



Geotechnical Investigation

Proposed Residential Development – Fourteen Estates

Honey Heights Development Ltd.

21 May 2025

➔ **The Power of Commitment**



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1. Introduction

GHD Limited (GHD) was retained by Honey Heights Development Ltd. (Client) to conduct a geotechnical investigation for the proposed residential development to be located for lands located on Part Lots 21 and 22, Concession 8, Township of Scugog, Municipality of Durham, Ontario (herein referred to as “the Site”). The location of the Site is provided on the **Site Location Plan, Figure 1**.

The Site encompasses an area of 20.4 hectares (ha) (50.4 acres). The development will include residential homes, a detention pond, and internal streets. The Site area does not include the identified conveyance lands or other lands owned by the Client (i.e. these areas will not be discussed further in this report). The future residential lots are indicated on the provided Draft Plan of Subdivision as Lots 1 – 26 and are proposed to range in area from about 0.48 ha to 1.16 ha. There is a block in the north-central area of the Site (Block 27) where the proposed detention pond is to be constructed. The residential lots will be serviced on individual wells and septic systems. The Draft Plan of Subdivision¹ is illustrated on **Figure 2**.

The purpose of the geotechnical investigation was to obtain subsurface information regarding the soil and groundwater conditions at the test hole locations and prepare a report summarizing the conditions encountered. This geotechnical report provides engineering recommendations regarding earthwork construction, backfilling, groundwater control during construction, lateral earth pressure parameters for basement walls, bearing capacity and foundations design, slab-on-grade design, construction of stormwater management facilities, service installation (bedding and backfill), and pavement structure for roadways.

The factual data, interpretations and preliminary recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. This report should be read in conjunction with the Statement of Limitations in Section 7 of this report. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2. Scope of Work

GHD's scope of work was carried out from March 2025 and involved the following tasks:

- Pre-Planning activities:
 - Preparation of a Site-specific health and safety plan (HASP).
 - Completion of underground utility locate clearances (public and private).
- Field activities:
 - Advancement of five (5) boreholes identified as MW01-25, MW02-25, MW03-25, MW04-25 and BH05-25 as shown on **Figure 2** to depths ranging between 3.1 to 6.7 metres below ground surface (mbgs).
 - Completion of Standard Penetration Testing (SPT) and associated split spoon soil sampling in accordance with ASTM D1586.
 - Monitoring wells were installed in four (4) of the boreholes to depths ranging from 3.1 to 6.1 mbgs.
 - Advancement of nine (9) test pits identified as TP01-25 to TP09-25 as shown on **Figure 2** to depths ranging between 3.1 to 3.7 mbgs.
 - Monitoring wells were installed in three (3) of the test pits to depths ranging from 2.4 to 3.1 mbgs in test pits TP01-25, TP05-25, and TP06-25.
 - Measured groundwater levels at the seven (7) monitoring wells.

¹ D.G. Biddle & Associates Ltd. “Draft Plan of Subdivision, Part of Lot 21 & 22, Concession 8, Formerly in the Township of Reach Now in the Township of Scugog, Regional Municipality of Durham”, Project No. 112112, Drawing No. DP-1, dated April 2025.

- Conducted Single Well Response Tests (SWRTs) to assess the horizontal hydraulic conductivity and groundwater flux of the saturated stratigraphic deposits investigated.
- Constant Head Well Permeameter testing to evaluate the hydraulic conductivity of the unsaturated surficial soils.
- Completion of geotechnical laboratory testing on the selected soil samples.
- Preparation of a geotechnical investigation report (factual data, analysis and recommendations).

3. Methodology

3.1 Health and Safety

For projects that incorporate field activities, GHD conducts Health and Safety planning. For this project, a site-specific Health and Safety Plan (HASP) was prepared and implemented during the field activities. The HASP presents the visually observed Site conditions to identify potential physical hazards to field personnel. Required personal protective equipment was also listed in the HASP. It is mandatory for GHD personnel involved in the field program, to read and have a copy of the HASP available at the Site.

3.2 Utility Clearance

GHD completed a pre-drilling Site visit to review the Site conditions and access restrictions. Based on the limits of approach, the boreholes were positioned appropriately to avoid potential obstructions. The test holes were placed in the field based on the site plan and where access for the drill rig and excavator was possible.

Prior to initiating the subsurface investigation activities, all applicable utility companies (gas, hydro, network cables, water, waste water, etc.) were contacted, to demarcate the location of their respective underground utilities to ensure that service lines would not be damaged during the investigative works.

GHD also retained a specialist private services locator (Utility Marx) to locate any underground private utilities that could potentially be present at the Site. The proposed test holes were positioned at appropriate locations to avoid existing service lines.

3.3 Field Investigation

3.3.1 Test Hole and Monitoring Well Installations

The field program associated with the geotechnical investigation was conducted on February 10, 2025. The field program consisted of advancing a total of five (5) exploratory boreholes on Site to depths ranging between approximately 3.4 and 6.7 mbgs. Additionally, nine (9) test pits were excavated on Site to depths ranging between 3.1 to 3.7 mbgs. Four (4) of the boreholes were equipped with groundwater monitoring wells and three (3) monitoring wells were installed in the test pits. The test holes were located as shown in **Figure 2**.

The drilling work was carried out by a track-mounted drilling rig, supplied, and operated by ACE Drilling (ACE) and the test pits were completed by an excavator retained by the Client under the full-time supervision of an experienced GHD technical representative.

The boreholes were advanced using continuous solid stem augers and soil samples were collected using a 50 millimetre (mm) outside diameter split spoon sampler in general accordance with the specifications of the Standard Penetration Test Method (ASTM D1586). The relative density or consistency of the subsurface soil layers were measured using the SPT method, by counting the number of blows ('N') required to drive a conventional split barrel soil sampler to a depth of 300 mm. Groundwater level observations and measurements were made in the boreholes

as drilling proceeded and upon completion of the boreholes. The boreholes were backfilled upon completion and sealed in accordance with Ontario Regulation 903. The observed conditions and measured groundwater levels are provided in the record of the drilled boreholes in **Appendix A**.

Monitoring wells were constructed with 50 mm (2-inch) Schedule 40 PVC screen and casing. The well screens are either 1.5 m (5 feet) or 3.0 m (10 feet) in length and pre-slotted (No. 10 slot). Silica sand pack was placed around the monitoring well screen and typically extended approximately 0.3 m above the screen. The remaining annular space was sealed with bentonite, and the wells were completed with protective monument style casings. The installation details for each monitoring well are provided in the respective borehole records. The installed monitoring wells will need to be abandoned in accordance with O. Reg. 903 once no longer required.

The GHD technical representative logged the material encountered in the test holes and examined the samples as they were obtained. The recovered samples were sealed in clean, airtight containers and transferred to GHD's laboratory, where they were reviewed by a geotechnical engineer. The detailed results of the examination are recorded on the borehole records presented in **Appendix A**.

The boreholes, monitoring wells and test pit locations were surveyed with an EOS Arrow Gold Plus that streams to the Real Time Kinetic (RTK) Network connected to the NAD 83 datum. The ground elevations are provided for engineering analysis purposes only, are not for construction and should be confirmed by a licensed surveyor. A summary of the test hole locations, geographic coordinates, ground surface elevation, and termination depths are presented in the table below.

Table 3.1 *Summary of Test Holes*

Test Hole / Monitoring Well ID	Location – UTM Coordinate System		Ground Surface Elevation (m)	Test Hole Termination Depth (mbgs)	Test Hole Termination Elevation (m)
	Northing (m)	Easting (m)			
MW01-25	4889608	664964	272.2	3.1	269.1
MW02-25	4889512	664658	266.4	5.2	261.2
MW03-25	4889408	664401	265.2	6.7	258.5
MW04-25	4889443	664388	265.1	5.2	259.9
BH05-25	4889427	664316	266.3	3.7	262.6
TP01-25	4889433	664267	266.1	3.4	262.7
TP02-25	4899329	664302	266.9	3.4	263.5
TP03-25	4889468	664412	264.4	3.7	260.7
TP04-25	4889544	664558	263.5	3.4	260.1
TP05-25	4889447	664585	265.2	3.4	261.8
TP06-25	4889576	664646	265.6	3.1	262.5
TP07-25	4889427	664699	267.1	3.4	263.7
TP08-25	4889547	664836	270.2	3.4	266.8
TP09-25	4889691	664944	270.2	3.1	267.1

It should be noted that the coordinates and elevations provided in **Table 1** are approximate and should not be used for construction purposes. The ground elevations are provided for engineering analysis purposes only and should be confirmed by a licensed surveyor.

3.3.2 Groundwater Monitoring

Manual groundwater levels were collected using a Solinst water level meter from the installed monitoring wells. Groundwater levels were collected from the monitoring wells on March 17th and April 2nd, 2025. These measurements are summarized in **Table 5.9**. Additionally, GHD has prepared a hydrogeological investigation report with a more in-depth review of the Site and area hydrogeology

3.3.3 Geotechnical Laboratory Testing

Prior to conducting geotechnical laboratory testing, the soil samples extracted from the test holes were subjected to visual and tactile examination by a geotechnical engineer who confirmed the field descriptions and selected representative samples for detailed testing.

Geotechnical laboratory testing was conducted in accordance with the American Society for Testing and Materials (ASTM) and Canadian Council of Independent Laboratories (CCIL) applicable standards. Laboratory testing consisted of moisture content tests on all recovered soil samples, grain size distribution analyses (sieve and hydrometer testing) on seven (7) select soil samples and Atterberg limits testing on two (2) samples of the cohesive native soil.

The results of water content and grain size distribution tests are reported on the borehole records presented in **Appendix A**. The associated laboratory test results are provided in **Appendix B**.

The geotechnical laboratory testing program and soil classification conformed to the latest edition of the following standards:

- ASTM D2216: Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- MTO LS-702 Standard Test Method for Particle Size Analysis of Soils (Hydrometer Analysis)
- ASTM D2487 Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils
- ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System-USCS)

3.3.4 Single Well Response Testing

Single well response testing (SWRTs) was conducted at two (2) monitoring wells to estimate the horizontal hydraulic conductivity of the saturated geologic deposits underlying the Site. SWRTs were completed on monitoring wells MW02-25 and MW04-25.

SWRTs involve the injection or removal of a known volume of water into / from the well and measuring the water level response in the well until it returns to static or near static conditions (i.e., falling / rising head test). The results of the hydraulic testing were analyzed using the Bouwer-Rice (1976) solution for an unconfined aquifer condition as provided in the software package AQTESOLV™.

These solutions were used to determine the horizontal hydraulic conductivity of the saturated soils within the immediate vicinity of the screened interval of each monitoring well. The SWRTs conducted are summarized in **Table 5.10**. The results of the testing are presented in **Appendix C**.

3.3.5 Constant Head Well Permeameter Testing

In-situ permeability testing was conducted using an ETC Pask (Constant Head Well or CHW) permeameter to provide infiltration parameters for development of potential stormwater management options. The CHW testing is used to assess the “field-saturated” hydraulic conductivity (K_f s) (Reynolds, 1993) within the immediate vicinity of the testing equipment. The CHW method measures the quasi-steady state flow rate (Q) necessary to maintain a constant depth of water (H) in an uncased borehole. K_f s can then be calculated from Q and H and other coefficients (Reynolds,

1993) or as used with the ETC Pask, quick reference tables are provided for the specific permeameter characteristics and hole diameter and were used by GHD during our testing.

The infiltration tests were performed on March 6, 2025, within the proposed development area at four (4) locations adjacent to TP01-25, TP05-25, TP06-25, and TP08-25. One shallow infiltration test was completed at each location. The infiltration data results are summarized in **Table 5.11**. The results of the testing are presented in **Appendix D**.

4. Site Description

The Site is currently a greenfield with an area of the Site used as a laydown area located within the Township of Scugog in the Municipality of Durham. The Site does not have a municipal address and is geographically located on Part Lots 21 and 22, Concession 8 along Whitfield Road in Scugog, Ontario. Surrounding properties are generally residential or agricultural. In addition to the residential lots developed during the previous phases of this development, which are privately serviced for water and for septic, there are agricultural fields north of the Site.

5. Regional Geology and Subsurface Conditions

5.1 Regional Geology

According to the Quaternary Geology, the Province of Ontario Map Data Set 14 ("Quaternary Geology of Ontario-Southern Sheet", prepared by the Ontario Geological Survey, (published in 1997), the Quaternary deposits in the area of the Site consists of glaciolacustrine deposits of sand, gravelly sand, and gravel, containing nearshore and beach deposits from the Pleistocene Era.

According to the Paleozoic Geology of Southern Ontario map, the bedrock in the area consists of limestone, with shale of the Lindsay Formation, Simcoe Group of the Middle Ordovician era.

5.2 Subsurface Conditions

Details of the subsurface conditions encountered in the fourteen (14) test holes advanced at the Site during GHD's investigation are summarized in the following sections of the report. Detailed stratigraphy is shown on the test hole records presented in **Appendix A**. It should be noted that the subsurface conditions are only confirmed at the borehole locations and may vary between and beyond the test hole locations. The boundaries between the various strata, as shown on the borehole records are based on non-continuous sampling and drilling resistance noted and observed at the time of drilling. These boundaries represent an inferred transition between the various strata, rather than precise planes of geological change.

5.2.1 Topsoil

A layer of topsoil was encountered at the surface in all test holes. This topsoil layer ranged in thickness from 300 mm to 460 mm with an average of 400 mm based upon the fourteen (14) test holes. The topsoil was observed to be in a damp, loose state, with a silty, medium to high organic content. As such, it is expected to be devoid of any structural engineering properties.

5.2.2 Fill

A layer of fill material was encountered below the topsoil in boreholes MW04-25 and BH05-25 and extended to depths ranging between 0.7 to 2.3 mbgs. The fill material consisted of a sandy silt material containing varying amounts of gravel and clay and was indicated to be brown in colour.

The SPT 'N' values within the fill material were reported between 3 blows / 300 mm to 8 blows / 300 mm indicating a very loose to loose in-situ state of relative density. Samples of the fill material were visually described to be in a generally moist to wet condition. Measured moisture contents within the fill layer were found to be between 13 to 24 percent by weight.

One (1) grain size distribution test was carried out a select soil sample within the fill material. The results are provided in **Appendix B** and also presented on the test hole records in **Appendix A**. The results are summarized in the table below:

Table 5.1 Grain Size Distribution Testing – Fill

Sample Location	Depth (mbgs)	Particle Size Distribution (%)				Soil Description (USCS Classification)
		Gravel	Sand	Silt	Clay	
MW04-25 / SS2	0.8 – 1.4	19	21	38	22	Clayey Sandy Silt (SM)

5.2.3 Sandy Silt / Silty Sand

Native sandy silt / silty sand was encountered within the majority of the test holes. The sandy silt / silty sand was initially encountered at depths ranging from approximately 0.3 to 3.1 mbgs and extended to depths ranging from approximately 0.6 to 3.7 mbgs. The sandy silt / silty sand layers contained varying amounts of gravel and clay, contained occasional cobbles / boulders and was visually described as reddish-brown to brown to grey in colour.

The SPT 'N' values within the sandy silt / silty sand material were reported between 3 blows / 300 mm to 17 blows / 300 mm of penetration indicating a very loose to compact in-situ state of relative density. Samples of this material were visually described to be in a generally moist to wet condition. Measured moisture contents within this layer were found to be between 9 to 27 percent by weight.

One (1) grain size distribution test was carried out a select soil sample within the native silty sand material. The results are provided in **Appendix B** and also presented on the test hole records in **Appendix A**. The results are summarized in the table below:

Table 5.2 Grain Size Distribution Testing – Non-cohesive Silty Sand Deposit

Sample Location	Depth (mbgs)	Particle Size Distribution (%)				Soil Description (USCS Classification)
		Gravel	Sand	Silt	Clay	
TP04-25 / GS1	0.3 – 0.6	0	51	36	13	Silty Sand (SM)

5.2.4 Sand

A layer of sand was encountered below the topsoil in test pit TP03-25 and beneath the fill material in borehole BH05-25. The sand material extended to depths ranging between 1.2 to 2.3 mbgs. The sand layer contained some silt and trace gravel and was visually described as reddish-brown to brown in colour.

The SPT 'N' values within the sand layer were reported between 13 blows / 300 mm to 16 blows / 300 mm indicating a compact in-situ state of relative density. Samples of the sand material were visually described to be in a generally

moist to wet condition. Measured moisture contents within the sand layer were found to be between 12 to 21 percent by weight.

5.2.5 Silt

A layer of silt was encountered in test pit TP09-25 initially at a depth of about 0.8 mbgs and extended to a depth of 3.1 mbgs. The silt layer contained some sand and clay and was visually described as light brown in colour. Samples of the silt material were visually described to be in a generally moist to wet condition. Measured moisture contents within the silt layer were found to be between 16 to 17 percent by weight.

5.2.6 Silty Clay / Clayey Silt

Layers of native silty clay / clayey silt were encountered within boreholes MW03-25 and test pits TP01-25, TP03-25, TP04-25, and TP05-25. The native silty clay / clayey silt was initially encountered at depths ranging between approximately 0.5 to 2.3 mbgs and extended to depths ranging from about 1.7 to 5.3 mbgs. The silty clay / clayey silt was indicated to be brown to grey in colour containing varying amounts of gravel and sand with occasional cobbles/boulders. Within the very soft clayey silt encountered within borehole MW03-25 organic material and rootlets were encountered at a depth of approximately 4.6 mbgs.

The SPT 'N' values within the silty clay / clayey silt material were reported between 0 blows / 300 mm to 19 blows / 300 mm of penetration indicating a very soft to very stiff consistency. Samples of this material were visually described to be in a generally moist to wet condition. Measured moisture contents within this layer were found to be between 10 to 23 percent by weight.

Vane tests were completed in borehole MW03-25 at depths of approximately 2.9 mbgs and 3.7 mbgs within the very soft sandy clayey silt material. The undrained shear strength was 38 kPa and 95 kPa at depths of 2.9 mbgs and 3.7 mbgs, respectively placing the material in the firm to stiff condition. The remolded shear strength was 19 kPa and 38 kPa at depths of 2.9 mbgs and 3.7 mbgs, respectively.

One (1) grain size distribution test was carried out a select soil sample within the clayey silt material. The results are provided in **Appendix B** and also presented on the test hole records in **Appendix A**. The results are summarized in the table below:

Table 5.3 Grain Size Distribution – Cohesive Clayey Silt Deposit

Sample Location	Depth (mbgs)	Particle Size Distribution (%)				Soil Description
		Gravel	Sand	Silt	Clay	
MW03-25 / SS4	2.3 – 2.9	2	32	36	30	Sandy Clayey Silt

An Atterberg limit test was also performed on this sample of the cohesive sandy clayey silt deposit. The result of this test is provided in **Appendix B** and represented on its test hole record in **Appendix A**. The result is summarized in **Table 5.4** below:

Table 5.4 Atterberg Limits Testing Results – Cohesive Clayey Silt Deposit

Sample Identification	Depth (mbgs)	Atterberg Results (%)			Natural Moisture Content (%)	USCS Classification
		Liquid Limit	Plastic Limit	Plasticity Index		
MW03-25, SS5	2.3 – 2.9	20	13	7	18.0	ML

5.2.7 Silty Gravel / Sand and Gravel

A layer of silty gravel / sand and gravel was encountered in test pits TP05-25 and TP07-25 initially at depths ranging from approximately 1.5 to 3.1 mbgs and extended to a depth of approximately 3.4 mbgs. This material contained varying amounts of gravel, sand, and silt and contained occasional cobbles/boulders. The silty gravel / sand and gravel was visually described as light brown to brown in colour. Samples of the silty gravel / sand and gravel material were visually described to be in a generally moist to wet condition. Measured moisture contents within the silty gravel / sand and gravel layer were found to be between 7 to 10 percent by weight.

5.2.8 Non-Cohesive Till

A layer of non-cohesive sandy silt / silty sand till was encountered below the native soils in test holes MW01-25, MW02-25, BH05-25, TP01-25, TP03-25, TP04-25, and TP05-25. The non-cohesive till deposit extended to depths of 3.1 to 5.2 mbgs. The non-cohesive till was indicated to be light brown to brown to grey in colour with varying amounts of gravel (trace to gravelly) and clay, with occasional cobbles and boulders.

The SPT 'N' values within the non-cohesive till material were reported between 22 blows / 300 mm of penetration to 74 blows / 300 mm of penetration, with several split spoons encountering refusal, indicating a compact to very dense state of relative density. The relative density of the till material generally increased with depth. Samples of this material were visually described to be in a generally moist to wet condition. Measured moisture contents within this layer were found to be between 5 and 19 percent by weight.

Grain size distribution testing was carried out on two (2) select soil samples within the non-cohesive till deposit. The results are provided in **Appendix B** and also presented on the borehole records in **Appendix A**. The results are summarized in the table below:

Table 5.5 Grain Size Distribution Testing – Non-Cohesive Till Deposit

Sample Location	Depth (mbgs)	Particle Size Distribution (%)				Soil Description (USCS Classification)
		Gravel	Sand	Silt	Clay	
MW01-25 / SS3	1.5 – 2.1	4	46	35	15	Silty Sand Till (SM)
MW02-25/SS6	4.6 – 5.2	29	59	8	14	Gravelly Sandy Till (SM)

5.2.9 Cohesive Till

A layer of cohesive silty clay till was encountered in boreholes MW03-25 and MW04-25 initially at depths ranging from approximately 4.9 to 5.3 mbgs and extended to the termination depth of the boreholes (5.2 to 6.7 mbgs). The cohesive till was indicated to be grey in colour containing trace amounts of gravel and some sand.

The SPT 'N' values obtained within the cohesive till material were reported between 13 blows / 300 mm to 22 blows / 300 mm indicating a stiff to very stiff in-situ consistency. Samples of this material were visually described to be in a generally moist to wet condition. Measured moisture contents within this layer were found to be between 19 to 22 percent by weight.

A vane test completed in borehole MW03-25 at approximately 5.9 mbgs within the cohesive silty clay till. The undrained shear strength was 150 kPa and the refusal was encountered when remolded the vane.

Grain size distribution testing was carried out on a selected soil sample of the cohesive till deposit. The result is provided in **Appendix B**, presented on the borehole records in **Appendix A** and summarized in **Table 3** below:

Table 5.6 Grain Size Distribution Testing – Cohesive Till Deposit

Sample Location	Depth (mbgs)	Particle Size Distribution (%)				Soil Description
		Gravel	Sand	Silt	Clay	
MW03-25 / SS8	5.3 – 5.9	1	10	36	53	Silty Clay Till

An Atterberg limit test was also performed on this sample of the cohesive silty clay deposit. The result of this test is provided in **Appendix B** and represented on its borehole record in **Appendix A**. The result is summarized in **Table 4** below:

Table 5.7 Atterberg Limits Testing Result – Cohesive Silty Clay Deposit

Sample Identification	Depth (mbgs)	Atterberg Results (%)			Natural Moisture Content (%)	USCS Classification
		Liquid Limit	Plastic Limit	Plasticity Index		
MW03-25, SS8	5.3 – 5.9	36	17	19	21.6	CL

5.3 Groundwater Observations and Measurements

Groundwater observations and measurements were collected from the open test holes during and upon completion of drilling / excavation of each test hole. Groundwater seepage during excavation activities was only observed in several test pits ranging in depth between approximately 0.9 to 3.1 mbgs. Upon completion, minimal groundwater accumulation was present in all test pits except for TP06-25, TP08-25, TP09-25. Measured groundwater accumulation in test pit TP05-25 was 2.1 mbgs. Minimal groundwater accumulation was observed in all boreholes upon completion except for MW01-25. The depth of groundwater accumulation measured in the completed boreholes ranged from 0.9 to 3.7 mbgs. Test holes MW01-25, TP06-25, TP08-25, and TP09-25 were observed to be dry upon completion.

A summary of the test holes and monitoring well details are provided in **Table 5.8**. The groundwater seepage depth refers to the approximate depth where water was first encountered during excavation activities and the groundwater accumulation depth refers to the approximate depth where water was measured upon completion of the boreholes.

Table 5.8 Summary of Test Hole and Monitoring Well Information

Location	Ground Elevation (m)*	Well Pipe Stick up (m)	Screened Interval		Sandpack Interval (effective screen)		Screened Material	Groundwater Accumulation**	
			Depth (mbgs)	Elevation (m)	Depth (mbgs)	Elevation (m)		Depth (mbgs)	Elevation (m)
MW01-25	272.2	0.92	1.5 – 3.1	270.7 – 269.2	1.2 – 3.1	271.0 – 269.2	Till – Silt and Sand	Not Observed	
MW02-25	266.4	0.91	1.5 – 4.6	264.8 – 261.8	1.2 – 4.6	265.2 – 261.8	Till –Sandy Silt	3.7**	262.7
MW03-25	265.2	0.98	3.1 – 6.1	262.2 – 259.1	2.4 – 6.1	262.8 – 259.1	Till – Silty Clay & Sandy Clayey Silt	0.9**	264.3
MW04-25	265.1	0.99	3.1 – 4.6	262.1 – 260.5	2.8 – 4.6	262.3 – 260.5	Silty Sand	0.9**	264.2

Notes:

m = metres; mbgs = metres below ground surface

(*) Ground elevations were measured using an EOS Arrow Gold Plus GPS system and, are for the purposes of evaluating groundwater elevation and flow direction and should not be relied upon as a legal survey or topographic elevation survey. The ground elevations are not for construction purposes.

(**) Groundwater accumulation noted in open borehole upon completion of drilling.

Groundwater levels were collected from the monitoring wells on March 10, 2025, March 17, 2025, and April 2, 2025, and are summarized in **Table 5.9**.

Table 5.9 Groundwater Levels and Elevations

Location	Ground Surface Elevations (m)	Water Levels (March 17, 2025)		Water Levels (April 2, 2025)	
		Water Level (mbgs)	Groundwater Elevation (m)	Water Level (mbgs)	Groundwater Elevation (m)
MW01-25	272.2	Monitoring Well noted to be dry (269.2 m)			
MW02-25	266.4	1.78	264.62	1.55	264.85
MW03-25	265.2	-0.13	265.33	0.18	265.03
MW04-25	265.1	0.13	264.97	0.40	264.71

Monitoring well MW01-25 was reported as dry during both monitoring events. Groundwater levels measured from the monitoring wells ranged from -0.14 (i.e. potentiometric surface above grade) to about 1.8 mbgs at elevations ranging between 264.62 (MW02-25) and 265.33 m (MW03-25). It is noted that the shallow groundwater will be subject to seasonal fluctuations and expected to rise and decline in response to weather events including wet and dry periods.

5.4 Single Well Response Testing

Single well response testing (SWRTs) was completed at monitoring wells MW02-25 and MW04-25. The monitoring wells are screened within the overburden. The data from the SWRTs are provided in **Appendix C** and are summarized in the following table:

Table 5.10 Single Well Response Test Results

Monitoring Well	Unit Tested	Test Type / Number	Analysis Method	Horizontal Hydraulic Conductivity – K _H (each test) (m/sec)	Geometric Mean Horizontal Hydraulic* Conductivity – K _H (m/sec)
MW02-25	Sandy Silt / Sandy Silt Till	Falling Head	Bouwer-Rice	3.3 x 10 ⁻⁷	2.4 x 10 ⁻⁷
		Rising Head		1.7 x 10 ⁻⁷	
MW04-25	Fill / Native Silty Sand	Falling Head		1.0 x 10 ⁻⁵	3.7 x 10 ⁻⁷
		Rising Head		1.4 x 10 ⁻⁸	
GEOMETRIC MEAN (all tests)				3.0 x 10 ⁻⁷	

The SWRT results range from 1.0×10^{-5} m/s at MW04-25 to 1.7×10^{-7} m/s at MW02-25. The geometric mean of all tests is 3.0×10^{-7} m/s and falls within the range of the expected hydraulic conductivity of a silty sand / glacial till.

5.5 Infiltration Testing Results

Constant Head Well Permeameter (CHWP) testing was completed on the unsaturated native sandy silt / silty sand material between 0.75 mbgs and 0.8 mbgs at two (2) locations across the Site. The testing was conducted at locations adjacent to TP05-25 and TP08-25. One shallow infiltration test was completed at each location. The test data is provided in **Appendix D**, and the summary of the infiltration testing completed is presented in **Table 5.11**.

Table 5.11 Infiltration Testing Results

Infiltration Test ID	Depth Tested (mbgs)	Soil Tested	Kfs (m/s)	Test Duration (min)	Estimated Infiltration Rate (mm/hr)
TP05-25	0.8	Sandy Silt	1.6×10^{-6}	15.0	~53
TP08-25	0.75	Sandy Silt / silty Sand	1.3×10^{-5}	7.5	~92

The field saturated hydraulic conductivity (K_{fs}) ranged from 1.3×10^{-5} m/s to 1.6×10^{-6} m/s (geometric mean of 4.56×10^{-6} m/s). The corresponding infiltration rate at these locations ranges from approximately 53 to 92 mm/hour. The field saturated hydraulic conductivity indicates the native sandy silt / silty sand at these locations provides relatively low infiltration rates.

It should be noted that the design infiltration rate is based on the applied safety factor determined by the ratio between the mean infiltration rate at the bottom of the LID feature and the mean infiltration rate for soils within 1.5 metres below the base of the LID feature. The safety factor increases from 2.5 to 8.5 times, the higher the ratio the greater the safety factor required (based upon Appendix C Table C2 of the Site Evaluation and Soil Testing Protocol for Stormwater Infiltration²).

² CVC, 2010. Low Impact Development Stormwater Management Planning and Design Guide.

6. Discussion and Recommendations

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report. The following recommendations are governed by the physical properties of the subsurface materials that were encountered at the Site and assume that they are representative of the overall site conditions. It should be noted that the recommendations provided herein are intended for use by designers only. Contractors bidding on or undertaking any work at the site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data given above as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and other related issues. Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project. Comments, techniques, or recommendations pertaining to construction should not be considered as instructions to the contractor.

It is GHD's understanding that the proposed development spans 20.4 ha (50.4 acres) and includes residential lots, an internal road network, and stormwater management pond. A site plan provided by the Client illustrated the proposed development layout. The Site's proposed grading plan was unknown at the time of writing this report.

Based upon the above comments and on the borehole information, and assuming them to be representative of the subsoil conditions across the Site, the following comments and recommendations are offered. On-going liaison with GHD during the final design and construction phase of the project is recommended to ensure that the recommendations in this report are applicable and / or correctly interpreted and implemented.

6.1 Site Preparation, Grading and Backfill

The boreholes generally encountered a surficial layer of topsoil, over fill or native silty sand/ sandy silt / sand / silt / silty clay over stiff to very stiff / compact to dense glacial till. In the area of borehole MW03-25 a very soft layer of cohesive soil was encountered at depths between approximately 2.3 to 5.3 mbgs.

Any topsoil, asphalt, vegetation, disturbed earth, fill, organic and organic-bearing material should be removed from the footprint of the proposed building and within pavement areas prior to site grading activities. Fill materials found to contain significant amounts of topsoil / organics or rootlets should not be used as backfill. Additionally, care will be required during excavation to separate any fill materials that appear to contain significant amounts of topsoil / organics or rootlets from the clean earth fill.

The native soils encountered at the Site are generally suitable for reuse as backfill to raise site grades (where required), or as trench backfill during installation of buried services where they will underlie a roadway, provided they are free of organic material, and are within the optimum moisture content. The site soils appear to exhibit moisture content higher than the laboratory optimum for compactable soil and reconditioning of these soils may be required during construction. Control of moisture content during placement and compaction will be essential for maintaining adequate compaction. Further, the cohesive silty clay native soils encountered at the Site are naturally more susceptible and sensitive to climatic conditions including frost and rain. This should be taken into account when considering the season in which the construction earthworks will occur. A final review and approval to reuse any soils should be made at the time of construction.

If imported materials are required to raise Site grades to design levels, then potential source sites should be evaluated for geotechnical and environmental quality prior to acceptance. It is recommended that any proposed fill considered for reuse on the Site be comprised of clean earth material, free of topsoil and building rubble, and is at a moisture content ± 2 percent of the laboratory optimum for compaction. Installation of engineered fill, where required, must be continuously monitored on a full-time basis by qualified geotechnical personnel.

6.2 Site Servicing

It is anticipated that lots will be privately serviced by wells and septs and that the storm water management for the roads will consist of ditches which will outlet to a storm water pond. The materials encountered during this investigation at the shallow depths involved will consist of native till or silty clay / clayey silt soils. In the stronger material such as the native till or the clayey soils the ditches will be less prone to erosion but in the sandy silt soils some erosional protection may be required during the time between road construction and the completion of house construction. The recommended bedding material for the septs should comply with the Ontario Building Code. For the storm sewer pipes used to outlet the ditches to the stormwater management pond, the bedding should consist of Class B which consists of Granular "A" or 19 mm crusher run (angular) stone, as per Ontario Provincial Standard Specifications (OPSS). All bedding materials should be compacted to 100% of their SPMDD. In areas where the bedding is to be placed in overly wet, loose or soft bedding subgrade, bedding material could consist of a graded clear stone product, such as HL-8 stone or High Performance Bedding (HPB), wrapped in non-woven geotextile fabric approximately equivalent to Terrafix 270R and placed in accordance with manufacture's specifications.

Prior to placement of bedding, the exposed subgrade should be inspected by an experienced geotechnical engineer and any identified soft or loose areas should be subexcavated and replaced with suitably compacted fill. If the subgrade warrants, a woven geotextile (Terrafix 200W or approximate equivalent) may be required on the subgrade prior to bedding material, to protect soft and/or sensitive areas.

It is recommended that cover backfilling of the underground services be accomplished using Granular "A", sand, or other suitable material as allowed by the Municipality's standards, to a minimum of 300 mm above the pipe. Compaction of this material should attain 100 percent SPMDD.

It is expected that the higher site areas where soil above the proposed grade would be cut could be used as fill on site in the areas below finished grade. Some of the inorganic soils may be suitable for reuse as road subgrade backfill, conditional upon suitable moisture content (within 2 % of optimum) and final review and approval by an experienced geotechnical engineer, at the beginning, and throughout the duration of construction. It is anticipated that significant aeration will be required for the clay soils to create a stable subgrade for road building. Compaction of any native soil in roadway subgrade is recommended to be a minimum of 98 percent of its SPMDD.

It is recommended that the service bedding subgrade in the area of pond sloping should be inspected and approved by an experienced geotechnical engineer prior to placing the bedding fill, to ensure its suitability and consistency with conditions encountered during this investigation. Bedding and backfill materials, and compaction, should also be inspected and tested during placement around the area of the pond slopes.

6.3 Road Construction

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed new rural profile roadways for construction:

1. Remove any saturated or frozen earth, and boulders larger than 150 mm in diameter encountered at subgrade elevation for the full width of construction. It is expected that some of the excavated soils may be suitable for reuse as grading material on lower sections of the roadway, conditional upon suitable moisture content (within 2 percent of optimum) and final review and approval by an experienced geotechnical engineer or representative at the time of construction.
2. Proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. Any unstable areas thus delineated should be reinforced with woven geotextile approximately equivalent to Terrafix 200W, or replaced with acceptable granular material compacted to a minimum of 98 percent of its SPMDD.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials. The contour should extend all the way to the ditch sides.
4. Construct transitions between varying depths of granular base materials at a rate of 1:10 minimum.

It is expected that the proposed new roads will experience relatively low traffic volumes consisting of passenger vehicles and occasional heavy service trucks and are in a rural cross section with ditches on each side. In this regard, based on the subgrade soils encountered in our test holes, the following minimum flexible pavement structure is recommended for roadway construction.

Table 6.1 *Pavement Structure for Local Roadway*

Profile	Material	Minimum Thickness (mm)	In Conformance with Form
Asphalt Surface	H.L.3	40	OPSS 1150
Asphalt Base	H.L.8	50	
Granular Base	Granular "A"	150	OPSS 1010
Granular Subbase	Granular "B"	300	

The following steps are recommended for optimum construction of paved areas:

1. The Granular "A" and "B" courses should be compacted to a minimum 100 percent of their respective SPMD's and should extend outwards through the shoulder to the ditch sides.
2. All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS 310 or equivalent. All asphaltic concrete should be compacted to a minimum 92.0 percent of their respective laboratory Maximum Relative Density (MRD).
3. Adequate drainage should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 percent of their optimum moisture content. All granular materials should be compacted to 100 percent SPMD. Granular materials should consist of Granular "A" and Granular "B" conforming to the requirements of OPSS.MUNI 1010 or equivalent.

The performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved as much as practically possible. It is noted that the above recommended pavement structures are for the end use of the project. The most severe loading conditions on pavement areas and the subgrade may occur during construction. As such, during construction of the project, the recommended granular depths may not be sufficient to support loadings encountered. Consequently, special provisions such as restricted lanes, half-loads during paving, etc. may be required, especially if construction is carried out during unfavourable weather.

6.4 Depth of Frost Depth

The estimated depth of frost penetration at the Site is 1.4 m as per the OPSD 3090.101. It is recommended that foundations within unheated areas should be protected from frost effects by at least 1.4 m of earth cover or equivalent insulation. All exterior footings, footings beneath unheated areas, and foundations exposed to freezing temperatures should have at least such earth cover or equivalent synthetic insulation for frost protection.

During winter construction exposed surfaces to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

6.5 Seismic Site Classification

The latest Ontario Building Code (OBC) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the latest OBC, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil

strata to a depth of 30 m below the ground surface. The OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

- Average shear wave velocity.
- Average Standard Penetration Test (SPT) values (uncorrected for overburden).
- Average undrained shear strength.

For design purposes, based on the criteria listed in Table 4.1.8.4.A. of the OBC and the results obtained from standard penetration resistance of the underlying subsurface conditions and our knowledge of the regional geology, a Seismic Site Class 'D' can be used for the design of the proposed development.

6.6 Foundation Design

The Ontario Building Code (OBC) requires buildings to be designed using Limit States Design considering Serviceability Limit States (SLS) and Ultimate Limit States (ULS). Structural drawings were not available at the time of this report and the recommendations provided in the following sections may need to be revised based on the detailed structural design.

The common practice for the SLS design of most structures and building foundations is to limit the total and differential foundation settlements to 25 mm and 19 mm, respectively. However, other serviceability criteria for the proposed building may be determined by the structural engineer considering tolerable settlement that would not restrict the use or operation of the facility.

6.6.1 Shallow Foundations

It is expected that structural loading for the proposed residential buildings can be supported on spread and continuous strip footings for column and load bearing walls, respectively. The footings should be founded on the compact to very dense / stiff to very stiff native till soils. Depths at which the compact to dense native soils were encountered at each borehole is summarized in **Table 6.2** below:

Table 6.2 Minimum Depths and Elevations for Footings on Compact to Very Dense / Stiff to Very Stiff Till

Borehole ID	Minimum Foundation Depth (mbgs)	Maximum Foundation Elevation (m)
MW01-25	0.8	271.4
MW02-25	1.5	264.9
MW03-25	5.3	259.9
MW04-25	4.9	260.2
BH05-25	3.0	263.3

For design purposes, it is recommended that footings constructed on the compact to very dense / stiff to very stiff native soils or on engineered fill placed directly on such soils be proportioned using the following bearing capacities:

Table 6.3 Preliminary Bearing Pressure for Foundation Design

Parameter	Bearing Pressure	
	Compact to Dense Undisturbed Native Soils	Engineered Fill
Factored Bearing Capacity at ULS ⁽¹⁾	225 kPa	180 kPa
Bearing Capacity at SLS	150 kPa	120 kPa
Notes: (1) Resistance factor $\Phi = 0.5$ applied to the ULS bearing pressure for design purposes.		

These capacities assumed a minimum footing width of 0.5 m, maximum footing width of 4 m, and vertical and concentric loadings only.

In the area of MW03-25, the high-water table may require the basement floor slab to employ underslab drainage but this will depend on the elevation chosen for the founding level. It should be noted that the soil at depth around MW03-25 is very weak possibly from the artesian water condition, and that additional loading from fill added to this lot may result in consolidation settlement.

Any engineered fill upon which footings are placed must be a minimum thickness corresponding to the notes that accompany the above table. Footings (and foundation walls) placed on engineered fill must be suitably reinforced; as a minimum, and where not already specified in the design drawings, this reinforcing should use 2 continuous runs of 15M rebar throughout the footings, and 2 runs of 15M rebar throughout near the top and bottom of the foundation walls.

The following is recommended for the construction of any engineered fill for the footings:

1. Remove any and all existing vegetation, topsoil, fill, organics, and organic-bearing soils to the competent, undisturbed native soil from within the area of the proposed engineered fill.
2. The area of the engineered fill should extend horizontally 1m beyond the outside edge of the building foundations and then extend downward at a 1:1 slope to the competent native soil.
3. The base of the engineered fill area must be approved by a member of GHD prior to placement of any fill, to ensure that all unsuitable materials have been removed, that the materials encountered are similar to those observed, and that the subgrade is suitable for the engineered fill.
4. All engineered fill material is to be approved by GHD at the time of construction.
5. Place approved engineered fill, in maximum 200 mm lifts, compacted to 100 percent of its SPMDD. Any fill material placed under wet conditions should consist of an approved, rock-based fill, with the inclusion of appropriate geotextile fabric around the rock-based fill should the rock fill contain enough voids to warrant. Rock-based fill material should be compacted by a plate tamper and visually inspected by a geotechnical engineer to confirm appropriate compaction.
6. Full time testing and inspection of the engineered fill will be required, to ensure compliance with material and compaction specifications.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of GHD's geotechnical group. This will ensure that the foundation bearing material has been prepared properly at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

Exterior footings placed on native soils must be provided with a minimum of 1.4 m of earth cover or equivalent insulation. During winter construction exposed surfaces to support foundations must be protected against freezing by means of loose straw and tarpaulins, heating, etc.

Should basements or otherwise subgrade areas be incorporated into any of the buildings' designs, it is recommended that for drainage purposes, perimeter drains be installed about the structure in accordance with the Ontario Building Code (OBC). The subdrains would serve to drain seepage water that infiltrates the backfill, intersect any groundwater that may be present, and help relieve hydrostatic pressures due to any seasonally high groundwater levels. The drains should consist of a perforated pipe, at least 100 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The drain should discharge to a positive sump or other permanent frost-free outlet. It is also strongly recommended that the building's foundation walls be sealed and waterproofed where the water table will be located above the basement slab.

6.6.2 Helical Piers

Alternatively, a helical pier can be considered to support loads for the proposed residential buildings in the locations where suitable native material was not encountered until a deeper depth (Boreholes MW03-25 and MW04-25). This installation technique is vibration free and does not require any dewatering and does not generate any spoils/cuttings. The proposed residential buildings could be supported on the underlying compact to very dense / stiff to very stiff native soils.

Since the helical pier is a proprietary system, it is recommended that the piers be design and installed by experienced specialist contractors. The allowable bearing capacity should be confirmed in writing by the installer.

The pile stability, pile head, and pile cap details should be designed and checked by an experienced Structural Engineer and reviewed by the Geotechnical Consultant for the soil – structure interaction aspects.

6.7 Floor Slabs

Floors may generally be constructed as normal slabs-on-grade using 19 mm clear stone over native, inorganic subsoils. The floor slab should be formed over 19 mm angular clear stone material underneath basement areas, compacted by a plate tamper as per OBC requirements. All grade increases or infilling below the clearstone should be constructed in accordance with the engineered fill steps provided in **Section 6.6** of this report.

If the groundwater table is intersected by any basement excavations, the floor slabs should incorporate under slab drains, and a vapour barrier should be installed beneath the slab to prevent migration of moisture vapour. The drain should discharge to a positive sump or other permanent frost-free outlet.

All fill placed as engineered fill must be inspected, approved and compaction verified by personnel from GHD.

6.8 Basement and Retaining Walls

It is recommended that free draining backfill consisting of Granular "B" Type I material complying with Ontario Provincial Standard Specifications (OPSS) 1010, to basement and retaining walls be provided. Walls may be designed for lateral earth pressures using the following equation:

$p = k (w h + q)$, where:

- p = the lateral earth pressure in kPa acting on the subsurface wall at depth h ;
- k_a = the coefficient of active earth pressure;
(= 0.3 for walls restrained from the bottom only);
(= 0.5 for walls restrained at the top and bottom*);
- k_p = the coefficient of passive earth pressure, (= 3.0);
- w = the granular or native soil bulk density in kN/m³;
(= 21.0 kN/m³ for well compacted, OPSS-approved Granular "B" or native soils);
- h = the depth (in metres) below the exterior grade at which the earth pressure is being calculated; and

- q = the equivalent value of any surcharge (in kN/m³) acting on the ground surface adjacent to the walls.

(*) This value is recommended for rigid walls retaining compacted backfill.

The recommended value for the coefficient for sliding friction between the soil and the concrete is 0.4. Also, any additional surcharge loading that will influence the wall must be taken into account in its design.

6.9 Excavation and Temporary Shoring

The Occupational Health and Safety Act (OHSA) regulations require that if workers must enter an excavation deeper than 1.2 m, the excavation must be suitably sloped and/or braced in accordance with the OHSA requirements. OHSA specifies maximum slope of the excavations for four broad soil types as summarized in the following table:

Table 6.4 Soil Types and Slope Information

Soil Type	Base of Slope	Maximum Slope Inclination
1	Within 1.2 metres of bottom	1 horizontal to 1 vertical
2	Within 1.2 metres of bottom of trench	1 horizontal to 1 vertical
3	From bottom of excavation	1 horizontal to 1 vertical
4	From bottom of excavation	3 horizontal to 1 vertical

The fill and native soils underlying the Site are considered Type 3 soils above groundwater level, and Type 4 if affected by surface water or groundwater seepage. If the above recommended excavation side slopes cannot be maintained due to lack of space or any other reason, the excavation side slopes must be supported by an engineered shoring system. The shoring system should be designed in accordance with Canadian Engineering Foundation Manual (2023) and the OHSA Regulations for Construction Projects.

During the excavation, no excavated material should be piled, nor machinery or equipment placed, closer than 4 m from the top of the excavation slope. Furthermore, no vertical un-braced excavations greater than 1.2 m in depth should be performed in the soil where workers must enter the excavation.

An examination of the slopes should be carried out by qualified soils personnel before any worker enters the excavation. The exposed fill material and native soil should be protected against erosion from water run-off or rain.

6.10 Storm Water Management Pond

It is GHD's understanding that a Storm Water Management Pond (SWMP) is proposed in the north-central area of the Site (Block 27) and is to be located within the area of borehole TP04-25 as shown on **Figure 2**. The proposed base elevation of the SWMP is not known at the time of writing this report; however, it is expected that the bottom of the SWMP will consist of compact to dense silty sand glacial till native soils. The hydraulic conductivity of the till material was measured to be on the order of about 10^{-7} cm/sec based on the SWRTs. It is noted, however, that slight variations in the soil stratigraphy may cause variations in the permeability of the soil in both vertical and horizontal orientations.

Based on the soils observed, and the assumed base elevations, it appears that construction of the SWMP in this area is feasible. In general, excavation of the soils for the SWMP is expected to be straightforward, provided that appropriate measures are taken during construction to minimize any overland or near-surficial flow of water into the area. Groundwater and surficial water inflow into the open SWMP excavation may be encountered depending on the time of the year in which construction is conducted, however this is expected to be controlled by pumping from within the excavation, along with further measures if required including up-gradient cutoff trenching with appropriate drainage outletting.

It is recommended that the SWMP subgrade surfaces be proof rolled, and a representative of GHD approve the subgrade prior to construction of the berms. Construction of the berms may utilize excavated soils, such as the sandy

silt till native soils. Such operations should place soils in lifts no thicker than 150 mm prior to compaction and compacted to at least 95 percent SPMD.

The native, undisturbed compact to dense silty sand glacial till could have a sufficiently low permeability where it could substitute for a liner. Site specific infiltration testing at the proposed bottom of the SWMP is recommended once design details are available.

An inspection of the excavated and exposed SWMP surface should be performed at the time of construction, to assess whether any discrete or localized areas of increased hydraulic conductivity (such as sand and gravel seams typically encountered within till soils) are present within the exposed soils, in which case such areas may be lined with a more suitable (i.e. less hydraulically conductive) material such as the shallow silty clay native soils encountered at the Site or an impermeable geosynthetic membrane.

For the purpose of the proposed SWMP, the soils observed should be stable from slip circle failure if sloped at 3 horizontal to 1 vertical (3H:1V) or flatter in the long term both above and below the water table. Between the stable water level and the expected high-water level, it is recommended that the slopes be lessened to 4H:1V (or flatter) to guard against erosion by wavelet action. The native material will require vegetative root mass (or otherwise suitable erosion protection) to minimize erosional forces on exposed slopes.

Slopes and berms of the SWMP should be constructed to reduce or eliminate the effects of surficial erosion. Features to do so may include slope vegetation, installation of erosion or gabion mats, rip rap, and/or other acceptable stabilizing features.

6.11 Construction Monitoring

The foundation installations and Engineered Fill placement must be closely monitored and inspected by qualified personnel to ensure consistency with the design bearing. The on-site review of the condition of the foundation soil as the foundations are constructed is an integral part of the geotechnical design function and is required by Section 4.2.2.2 of the Ontario Building Code 2012.

Qualified Geotechnical personnel should inspect and test all stages of the proposed development. Specifically, they should ensure that the materials and conditions comply with this geotechnical assessment report. In addition, qualified geotechnical personnel should provide material testing services prior to and during backfilling and grade raising operation. Should soil conditions be encountered that vary from those described in this report, our office should be informed immediately such that the proper measures are undertaken.

7. Limitations of the Investigation

This report is intended solely for Honey Heights Development Ltd. and their designers and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevation and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the geotechnical engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions confirmed at the test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (e.g., excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

All of Which is Respectfully Submitted,

GHD

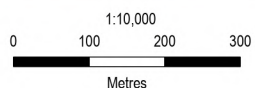
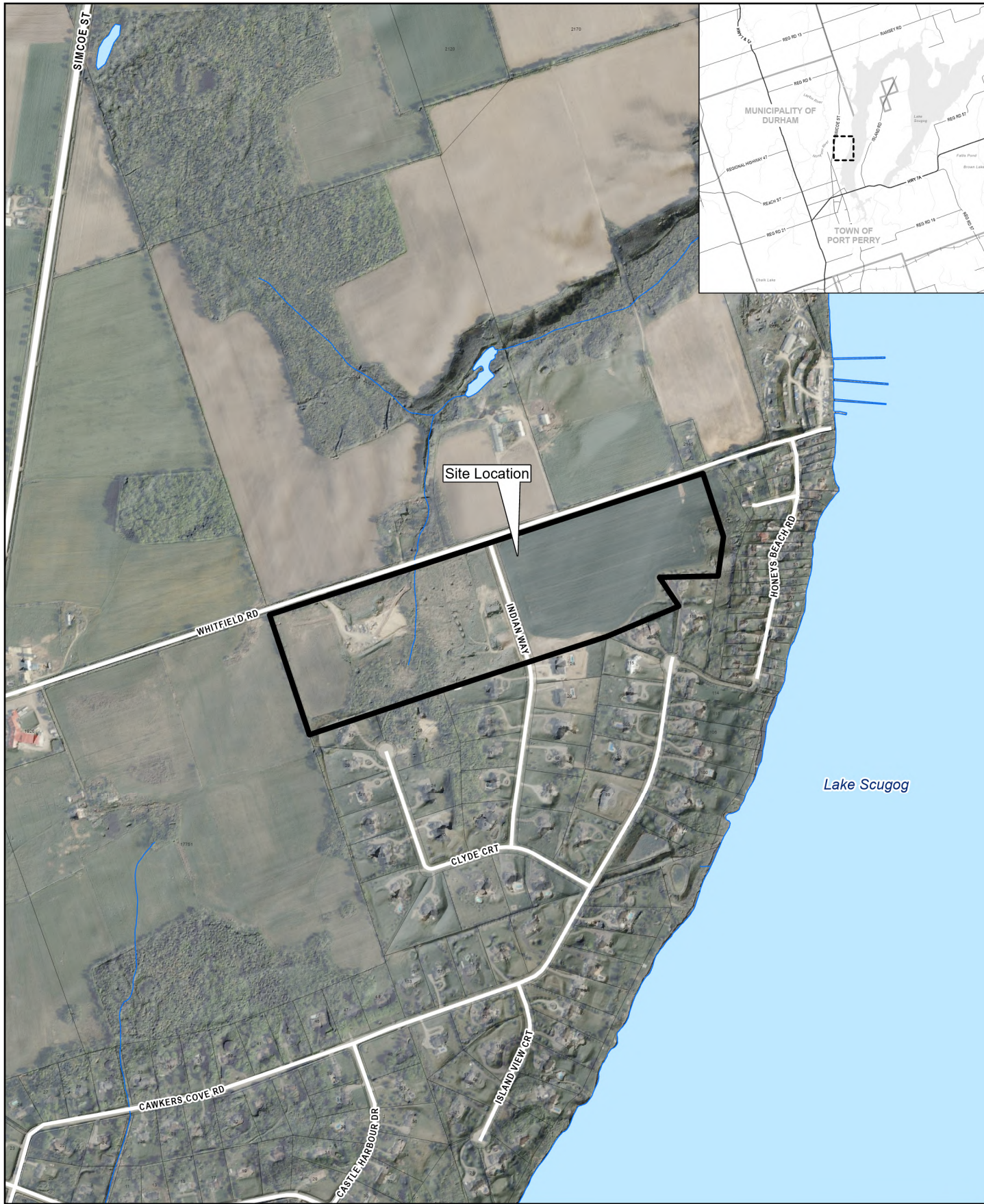


Michael Nieukirk, P.Eng.
Geotechnical Engineer



Andy Fawcett, P.Eng.
Senior Geotechnical Engineer

Figures



Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

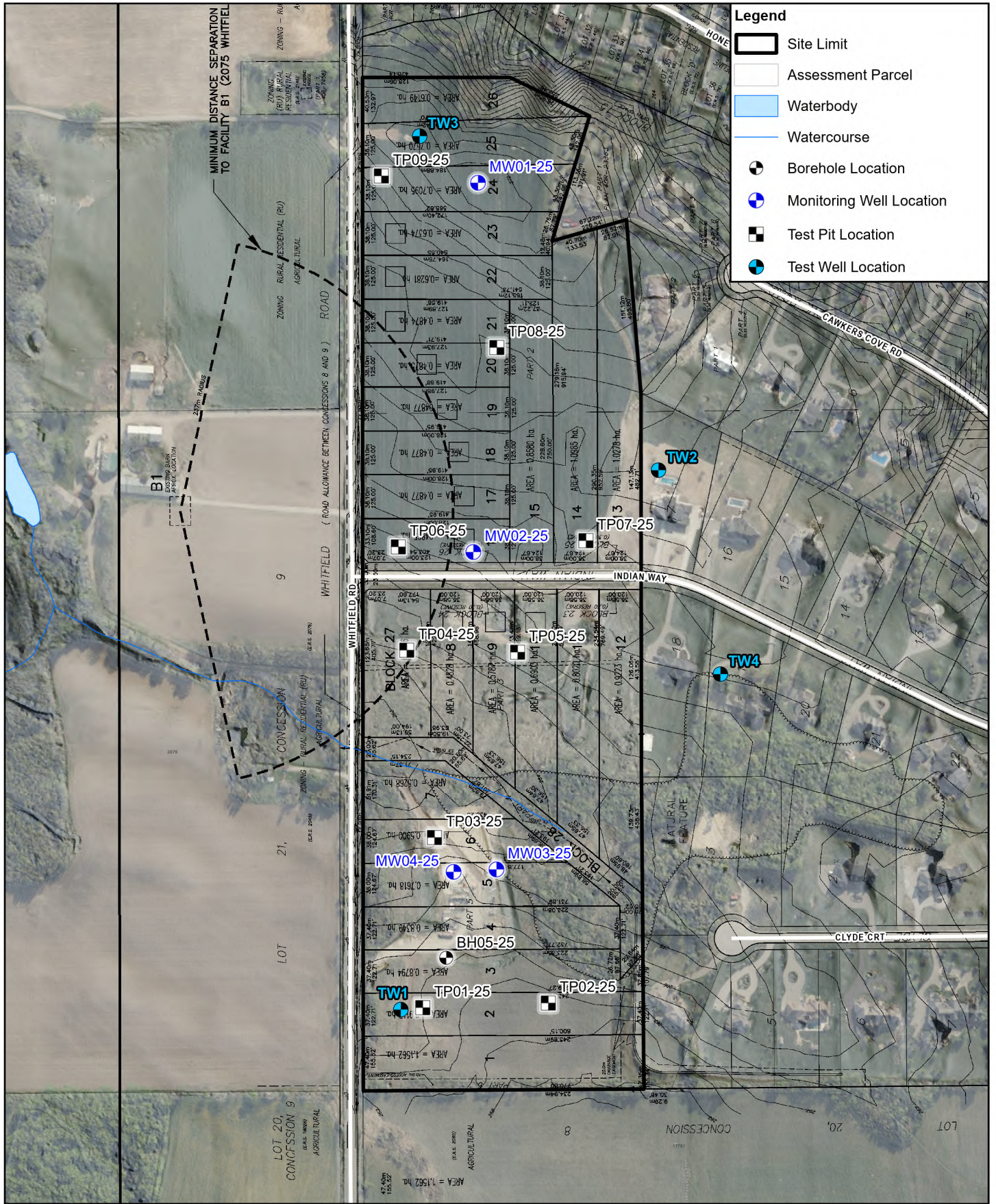


Honey Heights Developments Ltd
Whitfield Road, Scugog, Ontario
Municipality of Durham

Geotechnical Investigation Site Location Plan

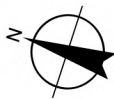
Project No. 12656921
Revision No.
Date May 20, 2025

Figure 1



0 45 90 135
Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N



Honey Heights Developments Ltd
Whitfield Road, Scugog, Ontario
Municipality of Durham

Geotechnical Investigation
Test Hole Plan

Project No. 12656921
Revision No.
Date May 20, 2025

Figure 2

Appendices

Appendix A

Test Hole Records



STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW01-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 10/03/2025
Drilling Company: ACE Drilling
Equipment Used: Geo Probe
Drilling Method(s): Solid Stem Auger

Page 1 of 1

Northing: 4889608 m**Logged By:** Jacob Kempt**Easting:** 664964 m**Reviewed By:** Michael Nieu Kirk**Horizontal Datum:** NAD83 / UTM zone 17N**Elevation:** 272.20 m**Final Depth:** 3.12 m**Elevation Datum:** MAMSL**Coordinates and Elevation Values are Approximate**

Depth Scale (m)	Depth (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	N'/RQD Value	PID (ppm)	Grain Size Analysis					Moisture Content %	Water Level(s)	Monitoring Well
	Elev. (m)								Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 272.20															
1	0.45		TOPSOIL (450 mm)	SS1	83	6-6-11-7	17	0						14		 Hole-Plug 1.22 270.98 T.O.S. 1.52 270.68 Sand 3.05 269.15 B.O.S. 3.05 269.15
	271.75		NATIVE: SILTY SAND, some clay, trace gravel, light brown, moist, compact													
	0.76															
	271.44		SILT AND SAND TILL, trace gravel, some clay, light brown, moist, dense	SS2	92	14-15-17-19	32	0						8		
2				SS3	96	17-18-17-17	35	0	4	46	35	15		8		 Hole-Plug 1.22 270.98 T.O.S. 1.52 270.68 Sand 3.05 269.15 B.O.S. 3.05 269.15
			- very dense, occasional cobbles, auger grinding at 2.29m BGS													
				SS4	96	11-26-48-50/ 127 mm	74	0						5		
				SS5	100	50/76 mm	R	0						6		
3	3.12 269.08		End of Hole at 3.12 m BGS													 Hole-Plug 1.22 270.98 T.O.S. 1.52 270.68 Sand 3.05 269.15 B.O.S. 3.05 269.15
4																
5																
6																
7																
8																 Hole-Plug 1.22 270.98 T.O.S. 1.52 270.68 Sand 3.05 269.15 B.O.S. 3.05 269.15
9																

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: Dry

Last Water Level Taken: 17/03/2025

N Value: R - Refusal

Well - Reference Elevation(s)

Location Elevation (m)

MW01-25

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC

Water Readings

Date (dd/mm/yyyy) Depth Unit

17/03/2025 Dry



STRATIGRAPHIC AND INSTRUMENTATION RECORD (Overburden)

MW02-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 10/03/2025
Drilling Company: ACE Drilling
Equipment Used: Geo Probe
Drilling Method(s): Solid Stem Auger

Page 1 of 1

Northing: 4889512 m
Easting: 664658 m
Horizontal Datum: NAD83 / UTM zone 17N
Elevation: 266.40 m
Elevation Datum: MAMSL
Logged By: Jacob Kempt
Reviewed By: Michael Nieu Kirk
Final Depth: 5.18 m
Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	N/RQD Value	PID (ppm)	Grain Size Analysis					Moisture Content %	Water Level(s)	Monitoring Well
	Elev. (m)								Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 266.40															
1	0.40 266.00		TOPSOIL (400 mm)	SS1	96	7-7-3-4	10	0						23		
			NATIVE: SANDY SILT, some clay, trace gravel, brown, moist, compact													
2	1.52 264.88		SANDY SILT TILL, some clay, trace gravel, brown, moist, compact	SS2	100	6-9-8-12	17	0						10		1.22 265.18 T.O.S. 1.52 264.88
				SS3	100	9-12-15-18	27	0						14		
				SS4	100	9-11-11-14	22	0						13		
				SS5	100	13-19-25-48	44	0						11		
5	4.57 261.83		GRAVELLY SAND TILL, trace silt, trace clay, light brown, wet, very dense - groundwater encountered, wet at 4.57m BGS													4.57 261.83 B.O.S. 4.57 261.83
	5.18 261.22		End of Hole at 5.18 m BGS	SS6	87	14-22-35-37	57	0	29	59	8	4	10			
6																
7																
8																
9																

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: 3.05 m on 10/03/2025

Last Water Level Taken: 02/04/2025

Well - Reference Elevation(s)

Location	Elevation (m)
----------	---------------

MW02-25

T.O.S.: Top of Screen

B.O.S.: Bottom of Screen

Screen Diameter: 51 mm

Screen Slot Size:

Material: PVC

mBGS: Meters below ground surface

mBTC: Meters below top of casing

Water Readings

Date (dd/mm/yyyy)	Depth	Unit
-------------------	-------	------

17/03/2025 1.78 mBGS

02/04/2025 1.55 mBGS



STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

MW03-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 10/03/2025
Drilling Company: ACE Drilling
Equipment Used: Geo Probe
Drilling Method(s): Solid Stem Auger

Page 1 of 1

Northing: 4889408 m
Easting: 664401 m
Horizontal Datum: NAD83 / UTM zone 17N
Elevation: 265.20 m
Elevation Datum: MAMSL
Logged By: Jacob Kempt
Reviewed By: Michael Nieu Kirk
Final Depth: 6.71 m
Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	N/RQD Value	PID (ppm)	Grain Size Analysis					Moisture Content %	Water Level(s)	Monitoring Well
	Elev. (m)								Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 265.20															
	0.45 264.75		TOPSOIL (450 mm)	SS1	100	3-4-5-5	9	0						18		
1			NATIVE: SILTY CLAY, trace sand, trace gravel, grey, moist, very stiff	SS2	100	7-10-9-10	19	0						15		
			- stiff at 1.52m BGS	SS3	92	3-4-6-2	10	0						14		
2	2.29 262.91		SANDY CLAYEY SILT, brown, wet, very soft	SS4	50	0-0-0-0	0	0	2	32	36	30		18		
			- VANE TEST at 2.90m BGS	V1												
3				SS5	50	0-0-0-0	0	0						20		
			- VANE TEST at 3.66m BGS	V2												
4			- dark brown, saturated at 3.81m BGS	SS6	67	0-0-11-24	11	0						50		
			- trace root, no recovery, at 4.57m BGS	SS7	0	1-0-2-6	2	0						22		
5	5.33 259.87		SILTY CLAY TILL, trace sand, grey, moist, stiff	SS8	67	2-5-8-10	13	0	1	10	36	53		22		
			- VANE TEST at 5.94m BGS	V3												
6			- very stiff at 6.10m BGS	SS9	79	3-7-12-15	19	0						13		
	6.71 258.49		End of Hole at 6.71 m BGS													
7																
8																
9																

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: 0.91 m on 10/03/2025

Last Water Level Taken: 02/04/2025

Well - Reference Elevation(s)

Location	Elevation (m)
MW03-25	

T.O.S.: Top of Screen
B.O.S.: Bottom of Screen
Screen Diameter: 51 mm
Screen Slot Size:
Material: PVC
mBGS: Meters below ground surface
mBTC: Meters below top of casing

Water Readings

Date (dd/mm/yyyy)	Depth	Unit
02/04/2025	0.17	mBGS



STRATIGRAPHIC AND INSTRUMENTATION RECORD (Overburden)

MW04-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 10/03/2025
Drilling Company: ACE Drilling
Equipment Used: Geo Probe
Drilling Method(s): Solid Stem Auger

Page 1 of 1

Northing: 4889443 m
Easting: 664388 m
Horizontal Datum: NAD83 / UTM zone 17N
Elevation: 265.10 m
Elevation Datum: MAMSL
Logged By: Jacob Kempt
Reviewed By: Michael Nieu Kirk
Final Depth: 5.18 m
Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m)	Elev. (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	N/RQD Value	PID (ppm)	Grain Size Analysis					Moisture Content %	Water Level(s)	Monitoring Well
										Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00	265.10															
	0.40	264.70		TOPSOIL (400 mm)	SS1	33	4-6-4-12	10	0						13		
				FILL: CLAYEY SANDY SILT, some gravel, brown, moist to wet, very loose													
1					SS2	38	3-1-2-1	3	0	19	21	38	22		24		Hole-Plug
				- loose at 1.52m BGS													1.22 263.88
2					SS3	79	1-1-5-7	6	0						21		
	2.29	262.81		NATIVE: SILTY SAND, some gravel, some clay, brown, wet, compact													
				- loose at 3.05m BGS	SS4	54	5-4-7-11	11	0						19		
3																	
					SS5	62	2-3-4-5	7	0						14		Sand T.O.S. 3.05 262.05
4																	
5																	
	4.88	260.22		SILTY CLAY TILL, some sand, trace gravel, wet, very stiff	SS6	67	8-10-12-13	22	0						19		4.57 260.53 B.O.S. 4.57 260.63
	5.18	259.92		End of Hole at 5.18 m BGS													
6																	
7																	
8																	
9																	

Legend:	Well - Reference Elevation(s)		Water Readings		
	Location	Elevation (m)	Date (dd/mm/yyyy)	Depth	Unit
	MW04-25		17/03/2025	0.13	mBGS
Measuring Point Elevation may change; Refer to Current Elevation Table			02/04/2025	0.39	mBGS
At Time of Drilling:					
Upon Completion of Drilling: 0.91 m on 10/03/2025					
Last Water Level Taken: 02/04/2025					



STRATIGRAPHIC AND INSTRUMENTATION RECORD

(Overburden)

BH05-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 10/03/2025
Drilling Company: ACE Drilling
Equipment Used: Geo Probe
Drilling Method(s): Solid Stem Auger

Page 1 of 1

Northing: 4889427 m**Logged By:** Jacob Kempt**Easting:** 664316 m**Reviewed By:** Michael Nieu Kirk**Horizontal Datum:** NAD83 / UTM zone 17N**Elevation:** 266.30 m**Final Depth:** 3.66 m**Elevation Datum:** MAMSL**Coordinates and Elevation Values are Approximate**

Depth Scale (m)	Depth (m)	Strata	Description	Sample Number	Recovery %	Blows per 0.15m or Partial Increment	N/RQD Value	PID (ppm)	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)								Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 266.30															
1	0.40	TOPSOIL/FILL (400 mm)	SS1	83	2-3-5-3	8								27		
	265.90	FILL: SANDY SILT, some clay, trace gravel, brown, moist, loose														
	0.66															
	265.64	NATIVE: SAND, some silt, trace gravel, brown, wet, compact	SS2	42	6-6-10-9	16								12		
2	2.29		SS3	42	3-6-7-7	13								19		
	264.01	SANDY SILT, trace gravel, trace clay, brown, moist to wet, compact	SS4	100	9-8-8-12	16								20		
3	3.05															
	263.25	SANDY SILT TILL, trace gravel, trace clay, brown, moist to wet, dense	SS5	79	10-20-21-30	41								18		
4	3.66	End of Hole at 3.66 m BGS														
	262.64															
5																
6																
7																
8																
9																

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Drilling:

Upon Completion of Drilling: 0.91 m on 10/03/2025

Last Water Level Taken:

Well - Reference Elevation(s)

Location Elevation (m)

Water Readings

Date (dd/mm/yyyy) Depth Unit



TEST PIT STRATIGRAPHIC RECORD

TP01-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Drilling Company: Client

Equipment Used: Backhoe

Drilling Method(s): Excavation

Northing: 4889433 m

Easting: 664267 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 266.10 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Page 1 of 1

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Hydraulic piezometer
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 266.10												
	0.46		TOPSOIL (460 mm)										
	265.64		NATIVE: SANDY SILT, some clay, with rootlets, reddish brown, moist		GS1						21		
	0.76												
	265.34		SILTY CLAY, trace sand, trace gravel, brown, moist to wet, medium plasticity - mottled grey to brown at 0.91m BGS										
1			- groundwater seepage observed at 1.52m BGS		GS2						19		
2			- groundwater seepage observed at 2.44m BGS										
	3.05												
	263.05		SANDY SILT TILL, some clay, trace gravel, grey, moist		GS3						13		
	3.35												
	262.75		End of Hole at 3.35 m BGS										
4			Note: Groundwater accumulation 305 mm in 7 hours, Test pit caved to 2.44 m .										
5													
6													
7													
8													
9													

Legend:
Measuring Point Elevation may change; Refer to Current Elevation Table
▼ At Time of Excavation:
▼ Upon Completion of Excavation:

Well - Reference Elevation(s)		T.O.S.: Top of Screen B.O.S.: Bottom of Screen Screen Diameter: mm Screen Slot Size: Material:
Location	Elevation (m)	
1	267.44	

Water Readings		
Date (dd/mm/yyyy)	Depth	Unit
17/03/2025	At ground surface	



TEST PIT STRATIGRAPHIC RECORD

TP02-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Excavation Company: Client

Equipment Used: Backhoe

Excavation Method(s): Excavation

Northing: 4899329 m

Easting: 664302 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 266.90 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Page 1 of 1

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00												
	266.90												
	0.46		TOPSOIL (460 mm)										
	266.44		NATIVE: SANDY SILT, some clay, with rootlets, brown, moist		GS1						11		
1	0.91		SILTY SAND, trace gravel, occasional cobble/boulders, brown, moist										1
	265.99				GS2						15		
2													2
			- water seepage (rapid) observed, wet at 2.44m BGS										
3					GS3						18		3
	3.35		End of Test Pit at 3.35 m BGS										
	263.55		Note: Groundwater accumulation 76 mm in minutes then side walls sloughed into hole up to 2.44 m.										4
4													4
5													5
6													6
7													7
8													8
9													9

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▼ At Time of Excavation:

▼ Upon Completion of Excavation:



TEST PIT STRATIGRAPHIC RECORD

TP03-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Page 1 of 1

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Excavation Company: Client

Equipment Used: Backhoe

Excavation Method(s): Excavation

Northing: 4889468 m

Easting: 664412 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 264.40 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.66 m

Dimension:

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 264.40												
1	0.46 263.94		TOPSOIL (460 mm)										
			NATIVE: SAND, some silt, reddish brown, wet		GS1				21				
	1.22 263.18		- brown, oxidation staining, groundwater seepage (rapid) observed, wet, test pit collapsing at 0.91m BGS										
			SILTY CLAY, some sand, some gravel, cobble/boulders, grey, moist, medium plasticity		GS2				10				
3	3.05 261.35												
			SILTY SAND, grey, wet, dilatent		GS3				27				
	3.66 260.74												
4			End of Test Pit at 3.66 m BGS										
			Note: Groundwater accumulation 203 mm in 5 minutes.										
5													
6													
7													
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▼ At Time of Excavation:

▼ Upon Completion of Excavation:



TEST PIT STRATIGRAPHIC RECORD

TP04-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Excavation Company: Client

Equipment Used: Backhoe

Excavation Method(s): Excavation

Northing: 4889544 m

Easting: 664558 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 263.50 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Page 1 of 1

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
1	0.30		TOPSOIL (300 mm)										
	263.20		NATIVE: SILTY SAND, some clay, reddish brown, moist		GS1	0	51	36	13	15			
	1.37		- groundwater seepage observed, wet (perched) at 1.22m BGS										
	262.13		SILTY CLAY, grey to brown, mottled, moist		GS2						23		
	1.68												
	261.82		SILTY SAND TILL, some gravel, occasional cobbles/boulders, brown, moist		GS3						9		
			- some silt, groundwater seepage observed, wet at 2.74m BGS		GS4						10		
2	3.35		End of Test Pit at 3.35 m BGS										
	260.15		Note: Groundwater accumulation 76 mm in 10 minutes.										
3													
4													
5													
6													
7													
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Excavation:

Upon Completion of Excavation:



TEST PIT STRATIGRAPHIC RECORD

TP05-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Drilling Company: Client

Equipment Used: Backhoe

Drilling Method(s): Excavation

Northing: 4889447 m

Easting: 664585 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 265.20 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Page 1 of 1

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Hydraulic piezometer
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 265.20												
1	0.30		TOPSOIL (300 mm)										
	264.90		NATIVE: SANDY SILT, some clay, reddish brown, moist		GS1						22		
			- trace clay, light brown at 0.76m BGS										
					GS2						16		
	1.52												
2	263.68		SILTY CLAY, light grey, mottled, moist		GS3						20		
	1.68		SILTY SAND, some gravel, occasional cobbles/boulder, light brown, moist										
	263.52												
					GS4						9		
3	3.05		SILTY GRAVEL, some sand, brown, wet		GS5								
	262.15		- groundwater seepage observed at 3.05m BGS								10		
	3.35		End of Hole at 3.35 m BGS										
	261.85												
4			Note: Groundwater accumulation 102 mm in 5 minutes; Groundwater accumulation 2.13 m after 3 hours.										
5													
6													
7													
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Excavation:

Upon Completion of Excavation:

Well - Reference Elevation(s)

Location	Elevation (m)
1	266.58

T.O.S.: Top of Screen

B.O.S.: Bottom of Screen

Screen Diameter: mm

Screen Slot Size:

Material:

Water Readings

Date (dd/mm/yyyy)	Depth	Unit
17/03/2025	Dry	



TEST PIT STRATIGRAPHIC RECORD

TP06-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Page 1 of 1

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Drilling Company: Client

Equipment Used: Backhoe

Drilling Method(s): Excavation

Northing: 4889576 m

Logged By: Matt Yee

Easting: 664646 m

Reviewed By: Michael Nieu Kirk

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 265.60 m

Final Depth: 3.05 m

Elevation Datum: MAMSL

Dimension:

Coordinates and Elevation Values are Approximate

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Hydraulic piezometer
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 265.60												
	0.46 265.14		TOPSOIL (460 mm)										
	0.91 264.69		NATIVE: SANDY SILT, some clay, brown, moist		GS1						11		
1			SILTY SAND, some gravel, occasional cobbles/boulder, light brown, moist		GS2						10		
2													
3	3.05 262.55		End of Hole at 3.05 m BGS		GS3						7		
4			Note: No groundwater seepage observed; No groundwater accumulation after 10 minutes; Groundwater accumulation 25 mm after 2 hours.										
5													
6													
7													
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Excavation:

Upon Completion of Excavation:

Well - Reference Elevation(s)

Location	Elevation (m)
1	267.00

T.O.S.: Top of Screen

B.O.S.: Bottom of Screen

Screen Diameter: mm

Screen Slot Size:

Material:

mBGS: Meters below ground surface

mBTC: Meters below top of casing

Water Readings

Date (dd/mm/yyyy)	Depth	Unit
17/03/2025	0.69	mBGS



TEST PIT STRATIGRAPHIC RECORD

TP07-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Page 1 of 1

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Excavation Company: Client

Equipment Used: Backhoe

Excavation Method(s): Excavation

Northing: 4889427 m

Easting: 664699 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 267.10 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 267.10												
	0.30		TOPSOIL (300 mm)										
	266.80 0.61		NATIVE: SANDY SILT, some clay, brown, moist		GS1						13		
	266.49		SILTY SAND, some gravel, light brown, moist										
1					GS2						9		1
	1.52 265.58		SILTY SAND and GRAVEL, occasional cobbles/boulders light brown, moist										2
2													3
3			- groundwater seepage observed, wet at 3.05m BGS		GS3						7		4
	3.35 263.75		End of Test Pit at 3.35 m BGS										5
4			Note: Groundwater accumulation 102 mm in 5 minutes.										6
5													7
6													8
7													9
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▼ At Time of Excavation:

▼ Upon Completion of Excavation:



TEST PIT STRATIGRAPHIC RECORD

TP08-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.

Project: Fourteen Estates, Whitfield Road

Location: Whitfield Road, Scugog, Ontario

Date Range (dd/mm/yyyy): 06/03/2025

Excavation Company: Client

Equipment Used: Backhoe

Excavation Method(s): Excavation

Northing: 4889547 m

Easting: 664836 m

Horizontal Datum: NAD83 / UTM zone 17N

Elevation: 270.20 m

Elevation Datum: MAMSL

Coordinates and Elevation Values are Approximate

Logged By: Matt Yee

Reviewed By: Michael Nieu Kirk

Final Depth: 3.35 m

Dimension:

Page 1 of 1

Depth Scale (m)	Depth (m)	Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Backfill Details
	Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00 270.20												
	0.41		TOPSOIL (460 mm)										
	269.79		NATIVE: SANDY SILT, some clay, brown, moist										
1	0.91				GS1						15		
	269.29		SILTY SAND, some gravel, occasional cobbles/boulder, light brown, moist										
	1.52				GS2						8		
	268.68		SILTY SAND TILL, some gravel, occasional cobbles/boulders, brown, moist										
2													
3													
	3.35				GS3						7		
	266.85		End of Test Pit at 3.35 m BGS										
4			Note: No groundwater seepage observed; No groundwater accumulation.										
5													
6													
7													
8													
9													

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

▼ At Time of Excavation:

▼ Upon Completion of Excavation:



TEST PIT STRATIGRAPHIC RECORD

TP09-25

Project Number: 12656921

Client: Honey Heights Developments Ltd.
Project: Fourteen Estates, Whitfield Road
Location: Whitfield Road, Scugog, Ontario
Date Range (dd/mm/yyyy): 06/03/2025
Drilling Company: Client
Equipment Used: Backhoe
Drilling Method(s): Excavation

Page 1 of 1

Northing: 4889691 m**Logged By:** Matt Yee**Easting:** 664944 m**Reviewed By:** Michael Nieu Kirk**Horizontal Datum:** NAD83 / UTM zone 17N**Elevation:** 270.20 m**Final Depth:** 3.05 m**Elevation Datum:** MAMSL**Dimension:****Coordinates and Elevation Values are Approximate**

Depth Scale (m)	Depth (m)		Strata	Description	PID (ppm)	Sample Number	Grain Size Analysis					Moisture Content %	Water Level(s)	Hydraulic piezometer
		Elev. (m)					Gravel %	Sand %	Silt %	Clay %	Fines %			
	0.00	270.20												
1	0.30		TOPSOIL (300 mm)			GS1						19		
	269.90		NATIVE: SANDY SILT, some clay, reddish brown, moist											
	0.76		SILT, some clay, some sand, light brown, moist				GS2	2	11	75	12			
	269.44													
2														
3	3.05		- oxidation staining at 2.74m BGS	End of Hole at 3.05 m BGS		GS3						16	B.O.S. 3.05 267.15	
	267.15		Note: No groundwater seepage observed; No groundwater accumulation.											
4														
5														
6														
7														
8														
9														

Legend:

Measuring Point Elevation may change; Refer to Current Elevation Table

At Time of Excavation:

Upon Completion of Excavation:

Well - Reference Elevation(s)

Location	Elevation (m)
1	271.64

T.O.S.: Top of Screen

B.O.S.: Bottom of Screen

Screen Diameter: mm

Screen Slot Size:

Material:

mBGS: Meters below ground surface

mBTC: Meters below top of casing

Water Readings

Date (dd/mm/yyyy)	Depth	Unit
17/03/2025	0.40	mBGS

Appendix B

Geotechnical Laboratory Test Results



Particle-Size Analysis of Soils

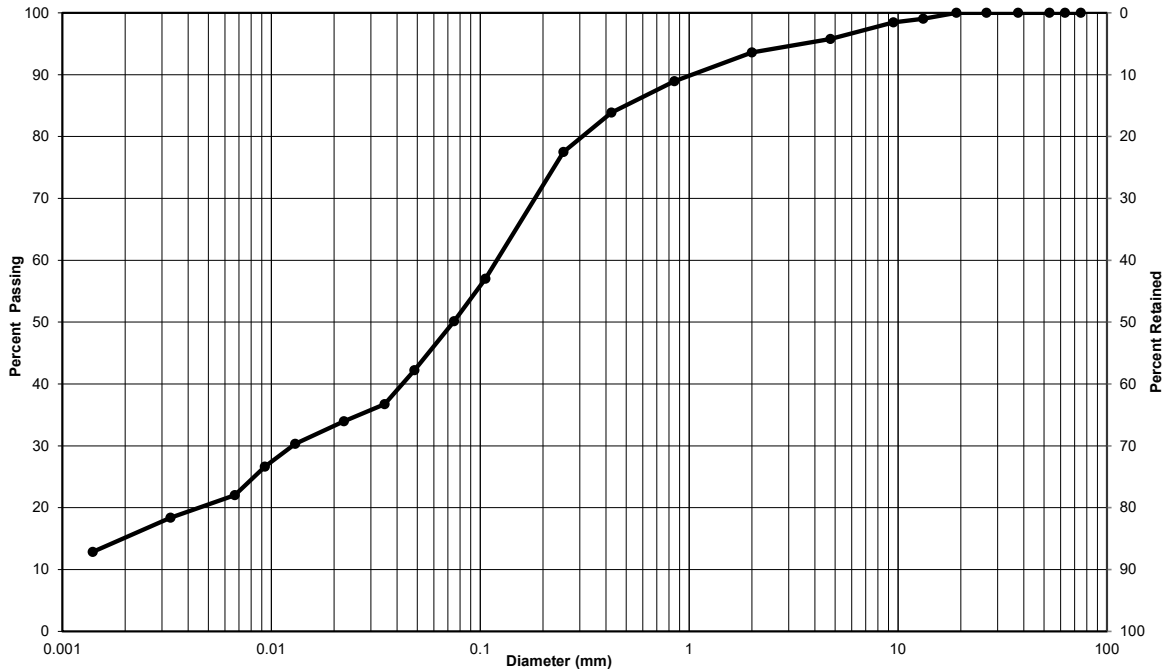
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: MW1-25 Sample No.: SS3

Depth: 1.5-2.1m Enclosure: -



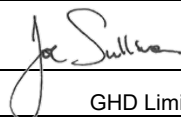
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt and sand, some clay, trace gravel	4	46	50
Silt-size particles (%) :	35		
Clay-size particles (%) (<0.002 mm):	15		

Additional laboratory reporting information available upon request.

Remarks: _____

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Particle-Size Analysis of Soils

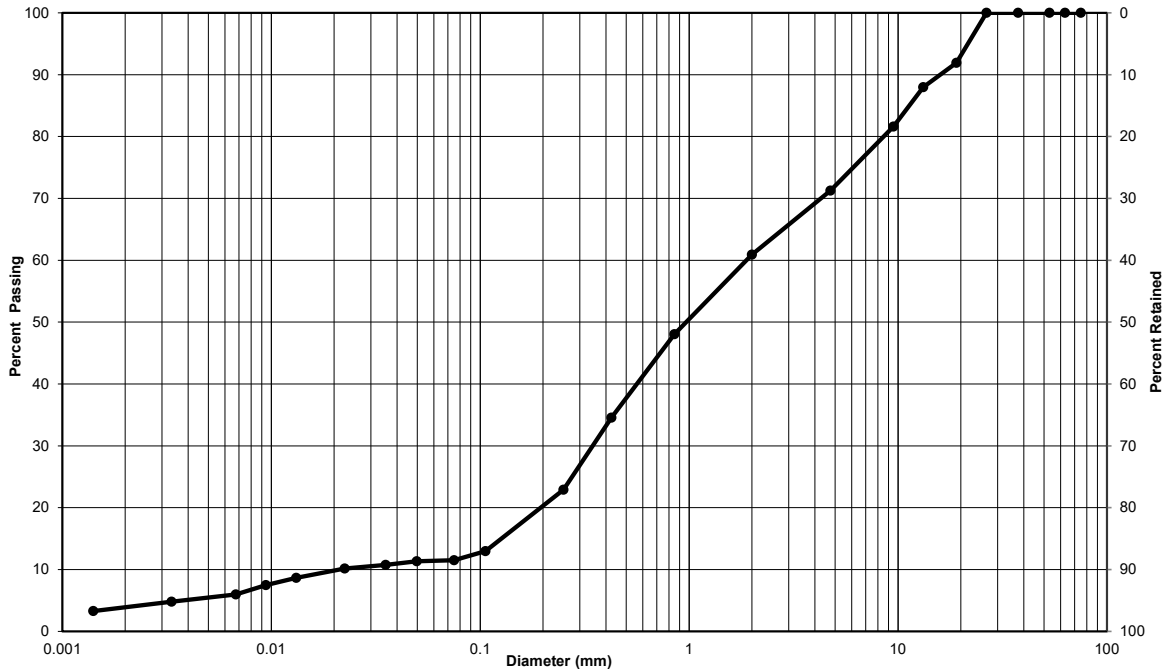
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: MW2-25 Sample No.: SS6

Depth: 4.6-5.2m Enclosure: -



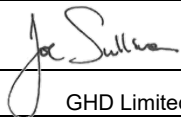
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravelly sand, trace silt and clay	29	59	12
Silt-size particles (%) :	8		
Clay-size particles (%) (<0.002 mm):	4		

Additional laboratory reporting information available upon request.

Remarks: _____

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Particle-Size Analysis of Soils

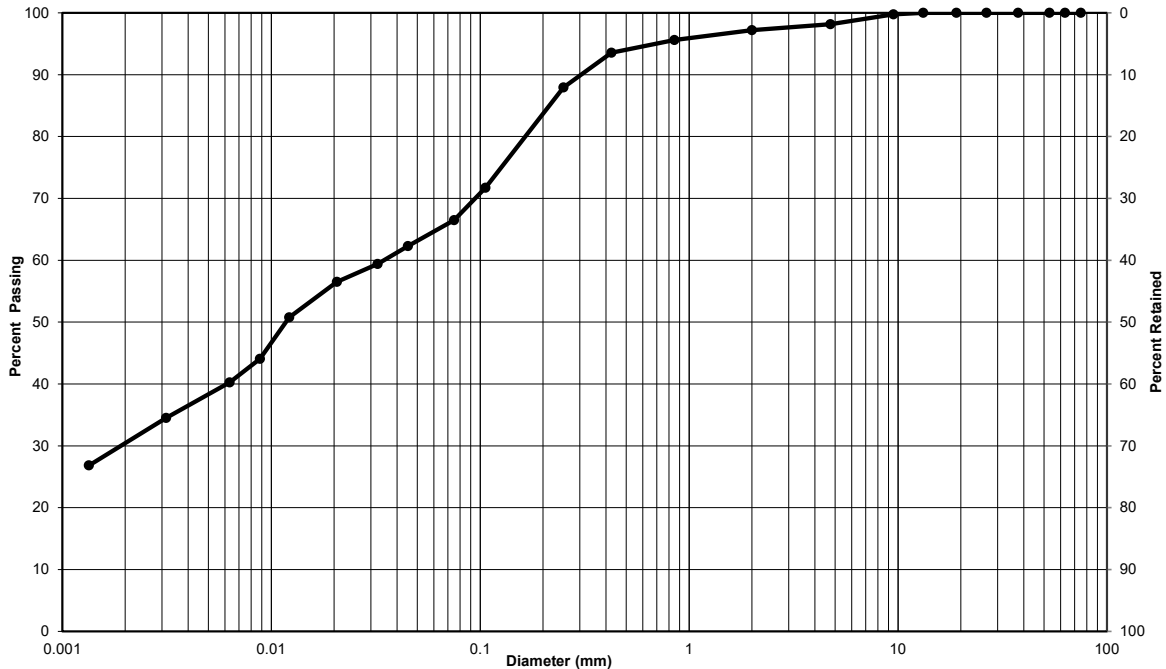
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: MW3-25 Sample No.: SS4

Depth: 2.3-2.9m Enclosure: -



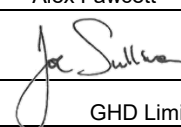
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy, clayey silt, trace gravel	2	32	66
Silt-size particles (%) :	36		
Clay-size particles (%) (<0.002 mm):	30		

Additional laboratory reporting information available upon request.

Remarks: _____

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client: Fourteen Estates Ltd.		Lab no.: SS-25-23	
Project/Site: Fourteen Estates, Whitfield Road		Project no.: 12656921	
Borehole no.: MW3-25		Sample no.: SS4	
Soil Description:		Sample Depth: 2.3-2.9m	
Date sampled:			
Apparatus: Hand Crank		Balance no.: 10	
Liquid limit device no.: 1		Porcelain bowl no.: 1	
Sieve no.: 0.425		Oven no.: B23-002667	
		Spatula no.: 1	
Glass plate no.: 1			

Liquid Limit (LL):				Soil Preparation:							
	Test No. 1	Test No. 2	Test No. 3	☒ Cohesive <425 µm	☒ Dry preparation (oven dried))						
Number of blows	35	20	15	☐ Cohesive >425 µm	☐ Dry preparation (air dried)						
Water Content:											
Tare no.	134	404	409	☐ Non-cohesive	☐ Wet preparation						
Wet soil+tare, g	31.17	32.03	33.59	Results Soil Plasticity Chart ASTM D2487 							
Dry soil+tare, g	29.69	30.19	31.46								
Mass of water, g	1.48	1.84	2.13								
Tare, g	21.86	21.16	21.43								
Mass of soil, g	7.83	9.03	10.03								
Water content %	18.9%	20.4%	21.2%								
Plastic Limit (PL) - Water Content:											
Tare no.	2	407									
Wet soil+tare, g	28.72	27.70									
Dry soil+tare, g	27.90	26.94									
Mass of water, g	0.82	0.76									
Tare, g	21.77	21.24									
Mass of soil, g	6.13	5.70									
Water content %	13.4%	13.3%									
Average water content %	13.4%										
Natural Water Content (W_n):											
Tare no.	BOWL										
Wet soil+tare, g	712.65										
Dry soil+tare, g	629.24										
Mass of water, g	83.41										
Tare, g	166.04										
Mass of soil, g	463.20										
Water content %	18.0%										
<table border="1" style="width:100%"><tr><td>Liquid Limit (LL)</td><td>Plastic Limit (PL)</td><td>Plasticity Index (PI)</td><td>Natural Water Content W_n</td></tr><tr><td>20</td><td>13</td><td>7</td><td>18.0</td></tr></table>				Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W _n	20	13	7	18.0
Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W _n								
20	13	7	18.0								

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

Remarks:	
Performed by: Josh Sullivan	Date: March 26, 2025
Reviewed by: Joe Sullivan	Date: March 26, 2025
Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON	



Particle-Size Analysis of Soils

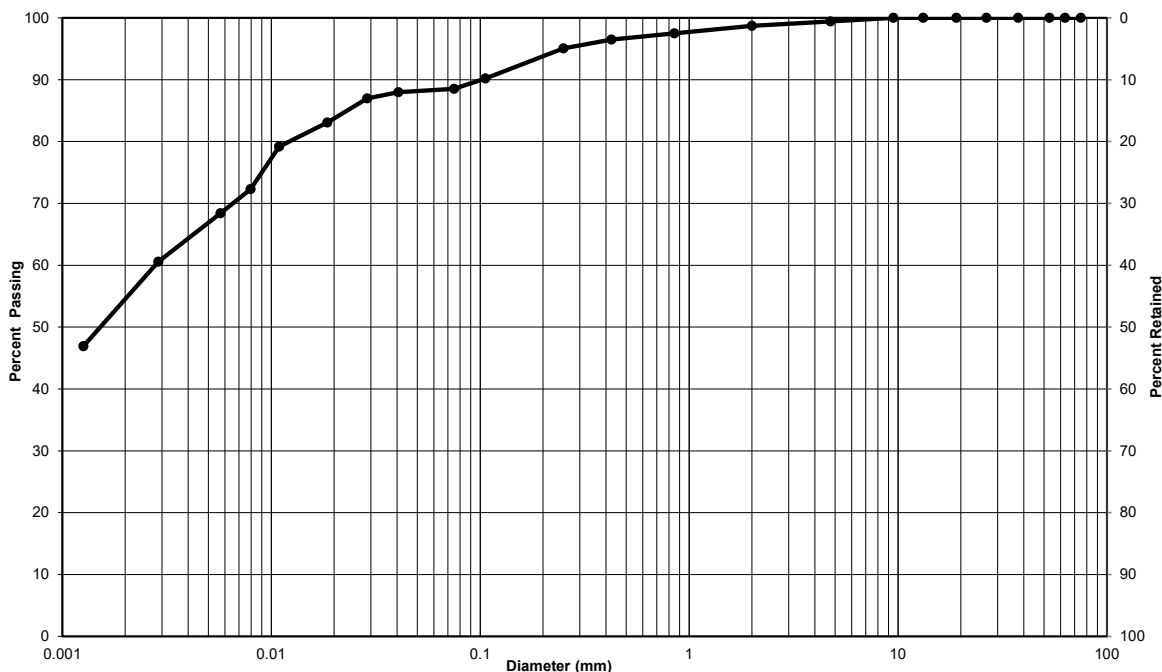
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: MW3-25 Sample No.: SS8

Depth: 5.3-5.9m Enclosure: -



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clay and silt, some sand, trace gravel	1	10	89
Silt-size particles (%) :	36		
Clay-size particles (%) (<0.002 mm):	53		

Additional laboratory reporting information available upon request.

Remarks:

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Liquid Limit, Plastic Limit and Plasticity Index of Soils

(ASTM D4318, MTO LS-703/704)

Client: Fourteen Estates Ltd.		Lab no.: SS-25-23	
Project/Site: Fourteen Estates, Whitfield Road		Project no.: 12656921	
Borehole no.: MW3-25		Sample no.: SS8	
Soil Description:		Sample Depth: 5.3-5.9m	
Date sampled:			
Apparatus: Hand Crank		Balance no.: 10	
Liquid limit device no.: 1		Porcelain bowl no.: 1	
Sieve no.: 0.425		Oven no.: B23-002667	
		Spatula no.: 1	
Glass plate no.: 1			

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	21	17

Water Content:

Tare no.	1	329	331
Wet soil+tare, g	30.81	31.89	32.03
Dry soil+tare, g	28.49	29.10	29.11
Mass of water, g	2.32	2.79	2.92
Tare, g	21.80	21.45	21.27
Mass of soil, g	6.69	7.65	7.84
Water content %	34.7%	36.5%	37.2%

Plastic Limit (PL) - Water Content:

Tare no.	81	40
Wet soil+tare, g	29.37	28.07
Dry soil+tare, g	28.17	27.04
Mass of water, g	1.20	1.03
Tare, g	21.22	21.10
Mass of soil, g	6.95	5.94
Water content %	17.3%	17.3%
Average water content %	17.3%	

Natural Water Content (Wⁿ):

Tare no.	BOWL
Wet soil+tare, g	780.59
Dry soil+tare, g	678.66
Mass of water, g	101.93
Tare, g	206.83
Mass of soil, g	471.83
Water content %	21.6%

Soil Preparation:

☒ Cohesive <425 µm ☒ Dry preparation (oven dried))
☐ Cohesive >425 µm ☐ Dry preparation (air dried)
☐ Non-cohesive ☐ Wet preparation

Results

Soil Plasticity Chart ASTM D2487

Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content Wn
36	17	19	21.6

Plasticity Chart based on ASTM D2487. Additional laboratory reporting information available upon request.

Remarks:

Performed by: Josh Sullivan

Date: March 26, 2025

Reviewed by: Joe Sullivan

Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON

November 2022



Particle-Size Analysis of Soils

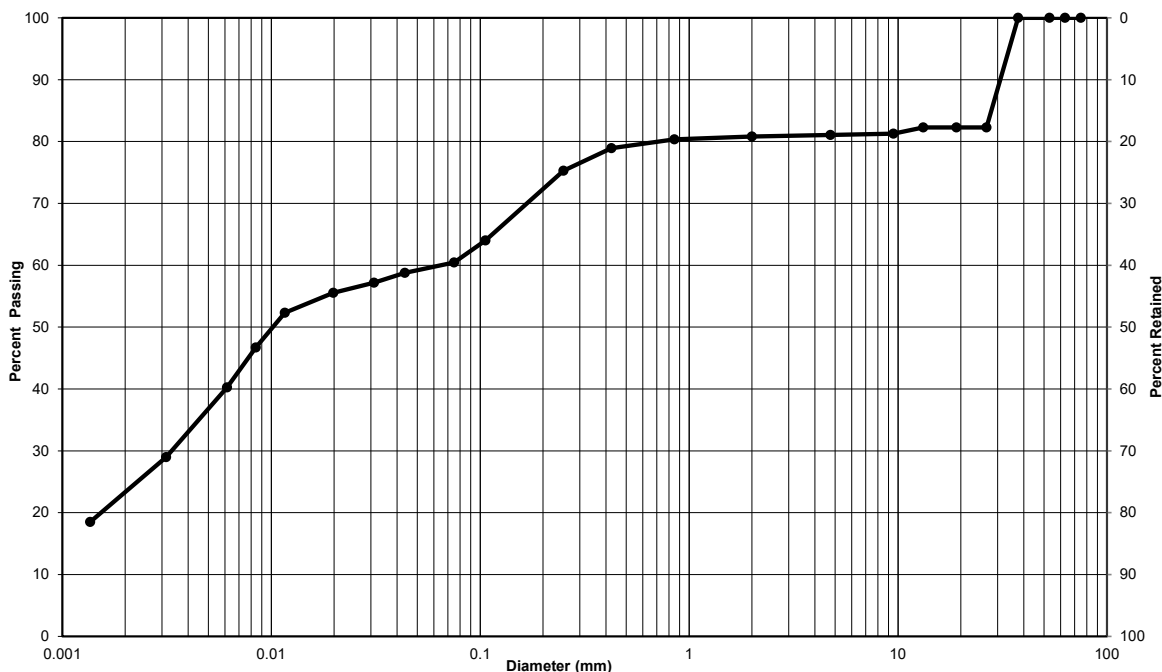
MT0 LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: MW4-25 Sample No.: SS2

Depth: 0.8-1.4m Enclosure: -



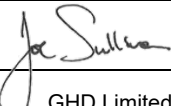
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clayey, sandy silt, some gravel	19	21	60
Silt-size particles (%) :	38		
Clay-size particles (%) (<0.002 mm):	22		

Additional laboratory reporting information available upon request.

Remarks: _____

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Particle-Size Analysis of Soils

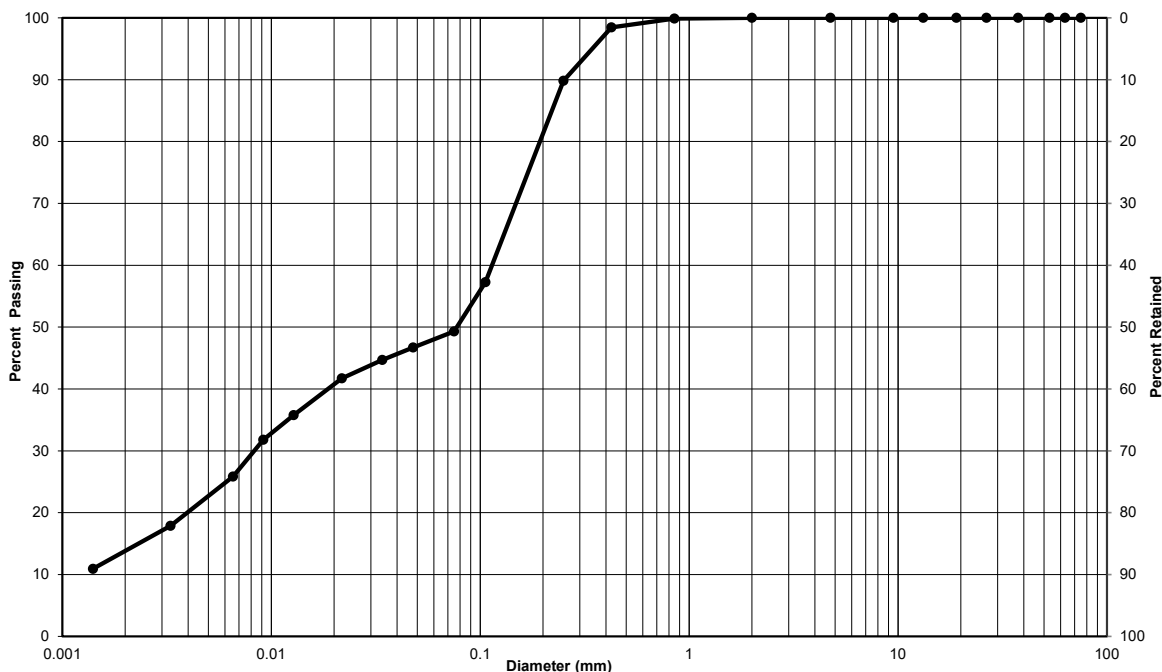
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: TP4-25 Sample No.: GS1

Depth: 0.3-0.6m Enclosure: -



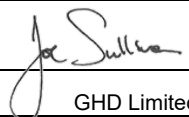
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and silt, some clay	0	51	49
Silt-size particles (%) :	36		
Clay-size particles (%) (<0.002 mm):	13		

Additional laboratory reporting information available upon request.

Remarks: _____

Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON



Particle-Size Analysis of Soils

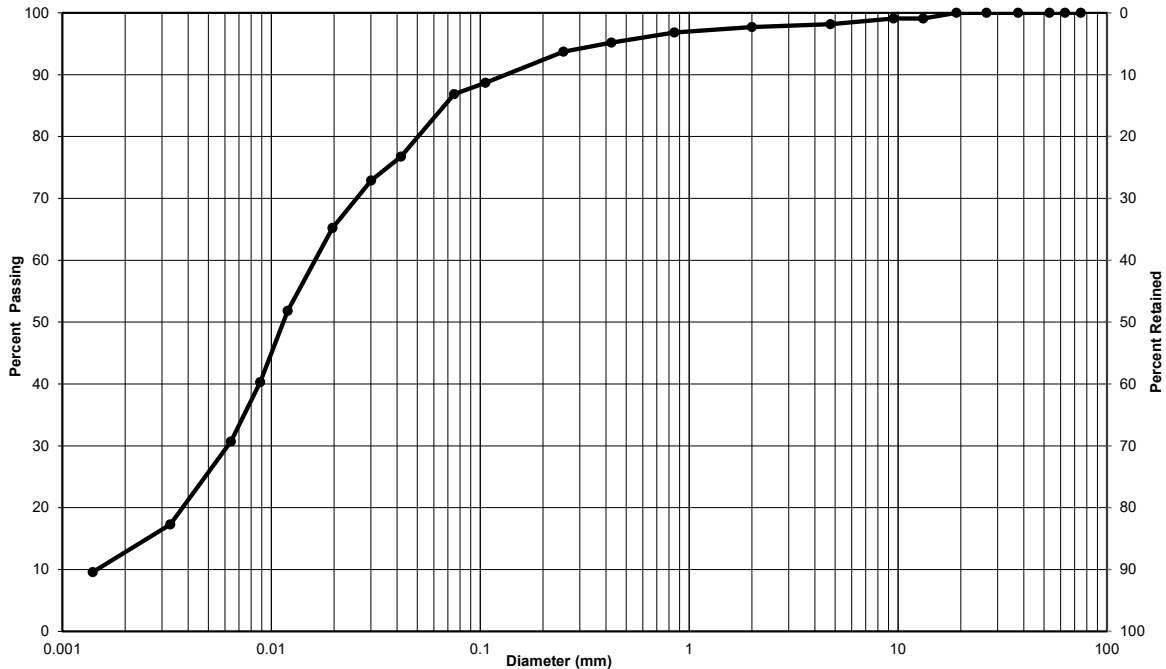
MTO LS-702/ASTM D422 (Geotechnical)

Client: Fourteen Estates Ltd. Lab No.: SS-25-23

Project/Site: Fourteen Estates, Whitfield Road Project No.: 12656921-01

Borehole No.: TP9-25 Sample No.: GS2

Depth: 0.9-1.2m Enclosure: -



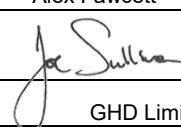
Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Particle-Size Limits as per USCS (ASTM D-2487)					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silt, some clay and sand, trace gravel	2	11	87
Silt-size particles (%) :	75		
Clay-size particles (%) (<0.002 mm):	12		

Additional laboratory reporting information available upon request.

Remarks: _____

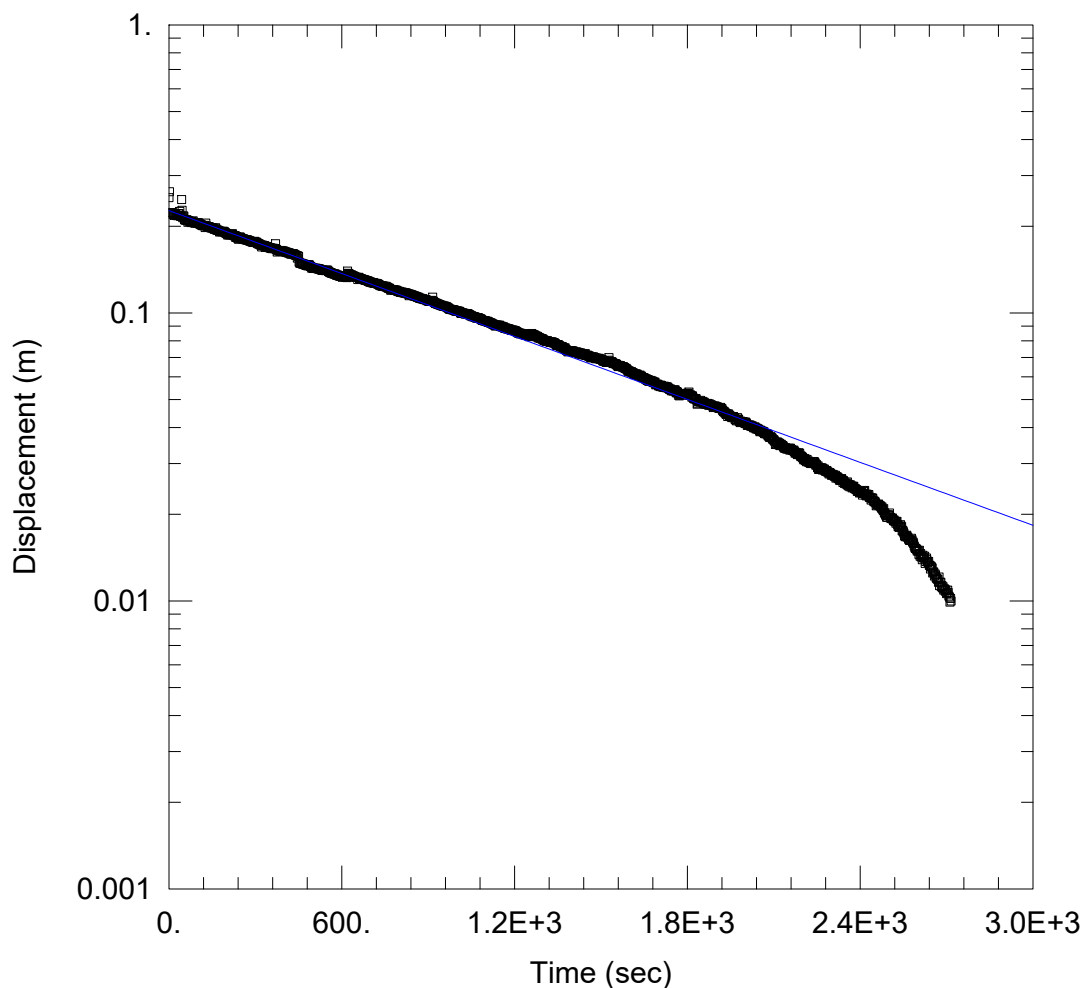
Performed by: Alex Fawcett Date: March 26, 2025

Verified by: Joe Sullivan  Date: March 26, 2025

Laboratory Location: GHD Limited - 347 Pido Road, Unit 29, Peterborough, ON

Appendix C

Single Well Response Test Results



MW02-25: SWRT FALLING HEAD TEST

Data Set: N:\...MW02-25-falling head test.aqt

Date: 05/13/25

Time: 10:51:04

PROJECT INFORMATION

Company: GHD Ltd

Client: Fourteen Estates Ltd.

Project: 12656921

Location: Scugog, ON

Test Well: MW02-25

Test Date: April 02, 2025

AQUIFER DATA

Saturated Thickness: 3.07 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW02-25)

Initial Displacement: 0.22 m

Static Water Column Height: 3.07 m

Total Well Penetration Depth: 3.07 m

Screen Length: 3.05 m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.3

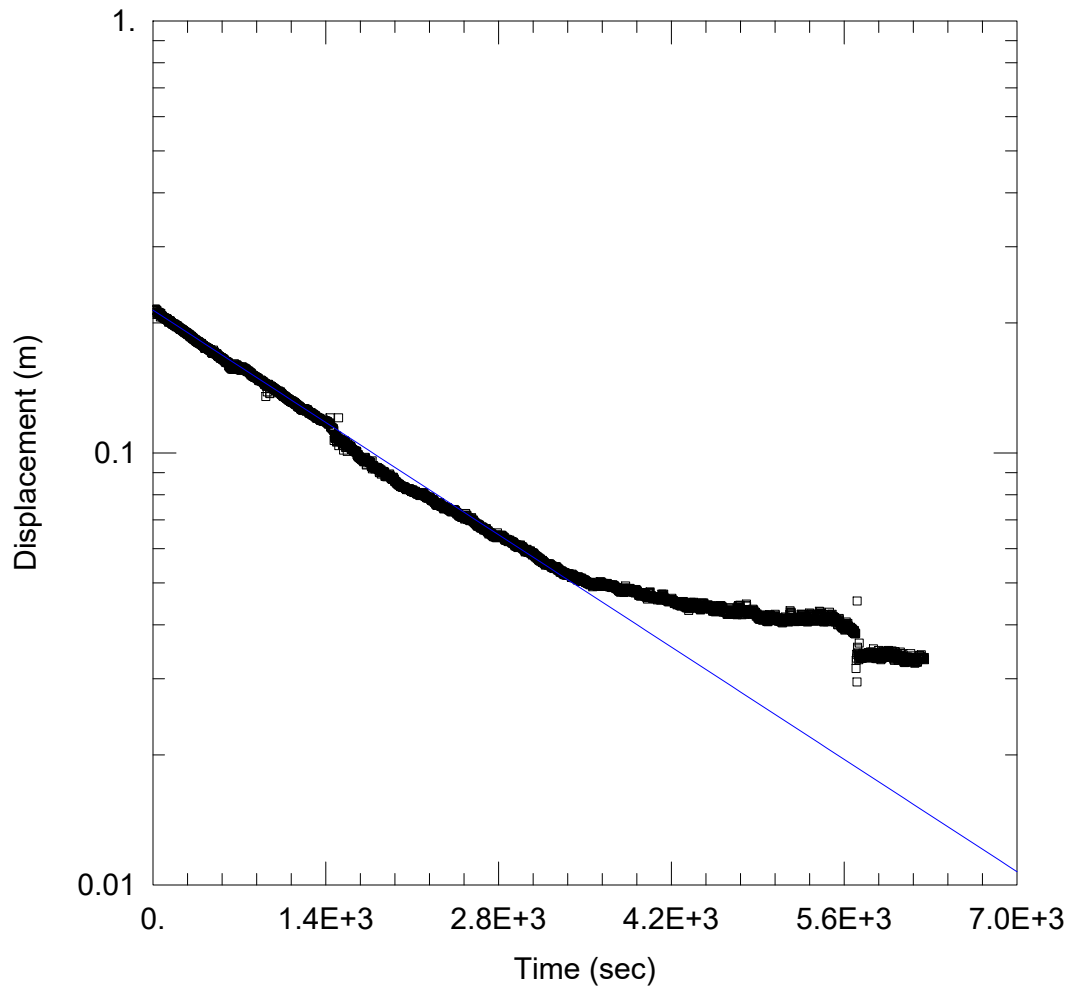
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 3.279E-7$ m/sec

$y_0 = 0.2267$ m



MW02-25: SWRT RISING HEAD TEST

Data Set: N:\...MW02-25-rising head test.aqt

Date: 05/13/25

Time: 10:56:22

PROJECT INFORMATION

Company: GHD Ltd

Client: Fourteen Estates Ltd.

Project: 12656921

Location: Scugog, ON

Test Well: MW02-25

Test Date: April 02, 2025

AQUIFER DATA

Saturated Thickness: 3.07 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW02-25)

Initial Displacement: 0.21 m

Static Water Column Height: 3.07 m

Total Well Penetration Depth: 3.07 m

Screen Length: 3.05 m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.3

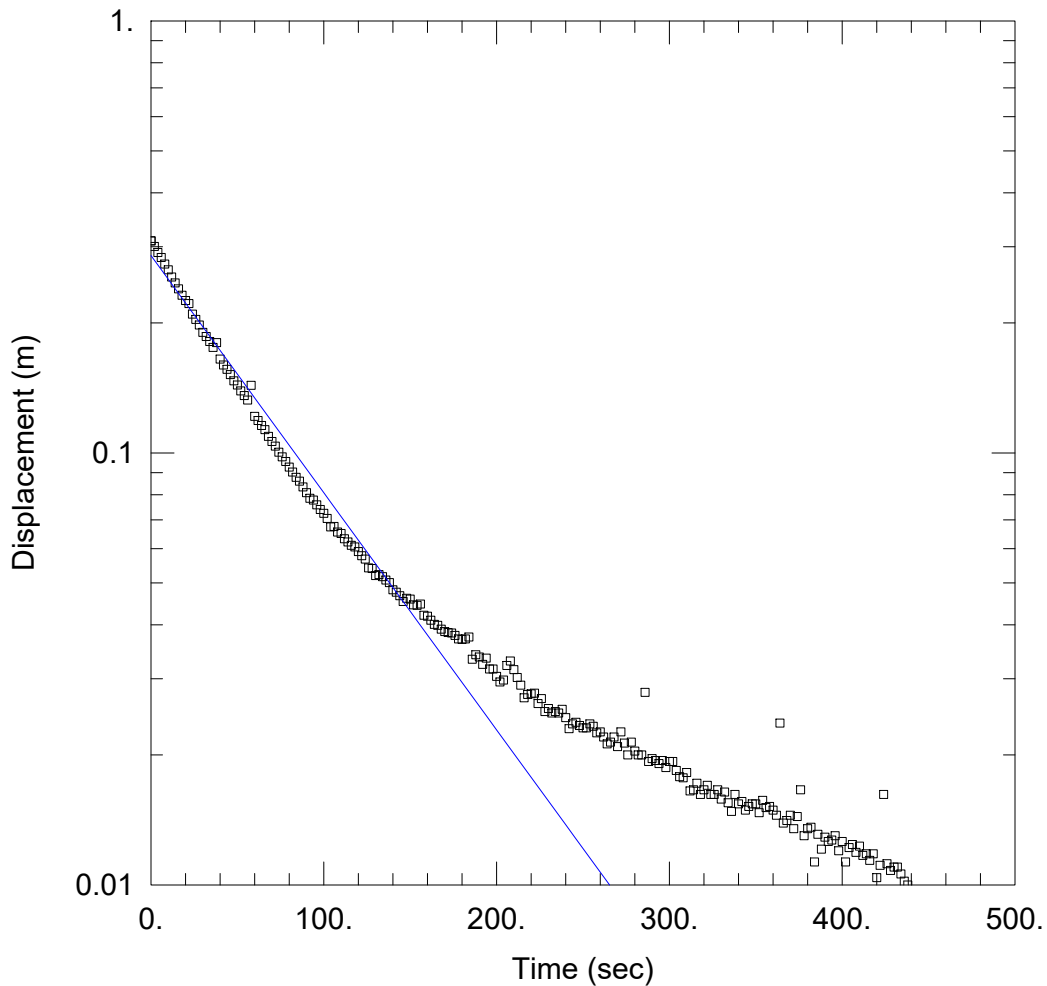
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.672E-7$ m/sec

$y_0 = 0.2141$ m



MW04-25: SWRT FALLING HEAD TEST

Data Set: N:\...\MW04-25, Falling head test.aqt

Date: 05/13/25

Time: 11:35:39

PROJECT INFORMATION

Company: GHD Ltd

Client: Fourteen Estates Ltd.

Project: 12656921

Location: Scugog, ON

Test Well: MW04-25

Test Date: April 02, 2025

AQUIFER DATA

Saturated Thickness: 4.18 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW04-25)

Initial Displacement: 0.31 m

Static Water Column Height: 4.18 m

Total Well Penetration Depth: 4.18 m

Screen Length: 1.52 m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.3

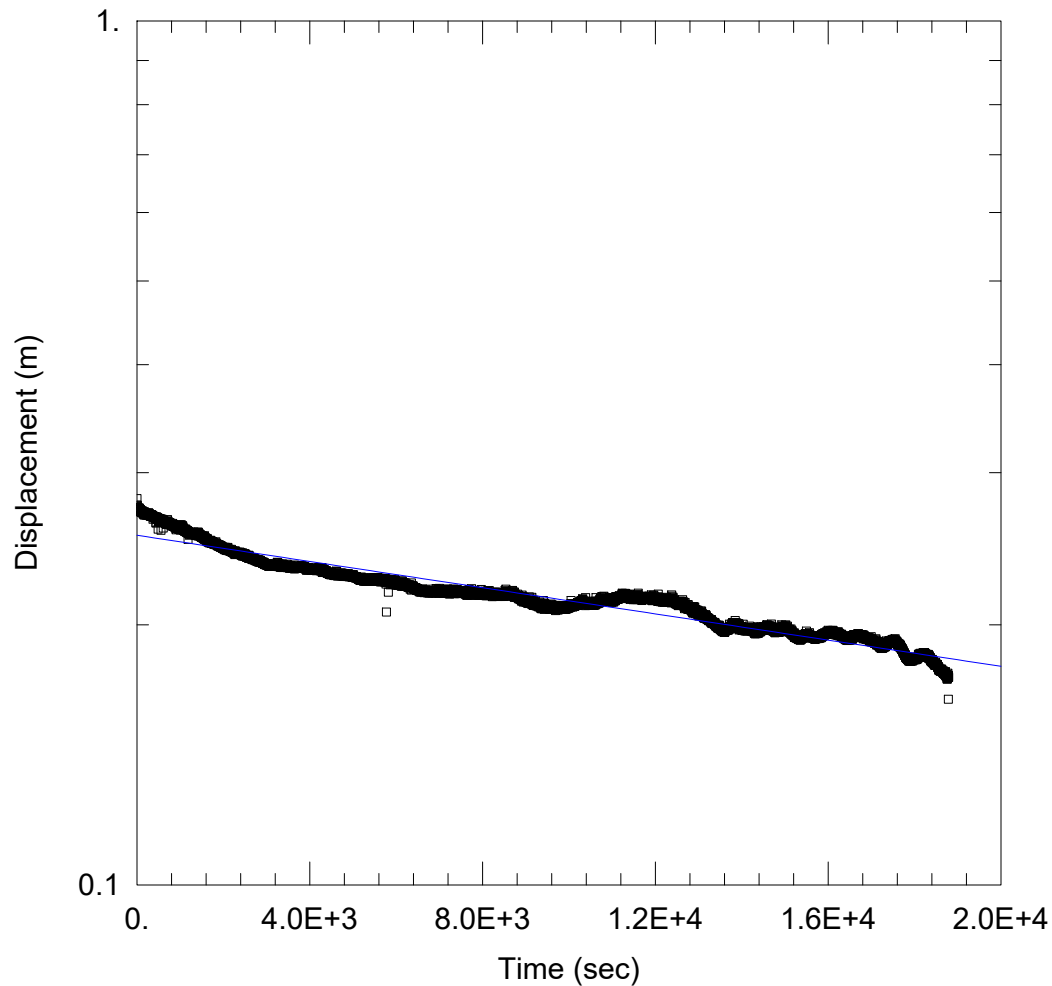
SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.011E-5$ m/sec

$y_0 = 0.2863$ m



MW04-25: SWRT RISING HEAD TEST

Data Set: N:\...MW04-25, Rising head test.aqt

Date: 05/13/25

Time: 11:38:01

PROJECT INFORMATION

Company: GHD Ltd

Client: Fourteen Estates Ltd.

Project: 12656921

Location: Scugog, ON

Test Well: MW04-25

Test Date: April 02, 2025

AQUIFER DATA

Saturated Thickness: 4.18 m

Anisotropy Ratio (K_z/K_r): 1.

WELL DATA (MW04-25)

Initial Displacement: 0.28 m

Static Water Column Height: 4.18 m

Total Well Penetration Depth: 4.18 m

Screen Length: 1.52 m

Casing Radius: 0.0254 m

Well Radius: 0.0254 m

Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined

Solution Method: Bouwer-Rice

$K = 1.397E-8$ m/sec

$y_0 = 0.2539$ m

Appendix D

Infiltration Testing Results

Appendix D: Infiltration Testing (in-situ)

Project No.: 12656921
Date: March 25, 2025
Equipment: ETC Pask Permeameter

Test ID.: TP05-25
Location: Central area of the Site
Depth of hole: 0.8 mbgs

TP08-25
East area of the Site
0.75 mbgs

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	31.3	--
4.0	31.2	0.03
5.0	31.1	0.10
5.5	31.0	0.20
6.5	30.9	0.10
7.5	30.2	0.70
8.0	30.0	0.40
9.0	29.7	0.30
10.0	29.4	0.30
11.0	29.1	0.30
12.0	28.8	0.30
13.0	28.5	0.30
14.0	28.2	0.30
15.0	27.9	0.30

Elapsed Time (minutes)	Permeameter Reading (cm)	Rate (cm/min)
0.0	18.6	--
0.5	16.4	4.40
1.5	15.1	1.30
2.0	13.9	2.40
2.5	12.5	2.80
3.0	11.0	3.00
3.5	9.9	2.20
4.0	8.6	2.60
4.5	7.5	2.20
5.0	6.1	2.80
5.5	5.0	2.20
6.0	3.9	2.20
6.5	2.7	2.40
7.0	1.5	2.40
7.5	0.4	2.20

Quasi Steady Flow Rate ® (cm/min)	0.30	2.4 Over duration of the testing
Field-Saturated Hydraulic Conductivity (Kfs) (m/sec)	1.60E-06	1.30E-05
Estimated Infiltration Rate = (Kfs / 6E-11) exp (3.7363^-1) (mm/hr)	52.5	91.9



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