

Geotechnical Engineering Report

New Fire Station
Scott Avenue, Paris, ON

County of Brant
Revised Report

June 25, 2025
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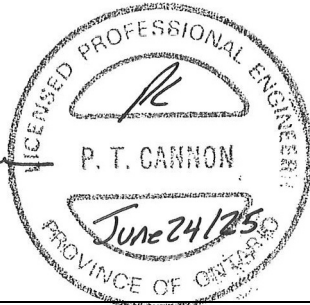
County of Brant

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1 Introduction

Englobe Corp. (Englobe) was retained by the County of Brant to carry out a geotechnical investigation in support of the proposed new fire station located at the north side of Scott Avenue and east of Pinehurst Road in Paris, Ontario, as shown on Drawing 1 in Appendix A.

The new fire station building will be single storey, slab-on-grade construction and cover a plan area of approximately 915 sq. m. A 260 sq. m future paramedic station is proposed at the west side of the fire station building. Light duty (car parking) pavements will be built along the north and northeast perimeter of the site and heavy duty (fire trucks) pavements will be built on the north and south sides of the building (entering and exiting the fire bays) and along the east side of the building from Scott Avenue. It is understood that infiltration is being considered in front of the building (south side of the site).

The purpose of the work was to investigate and report on the subsurface soil and groundwater conditions in a series of boreholes drilled at the site. Based on this information, advice is provided with respect to the geotechnical aspects of the proposed development, including the design of foundations, floor slabs-on-grade, pavements, stormwater management, infiltration and other elements. The anticipated construction conditions pertaining to excavation, backfill, infiltration and temporary groundwater control are also discussed, but only with regard to how these might influence the design.

The recommendations and opinions in this report are applicable only to the proposed development as described above and the Limitations of the Investigation found in Section 5 is an integral part of this report.

2 Investigation Procedure

2.1 Field Program

The fieldwork for this investigation was performed on August 30, 2024, during which time ten (10) boreholes (Boreholes BH-01-24 to BH-10-24) were drilled to depths of about 3.5 to 5.2 metres below ground surface (m BGS). The locations of the boreholes are shown on Drawing 2 in Appendix A.

The field investigation was carried out in general conformance with the professional standards set out in the Canadian Foundation Engineering Manual (CFEM 2023, 5th Edition), applicable Ontario Regulations and the ASTM International (ASTM) standards. The following is a summary of field investigation tasks:

- Public and private utility companies were contacted prior to the start of drilling activities in order to demarcate underground utilities on the site.
- The boreholes were advanced using Diedrich D70 Track drill rig equipped with hollow stem augers supplied and operated by Elements Geo Corp under the supervision of an Englobe drilling supervisor. The boreholes were logged by our geotechnical supervisor.
- The borehole locations and ground surface elevations were surveyed by Englobe personnel using a GENEQ Field Genius 10 SXBLUE GPS (GNSS). The borehole locations were referenced to Universal Trans Mercator North American Datum of 1983 (UTM NAD83) coordinates; the zone reference (17T) has been excluded for presentation purposes. The ground surface elevations are geodetic, based on GNSS and local base station telemetry with a vertical root mean squared error of less than 20 mm.

- Soil samples were recovered from the borehole at regular depth intervals using a 50 mm outside diameter split spoon sampler in accordance with ASTM D1586 Standard Penetration Test (SPT). The recorded SPT N-values are provided on the borehole logs (Appendix B).
- Groundwater observations and measurements were carried out in the open boreholes during and upon completion of drilling and are noted on the borehole logs. There was no provision for long term ground water monitoring at the site. Long-term ground water monitoring was beyond the scope of work for this preliminary investigation.
- The boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 903 as amended, under the Ontario Water Resources Act.

2.2 Geotechnical Laboratory Testing

All soil samples recovered during this investigation were returned to Englobe laboratory for visual examination. Moisture content determinations were completed on all the samples from the boreholes and the moisture content values are shown on the appended borehole logs. Particle size analyses (sieve and hydrometer) were completed on selected soil samples.

Detailed description and the results of the laboratory tests are provided on the appended borehole logs in Appendix B and the Laboratory test result data sheets are included in Appendix C.

It is important to note that as per the standard policy of Englobe, the soil samples will be stored for a period of three months from the date of sampling. These soil samples will be discarded after the three-month period unless prior arrangements have been made for longer storage.

3 Subsurface Conditions

The subsurface soil and groundwater conditions encountered in the boreholes, and the results of the field and laboratory testing, are shown on the Log of Borehole sheets in Appendix B. A list of abbreviations and symbols are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. These boundaries generally represent a transition from one soil type to another and should not be inferred to represent exact planes of geological change. The subsurface conditions will vary between and beyond the locations investigated.

3.1 Soil Conditions

The following discussion has been simplified in terms of the major soil strata for the purposes of geotechnical design. In general, the boreholes drilled at the site penetrated topsoil overlying sand to sand and gravel strata.

3.1.1 Topsoil

All the boreholes were drilled on a vacant parcel of land at the north side of Scott Avenue adjacent to the Sobeys store. Topsoil was encountered at the ground surface in all the boreholes and ranged in thickness from 150 to 350 mm. The topsoil comprised dark brown silty sand topsoil. The variability is likely due to tilling operation as part of the site agricultural activities. Thicker topsoil should be expected to be encountered in some areas.

3.1.2 Sand

Sand was encountered below the topsoil in all the boreholes drilled. The sand ranged in composition from sand with some silt and trace gravel to silty sand to gravelly sand with some silt. The sand typically extended to depths of 0.8 to 1.5 m and extended to the termination depth in Boreholes BH-03-24 (5.0 m) and BH-09-10 (3.5 m). A lower sand deposit was encountered in Boreholes BH-01-24, BH-06-24 and BH10-24. Standard Penetration Test results (N values) in the sand ranged between 7 and 38 (Average 22) blows per 305 mm indicating a loose to dense relative density. Moisture content tests of 5 to 26 percent in the sand soils indicates moist to saturated conditions.

3.1.3 Sand and Gravel

A sand and gravel stratum was encountered below the surficial sand in all the boreholes except Boreholes BH-03-24 and BH-09-24 and extends to the termination depth of most of the boreholes. SPT (N) values in the sand and gravel ranged between 15 and 64 (Average of 32) blows per 305 mm indicating compact to very dense relative density. Moisture content tests of 3 to 20 percent in the sand and gravel indicates moist to saturated conditions.

Two particle size analysis were carried out on the native sand and gravel and the results are provided on Figures 1 and 2 in Appendix C.

3.2 Groundwater Conditions

Groundwater observations were made in each of the boreholes as they were drilled and after completion of drilling. The unstabilized groundwater conditions as observed in the boreholes upon completion of drilling are summarized in the following Table 1. In summary, ground water was observed in all boreholes at depths in the range of about 2.3 to 4.0 m BGS, or at elevations in the range of 252.5 to 250.5 m. These conditions may not necessarily represent stabilized conditions. Fluctuation in the ground water levels will also occur due to seasonal variations and precipitation conditions.

Table 1: Summary of Unstabilized Groundwater levels

Borehole ID	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)
BH-01-24	255.3	3.8	251.5
BH-02-24	255.1	3.4	251.7
BH-03-24	254.5	4.0	250.5
BH-04-24	254.9	3.4	251.5
BH-05-24	254.8	3.3	251.5
BH-06-24	254.5	3.4	251.1
BH-07-24	254.8	3.1	251.7
BH-08-24	253.8	2.4	251.4
BH-09-24	253.5	2.3	251.2
BH-10-24	255.3	3.0	252.5

It is important to note that the groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary locally due to seasonal fluctuations, groundwater regimes encountered at the site or as a consequence of construction activities on the site or adjacent sites.

4 Geotechnical Design

The following discussion is based on our interpretation of the factual data obtained during this investigation and is intended for the use of the design engineer only. Comments made regarding the construction aspects are provided only in as much as they may impact on design considerations. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

The project involves the design and construction of a single storey 915 sq. m fire station building with a mezzanine and future 260 sq. m building addition (paramedic station) to the west side of the fire station building located at the north side of Scott Avenue and east of Pinehurst Road in Paris, Ontario. The proposed building will be slab-on-grade construction and the finished floor slab will be set at Elevation 254.90 m with footings at approximately 1.2 m below finished floor (elevation 253.7 m). Light duty (car parking) and heavy duty (fire truck traffic) pavements will be built around the new building. Infiltration is proposed at the south side of the site and a stormwater management pond will be constructed at the southeast corner of the site.

The following sections provide comments and recommendations for the proposed development as well as other geotechnical related design and construction 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 construed as instructions to the contractor. On-going liaison with Englobe 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.

4.1 Site Preparation

Development of the site will include clearing and grubbing and removal of topsoil. The results of the boreholes suggest that a relatively high volume of topsoil may result from stripping. The thickness of topsoil was found to vary from about 150 to 350 mm. Contractor's bidding on the work should undertake test pits to better assess topsoil stripping requirements.

Any fill that will be required in areas to be developed for foundations or floor slabs-on-grade must be constructed as an engineered fill. It is expected that the site restoration and filling will be carried out in advance of construction.

The engineered fill should extend for a distance of at least 2 m beyond the perimeter of the building envelope as measured at the founding level and should extend downwards from this point at a 1 to 1 (horizontal to vertical) slope, to the original ground. In addition, the engineered fill should extend to an elevation of at least 0.6 m above the proposed footing elevation. This is to ensure that the foundations are placed on the engineered fill both in plan and elevation. The engineered fill must be provided with a minimum of 1.2 m of earth cover or equivalent insulation to provide adequate frost protection.

Engineered fill required to raise the grade or to achieve the site grading plan must consist of clean earth materials, free of topsoil, rubble, wood, plant materials etc. and at a suitable placement water content to consistently achieve the compaction requirements outlined below. Selective re-use of excavated soil consisting of the underlying native soils from the site for engineered fill may be feasible subject to the weather conditions at the time of construction. For this reason, we do not recommend undertaking pre-grading activities during spring or spring-like conditions.

Imported earth for use as engineered fill will be subject to the requirements of Ontario Regulation (O. Reg.) 406/19 including the document 'Rules for Soil Management and Excess Soil Quality Standards' as adopted by reference in O. Reg. 406/19. Alternatively, consideration could be given to using OPSS Granular B Type II material imported from an MECP licensed quarry. Source acceptance testing of materials imported for use as engineered fill must be carried out prior to the importation to the site.

Engineered fill must be placed and uniformly compacted in 200 mm thick lifts to at least 100 percent of standard Proctor maximum dry density (SPMDD). For optimal performance, the placement water content of the fill should be maintained within about 2 percent of the laboratory optimum water content for compaction. The limits of any engineered fill can best be determined by the geotechnical engineer during construction.

All aspects of engineered fill construction including final excavation, material selection, placement and compaction must be verified by the geotechnical engineer. In-situ density testing is required during construction to confirm that each lift has been compacted to the specified degree and that the placement moisture content is within an acceptable range.

Engineered fill can be expected to experience post-construction settlement on the order of 1 percent of the depth of the engineered fill. The time period over which this settlement occurs depends on the composition of the engineered fill as follows (after initial placement):

- a) Sand or gravel soil; several days
- b) Silt soil; several weeks
- c) Clay or clayey soil; several months

The placement of engineered fill might also result in post-construction settlement of the underlying natural soil. The timing of foundation construction must take into account the post-construction settlement of the engineered fill and the foundation soil.

4.2 Preliminary Foundation Design

It is understood that the new building will be supported on conventional strip and spread footings founded approximately 1.2 m below finished floor or elevation 253.7 m. The following discussion is provided with the understanding that any and all buildings proposed for the site will be designed in conformance to the current Ontario Building Code (OBC) or other regulatory bodies within the jurisdiction. This section addresses the feasibility of constructing conventional spread and/or strip footings.

4.2.1 Conventional Spread Footings in Undisturbed Soil

Boreholes BH-01-24 to BH-06-24 and Borehole BH-10-24 were located within the approximate envelope of the proposed building. Based on the results of the boreholes, it is considered feasible to support the building on conventionally designed spread and/or continuous strip footings bearing in the undisturbed native bearing strata. The existing fill and some of the surficially loose soil strata is not suitable for the support of foundations.

The following Table 2 summarizes the bearing resistance at serviceability limit states (SLS) and factored geotechnical resistance at ultimate limit states (ULS) for design purposes possible for conventional spread footing foundations by borehole location at the highest permissible elevations.

Table 2: Recommended Footing Depths and Soil Bearing Capacities

Borehole	Minimum Founding Depth Below Existing Grade (m BGS) / Elevation (m)	Bearing Capacity at Serviceability Limit State (kPa)	Bearing Capacity at factored Ultimate Limit State (kPa)	Bearing Strata	Unstabilized Ground Water (m BGS) / Elevation (m)
BH-01-24	0.8/254.5	200	300	Sand and Gravel	3.8/251.5
BH-02-24	1.0/254.1	150	225	Sand	3.4/251.7
	1.7/253.4	200	300	Sand and Gravel	
BH-03-24	0.8/2253.7	150	225	Silty Sand	4.0/250.5
	1.5/253.0	200	300	Sand and Gravel	
BH-04-24	0.8/254.1	200	300	Gravelly Sand	3.4/251.5
BH-05-24	0.8/254.0	200	300	Sand and Gravel	3.3/251.5
BH-06-24	0.8/253.7	200	300	Sand and Gravel	3.4/251.1
BH-10-24	0.8/254.0	200	300	Sand and Gravel	3.0/252.3

Some variability in the consistency and depth of the native undisturbed strata is expected. For this reason, it is important that all of the foundation excavations be inspected by Englobe to confirm that the soft / loose surficial strata have been fully penetrated and to identify any preparatory work required prior to placing the footing concrete. Where deeper excavations are required, the footings should be lowered in a series of steps with maximum vertical increments of 0.6 m and with a rise to run ratio of 1:2.

The footing areas must be checked by a geotechnical engineer from Englobe to ensure that the soil conditions encountered at the time of construction are suitable to support the design pressure. Any disturbed soil identified during the inspection should be removed from the footing areas and replaced with concrete.

4.2.2 Conventional Spread Footing Foundations on Engineered Fill

Based on the existing site grades within the proposed building area it doesn't appear that structural fill be required for the proposed fire station building. If structural fill is required at the east side of the site where the site grades are lower, recommendations for the construction of engineered fill are provided in Section 4.1 of this report. A maximum net allowable bearing pressure of up to 150 kPa for SLS design and 225 kPa for a factored ULS design can be used for foundations placed within the engineered fill area.

4.2.3 Frost Protection Depth

To provide sufficient protection against heave due to frost action, all exterior footing must incorporate a minimum depth of soil cover of 1.2 m between the footing subgrade and the finished ground surface. Where a minimum soil cover of 1.2 m is not practical, insulation can be used as an alternative to offset penetration depths. The insulation manufacturer recommendations shall be referenced for equivalent frost penetration depths and shall be confirmed by the geotechnical engineer during design and construction.

4.3 Site Classification for Seismic Site Response

The Ministry of Municipal Affairs and Housing (MMAH) has adopted the 2024 Ontario Building Code (OBC) that came into effect on January 1, 2025. The 2024 OBC is further harmonized with the 2020 National Building Code (NBC) of Canada. This includes the use of the new 6th Generation Seismic Hazard Model for determining seismic hazard, which was developed for the 2020 NBC.

The 2024 OBC provides seismic hazard values based on Site Designation. The Site Designation shall be X_V , where V is the value of the average shear wave velocity, V_{s30} , calculated from in-situ measurements of the shear wave velocity in top 30 m of the ground profile **except** for the four (4) specific ground profiles as set out in the Table 4.1.8.4.-A of 2024 OBC where Site Designation shall be determined in accordance with Table 4.1.8.4-A.

The 2024 OBC also provides an alternative method to determine the Site Designation (X_S), if V_{s30} calculated from in-situ measurements is not available. In this case, the Site Designation shall be X_S , where S is the Site Class determined using energy-corrected average Standard Penetration Resistance (N_{60}) or the average Undrained Shear Strength (S_u) in accordance with Table 4.1.8.4.-B (and associated notes), which defines 6 Site Classes (S) from A to F. Note that providing a Site Designation based on a Site Class approach (i.e., without direct measurement of shear wave velocities) will generally result in higher seismic demand for the site.

In-situ shear wave velocities were not measured at this site, therefore, the Site Designation was determined based on the Site Class approach using energy-corrected average Standard Penetration Resistance (N_{60}) or the average Undrained Shear Strength (S_u), as applicable, in accordance with Table 4.1.8.4-B (and associated notes). Based on this approach, the Site Designation for seismic analysis may be taken as Site Class D, as per the 2024 Ontario Building Code.

We recommend that a site-specific MASW test should be considered to determine the Site Designation for this site, as the Site Designation based on V_{s30} will likely result in a lower seismic demand than Site Designation D determined using the Site Class approach. The project structural engineer can advise if an in-situ shear wave velocity measurement (such as MASW test) is advantageous for the subject project.

4.4 Slab-on-Grade Construction

Based on the existing site grades, it is likely that some portions of the site will require filling. Recommendations for the construction of engineered fill are provided in Section 4.1 of this report.

Final construction beneath slabs on grade should consist of 200 mm of uniformly compacted Granular A uniformly compacted to 98 percent of standard Proctor maximum dry density. A slab on grade would be founded on sand to sand and gravel soils, engineered fill, or approved existing fill. The moduli of subgrade reaction appropriate for slab on grade design on the aforementioned soils are as follows:

- Engineered fill: 25,000 kPa/m
- Sand to sand and gravel: 30,000 kPa/m

If moisture sensitive floor finishes are proposed, a capillary moisture barrier will be required beneath the slab. The capillary moisture barrier may consist of a layer of suitably graded clear crushed stone rather than the Granular A as outlined above. If a clear stone capillary moisture barrier is selected for the underfloor design, this material has poor stability under wheel loading and can be an impediment to other site activities such as steel and mechanical erection. If this is the case, substitution of the upper 50 mm with compacted Granular A to provide a travel surface, constitutes no technical compromise to the capillary barrier effect intended. The placement of a polyethylene vapour barrier is to be at the discretion of the design engineer and architect, as this may have implications on slab curing and certain floor finishes are more sensitive to moisture diffusion through the slab than others.

All slabs-on-grade should be structurally separate from foundation walls and columns. Saw cut control joints should be incorporated into the slabs along column lines and at regular intervals. Interior load bearing walls should not be founded on the slab but on spread footings as outlined above.

From a geotechnical perspective no special underfloor drains are required provided the exterior grades are at least 200 mm lower than the finished floor slab and positively sloped away from the building.

Concrete slabs exposed to freezing temperatures should be provided with 50 mm thick rigid Styrofoam insulation below the slab in order to prevent differential settlements from frost heave and thaw settlement. All weather exposed concrete shall have 5 to 8% air entrainment or as otherwise specified in Tables 2 and 4 of CSA A23.1.

4.5 Pavement Design

Light duty (car parking) pavements will be built at the northeast and east sides of the new building and heavy duty (fire trucks) pavements will be built on the north, south and east sides of the building. The following provides recommendations for the design and construction of the proposed pavements.

4.5.1 Subgrade Preparation

Any existing surficial vegetation, topsoil, pre-existing loose fill should be removed from below the pavement areas and if required, grades should be raised with approved on-site inorganic soils or imported granular materials. The subgrade fill should be placed in 200 mm thick lifts and compacted to 100% SPMDD.

In-situ density testing to monitor the effectiveness of the compaction equipment in achieving the required densities is also recommended. The most severe loading conditions on pavement areas and the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of subbase fills, restricted construction lanes, and half-loads during paving may be required, especially if construction is carried out during inclement weather conditions.

4.5.2 Recommended Pavement Structure

The preliminary pavement component thicknesses in Table 3 are recommended based on the anticipated pavement usage, the frost-susceptibility, and strength of the subgrade soils. The pavement structures should be reviewed once the traffic loading is determined. Light Duty pavement is designed for less than 5 commercial vehicles per day.

Table 3: Pavement Component Thicknesses

Pavement Component	Light Duty (Car Parking)	Heavy Duty (Fire Trucks)
	Thickness (mm)	
Hot-Mix Asphalt	80	100
Granular A Base Course	150	150
Granular B Type I Subbase Course	300	350

It is noted that the pavement granular base and subbase layers can consist of sand and gravel, crushed limestone, or crushed concrete materials. The material gradation and durability requirements of the selected granular courses should meet OPSS 101 specifications.

Samples of both the Granular A and Granular B Type 1 aggregates should be checked for conformance to OPSS.MUNI 1010 prior to utilization on site and during construction. The Granular B Type 1 subbase and Granular A base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The hot-mix asphalt should comprise 40 mm of HL3 surface asphalt and 40 mm of HL4 binder asphalt for light duty pavement, and 40 mm of HL3 surface asphalt and 60 mm of HL4 or HL8 binder asphalt for heavy duty pavements, respectively. The hot-mix asphalt paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. Performance graded asphalt cement (PGAC) 58S-28 should be utilized in the hot mix asphalt for light duty and heavy-duty pavements, respectively, in accordance with the recommendations of OPSS 1101.

The pavement subgrade and granular courses will lose their strength to support traffic loads if allowed to become wet due to surface water or groundwater infiltration; therefore, drainage of the pavement and the granular courses is essential. In this regard, it is recommended that subdrains be installed to intercept and remove excess subsurface moisture. The subdrains should be connected to the catch basins. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped to provide effective drainage. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas.

The need for continuous paving supervision by a qualified pavement technician, and quality control testing during pavement construction cannot be over emphasized. All materials and construction services required for the work should be in accordance with the applicable sections of the Ontario Provincial Standard Specifications.

4.5.3 Portland Cement Concrete Pavements

A rigid concrete pavement may be required at the fire truck bay areas. Since this is an exposed concrete pavement, uniform support is important to mitigate heave of the slab during the cold months of the year. Regardless, the slab must be physically separated from the building structure. Consideration should be given to the relative merits and economies of reinforced versus unreinforced concrete pavement, given an environment where the concrete will be exposed to de-icing salts. Concrete pavement is specified under CSA A23.1 for Class C-2 exposure which implies minimum 28-day compressive strength of 32 MPa. The following Portland cement concrete pavement structure recommended for this site is comprised as follows:

Table 4: Portland Cement Concrete Pavement Structure

Pavement Layer	Placement Requirements	Truck Traffic Minimum Component Thickness
Portland Cement Concrete Surface CSA A23.1 Class C-2	CSA A23.1	240 mm
Base Course: Granular A (OPSS 1010) or 19 mm Crusher Run Limestone	100% Standard Proctor Maximum Dry Density (ASTM-D1557)	300 mm

To prevent the formation of irregular cracking and control stressing within the concrete slab, it is recommended that joints be designed within the concrete slab at a maximum spacing of 4.5 metres. Along the concrete/asphalt interface, the concrete slab should be sufficiently thickened to enhance the load-carrying capacity. The rigid concrete pavement must be physically separated from any building structures.

4.5.4 Drainage

Control of surface water is a significant factor in achieving good pavement life. Grading adjacent to pavement areas must be designed so that water is not allowed to pond adjacent to the outside edges of the pavement or curb. The subgrade must be free of depressions and sloped (preferably at a minimum grade of two percent) to provide effective drainage toward subgrade drains or swales and/or ditches.

Continuous perimeter subdrains should be provided in paved areas and short perforated sub drains should be provided at all catch basins locations. The subdrain invert elevations should be maintained at least 0.3 metres below subgrade level.

4.6 Excavations and Dewatering

Excavations must be carried out in accordance with the Occupational Health and Safety Act, Ontario Regulation 213/91 (as amended), Construction Projects, Part III - Excavations, Sections 222 through 242. These regulations designate four (4) broad classifications of soils to stipulate appropriate measures for excavation safety.

Groundwater seepage is not expected within excavation for foundations or services at conventional depth. Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

The boreholes show that the excavation for the construction is expected to extend through topsoil and into the native sand and sand and gravel soils. As per the OHSA, the soil at this site may be classified as shown in the Table 5 below.

Table 5: Soil Classification for Excavations

Soil Type	Above Groundwater level	Below Groundwater Level
Fill material	Type 3	N/A
Native Sand and Sand and Gravel	Type 3	Type 4

Where workmen must enter a trench or excavation the soil must be suitably sloped and/or braced in accordance with the regulation requirements. The regulation stipulates safe excavation slopes by soil type as Table 6.

Table 6: Safe Excavation Slope Based on Soil Type (Ontario Regulation 213/91 Occupational Health and Safety Act (OHSA))

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

Depending on the construction feasibility and where space limitations (from utility poles, existing underground services, or buildings) do not permit overburden cut slopes at inclinations specified above, a steeper cut slope can be employed and the excavation walls can be supported by temporary shoring systems. During excavations, adjacent existing structures, if present, must be protected by proper shoring or sloping. Some ground movement adjacent to the trench is to be expected.

Every prefabricated hydraulic or engineered support system shall be designed by a professional engineer and shall be constructed, installed, used and maintained in accordance with its design drawings and specifications (O.Reg. 213/91, s. 236).

The trench side slopes should be regularly inspected for evidence of instability following periods of heavy rainfall, following periods of thawing, or when the trench has been left open for an extended period of time. Appropriate remedial action should be taken to ensure the continued stability of the slopes.

Unstabilized water levels were measured in all the boreholes indicating water levels at a depth of 2.3 to 4.0 m below existing grade (Elevation 250.9 to 251.7). No free groundwater is expected within the proposed excavation depths for foundations and services within the site; however a deeper storm connection on Scott Avenue is planned to extend to Elevation 249.38.

The amount of seepage into the excavation will depend on the actual depth of excavation relative to the groundwater level at the time of construction. Care should also be taken to divert surface water away from excavations. Sump pits should be lined with suitable geotextile filter fabric and pump inlet should be set in clear stone, which must fill the sump pit completely. Unfiltered pumping can cause excessive migration of soil fines which will loosen the soil deposits that may subsequently result in ground surface settlement.

Moderate inflow is expected where excavations extend up to 0.5 m below the stabilized groundwater level. It is believed that this groundwater can be controlled using a gravity dewatering system with perimeter interceptor ditches and high-capacity pumps.

Excavations below 0.5 m below the stabilized groundwater may require a positive dewatering system installed by a specialist dewatering contractor to lower the groundwater level prior to excavating to maintain a safe and adequately dry excavation. An Environmental Activity and Sector Registry (EASR) or a Permit to Take Water (PTTW) is required by the MECP in the event that the daily taking of groundwater exceeds 50,000 L or 400,000 L per day, respectively.

The contractor should decide on the method and technique of dewatering to maintain a stable base and side slopes based on the factual information provided in this report. It is also recommended that prior to construction, trial test pits be dug in order to evaluate the expected groundwater inflow and to determine best means to achieve adequate dewatering.

4.7 Site Servicing

The invert elevations for any service trenches are expected to be within the undisturbed sand to sand and gravel, however based on the current grades on the site it may be possible that some services may have invert elevations within in loose surficial soil strata or engineered fill. In this event, it will be necessary to sub-excavate the loose soil and replace it with engineered fill to ensure the service is properly supported and to minimize the potential of settlement. Engineered fill should consist of OPSS 1010 Granular A or Granular B Type II material placed and uniformly compacted to 98 percent of standard Proctor maximum dry density. Consideration could also be given to the use of lean concrete to restore the grade to the proposed invert elevation.

4.7.1 Bedding

The bedding materials should be adequately compacted to provide support and protection to the service pipes. Provided the base area for the sewer pipes and watermain are free of all soft and deleterious materials, the pipe bedding should comply with a Class B bedding configuration as per the requirements of OPSD 802.030 (rigid pipe) and/or OPSD 802.010 (flexible pipe). Where disturbance of the trench base has occurred, due to the presence of soft fine-grained soils, ground water seepage and the like, the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill. If standing water is present in the base of the service and watermain trenches, then High Performance Bedding (HPB) and/or HL6 clear stone wrapped in geo-textile may be adopted as bedding material below the pipe to provide stabilization.

4.7.2 Backfill

Based on the results of the boreholes, it is assumed that the majority of excavated soil at the site from the construction of service trenches will consist of sand or sand and gravel.

Service trench backfill should consist of clean earth, free of excessively wet or frozen soil and should be placed in lifts of 300 mm thickness or less and uniformly compacted to at least 95 percent of standard Proctor maximum dry density at placement water contents within 2 percent of the corresponding laboratory optimum water content for compaction. The upper 1 m of the backfill forming the pavement subgrade, should be uniformly compacted to 98 percent of standard Proctor maximum dry density.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to direct surface runoff away from the excavations. Should construction extend into the winter season then backfilling operations should be planned to ensure that backfill material is kept to a minimum and ensured that frozen material is not used as backfill.

Excessively wet soil should be wasted, or it may be used as backfill within non-settlement sensitive areas, such as landscaped areas.

4.8 Infiltration

The hydraulic conductivity of the grain size distribution samples was assessed using those of the 15 available methods implemented in the spreadsheet "HydrogeoSieveXL ver. 2.2", J.F. Devlin, University of Kansas, 2015. The hydraulic conductivity and factored infiltration rates are provided in Table 7.

Table 7: Hydraulic Conductivity and Factored Infiltration Rates

Borehole Number	Sample Depth (m)	Soil Classification	Hydraulic Conductivity (cm/sec)	Recommended Factored Infiltration Rate (mm/hr)
BH-05-24, SS 3	1.50 - 2.1	SP-SM	1.3×10^{-2}	50
BH-08-24, SS 4	2.30 - 2.90	SP-SM	7.4×10^{-4}	17

It should be noted that hydraulic conductivity and infiltration rate are distinct concepts and such, unit conversion does not apply.

4.9 Quality Control

All aspects of the engineered fill construction must be verified by the geotechnical engineer including the final excavation, proof-rolling of the native subgrade, fill selection, placement, and compaction. Insitu density testing should be carried out during construction to confirm that each lift has been compacted to the specified degree. Source acceptance testing of materials imported for use as engineered fill must be carried out prior to importation to the site.

The foundation construction must be field reviewed by the geotechnical engineer to confirm that the founding soil exposed is consistent with the intended design bearing resistance. 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.

The long-term performance of floor slabs 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. The design advice in this report is based on an assessment of the subgrade support capabilities as indicated by the boreholes.

The requirements for fill placement on this project have been stipulated relative to standard Proctor maximum dry density. In situ determinations of density during fill and asphaltic placement on site are required to demonstrate that the specified placement density is achieved.

Appropriate laboratory and field testing of the pavement structure components (granulars and hot-mix asphalt) should be conducted, as well as concrete testing for the curbs and sidewalks. Compaction testing of the hot-mix asphalt should be carried out at the time of placement. Mix designs for the concrete materials and hot-mix asphalt should be reviewed for suitability and specification compliance at least two weeks prior to production and placement.

During the placement of concrete at the construction site, testing should be performed to determine the slump and air content of the concrete, and concrete cylinders should be cast for every 100 m³ of concrete or daily, whichever is greater. Compressive strength to be tested in accordance with the requirements of CSA A23.1 and A23.2. Field sampling and testing of concrete shall be according to OPSS 1350 MUNI.

4.10 Site Work

The soil at this site is generally fine-grained and will become weakened when subjected to traffic when wet. If there is site work carried out during periods of wet weather, then it can be expected that the subgrade will be disturbed unless an adequate granular working surface is provided to protect the integrity of the subgrade soils from construction traffic. Subgrade preparation works cannot be adequately accomplished during wet weather and the project must be scheduled accordingly. The disturbance caused by the traffic can result in the removal of disturbed soil and use of fill material for site restoration or underfloor fill that is not intrinsic to the project requirements. Attempting to build slabs and pavements at this site during wet weather could significantly increase earthworks and pavement costs.

The most severe loading conditions on the subgrade may occur during construction. Consequently, special provisions such as end dumping and forward spreading of earth and aggregate fills, restricted construction lanes, and half-loads during paving and other work are required, especially if construction is carried out during unfavourable weather.

If construction proceeds during freezing weather conditions, adequate temporary frost protection for the founding subgrade and concrete must be provided. The soil at this site is highly susceptible to frost damage. Consideration must be given to frost effects, such as heave or softening, on exposed soil surfaces in the context of this particular project development.

5 Statement of Limitations

The geotechnical recommendations provided in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its agent and may not be used by a Third Party without the expressed written consent of Englobe and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It should be noted that the soil boundaries indicated on the borehole logs are inferred from noncontinuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only.

It is further noted that, depending on the time of year the field work was completed, water levels should be expected to vary, perhaps significantly from those observed at the time of this investigation.

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also, such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions.

Englobe will not be responsible to any party for damages incurred as a result of failing to notify Englobe that differing site or subsurface conditions are present upon becoming aware of such conditions.

The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

The Englobe recommendations are contingent upon provision of a consistently competent, stable subgrade, which is properly drained and free of soft spots and objectionable materials such as organics.

All construction works should only be completed during periods of favourable weather. The need for continuous construction supervision by a qualified, experienced technician, and quality control testing during construction projects cannot be over-emphasized. All materials and construction services required should be in accordance with Ontario Provincial Standard Specifications.

Appendix A

Drawings

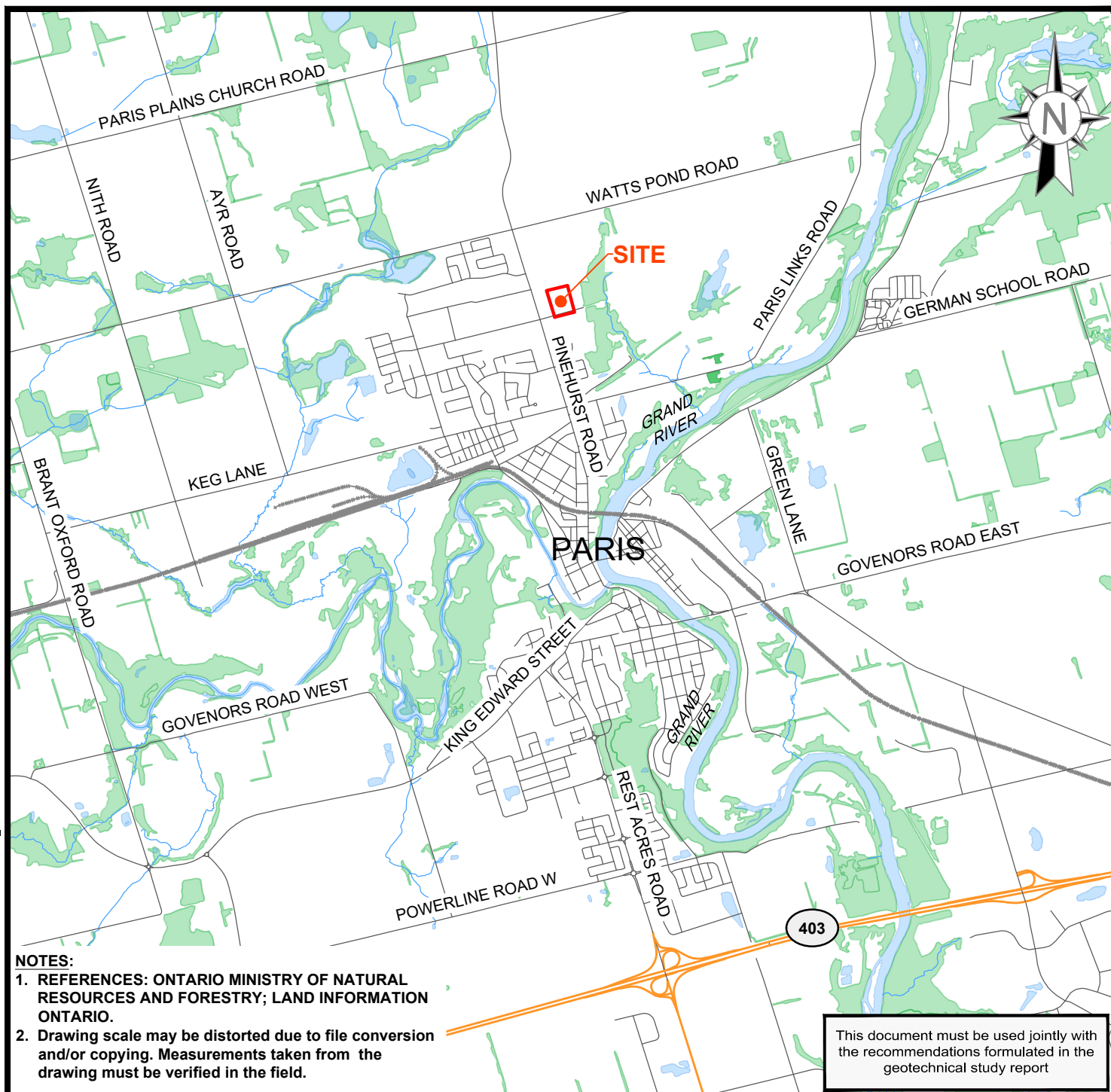
Drawing 1: Location Plan

Drawing 2: Site Plan



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NOTES:

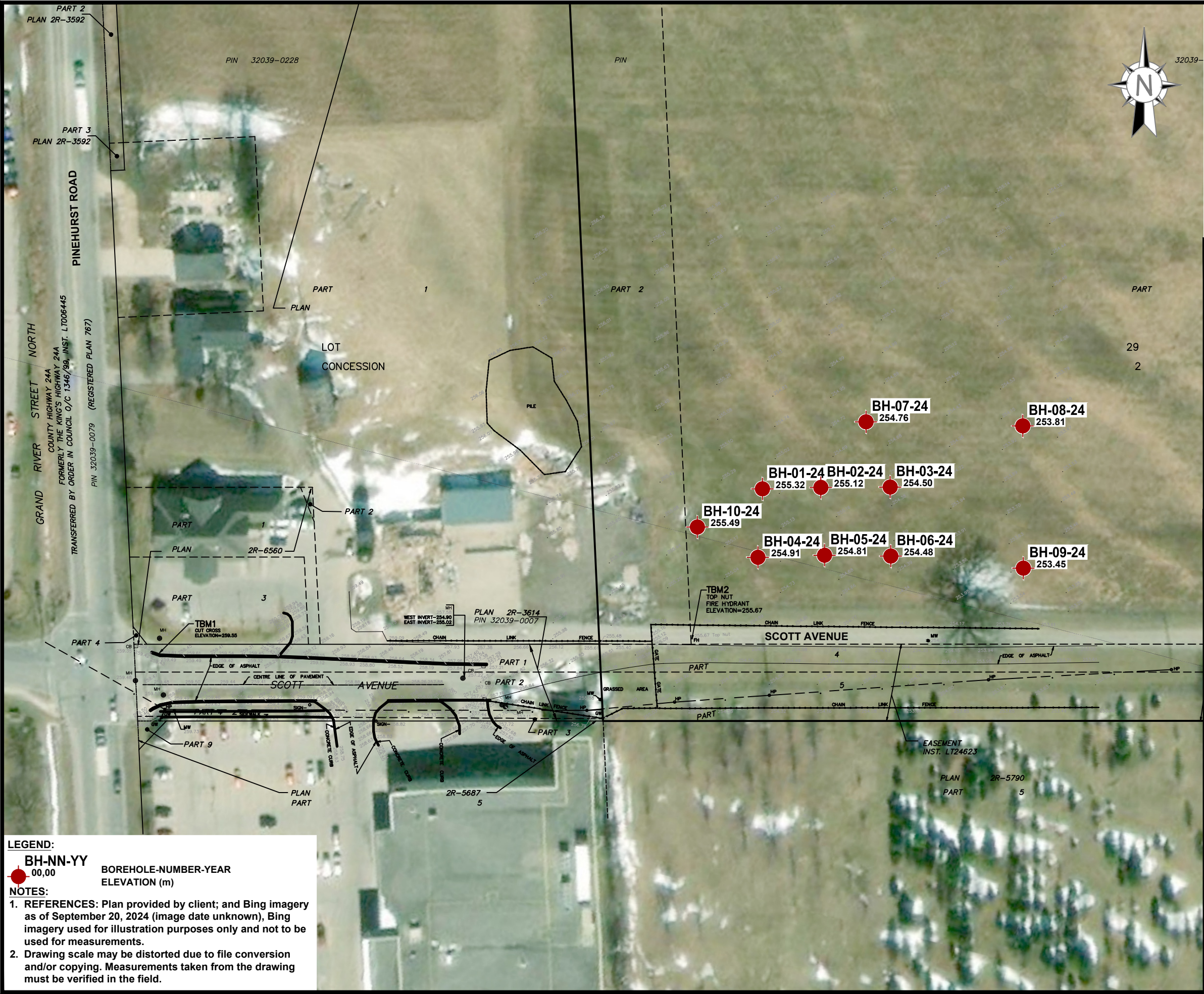
1. REFERENCES: ONTARIO MINISTRY OF NATURAL RESOURCES AND FORESTRY; LAND INFORMATION ONTARIO.
2. Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

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Client	County of Brant
Project	New Fire Station Building
	Scott Avenue, Paris, ON
Title	Site Plan

ENGLOBE 		Englobe Corp. 440 Hardy Road, Suite 3 Brantford, ON N3T 5L8 T 519 720-0078 F 519 720-0976				
Discipline: Geosciences		Prepared by: LK	Checked by: MH			
Scale: 1:50 000		Drawn by: LK	Approved by: TS			
Date: 20/09/2024		Figure N°: 01 of 02				
Page setup: 0001		Register N°:				
Resp.	Project	Phase	Disc.	Type	Drawing N°	Rev.
00	02405146.000	0000	GE	D	0001	00

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LEGEND:

BH-NN-YY
00,00 BOREHOLE-NUMBER-YEAR
ELEVATION (m)

NOTES:

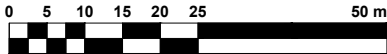
1. REFERENCES: Plan provided by client; and Bing imagery as of September 20, 2024 (image date unknown), Bing imagery used for illustration purposes only and not to be used for measurements.
2. Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

This document must be used jointly with the recommendations formulated in the geotechnical study report

XX	REVISION	JJ/MM/AA	XX	XX	XX
No.	Version	Date	By	Check	Appr.

Seal

Scale



1:1 000

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Client

County of Brant



Englobe Corp.

440 Hardy Road, Suite 3
Brantford, ON N3T 5L8
T 519 720-0078
F 519 720-0976

Project

New Fire Station Building

Scott Avenue, Paris, ON

Title

Borehole Location Plan

Discipline:		Geosciences		Prepared by:		LK		Checked by:		MH	
Scale:		1:1 000		Drawn by:		LK		Approved by:		TS	
Date:		20/09/2024		Figure N°:						02 of 02	
Page setup:		Paper format:		Register N°:							
0002		ANSI full bleed B (17.00 x 11.00 Inches)									
Resp.	Project		Phase	Disc.	Type	Drawing N°			Rev.		
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Appendix B

Borehole Logs

List of Abbreviations

Boreholes BH-01-24 to BH-10-24



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List of Abbreviations

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Test and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Core Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ϕ	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic Limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_L	Liquid Limit
WC	Water Content Sample	I_L	Liquidity Index
TP	Thinwall, Piston	I_p	Plastic Index
		PP	Pocket Penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60° cone a distance 300 mm (12 in.) The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	Sampler advanced by weight of hammer
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure

Soil Description		
Cohesionless Soils Compactness Condition	SPT N-Value (blows per 0.3 m)	Relative Density (D_r) (%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	Over 50	80 to 100
Cohesive Soils Consistency	Undrained Shear Strength (C_u)	
	kPa	psf
Very Soft	Less than 12	Less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000
DTPL	Drier than plastic limit	Low Plasticity, $w_L < 30$
APL	About plastic limit	Medium Plasticity, $30 < w_L < 50$
WTPL	Wetter than plastic limit	High Plasticity, $w_L > 50$

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549707, N: 4784775 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	255.3	GROUND SURFACE													
0.2	255.1	175mm TOPSOIL , Silty Sandy, dark brown		1	SS	13	255								
		SAND , some silt, trace gravel, trace rootlets, compact, brown, moist													
0.8	254.5	SAND AND GRAVEL , trace to some silt, compact, greyish brown, moist		2	SS	20	254								
				3	SS	26	253								
		...very dense													
				4	SS	52	252								
3.0	252.3	SAND , some gravel, trace silt, dense, brown, moist		5	SS	35	251								
		...saturated													
4.6	250.7	SAND AND GRAVEL , trace silt, dense, brown, saturated		6	SS	48									
5.0	250.3														

END OF BOREHOLE

Unstabilized water level measured at 3.8 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549722, N: 4784779 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone 10 20 30 40	Undrained Shear Strength (kPa) 40 80 120 160	Plastic Limit Natural Water Content Liquid Limit	PL	MC	LL		
0	255.1	GROUND SURFACE					255								
0.2	254.9	350mm TOPSOIL , Silty Sandy, dark brown		1	SS	8	255								
		SAND , some silt, trace gravel, trace rootlets, loose, brown, moist		2	SS	10	254								
1.5	253.6	SAND AND GRAVEL , trace to some silt, compact, greyish brown to brown, moist		3	SS	22	253								
		...dense		4	SS	42	252								
		...saturated		5	SS	21	251								
5.2	249.9	END OF BOREHOLE		6	SS	28	250								

Unstabilized water level measured at 3.4 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549739, N: 4784784 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		X Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	254.5	GROUND SURFACE													
		250mm TOPSOIL , Silty Sandy, dark brown		1	SS	7	254								
		SAND , some silt, trace rootlets, loose, brown, moist													
-1	253.7	SILTY SAND , trace clay, trace organics, compact, brown, very moist		2	SS	11									
	0.8														
	253.0	SAND AND GRAVEL , trace silt, compact, greyish brown to brown, moist		3	SS	26	253								
	1.5														
-2		...dense		4	SS	38	252								
-3				5	SS	18	251								
-4		...saturated													
	249.9	SAND , trace gravel, trace silt, compact, brown, saturated		6	SS	14	250								
	4.6														
-5	249.5														
	5.0														

END OF BOREHOLE

Unstabilized water level measured at 4.0 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549710, N: 4784758 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

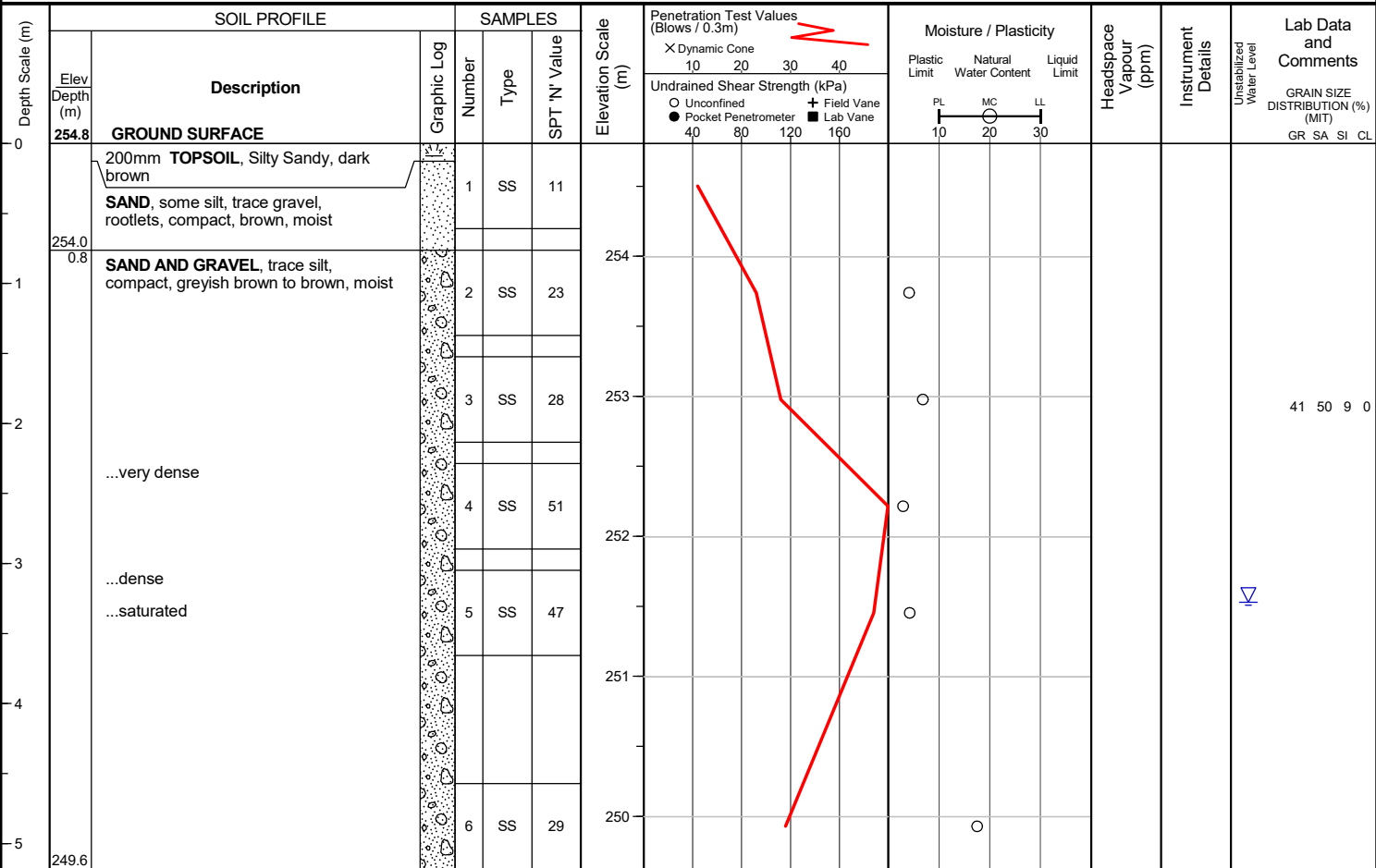
Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		X Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	254.9	GROUND SURFACE													
		230mm TOPSOIL , Silty Sandy, dark brown		1	SS	8									
		SILTY SAND , trace rootlets, loose, brown, moist													
-1	254.1 0.8	GRAVELLY SAND , some silt, dense, brown, moist		2	SS	35	254								
-2	253.4 1.5	SAND AND GRAVEL , trace to some silt, dense, brown, moist		3	SS	40	253								
				4	SS	34									
-3		...compact					252								
		...saturated		5	SS	27									
-4							251								
-5	249.9 5.0			6	SS	32	250								

END OF BOREHOLE

Unstabilized water level measured at 3.4 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549727, N: 4784762 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers



END OF BOREHOLE

Unstabilized water level measured at 3.3 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000

Client : County of Brant

Originated by : BT

Date started : August 30, 2024

Project : New Fire Station Building

Compiled by : LK

Sheet No. : 1 of 1

Location : Scott Avenue, Paris, ON

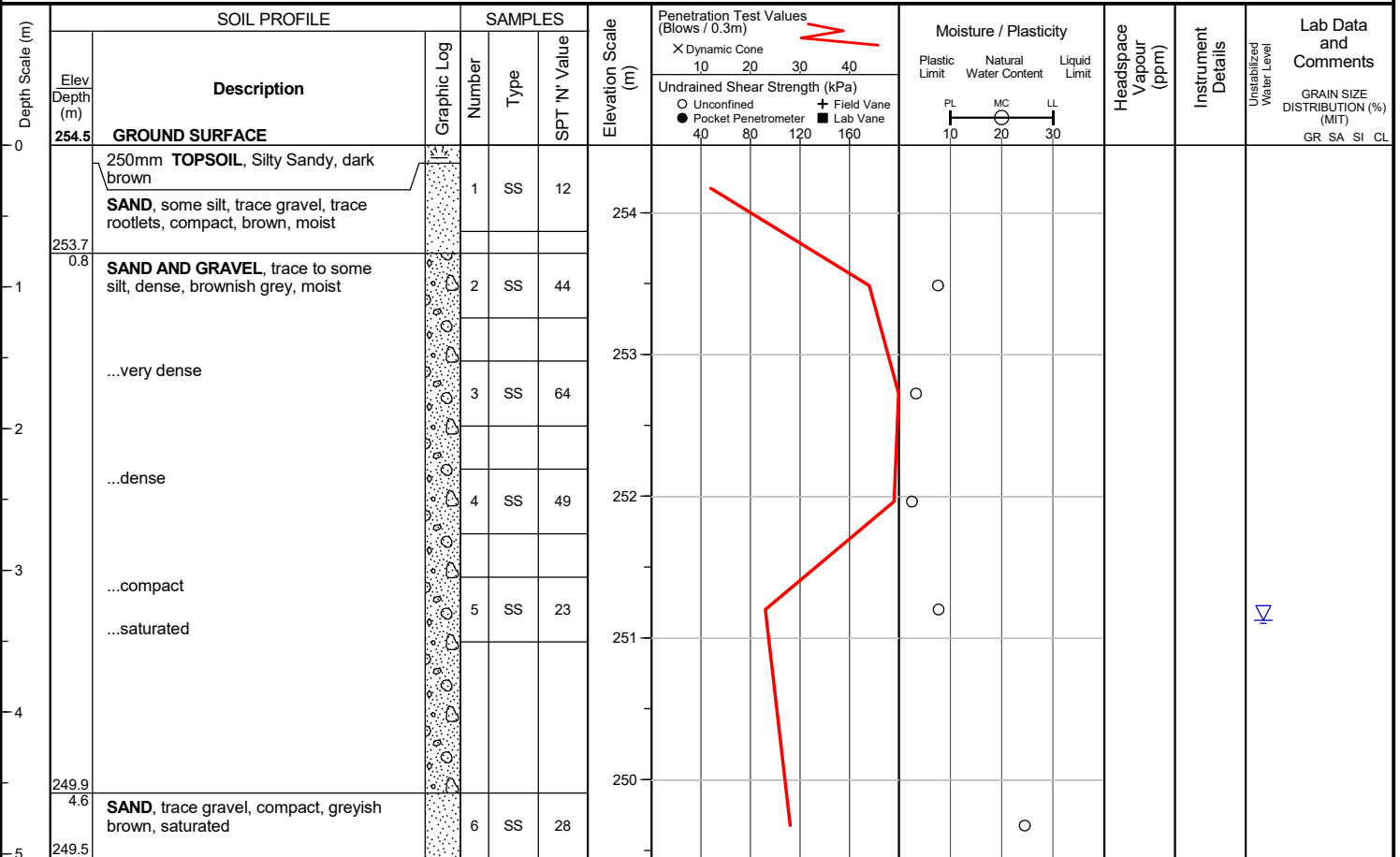
Checked by : MH

Position : E: 549744, N: 4784767 (UTM 17T)

Elevation Datum : Geodetic

Rig type : D70

Drilling Method : Hollow stem augers



END OF BOREHOLE

Unstabilized water level measured at 3.4 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549729, N: 4784799 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	254.8	GROUND SURFACE													
0.2	254.6	300mm TOPSOIL , Silty Sandy, dark brown		1	SS	15									
		SAND , some silt, trace gravel, trace rootlets, compact, brown, moist													
0.8	254.0	SAND AND GRAVEL , trace to some silt, compact, greyish brown to brown, moist		2	SS	21	254								
		...very dense		3	SS	50 / 125mm	253								
				4	SS	23	252								
		...saturated		5	SS	15									
3.5	251.3	END OF BOREHOLE													

Unstabilized water level measured at 3.1 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 4784808, N: 4784808 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)	Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value			Plastic Limit	Natural Water Content	Liquid Limit			
0	253.8	GROUND SURFACE												
0.2	253.6	150mm TOPSOIL , Silty Sandy, dark brown		1	SS	13								
		SAND , trace silt, trace to some gravel, trace rootlets, compact, brown, moist		2	SS	26								
1														
	252.3	SILTY SAND AND GRAVEL , trace clay, dense, brown, moist		3	SS	36								
2		...compact												
		...saturated		4	SS	15								
3														
	250.3			5	SS	15								
3.5														

END OF BOREHOLE

Unstabilized water level measured at 2.4 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549778, N: 4784772 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	253.5	GROUND SURFACE													
		200mm TOPSOIL , Silty Sandy, dark brown		1	SS	7	253								
		SAND , some silt, trace rootlets, loose to compact, brown, moist													
-1				2	SS	13									
	252.0						252								
-2	1.5	SAND AND GRAVEL , trace silt, dense, greyish brown to brown, moist		3	SS	36									
		...saturated, compact													
-3				4	SS	29	251								
	250.0			5	SS	24	250								
	3.5														

END OF BOREHOLE

Unstabilized water level measured at 2.3 m below ground surface; borehole was open upon completion of drilling.

Project No. : 02405146.000 Client : County of Brant Originated by : BT
 Date started : August 30, 2024 Project : New Fire Station Building Compiled by : LK
 Sheet No. : 1 of 1 Location : Scott Avenue, Paris, ON Checked by : MH

Position : E: 549693, N: 4784761 (UTM 17T) Elevation Datum : Geodetic
 Rig type : D70 Drilling Method : Hollow stem augers

Depth Scale (m)	SOIL PROFILE			SAMPLES			Elevation Scale (m)	Penetration Test Values (Blows / 0.3m)		Moisture / Plasticity			Headspace Vapour (ppm)	Instrument Details	Lab Data and Comments
	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value		X Dynamic Cone	Undrained Shear Strength (kPa)	Plastic Limit	Natural Water Content	Liquid Limit			
0	255.5	GROUND SURFACE													
0.2	255.3	180mm TOPSOIL , Silty Sandy, dark brown		1	SS	17	255								
		SAND , some silt, trace gravel, compact, brown, moist													
0.8	254.7	SAND AND GRAVEL , trace silt, very dense, greyish brown, moist		2	SS	51	254								
		...compact		3	SS	17									
				4	SS	19	253								
3.0	252.5	SAND , some gravel, trace silt, compact, brown, moist		5	SS	30	252								
4.6	250.9	GRAVELLY SAND , trace clay, compact, brown, saturated		6	SS	13	251								
5.0	250.5														

END OF BOREHOLE

Unstabilized water level measured at 4.4 m below ground surface; borehole was open upon completion of drilling.

Appendix C

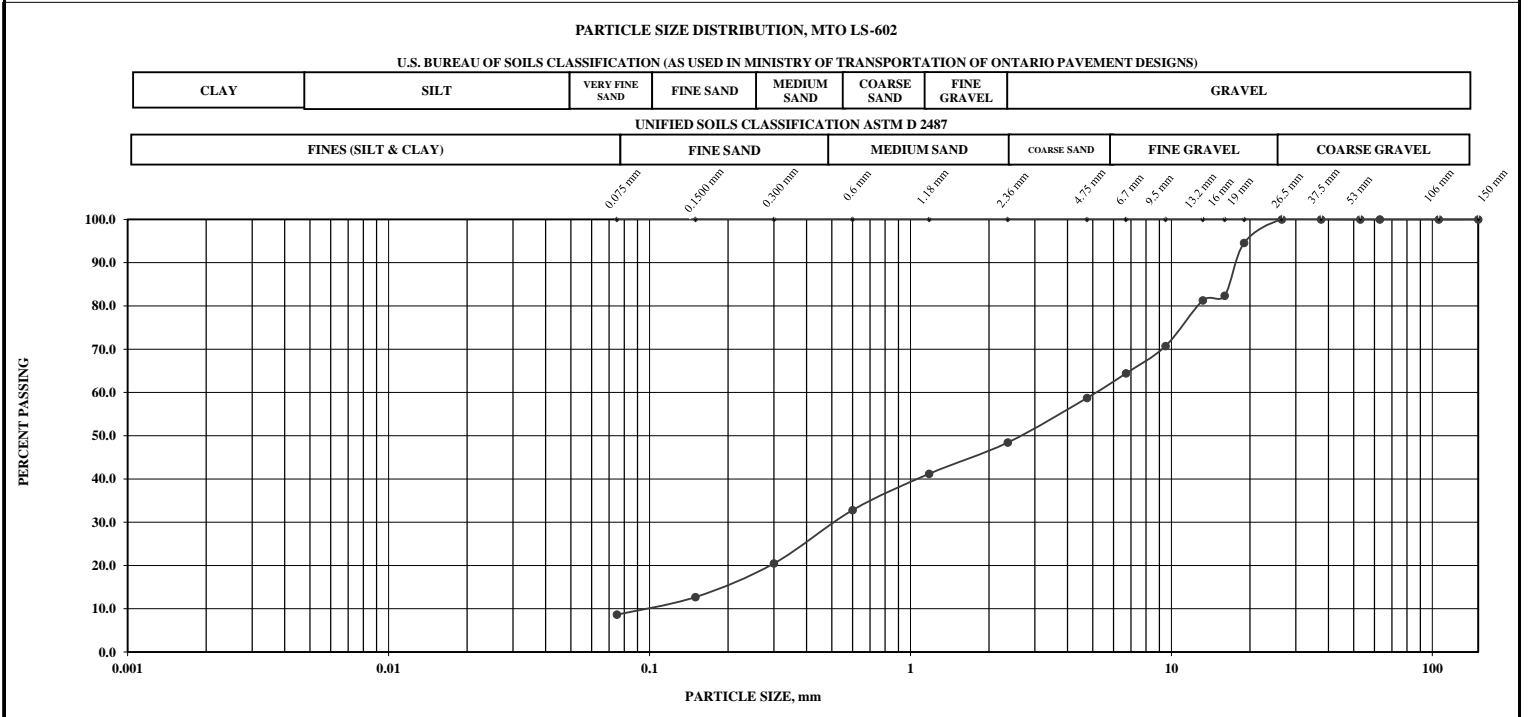
Laboratory Test Results

Figures 1 and 2 - Particles Size Analyses



eNGLOBE

Project Number: 02405146.000 Project Name: New Fire Station Building-Scott Ave Client: Corporation of the County of Brant
 ROS: 13351 Sample ID: BH 5, Sa 3 Depth: 1.5 - 2.1 m
 Sampled By: Englobe Date Received: September 6, 2024 Date Completed: September 23, 2024
 File Number: 04.02405146.000.MT-GR-001-00 Englobe Laboratory: Kitchener



Coefficients									
D60	5.186	D30	0.532	D10	0.100	Cc	0.545	Cu	51.85

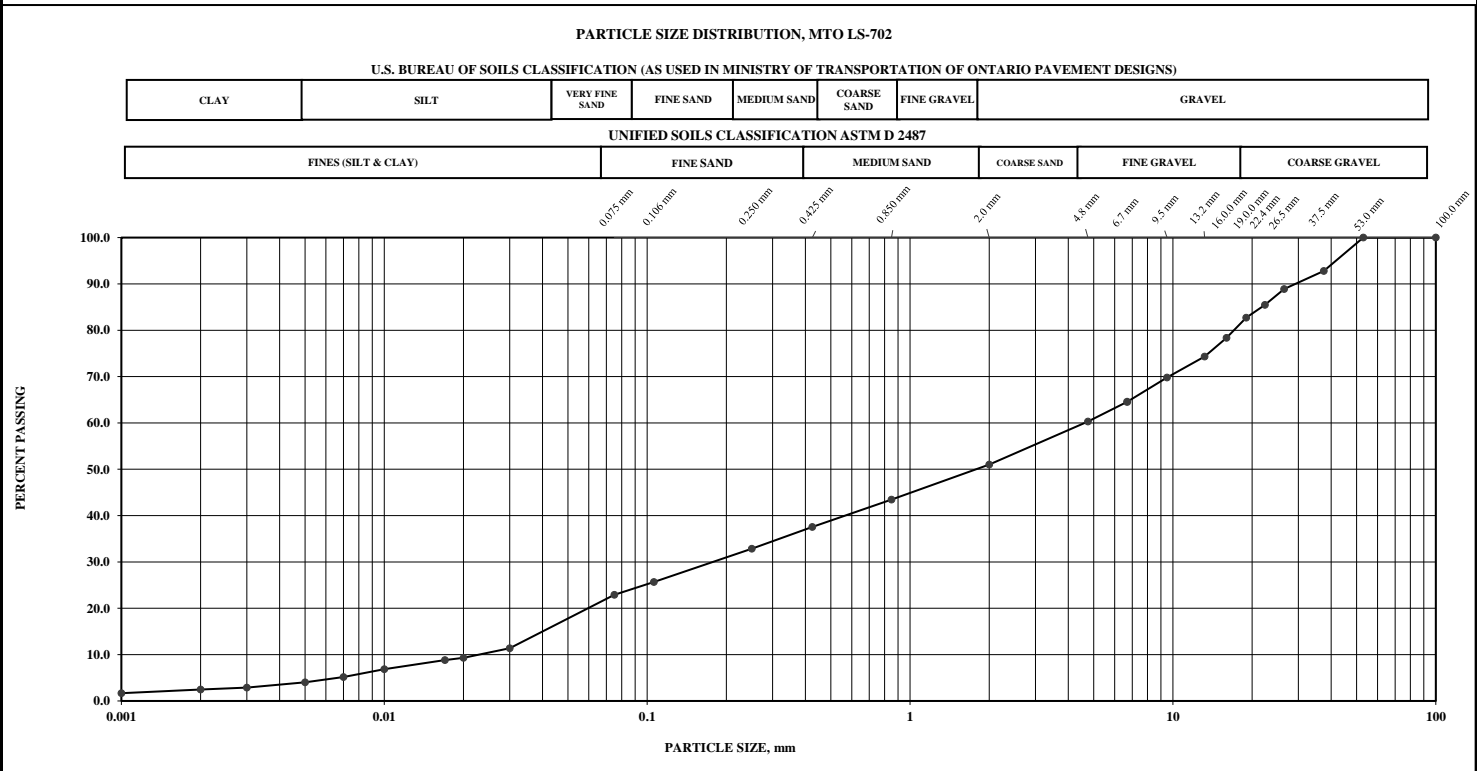
Sieve Analysis		Gran Size Porportions, %			
Sieve Size, mm	% Passing	% Gravel (> 4.75 mm):	41.3	% Coarse Aggregate	41.3
		% Sand (75 µm to 4.75 mm):	50.1	% Fine Aggregate	58.7
150	100.0	% Silt (2 µm to 75 µm):	8.6		
106	100.0	Group Symbol / Soil Description			
53	100.0				
37.5	100.0				
26.5	100.0				
19	94.6				
16	82.4	Remarks			
13.2	81.3				
9.5	70.7				
6.7	64.4				
4.75	58.70				
2.36	48.4				
1.18	41.2				
0.6	32.8				
0.3	20.5				
0.15	12.7				
0.075	8.60				

Figure: 1

TESTED BY: Jason Taylor, B.A.Sc. Reviewed By: David McBay, C.E.T. Date: September 24, 2024
 Senior Laboratory Technician Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

Project Number:	02405146.000	Project Name:	New Fire Station Building-Scott Ave	Client:	Corporation of the County of Brant
ROS:	13352	Sample ID:	BH 8, Sa 4	Sample Depth:	2.3 - 2.9 m
Sampled By:	Englobe	Date Received:	September 6, 2024	Date Completed:	September 23, 2024
File Number:	04.02405146.000.MT-SH-001-00			Englobe Laboratory	Kitchener

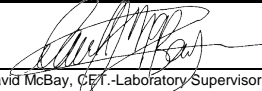


Coefficients									
D60	4.662	D30	0.193	D10	0.023	Cc	0.341	Cu	199.69

Sieve Analysis		Hydrometer Analysis			GRAIN SIZE PROPORTIONS, %			
Sieve Size, mm	% Passing	Diameter, mm	% Passing					
53	100.0	0.030	11.4		% Gravel (> 4.75 mm): 39.7			
37.5	92.8	0.020	9.3		% Sand (75 µm to 4.75 mm): 37.4			
26.5	88.9	0.017	8.8		% Silt (2 µm to 75 µm): 20.4			
22.4	85.5	0.010	6.8		% Clay (<2 µm): 2.5			
19	82.7	0.007	5.2					
16	78.3	0.005	4.0		Group Symbol / Soil Description			Silty SAND and GRAVEL, trace Clay
13.2	74.3	0.002	2.5		Remarks			
9.5	69.8	0.001	1.7					
6.7	64.5	Atterberg Limits						
4.75	60.3							
2.00	51.0	Liquid Limit						
0.850	43.4							
0.425	37.6	Plastic Limit						
0.250	32.9							
0.106	25.7	Plastic Index						
0.075	22.9							

Figure: 2

Figure: 2

Tested By:	Jason Taylor, B.A.Sc. Senior Laboratory Technician	Reviewed By:		Date:	September 24, 2024
Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.					

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