GEOTECHNICAL INVESTIGATION
500 Erbsville Road, Waterloo, Ontario

October 10th, 2025

Prepared for:
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1.0 INTRODUCTION

1.1 GENERAL

Stantec Consulting Ltd., (Stantec) has been requested by 10000507877 Ontario Inc. (Client) to conduct a geotechnical investigation for an existing residential land, located at 500 Erbsville Road, Waterloo, Ontario (Site).

At the time of the geotechnical investigation, a total of two blocks were proposed for 500 Erbsville Road. One block, Block 1, will be for the development of a stormwater management (SWM) pond in the southeastern corner of the Site and a road providing access to the proposed SWM pond. A storm sewer conveying flows from the proposed residential subdivision at 515 Erbsville (west side of Erbsville road) to the proposed SWM pond was proposed to be installed under the access road. A sanitary sewer crossing Erbsville Road could also be installed under the access road alignment to connect to the existing servicing easement on Woodlawn Place. The second block, Block 2, was to contain the existing woodlot and existing residential dwelling.

Stantec conducted a geotechnical investigation in January 2025 and issued a draft report titled 'Geotechnical Investigation, 500 Erbsville Road, Waterloo, Ontario' dated March 7, 2025, supplementing the subsurface data by using the borehole logs from the Stantec 2023 hydrogeological investigation.

An updated Draft plan of subdivision was issued in July 2025, with changes to the block boundaries. Additionally, Block 1 has been split into two blocks, Block 1 and Block 3. Block 3 comprises of a 0.074 ha parcel located at the entrance of the site in the southeast corner. The proposed development plan is shown on **Drawing No.1 – Appendix B.**

Based on the changes of the site layout, this report pertains only to the Blocks 1 and 3 of 500 Erbsville Road, containing the SWM pond, access road, and proposed storm and sanitary sewers under the access road alignment.

This updated report provides geotechnical design and construction recommendations for the development concept issued in July 2025 based on the results of the geotechnical investigations conducted in January 2025 and hydrogeological investigations carried out in 2023. No new investigations were carried out for the revised development concept.

Stantec is also conducting a geotechnical investigation for the adjacent property at 515 Erbsville Road. The findings and recommendations for the 515 Erbsville Road will be issued under a separate cover.

A hydrogeology study by Stantec is currently ongoing, and a draft letter titled "Interim Hydrogeological Assessment / 2023 Groundwater Monitoring Report 500 & 515 Erbsville Road, City of Waterloo, Ontario" was issued on September 9th, 2024. All the relevant findings from the letter have been incorporated into this report.

Limitations associated with this report and its contents are provided in the statement included in **Appendix A**.

1.2 REVIEWED DOCUMENTS

Stantec has reviewed the following documents in preparation of this report:

- "Conceptual Stormwater Management Facility – 500 Erbsville Road" Issued in September 2024 by Stantec. This is referred to within the report as the "Original Concept Plan"
- "Preliminary Grading Plan – 500 Erbsville Road – Drawing No. C-401" issued in July 2025 by Stantec. This is referred to within the report as the "Revised Concept Plan"

2.0 PROJECT AND SITE DESCRIPTION

The Site is located at 500 Erbsville Road, Waterloo, Ontario, comprising of an irregularly shaped parcel with an area of approximately 3.7 hectares. The Site is bounded by existing urban development on its north, south, east, and by Erbsville Road on its west. An existing stormwater management pond is located between the Site's western boundary and Erbsville Road. A single residential property is located within the southwest corner of the Site fronting Erbsville Road, with a paved driveway connecting to Erbsville Road. The paved driveway transition to a gravel laneway that extends to the southeastern corner of the property, where a shed is located. There are three wetlands located on the Site, two wetlands cover the middle portion of the Site between northern boundary and gravel road running along the southern boundary, and the third smaller wetland is located between the shed and eastern Site boundary.

The revised concept plan splits Block 1 into two blocks, labeled as Block 1 and Block 3. Block 1 and will be used for the creation of a 0.9-hectare SWM pond with a permanent pool level in the southeastern corner of the Site, Rip-rap will be placed along the eastern, northern and western perimeter of the SWM pond for drainage purposes. Block 3 will be used as driveway from Erbsville Road, with an area of 0.07 ha.

It is understood that the existing vehicular access/driveway will be shared between all blocks. A 300 mm to 450 mm diameter concrete storm sewer under the access road conveying flows from the proposed residential development from across the Erbsville road to the pond. There could also be a 200 mm diameter PVC sanitary sewer crossing Erbsville Road then directed along the access road alignment to connect to the existing service easement on Woodlawn Place.

A review of a preliminary Plan and Profile Drawing by CCL dated 20/05/04 titled 'Woodland Place Extension Plan and Profile Sta. 0+090 to End shows that the storm sewer will be installed at an approximate depth of 2 m below the existing grades, and the sanitary sewer is proposed to be installed at a depth of 3 m to 3.5 m below the existing grades.

The Site topography shows a high point at along the western boundary of the Site, and slope towards the east, with an 8 m topographic relief from Erbsville Road to the eastern boundary of the Site. The elevation varies from 358 m Above Mean Sea Level (AMSL) along the eastern boundary, to a low point of 350 m AMSL. Based on the concept plans, the 0.9-hectare 2-m deep SWM pond bottom will be set at elevation 349 m AMSL.

The conceptual development plan is shown on **Drawing No. 1 – Borehole Location Plan.**

3.0 REGIONAL GEOLOGY

The physiography of southern Ontario suggests that the Site is situated within the physiographic region of Waterloo Hills and features Kame Moraines as its predominant landform. The Waterloo Hills region spans approximately 776 square kilometers (192,000 acres), primarily within the Regional Municipality of Waterloo, extending into Blandford-Blenheim and North Easthope in Perth County. The landscape consists of sandy hills, including kames, kame moraines, and sandy till ridges, with outwash sands filling the hollows. Elevations range between 304.0 m to 426.0 m AMSL., with generally less rugged topography compared to typical kame moraines. The region extends west of Kitchener, from St. Clements to Ayr, and is notable for its abundance of fine sand and sandy till.[1]

Based on the Quaternary Geology Map[2], The surficial deposits of the Site consist of Ice-contact sand deposits which is characterized as poorly to well sorted and contains fine to coarse sand and gravel, which extends from Erbsville Road towards the east up to the central portion of the Site. The Ice-contact deposit is underlain by Maryhill till deposits which comprises of clayey deposits. The till deposit rises to the surface from the central portion and extending to the astern limits of the Site.

The Paleozoic bedrock geology of southern Ontario identifies the Site within the Salina Formation, which comprises limestone, dolostone, shale, sandstone, gypsum, and salt. This formation dates back to the Upper Silurian Epoch of the Silurian Period (approximately 416.0 to 443.7 million years ago) within the Paleozoic Era of the Phanerozoic Eon[3]. The bedrock elevation within the Site limits is at 282.0 m AMSL which indicates that the bedrock is generally at 78 m to 108 m below the existing ground surface.

4.0 SCOPE OF WORK

The project Scope of Work (SOW) consisted of drilling geotechnical boreholes, conducting geotechnical laboratory testing, and providing factual results obtained from geotechnical investigations as well as providing design recommendations for the proposed development.

The field and laboratory investigation components of the geotechnical investigation comprised of the following tasks:

- Contact the public utility authorities to confirm the locations of major public utilities.
- Retain a private utility locate firm to scan the intended borehole locations and mark any buried services or utilities within 3 m of the proposed location.
- Advance four (4) geotechnical boreholes to the following depths as shown in the borehole location plan.
    - Two (2) boreholes in the proposed access road area, advanced to 7.6 m below ground surface (BGS) or up to auger refusal, whichever comes first. Each borehole was equipped with a

[1] The Physiography of Southern Ontario, third edition by L.J. Chapman and D.F. Putnam, 1984.
[2] Karrow, P.F. 1993. Quaternary Geology, Stratford area; Ontario Geological Survey, Map 2559, scale 1:50 000.
[3] Bedrock geology of Ontario, southern sheet; Ontario Geological Survey, Map2544, scale 1:1 000 000.

standpipe style monitoring well extending to termination depth with a 3 m screen, covered with a lockable monument casing.
  - Two (2) boreholes in the proposed stormwater management facility advanced to 9.6 m below ground surface (BGS). Each borehole was equipped with a standpipe style monitoring well extending to termination depth with a 3.0 m screen, covered with a lockable monument casing.
- Collected soil samples in each borehole at regular intervals by driving a split tube sampler in accordance with the methods and procedures described in ASTM D1586. The samples obtained were placed in moisture-proof containers and transported to our geotechnical materials testing laboratory for classification and testing.
- Recorded the presence and depth (where encountered) of free groundwater in the open boreholes.
- The coordinates of the boreholes were obtained by Stantec personnel using Survey Equipment.

The Boreholes/Monitoring Well locations plan is shown on **Drawing No. 1 – Borehole Location Plan, Appendix B**.

4.1 UTILITY LOCATES

Prior to commencing the field investigation, Stantec contacted Ontario-One-Call to locate the underground public utilities to provide utility clearances at the staked borehole locations. Public locates do not locate services such as water, sewer, cable etc., on private properties, Stantec therefore retained the services of a utility locate company, True North Locates, to provide private utility locate services to identify any traceable underground utilities not identified by the public locates.

4.2 FIELDWORK

The borehole drilling component of the geotechnical investigation was carried out from January 31, 2025, to February 3, 2025. Four (4) boreholes were advanced to various depths, BH/MW01-25 to BH/MW04-25. The locations of the boreholes are shown on the borehole location plan included on **Drawing 1 – Borehole Location Plan** included in **Appendix B.**

Stantec retained the services of DrillTech Ltd. to complete the field scope of work. The boreholes were advanced using a track mounted CME75 drill rig equipped with solid stem augers. Stantec field personnel recorded the conditions encountered in the boreholes. Soil samples were recovered at regular intervals using a 50 mm (outside diameter) split-tube sampler by conducting Standard Penetration Tests (SPTs) in accordance with the procedures outlined in ASTM specification D1586. Soil samples recovered from the boreholes were placed in moisture proof bags. All samples were returned to Stantec's laboratory for geotechnical classification. Groundwater conditions were recorded in the open boreholes upon completion of drilling, as well as in the monitoring wells approximately two weeks following installation.

Four monitoring wells were installed in all borehole locations. Boreholes BH/MW01-25 and BH/MW02-25 were equipped with a monitoring well to a depth of 7.6 m BGS, with a 3.1 m screen. Boreholes BH/MW03-25 and BH/MW04-25 were equipped with a monitoring well to a depth of 9.1 m BGS, with a 3.0 m screen.

A drilling program was conducted by Stantec in 2022 as a part of an ongoing hydrogeology study for the proposed Site. Stantec retained Aardvark Drilling Inc. to complete the drilling for the proposed monitoring wells. The Hydrogeology study involved drilling three (3) monitoring well across the Site, MW201-22 to

MW203-22. Only MW203-22 is within Block 1 proposed for the SWM pond. Soil samples were recovered at regular intervals using a 50 mm (outside diameter) split-tube sampler by conducting Standard Penetration Tests (SPTs) in accordance with the procedures outlined in ASTM specification D1586. It is noted that only MW203-22 is within the proposed SWM block.

Both drilling contractors installed the monitoring wells adhering to the construction requirements as outlined under Ontario Regulation 903 (O. Reg. 903) (MECP, 1990). Each monitoring well is constructed with 50 mm inside diameter, Schedule 40 polyvinyl chloride (PVC) pipe, having a No. 10 slot screen (0.01-inch slot) measuring 3.0 m in length. Backfilling of the screened interval consisted of silica sand to a height of approximately 0.3 m above the top of screen, followed by granular bentonite to ground surface to prevent a hydraulic connection from occurring between the screened formation and overlying soils. The completion of each monitoring well involved encasing the pipe stick-up in a lockable steel casing, with exception to BH/MW01-25 which was drilled on the driveway of the privately owned dwelling to the northwest of the Site and was equipped with a flush-mount casing. The installation details are shown on the borehole logs included in **Appendix C – Borehole Records.**

Symbols and Terms Used on Boreholes are included as **Appendix C1**. The borehole stratigraphic logs, reviewed by a professional engineer, including moisture content, SPT 'N' values, and laboratory results, are provided in **Appendix C2 – Borehole Records**.

4.2.1 BOREHOLE LOCATIONS SURVEY

Upon approval to proceed with the fieldwork, Stantec team marked the borehole locations on site with wooden stakes. Ground surface elevations at the borehole locations referenced to a geodetic datum and UTM coordinates (Zone 17 NAD 83) and are provided in Error! Reference source not found. below.

Table 4.1: Borehole Location and Elevation Survey

Borehole and Monitoring Well IDs	Ground Surface Elevation (m)	Advanced Depth (m BGS)	UTM Coordinates (Zone 17 NAD83)	
			Easting (m)	Northing (m)
BH/MW01-25	356.9	8.1	533436.4	4812858.3
BH/MW02-25	354.9	8.1	533474.4	4812885.1
BH/MW03-25	353.6	9.6	533520.4	4812898.4
BH/MW04-25	351.8	9.6	533612.2	4812932.0
MW203-22	350.3	9.1	533587.0	4812974.0

4.3 LABORATORY TESTING

4.3.1 Geotechnical Analysis

All soil samples obtained from the boreholes were subjected to visual and tactile examination upon return to the geotechnical and construction materials testing laboratory. The geotechnical laboratory testing was completed on a number of samples, as shown in **Table 4.2**.

Table 4.2: Geotechnical Laboratory Testing Program

Laboratory Test	Number of Samples Tested
ASTM D2216-10 – Natural Moisture Content	29
ASTM D422-63 (2007) – Grain Size Distribution with Hydrometer	5
ASTM D4318-10 – Atterberg Limits	5

The results of the laboratory tests are discussed in the text of this report and are plotted on the respective borehole logs included in **Appendix C2 – Borehole Records.** The detailed geotechnical laboratory tests results are included in **Appendix D1.**

Unless specific instructions are received to the contrary, the samples will be discarded three (3) months after issue of this report.

5.0 RESULTS OF INVESTIGATION

5.1 FRAME OF REFERENCE

The soils encountered in the boreholes and reported herein have been classified in accordance with the Unified Soil Classification System as defined in ASTM D2487 per Unified Soil Classification System (USCS) and D2488 per visual-manual method.

It should be noted that the internal diameter (I.D.) of the SPT sampler is 38 mm and hence the grain size test results and soil classifications may not reflect the entire gravel size fraction which extends to 75 mm diameter. The presence of cobbles (particles from 75 mm to 300 mm) and boulders (particles > 300 mm) were inferred to be present in specific stratum and are described separately from the gravel content.

It should also be noted that the stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling and should be considered approximate only.

5.2 OVERVIEW OF CONDITIONS

The subsurface conditions encountered at the borehole locations are provided on the Borehole Records in **Appendix C**, along with an explanation of the symbols and terms used in the Borehole Records. The subsurface stratigraphy can be summarized as follows:

- Pavement Structure comprised of Asphalt and Granular Base (encountered in BH/MW01-25)
- Topsoil (encountered in BH/MW02-25, BH/MW03-25, and BH/MW04-25); underlain by,
- Silt with Sand (encountered in BH/MW01-25 and BH/MW02/25)
- Sandy Silty Clay Till, Lean Clay with Sand Till

The following paragraphs provide additional information on the soil strata encountered in the boreholes. The following is intended to summarize the conditions encountered; the Borehole Records provided in **Appendix C** should be used as the primary source of information supplemented by the information provided in the following sections. The soil conditions shown on the records are a direct extraction from the associated boreholes.

5.3 PAVEMENT STRUCTURE

Pavement was encountered at the surface of borehole BH/MW01-25. The pavement structure comprises of 30 mm of asphalt pavement underlain by 270 mm of granular subbase, which is typical of residential driveway structures.

The existing pavement appeared to be in 'fair' condition. The pavement subbase was observed to be in a dense state, with an SPT N value of 37 per 0.3 m penetration. The subbase was observed to be damp to moist.

5.4 TOPSOIL

Approximately 400 mm to 600 mm thick topsoil was present at the ground surface of three (3) borehole locations. The topsoil contained rootlets and is comprised of clayey silt to silty sand. The thickness of the topsoil can be attributed to the tilling of the surface for agricultural purposes. **Table 5.1** below shows the thickness of the topsoil across the Site.

Table 5.1: Topsoil Thickness at Each Borehole Location

Borehole IDs	Topsoil Thickness
BH/MW02-25	500
BH/MW03-25	400
BH/MW04-25	600

5.5 SANDY SILT, SILT WITH SAND

A non-cohesive deposit of poorly graded sandy silt was encountered in boreholes BH/MW01-25, BH/MW02-25. The sandy silt layer was encountered below the topsoil/road base in the western portion of the Site extending southwest towards Erbsville Road. The thickness of the layer is approximately 2 m, which corresponds with elevations between 355.4 to 353.4 m AMSL. The layer was observed to be brown in colour, and it was described as moist to wet.

The SPT N-values obtained from the sand layer during the investigation ranged from 4 to 10 blows per 0.3 m penetration, indicating a loose to compact consistency. The moisture content was 21%, indicating wet conditions.

Grain size distribution and Atterberg Limits tests were completed on select samples. The results of the tests are shown in **Table 5.2** below.

Table 5.2: Grain Size Distribution and Atterberg Limits - Silt with Sand

Borehole	Depth	Grain Size (%)				Wn (%)	Atterberg Limits (%)			Soil Classification
	(m BGS)	Gravel	Sand	Silt	Clay		LL	PL	PI	
BH/MW02-25	2.5	2	24	59	15	13	14	13	1	SILT with SAND(ML)

Based on the results of the grain size distribution, the layer is classified as Silt with Sand (ML)

5.6 SANDY SILTY CLAY TILL, LEAN CLAY WITH SAND TILL

A cohesive deposit of sandy silty clay to lean clay with sand was encountered below the sand and silt in boreholes BH/MW01-25 and BH/MW02-25 and below the topsoil in boreholes BH/MW03-25 and BH/MW04-25.

It was observed that the clay content increased from the central portion of the Site to the eastern boundary. The cohesive layer extended from 0.4 m to the termination depth of 9.6 m, which corresponds to elevations between 355.1 to 342.2 m AMSL. It was noted that the layer was to be brown to grey in colour, and it was described as moist to wet.

The SPT N-values obtained from the layer ranged between 9 to 35 in blows per 0.3 m penetration, indicating a stiff to hard consistency (generally very stiff). The moisture content ranged between 12% to 35%, indicating a moist to wet conditions (generally moist). A higher moisture content was reported in the samples taken closer to ground surface.

Grain size distribution and Atterberg Limits tests were completed on select samples. The results of the tests are shown in **Table 5.3** below.

Table 5.3: Grain Size Distribution and Atterberg Limits - Sandy Silty Clay

Borehole	Depth (m BGS)	Grain Size (%)				Wn (%)	Atterberg Limits (%)				Activity	Soil Classification
		Gravel	Sand	Silt	Clay		LL	PL	PI	LI		
BH/MW03-25	2.5	4	31	52	13	15	16	12	4	0.75	0.31	SANDY SILTY CLAY(CL-ML)
BH/MW03-25	7.8	1	29	51	19	13	16	11	5	0.40	0.26	SANDY SILTY CLAY(CL-ML)
BH/MW04-25	3.3	0	22	52	26	15	20	12	8	0.38	0.31	LEAN CLAY with SAND(CL)
BH/MW04-25	4.8	1	18	45	36	22	23	12	11	0.91	0.31	LEAN CLAY with SAND(CL)

Notes:
1. Fines denote fraction passing the No. 200 sieve.
2. Wn denotes the natural water content.
3. LL, PL, and PI denote Liquid Limit, Plastic Limit and Plasticity Index, respectively.
4. LI denotes Liquidity Index = (Wn - PL)/PI
5. Soil classification in accordance with USCS (ASTM D2487)

The liquidity index (LI) is a parameter that is useful for predicting the consolidation state of the layer. Based on a review of the limits, the liquidity was calculated for the samples above. The LI ranged between 0.38 to 0.91 which indicates that the clays are normally consolidated to slightly over consolidated state.

Activity is a parameter that is useful for indicating the anticipated swelling or contraction potential of clays based on exposure to moisture. The activity of the soils encountered ranged between 0.31 to 0.38, indicating that the clays on site are in an inactive state, which corresponds minimal volume change with moisture content variations.

5.7 GROUNDWATER

Four (4) monitoring wells were installed as a part of the geotechnical investigation, The depth of the monitoring wells ranged between 7.6 to 9.1 m BGS. Water levels were measured in February 2025 for the boreholes installed during the geotechnical investigation.

Available information has been reviewed from the on-going hydrogeology study. Three (3) monitoring wells were installed within the Site as a part of the hydrogeology study, however, only MW203-22 is within the proposed SWM area. The depth of the monitoring well 9.1 m BGS.

The depth and elevations of the groundwater encountered within the monitoring wells are provided in **Table 5.4** below arranged in a higher to lower topography order**.**

Table 5.4: Well Details and Water Level Measurement

Monitoring Well #	Ground surface Elevation (m AMSL)	Advanced Depth (m BGS)	Well Depth (m BGS)	Water Level Measurements		Date
				Depth (m BGS)	Elevation (m ASL)	
MW203-22	350.3	9.14	8.32	4.03	346.30	20-Jan-23
BH/MW04-25	351.8	9.6	9.14	1.00	350.80	21-Feb-25
BH/MW03-25	353.6	9.6	9.14	1.77	351.80	21-Feb-25
BH/MW02-25	354.9	8.08	7.62	1.00	353.90	21-Feb-25
BH/MW01-25	356.9	8.08	7.62	1.65	355.20	21-Feb-25

Based on the water level measurements, the groundwater elevations range between 346.3 m and 351.8 m AMSL across the proposed SWM pond. It is noted that BH/MW03-25, BH/MW04-25 and MW203-22 are located within the proposed SWM pond.

The groundwater level is subject to seasonal fluctuation and rainfall patterns and will influence the water levels.

6.0 GEOTECHNICAL ENGINEERING DESIGN AND RECOMMENDATION

It is understood that the proposed project will include the construction of a SWM pond in southeastern corner of the Site, construction of an access road from Erbsville Road to the proposed SWM pond, and installation of storm and sanitary sewers within the access road alignment. No residential or commercial developments are proposed for the Site. Some earthworks will be required to achieve the proposed grades for the SWM pond.

As per the conceptual stormwater management facility drawing (161414128_C-800HX dated September 12, 2024), the proposed topographic high elevation for the SWM pond will be 351 m AMSL, and proposed low topographic elevation of the SWM pond will be 347.5 m AMSL.

The geotechnical comments, discussion, and recommendations are provided in the following sections for the preliminary design and construction of the planned SWM pond and road development. Based on the results of the geotechnical investigation, the Site is considered suitable for the proposed development from a geotechnical point of view, subject to the recommendations discussed in the following sections.

6.1 GRADING

Based on the soil stratigraphy, it is anticipated that non cohesive material will be encountered at the surface along the western extent of the Site along the access road. The subsurface material changes to cohesive clay from the central portion of the Site extending to the east toward the proposed location of the SWM pond. The Revised Site Plan indicates that the bottom of the SWM pond will be at an elevation of 347.5 m AMSL, which indicates approximately a 3 m cut into the native subgrade. Recommendations pertaining to the construction of the SWM pond are included in **Section 7.4.**

The existing shed structure is within the footprint of the proposed SWM pond and therefore will require demolishing. The foundations and slab-on-grade of the existing shed structure and must be completely removed and void thus created should be backfilled using the recommendation provided in **Section 6.1.1.**

6.1.1 Compacted Fill

It is anticipated that the upper 0.4 to 0.6 m of the Site consists of organic rich silty clay to sandy silt topsoil. Topsoil, organic rich or deleterious material should be removed prior to Site grading activities. The subgrade soils exposed after the removal of the unsuitable material should consist of a native mineral soil. The subgrade soils should be visually inspected by a geotechnical engineer; compacted and proof rolled using appropriate equipment, compatible with the type of soil.

Fine-grained on-Site soils such as cohesive clays and silty clays/clayey silts, provided their moisture content is stringently controlled within ±2 percent of their respective optimum moisture contents. The on-Site material should be placed in thin layers (200 mm thick or less) and compacted to a minimum of 100 percent of its Standard Proctor Maximum Dry Density (SPMDD).

Drying of excavated on-Site soils may be required depending on the weather conditions at the time of construction or the depth of excavation. Any materials with high water content values can be air-dried or mixed with drier material before reuse as compacted fill.

All subgrade filling and compaction operations must be conducted under supervision of the geotechnical engineer.

It is anticipated that the most severe loading conditions will be during the construction of the SWM pond. It is recommended that an access road should constructed on site prior to completing the SWM pond earthworks in the movement of trucks on site during the construction. The access road may be constructed using excavated engineered fill material in accordance with the recommendations above, subject to approval by a geotechnical engineer.

6.2 DEPTH OF FROST PENETRATION

The design depth of frost penetration in the general Site area is 1.4 m in accordance with the Ontario Provincial Standard Drawing (OPSD) 3090.101.

7.0 CONSTRUCTION RECOMMENDATION

7.1 TEMPORARY EXCAVATIONS AND GROUNDWATER CONTROL

Decisions regarding shoring methods and sequencing are the responsibility of the Contractor. Temporary protection systems shall be designed in accordance with OPSS.MUNI 539 and the designs shall be carried out by a licensed Professional Engineer experienced in shoring design. Support systems for shallower excavations shall be installed in accordance with OPSS.MUNI 404.

All excavations must be carried out in accordance with the guidelines outlined in the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. Where workers must enter excavations extending deeper than 1.2 m, the trench walls must be suitably sloped and/or braced in accordance with the OHSA. For temporary excavations that will not exceed 2 m in depth, the OHSA soil classifications are:

- Sandy silt Soils – Type 3 soil above the ground water level and Type 4 soil below the ground water level.
- Cohesive Clay Soils – Type 2 soil above the ground water level and Type 3 soil below the ground water level.

The side slopes of temporary excavations may be formed no steeper than 1H:1V for Type 3 soils and 3H:1V or flatter for Type 4 soils. If an excavation contains more than one type of soil, the excavation requirements should be based on the highest soil type number. Excavations at steeper inclinations will require temporary support. Excavations should be carried out in accordance with OPSS.PROV 401.

Based on the groundwater monitoring program, the groundwater elevations range from 346 to 355 m AMSL across the Site and 346.3 m and 351.8 m AMSL within the SWM pond footprint. Dewatering will therefore be required for the SWM pond excavation and utility installation. Borehole advanced within the proposed SWM pond area show the presence of fine-grained clayey soils at and extending below elevation 349 m AMSL. Excavation for utilities will extend to elevations 348 m to 349 m AMSL. As such groundwater ingress into an open excavation from embedded silt and sand seams should therefore be expected in low to moderate magnitudes, which can be handled using conventional filtered sump pumping techniques. However, the glacial tills are known to contain isolated large pockets of water. The contractor is referred to the Stantec hydrogeological study for the detailed dewatering recommendations.

7.2 SITE SERVICING

The predominant subgrade soils beneath the storm and sanitary service pipes will consist of very clayey till soils, which would provide suitable support to the proposed service utility pipes. Prior to installation of the services, the subgrade should be inspected by an experienced geotechnical technician. If any very loose or soft areas are detected during inspection, they should be excavated and replaced with compacted granular material such as OPSS.MUNI 1010 Granular A or Granular B Type II.

The pipe bedding for the services should be conventional Class B pipe bedding comprising a minimum 150 mm thick layer of OPSS.MUNI 1010 Granular ‘A’ aggregate below the pipe invert. The bedding course may be thickened if portions of the subgrade become wet during excavation. OPSS.MUNI 1010 Granular A type aggregate should be provided around the pipe to at least 300 mm above the top, and the bedding should be compacted to 98% SPMDD. The bedding and cover on each side of the pipe should be completed simultaneously and at no time should the difference from one side of the pipe to the other exceed 200 mm.

These recommendations should be confirmed with the pipe manufacturer and care must be taken to avoid incurring damage to the services. Pipe manufactures may have additional/alternative requirements that should be reviewed by the Designer and Contractor prior to installation of the services.

Service lines installed outside of heated areas should be provided with a minimum 1.2 m of soil cover or equivalent insulation for frost protection.

Additional specific comment to the design of buried services and utilities in view of the subsurface conditions encountered in the boreholes and in consideration of good industry practice is provided as follows.

7.3 TRENCH BACKFILL

The trenches above the specified pipe bedding should be backfilled with inorganic on-Site soils that are not excessively wet placed in 200 mm thick lifts and compacted to at least 95% SPMDD. Any trench backfill below a pavement structure should be compacted to 98% SPMDD within 1 m from the top of subgrade level. Based on the results of in-situ moisture content tests carried out on the native overburden deposits, the materials may be suitable for reuse as trench backfill. Any overly wet material may require drying prior to reusing as backfill.

7.4 STORMWATER MANAGEMENT POND

Boreholes BH/MW03-25, BH/MW04-25 and MW203-22 are located within the proposed SWM pond. These boreholes revealed typical site stratigraphy conditions for the Site, which include topsoil, underlain by cohesive silty clay to lean clay with sand. The native soils can provide suitable support for the berm construction.

The proposed SWM pond elevations will range from 351 top of the berm to 347.5 m AMSL at the bottom of the pond. The ground surface grades around the pond must be sloped away to minimize the potential for overland flow that could damage the sidewalls of the pond. Preliminary design of side slopes should include inclinations of 3H to 1V or flatter slopes above and below the permanent pond level. Slope drains may be needed to ensure stability of the slopes in areas where seepage is a concern.

For berm construction, the on-site sandy lean clay to lean clay with sand (CL) till soils should be placed in 200 mm thick loose lifts. Each lift should be uniformly compacted to achieve a minimum of 98% SPMDD using vibratory compaction equipment. Recommendations provided in Section6.1.1 are relevant and should be considered during construction.

An allowable Factor of Safety within the range of 1.5 - 2.0 is usually considered for base heave. It is noted that. due to the requirement of the permanent pool level, there will be water inside the pond following construction, which will improve the Factor of Safety.

The Contractor should determine the appropriate groundwater control/dewatering measures are commensurate with their equipment and methods and maintain the excavation in stable conditions. The Contractor's method should be provided for the Engineer's/Owner's Representative Civil Engineer's review.

The native surficial topsoil identified in the boreholes advanced within the SWM Pond are subject to softening and loss of strength in the presence of excess moisture originating from precipitation and/or ground surface runoff.

7.4.1 Low Permeability Liner and Pond Surface Treatment

Due to the requirement of a permanent pool level and the presence of sandy soils at shallow depths, it is recommended that prior to construction; a test pit program be conducted to confirm the soil stratigraphy to the bottom of the pond including laboratory testing to estimate the infiltration rate (Coefficient of Permeability) of the cohesive silty clay to lean clay with sand. Test pits may also help to infer the presence of and the potential impact of any artesian layer.

The typical threshold hydraulic conductivity for a contained SWM Pond (wet pond) is 10^{-5} to 10^{-6} cm/s. It is likely that founding the base of the SWM Pond in the cohesive till soil will meet this requirement. However, given the sand and silt contents present within the clay till, the use of a low-permeability liner may be required. If an adequate quantity of material is not available from the excavation for the pond, then a suitably approved off-site source would need to be identified.

The minimum recommended industry standard for the thickness of the low-permeability soil liner is 300 mm. The soil liner material can be placed in a 300 mm thick lifts, and compacted using a pad foot compactor, to achieve a minimum compaction of 95% of the materials SPMDD.

It is recommended that the base and side slopes of the pond be protected against erosion using either vegetation or granular/rip rap materials. Specific consideration should be provided to inflow/outfall areas and zones of the pond that may be subject to potential overland flow. In areas of inflow/outfall structures, a rip rap meeting the requirement of OPSS 1004 should be used.

8.0 PAVEMENT DESIGN AND CONSTRUCTION

Based on the review of the preliminary grading plans, it is proposed that the development will include the construction of the SWM pond access road, extending from Erbsville Road, heading east towards the SWM pond. It is anticipated that the access road will be used by light-duty maintenance vehicles only (pick-up trucks, and occasional dump truck) during the service life of the SWM pond. Based on this understanding, the following sections provide recommendations for the design and the construction of the proposed pavement.

8.1 SUBGRADE PREPARATION

Based on the borehole findings, the pavement subgrade for the proposed access roads will likely consist of compact sandy silt along the proposed access road, however, the possibility of encountering silty clay during the road construction should not be ruled out.

The subgrade comprising of native inorganic undisturbed soils consisting of sandy silt, lean clay, or approved compacted fill materials would provide adequate support to the pavement structure of the proposed access roads, provided a subgrade is proof-rolled and approved by the geotechnical specialist prior to the construction of the pavement structure.

Where there is existing fill or loose native material on the Site, caution needs to be exercised in the preparation of the subgrade on this material. It is recommended that any subgrades comprising of loose soils be inspected for obvious soft/loose areas and presence of deleterious materials. Should such areas be found, these should be replaced or treated as advised by the geotechnical engineer.

The fine-grained cohesive soils will be weakened by construction traffic when wet, especially if site work is carried out during periods of wet weather. During these weather conditions, an adequate granular working surface would be required to minimize subgrade disturbance. Subgrade preparation and fill construction should not be carried out in the winter.

Immediately prior to placing the granular base course, the subgrade soils shall be compacted and then proofrolled with a heavy rubber-tired vehicle (such as a loaded gravel truck). The subgrade shall be inspected for signs of rutting or displacement. Areas displaying signs of rutting or displacement shall be recompacted and retested or, the material should be excavated and replaced with well-compacted and clean fill.

The top of pavement shall be sloped (normally 2%) and the pavement subgrade shall be sloped at 3% towards the sides.

8.2 RECOMMENDED STRUCTURE

The following pavement thickness provided in **Table 8.1** may be used for the design of the access roads within the proposed development.

Table 8.1: Recommended Pavement – Component Thickness

Pavement Layer	Compaction Requirements	Access Road Pavement Design
Base Course: Granular 'A' (19mm Crusher Run)	100% Standard Proctor Maximum Dry Density (ASTM-D698)	200 mm
Subbase Course: Granular B (50mm Crusher Run)		300 mm
Geotextile	-	Terrafix 600R or equal

Some maintenance to replenish surface granular material will be required.

9.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in **Appendix A**. It is the responsibility of 10000507877 Ontario Inc. who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. Should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report.
- Basis of the report.
- Standard of care.
- Interpretation of site conditions.
- Varying or unexpected site conditions; and,
- Planning, design, or construction.

Respectfully Submitted,

STANTEC CONSULTING LTD.

APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

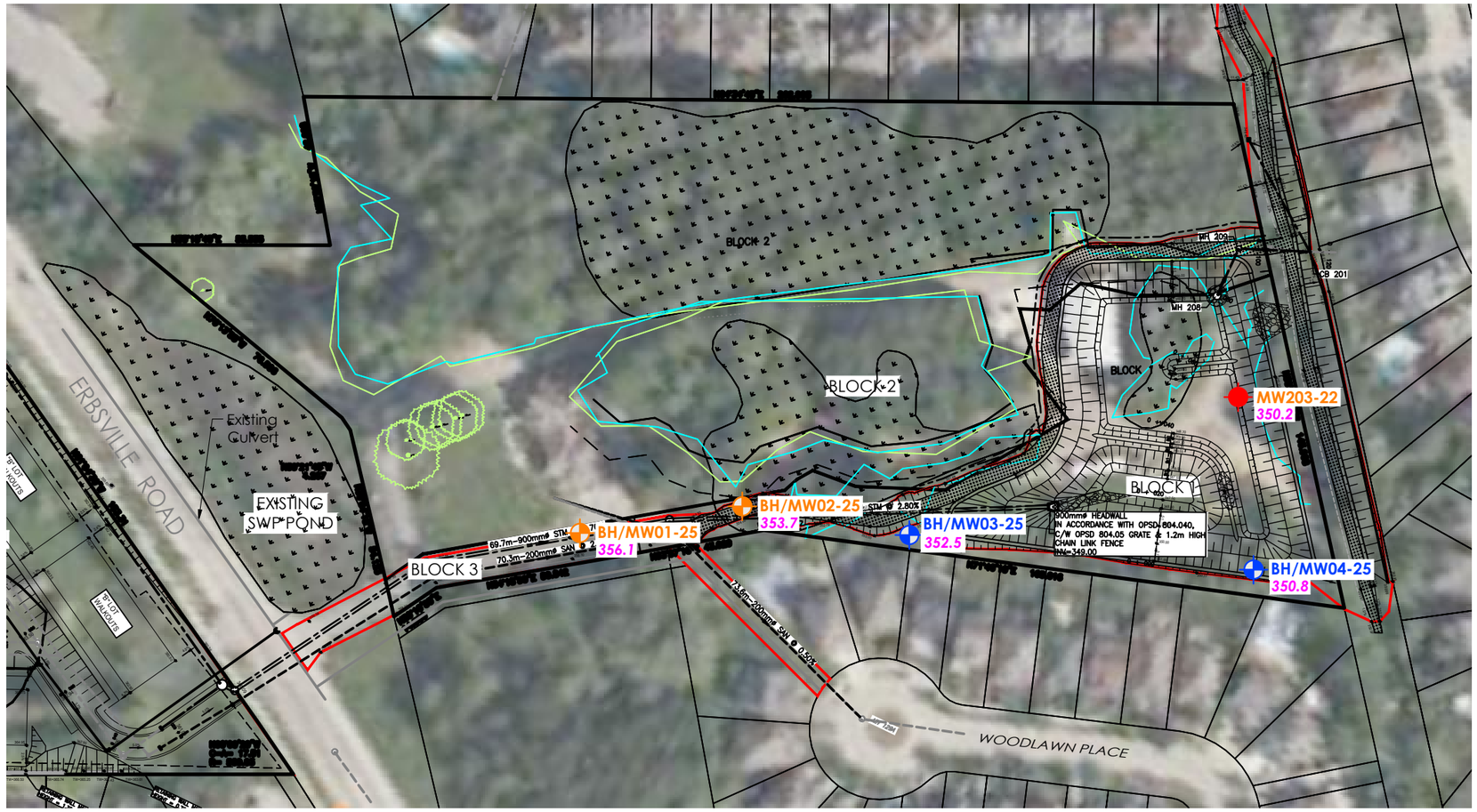
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

APPENDIX B

B.1 BOREHOLE LOCATIONS PLAN



Stantec
300 - 1331 Clyde Avenue
Ottawa, ON, Canada K2C 3G4
www.stantec.com

LEGEND

- BOREHOLE (6.1 m)
- BOREHOLE (9.76 m)
- MONITORING WELL (STANTEC, 2025)
- *350.2* GROUND SURFACE ELEVATION



KEY PLAN 1 : 50 000

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASEPLAN: 2000_161414128_C-FB.DWG, RECEIVED OCT. 8, 2025.
3. IMAGERY: © 2025 MICROSOFT CORPORATION © 2025 MAXAR © CNES (2025) DISTRIBUTION AIRBUS DS.

15m 0 15 30m
1 : 1500

OCTOBER 2025
Project No. 121626197

Client/Project
10000507877 ONTARIO INC
GEOTECHNICAL INVESTIGATION
500 ERBSVILLE ROAD, WATERLOO, ON

Drawing No.
1

Title
BOREHOLE LOCATION PLAN

T:\Autocad\Drawings\Project Drawings\2025\121626197\121626197_500 Erbsville_Borehole Plan_251009.dwg
Printed: Oct 09, 2025 By: G. Briones

APPENDIX C

C.1 SYMBOLS AND TERMS USED ON BOREHOLES

C.2 BOREHOLE LOGS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT



measured in standpipe, piezometer, or well



inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

Stantec

BOREHOLE RECORD

N: 4 812 858 E: 533 436

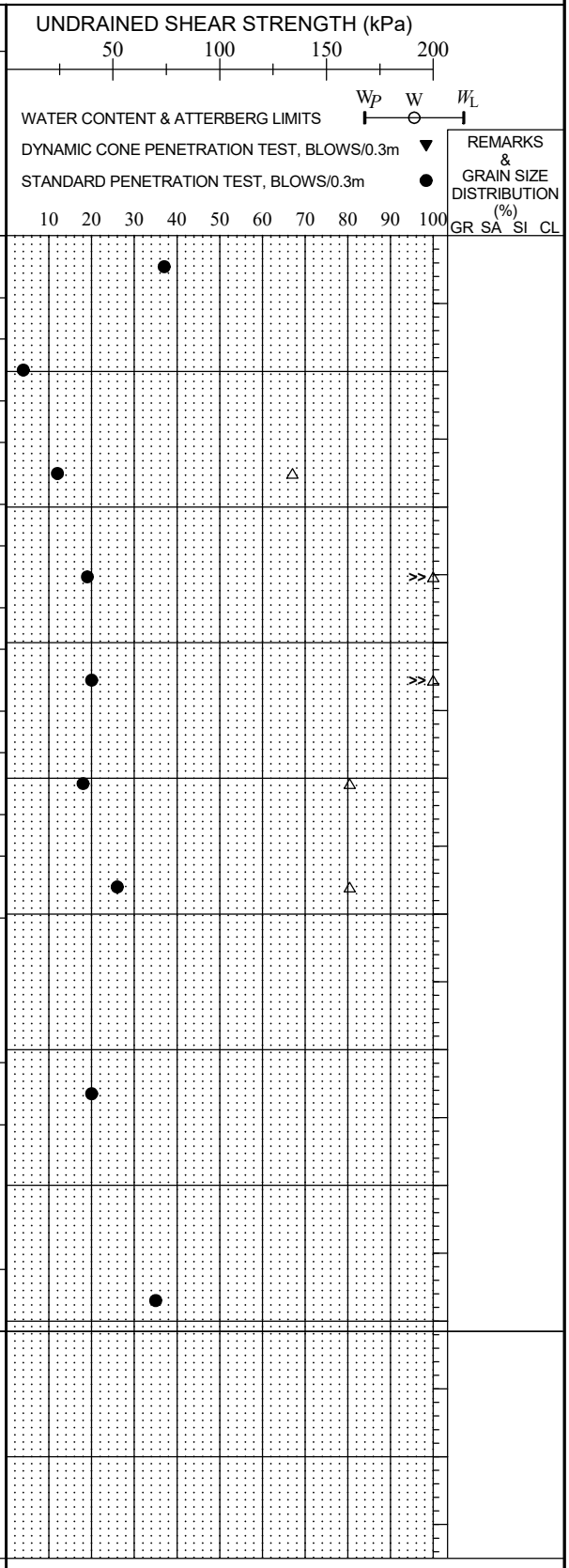
BH/MW01-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 01/31/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	DEPTH (ft)	SAMPLES TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
0	356.9		0				
	356.6	**PAVEMENT** - 30 mm Asphalt					
		FILL Sand and gravel Brown, compact, moist	1	SS	1	410/460	37
1		**SILT WITH SAND (ML)** Brown, very loose, moist	3	SS	2	180/460	4
	355.3		4				
		SANDY SILTY CLAY TILL (CL-ML) Brown, stiff, moist	6	SS	3	460/460	12
2	354.6		7				
		LEAN CLAY WITH SAND TILL (CL) Brown to grey, very stiff, moist to wet	8	SS	4	460/460	19
3			10	SS	5	460/460	20
			12				
4			13	SS	6	460/460	18
			14				
			15	SS	7	460/460	26
5			16				
			17				
			18				
			19				
6	350.8		20				
		SANDY SILTY CLAY TILL (CL-ML) Grey, very stiff to hard, wet	21	SS	8	460/460	20
7			22				
			23				
			24				
			25				
			26	SS	9	460/460	35
8	348.8		27				
		Borehole terminated at 8.1 m BGS Borehole caved at 6.7 m BGS and groundwater encountered at 3.0 m BGS	28				
			29				
9			30				
			31				



□ Field Vane Test, kPa

■ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

MONITORING WELL RECORD

N: 4 812 858 E: 533 436

BH/MW01-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 01/31/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE
0	356.9				
	356.6	**PAVEMENT** - 30 mm Asphalt			
		FILL Sand and gravel Brown, compact, moist	SS	1	37
1		**SILT WITH SAND (ML)** Brown, very loose, moist	SS	2	4
	355.3				
		SANDY SILTY CLAY TILL (CL-ML) Brown, stiff, moist	SS	3	12
2	354.6				
		LEAN CLAY WITH SAND TILL (CL) Brown to grey, very stiff, moist to wet	SS	4	19
3			SS	5	20
4			SS	6	18
			SS	7	26
5					
6	350.8				
		SANDY SILTY CLAY TILL (CL-ML) Grey, very stiff to hard, wet	SS	8	20
7					
			SS	9	35
8	348.8				
		Borehole terminated at 8.1 m BGS Borehole caved at 6.7 m BGS and groundwater encountered at 3.0 m BGS			
9					

VAPOUR CONCENTRATIONS — ● %LEL ▲ ppm — ● 20 40 60 80 — ▲ 100 200 300 400

DEPTH (ft): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

WELL CONSTRUCTION

LABORATORY ANALYSES:

Stantec

BOREHOLE RECORD

N: 4 812 885 E: 533 474

BH/MW02-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 01/31/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	DEPTH (ft)	SAMPLES TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
0	354.9		0				
	354.4	**TOPSOIL** Sandy silt Dark brown, very loose, moist	1	SS	1	460/460	4
1	353.4	**SILT WITH SAND (ML)** Brown, compact, wet	3	SS	2	410/460	10
2		**SANDY SILTY CLAY TILL (CL-ML)** Brown to grey, very stiff, moist	6	SS	3	460/460	16
		Wet spoon encountered	8	SS	4	460/460	20
3	351.1	Traces of organics	11	SS	5	100/460	16
4		**LEAN CLAY WITH SAND (CL) TILL** Grey, very stiff, moist	13	SS	6	460/460	22
			16	SS	7	460/460	16
6			21	SS	8	460/460	15
7							
8	346.8		26	SS	9	460/460	12
		Borehole terminated at 8.1 m BGS Borehole was open and groundwater encountered at 7.6 m BGS	27				
9			31				

UNDRAINED SHEAR STRENGTH (kPa)

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m ▼

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90 100

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

2 24 59 15

□ Field Vane Test, kPa

■ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

MONITORING WELL RECORD

N: 4 812 885 E: 533 474

BH/MW02-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 01/31/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	STRATA PLOT	WATER LEVEL	DEPTH (ft)	VAPOUR CONCENTRATIONS ● %LEL ▲ ppm (● 20 40 60 80 ▲ 100 200 300 400)	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE	WELL CONSTRUCTION
0	354.9				0					
	354.4	**TOPSOIL** Sandy silt Dark brown, very loose, moist			1		SS	1	4	
		SILT WITH SAND (ML) Brown, compact, wet			2					
1	353.4				3		SS	2	10	
		SANDY SILTY CLAY TILL (CL-ML) Brown to grey, very stiff, moist			4					
					5					
		Wet spoon encountered			6		SS	3	16	
2					7					
					8		SS	4	20	
		Traces of organics			9					
3					10		SS	5	16	
	351.1				11					
		LEAN CLAY WITH SAND (CL) TILL Grey, very stiff, moist			12		SS	6	22	
4					13					
					14					
					15		SS	7	16	
5					16					
					17					
					18					
					19					
6					20					
					21		SS	8	15	
					22					
					23					
7					24					
				▽	25					
					26		SS	9	12	
8	346.8									
		Borehole terminated at 8.1 m BGS Borehole was open and groundwater encountered at 7.6 m BGS			27					
					28					
					29					
9					30					
					31					

LABORATORY ANALYSES:

Stantec

BOREHOLE RECORD

N: 4 812 898 E: 533 520

BH/MW03-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 02/03/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	DEPTH (ft)	SAMPLES TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
0	353.6		0				
		TOPSOIL Sandy silty clay					
	353.1	Dark brown, stiff, moist	1	SS	1	460/460	9
		SANDY SILTY CLAY TILL (CL-ML) trace gravel	2				
1		Brown to grey, stiff to very stiff, moist to wet	3	SS	2	200/460	10
			4				
			5				
			6	SS	3	410/460	13
2			7				
		Silt with sand layer	8	SS	4	430/460	16
		Grey, wet	9				
			10				
3			11	SS	5	460/460	19
			12				
			13	SS	6	460/460	17
4			14				
			15				
			16	SS	7	460/460	13
5			17				
			18				
			19				
6			20				
		Wet spoon encountered	21	SS	8	460/460	9
			22				
7		▽	23				
			24				
			25				
			26	SS	9	460/460	10
8			27				
			28				
			29				
9			30				
	344.0		31	SS	10	460/460	14
		Borehole terminated at 9.6 m BGS	32				
10		Borehole was open and groundwater encountered at 7 m BGS	33				
			34				
			35				

UNDRAINED SHEAR STRENGTH (kPa)

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m ▼

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90 100

REMARKS & GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	4	31	52	13
	1	29	51	19

□ Field Vane Test, kPa

■ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

MONITORING WELL RECORD

N: 4 812 898 E: 533 520

BH/MW03-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 02/03/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE
0	353.6				
	353.1	**TOPSOIL** Sandy silty clay Dark brown, stiff, moist	SS	1	9
1		**SANDY SILTY CLAY TILL (CL-ML)** trace gravel Brown to grey, stiff to very stiff, moist to wet	SS	2	10
			SS	3	13
2		Silt with sand layer Grey, wet	SS	4	16
3			SS	5	19
4			SS	6	17
			SS	7	13
5					
6		Wet spoon encountered	SS	8	9
7					
8			SS	9	10
9					
	344.0		SS	10	14
10		Borehole terminated at 9.6 m BGS Borehole was open and groundwater encountered at 7 m BGS			

VAPOUR CONCENTRATIONS — ● %LEL ▲ ppm — ● 20 40 60 80 — ▲ 100 200 300 400

DEPTH (ft): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

WELL CONSTRUCTION

LABORATORY ANALYSES:

Stantec

BOREHOLE RECORD

N: 4 812 932 E: 533 612

BH/MW04-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 02/03/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	DEPTH (ft)	SAMPLES TYPE	NUMBER	RECOVERY (mm) TCR(%) / SCR(%)	N-VALUE OR RQD(%)
0	351.8		0				
		TOPSOIL Sandy silty clay, traces of organics, rootlets	1	SS	1	300/460	9
	351.2	Dark brown, stiff, moist	2				
1		**SANDY SILTY CLAY TILL (CL-ML)** trace gravel	3	SS	2	460/460	10
		Brown, stiff to very stiff, moist to wet	4				
			5				
2			6	SS	3	460/460	11
			7				
		Wet spoon encountered	8	SS	4	460/460	20
			9				
3	348.7		10				
		LEAN CLAY WITH SAND TILL (CL) trace gravel	11	SS	5	460/460	22
		Brown to grey, stiff to hard, moist to wet	12				
4			13	SS	6	460/460	11
			14				
			15				
5			16	SS	7	460/460	14
			17				
			18				
			19				
6			20				
			21	SS	8	130/460	15
			22				
7			23				
			24				
			25				
8			26	SS	9	460/460	31
			27				
			28				
			29				
9			30				
	342.2		31	SS	10	460/460	27
		Borehole terminated at 9.6 m BGS	32				
10		Borehole was open and groundwater encountered at 1.8 m BGS	33				
			34				
			35				

UNDRAINED SHEAR STRENGTH (kPa)

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC CONE PENETRATION TEST, BLOWS/0.3m ▼

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90 100

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

0 22 52 26

1 18 45 36

□ Field Vane Test, kPa

■ Remoulded Vane Test, kPa

△ Pocket Penetrometer Test, kPa

Stantec

MONITORING WELL RECORD

N: 4 812 932 E: 533 612

BH/MW04-25

CLIENT 10000507877 Ontario Inc — PROJECT No. 121626197

LOCATION 500 Erbsville Road, Waterloo, ON — DATUM NAD83

DATES: BORING 02/03/2025 — WATER LEVEL — TPC ELEVATION

DEPTH (m)	ELEVATION (m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES N-VALUE
0	351.8				
		TOPSOIL Sandy silty clay, traces of organics, rootlets	SS	1	9
	351.2	Dark brown, stiff, moist			
1		**SANDY SILTY CLAY TILL (CL-ML)** trace gravel	SS	2	10
		Brown, stiff to very stiff, moist to wet			
2			SS	3	11
		Wet spoon encountered	SS	4	20
3	348.7				
		LEAN CLAY WITH SAND TILL (CL) trace gravel	SS	5	22
4		Brown to grey, stiff to hard, moist to wet	SS	6	11
			SS	7	14
5					
6			SS	8	15
7					
8			SS	9	31
9					
	342.2		SS	10	27
10		Borehole terminated at 9.6 m BGS Borehole was open and groundwater encountered at 1.8 m BGS			

VAPOUR CONCENTRATIONS — ● %LEL ▲ ppm — ● 20 40 60 80 — ▲ 100 200 300 400

DEPTH (ft): 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35

WELL CONSTRUCTION

LABORATORY ANALYSES:

Monitoring Well: MW203-22

Project: Hydrogeological Assessment
Client: 10000507877 Ontario Inc.
Location: 500 Erbsville Rd, Waterloo, ON
Number: 161414339

Field investigator: Scott Hutchinson
Contractor: Aardvark Drilling Inc.
Method: Hollow-Stem Auger
Date started/completed: 19-Dec-2022

SUBSURFACE PROFILE				SAMPLE DETAILS				WELL DETAILS
Depth (ft) (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	N Value	GS Elev: 350.26 m AMSL TOC Elev: 351.10 m AMSL Easting: 533587 Northing: 4812974 Stick-up: 0.84 m
			350.87					
								Above Ground Casing 0.84 m stick up
0 — 0		Ground Surface	350.26					
		GRAVEL & COBBLES Some sand, loose, well graded	0.00 350.11					
		SAND Fine sand, some gravel, light yellowish brown (10YR 4/3), moist, loose, well graded	0.15 349.88	1	SS	17" 71%	4-3-4-5 (7)	
		SILTY CLAY Some gravel and sand, very dark grayish brown (10YR 3/2), moist, stiff, well graded	0.38					
				2	SS	6" 25%	2-2-7-12 (9)	
5			348.74					
		SAND Fine sand, yellowish brown (10YR 5/4), wet, compact, poorly graded	1.52	3	SS	15" 63%	3-7-8-7 (15)	
2			347.97					
		SANDY GRAVEL Yellowish brown (10YR 6/4), moist, compact, well graded	2.29 347.72	4	SS	18" 75%	13-9-10-8 (19)	Holeplug 0 to 4.97 m BGS
		SILTY CLAY Brown (10YR 5/3), moist, very stiff, poorly graded	2.54					
10			347.21					
		SANDY SILT Some gravel, very dark grayish brown (10YR 3/2), wet, stiff, well graded	3.05 347.01	5	SS	21" 88%	3-6-7-12 (13)	
		CLAY (TILL) Trace medium to coarse sand and gravel, very dark grayish brown (10YR 4/2), wet, firm, well graded	3.25					
4		Firm		6	SS	24" 100%	2-5-0-11 (5)	Water Level 20-Jan-2023 4.03 m BGS
15			345.53					203 mm Borehole Diameter 0 to 9.14 m
		SANDY SILT Fine to medium sand, light grayish brown (10YR 6/2), firm, wet, moderately graded	4.72 345.36	7	SS	23" 96%	5-8-11-11 (19)	
		CLAY (TILL) Trace medium to coarse sand and gravel, light brownish gray (10YR 6/2), wet, very stiff, well graded	4.90					
6								
20		Dark grayish brown (10YR 4/2), stiff at 6.10 m BGS		8	SS	21" 88%	2-4-5-6 (9)	No. 10 Slot Schedule 40 PVC Screen 5.27 to 8.32 m BGS
								No. 2 Silica Sand 4.97 to 9.14 m BGS
25		Very stiff		9	SS	13" 54%	8-8-10-15 (18)	
8								
30			341.12					
		End of Borehole	9.14					
10								

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

AGS - Above Ground Surface

Screen Interval: 5.27 - 8.32 m BGS
Sand Pack Interval: 4.97 - 9.14 m BGS
Well Seal Interval: 0.00 - 4.97 m BGS

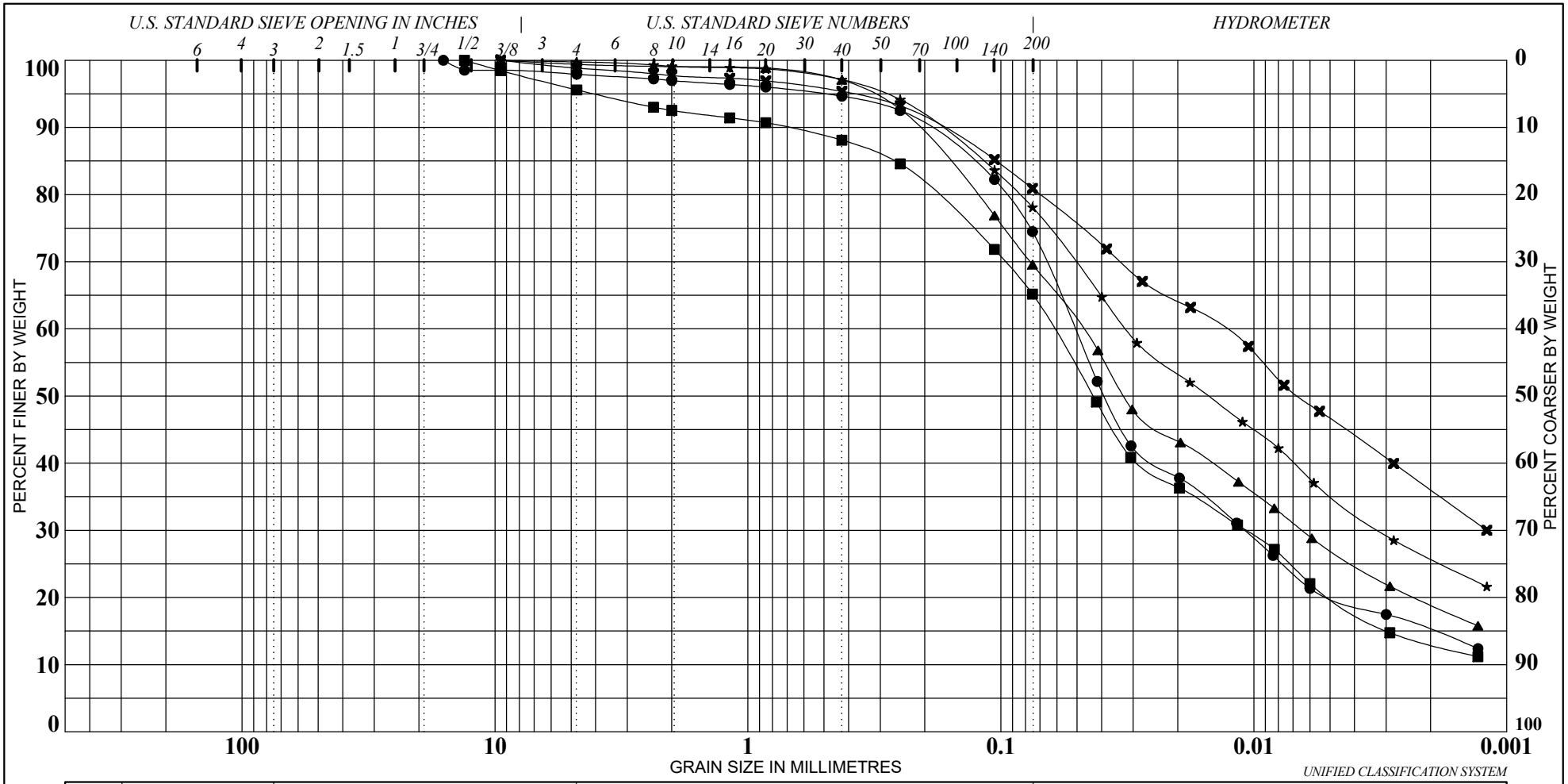
Stantec

Drawn By/Checked By: SH/ GW

STANTEC BOREHOLE AND WELL - CLUST 11X17 500-ERBSVILLE_BOREHOLE_LOGS.GPJ STANTEC - DATA TEMPLATE.GDT 5/14/24 DRSMITH

APPENDIX D

D.1 LABORATORY TESTING RESULTS



BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample		Depth (m)	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
●	BH02-25	2.5	SILT with SAND(ML)	13	14	13	1	2	24	59	15
■	BH03-25	2.5	SANDY SILTY CLAY(CL-ML)	15	16	12	4	4	31	52	13
▲	BH03-25	7.8	SANDY SILTY CLAY(CL-ML)	13	16	11	5	1	29	51	19
★	BH04-25	3.3	LEAN CLAY with SAND(CL)	15	20	12	8	0	22	52	26
✖	BH04-25	4.8	LEAN CLAY with SAND(CL)	22	23	12	11	1	18	45	36

Stantec

Project: 500 Erbsville Rd. Waterloo

Location: 500 Erbsville Road, Waterloo, ON

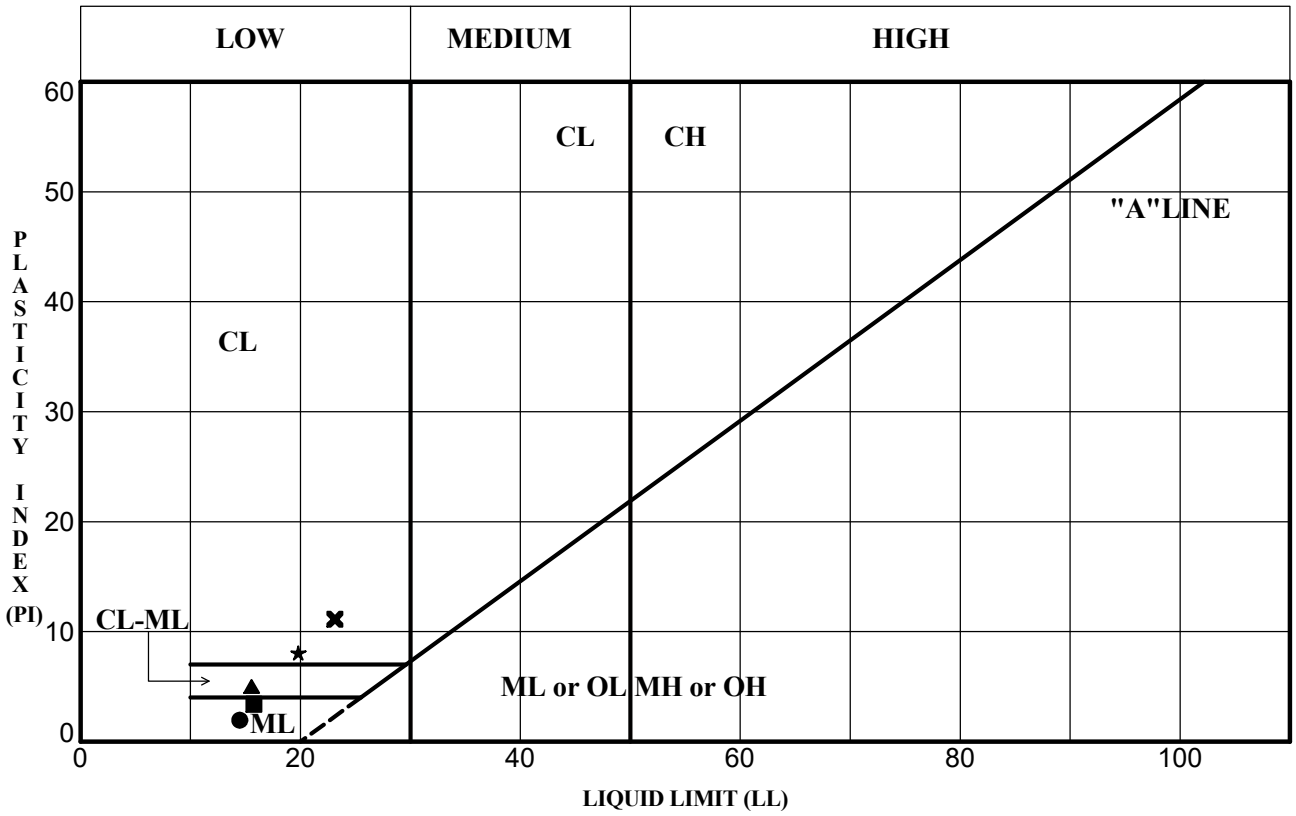
Project No.: 121626197

GRADATION CURVE (ASTM D422)

Figure: 1

Remarks: More information will be available upon request

PLASTICITY CHART



	Specimen	Depth (m)	LL	PL	PI	Fines	W%	Classification
●	BH02-25	2.5	14	13	1	74	13	SILT with SAND(ML)
■	BH03-25	2.5	16	12	4	65	15	SANDY SILTY CLAY(CL-ML)
▲	BH03-25	7.8	16	11	5	70	13	SANDY SILTY CLAY(CL-ML)
★	BH04-25	3.3	20	12	8	78	15	LEAN CLAY with SAND(CL)
✖	BH04-25	4.8	23	12	11	81	22	LEAN CLAY with SAND(CL)

Stantec

Project: 500 Erbsville Rd. Waterloo

Location: 500 Erbsville Road, Waterloo, ON

Project No.: 121626197

ATTERBERG LIMITS
(ASTM D4318)

Figure: 2

Remarks: More information will be available upon request

STN13-ATTERBERG 121626197.GPJ STANTEC_MARKHAM_DATA_TEMPLATE 2015-05-20.GDT 2/20/25

PROJECT # 121626197

LAB#: 1626

DATE: 18-Feb-25

PROJECT: **500 Erbsville Road, Waterloo**

MOISTURE CONTENT

BH	DEPTH (m)	SAMPLE	Moisture Content %
BH02-25	0.2	1	34.8
BH02-25	1.0	2	20.6
BH02-25	1.8	3	13.1
BH02-25	2.5	4	13.5
BH02-25	3.3	5	15.8
BH02-25	4.0	6	12.8
BH02-25	4.8	7	23.6
BH02-25	6.3	8	16.9
BH02-25	7.8	9	12.5
BH03-25	0.2	1	16.5
BH03-25	1.0	2	22.8
BH03-25	1.8	3	13.3
BH03-25	2.5	4	15.0
BH03-25	3.3	5	12.4
BH03-25	4.0	6	19.3
BH03-25	4.8	7	13.5
BH03-25	6.3	8	16.1
BH03-25	7.8	9	13.3
BH03-25	9.4	10	16.8
BH04-25	0.2	1	41.1
BH04-25	1.0	2	34.9
BH04-25	1.8	3	22.7
BH04-25	2.5	4	23.9
BH04-25	3.3	5	15.4
BH04-25	4.0	6	17.9
BH04-25	4.8	7	21.8
BH04-25	6.3	8	18.2
BH04-25	7.8	9	13.5
BH04-25	9.4	10	17.1