8 2.0	**CLAYEY SILT**, some sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		3B		
		...at 2.3 m, grey		4	SS	20
	222.1 3.7			5	SS	25

depth scale (m): 0, 1, 2, 3
elevation (m): 225, 224, 223

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane; 40, 80, 120, 160
SPT N-values (bpf): dynamic cone; 10, 20, 30, 40
headspace vapour (ppm): hexane, isobutylene, methane; 100, 200, 300
moisture / plasticity: PL, MC, LL; 10, 20, 30

unstabilized water level

lab data and comments
grain size distribution (%) (MIT)
GR SA SI CL

SS1: OCs
SS2: H-Ms, Metals, ORPs

END OF BOREHOLE

Unstabilized water level measured at 1.5 m below ground surface; caved to 2.1 m below ground surface upon completion of drilling.

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

GROUNDED ENGINEERING

Date Started : May 10, 2024
Position : E: 591732, N: 4832950 (UTM 17T)
Elev. Datum : Geodetic

BOREHOLE LOG 117

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method	elev / depth (m)	description	graphic log	number	type	SPT N-value
	226.0	**GROUND SURFACE**				
hollow stem augers OD=215 mm		150mm **TOPSOIL**		1	SS	2
		FILL, silty sand, trace clay, trace gravel, trace construction debris, very loose, dark brown, moist		2A/2B	SS	13
	224.2 / 1.8	...at 0.8 m, sandy silt, trace rootlets, compact ...at 0.9 m, gravelly sand, some silt		3A/3B	SS	11
	223.7 / 2.3	**SILT AND CLAY**, trace to some sand, trace gravel, stiff, brown, moist		4	SS	33
		CLAYEY SILT, some sand, trace gravel, hard to very stiff, grey, moist (GLACIAL TILL)		5	SS	27
	220.8 / 5.2	...at 4.6 m, trace rock fragments, sand seams		6	SS	73

depth scale (m) 0–5 | well details | elevation (m) 226–221

undrained shear strength (kPa): unconfined, field vane, pocket penetrometer, Lab Vane; 40 80 120 160
SPT N-values (bpf): dynamic cone; 10 20 30 40
headspace vapour (ppm): hexane, isobutylene, methane; 100 200 300
moisture / plasticity: PL MC LL; 10 20 30
unstabilized water level
lab data and comments
grain size distribution (%) (MIT): GR SA SI CL

3A: BTEX, VOCs

END OF BOREHOLE

Unstabilized water level measured at 3.7 m below ground surface; open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	1.6	224.4
Jun 3, 2024	1.4	224.6

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

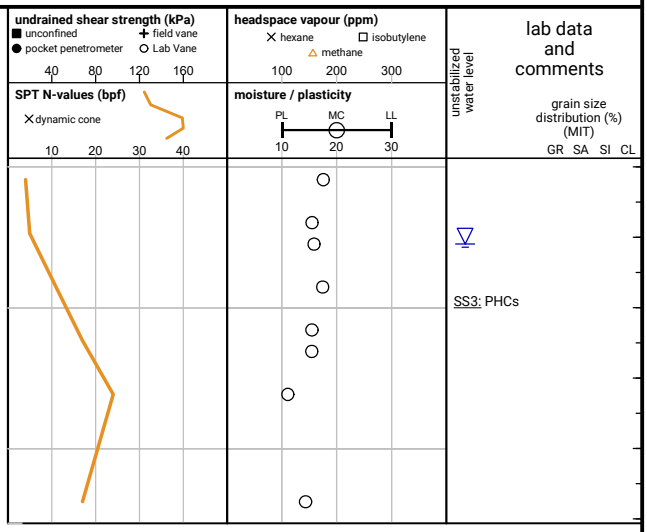
BOREHOLE LOG 118

Date Started : May 13, 2024
Position : E: 591756, N: 4832964 (UTM 17T)
Elev. Datum : Geodetic

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method : hollow stem augers OD=215 mm

elev depth (m)	description	graphic log	number	type	SPT N-value
226.1	**GROUND SURFACE**				
	150mm **TOPSOIL**		1	SS	4
	FILL, sandy silt, trace to some clay, trace rootlets, loose, dark brown, moist		2A	SS	5
	...at 1.1 m, gravelly sand, trace silt		2B		
224.6 1.5	**SAND**, some gravel, trace silt, compact, brown, wet		3	SS	11
223.5 2.6	...at 2.3 m, trace gravel		4A	SS	17
	CLAYEY SILT, some sand, trace gravel, very stiff, brown, moist (GLACIAL TILL)		4B		
	...at 3.0 m, grey		5	SS	24
	...at 4.6 m, trace rock fragments		6	SS	17
220.9 5.2	**END OF BOREHOLE**				



Unstabilized water level measured at 1.2 m below ground surface; caved to 4.0 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	1.6	224.5
Jun 3, 2024	1.6	224.5

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

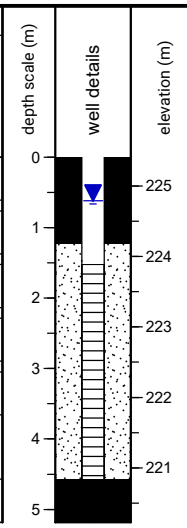
GROUNDED ENGINEERING

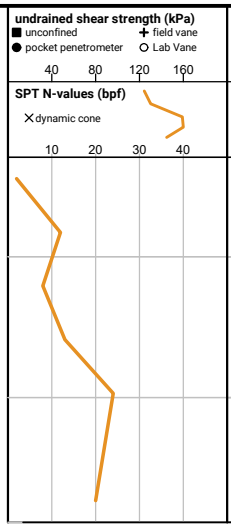
Date Started : May 10, 2024
Position : E: 591777, N: 4832930 (UTM 17T)
Elev. Datum : Geodetic

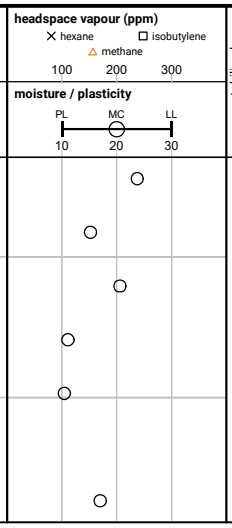
BOREHOLE LOG 119

File No. : 24-048 **Project** : 16469 10 Side Road, Halton Hills **Client** : Russell Pines Property Corp.

drill method	elev / depth (m)	description	graphic log	samples: number	samples: type	samples: SPT N-value
	225.4	**GROUND SURFACE**				
hollow stem augers OD=215 mm		150mm **TOPSOIL**		1	SS	2
		FILL, sand, some silt, trace gravel, trace clay, trace rootlets, very loose, dark brown, wet		2	SS	12
	223.9	...at 0.8 m, some gravel, trace silt				
	1.5	**CLAYEY SILT**, some sand, trace gravel, firm, brown, moist (GLACIAL TILL)		3	SS	8
		...at 2.3 m, sandy, stiff to very stiff, grey		4	SS	13
				5	SS	24
		...at 4.6 m, some sand		6	SS	20
	220.2					
	5.2	**END OF BOREHOLE**				







unstabilized water level

lab data and comments

grain size distribution (%) (MIT)
GR SA SI CL

SS5: BTEX, PHCs

Unstabilized water level measured at 1.2 m below ground surface; open upon completion of drilling.

50 mm dia. monitoring well installed.
No. 10 screen

GROUNDWATER LEVELS

date	depth (m)	elevation (m)
May 27, 2024	0.5	224.9
Jun 3, 2024	0.6	224.8

file: gint 24-048 - hg rev.gpj

Tech : BJW | **PM** : SB/LL | **Rev** : KB

APPENDIX H

ALS Canada Ltd.

CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: **WT2413558**	Page	: 1 of 17
Client	: **Grounded Engineering Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Haley Gazo	Account Manager	: Amanda Overholster
Address	: 1 Banigan Drive Toronto ON Canada M4H 1G3	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: 1 416 817 2944
Project	: 24-048	Date Samples Received	: 28-May-2024 08:40
PO	: ----	Date Analysis Commenced	: 28-May-2024
C-O-C number	: 20-1085356	Issue Date	: 04-Jun-2024 16:33
Sampler	: CLIENT		
Site	: ----		
Quote number	: Halton Sewer Use and PWQO/ODWS		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Andrea Armstrong	Department Manager - Air Quality and Volatiles	VOC, Waterloo, Ontario
Greg Pokocky	Manager - Inorganics	Inorganics, Waterloo, Ontario
Jeremy Gingras	Supervisor - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
Jocelyn Kennedy	Department Manager - Semi-Volatile Organics	Organics, Waterloo, Ontario
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Metals, Waterloo, Ontario
Srihari Prathap	Account Manager Assistant	Administration, Waterloo, Ontario
Zeba Patel	Analyst	Microbiology, Waterloo, Ontario

Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
BH109-SW	Water	Temperature, field	Temperature indirectly affects health and aesthetics through impacts on disinfection, corrosion control and formation of biofilms in the distribution system.	ONDWS	AO/OG	18.9 °C	15 °C
	Water	Colour, apparent	May interfere with disinfection; removal is important to ensure effective treatment.	ONDWS	AO/OG	350 CU	5 CU
	Water	Hardness (as CaCO3), dissolved	Hardness levels between 80 and 100 mg/L (as CaCO3) provide acceptable balance between corrosion and incrustation; where a water softener is used, a separate unsoftened supply for cooking and drinking purposes is recommended.	ONDWS	AO/OG	400 mg/L	80-100 mg/L
	Water	Turbidity	Filtration systems should be designed and operated to reduce turbidity levels as low as reasonably achievable and strive to achieve a treated water turbidity target from individual filters of less than 0.1 NTU. Particles can harbour microorganisms, protecting them from disinfection, and can entrap heavy metals and biocides; elevated or fluctuating turbidity in filtered water can indicate a problem with the water treatment process and a potential increased risk of pathogens in treated water.	ONDWS	AO/OG	83.2 NTU	5 NTU
	Water	Aluminum, total	There is no consistent, convincing evidence that aluminum in drinking water causes adverse health effects in humans. The operational guideline applies to treatment plants using aluminum-based coagulants; it does not apply to naturally occurring aluminum found in groundwater. For treatment plants using aluminum-based coagulants, monthly samples should be taken of the water leaving the plant; the OGs are based on a running annual average of monthly samples.	ONDWS	AO/OG	17.7 mg/L	0.1 mg/L
	Water	Iron, total	Based on taste and staining of laundry and plumbing fixtures; no evidence exists of dietary iron toxicity in the general population.	ONDWS	AO/OG	37.6 mg/L	0.3 mg/L
	Water	Manganese, total	Based on taste and staining of laundry and plumbing fixtures.	ONDWS	AO/OG	1.23 mg/L	0.05 mg/L
	Water	Coliforms, Escherichia coli [E. coli]	The presence of E. coli indicates recent faecal contamination and the potential presence of microorganisms capable of causing gastrointestinal illnesses; pathogens in human and animal faeces pose the most immediate danger to public health.	ONDWS	MAC	2 CFU/100mL	1 CFU/100mL
	Water	Arsenic, total	Health basis of MAC: Cancer (lung, bladder, liver, skin) (classified as human carcinogen). Other: Skin, vascular and neurological effects (numbness and tingling of extremities).	ONDWS	MAC	0.0108 mg/L	0.01 mg/L

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
	Water	Lead, total	Health basis of MAC: Biochemical and neurobehavioural effects (intellectual development, behaviour) in infants and young children (under 6 years). Other: Anaemia, central nervous system effects; in pregnant women, can affect the unborn child; in infants and children under 6 years, can affect intellectual development, behaviour, size and hearing; classified as probably carcinogenic to humans. MAC is based on chronic effects, it is intended to apply to average concentrations in water consumed for extended periods. Exposure to lead should nevertheless be kept to a minimum; plumbing should be thoroughly flushed before water is used for consumption; most significant contribution is generally from lead service line entering the building.	ONDWS	MAC	0.0115 mg/L	0.01 mg/L
	Water	Phosphorus, total		ONPWQO	IPWQOT2<100	0.206 mg/L	0.01 mg/L
	Water	Aluminum, total	Based on pH between 6.5 and 9.0	ONPWQO	IPWQOT2<100	17.7 mg/L	0.075 mg/L
	Water	Arsenic, total		ONPWQO	IPWQOT2<100	0.0108 mg/L	0.005 mg/L
	Water	Cadmium, total	Based on Hardness < 100 mg/L	ONPWQO	IPWQOT2<100	0.000191 mg/L	0.0001 mg/L
	Water	Cobalt, total		ONPWQO	IPWQOT2<100	0.0154 mg/L	0.0009 mg/L
	Water	Copper, total	Based on Hardness < 20 mg/L	ONPWQO	IPWQOT2<100	0.0649 mg/L	0.001 mg/L
	Water	Lead, total	Based on Hardness <30 mg/L	ONPWQO	IPWQOT2<100	0.0115 mg/L	0.001 mg/L
	Water	Nickel, total		ONPWQO	IPWQOT2<100	0.0348 mg/L	0.025 mg/L
	Water	Vanadium, total		ONPWQO	IPWQOT2<100	0.0328 mg/L	0.006 mg/L
	Water	Zinc, total		ONPWQO	IPWQOT2<100	0.0917 mg/L	0.02 mg/L
	Water	Cadmium, dissolved	Based on Hardness < 100 mg/L	ONPWQO	IPWQOT2<100	0.000234 mg/L	0.0001 mg/L
	Water	Phosphorus, total		ONPWQO	IPWQOT2>100	0.206 mg/L	0.01 mg/L
	Water	Aluminum, total	Based on pH between 6.5 and 9.0	ONPWQO	IPWQOT2>100	17.7 mg/L	0.075 mg/L
	Water	Arsenic, total		ONPWQO	IPWQOT2>100	0.0108 mg/L	0.005 mg/L
	Water	Cobalt, total		ONPWQO	IPWQOT2>100	0.0154 mg/L	0.0009 mg/L
	Water	Copper, total	Based on Hardness > 20 mg/L	ONPWQO	IPWQOT2>100	0.0649 mg/L	0.005 mg/L
	Water	Lead, total	Based on Alkalinity >80 mg/L	ONPWQO	IPWQOT2>100	0.0115 mg/L	0.005 mg/L
	Water	Nickel, total		ONPWQO	IPWQOT2>100	0.0348 mg/L	0.025 mg/L
	Water	Vanadium, total		ONPWQO	IPWQOT2>100	0.0328 mg/L	0.006 mg/L
	Water	Zinc, total		ONPWQO	IPWQOT2>100	0.0917 mg/L	0.02 mg/L
	Water	Copper, total		ONPWQO	PWQOT2<100	0.0649 mg/L	0.005 mg/L

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
	Water	Iron, total		ONPWQO	PWQOT2<100	37.6 mg/L	0.3 mg/L
	Water	Lead, total	Based on Alkalinity <20 mg/L	ONPWQO	PWQOT2<100	0.0115 mg/L	0.005 mg/L
	Water	Nickel, total		ONPWQO	PWQOT2<100	0.0348 mg/L	0.025 mg/L
	Water	Zinc, total		ONPWQO	PWQOT2<100	0.0917 mg/L	0.03 mg/L
	Water	Cadmium, dissolved		ONPWQO	PWQOT2<100	0.000234 mg/L	0.0002 mg/L
	Water	Phenols, total (4AAP)		ONPWQO	PWQOT2<100	0.0013 mg/L	0.001 mg/L
	Water	Copper, total		ONPWQO	PWQOT2>100	0.0649 mg/L	0.005 mg/L
	Water	Iron, total		ONPWQO	PWQOT2>100	37.6 mg/L	0.3 mg/L
	Water	Nickel, total		ONPWQO	PWQOT2>100	0.0348 mg/L	0.025 mg/L
	Water	Zinc, total		ONPWQO	PWQOT2>100	0.0917 mg/L	0.03 mg/L
	Water	Cadmium, dissolved		ONPWQO	PWQOT2>100	0.000234 mg/L	0.0002 mg/L
	Water	Phenols, total (4AAP)		ONPWQO	PWQOT2>100	0.0013 mg/L	0.001 mg/L

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.
Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	Description
-	no units
%	percent
°C	degrees celsius
µg/L	micrograms per litre
µS/cm	microsiemens per centimetre
CFU/100mL	colony forming units per hundred millilitres
CU	colour units (1 cu = 1 mg/l pt)
meq/L	milliequivalents per litre
mg/L	milligrams per litre
NTU	nephelometric turbidity units
pH units	pH units

>: greater than.
<: less than.
Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).
For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit.

Qualifiers

Qualifier	Description
BODL	*Limit of Reporting for BOD was increased to account for the largest volume of sample tested.*
DLDS	*Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.*
DLHC	*Detection Limit Raised: Dilution required due to high concentration of test analyte(s).*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results Evaluation

Matrix: **Water**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH109-SW	----	----	----	----	----	----
				Sampling date/time	27-May-2024 13:25	----	----	----	----	----	----
				Sub-Matrix	Water	----	----	----	----	----	----
					WT2413558-001	--------	--------	--------	--------	--------	--------
Field Tests											
pH, field	----	EF001/WT	pH units		7.49	----	----	----	----	----	----
Temperature, field	----	EF001/WT	°C		18.9	----	----	----	----	----	----
Physical Tests											
Alkalinity, bicarbonate (as HCO3)	71-52-3	E290/WT	mg/L		308	----	----	----	----	----	----
Alkalinity, carbonate (as CO3)	3812-32-6	E290/WT	mg/L		<1.0	----	----	----	----	----	----
Alkalinity, hydroxide (as OH)	14280-30-9	E290/WT	mg/L		<1.0	----	----	----	----	----	----
Alkalinity, total (as CaCO3)	----	E290/WT	mg/L		252	----	----	----	----	----	----
Colour, apparent	----	E330/WT	CU		350 DLM	----	----	----	----	----	----
Conductivity	----	E100/WT	µS/cm		831	----	----	----	----	----	----
Hardness (as CaCO3), dissolved	----	EC100/WT	mg/L		400	----	----	----	----	----	----
pH	----	E108/WT	pH units		7.94	----	----	----	----	----	----
Solids, total dissolved [TDS]	----	E162/WT	mg/L		464 DLDS	----	----	----	----	----	----
Solids, total dissolved [TDS], calculated	----	EC103A/WT	mg/L		540	----	----	----	----	----	----
Solids, total suspended [TSS]	----	E160/WT	mg/L		142	----	----	----	----	----	----
Turbidity	----	E121/WT	NTU		83.2	----	----	----	----	----	----
Langelier index (@ 20°C)	----	EC105A/WT	-		1.16	----	----	----	----	----	----
Langelier index (@ 4°C)	----	EC105A/WT	-		0.914	----	----	----	----	----	----
pH, saturation (@ 20°C)	----	EC105A/WT	pH units		6.78	----	----	----	----	----	----
pH, saturation (@ 4°C)	----	EC105A/WT	pH units		7.03	----	----	----	----	----	----
Anions and Nutrients											
Ammonia, un-ionized (as N), field	7664-41-7	EC298A/WT	mg/L		0.0022	----	----	----	----	----	----
Ammonia, un-ionized (as NH3), field	7664-41-7	EC298A/WT	mg/L		0.0027	----	----	----	----	----	----
Fluoride	16984-48-8	E235.F/WT	mg/L		0.167	----	----	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318/WT	mg/L		0.791	----	----	----	----	----	----
Phosphorus, total	7723-14-0	E372-U/WT	mg/L		0.206	----	----	----	----	----	----
Sulfate (as SO4)	14808-79-8	E235.SO4/WT	mg/L		63.3	----	----	----	----	----	----
Ammonia, total (as N)	7664-41-7	E298/WT	mg/L		0.198	----	----	----	----	----	----

Analytical Results Evaluation

Matrix: **Water**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH109-SW	----	----	----	----	----	----
				Sampling date/time	27-May-2024 13:25	----	----	----	----	----	----
				Sub-Matrix	Water	----	----	----	----	----	----
				WT2413558-001	--------	--------	--------	--------	--------	--------	--------
Anions and Nutrients											
Bromide	24959-67-9	E235.Br/WT	mg/L	<0.10	----	----	----	----	----	----	----
Chloride	16887-00-6	E235.Cl/WT	mg/L	66.7	----	----	----	----	----	----	----
Nitrate (as N)	14797-55-8	E235.NO3/WT	mg/L	6.78	----	----	----	----	----	----	----
Nitrate + Nitrite (as N)	----	EC235.N+N/WT	mg/L	7.04	----	----	----	----	----	----	----
Nitrite (as N)	14797-65-0	E235.NO2/WT	mg/L	0.264	----	----	----	----	----	----	----
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U/WT	mg/L	<0.0010	----	----	----	----	----	----	----
Cyanides											
Cyanide, strong acid dissociable (Total)	----	E333/WT	mg/L	<0.0020	----	----	----	----	----	----	----
Organic / Inorganic Carbon											
Carbon, total organic [TOC]	----	E355-L/WT	mg/L	2.89	----	----	----	----	----	----	----
Carbon, dissolved organic [DOC]	----	E358-L/WT	mg/L	1.30	----	----	----	----	----	----	----
Microbiological Tests											
Coliforms, Escherichia coli [E. coli]	----	E012A.EC/WT	CFU/100 mL	2	----	----	----	----	----	----	----
Metals											
Sodium adsorption ratio [SAR]	----	EC102/WT	-	0.21	----	----	----	----	----	----	----
Ion Balance											
Anion sum	----	EC101A/WT	meq/L	8.75	----	----	----	----	----	----	----
Cation sum (total)	----	EC101A/WT	meq/L	18.3	----	----	----	----	----	----	----
Ion balance (APHA)	----	EC101A/WT	%	35.3	----	----	----	----	----	----	----
Ion balance (cations/anions)	----	EC101A/WT	%	209	----	----	----	----	----	----	----
Total Metals											
Aluminum, total	7429-90-5	E420/WT	mg/L	17.7 DLHC	----	----	----	----	----	----	----
Antimony, total	7440-36-0	E420/WT	mg/L	<0.00100 DLHC	----	----	----	----	----	----	----
Arsenic, total	7440-38-2	E420/WT	mg/L	0.0108 DLHC	----	----	----	----	----	----	----
Barium, total	7440-39-3	E420/WT	mg/L	0.117 DLHC	----	----	----	----	----	----	----
Beryllium, total	7440-41-7	E420/WT	mg/L	0.000929 DLHC	----	----	----	----	----	----	----
Bismuth, total	7440-69-9	E420/WT	mg/L	<0.000500 DLHC	----	----	----	----	----	----	----

Analytical Results Evaluation

Matrix: **Water**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH109-SW	----	----	----	----	----	----
				Sampling date/time	27-May-2024 13:25	----	----	----	----	----	----
				Sub-Matrix	Water	----	----	----	----	----	----
				WT2413558-001	--------	--------	--------	--------	--------	--------	--------
Total Metals											
Boron, total	7440-42-8	E420/WT	mg/L	<0.100 DLHC	----	----	----	----	----	----	----
Cadmium, total	7440-43-9	E420/WT	mg/L	0.000191 DLHC	----	----	----	----	----	----	----
Calcium, total	7440-70-2	E420/WT	mg/L	193 DLHC	----	----	----	----	----	----	----
Cesium, total	7440-46-2	E420/WT	mg/L	0.00162 DLHC	----	----	----	----	----	----	----
Chromium, total	7440-47-3	E420/WT	mg/L	0.0257 DLHC	----	----	----	----	----	----	----
Cobalt, total	7440-48-4	E420/WT	mg/L	0.0154 DLHC	----	----	----	----	----	----	----
Copper, total	7440-50-8	E420/WT	mg/L	0.0649 DLHC	----	----	----	----	----	----	----
Iron, total	7439-89-6	E420/WT	mg/L	37.6 DLHC	----	----	----	----	----	----	----
Lead, total	7439-92-1	E420/WT	mg/L	0.0115 DLHC	----	----	----	----	----	----	----
Lithium, total	7439-93-2	E420/WT	mg/L	0.0449 DLHC	----	----	----	----	----	----	----
Magnesium, total	7439-95-4	E420/WT	mg/L	55.6 DLHC	----	----	----	----	----	----	----
Manganese, total	7439-96-5	E420/WT	mg/L	1.23 DLHC	----	----	----	----	----	----	----
Mercury, total	7439-97-6	E508/WT	mg/L	<0.0000050	----	----	----	----	----	----	----
Molybdenum, total	7439-98-7	E420/WT	mg/L	0.00233 DLHC	----	----	----	----	----	----	----
Nickel, total	7440-02-0	E420/WT	mg/L	0.0348 DLHC	----	----	----	----	----	----	----
Potassium, total	7440-09-7	E420/WT	mg/L	8.13 DLHC	----	----	----	----	----	----	----
Rubidium, total	7440-17-7	E420/WT	mg/L	0.0192 DLHC	----	----	----	----	----	----	----
Selenium, total	7782-49-2	E420/WT	mg/L	<0.000500 DLHC	----	----	----	----	----	----	----
Silicon, total	7440-21-3	E420/WT	mg/L	29.8 DLHC	----	----	----	----	----	----	----
Silver, total	7440-22-4	E420/WT	mg/L	<0.000100 DLHC	----	----	----	----	----	----	----
Sodium, total	7440-23-5	E420/WT	mg/L	12.7 DLHC	----	----	----	----	----	----	----
Strontium, total	7440-24-6	E420/WT	mg/L	0.518 DLHC	----	----	----	----	----	----	----
Sulfur, total	7704-34-9	E420/WT	mg/L	27.2 DLHC	----	----	----	----	----	----	----
Tellurium, total	13494-80-9	E420/WT	mg/L	<0.00200 DLHC	----	----	----	----	----	----	----
Thallium, total	7440-28-0	E420/WT	mg/L	0.000159 DLHC	----	----	----	----	----	----	----
Thorium, total	7440-29-1	E420/WT	mg/L	0.00430 DLHC	----	----	----	----	----	----	----
Tin, total	7440-31-5	E420/WT	mg/L	<0.00100 DLHC	----	----	----	----	----	----	----
Titanium, total	7440-32-6	E420/WT	mg/L	0.183 DLHC	----	----	----	----	----	----	----
Tungsten, total	7440-33-7	E420/WT	mg/L	<0.00100 DLHC	----	----	----	----	----	----	----

Analytical Results Evaluation

Matrix: **Water**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID						
				BH109-SW	----	----	----	----	----	----
				Sampling date/time	27-May-2024 13:25	----	----	----	----	----	----
				Sub-Matrix	Water	----	----	----	----	----	----
				WT2413558-001	--------	--------	--------	--------	--------	--------
Total Metals										
Uranium, total	7440-61-1	E420/WT	mg/L	0.00172 DLHC	----	----	----	----	----	----
Vanadium, total	7440-62-2	E420/WT	mg/L	0.0328 DLHC	----	----	----	----	----	----
Zinc, total	7440-66-6	E420/WT	mg/L	0.0917 DLHC	----	----	----	----	----	----
Zirconium, total	7440-67-7	E420/WT	mg/L	<0.00200 DLHC	----	----	----	----	----	----
Silicon (as SiO2), total	7631-86-9	EC420.SiO2/WT	mg/L	63.7	----	----	----	----	----	----
Dissolved Metals										
Cadmium, dissolved	7440-43-9	E421/WT	mg/L	0.000234	----	----	----	----	----	----
Calcium, dissolved	7440-70-2	E421/WT	mg/L	106	----	----	----	----	----	----
Magnesium, dissolved	7439-95-4	E421/WT	mg/L	33.0	----	----	----	----	----	----
Dissolved metals filtration location	----	EP421/WT	-	Field	----	----	----	----	----	----
Aggregate Organics										
Biochemical oxygen demand [BOD]	----	E550/WT	mg/L	<3.0 BODL	----	----	----	----	----	----
Oil & grease (gravimetric)	----	E567/WT	mg/L	<5.0	----	----	----	----	----	----
Oil & grease, animal/vegetable (gravimetric)	----	EC567A.SG/WT	mg/L	<5.0	----	----	----	----	----	----
Oil & grease, mineral (gravimetric)	----	E567SG/WT	mg/L	<5.0	----	----	----	----	----	----
Phenols, total (4AAP)	----	E562/WT	mg/L	0.0013	----	----	----	----	----	----
Volatile Organic Compounds										
Benzene	71-43-2	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Chloroform	67-66-3	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Dichlorobenzene, 1,4-	106-46-7	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Dichloromethane	75-09-2	E611D/WT	µg/L	<1.0	----	----	----	----	----	----
Ethylbenzene	100-41-4	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Tetrachloroethylene	127-18-4	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Toluene	108-88-3	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Trichloroethylene	79-01-6	E611D/WT	µg/L	<0.50	----	----	----	----	----	----
Volatile Organic Compounds Surrogates										
Bromofluorobenzene, 4-	460-00-4	E611D/WT	%	95.6	----	----	----	----	----	----
Difluorobenzene, 1,4-	540-36-3	E611D/WT	%	90.8	----	----	----	----	----	----

Analytical Results Evaluation

Matrix: **Water**

Analyte	CAS Number	Method/Lab	Unit	Client sample ID	BH109-SW	----	----	----	----	----	----
				Sampling date/time	27-May-2024 13:25	----	----	----	----	----	----
				Sub-Matrix	Water	----	----	----	----	----	----
				WT2413558-001	--------	--------	--------	--------	--------	--------	--------
Polycyclic Aromatic Hydrocarbons											
Naphthalene	91-20-3	E641A/WT	µg/L	<0.050	----	----	----	----	----	----	----
Polycyclic Aromatic Hydrocarbons Surrogates											
Chrysene-d12	1719-03-5	E641A/WT	%	91.4	----	----	----	----	----	----	----
Naphthalene-d8	1146-65-2	E641A/WT	%	98.0	----	----	----	----	----	----	----
Phenanthrene-d10	1517-22-2	E641A/WT	%	106	----	----	----	----	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Summary of Guideline Limits

Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM	ONDWS AO/OG	ONDWS MAC	ONPWQO IPWQOT2<100	ONPWQO IPWQOT2>100	ONPWQO PWQOT2<100
Field Tests									
pH, field	----	pH units	--	--	--	--	--	--	--
Temperature, field	----	°C	--	--	15 °C	--	--	--	--
Physical Tests									
Alkalinity, bicarbonate (as HCO3)	71-52-3	mg/L	--	--	--	--	--	--	--
Alkalinity, carbonate (as CO3)	3812-32-6	mg/L	--	--	--	--	--	--	--
Alkalinity, hydroxide (as OH)	14280-30-9	mg/L	--	--	--	--	--	--	--
Alkalinity, total (as CaCO3)	----	mg/L	--	--	30 - 500 mg/L	--	--	--	--
Colour, apparent	----	CU	--	--	5 CU	--	--	--	--
Conductivity	----	µS/cm	--	--	--	--	--	--	--
Hardness (as CaCO3), dissolved	----	mg/L	--	--	80 - 100 mg/L	--	--	--	--
Langelier index (@ 20°C)	----	-	--	--	--	--	--	--	--
Langelier index (@ 4°C)	----	-	--	--	--	--	--	--	--
pH, saturation (@ 20°C)	----	pH units	--	--	--	--	--	--	--
pH, saturation (@ 4°C)	----	pH units	--	--	--	--	--	--	--
pH	----	pH units	6 - 10 pH units	6.5 - 8.5 pH units	6.5 - 8.5 pH units	--	--	--	6.5 - 8.5 pH units
Solids, total dissolved [TDS], calculated	----	mg/L	--	--	--	--	--	--	--
Solids, total dissolved [TDS]	----	mg/L	--	--	500 mg/L	--	--	--	--
Solids, total suspended [TSS]	----	mg/L	350 mg/L	--	--	--	--	--	--
Turbidity	----	NTU	--	--	5 NTU	--	--	--	--
Anions and Nutrients									
Ammonia, total (as N)	7664-41-7	mg/L	--	--	--	--	--	--	--
Ammonia, un-ionized (as N), field	7664-41-7	mg/L	--	--	--	--	--	--	--
Ammonia, un-ionized (as NH3), field	7664-41-7	mg/L	--	--	--	--	0.02 mg/L	0.02 mg/L	0.02 mg/L
Bromide	24959-67-9	mg/L	--	--	--	--	--	--	--
Chloride	16887-00-6	mg/L	1500 mg/L	--	250 mg/L	--	--	--	--
Fluoride	16984-48-8	mg/L	10 mg/L	--	--	1.5 mg/L	--	--	--
Kjeldahl nitrogen, total [TKN]	----	mg/L	100 mg/L	--	--	--	--	--	--
Nitrate (as N)	14797-55-8	mg/L	--	--	--	10 mg/L	--	--	--
Nitrate + Nitrite (as N)	----	mg/L	--	--	--	10 mg/L	--	--	--
Nitrite (as N)	14797-65-0	mg/L	--	--	--	1 mg/L	--	--	--
Phosphate, ortho-, dissolved (as P)	14265-44-2	mg/L	--	--	--	--	--	--	--
Phosphorus, total	7723-14-0	mg/L	10 mg/L	--	--	--	0.01 mg/L	0.01 mg/L	--
Sulfate (as SO4)	14808-79-8	mg/L	1500 mg/L	--	500 mg/L	--	--	--	--
Cyanides									
Cyanide, strong acid dissociable (Total)	----	mg/L	2 mg/L	--	--	0.2 mg/L	--	--	0.005 mg/L
Organic / Inorganic Carbon									

Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM	ONDWS AO/OG	ONDWS MAC	ONPWQO IPWQOT2<100	ONPWQO IPWQOT2>100	ONPWQO PWQOT2<100
Organic / Inorganic Carbon - Continued									
Carbon, dissolved organic [DOC]	----	mg/L	--	--	5 mg/L	--	--	--	--
Carbon, total organic [TOC]	----	mg/L	--	--	--	--	--	--	--
Microbiological Tests									
Coliforms, Escherichia coli [E. coli]	----	CFU/100mL	--	200 CFU/100mL	--	1 CFU/100mL	--	--	100 CFU/100mL
Metals									
Sodium adsorption ratio [SAR]	----	-	--	--	--	--	--	--	--
Ion Balance									
Anion sum	----	meq/L	--	--	--	--	--	--	--
Cation sum (total)	----	meq/L	--	--	--	--	--	--	--
Ion balance (APHA)	----	%	--	--	--	--	--	--	--
Ion balance (cations/anions)	----	%	--	--	--	--	--	--	--
Total Metals									
Aluminum, total	7429-90-5	mg/L	50 mg/L	--	0.1 mg/L	--	0.075 mg/L	0.075 mg/L	--
Antimony, total	7440-36-0	mg/L	5 mg/L	--	--	0.006 mg/L	0.02 mg/L	0.02 mg/L	--
Arsenic, total	7440-38-2	mg/L	1 mg/L	--	--	0.01 mg/L	0.005 mg/L	0.005 mg/L	0.1 mg/L
Barium, total	7440-39-3	mg/L	--	--	--	1 mg/L	--	--	--
Beryllium, total	7440-41-7	mg/L	5 mg/L	--	--	--	--	--	1.1 mg/L
Bismuth, total	7440-69-9	mg/L	5 mg/L	--	--	--	--	--	--
Boron, total	7440-42-8	mg/L	--	--	--	5 mg/L	--	--	--
Cadmium, total	7440-43-9	mg/L	1 mg/L	--	--	0.005 mg/L	0.0001 mg/L	0.0005 mg/L	0.0002 mg/L
Calcium, total	7440-70-2	mg/L	--	--	--	--	--	--	--
Cesium, total	7440-46-2	mg/L	--	--	--	--	--	--	--
Chromium, total	7440-47-3	mg/L	3 mg/L	--	--	0.05 mg/L	--	--	--
Cobalt, total	7440-48-4	mg/L	5 mg/L	--	--	--	0.0009 mg/L	0.0009 mg/L	--
Copper, total	7440-50-8	mg/L	3 mg/L	--	1 mg/L	--	0.001 mg/L	0.005 mg/L	0.005 mg/L
Iron, total	7439-89-6	mg/L	50 mg/L	--	0.3 mg/L	--	--	--	0.3 mg/L
Lead, total	7439-92-1	mg/L	3 mg/L	--	--	0.01 mg/L	0.001 mg/L	0.005 mg/L	0.005 mg/L
Lithium, total	7439-93-2	mg/L	--	--	--	--	--	--	--
Magnesium, total	7439-95-4	mg/L	--	--	--	--	--	--	--
Manganese, total	7439-96-5	mg/L	5 mg/L	--	0.05 mg/L	--	--	--	--
Mercury, total	7439-97-6	mg/L	0.05 mg/L	--	--	0.001 mg/L	--	--	0.0002 mg/L
Molybdenum, total	7439-98-7	mg/L	5 mg/L	--	--	--	0.04 mg/L	0.04 mg/L	--
Nickel, total	7440-02-0	mg/L	3 mg/L	--	--	--	0.025 mg/L	0.025 mg/L	0.025 mg/L
Potassium, total	7440-09-7	mg/L	--	--	--	--	--	--	--
Rubidium, total	7440-17-7	mg/L	--	--	--	--	--	--	--
Selenium, total	7782-49-2	mg/L	5 mg/L	--	--	0.05 mg/L	0.1 mg/L	--	0.1 mg/L
Silicon (as SiO2), total	7631-86-9	mg/L	--	--	--	--	--	--	--
Silicon, total	7440-21-3	mg/L	--	--	--	--	--	--	--

Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM	ONDWS AO/OG	ONDWS MAC	ONPWQO IPWQOT2<100	ONPWQO IPWQOT2>100	ONPWQO PWQOT2<100
Total Metals - Continued									
Silver, total	7440-22-4	mg/L	5 mg/L	--	--	--	0.0001 mg/L	0.0001 mg/L	0.0001 mg/L
Sodium, total	7440-23-5	mg/L	--	--	200 mg/L	20 mg/L	--	--	--
Strontium, total	7440-24-6	mg/L	--	--	--	--	--	--	--
Sulfur, total	7704-34-9	mg/L	--	--	--	--	--	--	--
Tellurium, total	13494-80-9	mg/L	--	--	--	--	--	--	--
Thallium, total	7440-28-0	mg/L	--	--	--	--	0.0003 mg/L	0.0003 mg/L	--
Thorium, total	7440-29-1	mg/L	--	--	--	--	--	--	--
Tin, total	7440-31-5	mg/L	5 mg/L	--	--	--	--	--	--
Titanium, total	7440-32-6	mg/L	5 mg/L	--	--	--	--	--	--
Tungsten, total	7440-33-7	mg/L	--	--	--	--	0.03 mg/L	0.03 mg/L	--
Uranium, total	7440-61-1	mg/L	--	--	--	0.02 mg/L	0.005 mg/L	0.005 mg/L	--
Vanadium, total	7440-62-2	mg/L	5 mg/L	--	--	--	0.006 mg/L	0.006 mg/L	--
Zinc, total	7440-66-6	mg/L	3 mg/L	--	5 mg/L	--	0.02 mg/L	0.02 mg/L	0.03 mg/L
Zirconium, total	7440-67-7	mg/L	--	--	--	--	0.004 mg/L	0.004 mg/L	--
Dissolved Metals									
Cadmium, dissolved	7440-43-9	mg/L	--	--	--	0.005 mg/L	0.0001 mg/L	0.0005 mg/L	0.0002 mg/L
Calcium, dissolved	7440-70-2	mg/L	--	--	--	--	--	--	--
Dissolved metals filtration location	----	-	--	--	--	--	--	--	--
Magnesium, dissolved	7439-95-4	mg/L	--	--	--	--	--	--	--
Aggregate Organics									
Biochemical oxygen demand [BOD]	----	mg/L	300 mg/L	--	--	--	--	--	--
Oil & grease (gravimetric)	----	mg/L	--	--	--	--	--	--	--
Oil & grease, animal/vegetable (gravimetric)	----	mg/L	150 mg/L	--	--	--	--	--	--
Oil & grease, mineral (gravimetric)	----	mg/L	15 mg/L	--	--	--	--	--	--
Phenols, total (4AAP)	----	mg/L	1 mg/L	--	--	--	--	--	0.001 mg/L
Volatile Organic Compounds									
Benzene	71-43-2	µg/L	10 µg/L	--	--	1 µg/L	100 µg/L	100 µg/L	--
Chloroform	67-66-3	µg/L	40 µg/L	--	--	--	--	--	--
Dichlorobenzene, 1,4-	106-46-7	µg/L	80 µg/L	--	1 µg/L	5 µg/L	--	--	4 µg/L
Dichloromethane	75-09-2	µg/L	2000 µg/L	--	--	50 µg/L	100 µg/L	100 µg/L	--
Ethylbenzene	100-41-4	µg/L	160 µg/L	--	2.4 µg/L	140 µg/L	8 µg/L	8 µg/L	--
Tetrachloroethylene	127-18-4	µg/L	1000 µg/L	--	--	10 µg/L	50 µg/L	50 µg/L	--
Toluene	108-88-3	µg/L	16 µg/L	--	24 µg/L	60 µg/L	0.8 µg/L	0.8 µg/L	--
Trichloroethylene	79-01-6	µg/L	400 µg/L	--	--	5 µg/L	20 µg/L	20 µg/L	--
Volatile Organic Compounds Surrogates									
Bromofluorobenzene, 4-	460-00-4	%	--	--	--	--	--	--	--
Difluorobenzene, 1,4-	540-36-3	%	--	--	--	--	--	--	--
Polycyclic Aromatic Hydrocarbons									
Naphthalene	91-20-3	µg/L	140 µg/L	--	--	--	7 µg/L	7 µg/L	--

Analyte	CAS Number	Unit	HALSUB SAN	HALSUB STM	ONDWS AO/OG	ONDWS MAC	ONPWQO IPWQOT2<100	ONPWQO IPWQOT2>100	ONPWQO PWQOT2<100
Polycyclic Aromatic Hydrocarbons Surrogates - Continued									
Chrysene-d12	1719-03-5	%	--	--	--	--	--	--	--
Naphthalene-d8	1146-65-2	%	--	--	--	--	--	--	--
Phenanthrene-d10	1517-22-2	%	--	--	--	--	--	--	--

Analyte	CAS Number	Unit	ONPWQO PWQOT2>100
Field Tests			
pH, field	----	pH units	--
Temperature, field	----	°C	--
Physical Tests			
Alkalinity, bicarbonate (as HCO3)	71-52-3	mg/L	--
Alkalinity, carbonate (as CO3)	3812-32-6	mg/L	--
Alkalinity, hydroxide (as OH)	14280-30-9	mg/L	--
Alkalinity, total (as CaCO3)	----	mg/L	--
Colour, apparent	----	CU	--
Conductivity	----	µS/cm	--
Hardness (as CaCO3), dissolved	----	mg/L	--
Langelier index (@ 20°C)	----	-	--
Langelier index (@ 4°C)	----	-	--
pH, saturation (@ 20°C)	----	pH units	--
pH, saturation (@ 4°C)	----	pH units	--
pH	----	pH units	**6.5 - 8.5 pH units**
Solids, total dissolved [TDS], calculated	----	mg/L	--
Solids, total dissolved [TDS]	----	mg/L	--
Solids, total suspended [TSS]	----	mg/L	--
Turbidity	----	NTU	--
Anions and Nutrients			
Ammonia, total (as N)	7664-41-7	mg/L	--
Ammonia, un-ionized (as N), field	7664-41-7	mg/L	--
Ammonia, un-ionized (as NH3), field	7664-41-7	mg/L	**0.02 mg/L**
Bromide	24959-67-9	mg/L	--
Chloride	16887-00-6	mg/L	--
Fluoride	16984-48-8	mg/L	--
Kjeldahl nitrogen, total [TKN]	----	mg/L	--
Nitrate (as N)	14797-55-8	mg/L	--
Nitrate + Nitrite (as N)	----	mg/L	--
Nitrite (as N)	14797-65-0	mg/L	--
Phosphate, ortho-, dissolved (as P)	14265-44-2	mg/L	--
Phosphorus, total	7723-14-0	mg/L	--

Analyte	CAS Number	Unit	ONPWQO PWQOT2>100
Anions and Nutrients - Continued			
Sulfate (as SO4)	14808-79-8	mg/L	--
Cyanides			
Cyanide, strong acid dissociable (Total)	----	mg/L	**0.005 mg/L**
Organic / Inorganic Carbon			
Carbon, dissolved organic [DOC]	----	mg/L	--
Carbon, total organic [TOC]	----	mg/L	--
Microbiological Tests			
Coliforms, Escherichia coli [E. coli]	----	CFU/100mL	**100 CFU/100mL**
Metals			
Sodium adsorption ratio [SAR]	----	-	--
Ion Balance			
Anion sum	----	meq/L	--
Cation sum (total)	----	meq/L	--
Ion balance (APHA)	----	%	--
Ion balance (cations/anions)	----	%	--
Total Metals			
Aluminum, total	7429-90-5	mg/L	--
Antimony, total	7440-36-0	mg/L	--
Arsenic, total	7440-38-2	mg/L	**0.1 mg/L**
Barium, total	7440-39-3	mg/L	--
Beryllium, total	7440-41-7	mg/L	**0.011 mg/L**
Bismuth, total	7440-69-9	mg/L	--
Boron, total	7440-42-8	mg/L	--
Cadmium, total	7440-43-9	mg/L	**0.0002 mg/L**
Calcium, total	7440-70-2	mg/L	--
Cesium, total	7440-46-2	mg/L	--
Chromium, total	7440-47-3	mg/L	--
Cobalt, total	7440-48-4	mg/L	--
Copper, total	7440-50-8	mg/L	**0.005 mg/L**
Iron, total	7439-89-6	mg/L	**0.3 mg/L**
Lead, total	7439-92-1	mg/L	**0.025 mg/L**
Lithium, total	7439-93-2	mg/L	--
Magnesium, total	7439-95-4	mg/L	--
Manganese, total	7439-96-5	mg/L	--
Mercury, total	7439-97-6	mg/L	**0.0002 mg/L**
Molybdenum, total	7439-98-7	mg/L	--
Nickel, total	7440-02-0	mg/L	**0.025 mg/L**
Potassium, total	7440-09-7	mg/L	--

Analyte	CAS Number	Unit	ONPWQO PWQOT2>100
Total Metals - Continued			
Rubidium, total	7440-17-7	mg/L	--
Selenium, total	7782-49-2	mg/L	0.1 mg/L
Silicon (as SiO2), total	7631-86-9	mg/L	--
Silicon, total	7440-21-3	mg/L	--
Silver, total	7440-22-4	mg/L	0.0001 mg/L
Sodium, total	7440-23-5	mg/L	--
Strontium, total	7440-24-6	mg/L	--
Sulfur, total	7704-34-9	mg/L	--
Tellurium, total	13494-80-9	mg/L	--
Thallium, total	7440-28-0	mg/L	--
Thorium, total	7440-29-1	mg/L	--
Tin, total	7440-31-5	mg/L	--
Titanium, total	7440-32-6	mg/L	--
Tungsten, total	7440-33-7	mg/L	--
Uranium, total	7440-61-1	mg/L	--
Vanadium, total	7440-62-2	mg/L	--
Zinc, total	7440-66-6	mg/L	0.03 mg/L
Zirconium, total	7440-67-7	mg/L	--
Dissolved Metals			
Cadmium, dissolved	7440-43-9	mg/L	0.0002 mg/L
Calcium, dissolved	7440-70-2	mg/L	--
Dissolved metals filtration location	----	-	--
Magnesium, dissolved	7439-95-4	mg/L	--
Aggregate Organics			
Biochemical oxygen demand [BOD]	----	mg/L	--
Oil & grease (gravimetric)	----	mg/L	--
Oil & grease, animal/vegetable (gravimetric)	----	mg/L	--
Oil & grease, mineral (gravimetric)	----	mg/L	--
Phenols, total (4AAP)	----	mg/L	0.001 mg/L
Volatile Organic Compounds			
Benzene	71-43-2	µg/L	--
Chloroform	67-66-3	µg/L	--
Dichlorobenzene, 1,4-	106-46-7	µg/L	4 µg/L
Dichloromethane	75-09-2	µg/L	--
Ethylbenzene	100-41-4	µg/L	--
Tetrachloroethylene	127-18-4	µg/L	--
Toluene	108-88-3	µg/L	--
Trichloroethylene	79-01-6	µg/L	--
Volatile Organic Compounds Surrogates			

Analyte	CAS Number	Unit	ONPWQO PWQOT2>100						
Volatile Organic Compounds Surrogates - Continued									
Bromofluorobenzene, 4-	460-00-4	%	--						
Difluorobenzene, 1,4-	540-36-3	%	--						
Polycyclic Aromatic Hydrocarbons									
Naphthalene	91-20-3	µg/L	--						
Chrysene-d12	1719-03-5	%	--						
Naphthalene-d8	1146-65-2	%	--						
Phenanthrene-d10	1517-22-2	%	--						

Please refer to the General Comments section for an explanation of any qualifiers detected.

Key:

HALSUB		Ontario Halton Sanitary Sewer By-Law No. 02-03 (Mar, 2003)
	SAN	Halton Sanitary By-Law (02-03, March 2003)
	STM	Halton Storm Sewer By-Law 02-03 (Mar, 2003)
ONDWS		Ontario Drinking Water Regulation (JAN, 2020)
	AO/OG	Aesthetic Objective/Operational Guideline (2006)
	MAC	Schedule 1 (Microbiological) and 2 (Chemical) Standards (JAN,2020)
ONPWQO		Ontario PWQO (Provincial Water Quality Objectives, JULY, 1994)
	IPWQOT2<100	Surface Water T2 Interim PWQOs (Hardness < 100 mg/L)
	IPWQOT2>100	Surface Water T2 Interim PWQOs (Hardness > 100 mg/L)
	PWQOT2<100	Surface Water T2 PWQOs (Hardness < 100 mg/L)
	PWQOT2>100	Surface Water T2 PWQOs (Hardness > 100 mg/L)

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2413558**	Page	: 1 of 15
Client	: **Grounded Engineering Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Haley Gazo	Account Manager	: Amanda Overholster
Address	: 1 Banigan Drive Toronto ON Canada M4H 1G3	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: 1 416 817 2944
Project	: 24-048	Date Samples Received	: 28-May-2024 08:40
PO	: ----	Issue Date	: 04-Jun-2024 16:24
C-O-C number	: 20-1085356		
Sampler	: CLIENT		
Site	: ----		
Quote number	: Halton Sewer Use and PWQO/ODWS		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Aggregate Organics : Biochemical Oxygen Demand - 5 day										
HDPE [BOD HT-4d] BH109-SW	E550	27-May-2024	----	----	----		28-May-2024	4 days	0 days	✓
Aggregate Organics : Mineral Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) BH109-SW	E567SG	27-May-2024	30-May-2024	28 days	3 days	✓	03-Jun-2024	28 days	7 days	✓
Aggregate Organics : Oil & Grease by Gravimetry										
Amber glass (hydrochloric acid) BH109-SW	E567	27-May-2024	30-May-2024	28 days	3 days	✓	03-Jun-2024	28 days	7 days	✓
Aggregate Organics : Phenols (4AAP) in Water by Colorimetry										
Amber glass total (sulfuric acid) [ON MECP] BH109-SW	E562	27-May-2024	31-May-2024	28 days	4 days	✓	31-May-2024	28 days	4 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) [ON MECP] BH109-SW	E298	27-May-2024	31-May-2024	28 days	4 days	✓	31-May-2024	28 days	4 days	✓
Anions and Nutrients : Bromide in Water by IC										
HDPE [ON MECP] BH109-SW	E235.Br	27-May-2024	29-May-2024	28 days	2 days	✓	30-May-2024	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC										
HDPE [ON MECP] BH109-SW	E235.Cl	27-May-2024	29-May-2024	28 days	2 days	✓	30-May-2024	28 days	3 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)										
HDPE [ON MECP]										
BH109-SW	E378-U	27-May-2024	29-May-2024	7 days	2 days	✓	30-May-2024	7 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE [ON MECP]										
BH109-SW	E235.F	27-May-2024	29-May-2024	28 days	2 days	✓	30-May-2024	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC										
HDPE [ON MECP]										
BH109-SW	E235.NO3	27-May-2024	29-May-2024	7 days	2 days	✓	30-May-2024	7 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC										
HDPE [ON MECP]										
BH109-SW	E235.NO2	27-May-2024	29-May-2024	7 days	2 days	✓	30-May-2024	7 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE [ON MECP]										
BH109-SW	E235.SO4	27-May-2024	29-May-2024	28 days	2 days	✓	30-May-2024	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) [ON MECP]										
BH109-SW	E318	27-May-2024	03-Jun-2024	28 days	7 days	✓	03-Jun-2024	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) [ON MECP]										
BH109-SW	E372-U	27-May-2024	31-May-2024	28 days	4 days	✓	03-Jun-2024	28 days	7 days	✓
Cyanides : Total Cyanide										
UV-inhibited HDPE - total (sodium hydroxide)										
BH109-SW	E333	27-May-2024	28-May-2024	14 days	1 days	✓	28-May-2024	14 days	1 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid)										
BH109-SW	E421	27-May-2024	29-May-2024	180 days	2 days	✓	29-May-2024	180 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Field Tests : Field pH,EC,Salinity,Cl2,ClO2,ORP,DO, Turbidity,T,T-P,o-PO4,NH3,Chloramine										
Amber glass (hydrochloric acid)										
BH109-SW	EF001	27-May-2024	----	----	----		28-May-2024	----	1 days	
Microbiological Tests : E. coli (MF-mFC-BCIG)										
Sterile HDPE (Sodium thiosulphate) [ON MECP]										
BH109-SW	E012A.EC	27-May-2024	----	----	----		28-May-2024	48 hrs	23 hrs	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
HDPE [ON MECP]										
BH109-SW	E358-L	27-May-2024	30-May-2024	3 days	3 days	✓	31-May-2024	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) [ON MECP]										
BH109-SW	E355-L	27-May-2024	31-May-2024	28 days	4 days	✓	03-Jun-2024	28 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE [ON MECP]										
BH109-SW	E290	27-May-2024	29-May-2024	14 days	2 days	✓	30-May-2024	14 days	3 days	✓
Physical Tests : Colour (Apparent) by Spectrometer										
HDPE [ON MECP]										
BH109-SW	E330	27-May-2024	----	----	----		29-May-2024	48 hrs	48 hrs	✓
Physical Tests : Conductivity in Water										
HDPE [ON MECP]										
BH109-SW	E100	27-May-2024	29-May-2024	28 days	2 days	✓	30-May-2024	28 days	3 days	✓
Physical Tests : pH by Meter										
HDPE [ON MECP]										
BH109-SW	E108	27-May-2024	29-May-2024	14 days	2 days	✓	30-May-2024	14 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE [ON MECP]										
BH109-SW	E162	27-May-2024	----	----	----		29-May-2024	7 days	2 days	✓

Matrix: **Water**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry										
HDPE [ON MECP]										
BH109-SW	E160	27-May-2024	----	----	----		29-May-2024	7 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE [BOD HT-4d]										
BH109-SW	E121	27-May-2024	----	----	----		29-May-2024	48 hrs	42 hrs	✓
Polycyclic Aromatic Hydrocarbons : PAHs in Water by Hexane LVI GC-MS										
Amber glass/Teflon lined cap (sodium bisulfate)										
BH109-SW	E641A	27-May-2024	29-May-2024	14 days	2 days	✓	30-May-2024	40 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) [ON MECP]										
BH109-SW	E508	27-May-2024	30-May-2024	28 days	3 days	✓	03-Jun-2024	28 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
BH109-SW	E420	27-May-2024	29-May-2024	180 days	2 days	✓	29-May-2024	180 days	2 days	✓
Volatile Organic Compounds : VOCs (Eastern Canada List) by Headspace GC-MS										
Glass vial (sodium bisulfate)										
BH109-SW	E611D	27-May-2024	30-May-2024	14 days	3 days	✓	30-May-2024	14 days	3 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration	E290	1464611	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	1468661	1	20	5.0	5.0	✓
Biochemical Oxygen Demand - 5 day	E550	1462434	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	1464609	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	1464605	1	19	5.2	5.0	✓
Colour (Apparent) by Spectrometer	E330	1464705	1	12	8.3	5.0	✓
Conductivity in Water	E100	1464613	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1463773	1	6	16.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1467154	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1464615	1	5	20.0	5.0	✓
E. coli (MF-mFC-BCIG)	E012A.EC	1462789	1	12	8.3	5.0	✓
Fluoride in Water by IC	E235.F	1464610	1	6	16.6	5.0	✓
Nitrate in Water by IC	E235.NO3	1464608	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	1464607	1	11	9.0	5.0	✓
pH by Meter	E108	1464614	1	17	5.8	5.0	✓
Phenols (4AAP) in Water by Colorimetry	E562	1468662	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1464606	1	14	7.1	5.0	✓
TDS by Gravimetry	E162	1465071	1	20	5.0	5.0	✓
Total Cyanide	E333	1463506	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1468656	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	1466317	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1463730	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	1468657	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1468659	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	1465077	1	20	5.0	4.7	✓
Turbidity by Nephelometry	E121	1464009	1	20	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1466502	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration	E290	1464611	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	1468661	1	20	5.0	5.0	✓
Biochemical Oxygen Demand - 5 day	E550	1462434	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	1464609	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	1464605	1	19	5.2	5.0	✓
Colour (Apparent) by Spectrometer	E330	1464705	1	12	8.3	5.0	✓
Conductivity in Water	E100	1464613	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1463773	1	6	16.6	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1467154	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1464615	1	5	20.0	5.0	✓
Fluoride in Water by IC	E235.F	1464610	1	6	16.6	5.0	✓
Mineral Oil & Grease by Gravimetry	E567SG	1466933	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	1464608	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	1464607	1	11	9.0	5.0	✓
Oil & Grease by Gravimetry	E567	1466932	1	17	5.8	5.0	✓
PAHs in Water by Hexane LVI GC-MS	E641A	1463995	1	1	100.0	5.0	✓
pH by Meter	E108	1464614	1	17	5.8	5.0	✓
Phenols (4AAP) in Water by Colorimetry	E562	1468662	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1464606	1	14	7.1	5.0	✓
TDS by Gravimetry	E162	1465071	1	20	5.0	5.0	✓
Total Cyanide	E333	1463506	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1468656	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	1466317	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1463730	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	1468657	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1468659	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	1465077	1	20	5.0	4.7	✓
Turbidity by Nephelometry	E121	1464009	1	20	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1466502	1	20	5.0	5.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration	E290	1464611	1	14	7.1	5.0	✓
Ammonia by Fluorescence	E298	1468661	1	20	5.0	5.0	✓
Biochemical Oxygen Demand - 5 day	E550	1462434	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	1464609	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	1464605	1	19	5.2	5.0	✓
Colour (Apparent) by Spectrometer	E330	1464705	1	12	8.3	5.0	✓
Conductivity in Water	E100	1464613	1	16	6.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1463773	1	6	16.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1467154	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1464615	1	5	20.0	5.0	✓
E. coli (MF-mFC-BCIG)	E012A.EC	1462789	1	12	8.3	5.0	✓
Fluoride in Water by IC	E235.F	1464610	1	6	16.6	5.0	✓
Mineral Oil & Grease by Gravimetry	E567SG	1466933	1	10	10.0	5.0	✓
Nitrate in Water by IC	E235.NO3	1464608	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	1464607	1	11	9.0	5.0	✓
Oil & Grease by Gravimetry	E567	1466932	1	17	5.8	5.0	✓
PAHs in Water by Hexane LVI GC-MS	E641A	1463995	1	1	100.0	5.0	✓

Matrix: **Water**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
Phenols (4AAP) in Water by Colorimetry	E562	1468662	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1464606	1	14	7.1	5.0	✓
TDS by Gravimetry	E162	1465071	1	20	5.0	5.0	✓
Total Cyanide	E333	1463506	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1468656	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	1466317	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1463730	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	1468657	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1468659	1	20	5.0	5.0	✓
TSS by Gravimetry	E160	1465077	1	20	5.0	4.7	✓
Turbidity by Nephelometry	E121	1464009	1	20	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1466502	1	20	5.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	1468661	1	20	5.0	5.0	✓
Bromide in Water by IC	E235.Br	1464609	1	5	20.0	5.0	✓
Chloride in Water by IC	E235.Cl	1464605	1	19	5.2	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	1463773	1	6	16.6	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	1467154	1	20	5.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	1464615	1	5	20.0	5.0	✓
Fluoride in Water by IC	E235.F	1464610	1	6	16.6	5.0	✓
Nitrate in Water by IC	E235.NO3	1464608	1	11	9.0	5.0	✓
Nitrite in Water by IC	E235.NO2	1464607	1	11	9.0	5.0	✓
Phenols (4AAP) in Water by Colorimetry	E562	1468662	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	1464606	1	14	7.1	5.0	✓
Total Cyanide	E333	1463506	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	1468656	1	19	5.2	5.0	✓
Total Mercury in Water by CVAAS	E508	1466317	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	1463730	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	1468657	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	1468659	1	20	5.0	5.0	✓
VOCs (Eastern Canada List) by Headspace GC-MS	E611D	1466502	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
E. coli (MF-mFC-BCIG)	E012A.EC ALS Environmental - Waterloo	Water	ON E3433 (mod)	Following filtration (0.45 µm), and incubation at 44.5±0.2°C for 24 hours, colonies exhibiting characteristic morphology of the target organism are enumerated.
Conductivity in Water	E100 ALS Environmental - Waterloo	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 ALS Environmental - Waterloo	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 ALS Environmental - Waterloo	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
TSS by Gravimetry	E160 ALS Environmental - Waterloo	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 ALS Environmental - Waterloo	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC	E235.Br ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC	E235.Cl ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Nitrite in Water by IC	E235.NO2 ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC	E235.NO3 ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 ALS Environmental - Waterloo	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration	E290 ALS Environmental - Waterloo	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 ALS Environmental - Waterloo	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 ALS Environmental - Waterloo	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Colour (Apparent) by Spectrometer	E330 ALS Environmental - Waterloo	Water	APHA 2120 C (mod)	Colour (Apparent) is measured in an unfiltered sample spectrophotometrically using the single wavelength method. The colour contribution of settleable solids are not included in the result. This method is intended for potable waters. Colour measurements can be highly pH dependent, and apply to the pH of the sample as received (at time of testing), without pH adjustment.
Total Cyanide	E333 ALS Environmental - Waterloo	Water	ISO 14403 (mod)	Total or Strong Acid Dissociable (SAD) Cyanide is determined by Continuous Flow Analyzer (CFA) with in-line UV digestion followed by colourmetric analysis. Method Limitation: High levels of thiocyanate (SCN) may cause positive interference (up to 0.5% of SCN concentration).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L ALS Environmental - Waterloo	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Organic Carbon by Combustion (Low Level)	E358-L ALS Environmental - Waterloo	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U ALS Environmental - Waterloo	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U ALS Environmental - Waterloo	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 ALS Environmental - Waterloo	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Metals in Water by CRC ICPMS	E421 ALS Environmental - Waterloo	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Mercury in Water by CVAAS	E508 ALS Environmental - Waterloo	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Biochemical Oxygen Demand - 5 day	E550 ALS Environmental - Waterloo	Water	APHA 5210 B (mod)	Samples are diluted and incubated for a specified time period, after which the oxygen depletion is measured using a dissolved oxygen meter. Free chlorine is a negative interference in the BOD method; please advise ALS when free chlorine is present in samples.
Phenols (4AAP) in Water by Colorimetry	E562 ALS Environmental - Waterloo	Water	EPA 9066	This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide (K3Fe(CN)6) and 4-amino-antipyrine (4-AAP) to form a red complex which is measured colorimetrically.
Oil & Grease by Gravimetry	E567 ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane and the extract is evaporated to dryness. The residue is then weighed to determine Oil and Grease.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Mineral Oil & Grease by Gravimetry	E567SG ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane, followed by silica gel treatment after which the extract is evaporated to dryness. The residue is then weighed to determine Mineral Oil and Grease.
VOCs (Eastern Canada List) by Headspace GC-MS	E611D ALS Environmental - Waterloo	Water	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PAHs in Water by Hexane LVI GC-MS	E641A ALS Environmental - Waterloo	Water	EPA 8270E (mod)	Polycyclic Aromatic Hydrocarbons (PAHs) are analyzed by large volume injection (LVI) GC-MS.
Dissolved Hardness (Calculated)	EC100 ALS Environmental - Waterloo	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Total Metals	EC101A ALS Environmental - Waterloo	Water	APHA 1030E	Cation Sum (using total metals), Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).
Sodium Adsorption Ratio [SAR] from Total Metals	EC102 ALS Environmental - Waterloo	Water	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a water sample is calculated from the Sodium, Calcium, and Magnesium concentrations of the water, using the same calculations as would be used for a sediment paste extract.
TDS calculated from conductivity	EC103A ALS Environmental - Waterloo	Water	APHA 1030 E	Total dissolved solids (as mg/L) can be estimated by multiplying electrical conductance (in umhos/cm) by 0.65.
Saturation Index using Laboratory pH (Ca-T)	EC105A ALS Environmental - Waterloo	Water	APHA 2330B	Langelier Index provides an indication of scale formation potential at a given pH and temperature, and is calculated as per APHA 2330B Saturation Index. Positive values indicate oversaturation with respect to CaCO3. Negative values indicate undersaturation of CaCO3. This calculation uses laboratory pH measurements and provides estimates of Langelier Index at temperatures of 4, 15, 20, 25, 66, and 77°C. Ryznar Stability Index is an alternative index used for scale formation and corrosion potential.
Nitrate and Nitrite (as N) (Calculation)	EC235.N+N ALS Environmental - Waterloo	Water	EPA 300.0	Nitrate and Nitrite (as N) is a calculated parameter. Nitrate and Nitrite (as N) = Nitrite (as N) + Nitrate (as N).
Un-ionized and Ionized Ammonia (Calculation) (Field Temperature and pH)	EC298A ALS Environmental - Waterloo	Water	CCME CWQG Ammonia	Un-ionized ammonia is calculated from test results for total ammonia, field temperature and pH, and is expressed in units of mg/L "as N".

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Total Silicon as Silica (Calculation)	EC420.SiO2 ALS Environmental - Waterloo	Water	N/A	Total Silicon (as SiO2) is a calculated parameter. Total Silicon (as SiO2 mg/L) = 2.139 x Total Silicon (mg/L).
Animal & Vegetable Oil & Grease by Gravimetry	EC567A.SG ALS Environmental - Waterloo	Water	APHA 5520 (mod)	Animal & vegetable oil and grease is calculated as follows: Oil & Grease (gravimetric) minus Mineral Oil & Grease (gravimetric)
Field pH,EC,Salinity,Cl2,ClO2,ORP,DO, Turbidity,T,T-P,o-PO4,NH3,Chloramine	EF001 ALS Environmental - Waterloo	Water	Field Measurement (Client Supplied)	Field pH,EC,Salinity,Cl2,ClO2,ORP,DO, Turbidity,T,T-P,o-PO4,NH3 or Chloramine measurements provided by client and recorded on ALS report may affect the validity of results.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 ALS Environmental - Waterloo	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 ALS Environmental - Waterloo	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 ALS Environmental - Waterloo	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 ALS Environmental - Waterloo	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 ALS Environmental - Waterloo	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 ALS Environmental - Waterloo	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Oil & Grease Extraction for Gravimetry	EP567 ALS Environmental - Waterloo	Water	BC MOE Lab Manual (Oil & Grease) (mod)	The entire water sample is extracted with hexane by liquid-liquid extraction.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
VOCs Preparation for Headspace Analysis	EP581 ALS Environmental - Waterloo	Water	EPA 5021A (mod)	Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler. An aliquot of the headspace is then injected into the GC/MS-FID system.
PHCs and PAHs Hexane Extraction	EP601 ALS Environmental - Waterloo	Water	EPA 3511 (mod)	Petroleum Hydrocarbons (PHCs) and Polycyclic Aromatic Hydrocarbons (PAHs) are extracted using a hexane liquid-liquid extraction.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WT2413558**	Page	: 1 of 17
Client	: Grounded Engineering Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Haley Gazo	Account Manager	: Amanda Overholster
Address	: 1 Banigan Drive Toronto ON Canada M4H 1G3	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: 1 416 817 2944
Project	: 24-048	Date Samples Received	: 28-May-2024 08:40
PO	: ----	Date Analysis Commenced	: 28-May-2024
C-O-C number	: 20-1085356	Issue Date	: 04-Jun-2024 16:27
Sampler	: CLIENT		
Site	: ----		
Quote number	: Halton Sewer Use and PWQO/ODWS		
No. of samples received	: 1		
No. of samples analysed	: 1		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Andrea Armstrong	Department Manager - Air Quality and Volatiles	Waterloo VOC, Waterloo, Ontario
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Nik Perkio	Senior Analyst	Waterloo Metals, Waterloo, Ontario
Srihari Prathap	Account Manager Assistant	Waterloo Administration, Waterloo, Ontario
Zeba Patel	Analyst	Waterloo Microbiology, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1464009)											
WT2413602-012	Anonymous	Turbidity	----	E121	0.10	NTU	660	659	0.152%	15%	----
Physical Tests (QC Lot: 1464611)											
WT2413348-023	Anonymous	Alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	464	466	0.366%	20%	----
Physical Tests (QC Lot: 1464613)											
WT2413348-023	Anonymous	Conductivity	----	E100	2.0	µS/cm	2930	2890	1.37%	10%	----
Physical Tests (QC Lot: 1464614)											
WT2413348-023	Anonymous	pH	----	E108	0.10	pH units	7.87	7.90	0.380%	4%	----
Physical Tests (QC Lot: 1464705)											
WT2413558-001	BH109-SW	Colour, apparent	----	E330	4.0	CU	350	346	1.34%	20%	----
Physical Tests (QC Lot: 1465071)											
WT2413345-001	Anonymous	Solids, total dissolved [TDS]	----	E162	20	mg/L	1180	1180	0.635%	20%	----
Physical Tests (QC Lot: 1465077)											
WT2413345-001	Anonymous	Solids, total suspended [TSS]	----	E160	3.0	mg/L	148	156	5.27%	20%	----
Anions and Nutrients (QC Lot: 1464605)											
WT2413558-001	BH109-SW	Chloride	16887-00-6	E235.Cl	0.50	mg/L	66.7	66.6	0.0673%	20%	----
Anions and Nutrients (QC Lot: 1464606)											
WT2413558-001	BH109-SW	Sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	63.3	63.5	0.269%	20%	----
Anions and Nutrients (QC Lot: 1464607)											
WT2413558-001	BH109-SW	Nitrite (as N)	14797-65-0	E235.NO2	0.010	mg/L	0.264	0.263	0.153%	20%	----
Anions and Nutrients (QC Lot: 1464608)											
WT2413558-001	BH109-SW	Nitrate (as N)	14797-55-8	E235.NO3	0.020	mg/L	6.78	6.71	1.04%	20%	----
Anions and Nutrients (QC Lot: 1464609)											
WT2413558-001	BH109-SW	Bromide	24959-67-9	E235.Br	0.10	mg/L	<0.10	<0.10	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1464610)											
WT2413558-001	BH109-SW	Fluoride	16984-48-8	E235.F	0.020	mg/L	0.167	0.166	0.001	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1464615)											
WT2413476-005	Anonymous	Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<1.0 µg/L	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1468656)											
WT2413528-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.384	0.371	0.013	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1468659)											

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 1468659) - continued											
HA2401201-001	Anonymous	Phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0032	0.0034	0.0002	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 1468661)											
WT2413600-001	Anonymous	Ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0418	0.0421	0.0003	Diff <2x LOR	----
Cyanides (QC Lot: 1463506)											
EO2403924-001	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 1467154)											
WT2413156-001	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	7.17	7.79	8.26%	20%	----
Organic / Inorganic Carbon (QC Lot: 1468657)											
HA2401155-001	Anonymous	Carbon, total organic [TOC]	----	E355-L	0.50	mg/L	2.28	2.30	0.02	Diff <2x LOR	----
Microbiological Tests (QC Lot: 1462789)											
WT2413558-001	BH109-SW	Coliforms, Escherichia coli [E. coli]	----	E012A.EC	1	CFU/100mL	2	1	1	Diff <2x LOR	----
Total Metals (QC Lot: 1463730)											
HA2401164-001	Anonymous	Aluminum, total	7429-90-5	E420	0.0030	mg/L	0.369	0.362	1.71%	20%	----
		Antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Arsenic, total	7440-38-2	E420	0.00010	mg/L	0.0120	0.0118	0.936%	20%	----
		Barium, total	7440-39-3	E420	0.00010	mg/L	0.00226	0.00226	0.212%	20%	----
		Beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		Bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		Cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0000116	0.0000121	0.0000005	Diff <2x LOR	----
		Calcium, total	7440-70-2	E420	0.100	mg/L	0.670	0.660	0.010	Diff <2x LOR	----
		Cesium, total	7440-46-2	E420	0.000010	mg/L	0.000054	0.000052	0.000002	Diff <2x LOR	----
		Chromium, total	7440-47-3	E420	0.00050	mg/L	0.00073	0.00070	0.00003	Diff <2x LOR	----
		Cobalt, total	7440-48-4	E420	0.00010	mg/L	0.00032	0.00032	0.000002	Diff <2x LOR	----
		Copper, total	7440-50-8	E420	0.00050	mg/L	0.00051	0.00052	0.0000006	Diff <2x LOR	----
		Iron, total	7439-89-6	E420	0.010	mg/L	0.641	0.642	0.181%	20%	----
		Lead, total	7439-92-1	E420	0.000050	mg/L	0.000755	0.000762	0.857%	20%	----
		Lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		Magnesium, total	7439-95-4	E420	0.0050	mg/L	0.465	0.458	1.54%	20%	----
		Manganese, total	7439-96-5	E420	0.00010	mg/L	0.0432	0.0424	1.88%	20%	----
		Molybdenum, total	7439-98-7	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		Nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		Potassium, total	7440-09-7	E420	0.050	mg/L	0.533	0.521	2.19%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 1463730) - continued											
HA2401164-001	Anonymous	Rubidium, total	7440-17-7	E420	0.00020	mg/L	0.00182	0.00174	0.00008	Diff <2x LOR	----
		Selenium, total	7782-49-2	E420	0.000050	mg/L	0.000114	0.000151	0.000037	Diff <2x LOR	----
		Silicon, total	7440-21-3	E420	0.10	mg/L	1.17	1.16	1.63%	20%	----
		Silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Sodium, total	7440-23-5	E420	0.050	mg/L	4.30	4.20	2.52%	20%	----
		Strontium, total	7440-24-6	E420	0.00020	mg/L	0.00696	0.00682	2.17%	20%	----
		Sulfur, total	7704-34-9	E420	0.50	mg/L	0.55	<0.50	0.05	Diff <2x LOR	----
		Tellurium, total	13494-80-9	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		Thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		Thorium, total	7440-29-1	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Titanium, total	7440-32-6	E420	0.00030	mg/L	0.00615	0.00617	0.333%	20%	----
		Tungsten, total	7440-33-7	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		Uranium, total	7440-61-1	E420	0.000010	mg/L	0.000019	0.000021	0.000002	Diff <2x LOR	----
		Vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00062	0.00060	0.00001	Diff <2x LOR	----
		Zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
		Zirconium, total	7440-67-7	E420	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
Total Metals (QC Lot: 1466317)											
TY2405064-001	Anonymous	Mercury, total	7439-97-6	E508	0.0000050	mg/L	0.0000097	0.0000093	0.0000004	Diff <2x LOR	----
Dissolved Metals (QC Lot: 1463773)											
HA2401166-001	Anonymous	Cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000229	0.0000234	0.0000005	Diff <2x LOR	----
		Calcium, dissolved	7440-70-2	E421	0.050	mg/L	14.7	14.7	0.138%	20%	----
		Magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	2.99	3.12	4.30%	20%	----
Aggregate Organics (QC Lot: 1462434)											
WT2413511-001	Anonymous	Biochemical oxygen demand [BOD]	----	E550	2.0	mg/L	3.3	3.5	5.3%	30%	----
Aggregate Organics (QC Lot: 1468662)											
WT2413558-001	BH109-SW	Phenols, total (4AAP)	----	E562	0.0010	mg/L	0.0013	0.0011	0.0002	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 1466502)											
WT2413695-005	Anonymous	Benzene	71-43-2	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Chloroform	67-66-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Dichloromethane	75-09-2	E611D	1.0	µg/L	<1.0	<1.0	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Tetrachloroethylene	127-18-4	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Volatile Organic Compounds (QC Lot: 1466502) - continued											
WT2413695-005	Anonymous	Toluene	108-88-3	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----
		Trichloroethylene	79-01-6	E611D	0.50	µg/L	<0.50	<0.50	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1464009)						
Turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 1464611)						
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 1464613)						
Conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 1464705)						
Colour, apparent	----	E330	2	CU	<2.0	----
Physical Tests (QCLot: 1465071)						
Solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 1465077)						
Solids, total suspended [TSS]	----	E160	3	mg/L	<3.0	----
Anions and Nutrients (QCLot: 1464605)						
Chloride	16887-00-6	E235.Cl	0.5	mg/L	<0.50	----
Anions and Nutrients (QCLot: 1464606)						
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 1464607)						
Nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	<0.010	----
Anions and Nutrients (QCLot: 1464608)						
Nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 1464609)						
Bromide	24959-67-9	E235.Br	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 1464610)						
Fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 1464615)						
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 1468656)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 1468659)						
Phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 1468661)						
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Cyanides (QCLot: 1463506)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Cyanides (QCLot: 1463506) - continued						
Cyanide, strong acid dissociable (Total)	----	E333	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 1467154)						
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 1468657)						
Carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Microbiological Tests (QCLot: 1462789)						
Coliforms, Escherichia coli [E. coli]	----	E012A.EC	1	CFU/100mL	<1	----
Total Metals (QCLot: 1463730)						
Aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
Barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
Beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
Boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
Calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
Cesium, total	7440-46-2	E420	0.00001	mg/L	<0.000010	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	<0.00050	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
Copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
Iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
Lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
Lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
Magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
Potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
Rubidium, total	7440-17-7	E420	0.0002	mg/L	<0.00020	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
Silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
Silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
Sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
Strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 1463730) - continued						
Sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
Tellurium, total	13494-80-9	E420	0.0002	mg/L	<0.00020	----
Thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
Thorium, total	7440-29-1	E420	0.0001	mg/L	<0.00010	----
Tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
Titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
Tungsten, total	7440-33-7	E420	0.0001	mg/L	<0.00010	----
Uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
Zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Zirconium, total	7440-67-7	E420	0.0002	mg/L	<0.00020	----
Total Metals (QCLot: 1466317)						
Mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 1463773)						
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
Aggregate Organics (QCLot: 1462434)						
Biochemical oxygen demand [BOD]	----	E550	2	mg/L	<2.0	----
Aggregate Organics (QCLot: 1466932)						
Oil & grease (gravimetric)	----	E567	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 1466933)						
Oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	<5.0	----
Aggregate Organics (QCLot: 1468662)						
Phenols, total (4AAP)	----	E562	0.001	mg/L	<0.0010	----
Volatile Organic Compounds (QCLot: 1466502)						
Benzene	71-43-2	E611D	0.5	µg/L	<0.50	----
Chloroform	67-66-3	E611D	0.5	µg/L	<0.50	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	<0.50	----
Dichloromethane	75-09-2	E611D	1	µg/L	<1.0	----
Ethylbenzene	100-41-4	E611D	0.5	µg/L	<0.50	----
Tetrachloroethylene	127-18-4	E611D	0.5	µg/L	<0.50	----
Toluene	108-88-3	E611D	0.5	µg/L	<0.50	----
Trichloroethylene	79-01-6	E611D	0.5	µg/L	<0.50	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1463995)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Polycyclic Aromatic Hydrocarbons (QCLot: 1463995) - continued						
Naphthalene	91-20-3	E641A	0.05	µg/L	<0.050	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1464009)									
Turbidity	----	E121	0.1	NTU	200 NTU	100	85.0	115	----
Physical Tests (QCLot: 1464611)									
Alkalinity, total (as CaCO3)	----	E290	1	mg/L	150 mg/L	101	85.0	115	----
Physical Tests (QCLot: 1464613)									
Conductivity	----	E100	1	µS/cm	1410 µS/cm	104	90.0	110	----
Physical Tests (QCLot: 1464614)									
pH	----	E108	----	pH units	7 pH units	101	98.0	102	----
Physical Tests (QCLot: 1464705)									
Colour, apparent	----	E330	2	CU	25 CU	104	70.0	130	----
Physical Tests (QCLot: 1465071)									
Solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	88.4	85.0	115	----
Physical Tests (QCLot: 1465077)									
Solids, total suspended [TSS]	----	E160	3	mg/L	150 mg/L	89.3	85.0	115	----
Anions and Nutrients (QCLot: 1464605)									
Chloride	16887-00-6	E235.Cl	0.5	mg/L	100 mg/L	99.4	90.0	110	----
Anions and Nutrients (QCLot: 1464606)									
Sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.2	90.0	110	----
Anions and Nutrients (QCLot: 1464607)									
Nitrite (as N)	14797-65-0	E235.NO2	0.01	mg/L	0.5 mg/L	98.1	90.0	110	----
Anions and Nutrients (QCLot: 1464608)									
Nitrate (as N)	14797-55-8	E235.NO3	0.02	mg/L	2.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 1464609)									
Bromide	24959-67-9	E235.Br	0.1	mg/L	0.5 mg/L	99.0	85.0	115	----
Anions and Nutrients (QCLot: 1464610)									
Fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	99.5	90.0	110	----
Anions and Nutrients (QCLot: 1464615)									
Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.031 mg/L	97.9	80.0	120	----
Anions and Nutrients (QCLot: 1468656)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 1468659)									
Phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.434 mg/L	99.2	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike: Target Concentration	Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Anions and Nutrients (QCLot: 1468661)									
Ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	105	85.0	115	----
Cyanides (QCLot: 1463506)									
Cyanide, strong acid dissociable (Total)	----	E333	0.002	mg/L	0.25 mg/L	88.8	80.0	120	----
Organic / Inorganic Carbon (QCLot: 1467154)									
Carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	107	80.0	120	----
Organic / Inorganic Carbon (QCLot: 1468657)									
Carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	100	80.0	120	----
Total Metals (QCLot: 1463730)									
Aluminum, total	7429-90-5	E420	0.003	mg/L	0.1 mg/L	107	80.0	120	----
Antimony, total	7440-36-0	E420	0.0001	mg/L	0.05 mg/L	106	80.0	120	----
Arsenic, total	7440-38-2	E420	0.0001	mg/L	0.05 mg/L	110	80.0	120	----
Barium, total	7440-39-3	E420	0.0001	mg/L	0.012 mg/L	106	80.0	120	----
Beryllium, total	7440-41-7	E420	0.00002	mg/L	0.005 mg/L	103	80.0	120	----
Bismuth, total	7440-69-9	E420	0.00005	mg/L	0.05 mg/L	103	80.0	120	----
Boron, total	7440-42-8	E420	0.01	mg/L	0.05 mg/L	99.0	80.0	120	----
Cadmium, total	7440-43-9	E420	0.000005	mg/L	0.005 mg/L	106	80.0	120	----
Calcium, total	7440-70-2	E420	0.05	mg/L	2.5 mg/L	105	80.0	120	----
Cesium, total	7440-46-2	E420	0.00001	mg/L	0.002 mg/L	106	80.0	120	----
Chromium, total	7440-47-3	E420	0.0005	mg/L	0.012 mg/L	115	80.0	120	----
Cobalt, total	7440-48-4	E420	0.0001	mg/L	0.012 mg/L	106	80.0	120	----
Copper, total	7440-50-8	E420	0.0005	mg/L	0.012 mg/L	106	80.0	120	----
Iron, total	7439-89-6	E420	0.01	mg/L	0.05 mg/L	116	80.0	120	----
Lead, total	7439-92-1	E420	0.00005	mg/L	0.025 mg/L	105	80.0	120	----
Lithium, total	7439-93-2	E420	0.001	mg/L	0.012 mg/L	99.3	80.0	120	----
Magnesium, total	7439-95-4	E420	0.005	mg/L	2.5 mg/L	115	80.0	120	----
Manganese, total	7439-96-5	E420	0.0001	mg/L	0.012 mg/L	106	80.0	120	----
Molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.012 mg/L	110	80.0	120	----
Nickel, total	7440-02-0	E420	0.0005	mg/L	0.025 mg/L	106	80.0	120	----
Potassium, total	7440-09-7	E420	0.05	mg/L	2.5 mg/L	100	80.0	120	----
Rubidium, total	7440-17-7	E420	0.0002	mg/L	0.005 mg/L	106	80.0	120	----
Selenium, total	7782-49-2	E420	0.00005	mg/L	0.05 mg/L	105	80.0	120	----
Silicon, total	7440-21-3	E420	0.1	mg/L	0.5 mg/L	106	80.0	120	----
Silver, total	7440-22-4	E420	0.00001	mg/L	0.005 mg/L	98.1	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Target Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 1463730) - continued									
Sodium, total	7440-23-5	E420	0.05	mg/L	2.5 mg/L	113	80.0	120	----
Strontium, total	7440-24-6	E420	0.0002	mg/L	0.012 mg/L	108	80.0	120	----
Sulfur, total	7704-34-9	E420	0.5	mg/L	2.5 mg/L	107	80.0	120	----
Tellurium, total	13494-80-9	E420	0.0002	mg/L	0.005 mg/L	107	80.0	120	----
Thallium, total	7440-28-0	E420	0.00001	mg/L	0.05 mg/L	106	80.0	120	----
Thorium, total	7440-29-1	E420	0.0001	mg/L	0.005 mg/L	100	80.0	120	----
Tin, total	7440-31-5	E420	0.0001	mg/L	0.025 mg/L	105	80.0	120	----
Titanium, total	7440-32-6	E420	0.0003	mg/L	0.012 mg/L	100	80.0	120	----
Tungsten, total	7440-33-7	E420	0.0001	mg/L	0.005 mg/L	105	80.0	120	----
Uranium, total	7440-61-1	E420	0.00001	mg/L	0 mg/L	106	80.0	120	----
Vanadium, total	7440-62-2	E420	0.0005	mg/L	0.025 mg/L	108	80.0	120	----
Zinc, total	7440-66-6	E420	0.003	mg/L	0.025 mg/L	106	80.0	120	----
Zirconium, total	7440-67-7	E420	0.0002	mg/L	0.005 mg/L	103	80.0	120	----
Total Metals (QCLot: 1466317)									
Mercury, total	7439-97-6	E508	0.000005	mg/L	0 mg/L	105	80.0	120	----
Dissolved Metals (QCLot: 1463773)									
Cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.005 mg/L	102	80.0	120	----
Calcium, dissolved	7440-70-2	E421	0.05	mg/L	2.5 mg/L	96.9	80.0	120	----
Magnesium, dissolved	7439-95-4	E421	0.005	mg/L	2.5 mg/L	102	80.0	120	----
Aggregate Organics (QCLot: 1462434)									
Biochemical oxygen demand [BOD]	----	E550	2	mg/L	198 mg/L	100	85.0	115	----
Aggregate Organics (QCLot: 1466932)									
Oil & grease (gravimetric)	----	E567	5	mg/L	200 mg/L	94.1	70.0	130	----
Aggregate Organics (QCLot: 1466933)									
Oil & grease, mineral (gravimetric)	----	E567SG	5	mg/L	100 mg/L	87.4	70.0	130	----
Aggregate Organics (QCLot: 1468662)									
Phenols, total (4AAP)	----	E562	0.001	mg/L	0.02 mg/L	102	85.0	115	----
Volatile Organic Compounds (QCLot: 1466502)									
Benzene	71-43-2	E611D	0.5	µg/L	100 µg/L	96.9	70.0	130	----
Chloroform	67-66-3	E611D	0.5	µg/L	100 µg/L	97.7	70.0	130	----
Dichlorobenzene, 1,4-	106-46-7	E611D	0.5	µg/L	100 µg/L	97.3	70.0	130	----
Dichloromethane	75-09-2	E611D	1	µg/L	100 µg/L	102	70.0	130	----
Ethylbenzene	100-41-4	E611D	0.5	µg/L	100 µg/L	94.0	70.0	130	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Target Concentration	LCS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1466502) - continued									
Tetrachloroethylene	127-18-4	E611D	0.5	µg/L	100 µg/L	93.3	70.0	130	----
Toluene	108-88-3	E611D	0.5	µg/L	100 µg/L	80.6	70.0	130	----
Trichloroethylene	79-01-6	E611D	0.5	µg/L	100 µg/L	87.3	70.0	130	----
Polycyclic Aromatic Hydrocarbons (QCLot: 1463995)									
Naphthalene	91-20-3	E641A	0.05	µg/L	0.526 µg/L	89.8	50.0	140	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 1464605)										
WT2413558-001	BH109-SW	Chloride	16887-00-6	E235.Cl	100 mg/L	100 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 1464606)										
WT2413558-001	BH109-SW	Sulfate (as SO4)	14808-79-8	E235.SO4	98.6 mg/L	100 mg/L	98.6	75.0	125	----
Anions and Nutrients (QCLot: 1464607)										
WT2413558-001	BH109-SW	Nitrite (as N)	14797-65-0	E235.NO2	0.589 mg/L	0.5 mg/L	118	75.0	125	----
Anions and Nutrients (QCLot: 1464608)										
WT2413558-001	BH109-SW	Nitrate (as N)	14797-55-8	E235.NO3	ND mg/L	----	ND	75.0	125	----
Anions and Nutrients (QCLot: 1464609)										
WT2413558-001	BH109-SW	Bromide	24959-67-9	E235.Br	0.50 mg/L	0.5 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 1464610)										
WT2413558-001	BH109-SW	Fluoride	16984-48-8	E235.F	0.989 mg/L	1 mg/L	98.9	75.0	125	----
Anions and Nutrients (QCLot: 1464615)										
WT2413476-005	Anonymous	Phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0204 mg/L	0.02 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 1468656)										
WT2413528-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	3.16 mg/L	2.5 mg/L	127	70.0	130	----
Anions and Nutrients (QCLot: 1468659)										
HA2401201-001	Anonymous	Phosphorus, total	7723-14-0	E372-U	0.0885 mg/L	0.1 mg/L	88.5	70.0	130	----
Anions and Nutrients (QCLot: 1468661)										
WT2413600-001	Anonymous	Ammonia, total (as N)	7664-41-7	E298	0.104 mg/L	0.1 mg/L	104	75.0	125	----
Cyanides (QCLot: 1463506)										
EO2403924-001	Anonymous	Cyanide, strong acid dissociable (Total)	----	E333	0.223 mg/L	0.25 mg/L	89.2	75.0	125	----
Organic / Inorganic Carbon (QCLot: 1467154)										
WT2413156-001	Anonymous	Carbon, dissolved organic [DOC]	----	E358-L	ND mg/L	----	ND	70.0	130	----
Organic / Inorganic Carbon (QCLot: 1468657)										
HA2401155-001	Anonymous	Carbon, total organic [TOC]	----	E355-L	5.87 mg/L	5 mg/L	117	70.0	130	----
Total Metals (QCLot: 1463730)										
HA2401164-002	Anonymous	Aluminum, total	7429-90-5	E420	ND mg/L	----	ND	70.0	130	----
		Antimony, total	7440-36-0	E420	0.0490 mg/L	0.05 mg/L	98.1	70.0	130	----
		Arsenic, total	7440-38-2	E420	0.0513 mg/L	0.05 mg/L	103	70.0	130	----
		Barium, total	7440-39-3	E420	0.0124 mg/L	0.012 mg/L	98.8	70.0	130	----
		Beryllium, total	7440-41-7	E420	0.00468 mg/L	0.005 mg/L	93.7	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 1463730) - continued										
HA2401164-002	Anonymous	Bismuth, total	7440-69-9	E420	0.0508 mg/L	0.05 mg/L	102	70.0	130	----
		Boron, total	7440-42-8	E420	0.047 mg/L	0.05 mg/L	93.4	70.0	130	----
		Cadmium, total	7440-43-9	E420	0.00500 mg/L	0.005 mg/L	100	70.0	130	----
		Calcium, total	7440-70-2	E420	2.38 mg/L	2.5 mg/L	95.3	70.0	130	----
		Cesium, total	7440-46-2	E420	0.00242 mg/L	0.002 mg/L	97.0	70.0	130	----
		Chromium, total	7440-47-3	E420	0.0125 mg/L	0.012 mg/L	100	70.0	130	----
		Cobalt, total	7440-48-4	E420	0.0125 mg/L	0.012 mg/L	100	70.0	130	----
		Copper, total	7440-50-8	E420	0.0128 mg/L	0.012 mg/L	102	70.0	130	----
		Iron, total	7439-89-6	E420	ND mg/L	----	ND	70.0	130	----
		Lead, total	7439-92-1	E420	0.0249 mg/L	0.025 mg/L	99.5	70.0	130	----
		Lithium, total	7439-93-2	E420	0.0113 mg/L	0.012 mg/L	90.5	70.0	130	----
		Magnesium, total	7439-95-4	E420	2.56 mg/L	2.5 mg/L	102	70.0	130	----
		Manganese, total	7439-96-5	E420	0.0114 mg/L	0.012 mg/L	91.0	70.0	130	----
		Molybdenum, total	7439-98-7	E420	0.0124 mg/L	0.012 mg/L	99.5	70.0	130	----
		Nickel, total	7440-02-0	E420	0.0252 mg/L	0.025 mg/L	101	70.0	130	----
		Potassium, total	7440-09-7	E420	2.32 mg/L	2.5 mg/L	92.6	70.0	130	----
		Rubidium, total	7440-17-7	E420	0.00489 mg/L	0.005 mg/L	97.9	70.0	130	----
		Selenium, total	7782-49-2	E420	0.0505 mg/L	0.05 mg/L	101	70.0	130	----
		Silicon, total	7440-21-3	E420	ND mg/L	----	ND	70.0	130	----
		Silver, total	7440-22-4	E420	0.00448 mg/L	0.005 mg/L	89.7	70.0	130	----
		Sodium, total	7440-23-5	E420	ND mg/L	----	ND	70.0	130	----
		Strontium, total	7440-24-6	E420	0.0122 mg/L	0.012 mg/L	97.6	70.0	130	----
		Sulfur, total	7704-34-9	E420	2.52 mg/L	2.5 mg/L	101	70.0	130	----
		Tellurium, total	13494-80-9	E420	0.00488 mg/L	0.005 mg/L	97.7	70.0	130	----
		Thallium, total	7440-28-0	E420	0.0498 mg/L	0.05 mg/L	99.7	70.0	130	----
		Thorium, total	7440-29-1	E420	0.00451 mg/L	0.005 mg/L	90.2	70.0	130	----
		Tin, total	7440-31-5	E420	0.0246 mg/L	0.025 mg/L	98.4	70.0	130	----
		Titanium, total	7440-32-6	E420	0.0109 mg/L	0.012 mg/L	87.5	70.0	130	----
		Tungsten, total	7440-33-7	E420	0.00495 mg/L	0.005 mg/L	98.9	70.0	130	----
		Uranium, total	7440-61-1	E420	0.000255 mg/L	0 mg/L	102	70.0	130	----
		Vanadium, total	7440-62-2	E420	0.0251 mg/L	0.025 mg/L	100	70.0	130	----
		Zinc, total	7440-66-6	E420	0.0242 mg/L	0.025 mg/L	97.0	70.0	130	----
		Zirconium, total	7440-67-7	E420	0.00362 mg/L	0.005 mg/L	72.3	70.0	130	----
Total Metals (QCLot: 1466317)										
TY2405083-001	Anonymous	Mercury, total	7439-97-6	E508	0.000101 mg/L	0 mg/L	101	70.0	130	----
Dissolved Metals (QCLot: 1463773)										
HA2401166-002	Anonymous	Cadmium, dissolved	7440-43-9	E421	0.00503 mg/L	0.005 mg/L	100	70.0	130	----
		Calcium, dissolved	7440-70-2	E421	ND mg/L	----	ND	70.0	130	----
		Magnesium, dissolved	7439-95-4	E421	ND mg/L	----	ND	70.0	130	----
Aggregate Organics (QCLot: 1468662)										
WT2413558-001	BH109-SW	Phenols, total (4AAP)	----	E562	0.0206 mg/L	0.02 mg/L	103	75.0	125	----
Volatile Organic Compounds (QCLot: 1466502)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Volatile Organic Compounds (QCLot: 1466502) - continued										
WT2413695-005	Anonymous	Benzene	71-43-2	E611D	96.5 µg/L	100 µg/L	96.5	60.0	140	----
		Chloroform	67-66-3	E611D	101 µg/L	100 µg/L	101	60.0	140	----
		Dichlorobenzene, 1,4-	106-46-7	E611D	88.5 µg/L	100 µg/L	88.5	60.0	140	----
		Dichloromethane	75-09-2	E611D	115 µg/L	100 µg/L	115	60.0	140	----
		Ethylbenzene	100-41-4	E611D	81.7 µg/L	100 µg/L	81.7	60.0	140	----
		Tetrachloroethylene	127-18-4	E611D	77.0 µg/L	100 µg/L	77.0	60.0	140	----
		Toluene	108-88-3	E611D	78.5 µg/L	100 µg/L	78.5	60.0	140	----

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 1085356

Page 1 of 1

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Environmental Division
Waterloo
Work Order Reference
WT2413558

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report
Company:	Grounded Eng Inc
Contact:	Holly Gaza
Phone:	647-264-7458
Company address below will appear on the final report	
Street:	1 Banigan Dr
City/Province:	Toronto, ON
Postal Code:	M4H 1G3
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☑ YES ☐ NO
Company:	Grounded Eng Inc
Contact:	Accounts Payable

Project Information

ALS Account # / Quote #:	WT2024ENG100001
Job #:	24-048
PO / AFE:	
LSD:	
ALS Lab Work Order # (ALS use only):	WT2413558

Reports / Recipients

Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)

Merge QC/QCI Reports with COA ☑ YES ☐ NO ☐ N/A

☑ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: hgaza@groundedeng.ca

Email 2:

Email 3:

Invoice Recipients

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: hgaza@groundedeng.ca

Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact: Sampler:

Turnaround Time (TAT) Requeste

☑ Routine [R] if received by 3pm M-F - no surcharges ap
☐ 4 day [P4] if received by 3pm M-F - 20% rush surchar
☐ 3 day [P3] if received by 3pm M-F - 25% rush surchar
☐ 2 day [P2] if received by 3pm M-F - 50% rush surchar
☐ 1 day [E] if received by 3pm M-F - 100% rush surchar
☐ Same day [E2] if received by 10am M-S - 200% rush surch may apply to rush requests on weekends, statutory holidays

Date and Time Required for all E&P TATs:

For all tests with rush TATs requested

Analy

Indicate Filtered (F), Preserved (P) or Fi

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Halton San + Storm PRG	Gretchen 3 PRG (Custom)	SAMPLES ON HOLD	EXTENDED STORAGE REQ	SUSPECTED HAZARD (see notes)
	BH109-SW	27-05-24	13:25	GW	15	X	X			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

Halton San + Storm Sewer Use PRG PH=7.49 Temp=18.3°C + Gretchen 3 PRG (Custom) - compared to ODWS, PWQO crit.

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☐ NONE ☑ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	5.3

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
BJW	05/27/24	17:30

INITIAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (ALS use only)

Received by:	Date:	Time:
BB	05/28/24	8:40

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 FRONT

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

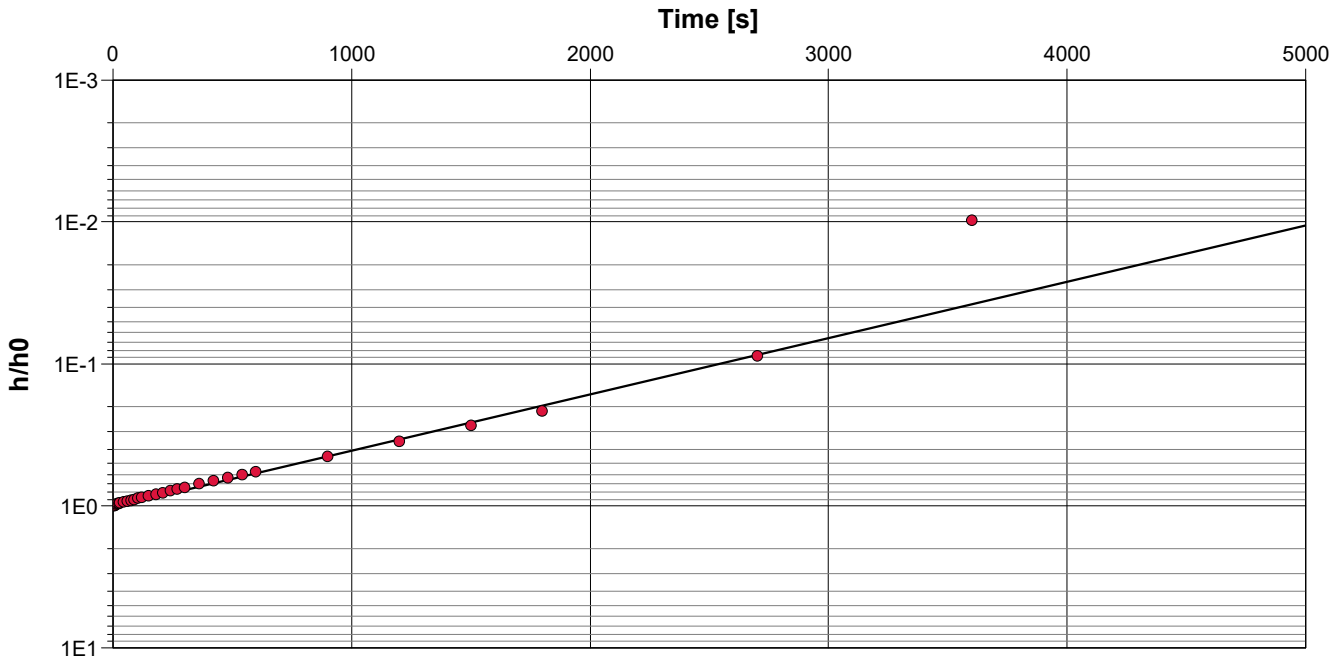
1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

VW-244 MM-648
OR-193 OGG-50
CM-540 B-682 GC-027 N-865

APPENDIX I

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH102	Test Well: BH102
Test Conducted by: BJW		Test Date: 2024-05-28
Analysis Performed by: HG	BH102	Analysis Date: 2024-06-03
Aquifer Thickness: 5.20 m		

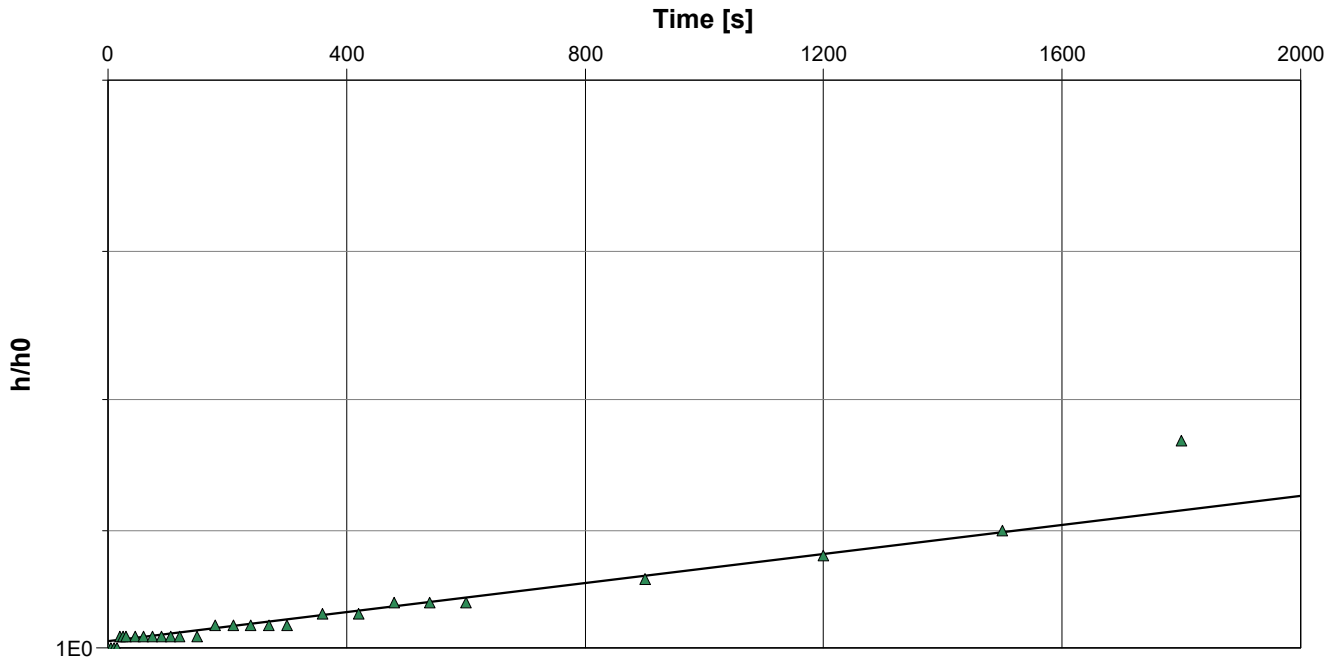


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH102	4.10×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH103	Test Well: BH103
Test Conducted by: IH		Test Date: 2024-06-03
Analysis Performed by: HG	BH103	Analysis Date: 2024-06-03
Aquifer Thickness: 12.20 m		

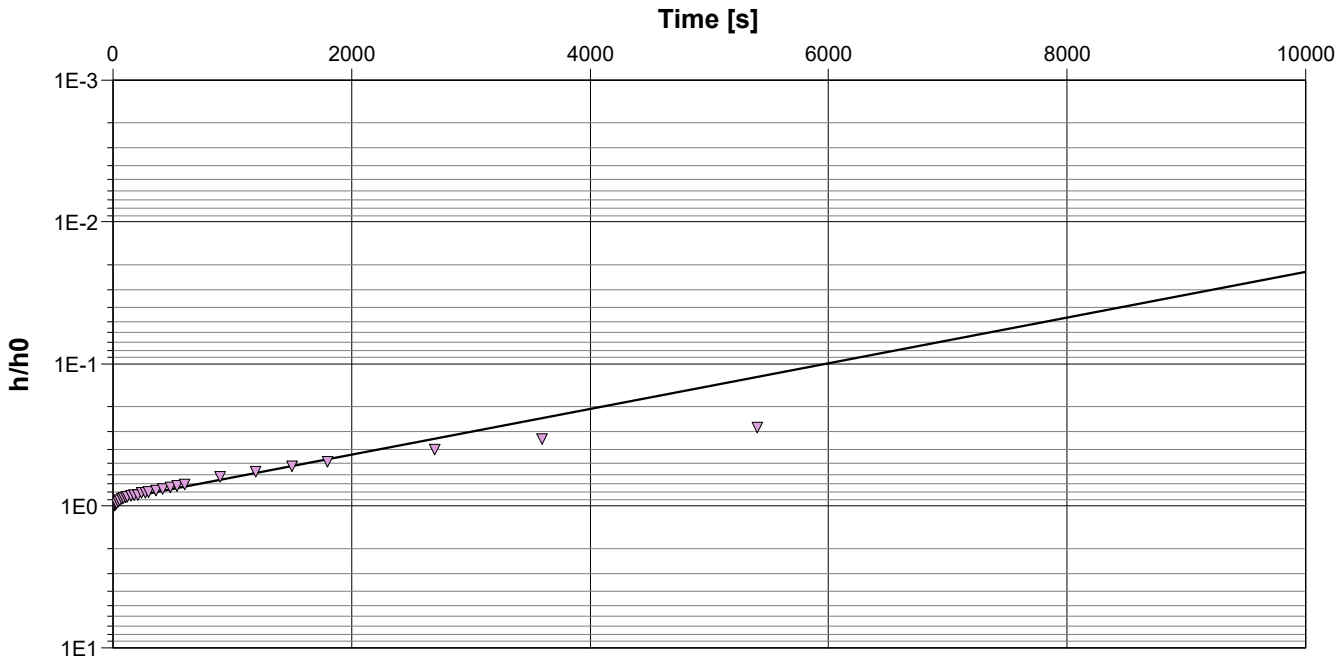


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH103	3.35×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH104-S	Test Well: BH104-S
Test Conducted by: BJW		Test Date: 2024-05-28
Analysis Performed by: HG	BH104-S	Analysis Date: 2024-06-03
Aquifer Thickness: 7.60 m		

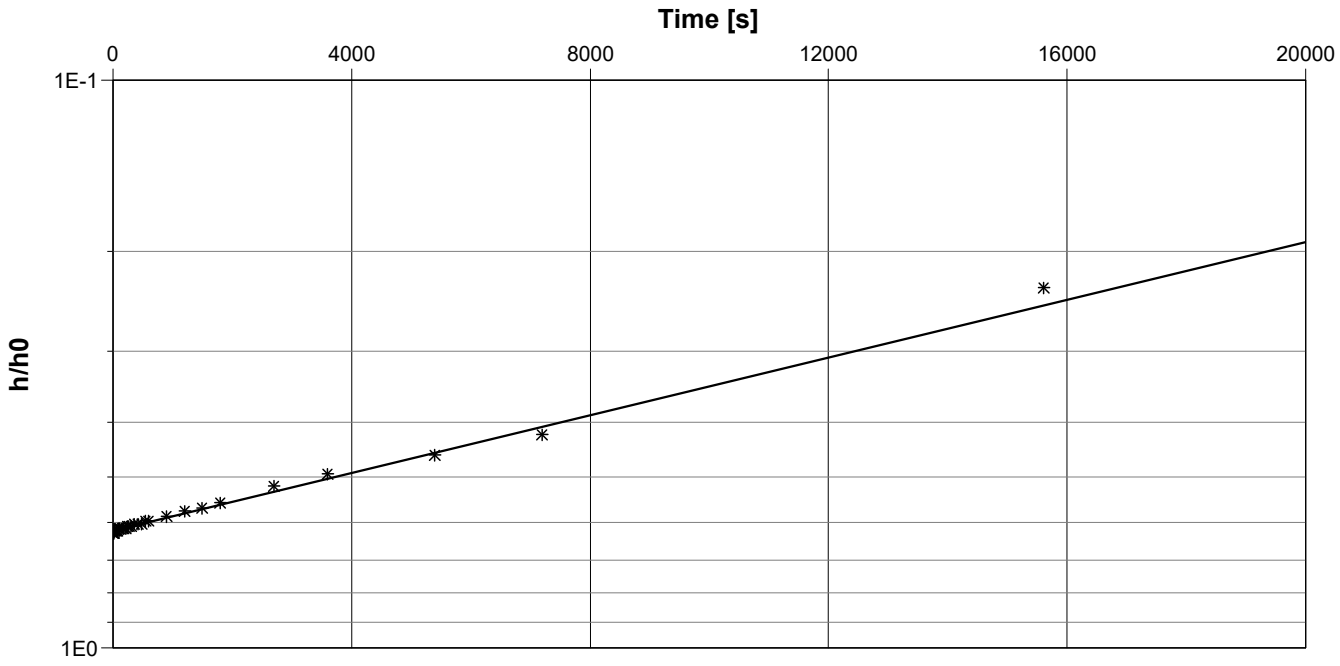


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104-S	1.77×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH104-D	Test Well: BH104-D
Test Conducted by: BJW		Test Date: 2024-05-28
Analysis Performed by: HG	BH104-D	Analysis Date: 2024-06-03
Aquifer Thickness: 19.80 m		

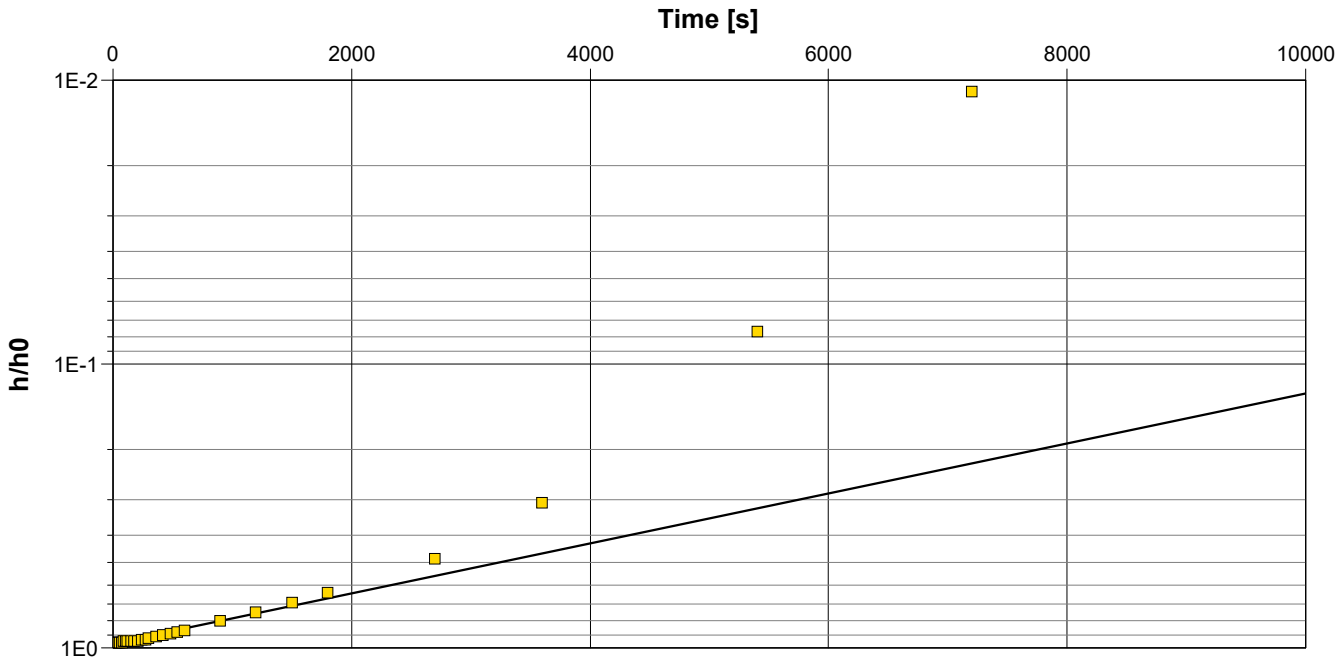


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH104-D	3.20×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH106-S	Test Well: BH106-S
Test Conducted by: SN		Test Date: 2024-06-03
Analysis Performed by: HG	BH106-S	Analysis Date: 2024-06-03
Aquifer Thickness: 2.44 m		

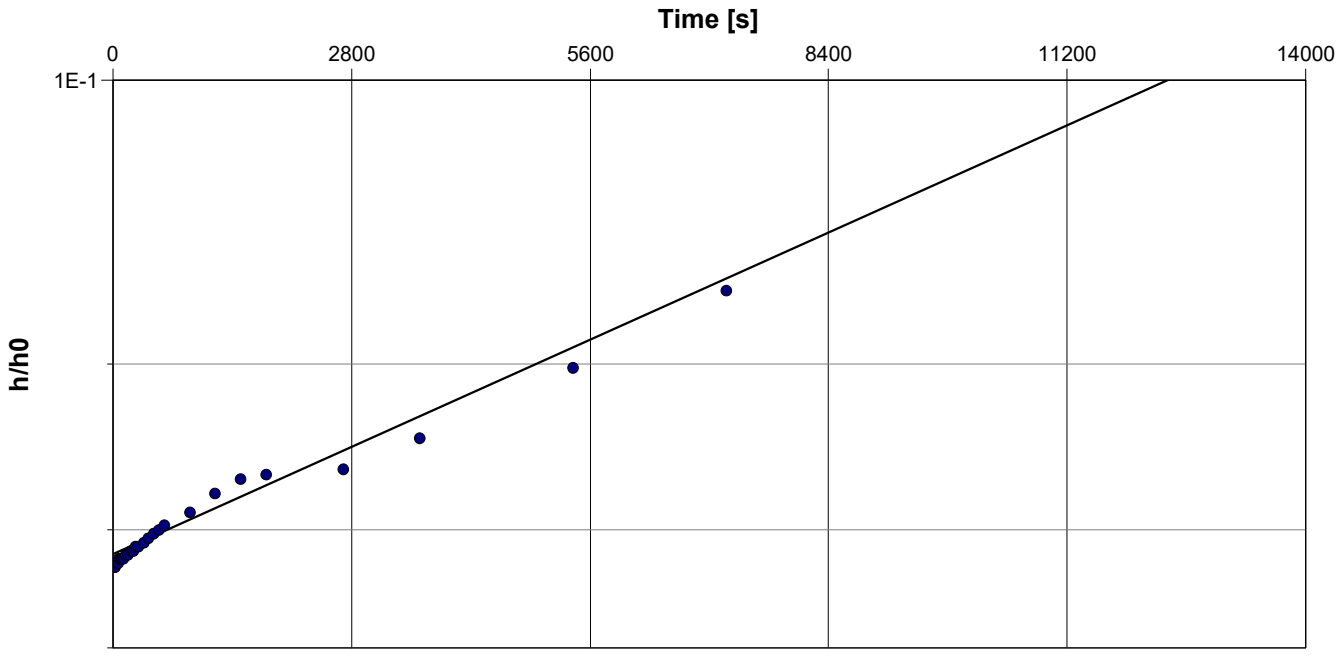


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106-S	1.38×10^{-7}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH106-D	Test Well: BH106-D
Test Conducted by:		Test Date: 2024-06-03
Analysis Performed by: HG	BH106-D	Analysis Date: 2024-06-03
Aquifer Thickness: 6.10 m		

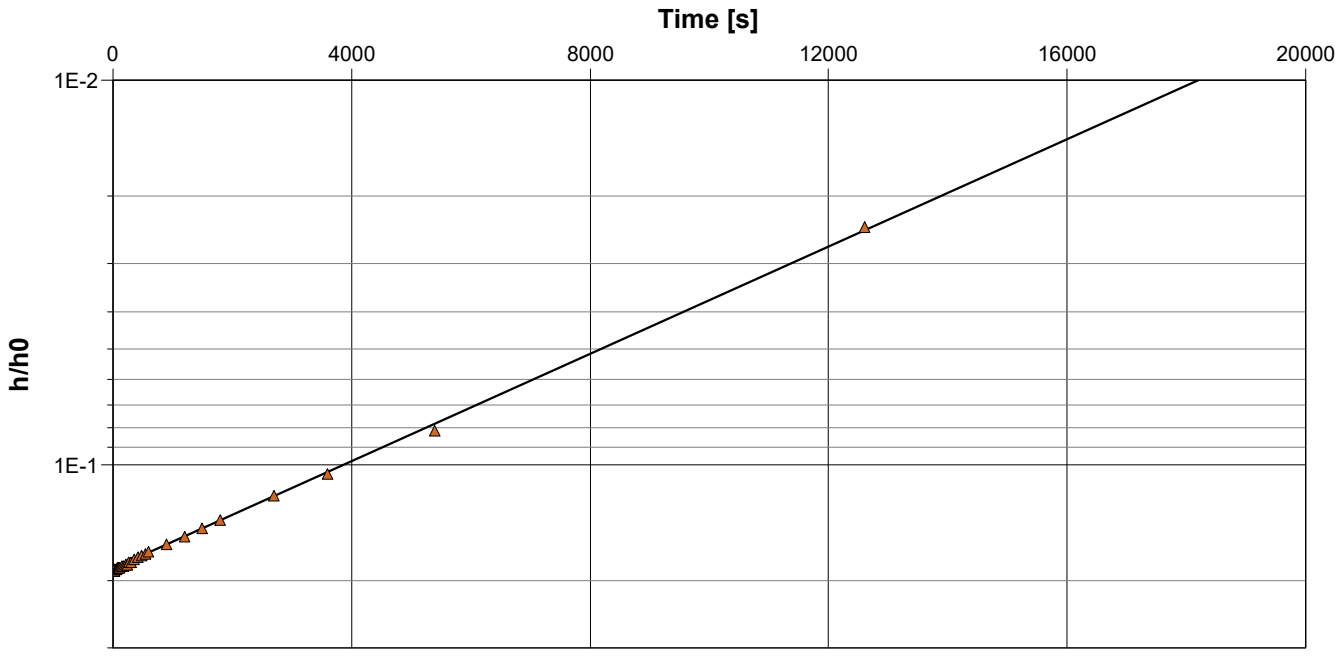


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH106-D	8.36×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH107	Test Well: BH107
Test Conducted by: BJW		Test Date: 2024-06-28
Analysis Performed by: HG	BH107	Analysis Date: 2024-06-03
Aquifer Thickness: 6.10 m		

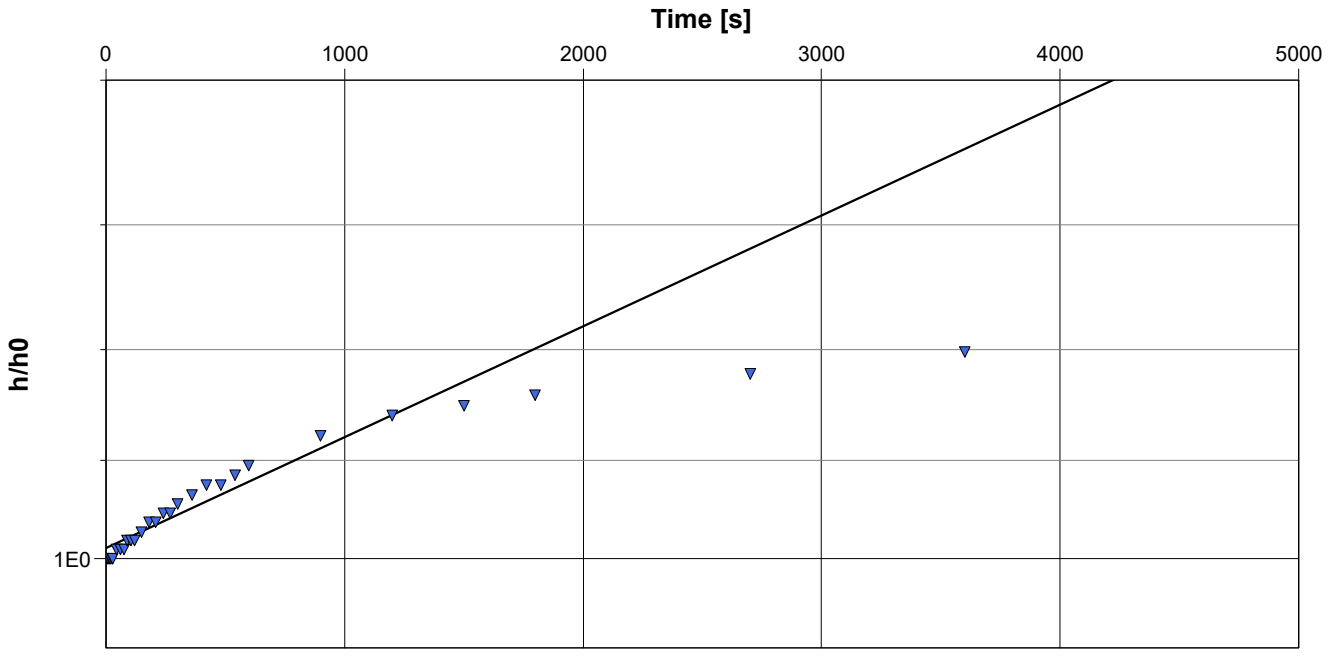


Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH107	7.39×10^{-8}	

GROUNDED ENGINEERING	**Slug Test Analysis Report**
	Project: 16469 10 Side Road
	Number: 24-048
	Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH109	Test Well: BH109
Test Conducted by: BJW		Test Date: 2024-06-03
Analysis Performed by: HG	BH109	Analysis Date: 2024-06-03
Aquifer Thickness: 6.10 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH109	5.44×10^{-8}	

GROUNDED ENGINEERING

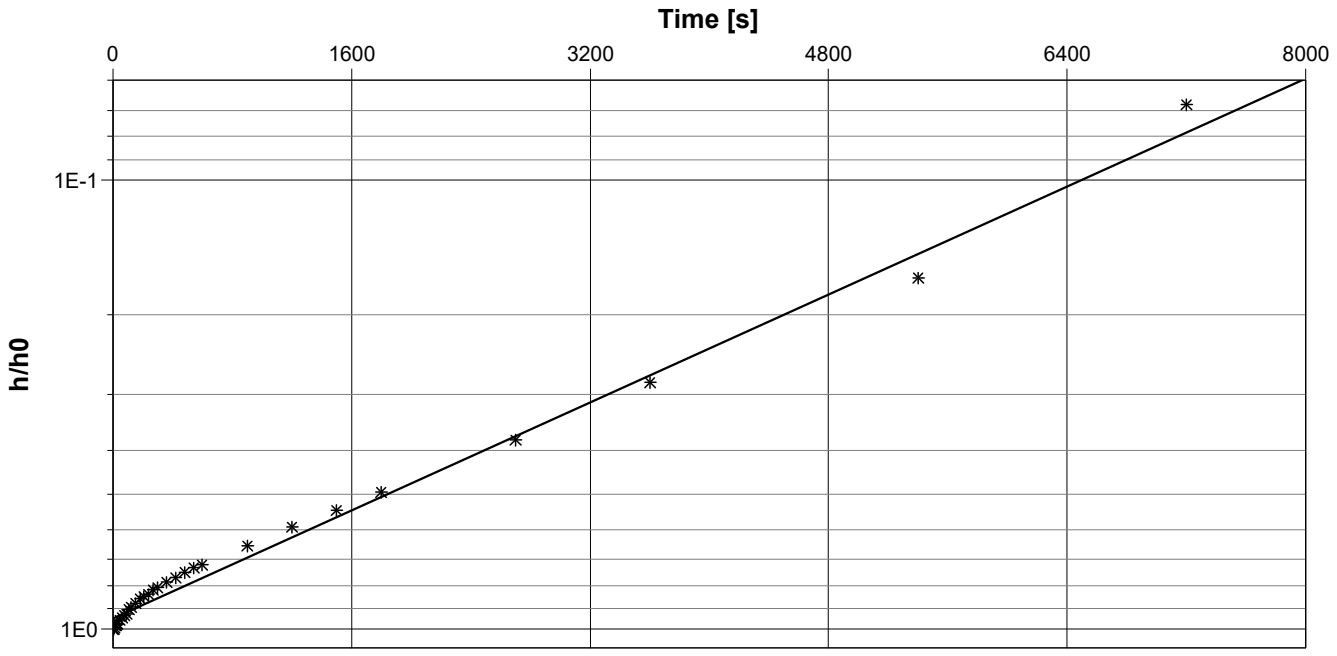
Slug Test Analysis Report

Project: 16469 10 Side Road

Number: 24-048

Client: Russell Pines Property Corp.

Location: Norval	Slug Test: BH112	Test Well: BH112
Test Conducted by: BJW		Test Date: 2024-06-03
Analysis Performed by: HG	BH112	Analysis Date: 2024-06-03
Aquifer Thickness: 6.10 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH112	1.59×10^{-7}	

GROUNDED ENGINEERING

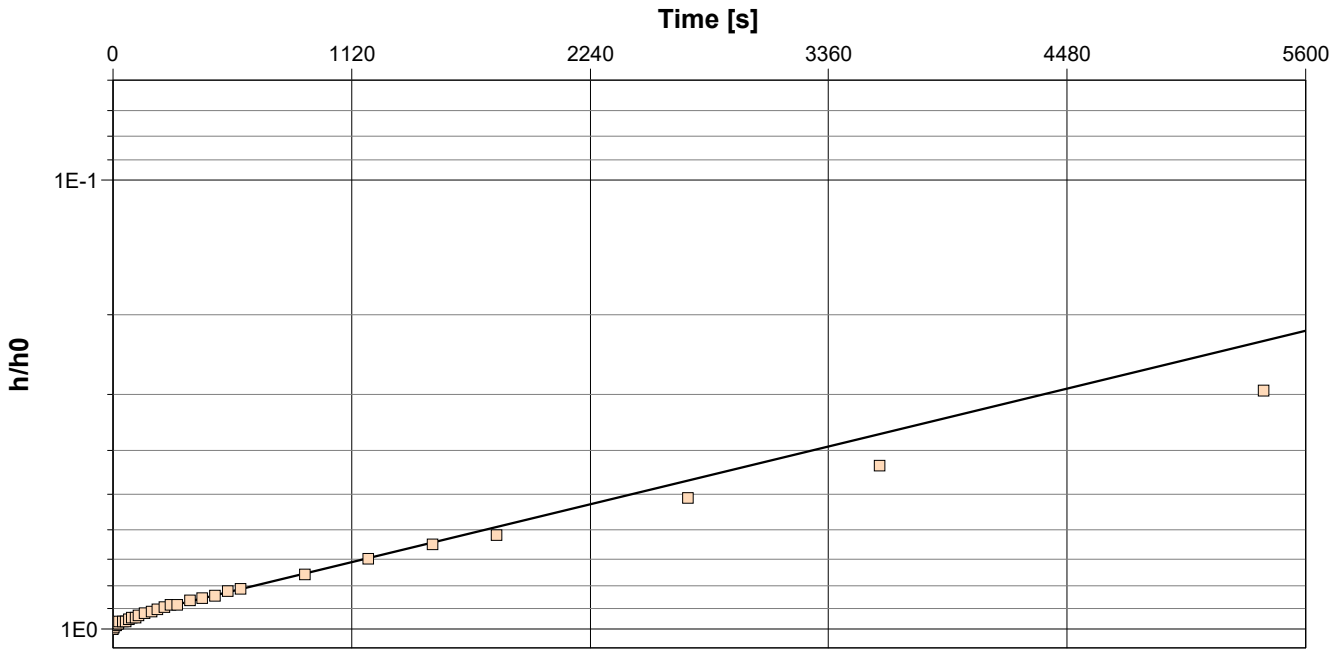
Slug Test Analysis Report

Project: 16469 10 Side Road

Number: 24-048

Client: Russell Pines Property Corp.

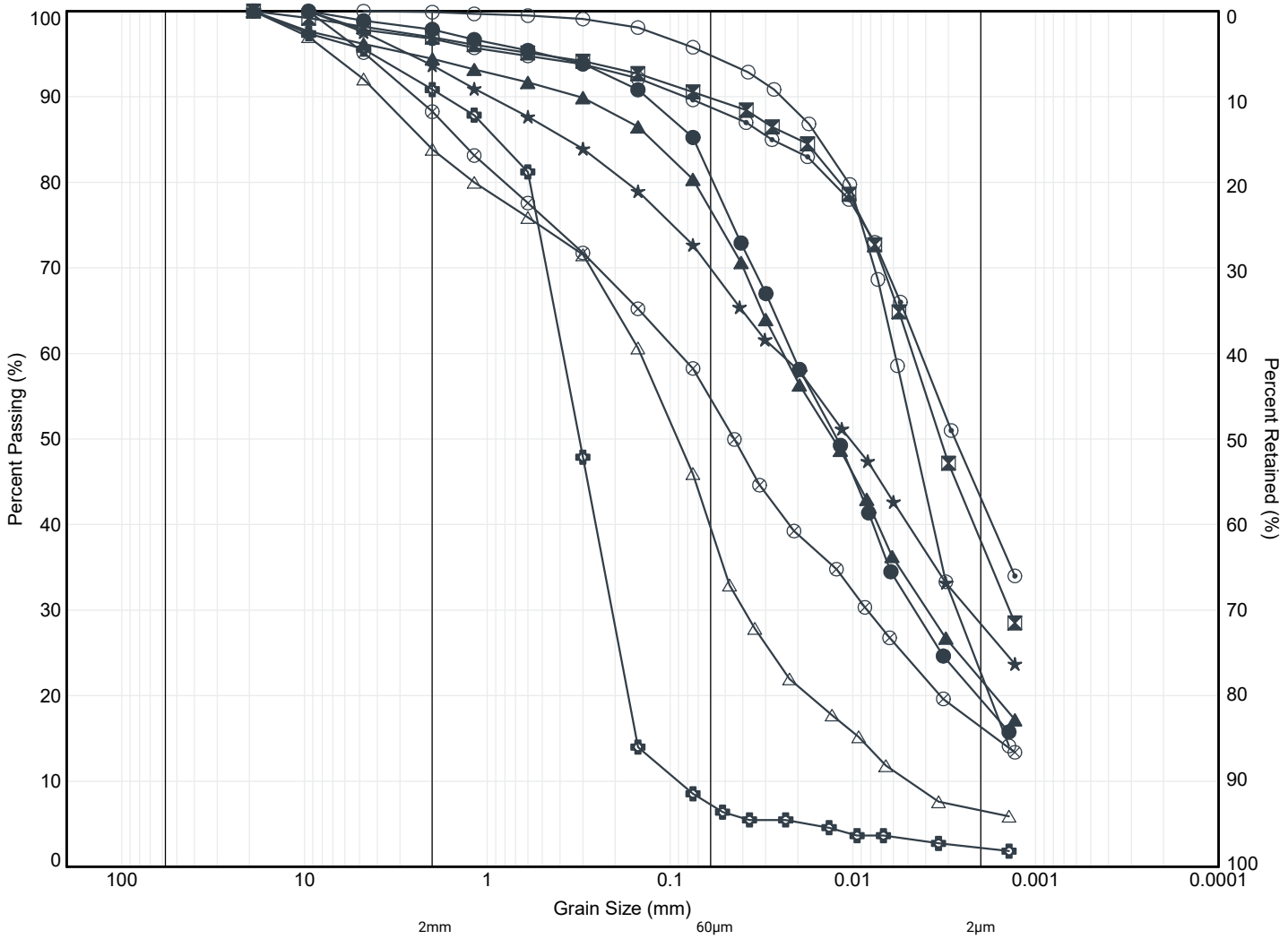
Location: Norval	Slug Test: BH114	Test Well: BH114
Test Conducted by:		Test Date: 2024-06-03
Analysis Performed by: HG	BH114	Analysis Date: 2024-06-03
Aquifer Thickness: 4.90 m		



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH114	1.17×10^{-7}	

APPENDIX J



MIT SYSTEM	COBBLES	GRAVEL			SAND			SILT	CLAY
		COARSE	MEDIUM	FINE	COARSE	MEDIUM	FINE		

MIT SYSTEM

	Location	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**BH 102**	SS5	3.3	224.1	2	17	61	20	*(0)*
⊠	**BH 103**	SS8	7.8	218.6	3	7	52	38	*(0)*
▲	**BH 103**	SS9	9.4	217.1	6	17	55	22	*(0)*
★	**BH 104**	SS6	4.8	219.9	6	24	42	28	*(0)*
⊙	**BH 104**	SS16	18.5	206.2	3	8	46	43	*(0)*
✿	**BH 106**	SS3	1.8	222.3	9	84	5	2	*(0)*
○	**BH 112**	SS6	4.8	224.0	0	5	72	23	*(0)*
△	**BH 113**	SS4	2.6	228.6	16	44	33	7	*(0)*
⊗	**BH 113**	SS5	3.3	227.9	12	34	38	16	*(0)*

GROUNDED ENGINEERING

Title: **GRAIN SIZE DISTRIBUTION**

File No.: **24-048**

file: gint 24-048.gpj

K from Grain Size Analysis Report

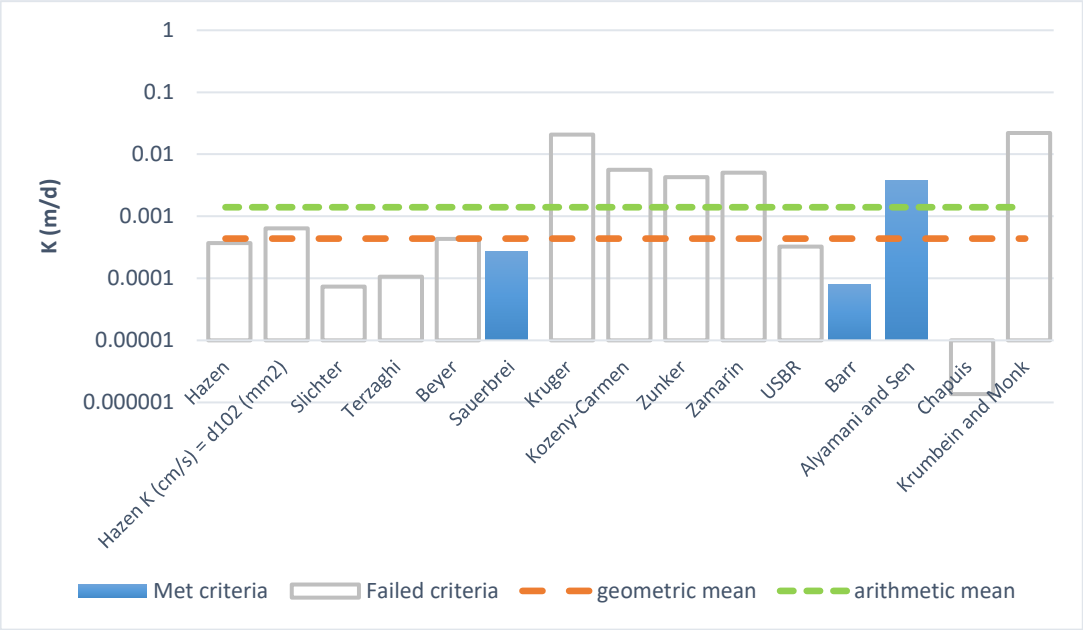
Date: 04-Jun-24

Sample Name: BH102 SS5

Mass Sample (g): 163

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.3E-07	4.3E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	7.4E-07	7.4E-09	0.00	
Slichter	8.5E-08	8.5E-10	0.00	
Terzaghi	1.2E-07	1.2E-09	0.00	
Beyer	5.0E-07	5.0E-09	0.00	
Sauerbrei	3.1E-07	3.1E-09	0.00	
Kruger	2.4E-05	2.4E-07	0.02	
Kozeny-Carmen	6.5E-06	6.5E-08	0.01	
Zunker	4.9E-06	4.9E-08	0.00	
Zamarin	5.8E-06	5.8E-08	0.01	
USBR	3.8E-07	3.8E-09	0.00	
Barr	9.1E-08	9.1E-10	0.00	
Alyamani and Sen	4.5E-06	4.5E-08	0.00	
Chapuis	1.6E-09	1.6E-11	0.00	
Krumbein and Monk	2.6E-05	2.6E-07	0.02	
geometric mean	5.1E-07	5.1E-09	0.00	
arithmetic mean	1.6E-06	1.6E-08	0.00	

K from Grain Size Analysis Report

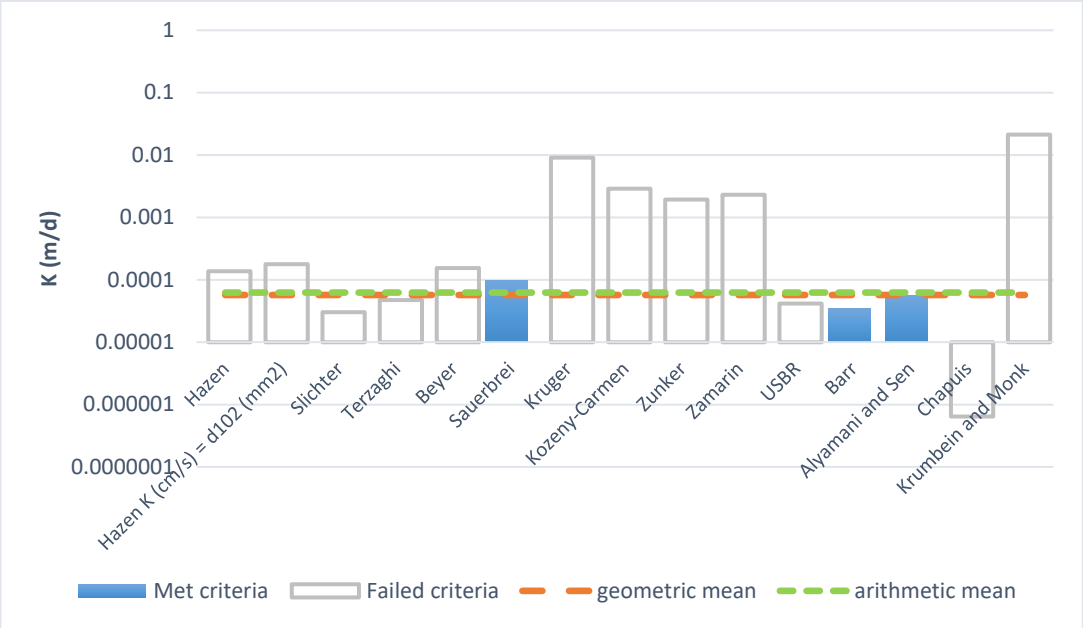
Date: 13-Jun-24

Sample Name: BH103 SS8

Mass Sample (g): 214.3

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.6E-07	1.6E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	2.1E-07	2.1E-09	0.00	
Slichter	3.5E-08	3.5E-10	0.00	
Terzaghi	5.5E-08	5.5E-10	0.00	
Beyer	1.8E-07	1.8E-09	0.00	
Sauerbrei	1.1E-07	1.1E-09	0.00	
Kruger	1.1E-05	1.1E-07	0.01	
Kozeny-Carmen	3.3E-06	3.3E-08	0.00	
Zunker	2.2E-06	2.2E-08	0.00	
Zamarin	2.7E-06	2.7E-08	0.00	
USBR	4.8E-08	4.8E-10	0.00	
Barr	4.0E-08	4.0E-10	0.00	
Alyamani and Sen	6.4E-08	6.4E-10	0.00	
Chapuis	7.5E-10	7.5E-12	0.00	
Krumbein and Monk	2.5E-05	2.5E-07	0.02	
geometric mean	6.6E-08	6.6E-10	0.00	
arithmetic mean	7.2E-08	7.2E-10	0.00	

K from Grain Size Analysis Report

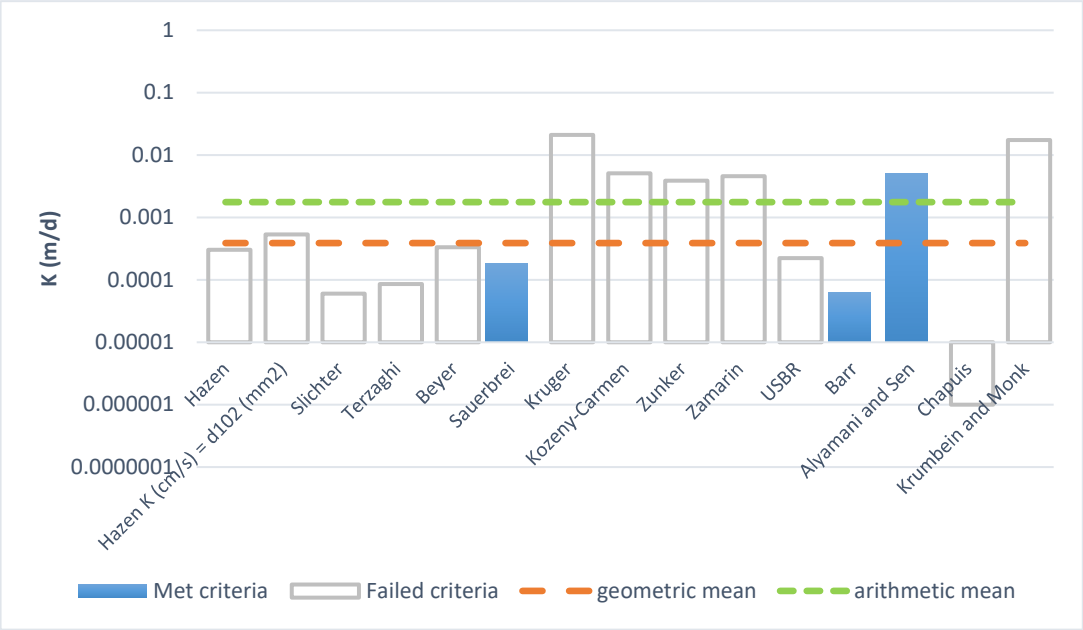
Date: 04-Jun-24

Sample Name: BH103 SS9

Mass Sample (g): 147.6

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	3.5E-07	3.5E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	6.2E-07	6.2E-09	0.00	
Slichter	6.9E-08	6.9E-10	0.00	
Terzaghi	9.9E-08	9.9E-10	0.00	
Beyer	3.8E-07	3.8E-09	0.00	
Sauerbrei	2.1E-07	2.1E-09	0.00	
Kruger	2.4E-05	2.4E-07	0.02	
Kozeny-Carmen	5.9E-06	5.9E-08	0.01	
Zunker	4.5E-06	4.5E-08	0.00	
Zamarin	5.3E-06	5.3E-08	0.00	
USBR	2.6E-07	2.6E-09	0.00	
Barr	7.4E-08	7.4E-10	0.00	
Alyamani and Sen	5.9E-06	5.9E-08	0.01	
Chapuis	1.1E-09	1.1E-11	0.00	
Krumbein and Monk	2.0E-05	2.0E-07	0.02	
geometric mean	4.5E-07	4.5E-09	0.00	
arithmetic mean	2.0E-06	2.0E-08	0.00	

K from Grain Size Analysis Report

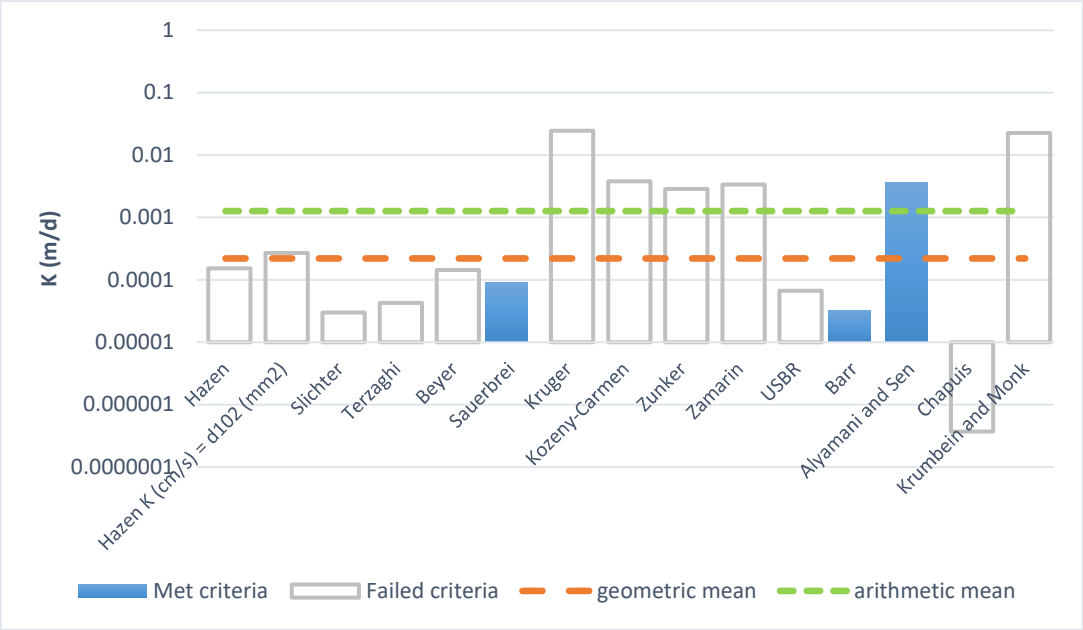
Date: 04-Jun-24

Sample Name: BH104 SS6

Mass Sample (g): 164.6

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.8E-07	1.8E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	3.1E-07	3.1E-09	0.00	
Slichter	3.5E-08	3.5E-10	0.00	
Terzaghi	4.9E-08	4.9E-10	0.00	
Beyer	1.7E-07	1.7E-09	0.00	
Sauerbrei	1.1E-07	1.1E-09	0.00	
Kruger	2.8E-05	2.8E-07	0.02	
Kozeny-Carmen	4.4E-06	4.4E-08	0.00	
Zunker	3.3E-06	3.3E-08	0.00	
Zamarin	3.9E-06	3.9E-08	0.00	
USBR	7.7E-08	7.7E-10	0.00	
Barr	3.7E-08	3.7E-10	0.00	
Alyamani and Sen	4.3E-06	4.3E-08	0.00	
Chapuis	4.3E-10	4.3E-12	0.00	
Krumbein and Monk	2.6E-05	2.6E-07	0.02	
geometric mean	2.6E-07	2.6E-09	0.00	
arithmetic mean	1.5E-06	1.5E-08	0.00	

K from Grain Size Analysis Report

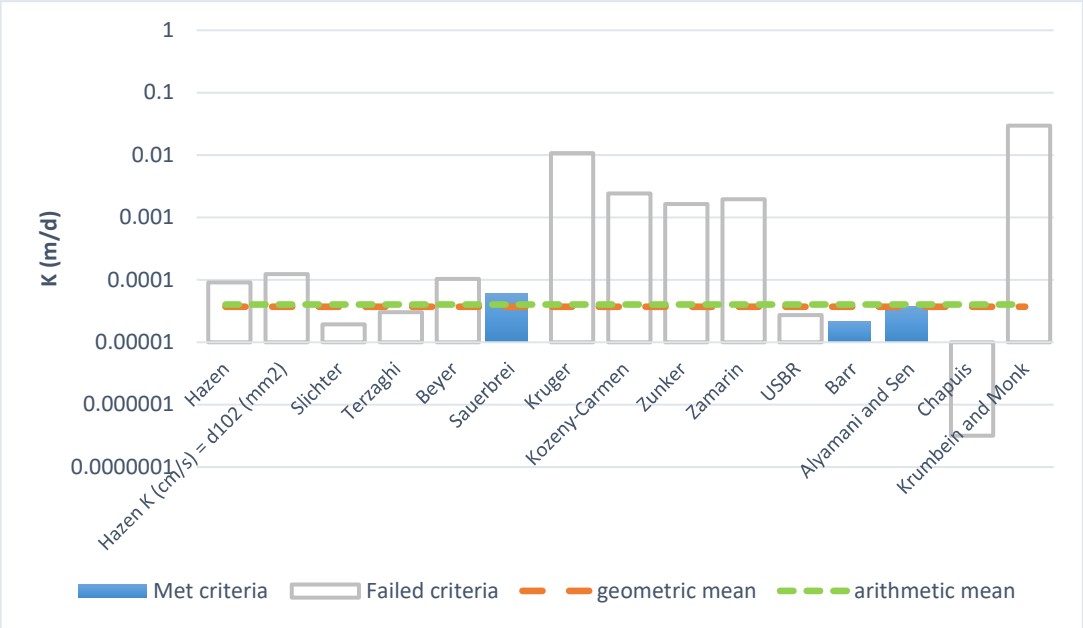
Date: 04-Jun-24

Sample Name: BH104 SS16

Mass Sample (g): 235.1

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.0E-07	1.0E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	1.4E-07	1.4E-09	0.00	
Slichter	2.2E-08	2.2E-10	0.00	
Terzaghi	3.5E-08	3.5E-10	0.00	
Beyer	1.2E-07	1.2E-09	0.00	
Sauerbrei	7.2E-08	7.2E-10	0.00	
Kruger	1.2E-05	1.2E-07	0.01	
Kozeny-Carmen	2.8E-06	2.8E-08	0.00	
Zunker	1.9E-06	1.9E-08	0.00	
Zamarin	2.3E-06	2.3E-08	0.00	
USBR	3.2E-08	3.2E-10	0.00	
Barr	2.5E-08	2.5E-10	0.00	
Alyamani and Sen	4.4E-08	4.4E-10	0.00	
Chapuis	3.6E-10	3.6E-12	0.00	
Krumbein and Monk	3.4E-05	3.4E-07	0.03	
geometric mean	4.3E-08	4.3E-10	0.00	
arithmetic mean	4.7E-08	4.7E-10	0.00	

K from Grain Size Analysis Report

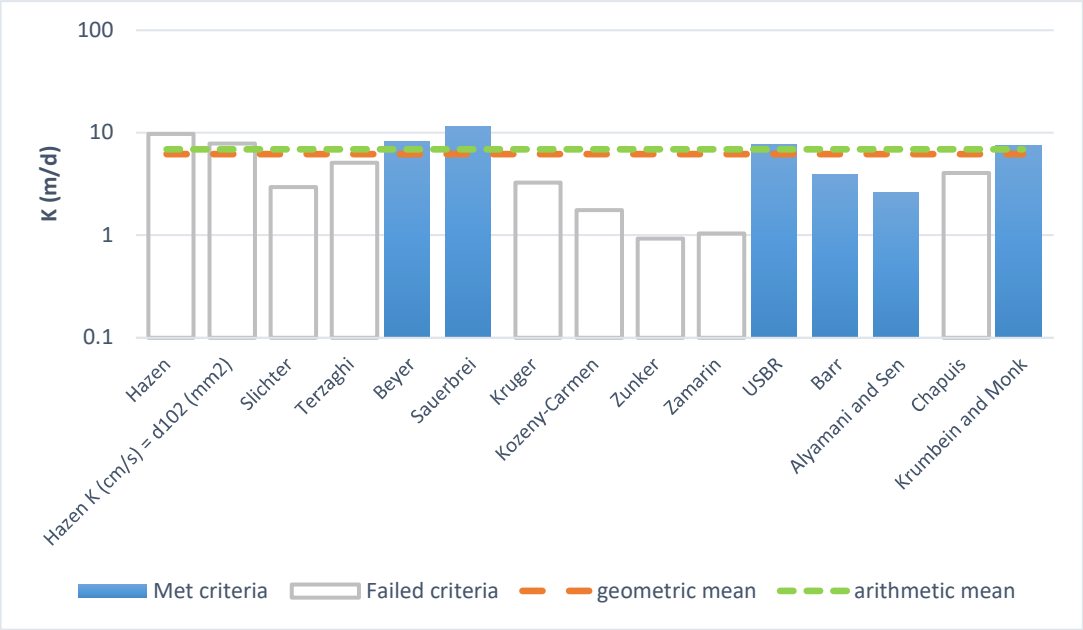
Date: 04-Jun-24

Sample Name: BH106 SS3

Mass Sample (g): 179.9

T (oC) 20

Moderately well sorted sand low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.1E-02	1.1E-04	9.75	
Hazen K (cm/s) = d_{10} (mm)	9.0E-03	9.0E-05	7.82	
Slichter	3.4E-03	3.4E-05	2.94	
Terzaghi	5.9E-03	5.9E-05	5.08	
Beyer	9.6E-03	9.6E-05	8.34	
Sauerbrei	1.3E-02	1.3E-04	11.46	
Kruger	3.8E-03	3.8E-05	3.27	
Kozeny-Carmen	2.0E-03	2.0E-05	1.75	
Zunker	1.1E-03	1.1E-05	0.93	
Zamarin	1.2E-03	1.2E-05	1.04	
USBR	8.8E-03	8.8E-05	7.64	
Barr	4.6E-03	4.6E-05	3.96	
Alyamani and Sen	3.0E-03	3.0E-05	2.60	
Chapuis	4.7E-03	4.7E-05	4.05	
Krumbein and Monk	8.6E-03	8.6E-05	7.46	
geometric mean	7.2E-03	7.2E-05	6.18	
arithmetic mean	8.0E-03	8.0E-05	6.91	

K from Grain Size Analysis Report

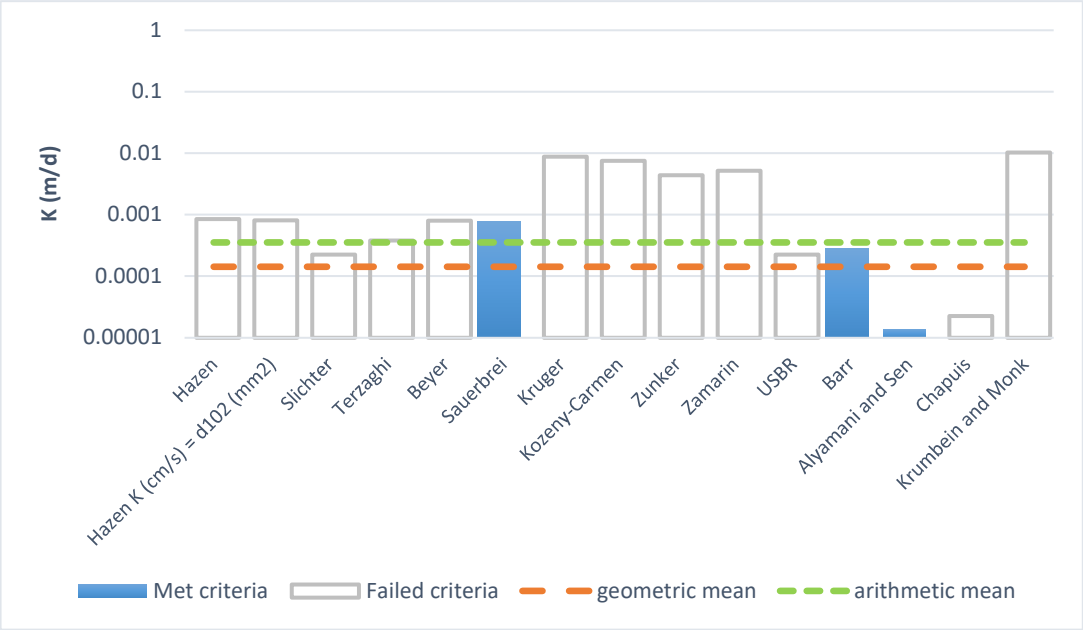
Date: 04-Jun-24

Sample Name: BH112 SS6

Mass Sample (g): 106.7

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	9.8E-07	9.8E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	9.3E-07	9.3E-09	0.00	
Slichter	2.6E-07	2.6E-09	0.00	
Terzaghi	4.4E-07	4.4E-09	0.00	
Beyer	9.2E-07	9.2E-09	0.00	
Sauerbrei	9.0E-07	9.0E-09	0.00	
Kruger	1.0E-05	1.0E-07	0.01	
Kozeny-Carmen	8.7E-06	8.7E-08	0.01	
Zunker	5.1E-06	5.1E-08	0.00	
Zamarin	6.0E-06	6.0E-08	0.01	
USBR	2.6E-07	2.6E-09	0.00	
Barr	3.2E-07	3.2E-09	0.00	
Alyamani and Sen	1.6E-08	1.6E-10	0.00	
Chapuis	2.6E-08	2.6E-10	0.00	
Krumbein and Monk	1.2E-05	1.2E-07	0.01	
geometric mean	1.7E-07	1.7E-09	0.00	
arithmetic mean	4.1E-07	4.1E-09	0.00	

K from Grain Size Analysis Report

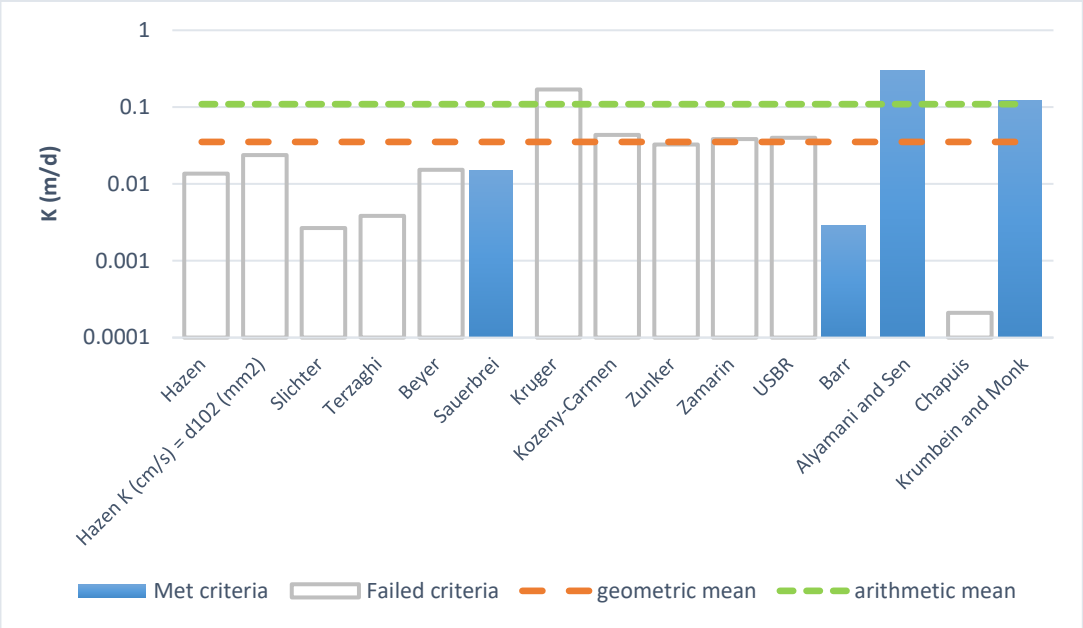
Date: 13-Jun-24

Sample Name: BH113 SS4

Mass Sample (g): 191.2

T (oC) 20

Poorly sorted gravelly sand low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.6E-05	1.6E-07	0.01	
Hazen K (cm/s) = d_{10} (mm)	2.7E-05	2.7E-07	0.02	
Slichter	3.1E-06	3.1E-08	0.00	
Terzaghi	4.4E-06	4.4E-08	0.00	
Beyer	1.8E-05	1.8E-07	0.02	
Sauerbrei	1.7E-05	1.7E-07	0.01	
Kruger	2.0E-04	2.0E-06	0.17	
Kozeny-Carmen	5.0E-05	5.0E-07	0.04	
Zunker	3.8E-05	3.8E-07	0.03	
Zamarin	4.4E-05	4.4E-07	0.04	
USBR	4.6E-05	4.6E-07	0.04	
Barr	3.3E-06	3.3E-08	0.00	
Alyamani and Sen	3.4E-04	3.4E-06	0.30	
Chapuis	2.4E-07	2.4E-09	0.00	
Krumbein and Monk	1.4E-04	1.4E-06	0.12	
geometric mean	4.1E-05	4.1E-07	0.04	
arithmetic mean	1.3E-04	1.3E-06	0.11	

K from Grain Size Analysis Report

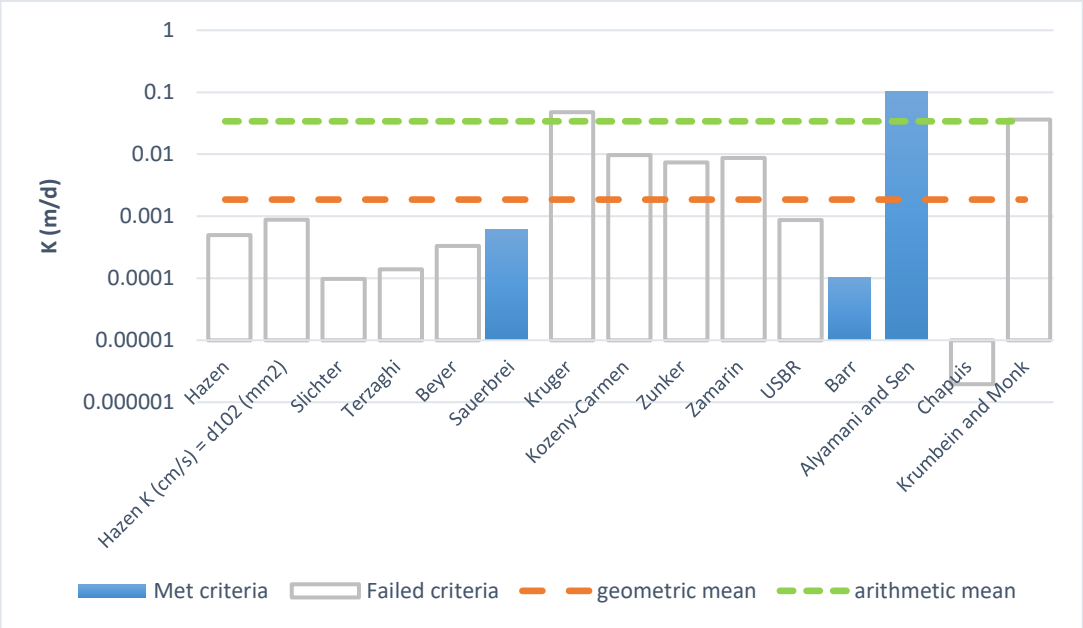
Date: 13-Jun-24

Sample Name: BH113 SS5

Mass Sample (g): 174

T (oC) 20

Poorly sorted sandy gravelly silt with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	5.8E-07	5.8E-09	0.00	
Hazen K (cm/s) = d_{10} (mm)	1.0E-06	1.0E-08	0.00	
Slichter	1.1E-07	1.1E-09	0.00	
Terzaghi	1.6E-07	1.6E-09	0.00	
Beyer	3.8E-07	3.8E-09	0.00	
Sauerbrei	7.0E-07	7.0E-09	0.00	
Kruger	5.5E-05	5.5E-07	0.05	
Kozeny-Carmen	1.1E-05	1.1E-07	0.01	
Zunker	8.5E-06	8.5E-08	0.01	
Zamarin	1.0E-05	1.0E-07	0.01	
USBR	1.0E-06	1.0E-08	0.00	
Barr	1.2E-07	1.2E-09	0.00	
Alyamani and Sen	1.2E-04	1.2E-06	0.10	
Chapuis	2.3E-09	2.3E-11	0.00	
Krumbein and Monk	4.2E-05	4.2E-07	0.04	
geometric mean	2.1E-06	2.1E-08	0.00	
arithmetic mean	3.9E-05	3.9E-07	0.03	

APPENDIX K

2.1 CTC SOURCE PROTECTION REGION

The CTC Source Protection Region (**Figure 2-2**) contains 25 large and small watersheds and spans over 10,000 km^2, from the Oak Ridges Moraine in the north to Lake Ontario in the south. The region contains portions of the Niagara Escarpment, Oak Ridges Moraine, Greenbelt, Lake Ontario and the most densely populated region of Canada.

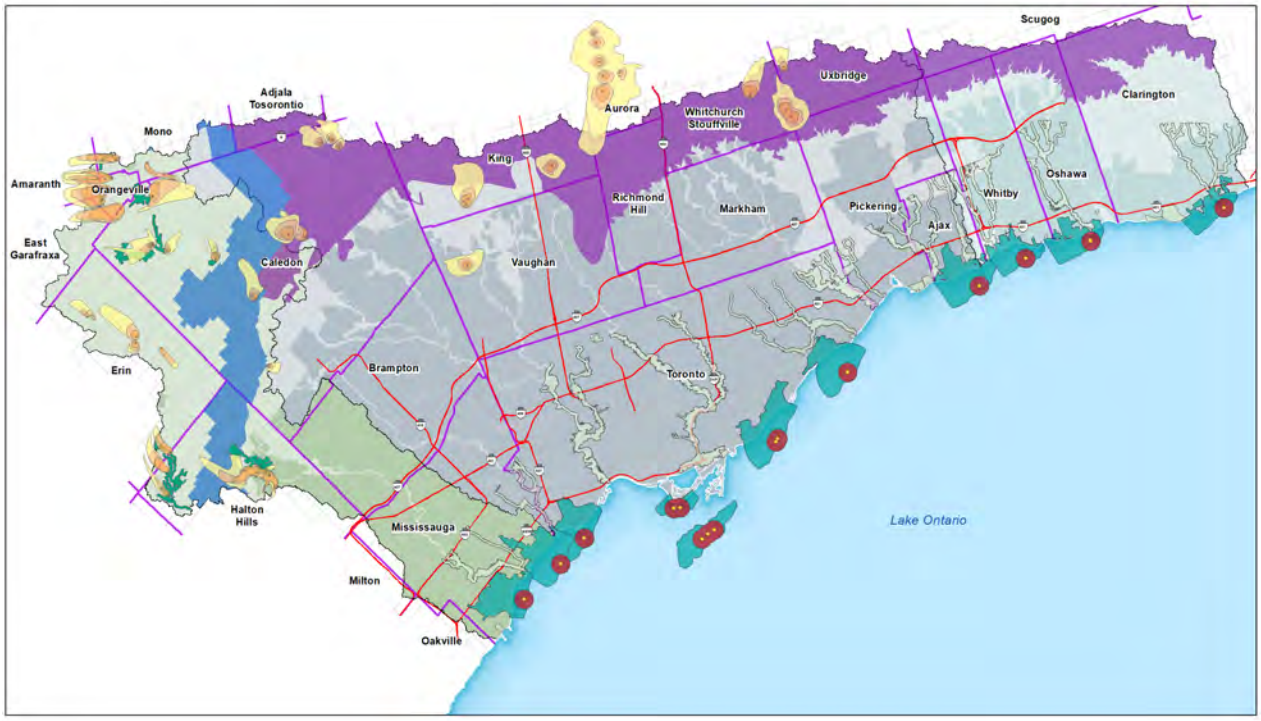


Figure 2-2: Map of the CTC Source Protection Region

The CTC Source Protection Region includes:

- 25 local municipalities and eight single tier, regional or county municipalities;
- 63 active municipal supply wells; and
- 16 municipal surface water intakes on Lake Ontario.

The region is complex and diverse in terms of geology, physiology, population, and development pressures, with many, often conflicting, water uses including drinking water supply, recreation, irrigation, agriculture, commercial and industrial uses, as well as ecosystem needs. This diverse setting

APPENDIX L

1. Climate Information

Precipitation	806.8	mm/a
Evapotranspiration	365	mm/a
Water Surplus	441.8	mm/a

2. Infiltration Rates

Table 2 Approach - Infiltration Factors

Topography - Hilly Land	0.1
Soil - Medium combinations of clay and silt	0.2
Cover - Cultivated lands	0.1
TOTAL	0.4

Infiltration (0.5 x 303)	176.72	mm/a
Run-off (303-151.5)	265.08	mm/a

Table 3 Approach - Typical Recharge Rates

silty sand to sandy silt	150 - 200	mm/a
silt	125 - 150	mm/a
clayey silt	100 - 125	mm/a

Site development area is underlain primarily by low permeability clayey silt.

Based on the above, the recharge rate is 125 mm/a

with runoff of 317 mm/a

3. Property Statistics

Building Area (Roofs)	125,750	m^2	12.58	ha
Open Space, Greenspace	224,850	m^2	22.49	ha
SWMP	5,660	m^2	0.57	ha
Impervious (Parking, Roadways)	162,340	m^2	16.23	ha
TOTAL	518,600	m^2	51.86	ha

*The land to be severed has not been included as part of the water budget

4. Annual Pre-Development Water Budget

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Undeveloped	518,600	418,406	189,289	64,825	164,292
TOTAL	**518,600**	**418,406**	**189,289**	**64,825**	**164,292**

5. Annual Post-Development Water Budget

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Open space, Greenspace	224,850	181,409	82,070	28,106	71,232
Pavement Areas	162,340	130,976	nil	nil	130,976
SWMP	5,660	4,566	2,066	708	2,501
Building Area	125,750	101,455	nil	nil	101,455
TOTAL	**518,600**	**418,406**	**84,136**	**28,814**	**306,164**

6. Comparison of Pre-Development and Post-Development

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	418,406	189,289	64,825	164,292
Post-Development	418,406	84,136	28,814	306,164

7. Requirement for Infiltration of Roof Runoff

Volume of post-development infiltration	28,814	m^3
Volume of pre-development infiltration	64,825	m^3
Defecit from pre- to post- development infiltration	36,011	m^3
Volume of available roof runoff	101,455	m^3
Percentage of roof runoff required to match pre-development infiltration	35%	