SOLA ENGINEERING

RE: GEOTECHNICAL INVESTIGATION
PROPOSED MID-RISE BUILDING DEVELOPMENT
3043 SIXTH LINE
OAKVILLE, ONTARIO

FOR: 3043 Sixth Line Inc. c/o S2S Environmental Inc.
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ATTENTION: Ms. Deepthi Prakash

REPORT NO.: 2020-14892R

DATE: December 19, 2025

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1.0 INTRODUCTION

Sola Engineering Inc. (Sola) was retained by 3043 Sixth Line Inc. c/o S2S Environmental Inc. ("the Client" or "the Clients") to carry out a geotechnical investigation for the Proposed Mid-rise Building Development located at 3043 Sixth Line in Oakville, Ontario (the "subject site" or "site"). Authorization to proceed with the investigation was received on September 18, 2020, through the acceptance of Sola's Email Proposal No. 2020-2360.

As per the scope of services detailed in Sola's proposal dated February 21, 2020, and the email communications with the client, it is understood that the purpose of this study is to provide recommendations for the design and construction of the proposed eight (8) storey (mid-rise) residential building development and four (4) storey townhouses. The mid-rise residential building development would include two (2) underground parking levels.

The Client has provided Sola with the conceptual drawing set (Sixth on the Green- Apartment Building) prepared by Gren Weis Architect and Associates, dated November 27, 2019, showing the approximate locations of the proposed development in order to assist with the understanding of the project objectives.

The Client has also provided a Topographical Survey Plan of Lot 15, Concession 1, North of Dundas Street (Registered Plan 20R-20379) prepared by J. D. Barnes Limited, and dated January 26, 2016, for our reference.

In this report, standard site investigation procedures have been adopted. The procedures including those developed by Ontario Building Code (OBC), Canadian Foundation Engineering Manual (CFEM), American Society for Testing and Materials (ASTM), Ontario Ministry of Transportation (MTO), and Toronto Transit Commission (TTC), are considered by far the most accepted methods by the local geotechnical society for the general engineering purposes. Soil Classification Systems used for developing this report have been in general conformance with those outlined in the above-mentioned procedures, with modifications where appropriate. Where in doubt, this office must be contacted for further interpretation or clarification.

This report presents the details of Sola's fieldwork and laboratory testing, outlines the subsoil and groundwater conditions at the subject site, and provides recommendations on the aforementioned items.

This report has been prepared for the Client, and their nominated engineers and designers. Third-party use or reproduction, in part or in full, of this report, is prohibited without written authorization from Sola. This report is also subject to the *Statement of Limitations* which forms an integral part of this document.

1.1 REVISION NOTE

Following the submission of the 2020 report, the Client provided an updated design concept plan prepared by Sweeny and Co. Architects, dated 19 September 2025. Based on a cursory review of the updated concept plan, the 2020 report and its recommendations remain largely applicable to the revised building configuration, now comprising a 12 storey residential buildings. This revision does not result in a material change to the engineering recommendations presented in the 2020 report.

2.0 PROJECT AND SITE DESCRIPTION

2.1 SITE LOCATION

The proposed site is located at 3043 Sixth Line in Oakville, Ontario.

The study area is currently occupied by single residential dwellings including driveways, trees landscaping areas. The subject site is bounded to the north and west by bare lands, to the east by the Church premises, and to the south by Sixth Line. A Borehole Location Site Plan is included in this report as **Enclosure 1**.

The Client is contemplating to redevelop the site with a 12-storey residential building. It is understood that the development would include two (2) underground parking levels.

2.2 PUBLISHED GEOLOGY

Based on a review of the existing geological publication for the site area, Ontario Geological Survey (OGS) Map P2509: "*Quaternary Geology, Hamilton Area (Southern Ontario)",* the site surrounding area is underlain by Halton Till: clay or silt till. According to the OGS Map M2544: "*Bedrock Geology of Ontario – Southern Ontario*", the superficial geology is underlain by a bedrock of the Upper Ordovician Queenston Formation, comprising Shale, Limestone, Dolostone, and Siltstone. Based on the data from records for Borehole ID 890606, the bedrock (shale) is at a shallow depth.

2.3 SURVEY

The ground surface elevations at the borehole locations were provided by S2S.

3.0 GROUND INVESTIGATION

3.1 FIELD INVESTIGATION

The geotechnical study was carried out in conjunction with the field drilling program by S2S for their environmental and hydrogeology investigations. S2S coordinated the overall project management work. Sola provided geotechnical supervision only. Prior to undertaking field drilling, S2S obtained clearances of existing public utility services to the site from all applicable agencies and companies.

The geotechnical aspects were supervised by Sola on October 13, 14, and 15, 2020, and comprised the drilling of five (5) boreholes (BH) BH1 to BH5.

All five (5) boreholes have been incorporated for environmental sampling purposes. All boreholes were converted to monitoring wells for a study being carried out by the project hydrogeologist.

The boreholes have been advanced to a maximum depth of 9.22 m below the ground surface. The details of borehole termination depths are summarized in **Table 1**.

Table 1: Summary of Borehole Depths

BH No.	Depth (m)	Approximate Elevation (m)	Type	Remarks
BH1	9.17	170.666	Foundation, Environmental, Hydrogeological	Spoon Refusal
BH2	9.17	170.399	Foundation, Environmental, Hydrogeological	Spoon Refusal
BH3	9.17	171.024	Foundation, Environmental, Hydrogeological	Spoon Refusal
BH4	9.17	171.223	Foundation, Environmental, Hydrogeological	Spoon Refusal
BH5	9.22	170.999	Foundation, Environmental, Hydrogeological	Spoon Refusal

All boreholes were advanced using the truck-mounted Boom-52 drill rig. Standard Penetration Tests (SPTs) split spoon samples were collected from boreholes using a 50 mm outer diameter and 35 mm inner diameter split barrel sampler driven with a 63.5 kg automatic hammer dropping 760 mm.

The soil drilling equipment was supplied and operated by Groundwork Drilling Inc. of Etobicoke, Ontario, and the drilling works were completed under the full-time supervision of a qualified Sola Technician.

The approximate locations of the boreholes are presented in **Enclosure 1**.

All soil samples were logged in the field and returned to Sola's laboratory in Vaughan for review and subsequent laboratory testing.

The logs of all boreholes completed, together with their depths relative to their elevations, are presented in **Enclosures 2 through 6**. The ground surface elevations at the borehole locations were provided by S2S.

Groundwater level observations were made during drilling and in the open boreholes upon completion of the drilling operations.
The scope of this investigation also included the installation of five (5), 50 mm diameter monitoring wells, in BH1 through BH5. The groundwater level in the piezometers was noted during the course of the drilling works at the site.

Details pertaining to groundwater observations for each borehole are provided on the respective borehole logs presented in **Enclosures 2 through 6**. Further discussion on groundwater is provided in **Section 4.2** of this report.

3.2 GEOTECHNICAL FIELD AND LABORATORY TESTING

All soil samples were returned to Sola's laboratory for natural moisture content determination. The results of the moisture content are presented in the borehole logs in **Enclosures 2 through 6**.

4.0 SUBSURFACE CONDITIONS

The detailed descriptions of the sub-soil conditions encountered at each borehole locations are given in the Borehole Logs in **Enclosures 2 through 6**.

The borehole data collected by Sola only represents the subsurface conditions at the borehole locations. It should be pointed out that the material boundaries indicated on the Borehole Logs are approximate and based on visual observations and interpolation between successive samples. These boundaries typically represent a transition from one material type to another and should not be regarded as an exact plane of geological change. It should also be noted that the subsurface conditions may vary across the site.

A summary of the characteristics for each unit of subsoil encountered within the borehole depths is given in the following paragraphs.

4.1 SOIL CHARACTERISATION

4.1.1 Ground Cover

A layer of asphaltic concrete was initially encountered in BH4, and the approximate thickness of the asphaltic concrete was measured to be 80 mm. Below the asphalt cover, a granular base course layer (sand and gravel) was encountered with an approximate thickness of 320 mm.

A layer of topsoil was encountered at all the borehole locations except in BH4. The topsoil thicknesses were found to be ranging from 100 mm to 175 mm.

It is important to note that topsoil thicknesses may vary throughout the site area, depending upon their location. As such, these findings should not be relied upon for any estimation of topsoil quantities to be stripped prior to construction.

4.1.2 Fill Materials

Fill materials consisting of sandy silt to clayey silt, trace gravel, trace organic, and trace rootlets were encountered at all the borehole locations BH1 through BH5. The fill layers varied in thicknesses from approximately 1.5 m (BH1 and BH2) to 2.27 m (BH3, BH4, and BH5).

Standard penetration tests (SPT) were carried out during the split spoon sampling process. SPT “N” values for fill materials were recorded between 6 (BH2 and BH3) and 40 (BH5) blows per 300mm, indicating that the fill was not constructed under engineering control.

The moisture content in the fill layers varied from 10.1% (BH4) to 47.9% (BH5).

4.1.3 Highly Weathered Shale Bedrock

Highly Weathered Shale Bedrock was encountered below the fill materials in all boreholes at the depth of approximately 1.5 to 2.3 m below the ground surface. The highly weathered shale bedrock is of the Queenston Formation. All boreholes were terminated in the highly weathered shale bedrock.

The highly weathered shale bedrock was readily penetrated using solid stem augers which indicates that in all likelihood, the material will have the engineering characteristics of hard-clayey silt till soil. SPT tests carried out in this sub-unit of the weathered shale bedrock measured N-values of more than 50 blows for less than 300 mm spoon penetration. The shale bedrock was not cored and laboratory tested.

It is important to note that top elevations of the rock at the borehole locations are only local conditions. They may vary across the site area, sometimes significantly. The contractor carrying out the construction must verify the data themselves. Limestone seams or hard layers are commonly present with the weathered shale.

4.2 GROUNDWATER CONDITIONS

Groundwater level observations were made during drilling and in the open boreholes upon completion of the drilling operations. Cave depths were recorded on the borehole logs shown in **Enclosures 2 through 6**. Five (5) monitoring wells were installed at the completion of the boreholes.

A groundwater monitoring visit was also undertaken by S2S Environmental Inc. later on October 19, 2020, and the investigation results are provided in **Table 2**.

Table 2: Summary of Groundwater Levels

Borehole	Cave Depth (m)	Groundwater Measurements (mbgs)	
		Upon completion of Drilling (October 13, 14, and 15, 2020)	By S2S (October 19, 2020)
BH1	8.23	3.35	4.50
BH2	6.71	2.44	4.20
BH3	8.84	4.57	Dry
BH4	8.53	6.10	Dry
BH5	Open	6.40	4.40

It should be noted that water levels can vary in response to seasonal fluctuations and major weather. In addition, a perched water condition can occur due to the accumulation of surface water in the more pervious fill overlying less pervious deposits, especially during seasonally wetter periods.

Long term groundwater level should be determined by the Project Hydrogeologist.

5.0 DISCUSSIONS AND RECOMMENDATIONS

It is understood that the site will be redeveloped with a 12-storey residential building. The residential building would include two (2) underground parking levels. Based on the ground conditions found at the site, our recommendations are presented in the following sections.

The investigation and comments should be considered on-going as new information about the underground conditions will continue to become available, for example, when more specific information is available with respect to conditions between boreholes during foundation construction. The interpretation between boreholes and the recommendations of this report must be checked through field inspections carried out by a Geotechnical Engineer to validate the information for use during construction.

The recommendations given below are based on that only minimal grade change, no more than 1 m, will be allowed to facilitate the site development.

5.1 FROST PROTECTION

All footings and structural elements exposed to seasonal freezing conditions must have at least 1.2 m of soil cover for frost protection in the GTA areas.

5.2 CONVENTIONAL SPREAD OR STRIP FOUNDATIONS

At the time of preparation of this report, design loading requirements have not been made available. The following discussions are provided to advance the design phase of the proposed residential townhouses. For geotechnical design purposes, it is recommended that the footings will be positioned over the undisturbed native stratum.

At the borehole locations, for two (2) level basement construction, the foundation level is generally at a depth of approximately 6.0 to 6.5 m below the existing grade. The founding stratum at these depths was found to be highly weathered shale bedrock. Based on the soil resistance values, the proposed building development with two (2) basement levels can be supported by spread and strip footings founded on the native deposit for a bearing capacity of 250 kPa for footing at the serviceability limit states (SLS), and for a factored geotechnical resistance of 375 kPa at the ultimate limit states (ULS).

For the other locations, the footings on undisturbed native soil can be designed based on geotechnical parameters as outlined in **Table 3**.

Table 3: Bearing Capacities and Founding Elevations

Borehole Number	SLS (kPa)	ULS (kPa)	Founding Depth (mBGS)	Founding Stratum
BH1	250	375	1.5	Highly Weathered Shale
BH2	250	375	1.5	Highly Weathered Shale
BH3	250	375	2.3	Highly Weathered Shale
BH4	250	375	2.3	Highly Weathered Shale
BH5	250	375	2.3	Highly Weathered Shale

The base of all footing excavations must be inspected by the Geotechnical Engineer prior to placing concrete to confirm the design pressures and to ensure that there is no disturbance of the founding soils.

Queenston Shale formation bedrock, when encountered with excessive moistures, will quickly turn into "mud" and subsequently lose its strength. Foundation construction should be planned to minimize the pending period after the shale is exposed. Otherwise, the exposed bedrock surface must be protected from runoff or ponding of water.

The design values provided above are based on the presumption that the allowable bearing pressure at SLS is governed by total and differential settlements of 25 mm and 19 mm respectively, and the structure will tolerate an angular distortion of 1 in 300.
Where it is necessary to place footings on the soil at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line (10H:7V) drawn up from the base of the lower footing. The lower footing must be installed first to minimize the risk of undermining the upper footing.

Footings and any foundation wall should be reinforced as per the design to be provided by the Structural Engineer of the project.

The recommended bearing capacities and the corresponding founding elevations would need to be confirmed by geotechnical engineering staff at the site prior to pouring footing concrete.

It should be noted that the recommended bearing capacities have been calculated by Sola from the borehole information for the design stage only. Should higher bearing values be required, this office should be contacted to review this report.

Where construction is undertaken during winter conditions, footing subgrades should be protected from freezing. Foundation walls and columns should be protected against heave due to soil adfreeze.

5.3 CAISSON FOUNDATION (IF LARGER BEARING CAPACITY IS REQUIRED)

If larger bearing capacity is required, the proposed structures may be founded on a caisson plus grade beam foundation system. Caisson foundations will have to be extended at least 1.0 m into the competent native soils. Accordingly, a net geotechnical reaction of 500 kPa at SLS and a factored geotechnical resistance of 750 kPa at ULS may be used for caisson design with the caisson tip extended to the elevation of 161.0 m (approx. 10 m below the ground surface).

The caissons are end bearing units and will require base inspection and cleaning of the base prior to concrete placement. The caissons should have a minimum diameter of 915 mm regardless of loading considerations to facilitate foundation subgrade inspection and cleaning of the base. The current requirements for minimum caisson diameter for entry are 760 mm, however, in our experience, deep foundation contractors request a minimum 915 mm caisson diameter to permit entry.

Caisson foundations at different elevations must be designed such that the higher caissons are set below a line drawn up at 10H: 7V from the closest edge of the lower caisson. Grade beam and pile cap units subjected to freezing temperatures must be provided with a minimum soil cover of 1.2 m for adequate frost protection. Inspection and cleaning of the end bearing caissons base are critical and must be done prior to concrete placement. Excavation and installation of the caissons must conform to all applicable sections of the Occupational Health and Safety Act, and all caissons must be installed with an adequate temporary steel safety liner to facilitate inspection and cleaning of the base. The caisson contract must stipulate that the caisson contractor will be responsible for the provision of all necessary equipment (including steel liner of adequate strength) and monitoring devices (as needed) for safe access of the inspection and base cleaning personnel into the caissons, in accordance with the Occupational Health and Safety Act requirements.

Prior to pouring concrete, the base of each caisson should be inspected by a Geotechnical Engineer.

5.4 SLAB ON GRADE / FLOOR SLABS

The floor slab / Slab on grade can be adequately supported at the exposed subgrade. Any exposed soil subgrade must be proof-rolled to detect any soft or unstable areas, which must be removed and replaced with suitably compacted engineered fill, as defined in **Section 5.9** of this report.

Once the required subgrade has been developed, Sola recommends that the exposed subgrade be inspected and approved by a Geotechnical Engineer prior to the placement of any granular fill or concrete.

A granular layer consisting of at least 200 mm thick layer of 19 mm Crusher Run Limestone (CRL) or OPSS Granular A should be installed under the floor slab as a bedding layer, as well to enhance under slab moisture condition.
Such a layer has been proven to be an effective moisture barrier for conventional floor surfaces. However, if special floor coverings such as sheet PVC with heat-sealed seams are considered, either a high-efficiency vapour barrier or venting may be added to the granular layer to prevent moisture accumulating between the concrete floor and the PVC flooring.

It is considered by Sola that completed excavations for floor slabs should not be left open before pouring concrete for any period longer than 24 hours, particularly if the floor construction works are being completed during the winter months or wet weather periods. The base of any floor slab excavation that is to be left exposed for longer than 24 hours should be suitably covered and protected from water ponding, and/or protected to prevent degradation of the exposed founding stratum with the construction of a mud mat.

The design of the concrete slabs on native soils may be based on a value of modulus of subgrade reaction of 25 MPa/m on the surface of the granular moisture barrier.

The floor slab should be structurally independent of any load-bearing structural elements. The long-term groundwater level should be determined by the project hydrogeologist.

Should the lowest construction element extend below the site permanent water table, proper permanent water control provisions, i.e. watertight structure considerations, positive pumping plus backup systems, waterproofing, etc., must be included in the basement design and construction.

5.5 SITE PREPARATORY WORKS

The site preparation work may include stripping of the ground cover and existing fill in order to develop the required construction or engineered fill subgrades. Depending on the final grading plan, stripping depths will likely vary locally and should be adjusted to remove all unsuitable material.

It is recommended that the Geotechnical Engineer monitor the stripping operations to ensure that unsuitable materials have been fully removed prior to construction works or the placement of engineered fill. Unacceptable areas identified are to be remediated as soon as practicable and, the procedures would be dependent upon conditions encountered.

5.6 EXCAVATABILITY AND SITE EXCAVATIONS

Given the layout of the proposed development in relation to the site area, it has been assumed that all excavations for the building and utilities will be open cut. In order to enable entry into excavations during the construction process, all excavations must comply with the definitions prescribed by the "*Occupational Health and Safety Act*" (OHSA), Ontario Regulation 213/91 "*Construction Projects*".

The borehole data indicate that the shale has a hard till characteristics and should present as a Type 1 soil as defined in the OHSA and Regulations for Construction Projects (Part III Excavations, Section 226); fill, Type 3. Excavations in these materials should be constructed in conformance with the regulations. It is noted that the above soil classifications have been estimated based on small, discontinuous samples from boreholes. The excavation conditions must be confirmed and/or modified on the basis of field inspections during the construction stage when large scale observations can be made with ease.

As defined by the OHSA, excavation walls within the Type 3 soils will require battering back at slopes no steeper than 1H (horizontal):1V (vertical). For Type 1 soils, the bottom 1.2 m high of the

trench wall can be vertical. In weathered shale bedrock for short term construction purposes, the excavation wall may be cut near vertical and remain relatively stable, however, the red Queenston Shale Bedrock has a known notorious characteristic that it can break down rapidly when exposes to excessive moistures. This must be examined by a Geotechnical Engineer during construction and construction vibration/settlement monitoring may be required.

Depending on the construction feasibility 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.

Based on the findings of the investigation, it is considered that excavation of the overburden native soils at the site can be carried out using a conventional backhoe excavator.

At the time of preparation of this report, it is unknown if rock excavation is required. Using the estimated parameters of the degree of weathering, rock strength, joints, and bedding spacing, and diggability index rating developed by Scoble and Muftuoglu (2001), it is anticipated that the shale rock materials, their ease of digging and typical construction equipment, should conform to the following **Table 4:**

Table 4: Excavatability of Rock

Stratigraphic Unit	Class	Ease of Digging	Typical Plant Fitted with Rock Teeth and Ripper which may be used Without Blasting
Weathered shale	II	Easy	Hydraulic shovel or Backhoe, e.g., CAT 245
Unweathered shale	III	Moderately	Hydraulic shovel, e.g., CAT 245
Limestone	IV	Difficult	Hydraulic shovel, Short Boom of backhoe e.g., CAT 245, O and K RH 40

The above table and applicable machine types are for information only. Contractors who plan the construction work should carry out their own assessment of the constructability.

It is important to note that the above discussion about the excavation is for information purposes only. Contractor bidding on the projects must make their own assessment based on the real site conditions.

Hard limestone thin seams were inferred in the boreholes. The contractor carrying out the excavation work should account for removing such in their site excavation work.

It is assumed that the groundwater will be lowered to 1.0 m below the required excavation depth to enable the construction to be carried out in the 'dry' condition. It is expected that the 'perched water' can be controlled by the conventional 'sump and pump' methodology. If more aggressive dewatering methods are required, a dewatering specialist should be consulted.

5.7 TEMPORARY SHORING DESIGN CONSIDERATIONS (WHERE APPLICABLE)

The recommendations in this subsection may be ignored if the construction can be carried out using open-cut techniques.

If the proposed building will take up a large portion of the property, it may be expected that shoring is required to facilitate the construction of the proposed building. It should be noted that, if shoring is required, a specialist shoring contractor should be consulted to establish the most appropriate design and seating depths for the construction shoring solution.

The shoring system may be designed in accordance with the Canadian Foundation Engineering Manual (CFEM), the 4th Edition. Though not a design code, the CFEM design manual provides a comprehensive guide for shoring and anchor design and is still considered the most widely used and accepted design approach in the Greater Toronto Area (herein "GTA").

Shoring subject to unbalanced earth pressures must be designed to resist a pressure distribution that can be calculated as follows:

$$p = K [\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w$$

where: p = Lateral earth pressure in kPa acting at depth h

K = parameters are provided below
h = the depth below the ground surface (m)
h_w = the depth below the groundwater level (m)
γ = the bulk unit weight of soil, (kN/m^3) use 20.0
γ' = the submerged unit weight of the exterior soil, (γ - 9.8 kN/m^3)
q = equivalent value of surcharge on the ground surface in kPa (min 12 kPa)

Where the backfill against the buried structure can be drained effectively to eliminate hydrostatic pressures on the wall, this equation can be simplified to:

$$p = K (\gamma h + q)$$

The soil parameters estimated to be applicable for this design are as follows in **Table 5**:

Table 5: Soil Parameters for Shoring Design

Material	Effective Friction Angle Ø' (deg)	Unit Weight γ (kN/m³)	Coeff. Of Lateral Earth Pressure		
			Active, Ka	Passive, Kp	At-rest, Ko
OPSS Granular A or B	34	22	0.28	3.6	0.44
Fill	28	19	0.37	2.7	0.53
Native Soil or Highly Weathered Shale	30	20	0.33	3.0	0.50

For a global stability check:

$\phi = 30°$
$\gamma = 20\ kN/m^3$

Wall friction should be considered negligible.

The design groundwater table should be assumed at a depth of approximately 3.0 m below the ground surface. The long-term groundwater level should be determined by the project hydrogeologist.

The surcharge needs should be determined by the Structural Engineer but should not be less than 12 kPa.

The design calculations should be submitted to Sola for geotechnical review.

Movement of the shoring system is considered inevitable. The magnitude of this movement can be controlled by sound construction practices, and it is anticipated that the horizontal movement will be in the range of 0.1 % H to 0.25 % H. Vertical movements increase the horizontal movements because of the reduced stress in the inclined anchors. For this reason, the shoring design must be carried out to minimize the vertical movement of the shoring system.

To ensure that movements of the shoring are within an acceptable range, monitoring must be undertaken throughout the site development process. Vertical and horizontal targets must be located and surveyed before excavation begins. Weekly readings during excavation should show that the movements will be within those predicted; if not, the monitoring results should enable directions to be given to improving the shoring.

5.8 CONSTRUCTION DEWATERING

The borehole data have indicated that no unusual groundwater seepage problems should be expected during excavation and 'perched water' can be controlled by conventional sump pumping. However, the construction dewatering requirements should be dictated by a hydrogeologist.

5.9 ENGINEERED FILL

On-site excavated, clean inorganic earth (native and/or fill) may be reused as engineered fill material, provided that the moisture contents are strictly controlled. It is not recommended to reuse broken shale bedrock for engineered fill in the pavement area or under structural elements.

If imported inorganic mineral soils are used for engineered fill construction, they must meet the applicable environmental guidelines, and their moisture contents should preferably be close to their respective optimum water content values.

For the on-site excavated clean fill/native soils or similar imported soils, heavy compaction equipment should be employed to achieve the specified degree of field density.

Consideration may also be given to backfilling excavations with a well-graded, compacted granular soil such as Granular B as it, if thoroughly compacted, would reduce the post-construction settlements to an acceptable level and may also expedite the compaction process.

Fill materials required for replacing locally softened soils or raising grades within the footprint of the structures are to comprise suitably organic free materials approved for use by a Geotechnical Engineer. Fill materials are to be placed in lifts of a maximum thickness of 300 mm and compacted, using appropriate compaction equipment, to 98 % of its Standard Proctor Maximum Dry Density (SPMDD).

Fill located in areas outside of the footprint of any proposed structure or driveway should be compacted to at least 95 % of the material's SPMDD below 1.0 m of the subgrade level, and then to 98 % of its SPMDD up to the required grade. Imported granular fill used in confined areas should be compacted using only hand-held compaction equipment only.

Sola recommends that any and all engineered subgrades beneath proposed structures are to be inspected and/or proof rolled prior to construction.

5.10 PAVEMENT

Pavement structure adjoining the proposed construction areas should be protected from damages resulting from construction activities. All heavy vehicles should be appropriately planned and re-routed to avoid such damages.

5.10.1 Pavement Thickness Design

For pavement construction, if contemplated, the existing subgrade soils, when compacted and proof rolled, will be competent to support a conventional pavement structural thickness. Any unsuitable soils, such as topsoil/organic mixed soil and other spongy materials, if found, should be sub-excavated and replaced with approved materials and the profiled subgrade compacted to 98% of its SPMDD.

The pavement construction may consist of upfilling (if applicable) from the prepared subgrade surface to the underside of the granular base layer using well-graded granular subbase material (OPSS Granular B-Type I) up to a maximum thickness of 500 mm. The material should be laid and compacted in thin lifts to at least 100% of its SPMDD. The pavement thickness design should conform to the Town of Oakville's Standard Design Drawing 7-2 as shown in **Table 6**. It is assumed that there will be only occasional delivery truck travels allowed for medium duty areas. In the areas where fire routes and loading dock are expected, the heavy-duty pavement design should be implemented.

Table 6: Recommended Pavement Design

Pavement Component	Medium Duty Thickness (mm)	Heavy-Duty Thickness (mm)	Compaction Requirements
OPSS Asphaltic Concrete Surface Course (HL-3)	40	40	Minimum of 92.0% of Maximum Relative Density (MRD)
OPSS Asphaltic Concrete Binder Course (HL-8)	50	80	
Granular Base (OPSS Granular A)	150	150	100% SPMDD
Granular Sub-Base (OPSS Granular B Type I)	350	350	

All pavement component materials should be produced and laid in accordance with current OPSS requirements. Asphaltic concrete materials would be compacted to 92% of their Maximum Relative Density (MRD) or higher. Granular materials would be compacted to at least 100% of its SPMDD.

The pavement design as presented above in **Table 6** is based on the assumption that construction will be undertaken under dry weather conditions and that the subgrade is stable and not heaving under construction equipment traffic. However, if the construction conditions are non-ideal, with the final subgrade being wet and/or unstable, additional imported subbase material may become necessary.

The design and construction of the driveways should conform to the Town of Oakville's Standard Design Drawing 7-2. The pavement make-up for the entrance driveways should match the respective road pavement design at the road/driveway interface.

Prior to placing the granular subbase, the final subgrade should be proof-rolled to identify soft spots, if any, and rectified as required in consultation with a Geotechnical Engineer.

The recommended pavement structure should be considered for preliminary design purposes only. A functional design life of eight (8) to ten (10) years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific design life requirements. Such further analysis will also involve specific laboratory tests to determine the frost susceptibility and strength characteristics of the subgrade soils.

If required, a more refined pavement structure can be designed based on specific traffic data and design life requirements. Such further analysis will also involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific traffic loading data input from the Client.

Pavement Drainage: The ability of the soils to provide adequate subgrade support is reduced if allowed to become too wet. Therefore, in order to intercept infiltrating water and provide drainage of the subgrade and pavement material, it is recommended that 100 mm diameter sub-drains, wrapped in filter cloth, be provided along both sides of the driveways; in addition, similar stub-drains should be installed in four (4) directions from the catch basins and at strategic locations under the parking lot pavement. Furthermore, the subgrade should be graded to promote the flow of water towards the subdrains. In the cases where the sub-drains connecting to the municipal sewer system are not preferred, the pavement profile should be adjusted to direct any runoff flow of water to the on-site stormwater management system, i.e. infiltration gallery.

5.10.2 Pavement Construction Considerations

For pavement construction, the subgrade must be compacted to at least 98% SPMDD, for at least the upper 300 mm, unless an alternative is approved by Sola.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved.

Additional comments on the construction of pavement areas are as follows:

- The subgrade preparation should include stripping of any objectionable materials, e.g. loose fill with organics. The base should be properly shaped and thoroughly proof rolled using a loaded truck. Soft and/or unstable subgrade areas should be further sub-excavated and backfilled to the design subgrade level using an approved material, placed in thin lifts and compacted to 98% of its SPMDD;
- The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed grading. Assuming that satisfactory crossfalls in the order of 3.0% have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that flatter crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by Sola; and,
- The most severe loading conditions on the pavement areas and subgrade may occur during construction. Consequently, special provisions such as restricted access routes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

It is recommended that Sola be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations in this report.

5.11 EARTHQUAKE CONSIDERATIONS

Using the information provided by the site investigation, the general soil profile comprises *"Stiff Soil – Site Class D"* as defined by Table 4.1.8.4.A *"Site Classification for Seismic Site Response"* of the Ontario Building Code.

If a higher site class is desired, a site-specific shear wave velocity testing should be carried out by a specialist.

5.12 SERVICE INSTALLATION CONSIDERATIONS (WHERE APPLICABLE)

5.12.1 General

The materials found in the boreholes at the expected elevations of the proposed servicing trench generally consist of competent soils. In general, the site materials are suitable for pipeline support. Localized loose/soft subgrade conditions, if encountered during construction, should be sub excavated to a depth of at least 300 mm or to a firm base, if shallower, and backfilled with clean, compactable materials and stabilized as per the project specifications.

Prior to placement of bedding, the exposed subgrade at the bottom of each servicing trench excavation should be inspected by a Geotechnical Engineer to identify any soft, loose or disturbed base conditions. All disturbed soils resulting from construction activities should be removed and replaced as noted above.

Design and construction consideration for both flexible (PVC) and rigid (concrete) pipes are included in the following sections.

5.12.2 Excavations and Health and Safety Considerations

The same recommendations as given in **Section 5.6** will generally apply for the excavations for laying of the underground services. The excavated soils should be placed not closer than the depth of the trenches from the trench edge.

5.12.3 Bedding

The improved fill materials and native subgrade in an undisturbed state will provide adequate support for the proposed service pipes and will allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard Specifications (OPSS 1010) and/or the Town of Oakville standards for bedding stone gradation requirements. The pipes should be placed with a minimum bedding thickness in conformance with Ontario Provincial Standard Drawing OPSD 802.010 (for flexible pipes) or OPSD 802.031 (for rigid pipes), though the bedding thickness will be subject to variation and ultimately be based on the proposed pipe diameter, bedding specifications used, etc.

On completion of the servicing pipe installation, a granular surround of the same bedding material should be placed around the pipe to cover it to at least 300 mm above the pipe obvert.

The backfill above the bedding and cover materials may consist of a clean, compactable fill that possesses similar properties to the existing subgrade soil. Based on the borehole data it is anticipated that the local soil material may be reused as trench backfill. Some moisture conditioning of the soil may be required to facilitate soil compaction. It is not recommended to reuse broken shale for service backfill. In the event that imported soil is used as a trench backfill, it must be ensured that the drainage properties of the subgrade are maintained and that there is no differential frost movement. Trench backfill should be compacted to at least 95% of the material's SPMDD, or Town of Oakville standards, whichever is more stringent.

5.12.4 Trench Backfill

Backfilling During Dry-Weather Conditions

The excavated subgrade soils are considered suitable for re-use as fill to backfill wider service trenches, provided that heavy compaction equipment can be used to compact the fill material. It is not recommended to reuse broken shale for trench backfill. In confined areas, consideration may be also given to backfilling the areas with a well-graded, compacted granular soil such as Granular 'B' material. As such material, if thoroughly compacted, would reduce the post-construction settlements to an acceptable level and may also expedite the compaction process.

Each lift should be no greater than 300 mm thick and compacted using an appropriate heavy compaction machine to at least 95 % of the material's SPMDD to within 1 m of the top of the subgrade, and then to 98 % SPMDD up to the required grade.

Exposed, excavated soil stockpiles that are to be reused as fill on-site should be compacted at the surface or temporarily covered during wet weather to help maintain their original moisture content. Such stockpiles are prone to wet weather exposure and, as such, the increased moisture contents will make these materials too wet to achieve the required levels of compaction.

Conversely, if the excavated native soils are too dry to achieve the required levels of compaction, some moisture addition/conditioning by means of water hosing or misting should be expected if the trench excavation works are to be undertaken during the dry seasons.

We recommend the subgrade be observed and approved by a Geotechnical Engineer prior to the placement of the bedding material to confirm that the subgrade conditions are consistent with the recommendations given in this report. Where unsuitable subgrade conditions are observed, remedial procedures can be established in the field to avoid construction delays.

Backfilling During Winter Months

Should this project proceed during the winter months, the following additional recommendations will apply in order to avoid any detrimental effects of frost.

In this situation, it is imperative that the excavation and backfilling operations follow simultaneously. This procedure is required to avoid time gaps between the two constructions stages, as prolonged exposure to frost may lead to the inclusion of frozen material during backfilling. It is recommended that prior to resuming backfilling over the frozen surface, all frost should be removed to achieve a satisfactory bond between the current and previously laid fills. Also, this procedure would prevent leaving frozen layers of soils which could cause long term settlements while undergoing slow thawing.

It is further recommended that any accumulation of water or ice in the small Sheepsfoot footprint overnight or weekends should be prevented by adequately shaping up and back-blading the compacted grades prior to leaving the site.

In order to ensure that no frozen material is being backfilled in the trenches, it is recommended that the backfilling and compaction operations should be supervised and closely monitored by Sola on a continuous basis.

For the construction of the road/parking lot, the final subgrade should be prepared during 'dry weather' conditions so as to achieve a satisfactory end product.

5.13 GENERAL CONSTRUCTION CONSIDERATIONS

Load bearing soils are susceptible to disturbance from environmental factors (temperature, moisture change, etc.) and construction activity. Therefore, due care should be given to minimizing the trafficking of such areas during periods of excavation and the construction of the floor slab and footings to minimize disturbance of the bearing soils.

Any excessive disturbances of the load-bearing and underlying soils affected during construction works could influence the long-term settlement of the structures and will, therefore, require further excavation and replacement of such impacted soils with suitable engineered fill.

During winter seasons, foundations and slab-on-grade construction should be carried out to avoid pouring concrete on frozen soil. Foundations must be adequately protected at all times from cold weather and freezing conditions.

A Geotechnical Engineer should evaluate all subgrade surfaces to confirm that the subgrade and founding conditions are consistent with the recommendations given by this report.

6.0 MATERIAL TESTING AND INSPECTION

It is recommended that Sola be appointed to carry out field inspection and materials testing during construction to ensure that the construction complies with the design recommendations.

7.0 DRAWING REVIEW

Once the final design drawings for this project are prepared, it is recommended that one (1) set of the drawings should be submitted to Sola for review and to make any amendments to our recommendations that may be required, prior to starting construction.

Sola should also be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Sola will assume no responsibility for the interpretation of the recommendations in this report.

The comments given in this report are preliminary and intended only for the guidance of design engineers. Contractors bidding on or undertaking the works should make their own interpretations of the factual borehole results, so that they may draw their own conclusions on how the subsurface conditions may affect them.

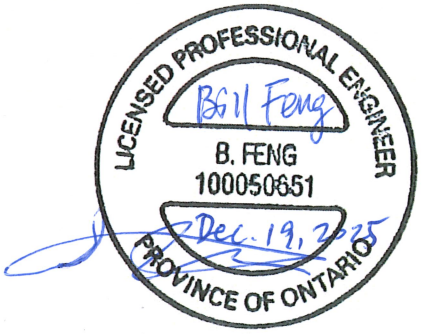
The information in this report in no way reflects on the environmental aspects of soil conditions at the site and has not been addressed in this report, since this aspect was beyond the scope and terms of reference.

8.0 CLOSURE

This report is subject to the Statement of Limitations which forms an integral part of this document. The Statement of Limitations is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust that this report meets your needs. Should you have any queries, please contact the Sola office.

Sincerely
SOLA ENGINEERING INC.



George Hao, P. Eng.
Geotechnical Engineer

Bill Feng P. Eng.
Chief Engineer

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Enclosures

STATEMENT OF LIMITATIONS

Standard of Care and Basis of this Report
Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

Use of this Report
This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

Site Conditions
The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

Indemnification of Risk
Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

Subconsultants and Contractor Services
In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

Work and Job Site Safety
Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.

SOLA ENGINEERING	File No.: 10760-S0068-Geo	**BH Location Plan**	The figure provided is for the intended purpose of presenting the approximate borehole locations. This figure should not be used for any other purposes including construction, architecture or for accuracy of dimensions and orientation of objects.	Enclosure No.: **1**
	Report Number: 2020-14892R	**Proposed Site Development**		
		3043 Sixth Line, Oakville, ON		
	Date: November 5, 2020	**S2S Environmental Inc.**		Not to Scale

SOLA ENGINEERING

ENCLOSURE No. 2

RECORD OF BOREHOLE No. BH1

1 OF 3

METRIC

PROJECT NUMBER 10760 | LOCATION | ORIGINATED BY CC

DIST | HWY | BOREHOLE TYPE Solid Stem Auger | COMPILED BY JA

DATUM Geodetic | DATE 2020.10.14 - 2020.10.14 | LATITUDE | LONGITUDE | CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
170.7											
0.0 / 170.5	TOPSOIL- 150 mm thick		1A						○		
0.2 / 169.9	FILL - sandy silt, trace gravel, brown, moist		1B	SS	7		170		○		
0.8 / 169.1	- trace clay		2	SS	34				○		
1.5	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist		3	SS	66*/ 28cm		169		○		
			4	SS	50*/ 3cm		168		○		
			5	SS	50*/ 3cm		167		○		

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 2

RECORD OF BOREHOLE No. BH1 2 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.14 - 2020.10.14 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*										
	- wet		6	SS	50*/ 8cm		166		○		
							165				
164.6											
6.1	- greenish grey		7	SS	50*/ 3cm		164		○		
163.0											
7.6			8	SS	50*/ 5cm		163		○		

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 2

RECORD OF BOREHOLE No. BH1 3 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.14 - 2020.10.14 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*						162				
161.5 / 9.2	End of Borehole at Target Depth of 9.17 m Below the Ground Surface. Groundwater was Measured at 3.35 m Below Ground Surface Upon Completion of Drilling. Borehole Caved at 8.23 m Upon Completion of Drilling.		9	SS	50*/ 3cm				○		

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 3

RECORD OF BOREHOLE No. BH2

1 OF 3

METRIC

PROJECT NUMBER 10760 | LOCATION | ORIGINATED BY CC

DIST | HWY | BOREHOLE TYPE Solid Stem Auger | COMPILED BY JA

DATUM Geodetic | DATE 2020.10.14 - 2020.10.14 | LATITUDE | LONGITUDE | CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
170.4											
0.0 / 170.3	TOPSOIL- 100 mm thick		1A								
0.1	FILL - sandy silt, trace gravel, trace rootlets, brown, moist		1B	SS	6		170				
169.6											
0.8	FILL - clayey silt, trace gravel, trace sand, trace rootlets, brown, moist		2	SS	16		169				
168.9											
1.5	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist		3	SS	80*/ 20cm						
	- wet layer		4	SS	50*/ 15cm	▽	168				
167.3											
3.1			5	SS	50*/ 13cm		167				

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 3

RECORD OF BOREHOLE No. BH2 2 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.14 - 2020.10.14 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*					
			6	SS	50*/ 3cm	
	- greenish grey		7	SS	50*/ 3cm	
162.8 / 7.6			8	SS	50*/ 3cm	

ELEVATION SCALE: 166, 165, 164, 163

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 3

RECORD OF BOREHOLE No. BH2 3 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.14 - 2020.10.14 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*						162				
161.2 / 9.2	End of Borehole at Target Depth of 9.17 m Below the Ground Surface. Groundwater was Measured at 2.44 m Below Ground Surface Upon Completion of Drilling. Borehole Caved at 6.71 m Upon Completion of Drilling.		9	SS	50*/ 3cm				○		

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 4

RECORD OF BOREHOLE No. BH3

1 OF 3

METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
171.0							171
0.0 / 170.9	TOPSOIL- 100 mm thick		1A				
0.1 / 170.7	FILL - sand, trace gravel, brown, moist		1B				
0.3 / 170.3	FILL - sandy silt, trace gravel, trace rootlets, trace organic, dark brown, moist		1C	SS	6		
0.8	FILL - clayey silt, trace gravel, greyish brown, moist		2	SS	17		170
168.7			3	SS	28		169
2.3	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist		4	SS	50*/ 5cm		
			5	SS	50*/ 8cm		168

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 4

RECORD OF BOREHOLE No. BH3 2 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*		6	SS	50*/ 5cm		167		○	
							166			
			7	SS	50*/ 3cm		165		○	
							164			

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 4

RECORD OF BOREHOLE No. BH3

3 OF 3

METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*						163				
							162				
161.9 / 9.2	- wet		9	SS	50*/ 3cm				○		
	End of Borehole at Target Depth of 9.17 m Below the Ground Surface. Groundwater was Measured at 4.57 m Below Ground Surface Upon Completion of Drilling. Borehole Caved at 8.84 m Upon Completion of Drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 5

RECORD OF BOREHOLE No. BH4

1 OF 3

METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES
171.2					
0.0 / 171.1	ASHPHALT- 80 mm thick		1A		
0.1 / 170.8	SAND AND GRAVEL- 320 mm thick		1B	SS	27
0.4 / 170.5	FILL - sand, trace gravel, brown, moist		1C		
0.8 / 169.7	FILL - clayey silt, trace gravel, brown, moist		2	SS	24
1.5 / 168.9	FILL - sandy silt, trace gravel, trace clay, brown, moist		3	SS	37
2.3	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist		4	SS	50*/ 13cm
			5	SS	50*/ 8cm

GROUND WATER CONDITIONS

ELEVATION SCALE: 171, 170, 169, 168

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
20 40 60

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 5

RECORD OF BOREHOLE No. BH4 2 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE			GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*		6	AS			167		○		
							166				
			7	SS	50*/ 5cm				○		
							165				
			8	AS			164				

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 5

RECORD OF BOREHOLE No. BH4 3 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.13 - 2020.10.13 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*						163				
162.1 / 9.2	End of Borehole at Target Depth of 9.17 m Below the Ground Surface. Groundwater was Measured at 6.1 m Below Ground Surface Upon Completion of Drilling. Borehole Caved at 8.53 m Upon Completion of Drilling.		9	SS	50*/ 3cm				○		

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 6

RECORD OF BOREHOLE No. BH5

1 OF 3

METRIC

PROJECT NUMBER 10760 | LOCATION | ORIGINATED BY CC

DIST | HWY | BOREHOLE TYPE Solid Stem Auger | COMPILED BY JA

DATUM Geodetic | DATE 2020.10.15 - 2020.10.15 | LATITUDE | LONGITUDE | CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
171.0											
0.0 / 170.8	TOPSOIL- 175 mm thick		1A						○ at 40		
0.2 / 170.2	FILL - silty sand, trace gravel, trace organic, trace rootlets, dark brown, moist		1B	SS	10						
0.8	FILL - sandy silt, trace gravel, trace clay, brown, moist		2	SS	57		170		○		
			3	SS	40		169		○		
168.7											
2.3	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist		4	SS	50*/ 10cm				○		
			5	SS	50*/ 10cm		168		○		

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 6

RECORD OF BOREHOLE No. BH5 2 OF 3 METRIC

PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.15 - 2020.10.15 LATITUDE LONGITUDE CHECKED BY JA

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (20 40 60 80 100): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
166.4 / 4.6	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)*		6	SS	50*/ 3cm		166	○	○		
			7	SS	50*/ 10cm	▽	165		○		
			8	SS	50*/ 8cm		164		○		

Continued Next Page

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

SOLA ENGINEERING

ENCLOSURE No. 6

RECORD OF BOREHOLE No. BH5 3 OF 3 METRIC

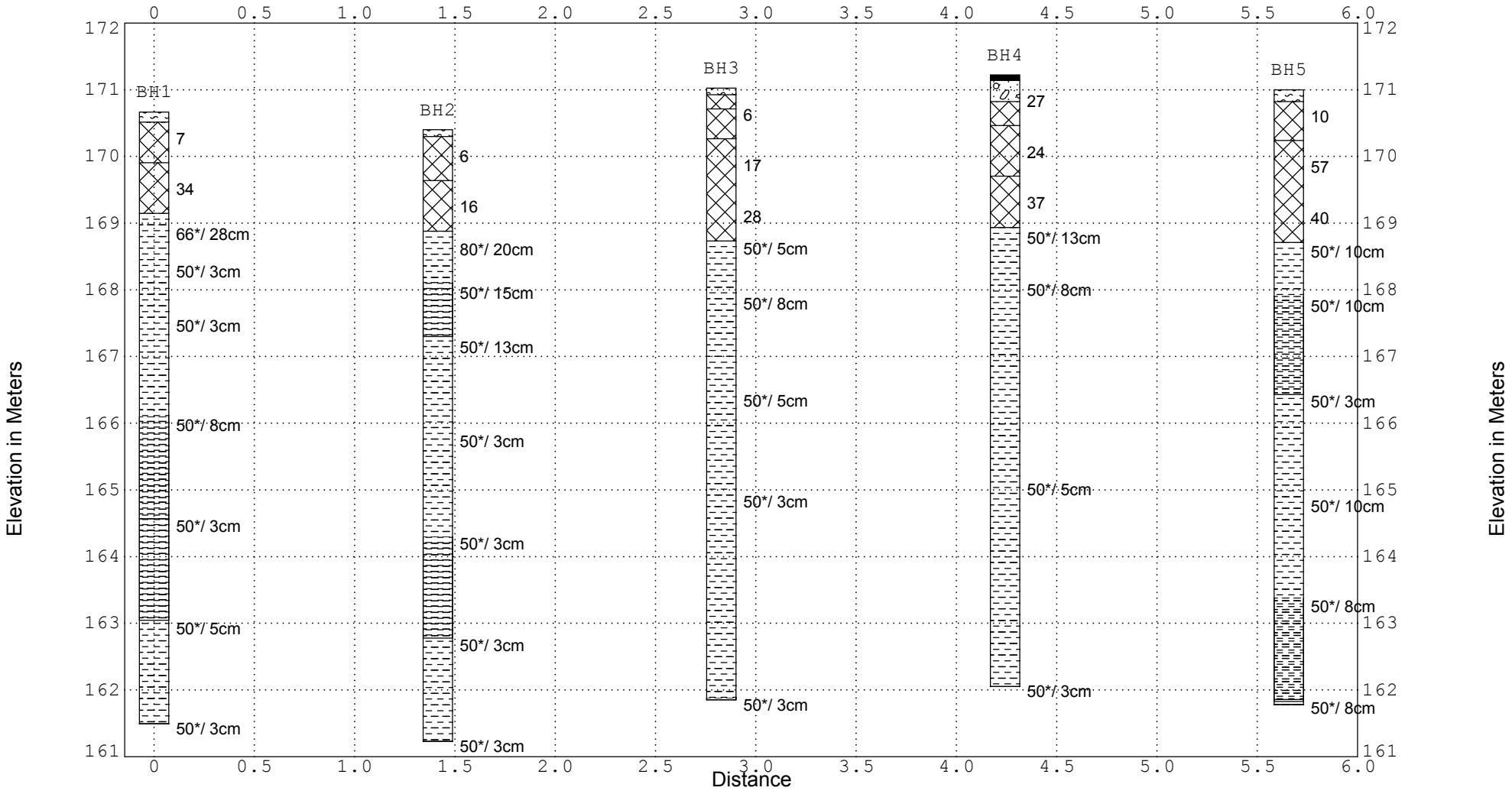
PROJECT NUMBER 10760 LOCATION ORIGINATED BY CC

DIST HWY BOREHOLE TYPE Solid Stem Auger COMPILED BY JA

DATUM Geodetic DATE 2020.10.15 - 2020.10.15 LATITUDE LONGITUDE CHECKED BY JA

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	WEATHERED SHALE BEDROCK- queenston formation, highly weathered, fractured, poor, weak, reddish brown, moist *(continued)* - moist - moist *(continued)* - very moist - very moist *(continued)*						162				
161.9											
161.8	-wet		9	SS	50*/ 8cm				○		
161.8											
9.2	End of Borehole at Target Depth of 9.22 m Below the Ground Surface. Groundwater was Measured at 6.4 m Below Ground Surface Upon Completion of Drilling. Borehole was Open Upon Completion of Drilling.										

$+^3, \times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



Plan View

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SOLA ENGINEERING INC.
CONCEPTUAL SOIL PROFILE

Horizontal Scale:	Drawn By:	
Vertical Scale:	Approved By:	

3043 Sixth Line Inc.

Project Number: 10760

Enclosure No.: 7

SOLA ENGINEERING

KEY TO SYMBOLS

Enclosure No.:8

PROJECT NUMBER 10760

PROJECT NAME 3043 Sixth Line Inc.

LOCATION

CLIENT S2S Environmental Inc.

LITHOLOGIC SYMBOLS (Unified Soil Classification System)


ASPHALT: Asphalt


FILL: TTC Fill (made ground)


SAND-GRL: SAND & GRAVEL


SHALE: TTC Shale


TOPSOIL: Topsoil/peat/organics

SAMPLER SYMBOLS


Split Spoon Sample

WELL CONSTRUCTION SYMBOLS


Bentonite Seal: 1 pipe group, 1 pipe


Bentonite Grout: Bottom of hole


Solid pipe packed in granular material


Slotted pipe packed in granular material

Notes:

Terms describing RELATIVE DENSITY, based on Standard Penetration Test "N"-Value for COURSE GRAINED soils (major portion retained on No. 200 seive):

DESCRIPTIVE TERM ["N"-Value (blows/0.3m), Relative Density (%)]

- **Very Loose [less than 4, less than 15]**
- **Loose [4 to 10, 15 to 35]**
- **Compact or Medium [10 to 30, 35 to 65]**
- **Dense [30 to 50, 65 to 85]**
- **Very Dense [greater than 50, greater than 85]**

Terms describing CONSISTENCY, based on Standard Penetration Test "N"-Value for FINE GRAINED soils (major portion passing No. 200 sieve):

DESCRIPTIVE TERM [Unconfined Compressive Strength (kPa), "N"-Value (blows/0.3m)]

- **Very Soft [less than 25, less than 2]**
- **Soft [25 to 50, 2 to 4]**
- **Firm [50 to 100, 4 to 8]**
- **Stiff [100 to 200, 8 to 15]**
- **Very Stiff [200 to 400, 15 to 30]**
- **Hard [greater than 400, greater than 30]**