Supplementary Geotechnical Investigation

Proposed Industrial Development - Intersection of Rideau Street and Somme Street
Ottawa, Ontario

Consolidated FastFrate (Ottawa) Holdings Inc.

January 24, 2022

→ **The Power of Commitment**

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1. Introduction

GHD Limited (GHD) has been retained by Consolidated FastFrate (Ottawa) Holdings Inc. (FastFrate), representative Mr. Pierre Courteau of CBRE Limited, to undertake a supplementary geotechnical investigation for a new warehouse and office building located southeast of the intersection of Rideau Street and Somme Street in Ottawa, Ontario, hereafter referred to as the 'Site'.

The Site location map is provided as **Figure** 1 at the end of this report.

The supplementary investigation was carried out in accordance with GHD's offer of professional services no. 11228236, dated July 20, 2021, and addressed to Mr. Pierre Courteau and Mr. Keefe Primett.

The purpose of this supplementary geotechnical investigation was to further define the subsurface soil and groundwater conditions within the site development footprint, not previously covered by GHD in previous investigations, following modifications to the proposed building footprint location. This supplementally geotechnical report provides recommendations with respect to the new proposed development footprint, including but not limited to:

- Foundation design option and general recommendations with respect to deep dynamic compaction, as this is understood to be the client's preferred construction and soil improvement method.
- Subgrade preparation for proposed building slabs and exterior pavement areas, including exterior pavement design.
- General excavation recommendations.
- Site seismic classification in accordance with the National Building Code of Canada (NBCC).
- Control of groundwater.
- General Construction recommendations.

In addition, this report is accompanied by a series of four appendices:

- Appendix A A1 Borehole Logs
  - A2 Geotechnical Lab Results
  - A3 Analytical Lab Results
- Appendix B Dynamic Compaction Condition Slope Stability
- Appendix C Final Slope Stability
- Appendix D D1 Geotechnical Investigation Report dated October 27, 2021
  - D2 Geotechnical Study Report dated May 4th, 2009.

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

2. Previous investigations and analyses

GHD previously completed two geotechnical investigations on this site and surrounding areas.

The first, titled "Geotechnical Study Subdivision Plan Hawthorne Industrial Park Lots 26 and 27, Concession 6 Southeast of Hawthorne and Rideau Roads", was completed by heritage GHD (InspecSol) and dated May 4th, 2009. This study, which also incorporates previous CRA (2008) and Golder Reports (1993), covered a larger area and was not specific to the present development footprint but did include a limited number of soundings on the currently investigated site. The second, a geotechnical investigation carried out specifically for this project in 2020. This report, titled “Geotechnical Investigation – Warehouse and Offices, Intersection of Rideau Street and Somme Street”, was prepared by GHD and submitted on October 27th, 2021. At the time of that investigation, the proposed building footprint was different from the one considered today. Regardless, both reports are presented as attachments in Appendix D of this report. Relevant information provided within these former investigations was considered during the preparation of the present investigative report.

Further to geotechnical investigations, GHD also provided a Hydrogeological Assessment Report, dated January 19th, 2021, and a Septic Assessment and Percolation Rate Evaluation on April 12th, 2021, for this site.

Finally, following the latest update to the proposed development plan, FastFrate approached GHD to evaluate the stability of the Site slopes during eventual dynamic compaction work and following the final grading plan. These evaluations, completed as a separate mandate to the current supplementary investigation, are presented as individual letter reports and are amended to Appendices B and C of this report.

3. Site and project description

At the time of the investigation, the Site was vacant and overgrown with vegetation. Evidence of fill (gravel, concrete, and asphalt) could be observed on the ground surface. The surrounding blocks in the area were in a similar condition. There was also a tree line along the north perimeter of the Site where a steep slope was also observed leading from the Site down to the ditch directly to the south of Rideau Street.

GHD observed three existing groundwater monitoring wells and one hydrogeological testing well on the Site. One of these wells was confirmed as MW7-08 installed by GHD (heritage CRA) in 2008. Based on the position of the hydrogeological testing well adjacent to MW7-08, GHD believes this is TW-2 installed by Capital Water Supply Ltd. in 1993, as discussed in Golder's Hydrogeological report for the Site. It appeared that minimal to no fill placement has occurred around these well locations since 2008. The details of the remaining two existing wells on Site could not be confirmed.

The Site topography is relatively flat with various small mounds of fill material sloping down to the surrounding streets. The surrounding topography slopes up from south to north by approximately 3.5 meters (m) from Rideau Street to the section of Somme Street south of the Site. The Site elevation is higher compared to the surrounding streets varying from approximately 0.2 m higher on the south side (Somme Street) to 4.0 m higher on the north side (Rideau Street). There was also a ditch along the south, west, and north perimeters of the Site.

The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site.

GHD's understanding of the proposed building, is based on a sketch provided by the FastFrate illustrated on the Borehole Location Plan provided in **Figure** 2.

It is our understanding that the proposed new building will consist of an approximately 50,000 square feet (sf) warehouse on the eastern portion of the Site, connected to an approximately 20,000 sf cross dock on the western portion, with approximately 1,500 sf of associated office space.

The location of the Site is shown on the Site Location Plan attached as **Figure** 1.

4. Methodology

The field investigation and geotechnical laboratory testing protocols and methodologies for this investigation are presented in the following sections.

4.1 Safety planning and utility clearances

Upon project initiation, a Site-specific Health and Safety Plan (HASP) was prepared for implementation during the field investigation program. The HASP presented the visually observed Site conditions and identified potential physical hazards to field personnel. Required personal protective equipment was also listed in the HASP. The HASP was reviewed by GHD's field personnel prior to undertaking field activities and a copy of the HASP was maintained at the Site for the duration of the investigative work. Health and Safety requirements in the HASP were implemented during the field investigation program.

Prior to initiating the subsurface investigation activities, GHD requested public utilities to be marked by utility operators in accordance with the Ontario One Call damage prevention laws. All applicable utility companies (gas, hydro, bell, network cables, pipeline, municipal sewers, etc.) were contacted. In addition, GHD also retained private utility locating companies (Utility Marx) to locate any underground private utilities that could potentially be present at the Site. The proposed boreholes were positioned at appropriate locations to avoid existing service lines.

4.2 Field investigation

The drilling program associated with the current (2021) supplementary geotechnical investigation was conducted between July 26 and 28, 2021, and consisted of advancing a total of five exploratory boreholes denoted as BH1-21 to BH5-21. Three of the boreholes were located within the proposed building footprints and extended to 9.1 to 18.9 metres below ground surface (mbgs), and two of the boreholes were located in the proposed retaining wall footprint and extended to 8.0 to 12.0 mbgs.

Drilling for the previous (2020) geotechnical investigation was conducted between August 6 and 7, 2020, and consisted of advancing an initial total of four exploratory boreholes and one dynamic cone penetration test denoted as BH1 to BH4 and DCPT5. The exploratory boreholes were advanced to depths ranging between 11.1 and 14.9 mbgs, and the dynamic cone penetration test was terminated at 5.9 mbgs.

The drilling work was carried out by a track-mounted power auger drilling rig, supplied, and operated by George Downing Estate Drilling Ltd., under the full-time supervision of a GHD experienced technical representative.

The boreholes were advanced using hollow stem augers, and soil samples were collected every 0.75 m intervals to the termination depth of the boreholes. All samplings were conducted using a 50 millimetre (mm) outside diameter split spoon sampler in general accordance with the specifications of the Standard Penetration Test Method (ASTM D1587-8). In addition, at each borehole location, the relative density or consistency of the subsurface soil layers was measured using the Standard Penetration Test (SPT) method, by counting the number of blows ('N') required to drive a conventional split-barrel soil sampler 0.30 m depth. Soil samples were retrieved from each borehole location to verify strata boundaries and soil properties.

The GHD technical representatives logged the overburden material encountered in the boreholes and examined the samples as they were obtained. The recovered samples were sealed in clean, airtight containers and transferred to the GHD laboratory, where they were reviewed by a senior geotechnical engineer. The detailed results of the individual boreholes are recorded on the accompanying borehole logs presented in Appendix A1 for boreholes advanced in the most recent 2021 supplementary investigation completed and in Appendix D1 for borehole advanced in 2020.

Groundwater level observations and measurements were made in the boreholes as drilling proceeded and upon completion of drilling. As part of the preliminary geotechnical investigation and to measure the more stabilized groundwater table in the area, a nominal 19 mm outside diameter monitoring well (schedule 40 PVC screen and riser pipe) was installed in BH1 at appropriate horizons to obtain information on groundwater conditions. The screen length used for the monitoring well was 3.0 m, and a silica sand pack was placed at the tip of the monitoring well and extended at least 0.3 m above the screen. The well was backfilled using sand around and beyond the screen interval, bentonite 0.6 m above the sand, and cuttings to the ground surface. Details of the monitoring well construction are presented on the attached borehole logs.

The boreholes, in which monitoring wells were not installed, were backfilled upon completion and sealed in accordance with Ontario Regulation 903 (O. Reg. 903). Excess soil cuttings were distributed evenly on the ground surface in the area of the location of the boreholes.

4.3 Surveying

Geodetic ground surface elevations were collected by GHD field staff with a Leica 1200+ Real-Time-Kinematic (RTK) GPS survey system. The elevations of the boreholes are for use within the context of this report only.

4.4 Laboratory testing

The following laboratory testing on recovered soil samples and rock core samples were completed:

Table 1 Laboratory Testing Completed

Laboratory test	2021 investigation (current)	2020 investigation (previous)
Hydrometer grain size analyses	7	4
Atterberg limit tests	5	1
Moisture content determination	79 (on all collected samples)	48 (on all collected samples)
Unconfined compressive strength test (UCS)	1	1

The results of water content tests on the extracted soil samples are reported at the corresponding borehole logs presented in Appendix A1 D of this report. The results of the grain size analysis (sieve and hydrometer testing), Atterberg limit tests, and UCS testing are discussed in more detail in section 5.2, and a copy of the laboratory results are presented in Appendix A3 for the 2021 boreholes and in Appendix D for the previously completed boreholes in 2020.

Analytical testing was also carried out on one soil sample collected during the previous 2020 investigation to determine the corrosion potential of the subsurface soils at the Site. The certificates of analysis of the corrosion testing are provided in Appendix A3 and summarized in section 5.4.

5. Subsurface conditions

Table 2 presents a summary of the depth (elevation) or thickness of each subsoil stratum encountered at the borehole locations completed by GHD. The corresponding borehole logs are presented in Appendices A1 and D of this report. The subsections below briefly summarize the encountered stratigraphy.

It should be noted that the subsurface conditions are confirmed at the borehole locations only and may vary at other locations (between and beyond the borehole locations). The boundaries between the various strata, as shown on the borehole logs, are based on non-continuous sampling. These boundaries represent an inferred transition between the various strata, rather than a precise plane of geological change.

The general stratigraphy at the Site consists of topsoil overlying a thick layer of fill material, underlain by native silty sand to sandy silt followed by a glacial till. Limestone bedrock with interbedded sandstone was encountered at depths ranging from 8.2 mbgs (BH1) to 14.8 mbgs (BH2-21). A brief description of each soil stratum is summarized in **Table 2** and in the sections below.

Table 2 Subsoil Stratigraphy Depth and Elevation (m)

Borehole no. **(Surface elevation)**	**Topsoil thickness (m)**	**Fill Thickness (m)**	**Silty sand and sandy silt depth (Elevation)**	**Sandy clay depth (Elevation)**	**Silty clay depth (Elevation)**	**Bedrock depth (Elevation)**	**End of borehole depth (Elevation)**
2021 Investigation (present)							
BH1-21 (91.07)	0.075	4.50	4.58 (86.49)	--	--	9.86 (81.21)	13.82 (77.25)
BH2-21 (90.79)	0.075	5.26(1)	5.34 (85.45)	--	11.56 (79.23)	14.78 (76.01)	18.87 (71.92)
BH3-21 (90.55)	0.075	3.33(1)	3.81 (86.74)	--	--	--	9.14(2) (81.11)
BH4-21 (90.23)	0.075	6.48(1)	6.55 (83.68)	--	11.43 (78.80)	--	12.04(2) (78.19)
BH5-21 (90.39)	0.075	4.50	4.57 (85.82)	--	--	--	8.00(2) (82.39)
2020 Investigation							
BH1 (90.21)	0.075	5.84	5.91 (84.30)	--	--	8.21 (82.00)	11.30 (78.91)
BH2 (89.80)	0.075	6.03	6.10 (83.70)	--	--	9.30 (80.50)	12.20 (77.60)
BH3 (90.88)	0.125	5.96	6.08 (84.80)	--	--	11.88 (79.00)	14.90 (75.98)
BH4 (90.44)	0.125	6.02(1)	6.14 (84.30)	--	--	--	11.14(2) (79.30)
2008 Study							
B5-1 (90.48)	--	5.33((1)	5.33 (85.15)	6.86 (83.62)	7.32 (83.16)	--	10.03(2) 80.45
B5-2 (90.78)	--	4.57(1)	--	--	4.57 (86.21)	--	6.71 (84.07)
B5-3 (90.51)	--	6.10(1)	--	--	6.10 (84.41)		7.62 (82.89)
MW7-08 (93.81)	--	5.49	5.49 (88.32)	--	--	--	3.92 (89.83)

Notes:

(1): Some organic materials encountered in the fill

(2): Borehole terminated on auger refusal

--: Not encountered

5.1.1 Topsoil

A surficial layer of topsoil with rootlets and organic matter was encountered at the ground surface of all 2021 and 2020 boreholes drilled at the Site. The thickness of the topsoil layer ranged from 75 mm to 125 mm at the borehole locations. It should be noted that the thickness of topsoil may vary between borehole locations. Classification of this material was based solely on visual and textural evidence.

5.1.2 Fill

Fill was encountered below the ground cover in all boreholes. The fill materials generally extended to approximate depths ranging between 3.0 to 6.0 mbgs. The fill composition is in general heterogeneous, consisting of a mixture of sand, silt, clay, and gravel. Cobbles and possible boulders were encountered in the boreholes at varying depths. Traces amount of organic matter and/or rootlets were also observed within the fill in boreholes BH2-21 through BH4-21, BH4 and B5-1 through B5-3. Fragments of buried asphalt were noted in boreholes BH3, BH4, BH3-21, B5-1, B5-2, B5-3 and MW7-08.

Standard Penetration (SPT) 'N' values obtained within the fill layer varied between 2 to 46 blows per 300 mm, indicating a soft to stiff consistency of the fine-grained fill materials or very loose to dense relative density of the granular fill. One shear vane test was performed within the clay fill material at the BH2 location that recorded a shear strength of 50 kilopascals (kPa).

Samples of this material were visually described to be in a generally moist condition transitioning to wet at around 3 to 4 mbgs depth. The measured moisture content of the fill samples extracted from the borings generally ranged between 10 and 20 percent by weight. Occasionally elevated moisture content values obtained from the fill material indicate the presence of organics matter.

5.1.3 Silty sand and sandy silt

The predominant native soil at the Site consists of granular deposits of silty sand or sandy silt that were encountered beneath the earth fill layer in all the drilled boreholes. The granular soils contained varying amounts of gravel and clay. Cobbles and possible boulders are expected within this deposit becoming more frequent with depth.

SPT 'N' values within the silty sand or sandy silt stratum varied between 5/300 mm and greater than 100/300 mm, indicating a loose to very dense relative density. The deposits were generally in a compact to very dense condition except in BH3-21, where the silty sand soils were locally observed to be loose (4.8 to 5.2 mbgs).

Water content measurements obtained from extracted samples of the granular soils varied between 7 and 30 percent indicating a moist to wet condition.

5.1.4 Sandy clay

A deposit of sandy clay was encountered below the native sandy silt at the historical B5-1 location. The material was very soft and in a moist condition. This material was not encountered within the new borehole locations as part of this investigation.

5.1.5 Silty clay

Below the fill material and the native sandy clay (in the historic borehole B5-1) was a native silty clay deposit. The deposit was encountered at depths ranging from 4.6 (B5-2) to 11.4 (BH4-21 and BH2-21) mbgs. Auger refusal was encountered within this material at previous studies and depth of about 14.3 mbgs in borehole BH2-21.

SPT 'N' values within the sandy clay stratum generally varied between 8/300 mm and in excess of 100 blows/300 mm penetration, indicating firm to hard consistency.

Water content measurements obtained from extracted samples of the fine-grained soils varied between 11 and 14 percent, indicating a moist condition.

5.1.6 Bedrock

Limestone bedrock with interbedded sandstone was encountered at depths of 8.2 mbgs (BH1), 9.3 mbgs (BH2), 11.9 m (BH3), 9.9 mbgs (BH1-21), and 14.8 mbgs (BH2-21). Boreholes BH4, BH3-21 to BH5-21 and B5-1 were terminated upon refusal at depths ranging from 8.0 to 12.0 mbgs in inferred bedrock or boulders. The bedrock quality varied with depth and location; the recorded rock quality designation (RQD) ranged between 37 to 95 percent.

5.1.7 DCPT results

The results of the DCPT test show the upper 5.9 m of the material is in loose to compact condition based on blow counts of less than 10 up to 20/300 mm.

5.2 Geotechnical laboratory testing results

Prior to the geotechnical laboratory testing, the soil samples extracted from the Site were subjected to tactile examination by an experienced GHD geotechnical engineer who confirmed the field descriptions and selected representative samples for detailed testing. Geotechnical laboratory testing included moisture content determination on all the recovered samples. Soil classification has been conducted in accordance with the Unified Soil Classification System (ASTM D2487).

In addition, a total of 11 particle size distribution tests (gradation analysis) using sieve analysis (ASTM D6913) and hydrometer testing (MTO LS-702) were completed. The results of the grain size analysis (sieve and hydrometer) are summarized in **Table 3** and the grain-size distribution curves are presented in Appendix A2 for the current 2021 (present) investigation and in Appendix D for the previous 2020 report (initial).

Table 3 Summary of the Particle Size Distribution Tests

Borehole ID	Sample number	Depth (mbgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Fines Silt and Clay (%)
BH1	SS3	1.5 – 2.1	51	43	5	1	6
BH2	SS4	2.3 – 3.0	1	2	36	61	97
BH2	SS7	4.5 – 6.1	25	38	29	8	37
BH3	SS10	6.9 – 7.5	8	47	37	8	45
BH1-21	SS2B	0.9 – 1.4	17	60	19	4	23
BH1-21	SS13	9.1 – 9.8	16	32	36	16	52
BH2-21	SS12	8.4 – 9.0	20	38	33	9	42
BH2-21	SS18	13.0 – 13.6	6	29	42	23	65
BH3-21	SS8	5.3 – 5.9	19	49	26	6	32
BH5-21	SS3	1.5 – 2.1	25	38	29	8	37
BH5-21	SS7	4.6 – 5.2	10	38	41	11	52

Atterberg limits tests (ASTM D4318) were also conducted on 6 representative samples containing fine-grained soils. The results are reported on the soil plasticity charts provided in Appendix A2 for the current supplementary 2021 investigation and in Appendix D for the previous 2020 investigation. A summary of the obtained results is tabulated in **Table 4**.

Table 4 Summary of Atterberg Limit Tests

Borehole ID	Sample Number	Depth (mbgs)	WL (%)	WP (%)	IP (%)	W (%)
BH2	SS4	2.3 – 3.0	69	21	48	56.0
BH1-21	SS13	9.1 – 9.8	26	18	8	8.0
BH2-21	SS12	8.4 – 9.0	25	17	8	8.9
BH2-21	SS18	13.0 – 13.6	28	14	14	11.9
BH3-21	SS8	5.3 – 5.9	17	13	4	9.7
BH5-21	SS7	4.6 – 5.2	20	13	7	15.0
Notes: W – Natural Water Content WL – Liquid Limit WP – Plastic Limit IP – Plasticity Index						

Uniaxial Compressive Strength of Intact Rock Core Specimens tests (ASTM D7012 – Method C) were conducted on two representative rock core samples. The results are presented in Appendix A2 for the 2021current supplementary 2021 investigation and in Appendix D for the 2020 report investigation. A summary of the obtained results is tabulated in **Table 5**.

Table 5 Summary of Uniaxial Compressive Strength of Intact Rock Core Specimens

Borehole ID	Rock type	Depth (mbgs)	Compressive strength (MPa)
BH2	Limestone	9.4 – 9.6	125.2
BH2-21	Limestone	15.7 – 15.8	139.1

Based on the results of the unconfined compressive strength test, the tested rock core samples may be generally classified in accordance with ISRM (International Society of Rock Mechanics) guidelines as very strong.

5.3 Groundwater conditions

Three existing groundwater monitoring wells were present on site. One well was confirmed as MW7-08. The details of the other two wells are unknown.

One additional monitoring well was installed as part of the scope of work for this investigation. Groundwater levels were measured on August 18, 2020, at the monitoring wells. The following **Table 6** shows measured water levels.

Table 6 Groundwater Readings

Monitoring well ID	Installation date	Ground surface elevation (2) (m)	Well installation depth (mbgs)	Water level readings depths mbgs(1)/Elev. (m)(2) August 18, 2020
BH1 (GHD)	August 6, 2020	90.2	7.1	4.0/86.2
MW7 (CRA)	2008	90.8	6.0	3.3/87.5
Northwest Well	Unknown	90.9	5.3	3.3/87.6
Northeast Well	Unknown	90.3	5.4	3.5/86.8
Notes: (1) metres below ground surface (2) metres above mean sea level				

The measured groundwater levels in the installed monitoring wells ranged between 3.3 and 4.0 mbgs, at elevations ranging between 86.2 and 87.6 m. These levels indicated the water is within the fill material. It should be noted that the groundwater table is subject to seasonal fluctuations and in response to precipitation and snowmelt events. Also, it would be expected that water may be perched within the fill materials, especially during and following periods of precipitation and in the spring and fall or other wet seasonal periods.

5.4 Corrosivity testing results

One soil sample was previously submitted for analysis of parameters used to assess the potential corrosivity of the site soils to steel and concrete during the 2020 investigation. The Certificates of Analysis are provided in Appendix D and summarized in **Table 7**.

Table 7 Corrosion Parameter Results

Sample ID	BH3 SS3
pH	8.66
Resistivity (ohm-cm)	1920
Sulphate (%)	0.08
Chloride (%)	0.008
REDOX Potential (mV)	205
Sulphide (ug/g)	<0.20

6. Discussion and recommendations

The recommendations in this report are based on GHD's understanding of the most recent (updated) proposed development, which is outlined below:

- An approximate 50,000 sf warehouse on the west portion of the Site.
- An approximate 20,000 sf cross-dock connected to the east face of the warehouse.
- Approximately 1,500 sf of office space connected to the south face of the cross-dock.
- No underground levels are planned for the proposed structure.

Note that the proposed finish grade for the new building was not known at the time the report was prepared. Furthermore, structural details, specifically column loads were not known at the time the report was prepared.

Finally, GHD understands that the Client has selected Deep Dynamic Compaction as the preferred construction and soil improvement method in order to densify the existing fills and render the site acceptable to accommodate the use of conventional shallow foundation, slab-on-grades and possibly paved areas.

Based on the proposed development, the subsurface conditions encountered in the boreholes, and assuming the boreholes to be representative of the subsurface conditions across the Site, the following recommendations are provided for the design of the proposed building:

- **Fill material |** An approximate 3.5 m to 6.0 m thick layer of fill is present throughout the Site. The composition of the fill material is not consistent with depth or from borehole to borehole. Buried asphalt was also noted in the fill material at various locations. Traces of organic matters and layers up to 3.51 m bgs were also locally encountered in the fill material. ***It is our understanding that FastFrate has selected deep dynamic compaction as the preferred ground improvement method to render the existing fill suitable to support the shallow foundation for the proposed structure. Although the deep dynamic compaction is generally considered suitable for deep loose low plasticity mineral fills, it is not effective in adequately compact***

***high organic layers. It is therefore recommended that prior to commencing the deep dynamic compaction detailed design, the specialty soil improvement contractor should conduct a supplementary test pit investigation to determine the nature and extent of organics within the fill layer or at the fill/native deposit interface to confirm that the deep dynamic compaction method is the most viable and feasible soil improvement method for this project*. Over excavation of organics/clayey lens and addition of sand and gravel layer during the compacting process could be locally required**. Alternatively, other soil improvement techniques such as the installation of rigid inclusions may be considered or deep foundations such as steel piles driven to refusal could be used to support both the building structure and slabs may be considered. GHD can provide recommendations for other foundation support systems (including other soil improvement techniques) at FastFrate's request, and if required.

- **Presence of cobbles and boulders |** Obstructions to SPT were encountered within the fill material as well as within the native deposit overlying the bedrock. The obstructions are assumed to be possible cobbles or boulders. The specialty soil improvement contractor should review the presence of cobbles and boulders in the fill and native deposits and determine if their presence would affect the preferred methodology and its effectiveness. During detailed design, it is recommended that an additional investigation by means of test pits be completed to further determine the nature of the obstructions should piles eventually be deemed the preferred option.
- **Dewatering |** If excavations will extend below the measured groundwater level of approximately 3.3 mbgs, groundwater infiltration into the excavations is expected. The water quantities expected to enter open excavations during construction will depend on the seasonal conditions, depth of excavations, and the duration that excavations are left open. Hydrogeological assessment to estimate the extent of dewatering activities and determine whether a Permit to take water (PTTW) or submission on the Ontario Environmental Activity and Site Registry (EASR) are discussed in the Hydrogeological Assessment Report no 11220832-01 issued by GHD on January 19th, 2021.
- **Slope stability |** The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site. Based on the preliminary slope stability analysis completed within the previous geotechnical investigation report, depending on the composition and compactness state of the fill material, the factor of safety for the slope may be equal or slightly below (i.e., 1.4 under static condition and 1.0 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static. Since this analysis was completed, FastFrate has provided GHD with updated survey and development plans. GHD has prepared a complete slope stability analysis for the construction sequence under dynamic compaction conditions and the geometry of the final slopes. The analysis is attached to this report in Appendix B and Appendix C.

Once detailed design advanced, we recommend that the comments and recommendations presented herein be reviewed and updated or adjusted accordingly.

6.1 Site preparation and grading

6.1.1 Building footprints (Foundations and Slabs)

Site preparation within the building footprint will depend on design finish grade and preferred foundation option. Furthermore, the site in its current state, as a result of the presence of a 3.5 m to 6.0 m thick layer is not suitable to accept conventional shallow foundations and slab-on-grades.

If shallow foundations and slab-on grades are preferred, as is currently understood, the existing site conditions would need to be improved in order to accommodate such structures founded directly on the subgrade.

Based on the anticipated subsoil stratigraphy encountered across the site, two soil improvement techniques could potentially be feasible for this site. The first is deep dynamic compaction in order to adequately densify the existing fill material across the building footprint. The second is the installation of rigid inclusions in order to transfer the loads induced by both the building foundations and slabs to deeper more competent layers.

As previously stated, GHD understands that the Client has selected Deep Dynamic Compaction as the preferred construction and soil improvement method. Such soil improvement works must be completed and certified by a contractor specialized in this field.

As mentioned in the introductory section 6, the feasibility of deep dynamic compaction, as a result of identification of organics within the uncontrolled fill during the completion of the current supplementary, should be confirmed by a test pit investigation completed by the retained soil improvement contractor prior to the start of any soil improvement activities.

This method would compact the existing fill material using a crane that repeatedly drops a weight in a closely spaced grid pattern across the site, creating a uniformly compacted subgrade.

This would result in consolidation and thus lower the existing grades. Additional fill could be required to achieve the design grades.

Prior to Site grading activity, the exposed dynamically compacted subgrade soils should be visually inspected and probed. Any soft, organic, or unacceptable areas should be removed as directed by the Geotechnical Engineer and replaced with suitable engineered materials.

The fill required to achieve the design grades must comprise clean granular materials free of organics, frozen soils, construction debris, particle sizes larger than 100 mm, and any other deleterious materials. This material, approved by the geotechnical engineer, should be placed in loose lifts to 200 mm thick and compacted to 98% SPMDD in the building footprint.

Fill in the building footprint must be placed under full-time geotechnical supervision to be certified as engineered fill.

6.1.2 Exterior pavement and underground servicing

Similarly, as stated above the presence of a 3.5 m to 6.0 m thick layer of uncontrolled fill would require site soil improvement for the pavement and servicing subgrade.

Ideally, this improvement would involve similar dynamic compaction methods as discussed in the building subgrade preparation section above.

Should these operations not be economically justified, the client must be aware that deflections and cracking and potential movement of underground servicing should be anticipated where parking areas and underground services are constructed over the existing fill. A pavement and servicing maintenance program should be considered for this development.

Should the client forgo dynamic compaction within the pavement and exterior servicing areas, alternate less significant improvement methods would involve additional compaction of the subgrade as well as placement of thicker base and subbase layers.

Prior to Site grading activity, the exposed subgrade soils should be visually inspected, compacted, and proof rolled using large axially loaded equipment. Any soft, organic, or unacceptable areas should be removed as directed by the Geotechnical Engineer and replaced with suitable engineered materials.

The fill required to achieve the design grades must comprise clean granular material, free of organics, frozen soils, construction debris, particle sizes larger than 100 mm, and any other deleterious materials. The material approved by the geotechnical engineer should be placed in loose lifts up to 200 mm thick and compacted to 98% SPMDD in the pavement footprint areas and 92% SPMDD in the proposed landscaped areas. The pavement subbase and base layers must be compacted to 100% SPMDD.

Perimeter drainage must be designed so as to prevent lateral infiltration beneath the asphalt surfaces from adjacent grassed or landscaped areas.

Sanitary sewer and watermain bedding should comply with the City of Ottawa Standard S6 and S7, and W17, respectively Class B bedding consisting of OPSS Granular “A” 300 mm thick below the invert of the pipe and extending to 300 mm above the crown of the pipe. The bedding material should be compacted to 95% SPMDD.

6.2 Excavation and dewatering

The following are general comments regarding the excavations and dewatering requirements, as the depth of the excavations and dewatering requirements are dependent on final grades and the foundation option selected.

Roadway construction debris, including concrete and asphalt, are expected within the fill material. This debris was also observed on the surface at the time of GHD's Site visit. For excavations, less than two (2) m of depth, the walls of the excavations must be sloped at a minimum of 1H:1V as per the Occupational Health and Safety Act (OHSA) requirements for Type 3 soils (fill) or supported by temporary shoring. For excavations, more than two (2) m deep, the walls of the excavation must be sloped at a minimum of 2H: 1V.

Unsupported side slopes should be adjusted depending on the true subsoil and groundwater conditions encountered during excavation work and flatter side slopes than those mentioned above may be required locally.

During the excavation, no excavated material should be piled, nor machinery or equipment placed, closer than the distance equivalent to the depth of the excavations. Furthermore, no vertical un-braced excavations should be performed in the soil. In addition, the exposed subsoils should be protected against erosion from water runoff or rain.

The stability and safety of unsupported excavation slopes remain the responsibility of the contractor at all times.

It is recommended that the FastFrate's design team include in the specification package, requirements for the successful contractor to submit written Plans for Excavation as well as Soil and Groundwater Management for review by the FastFrate design team.

A hydrogeological assessment of this Site was not part of the scope of work for this investigation. If excavations will extend below the measured groundwater level of approximately 3.5 mbgs, groundwater infiltration into the excavations is expected. The water quantities expected to enter the open excavations during construction will depend on seasonal conditions, depth of excavations, and duration that excavations are left open. Hydrogeological assessment to estimate the extent of dewatering activities and determine whether a PTTW or submission on the Ontario EASR are discussed in the Hydrogeological Assessment Report no 11220832-01 issued by GHD on January 19th, 2021.

6.3 Foundation

The foundation options for the proposed building depend upon the proposed final grade elevations for the structure and design loadings. The suggested options and preliminary recommendations for the foundations for the proposed warehouse are provided in the following sections. Note that recommendations and comments are solely provided for the dynamic compaction solution as this is the Client’s preferred construction and soil improvement method at the moment. Recommendations for other suitable foundations and slab options, such as rigid inclusion systems or deep foundations, can be provided upon request.

6.3.1 Shallow foundation

Once the building footprint is prepared as discussed in section 6.1.1 and certified by the soil improvement contractor, the site would be suitable to support conventional shallow foundations.

The soil improvement works must be completed by a contractor specialized in this field. As the resulting serviceability and ultimate bearing capacity values are an integral part of the eventual foundation design, these values must be determined and confirmed by the soil improvement designer. Generally, the degree of densification must be monitored and confirmed by in-situ testing by the specialty soil improvement contractor during and following the dynamic compaction operations. The dynamic compaction work and pad preparation must be certified by the soil improvement contractor prior to construction of the proposed building.

For preliminary footings design, footings placed on at least 1 m thick engineered fill underlain by improved ground can be sized for Serviceability Limit State (SLS) soil bearing resistance of 150 kPa and factored ($\Phi=0.5$) Ultimate Limit State soil bearing resistance of 225 kPa. As previously mentioned, the bearing capacity design values must be confirmed by the soil improvement designer following the completion of the soil improvement works.

6.4 Seismic site classification

The 2012 Ontario Building Code (OBC) requires the assignment of a Seismic Site Class for calculations of earthquake design forces and the structural design based on a two percent probability of exceedance in 50 years. According to the 2012 OBC, the Seismic Site Class is a function of soil profile and is based on the average properties of the subsoil strata to a depth of 30 m below the ground surface. The 2012 OBC provides the following three methods to obtain the average properties for the top 30 m of the subsoil strata:

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

During the preliminary geotechnical investigation, the depths of boreholes extended to a maximum depth of approximately 14 m bgs, and the subsurface profile below this depth is inferred. Based on the borehole information for the Site, and using site classification criteria provided in Table 4.1.8.4.A, of the 2012 OBC a Seismic Site Class 'D' can be used for preliminary design purposes if the proposed building is supported on certified improved ground.

A Seismic Site Class ‘C’ may potentially be obtained following the soil improvement work should shear wave velocity testing confirm this improved classification.

6.5 Frost protection

All of the exterior building foundations (footings, etc.) for heated structures should be placed at least 1.5 m beneath the final exterior grade in order to provide adequate frost protection.

Building foundations for unheated structures or isolated exterior foundations (retaining walls, signs, lamp posts, etc.) should be placed at least 1.8 m beneath the final exterior grade in order to provide adequate frost protection.

Note that exterior building foundation sections (even for a heated structure) with exposed foundation walls, such as foundation walls at dock areas must be considered unheated for frost protection design purposes.

Should construction take place during winter, the exposed surfaces to support foundations must be protected by Contractors against freezing assuming unheated conditions.

6.6 Interior floor slabs

Once the building footprint is prepared as discussed in section 6.1.1 and certified by the soil improvement contractor, the site would be suitable to support conventional slab-on-grades.

The slab-on-grade foundation should incorporate a final granular base layer consisting of at least 300 mm of Granular ‘A’ material as per Ontario Provincial Standard Specifications (OPSS form 1010), compacted to at least 100% of the material's SPMDD. Depending on the final floor's finish, the architect may require the use of a vapour barrier to be installed to limit vapour emission through the concrete slab.

The slab-on-grade must be set at least 200 mm above the exterior grades, which should be sloping away from the building footprint at 5% in landscaped areas and 2% in paved areas.

The specialty contractor should be providing the modulus of subgrade reaction for design of the slab-on-grade if required.

6.7 Exterior slabs

Once the building footprint is prepared as discussed in section 6.1.1 and certified by the soil improvement contractor, the site would be suitable to support conventional slab-on-grades.

In order to avoid the potentially detrimental effects of freeze-thaw cycles on the good behaviour of exterior concrete slabs around the proposed building, we recommend that a non-frost susceptible base layer, such as a Granular ‘A’ as per Ontario Provincial Standard Specifications (OPSS Form 1010), be used under the exterior slabs down to a depth of 1.8 m below the top of the slabs.

This base layer should be placed in thin lifts not exceeding 300 mm and compacted to a minimum of 98 percent SPMDD.

The base layer should also be properly drained by means of a French drain in order to prevent water accumulation under the slabs. Note that this requirement also applies to the exterior concrete aprons.

Transition slopes of 3.0 H / 1.0 V should be provided at the edges of the various slabs between the non-frost susceptible granular foundation and the surrounding soils (silty clay/clayey silt deposit), over the entire frost depth of 1.8 m.

A possible alternative to the placement of non-frost susceptible base material to a depth of 1.8 m below exterior slabs grades could include the use of sufficient insulation material under the slab to replace the equivalent amount of granular base backfill omitted to frost depth. As a general rule of thumb, one inch 25 mm of insulation is equivalent to 300 mm of non-frost susceptible material.

In any case, the slabs should incorporate a granular base layer consisting of at least 300 mm of OPSS Granular ‘A’ compacted to at least 100% of the material's SPMDD.

6.8 Pavement recommendations

Once the exterior pavement footprint is adequately prepared, as discussed in section 6.1.2, the following preliminary pavement structures are suggested.

Note that the final pavement design will be a function of traffic and loading conditions and should be confirmed by the client prior to the beginning of construction.

Table 8 Preliminary Pavement Design (Flexible Pavement Structure)

Pavement structure element	Compaction requirement	Layer thickness (mm)	
		Light duty	Heavy duty
Surface course OPSS 1150 HL1 Hot Mix, PG70-34	OPSS 310, Table 8	40	40
Base course OPSS 1150 HL8 HS Hot Mix Asphalt, PG64-34	OPSS 310, Table 8	50	100 (in two lifts)
Granular A base (19 mm crusher run limestone)	100 % SPMDD	300	300
Granular B Type II subbase (50 mm crusher run limestone)	100 % SPMDD	400	500

Table 9 Preliminary Pavement Design (Rigid Pavement Structure)

Pavement structure element	Compaction requirement	Layer thickness (mm)
Rolled compacted concrete	N/A	180
Base course: Granular A (19 mm crusher run limestone)	100 percent of SPMDD ASTM D698	300
Granular B Type II subbase (50 mm crusher run limestone)	100 percent of SPMDD ASTM D698	300

The pavement contractor is responsible for ensuring adequate compaction of the asphalt and base layers as per OPSS.

It is noted that the pavement granular base and subbase layers can consist of gravel or crushed limestone, as specified above. The material gradation and durability requirements of the selected granular courses should meet OPSS 1010 specifications.

The pavement design considers that construction will be carried out during dry periods of the year and that the subgrade is competent as discussed in section 6.1.2 of this report. If the subgrade becomes excessively wet or rutted during construction activities, additional subbase material may be required. The need for additional subbase material is best determined during construction.

Joint design and construction should be carried out in accordance with the OPSS/OPSD requirements.

The installation of a geotextile membrane at the subgrade level is required to prevent contamination of the sub-base layers with fines particles.

To maintain the integrity of the pavement at the Site, subdrains should be installed at all catch basins and along the perimeter of the parking lot.

Grading adjacent to pavement areas should be designed so that water is not allowed to pond adjacent to the outside edges of the pavement.

6.9 Underground service trenches

Underground service lines, if any, should be founded on a prepared fill subgrade as discussed in section 6.1.2. The suitability of the foundation soils to provide adequate support for buried services must be verified and confirmed on the Site at the time of construction/installation by qualified geotechnical personnel experienced in such work. For subgrade consisting of the existing uncontrolled fill, which is outside the projected footprint of the soil amelioration work, some settlements may occur, and a servicing maintenance program should be considered.

The frost penetration depth for the region of Ottawa is considered as 1.8 m in accordance with Ontario Provincial Standard Drawing (OPSD) 3090.101. Accordingly, underground services should be located below the depth of frost penetration and in accordance with City of Ottawa specifications.

Note that the City of Ottawa specifies that watermains and sewer require respective minimum soil cover above of 2.4 and 2.0 m. Where the available cover is less than required, thermal rigid insulation should be used as specified in the City of Ottawa specifications.

The bedding and sand cover materials should be adequately compacted to provide support and protection to the service pipes. Provided the base area of the underground service line is free of all soft/loose and deleterious materials, the pipe bedding should comply with a Class B bedding configuration as per the requirements of OPSD 802.031 and OPSD 802.032 (rigid pipe) and/or OPSD 802.010 (flexible pipe). Where disturbance of the trench base has occurred, because of surface water or groundwater seepage and the like, the disturbed soils should be sub-excavated and replaced with suitably compacted granular fill.

Backfilling of trenches can be accomplished by reusing the excavated soils or similar fill material or imported granular soil, provided the moisture content of the material is maintained within ±2% of optimum and the fill is free of topsoil, organics, and any deleterious material. The fill placed in excavated trenches should be in loose lifts not exceeding 200 mm thick and compacted to not less than 95% of its SPMDD.

Due to the relatively low permeability of the existing fill and depth of excavation, no major groundwater problems are foreseen at this time for such excavations. Infiltration into the excavations should be readily handled with ordinary sumps and pumps.

6.10 Permanent drainage

6.10.1 Underfloor drainage slab-on-grade – No basement

Under-floor drains are not considered necessary for a structure without a basement and a floor slab set above the surrounding grades. However, the drainage requirements must be re-evaluated once final design grades and proximity to the water table are determined.

6.10.2 Perimeter drainage

For the proposed building with no basement or underground level and based on the Site subsurface condition, perimeter drainage around the exterior of the walls of the proposed building is not considered necessary. However, the drainage requirements must be re-evaluated once final design grades and proximity to the water table are determined.

6.11 Corrosion potential of soils

Analytical testing was carried out on a soil sample collected (BH3 SS3) to determine the corrosion potential of the subsurface soils at the Site. The certificates of analysis for the sample tested are presented in Appendix A-3 and are summarized in **Table 7**.

The American Water Works Association (AWWA) publication 'Polyethylene Encasement for Ductile-Iron Pipe Systems' ANSI/AWWA C105/A21.5-10 dated October 1, 2010, assigns points based on the results of the above tests. Soil that has a total point score of 10 or more is considered to be potentially corrosive to ductile iron pipe. A score of less than 10 was obtained for the soil sample submitted.

Table 10 of the Canadian Standards Association (CSA) document A23.1-04/A23.2-04 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete' divides the degree of exposure into the following three classes:

Table 10 *Classes of Exposure*

Degrees (Class) of Exposure	Water Soluble (SO_4) in Soil Samples (%)
Very Severe (S-1)	>2.0
Severe (S-2)	0.20 – 2.0
Moderate (S-3)	0.10 – 0.20

A review of the analytical test results shows the sulphate content in the tested samples was found to be less than 0.08 percent.

Although both test samples suggest a low degree of corrosivity, we recommend that further tests be carried out through the entire site in order to obtain a broader representation of corrosivity potential as a result of the variability and uncontrolled nature of the existing fill on site.

6.12 Slope stability

The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site.

A slope stability assessment was performed for the existing slope along the north perimeter of the Site. GHD's understanding of the existing slope conditions is based on Site observations and field measurement. In the 2020 geotechnical investigation, analysis was performed on the existing slope under static condition and pseudo-static (i.e., seismic) conditions considering drained soil conditions with the results shown in Appendix D-1. FastFrate has provided GHD with updated survey and development plans with modified slopes geometry for the construction and final state. GHD has completed a slope stability analysis for each condition, and the results are presented in the attached Appendix B and C of this report.

6.13 Backfill

The placement and compaction of the materials that will support pavement, floor slab, or footings must be treated as engineered fill.

6.13.1 Engineered fill

The fill operations for Engineered Fill must satisfy the following criteria:

- Engineered fill must be placed under the continuous supervision of the geotechnical engineer.
- Prior to placing any engineered fill, all unsuitable fill materials must be removed, and the subgrade proof rolled and approved. Any deficient areas should be repaired.
- Prior to the placement of engineered fill, the source or borrow areas for the engineered fill must be evaluated for their suitability. Samples of proposed fill material must be provided to the geotechnical engineer and tested in the geotechnical laboratory for standard proctor maximum dry density (SPMDD) and grain size prior to approval of the material for use as engineered fill. The engineered fill must consist of environmentally suitable soils (as per industry standard procedures of federal or provincial guidelines/regulations), free of organics and other deleterious material (building debris such as wood, bricks, metal, and the like), compactable, and of suitable moisture content so that it is within -2 percent to +0.5 percent of the optimum moisture as determined by the standard proctor test. Imported granular soils meeting the requirements of Granular 'A', or Type II OPSS 1010 criteria would be suitable.
- The engineered fill must be placed in maximum loose lift thicknesses of 0.2 m. Each lift of engineered fill must be compacted with a heavy roller to 100 percent SPMDD.
- Field density tests must be taken by the geotechnical engineer, on each lift of engineered fill. Any engineered fill, which is tested and found to not meet the specifications, shall be either removed or re-compacted and retested.

6.13.2 Existing foundation wall backfill

Where applicable and/or if necessary, any backfill placed against the foundation walls should be free draining granular materials meeting the grading requirements of OPSS 1010 for Granular 'B' Type I specifications up to within 0.3 m of the ground surface. The upper 0.3 m should be a low permeable soil to reduce surface water infiltration. Foundation backfill should be placed and compacted as outlined below:

- Free-draining granular backfill should be used for the foundation wall.
- Backfill should not be placed in a frozen condition or placed on a frozen subgrade.
- Backfill should be placed and compacted in uniform lift thickness compatible with the selected construction equipment, but not thicker than 0.2 m. Backfill should be placed uniformly on both sides of the foundation walls to avoid build-up of unbalanced lateral pressures.

- At exterior flush door openings, the underside of sidewalks should be insulated, or the sidewalk should be placed on frost walls to prevent heaving. Granular backfill should be used and extended laterally beneath the entire area of the entrance slab. The entrance slab should slope away from the building.
- For backfill that would underlie paved areas, sidewalks, or exterior slabs-on-grade each lift should be uniformly compacted to at least 98 percent of its SPMDD.
- For backfill for the building exterior that would underlie landscaped areas each lift should be uniformly compacted to at least 95 percent of its SPMDD.
- In areas on the building exterior where an asphalt or concrete pavement will not be present adjacent to the foundation wall, the upper 0.3 m of the exterior foundation wall backfill should be a low permeable soil to reduce surface water infiltration.
- Exterior grades should be sloped away from the foundation wall, and roof drainage downspouts should be placed so that water flows away from the foundation wall.

6.14 Construction field review

The recommendations provided in this report are based on an adequate level of construction monitoring being conducted during the construction phase of the proposed building. GHD requests to be retained to review the drawings and specifications, once complete, to verify that the recommendations within this report have been adhered to, and to look for other geotechnical problems. Due to the nature of the proposed development, an adequate level of construction monitoring is considered to be as follows:

- Prior to the construction of footings, the exposed foundation subgrade should be examined by a geotechnical engineer (GE) or a qualified technologist, acting under the supervision of a GE, to assess whether the subgrade conditions correspond to those encountered in the boreholes and test pits, and the recommendations provided in this report have been implemented.
- A qualified technologist, acting under the supervision of a GE, should monitor the placement of engineered fill underlying floor slabs.
- Backfilling operations should be conducted in the presence of a qualified technologist, on a part-time basis, to ensure that proper material is employed, and specified compaction is achieved.
- Placement of concrete should be periodically tested to ensure that job specifications are being achieved.

7. Limitations of the investigation

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

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

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

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

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

Data Disclaimer

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Paper Size ANSI A

0 70 140 210 280

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

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GHD

CONSOLIDATED FASTRATE
RIDEAU ROAD & SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

GEOTECHNICAL INVESTIGATION
SITE LOCATION PLAN

Project No.	**11231101**
Revision No.	
Date	**Sep 3, 2021**

FIGURE 1

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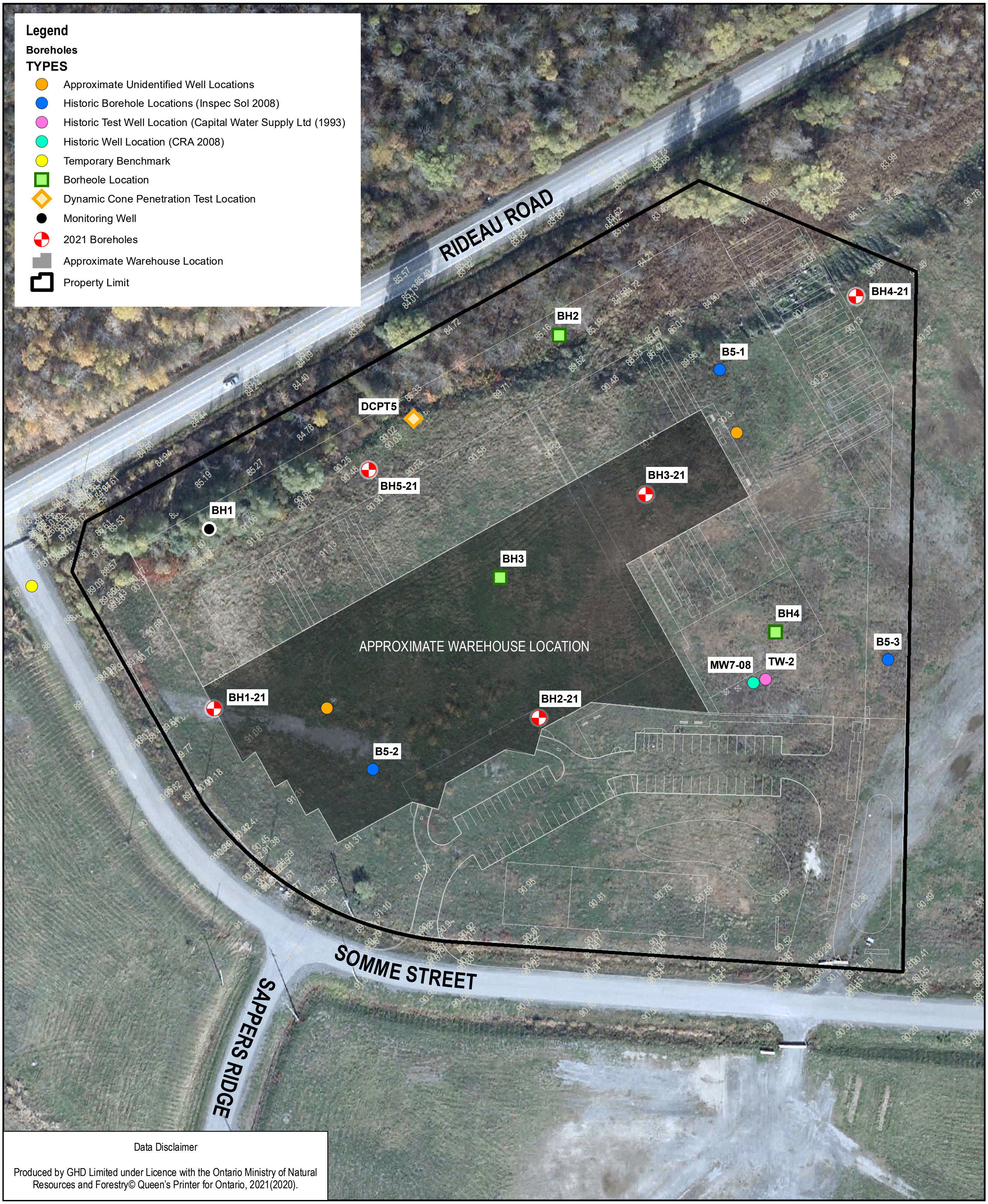
Print date: 03 Sep 2021 - 13:55

Imagery source: © City of Ottawa, 2019.



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Paper Size ANSI A
0 10 20 30 40
Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

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GHD

CONSOLIDATED FASTRATE
RIDEAU ROAD & SOMME STREET, OTTAWA, ON
PT LOT 26, CON 6 FROM RIDEAU RIVER
GEOGRAPHIC TOWNSHIP OF GLOUCESTER
CITY OF OTTAWA

GEOTECHNICAL INVESTIGATION
BOREHOLE LOCATION PLAN

Project No.	**11231101**
Revision No.	
Date	**Sep 3, 2021**

FIGURE 2

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Print date: 03 Sep 2021 - 13:52

Imagery source: © City of Ottawa, 2019; CAD Data: 1128236a1-dessin1.dwg

Appendices

Appendix A

Appendix A1

Boreholes Logs

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE LOG

Page: 1 of 2

BOREHOLE No.: BH1-21

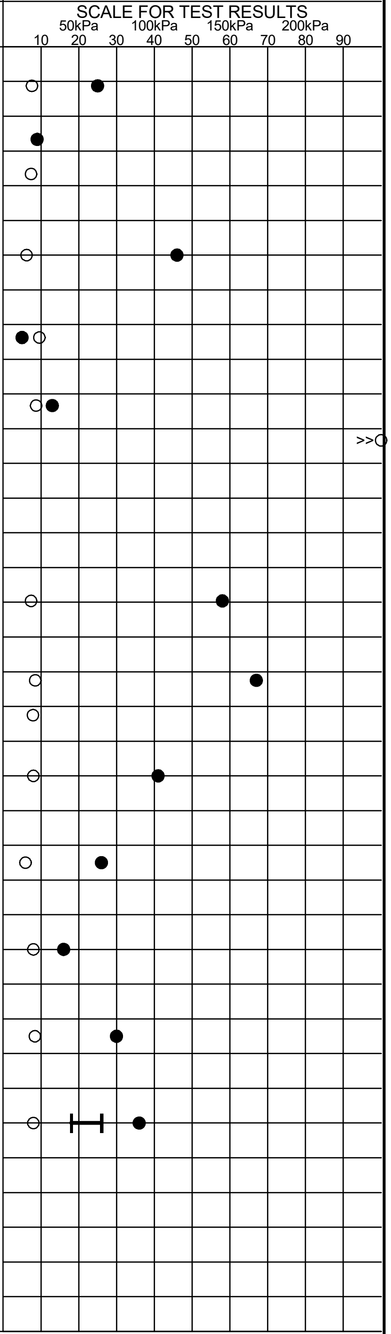
ELEVATION: 91.07 m

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.
PROJECT: ConFastfrate, New Warehouse & Offices
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: J. Scott CHECKED BY: Leandro Ramos
DATE (START): 26 July 2021 DATE (FINISH): 27 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	91.07		GROUND SURFACE			%		N
			TOPSOIL (75 mm)					
	90.99		**FILL** - SILTY SAND, trace gravel, trace clay, dark grey, moist, compact	☒	SS1	96	7-15-10-9	25
				☒	SS2A	71	9-6-3-4	9
1.0	90.20		**FILL** - SAND, trace silt, trace gravel, brown, moist, loose Gravel - 17%, Sand - 60%, Silt - 19%, Clay - 4%	☒	SS2B		--	
2.0	89.54		**FILL** - SILTY SAND, with clay, trace gravel, dark grey, moist, dense cobble encountered at 1.83 mbgs	☒	SS3	71	7-13-33-40	46
				☒	SS4	42	5-2-3-50/76 mm	5
3.0				☒	SS5A	67	8-8-5-3	13
			with organics and wood fragments	☒	SS5B		--	
				☒	SS6	0	50/51 mm	50/51 mm
4.0			augers grinding at 3.96 mbgs, inferred boulders or construction debri					
5.0	86.49		**SILTY SAND** - trace gravel, trace clay, brown, moist, dense to very dense	☒	SS7	83	10-21-37 -50/127 mm	58
				☒	SS8A	100	43-31-36-47	67
6.0	85.27		grey, very moist, augers grinding at 9.85 mbgs, inferred boulder	☒	SS8B		--	
				☒	SS9	83	24-23-18-26	41
7.0			cobble encoutered at 6.86 mbgs	☒	SS10	75	13-11-15-12	26
8.0				☒	SS11	71	6-4-12-23	16
9.0				☒	SS12	67	50-15-15-18	30
			Gravel - 16%, Sand - 32%, Silt - 36%, Clay - 16%	☒	SS13	67	13-17-19-17	36
10.0	81.21		**LIMESTONE** - interbedded sandstone, grey, poor to excellent quality based on RQD - highly weatherd from 9.86 mbgs to 9.93 mbgs	▮	RC1	58	38	38
11.0			silty sand seam at 10.92 mbgs	▮				



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

File: \\GHDNET\GHD\CA\PETERBOROUGH\PROJECTS\662\11231101\WORKSHARE\FIELD\GINT LOG\11231101 LOGS.GPJ Library File: 11231101 GHD_GEOTECH_V10.GLB Report: 11231101 BOREHOLE LOG Date: 12/8/21

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE No.: BH1-21

ELEVATION: 91.07 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.
PROJECT: ConFastfrate, New Warehouse & Offices
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: J. Scott CHECKED BY: Leandro Ramos
DATE (START): 26 July 2021 DATE (FINISH): 27 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
◫	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	91.07		GROUND SURFACE			%		N	
			vertical fracture at 11.58 mbgs		RC2	98	95	95	
12.0									
13.0					RC3	95	58	58	
14.0	77.25		Borehole terminated at 13.82 mbgs Note: Borehole Coordinate - UTM Zone 18 - Northing: 5017223.9 - Easting: 456487.2						
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									
21.0									
22.0									

NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101 ENCLOSURE No.:

GHD

BOREHOLE No.: BH2-21

ELEVATION: 90.79 m

BOREHOLE LOG

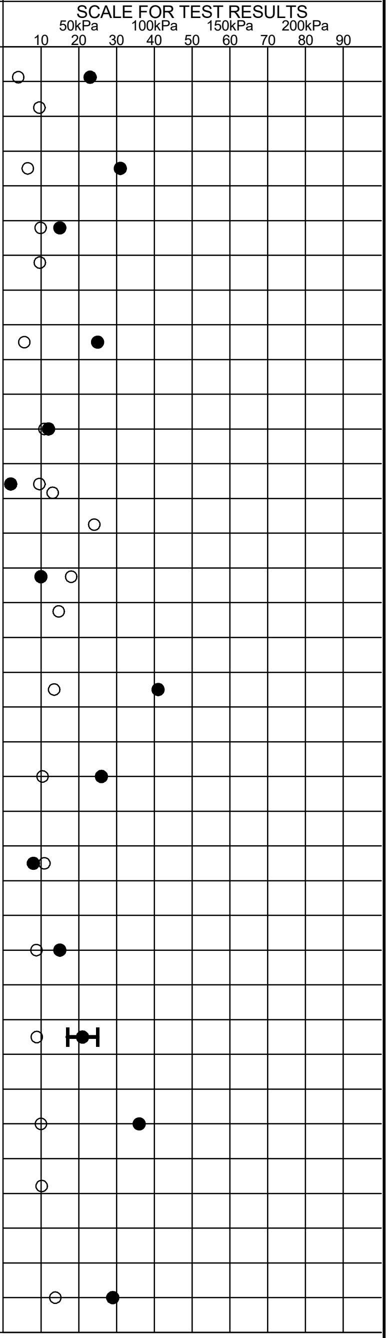
Page: 1 of 2

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.
PROJECT: ConFastfrate, New Warehouse & Offices
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: J. Scott CHECKED BY: Leandro Ramos
DATE (START): 27 July 2021 DATE (FINISH): 27 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	SAMPLE DATA			
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	90.79	GROUND SURFACE		%		N
	90.71	**TOPSOIL** (75 mm)	SS1A	92	3-12-11-15	23
	90.33	**FILL** - SILTY SAND, trace clay, trace bricks, trace asphalt, brown to black, moist, compact	SS1B		--	
1.0	90.03	**FILL** - SAND AND GRAVEL, trace silt, brown, moist, compact	SS2	88	6-14-17-15	31
		FILL - SILTY SAND, with gravel, trace clay, brown to grey, moist, dense				
		with clay at 1.65 mbgs	SS3A	46	7-9-6-6	15
2.0			SS3B		--	
		trace clay at 2.89 mbgs	SS4	67	28-13-12-38	25
3.0		asphalt at 3.35 mbgs	SS5	63	8-7-5-12	12
			SS6A	67	3-1-1-1	2
4.0	86.93	**ORGANIC**	SS6B		--	
	86.88	**FILL** - SILTY SAND, trace gravel, trace clay, brown, wet, loose	SS6C		--	
		with topsoil at 4.57 mbgs	SS7A	88	2-3-7-8	10
5.0		with clay, bricks fragments at 4.72 mbgs	SS7B		--	
	85.45	**SILTY SAND** - with clay, trace gravel, brown, moist to wet, compact to dense	SS8	83	8-19-22-40	41
6.0		grey at 6.10 mbgs	SS9	54	9-14-12-13	26
7.0			SS10	79	5-3-5-6	8
8.0			SS11	75	5-7-8-10	15
		Gravel - 20%, Sand - 38%, Silt - 33%, Clay - 9%	SS12	63	6-10-11-17	21
9.0		wet at 9.14 mbgs	SS13	71	11-18-18-21	36
10.0		augers grinding at 10.08 mbgs, inferred boulder	SS14	71	19-50/25 mm	50/25 mm
11.0			SS15	25	11-14-15-21	29



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE No.: BH2-21

ELEVATION: 90.79 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.

PROJECT: ConFastfrate, New Warehouse & Offices

LOCATION: Somme Street, Ottawa, ON

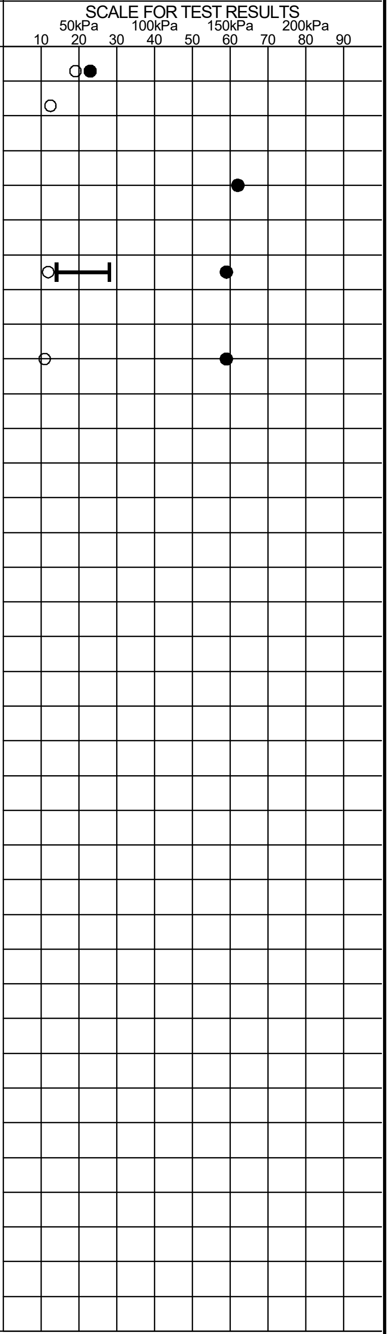
DESCRIBED BY: J. Scott CHECKED BY: L. Ramos

DATE (START): 27 July 2021 DATE (FINISH): 27 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	90.79	GROUND SURFACE		%		N
	79.36	**SAND** - trace silt, grey, wet, dense	SS16A	92	11-15-18-31	23
12.0	79.23	**SILTY CLAY** - with sand, trace gravel reddish brown, moist, hard	SS16B		--	
			SS17	0	21-31-31-40	62
13.0			SS18	100	9-21-38-50/127 mm	59
14.0			SS19	100	17-26-48-50/127 mm	59
15.0	76.01	**LIMESTONE** - interbedded sandstone, grey, good quality based on RQD UCS = 139.1 MPa	RC1	100	78	78
16.0			RC2	98	76	76
17.0						
18.0			RC3	100	89	89
19.0	71.92	Borehole terminated at 18.87 mbgs Note: Borehole Coordinates - UTM Zone 18N - Northing: 5017221.2 - Easting: 456581.5				
20.0						
21.0						
22.0						



NOTES:
m bgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE No.: BH3-21

ELEVATION: 90.55 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.

PROJECT: ConFastfrate, New Warehouse & Offices

LOCATION: Somme Street, Ottawa, ON

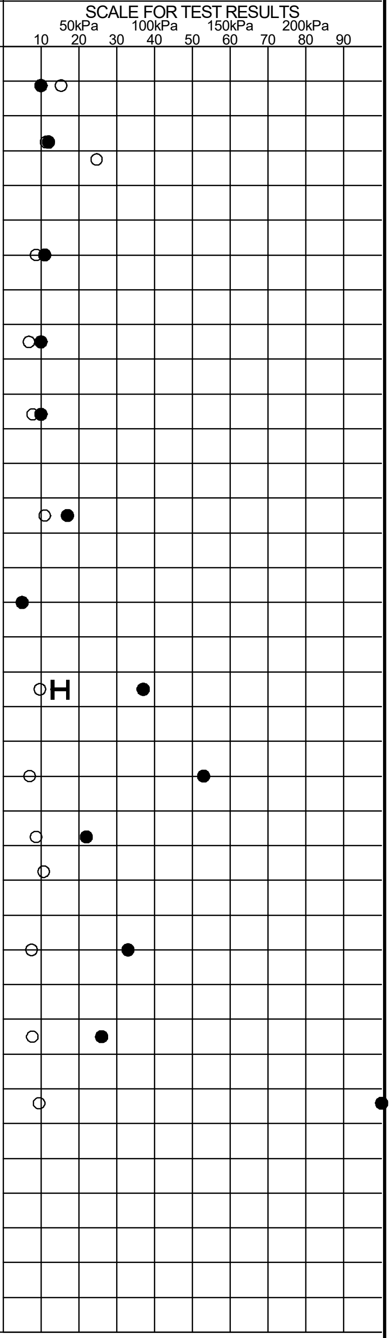
DESCRIBED BY: J. Scott CHECKED BY: L. Ramos

DATE (START): 26 July 2021 DATE (FINISH): 26 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY			SAMPLE DATA			
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	90.55		GROUND SURFACE			%		N
	90.48		**TOPSOIL** (75 mm)					
			FILL - SILTY SAND, with gravel, trace clay, brown, moist, compact	☒	SS1	71	2-6-4-10	10
				☒	SS2A	42	5-5-7-14	12
1.0	89.64		with presence of organics/topsoil	☒	SS2B		--	
2.0				☒	SS3	33	5-5-6-15	11
			with to trace clay at 2.5 m bgs	☒	SS4	42	7-6-4-3	10
3.0			grey at 3.0 m bgs moist	☒	SS5	86	2-2-8-27	10
	87.20		**ASPHALT**					
4.0	87.15		**FILL** - SANDY GRAVEL, dark grey, wet, compact					
	86.74		**SILTY SAND** - trace gravel, some clay, brown, moist, compact	☒	SS6	46	12-12-5-7	17
5.0			loose at 4.75 m bgs	☒	SS7	0	3-2-3-4	5
			compact to very dense at 5.5 m bgs Gravel - 19%, Sand - 49%, Silt - 26%, Clay - 6%	☒	SS8	73	10-16-21-46	37
6.0 ▼	WL6.2 2021-07-26			☒	SS9	100	13-26-27-41	53
7.0				☒	SS10A	100	9-11-11-15	22
	83.54		with clay, trace gravel, trace cobbles, grey, moist, compact	☒	SS10B		--	
8.0				☒	SS11	71	8-13-20-28	33
				☒	SS12	79	5-10-16-36	26
9.0			wet at 9.14 m bgs	☒	SS13	80	18-50/102 mm	100+
	81.11		Borehole terminated due to auger refusal at 9.45 mbgs. Bedrock or boulder inferred					
10.0			Noted: Borehole Location - UTM Zone 18N - Northing: 5017286.1 - Easting: 456612.6					
11.0								



NOTES:
m bgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE No.: **BH4-21**
ELEVATION: 90.23 m

BOREHOLE LOG

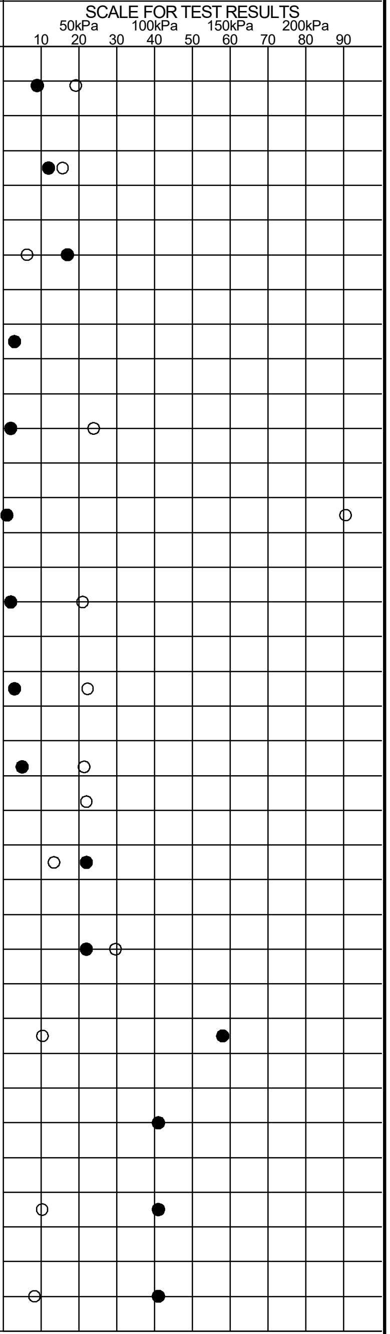
Page: 1 of 2

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.
PROJECT: ConFastfrate, New Warehouse & Offices
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: J. Scott
CHECKED BY: L. Ramos
DATE (START): 8 July 2021
DATE (FINISH): 28 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	SAMPLE DATA			
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	90.23	GROUND SURFACE		%		N
	90.16	**TOPSOIL** (75 mm) **FILL** - SILTY SAND, with clay, trace rootlets, brown to grey, moist, stiff	SS1	43	1-2-7-4	9
1.0		asphalt at 0.8 m bgs cobble at 0.9 m bgs	SS2	54	7-8-4-9	12
2.0		cobble at 1.5 m bgs	SS3	21	9-10-7-5	17
			SS4	0	4-2-1-2	3
3.0	87.19	**FILL** - very loose fill mixed with organics/top soil and wood fragments - dark brown, moist	SS5	67	2-1-1-4	2
4.0			SS6	13	5-1-0-1	1
5.0			SS7	17	2-1-1-2	2
			SS8	42	2-1-2-2	3
▼6.0	WL6.1 2021-07-26		SS9A	83	1-3-2-3	5
	83.68	**SILTY SAND** - with clay, trace rootlets, brown, moist	SS9B		--	
7.0		wet at 6.86 mbgs trace gravel, rootlets stopped at 7.01 mbgs	SS10	42	4-11-11-15	22
8.0		brown with grey mottling, moist at 7.62 m bgs	SS11	83	5-10-12-11	22
9.0		wet at 8.69 mbgs	SS12	100	21-27-31-30	58
			SS13	0	22-22-19-36	41
10.0			SS14	71	8-21-20-31	41
11.0		moist at 10.82 mbgs	SS15	67	20-16-25-25	41



NOTES:
m bgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101

ENCLOSURE No.:

GHD

BOREHOLE No.: BH4-21

ELEVATION: 90.23 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.

PROJECT: ConFastfrate, New Warehouse & Offices

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: J. Scott CHECKED BY: Leandro Ramos

DATE (START): 8 July 2021 DATE (FINISH): 28 July 2021

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
☐	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
metres	90.23		GROUND SURFACE			%		N	
	78.80	▨	**SILTY CLAY** - with sand, trace gravel, reddish brown, moist, hard	☒	SS16	100	13-24-26-22	50	○ ●
12.0	78.19		Borehole terminated due to auger refusal at 12.04 mbgs. Bedrock or boulder inferred Note: Borehole Coordinate - UTM 18 Zone - Northing: 5017343.6 - Easting: 456673.6						
13.0									
14.0									
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									
21.0									
22.0									

NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11231101

ENCLOSURE No.:

BOREHOLE No.: BH5-21

ELEVATION: 90.39 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Consolidated Fastfrate (Ottawa) Holdings Ltd.

PROJECT: ConFastfrate, New Warehouse & Offices

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: J. Scott

CHECKED BY: Leandro Ramos

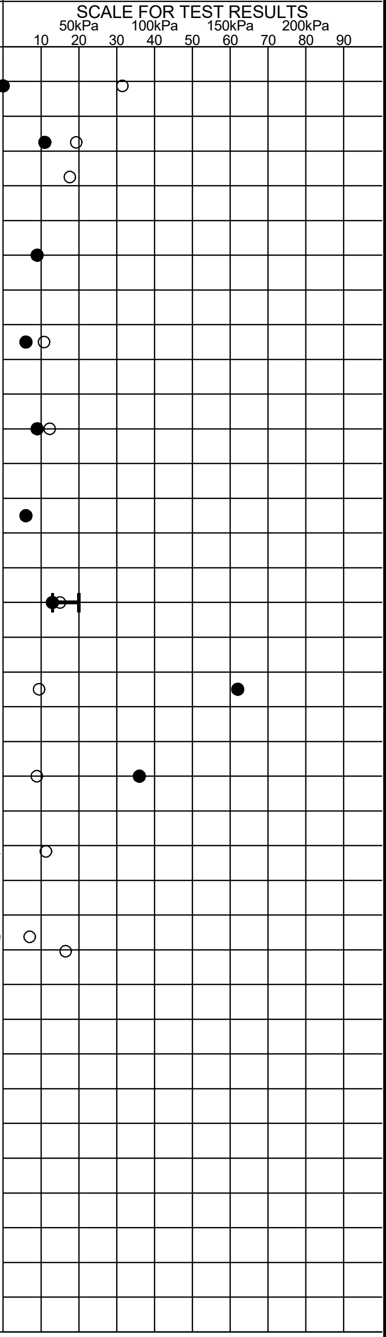
DATE (START): 26 July 2021

DATE (FINISH): 26 July 2021

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ◫ RC Rock Core
- ▼ Water Level
- ○ Water content (%)
- ├─┤ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Blows per 6 in. / 15 cm	Penetration Index / RQD %
metres	90.39		GROUND SURFACE			%		N
	90.32		**TOPSOIL** (75 mm) **FILL** - SILTY CLAY, trace sand, grey, moist, very soft	☒	SS1	21	1-0-0-1	0
				☒	SS2A	24	2-5-6-7	11
1.0	89.48		**FILL** - SANDY SILT, trace clay, trace gravel, dark brown, moist, compact	☒	SS2B		--	
			loose at 1.52 mbgs Gravel - 25%, Sand - 38%, Silt - 29%, Clay - 8%	☒	SS3	24	12-5-4-6	9
2.0			with clay, some gravel at 2.29 mbgs	☒	SS4	24	5-4-2-5-6	6
3.0			shale cobble at 3.2 mbgs	☒	SS5	24	4-3-6-7	9
4.0				☒	SS6	24	4-3-3-5	6
5.0	85.82		**SILTY SAND** - trace clay, trace gravel, brown, moist, compact to very dense Gravel - 10%, Sand - 38%, Silt - 41%, Clay - 11% wet at 5.03 mbgs	☒	SS7	24	3-5-8-9	13
			moist, containing cobbles at 5.33 mbgs	☒	SS8	24	14-20-42-42	62
6.0			grey at 6.1 mbgs	☒	SS9	24	8-16-20-20	36
7.0			wet, with clay at 6.86 mbgs	☒	SS10	16	15-34-50/102 mm	84/254 mm
			moist at 7.62	☒	SS11A	15	23-40-50/76 mm	90/229 mm
8.0	82.52		**SANDY SILT** - trace clay, grey, moist, very loose	☒	SS11B		--	
	82.39		Borehole terminated due to auger refusal at 8.0 mbgs. Bedrock or boulder inferred Note: Borehole Coordinate - UTM 18 Zone - Northing: 5017293.2 - Easting: 456532.1					
9.0								
10.0								
11.0								



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

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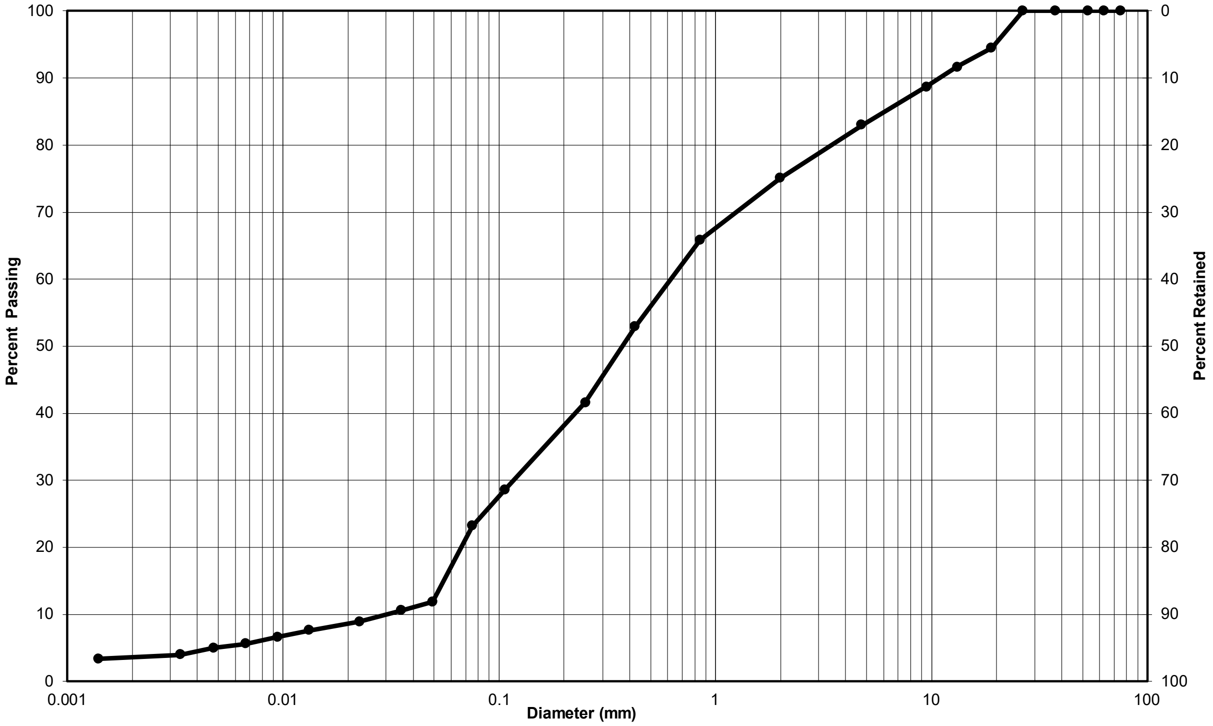
Appendix A2

Geotechnical Laboratory Results

Particle-Size Analysis of Soils (Geotechnical)
(USCS) (ASTM D422)

Client:	Consolidated Fastfrate (Ottawa) Holdings Inc.	**Lab No.:**	SS-21-66
Project/Site:	New Warehouse and Offices / Somme Street, Ottawa	**Project No.:**	11231101

Borehole no.:	BH1-21	Sample no.:	SS2B
Depth:	0.9 to 1.4m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty sand with gravel (SM)	17	60	23
Silt-size particles (%):	19		
Clay-size particles (%) (<0.002mm):	4		

Remarks:

Performed by:	Jade Gorman	**Date:**	August 10, 2021
Verified by:	Joe Sullivan	**Date:**	August 11, 2021

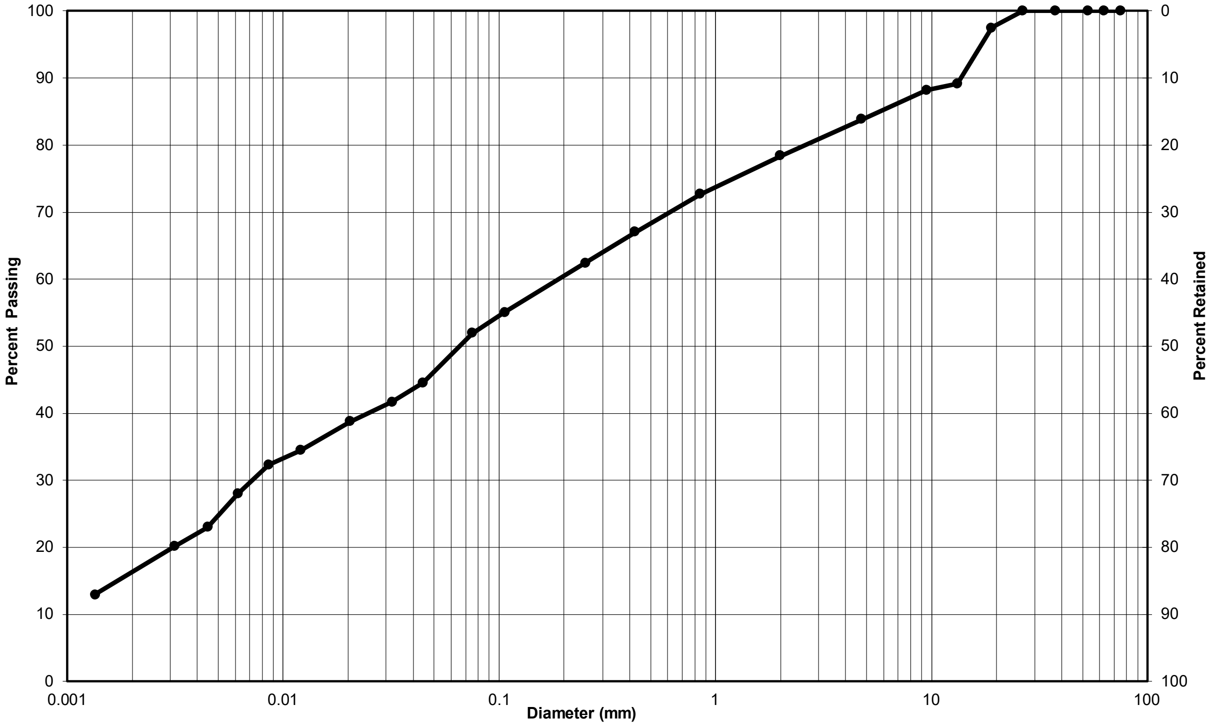
Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Lab No.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Project No.:** 11231101

Borehole no.: BH1-21 Sample no.: SS13

Depth: 9.1 to 9.8m Enclosure: -



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy lean clay with gravel (CL)	16	32	52
Silt-size particles (%):	36		
Clay-size particles (%) (<0.002mm):	16		

Remarks:

Performed by: Jade Gorman **Date:** August 10, 2021

Verified by: Joe Sullivan **Date:** August 11, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc.
Lab no.: SS-21-66
Project/Site: New Warehouse and Offices / Somme Street, Ottawa
Project no.: 11231101

Borehole no.: BH1-21
Sample no.: SS13
Depth: 9.1 to 9.8m
Soil Description: Lean Clay (CL)
Date sampled:

Apparatus: Hand Crank
Balance no.: 10
Porcelain bowl no.: 1
Liquid limit device no.: 1
Oven no.: B33-02667
Spatula no.: 1
Sieve no.: n/a
Glass plate no.: 1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	32	23	15
Water Content:			
Tare no.	1	8	43A
Wet soil+tare, g	26.69	30.76	28.34
Dry soil+tare, g	25.62	28.79	26.84
Mass of water, g	1.07	1.97	1.50
Tare, g	21.32	21.19	21.22
Mass of soil, g	4.30	7.60	5.62
Water content %	24.9%	25.9%	26.7%

Plastic Limit (PL) - Water Content:

Tare no.	20	22
Wet soil+tare, g	28.02	27.70
Dry soil+tare, g	26.99	26.75
Mass of water, g	1.03	0.95
Tare, g	21.36	21.56
Mass of soil, g	5.63	5.19
Water content %	18.3%	18.3%
Average water content %	18.3%	

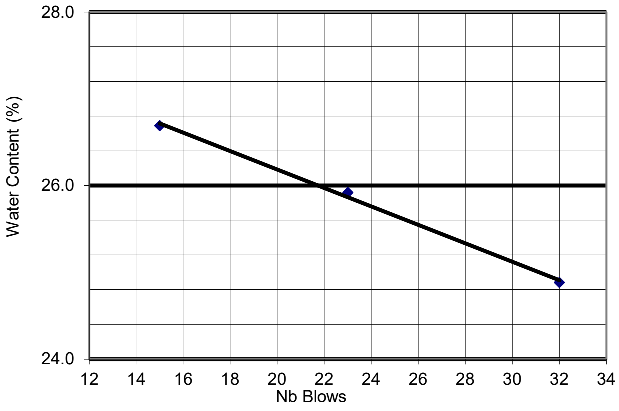
Natural Water Content (W^n):

Tare no.	N7	
Wet soil+tare, g	203.55	
Dry soil+tare, g	191.76	
Mass of water, g	11.79	
Tare, g	45.09	
Mass of soil, g	146.67	
Water content %	8.0%	

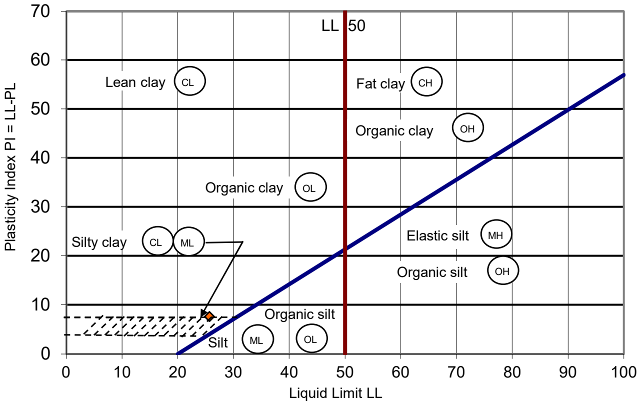
Soil Preparation:

☑ Cohesive <425 µm
☐ Cohesive >425 µm
☐ Non-cohesive
☑ Dry preparation
☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
26	18	8	8.0

Remarks:

Performed by: Josh Sullivan
Date: August 10, 2021
Verified by: Joe Sullivan
Date: August 11, 2021

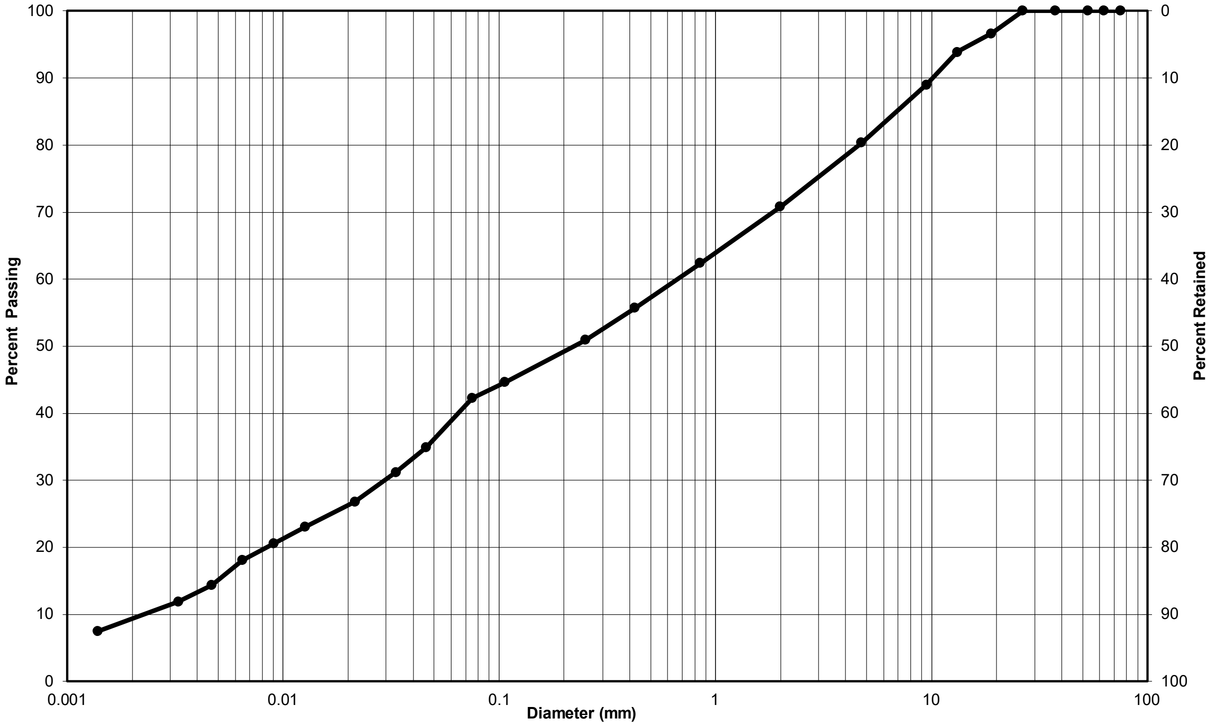
Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Lab No.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Project No.:** 11231101

Borehole no.: BH2-21 Sample no.: SS12

Depth: 8.4 to 9.0m Enclosure: -



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy lean clay with gravel (CL)	20	38	42
Silt-size particles (%):	33		
Clay-size particles (%) (<0.002mm):	9		

Remarks:

Performed by: Jade Gorman **Date:** August 10, 2021

Verified by: Joe Sullivan **Date:** August 11, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc.
Lab no.: SS-21-66
Project/Site: New Warehouse and Offices / Somme Street, Ottawa
Project no.: 11231101

Borehole no.: BH2-21
Sample no.: SS12
Depth: 8.4 to 9.0m
Soil Description: Lean Clay (CL)
Date sampled:

Apparatus: Hand Crank
Balance no.: 10
Porcelain bowl no.: 1
Liquid limit device no.: 1
Oven no.: B33-02667
Spatula no.: 1
Sieve no.: n/a
Glass plate no.: 1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	27	21	15
Water Content:			
Tare no.	1	8	43A
Wet soil+tare, g	29.51	29.53	29.71
Dry soil+tare, g	27.86	27.82	27.93
Mass of water, g	1.65	1.71	1.78
Tare, g	21.30	21.26	21.32
Mass of soil, g	6.56	6.56	6.61
Water content %	25.2%	26.1%	26.9%

Plastic Limit (PL) - Water Content:

Tare no.	20	22
Wet soil+tare, g	28.59	28.68
Dry soil+tare, g	27.57	27.62
Mass of water, g	1.02	1.06
Tare, g	21.57	21.36
Mass of soil, g	6.00	6.26
Water content %	17.0%	16.9%
Average water content %	17.0%	

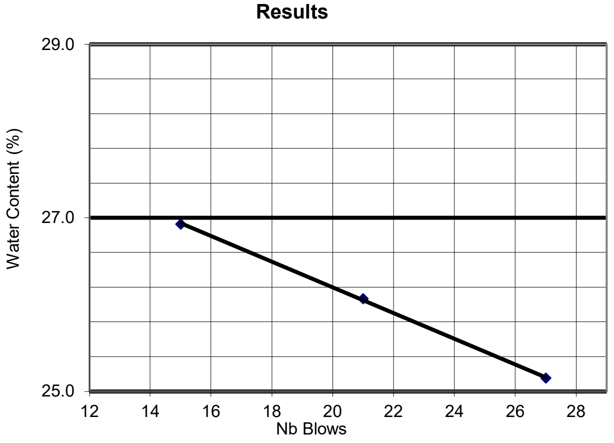
Natural Water Content (W^n):

Tare no.	Z57	
Wet soil+tare, g	194.57	
Dry soil+tare, g	182.50	
Mass of water, g	12.07	
Tare, g	47.10	
Mass of soil, g	135.40	
Water content %	8.9%	

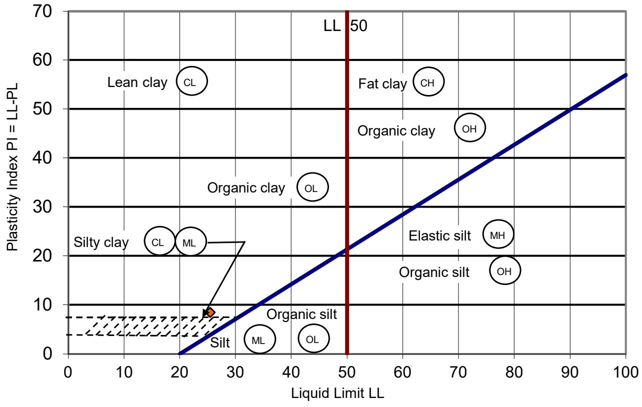
Soil Preparation:

☑ Cohesive <425 µm
☐ Cohesive >425 µm
☐ Non-cohesive
☑ Dry preparation
☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
25	17	8	8.9

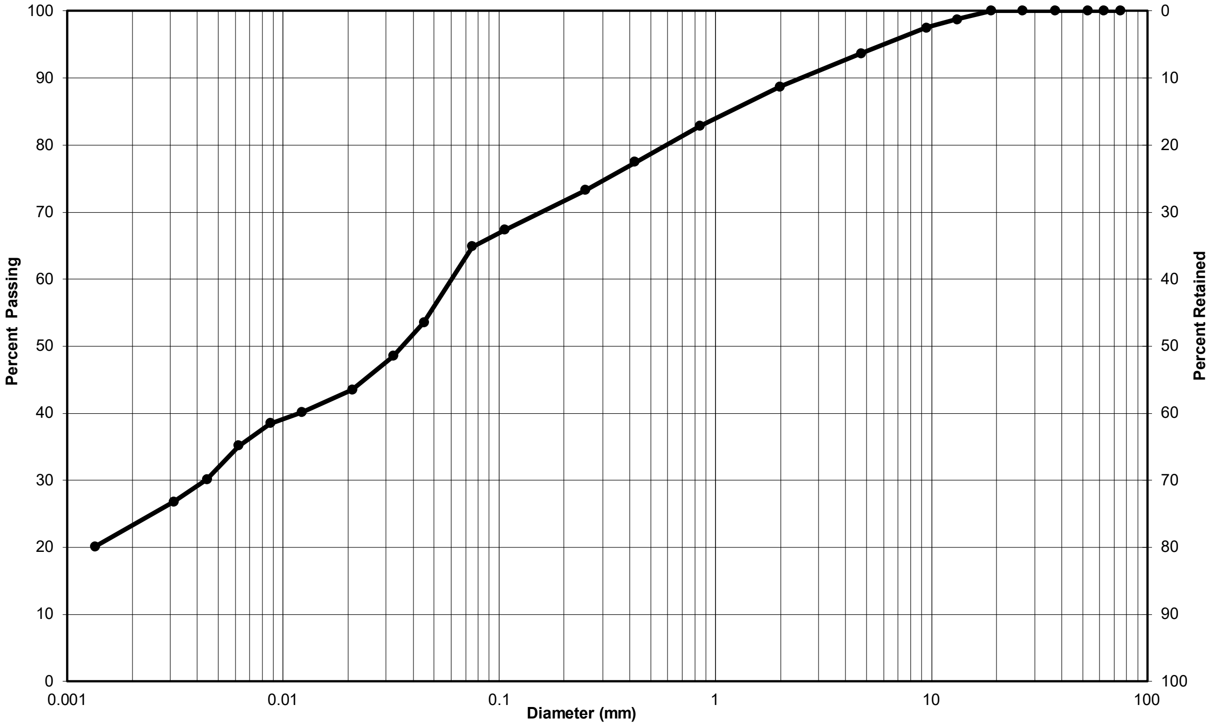
Remarks:

Performed by: Josh Sullivan
Date: August 10, 2021
Verified by: Joe Sullivan
Date: August 11, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate (Ottawa) Holdings Inc.	**Lab No.:**	SS-21-66
Project/Site:	New Warehouse and Offices / Somme Street, Ottawa	**Project No.:**	11231101

Borehole no.:	BH2-21	Sample no.:	SS18
Depth:	13.0 to 13.6m	Enclosure:	-



<table>
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<tr><td>Fine</td><td>Medium</td><td>Coarse</td><td>Fine</td><td>Coarse</td></tr>
<tr><td colspan="6">Unified Soil Classification System</td></tr>
</table>

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy lean clay (CL)	6	29	65
Silt-size particles (%):	42		
Clay-size particles (%) (<0.002mm):	23		

Remarks:

Performed by:	Josh Sullivan	**Date:**	September 9, 2021
Verified by:	Joe Sullivan	**Date:**	September 13, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Consolidated Fastfrate (Ottawa) Holdings Inc.	**Lab no.:**	SS-21-66
Project/Site:	New Warehouse and Offices / Somme Street, Ottawa	**Project no.:**	11231101

Borehole no.:	BH2	Sample no.:	SS18	Depth:	13.0 to 13.6m
Soil Description:	Lean Clay (CL)			Date sampled:	

Apparatus:	Hand Crank	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B33-02667	Spatula no.:	1
Sieve no.:	n/a	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	34	23	15
Water Content:			
Tare no.	116	117	118
Wet soil+tare, g	30.86	30.40	29.04
Dry soil+tare, g	28.88	28.46	27.37
Mass of water, g	1.98	1.94	1.67
Tare, g	21.48	21.50	21.60
Mass of soil, g	7.40	6.96	5.77
Water content %	26.8%	27.9%	28.9%

Plastic Limit (PL) - Water Content:

Tare no.	20	21
Wet soil+tare, g	27.84	27.84
Dry soil+tare, g	27.06	27.09
Mass of water, g	0.78	0.75
Tare, g	21.41	21.54
Mass of soil, g	5.65	5.55
Water content %	13.8%	13.5%
Average water content %	13.7%	

Natural Water Content (W^n):

Tare no.	S19	
Wet soil+tare, g	167.57	
Dry soil+tare, g	154.66	
Mass of water, g	12.91	
Tare, g	45.95	
Mass of soil, g	108.71	
Water content %	11.9%	

Soil Preparation:

☑ Cohesive <425 µm

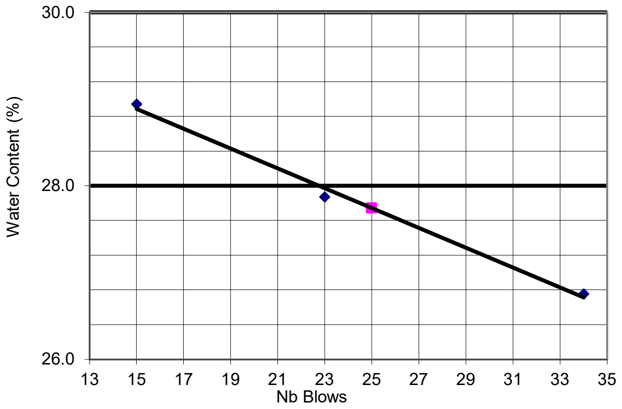
☐ Cohesive >425 µm

☐ Non-cohesive

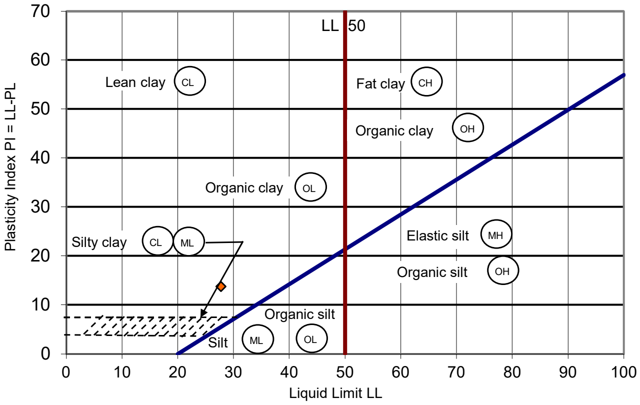
☑ Dry preparation

☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
28	14	14	11.9

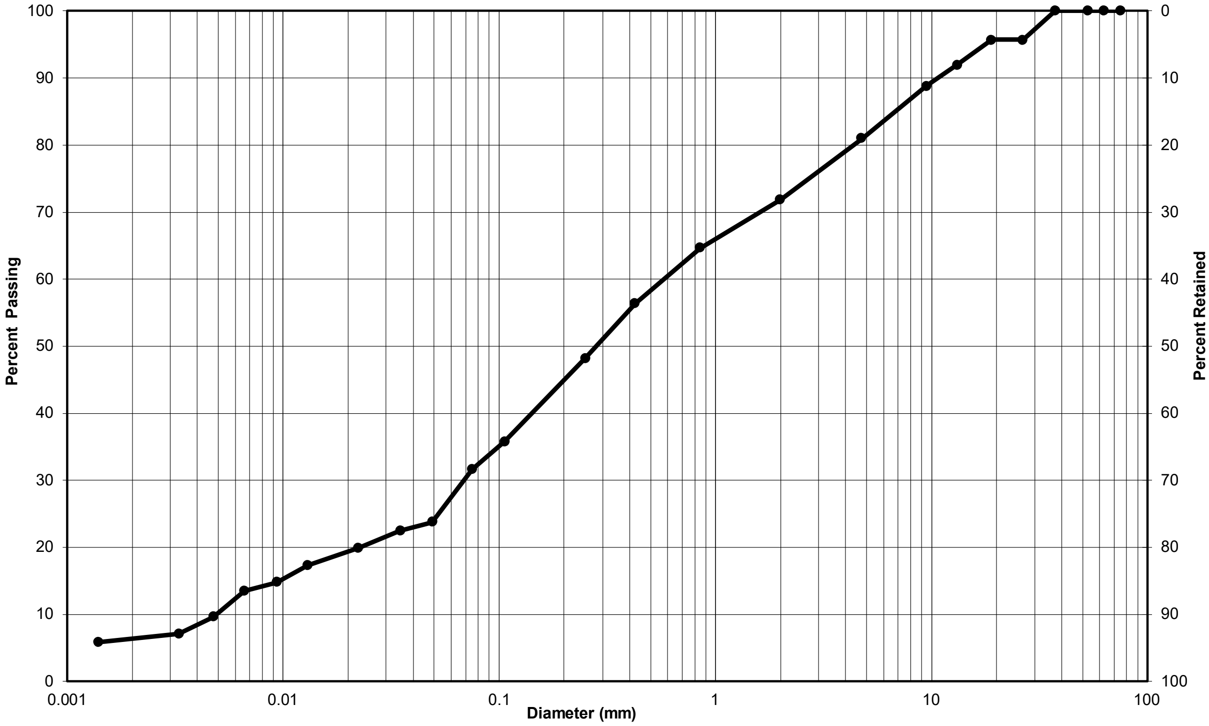
Remarks:

Performed by:	Josh Sullivan	**Date:**	September 10, 2021
Verified by:	Joe Sullivan	**Date:**	September 13, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate (Ottawa) Holdings Inc.	**Lab No.:**	SS-21-66
Project/Site:	New Warehouse and Offices / Somme Street, Ottawa	**Project No.:**	11231101

Borehole no.:	BH3-21	Sample no.:	SS8
Depth:	5.3 to 5.9m	Enclosure:	-



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy silty clay with gravel (CL-ML)	19	49	32
Silt-size particles (%):	26		
Clay-size particles (%) (<0.002mm):	6		

Remarks:

Performed by:	Jade Gorman	**Date:**	August 10, 2021
Verified by:	Joe Sullivan	**Date:**	August 11, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc.
Lab no.: SS-21-66
Project/Site: New Warehouse and Offices / Somme Street, Ottawa
Project no.: 11231101

Borehole no.: BH3-21
Sample no.: SS8
Depth: 5.3 to 5.9m
Soil Description: Silty Clay (CL-ML)
Date sampled:

Apparatus: Hand Crank
Balance no.: 10
Porcelain bowl no.: 1
Liquid limit device no.: 1
Oven no.: B33-026667
Spatula no.: 1
Sieve no.: n/a
Glass plate no.: 1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	25	21	15
Water Content:			
Tare no.	116	9	7
Wet soil+tare, g	32.73	31.64	30.02
Dry soil+tare, g	31.13	30.20	28.77
Mass of water, g	1.60	1.44	1.25
Tare, g	21.46	21.75	21.67
Mass of soil, g	9.67	8.45	7.10
Water content %	16.5%	17.0%	17.6%

Plastic Limit (PL) - Water Content:

Tare no.	100	117
Wet soil+tare, g	27.92	28.13
Dry soil+tare, g	27.17	27.33
Mass of water, g	0.75	0.80
Tare, g	21.53	21.48
Mass of soil, g	5.64	5.85
Water content %	13.3%	13.7%
Average water content %	13.5%	

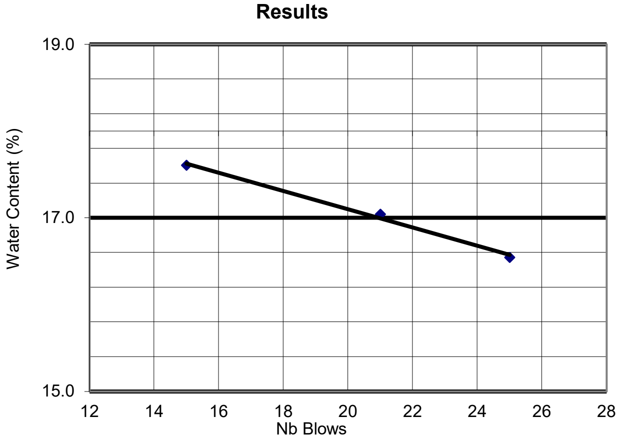
Natural Water Content (W^n):

Tare no.	T3	
Wet soil+tare, g	313.52	
Dry soil+tare, g	289.92	
Mass of water, g	23.60	
Tare, g	46.54	
Mass of soil, g	243.38	
Water content %	9.7%	

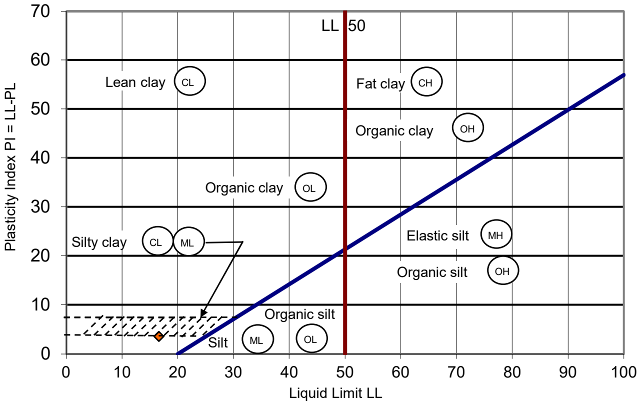
Soil Preparation:

☑ Cohesive <425 µm
☐ Cohesive >425 µm
☐ Non-cohesive
☑ Dry preparation
☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
17	13	4	9.7

Remarks:

Performed by: Josh Sullivan
Date: August 10, 2021
Verified by: Joe Sullivan
Date: August 11, 2021

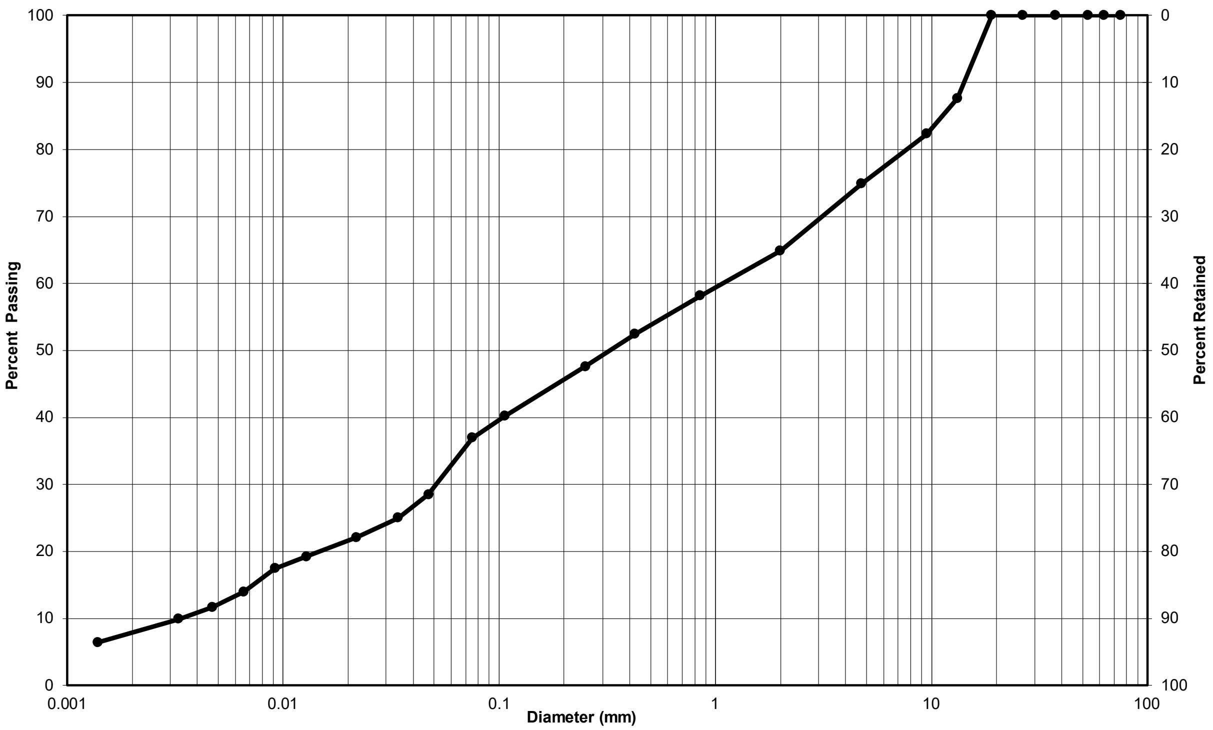
Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Lab No.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Project No.:** 11231101

Borehole no.: BH5-21 Sample no.: SS3

Depth: 1.5 to 2.1m Enclosure: -



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<tr><td>Fine</td><td>Medium</td><td>Coarse</td><td>Fine</td><td>Coarse</td></tr>
<tr><td colspan="6">Unified Soil Classification System</td></tr>
</table>

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Silty sand with gravel (SM)	25	38	37
Silt-size particles (%):	29		
Clay-size particles (%) (<0.002mm):	8		

Remarks:

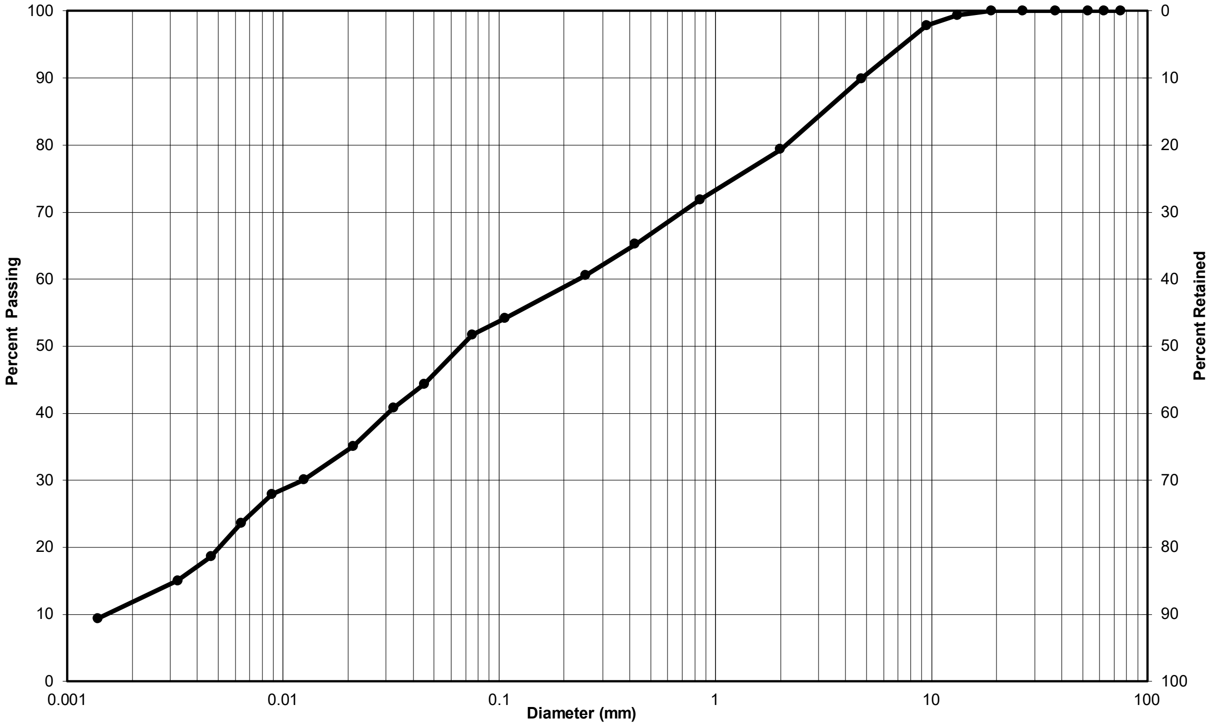
Performed by: Jade Gorman **Date:** August 10, 2021

Verified by: Joe Sullivan **Date:** August 11, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Consolidated Fastfrate (Ottawa) Holdings Inc.	**Lab No.:**	SS-21-66
Project/Site:	New Warehouse and Offices / Somme Street, Ottawa	**Project No.:**	11231101

Borehole no.:	BH5-21	Sample no.:	SS7
Depth:	4.6 to 5.2m	Enclosure:	-



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<tr><td>Fine</td><td>Medium</td><td>Coarse</td><td>Fine</td><td>Coarse</td></tr>
<tr><td colspan="6">Unified Soil Classification System</td></tr>
</table>

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sandy silty clay with gravel (CL-ML)	10	38	52
Silt-size particles (%):	41		
Clay-size particles (%) (<0.002mm):	11		

Remarks:

Performed by:	Jade Gorman	**Date:**	August 10, 2021
Verified by:	Joe Sullivan	**Date:**	August 11, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc.
Lab no.: SS-21-66
Project/Site: New Warehouse and Offices / Somme Street, Ottawa
Project no.: 11231101

Borehole no.: BH5-21
Sample no.: SS7
Depth: 4.6 to 5.2m
Soil Description: Silty Clay (CL-ML)
Date sampled:

Apparatus: Hand Crank
Balance no.: 10
Porcelain bowl no.: 1
Liquid limit device no.: 1
Oven no.: B33-02667
Spatula no.: 1
Sieve no.: n/a
Glass plate no.: 1

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	25	20	15
Water Content:			
Tare no.	2	5	142
Wet soil+tare, g	28.96	28.31	27.50
Dry soil+tare, g	27.69	27.09	26.38
Mass of water, g	1.27	1.22	1.12
Tare, g	21.44	21.39	21.40
Mass of soil, g	6.25	5.70	4.98
Water content %	20.3%	21.4%	22.5%

Plastic Limit (PL) - Water Content:

Tare no.	19	21
Wet soil+tare, g	28.76	28.58
Dry soil+tare, g	27.93	27.75
Mass of water, g	0.83	0.83
Tare, g	21.58	21.39
Mass of soil, g	6.35	6.36
Water content %	13.1%	13.1%
Average water content %	13.1%	

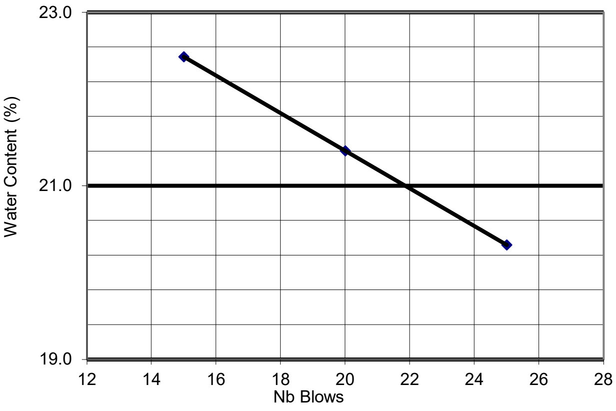
Natural Water Content (W^n):

Tare no.	N30	
Wet soil+tare, g	240.14	
Dry soil+tare, g	214.80	
Mass of water, g	25.34	
Tare, g	46.40	
Mass of soil, g	168.40	
Water content %	15.0%	

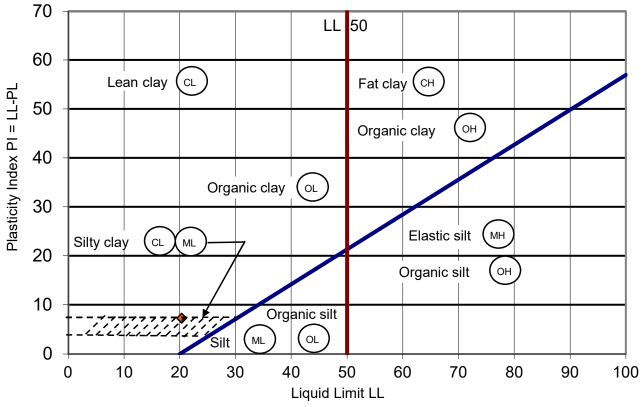
Soil Preparation:

☑ Cohesive <425 µm
☐ Cohesive >425 µm
☐ Non-cohesive
☑ Dry preparation
☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
20	13	7	15.0

Remarks:

Performed by: Josh Sullivan
Date: August 10, 2021
Verified by: Joe Sullivan
Date: August 11, 2021

Uniaxial Compressive Strength of Intact Rock Core Specimens
(ASTM D7012 - Method C)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc **Lab No.:** SS-21-66

Project/Site: New Warehouse and Offices
Somme Street, Ottawa **Project No.:** 11231101

Borehole No.: BH2-21 **Sampled ID:** Run #2

Depth: 51'5" - 51'8" (1570 to 1579.4cm) **Date Sampled:** n/a

Lithological Description: Limestone

Initial Specimen Parameters	
Diameter, mm	47.0
Height, mm	94.0
Height-to-Diameter Ratio	2.0
Volume, cm^3	163.1
Mass, g	466.5
Bulk Density, kg/m^3	2860
Moisture Condition	As Received
Moisture Content, %	0.2

Maximum Applied Load, kN	241.3
Compressive Strength, MPa	139.1

REMARKS:

PERFORMED BY: Jesse Carreau **DATE:** August 3, 2021

VERIFIED BY: Joe Sullivan Joe Sullivan **DATE:** August 5, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Lab No.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Project No.:** 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH1	BH1	BH1	BH1	BH1	BH1	BH1	BH1
	SS1	SS2A	SS2B	SS3	SS4	SS5A	SS5B	SS6
	3"-2'	2.5-2'10"	2'10"-4.5'	5-7'	7.5-9.5'	10-10'8"	10'8"-12'	
Container no.	N25	S40	N18	N20	N23	N15	N13	NO RECOVERY
Mass of container + wet soil (g)	233.32	166.90	185.70	290.57	265.60	180.34	126.64	
Mass of container + dry soil (g)	220.09	156.92	176.04	276.32	246.39	169.56	85.39	
Mass of container (g)	45.78	45.80	45.25	46.05	46.17	46.15	45.12	
Mass of dry soil (g)	174.3	111.1	130.8	230.3	200.2	123.4	40.3	
Mass of water (g)	13.2	10.0	9.7	14.3	19.2	10.8	41.3	
Moisture content (%)	7.6	9.0	7.4	6.2	9.6	8.7	102.4	

BH No.:	BH1	BH1	BH1	BH1	BH1	BH1	BH1	BH1
	SS7	SS8A	SS8B	SS9	SS10	SS11	SS12	SS13
	15-17'	17.5-19'	19-19.5'	20-22'	22.5-24.5'	25-27'	27.5-29.5'	30-32'
Container no.	N1	N4	N10	N17	N8	N9	N16	N7
Mass of container + wet soil (g)	278.30	213.70	240.62	252.25	238.93	201.02	246.61	203.55
Mass of container + dry soil (g)	262.26	200.59	226.34	236.87	228.08	189.49	231.05	191.76
Mass of container (g)	45.80	46.34	45.40	45.80	45.62	45.75	46.75	45.08
Mass of dry soil (g)	216.5	154.3	180.9	191.1	182.5	143.7	184.3	146.7
Mass of water (g)	16.0	13.1	14.3	15.4	10.9	11.5	15.6	11.8
Moisture content (%)	7.4	8.5	7.9	8.0	5.9	8.0	8.4	8.0

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021

Verified by : Joe Sullivan **Date:** August 11, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Project no.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Lab No.:** 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH2	BH2	BH2	BH2	BH2	BH2	BH2	BH2
	SS1A	SS1B	SS2	SS3A	SS3B	SS4	SS5	SS6A
	3"-1.5'	1.5-2'	2.5-4.5'	5-5'5"	5'5"-7'	7.5-9.5'	10-12'	12.5'-12'8"
Container no.	N14	N12	N21	N19	N5	T6	Z48	T2
Mass of container + wet soil (g)	174.43	177.11	281.71	266.40	269.35	207.95	199.66	151.70
Mass of container + dry soil (g)	169.52	165.71	267.18	246.46	249.63	199.32	184.55	142.47
Mass of container (g)	45.42	47.01	45.23	45.24	46.36	45.90	45.46	46.27
Mass of dry soil (g)	124.1	118.7	222.0	201.2	203.3	153.4	139.1	96.2
Mass of water (g)	4.9	11.4	14.5	19.9	19.7	8.6	15.1	9.2
Moisture content (%)	4.0	9.6	6.5	9.9	9.7	5.6	10.9	9.6
BH No.:	BH2	BH2	BH2	BH2	BH2	BH2	BH2	BH2
	SS6B	SS6C	SS7A	SS7B	SS8	SS9	SS10	SS11
	12'8"-12'10"	12'10"-14.5'	15-15.5'	15.5'-17'	17.5-19.5'	20-22'	22.5-24.5'	25-27'
Container no.	S18	S39	N6	S37	Z47	S20	Z60	N11
Mass of container + wet soil (g)	119.33	171.21	217.62	216.49	207.82	292.03	245.95	186.74
Mass of container + dry soil (g)	110.90	147.07	191.26	194.79	188.53	268.92	226.39	175.42
Mass of container (g)	46.62	46.88	44.84	46.95	45.88	45.81	46.79	46.06
Mass of dry soil (g)	64.3	100.2	146.4	147.8	142.7	223.1	179.6	129.4
Mass of water (g)	8.4	24.1	26.4	21.7	19.3	23.1	19.6	11.3
Moisture content (%)	13.1	24.1	18.0	14.7	13.5	10.4	10.9	8.8

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021

Verified by : Joe Sullivan Joe Sullivan **Date:** August 11, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc.
Project no.: SS-21-66
Project/Site: New Warehouse and Offices / Somme Street, Ottawa
Lab No.: 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH2	BH2	BH2	BH2	BH2	BH2	BH2	BH2
	SS12	SS13	SS14	SS15	SS16A	SS16B	SS17	SS18
	25.5-27.5'	30-32'	32.5-33'1"	35-37.5'	37.5-37'11"	37'11"-39.5'		42.5-44.5'
Container no.	Z57	S42	S32	S14	N24	N2	NO RECOVERY	S19
Mass of container + wet soil (g)	194.57	243.64	324.30	153.82	193.01	177.26		167.57
Mass of container + dry soil (g)	182.50	225.66	298.54	140.73	169.48	162.64		154.66
Mass of container (g)	47.10	46.28	46.23	45.69	46.17	45.34		45.95
Mass of dry soil (g)	135.4	179.4	252.3	95.0	123.3	117.3		108.7
Mass of water (g)	12.1	18.0	25.8	13.1	23.5	14.6		12.9
Moisture content (%)	8.9	10.0	10.2	13.8	19.1	12.5		11.9
BH No.:	BH2	BH3	BH3	BH3	BH3	BH3	BH3	BH3
	SS19	SS1	SS2A	SS2B	SS3	SS4	SS5	SS6
	45-47'	3"2'	2.5-3'	3-4.5'	5-7'	7.5-9.5'	11-12'	12.5-14.5'
Container no.	Z10	T15	S21	N27	N26	N3	S12	Z35
Mass of container + wet soil (g)	280.41	152.86	168.64	127.67	189.62	218.13	237.71	267.69
Mass of container + dry soil (g)	257.18	138.71	156.14	111.54	178.16	207.09	223.83	245.63
Mass of container (g)	45.63	46.45	45.80	46.20	46.18	45.73	46.68	45.80
Mass of dry soil (g)	211.6	92.3	110.3	65.3	132.0	161.4	177.2	199.8
Mass of water (g)	23.2	14.2	12.5	16.1	11.5	11.0	13.9	22.1
Moisture content (%)	11.0	15.3	11.3	24.7	8.7	6.8	7.8	11.0

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021
Verified by : Joe Sullivan **Date:** August 11, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Project no.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Lab No.:** 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH3	BH3	BH3	BH3	BH3	BH3	BH3	BH3
	SS7	SS8	SS9	SS10A	SS10B	SS11	SS12	SS13
		17.5-19.5'	20-22'	22.5-23'	23-24.5'	25-27'	27.5-29.5'	30-30'10"
Container no.	NO RECOVERY	T3	Z59	S34	S36	Z42	Z37	S28
Mass of container + wet soil (g)		313.52	205.80	266.00	231.33	241.74	209.23	215.78
Mass of container + dry soil (g)		289.92	195.39	248.34	213.60	228.08	197.56	201.01
Mass of container (g)		46.54	47.06	45.98	47.55	46.42	45.91	46.34
Mass of dry soil (g)		243.4	148.3	202.4	166.1	181.7	151.7	154.7
Mass of water (g)		23.6	10.4	17.7	17.7	13.7	11.7	14.8
Moisture content (%)		9.7	7.0	8.7	10.7	7.5	7.7	9.5

BH No.:	BH4	BH4	BH4	BH4	BH4	BH4	BH4	BH4
	SS1	SS2	SS3	SS4	SS5	SS6	SS7	SS8
	3"-2'	2.5-4.5'	5-7'		10-12'	12.5-14.5'	15-17'	15.5-17.5'
Container no.	S26	Z29	S17	NO RECOVERY	S27	Z50	T14	T8
Mass of container + wet soil (g)	223.60	225.82	263.66		222.97	116.87	151.70	224.79
Mass of container + dry soil (g)	194.94	201.43	250.71		188.87	83.71	133.21	192.23
Mass of container (g)	46.01	46.15	45.21		46.16	47.05	45.34	46.06
Mass of dry soil (g)	148.9	155.3	205.5		142.7	36.7	87.9	146.2
Mass of water (g)	28.7	24.4	13.0		34.1	33.2	18.5	32.6
Moisture content (%)	19.2	15.7	6.3		23.9	90.5	21.0	22.3

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021

Verified by : Joe Sullivan **Date:** August 11, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Con **Project no.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Lab No.:** 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH4	BH4	BH4	BH4	BH4	BH4	BH4	BH4
	SS9A	SS9B	SS10	SS11	SS12	SS13	SS14	SS15
	20-21.5'	21.5-22'	22.5-24.5'	25-27'	27.5-29.5'		32.5-34.5'	35-37'
Container no.	Z31	T1	N22	S30	S29	NO RECOVERY	S45	T9
Mass of container + wet soil (g)	197.83	262.26	335.05	205.12	240.22		242.41	271.90
Mass of container + dry soil (g)	171.06	223.24	300.88	168.62	221.98		224.01	254.61
Mass of container (g)	45.87	45.83	45.42	45.70	45.78		46.07	45.78
Mass of dry soil (g)	125.2	177.4	255.5	122.9	176.2		177.9	208.8
Mass of water (g)	26.8	39.0	34.2	36.5	18.2		18.4	17.3
Moisture content (%)	21.4	22.0	13.4	29.7	10.4		10.3	8.3
BH No.:	BH4	BH5	BH5	BH5	BH5	BH5	BH5	BH5
	SS16	SS1	SS2A	SS2B	SS3	SS4	SS5	SS6
	37.5-39.5'	3"-2'	2.5-3'	3-4.5'		7.5-9.5'	10-12'	
Container no.	N32	N28	Z5	N29	USED FOR HYDROMETER	N34	N36	NO RECOVERY
Mass of container + wet soil (g)	171.49	204.87	277.76	199.82		184.69	171.27	
Mass of container + dry soil (g)	156.21	166.78	240.15	176.72		171.19	157.43	
Mass of container (g)	45.50	45.93	45.70	45.71		46.67	45.36	
Mass of dry soil (g)	110.7	120.9	194.5	131.0		124.5	112.1	
Mass of water (g)	15.3	38.1	37.6	23.1		13.5	13.8	
Moisture content (%)	13.8	31.5	19.3	17.6		10.8	12.3	

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021

Verified by : Joe Sullivan **Date:** August 11, 2021

Moisture Content of Soils
(ASTM D 2216)

Client: Consolidated Fastfrate (Ottawa) Holdings Inc. **Project no.:** SS-21-66

Project/Site: New Warehouse and Offices / Somme Street, Ottawa **Lab No.:** 11231101

Oven No.: B33-02932 **Scale No.:** 10

BH No.:	BH5	BH5	BH5	BH5	BH5	BH5		
	SS7	SS8	SS9	SS10	SS11A	SS11B		
	15-17'	17.5-19.5'	20-22'	22.5-24.5'	25-25'10"	25'10"-26'3"		
Container no.	N30	N35	N33	S44	S13	T13		
Mass of container + wet soil (g)	240.14	211.88	229.19	230.05	189.96	186.46		
Mass of container + dry soil (g)	214.80	197.53	214.27	211.44	180.54	166.64		
Mass of container (g)	46.40	46.08	47.12	46.44	46.30	46.88		
Mass of dry soil (g)	168.4	151.5	167.2	165.0	134.2	119.8		
Mass of water (g)	25.3	14.4	14.9	18.6	9.4	19.8		
Moisture content (%)	15.0	9.5	8.9	11.3	7.0	16.5		
BH No.:								
Container no.								
Mass of container + wet soil (g)								
Mass of container + dry soil (g)								
Mass of container (g)								
Mass of dry soil (g)								
Mass of water (g)								
Moisture content (%)								

Remarks:

Performed By: Jade Gorman **Date:** August 10, 2021

Verified by : Joe Sullivan Joe Sullivan **Date:** August 11, 2021

Appendix A3

Analytical Laboratory Results

Certificate of Analysis

Client:	GHD Limited (Ottawa) 400-179 Colonnade Rd. Ottawa, ON K2E 7J4	Report Number:	1936331
		Date Submitted:	2020-08-11
		Date Reported:	2020-08-25
		Project:	11215612-A2
		COC #:	210163
Attention:	Mr. Ryan Vanden Tillaart		
PO#:	73520576		
Invoice to:	GHD Limited (Ottawa)		

Dear Ryan Vanden Tillaart:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: ______________________________

Addrine Thomas, Inorganics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

eurofins | Environment Testing

Certificate of Analysis

Client: GHD Limited (Ottawa)
400-179 Colonnade Rd.
Ottawa, ON
K2E 7J4
Attention: Mr. Ryan Vanden Tillaart
PO#: 73520576
Invoice to: GHD Limited (Ottawa)

Report Number: 1936331
Date Submitted: 2020-08-11
Date Reported: 2020-08-25
Project: 11215612-A2
COC #: 210163

				Lab I.D.	1509594
				Sample Matrix	Soil
				Sample Type	
				Sampling Date	2020-08-11
				Sample I.D.	BH3-SS3
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	Cl	0.002	%		0.008
	SO4	0.01	%		0.08
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.52
	pH	2.00			8.66
	Resistivity	1	ohm-cm		1920
Redox Potential	REDOX Potential		mV		205
Subcontract	Moisture-Humidite	0.25	%		8.54
	S2-	0.2	ug/g		<0.20

Guideline =

*** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 387642 **Analysis/Extraction Date** 2020-08-13 **Analyst** AET **Method** C CSA A23.2-4B			
Chloride		98	90-110
Run No 387870 **Analysis/Extraction Date** 2020-08-14 **Analyst** AET **Method** SUBCONTRACT-A			
Moisture-Humidite	<0.25 %	101	
S2-	<0.20 ug/g	98	
Run No 387916 **Analysis/Extraction Date** 2020-08-18 **Analyst** SG **Method** Cond-Soil			
Electrical Conductivity	<0.05 mS/cm	97	90-110
pH	5.63	100	90-110
Resistivity			
Run No 388007 **Analysis/Extraction Date** 2020-08-19 **Analyst** SKH **Method** AG SOIL			
SO4	<0.01 %	96	70-130
Run No 388317 **Analysis/Extraction Date** 2020-08-25 **Analyst** AET **Method** C SM2580B			
REDOX Potential	258 mV	101	

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Appendix B

Dynamic Compaction Condition (DCC)

Slope Stability

179 Colonnade Road South, Suite 400
Ottawa, Ontario K2E 7J4
Canada
www.ghd.com

Our ref: 11228236

January 20, 2022

Mr. Pierre Courteau
Consolidated Fastfrate (Ottawa) Holdings Inc.
55 Commerce Valley Drive West
Suite 220
Thornhill, ON L3T 7V9

Slope Stability Assessment for Dynamic Compaction, Warehouse and Offices, Ottawa, ON - Issued for site plan application

Dear Mr. Courteau

1. Introduction

Consolidated Fastfrate (Ottawa) Holdings Inc. (Fastfrate) has requested GHD Limited (GHD) to perform a slope stability assessment for the slopes along Rideau Road and Somme Street (Site) in preparation for the dynamic compaction works. The location of the Site is shown on the site layout in Figure 1.

The Site is located at the intersection of Rideau Road to the north and Somme Street to the west and is relatively flat and is covered with approximately 6 metres (m) thick fill, reportedly brought in from construction sites, which gives the Site its present flat surface albeit slightly hummocky look, sloping down to the surrounding streets. The surrounding topography slopes up at approximately two-horizontal to one-vertical (2H:1V) from south to north by approximately 3.5 m from Rideau Road to the section of Somme Street south of the Site. The Site elevation is higher compared to the surrounding streets varying from approximately 0.2 m higher on the south side (Somme Street) to 4 m higher on the north side (Rideau Street). There is also a ditch along the south, west, and north perimeters of the Site.

Fastfrate is proposing to develop an approximately 8,630 square meters (m^2) warehouse on the western portion of the Site. It is GHD's understanding that Fastfrate intends to use dynamic compaction method of ground improvement to densify the randomly placed fill materials within the building footprint only prior to the proposed development.

The stability assessment has been completed in alignment with the cross-sections received by GHD from CIVITAS on July 28, 2021, and July 22, 2021, for the north and west slopes respectively. The locations of the cross-sections are shown on the site plan provided in Figure 1 and the cross-sections are attached to the present letter.

GHD understands that the Client will elect a contractor to undertake the dynamic compaction works at the Site. As such, it is recommended that additional information, including the type of equipment, expected peak particle velocity (PPV), expected frequency and method of works be provided to GHD once confirmed. Additional information on the influence of the above inputs is explained in Section 3.2.

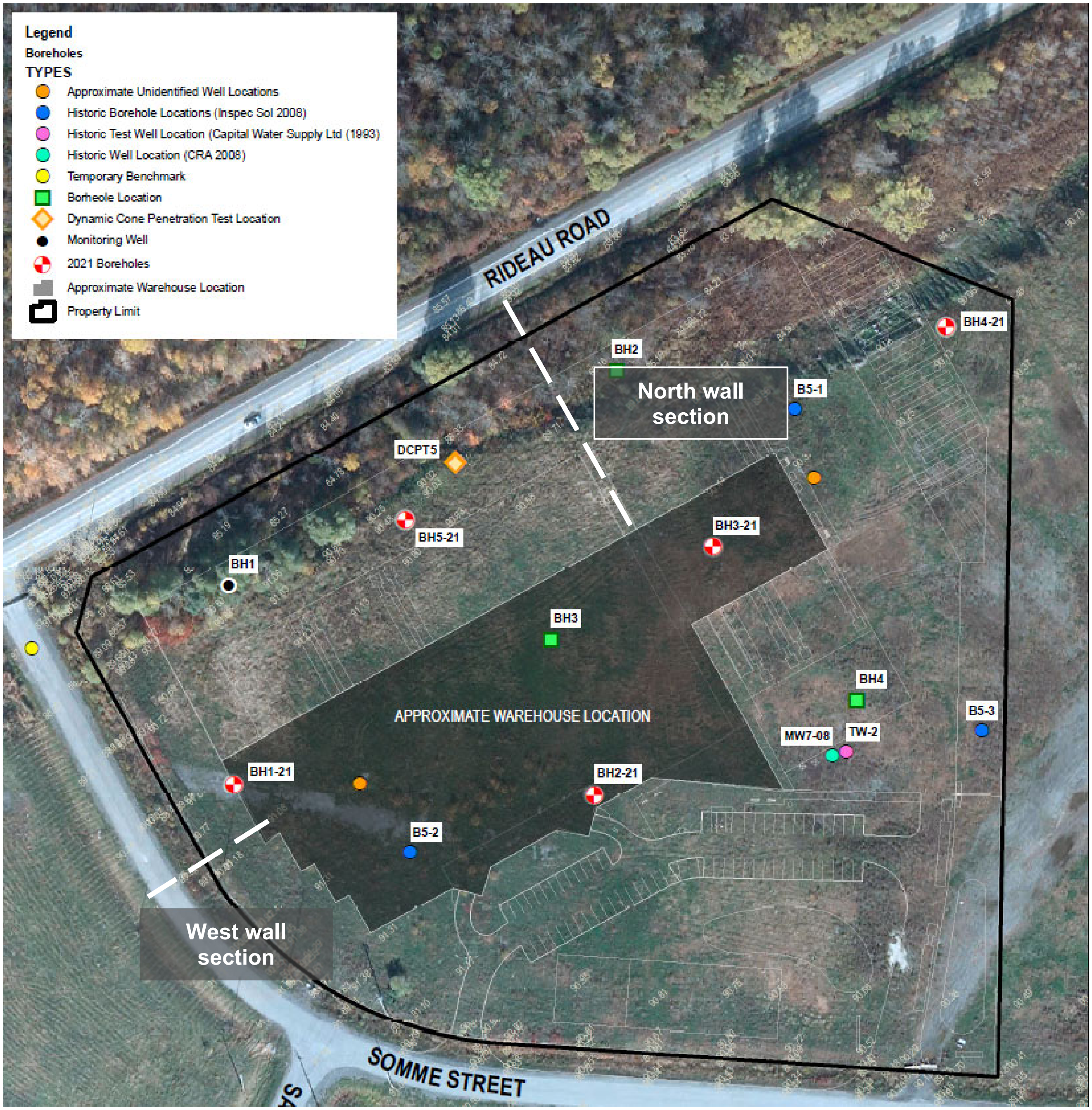


Figure 1 *Site Layout showing the location of the analysed cross sections and the proposed building footprint*

The following is attached to this letter:

- Attachment 1: West slope cross-section and global stability analysis results
- Attachment 2: North slope cross-section and global stability analysis results

2. Review of pre-construction geotechnical information

GHD has reviewed the following geotechnical investigations while preparing this letter:

- Geotechnical Study Subdivision Plan, Hawthorne Industrial Park, report ref. no. T020556-A1, by Inspec-Sol, dated May 4, 2009.
- Geotechnical Investigation, Warehouse and Offices Intersection of Rideau Street, report ref. no. 11215612-A1, by GHD, dated October 27, 2021.
- Supplementary Geotechnical Investigation, Warehouse and Offices Intersection of Rideau Street, report ref. no. 11231101-RPT-1, by GHD, dated January 20, 2022

GHD has also reviewed the following documents provided by the client as part of the assessment:

- Grade Control and Drainage Plan, Somme St, Ontario, Fastfrate facility, Job No. A001083-C006, by CIMA+, dated March 8, 2021.
- Draft Floor Plan, New Warehouse & Cross-Dock Facility, Fastfrate Ottawa, Somme Street, Ottawa, Ontario, Job No. 2001-A1, by CIVITAS, dated April 28, 2021.
- West slope cross-section, 2001-FastFrat-Civil Section-July 21, 2021_comm_GHD, by CIVITAS, received July 26, 2021.
- North slope cross-section, C006B_Grading, by CIMA+, received July 28, 2021.

3. Slope stability assessment

3.1 Subsurface conditions

As per the documentation reviewed and listed in Section 2, in general, soils encountered at the borehole locations consisted of a thick layer of fill material overlying native silty sand to sandy silt deposit. Limestone bedrock with interbedded sandstone was encountered at depths ranging from 8.2 (BH1) to 14.8 mbgs (BH2-21).

General descriptions of the subsurface conditions are summarized as follow:

1. Fill | Consisting of a mixture of sand, silt, clay, and gravel. The fill material contains traces to some asphalt, concrete, wood and brick fragments, topsoil, and pieces of reinforcing steel. The composition of fill varied with depth and borehole location. Cobbles and possible boulders were encountered in the boreholes at varying depths. The thickness of the fill at the borehole locations was approximately 6 m.
2. Native sandy silt | Below the fill material a native deposit of sandy silt to silty sand with varying amounts of clay and gravel was encountered. Cobbles and possible boulders are expected within this deposit becoming more frequent with depth. The deposit extended to depths ranging from 8.2 to 11.9 m below ground surface (mbgs).
3. Bedrock | Limestone bedrock with interbedded sandstone was encountered below the native sandy silt.
4. Groundwater | Groundwater levels were measured on August 18, 2020, groundwater elevation of 87 m was encountered at the monitoring wells.

The selected geotechnical parameters for the Site soils used in the analysis are summarized in Table 1.

Table 1 Geotechnical parameters

Material	Unit weight (kN.m^3)	Cohesion (kPa)	Internal friction angle (°)
Existing fill	18	4	25
Native sandy silt	17	2	34
Bedrock	N/A (considered impenetrable)		

3.2 Vibration analyses

Dynamic compaction is comprised of repeatedly dropping a 5 to 40 tons mass freely from a height of 10 to 40 m on a grid pattern. Dynamic compaction can densify suitable materials up to 10 m thick. Suitable materials are saturated free-draining soils, low moisture content poorly draining soils (moisture content lower than plastic limit) and silts with a plasticity index of less than eight. Due to the dropping of the heavy mass vibration is generated from the dynamic compaction works to the surrounding soil. Vibration then propagates through the surrounding soil until the vibration wave attenuates completely. If the vibrations exceed certain threshold limits for level or sloping ground conditions, ground displacements may occur. In addition, vibrations can cause a reduction in the shear strength of soils. As such, construction vibrations such as dynamic compaction need to be considered in the stability analyses.

Vibrations are a function of the amount of energy that gets dissipated with increase in distance from the source of energy. The established energy versus distance relationship is exponential in nature, meaning that an exponential reduction in vibration is realized with increasing distances. The energy measured as a function of Peak Particle Velocity (PPV) although meeting the specified criterion at the specified locations was exponentially higher when travelling through the slope at shorter distances from the source of vibration.

As indicated earlier, vibration (measured as PPV) energy gets dissipated with time as soil conditions have a damping effect on vibration. PPV follows a reverse log curve on an exponential scale, therefore, values begin very high near the source of vibrations and drop off rapidly farther from the source. A slope can experience movements if ground acceleration 'a' due to gravity exceeds yield acceleration (Ky) values[1].

Ground acceleration 'a' is related to PPV through the frequency of motion 'F', assuming sinusoidal motion, using the following equation:

$$a = 2*\pi*PPV*F \qquad \text{Eq. (1)}$$

Where:

- PPV = Peak Particle Velocity in mm/sec
- F = Frequency in Hz

For the west wall with a platform extended 4 m from the building footprint, the PPV was estimated to be 0.5 inches per second as shown in Figure 2 for a two-ton drop ball with a 40-foot drop.

---

[1] Matasovic' N., (1991): Selection of Method for Seismic Slope Stability Analysis. Proceedings: Second International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, March 11-15, 1991, St. Louis, Missouri, Paper No. 7.20

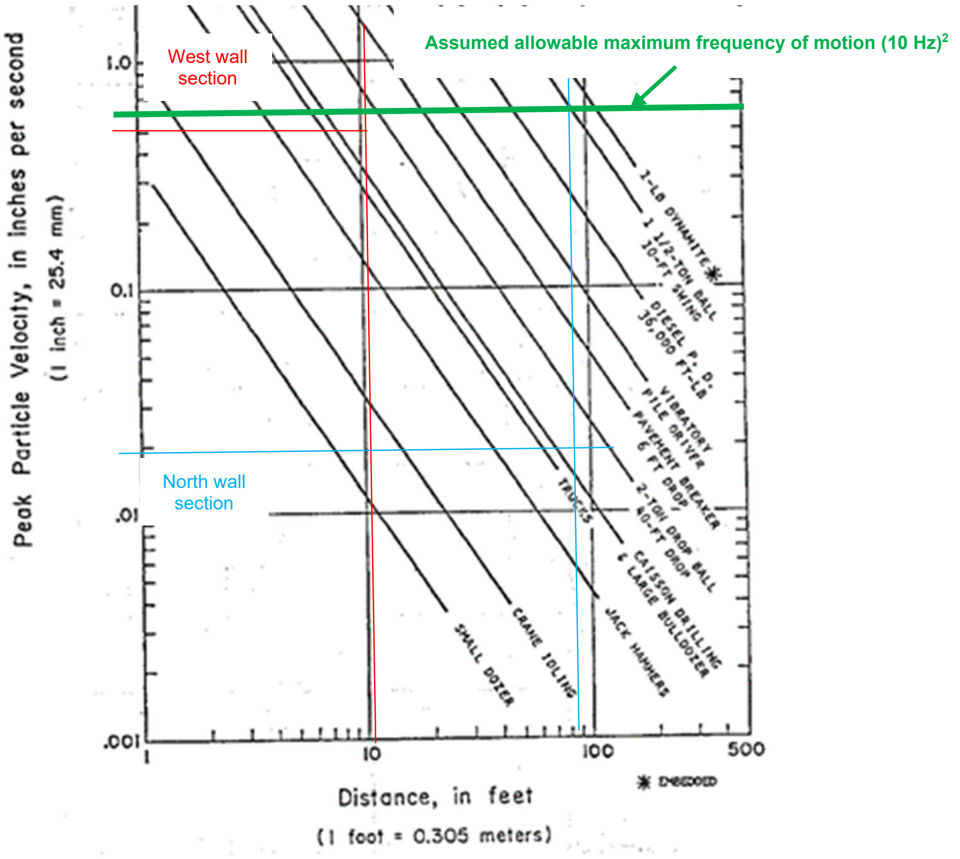


Figure 2 ***Dynamic compaction PPV estimation for west wall***

Due to the lack of information available at this stage of the design, it was also assumed that a maximum frequency of motion for the machinery of 10 Hz for construction operations[2].

As such the ground acceleration for the slope stability analysis for the west wall is estimated to be:

$$a = 2*3.14159*0.5*10 = 31.4 \text{ in/sec}$$

$$a = 0.08 \text{ g}$$

For the north wall with the slope crest located 35 m from the building footprint, the PPV was estimated to be 0.02 in/sec as shown in Figure 2 for a 2 Ton drop ball with a 40-foot drop. As such the ground acceleration for the slope stability analysis for the west wall is estimated to be:

$$a = 2*3.14159*0.02*10 = 1.26 \text{ in/sec}^2$$

$$a = 0.003 \text{ g}$$

---

2 OSM Blasting Performance Standards 30 Code of Federal Regulations

However, the graph is based on a two-ton drop ball, the dynamic compaction methodology is not available at this stage of the design and will be the responsibility of the ground improvement contractor. As such, the dynamic compaction may involve drop mass ranging from 5 to 40 tons, therefore, the following conservative acceleration values were used for the preliminary analyses:

West wall: a = 4 x 0.08 g = 0.32 g

North wall a = 4 x 0.003 g = 0.12 g

The above values should be reviewed by the ground improvement contractor and if required, GHD should be requested to revise the slope stability analyses.

3.2.1 Vibration limits

The vibrations limits within habited areas are set to avoid disturbance to inhabitants and to avoid damage to the structures. The criteria in Table 2 are, typically, set for a construction site.

Table 2 Prohibited construction vibrations

Frequency of vibration (Hz)	Vibration PPV (mm/sec)
Less than 4	8
4 to 10	15
More than 10	25

3.3 Western slope

It is understood that before the start of the dynamic compaction work, the western slope will be reprofiled in order to build a pad extending a minimum of 4 m from the projected building limit and with a 5.7H:1V slope. A slope stability assessment was performed for the reprofiled slope along the west perimeter of the Site. GHD's understanding of this slope conditions is based on the cross-sections provided by CIVITAS. Analysis was performed on the reprofiled slope under static condition and pseudo-static (i.e., construction vibrations) conditions using effective soil parameters.

The slope stability analysis was carried out using the SLOPE/W 2019 software package produced by GEO-SLOPE International Ltd. Each trial was modelled using the Morgenstern-Price method, and the optimized critical slip surface was selected. In general, this approach calculates a factor of safety that represents the ratio of forces resisting a failure (i.e., shear strength, friction, etc.) to those favouring failure (weight, external loading, etc.). Theoretically, a factor of safety of 1.0 would represent an equilibrium condition (i.e., a marginally stable slope). However, the City of Ottawa recommends a minimum factor of safety of 1.5 under static conditions and 1.1 under pseudo-static conditions to account for uncertainty in soil parameters used and slope geometry.

Due to the lack of information at this stage of the design, a distributed load of 200 kPa approximately 3 m away from the building edge was assumed to represent the crane used during dynamic compaction. The 200 kPa was determined based on GHD's experience and assumed to be spread over two tracks of three meters in length. The three meters offset was assumed to model a conservative reach of the machinery and is assumed based on GHD's experience. Additionally, it was assumed that a swale at the base of the slope will be constructed to direct the runoff away from the pad.

A summary of the analyses is shown in Table 3, with the graphical output for the analysis for each condition provided in Attachment 1.

Table 3 *Slope stability results*

	Factor of safety
Static	1.8
Pseudo static	1.1

Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factor of safety for the slope is above or equal to (i.e., 1.6 under static condition and 1.1 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static condition. Some sloughing and bulging-type movements at the west slope could be expected during the dynamic compaction. The slope will need to be restored to its design grades under-engineered controls after dynamic compaction is complete and before the proposed building is constructed.

The ground improvement contractor must review the vibration assumptions made during the above analyses and provide his input.

3.4 Northern wall

A slope stability assessment was performed for the existing slope along the north perimeter of the Site. GHD's understanding of the existing slope conditions is based on the cross-section provided by CIMA+. Analysis was performed on the existing slope under static conditions and pseudo-static (i.e., seismic) conditions considering drained soil conditions.

The slope stability analysis was carried out using the SLOPE/W 2019 software package produced by GEO-SLOPE International Ltd. Each trial was modelled using the Morgenstern-Price method, and the optimized critical slip surface was selected. In general, this approach calculates a factor of safety that represents the ratio of forces resisting a failure (i.e., shear strength, friction, etc.) to those favouring failure (weight, external loading, etc.). Theoretically, a factor of safety of 1.0 would represent a stable slope. However, the City of Ottawa recommends a minimum factor of safety of 1.5 under static conditions and 1.1 under pseudo-static conditions. The selected geotechnical parameters for the Site soils used in the analysis are summarized in Table 3.

A summary of the analyses is shown in Table 4 with the analysis for each condition provided in Attachment 2.

Table 4 *Slope stability results*

	Factor of safety
Static	2.1
Pseudo static	1.4

Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factor of safety for the slope is above (i.e., 2.1 under static condition and 1.4 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static condition. It is noted that in this case the dynamic compaction works being 35 m from the slope's crest has a negligible impact on the slope stability. Additionally, the condition of the slope must be monitored during site preparation and building construction.

4. Vibration monitoring and contingency plans

GHD understands that dynamic compaction will be undertaken on the building footprint only as shown on Figure 2. Additionally, as mentioned in Section 3.2, the dynamic compaction methodology is not known at this stage of the design and remains the responsibility of the ground improvement contractor. Nevertheless, during the dynamic compaction vibration works, monitoring must be carried out using approved seismographs/accelerometers. Continuous readings must be recorded for one week prior to the start of construction. Continuous readings comprised of PPV and construction frequency in all directions then must be recorded throughout construction at Site boundaries and any nearby structures. Readings must be checked at least once per day to ensure that the vibration levels are not exceeding the specified limits.

Should the recorded vibrations exceed the allowable limits recommended in Section 3.2.2 above, the ground improvement contractor together with GHD should review and modify the ground improvement methodology. The modifications may include reductions in the drop weight, drop height, or both, while increasing the number of drops per impact point. These assumptions are based on the empirical formula used to estimate the depth of improvement using the dynamic compaction method as given below:

$$D_i = n_c\ (W_t\ H_d)^{0.5}$$

Where:

Di = Depth of improvement

n_c = Constant, depending on soil type, degree of saturation, and speed of drop [nc values range from [0.35 (clays) to 0.5 (gravelly soils)]

W_t = Weight of hammer (tons)

H_d = Height of drop (m)

The fill soils at the Site extend to a depth of 6 m. For the silty clayey soils, a n_c value of 0.4 can be used for a preliminary design, resulting in a W_tH_d = 225. Assuming a drop of 15 m, a 15 ton weight will be required to be dropped to compact the soils to a depth of 6 m. As already discussed, vibrations reduce exponentially as distance form the source of vibrations increases until these are within tolerable limits before damping out completely. Before commencing the dynamic compaction operations, theoretical distance at which the vibration will reduce to allowable limits (Safe Distance) will be calculated using the parameters provided by the ground improvement contractor. It will be ensured that no sensitive structure is located within the Safe Distance. Alternatively, the dynamic parameters would be revised, and the Safe Distance recalculated. The theoretical Safe Distance will be confirmed through actual measurements and the dynamic compaction procedure modified if the vibrations are found to exceed the allowable limits at Safe Distances/boundaries.

5. Conclusion

- The west and north slope are stable under static and pseudo-static conditions under the described assumptions.
- The west slope could experience some minor instability during dynamic compaction, which will require restoration works post dynamic compaction.
- GHD considered that before dynamic compaction work is done near the west slope, a pad extending a minimum distance of 4 m and a 5.7H:1V slope will be built. It should be noted that this distance should be updated once the dynamic compaction construction method has been detailed (i.e., compaction weight and height, equipment, expected frequency).
- The north and west slope should remain stable during the dynamic compaction process using the described assumptions.
- GHD has carried out the analysis using assumed dynamic parameters. The ground improvement contractor should review the dynamic compaction parameters assumed in this study. GHD should revise the study based on the comments from the ground improvement contractor.

- Before commencing the dynamic compaction operations, theoretical distance at which the vibration will reduce to allowable limits (Safe Distance) should be calculated using the parameters provided by the ground improvement contractor. It will be ensured that no sensitive structure is located within the Safe Distance.

Regards,

LICENSED PROFESSIONAL ENGINEER
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO

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OG/HG/mc/mhp/1

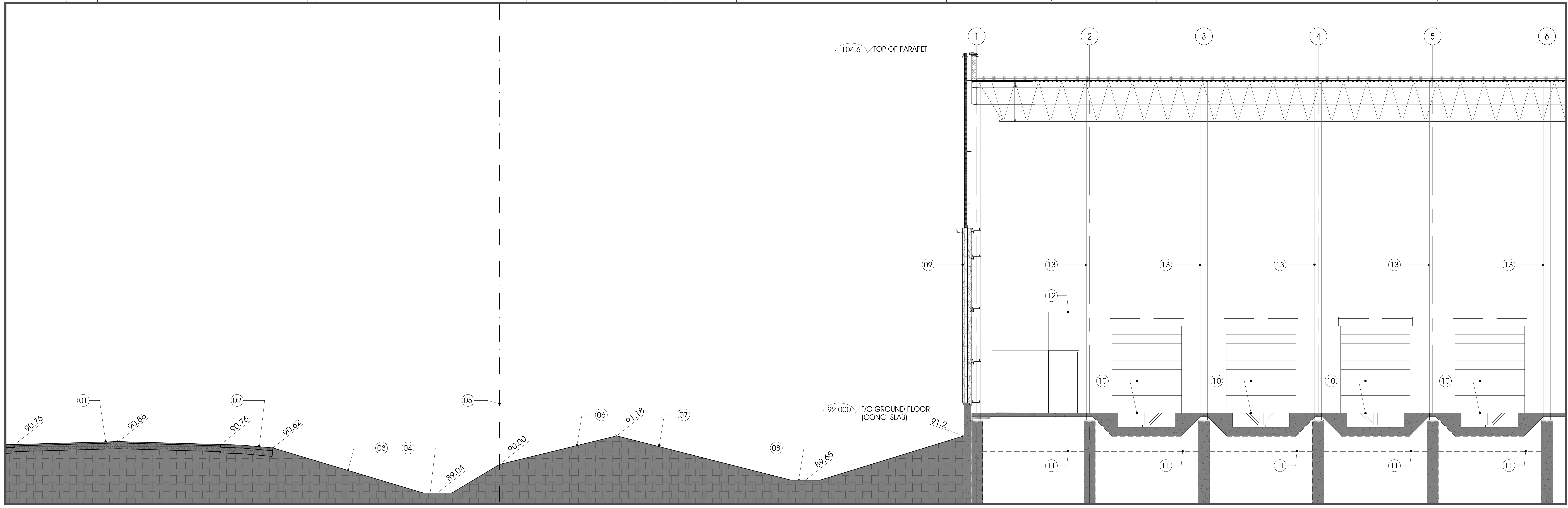
Copy to: David Rizk, GHD

Encl.

Attachments

Attachment 1

West slope cross-section and global stability analysis results



1 A611 SECTION AT ROAD/SWALE & WAREHOUSE BAY
1:75

DRAWING NOTES, A610 SERIES

01 EXISTING ASPHALT ROAD (SOMME STREET).
02 EXISTING GRAVEL.
03 EXISTING GRASS.
04 EXISTING SWALE.
05 PROPERTY LINE.
06 NEW GRADES AS PER CIVIL ENGINEER DRAWINGS.
07 NEW GRASS AS PER LANDSCAPE ENGINEER DRAWINGS.
08 NEW SWALE AS PER CIVIL ENGINEER DRAWINGS.
09 NEW WAREHOUSE WALL FINISH AS PER ARCHITECTURAL WORKING DRAWINGS.
10. NEW BAY DOORS C/W FLOOR LEVELERS.
11. NEW LINE OF FINISHED ROLLED COMPACTED CONCRETE SLAB.
12. NEW DOOR AND WINDOW AS PER ARCHITECTURAL WORKING DRAWINGS.
13. NEW STEEL COLUMNS AND FOUNDATION AS PER STRUCTURAL ENGINEER DRAWINGS.

CLIENT LOGO:

FASTFRATE

KEY PLAN:

TRUE NORTH:

PROJECT NORTH:

PRELIMINARY
NOT FOR CONSTRUCTION

RECORD OF REVISIONS:

NUMBER:	REVISION:	DATE: (MM/DD/YY)
6	.	.
5	.	.
4	.	.
3	.	.
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ISSUE:

PROFESSIONAL STAMP:

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CIVITAS GROUP
ARCHITECTURE & LANDSCAPE ARCHITECTURE

CIVITAS ARCHITECTURE INC.
14 CHAMBERLAIN AVENUE, SUITE 101
OTTAWA, ON
CANADA K1S 1V9
T: 613.742.7482
WWW.CIVITAS-INC.CA

CONSULTANT LOGO:

PROJECT TITLE:

NEW WAREHOUSE / OFFICE
BUILDING
PROJECT TITLE LINE 3

OTTAWA, ON.
PROJECT ADDRESS LINE 2

DRAWING TITLE:

SECTION DETAILS CONT'D
.
.
.
.

DRAWN BY: D.R.
DATE: YY.MM.DD
REVIEWED BY: D.RANCIER
APPROVED BY: D.RANCIER
PRINT DATE:
ISSUED DATE: ISSUED DATE

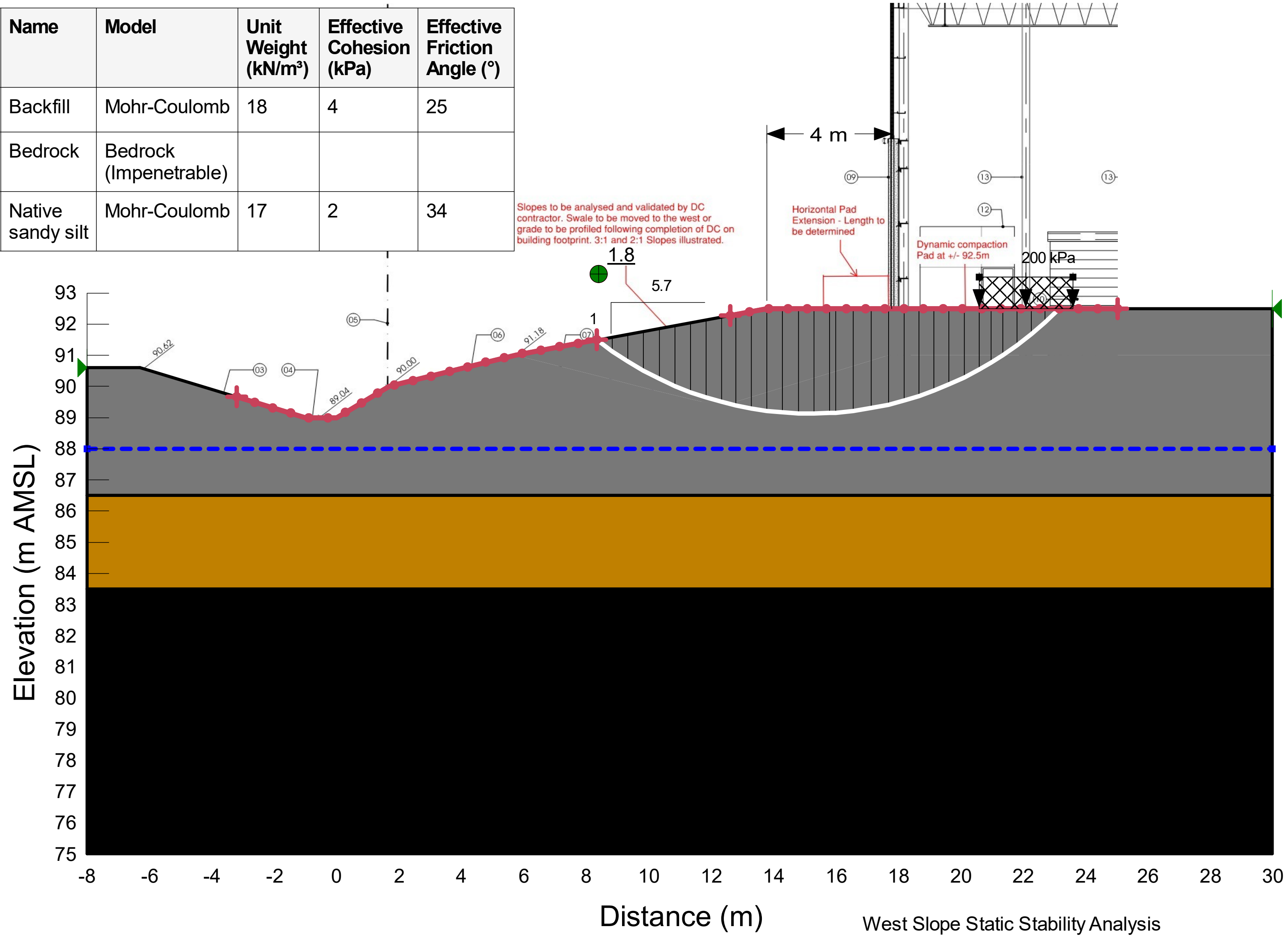
DRAWING NUMBER:
A611

REVISION NUMBER:
—

CLIENT PROJECT #:
CLIENT PROJ #

PROJECT #:
PROJ #

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	Mohr-Coulomb	18	4	25
■	Bedrock	Bedrock (Impenetrable)			
▨	Native sandy silt	Mohr-Coulomb	17	2	34



West Slope Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

22/12/2021

1:199

Seismic Coefficient = 0.32

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
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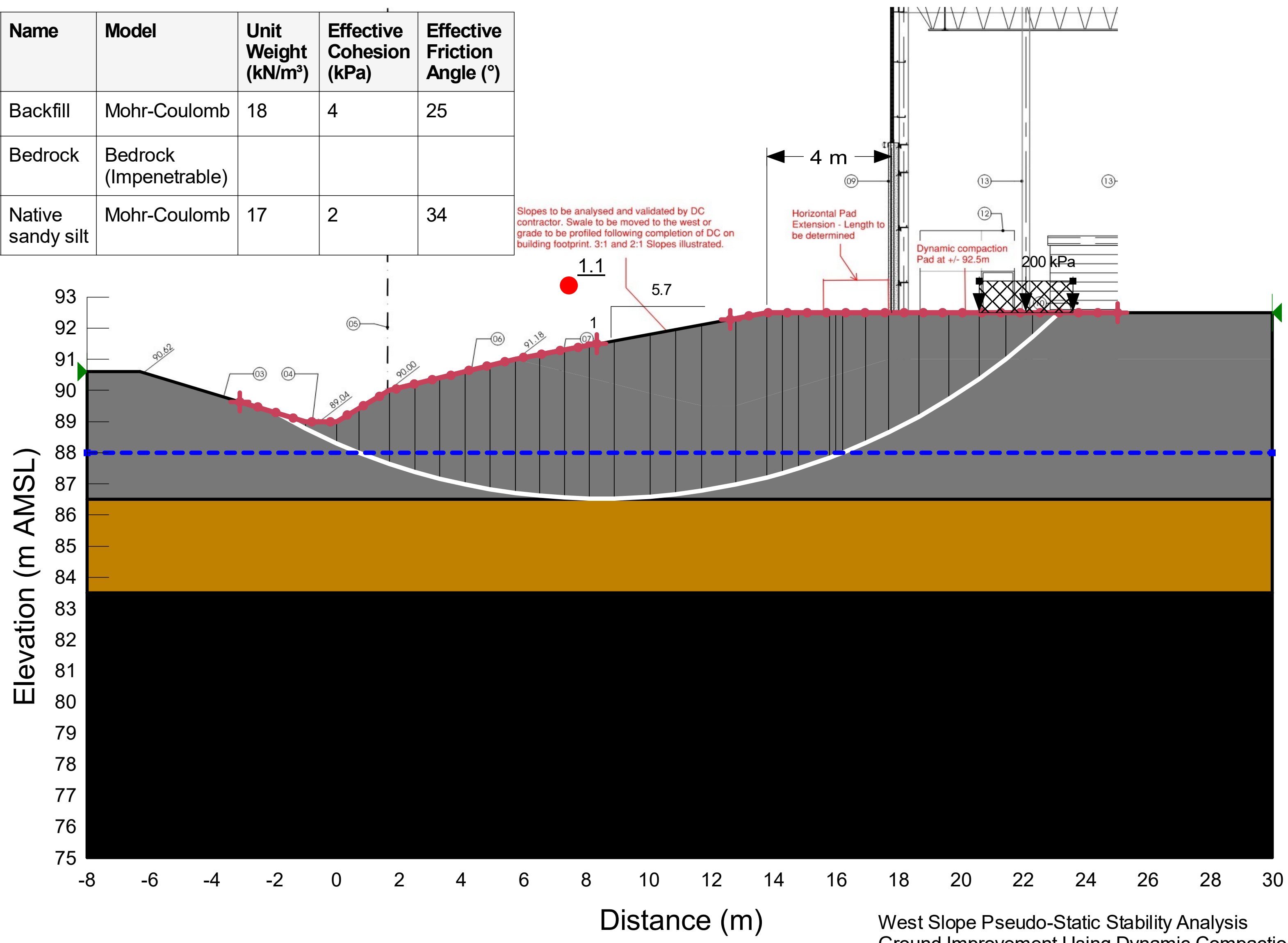
■	Bedrock	Bedrock (Impenetrable)			
🟧	Native sandy silt	Mohr-Coulomb	17	2	34



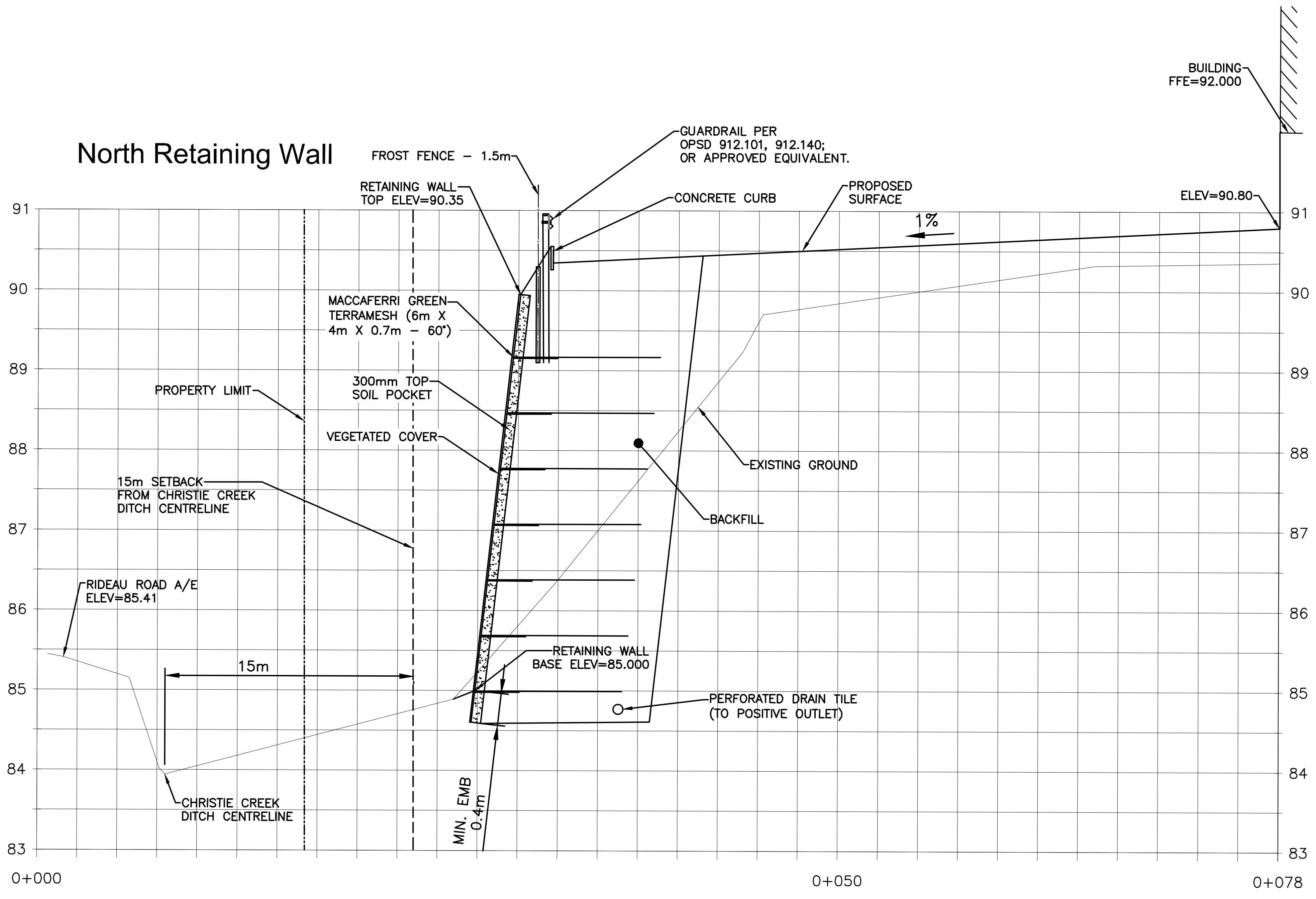
West Slope Pseudo-Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

22/12/2021

1:199

Attachment 2

North slope cross-section and global stability analysis results



North Retaining Wall

LEGEND

EXISTING	LEGEND	PROPOSED
A	WATERMAIN	
S	SANITARY SEWER	
P	STORM SEWER	
D	DRAIN	
G	GAS LINE (APPROX. LOC.)	
T	UNDERGROUND TELEPHONE (APPROX. LOC.)	
CA	UNDERGROUND CABLE (APPROX. LOC.)	
X X	FENCE	X
E	UNDERGROUND ELECTRICITY (APPROX. LOC.)	
	OVERHEAD WIRES	
	LOT LINE	
	RIGHT–OF–WAY LIMITS	
	EASEMENT	
	WORK LIMITS AREA	
	TOP OF SLOPE	
	DITCH CENTER	
	BOTTOM OF SLOPE	
	WOOD AREA	
	GRADE CROSSING	
	FLAGPOLE	
	CATCHBASIN	
	MANHOLE/CATCHBASIN	
○	MANHOLE	○
	FIRE HYDRANT	
⊗	VALVE	⊗
	REDUCER	
	TEE	
⊠	VALVE CHAMBER	⊠
Ⓢ	PRIVATE UTILITIES (WATERMAIN)	Ⓢ
	EXTERIOR WATER FAUCET	
Ⓟ	SLUICEWAY	
⊠	NATURAL GAS VALVE	
	SIGN	
Ⓐ	STOP SIGN	
	TRAFFIC LIGHT	
E ●	ELECTRICITY POLE	
T ●	TELEPHONE POLE	
E,T ●	ELECT.–TEL.–STREET LIGHT POLE	
E,T ●	ELECT.–TEL.–TRANSFORMER POLE	
	PRIVATE STREET LIGHT	
○ E	ELECTICITY MANHOLE	
○ T	TELEPHONE MANHOLE	
PK	SURVEY STATION	
× 136,000	ELEVATION	+ 99,000
	DRAINAGE DIRECTION	→
	SAMPLING LOCATION	●
	OVERLAND FLOW	⇨
	ROLLED CONCRETE (SEE DETAIL 203)	
	HEAVY DUTY PAVEMENT (SEE DETAIL 202)	☐
	CONCRETE SIDEWALK (SEE DETAIL SC2)	▨
	GRANULAR PAD (SEE DETAIL 202)	☒

0 5 10 20 30 40 50

NOTE OF CAUTION

THE GEODETIC COORDINATES OF EVERY ITEM INCLUDED AS PART OF THIS DOCUMENT HAVE NO LEGAL VALUE. THE SITE LAYOUT MUST BE COMPLETED USING THE OFFICIAL BENCHMARKS OF AN ACCREDITED LAND SURVEYOR.

THE UNDERGROUND FEATURES AND INFORMATION THAT APPEAR ON THE DRAWINGS WERE OBTAINED FROM THE PUBLIC UTILITY COMPANIES AND/OR FROM THE CITY EACH RESPECTIVELY.

ALL INFORMATION UNDER THE LEGEND 'EXISTING' IS FOR INFORMATION ONLY. COMPLETE OR EXACT LOCATION AND ELEVATION OF UNDERGROUND SERVICES ARE NOT GUARANTEED.

CERTAIN UNDERGROUND FEATURES ON PRIVATE PROPERTY ARE NOT SHOWN ON THE CURRENT DRAWING.

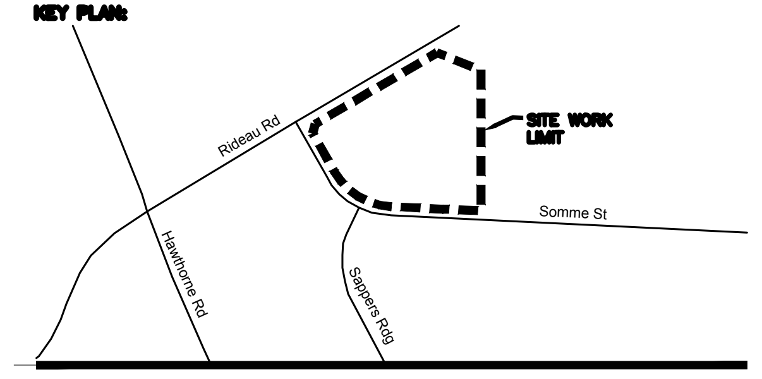
ANYONE WHO PROCEEDS WITH EXCAVATION WORK SHALL VERIFY THE EXACT LOCATION OF ALL UNDERGROUND FEATURES, BY EXPLORATORY EXCAVATIONS, AND SHALL ASSUME FULL RESPONSIBILITY IF THERE IS ANY DAMAGE THAT OCCURS DURING WORK.

THE CONTRACTOR WILL HAVE THE RESPONSIBILITY AND THE OBLIGATION TO VALIDATE, BY EXPLORATORY EXCAVATION, THE SIZE OF THE PUBLIC UTILITIES UNDERGROUND SERVICES AND TO WARN THE ENGINEER OF ANY CONFLICT WITH THE PROJECTED WORK.

CLIENT LOGO:

FASTFRATE

KEY PLAN:



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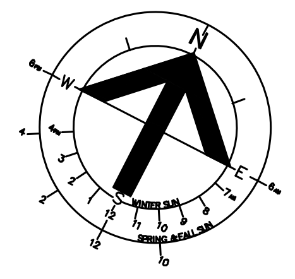
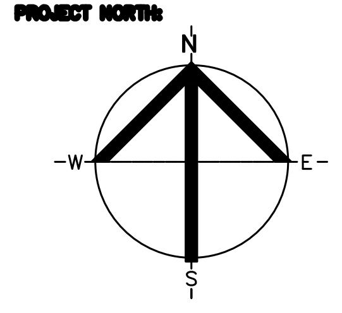


PROJECT NORTH:



PRELIMINARY
NOT FOR CONSTRUCTION

RECORD OF REVISIONS:

NUMBER:	REVISION:	DATE: (MM/DD/YY)
6		
5		
4		
3		
2		
1	ISSUED FOR SITE PLAN REVIEW	JULY 23, 2021

ISSUE:

PROFESSIONAL STAMP:

PROFESSIONAL STAMP:

CIVITAS GROUP
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CIVITAS ARCHITECTURE INC.
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CONSULTANT LOGO:

CIMA+

PROJECT TITLE:

FASTFRATE FACILITY

SCALE: 1:500

SOMME ST.
OTTAWA, ON

DRAWING TITLE:

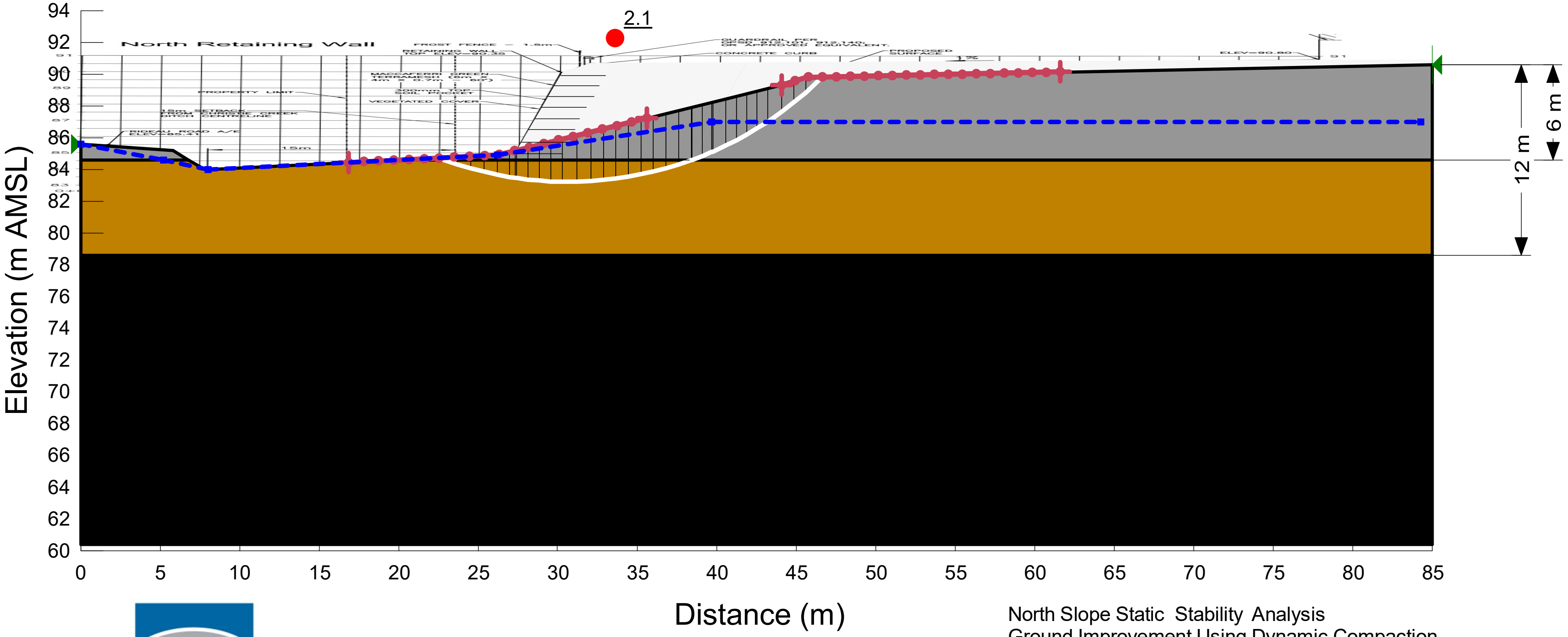
GRADE CONTROL AND DRAINAGE PLAN

DRAWN BY: D.CANN
DATE:
REVIEWED BY: J.SAUVE
APPROVED BY:
PRINT DATE:
ISSUED DATE: JULY 23, 2021
DRAWING NUMBER: C006
REVISION NUMBER:
CLIENT PROJECT #:
PROJECT #: A001083

DO NOT SCALE THIS DRAWING. USE FIGURE DIMENSIONS ONLY. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS AND NOTIFYING THE ARCHITECT OF ANY DISCREPANCIES BEFORE CONSTRUCTION COMMENCES. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL STRUCTURAL, MECHANICAL, ELECTRICAL, CIVIL, AND OTHER CONSULTANT DRAWINGS. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED BY THE ARCHITECT. COPYRIGHT RESERVED. ALL PARTS OF THIS DRAWING ARE THE EXCLUSIVE PROPERTY OF THE ARCHITECT AND SHALL NOT BE USED WITHOUT THE EXPRESSED PERMISSION FROM THE ARCHITECT.

\\CIMA.PLUS\CIMA\CIMA-C10\OTT_PROJECTS\A\A001000-A001499\A001083_FASTFRATE WAREHOUSE DEVELOPMENT\400\460_CIVIL\XREF

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▩	Backfill	Mohr-Coulomb	18	4	25
⬛	Bedrock	Bedrock (Impenetrable)			
🟧	Native sandy silt	Mohr-Coulomb	17	2	34



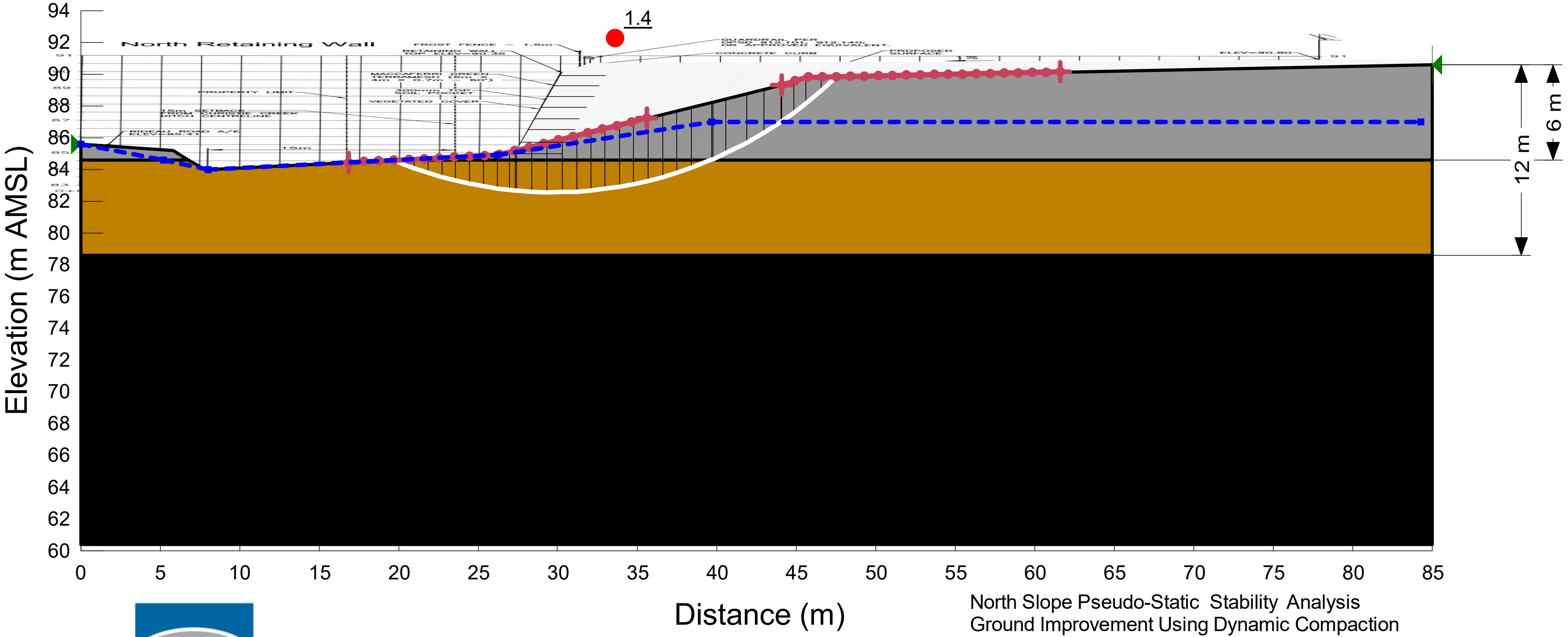
North Slope Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

22/12/2021

1:400

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	Mohr-Coulomb	18	4	25
⬛	Bedrock	Bedrock (Impenetrable)			
🟫	Native sandy silt	Mohr-Coulomb	17	2	34

Seismic Coefficient = 0.12



North Slope Pseudo-Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

22/12/2021

1:400

Appendix C

Final Slope Stability

179 Colonnade Road South, Suite 400
Ottawa, Ontario K2E 7J4
Canada
www.ghd.com

Our ref: 11228236

January 20, 2022

Mr. Pierre Courteau
Consolidated Fastfrate (Ottawa) Holdings Inc.
55 Commerce Valley Drive West
Suite 220
Thornhill, ON L3T 7V9

Slope stability assessment for final slopes, Warehouse and Offices, Ottawa, ON - Issued for site plan application

Dear Mr. Courteau

1. Introduction

Consolidated Fastfrate (Ottawa) Holdings Inc. (Fastfrate) has requested GHD Limited (GHD) to perform a slope stability assessment of the final slopes, along Rideau Road and Somme Street (Site), in preparation for the dynamic compaction works. The location of the Site is shown on the site layout in Figure 1.

The Site is located at the intersection of Rideau Road to the north and Somme Street to the west and is relatively flat and is covered with approximately 6 metres (m) thick fill, reportedly brought in from construction sites, which gives the Site its present flat surface albeit slightly hummocky look, sloping down to the surrounding streets. The surrounding topography slopes up at approximately two-horizontal to one-vertical (2H:1V) from south to north by approximately 3.5 m from Rideau Road to the section of Somme Street south of the Site. The Site elevation is higher compared to the surrounding streets varying from approximately 0.2 m higher on the south side (Somme Street) to 4 m higher on the north side (Rideau Street). There is also a ditch along the south, west, and north perimeter of the Site.

Fastfrate is proposing to develop an approximately 8,630 square metres (m^2) warehouse on the western portion of the Site. It is GHD's understanding that Fastfrate intends to use dynamic compaction method of ground improvement to densify the randomly placed fill materials within the projected building footprint prior to the proposed development.

The stability assessment of the final north slopes has been completed in alignment with the cross-sections received by GHD from Maccaferi which are presented in the wall drawings attached to this letter. The stability assessment of the final west slope has been completed in alignment with the cross-section provided by CIVITAS on July 22, 2021 which is attached to slope stability analysis of this letter. The locations of the cross-sections are shown on the site plan provided in Figure 1 Site layout.

GHD understands that the Client will select a contractor to undertake the dynamic compaction works at the Site. As such, it is recommended that additional information, including the type of equipment, expected peak particle velocity (PPV), expected frequency, and method of works be provided to GHD once confirmed. Additional changes to the geometry of the final slopes should also be provided to GHD once confirmed.

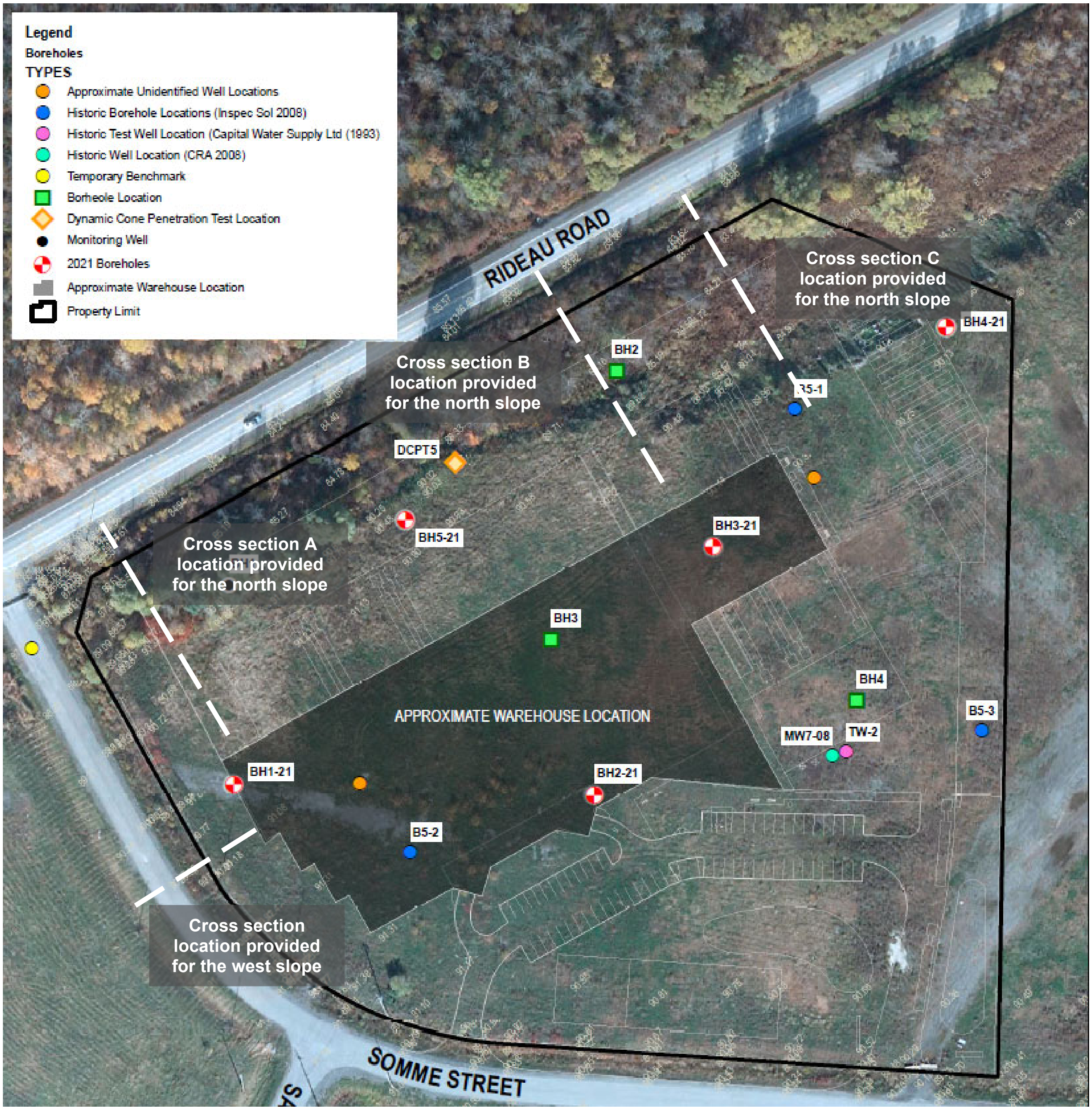


Figure 1. *Site layout showing the location of the analyzed cross-sections and the proposed building footprint*

The following are attached to this letter:

– Attachment 1: West slope crosse-section and global stability analysis results

– Attachment 2: Maccaferri's retaining wall drawings

– Attachment 3: Geogrid technical data sheet

- Attachment 4: North wall slope stability analysis results

2. Review of pre-construction geotechnical information

GHD has reviewed the following geotechnical investigations while preparing this letter:

- Geotechnical Study Subdivision Plan, Hawthorne Industrial Park, report ref. no. T020556-A1, by Inspec-Sol, dated May 4, 2009.
- Geotechnical Investigation, Warehouse and Offices Intersection of Rideau Street, report ref. no. 11215612-A1, by GHD, dated October 27, 2021.
- Supplementary Geotechnical Investigation, Warehouse and Offices Intersection of Rideau Street, report ref. no. 11231101-RTP-1, by GHD, submitted on December 22, 2021.

GHD has also reviewed the following documents provided by the client as part of the assessment:

- Grade Control and Drainage Plan, Somme St, Ontario, Fastfrate facility, Job No. A001083-C006, by CIMA+, dated March 8, 2021.
- Draft Floor Plan, New Warehouse & Cross-Dock Facility, Fastfrate Ottawa, Somme Street, Ottawa, Ontario, Job No. 2001-A1, by CIVITAS, dated April 28, 2021.
- West slope cross-section, 2001-FastFrat-Civil Section-July 21, 2021_comm_GHD, by CIVITAS, received July 26, 2021.
- North slope cross-section, C006B_Grading, by CIMA+, received July 28, 2021.

3. Slope stability assessment

3.1 Subsurface conditions

As per the documentation reviewed and listed in section 2, in general, soils encountered at the borehole locations consisted of a thick layer of fill material overlying native silty sand to sandy silt deposit. Limestone bedrock with interbedded sandstone was encountered at depths ranging from 8.2 (BH1) to 14.8 mbgs (BH2-21).

General descriptions of the subsurface conditions are summarized as follow:

1. Fill | Consisting of a mixture of sand, silt, clay, and gravel. The fill material contains traces to some asphalt, concrete, wood and brick fragments, topsoil, and pieces of reinforcing steel. The composition of fill varied with depth and borehole location. Cobbles and possible boulders were encountered in the boreholes at varying depths. The thickness of the fill at the borehole locations was approximately 6 m.
2. Native sandy silt | Below the fill material a native deposit of sandy silt to silty sand with varying amounts of clay and gravel was encountered. Cobbles and possible boulders are expected within this deposit becoming more frequent with depth. The deposit extended to depths ranging from 8.2 to 11.9 mbgs.
3. Bedrock | Limestone bedrock with interbedded sandstone was encountered below the native sandy silt.
4. Groundwater | Groundwater levels were measured on August 18, 2020, groundwater elevation of 87 m was encountered at the monitoring wells.

Additionally, the Mechanically Stabilized Earth (MSE) retaining wall and its foundation and backfill would comprise of the following materials:

1. Fill | Consisting of a mixture of sand, silt, clay, and gravel. Mineral materials only should be used as backfill.
2. Dynamic compacted fill | The dynamic compaction technical parameters are not available at this stage of the design and will be available once the subcontractor has been selected.
3. Reinforced fill | It is understood that the existing on-Site excavated fill will be reused for the construction of the MSE wall.

As such, GHD has assumed the material parameters presented in Table 1 based on the available information of the existing fill, the impact of the assumed compaction process, and GHD's experience.

Table 1 Geotechnical parameters

Material	Unit weight (kN.m^3)	Cohesion (kPa)	Internal friction angle (°)
Existing fill	18	4	25
Reinforced fill	18	4	25
Soil pocket	18	4	25
Native sandy silt	17	2	34
Bedrock	N/A (considered impenetrable)		

3.2 Seismic considerations

The earthquake Peak Ground Acceleration (PGA) with a 2 percent probability of exceedance in 50 years is 0.308 g, where 'g' is the acceleration due to gravity. The PGA occurs only for a fraction of a second in a given earthquake. A use of PGA may therefore result in a very conservative design. Hynes-Griffin and Franklin[1] concluded that slopes and embankments with a yield acceleration equal to half the peak ground acceleration would experience permanent seismic deformations of less than 1 m in any earthquake, even for embankments where amplification of acceleration by a factor of three occurs. In the absence of amplification, or if amplification is taken into account in determining the peak acceleration, the Hynes and Franklin data suggest that deformations will remain less than 0.3 m for yield accelerations less than or equal to one-half the peak acceleration. In this case, the amplification is only by a factor of 1.05, therefore an earthquake-induced deformation of less than 0.3 m is expected. Therefore, the seismic coefficient used in the pseudo-static analyses was 50 percent of the PGA value of 0.308, i.e., 0.154.

3.3 Western wall

A slope stability assessment was performed for the proposed final slope along the west perimeter of the Site. GHD's understanding of this slope conditions is based on the cross-sections provided by CIVITAS. Analysis was performed on the slope under static condition and pseudo-static (i.e., construction vibrations) conditions using effective soil parameters.

The slope stability analysis was carried out using the SLOPE/W 2019 software package produced by GEO-SLOPE International Ltd. Each trial was modelled using the Morgenstern-Price method, and the optimized critical slip surface was selected. In general, this approach calculates a factor of safety that represents the ratio of forces resisting a failure (i.e., shear strength, friction, etc.) to those favouring failure (weight, external loading, etc.). Theoretically, a factor of safety of 1.0 would represent an equilibrium condition (i.e., a marginally stable slope). However, the City of Ottawa recommends a minimum factor of safety of 1.5 under static conditions and 1.1 under pseudo-static conditions to account for uncertainty in soil parameters used and slope geometry.

---

[1] Hynes-Griffin, M.E., Franklin A.G., (1984): Rationalizing the Seismic Coefficient Method, Miscellaneous Paper GL-84-13, Corps of Engineers

It should be noted that prior to the dynamic compaction work, it is planned to reprofile the slope in order to build a pad extending a minimum of 4 m from the projected building limit and with a 5H:1V slope. Following the dynamic compaction work, the slope will be reprofiled to its final geometry. This final slope geometry was analyzed based on the cross section provided by Civitas on July 22 2021. final grading plans provided by CIMA+ dated October 18, 2021.

A summary of the slope stability analyses result for the final west slope geometry is shown in Table 2, with the graphical output for the analysis for each condition provided in Attachment 1.

Table 2 Slope stability results – Final slope geometry as provided by CIVITAS

	Factor of safety
Static	3.34
Pseudo static	2.17

Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factor of safety for the slope is above or equal to (i.e., 2.84 under static condition and 1.85 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static condition.

3.4 North MSE retaining wall

GHD understands that due to the required facility footprint, a Mechanically Reinforced Earth (MSE) retaining wall, up to approximately 6.49 m in height and a face slope of 45 to 60 degrees from the vertical, will be constructed along the Site's north boundary due to vehicle circulation constraints and to redirect the stormwater drainage to the south. Shop drawings provided by Maccaferri showing plan view, cross sections and elevation views are shown in Attachment 2. At this stage of the design, the intent is to use an MSE wall using the fill available on Site from the Site excavations. It is GHD's opinion that the on-site material can be reused to raise the pad before dynamic compaction work or for the retaining wall construction as long as it is comprised of mineral soils only. Note that some organic materials have been noted within the fill. Also, buried asphalt was observed in some boreholes during the field investigation. Please note that this recommendation does not consider environmental considerations if any.

Literature-based parameters for the existing fill are provided in Table 3 for the design of the mechanically reinforced earth (MSE) retaining wall.

Table 3 North slope retaining wall parameters

Parameter	Value
Cv - coefficient of consolidation (m^2/year)	1 to 10 m^2/year
K - permeability (cm/sec)	10^{-4} to 10^{-7} cm/sec
Mv - coefficient of volume compressibility (m^2/MN)	0.05 to 0.2 /MPa
Cc - compressibility index	- 0.2
Unit weight (kN/m^3)	19
Friction angle (degrees)	28 - 34
Cohesion (kPa)	0 - 2

The other following recommendations are provided:

– It is recommended that compaction of the fill be completed using layers with a thickness of 200 millimetres (mm) to achieve a 95 percent proctor.

- For the capping prior to dynamic compaction, an initial 300 mm can be OPSS Granular 'B' Type 1 material. The final surface 300 mm capping material must be either OPSS Granular 'A' or well-graded 19 mm or 50 mm crusher run limestone meeting Granular A or Granular B gradation requirements, compacted to 100 percent standard Proctor maximum dry density.

MSE wall is a generic term that includes reinforced soil when multiple layers of metallic or synthetic geogrid act as reinforcement in soils placed as fill. MSE walls are cost-effective alternatives for most applications where the Right-of-Way (ROW) is restricted such that an embankment or excavation with stable side slopes cannot be constructed. MSE walls are particularly suited to economical construction in steep-sided terrain, in-ground subject to slope instability, or in areas where foundation soils are poor.

A slope stability assessment was performed for the MSE wall along the north perimeter of the Site. GHD's understanding of the MSE wall is based on the cross-section provided by Maccaferri that are shown in Attachment 2. Analysis was performed on the MSE wall under static conditions and pseudo-static (i.e., seismic) conditions considering drained soil conditions.

GHD understands that Maccaferri Geogrid ParaDrain^{TM} 80 is proposed to be used as mechanical reinforcement. The Geogrid ParaDrain^{TM} 80 technical data sheet is shown in Attachment 3.

The design factor, which governs the design is the allowable tensile capacity (T_{allow}) of a geogrid. The ultimate tensile strength given by the manufacturer for a ParaDrain^{TM} 80 geogrid at 10 percent elongation is 80 kilonewton per metre (kN/m). For long term design, which include reduction factors for installation damage, durability and creep, the manufacturer recommends the use of an allowable tensile capacity of 53.7 kN/m. This value was used in the global stability analysis completed by GHD.

The slope stability analysis was carried out using the SLOPE/W 2019 software package produced by GEO-SLOPE International Ltd. Each trial was modelled using the Morgenstern-Price method, and the optimized critical slip surface was selected. In general, this approach calculates a factor of safety that represents the ratio of forces resisting a failure (i.e., shear strength, friction, etc.) to those favouring failure (weight, external loading, etc.). Theoretically, a factor of safety of 1.0 would represent a stable slope. However, the City of Ottawa recommends a minimum factor of safety of 1.5 under static conditions and 1.1 under pseudo-static conditions. The selected geotechnical parameters for the Site soils used in the analysis are summarized in Table 3.

The analysis were completed on three different cross sections each under static and pseudo-static conditions. The geometry of each cross section is based on the drawings provided by Maccaferri and attached in Attachment 2.

A summary of the slope stability analyses is shown in Table 4, with the graphical output for each analysis provided in Attachment 4.

Table 4 Slope stability results

	Factor of safety	
	Static condition	**Pseud-static condition**
Cross section A	1.75	1.29
Cross section B	1.60	1.19
Cross section C	1.64	1.24

Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factors of safety for the slope with the retaining wall is above the recommend values of 1.5 for static condition and 1.1 for pseudo-static condition.

It should be noted that due to the presence of a stream at the base of the MSE wall, erosion potential should be evaluated and erosion protection measures such as biodegradable erosion control blankets should be used, if required and suitable, until the vegetative cover on the MSE wall gets established.

4. Conclusion

- The west slope meets the factors of safety under static and pseudo-static conditions.
- The north slope meets the factors of safety under static and pseudo-static conditions under the described assumptions.

Regards,

LICENSED PROFESSIONAL ENGINEER
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO

Oliver Galvier, M. Eng., P. Eng. (NS)
Engineer

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oliver.galvier@ghd.com

Hassan Gilani, M.Sc., P. Eng.
Geotechnical Engineer

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hassan.gilani@ghd.com

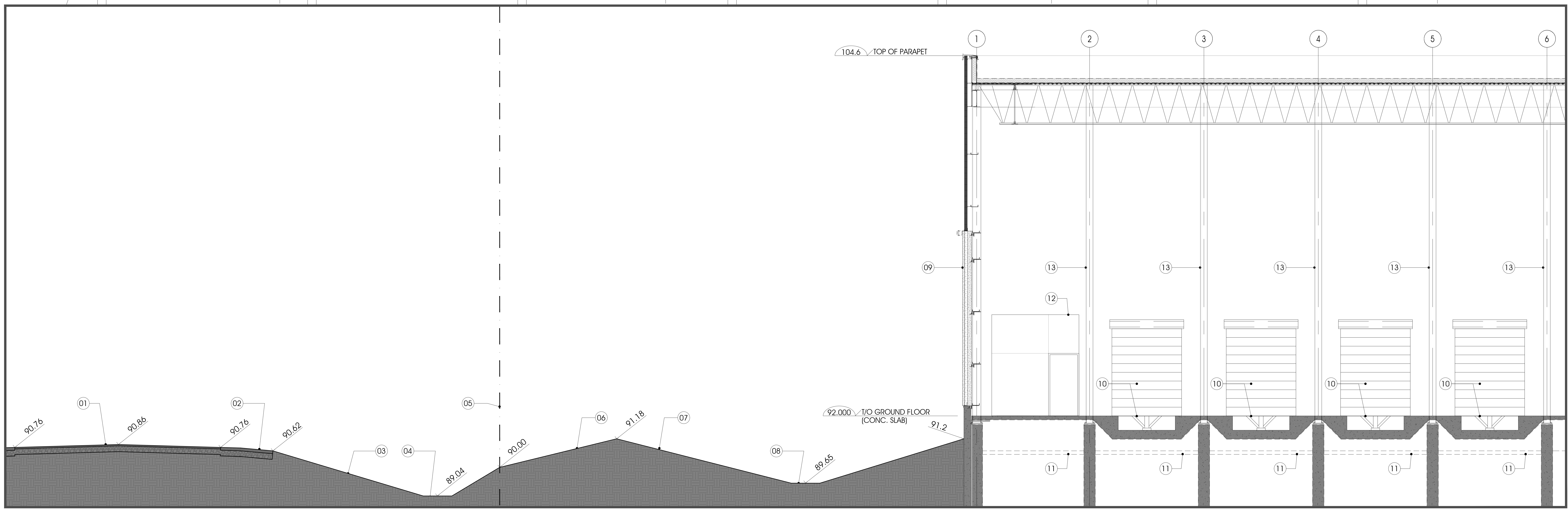
OG/HG/vl/2

Encl.

Attachments

Attachment 1

West Slope cross-section and Global Stability Analysis Results



1
A611
SECTION AT ROAD/SWALE & WAREHOUSE BAY
1:75

DRAWING NOTES, A610 SERIES

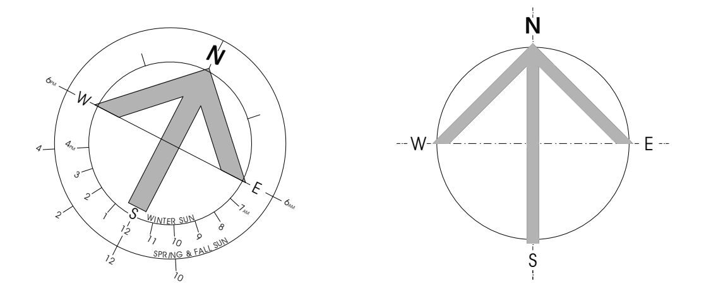
01 EXISTING ASPHALT ROAD (SOMME STREET).
02 EXISTING GRAVEL.
03 EXISTING GRASS.
04 EXISTING SWALE.
05 PROPERTY LINE.
06 NEW GRADES AS PER CIVIL ENGINEER DRAWINGS.
07 NEW GRASS AS PER LANDSCAPE ENGINEER DRAWINGS.
08 NEW SWALE AS PER CIVIL ENGINEER DRAWINGS.
09 NEW WAREHOUSE WALL FINISH AS PER ARCHITECTURAL WORKING DRAWINGS.
10. NEW BAY DOORS C/W FLOOR LEVELERS.
11. NEW LINE OF FINISHED ROLLED COMPACTED CONCRETE SLAB.
12. NEW DOOR AND WINDOW AS PER ARCHITECTURAL WORKING DRAWINGS.
13. NEW STEEL COLUMNS AND FOUNDATION AS PER STRUCTURAL ENGINEER DRAWINGS.

CLIENT LOGO:

FASTFRATE

KEY PLAN:

TRUE NORTH:
PROJECT NORTH:



PRELIMINARY
NOT FOR CONSTRUCTION

RECORD OF REVISIONS:

NUMBER:	REVISION:	DATE: (MM/DD/YY)
6	.	.
5	.	.
4	.	.
3	.	.
2	.	.
1	.	.

ISSUE:

PROFESSIONAL STAMP:
PROFESSIONAL STAMP:

CIVITAS GROUP
ARCHITECTURE & LANDSCAPE ARCHITECTURE

CIVITAS ARCHITECTURE INC.
14 CHAMBERLAIN AVENUE, SUITE 101
OTTAWA, ON
CANADA K1S 1V9
T: 613.742.7482
WWW.CIVITAS-INC.CA

CONSULTANT LOGO:

PROJECT TITLE:
NEW WAREHOUSE / OFFICE
BUILDING
PROJECT TITLE LINE 3

OTTAWA, ON.
PROJECT ADDRESS LINE 2

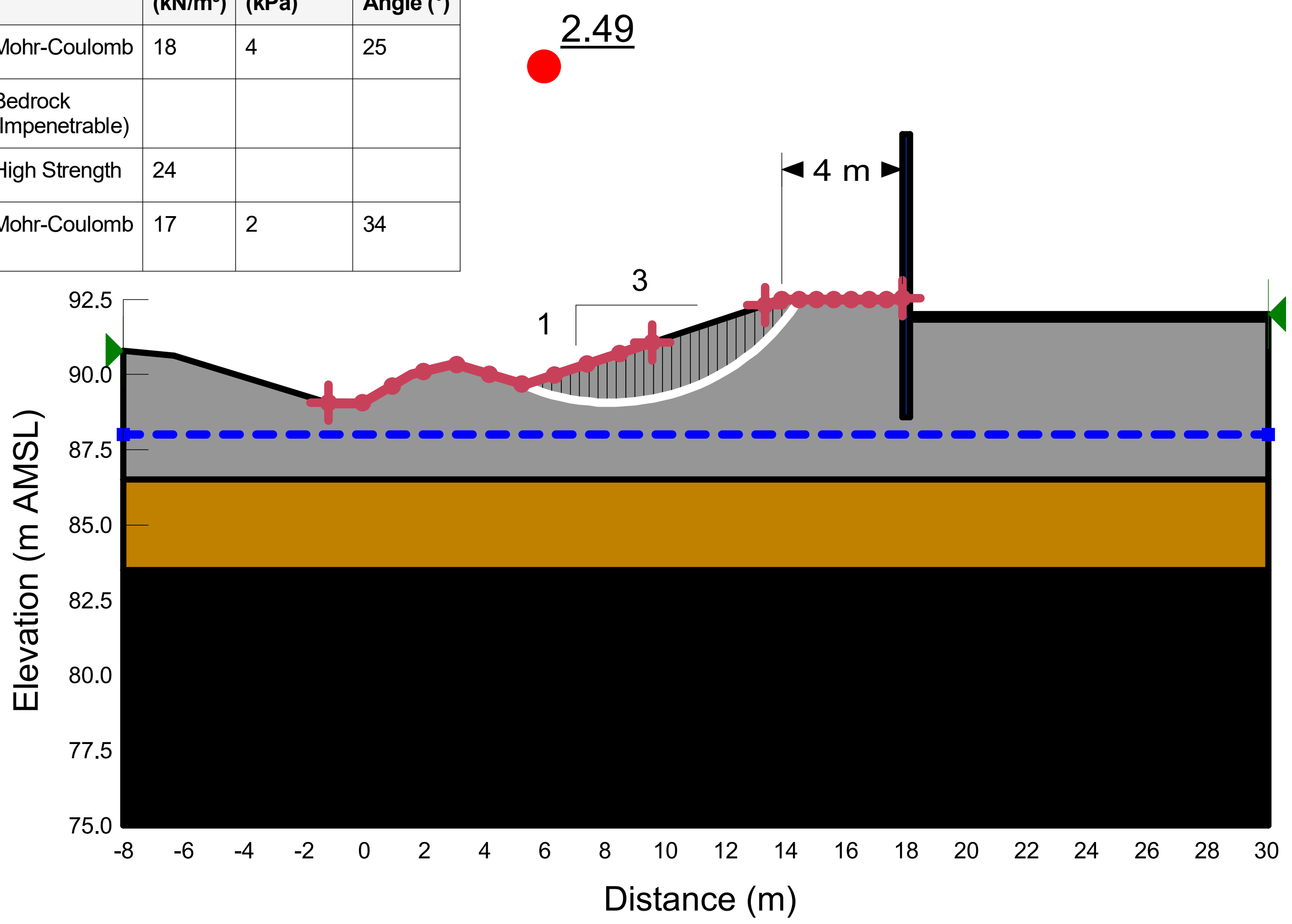
DRAWING TITLE:
SECTION DETAILS CONT'D
.
.
.
.

DRAWN BY: D.R.
DATE: YY.MM.DD
REVIEWED BY: D.RANCIER
APPROVED BY: D.RANCIER
PRINT DATE:
ISSUED DATE: ISSUED DATE

DRAWING NUMBER:
A611
REVISION NUMBER:

CLIENT PROJECT #:
CLIENT PROJ #
PROJECT #:
PROJ #

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▒	BackFill	Mohr-Coulomb	18	4	25
⬛	Bedrock	Bedrock (Impenetrable)			
🟦	Concrete	High Strength	24		
🟧	Native sandy silt	Mohr-Coulomb	17	2	34

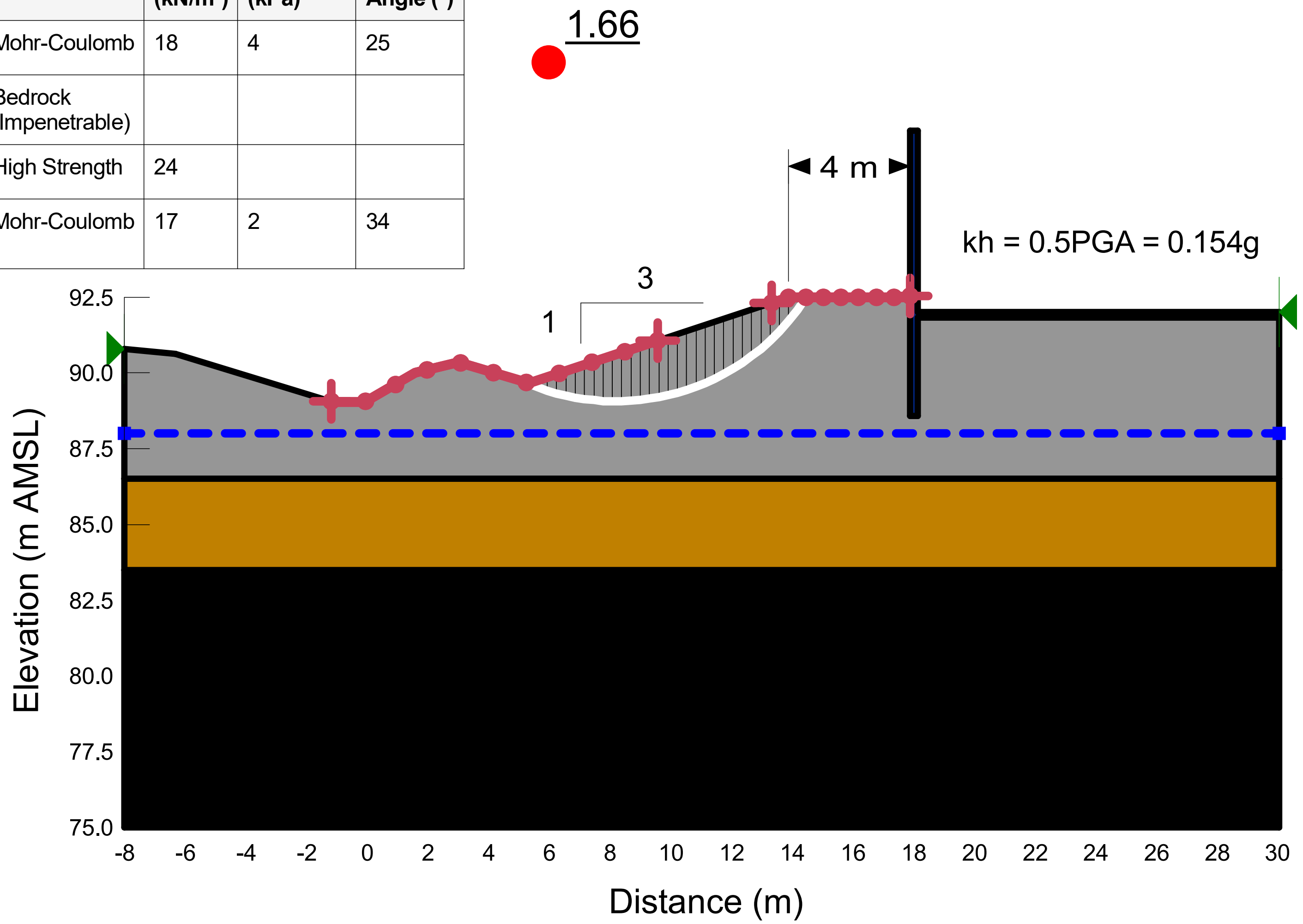


West Slope (Scenario after Dynamic Compaction)-Static Stability Analysis
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

21/12/2021

1:230

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	BackFill	Mohr-Coulomb	18	4	25
⬛	Bedrock	Bedrock (Impenetrable)			
🟦	Concrete	High Strength	24		
🟫	Native sandy silt	Mohr-Coulomb	17	2	34



West Slope (Scenario after Dynamic Compaction)- Pseudo Static Stability Analysis
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

21/12/2021

1:230

Attachment 2

Maccaferri Retaining Wall Drawings

PROJECT: SOMME STREET

OTTAWA, ON
FASTFRATE FACILITY

MACCAFERRI GREEN TERRAMESH SYSTEM

DRAWINGS:

CA21023_1	* Plan View
CA21023_2,3	* Elevation View
CA21023_4	* Cross Section A
CA21023_5	* Cross Section B
CA21023_6	* Cross Section C
CA21023_7	* Construction Notes
CA21023_8	* Installation Guide

Rev:	Issue / Revision:	By:	Date:
2	Issued for Construction	JN	20/12/21
1	Issued to Client for review	JN	15/12/21
0	Issued to Client for review	JN	20/07/21

MACCAFERRI

Maccaferri Canada Ltd.
400 Collier MacMillan Drive, Unit B
Cambridge, ON CANADA N1R 7H7
Ph. (519) 623-9990 Fax (519) 623-1309

This drawing is stored in file:Maccaferri_WDC/Canada_Maccaferri/CA06001

This drawing is stored in file:Maccaferri_WDC/USA_Maccaferri/East_Coast/CA21023

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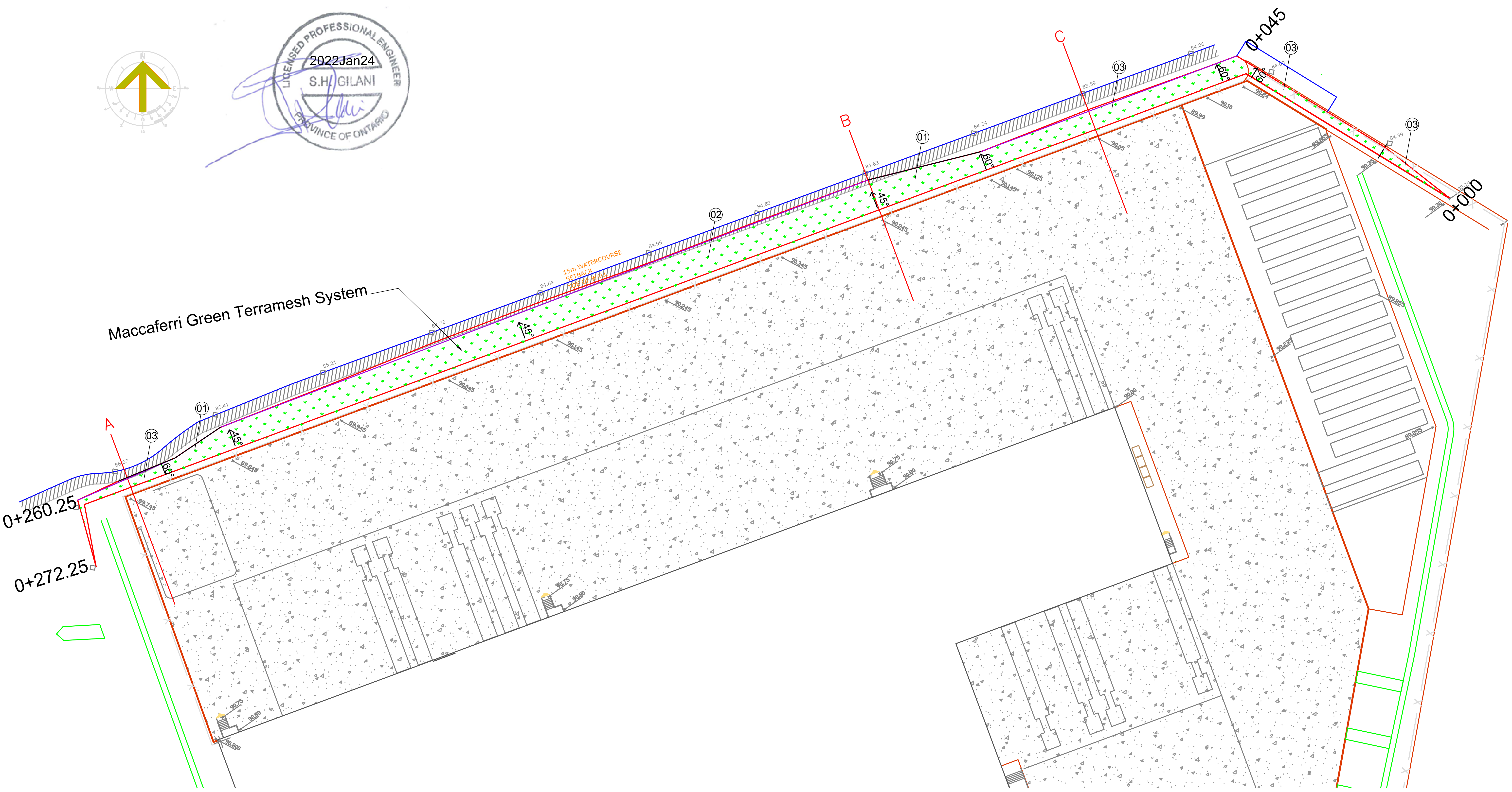
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO



Rev:	Issue / Revision:	Drawn:	App:	Date:
2	Issued for Construction	JN		20/12/21
1	Issued to Client for review	JN		15/12/21
0	Issued to Client for review	JN		20/07/21

Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023
Client:

Drawing No: CA21023 _1
Scale: NTS
Rev: 2

Designed: Date:
Drawn: JN Date: 20/07/21
Checked: Date:
Approved: Date:

Drawing Title:
PLAN VIEW

GHD

MACCAFERRI
Maccaferri Canada Ltd.
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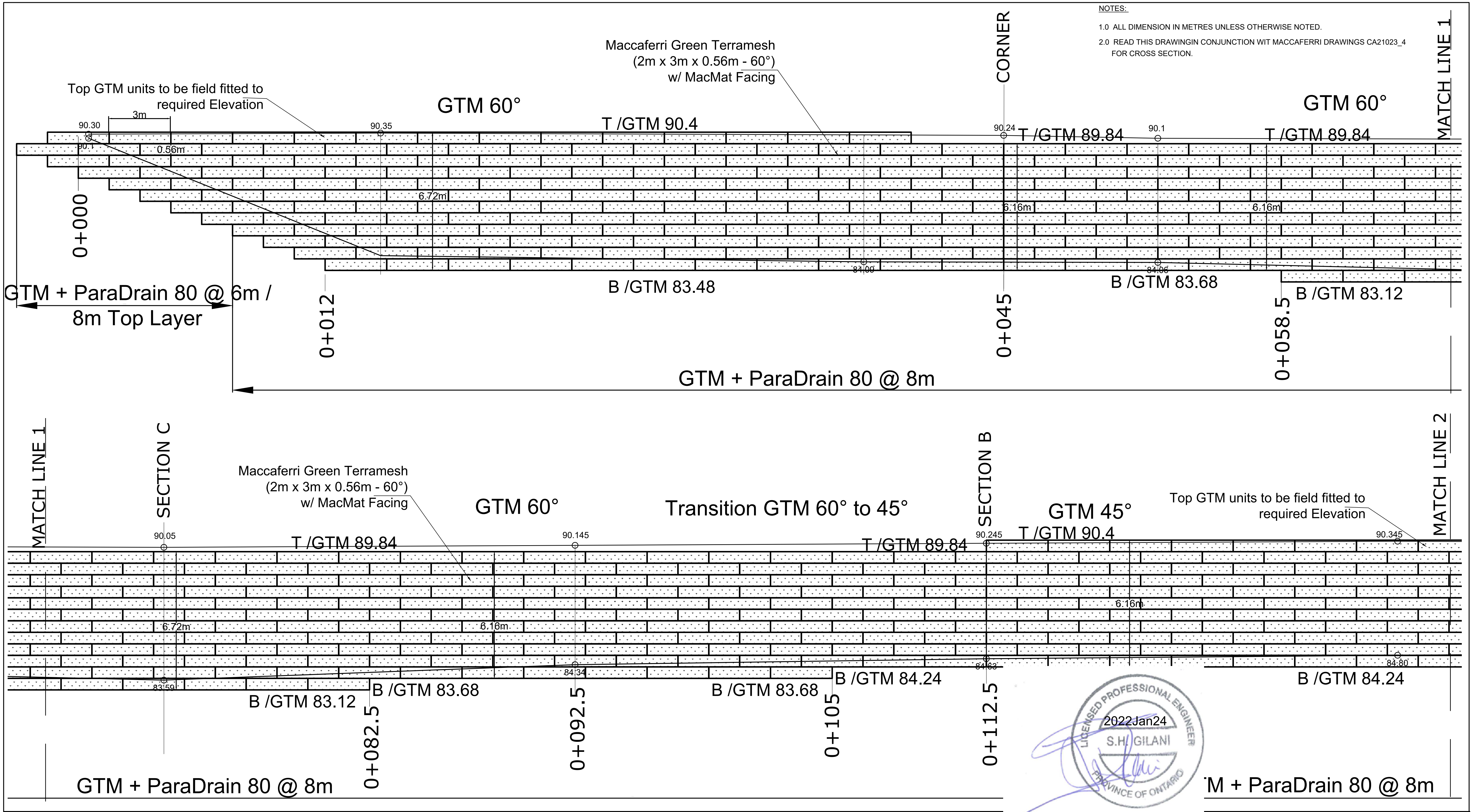
NOTES:

1.0 ALL DIMENSION IN METRES UNLESS OTHERWISE NOTED.

2.0 READ THIS DRAWINGIN CONJUNCTION WIT MACCAFERRI DRAWINGS CA21023_4
FOR CROSS SECTION.



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1	Issued to Client for review	JN		15/12/21
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Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023
Client:

Drawing No: CA21023 _2
Scale: NTS
Rev: 2

Designed:
Date:
Drawn: JN
Date: 20/07/21
Checked:
Date:
Approved:
Date:

Drawing Title: ELEVATION VIEW

GHD

MACCAFERRI

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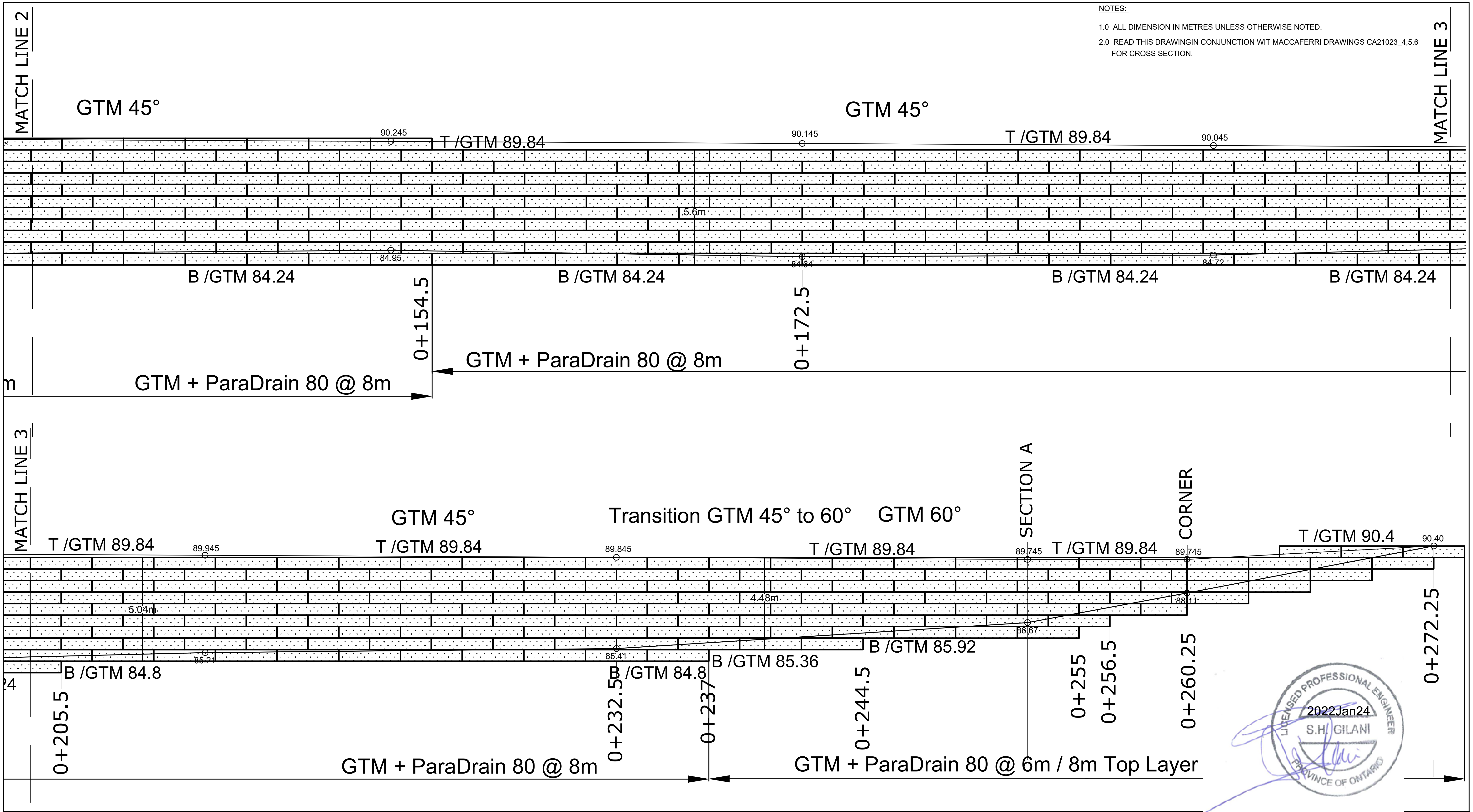
NOTES:

1.0 ALL DIMENSION IN METRES UNLESS OTHERWISE NOTED.

2.0 READ THIS DRAWINGIN CONJUNCTION WIT MACCAFERRI DRAWINGS CA21023_4,5,6
FOR CROSS SECTION.



2022Jan24
S.H. GILANI

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2	Issued for Construction	JN		20/12/21
1	Issued to Client for review	JN		15/12/21
0	Issued to Client for review	JN		20/07/21

Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023

Client:

Drawing No: CA21023 _2

Scale: NTS

Rev: 2

Designed:

Date:

Drawn: JN

Date: 20/07/21

Checked:

Date:

Approved:

Date:

Drawing Title: ELEVATION VIEW

GHD

MACCAFERRI

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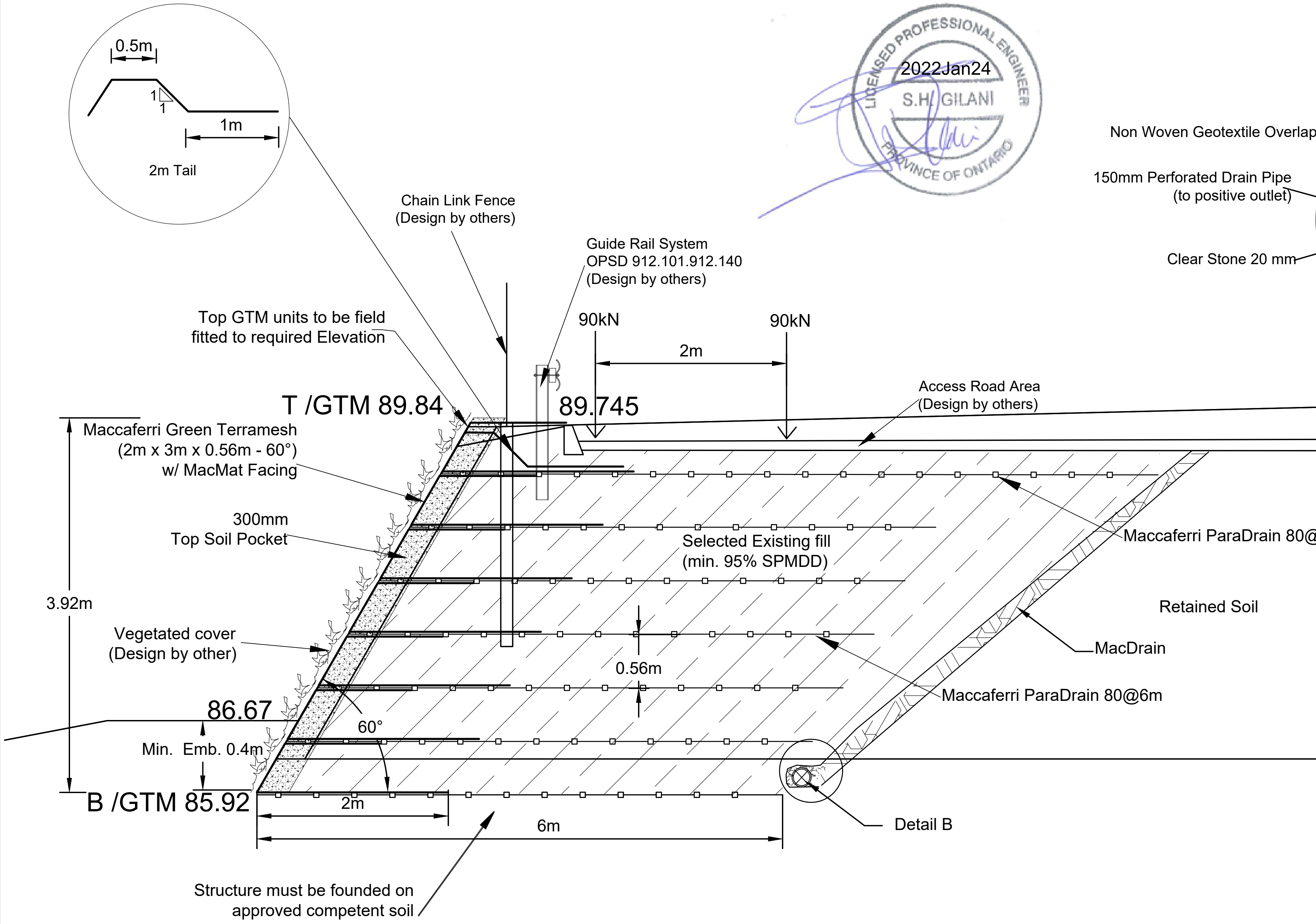
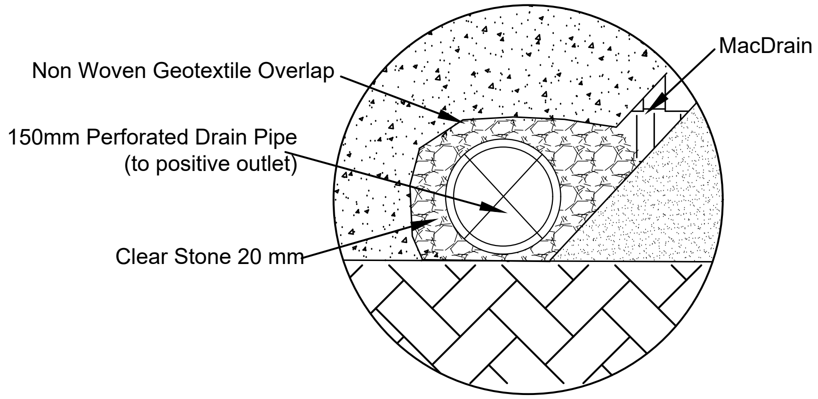
2022Jan24

S.H. GILANI



DETAIL B
SUBDRAIN
SCALE: N.T.S



NOTES:

1.0 DESIGN PARAMETERS

1.1 THE DESIGN PRESENTED HEREIN IS BASED ON THE SOIL PARAMETERS, FOUNDATION CONDITIONS, GROUNDWATER CONDITIONS AND LOADINGS STATED IN SECTION 1.2.

1.2 THE DESIGN OF THE GREEN TERRAMESH SYSTEM STRUCTURE IS BASED ON THE FOLLOWING SOIL PARAMETERS PROVIDED BY GHD GEOTECHNICAL INVESTIGATION/11215612/RPT-1 AND EMAIL DATED 12/16/2021

	FRICTION ANGLE (°)	EFFECTIVE COHESION (kPa)	MOIST. UNIT WT. (kN/m3)
SELECTED EXISTING FILL	25	4	18
FOUNDATION SOIL	34	2	17
RETAINED SOIL	25	4	18

1.3 FACTORS OF SAFETY

MINIMUM FACTOR OF SAFETY FOR SLIDING = 1.5(STATIC) 1.1(SEISMIC)
MINIMUM FACTOR OF INTERNAL STABILITY = 1.5(STATIC) 1.1(SEISMIC)

1.3.2 GLOBAL STABILITY IS THE RESPONSIBLITY OF GHD

1.4 SEISMIC DESIGN
HORIZONTAL ACCELERATION COEFFICIENT = 0.15g (50% of 0.3g)

1.5 STRUCTURE IS DESIGN USING 180kN AXLE LOAD

1.6 DESIGN OF STRUCTURE IS BASED UPON THE ASSUMPTION THAT GROUNDWATER IS AT ELEVATION 86.9m

2.0 READ DETAIL IN CONJUNCTION WITH STANDARD CONSTRUCTION NOTES FOR MACCAFERRI GREEN TERRAMESH SYSTEM PROVIDED WITH THIS DRAWING.

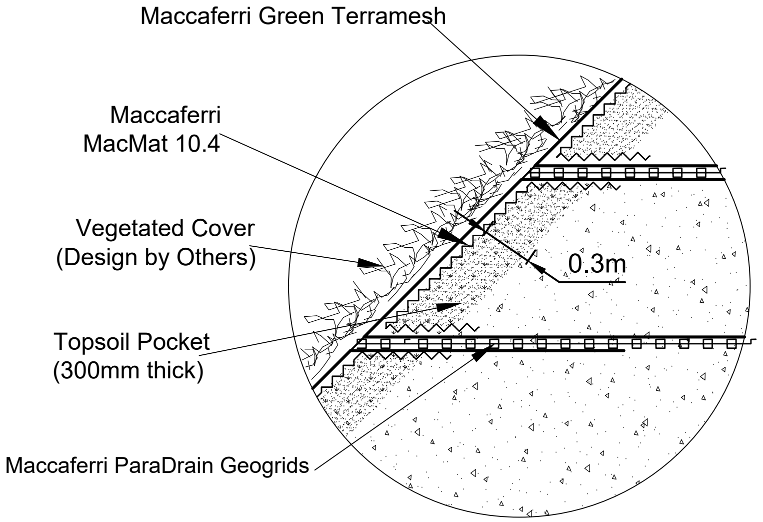
3.0 DESIGN TO BE REVIEWED BY PROJECT ENGINEER TO DETERMINE SUITABILITY OF STRUCTURE TO SITE CONDITIONS.

4.0 FOUNDATION IS TO BE REVIEWED BY THE PROJECT GEOTECHNICAL ENGINEER.

5.0 ONCE REINFORCED SLOPE SYSTEM HAS BEEN CONSTRUCTED, NO AUGURING OR EXCAVATION USING EXCAVATOR SHALL BE ALLOWED INTO REINFORCED SOIL ZONE. IF PENETRATION IN THE SOIL REINFORCEMENT IS REQUIRED , EXPOSE INDIVIDUAL LAYERS OF REINFORCEMENT AND CUT AN OPENING WITH SHARP INSTRUMENT CLEANLY THROUGH THE GEOGRID REINFORCEMENT.

6.0 THE SOIL DESIGN PARAMETERS STATED IN NOTE 1.2 SHALL BE BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.

DETAIL
GREEN TERRAMESH UNIT FACING
SCALE: N.T.S



* NO MORE THAN 0.56m OF COMPACTED SELECTED EXISTING FILL (Cv=100m2/year, mv = 0.18m2/MN) TO BE PLACED PER DAY

Rev:	Issue / Revision:	Drawn:	App:	Date:
2	Issued for Construction	JN		20/12/21
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0	Issued to Client for review	JN		20/07/21

Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023

Client:

Drawing No: CA21023 _4

Scale: NTS

Rev: 2

Designed: JN	Date: 20/07/21
Drawn: JN	Date: 20/07/21
Checked:	Date:
Approved:	Date:

Drawing Title:
CROSS SECTION A
Green Terramesh System

GHD

MACCAFERRI

Maccaferri Canada Ltd.
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Cambridge, ON CANADA N1R 7H7
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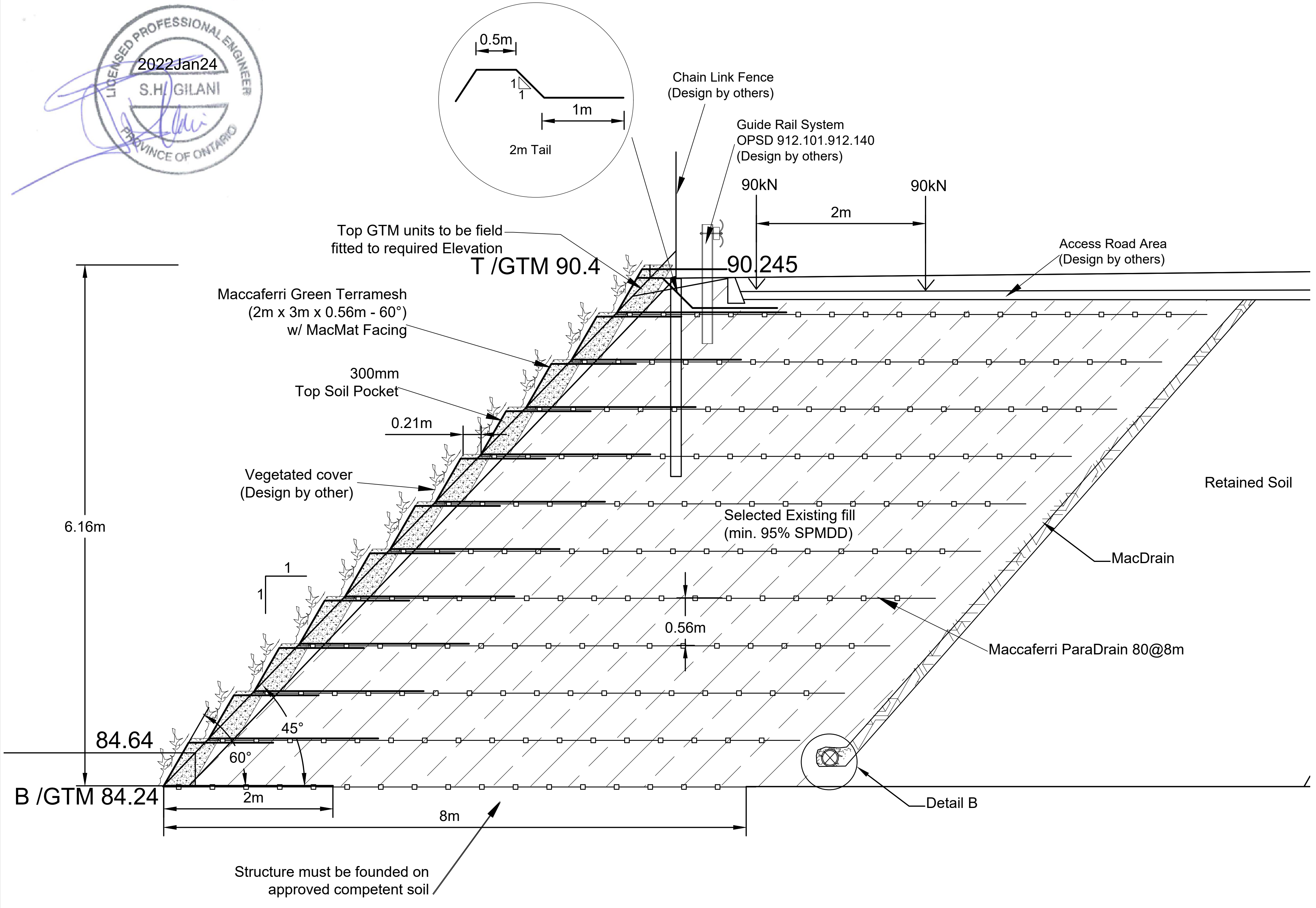
2022Jan24
S.H. GILANI



* NO MORE THAN 0.56m OF COMPACTED SELECTED EXISTING FILL (Cv=100m2/year, mv = 0.18m2/MN) TO BE PLACED PER DAY

NOTES:

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1.2 THE DESIGN OF THE GREEN TERRAMESH SYSTEM STRUCTURE IS BASED ON THE FOLLOWING SOIL PARAMETERS PROVIDED BY GHD GEOTECHNICAL INVESTIGATION/11215612/RPT-1 AND EMAIL DATED 12/16/2021

	FRICTION ANGLE (°)	EFFECTIVE COHESION (kPa)	MOIST. UNIT WT. (kN/m3)
SELECTED EXISTING FILL	25	4	18
FOUNDATION SOIL	34	2	17
RETAINED SOIL	25	4	18

1.3 FACTORS OF SAFETY
MINIMUM FACTOR OF SAFETY FOR SLIDING = 1.5(STATIC) 1.1(SEISMIC)
MINIMUM FACTOR OF INTERNAL STABILITY = 1.5(STATIC) 1.1(SEISMIC)

1.3.2 GLOBAL STABILITY IS THE RESPONSIBLITY OF GHD

1.4 SEISMIC DESIGN
HORIZONTAL ACCELERATION COEFFICIENT = 0.15g (50% of 0.3g)

1.5 STRUCTURE IS DESIGN USING 180kN AXLE LOAD

1.6 DESIGN OF STRUCTURE IS BASED UPON THE ASSUMPTION THAT GROUNDWATER IS AT ELEVATION 86.9m

2.0 READ DETAIL IN CONJUNCTION WITH STANDARD CONSTRUCTION NOTES FOR MACCAFERRI GREEN TERRAMESH SYSTEM PROVIDED WITH THIS DRAWING.

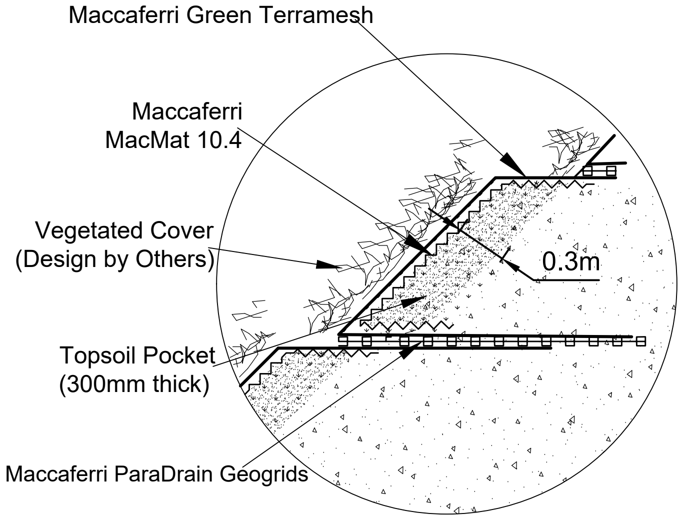
3.0 DESIGN TO BE REVIEWED BY PROJECT ENGINEER TO DETERMINE SUITABILITY OF STRUCTURE TO SITE CONDITIONS.

4.0 FOUNDATION IS TO BE REVIEWED BY THE PROJECT GEOTECHNICAL ENGINEER.

5.0 ONCE REINFORCED SLOPE SYSTEM HAS BEEN CONSTRUCTED, NO AUGURING OR EXCAVATION USING EXCAVATOR SHALL BE ALLOWED INTO REINFORCED SOIL ZONE. IF PENETRATION IN THE SOIL REINFORCEMENT IS REQUIRED , EXPOSE INDIVIDUAL LAYERS OF REINFORCEMENT AND CUT AN OPENING WITH SHARP INSTRUMENT CLEANLY THROUGH THE GEOGRID REINFORCEMENT.

6.0 THE SOIL DESIGN PARAMETERS STATED IN NOTE 1.2 SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.

DETAIL
GREEN TERRAMESH UNIT FACING
SCALE: N.T.S



Rev:	Issue / Revision:	Drawn:	App:	Date:
2	Issued for Construction	JN		20/12/21
1	Issued to Client for review	JN		15/12/21
0	Issued to Client for review	JN		20/07/21

Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY
Project No: CA21023
Client:
Drawing No: CA21023 _5
Scale: NTS
Rev: 2

Designed: JN Date: 20/07/21
Drawn: JN Date: 20/07/21
Checked: Date:
Approved: Date:

Drawing Title:
CROSS SECTION B
Green Terramesh System

GHD

MACCAFERRI

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Cambridge, ON CANADA N1R 7H7
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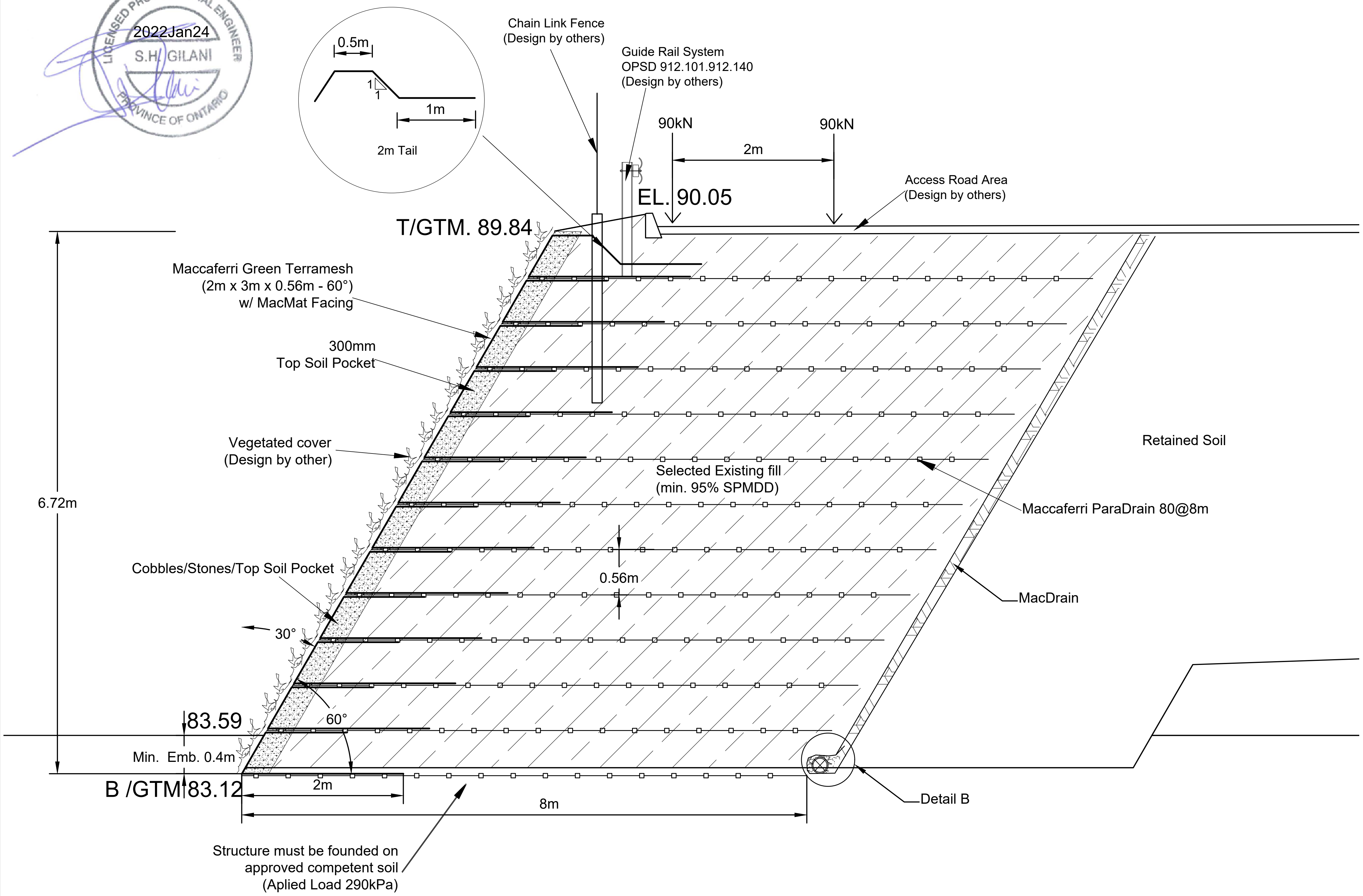
This drawing is stored in file:Maccaferri_WDC/USA_Maccaferri/East_Coast/CA21023

LICENSED PROFESSIONAL ENGINEER
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO



* NO MORE THAN 0.56m OF COMPACTED SELECTED EXISTING FILL (Cv=100m2/year, mv = 0.18m2/MN) TO BE PLACED PER DAY

NOTES:

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	FRICTION ANGLE (°)	EFFECTIVE COHESION (kPa)	MOIST. UNIT WT. (kN/m3)
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3.0 DESIGN TO BE REVIEWED BY PROJECT ENGINEER TO DETERMINE SUITABILITY OF STRUCTURE TO SITE CONDITIONS.

4.0 FOUNDATION IS TO BE REVIEWED BY THE PROJECT GEOTECHNICAL ENGINEER.

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0	Issued to Client for review	JN		20/07/21

Project Title:
SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023
Client:

Drawing No: CA21023 _6
Scale: NTS
Rev: 2

Designed: JN Date: 20/07/21
Drawn: JN Date: 20/07/21
Checked: Date:
Approved: Date:

Drawing Title:
CROSS SECTION C
Green Terramesh System

GHD

MACCAFERRI

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Cambridge, ON CANADA N1R 7H7
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LICENSED PROFESSIONAL ENGINEER
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO

CONSTRUCTION NOTES FOR MACCAFERRI GREEN TERRAMESH SYSTEM

MATERIALS

GREEN TERRAMESH SHALL BE GALVANIZED WITH POLIMAC COATING 8x10 HEXAGONAL DOUBLE TWIST WIRE MESH TYPE AS PER ASTM A975.

1.2 REINFORCED BACKFILL SHALL BE SELECTED EXISTING FILL AND HAVE THE REQUIRED SOIL PARAMETERS AS DEFINED ON THE CROSS SECTIONS PROVIDED.

1.3 REINFORCED BACKFILL MATERIAL SHALL BE SELECTED EXISTING FILL AND MUST BE APPROVED BY THE GEOTECHNICAL ENGINEER BEFORE USE.

1.5 REINFORCED BACKFILL MATERIAL SHALL BE FREE OF EXCESS MOISTURE, MUCK, SOD, SNOW, FROZEN LUMPS, ORGANICS, OR DELETERIOUS MATERIALS. NO STONE SIZES GREATER THAN 100mm SHALL BE PLACED DIRECTLY AGAINST THE REINFORCEMENT.

2.0 DRAINAGE

2.1 PERMANENT SURFACE WATER DIVERSIONS SHALL BE REQUIRED AND CONSTRUCTED IN ACCORDANCE WITH THE GRADING DESIGN DRAWINGS.

2.2 THIS DESIGN IS BASED ON THE ASSUMPTION THAT THE REINFORCED REINFORCED BACKFILL MATERIAL SHALL BE FREE OF SUBSURFACE MOISTURE/WATER. IT IS THE RESPONSIBILITY OF THE CONSTRUCTOR CONSTRUCTOR TO ENSURE THAT PROPER SUBSURFACE IS PROVIDED.

2.3 AT THE END OF EACH WORKDAY, BACKFILL SURFACE SHALL BE GRADED A MINIMUM OF 2% AWAY FROM THE WALL FACE AND COMPACTED WITH A SMOOTH WHEEL ROLLER TO MINIMIZE PONDING.

2.4 THE ENGINEERING, ANALYSIS, DESIGN AND MITIGATION OF SURFACE DRAINAGE AND SEEPAGE OF GROUND WATER IS THE RESPONSIBILITY OF THE CONSTRUCTOR.

3.0 TECHNICAL REQUIREMENTS

3.1 PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL CLEAR AND GRADE THE REINFORCED BACKFILL AREA, REMOVING TOP SOIL, BRUSH, SOD AND OTHER ORGANIC DELETERIOUS MATERIALS. ANY UNSUITABLE SOILS SHALL BE OVER EXCAVATED AND REPLACED AND COMPACTED WITH REINFORCED BACKFILL MATERIAL TO PROJECT SPECIFICATIONS OR AS OTHERWISE DIRECTED BY THE GEOTECHNICAL ENGINEER.

3.2 GREEN TERRAMESH SHALL BE INSTALLED ACCORDING TO MACCAFERRI CANADA LTD.'S SPECIFICATIONS.

3.3 GREEN TERRAMESH SHALL BE INSTALLED USING THE CORRECT BATTER ANGLE AS SHOWN ON THE DRAWING(S).

3.4 FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT EXCEEDING 200mm IN UNCOMPACTED THICKNESS FOR HEAVY COMPACTION EQUIPMENT. FOR ZONES WHERE COMPACTION IS ACHIEVED WITH HAND OPERATED EQUIPMENT FILL SHALL BE PLACED IN LIFTS NOT EXCEEDING 150mm IN UNCOMPACTED THICKNESS. ONLY HAND OPERATED EQUIPMENT SHALL BE ALLOWED WITHIN ONE METRE OF THE FRONT FACE.

3.5 FILL BEYOND ONE METRE FROM THE FRONT FACING SHALL BE COMPACTED AS REQUIRED BY PROJECT SPECIFICATIONS OR TO A MINIMUM OF 95% OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY (SPMDD) AS DETERMINED IN ACCORDANCE WITH ASTM D698 AT A MOISTURE CONTENT OF -1/+2% POINT FROM OPTIUM.

3.6 THE FACING ELEMENT OF THE GREEN TERRMESH SHALL BE MONITORED DURING BACKFILL PLACEMENT AND COMPACTION. MODIFICATIONS TO THE COMPACTION EQUIPMENT AND PROCEDURES MAY BE NECESSARY TO PREVENT EXCESSIVE DEFORMATION OF THE FACING.

3.7 FOUNDATION SHALL BE PROOF ROLLED USING A SMOOTH DRUM ROLLER TO 98% SPMDD OR PER PROJECT SPECIFICATIONS. IT IS THE RESPONSIBILITY OF THE CONSTRUCTOR TO CONFIRM THAT THE SITE IS ADEQUATELY PREPARED.

3.8 VERIFICATION OF MATERIAL SPECIFICATIONS, TESTING METHODS AND FREQUENCY AND COMPACTION ARE THE RESPONSIBILITY OF THE ENGINEER.

4.0 SPECIAL PROVISIONS

4.1 MACCAFERRI CANADA LTD. ASSUMES NO LIABILITY FOR INTERPRETATION OR VERIFICATION OF SUBSURFACE CONDITIONS, SUITABILITY OF THE ASSUMED SOIL DESIGN PARAMETERS, SHOWN ON THE CROSS SECTION, AND INTERPRETATION OF GROUNDWATER CONDITIONS.

4.2 IT IS THE RESPONSIBILITY OF THE CONSTRUCTOR TO VERIFY THAT THE ACTUAL SITE CONDITIONS ARE AS DESCRIBED ON THE CROSS SECTION. ANY DISCREPANCIES SHALL BE REPORTED TO MACCAFERRI AND THE GEOTECHNICAL ENGINEER.

4.3 THE SOIL DESIGN PARAMETERS STATED ON THE CROSS SECTION SHALL BE VERIFIED BY THE CONSTRUCTOR PRIOR TO COMMENCEMENT OF CONSTRUCTION. ANY DISCREPANCIES MUST BE REPORTED TO THE ENGINEER IMMEDIATELY.

4.4 THE BEARING CAPACITY OF THE FOUNDATION SOIL MUST BE APPROVED BY THE ENGINEER.

4.5 ANY REVISIONS TO THE DESIGN PARAMETERS STATED ON THE CROSS SECTION OR STRUCTURE GEOMETRY SHALL REQUIRE DESIGN MODIFICATIONS PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL CHECK AND VERIFY ALL DIMENSIONS ON THE STRUCTURAL DRAWINGS WITH SITE DRAWINGS PRIOR TO COMMENCEMENT OF CONSTRUCTION AND NOTIFY MACCAFERRI AND THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

4.6 THE ACCOMPANYING DRAWING(S) SHALL BE READ IN CONJUNCTION WITH ALL OTHER CONTRACT DOCUMENTS.

4.7 THESE CONSTRUCTION NOTES MUST BE READ IN CONJUNCTION WITH PRODUCT SPECIFICATIONS AND PRODUCT INSTALLATION GUIDE FOR THE GREEN TERRAMESH SYSTEM.

4.8 THIS DESIGN IS VALID ONLY FOR THE PROPOSED GREEN TERRAMESH SYSTEM AS SHOWN HEREIN.

4.9 THE DESIGN PROVIDED HEREIN IS PRELIMINARY IN NATURE AND MUST BE VERIFIED BY A CONSULTING ENGINEER PRIOR TO COMMENCEMENT OF CONSTRUCTION. MACCAFERRI CANADA LTD. ASSUMES NO RESPONSIBILITY OR LIABILITY IF CONSTRUCTION IS COMMENCED WITHOUT SUCH VERIFICATION BY A CONSULTING ENGINEER.

4.10 REINFORCED SLOPES SUCH AS GREEN TERRAMESH MUST BE VEGETATED AFTER CONSTRUCTION TO MINIMIZE OR PREVENT EROSION FROM RAINFALL AND RUNOFF ON THE FACE. IT IS THE RESPONSIBILITY OWNER OR THE OWNER'S REPRESENTATIVE TO SEEK THE SERVICES OF A COMPETENT HORTICULTURAL/ LANDSCAPE SPECIALIST, IN ORDER TO RECOMMEND THE MOST APPROPRIATE RECOMMEND THE MOST APROPIATE PLANT SPECIES, PLANT DENSITY AND MACCAFERRI LTD. ASSUMES NO RESPONSIBILTY OR LIABILITY FOR THE CHOICE CHOICE OF THE VEGETATION METHOD SELECTED FOR THE GREEN TERRAMESH FACING.

Rev:	Issue / Revision:	Drawn:	App:	Date:
2	Issued for Construction	JN		20/12/21
1	Issued to Client for review	JN		15/12/21
0	Issued to Client for review	JN		20/07/21

Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023
Client:

Drawing No: CA21023 _7
Scale: NTS
Rev: 2

Designed:
Date:
Drawn: JN
Date: 20/07/21
Checked:
Date:
Approved:
Date:

Drawing Title: CONSTRUCTION NOTES
GREEN TERRAMESH SYSTEM

GHD

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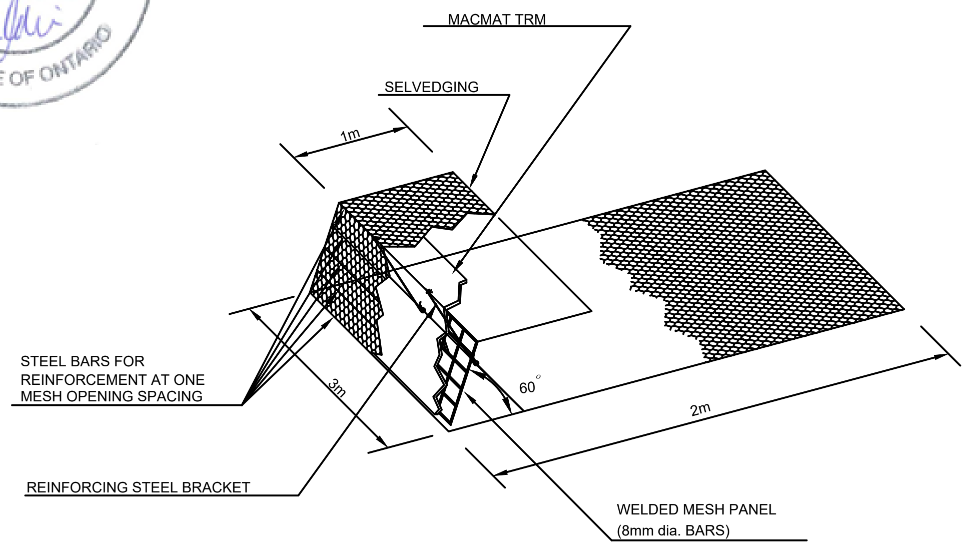
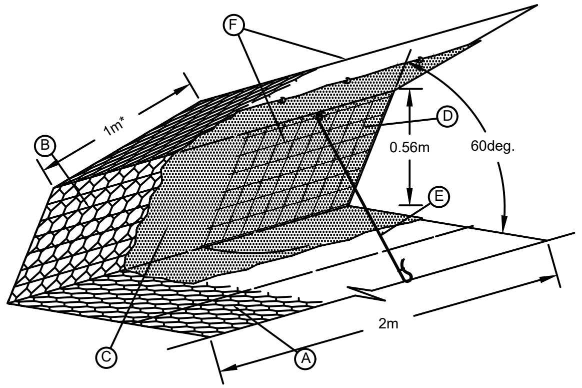
LICENSED PROFESSIONAL ENGINEER
2022Jan24
S.H. GILANI
PROVINCE OF ONTARIO

GREEN TERRAMESH + GEOGRIDS
CONSTRUCTION SEQUENCE

NOTE:

1) ALL DIMENSIONS IN mm's UNLESS OTHERWISE SPECIFIED.





* 2m FOR THE CLOSING ELEMENT

A = GREEN TERRAMESH UNIT IN DOUBLE TWISTED WIRE MESH,TYPE 8X10,HEAVILY ZINC COATED WITH POLIMAC COATED WIRE Ø2.70/3.70mm

C = MACMAT TURF REINFORCEMENT MAT (TRM)

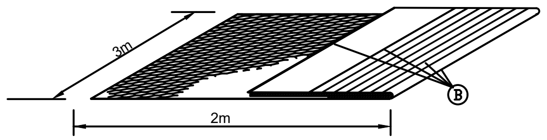
E = REINFORCING STEEL BRACKET

B = ZINC/PVC COATED METALLIC REINFORCING WIRES Ø3.40/4.40mm, INSERTED INTO THE DOUBLE TWIST MESH

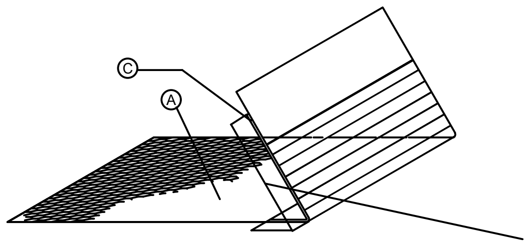
D = WELDED GRID MESH (Ø8mm)

F = HEAVILY ZINC COATED STEEL FIXING RINGS, Ø3.00mm

G = EARTH TYPE (ABOVE WATER TABLE) VEGETAL SOIL
H = SOIL FILL

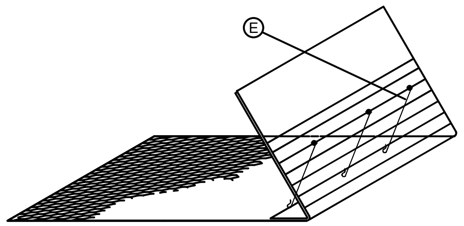


GREEN TERRAMESH UNIT PROVIDED WITH ONE FOLD, TO SIMPLIFY PLACEMENT IN THE STRUCTURE, WITH STEEL REINFORCING BARS, WELDED MESH PANEL AND REINFORCING STEEL BRACKET

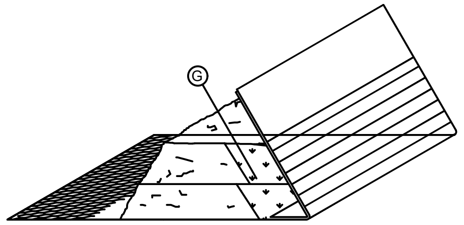


PLACEMENT AND OPENING OF THE UNIT ALONG THE LOWER REINFORCING WIRE

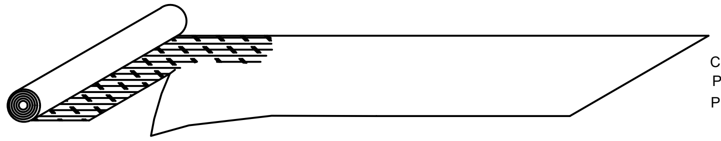
EDGE OF THE EROSION CONTROL MAT TO BE OVERLAPPED TO THE ADJACENT UNIT



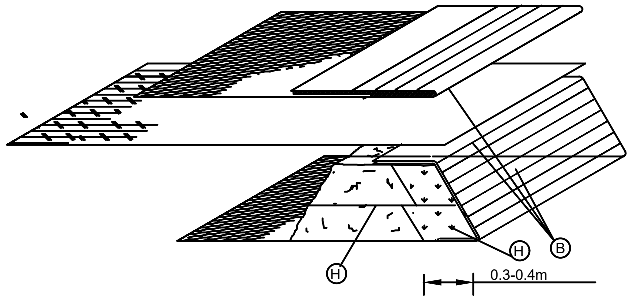
INSTALLATION OF REINFORCING STEEL SUPPORT BRACKETS



BACK FILLING UP TO THE DESIRED LEVEL



CUTTING OF THE GEOGRID USING THE CUTTER
PLACE THE GEOGRIDS IN HORIZONTAL LAYERS PERPENDICULAR TO THE FACE .



FOLDING OF THE EXTERNAL T.M. FACE ALONG THE UPPER REINFORCING WIRE. PLACEMENT OF THE GEOGRID, FOLLOWED BY THE PLACEMENT OF THE NEXT T.M. UNIT AND LACING BY STAINLESS STEEL RINGS TO THE UNIT UNDERNEATH

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Project Title: SOMME STREET
OTTAWA, ON
FASTFRATE FACILITY

Project No: CA21023
Client:

Drawing No: CA21023 _8
Scale: NTS
Rev: 2

Designed: JN
Date: 20/07/21
Drawn: JN
Date: 20/07/21
Checked:
Date:
Approved:
Date:

Drawing Title:
Installation Guide
GREEN TERRAMESH SYSTEM

GHD

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Attachment 3

Geogrid Technical Data Sheet

MACCAFERRI

TECHNICAL DATA SHEET

Rev: 03, Issue Date 13.04.2018

PARADRAIN™ 80

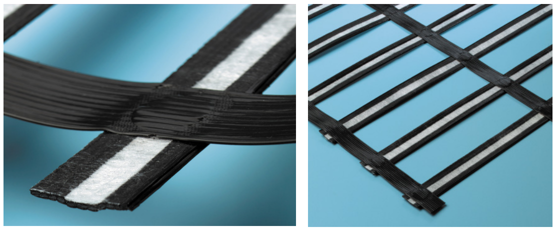
STRIP BONDED DRAINING GEOGRIDS WITH HIGH TENACITY POLYESTER CORE

ParaDrain™ 80 is manufactured from high tenacity, multifilament polyester yarns aligned and co-extruded with polyethylene (LLDPE) to form polymeric strips. The longitudinal strips has a channel shape and are covered by a geotextile to provide draining capacity in this direction. These strips are laid flat in the machine direction with a secondary strip laid and welded across the full width in the cross direction. **ParaDrain™ 80** is ideal for applications of reinforcement of cohesive soils with low permeability and high moisture content. In term of mechanical properties and installation damage factor the Paradrain products are equivalent to their correspondent Paragrid grade.

PROPERTY	TEST METHOD	VALUES	NOTES
		Metric	
Mechanical			
Tensile Strength (ultimate)	ASTM D6637	**80.0** kN/m	1
Elongation @ Ultimate strength	ASTM D6638	**10** %	2
Creep Reduced Strength		**58.4** kN/m	1,3
Long Term Design Strength (LTDS)		**53.7** kN/m	1,4
Hydraulic Properties			
In plane flow at 100 kPa; i=1.0		**3.8** l/mxh	5
In plane flow at 100 kPa; i=0.5		**1.9** l/mxh	5
In plane flow at 100 kPa; i=0.1		**0.9** l/mxh	5
Permeability normal to the plane	ASTM D4491	**90** l/m^2 sec	5
Filter's geotextile AOS$_{90}$	ASTM D4751	**100** micron	5
Polymeric (core)			
Carboxyl End Group (CEG Max.)	GRI-GG7	**<30** mmol/kg	
Molecular Weight (# average)	GRI-GG8	**>25000** M_w	
Physical			
Grid aperture size (MD)		**201** mm	5,6
Grid aperture size (XMD)		**51** mm	5,6
Mass/Unit Area	ASTM D5261	**450** g/m^2	5
Roll Dimension	Width	**3.9** m	7
	Length	**50** m	7
Roll Area		**195** m^2	7
Roll Weight		**99** kg	5

1. Minimum average roll values (MARV) are calculated as typical minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
2. The value reported is the typical value at the Tultimate; such strain can vary with a ±1 tolerance
3. Creep is calculated for a 75 years design life at 20°C; on request available data at 5, 50, 60, 100 & 120 years design life at 15 and 30°C
4. LTDS calculated for a standard temperature of 20°C, 4≤ph≤9.5 in concrete sand soil D$_{90}$≤4.0 mm; D$_{50}$<1 mm; installation damage factors for other soils and LTDS strength at different design life and temperature (see point 3) are available on request
5. Typical value; a tolerance of 10% on the reported value is admitted.
6. The indicates measure is from edge pitch to edge pitch (opening mesh size); 5% tolerance on the reported value is admitted
7. Width and length values per roll are nominal a tolerance of 5% on the reported value is admitted. Roll area is estimated and rounded up to the closest square yard

Maccaferri Canada Ltd. can engineer specific solutions in any of our products; please contact us if you may need a specific solution for your project.



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MACCAFERRI CANADA LTD.

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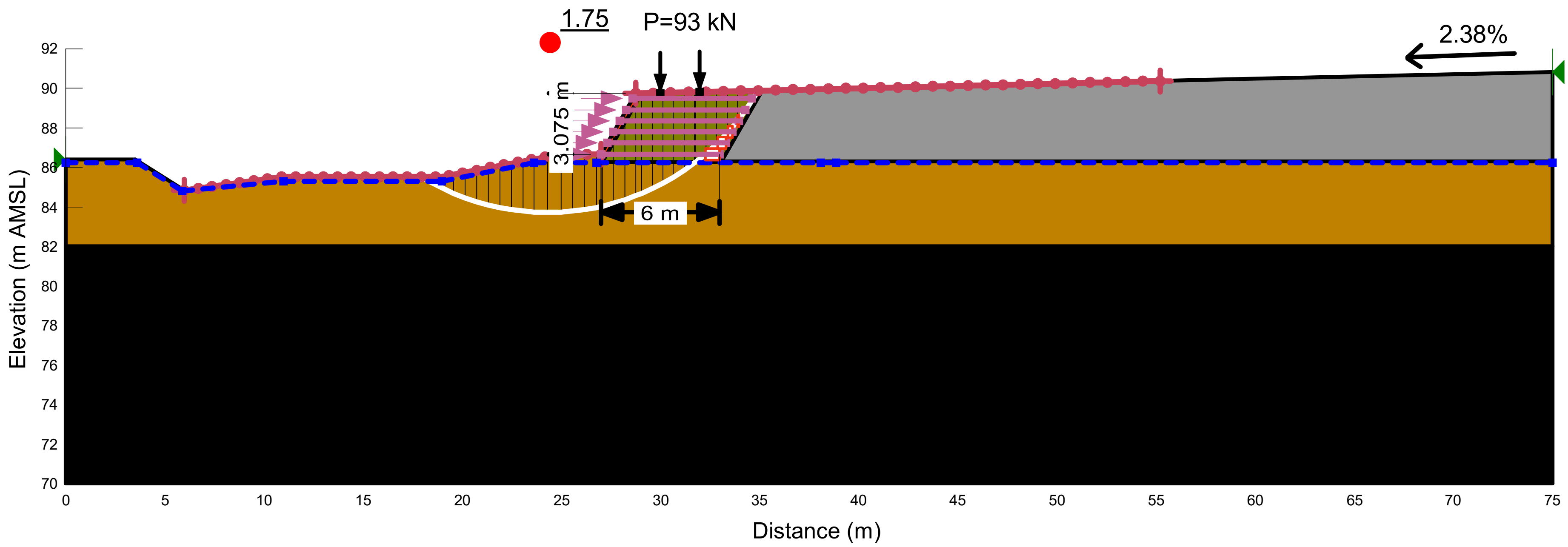
website: www.maccaferri.com/ca

Attachment 4

North Slope Global Stability Analysis Results

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	18	4	25
⬛	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25

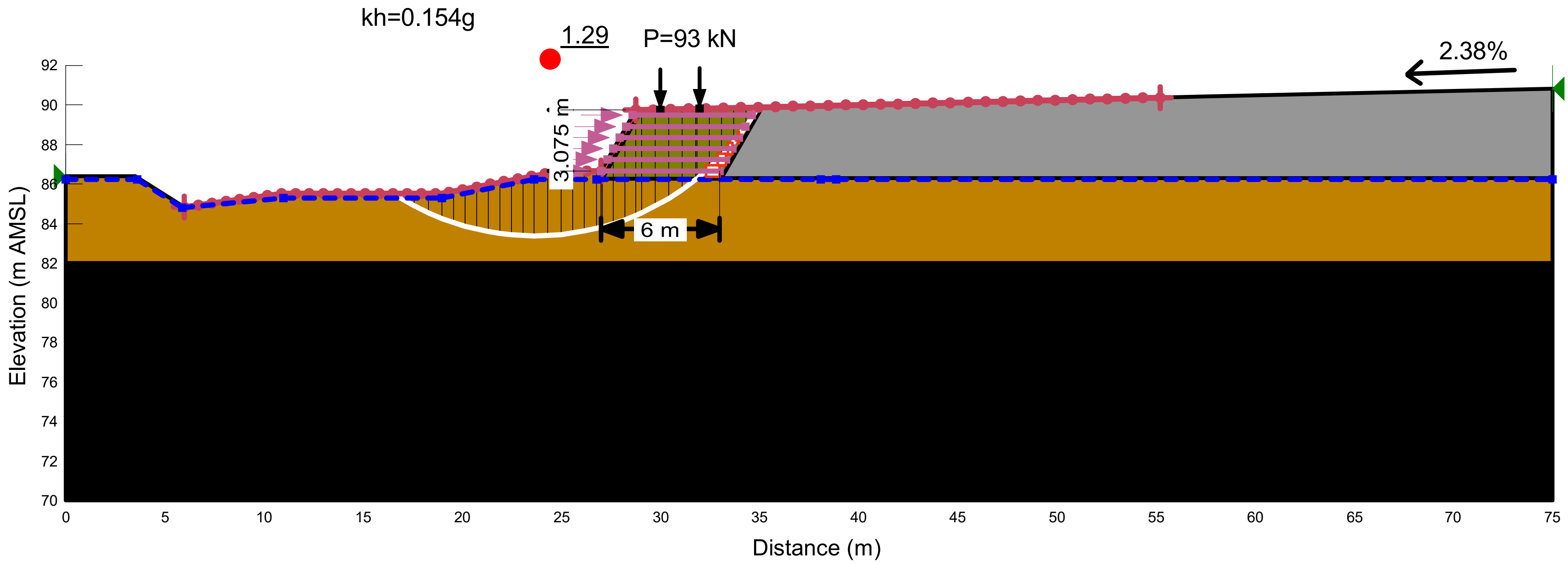


North Slope - Section A - Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	18	4	25
⬛	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25

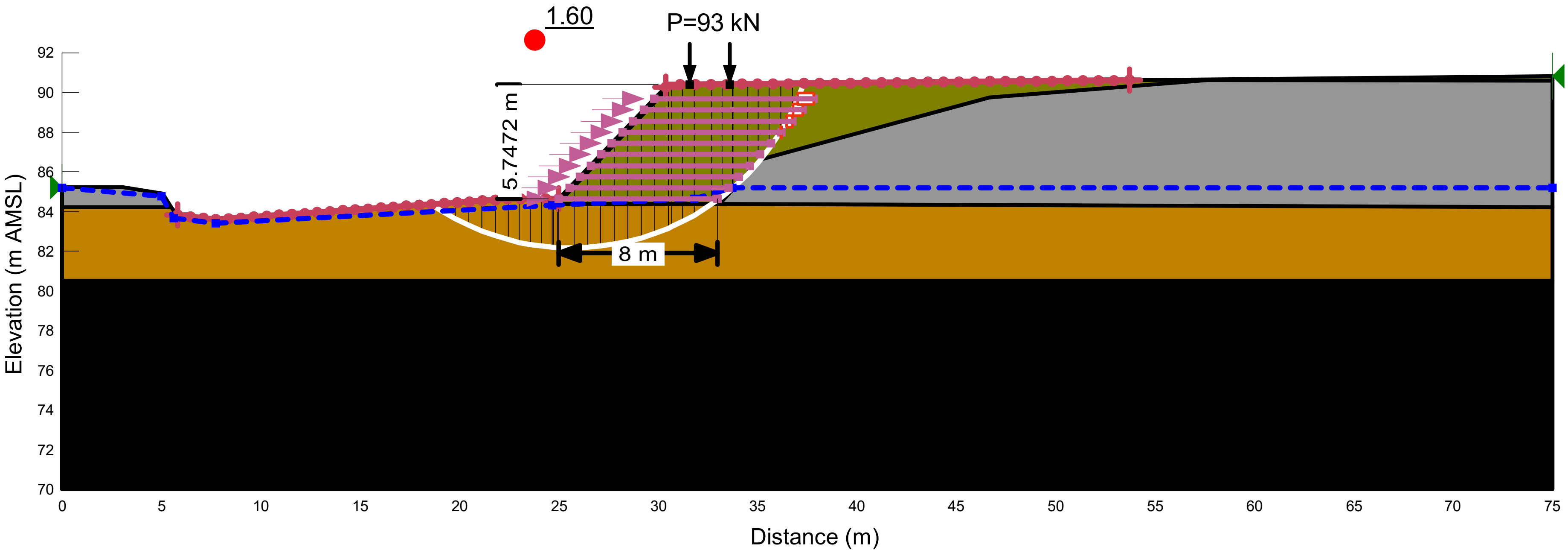


North Slope - Section A - Seismic Stability Analysis (kh=0.154g)
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	18	4	25
⬛	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25

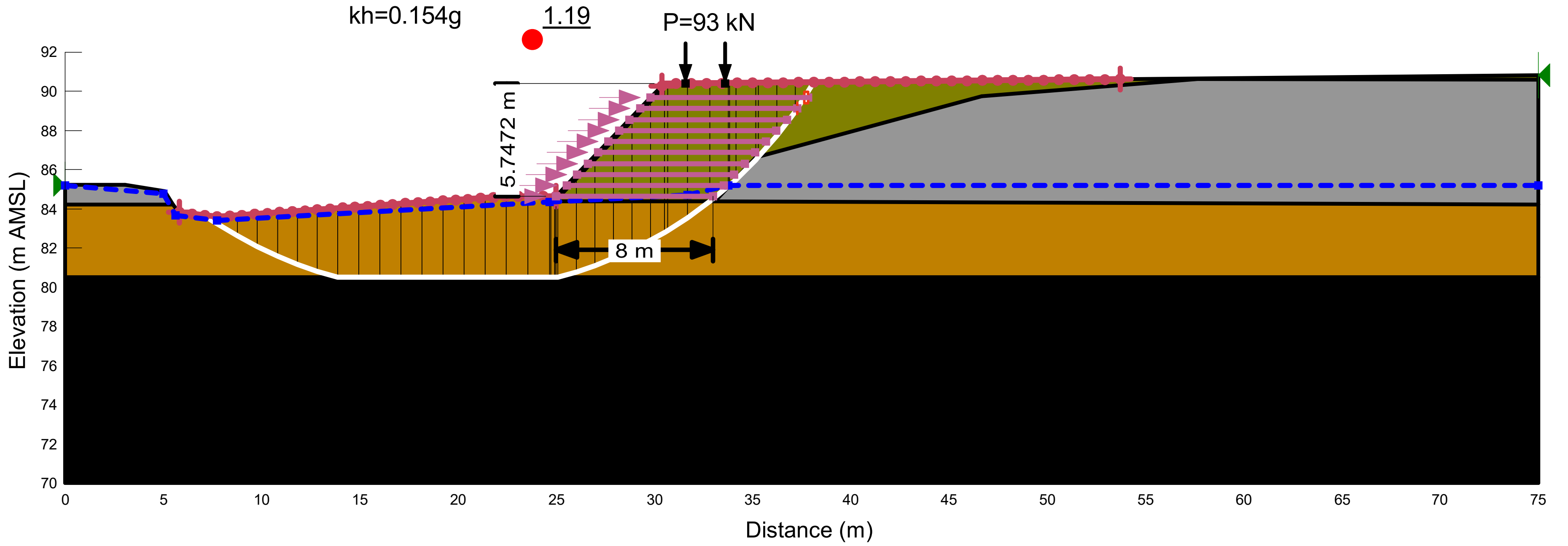


North Slope - Section B - Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▩	Backfill	18	4	25
⬛	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25

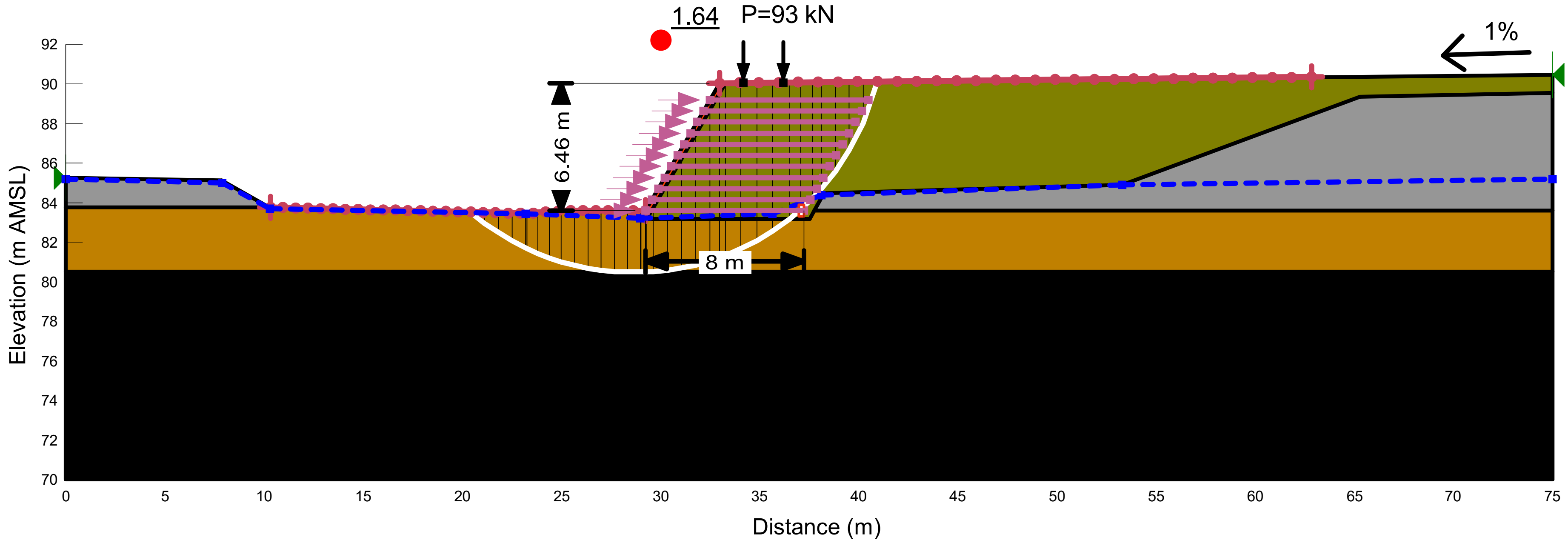


North Slope - Section B - Seismic Stability Analysis (kh=0.154g)
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	18	4	25
■	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25

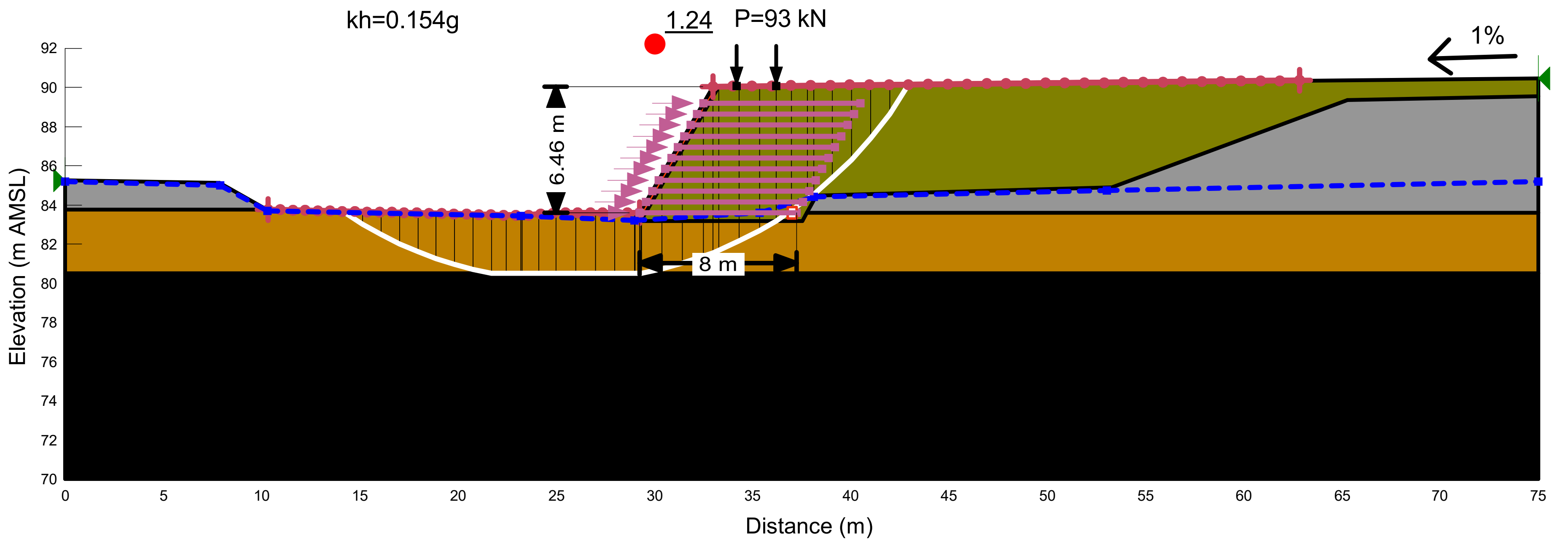


North Slope - Section C - Static Stability Analysis
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
▨	Backfill	18	4	25
⬛	Limestone			
🟫	Native sandy silt	17	2	34
🟩	Reinforced Fill	18	4	25
🟥	Soil Pocket	18	4	25



North Slope - Section C - Seismic Stability Analysis (kh=0.154g)
Ground Improvement Using Dynamic Compaction
Proposed Warehouse and Offices
Rideau Road and Somme Street, Ottawa, Ontario
11228236

16/12/2021

1:325

Appendix D

Appendix D1

Geotechnical Investigation Report
dated October 27, 2020

Geotechnical Investigation

Warehouse and Offices, Intersection of Rideau Street and Somme Street, Ottawa, Ontario

Consolidated Fastrate (Ottawa) Holdings Inc.

October 27, 2021

→ **The Power of Commitment**

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Ottawa, Ontario K2E 7J4, Canada
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Reviewer :

LICENSED PROFESSIONAL ENGINEER
S. SOLEIMANI
100135329
PROVINCE OF ONTARIO

Sahar Soleimani, Ph.D., Eng.

Approved :

David Beauseigle, M.A.Sc., P. Eng.

Document status

Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	01	Bahareh Vazhbakht, P. Eng.	Sahar Soleimani, Ph.D., Eng.		David Beauseigle, M.A.Sc., P. Eng.		October 27, 2021

→ The Power of Commitment

Contents

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Figure index

Appendices

1. Introduction

GHD was retained by Consolidated Fastfrate (Ottawa) Holdings Inc. representative Mr. Pierre Courteau of CBRE Limited to undertake a geotechnical investigation for a new warehouse and office building located southeast of the intersection of Rideau Street and Somme Street in Ottawa, Ontario (Site).

GHD (formerly Inspec Sol/CRA) completed a Geotechnical Investigation and Phase II Environmental Site Assessment for the Site in 2008 and 2009 respectively.

GHD has reviewed the following documents provided by the client as part of the investigation:

- Phase II Environmental Site Assessment and Hydrogeological Assessment, Report Ref. No. 045804 (12), by Conestoga-Rovers & Associates, dated September 2008.
- Hydrogeological Investigation, Terrain Analysis and Impact Assessment, Proposed Industrial Subdivision, Report Ref. No. 08-1122-0215, by Golder Associates, dated December 2008.
- Geotechnical Study Subdivision Plan, Hawthorne Industrial Park, Report Ref. No. T020556-A1, by Inspec-Sol, dated May 4, 2009.
- Stormwater Management Report. Hawthorne Industrial Park, Report Ref. No. JLR 20983, by J.L. Richards & Associates Limited, dated February 2009 (Revised May 2009).

This Geotechnical Investigation Report (Report) has been prepared with the understanding that the design will be as described in Section 2 and will be carried out in accordance with all applicable codes and standards. Any changes to the project described herein will require that GHD be retained to assess the impact of the changes on the report recommendations provided herein.

The purpose of the geotechnical investigation was to complete an evaluation of the subsurface stratigraphy on the Site and based upon the data, provide recommendations concerning foundation type and associated design bearing pressures, groundwater conditions as well as provide comments on excavation, backfill, pavement design and other geotechnical aspects of the development.

The scope of work for GHD consisted of the following activities:

- **Underground Service Clearances.**
- **Fieldwork |** The scope included the advancement of a total of four boreholes and one Dynamic Cone Penetration Test (DCPT). One of the boreholes was equipped with a monitoring well to measure ground water level along with the three existing wells on site.
- **Lab Testing |** Four hydrometer grain size analysis, two Atterberg limit tests, moisture contents on all collected samples, and corrosion testing on one collected sample. One collected rock core sample were selected for Unconfined Compressive Strength (UCS) testing.
- **Reporting |** Preparation of this Geotechnical Report which summarizes the findings of the fieldwork programs and presents recommendations for the design and construction of the structure and pavement areas.

2. Site and Project Description

At the time of the investigation, the Site was vacant and overgrown with vegetation. Evidence of fill (gravel, concrete, asphalt) could be observed on the ground surface. The surrounding blocks in the area were in a similar condition. There was also tree line along the north perimeter of the Site where a steep slope was also observed leading from the site down to the ditch directly to the south of Rideau Street.

GHD observed three existing groundwater monitoring wells and one hydrogeological testing well on the Site. One of these wells was confirmed as MW7-08 installed by CRA in 2008. Based on the position of the hydrogeological testing well adjacent to MW7-08, GHD believes this is TW-2 installed by Capital Water Supply Ltd. in 1993 as discussed in Golder's Hydrogeological report for the Site. It appeared that minimal to no fill placement has occurred around these well locations since 2008. The details of the remaining two existing wells on Site could not be confirmed.

The Site topography is relatively flat with various small mounds of fill material, sloping down to the surrounding streets. The surrounding topography slopes up from south to north by approximately 3.5 meters from Rideau Street to the section of Somme Street south of the Site. The Site elevation is higher compared to the surrounding streets varying from approximately 0.2 metres (m) higher on the south side (Somme Street) to 4.0 m higher on the north side (Rideau Street). There was also a ditch along the south, west, and north perimeters of the Site.

The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site.

GHD's understanding of the proposed building is based on a sketch provided by the client shown on the Borehole Location Plan provided in Figure 2.

It is our understanding that the proposed new building will consist of an approximately 50,000 square feet (sf) warehouse on the eastern portion of the Site, connected to an approximately 20,000 sf cross dock on the western portion with approximately 1,500 sf of associated office space.

The location of the Site is shown on the Site Location Plan attached as Figure 1

3. Field Investigation

3.1 Borehole Drilling

The drilling component of this Geotechnical Investigation consisted of the advancement of four boreholes and one Dynamic Cone Penetration Test (DCPT), denoted as BH1 to BH4 and DCPT5. Boreholes were advanced to depths ranging from 11.1 to 14.9 meters below ground surface (mbgs). The DCPT test was advanced to refusal encountered at 5.9 mbgs. Borehole BH1 was outfitted with a monitoring well to monitor the groundwater level. The location of the boreholes is shown in the Borehole Location Plan attached as Figure 2 at the end of this report.

The borehole drilling fieldwork program was undertaken on August 6 and August 7, 2020, with a track mounted drill rig, under the supervision of GHD field staff. Boreholes were advanced into the overburden using Standard Penetration Tests (SPTs) at regular intervals using a 50 millimetres (mm) diameter split-spoon sampler and a 63.5 kilogram (kg) hammer, free falling from a distance of 760 mm, to collect soil samples. The number of drops required to drive the sampler 0.3 m is corrected for a hammer weight of 63.5 kg and recorded on the borehole logs as "N" value. Boreholes were backfilled with combination of sand, bentonite, and auger cuttings.

Dynamic Cone Penetration Test was completed in one location to record continues penetration test within the fill layer.

General descriptions of the subsurface conditions are summarized in the following sections, with a graphical representation of each borehole on the Borehole Logs. Notes on Boreholes are provided in Appendix A, at the end of this Report.

3.2 Surveying

Geodetic ground surface elevations were collected by GHD field staff with a Leica 1200+ Real-Time-Kinematic (RTK) GPS survey system. The elevations of the boreholes are for use within the context of this report only.

3.3 Laboratory testing

Laboratory testing on recovered soil samples included four hydrometer grain size analysis, two Atterberg limit tests, and moisture contents on all collected samples. One collected rock core sample were selected for Unconfined Compressive Strength (UCS) testing. The results from the testing assisted in the subsoil descriptions provided below in Section 4 and on the borehole logs. The laboratory test results are also provided in Appendix B, at the end of this report.

Analytical testing was also carried out on a soil sample collected to determine corrosion potential of the subsurface soils at each site. The results of the corrosion testing are provided in Section 6.8.

4. Subsurface Conditions

In general, soils encountered at the borehole locations consisted of thick layer of fill material overlying a native silty sand to sandy silt deposit followed by a glacial till. Limestone bedrock with interbedded sandstone was encountered at depths ranging from 8.2 (BH1) to 11.9 mbgs (BH3).

General descriptions of the subsurface conditions are summarized in the following sections, with a graphical representation of each borehole on the Borehole Logs. Notes on Boreholes are provided in Appendix A, at the end of this Report.

4.1 Fill

The fill material encountered at the site consisted of a mixture of sand, silt, clay, and gravel. The composition of the fill material varied with depth and borehole location. The upper 3.0 m of the fill material ranged from a silty sand to gravel to silty clay. Cobbles and possible boulders were encountered in the boreholes at varying depths. Buried asphalt was also noted at the BH3 and BH4 locations.

The thickness of the fill at the borehole locations was approximately 6.0 m. The fill material was found to be loose to compact in compactness state and was recovered in a damp condition becoming moist to saturated with depth. Blow counts within the fill material ranged from weight of hammer within the clay material encountered at the BH2 location to greater than 50 in sand and gravel granular material.

One shear vane test was performed within the clay fill material at the BH2 location with a recorded shear strength of 50 kilopascal (kPa).

The results of the grain size analysis and Atterberg Limits completed on selected fill samples are summarized in Tables 1 and 2, respectively.

Table 1 ***Grain Size Analysis Results - Native***

Borehole/Sample Identification	Depth (mbgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH1/SS3	1.5 – 2.1	51	43	5	1
BH2/SS4	2.3 – 3.0	1	2	36	61
BH2/SS7	4.6 – 6.1	25	38	29	8

Table 2 ***Atterberg Limit Test Results - Native***

Borehole/Sample Identification	Depth (mbgs)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Natural Water Content (%)	Liquidity Index
BH2/SS4	2.3 – 3.0	69	21	48	56	0.73

The laboratory test results are also provided in Appendix B, at the end of this report.

4.2 Sandy Silt/Silty Sand

Below the fill material a native deposit of sandy silt to silty sand with varying amounts of clay and gravel was encountered. Cobbles and possible boulders are expected within this deposit becoming more frequent with depth. The deposit was found in a compact state and recovered in a moist condition becoming saturated below the groundwater table. The deposit extended to depths ranging from 8.2 (BH1) to 11.9 mbgs (BH3). Recorded N values within this deposit ranged from 12 to greater than 50.

The result of the grain size analysis completed on one selected sample from the native deposit is provided in the Table 3. The laboratory test results are also provided in Appendix B, at the end of this report.

Table 3 ***Grain Size Analysis Results - Native***

Borehole/Sample Identification	Depth (mbgs)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH3/SS10	6.9 – 7.5	8	47	37	8

4.3 Sandy Clay

A deposit of sandy clay was encountered below the native sandy silt at the historical B5-1 location. The material was very soft and in a moist condition. This material was not encountered within the new borehole locations as part of this investigation.

4.4 Silty Clay

Below the fill material and the native sandy clay (B5-1) was a native silty clay deposit. The deposit was encountered at depths ranging from 4.6 (B5-2) to 7.3 (B5-1) mbgs (2009). The deposit was firm becoming very stiff with depth and was recovered in a moist to wet condition. This material was not encountered within the new borehole locations as part of this investigation. Refusal was encountered within this deposit in the previous studies.

4.5 Bedrock

Limestone bedrock with interbedded sandstone was encountered at depths of 8.2 m (BH1), 9.3 m (BH2), and 11.9 m (BH3). Borehole BH4 was terminated upon refusal at a depth of 11.1 m on inferred bedrock. The bedrock quality varied with depth and location; the recorded Rock Quality Designation (RQD) ranged between 37 percent to 90 percent. The unconfined Compressive Strength (UCS) test results completed on a selected rock core sample (BH2-RC1) shows a compressive strength of 125.2 megapascal (MPa). The lab test results are provided in Appendix B of this report.

4.6 DCPT Results

The results of the DCPT test show the upper 5.9 m of the material is in loose to compact condition based on blow counts of less than 10 up to 20.

5. Groundwater

Three existing groundwater monitoring wells were present on site. One well was confirmed as MW7-08. The details of the other two wells are unknown.

One additional monitoring well was installed as part of the scope of work for this investigation. Groundwater levels were measured on August 18, 2020, at the monitoring wells. The following Table 4 shows the measured water levels.

Table 4 Groundwater Observations

Borehole ID (Year of Install)	Depth of Water (mbgs)	Groundwater Elevation (m)
BH1 (GHD 2020)	4.0	86.9
MW7 (CRA 2008)	3.3	87.5
Northwest well (Unknown)	3.3	87.6
Northeast well (Unknown)	3.5	86.8

These levels indicated the water is within the fill material. It should be noted that the groundwater table is subject to seasonal fluctuations and in response to precipitation and snowmelt events. Also, it would be expected that water may be perched within the fill materials, especially during and following periods of precipitation and in the spring and fall or other wet seasonal periods.

6. Discussion and Recommendations

The recommendations in this report are based on GHD's understanding of the proposed development, which is outlined as follows:

- A new approximately 50,000 sf warehouse on the west portion of the Site.
- An approximately 20,000 sf cross dock connected to the east face of the warehouse.
- Approximately 1,500 sf of office space connected to the south face of the cross dock.
- No underground levels are planned for the proposed structure.
- Structure will be slab-on grade construction.
- No information is available regarding the proposed finish grade for the new building.

Based on our understanding of the proposed development, the subsurface conditions encountered in the boreholes, and assuming them to be representative of the subsurface conditions across the Site, the following recommendations are provided. The most important geotechnical considerations for the design of the proposed building are the following:

- **Fill Material |** An approximately 6.0 m thick layer of fill is present throughout the Site. The composition of the fill material varies with depth borehole location. Buried asphalt was also noted in the fill material at various locations. The fill material in its current state is not suitable to support shallow foundations for the proposed structure. Soil improvement techniques may be an option; however, consultation with specially soil improvement contractors will be required. Refer to Section 6.3.1 of the Report for preliminary comments for soil improvement.
- **Presence of Cobbles and Boulders |** Obstructions to SPT were encountered within the fill material as well as within the native deposit overlying the bedrock. The obstructions are assumed to be possible cobbles or boulders. The presence of cobbles and boulder could make driving piles difficult; contractors should account for this if a deep foundation option is preferred. It is recommended that during the detailed design additional investigation by means of test pit excavation be carried out to further determine the nature of the obstructions.
- **Dewatering |** GHD has not been provided the proposed final grade of the new warehouse structure. If excavations will extend below the measured groundwater level of approximately 3.5 mbgs, groundwater infiltration into the excavations is expected. The water quantities expected to enter open excavations during construction will depend on seasonal conditions, depth of excavations, and the duration that excavations are left open. Hydrogeological assessment to estimate the extent of dewatering activities and determine whether a

Permit to take water (PTTW) or submission on the Ontario Environmental Activity and Site Registry (EASR) may be required.

- **Slope Stability |** The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site. Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factor of safety for the slope may be equal or slightly below (i.e., 1.4 under static condition and 1.0 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static. GHD must be provided a topographic survey plan for the existing slope and the proposed finish grade at the detailed design stage to determine the design setback allowance for the building. It is noted that the condition of the slope must be monitored during site preparation and building construction.

6.1 Site Preparation

6.1.1 Building Footprints

Site preparation within the building footprint will depend on design finish grade and preferred foundation option. If shallow foundations are preferred, the existing fill within the building footprint will need to be improved using site specific ground improvement techniques. Refer to Section 6.3.1 of this Report for preliminary comments regarding ground improvement of the existing fill material.

If deep foundations are selected, excavations for the pile caps will need to extend below frost depth below finish grade of 1.5 m if the building is heated and 1.8 m for unheated or isolated structures. A suitable compact soil subgrade is required for pile cap construction. Pile caps should not be constructed on disturbed or loose subgrade. The exposed subgrade should be examined by Geotechnical personnel prior to pile cap installation. Any loose or disturbed material should be removed and replaced with suitable fill material meeting the requirements of Engineered Fill as per Section 6.10 of this report.

6.1.2 Heavy Duty Road

GHD anticipates the Site will require heavy duty roads for the heavy truck traffic to and from the warehouse. Due to the presence of the uncontrolled fill material, improvement of the road subgrade may be required. Improvement methods may include:

- Additional compaction of the subgrade soils.
- Soil improvement methods such as Dynamic Compaction discussed in Section 6.3.1
- Placement of a thicker road base and/or subbase.
- Strengthening the subgrade using geosynthetic materials like TriAx or Biaxial geogrides.
- Or a combination of these options may be implemented depending on the design requirements for the access roads.

6.1.3 Underground Services

Depending on the final site grades subgrade improvement may also be required for underground services. Improvement methods may be similar to the options provided for the heavy-duty roads above.

6.2 Excavation and Dewatering

The following are general comments regarding the excavations and dewatering requirements, as the depth of the excavations and dewatering requirements are dependent on final grades and foundation option selected.

Roadway construction debris including concrete, and asphalt is expected within the fill material. This debris was also observed on the surface at the time of GHD's Site visit. The walls of the excavations must also be sloped at a minimum of 1H:1V as per the Occupational Health and Safety Act (OHSA) requirements for Type 3 soils (fill) or supported by temporary shoring.

Unsupported side slopes should be adjusted depending on the true subsoil and groundwater conditions encountered during excavation work and flatter side slopes than those mentioned above may be required locally.

During the excavation, no excavated material should be piled, nor machinery or equipment placed, closer than the distance equivalent to the depth of the excavations. Furthermore, no vertical un-braced excavations should be performed in the soil. In addition, the exposed subsoils should be protected against erosion from water run-off or rain.

The stability and safety of unsupported excavation slopes remain the responsibility of the contractor at all times.

It is recommended that the client's design team include in the specification package, requirements for the successful contractor to submit written Plans for Excavation as well as Soil and Groundwater Management for review by the client design team.

A hydrogeological assessment of this Site was not part of the scope of work for this investigation. If excavations will extend below the measured groundwater level of approximately 3.5 mbgs, groundwater infiltration into the excavations is expected. The water quantities expected to enter open excavations during construction will depend on seasonal conditions, depth of excavations, and the duration that excavations are left open. Hydrogeological assessment to estimate the extent of dewatering activities and determine whether a Permit to take water (PTTW) or submission on the Ontario Environmental Activity and Site Registry (EASR) may be required.

6.3 Foundations

The foundation options for the proposed building depend upon proposed final grade elevations for the structure and design loadings. The suggested options and preliminary recommendation for the foundations for the warehouse are provided in the following sections.

6.3.1 Shallow Foundation- Soil Improvement

Deep fill layers were encountered in all boreholes drilled on site. Fill thickness, composition and compactness/consistency varies with depth and location; therefore, soil improvement is required to allow for the use of shallow foundations for this project.

The recommended soil improvement method at this time is Dynamic Compaction performed by specialty contractors. This method of soil improvement and use of shallow foundations may be a cost-effective alternative to deep foundation. It is however noted that the suitability of this method for the site condition should be evaluated by the specialty contractors.

This method will compact the existing fill material using a crane that repeatedly drops a 15 to 20 ton weight in a closely spaced grid pattern across the site, creating a uniformly compacted subgrade. In the areas with softer cohesive soils, the addition and compaction of imported granular material may be required to further strengthen the soil.

Following completion of the compaction, the contractor will perform on site pressure meter tests in the compacted areas to confirm that the design bearing capacity has been achieved or whether additional compaction is required.

Further discussion and field investigations with the specialty contractors will be required to evaluate this improvement option for this Site and to provide the estimated cost to complete the work and provide the achievable design bearing capacity.

GHD also recommends the structural engineer for the project be consulted to provide the design loadings for the structure.

6.3.2 Deep Foundations

Drilled piles (Micro piles) or drilled cast-in-place concrete piles (caissons) are feasible options to support the proposed warehouse. In both cases, the piles should be designed relying on shaft friction only due to presence of groundwater and inability to provide a clean base end bearing piles are not recommended.

Due to presence of obstructions identified as possible cobbles and boulders within the fill material and within the native soils driven piles such as H-Piles are not considered suitable for this site. The nature of the obstructions can be further investigated by excavating test pits at the time of detailed design to decide whether driven piles can be an option.

6.3.2.1 Drilled Deep Foundation

Depending on the required bearing capacities drilled piles supported within the native soils or bedrock can be an option to support the proposed structure; it is noted that to evaluate the suitability of the piles supported on or within the native soils, discussion with structural engineer will be require. Therefore, this option can be further reviewed once the design loads are provided.

Caissons supported on bedrock surface can be designed using a recommended bearing capacity of 1,000 kPa under Ultimate Limit State (ULS). Due to the presence of groundwater and cohesionless soils, a permanent steel casing set into the bedrock will be required for the cast-in-place piles. The total loads for the caissons must have the Resistance Factor of 0.4 applied to the value to provide the factored ULS value as per Table 8.1 of CFEM.

Caissons or micro-piles socketed into bedrock will provide some increased bearing capacity, however as mentioned above due to anticipated groundwater infiltration and the inability to provide a 'clean' pile base, the recommended design approach is to rely on shaft friction only using methods outlined in CFEM Section 18.6.4.

For caissons/micro-pile designed as friction piles deriving frictional forces from bedrock the method outlined in Section 18.6.4.2 and formula 18.44 of CFEM is recommended which is:

- $Q_s = \pi B_s L_s q_s$ Equation 18.4.3 (CFEM)

where:

- B_s = diameter of the socket
- L_s = length of socket

And

- $q_s/P_a= b(q_u / P_a)^{0.5}$ Equation 18.44 (CFEM)

where:

- q_s = socket shear, kPa
- q_u –unconfined compressive strength of bedrock where UCS is less than f'_c or q_a= 0.05f'c, where UCS is higher than f'_c in kPa
- f'_c = concrete compressive strength, kPa
- b = empirical factor, assume as 1.41 for Limit State design approach
- P_a = atmospheric pressure, assume 101.5 kPa

The unconfined compressive strength of the bedrock from the UCS test performed on the core sample from BH2/RC1 location was 125.2 MPa.

For this Site, values of shaft adhesion will be limited by concrete compressive strength. Therefore, the formula $q_a=0.05f'_c$ must be used in the above equation. As an example, a design concrete strength of 30 megapascal (MPa) would result in a design shaft resistance of 550 kPa.

Designers can select economical socket length for the caisson based upon the formulas. The total loads for the caissons must have the Resistance Factor of 0.4 applied to the value to provide the factored ULS value as per Table 8.1 of CFEM.

Frictional forces derived from the existing fill and native soils are likely to be minimal, accordingly these have been neglected.

6.4 Seismic Site Classification

GHD understands that the proposed building will be governed by Part 4 of the Ontario Building Code (OBC-2012), and therefore will require a site classification for seismic site response.

Based upon the borehole information for the Site, a Site Classification 'D', with respect to Table 4.1.8.4.A of the National Building Code of Canada 2015 is recommended if deep foundations are used with pile caps placed on the existing unimproved fill.

A higher Site Classification 'C' may be achievable if the existing fill material is improved.

6.5 Floor Slabs

As discussed in Section 4 of this letter, approximately 6 m of fill material was encountered in boreholes drilled as part of this investigation.

The uncontrolled fill material may not be suitable to support a slab-on-grade construction and therefore following options are suggested regarding the floor slab design and construction:

– The use of a structural slab can be considered.

– Soil improvement methods may allow construction of slab on grade however this would require detailed discussion with soil improvement contractors.

6.6 Frost Protection

All exterior footings associated with the heated buildings must be provided with at least 1.5 m of soil cover or its equivalent in insulation, in order to provide adequate protection against detrimental frost action. This cover depth requirement must be increased to 1.8 m for footings for unheated or isolated structures such as signs, entrance canopy, or piers.

Should construction take place during winter, the exposed surfaces to support foundations must be protected by Contractors against freezing.

6.7 Permanent Drainage

6.7.1 Underfloor Drainage-Slab-on-Grade – No Basement

Under floor drains are not considered necessary for a structure without basement and a floor slab set above the groundwater table. However, the drainage requirements must be re-evaluated once final design grades and proximity to the water table are determined.

6.7.2 Perimeter drainage

For the proposed building with no basement or underground level and based on the Site subsurface condition, perimeter drainage around the exterior of the walls of the proposed building is not considered necessary. However, the drainage requirements must be re-evaluated once final design grades and proximity to the water table are determined.

6.8 Corrosion Potential of Soils

Analytical testing was carried out on a soil sample collected to determine corrosion potential of the subsurface soils at each site. The selected soil sample was tested for pH, resistivity, chlorides, and sulphides, sulphates, and redox potential. The test results are summarized in the following table.

Table 5 Corrosion Parameter Results

Sample ID	MW4
pH	8.66
Resistivity (ohm-cm)	1920
Sulphate (%)	0.08
Chloride (%)	0.008
REDOX Potential (mV)	205
Sulphide (µg/g)	<0.20

The American Water Works Association (AWWA) publication 'Polyethylene Encasement for Ductile-Iron Pipe Systems' ANSI/AWWA C105/A21.5-10 dated October 1, 2010, assigns points based on the results of the above tests. Soil that has a total point score of 10 or more is considered to be potentially corrosive to ductile iron pipe. Based on the results obtained for the sample submitted, the Site soils are not considered to be potentially corrosive to cast iron pipe.

Table 3 of the Canadian Standards Association (CSA) document A23.1-04/A23.2-04 'Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete' divides the degree of exposure into the following three classes:

Table 6 Classes of Exposure

Degree (Class) of Exposure	Water Soluble (SO_4) in Soil Sample (%)
Very Severe (S-1)	>2.0
Severe (S-2)	0.20 - 2.0
Moderate (S-3)	0.10 - 0.20

A review of the analytical test results shows the sulphate content in the tested samples was found to be less than 0.08 percent. Based upon the test results, the degree of exposure of the subsurface concrete structures to sulphate attack is low. Therefore, normal General Use (GU) hydraulic cement can be used for the below grade concrete structures.

6.9 Slope Stability

The historic fill placement at the Site has created sloping of approximately 2:1 (H:V) around the south, west, and north perimeters of the Site.

A slope stability assessment was performed for the existing slope along the north perimeter of the Site. GHD's understanding of the existing slope conditions is based on Site observations and field measurement. Analysis was performed on the existing slope under static condition and pseudo-static (i.e., seismic) conditions considering drained soil conditions.

The slope stability analysis was carried out using the SLOPE/W 2019 software package produced by GEO-SLOPE International Ltd. Each trial was modeled using the Morgenstern-Price method, and the optimized critical slip-surface was selected. In general, this approach calculates a factor of safety that represents the ratio of forces resisting a failure (i.e., shear strength, friction, etc.) to those favouring failure (weight, external loading, etc.). Theoretically, a factor of safety of 1.0 would represent a stable slope. However, the City of Ottawa recommends a minimum factor of safety of 1.5 under static condition and 1.1 under pseudo-static conditions.

The selected geotechnical parameters for the Site soils used in the analysis is summarized in Table 7 below.

Table 7 Geotechnical Parameters - Existing Slope

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Internal Friction Angle (°)
Existing Fill – Clayey Silty Sand	19	3	30
Existing Fill- Sand	19	0	30
Existing Fill- Clay	17	3	25
Native Silty Sand/Sandy Silt	20	0	30
Bedrock	N/A (Considered Impenetrable)		

A summary of the analyses is shown in Table 8 below, with the analysis for each condition provided in Appendix C at the end of this report.

Table 8 Summary of Analyses

Borehole Location	Condition (Drained)	Factor of Safety
BH1	Static	1.3
	Pseudo Static	0.9
BH2	Static	1.6
	Pseudo Static	1.1

Based on the preliminary slope stability analysis, depending on the composition and compactness state of the fill material, the factor of safety for the slope may be equal or slightly below (i.e., 1.3 under static condition and 0.9 under pseudo-static condition) the recommend values of 1.5 for static condition and 1.1 for pseudo-static condition. If the existing slopes are to remain on the Site, some slope remediation or adjustment may be required depending on the proposed structure location and distance from the slope. GHD must be provided a topographic survey plan for the existing slope and the proposed finish grade at the detailed design stage to determine the design setback allowance for the building and revise or confirm analysis. It is noted that the condition of the slope must be monitored during site preparation and building construction.

6.10 Backfill

The placement and compaction of the materials that will support pavement, floor slab, or footings must be treated as Engineered Fill.

6.10.1 Engineered Fill

The fill operations for Engineered Fill must satisfy the following criteria:

- Engineered Fill must be placed under the continuous supervision of the Geotechnical Engineer.
- Prior to placing any Engineered Fill, all unsuitable fill materials must be removed, and the subgrade proof rolled, and approved. Any deficient areas should be repaired.
- Prior to the placement of Engineered Fill, the source or borrow areas for the Engineered Fill must be evaluated for its suitability. Samples of proposed fill material must be provided to the Geotechnical Engineer and tested in the geotechnical laboratory for Standard Proctor Maximum Dry Density (SPMDD) and grain size, prior to approval of the material for use as Engineered Fill. The Engineered Fill must consist of environmentally suitable soils (as per industry standard procedures of federal or provincial guidelines/regulations), free of organics and other

deleterious material (building debris such as wood, bricks, metal, and the like), compactable, and of suitable moisture content so that it is within -2 percent to +0.5 percent of the Optimum Moisture as determined by the Standard Proctor test. Imported granular soils meeting the requirements of Granular 'A', or Type II OPSS 1010 criteria would be suitable.

- The Engineered Fill must be placed in maximum loose lift thicknesses of 0.2 m. Each lift of Engineered Fill must be compacted with a heavy roller to 100 percent SPMDD.
- Field density tests must be taken by the Geotechnical Engineer, on each lift of Engineered Fill. Any Engineered Fill, which is tested and found to not meet the specifications, shall be either removed or re-compacted and retested.

6.10.2 Exterior Foundation Wall Backfill

Where applicable and/or if necessary, any backfill placed against the foundation walls should be free draining granular materials meeting the grading requirements of OPSS 1010 for Granular 'B' Type I specifications up to within 0.3 m of the ground surface. The upper 0.3 m should be a low permeable soil to reduce surface water infiltration. Foundation backfill should be placed and compacted as outlined below.

- Free-draining granular backfill should be used for the foundation wall.
- Backfill should not be placed in a frozen condition or placed on a frozen subgrade.
- Backfill should be placed and compacted in uniform lift thickness compatible with the selected construction equipment, but not thicker than 0.2 m. Backfill should be placed uniformly on both sides of the foundation walls to avoid build-up of unbalanced lateral pressures.
- At exterior flush door openings, the underside of sidewalks should be insulated, or the sidewalk should be placed on frost walls to prevent heaving. Granular backfill should be used and extended laterally beneath the entire area of the entrance slab. The entrance slab should slope away from the building.
- For backfill that would underlie paved areas, sidewalks or exterior slabs-on-grade, each lift should be uniformly compacted to at least 98 percent of its SPMDD.
- For backfill on the building exterior that would underlie landscaped areas, each lift should be uniformly compacted to at least 95 percent of its SPMDD.
- In areas on the building exterior where an asphalt or concrete pavement will not be present adjacent to the foundation wall, the upper 0.3 m of the exterior foundation wall backfill should be a low permeable soil to reduce surface water infiltration.
- Exterior grades should be sloped away from the foundation wall, and roof drainage downspouts should be placed so that water flows away from the foundation wall.

6.11 Construction Field Review

The recommendations provided in this report are based on an adequate level of construction monitoring being conducted during construction phase of the proposed building. GHD requests to be retained to review the drawings and specifications, once complete, to verify that the recommendations within this report have been adhered to, and to look for other geotechnical problems. Due to the nature of the proposed development, an adequate level of construction monitoring is considered to be as follows:

- Prior to construction of footings, the exposed foundation subgrade should be examined by a Geotechnical Engineer (GE) or a qualified Technologist acting under the supervision of a GE, to assess whether the subgrade conditions correspond to those encountered in the boreholes and test pits, and the recommendations provided in this report have been implemented.
- A qualified Technologist acting under the supervision of a GE should monitor placement of Engineered Fill underlying floor slabs.

- Backfilling operations should be conducted in the presence of a qualified Technologist on a part-time basis, to ensure that proper material is employed, and specified compaction is achieved.
- Placement of concrete should be periodically tested to ensure that job specifications are being achieved.
- Piling operations should be monitored on a full-time basis by a qualified Technologist to verify pile installation and socket into bedrock and verticality.

7. Limitation of the Investigation

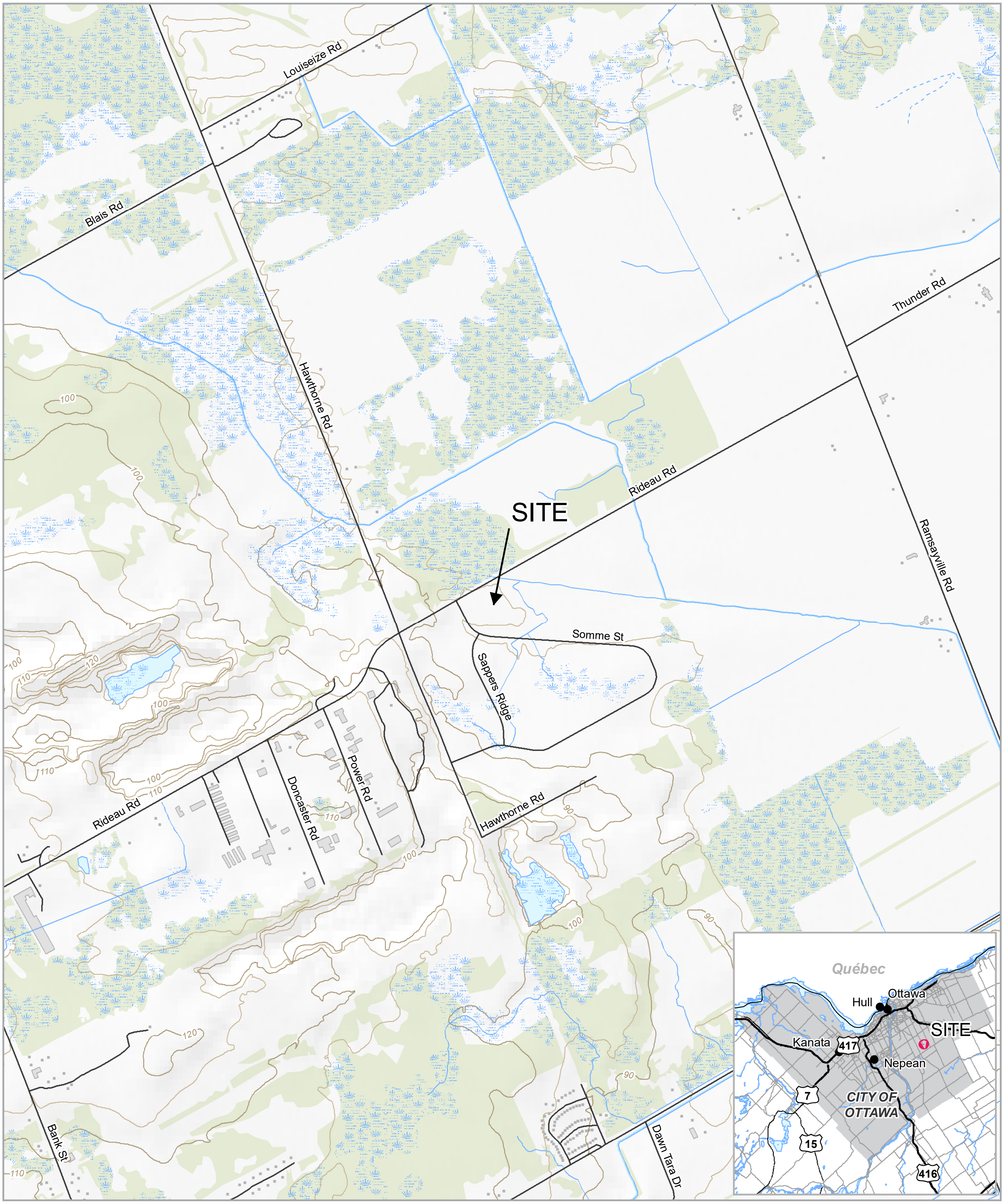
This Report is intended solely for Consolidated Fastfrate (Ottawa) Holdings Inc and other party explicitly identified in the report and is prohibited for use by others without GHD's prior written consent. This Report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. The Client shall defend, indemnify, and hold GHD harmless from any liability arising from or related to Client's unauthorized distribution of the report. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

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

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

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

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test hole locations only. The subsurface conditions confirmed at these test locations may vary at other locations. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction, which could not be detected or anticipated at the time of our investigation. Should any conditions at the Site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.



Paper Size ANSI A

0 140 280 420 560

Metres

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

N

GHD

CONSOLIDATED FASTRATE HOLDINGS INC.
NEW WAREHOUSE
INTERSECTION OF RIDEAU STREET AND SOMME STREET
GEOTECHNICAL INVESTIGATION

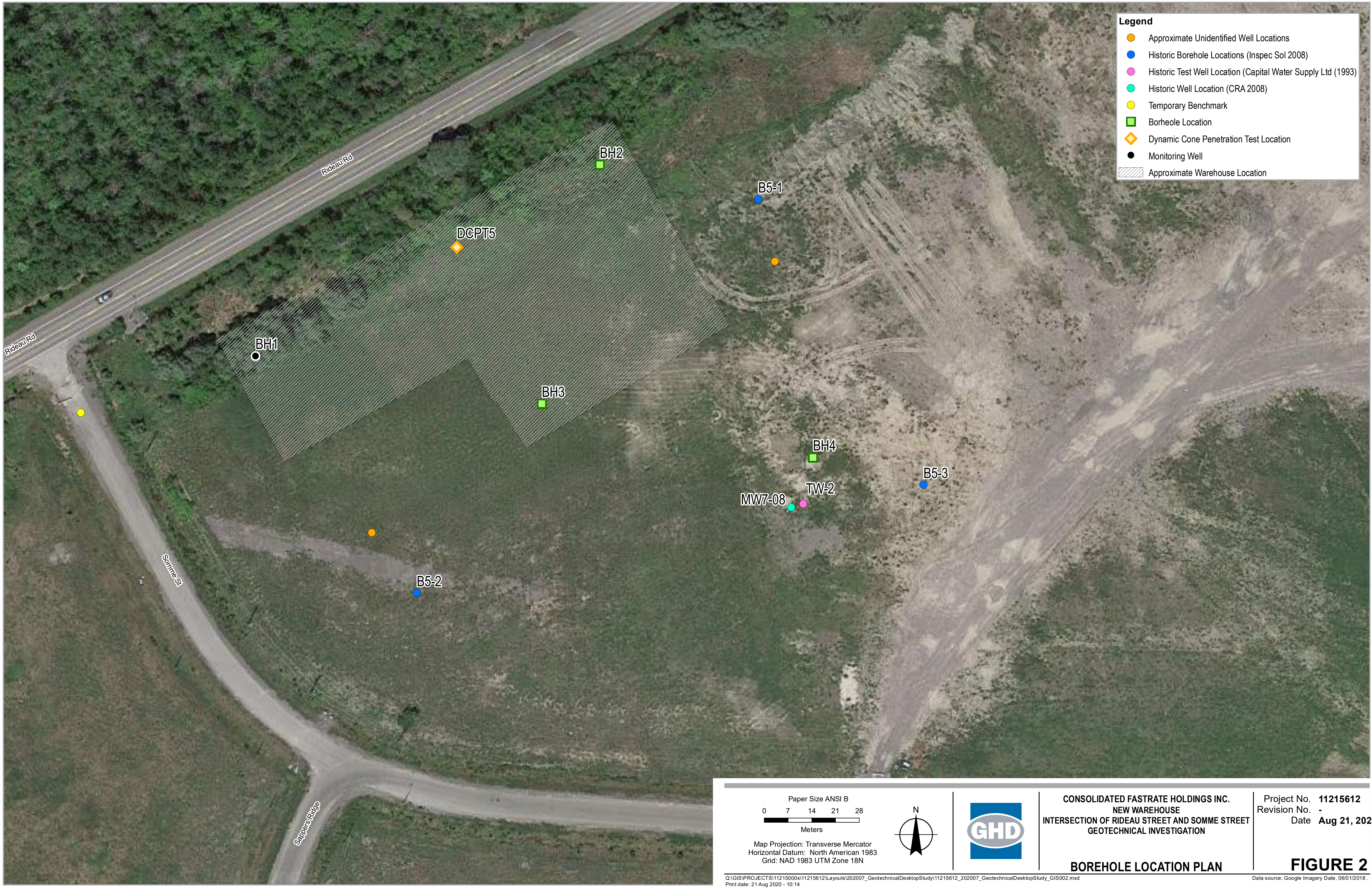
Project No.	**11215612**
Revision No.	**-**
Date	**Aug 21, 2020**

SITE LOCATION MAP

FIGURE 1

Q:\GIS\PROJECTS\11215000s\11215612\Layouts\202007_GeotechnicalDesktopStudy\11215612_202007_GeotechnicalDesktopStudy_GIS001.mxd
Print date: 21 Aug 2020 - 09:16

Data source: MNRF NRVIS, 2017. Produced by GHD under licence from Ontario Ministry of Natural Resources and Forestry, © Queen's Printer 2020.



Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 18N

CONSOLIDATED FASTRATE HOLDINGS INC.
NEW WAREHOUSE
INTERSECTION OF RIDEAU STREET AND SOMME STREET
GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

Project No. **11215612**
Revision No. **-**
Date **Aug 21, 2020**

FIGURE 2

Q:\GIS\PROJECTS\11215000s\11215612\Layouts\202007_GeotechnicalDesktopStudy\11215612_202007_GeotechnicalDesktopStudy_GIS002.mxd
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Data source: Google Imagery Date, 06/01/2018 .

Appendices

Appendix A

Borehole and Test Pit Logs and Notes on Boreholes

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 1

BOREHOLE No.: BH1

ELEVATION: 90.21 m

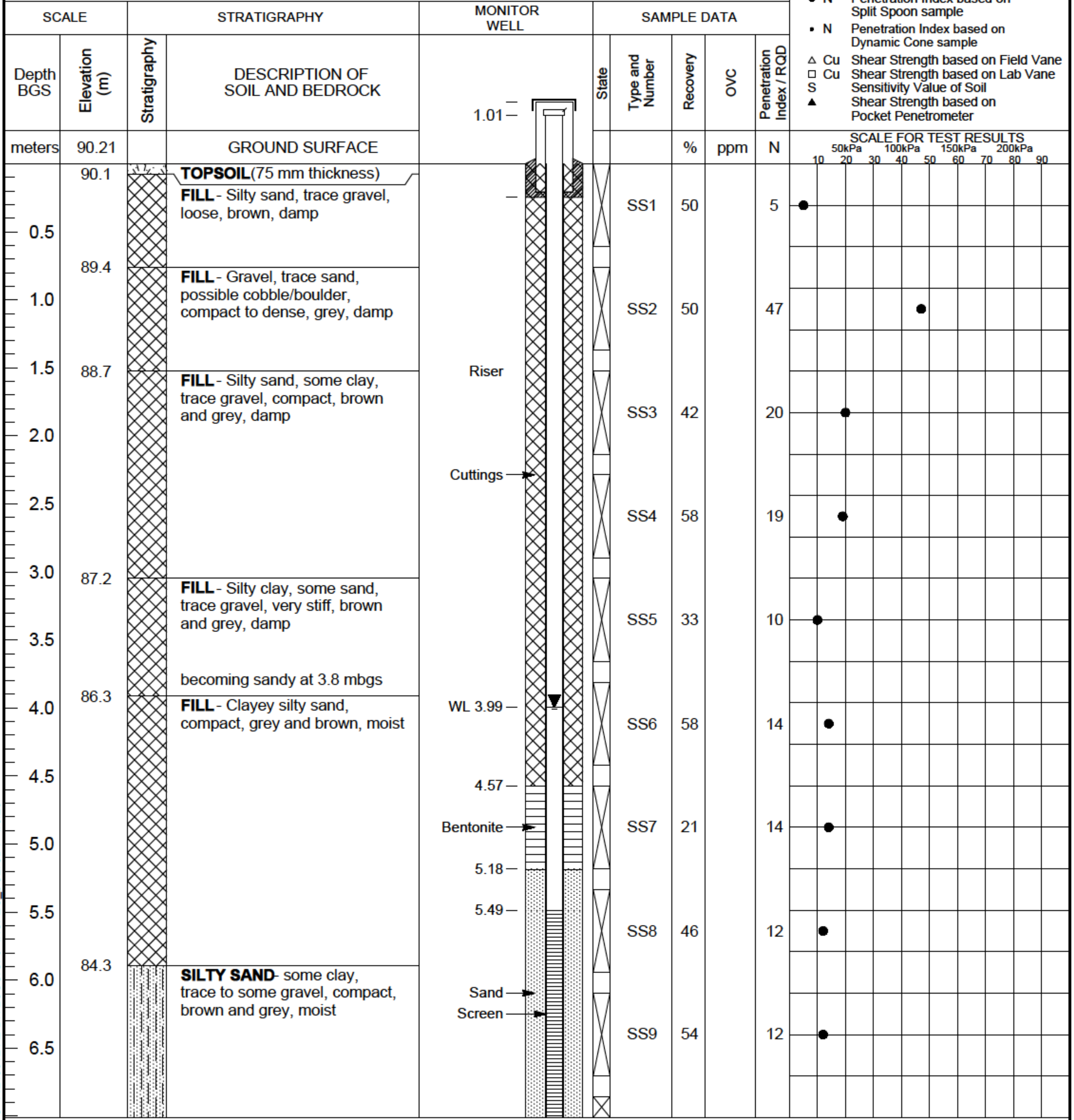
BOREHOLE LOG

Page: 1 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.
PROJECT: New Warehouse
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: RVT
CHECKED BY: BV
DATE (START): 6 August 2020
DATE (FINISH): 6 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer



Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
90.21	GROUND SURFACE
90.1	**TOPSOIL**(75 mm thickness)
	FILL - Silty sand, trace gravel, loose, brown, damp
89.4	**FILL** - Gravel, trace sand, possible cobble/boulder, compact to dense, grey, damp
88.7	**FILL** - Silty sand, some clay, trace gravel, compact, brown and grey, damp
87.2	**FILL** - Silty clay, some sand, trace gravel, very stiff, brown and grey, damp becoming sandy at 3.8 mbgs
86.3	**FILL** - Clayey silty sand, compact, grey and brown, moist
84.3	**SILTY SAND** - some clay, trace to some gravel, compact, brown and grey, moist

Type and Number	Recovery %	OVC ppm	Penetration Index / RQD N
SS1	50		5
SS2	50		47
SS3	42		20
SS4	58		19
SS5	33		10
SS6	58		14
SS7	21		14
SS8	46		12
SS9	54		12

NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 1

BOREHOLE No.: BH1

ELEVATION: 90.21 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

DATE (START): 6 August 2020

DATE (FINISH): 6 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		MONITOR WELL	SAMPLE DATA					SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	OVC	Penetration Index / RQD	
meters	90.21		GROUND SURFACE				%	ppm	N	
			Refusal encountered at 7.2 mbgs Cobbles and boulders encountered from 7.3 to 8.2 mbgs	7.01	☒	SS10	71		50+	● 50
7.5 8.0						RC1	49			
8.5 9.0 9.5	82.0		**LIMESTONE**- interbedded sandstone, grey, fair becoming good quality with depth based on RQD			RC2	94		73	
10.0 10.5						RC3	100		82	
11.0						RC4	100		90	
11.5 12.0 12.5 13.0 13.5	78.9		Borehole terminated at 11.3 mbgs							

NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 2

BOREHOLE No.: BH2

ELEVATION: 89.80 m

BOREHOLE LOG

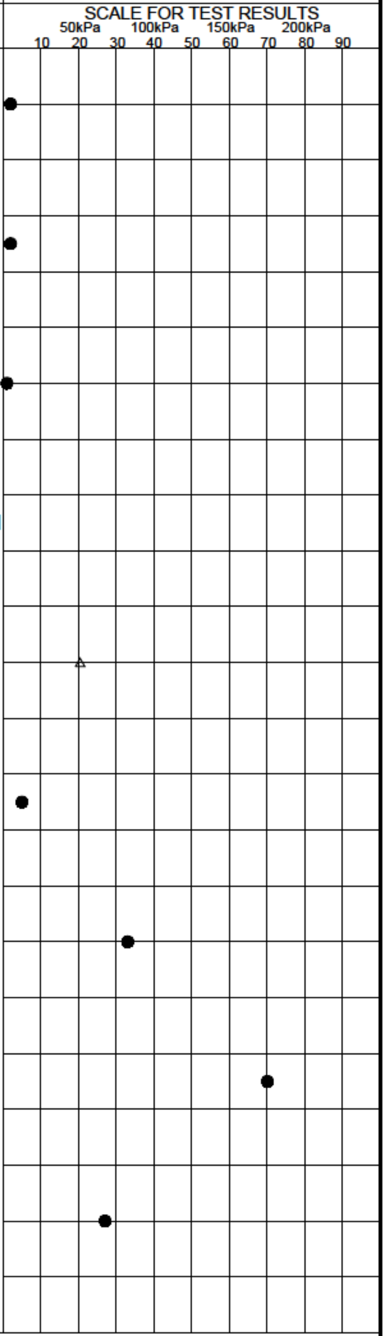
Page: 1 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.
PROJECT: New Warehouse
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: RVT
CHECKED BY: BV
DATE (START): 6 August 2020
DATE (FINISH): 6 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	SAMPLE DATA			
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	89.80	GROUND SURFACE		%	ppm	N
	89.7	**TOPSOIL**(75 mm thickness)				
		FILL - Silty clay, firm to stiff, grey, moist				
			SS1	58		2
0.5						
1.0						
			SS2	100		2
1.5						
			SS3	100		1
2.0						
2.5						
			SS4	100		WH
3.0						
			FV5			
3.5						
	86.0	**FILL** - Clayey sand, some gravel, organics, loose, grey and brown, moist				
4.0						
			SS6	75		5
4.5						
	85.2	**FILL** - Gravelly sandy silt, compact to very dense, brown and grey, saturated				
			SS7	83		33
5.0						
5.5						
			SS8	63		70
6.0						
	83.7	**SILTY SAND**- some gravel, compact to very dense, grey, moist to saturated				
			SS9	100		27
6.5						



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 2

BOREHOLE No.: BH2

ELEVATION: 89.80 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

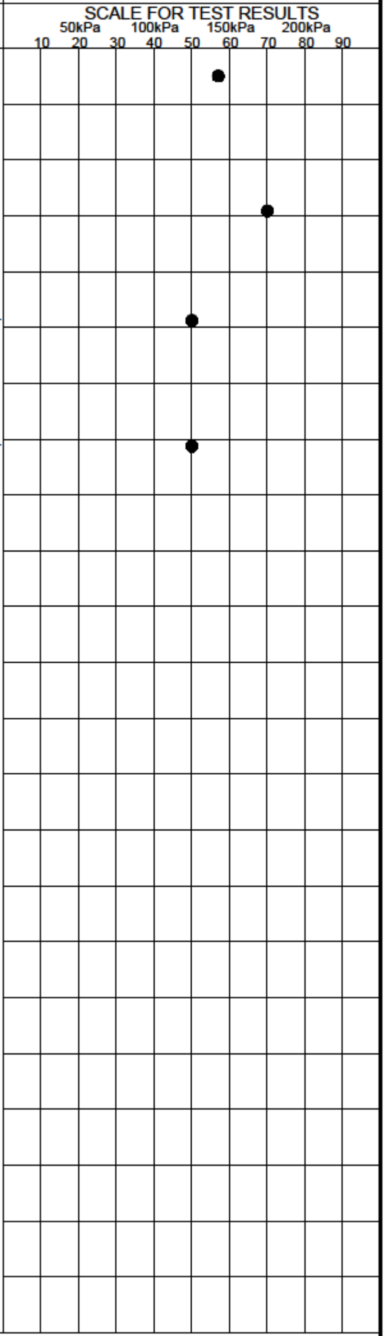
DATE (START): 6 August 2020

DATE (FINISH): 6 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	SAMPLE DATA				
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	89.80	GROUND SURFACE			%	ppm	N
			☒	SS10	83		57
7.5							
			☒	SS11	91		70
8.0							
8.5		Cobbles and boulders encountered from 8.4 to 9.3 mbgs	☒	SS12	100		50+
9.0							
		Refusal encountered at 9.3 mbgs	☒	SS13	100		50+
	80.5	**LIMESTONE**- interbedded sandstone, grey, fair to good quality based on RQD					
9.5							
			▮	RC1	100		85
10.0							
10.5							
			▮	RC2	100		83
11.0							
11.5							
			▮	RC3	100		52
12.0							
	77.6	Borehole terminated at 12.2 mbgs					
12.5							
13.0							
13.5							



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2 ENCLOSURE No.: 3

BOREHOLE No.: **BH3**
ELEVATION: 90.88 m

BOREHOLE LOG

Page: 1 of 3

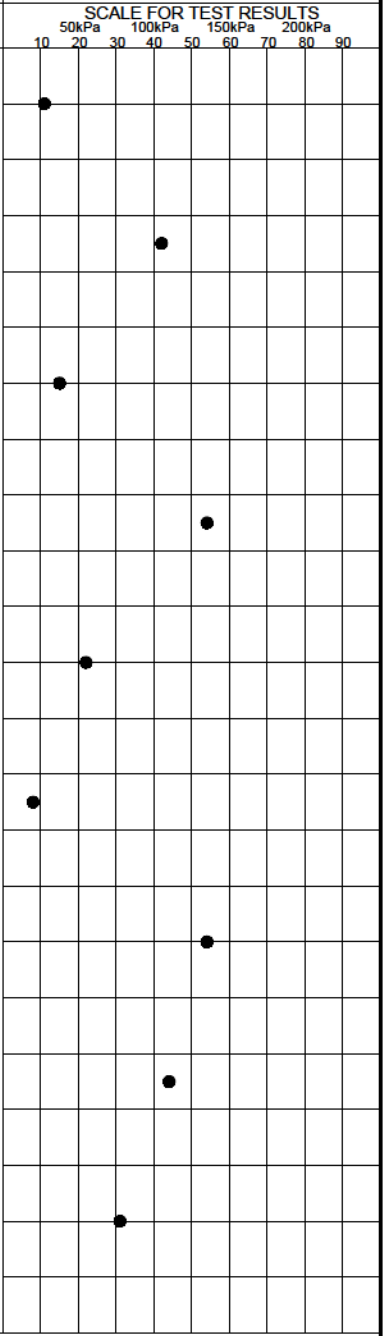
CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.
PROJECT: New Warehouse
LOCATION: Somme Street, Ottawa, ON
DESCRIBED BY: RVT CHECKED BY: BV
DATE (START): 7 August 2020 DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.88		GROUND SURFACE			%	ppm	N
	90.8		**TOPSOIL**(125 mm thickness)					
			FILL - Clayey silty sand, trace to some gravel, compact, brown and grey, damp	☒	SS1	63		11
0.5								
	90.0		**FILL** - Crushed limestone, asphalt, compact, grey and black, damp	☒	SS2	58		42
1.0								
1.5	89.4		**FILL** - Sand, trace gravel, clay pockets, asphalt, compact, grey and black, damp to moist	☒	SS3	38		15
2.0								
	88.6		**FILL** - Silty sand, some gravel, trace clay, possible cobbles/boulders, compact , grey, moist	☒	SS4	33		54
2.5								
3.0	87.8		**FILL** - Clayey sand, asphalt, loose to compact, grey and brown, moist	☒	SS5	33		22
3.5								
4.0				☒	SS6	4		8
4.5	86.3		**FILL** - Silty sand, trace gravel, trace to some clay, dense to very dense, brown and grey, damp to moist, possible cobbles/boulders	☒	SS7	50		54
5.0								
5.5				☒	SS8	33		44
6.0	84.8		**SANDY SILT**- some gravel, compact to very dense, grey, damp	☒	SS9	83		31
6.5								

SCALE FOR TEST RESULTS



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 3

BOREHOLE No.: BH3

ELEVATION: 90.88 m

BOREHOLE LOG

Page: 2 of 3

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

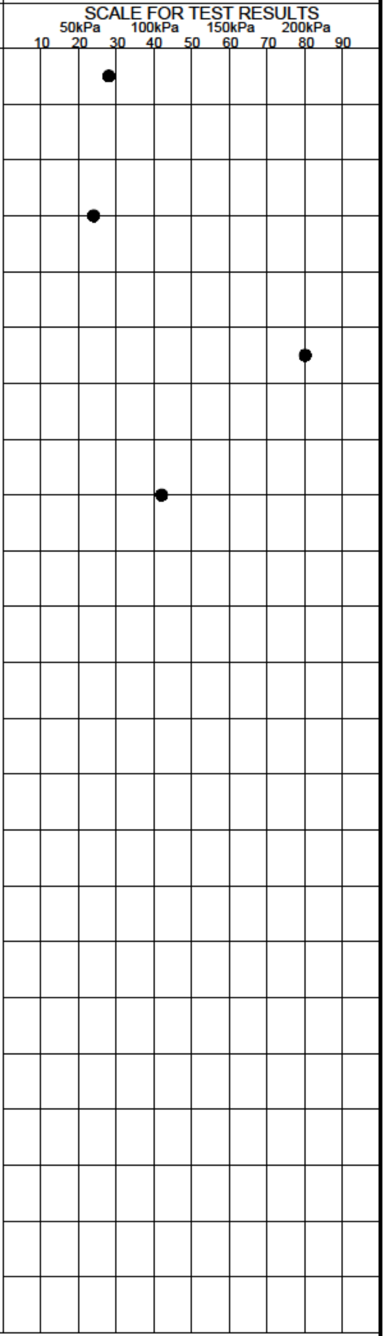
DATE (START): 7 August 2020

DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	SAMPLE DATA				
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.88	GROUND SURFACE			%	ppm	N
			☒	SS10	83		28
7.5							
		Possible cobbles/boulders encountered from 7.6 to 9.1 mbgs					
8.0			☒	SS11	83		24
8.5			☒	SS12	25		80
9.0							
9.5			☒	SS13	100		42
		Refusal encountered at 10 mbgs					
10.0		Cobbles and boulders encountered from 10.0 to 11.9 mbgs					
10.5							
11.0				RC1	32		
11.5							
	79.0	**LIMESTONE**- interbedded sandstone, grey, poor to fair quality based on RQD					
12.0							
12.5				RC2	100		57
13.0							
13.5		Rock core mechanical breaks during coring from 13.4 to 14.9 mbgs					



NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 3

BOREHOLE No.: BH3

ELEVATION: 90.88 m

BOREHOLE LOG

Page: 3 of 3

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

DATE (START): 7 August 2020

DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.88		GROUND SURFACE			%	ppm	N
				▮	RC3	92		37
14.5								
15.0	75.9		Borehole terminated at 14.9 mbgs					
15.5								
16.0								
16.5								
17.0								
17.5								
18.0								
18.5								
19.0								
19.5								
20.0								
20.5								

SCALE FOR TEST RESULTS

50kPa 100kPa 150kPa 200kPa

10 20 30 40 50 60 70 80 90

NOTES:
mbgs: meters below ground surface
RQD: Rock Quality Designation

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 4

BOREHOLE No.: BH4

ELEVATION: 90.44 m

BOREHOLE LOG

Page: 1 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

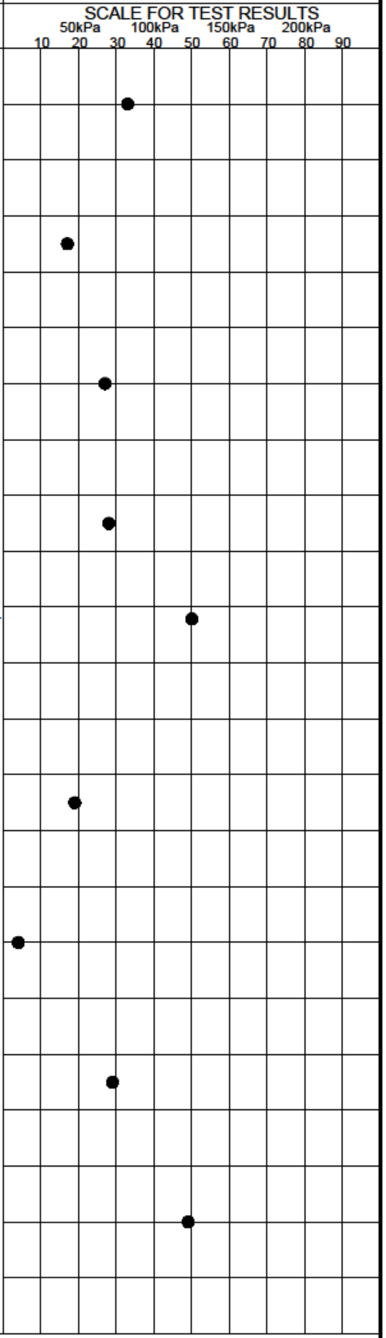
DATE (START): 7 August 2020

DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.44		GROUND SURFACE			%	ppm	N
	90.3		**TOPSOIL**(125 mm thickness)					
		▩	**FILL** - Gravelly sand, compact, grey, damp	☒	SS1	63		33
0.5								
	89.7	▩	**FILL** - Sand and gravel, compact, grey, damp					
1.0				☒	SS2	50		17
1.5								
			Asphalt encountered at 1.5 mbgs	☒	SS3	54		27
2.0								
2.5				☒	SS4	58		28
3.0								
	87.4	▩	**FILL** - Silty sand, trace clay, trace to some gravel, possible cobbles/boulders, brown and grey, damp to moist	☒	SS5	100		50+
3.5								
			Wood encountered at 3.8 mbgs					
4.0				☒	SS6	17		19
4.5								
				☒	SS7	0		4
5.0								
5.5				☒	SS8	75		29
6.0								
	84.3	▒	**SILTY SAND**- trace to some gravel, trace clay, compact to dense, grey and brown, moist	☒	SS9	79		49
6.5								
				☒				



NOTES:
mbgs: meters below ground surface

BOREHOLE LOG 11215612-A2-BH LOGS.GPJ INSPEC_SOL.GDT 4/9/20

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 4

GHD

BOREHOLE No.: BH4

ELEVATION: 90.44 m

BOREHOLE LOG

Page: 2 of 2

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

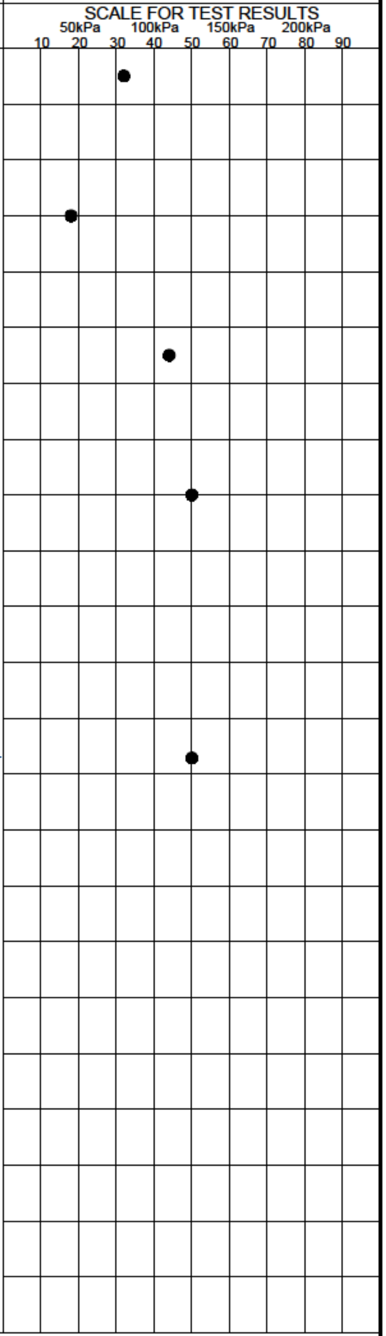
DESCRIBED BY: RVT CHECKED BY: BV

DATE (START): 7 August 2020 DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.44		GROUND SURFACE			%	ppm	N
				☒	SS10	4		32
7.5								
8.0				☒	SS11	58		18
8.5								
				☒	SS12	58		44
9.0								
9.5				☒	SS13	67		50
10.0								
10.5								
11.0				☒	SS14	88		50+
	79.3		Borehole terminated at refusal at 11.1 mbgs					
11.5								
12.0								
12.5								
13.0								
13.5								



NOTES:
mbgs: meters below ground surface

REFERENCE No.: 11215612-A2

ENCLOSURE No.: 5

BOREHOLE No.: DCPT5

ELEVATION: 90.76 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: Consolidated Fastrate (Ottawa) Holdings Ltd.

PROJECT: New Warehouse

LOCATION: Somme Street, Ottawa, ON

DESCRIBED BY: RVT

CHECKED BY: BV

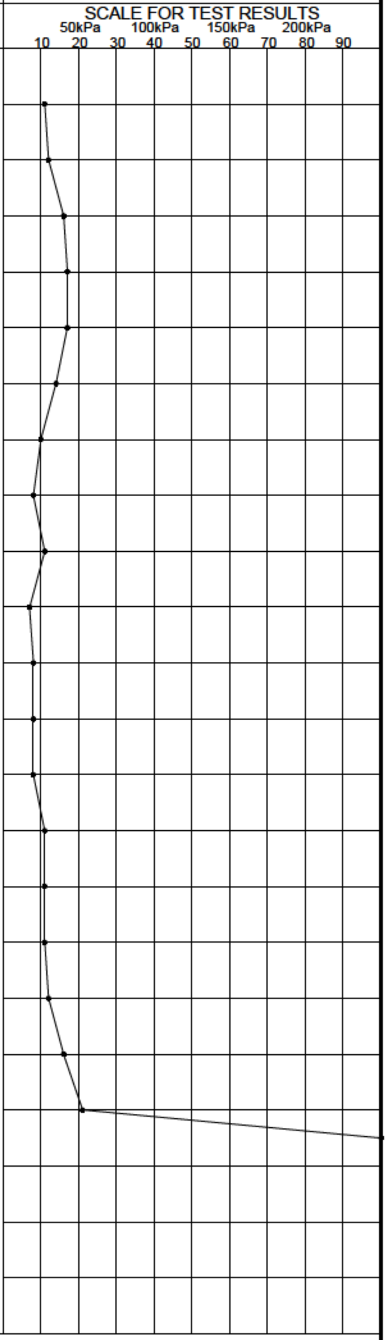
DATE (START): 7 August 2020

DATE (FINISH): 7 August 2020

LEGEND

☒	SS	Split Spoon
▮	GS	Auger Sample
▨	ST	Shelby Tube
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	OVC	Penetration Index / RQD
meters	90.76		GROUND SURFACE			%	ppm	N
			Dynamic Cone Penetration test from surface to refusal encountered at 5.9 mbgs					
0.5								
1.0								
1.5								
2.0								
2.5								
3.0								
3.5								
4.0								
4.5								
5.0								
5.5								
6.0	84.8							
6.5								



NOTES:
mbgs: meters below ground surface

Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey sols is measured by the value of undrained shear strength (Cu).

Classification (Unified system)

Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 4.25 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology

"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

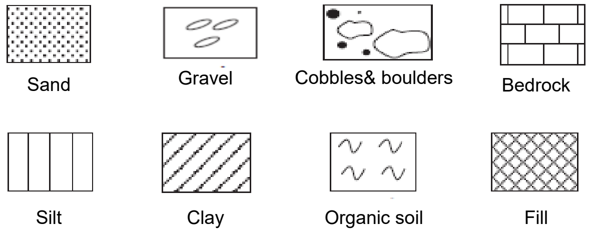
Relative density of granular soils	Standard penetration index "N" value
	(BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu)	
	(P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation

"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND



Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environmental sampling

ST: Shelby tube
PS: Piston sample (Osterberg)

AG: Auger
RC: Rock core
GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration

N_c: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressure meter

k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
Wp: Plastic limit

H: Hydrometer analysis
GSA: Grain size analysis

A: Atterberg limits
w: Water content
γ: Unit weight

C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis

O.V.: Organic vapor

Appendix B

Laboratory Testing Results

Liquid Limit, Plastic Limit and Plasticity Index of Soils
(ASTM D4318)

Client:	Consolidated Fastrate (Ottawa) Holdings ltd	**Lab no.:**	G-20-13
Project/Site:	New warehouse, Somme Street, Ottawa, On	**Project no.:**	11215612-A2

Borehole no.:	2	Sample no.:	4	Depth:	2.3 - 3.0m
Soil description:				Date sampled:	7-Aug-20

Apparatus:	Hand Crank/ Motor Driven	Balance no.:	1	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	1	Spatula no.:	1
Sieve no.:	1	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	30	27	20
Water Content:			
Tare no.	S15	S16	S29
Wet soil+tare, g	43.61	38.30	40.40
Dry soil+tare, g	34.97	31.57	32.70
Mass of water, g	8.64	6.73	7.70
Tare, g	22.02	21.72	21.82
Mass of soil, g	12.95	9.85	10.88
Water content %	66.7%	68.3%	70.8%

Plastic Limit (PL) - Water Content:

Tare no.	S14	S20
Wet soil+tare, g	27.14	27.75
Dry soil+tare, g	26.20	26.85
Mass of water, g	0.94	0.90
Tare, g	21.84	22.53
Mass of soil, g	4.36	4.32
Water content %	21.6%	20.8%
Average water content %	21.2%	

Natural Water Content (W^n):

Tare no.	S8	
Wet soil+tare, g	44.50	
Dry soil+tare, g	33.60	
Mass of water, g	10.90	
Tare, g	14.30	
Mass of soil, g	19.30	
Water content %	56.5%	

Soil Preparation:

☑ Cohesive <425 µm

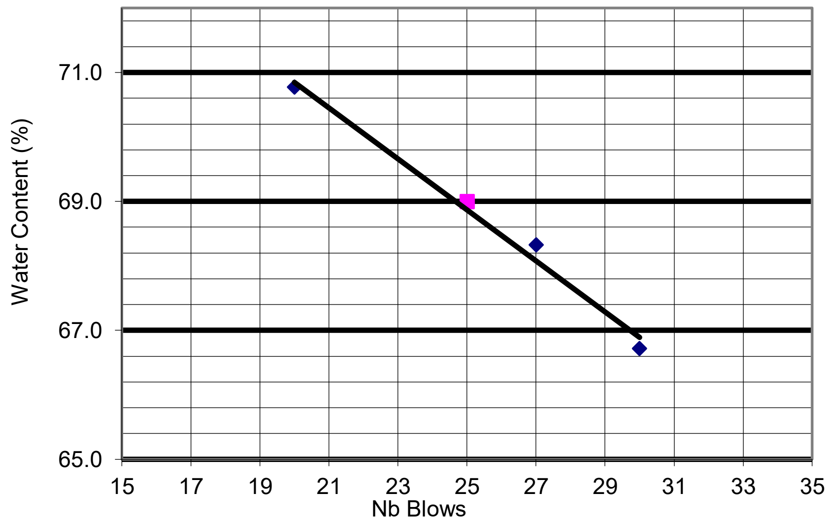
☐ Cohesive >425 µm

☐ Non-cohesive

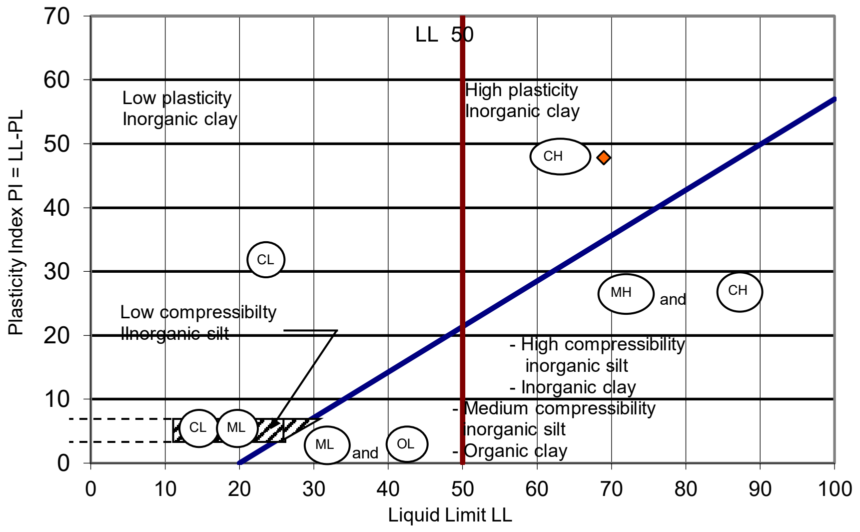
☐ Dry preparation

☑ Wet preparation

Results



Soil Plasticity Chart



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
69	21	48	56

Remarks:

Performed by:	Z. Mathurin	**Date:**	August 27, 2020
Verified by:		**Date:**	September 4, 2020

Moisture Content of Soils
(ASTM D2216)

Client: Consolidated Fastrate (Ottawa) Holdings Ltd

Project: New Warehouse, Somme Street, Ottawa, On

Location: Ottawa, On

Lab No.: G-20-13

Project No.: 11215612

Apparatus Used for Testing

Oven no.: 1 Scale no.: 1

Sample No.	BH1SS1	BH1SS2	BH1SS3	BH1SS4	BH1SS6	BH1SS7	BH1SS8	BH1SS9
Container no.	S18	S21	Bowl	S16	S15	S29	S43	S34
Mass of container + wet soil (g)	70.9	78.5	350.4	83.1	92.1	95.5	91.5	87.1
Mass of container + dry soil (g)	65.2	75.7	335.8	77.9	86.7	88.1	76.9	72.9
Mass of container (g)	22.7	21.8	0.0	21.8	22.1	21.8	22.1	14.6
Mass of dry soil (g)	42.5	53.9	335.8	56.1	64.6	66.3	54.8	58.3
Mass of water (g)	5.7	2.8	14.6	5.2	5.4	7.4	14.6	14.2
Moisture content (%)	13.4	5.2	4.3	9.3	8.4	11.2	26.6	24.4

Sample No.	BH1SS10	BH2SS1	BH2SS2	BH2SS2	BH2SS4	BH2SS4	BH2SS6	BH2SS6
Container no.	S5	S28	S41	S41	S8	S8	S9	S9
Mass of container + wet soil (g)	89.8	76.8	75.9	75.9	44.5	44.5	100.3	100.3
Mass of container + dry soil (g)	84.6	64.2	58.4	58.4	33.6	33.6	89.4	89.4
Mass of container (g)	22.2	21.9	22.9	22.9	14.3	14.3	21.7	21.7
Mass of dry soil (g)	62.4	42.3	35.5	35.5	19.3	19.3	67.7	67.7
Mass of water (g)	5.2	12.6	17.5	17.5	10.9	10.9	10.9	10.9
Moisture content (%)	8.3	29.8	49.3	49.3	56.5	56.5	16.1	16.1

Remarks:

Performed by: Z. Mathurin **Date:** August 27, 2020

Verified by : **Date:** September 4, 2020

Moisture Content of Soils
(ASTM D2216)

Client: Consolidated Fastrate (Ottawa) Holdings Ltd

Project: New Warehouse, Somme Street, Ottawa, On

Location: Ottawa, On

Lab No.: G-20-13

Project No.: 11215612-A2

Apparatus Used for Testing

Oven no.: 1

Scale no.: 1

Sample No.	BH2SS7	BH2SS8	BH2SS9	BH2SS10	BH2SS11	BH2SS12	BH2SS13	BH2SS14
Container no.	S11	S31	S38	S26	S36	S39	S35	S10
Mass of container + wet soil (g)	90.6	75.1	79.5	99.9	83.8	101.3	55.7	73.1
Mass of container + dry soil (g)	84.1	66.7	74.3	93.7	79.0	92.5	55.6	55.5
Mass of container (g)	21.5	21.6	21.5	21.6	22.1	22.0	14.5	22.0
Mass of dry soil (g)	62.6	45.1	52.8	72.1	56.9	70.5	41.1	33.5
Mass of water (g)	6.5	8.4	5.2	6.2	4.8	8.8	0.1	17.6
Moisture content (%)	10.4	18.6	9.8	8.6	8.4	12.5	0.2	52.5

Sample No.	BH3SS1	BH3SS2	BH3SS3	BH3SS4	BH3SS5	BH3SS6	BH3SS7	BH3SS8
Container no.	S37	S25	S22	S20	S14	S7	S17	S2
Mass of container + wet soil (g)	87.3	73.4	76.6	102.3	66.7	57.8	89.6	102.2
Mass of container + dry soil (g)	78.7	71.6	72.4	97.8	64.3	56.4	83.5	96.5
Mass of container (g)	22.0	21.8	22.2	22.5	21.8	21.7	21.5	21.8
Mass of dry soil (g)	56.7	49.8	50.2	75.3	42.5	34.7	62.0	74.7
Mass of water (g)	8.6	1.8	4.2	4.5	2.4	1.4	6.1	5.7
Moisture content (%)	15.2	3.6	8.4	6.0	5.6	4.0	9.8	7.6

Remarks:

Performed by: Z. Mathurin **Date:** August 27, 2020

Verified by : **Date:** September 4, 2020

Moisture Content of Soils
(ASTM D2216)

Client: Consolidated Fastrate (Ottawa) Holdings Ltd

Project: New Warehouse, Somme Street, Ottawa, On

Location: Ottawa, On

Lab No.: G-20-13

Project No.: 11215612-A2

Apparatus Used for Testing

Oven no.: 1

Scale no.: 1

Sample No.	BH3SS9	BH3SS10	BH3SS11	BH3SS12	BH3SS13	BH4SS1	BH4SS2	BH4SS3
Container no.	S12	S32	S13	S4	S120	S6	S23	S40
Mass of container + wet soil (g)	88.7	84.4	88.7	77.6	85.2	93.5	76.9	96.9
Mass of container + dry soil (g)	84.0	79.9	84.5	75.9	79.6	85.7	73.6	93.1
Mass of container (g)	21.6	21.7	24.1	21.8	21.9	21.9	22.3	22.3
Mass of dry soil (g)	62.4	58.2	60.4	54.1	57.7	63.8	51.3	70.8
Mass of water (g)	4.7	4.5	4.2	1.7	5.6	7.8	3.3	3.8
Moisture content (%)	7.5	7.7	7.0	3.1	9.7	12.2	6.4	5.4

Sample No.	BH4SS4	BH4SS5	BH4SS6	BH4SS8	BH4SS9	BH4SS11		
Container no.	S19	S1	S130	S42	S110	88		
Mass of container + wet soil (g)	105.4	92.9	44.1	101.8	98.5	73.0		
Mass of container + dry soil (g)	101.9	86.7	41.8	94.3	92.8	66.5		
Mass of container (g)	21.9	22.0	22.1	21.8	21.7	1.5		
Mass of dry soil (g)	80.0	64.7	19.7	72.5	71.1	65.0		
Mass of water (g)	3.5	6.2	2.3	7.5	5.7	6.5		
Moisture content (%)	4.4	9.6	11.7	10.3	8.0	10.0		

Remarks:

Performed by: Z. Mathurin **Date:** August 27, 2020

Verified by : **Date:** September 4, 2020

Moisture Content of Soils
(ASTM D2216)

Client: Consolidated Fastrate (Ottawa) Holdings Ltd
Project: New Warehouse, Somme Street, Ottawa, On
Location: Ottawa, On

Lab No.: G-20-13
Project No.: 11215612-A2

Apparatus Used for Testing

Oven no.: 1
Scale no.: 1

Sample No.	BH4SS12	BH4SS13	BH4SS14					
Container no.	70	42	44					
Mass of container + wet soil (g)	60.0	67.4	72.1					
Mass of container + dry soil (g)	54.0	61.2	64.6					
Mass of container (g)	1.5	1.4	1.4					
Mass of dry soil (g)	52.5	59.8	63.2					
Mass of water (g)	6.0	6.2	7.5					
Moisture content (%)	11.4	10.4	11.9					

Sample No.								
Container no.								
Mass of container + wet soil (g)								
Mass of container + dry soil (g)								
Mass of container (g)								
Mass of dry soil (g)								
Mass of water (g)								
Moisture content (%)								

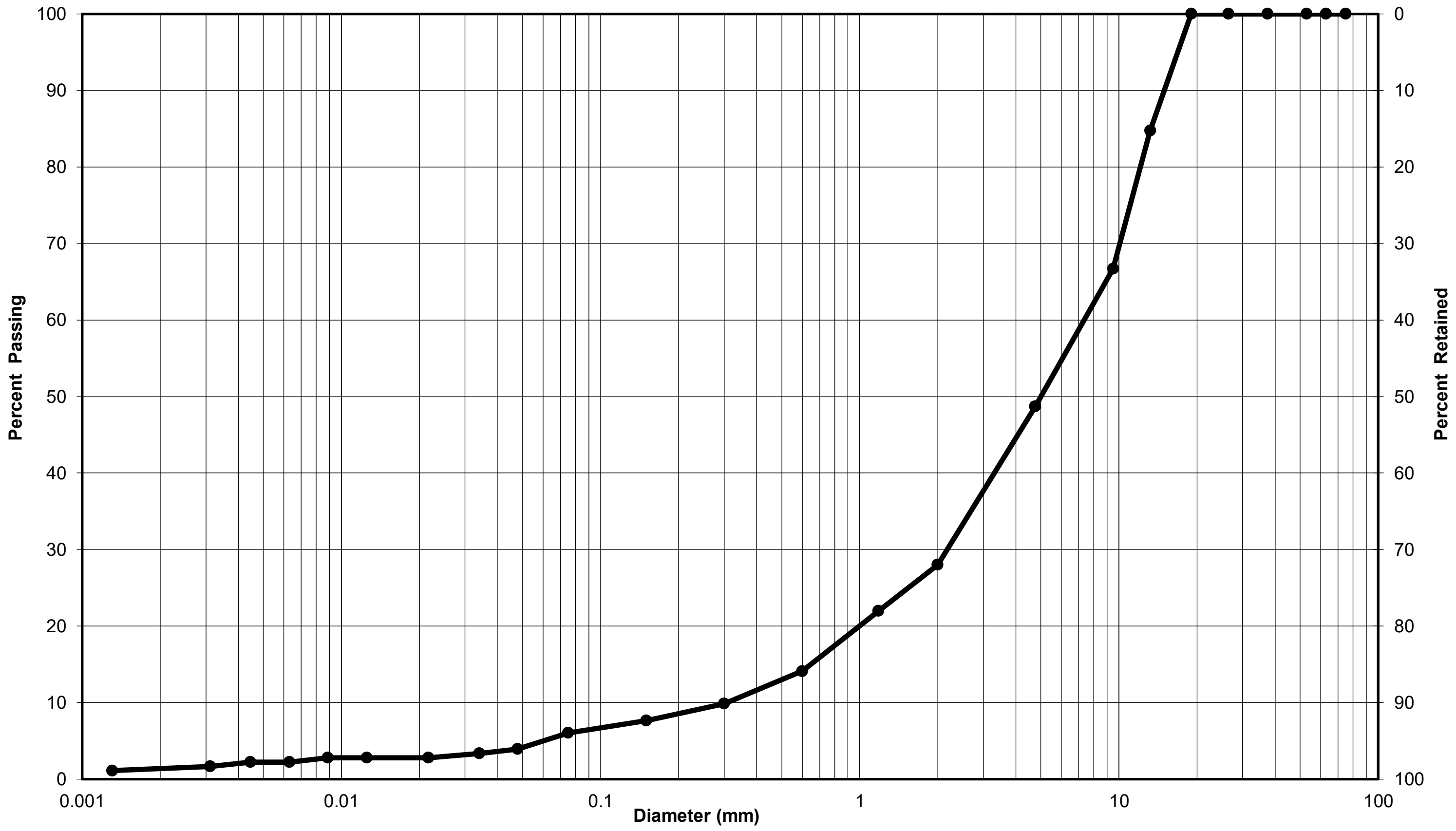
Remarks:

Performed by: Z. Mathurin **Date:** August 27, 2020

Verified by : **Date:** September 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Consolidated Fastrate (Ottawa) Holdings Ltd.	**Lab No.:**	G-20-13
Project, Site:	New Warehouse, Somme Street, Ottawa, ON	**Project No.:**	11215612
Borehole No.:	1	Sample No.:	3
Depth:	1.5 - 2.1m	Enclosure:	-



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravel and Sand, trace Silt, trace Clay	51	43	6
			1 %

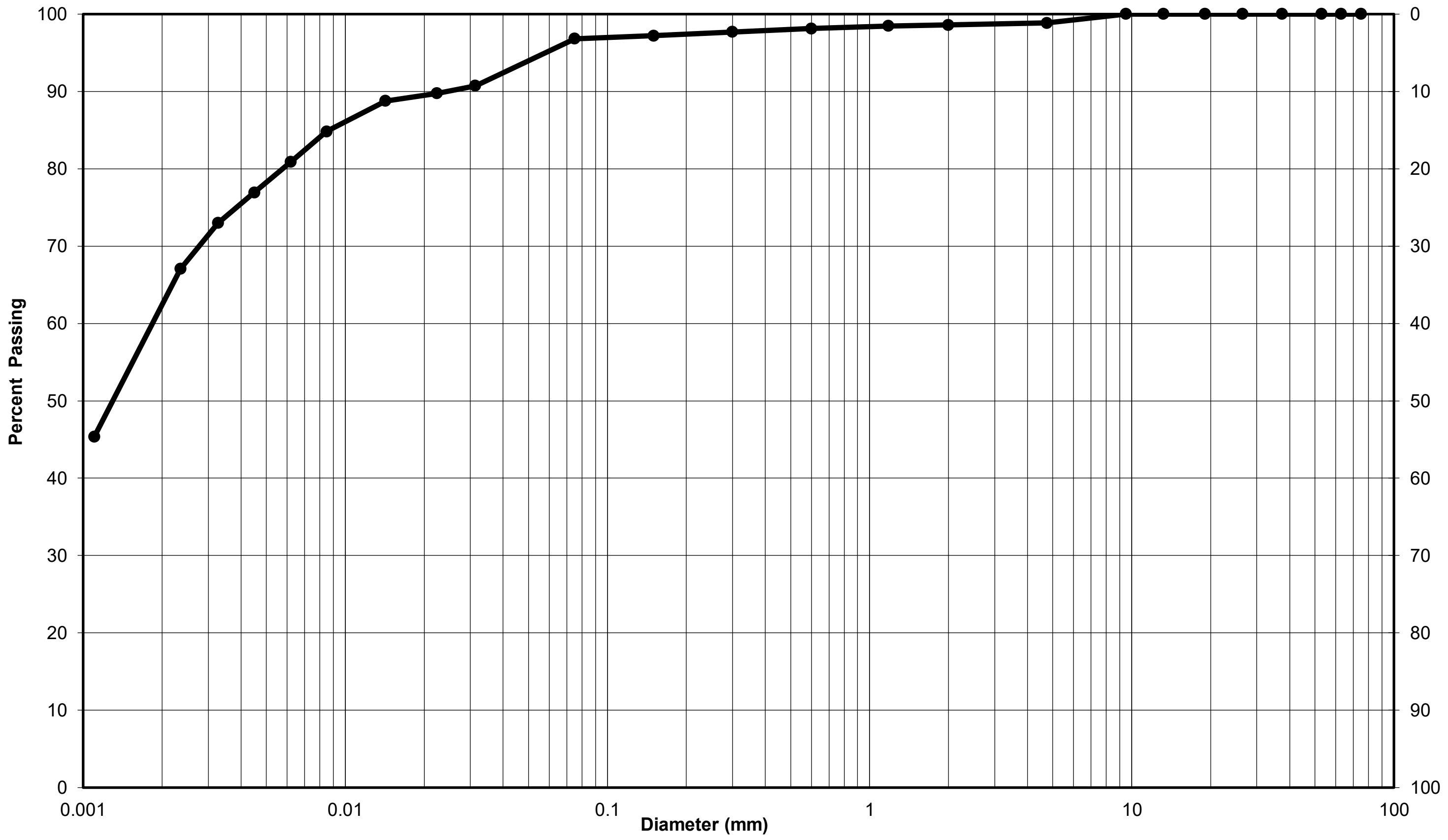
Remarks:

Performed by:	Z. Mathurin	**Date:**	August 27, 2020
Verified by:		**Date:**	September 4, 2020

GHD-FO-930.103 (On)-Particle-size Soils (USCS - GEO) MTO LS-702(Rev1) 12-08-2016

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Consolidated Fastrate (Ottawa) Holdings Ltd.	**Lab No.:**	G-20-13
Project, Site:	New Warehouse, Somme Street, Ottawa, ON	**Project No.:**	11215612
Borehole No.:	2	Sample No.:	4
Depth:	2.3 - 3.0m	Enclosure:	-



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Clay and Silt, trace Sand, trace Gravel	1	2	97
Clay-size particles (<0.002 mm):	61 %		

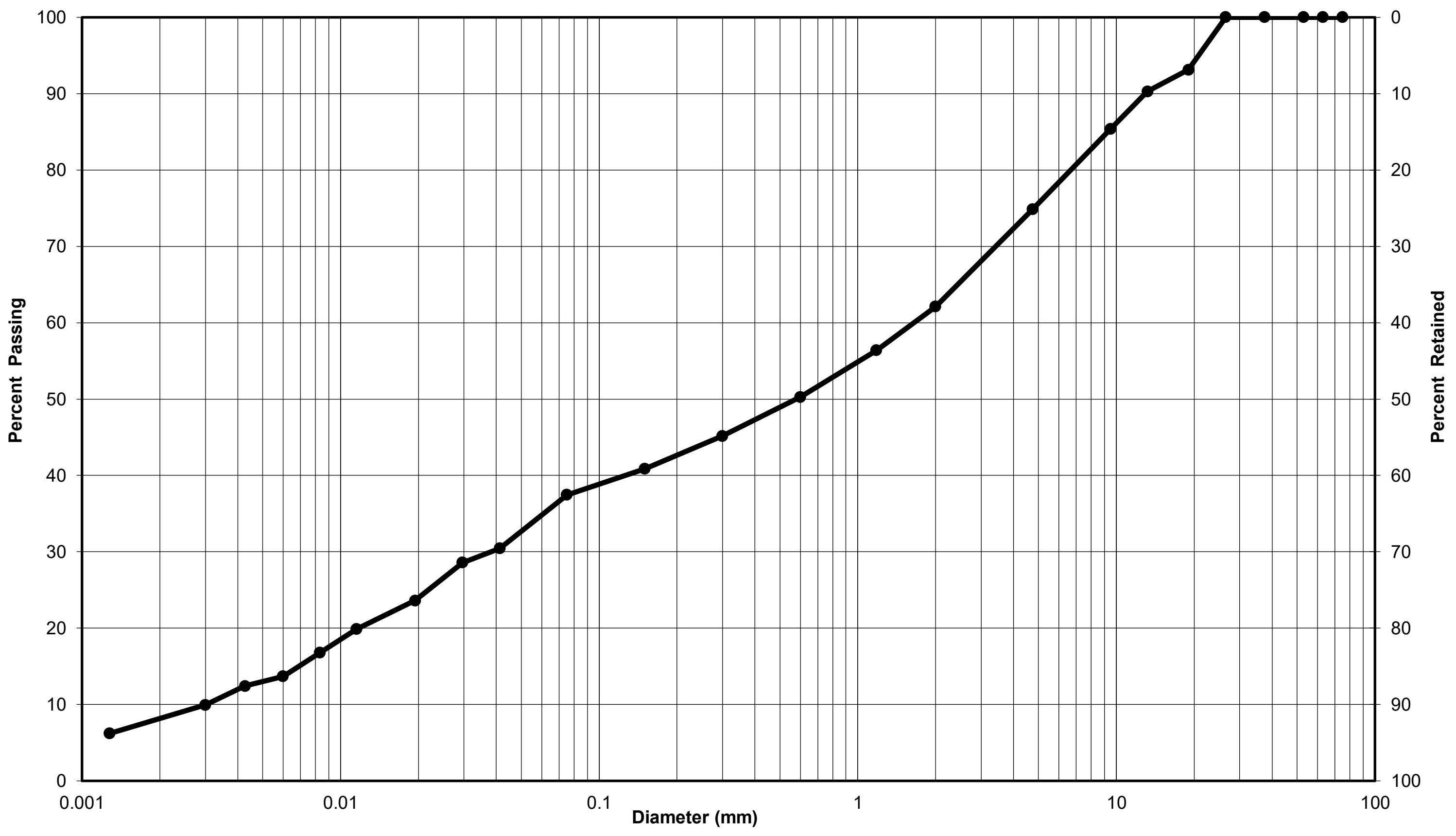
Remarks:

Performed by:	Z. Mathurin	**Date:**	August 27, 2020
Verified by:		**Date:**	September 4, 2020

Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client:	Consolidated Fastrate (Ottawa) Holdings Ltd.	**Lab No.:**	G-20-13
Project, Site:	New Warehouse, Somme Street, Ottawa, ON	**Project No.:**	11215612

Borehole No.:	2	Sample No.:	7
Depth:	4.5 - 6.1m	Enclosure:	-



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Gravelly, Silty, Sand, trace Clay	25	38	37
Clay-size particles (<0.002 mm):			8 %

Remarks:

Performed by:	Z. Mathurin	**Date:**	August 27, 2020
Verified by:		**Date:**	September 4, 2020

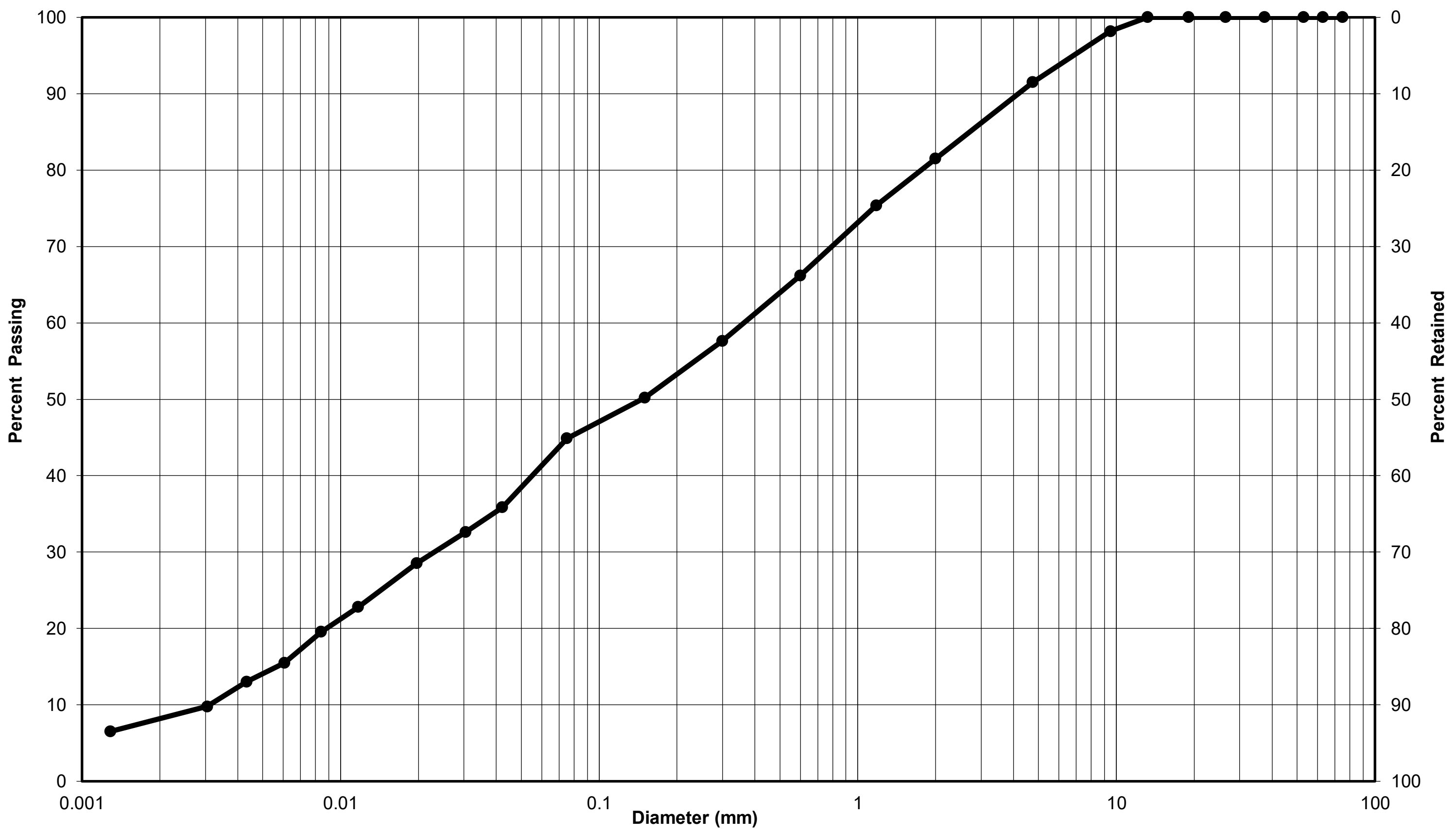
Particle-Size Analysis of Soils
MTO LS-702 (Geotechnical)

Client: Consolidated Fastrate (Ottawa) Holdings Ltd.
Lab No.: G-20-13

Project, Site: New Warehouse, Somme Street, Ottawa, ON
Project No.: 11215612

Borehole No.: 3
Sample No.: 10

Depth: 6.9 - 7.5m
Enclosure: -



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

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
Sand and Silt, trace Gravel, trace Clay	8	47	45
Clay-size particles (<0.002 mm):			8 %

Remarks:

Performed by: Z. Mathurin
Date: August 27, 2020

Verified by:
Date: September 4, 2020

Unconfined Compressive Strength of Intact Rock Core Specimen
ASTM D 7012, ASTM D 4543

Client : Consolidated Fastrate (Ottawa) Holdings ltd

Project : New Warehouse, Somme Street, Ottawa, O

Project N° : G-20-13

Sample N° : BH2-RC1

Depth : 30’11”- 31’5”

Sampling Date : August 7, 2020

Testing Apparatus Used : **Loading device N°** 1 **Caliper N°** 1

Technical Data

				Average	
Diameter :	47	46.9	47	47.0	(mm)
Length :	95	94.9	95.2	95.0	(mm)
Straightness (0.5mm maximum) (S1) :	0.3	0.3	0.3	0.3	(mm)
Flatness (25µm maximum) (FP2) :	Ok	Ok	Ok	Ok	
Parallelism (0.25 ° maximum) (FP2) :	0.15	0.2	0.2	0.15	(°)

Mass : 435.4 (g) Volume: 164644 (mm^3)

Density : 2644 (kg/m^3)

Moisture Conditions : Dry

Loading Rate (0.5 to 1.0 MPa / sec) : 0.8 (MPa/sec)

Type of Fracture : 3

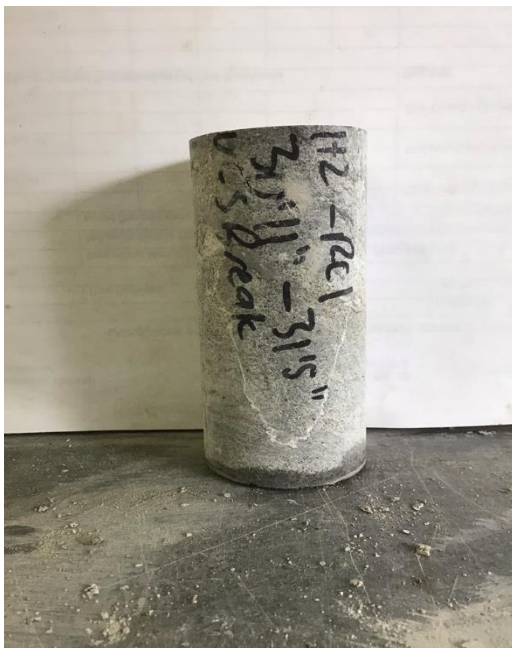
Test Duration (2-15 Minutes) : 3 (minutes)

Maximum Applied Load : 216.97 ☑ kN ☐ lbs

Compressive Strength : 125.2 (MPa)

View of Specimen

Before Test :



After Test :

Remarks :

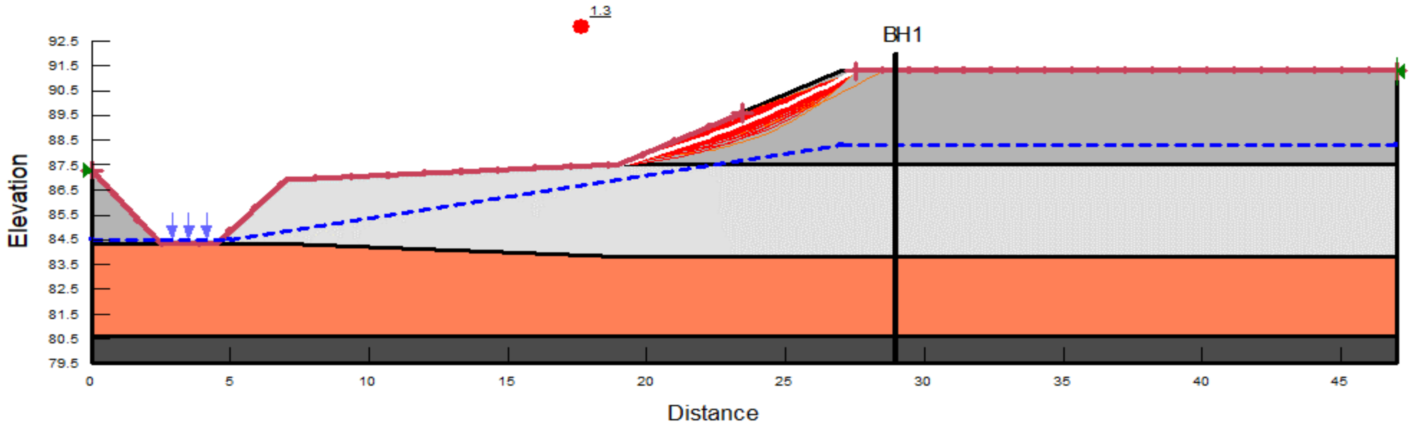
Analysed by : Z. Mathurin **Date :** September 4, 2020

Verified by : **Date :** September 4, 2020

Appendix C

Slope Stability Analysis Results

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
⬛	Bedrock			
⬜	Existing Fill - Clayey silty sand	19	3	30
▨	Existing Fill - Sand	19	0	30
🟧	Native Silty Sand/Sandy Silty	20	0	30



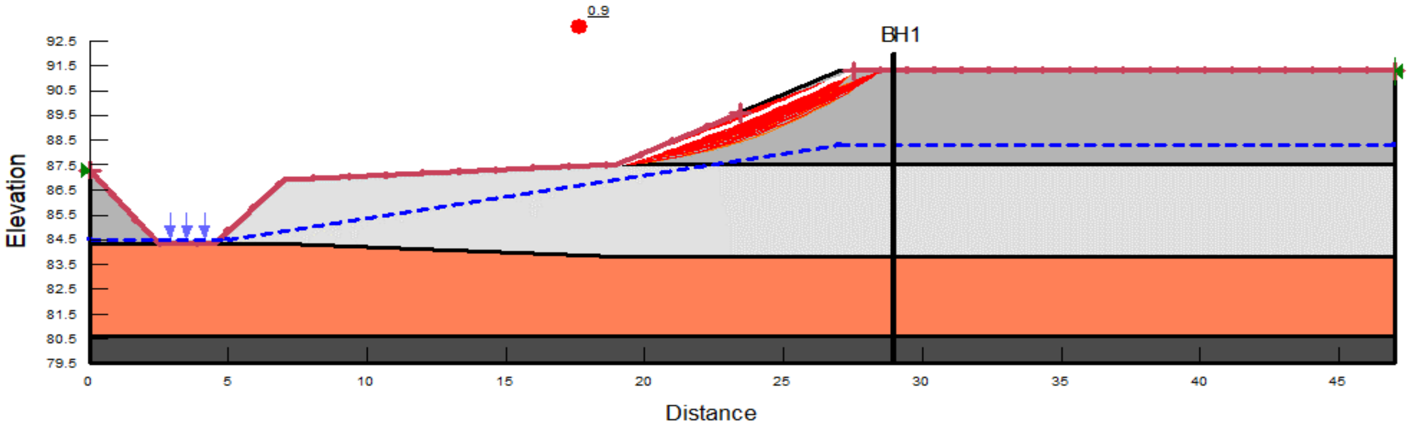
SLOPE STABILITY ANALYSIS - BH1
DRAINED CONDITION
STATIC ANALYSIS

GHD

COSTCO PEDESTRIAN BRIDGE REPLACEMENT

DRAWN BY: RVT	REFERENCE NO: 11215612-A2	
CHECKED BY: BV	DATE: 09/04/2020	SCENARIO NO. 1

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
■	Bedrock			
□	Existing Fill - Clayey silty sand	19	3	30
▒	Existing Fill - Sand	19	0	30
🟧	Native Silty Sand/Sandy Silty	20	0	30

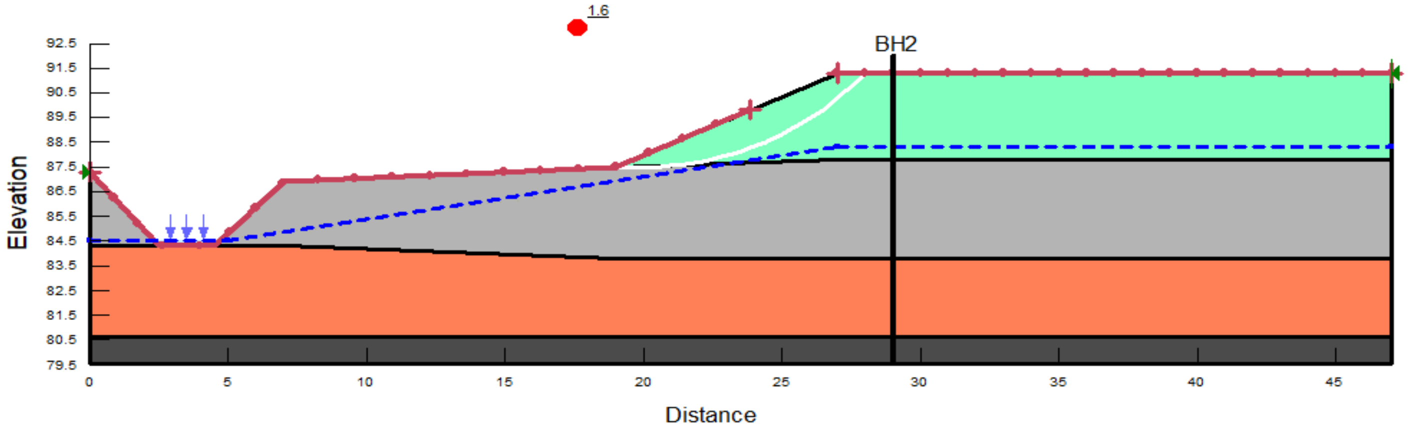


SLOPE STABILITY ANALYSIS - BH1
DRAINED CONDITION
PSEUDO-STATIC ANALYSIS

COSTCO PEDESTRIAN BRIDGE REPLACEMENT

DRAWN BY: RVT	REFERENCE NO: 11215612-A2	
CHECKED BY: BV	DATE: 09/04/2020	SCENARIO NO. 2

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
⬛	Bedrock			
🟩	Existing Clay Fill	17	3	25
⬜	Existing Granular Fill	19	0	30
🟧	Native Silty Sand/Sandy Silty	20	0	30

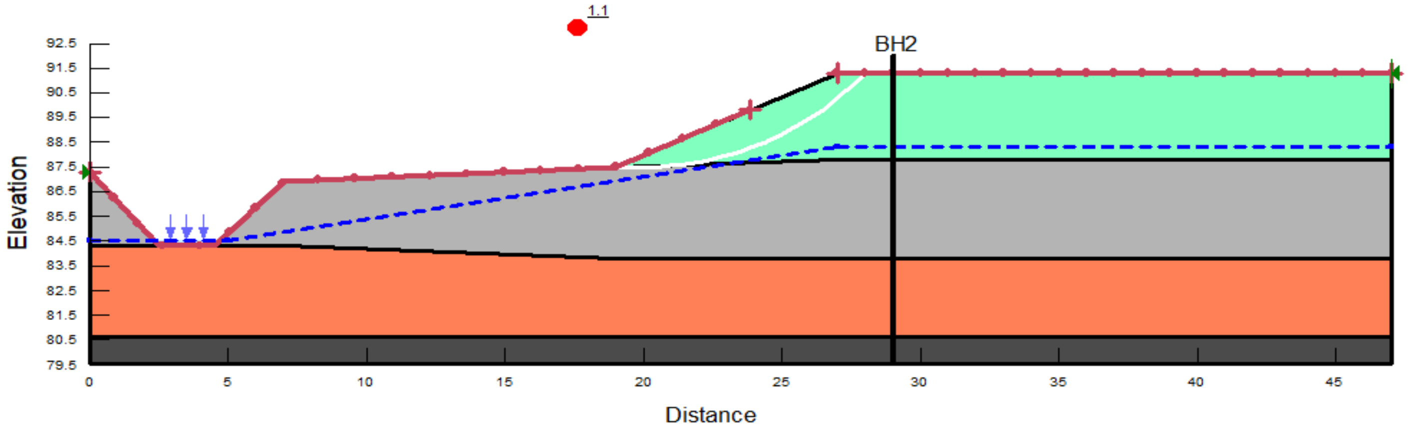


SLOPE STABILITY ANALYSIS - BH2
DRAINED CONDITION
STATIC ANALYSIS

COSTCO PEDESTRIAN BRIDGE REPLACEMENT

DRAWN BY: RVT	REFERENCE NO: 11215612-A2	
CHECKED BY: BV	DATE: 09/04/2020	SCENARIO NO. 3

Color	Name	Unit Weight (kN/m^3)	Cohesion' (kPa)	Phi' (°)
⬛	Bedrock			
🟩	Existing Clay Fill	17	3	25
⬜	Existing Granular Fill	19	0	30
🟧	Native Silty Sand/Sandy Silty	20	0	30



SLOPE STABILITY ANALYSIS - BH2
DRAINED CONDITION
PSEUDO-STATIC ANALYSIS

COSTCO PEDESTRIAN BRIDGE REPLACEMENT

DRAWN BY: RVT	REFERENCE NO: 11215612-A2	
CHECKED BY: BV	DATE: 09/04/2020	SCENARIO NO. 4

ghd.com

→ The Power of Commitment

Appendix D2

Geotechnical Study Report
dated May 4th, 2009

GEOTECHNICAL STUDY SUBDIVISION PLAN
HAWTHORNE INDUSTRIAL PARK
LOTS 26 AND 27, CONCESSION 6
SOUTHEAST OF HAWTHORNE AND RIDEAU ROADS
OTTAWA, ONTARIO

Date: **May 4th, 2009** Reference: **T020556-A1**

INSPEC-SOL
ENGINEERING SOLUTIONS

INSPEC-SOL INC. 179 Colonnade Rd., Suite 400, Nepean, Ontario K2E 7J4 • Tel.: (613) 727-0895 • Fax: (613) 727-0581

Reference No. T020556-A1 (revised)

Ottawa, May 4, 2009

Mr. Jim Blake
Business Development Division
R. W. Tomlinson Limited
5597 Power Road
Ottawa, Ontario
K1G 3N4

Re: Geotechnical Study Subdivision Plan
Hawthorne Industrial Park
Lots 26 & 27, Concession 6
Southeast of Hawthorne and Rideau Roads
Ottawa, Ontario

Dear Mr. Blake:

Inspec-Sol Inc**. (Inspec-Sol)** has completed the geotechnical study for the subdivision plan for the above captioned project.

The report has been modified to align with the new drawings received by **Inspec-Sol** from J.L. Richards and Associates on May 1, 2009, which outlined a new Block number system for legal identification.Otherwise, the content in the report remains unchanged.

We trust that this information meets with your approval. Please do not hesitate to contact us should any questions arise.

Yours very truly,

INSPEC-SOL INC.

Wm Beveridge

William S. Beveridge, B.Eng.
Project Manager

Joseph B. Bennett, P.Eng.
Vice-President

JBB/WSB/vl

Enclosures

Dist: Mr. Jim Blake – Mail (1)
c.c Mr. Tim Chadder- J.L. Richards and Assoc.,-email-(TChadder@jlrichards.ca) Mail (5)

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1.0 INTRODUCTION

Inspec-Sol Inc. **(Inspec-Sol)** was authorized to conduct a geotechnical study (Study) of Lots 26 and 27 of Concession No. 6, (Site), “Hawthorne Industrial Park”, located approximately southeast of the intersection of Rideau and Hawthorne Roads, in the City of Ottawa, Ontario. The purpose of the Study is to determine the current soil matrix and permeability conditions for the development of the site into an Industrial Park, as outlined in **Inspec-Sol** Proposal K2008-2A. This Study was authorized by Mr. Jim Blake, on behalf of R.W. Tomlinson Limited for **Inspec-Sol** to complete the work. It is understood by **Inspec-Sol** that this report will be submitted as part of a land development application by J. L. Richards and Associates to the City of Ottawa. The Site is currently zoned as a Rural Heavy Industrial Area. The location of the Site within the City of Ottawa is shown on Dwg. No. T020556-A1.

The Site is approximately 72 hectares (178 acres) and rectangular in shape. The Site has been subdivided into several blocks (Blocks 1 – 9 and the Hawthorne Road Realignment, (Block 10). One (1) block, “Future Development Block”, is located along the approximate north-east boundary of the site, is pending further investigation. A proposed internal roadway system will provide vehicle access to each Development Block. The Site is currently outside of the City of Ottawa’s municipal water and sewage network. For an overview of the Site Plan, Refer to Dwg. No. T020556-A1-2

This geotechnical study was conducted to determine the current soil material and permeability characteristics of the native and non-native soil matrix. The soil material information obtained will be used as input data supporting the preliminary designs, recommendations and caveats as applied to building foundations, grade raise restrictions, underground service layouts and access road construction. Information from the permeability studies are to be submitted for the calculation of the water balance requirements for the proposed site storm water management facility.

2.0 FIELDWORK

2.1 Soil and Permeability Exploration Programs

The Soil Explorations Program was planned and applied to determine the current soil material and permeability characteristics of the native and non-native soil matrix. Borehole and test pit depths varied for and within each block, primarily due to the placement of non-native fill materials in Blocks 1, 6, 7 parts of 2, 4 and 5 and the presence of undulating bedrock in 2 and 3. Test pits were used to verify the soil stratum, and water table elevations at locations that were either uneconomical or inaccessible for drilling. Only test pits were dug for Block 1, either due to the bedrock elevations proximate to the surface elevation within the Block and/or observations of fill material extending to elevation of bedrock. The Future Development Block could not be drilled due to inaccessible site conditions. It was determined, at time of drilling; that the presence of a high water table combined with soft, organic material at the proposed drilling locations would not support either the drilling or the excavation equipment.

All boreholes were carried out by means of a track mounted drill rig adapted for soil sampling and/or rock coring, as applicable. The boreholes were advanced with a continuous flight auger or casing for rock core sampling, as required. Representative samples of the various soils were recovered at regular intervals with a split spoon sampler driven with an approximate energy of 470 kilojoules (kJ). The number of drops with the falling weight to drive the sampler 0.3 m is recorded and shown on the borehole logs as SPT or “N” value. Casing and coring equipment for rock cores were advanced to using diamond tip drilling equipment obtain one to two runs (1.5 m - 3.0 m) of rock. All boreholes were drilled by George Downing Estate Drilling, Ltd., at various times within the period of October – November 2008. All test pits were excavated using a track mounted excavator, supplied by R.W. Tomlinson Limited, during early November 2008. Representative samples of the various soils were recovered at the different stratums. Soil samples were collected and returned to the **Inspec-Sol** Ottawa laboratory for further examination and classification. The Borehole and Test Pit Logs are attached in Enclosures 1 to 42. The Soil Gradation Data is attached in Appendix C.

The Permeability Explorations Program was planned and applied to determine the hydrological soil groups and infiltration rates of both in-situ and graded soils. A series of monitoring wells were installed at previously drilled select borehole locations in areas that were assumed to provide best surface water capture and representative soil permeability for the respective block. The Monitoring wells for Block 1 and the Future Development Block were installed by George Downing Estate Drilling, Ltd., during mid-July 2008 for Conestoga-Rovers and Associates as part of CRA-Project No. 045804(12). The Monitoring wells for Blocks 2, 3, 4, 5, 6 and 7 for the **Inspec-Sol** Permeability Explorations Program were installed by George Downing Estate Drilling, Ltd. during early November, 2008.

2.2 *Roadway Investigation Boreholes*

A summary of the roadway investigation boreholes is given in Table 1.

TABLE 1
ROADWAY INVESTIGATION BOREHOLES

Block Number	Roadway Borehole[1]	Past Report Depths, (m)	Planned Max. Depth, (m)	Actual Depth (m)	Comments
1	Representative Roadway Borehole logs are listed in adjoining Blocks 2 and 7				Past Report Depths Obtained from **Report No. 931-2820,** published by **Golder and Associates, March, 1994.** See Attachment T020556-A1-5 for an approximate reproduced location plan and Appendix B for Test Pit Logs.
2	RB2-01 - RB2-02	0.5 - 3.0	3.0	3.4 – 5.4	
3	RB3-01	2.0 – 2.9	3.0	1.9	
4	RB4-01	1.35 - 1.37	3.0	10.0	
5	RB5-01 - RB5-02	2.0 – 7.0	4.5	2.6 – 9.7	
7	RB7-01 - RB7-03	1.0 -7.6	4.5	2.9 – 9.1	
Hawthorne Road Realignment	RB10-01 - RB10-03	N/A	4.5	3.6 – 6.7	

Note 1: WX-Y, where: W**:** RB: “Roadway Borehole”, X: Block Number (Block Location), and Y: Sequence Number.

2.3 Block Investigation Boreholes and Test Pits

A summary of the block investigation boreholes and test pits are given in Table 2:

TABLE 2
BLOCK INVESTIGATION BOREHOLES AND TEST PITS

Block Number	Borehole & Test Pit[1,2]	Past Report Depths (m)	Planned Max. Depth (m)	Actual Depth Range (m)	Comments
1	Not Drilled	0.0 – 2.0	1.0	Not Drilled	Past Report depths obtained from Report No. 931-2820, published by Golder and Associates, March 1994. See Attachment T020556-A1-5 for an reproduced approximate location plan and Appendix B for the Test Pit Logs.
	TP01-08 – TP46-08			0.0 – 5.5	
2	B2-01 – B2-03	1.3	3.0	1.2 – 2.4	
	TP2-01			0.2	
3	SWM3-10– SWM3-2R	2.0	3.0	3.3 – 4.6	
	TP5-01			0.6	
4	B4-01	1.4	3.0	9.1	
	TP4-01 – TP4-03			3.0 – 4.5	
5	B5-01 – B5-03	2.0	3.0	6.7 - 10.0	
	TP5-01			3.0	
6	B6-01 – B6-04	3.5	3.0	1.8 – 6.3	
	TP6-01 – TP6-02			4.2 – 5.1	
7	B7-01 – B7-03	2.1	3.0	2.4 – 6.1	
	TP7-01 – TP7-02			1.7 – 4.0	
Hawthorne Rd. Realignment	RB10-01 - RB10-03	None	4.5	3.6 – 6.7	
	TP10-01 - TP10-02	None	4.5	1.2 – 1.9	

Note 1: WX-Y, where: W**:** B: "Borehole", SWM: "Storm Water Management" and TP: "Test Pit", X: Block Number (Block Location), and Y: Sequence Number.

Note 2: Boreholes B2-2, B3-3, B4-3, SWM5-1O, SWM5-1R, SWM5-2O, SWM5-2R, B6-1 and B9-1 had monitoring wells installed during backfilling. The monitoring wells are labelled B/MW2-2, B/MW3-3, B/MW4-3, SWM5-1O, SWM5-1R, SWM5-2O, SWM5-2R, B/MW6-1 and B/MW9-1.

Note 3: A representative set of Test Pits are included in this Study for Block 1. To review the all of the Test Pit Logs for Block 1, refer to CRA-Project No. 045804(12). A copy of the test pits are attached in Appendix A.

2.4 Slug Tests and Groundwater Investigations

Groundwater was present in all the monitoring wells. Slug tests were conducted in the monitoring wells located in blocks 2, 3, 4, 5, 6, and 7. Representative soil samples were taken in the soil stratums located between the perforated screen elevations then sent to the **Inspec-Sol** Ottawa Laboratory for analysis, as applicable. A summary of the monitoring well locations is given in Table 3.

TABLE 3
MONITORING WELL LOCATIONS

Block Number	**Monitoring Well / SWM Well**	**Screen Elevations Range (*Fill*/ Soil)**	**Screen Elevations Range (*Soil and Bedrock/* Bedrock)**	**Comments**
1	MW1-08, MW2-08, MW4-08, MW5-08[1]	*90.3–88.8* Not Applicable Not Applicable *91.7 – 90.2*	Not Applicable 92.6 – 90.3 *93.6 –92.3* Not Applicable	For **Block 1**, monitoring well screens were installed in non-native fill (MW1-08, MW5-08), native soil and bedrock (MW4-08), and bedrock (MW2-08). For **Block No. 4, 5, 6, and 7,** the monitoring well screen was installed in the native soil only. For **Block 4**, the monitoring well screen was installed in the bedrock only. For **Block 5**, the Storm Water Management "SWM" Borehole Nest screens were installed in the native soil "overburden" (O) and rock (R), respectively.
2	B/MW2-03	Not Applicable	82.3 – 80.5	
3	SWM3-1O SWM3-1R, SWM3-2O, SWM3-2R	80.3 – 78.5 Not Applicable 81.3 – 79.5 Not Applicable	Not Applicable 78.2 – 76.4 Not Applicable 77.8 – 76.3	
4	B/MW4-01	82.9 – 79.9	Not Applicable	
5	B/MW5-01	83.2 – 81.7	Not Applicable	
6	B/MW6-03	86.9 – 84.8	Not Applicable	
7	B/MW7-02[2]	88.6 – 87.1	Not Applicable	

Note 1: Monitoring Well: MWA – B, where: MW: "Monitoring Well", A: Sequence number, B: Last two digits of year, 2008. All MW series Monitoring Wells are in Block 1.

Note 2: Boreholes B2-2, B3-3, B4-3, SWM5-1O, SWM5-1R, SWM5-2O, SWM5-2R, B6-1 and B9-1 had monitoring wells installed during backfilling. The monitoring wells are labelled B/MW2-2, B/MW3-3, B/MW4-3, SWM5-1O, SWM5-1R, SWM5-2O, SWM5-2R, B/MW6-1 and B/MW9-1.

2.5 Locations and Elevations

The completed boreholes, test pits and monitoring wells had ground surface elevations recorded relative to a series of benchmarks. The benchmarks were previously located on site by the R.W. Tomlinson Limited. The locations and elevations of the benchmarks, boreholes, monitoring wells (as available) and test pits (as available) for Blocks 2, 3, 4, 5, 6 and 7 are enclosed on Drawing No. T020556-A1-3. The locations and elevations (as available) of the test pits for Block 1 are reproduced from the **Inspec-Sol** Report No. 45804-29 and enclosed on Dwg. No. T020556-A1-4.

3.0 SITE AND SUBSOIL CONDITIONS

3.1 General

Published geological maps of the area indicate that the native soils are shallow and variable, composed of organic soils underlain by silty clays, clays or silty sands. The underlying bedrock is either limestone, sandstone, dolomite, inter-bedding of sandstone and dolomite or interbedding of limestone and sandstone, depending on location. The site is located near the Gloucester Fault and near an intersection of the Nepean, Oxford and March Formations.

Most of the borehole and test pit logs show a non-native heterogeneous fill material, in which the soil component usually approximates a silty clay. The heterogeneous fill material also contains trace to some asphalt, concrete, brick, reinforcing steel, topsoil, and wood fragments. Some boreholes beneath the fill show a thin layer of topsoil/root mat with organics which overlies what is presumably the native soil. The native soil comprises of either sand, silty sand to silty clay/clayey silt and clayey gravel. Limestone interbedded with sandstone was encountered, as applicable, below the native soils. Groundwater or groundwater seepage was present in most of the drilled boreholes, excavated test pits and all of the monitoring wells.

The following sections, 3.2.1 to 3.2.8, presents more detailed descriptions of the field and laboratory findings.

3.2 Lot Conditions

3.2.1 Site Description for Proposed Block 1

3.2.1.1 Block 1 Overview

Block 1 is an approximately rectangular shaped property, located at the southwest corner of the site. The topography of the block slopes downward from southwest to northeast. The south western quadrant area consists mainly of a rock knoll, with its elevation gently sloping downward in a north to north easterly direction. The remaining quadrants consist of mainly fill material over bedrock or a thin layer of glacial till overlying bedrock. The northeast quadrant has a low-lying wet area with water observed at the surface. At practical test pit refusal, there was evidence of limestone interbedded with sandstone in the excavator. Table 4 provides the summary of soil conditions shown by representative test pits of Block 1. The representative test pits in Table 4 were listed with the first taken at the southwest quadrant, proceeding in a north easterly direction ending with the last at the northeast quadrant.

All test pit and monitoring wells for Block 1 have been reproduced from **Inspec-Sol** Report No. 45804-29 and are attached in Appendix A.

TABLE 4
REPRESENTATIVE TEST PIT LOG SUMMARY RESULTS BLOCK 1

Borehole/ Test Pit No.[1]	Grade Elev. (m)[2]	Summary of Subsurface Profile					Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Silty Sand Depth (m)	Sandy Silt Depth (m)	Silt Depth (m)	Bedrock (m)[3]		
TP01-08	N/A	0.0 - 0.2	None	None	None	0.2	0.2 [N/A]	None
TP13-08	N/A	0.0 - 0.3	None	None	None	0.3	0.3 [N/A]	None
TP32-08	93.3	0.0 - 0.2	None	None	None	0.2	0.2 [93.1]	None
TP38-08	91.4	0.0 - 1.2	None	None	None	1.2	1.2 [90.5]	1.2 [90.5]
TP04-08	96.0	0.0 - 0.9	0.9 – 2.6	None	None	2.6	2.6 [93.43]	2.4 [93.4]
TP15-08	N/A	0.0 - 0.3	None	0.3 – 2.1	None	2.1	2.1 [N/A]	2.1 [N/A]
TP28-08	91.7	0.0 - 2.4	2.4 – 3.4	None	None	3.4	3.4 [88.3]	2.3 [89.4]
TP05-08	94.8	0.0 - 1.8	None	None	None	1.8	1.8 [93.0]	1.2 [93.6]
TP18A-08	93.1	0.0 - 3.4	None	None	3.4 – 5.5	N/E[4]	N/E	1.5 [91.6]
TP19A-08	92.8	0.0 - 2.4	None	None	2.4 – 5.2	N/E	N/E	1.2 [91.5]

Note 1: CD-E: where C: TP: “Test Pit”, D: Sequence Number, and E: Year Excavated (2008).
Note 2: N/A: No elevation survey for specific Test Pit.
Note 3: Field Identified as Limestone
Note 4: N/E: Not encountered within depth of investigation.

3.2.1.2 Soil Permeability and Monitoring Well Information, Block 1

Four (4) monitoring wells were installed to determine general water levels and estimate the in-situ soil permeability for Block 1. The available permeability data is summarized in Table 5. Well description information can be found in MW1-08, MW2-08, MW4-08 and MW5-08.

TABLE 5
K (CONDUCTIVITY) RESULTS BLOCK 1

Blk. No.	**Well No.**	**Non-Native Soil Screen Range BGS[1] (m)**	**Native Soil Screen Range BGS (m)**	**Hydro-logic Soil Group (MOE)**	**Lab Test Results (USCS)**	**Estimated Laboratory K (cm/ sec)**	**Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)**	**Estimated Percolation Time (min/cm)**
1	MW1 -08	Fill (1.5+\- – 2.9 +\-)	N/A	CD	No Lab Test	No Lab Test	No Slug Test	20-50
	MW2 -08	N/A[2]	Bedrock (0.6+/- - 2.8 +/-)	D	No Lab Test	No Lab Test	No Slug Test	50+
	MW4 -08	N/A	Silty Sand & Limestone (1.6 +\- - 2.8 +\-)	C	No Lab Test	No Lab Test	No Slug Test	20-50
	MW5 -08	Fill (1.2+/- – 2.8+/-)	N/A	CD	No Lab Test	No Lab Test	No Slug Test	20-50

Note 1: BGS: Below Ground Surface
Note 2: N/A: Not applicable.

The values for the Hydrologic Soil Group and Estimated Percolation Time in Table 5 were estimated based on field and laboratory test data observations from other monitoring wells located in the site. The soil component of the heterogeneous fill material approximately exhibits the characteristics of a silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments will affect the compaction ability of this heterogeneous fill and its permeability in indeterminate and localized areas.

3.2.2 Site Description for Proposed Block 7

3.2.2.1 Block 7 Overview

Block 7 is an approximately rectangular shaped property, located along the northwest corner area of the site. The Block topography is sloping downward from south to north. There is an operating sediment pond near the southwest area of the Block, delineated as Block 8 within Block 7. For the purposes of this discussion, Block 7 will include Block 8. Refer to Dwg No. T020556-A1-2 for location of Block 7. The western property line borders the proposed Hawthorne Road Realignment area. The Block 7 area is mainly graded with heterogeneous fill material overlying native soil and bedrock, except for along the western boundary, where a low lying wet area is acting as both a drainage ditch for the existing Hawthorne Road and the sediment pond. The bedrock appears to be increasing in elevation from south to north, but falling from west to east. At practical auger refusal, there was evidence of limestone interbedded with sandstone in the split spoon sampler. Tables 6A and 6B provide the summary of soil conditions for Block 7. The Borehole and Test Pit Logs for Block 7 are attached in Enclosures 1 to 3, 19 to 21, & 31 to 32.

TABLE 6A
BOREHOLE LOG SUMMARY BLOCK 7

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile					Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Sand Depth (m)	Bedrock (m)		
B7-1	93.7	1.5	1.5- 6.1	None	None	6.1	6.1 [87.6]	3.0 [90.7]
B7-2	92.6	3.2	3.2 – 5.5	None	None	5.5	5.5 [87.0]	2.3 [90.34]
B7-3	90.6	2.1	None	2.1 – 2.4	None	2.4	2.4 [88.2]	None
RB7-1	93.8	2.9	None	None	None	2.9	2.9 [90.8]	2.8 [90.9]
RB7-2	93.0	3.3	3.3 – 9.2	None	None	N/E[1]	N/E	4.6 [88.4]
RB7-3	91.1	3.1	None	None	3.1 – 4.7	4.7	4.7 [86.4]	2.6 [88.5]

Note 1: N/E: Not encountered within depth of investigation.

TABLE 6B
TEST PIT LOG SUMMARY BLOCK 7

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile					Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Sand Depth (m)	Bedrock (m)[1]		
TP7-01	94.45	0.7	0.7 – 1.7	None	None	1.7	1.7 [92.7]	0.6
TP7-02	93.24	3.5	3.5 – 4.0	None	None	N/E[2]	No Refusal	3.6

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

3.2.2.2 Soil Permeability and Monitoring Well Information, Block 7

One monitoring well was installed to determine general water levels and field soil permeability for Block 7. The predictive, lab and field data are summarized in Table 7. Well description information for B/MW7-02 can be found in Borehole Log B7-02.

TABLE 7
K (CONDUCTIVITY) RESULTS BLOCK 7

Blk. No.	Well/ Location	Non-Native Soil	Native Soil Screen Range BGS (m)	Hydro-logic Soil Group (MOE)	Lab Test Results (USCS)	Estimated Laboratory K (cm/ sec)	Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)	Estimated Percolation Time (min/cm)
7	B/MW7-02	N/A	Silty Clay (4.0+/- - 5.5+/-)	CD	ML	10^{-5} – 10^{-6}	1.41 x E -03	20-50
	South 80%+/- Land Area	Fill	N/A	C	No Lab Test	No Lab Test	No Slug Test	20-50
	North 20%+/- Land Area	Fill	N/A	D	No Lab est	No Lab Test	No Slug Test	50+

The monitoring well B/MW7-02 field test results showed a higher conductivity 'K' value in-situ than the 'K' value determined from the laboratory testing of a representative soil sample obtained from the soil stratum located between the screen elevations.

Samples extracted from the soil during drilling and test pit excavation showed slight to moderate intermixing of soil material(s) and disturbed subgrade immediately above and below the native soil elevation. The re-compaction and disturbances of the non-native fill and native soil matrix during the earthmoving activities in the Block over time may have created voids and other fissures within the soil, creating increased soil permeability in localized areas. As the new soil matrix settles and compacts over time, the permeability within the soil should decrease to the estimated laboratory values. The rate of compaction is dependent on the localized soil mix, which is considerably variable throughout the Block.

The soil component of the heterogeneous fill material approximately exhibits the characteristics of a silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments may affect the compaction ability of the heterogeneous fill and its permeability in indeterminate and localized areas.

3.2.3 Site Description of Proposed Block 6

3.2.3.1 Block 6 Overview

Block 6 is an approximately triangular shaped property located within the centre area of the site and is planned to be surrounded by the proposed access road. The Block topography is sloping downward from west to east and northeast. The entire Block has been graded with heterogeneous fill material, except for a partial area located approximately southeast, which was observed to be an undisturbed low lying wet area. A drainage trench was excavated to drain the low lying wet area. The drainage ditch outlet is located at approximately the southwest corner of Block 3. There is a built up granular pad at approximately the southeast corner just southwest of the undisturbed low lying wet area. The majority of the Block area is comprised of a layer of heterogeneous fill material which lies over a native soil layer of either sandy silt, silty sand, sandy clay or silty clay, depending on location. The elevation of bedrock appears to be undulating. At practical auger refusal for applicable boreholes, there is evidence of either limestone or sandstone in the split spoon sampler. Table 8 provides the summary of soil conditions for Block 6. The Borehole and Test Pit Logs for Block 6 are attached in enclosures 4 to 7 and 33 to 34.

TABLE 8
BOREHOLE AND TEST PIT LOG SUMMARY BLOCK 6

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Sandy Silt Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]		
B6-1	91.3	3.8	3.8 – 4.6	None	4.6 – 5.4	None	5.4	5.4 [85.8]	3.0 [88.3]
B6-2	90.5	3.2	4.6 – 6.1	3.2 – 4.6	6.1 – 6.3	None	6.3	6.3 [84.2]	3.2 [87.3]
B6-3	91.8	3.4	4.4 – 6.1	3.4 – 4.4	3.4 – 6.2	None	6.2	6.2 [85.6]	1.9 [89.8]
B6-4	89.1	None	0.0 – 1.5	1.5 – 1.8	None	None	1.8	1.8 [87.2]	None
TP6-01	90.7	4.5	4.7 – 5.0	4.5 – 4.7	None	5.0 – 5.1	N/E[2]	No Refusal	4.5 [86.2]

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

3.2.3.2 Soil Permeability and Monitoring Well Information, Block 6

One monitoring well was installed to determine general water levels and soil permeability for Block 6. The predictive, lab and field data are summarized in Table 9. Well description information for B/MW6-03 can be found in Borehole Log B6-03.

TABLE 9
K (CONDUCTIVITY) RESULTS BLOCK 6

Blk. No.	**Location**	**Non-Native Soil**	**Native Soil Screen Range BGS (m)**	**Hydro-logic Soil Group (MOE)**	**Lab Test Results (USCS)**	**Estimated Laboratory K (cm/ sec)**	**Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)**	**Estimated Percolation Time (min/cm)**
6	B/MW6 -03	N/A[1]	Silty Sand (5.2 +/- – 7.0 +/-)	B	SM	$10^{-3} – 10^{-5}$	1.51 x E – 03	12-50
	West 80%+/- Land Area	Fill	N/A	C	No Lab Test	No Lab Test	No Slug Test	12-50
	East 20%+/- Land Area	Fill	N/A	D	No Lab Test	No Lab Test	No Slug Test	50+

Note 1: N/A: Not applicable.

The monitoring well B/MW6-03 field test results showed a higher conductivity ‘K’ value in-situ than the ‘K’ value determined from the laboratory testing of a representative soil sample obtained from the soil stratum located between the screen elevations.

Samples extracted from the soil during drilling and test pit excavation showed slight to moderate intermixing of soil material(s) and disturbed subgrade immediately above and below the native soil elevation. The re-compaction and disturbances of the non-native fill and native soil matrix during the earthmoving activities in the Block over time may have created voids and other fissures within the soil, creating increased soil permeability in localized areas. As the new soil matrix settles and compacts over time, the permeability within the soil should decrease to the estimated laboratory values. The rate of compaction is dependent on the localized soil mix, which is considerably variable throughout the Block.

The soil component of the fill material approximately exhibits the characteristics of silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments may affect the compaction ability of the heterogeneous fill and its permeability in indeterminate and localized areas.

3.2.4 Site Description for Proposed Block 2

3.2.4.1 Block 2 Overview

Block 2 is an approximately rectangular shaped property, located at the southeast corner of the site. The Block topography is sloping downward from west to east. The approximate western half of the Block has been graded with heterogeneous fill material mostly over bedrock, and the approximate eastern half is a cleared but un-grubbed area of a relatively shallow native topsoil soil layer over bedrock. At practical auger refusal for boreholes B2-1, B2-2, RB2-01 and RB2-02, there were traces of sandstone and limestone in the split spoon sampler and at B2-3 there were traces of only sandstone. Table 10A provides the summary of soil conditions for Block 2. The Borehole and Test Pit Logs for Block 2 are attached in enclosures 8 to 10, 22 to 23 and 35.

TABLE 10A
BOREHOLE LOG SUMMARY BLOCK 2

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Topsoil Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]		
B2-1	90.4	1.2	None	None	None	None	1.2	1.2 [89.2]	None
B2-2	88.6	1.4	None	None	None	None	1.4	1.4 [87.2]	None
B2-3	82.9	None	0.0 – 0.9	None	None	None	0.9	0.9 [82.1]	0.5 [82.4]
RB2-1	91.6	3.1	None	3.1 – 5.4	None	None	5.4	5.4 [87.2]	3.2 [88.4]
RB2-2	88.7	2.3	None	None	None	None	2.3	2.3 [86.6]	2.2 [86.5]

Note 1: Field Identified as Limestone interbedded with Sandstone.

TABLE 10B
TEST PIT LOG SUMMARY BLOCK 2

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Topsoil Depth (m)	Silty Sand Depth (m)	Sandy Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]		
TP2-01	90.6	2.9	None	2.9 – 4.2	None	4.2	N/E	No Refusal	2.9 [87.7]
TP2-02	86.9	None	None	None	None	0.0 – 0.2	0.2	0.2 [86.7]	0.1 [86.8]

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

3.2.4.2 Soil Permeability and Monitoring Well Information, Block 2

One monitoring well was installed to determine general water levels and soil permeability for Block 2. The predictive, lab and field data are summarized in Table 11. Well information is summarized in Borehole Log B2-3.

TABLE 11
K (CONDUCTIVITY) RESULTS BLOCK 2

Blk. No.	Location	Non-Native Soil	Native Soil/ [Rock] Screen Range BGS (m)	Hydro-logic Soil Group (MOE)	Lab Test Results (USCS)	Estimated Laboratory K (cm/ sec)	Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)	Estimated Percolation Time (min/cm)
2	B/MW2-03	N/A	[Sand Stone] (0.6+/- - 2.4 + /-)	N/A	No Lab Test	No Lab Test	5.90 x E -03	50 +
	West 50% (Fill Area)	Fill	N/A	D	No Lab Test	No Lab Test	No Slug Test	50+

Note 1: N/A: Not applicable.

In approximately the east 50% of Block 2, there exists native soil over bedrock. The monitoring well B/MW2-3 showed a higher conductivity ‘K’ value in-situ than what would be predicted for solid rock. Seams were present in the rock cores which may account for a local conductivity, at the core site, but this should not be considered as an indicator of permeability for the Block.

The soil component of the heterogeneous fill material in the west 50% of Block 2 approximately exhibits the characteristics of silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments may affect the compaction ability of the heterogeneous fill and its permeability in indeterminate and localized areas. It appears that the majority of this area is comprised of heterogeneous fill material directly overlying bedrock.

3.2.5 Site Description for Proposed Block 3

3.2.5.1 Block 3 Overview

Block 3 is an approximately square shaped property, located at the eastern boundary of the site. The south end of the Block is comprised of a rock knoll; located approximately 50 m south of the SWM3-2 (O and R) monitoring well nest. The knoll then drops abruptly from an estimated elevation of 88.0 m to 83.1 m. The low lying wet area is a cleared but un-grubbed area of relatively shallow native topsoil and soil layer of native silty clay over bedrock. At auger refusal, there were traces of sandstone and limestone in the split spoon sampler. At boreholes SWM3-1R and SWM3-2R, two 1.5 m runs each of limestone interbedded with sandstone were recovered. Table 12 provides the summary of soil conditions for Block 3. The Borehole and Test Pit Logs for Block 3 are attached in enclosures 11 to 14, 24 and 36.

TABLE 12
BOREHOLE AND TEST PIT LOG SUMMARY BLOCK 3

Borehole/ Test Pit No.[1]	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Topsoil Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[2]		
SWM3-1O	83.1	None	None	0.0 – 4.6	None	None	4.6	4.6 [78.5]	0.0 [83.1]
SWM3-1R	83.1	None	None	Bedrock Only	Bedrock Only	Bedrock Only	4.4	4.4 [78.7]	0.0 [83.1]
SWM3-2O	83.1	None	None	0.0 - 3.4	None	None	3.4	3.4 [79.7]	0.0 [83.1
SWM3-2R	83.1	None	None	Bedrock Only	Bedrock Only	Bedrock Only	3.5	3.5 [79.7]	0.0 [83.1]
RB3-1	87.9	1.8	None	1.8 – 1.9	None	None	1.9	1.9 [86.1]	None
TP3-01	88.0	None	None	0.0 – 0.8	None	None	0.8	0.8 [87.23]	None

Note 1: O: Overburden and R: Rock.

Note 2: Field Identified as Limestone interbedded with Sandstone.

3.2.5.2 Soil Permeability and Monitoring Well Information, Block 3

Two monitoring well nests were installed to determine general water levels and soil permeability for Block 3 proposed storm water management facilities. The predictive, lab and field data are summarized in Table 13. Information for the monitoring well nests is summarized in borehole logs SWM 3-1R, SWM 3-1O, SWM 3-2R and SWM 3-2O.

TABLE 13
K (CONDUCTIVITY) RESULTS BLOCK 3

Blk. No.	Location	Soil Type/ [Rock Type] Screen Range (m)	Hydro-Logic Soil Group (MOE)	Lab Test Results (USCS)	Estimated Laboratory K (cm/ sec)	Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)	Estimated Percolation Time (min/cm)
3	SWM 3-1R	[Limestone/ Sand-Stone] (4.9 +/- - 6.4 +/-)	N/A[1]	No Lab Test	No Lab Test	$< 10^{-7}$	50+
	SWM 3-1O	Silty Clay (2.7 +/- - 4.5 +/-)	D	ML	$10^{-5} – 10^{-6}$	8.79 x E - 06	20-50
	SWM 3-2R	[Limestone/ Sand-Stone] (5.3 +/- - 6.8 +/-)	N/A	No Lab Test	No Lab Test	7.64 x E - 06	50+
	SWM 3-2O	Silty Clay (1.8 +/- – 3.6 +/-)	D	No Lab Test	No Lab Test	9.26 x E - 07	20-50

Note 1: N/A: Not applicable.

The monitoring wells SWM3-1R and SWM3-2R showed a higher conductivity ‘K’ value in-situ than what would be predicted for rock. The little permeability shown in the two rock wells may be from localized fracturing in the rock due to drilling. The monitoring wells SWM3-1O and SWM3-2O appear fairly consistent with predictive values for silty clay.

3.2.6 Site Description for Proposed Block 4

3.2.6.1 Block 4 Overview

Block 4 is an approximately square shaped property, located at the north-central (east) area of the site. There is a reserved area allocated for a roadway section labelled as Block 9, adjacent to the west side of Block 4. For the purposes of this discussion, Block 9 will be included as part of Block 4. The Block topography is sloping downward from southwest to northeast. Immediately north and east of the Block is an approximately six (6) to seven (7) metre drop to a low lying wet area, settling at an elevation of 83.1 m (east) and 82.3 m (north). The Block elevation has been graded with a large layer of heterogeneous fill material over native soil overlying bedrock. The bedrock appears to be decreasing in elevation from the south to the north. At practical auger refusal, there were traces of limestone and sandstone fragments in the split spoon sampler. Table 14 provides the summary of soil conditions for Block 4. The borehole and test pit logs for Block 4 are attached in enclosures 15, 25 and 37 to 39.

TABLE 14
BOREHOLE AND TEST PIT LOG SUMMARY BLOCK 4

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Topsoil Depth (m)	Silty Clay Depth (m)	Silty Sand Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]		
B4-1	87.9	4.7	None	4.7 – 7.8	7.8 – 8.5	8.5 – 9.2	9.2	9.2 [78.8]	3.5 [84.4]
RB4-1	89.6	6.6	None	6.6 – 10.1	None	None	10.1	10.1 [79.6]	6.4 [83.2]
TP4-01	89.3	4.5	None	None	None	None	N/E[2]	No Refusal	None
TP4-02	88.7	3.0	None	None	None	None	N/E	No Refusal	3.0 [85.7]
TP4-03	82.7	None	None	None	0.0 – 0.2	0.2 –3.5	N/E	No Refusal	0.0 [82.7]

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

3.2.6.2 Soil Permeability and Monitoring Well Information, Block 4

One monitoring well was installed to determine general water levels and soil permeability for Block 4. The predictive, lab and field data are summarized in Tables 15. The monitoring well information for B/MW4-01 is summarized in borehole log B4-01.

TABLE 15
K (CONDUCTIVITY) RESULTS BLOCK 4

Blk. No.	**Location**	**Non-Native Soil**	**Native Soil Screen Range (m)**	**Hydro-logic Soil Group (MOE)**	**Lab Test Results (USCS)**	**Estimated Laboratory K (cm/ sec)**	**Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)**	**Estimated Percolation Time (min/cm)**
4	B/MW4-01	N/A	Silty Sand (5.0 +/- - 8.1+/-)	C	ML	$10^{-5} – 10^{-6}$	3.47 x E - 03	10-30
	All	Fill	N/A[1]	D	No Lab Test	No Lab Test	No Slug Test	50+

Note 1: N/A: Not applicable.

The monitoring well B/MW 4-01 field test results showed a higher conductivity 'K' value in-situ than the 'K' value determined from the laboratory testing of a representative soil sample obtained from the soil stratum located between the screen elevations.

Samples extracted from the soil during drilling and test pit excavation showed slight to moderate intermixing of soil material(s) and disturbed subgrade immediately above and below the native soil elevation. The re-compaction and disturbances of the non-native fill and native soil matrix during the earthmoving activities in the Block over time may have created voids and other fissures within the soil, creating increased soil permeability in localized areas. As the new soil matrix settles and compacts over time, the permeability within the soil should decrease to the estimated laboratory values. The rate of compaction is dependent on the localized soil mix, which is considerably variable throughout the Block.

The soil component of the fill material approximately exhibits the characteristics of silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments may affect the compaction ability of the heterogeneous fill and its permeability in indeterminate and localized areas.

3.2.7 Site Description for Proposed Block 5

3.2.7.1 Block 5 Overview

Block 5 is an approximately square shaped property, located at the north-central (west) area of the site. The area has a fairly constant elevation within the property lines. North of the site is a 6 m – 7 m drop to a low-lying wet area. The block area has been graded with a large layer of heterogeneous material placed over native soil overlying the bedrock. At practical auger refusal, there were traces of limestone fragments in the split spoon sampler. Table 16 provides the summary of soil conditions for Block 5. The Borehole and Test Pit Logs for Block 5 are attached in enclosures 16 to 18, 26 to 26, and 40 to 41.

TABLE 16
BOREHOLE AND TEST PIT LOG SUMMARY BLOCK 5

Borehole/ Test Pit No.	Grade Elev. (m)	Summary of Subsurface Profile						Practical Auger/ Shovel Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
		Fill Depth (m)	Topsoil Depth (m)	Silty Clay Depth (m)	Sandy Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]		
B5-1	90.5	5.3	None	5.3 – 6.1	6.1 – 7.3	7.3 –10.0	10.0	10.0 [80.5]	7.6 [82.9]
B5-2	90.8	4.6	None	4.6 – 6.7	None	None	N/E[2]	No Refusal	None
B5-3	90.5	6.1	None	6.1 – 7.6	None	None	N/E	No Refusal	7.6 [82.9]
RB5-1	90.1	2.6	None	None	None	None	2.6	2.6 [87.5]	None
RB5-2	91.5	6.1	None	6.1 – 10.4	None	None	10.4	10.4 [81.1]	5.3 [86.2]
TP5-01	91.08	3.0 m	None	None	N/A[3]	N/A	N/E	No Refusal	2.5 [88.6]

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

Note 3: N/A: Not applicable.

3.2.7.2 Soil Permeability and Monitoring Well Information, Block 5

One monitoring well was installed to determine general water levels and soil permeability for Block 5. The predictive, lab and field data are summarized in Table 17. Monitoring Well information for B/MW5-1 is summarized in borehole log B5-1.

TABLE 17

K (CONDUCTIVITY) RESULTS BLOCK 5

Blk. No.	**Location**	**Non-Native Soil**	**Native Soil Screen Range (m)**	**Hydrologic Soil Group (MOE)**	**Lab Test Results (USCS)**	**Estimated Laboratory K (cm/ sec)**	**Field K (Conductivity) AQT – Hvorslev Mean (cm / sec)**	**Estimated Percolation Time (min/cm)**
5	B/MW5-01	N/A	Silty Clay (7.3+/- 8.8+/-)	D	SM	$10^{-5} – 10^{-6}$	9.75 x E - 03	30-50
	All	Fill	N/A[1]	D	No Lab Test	No Lab Test	No Slug Test	50+

Note 1: N/A: Not applicable.

The monitoring well B/MW 5-1 field test results showed a higher conductivity 'K' value in-situ than the 'K' value determined from the laboratory testing of a representative soil sample obtained from the soil stratum located between the screen elevations.

Samples extracted from the soil during drilling and test pit excavation showed slight to moderate intermixing of soil material(s) and disturbed subgrade immediately above and below the native soil elevation. The re-compaction and disturbances of the non-native fill and native soil matrix during the earthmoving activities in the Block over time may have created voids and other fissures within the soil, creating increased soil permeability in localized areas. As the new soil matrix settles and compacts over time, the permeability within the soil should decrease to the estimated laboratory values. The rate of compaction is dependent on the localized soil mix, which is considerably variable throughout the Block.

The soil component of the fill material approximately exhibits the characteristics of silty clay. The varying composition and density of the asphalt, concrete, brick, reinforcing steel, topsoil and wood fragments may affect the compaction ability of the heterogeneous fill and its permeability in indeterminate and localized areas.

3.2.8 Site Description for Hawthorne Road Realignment

3.2.8.1 Hawthorne Road Realignment Overview (Block 10)

The roadway area for the proposed Hawthorne Road Re-alignment has a north-south orientation and is adjacent along the western boundary of Block 7 from Rideau Road to the Site entrance. Widenings for the remaining Block 10 area along Rideau Road southeast of Hawthorne Road will be addressed in a separate report. The area is being currently used as the east drainage ditch for the existing Hawthorne Road and as a drainage area for the sediment pond located within Block 7. At auger refusal, there were traces of limestone and sandstone fragments in the split spoon sampler. Table 18 provides the summary of soil conditions for Hawthorne Road Realignment right-of-way. The Borehole and Test Pit Logs for the Hawthorne Road Realignment are attached in enclosures 28 to 30 and 41 to 42.

TABLE 18

BOREHOLE AND TEST PIT LOG SUMMARY HAWTHORNE RD REALIGNMENT

Borehole/ Test Pit No.	Grade Elev. (m)	Fill Depth (m)	Peat Depth (m)	Silty Clay Depth (m)	Silty Sand Depth (m)	Clay Depth (m)	Silty Clay Depth (m)	Bedrock (m)[1]	Practical Refusal Depth, (m) [Elev.]	Water Table/ Seepage Depth (m) [Elev.]
RB10-1	93.7	1.1	None	1.1 – 1.7	1.7 – 2.4	None	2.4 – 6.7	N/E[2]	No Refusal	1.67 [92.0]
RB10-2	91.7	3.1	None	None	3.1 – 3.7	None	None	3.7	3.7 [88.05]	None
RB10-3	89.3	2.5	2.5 – 2.6	2.6 – 3.6	None	None	None	3.6	3.6 [85.7]	2.0 [87.3]
TP10-01	87.1	None	None	None	None	0.0 - 0.3	0.0 – 1.9	N/E	No Refusal	0.0 [87.1]
TP10-02	87.0	None	None	None	None	None	0.0 – 1.2	1.2	1.2 [85.8]	0.0 [87.0]

Note 1: Field Identified as Limestone interbedded with Sandstone.

Note 2: N/E: Not encountered within depth of investigation.

4.0 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

4.1 General

It is understood that the proposed structures to be built within Hawthorne Industrial Park will consist of low level (One (1) to Two (2) storey) Industrial Buildings. It is assumed that based on this Site not having access to the City of Ottawa water and sanitary sewer system, the water and sewer services for these buildings will be provided by independent wells and septic beds for each proposed block.

Each designated block was investigated using a combination of borehole, test pit and monitoring well investigation programs. Based on the findings, the following comments and recommendations for each block in turn are offered.

Further geotechnical studies should be conducted on any (or all) individual blocks to establish and provide parameters for specific planning or preliminary designs of any particular building. However, based upon the findings to date, there appears to be no major issue(s) that would preclude the development of this proposed Industrial Park site.

4.2 Building Foundations and Floor Slabs

4.2.1 Block 1

The Building Site Pad for the proposed Orgaworld building has been placed on engineered fill, which in turn was placed either directly on mostly bedrock or competent soils. There is no basement or sub-level beneath the Orgaworld building. The decision to use engineered fill for the foundation for the Orgaworld building was based on a specific building and site geotechnical investigation. Results of this investigation can be referenced in **Inspec-Sol** Report No. 45804-29.

4.2.2 Remaining Blocks 2, 3, 4, 5, 6, and 7

The subgrade building support options depend on, as applicable, which Block, building size and/or type, proposed final grade elevations and basement / non-basement options the designer/builder considers. The current topography, soil (subsoil) thickness, composition and relative bedrock elevation(s) vary considerably from Block to Block, and in many cases, within the specified block itself.

Any proposed building footprint location should consider the geotechnical characteristics of the soil matrix beneath it using a separate and specific geotechnical investigation mandated for the actual type, size and location parameters of the proposed structure(s).

The majority of the geotechnical field data presented in this report shows fill material directly over either bedrock or mostly competent native soils. Some competent native soil layers are separated from the fill materials by thin layer(s) of weaker soils. Approximately 15% to 20% of the Site has not been graded with heterogeneous fill. These areas comprise of relatively soft soils (including organics) of varying stratum thicknesses overlying bedrock. Local anomalies, including man-made features such as sediment ponds, drainage channels and drainage areas (low lying wet areas), also exist in some blocks. These anomalies should be addressed in the individual block areas with separate geotechnical investigations and recommendations.

Suggested options, as applicable, to address the foundation requirements of the remaining Blocks vary from:

- Complete excavation of the fill material and weak native soils (as applicable) and backfill excavated areas with engineered fill;
- Deepened spread or strip footings placed on competent subsoil (or engineered fill placed over competent subsoil;
- Excavated or drilled piers and grades with or without a structural slab;
- Driven pile foundations with or without a structural slab; and
- A global Block (or site) soil improvement program using Dynamic Consolidation Methods.

It is recommended, for each Block, that a cost/benefit analysis be conducted for the local vs. global (entire Block) application of each proposed geotechnical remedial action.

4.3 Seismic Classification

4.3.1 Block 1

A Multi Channel Analysis of Surface Waves (MASW) Analysis was performed on Block 1 to determine its seismic classification. The purpose of the MASW Analysis was to evaluate the seismic site class by measuring the average shear wave velocity within the upper 30 m of the soil/rock profile. In accordance to the Ontario Building Code (2006), the seismic site class determined was based on the measured shear wave velocities and previously obtained Test Pit data. The relevant Building Code (NBCC and OBC) excerpts, apparatus and methodology governing the work and complete findings can be referenced in the **Inspec-Sol** Report No. 45804-29.

The survey was carried out along two survey lines, one over the rock knoll (exposed bedrock) and the other over an area where the fill material was placed directly over the bedrock. A summary of findings indicates that the shear wave velocities for Line 1 (rock knoll) is 1871 m/s, and for Line 2, 1255 m/s. According to Table 4.1.8.4.A of the National Building Code of Canada NBCC (2005) and based on the lesser of the measured average shear wave velocities, (Line 2), the site was classified as **Class B** for seismic load calculations for this particular building and its design.

It is noted that according to the above mentioned codes Site Class B may be used provided that the footing are founded such that there is less than 3 m of soil or Engineered Fill material between the base of footing and top of bedrock.

This analysis and recommendation is valid for Block 1 only and is included here only as a reference. It is recommended that the remaining Blocks be individually evaluated for MASW testing requirements, as applicable.

4.3.2 Remaining Blocks 2, 3, 4, 5, 6, and 7

Any proposed building or structure should be designed to resist a minimum earthquake force in accordance to the latest release of the National Building Code of Canada (NBCC) and Ontario Building Code (OBC).

The seismic class is mostly based upon the location and elevation of the foundation elements (ex. strip footings, spread footings, or pile caps), and soil and rock types present in the study area.

Based on drilled or excavated findings within the remaining Blocks, with the possible exception of Block 5 and the Future Development Block (which share approximately the same soil / bedrock / moisture characteristics), it is not expected that the remaining Blocks will satisfy the criteria for Site Classes E or F. Block 5 and the adjoining similar low lying wet area (Future Development Block) may satisfy the Class E requirements. The remaining Blocks will likely satisfy the Class D or C requirements. It is advisable that a block and/or building footprint specific seismic investigation be undertaken once pertinent information is available from building designers.

5.0 EXCAVATION AND TEMPORARY DEWATERING

5.1 General (All Lots)

All excavations should be completed and maintained in accordance with the Occupational Health and Safety Act (OHSA) requirements. The following recommendations for excavations should be considered to be a supplement to, not a replacement of, the OHSA requirements.

5.2 Fill

Groundwater seepage is expected at varying depths of excavation. Seepage was observed through heterogeneous fill areas, sandy silt areas, silty clay areas and on top of bedrock during excavation. Seepage conditions may vary (increase) during wet seasonal periods from isolated water perches or rainwater infiltration. The anticipated groundwater seepage volume should be minimal and readily controlled by means of conventional construction dewatering techniques.

The heterogeneous fill materials encountered should be considered as OSHA Type 3 or 4 soils, depending on elevation of the water table.

5.3 Native Soils

Excavation to competent subgrade soils is expected to be below the water table. Suitable temporary groundwater dewatering systems should be constructed as required. Proposed dewatering programs may require Permits to Take Water and water discharge control measures. The native soils below the water table would be considered as OSHA Type 4 soils.

Excavations into the bedrock will very likely require the use of blasting programs. Pre-blast surveys are recommended, as applicable, subject to the location, depth and extent of the rock removal required. Hydraulic excavation methods may be sufficient for smaller areas, depending on its cost effectiveness. The bedrock would be considered as an OSHA Type 1 soil.

6.0 BACKFILL AND PERMANENT DRAINAGE

6.1 General (All Lots)

Foundation wall backfill and drainage should be in accordance with the most recent release of Ontario Building Code (OBC) requirements and should include free draining backfill.

Exterior and underflow drainage systems are anticipated in most buildings. Conventional perimeter foundation drain schemes are considered adequate, subject to proper installation which may consist of a perforated tile surrounded by clear stone and wrapped with geofabric. The drainage system should be connected to a frost-free outlet. If the proposed slab is below the exterior grades then the use of under-floor drains is recommended.

The backfill placed against foundation walls should be of free draining materials, such as the OPSS Granular 'B' specifications up to within 0.3 metres (m) of the ground surface. The upper 0.3 m should be a low permeable soil to reduce surface water infiltration. The native clayey silt soils at the site would be suitable for use as low permeable soil.

Foundation backfill should be placed and compacted as outlined below:

- Free-draining backfill should be used for both sides of the foundation wall;
- Backfill should be placed and compacted in uniform lift thickness compatible with the selected construction equipment, but not thicker than 200 millimetres (mm). Backfill should be placed uniformly on both sides of the foundation walls to avoid build-up of unbalanced lateral pressures;
- Backfill should not be placed in a frozen condition, or placed on a frozen subgrade;
- For backfill that would underlie paved areas, sidewalks or slabs-on-grade, each lift should be uniformly compacted to at least 98% Standard Proctor Maximum Dry Density (SPMDD);
- The underside of sidewalks at flush door openings should be insulated, or the sidewalk should be placed on frost walls to prevent heaving;
- For backfill on the building exterior that would underlie landscaped areas, each lift should be uniformly compacted to at least 95% of SPMDD;
- In areas on the building exterior where an asphalt or concrete pavement will not be present adjacent to the foundation wall, the upper 0.3 m of the exterior foundation wall should be

backfilled and compacted with a low permeable soil to reduce surface water infiltration; and;

- Exterior grades should be sloped away from the foundation wall, and roof drainage downspouts should be placed so that water flows away from the foundation wall.

Backfill should be placed and compacted in uniform lift thicknesses compatible with the selected construction equipment, but not thicker than 200 mm, and each lift should be uniformly placed and compacted.

6.2 Engineered Fill

Any fill used to raise the grade beneath floor slabs, foundations, roadways or parking areas foundations shall be considered to be engineered fill. To be considered engineered fill, the fill material requirements and placement operations are recommended to satisfy the following criteria listed below:

- Engineered fill must be placed under continuous supervision of the Geotechnical Engineer. Prior to placing any engineered fill, all unsuitable fill materials must be removed, the subgrade must be investigated for old buried fill or deleterious material, the subgrade must be proof-rolled, and the subgrade elevations must be surveyed;
- Prior to the placement of engineered fill, the source or borrow areas for the engineered fill must be evaluated for its suitability. Samples of proposed fill material must be provided to the Geotechnical Engineer and tested in the geotechnical laboratory for SPMDD and grain size prior to approval of the material for use as an engineered fill. The engineered fill must consist of environmentally suitable, free of organics and other deleterious material (building debris such as wood, bricks, metal, and the like), well graded and compactable, of suitable moisture content so that it is within -2 % to + 0.5% of the Optimum Moisture Content (OMC), as determined from the SPMDD. Granular soils meeting the requirements of Granular B Type I OPSS 1010 criteria would be considered suitable;
- The engineered fill must be placed in maximum loose lift thicknesses of 0.2 m. Each lift of engineered fill must be compacted with a heavy roller to 100% SPMDD; and;
- Field density tests must be taken by the Geotechnical Engineer, on each lift of engineered fill. Any engineered fill, which is tested and found to not meet the specifications, shall be either removed or reworked and retested.

7.0 SERVICES

7.1 Service Trench Backfill (All Lots)

The sides of the trench excavation should be tapered for soils that may be exposed to freezing (to a depth of 1.5 m below surface grade or limit of depth of frost penetration), to minimize the effects of differential frost heave. A taper ranging from 5 to 10 horizontal to 1 vertical is recommended.

Bedding for service pipes should conform to type and dimension with local municipal requirements and Ontario Provincial Standard Specifications (OPSS) and Ontario Provincial Standard Drawings (OPSD). Clear stone is not recommended as a bedding material. Sand cover is recommended to be placed on top of pipes with a minimum cover of 150 mm.

The heterogeneous fill and native materials may be used to over service trenches provided the following conditions are met. The fill and native materials will require a material separation (at the material source) of organic (wood, topsoil, peat etc.), non-compactable (steel, concrete, asphalt or other large fragments), high-moisture content (clays and other soils with a high plasticity) or other deleterious materials. Blast rock may be used provided that it is 150 mm minus diameter, well graded and free of clayey, organic or otherwise deleterious material.

Fill material to be placed in service trenches under the roadway/pavement sections should be placed and compacted to 300 mm lifts, placed and compacted to a minimum of 95% SPMDD, with the upper 300 mm below the pavement sub grade surface compacted to 100% SPMDD. Service trenches should be backfilled with free draining materials to prevent or minimize frost action if drainage of the material can be designed. The sides of the trench within the frost affected zone should have frost tapers incorporated into the backslope, as per OPSS requirements, i.e. should be sloped at 10H:1V. If not, two suggested alternatives are the use of non-shrink fill or backfilling above the pipe cover material with soils similar in texture to the trench sides.

8.0 ROADWAYS

8.1 Internal Access Road

8.1.1 Existing Conditions

There is a low lying wet area at the east – northeast area of Block 6. It was unknown when this study was conducted, if the proposed Internal Access Road roadway alignment crosses over this low lying wet area. An individual geotechnical assessment and construction recommendations may be required for this roadway section.

8.1.2 Recommendations

Within the proposed roadway alignment and area, excavation of the sediment and native soil materials to competent subgrade (likely bedrock) will be required for this and possibly for any other low lying wet area(s) encountered during the construction of the Internal Access Road.

The heterogeneous fill and native materials may possibly be used for embankment construction within the Hawthorne Industrial Park Site. The fill and native materials will require a material separation (at the material source) of organic (wood, topsoil, peat, etc.), non-compactable (steel, concrete, asphalt or other large fragments), high-moisture content (clays and other soils with a high plasticity) or other deleterious materials. Blast rock may also be used provided that it is a maximum of 150 mm minus diameter, well graded and free of clayey, organic or otherwise deleterious material. Placement of frozen backfill, or backfill on frozen grade, is not recommended.

As applicable, exposed cut areas of the existing roadway will require proof-rolling using a triaxial truck fully loaded with granular materials to verify subgrade strength prior to placement of the roadway section. Multiple truck passes over the exposed cut areas are recommended due to the heterogeneous composition of the subgrade. Poor subgrade strength areas are to be sub-excavated to a competent bearing fill or soil material, then backfilled with either a suitable similar graded soil or a 19 mm minus well graded granular material in 150 mm layers and again proof-rolled to ensure sufficient and reasonable bearing capacity.

As applicable, no cut/no fill areas (proposed grade elevation areas requiring an undercut to existing grade to accommodate a partial to total depth of the proposed roadway section) should be excavated 560 mm to accommodate the proposed roadway section as required.

Exposed cut areas in no cut/no fill roadway sections are to be addressed in the same manner as exposed cut areas to ensure sufficient and reasonable bearing capacity.

As applicable, prior to placing fill material for embankment construction, the existing grade should be stripped a minimum 150 mm to ensure good soil material friction within the proposed embankment footprint. As applicable, embankment slopes should be set at 3H:1V.

Positive drainage of the pavement surface course is required. The subgrade surface should be graded at a minimum 2% cross-fall and each subsequent layer of the pavement section (sub-base, base, binder and surface courses) should be graded at the same cross-fall percentage to ensure consistent off the surface layer. Assuming a closed drainage system, surface runoff should be directed to an adequate amount of storm water collection points at proper locations that will facilitate a rapid collection and drainage of the design storm water volume at the minimum.

All base course and sub-base materials shall be compacted to 100% SPMDD, and all pavement structure materials should meet the specification requirements of OPSS Division 10.

TABLE 19
RECOMMENDED PAVEMENT SECTIONS
INTERNAL ACCESS ROAD

PAVEMENT LAYER (Ministry of Transportation of Ontario)	PAVEMENT LAYER (Superpave)[1]
1 lift of 50 mm of HL3 Asphalt PG 58-34 (Surface Course)	1 lift x 50 mm HMA Superpave 12.5 mm for Surface PG 58-34 Level 2 (0.3 - <3.0 Million ESALs)
1 lift of 75 mm HL8 Asphalt PG 58-34 (Binder Course)	1 lift x 75 mm HMA Superpave 19.0 mm for Binder PG 58-34 Level 2 (0.3 - <3.0 Million ESALs)
1 lift of 150 mm OPSS Granular A (Base Course)	1 lift x 150 mm OPSS Granular A for Base
2 lifts of 150 mm OPSS Granular B Type II (Sub-Base Course)	2 lifts x 150 mm OPSS Granular B Type II for Subbase

Note 1: Superpave recommendations assume min. subgrade strength of CBR = 3 or M_r = 4500 psi.

Sufficient field-testing should be carried out during construction to assess the compaction level of each lift of the pavement layers. This should be accompanied by laboratory testing of the granular and asphalt materials.

Annual or regular maintenance will be required to achieve maximum life expectancy of the roadway section. Routine pavement maintenance generally involves crack sealing and repairs of local distresses.

8.2 Hawthorne Road Realignment

8.2.1 Existing Conditions

It is understood that the existing Hawthorne Road south of Rideau Road will be realigned to the east of the existing roadway alignment.

The existing Hawthorne Road alignment, between Rideau Road and the current entrance to the Hawthorne Industrial Park, is a fill section for its entire length. The height of the embankment increases to traverse a rock knoll comprised of fractured interbedded limestone and sandstone that crosses the roadway at approximately ¼ of the length between Rideau Road and the current entrance to the Hawthorne Industrial Park. The embankment of the existing roadway was constructed of non-native backfill directly placed over the native soil.

The right shoulder embankment (looking northwards) of the existing roadway between Rideau Road and the rock knoll has experience a slope base failures in localized areas into the adjoining soft clay and topsoil. It is recommended that this embankment area be delineated to approximately ½ the width of the northbound lane in affected areas, excavated to competent subgrade, and reconstructed with competent materials prior to placement of the new adjoining embankment and roadway section.

The proposed roadway alignment and area is located parallel and immediately east of existing Hawthorne Road and parallel and immediately west of Block 7. The proposed roadway alignment area is currently being used as a drainage ditch for the existing Hawthorne Road and for the runoff of an operating sediment pond, located at the approximately southwest quadrant of Block 7. Prior to construction, diversion of the active water and sediment drainage away from the proposed alignment area is recommended.

8.2.2 Recommendations

Within the proposed roadway alignment area, excavation of the sediment and native soil materials to competent subgrade (likely bedrock) will be required for approximately the northern half of the proposed roadway length. South of the rock knoll, competent native soil subgrade should become accessible at a relatively shallow excavation depth.

The heterogeneous fill material excavated in the Industrial Park may not be used as backfill for new or remedial (existing Hawthorne Road) embankment construction. Blast rock may be used provided that it is 150 mm minus diameter well graded, and free of clayey, organic or otherwise deleterious material. It is to be placed from competent subgrade in maximum 150 mm lift increments to an elevation of 560 mm below final roadway pavement grade elevation. The embankment slopes should be set at 3H:1V. Placement of frozen backfill, or backfill on frozen grade, is not recommended.

If the existing roadway embankment is to be tied in and partially used as part of the new roadway alignment, the affected existing slope areas should be examined and corrected for slope failures prior to construction (or tie-in) of the new embankment.

To avoid a slip joint in the existing Hawthorne Road embankment, while constructing the widened area, bench as appropriate using a 2H:1V cut into the embankment to top of subgrade. The height of the embankment will determine the amount of benching required. The existing roadway slope should be cleared and grubbed of all organic and deleterious material prior to benching.

As applicable, exposed cut areas of the existing roadway will require proof-rolling using a triaxial truck fully loaded with granular materials to verify subgrade strength prior to placement of the roadway section. Multiple truck passes over the exposed cut areas are recommended due to the heterogeneous composition of the existing embankment. Poor subgrade strength areas are to be sub-excavated to a competent bearing fill or soil material, then backfilled with either a suitable similar graded soil or a 19 mm minus well graded granular material in 150 mm layers and again proof-rolled to ensure a sufficient and reasonable bearing capacity.

As applicable, no cut/no fill areas (proposed grade elevation areas requiring an undercut to existing grade accommodate a partial to total depth of the proposed roadway section) should be excavated 560 mm to accommodate the proposed roadway section. Exposed cut areas in no cut/no fill areas are to be addressed in the same manner as exposed cut areas.

As applicable, proposed grade raises (or embankments) over the existing Hawthorne Road may be constructed provided that the existing roadway surface is stripped a minimum 150 mm deep prior to construction within the affected proposed embankment subgrade area. Exposed proposed weak embankment subgrade areas (after 150 mm stripping) are to be addressed in the same manner as exposed cut areas. Subsequent grade raise (or embankment) construction should proceed in the same manner and layers as the adjoining new embankment, as applicable. The finished embankment slopes should be set at 3H:1V.

Drainage of the pavement surface course is required. The subgrade surface should be graded at a minimum 2% cross-fall and each subsequent layer of the pavement section (sub-base, base, binder and surface courses) should be graded at the same cross-fall percentage to ensure consistent off the surface layer. As applicable, using a closed drainage system, surface runoff should be directed to an adequate amount of storm water collection points at proper locations that will facilitate a rapid collection and drainage of the design storm water volume at minimum. As applicable, using an open drainage system surface runoff should be directed to side ditches that produce positive drainage away from road surface and toe of slope (as applicable) areas.

TABLE 20

RECOMMENDED PAVEMENT SECTIONS HAWTHORNE ROAD

PAVEMENT LAYER (Ministry of Transportation of Ontario)	**PAVEMENT LAYER (Superpave)[1]**
1 lift of 50 mm of HL3 Asphalt PG 58-34 (Surface Course)	1 lift x 50 mm HMA Superpave 12.5 mm for Surface PG 58-34 Level 3 (3.0 - <10.0 Million ESALs)
1 lift of 100 mm HL8 Asphalt PG 58-34 (Binder Course)	1 lift x 100 mm HMA Superpave 19.0 mm for Binder PG 58-34 Level 3 (3.0 - <10.0 Million ESALs)
1 lift of 150 mm OPSS Granular A (Base Course)	1 lift x 150 mm OPSS Granular A for Base
2 lifts of 150 mm OPSS Granular B Type II (Sub-Base Course)	2 lifts x 150 mm OPSS Granular B Type II for Subbase

Note 1: Superpave recommendations assume min. subgrade strength of CBR = 3 or M_r = 4500 psi.

All base course and sub-base materials shall be compacted to 100 percent SPMDD, and all pavement structure materials should meet the specification requirements of OPSS Division 10.

Sufficient field-testing should be carried out during construction to assess compaction of each lift of the pavement layers. This should be accompanied by laboratory testing of the granular and asphalt materials.

Annual or regular maintenance will be required to achieve maximum life expectancy of the roadway section. Generally, routine asphalt pavement maintenance will involve crack sealing and repairs of local distresses.

9.0 LIMITATIONS OF THE INVESTIGATION

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to **Inspec-Sol** at the time of preparation. No portion of this report may be used as a separate entity, it is written to be read in its entirety. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.

Although every effort has been made to ensure that the values obtained from boreholes, test pits or monitoring wells represented in the Tables and Figures (as applicable) in this report are accurate, if there is a discrepancy, the values in the Enclosures shall be considered as correct.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is also important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the test locations only. It is, therefore, assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise.

INSPEC-SOL INC.

Wm Beveridge

JBBennett

William S. Beveridge, B.A., B.Eng.
Project Manager

Joseph B. Bennett, P. Eng.
Vice President

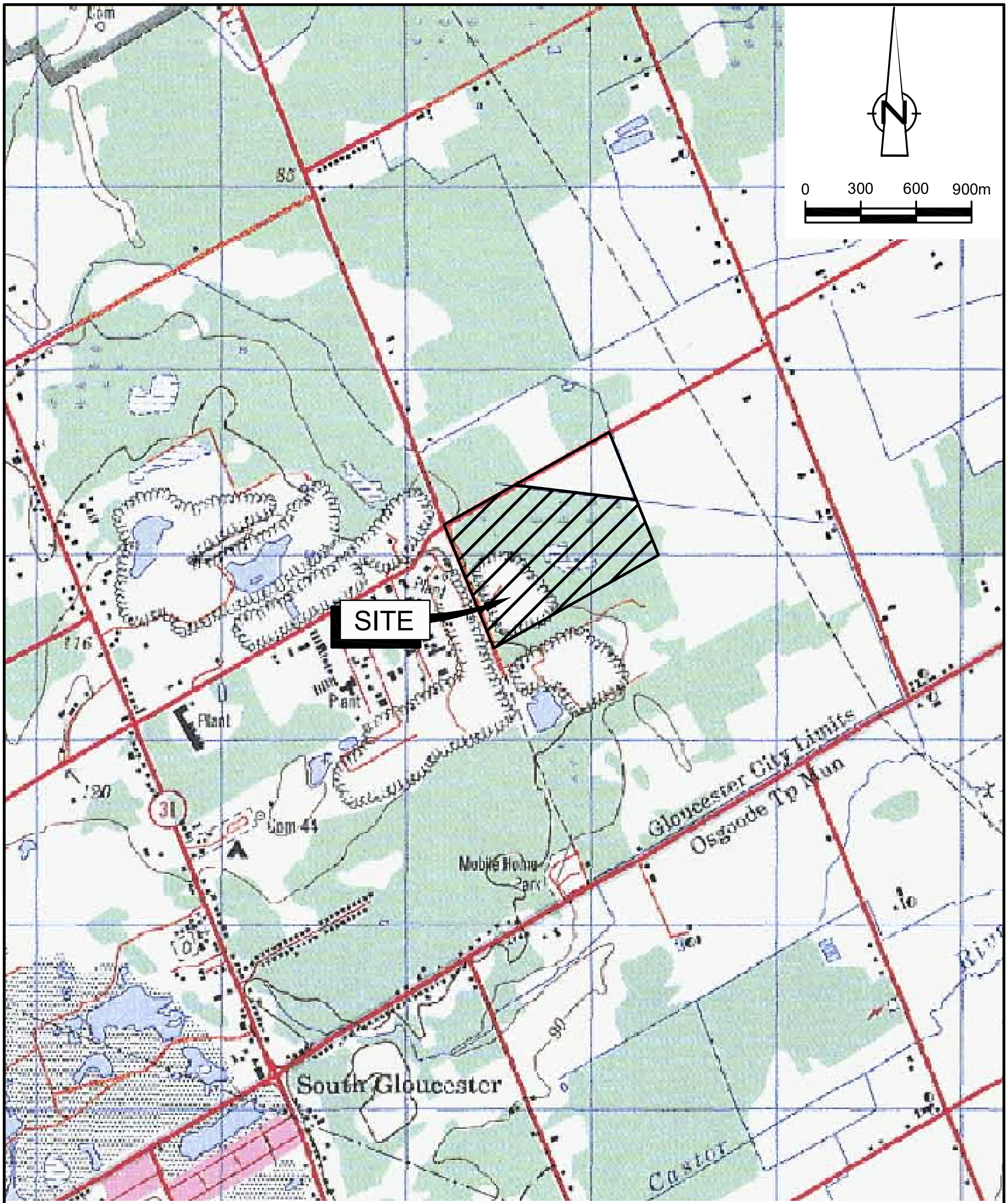
JBB/WSB/vl

Enclosures

Dist: Mr. Tim Chadder- J.L. Richards and Associates,-email-(TChadder@jlrichards.ca)

DRAWINGS

SITE LOCATION PLAN
SITE PLAN
BOREHOLE AND TEST PIT LOCATION PLAN
TEST PIT LOCATION PLAN (BLOCK 1)
TEST PIT LOCATION PLAN (1994)



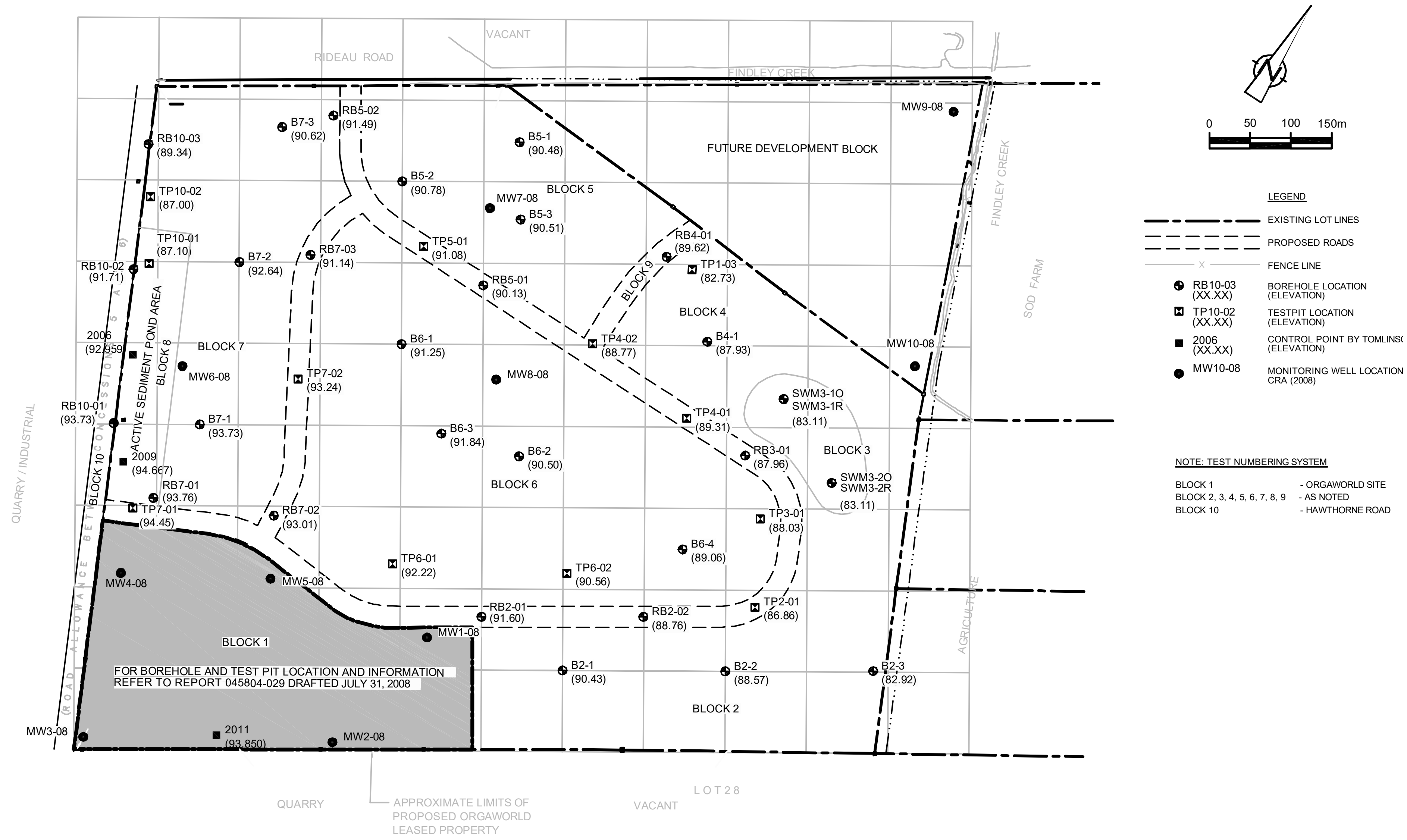
SOURCE: NRCAN TOPOGRAPHIC MAPS - OTTAWA AREA SCALE 1:50000
HER MAJESTY THE QUEEN IN RIGHT OF CANADA, DEPARTMENT
OF NATURAL RESOURCES,1998

SITE LOCATION MAP

GEOTECHNICAL INVESTIGATION
R.W. TOMLINSON Ltd.
LOT 26 AND 27, CONCESSION 6, OTTAWA, ONTARIO
T020556-A1-1

INSPEC•SOL

T020556-A1(001)GN-OT001 JAN 27/2009

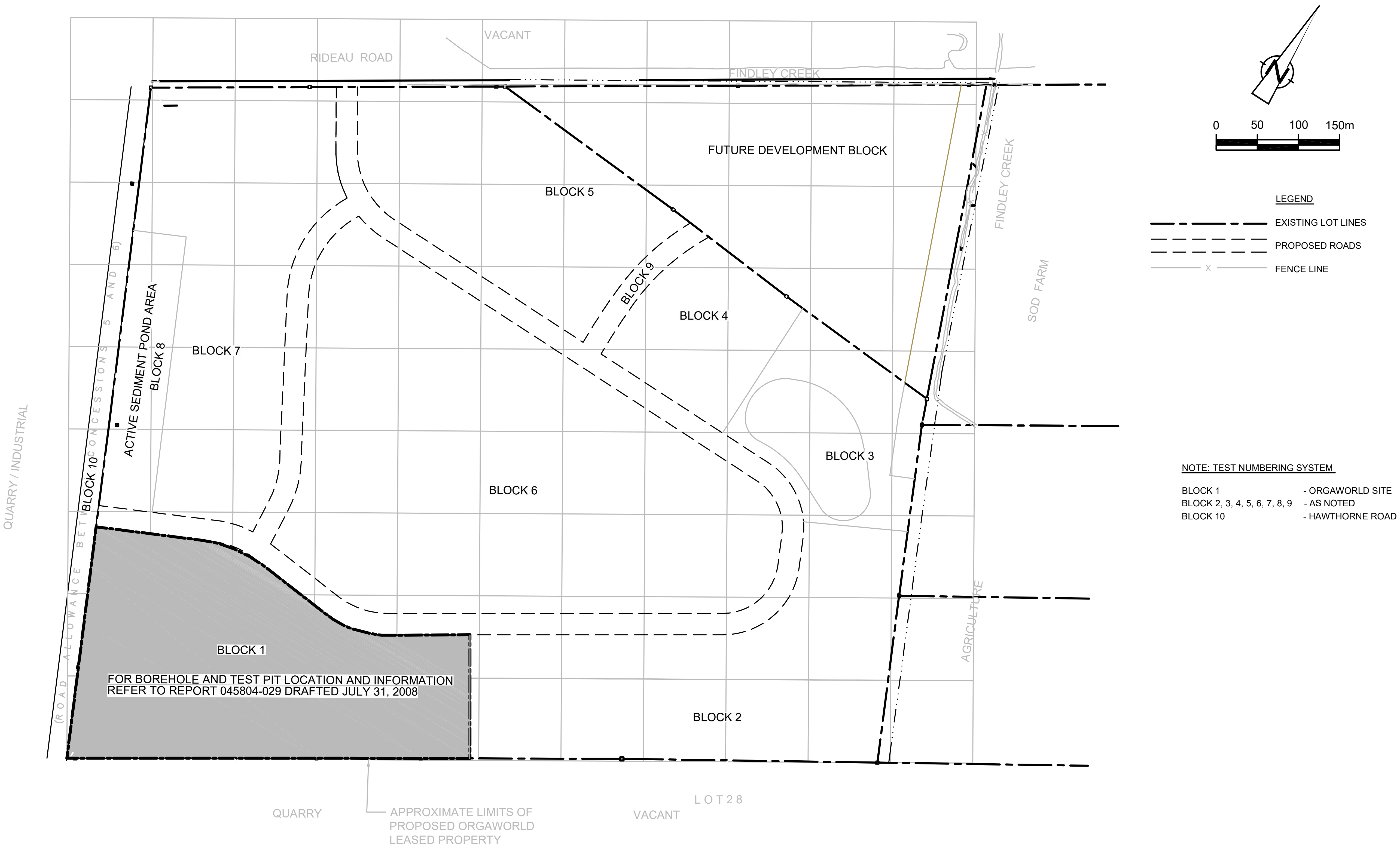


BOREHOLE AND TEST PIT LOCATION PLAN

GEOTECHNICAL INVESTIGATION
R.W.TOMLINSON Ltd.
LOT 26 AND 27, CONCESSION 6, OTTAWA, ONTARIO
T020556-A1-3

INSPEC•SOL

SOURCE: J.L. RICHARDS & ASSOCIATES LIMITED
PROJECT No. 20983, DRAWING C1
COORDINATE SYSTEM: MTM Z0NE 9, NAD27



NOTE: TEST NUMBERING SYSTEM

BLOCK 1	- ORGAWORLD SITE
BLOCK 2, 3, 4, 5, 6, 7, 8, 9	- AS NOTED
BLOCK 10	- HAWTHORNE ROAD

SITE PLAN

GEOTECHNICAL INVESTIGATION
R.W.TOMLINSON Ltd.
LOT 26 AND 27, CONCESSION 6, OTTAWA, ONTARIO
T020556-A1-2

INSPEC•SOL

SOURCE: J.L. RICHARDS & ASSOCIATES LIMITED
PROJECT No. 20983, DRAWING C1
COORDINATE SYSTEM: MTM Z0NE 9, NAD27

T020556-A1(001)GN-OT006 MAY 04/2009

NOTE: TEST NUMBERING SYSTEM

BLOCK 1	- ORGAWORLD SITE
BLOCK 2, 3, 4, 5, 6, 7, 8, 9	- AS NOTED
BLOCK 10	- HAWTHORNE ROAD

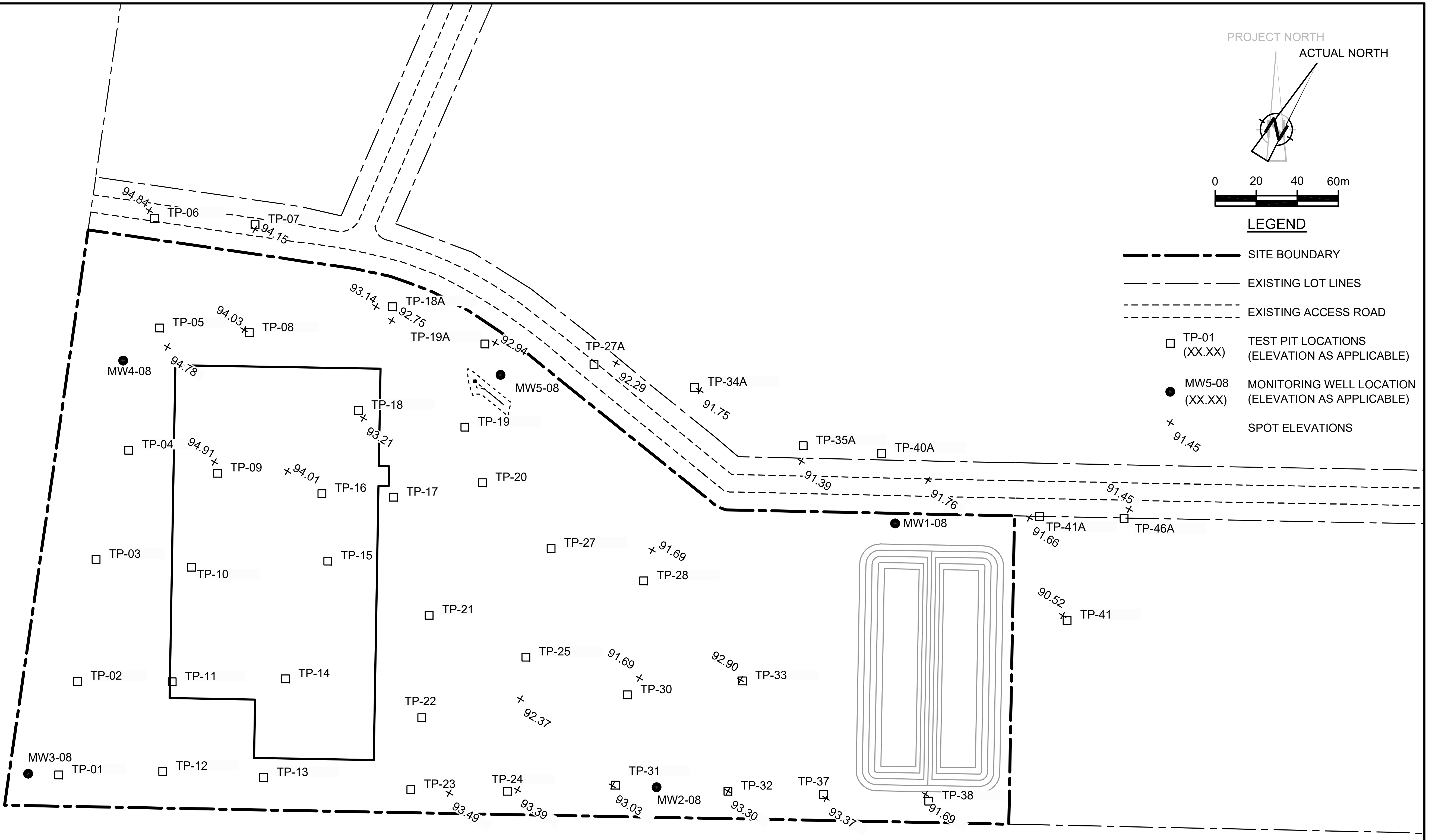
SOURCE: J.L. RICHARDS & ASSOCIATES LIMITED
PROJECT No. 20983, DRAWING C1
COORDINATE SYSTEM: MTM ZONE 9, NAD27

TEST PIT LOCATION PLAN (1994)

GEOTECHNICAL INVESTIGATION
R.W. TOMLINSON LTD.
LOT26 AND 27 CONCESSION 6, OTTAWA, ONTARIO
T020556-A1-5

INSPEC•SOL

T020556-A1(001)GN-OT005 MAY 04/2009



TEST PIT LOCATION PLAN (BLOCK 1)
GEOTECHNICAL INVESTIGATION
ORGANICS COMPOSTING FACILITY
OTTAWA, ONTARIO
T020556-A1-4

INSPEC•SOL

BOREHOLE LOCATION PLAN TAKEN FROM CRA REPORT 7 FIGURE 2 SEPT. 11, 2008

T020556-A1(001)GN-OT004 JAN 27/2009

ENCLOSURES

BOREHOLE AND MONITORING WELL LOGS
ROADWAY BOREHOLE LOGS
TEST PIT LOGS

REFERENCE No.: T020556-A1

ENCLOSURE No.: 1

INSPEC·SOL

BOREHOLE No.: B7-1

ELEVATION: 93.73 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

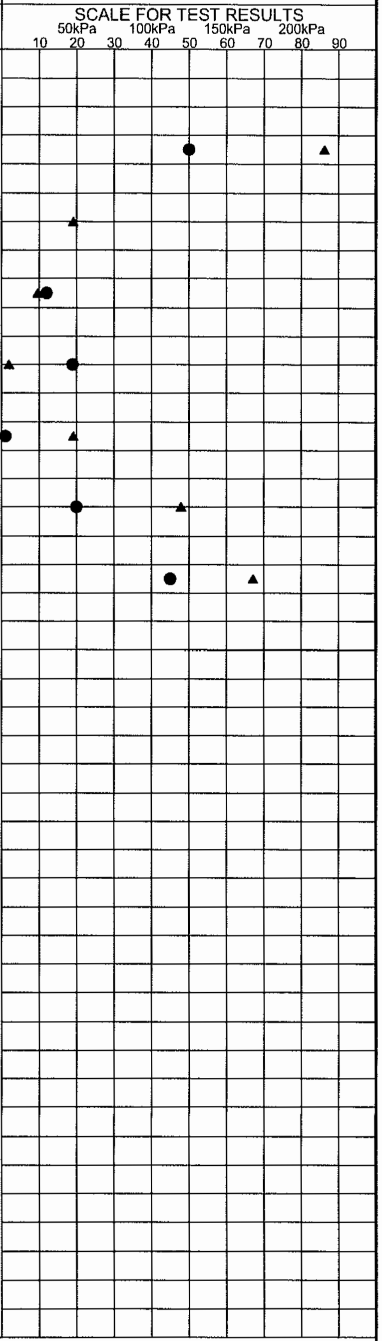
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	93.73		GROUND SURFACE			%	ppm	N
		☒	FILL- asphalt and concrete fragments, some gravel, sand, silt, clay, very dense, brownish black, dry					
1.0				☒	SS1	50		50+
	92.21	▨	SILTY CLAY- some gravel, organics, trace oxidation, stiff, brown / black, dry	☒	SS2	9		R
2.0	91.44	▨	SILTY CLAY, some gravel, sand, firm, brown / black, moist	☒	SS3	46		12
▼3.0	90.68	▨	SILTY CLAY - some gravel, trace organics, very soft, brownish grey, wet	☒	SS4	13		19
4.0				☒	SS5	25		1
	89.46		TOPSOIL, some organics, very soft, black, brown, wet					
	89.31	▨	SILTY CLAY- some organics, stiff, black / grey, wet					
5.0	89.16	▨	SILTY CLAY- trace oxidation, organics, grey brown, wet	☒	SS6	59		20
				☒	SS7	13		45
6.0	87.63		End of Borehole Auger Refusal Assumed Bedrock					
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 2

INSPEC-SOL

BOREHOLE No.: B7-2

ELEVATION: 92.64 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge

CHECKED BY: J.Bennett

DATE (START): October 31, 2008

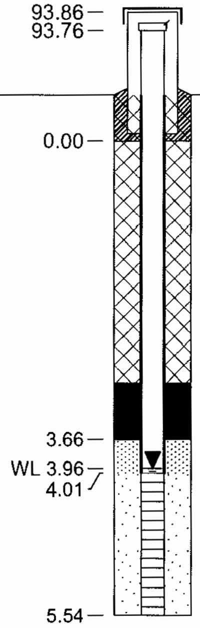
DATE (FINISH): October 31, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
☐	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

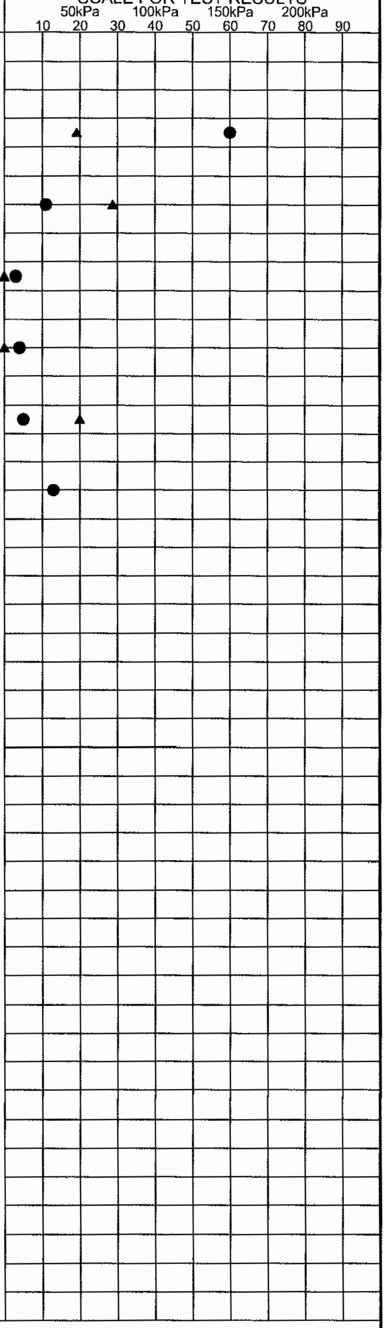
SCALE		STRATIGRAPHY	
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK
meters	92.64		GROUND SURFACE
1.0		▩	FILL- silty clay, some sand, gravel, asphalt and concrete fragments, trace organics, stiff, black, grey, brown, moist, petroleum odour
2.0		▩	-some trace gravel and asphalt
3.0		▩	-becoming very stiff to very soft, trace oxidation
	89.44	▨	SILTY CLAY- trace sand, oxidation stiff, greenish brown, moist
4.0	88.83	▨	SILTY CLAY- trace organics, oxidation, stiff, green, brown, red, moist
5.0	87.76	▨	SILTY CLAY- some gravel, sand, trace organics, stiff, black/grey, wet
	87.10		End of Borehole Auger Refusal Assumed Bedrock
6.0			
7.0			
8.0			
9.0			
10.0			
11.0			
12.0			
13.0			

MONITOR WELL



SAMPLE DATA				
State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
		%	ppm	N
☒	SS1	71		60
☒	SS2	50		11
☒	SS3	21		3
☒	SS4	75		4
☒	SS5	100		5
☒	SS6	46		13
	SS7	18		R

SCALE FOR TEST RESULTS



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 3

INSPEC-SOL

BOREHOLE No.: B7-3

ELEVATION: 90.62 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	90.62		GROUND SURFACE			%	ppm	N	
		☒	FILL- sand and gravel, some clay, compact, brown, moist						
1.0		☒		☒	SS1	42		26	●
		☒	-becoming compact to very dense	☒	SS2	46		R	
2.0	88.54	⁞	SILTY SAND - some gravel, very dense, brown, dry	☒	SS3	0		R	
	88.21		End of Borehole Auger Refusal						
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									

NOTES:

BOREHOLE LOG T020556-A1-BH(OCT-31-08).GPJ INSPEC_SOL.GDT 5/12/09

REFERENCE No.: T020556-A1 ENCLOSURE No.: 4

iNSPEC·SOL

BOREHOLE No.: B6-1

ELEVATION: 91.25 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

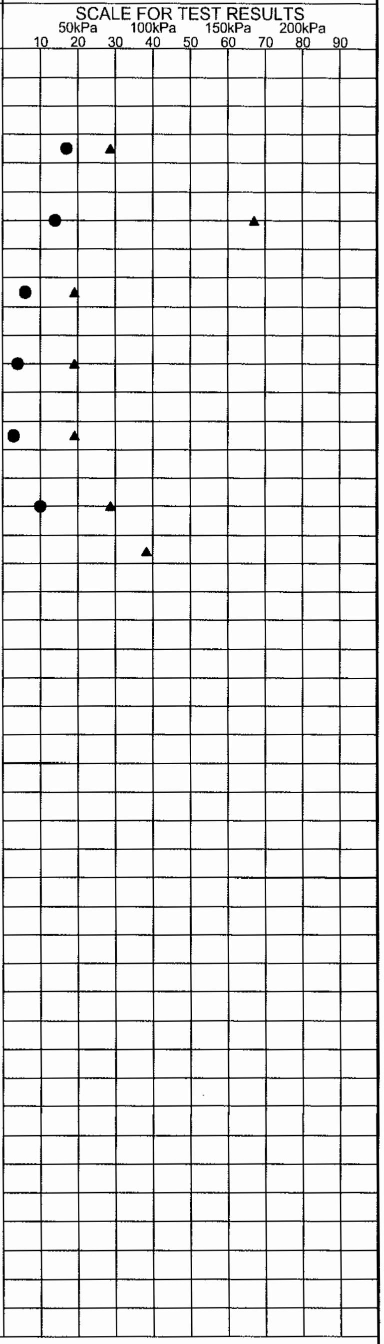
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 23, 2008 DATE (FINISH): October 23, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
◫	RC	Rock Core
▼		Water Level
o		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	91.25		GROUND SURFACE			%	ppm	N
			FILL- silty clay, some gravel, asphalt fragments and sand, trace oxidation, very stiff, greyish brown, moist					
1.0				☒	SS1	67		17
	89.73		FILL- silty clay, some gravel and sand, trace organics and oxidation, hard, greyish brown, moist	☒	SS2	67		14
2.0								
			-some trace of gravel to sand, becoming hard to very stiff, less organics	☒	SS3	67		6
▼3.0			-trace to some sand, moist to wet	☒	SS4	63		4
4.0	87.44		SANDY SILT- some gravel, very loose, brownish grey, wet	☒	SS5	75		3
5.0	86.68		SANDY CLAY- some gravel, trace organics, oxidation, very stiff, greenish grey, moist	☒	SS6	75		10
	85.92 85.89		SANDY CLAY- some gravel, trace organics, very stiff, brownish grey, wet		SS7	0		R
6.0			End of Borehole Auger Refusal Presumed Bedrock					
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 5

iNSPEC•SOL

BOREHOLE No.: B6-2

ELEVATION: 90.50 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

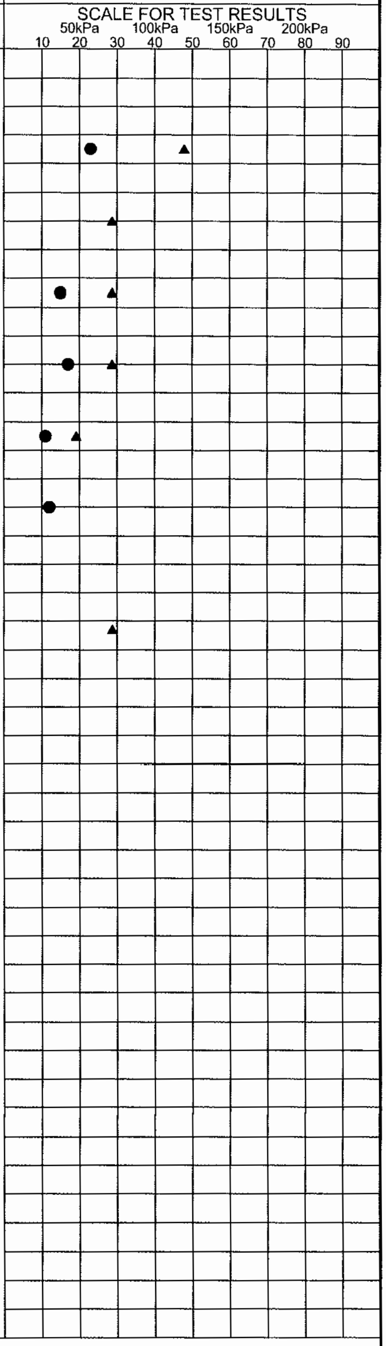
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 27, 2008 DATE (FINISH): October 27, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	90.50		GROUND SURFACE			%	ppm	N
			FILL- silty clay, some gravel and asphalt fragments, trace organics, hard, brown, grey, moist					
1.0				☒	SS1	67		23
2.0			-becomes hard to very stiff	☒	SS2	21		R
				☒	SS3	13		15
▼ 3.0	87.40		SILTY CLAY- some sand and gravel, trace organics, very stiff, grey, brown moist	☒	SS4	50		17
4.0	86.69		SANDY SILT- some sand and gravel, trace oxidation, stiff, grey, brown, moist	☒	SS5	34		11
	85.93		SANDY SILT- some gravel and organics, compact, grey, moist	☒	SS6	50		12
5.0				☒	SS7	0		R
			-becomes compact to dense					
6.0	84.40 84.22		SANDY CLAY- some gravel, very stiff, brownish grey, moist	☒	SS8	25		R
7.0			End of borehole Auger Refusal Presumed Bedrock					
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 6

INSPEC-SOL

BOREHOLE No.: B6-3

ELEVATION: 91.84 m

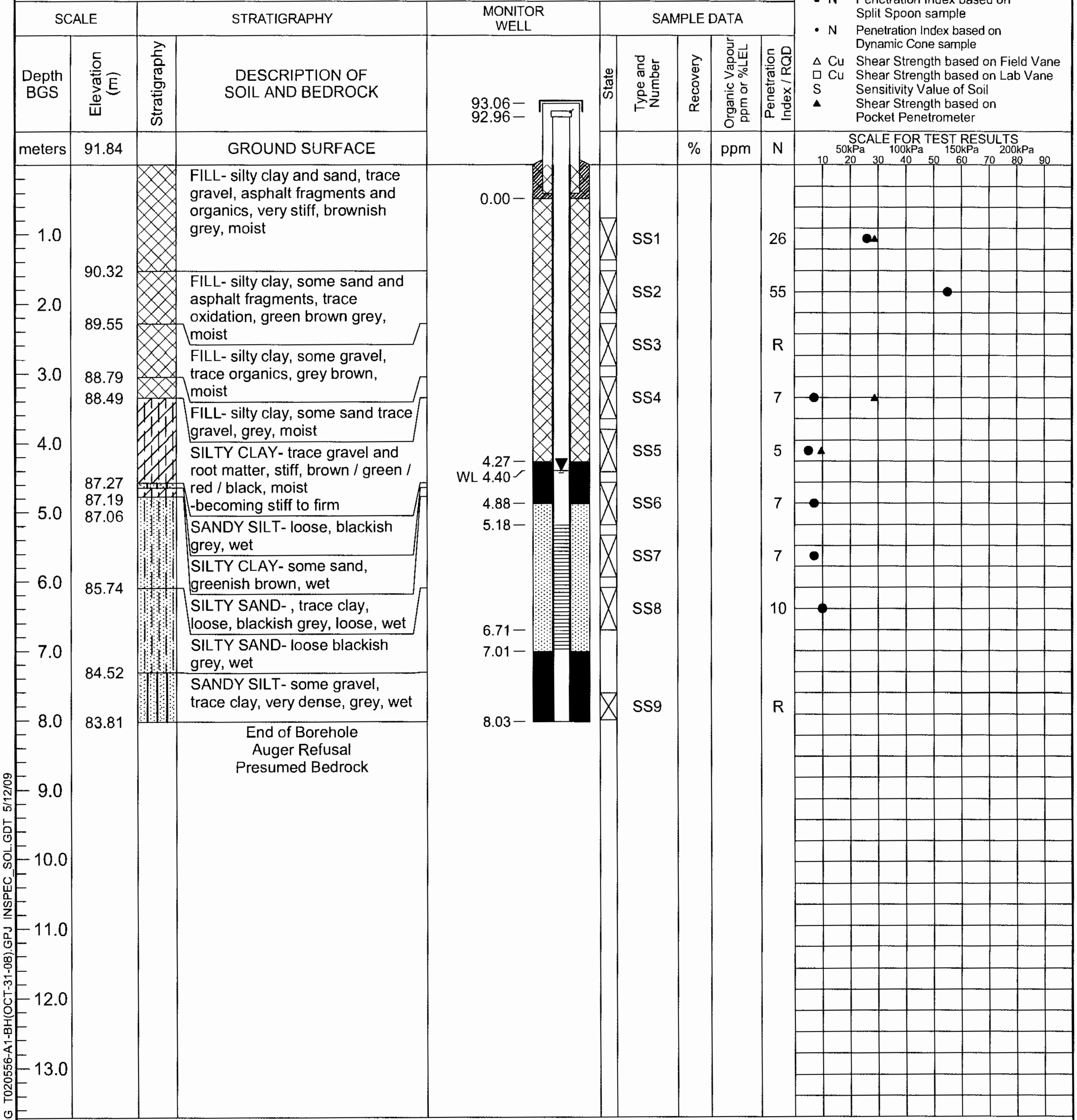
BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge
CHECKED BY: J.Bennett
DATE (START): October 31, 2008
DATE (FINISH): October 31, 2008

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ▯ RC Rock Core
- ▼ Water Level
- o Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer



Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
91.84	GROUND SURFACE
	FILL- silty clay and sand, trace gravel, asphalt fragments and organics, very stiff, brownish grey, moist
90.32	FILL- silty clay, some sand and asphalt fragments, trace oxidation, green brown grey, moist
89.55	FILL- silty clay, some gravel, trace organics, grey brown, moist
88.79	FILL- silty clay, some sand trace gravel, grey, moist
88.49	SILTY CLAY- trace gravel and root matter, stiff, brown / green / red / black, moist -becoming stiff to firm
87.27	SANDY SILT- loose, blackish grey, wet
87.19	SILTY CLAY- some sand, greenish brown, wet
87.06	SILTY SAND- , trace clay, loose, blackish grey, loose, wet
85.74	SILTY SAND- loose blackish grey, wet
84.52	SANDY SILT- some gravel, trace clay, very dense, grey, wet
83.81	End of Borehole Auger Refusal Presumed Bedrock

Type and Number	Recovery %	Organic Vapour ppm or %LEL ppm	Penetration Index / RQD N
SS1			26
SS2			55
SS3			R
SS4			7
SS5			5
SS6			7
SS7			7
SS8			10
SS9			R

NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 7

INSPEC·SOL

BOREHOLE No.: B6-4
ELEVATION: 89.06 m

BOREHOLE LOG

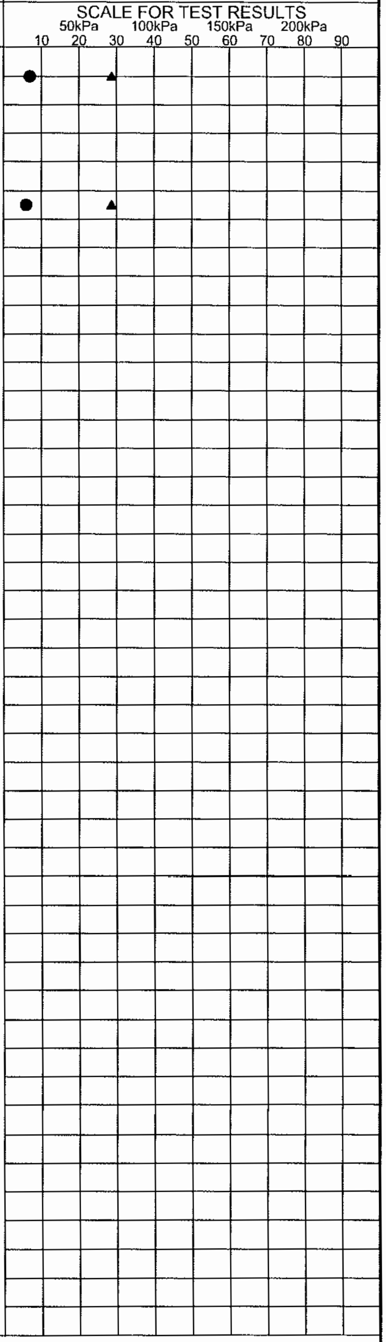
Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 27, 2008 DATE (FINISH): October 27, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	89.06		GROUND SURFACE			%	ppm	N
			SANDY SILT- some organics, trace gravel, very loose, greenish grey, moist	☒	SS1	58		7
1.0								
	87.35		SILTY CLAY- some sand, gravel and organics, trace oxidation, very stiff, blackish grey, moist	☒	SS2	17		6
2.0	87.23		End of Borehole Auger Refusal Assumed Bedrock					
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 8

INSPEC·SOL

BOREHOLE No.: B2-1

ELEVATION: 90.43 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

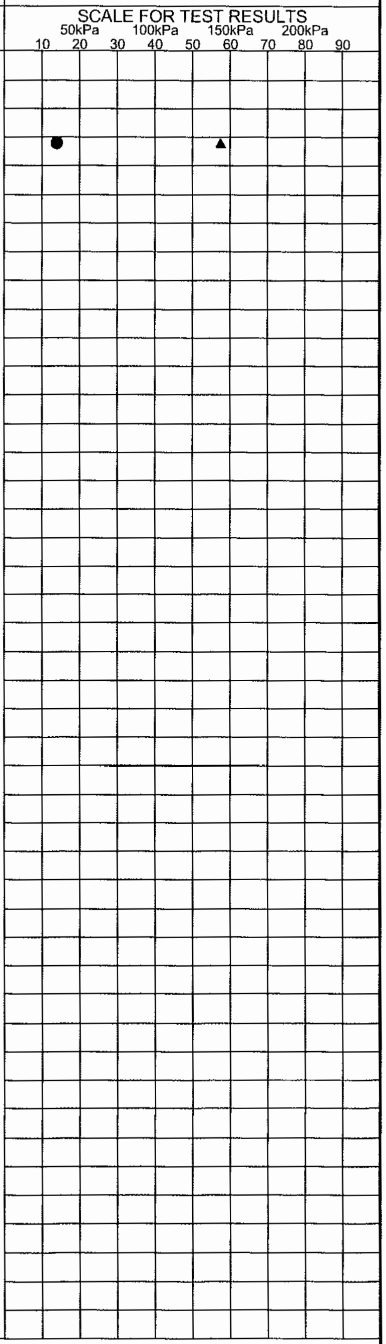
DATE (START): October 27, 2008 DATE (FINISH): October 27, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	90.43		GROUND SURFACE			%	ppm	N
1.0	89.24	☒	FILL- sandy silt, some gravel and organics, compact, brown, moist	☒	SS1	58		14
			End of Borehole Auger Refusal Assumed Bedrock					

Depth scale: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 9

INSPEC·SOL

BOREHOLE No.: B2-2

ELEVATION: 88.57 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 28, 2008 DATE (FINISH): October 28, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA					SCALE FOR TEST RESULTS
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD	50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	88.57		GROUND SURFACE			%	ppm	N	
		☒	FILL- sand, some gravel, organics, loose, blackish brown, moist						
1.0				☒	SS1	38		8	●
	87.15		End of Borehole Auger Refusal Assumed Bedrock						
2.0									
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									

NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 10

iNSPEC·SOL

BOREHOLE No.: B2-3

ELEVATION: 82.92 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

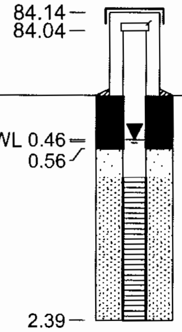
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 28, 2008 DATE (FINISH): October 28, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer



SCALE		STRATIGRAPHY		MONITOR WELL	SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	82.92		GROUND SURFACE				%	ppm	N
			TOPSOIL- organics, very soft, black, moist						
1.0	82.06		SANDSTONE- Nepean formation, tan, light grey seams, fine grained salicious, slightly weathered, hard, close partings, 2 open separations, 1/2"(12.5mm) sand filling		▯	RC1	85		81
2.0	80.53		End of Borehole						
3.0									
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									

SCALE FOR TEST RESULTS

50kPa 100kPa 150kPa 200kPa

10 20 30 40 50 60 70 80 90

NOTES:

INSPEC-SOL

BOREHOLE No.: SWM3-10

ELEVATION: 83.11 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

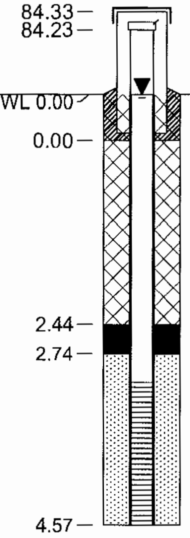
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

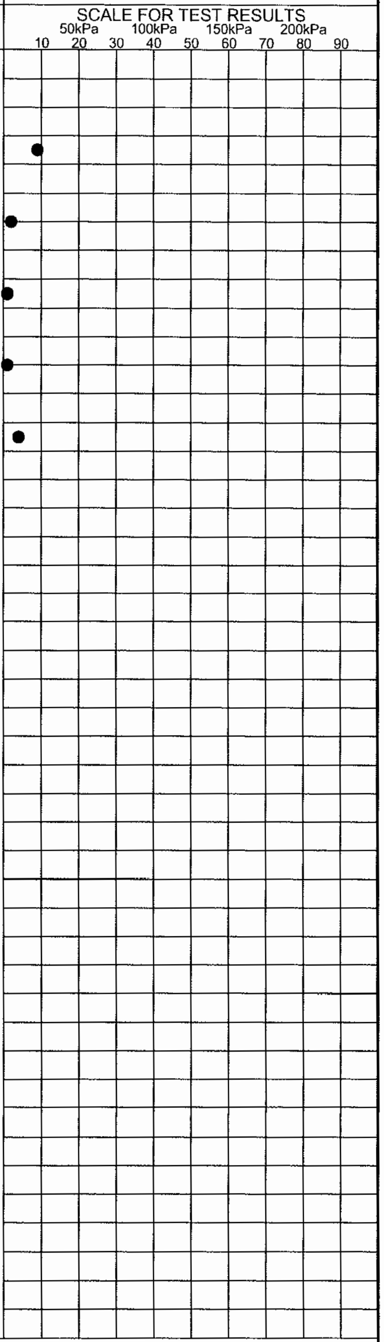
DATE (START): November 3, 2008 DATE (FINISH): November 3, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
	S	Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY	MONITOR WELL	SAMPLE DATA				
Depth BGS	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	83.11	GROUND SURFACE				%	ppm	N
		TOPSOIL- with organics, very soft, black, grey, wet	WL 0.00 0.00					
	82.55	SILTY CLAY- some organics, trace oxidation, sand, stiff, red / brown / black, wet		☒	SS1	100		9
				☒	SS2	100		2
			2.44 2.74	☒	SS3	100		1
				☒	SS4	47		1
				☒	SS5	0		4
	78.54	End of Borehole Auger Refusal Assumed Bedrock	4.57					





NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 12

INSPEC-SOL

BOREHOLE No.: SWM3-R

ELEVATION: 83.11 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

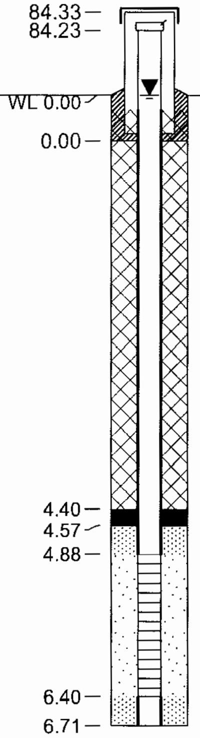
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): November 3, 2008 DATE (FINISH): November 3, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		MONITOR WELL	SAMPLE DATA					
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD	SCALE FOR TEST RESULTS 50kPa 100kPa 150kPa 200kPa 10 20 30 40 50 60 70 80 90
meters	83.11		GROUND SURFACE				%	ppm	N	
1.0 2.0 3.0 4.0			No soil samples taken. Refer to SWM5-1O.							
5.0 6.0	78.71		LIMESTONE- Oxford formation, trace sandstone, interbedding, calcarious, grey, tan, slightly weathered, hard, medium partings		▮	RC1	82		72	
7.0 8.0 9.0 10.0 11.0 12.0 13.0	76.38									



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 13

INSPEC·SOL

BOREHOLE No.: SWM3-2O
ELEVATION: 83.11 m

BOREHOLE LOG

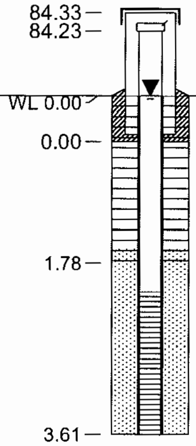
Page: 1 of 1

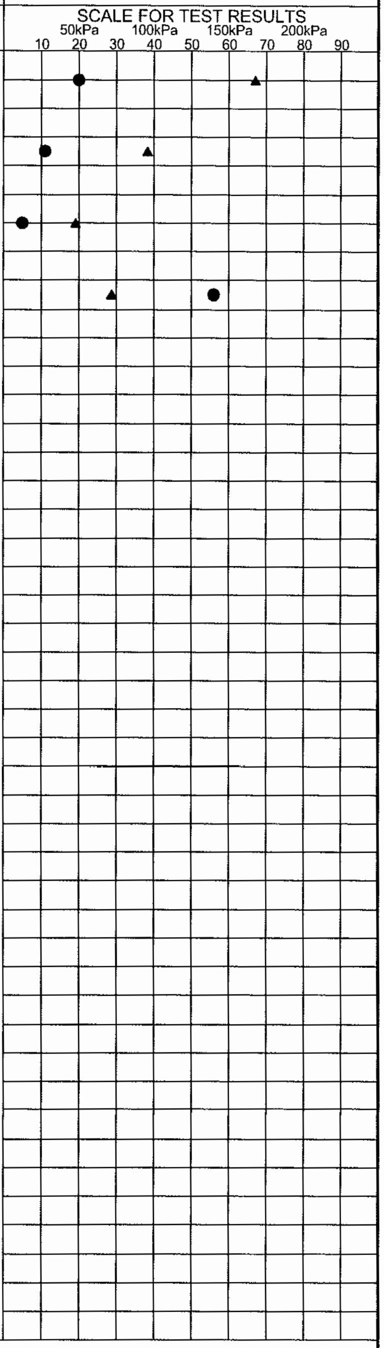
CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 28, 2008 DATE (FINISH): October 28, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		MONITOR WELL	SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	83.11		GROUND SURFACE				%	ppm	N
			TOPSOIL- organics, very soft, black, wet		☒	SS1	9		20
1.0	82.35		SILTY CLAY- some organics, trace sand, gravel, stiff, green / brown / red / white, wet		☒	SS2	5		11
					☒	SS3	71		5
2.0	80.98		SILTY CLAY- some gravel, trace organics, stiff, grey, wet		☒	SS4	71		56
3.0									
	79.50		End of Borehole Auger Refusal Assumed Bedrock						
4.0									
5.0									
6.0									
7.0									
8.0									
9.0									
10.0									
11.0									
12.0									
13.0									





NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 14

INSPEC·SOL

BOREHOLE No.: SWM3-2R
ELEVATION: 83.11 m

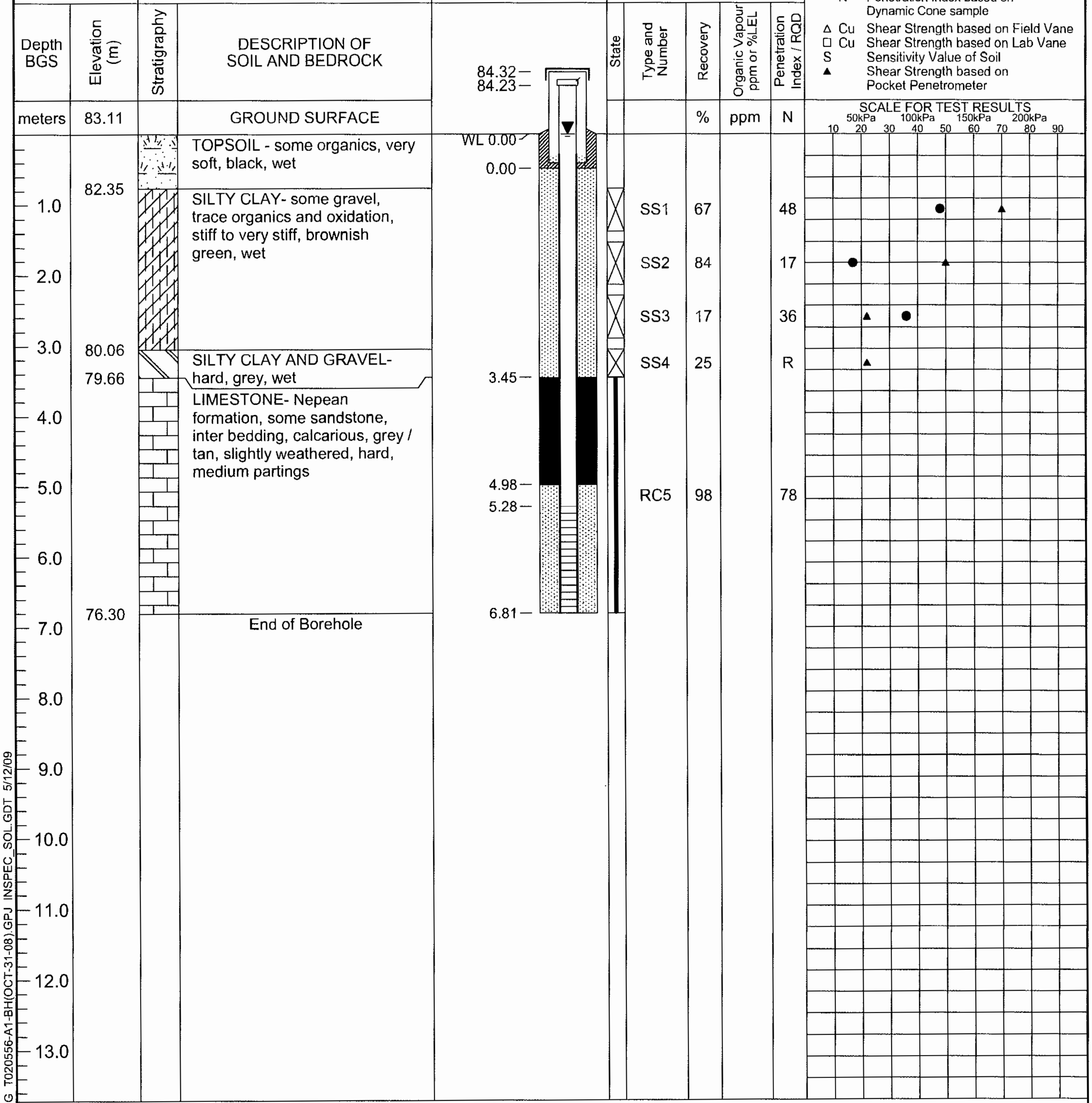
BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 28, 2008 DATE (FINISH): October 28, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
o		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer



SCALE		STRATIGRAPHY		MONITOR WELL	SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK		State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	83.11		GROUND SURFACE	84.32 84.23			%	ppm	N
			TOPSOIL - some organics, very soft, black, wet	WL 0.00 0.00					
	82.35		SILTY CLAY- some gravel, trace organics and oxidation, stiff to very stiff, brownish green, wet		☒	SS1	67		48
					☒	SS2	84		17
					☒	SS3	17		36
	80.06		SILTY CLAY AND GRAVEL- hard, grey, wet		☒	SS4	25		R
	79.66		LIMESTONE- Nepean formation, some sandstone, inter bedding, calcarious, grey / tan, slightly weathered, hard, medium partings	3.45					
				4.98 5.28	▮	RC5	98		78
	76.30		End of Borehole	6.81					

NOTES:

BOREHOLE LOG T020556-A1-BH(OCT-31-08).GPJ INSPEC_SOL.GDT 5/12/09

REFERENCE No.: T020556-A1 ENCLOSURE No.: 15

INSPEC-SOL

BOREHOLE No.: B4-1
ELEVATION: 87.93 m

BOREHOLE LOG

Page: 1 of 1

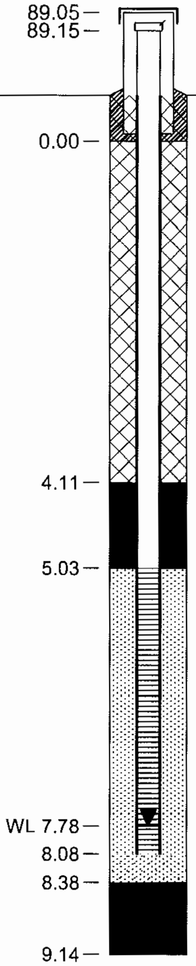
CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 29, 2008 DATE (FINISH): October 29, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

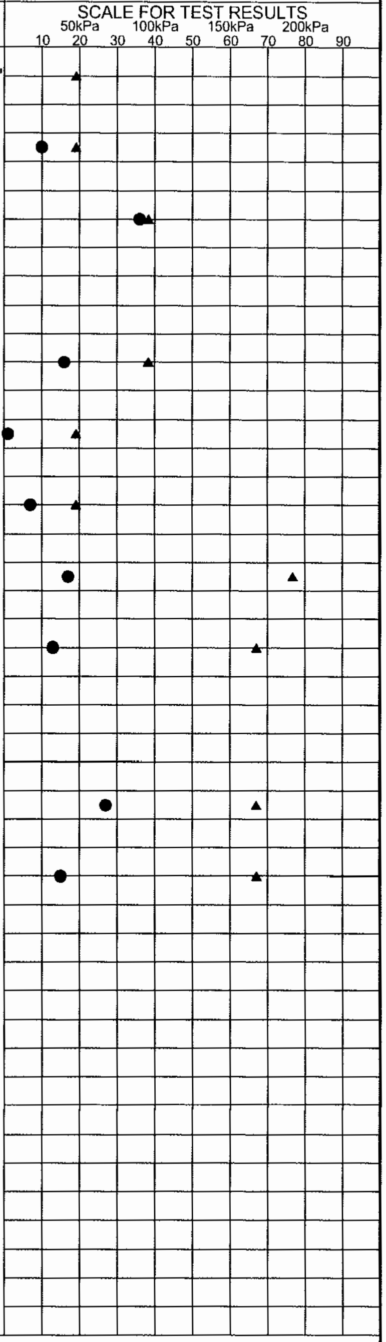
Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
	87.93	GROUND SURFACE
		FILL- silty clay, some sand and gravel, trace organics, sand, oxidation, stiff, grey, brown, moist - trace asphalt
	84.12	FILL-silty clay, some sand and gravel, trace oxidation and organics, firm, brown, moist
	83.21	SILTY CLAY- trace organics and oxidation, very soft, greenish brown, moist
	80.16	SILTY SAND- trace organics, compact, black / grey, wet
	79.39	SILTY CLAY- some sand and gravel, dark grey, wet
	78.79	End of Borehole Auger Refusal Assumed Bedrock

MONITOR WELL



SAMPLE DATA

Type and Number	Recovery %	Organic Vapour ppm or %LEL (ppm)	Penetration Index / RQD (N)
SS1	33		50/5"
SS2	83		10
SS3	75		36
SS4	42		16
SS5	50		1
SS6	63		7
SS7	92		17
SS8	71		13
SS9	83		27
SS10	8		15



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 16

INSPEC-SOL

BOREHOLE No.: B5-1

ELEVATION: 90.48 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

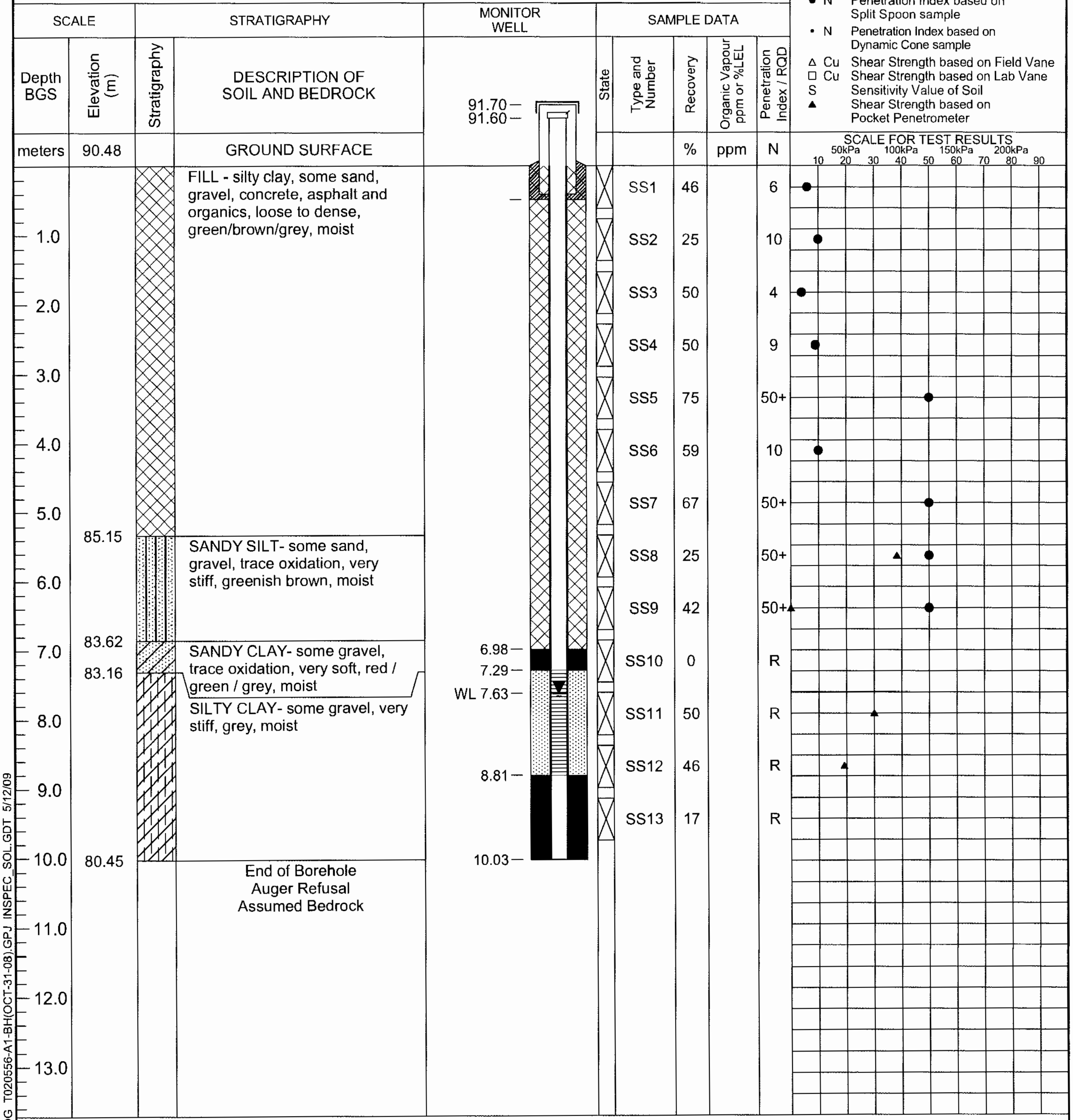
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 30, 2008 DATE (FINISH): October 30, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer



Depth BGS (meters)	Elevation (m)	DESCRIPTION OF SOIL AND BEDROCK
	90.48	GROUND SURFACE
		FILL - silty clay, some sand, gravel, concrete, asphalt and organics, loose to dense, green/brown/grey, moist
	85.15	SANDY SILT- some sand, gravel, trace oxidation, very stiff, greenish brown, moist
	83.62	SANDY CLAY- some gravel, trace oxidation, very soft, red / green / grey, moist
	83.16	SILTY CLAY- some gravel, very stiff, grey, moist
	80.45	End of Borehole Auger Refusal Assumed Bedrock

Type and Number	Recovery (%)	Organic Vapour ppm or %LEL (ppm)	Penetration Index / RQD (N)
SS1	46		6
SS2	25		10
SS3	50		4
SS4	50		9
SS5	75		50+
SS6	59		10
SS7	67		50+
SS8	25		50+
SS9	42		50+
SS10	0		R
SS11	50		R
SS12	46		R
SS13	17		R

NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 17

iNSPEC·SOL

BOREHOLE No.: B5-2

ELEVATION: 90.78 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

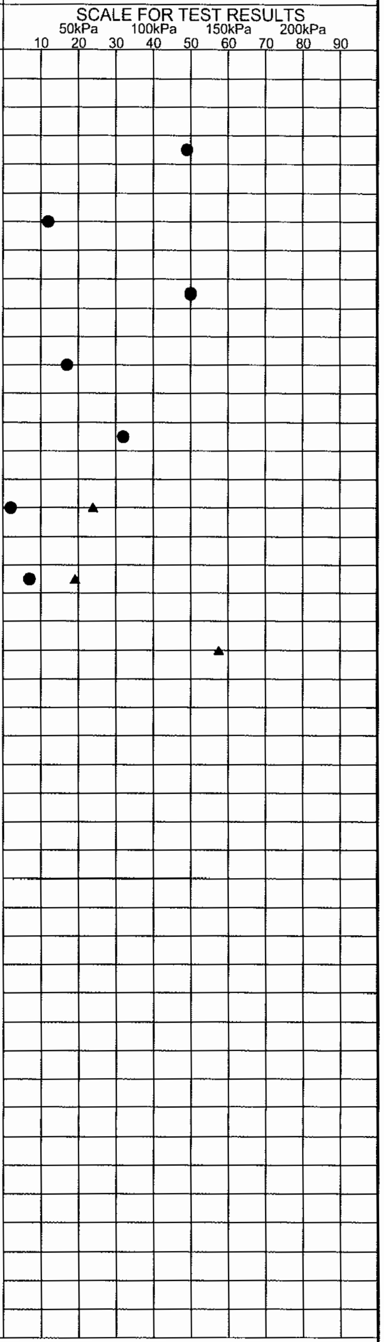
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 23, 2008 DATE (FINISH): October 23, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
◫	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	90.78		GROUND SURFACE			%	ppm	N
		▩	FILL - silty clay, some asphalt, sand and gravel, trace organics, compact to dense, brown/black, moist					
1.0				☒	SS1	92		49
				☒	SS2	55		12
2.0								
				☒	SS3	75		50+
3.0								
				☒	SS4	63		17
4.0								
				☒	SS5	71		32
	86.21	▨	SILTY CLAY - some gravel, trace oxidation, firm to stiff, brown/grey, moist to wet	☒	SS6	38		2
5.0								
				☒	SS7	100		7
6.0								
				☒	SS8	84		R
	84.07		End of Borehole					
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 18

INSPEC·SOL

BOREHOLE No.: B5-3

ELEVATION: 90.51 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge

CHECKED BY: J.Bennett

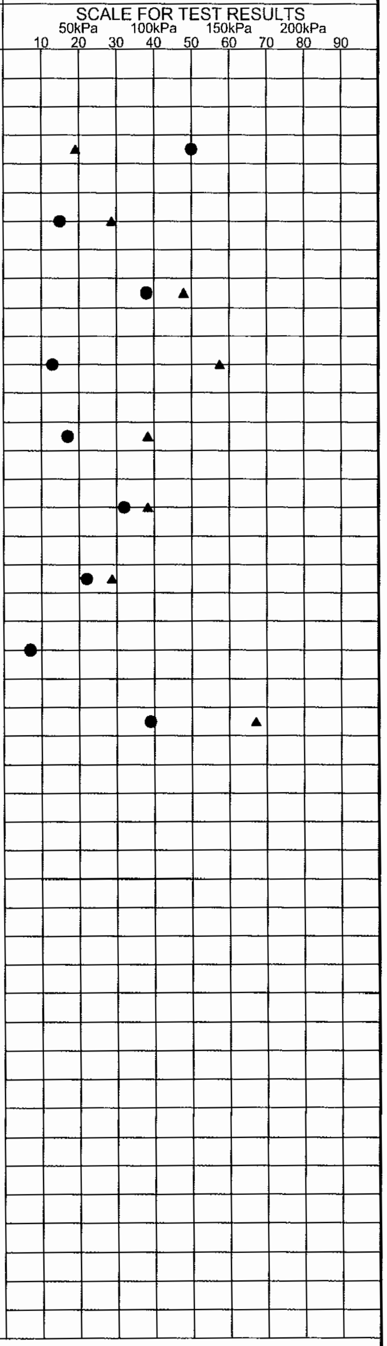
DATE (START): October 23, 2008

DATE (FINISH): October 23, 2008

LEGEND

☒ SS	Split Spoon
▨ ST	Shelby Tube
▯ RC	Rock Core
▼	Water Level
o	Water content (%)
⊢⊣	Atterberg limits (%)
● N	Penetration Index based on Split Spoon sample
• N	Penetration Index based on Dynamic Cone sample
△ Cu	Shear Strength based on Field Vane
□ Cu	Shear Strength based on Lab Vane
S	Sensitivity Value of Soil
▲	Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	90.51		GROUND SURFACE			%	ppm	N
		☒	FILL- concrete and asphalt fragments, some sand, trace organics					
1.0	89.75	☒	FILL- silty clay, some gravel, trace oxidation, stiff, brown, moist	☒	SS1	42		50+
2.0	88.99	☒	FILL- sandy silt, some gravel, trace clay, organics, very stiff, brownish green, moist	☒	SS2	58		15
	88.22	☒	FILL- silty clay, some asphalt, gravel and sand, trace organics, hard, brown, moist	☒	SS3	50		38
3.0		☒		☒	SS4	59		13
4.0	86.70	☒	FILL- silty clay, trace organics, oxidation, gravel, sand, hard, moist	☒	SS5	21		17
5.0		☒	-becoming trace to some gravel	☒	SS6	84		32
		☒	-becoming more asphalt fragments, hard to very stiff	☒	SS7	71		22
6.0	84.41	▨	SILTY CLAY- some sand, trace organics, firm, grey, moist	☒	SS8	25		7
7.0		▨	-becoming very stiff	☒	SS9	59		39
▼	82.89		End of Borehole					
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 19

INSPEC·SOL

BOREHOLE No.: RB7-01

ELEVATION: 93.76 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ◫ RC Rock Core
- ▼ Water Level
- ○ Water content (%)
- ├─┤ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	93.76		GROUND SURFACE			%	ppm	N
		▨	FILL- gravel and sand, trace clay, very dense, greyish black, dry					
1.0		▨		☒	SS1	9		R
	92.08	▨	FILL- silty sand, some gravel, asphalt and concrete fragments, trace clay, very dense, brownish yellow, dry	☒	SS2	9		R
2.0		▨						
▼		▨		☒	SS3	13		R
3.0	90.81		End of Borehole Auger Refusal					
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								

SCALE FOR TEST RESULTS

50kPa 100kPa 150kPa 200kPa

10 20 30 40 50 60 70 80 90

NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 20

iNSPEC*SOL

BOREHOLE No.: RB7-02

ELEVATION: 93.01 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

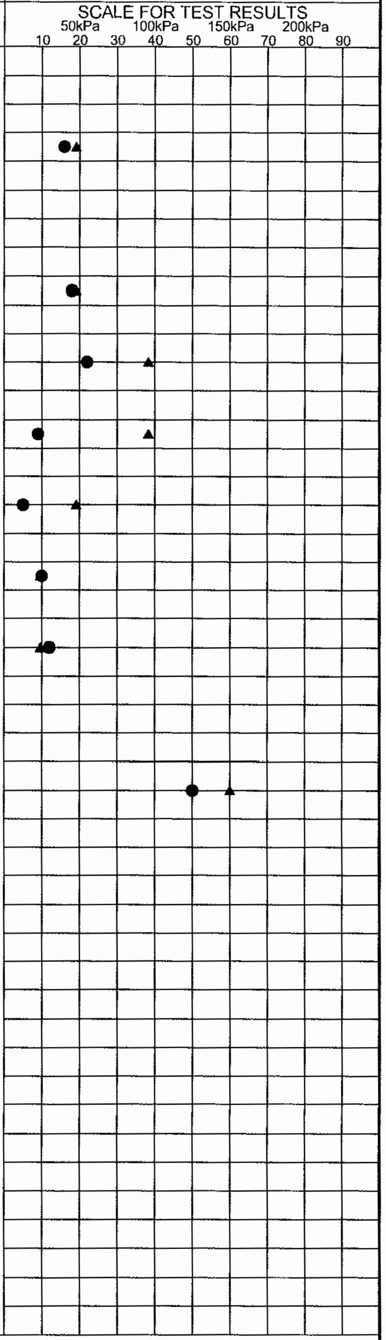
DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	93.01		GROUND SURFACE			%	ppm	N
			FILL- asphalt and gravel fragments, compact, black, moist					
1.0				☒	SS1	42		16
				☒	SS2	13		R
2.0			-trace sand and clay -becoming dense to very dense					
			-trace to some sand -dense to compact	☒	SS3	21		18
3.0	89.76		SILTY CLAY- trace organics, trace topsoil, brownish green	☒	SS4	84		22
4.0				☒	SS5	50		9
▼	88.44		SILTY CLAY- trace oxidation, organics, sand, stiff, greenish black, wet	☒	SS6	50		5
5.0	87.68		SILTY CLAY- trace organics oxidation, firm, green, wet	☒	SS7	17		10
6.0	86.91		SILTY CLAY- some gravel, trace oxidation and organics, stiff, grey, wet	☒	SS8	55		12
7.0								
8.0				☒	SS9	9		50+
	84.78		End of Borehole					
9.0								
10.0								
11.0								
12.0								
13.0								

SCALE FOR TEST RESULTS



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 21

INSPEC-SOL

BOREHOLE No.: RB7-03

ELEVATION: 91.14 m

BOREHOLE LOG

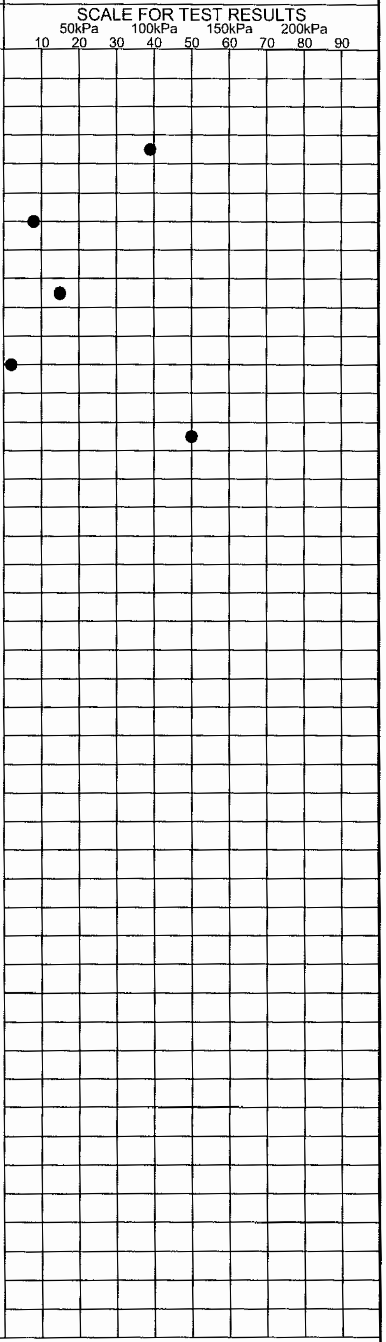
Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	91.14		GROUND SURFACE			%	ppm	N
		☒	FILL- asphalt and concrete fragments, some gravel and sand, dense, brown black, dry					
1.0		☒		☒	SS1	55		39
2.0		☒		☒	SS2	30		8
▼		☒	-seepage at 2.60m depth	☒	SS3	42		15
3.0	88.09	▒	SILTY SAND- trace gravel, organics, clay, very loose, grey, wet	☒	SS4	38		2
4.0		▒		☒	SS5	0		50+
	86.45		End of Borehole Auger Refusal Assumed Bedrock	☒	SS6	50		R
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 22

INSPEC*SOL

BOREHOLE No.: RB2-01

ELEVATION: 91.60 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

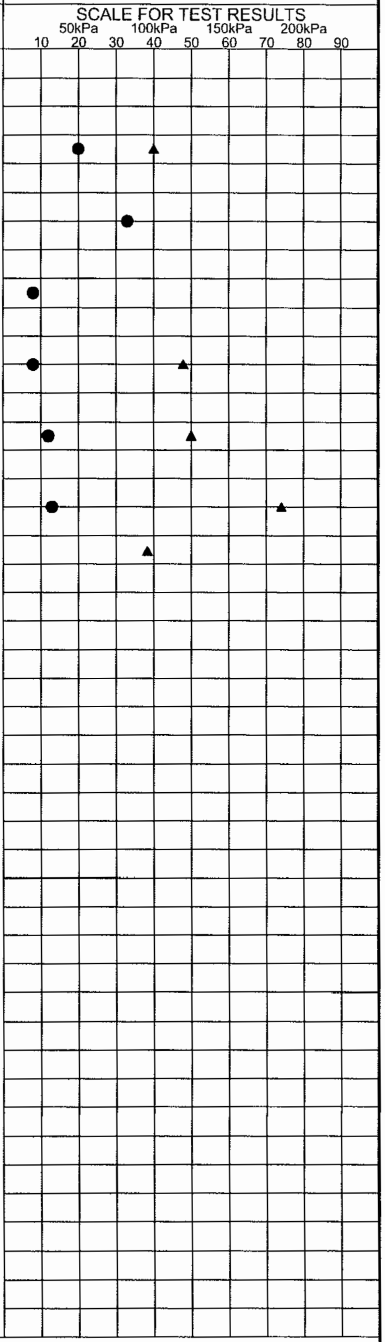
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	91.60		GROUND SURFACE			%	ppm	N
			FILL- sandy clay and gravel, very stiff, brownish grey, moist					
1.0				☒	SS1	50		20
2.0	90.08		FILL- clayey sand and gravel, some asphalt fragments, dense, brownish grey, moist	☒	SS2	34		33
				☒	SS3	30		8
▼3.0	88.55		SILTY CLAY- trace sand, hard, grey, brown traces, wet	☒	SS4	55		8
4.0				☒	SS5	67		12
5.0			-becoming stiff to very stiff	☒	SS6	59		13
	86.24		-becoming very stiff to hard		SS7	4		R
			End of Borehole Auger Refusal Assumed Bedrock					
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 23

INSPEC-SOL

BOREHOLE No.: RB2-02

ELEVATION: 88.76 m

BOREHOLE LOG

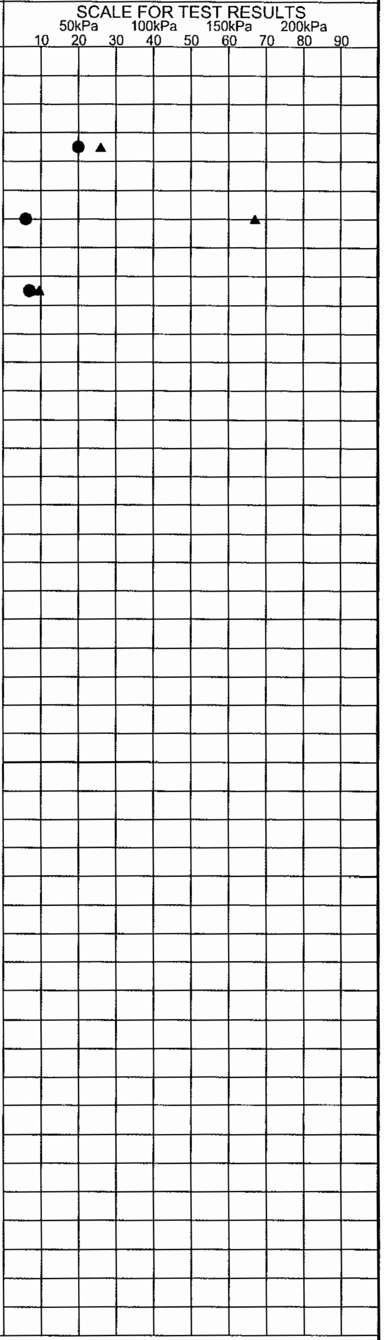
Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): October 21, 2008 DATE (FINISH): October 21, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	88.76		GROUND SURFACE			%	ppm	N
		▨	FILL- silty clay, some organics, asphalt and rock fragments, compact, brown, moist					
1.0				☒	SS1	13		20
▼2.0				☒	SS2	17		6
	86.47	▨	FILL- sandy clay, some organics, asphalt, concrete fragments, trace silt, loose, greenish grey, wet	☒	SS3	63		7
3.0	85.71	▨	FILL- silty sand, some organics, asphalt, concrete fragments, very loose, blackish brown, wet	☒	SS4	21		R
	85.41							
4.0			End of Borehole Auger Refusal Assumed Bedrock					
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 24

INSPEC·SOL

BOREHOLE No.: RB3-01

ELEVATION: 87.96 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge

CHECKED BY: J.Bennett

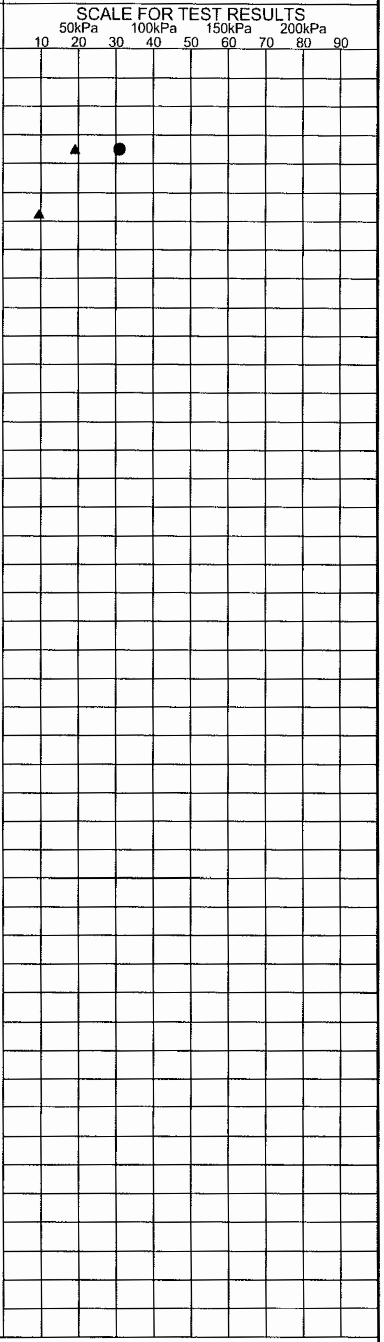
DATE (START): October 22, 2008

DATE (FINISH): October 22, 2008

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ▮ RC Rock Core
- ▼ Water Level
- ○ Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	87.96		GROUND SURFACE			%	ppm	N
		☒	FILL- silty clay and gravel, some asphalt and sand, stiff, brownish green grey, moist					
1.0				☒	SS1	46		31
	86.41	▨	SILTY CLAY- some organics and gravel, stiff, brownish green, grey, moist	☒	SS2	5		R
2.0	85.98		End of Borehole Auger Refusal Assumed Bedrock					
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 25

iNSPEC·SOL

BOREHOLE No.: RB4-01

ELEVATION: 89.62 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

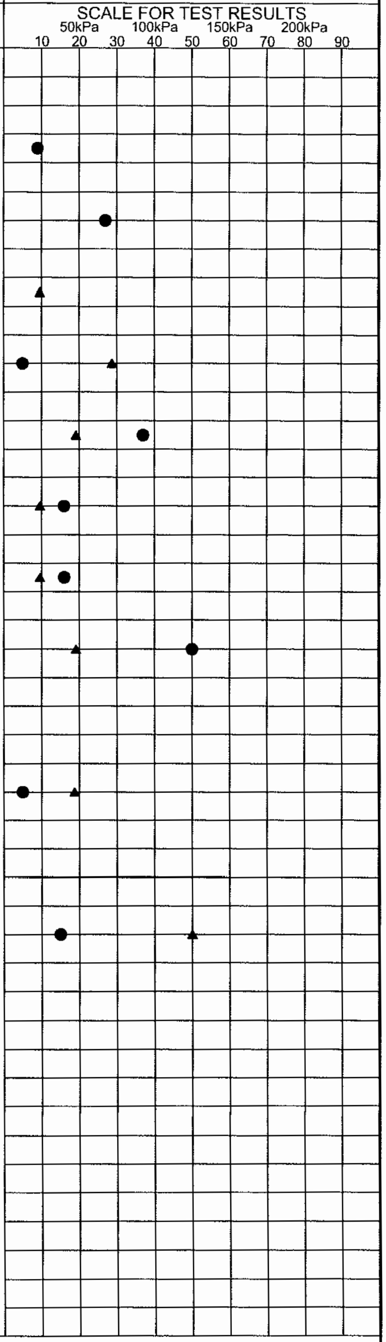
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 22, 2008 DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
◫	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
☐	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	89.62		GROUND SURFACE			%	ppm	N
1.0			FILL- silty sand, some clay, trace gravel, loose, brownish green, moist	☒	SS1	50		9
2.0	88.10		FILL- sand and gravel, trace clay and organics, compact, black, moist	☒	SS2	34		27
	87.33		FILL- silty clay and asphalt fragments, some gravel, trace sand and organics, firm, brownish black, moist	☒	SS3	34		R
3.0	86.62		FILL- sandy clay, and asphalt, some gravel and organics, very stiff, brownish black, moist	☒	SS4	34		5
4.0				☒	SS5	25		37
5.0	85.05		FILL- clayey sand and asphalt, some gravel, firm, brownish black, moist	☒	SS6	55		16
				☒	SS7	55		16
6.0 ▼	83.52		FILL- sand and gravel, some asphalt, trace organics, very dense, black, moist	☒	SS8	67		50+
	83.07		SILTY CLAY- trace sand, organics, firm, yellow grey green, wet					
7.0	82.61		SILTY CLAY- trace organics, gravel, stiff to very stiff, grey, wet					
8.0				☒	SS9	100		5
9.0				☒	SS10	55		15
10.0	79.56		End of Borehole Auger Refusal Assumed Bedrock					
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 26

INSPEC◆SOL

BOREHOLE No.: RB5-01

ELEVATION: 90.13 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

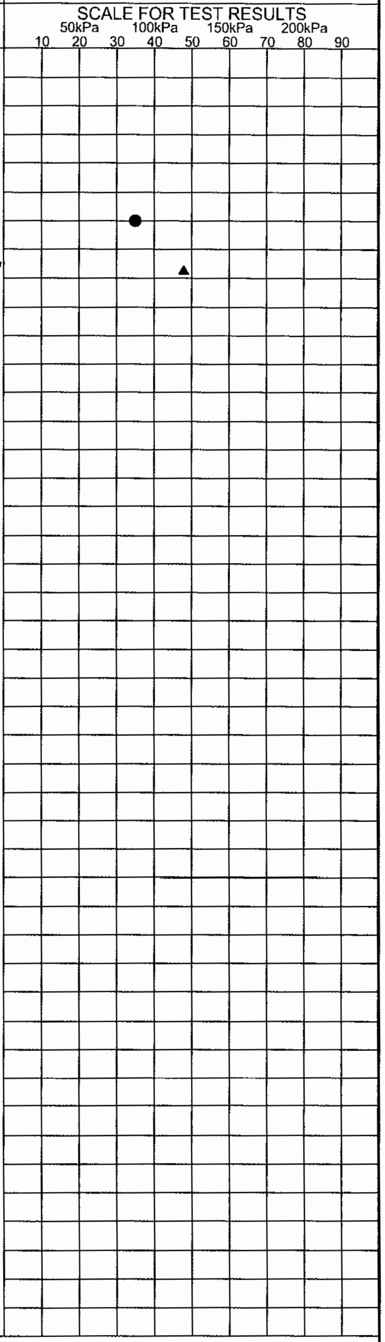
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

DATE (START): October 23, 2008 DATE (FINISH): October 23, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	90.13		GROUND SURFACE			%	ppm	N
			FILL- silty sand, some gravel, concrete and asphalt fragments, trace organics, silty clay, very dense, brownish black, dry					
1.0				☒	SS1	17		R
2.0			-becoming very dense to dense	☒	SS2	17		35
	87.84		FILL- silty clay, some asphalt, gravel, trace oxidation, hard, green grey brown, moist	☒	SS3	17		50/5'
	87.54		End of Borehole Auger Refusal					
3.0								
4.0								
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 27

iNSPEC·SOL

BOREHOLE No.: RB5-02

ELEVATION: 91.49 m

BOREHOLE LOG

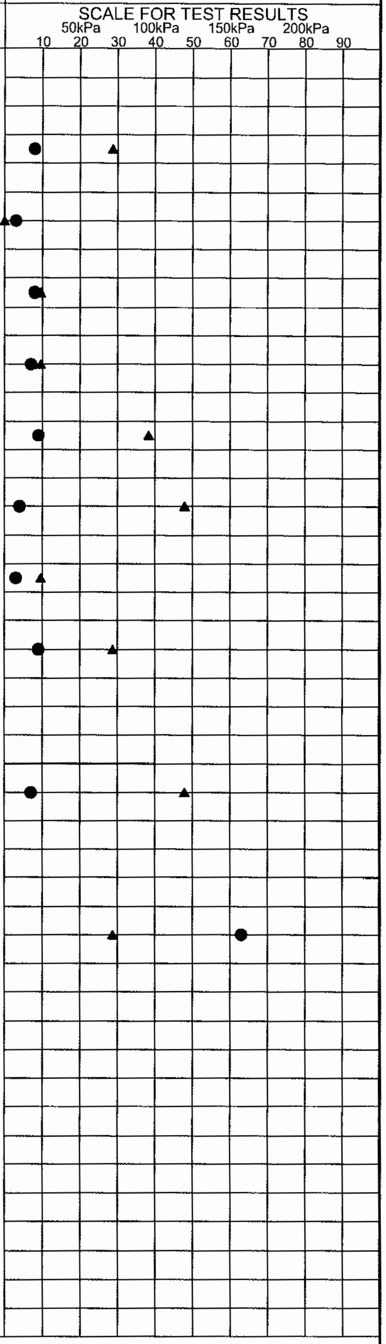
Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge
CHECKED BY: J.Bennett
DATE (START): October 22, 2008
DATE (FINISH): October 22, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
o		Water content (%)
⊢⊣		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	91.49		GROUND SURFACE			%	ppm	N
1.0			FILL-silty clay, some gravel, trace organics, very stiff, greensih grey, moist	☒	SS1	25		8
2.0	89.97		FILL- silty clay, some organics, very soft, brownish black, dry	☒	SS2	5		3
	89.20		FILL- silty clay, trace organics, sand, gravel, firm, brown, moist	☒	SS3	9		8
3.0 4.0	88.44		FILL-silty clay, some gravel, trace organics, oxidation, firm, brownish green, moist	☒ ☒	SS4 SS5	55 55		7 9
5.0 ▼	86.92		FILL- silty clay some asphalt and gravel, hard, brown, black, moist	☒	SS6	36		4
	86.16		FILL- silty clay, some sand, trace oxidation, firm, brownish green, moist	☒	SS7	59		3
6.0	85.39		TOPSOIL- some organics, trace sand, very soft, black wet	☒	SS8	75		9
7.0 8.0	85.24		SILTY CLAY- trace sand, oxidation and organics, very stiff, greyish green, moist	☒	SS9	100		7
9.0 10.0	82.60		SILTY CLAY AND GRAVEL- very stiff, grey, wet	☒	SS10	63		63
11.0 12.0 13.0	81.13		End of Borehole Auger Refusal Assumed Bedrock					



NOTES:

REFERENCE No.: T020556-A1

ENCLOSURE No.: 28

INSPEC-SOL

BOREHOLE No.: **RB10-01**

ELEVATION: 93.73 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett

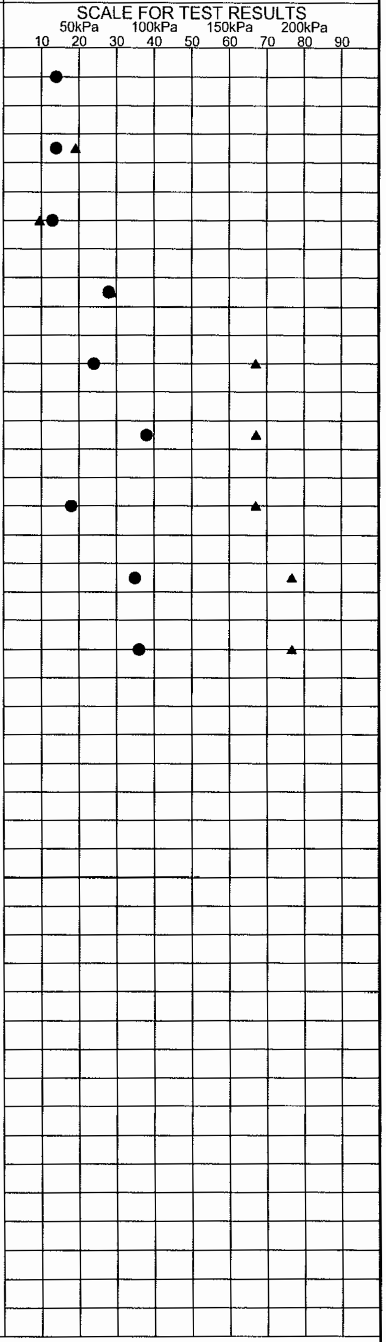
DATE (START): November 13, 2008 DATE (FINISH): November 13, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▮	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	93.73		GROUND SURFACE			%	ppm	N
			FILL- sand and gravel, compact, brown, dry	☒	SS1	55		14
1.0	92.66		SILTY CLAY- trace sand and organics, stiff, greyish green, moist	☒	SS2	71		14
▼	92.05		SILTY SAND- compact, greenish brown, wet	☒	SS3	50		13
2.0	91.29		SILTY CLAY- stiff, brown, wet	☒	SS4	75		28
3.0	91.14		SILTY CLAY- some gravel, trace sand, very stiff, grey, wet	☒	SS5	67		24
4.0				☒	SS6	92		38
5.0				☒	SS7	83		18
				☒	SS8	42		35
6.0	87.63		SILTY CLAY- some gravel, trace sand, hard, grey, wet	☒	SS9	75		36
	87.02		End of Borehole					
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								

SCALE FOR TEST RESULTS



NOTES:

REFERENCE No.: T020556-A1 ENCLOSURE No.: 29

INSPEC-SOL

BOREHOLE No.: RB10-02
ELEVATION: 91.71 m

BOREHOLE LOG

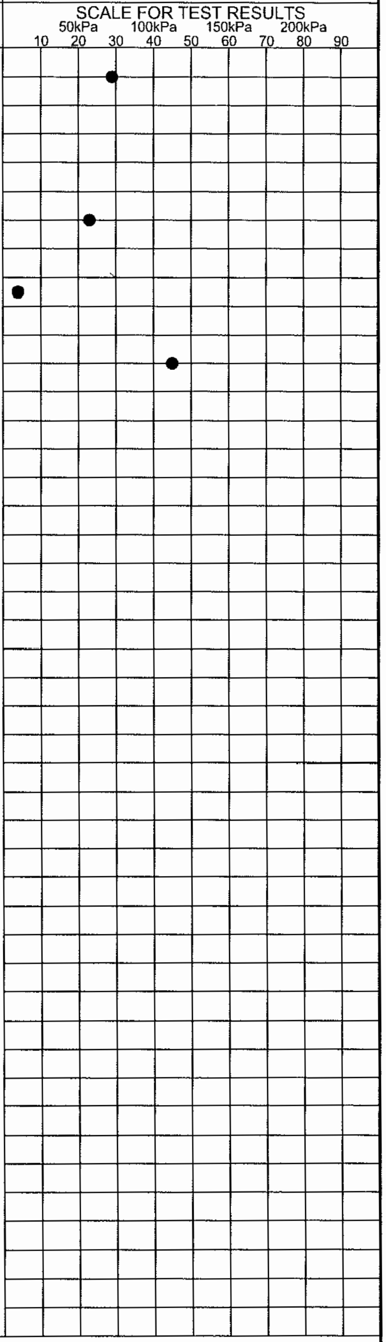
Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge CHECKED BY: J.Bennett
DATE (START): November 13, 2008 DATE (FINISH): November 13, 2008

LEGEND

☒	SS	Split Spoon
▨	ST	Shelby Tube
▯	RC	Rock Core
▼		Water Level
○		Water content (%)
├─┤		Atterberg limits (%)
●	N	Penetration Index based on Split Spoon sample
•	N	Penetration Index based on Dynamic Cone sample
△	Cu	Shear Strength based on Field Vane
□	Cu	Shear Strength based on Lab Vane
S		Sensitivity Value of Soil
▲		Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	91.71		GROUND SURFACE			%	ppm	N
		☒	FILL- sand and gravel, compact, brown, dry	☒	SS1	67		29
1.0	90.95	☒	Auger refusal at 0.76m. Moved 0.91m ahead, drilled to 0.76m and resumed sampling	☒	SS2	8		R
2.0	90.03	☒	FILL - sand and gravel, compact, brown, gray	☒	SS3	33		23
		☒		☒	SS4	0		4
3.0	88.66	☒	FILL- silty sand, some organics, dense, multicolorm trace gravel, dry	☒	SS5	83		45
4.0	88.05		End of Borehole Auger Refusal Assumed Bedrock					
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

BOREHOLE LOG T020556-A1-BH(OCT-31-08).GPJ INSPEC_SOL.GDT 5/12/09

REFERENCE No.: T020556-A1

ENCLOSURE No.: 30

INSPEC·SOL

BOREHOLE No.: RB10-03

ELEVATION: 89.34 m

BOREHOLE LOG

Page: 1 of 1

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge

CHECKED BY: J.Bennett

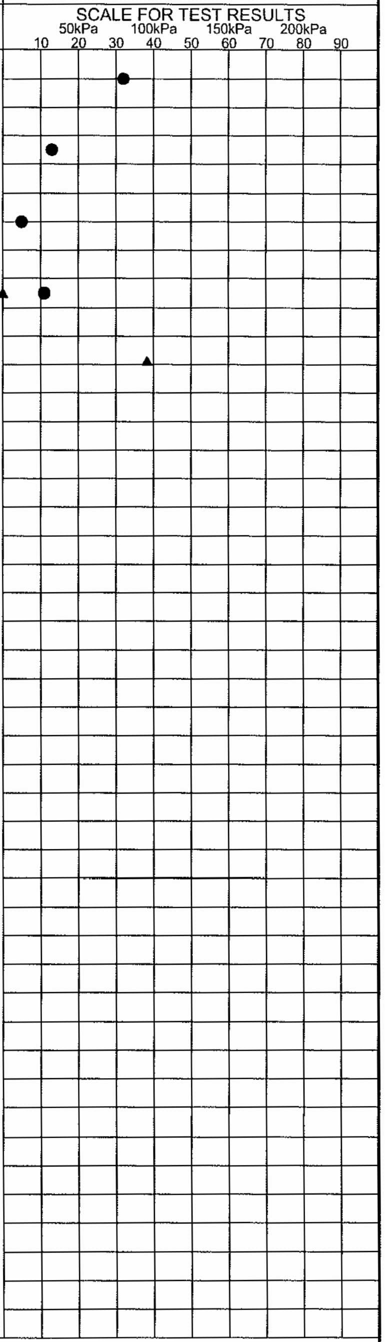
DATE (START): November 14, 2008

DATE (FINISH): November 14, 2008

LEGEND

- ☒ SS Split Spoon
- ▨ ST Shelby Tube
- ▯ RC Rock Core
- ▼ Water Level
- o Water content (%)
- ⊢⊣ Atterberg limits (%)
- ● N Penetration Index based on Split Spoon sample
- • N Penetration Index based on Dynamic Cone sample
- △ Cu Shear Strength based on Field Vane
- □ Cu Shear Strength based on Lab Vane
- S Sensitivity Value of Soil
- ▲ Shear Strength based on Pocket Penetrometer

SCALE		STRATIGRAPHY		SAMPLE DATA				
Depth BGS	Elevation (m)	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Organic Vapour ppm or %LEL	Penetration Index / RQD
meters	89.34		GROUND SURFACE			%	ppm	N
		▨	FILL- sand and gravel, dense, brown, dry	☒	SS1	59		32
1.0				☒	SS2	9		13
▼2.0				☒	SS3	5		5
	86.88 86.83	▨	TOPSOIL- trace sand, soft, black, wet	☒	SS4	46		11
3.0	86.44	▨	SILTY CLAY- black, trace organics, wet, soft					
	85.76	▨	SILTY CLAY- trace organics, sand, very stiff, greyish green, moist	☒	SS5	5		R
4.0			End of Borehole Auger Refusal Assumed Bedrock					
5.0								
6.0								
7.0								
8.0								
9.0								
10.0								
11.0								
12.0								
13.0								



NOTES:

APPENDICES

APPENDIX A

TEST PIT LOGS AND MONITORING WELL LOGS
(BLOCK 1/ORGAWORLD)

REFERENCE No.: T020556-A1

ENCLOSURE No.: 31

INSPEC-SOL

TEST PIT No.: **TP7-01**

ELEVATION: 309.88 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE:

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	309.88				ppm	Type	INF
			⊠	FILL- silty sand, some clay, organics, brick, asphalt, concrete fragments, brown black, moist				
1			⊠					
2	0.5		⊠	-Water infiltration was noted @ 0.6m BGS				
2.3		307.54	▨	SILTY CLAY- some cobbles, organics, brownish grey, wet, organic odour				
3	1.0		▨					
4			▨					
5	1.5		▨					
5.5		304.38		End of Test Pit Shovel Refusal Assumed Bedrock				
6	2.0							
7								
8	2.5							
9								
10	3.0							
11	3.5							
12								
13	4.0							
14								
15	4.5							
16	5.0							
17								
18	5.5							
19	6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 32

INSPEC-SOL

TEST PIT No.: **TP7-02**
ELEVATION: 305.91 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge   DATE: November 10, 2008

CHECKED BY: J.Bennett   DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth Feet	Depth Metres	Elevation (ft) 305.91	Symbol	STRATIGRAPHY	Sample Type & Number	OVC ppm	Tests Type	▼ / INF
			▨	FILL- silty clay, some asphalt, concrete, reinforced steel, wood fragments, brown, moist				
11.5	3.5	294.41		TOPSOIL- some organics, black, moist				
11.8		294.07		SILTY CLAY- some sand, trace organics, greenish brown, moist				
13.1	4.0	292.82		End of Test Pit				

REFERENCE No.: T020556-A1 ENCLOSURE No.: 33

INSPEC-SOL

TEST PIT No.: TP6-01
ELEVATION: 302.56 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge DATE: November 10, 2008
CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	302.56				ppm	Type	INF
			▨	FILL- silty clay, some asphalt, concrete and wood fragments, brownish black, moist				
1								
	0.5							
2								
3								
	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
14.8	4.5	287.81	▨	SILTY CLAY -trace organics, brownish green, wet -Water infiltration was observed at 4.6m BGS				
15								
15.5		287.06	▨	SILTY SAND- trace cobbles, trace organics, greyish black, wet				
16								
16.3	5.0	286.23	▨	SILTY CLAY- trace cobbles, grey, wet				
16.7		285.89		End of Test Pit				
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1 ENCLOSURE No.: 34

INSPEC-SOL

TEST PIT No.: **TP6-02**
ELEVATION: 297.11 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.
PROJECT: Geotechnical Investigation
LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario
DESCRIBED BY: B.Beveridge DATE: November 10, 2008
CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	297.11				ppm	Type	INF
			▨	FILL- silty clay, some cobbles, brick, asphalt and concrete fragments, black, moist				
9.5		287.61		TOPSOIL-some organics, black, moist -Water infiltration observed at 2.90m BGS				
9.8		287.28		SILTY SAND- some organics,blackish grey, wet				
13.8		283.36		SILTY CLAY- some sand, trace organics, brownish grey, wet				
13.9		283.19		End of Test Pit				

REFERENCE No.: T020556-A1

ENCLOSURE No.: 35

INSPEC-SOL

TEST PIT No.: **TP2-01**

ELEVATION: 284.97 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	284.97				ppm	Type	INF
0.3		284.64		TOPSOIL-some organics and rootmat, black, moist, water infiltration at surface				
0.7		284.31		SILTY CLAY-trace organics, brownish grey, wet				
1				End of Test Pit Shovel Refusal Assumed Bedrock				
	0.5							
2								
3								
	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
15	4.5							
16								
	5.0							
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 36

INSPEC-SOL

TEST PIT No.: TP3-01
ELEVATION: 288.81 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft) 288.81	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres					ppm	Type	INF
			▨	SILTY CLAY- some organics,brown, moist				
1			▨					
	0.5		▨					
220		286.81		End of Test Pit Shovel Refusal Assumed Bedrock				
3								
	1.0							
4								
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
	4.5							
15								
16								
	5.0							
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 37

INSPEC-SOL

TEST PIT No.: **TP4-01**
ELEVATION: 293.01 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	293.01				ppm	Type	INF
			▨	FILL- silty clay, some asphalt, concrete, reinforced steel and wood fragments, brown, moist				
1			▨					
	0.5		▨					
2			▨					
3			▨					
	1.0		▨					
4			▨					
5	1.5		▨					
6			▨					
	2.0		▨					
7			▨					
8	2.5		▨					
9			▨					
10	3.0		▨					
11			▨					
	3.5		▨					
12			▨					
13	4.0		▨					
14			▨					
14.8	4.5	278.26		End of Test Pit				
15								
16								
	5.0							
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 38

INSPEC-SOL

TEST PIT No.: **TP4-02**

ELEVATION: 291.24 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE	- GRAB SAMPLE (environmental)
GS	- GRAB SAMPLE (geotechnical)
Cu	- SHEAR TEST
CHEM	- CHEMICAL ANALYSIS
OVC	- ORGANIC VAPOR CONCENTRATION
INF	- INFILTRATION
▼	- WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	291.24				ppm	Type	INF
1 2 3 4 5 6 7 8 9	0.5 1.0 1.5 2.0 2.5		▨	FILL- silty clay, some asphalt, brick, concrete, gravel, wood, brownish black, moist -water infiltration observed at 3.0m BGS				
9.8 10	3.0	281.41		End of Test Pit				
11 12 13 14 15 16 17 18 19	3.5 4.0 4.5 5.0 5.5 6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 39

INSPEC-SOL

TEST PIT No.: TP4-03

ELEVATION: 271.42 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	271.42				ppm	Type	INF
0.3		271.09		TOPSOIL- some organics, black, wet, water infiltration at surface				
0.7		270.76		SILTY SAND- some organics, trace oxidation, brownish green, wet				
				SILTY CLAY- some organics, trace oxidation, grey, wet				
11.5	3.5	259.92		End of Test Pit				

REFERENCE No.: T020556-A1

ENCLOSURE No.: 40

INSPEC-SOL

TEST PIT No.: TP5-01

ELEVATION: 298.82 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge

DATE: November 10, 2008

CHECKED BY: J.Bennett

DATE:

LEGEND

GSE	- GRAB SAMPLE (environmental)
GS	- GRAB SAMPLE (geotechnical)
Cu	- SHEAR TEST
CHEM	- CHEMICAL ANALYSIS
OVC	- ORGANIC VAPOR CONCENTRATION
INF	- INFILTRATION
▼	- WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼
Feet	Metres	298.82				ppm	Type	INF
			▨	FILL-silty clay, some brick, asphalt, concrete, gravel, cobbles, trace organics, brownish black, moist				
1			▨					
	0.5		▨					
2			▨					
3			▨					
	1.0		▨					
4			▨					
5	1.5		▨					
6			▨					
	2.0		▨					
7			▨					
8	2.5		▨	-Water infiltration observed at 2.5m BGS				
9			▨					
9.8 10	3.0	288.99		End of Test Pit				
11								
	3.5							
12								
13	4.0							
14								
15	4.5							
16								
	5.0							
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1 ENCLOSURE No.: 41

INSPEC-SOL

TEST PIT No.: **TP10-01**
ELEVATION: 285.76 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE	- GRAB SAMPLE (environmental)
GS	- GRAB SAMPLE (geotechnical)
Cu	- SHEAR TEST
CHEM	- CHEMICAL ANALYSIS
OVC	- ORGANIC VAPOR CONCENTRATION
INF	- INFILTRATION
▼	- WATER LEVEL

Depth		Elevation (ft) 285.76	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼ / INF
Feet	Metres					ppm	Type	
0.3		285.43		TOPSOIL-some organics, trace silt and sand, black, wet, water infiltration at surface				
110		284.76		CLAY- blackish grey, wet, some organics				
				SILTY CLAY- brown, wet, some organics				
	0.5							
2								
3								
	1.0							
4								
5	1.5							
6 6.2		279.59		End of Test Pit				
	2.0							
7								
8								
	2.5							
9								
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
	4.5							
15								
16								
	5.0							
17								
18	5.5							
19								
	6.0							

REFERENCE No.: T020556-A1

ENCLOSURE No.: 42

INSPEC-SOL

TEST PIT No.: **TP10-02**

ELEVATION: 285.43 ft

TEST PIT REPORT

CLIENT: R.W.Tomlinson Ltd.

PROJECT: Geotechnical Investigation

LOCATION: Lot 26 and 27, concession 6, Ottawa, Ontario

DESCRIBED BY: B.Beveridge DATE: November 10, 2008

CHECKED BY: J.Bennett DATE:

LEGEND

GSE - GRAB SAMPLE (environmental)
GS - GRAB SAMPLE (geotechnical)
Cu - SHEAR TEST
CHEM - CHEMICAL ANALYSIS
OVC - ORGANIC VAPOR CONCENTRATION
INF - INFILTRATION
▼ - WATER LEVEL

Depth		Elevation (ft)	Symbol	STRATIGRAPHY	Sample Type & Number	OVC	Tests	▼ / INF
Feet	Metres	285.43				ppm	Type	
0.7		284.77		TOPSOIL - trace silt, clay, organics, black, wet, water infiltration at surface				
1				SILTY CLAY - some organics, trace gravel and oxidation, brownish grey, wet				
	0.5							
2								
3								
	1.0							
3.6		281.85		SILTY CLAY - some gravel, trace organics, grey, wet				
3.9		281.51		End of Test Pit Shovel Refusal Assumed Bedrock				
5	1.5							
6								
	2.0							
7								
8	2.5							
9								
10	3.0							
11								
	3.5							
12								
13	4.0							
14								
	4.5							
15								
16								
	5.0							
17								
18	5.5							
19								
	6.0							

TEST PIT LOG T020556-A1-TP(NOV-10-08).GPJ INSPEC_SOL.GDT 5/12/09

APPENDIX B

TEST PIT LOGS (GOLDER, REPORT No. 931-2820, MARCH, 1994)

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP1-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.15m BGS	0.15			
0.5	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP2-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.30m BGS	0.30			
0.5	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld

PROJECT NUMBER: 45804

CLIENT: Orgaworld Canada Real Estate Ltd.

LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP3-08

DATE COMPLETED: June 17, 2008

TEST PIT METHOD: Hydraulic Shovel

FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	END OF TEST PIT @ 0.00m BGS Bedrock at Surface	0.00			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP4-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE PID (ppm)
	GROUND SURFACE	96.02			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	FILL - sand with gravel, trace clay, compact	95.71			
0.5					
1.0	SM - TILL, silty sand with some gravel, compact to dense, brown, moist	95.10			
1.5					
2.0			G	1.83 - 2.44	2.9
	- water infiltration at 2.44m BGS				
2.5	END OF TEST PIT @ 2.59m BGS	93.43			
	End of Test Pit on Bedrock				
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP5-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	94.78			
	FILL - asphalt with trace of sand, gravel, dense, dark grey to black, moist				
0.5	FILL - sand and gravel with trace of wood, concrete, compact to loose, dark brown, moist	94.17		G 0.00 - 1.22	9.3
1.0	- water infiltration at 1.22m BGS				
1.5				G 1.22 - 1.83	11.0
2.0	END OF TEST PIT @ 1.83m BGS End of Test Pit on Bedrock	92.95			
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP6-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	94.84			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	FILL - SAND AND GRAVEL with trace wood and asphalt, dark brown, loose to compact and moist	94.69			
0.5					
			G	0.61 - 0.81	7.2
	END OF TEST PIT @ 0.81m BGS	94.03			
1.0	End of Test Pit on Bedrock				
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP7-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	94.15			
	FILL - sand and gravel with trace of concrete, compact to loose, dark brown, moist				
0.5					
1.0					
1.5	- water infiltration at 1.52m BGS		G	1.22 - 1.83	3.4
	END OF TEST PIT @ 1.83m BGS	92.32			
2.0	End of Test Pit on Assumed Boulder				
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP8-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	94.03			
	FILL - sand and gravel with trace of concrete, trace wood, compact to loose, dark brown, moist				
0.5					
1.0					
1.5	- water infiltration at 1.52m BGS			G 1.22 - 1.83	5.5
		92.20			
2.0				G 1.83 - 2.44	2.5
2.5	END OF TEST PIT @ 2.44m BGS End of Test Pit on Bedrock				
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP9-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
0.5 1.0 1.5 2.0	FILL - sand and gravel with trace of concrete, trace plastics, trace steel, trace asphalt, compact to loose, dark brown, moist	2.13		G 1.22 - 1.83	5.0
2.5 3.0 3.5	SM - TILL - silty sand with some gravel, compact to dense, brown, moist - cobbles and boulders at 3.66m BGS	3.96		G 3.05 - 3.66	7.7
4.0 4.5 5.0 5.5	END OF TEST PIT @ 3.96m BGS End of Test Pit on Bedrock				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP10-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	END OF TEST PIT @ 0.00m BGS Bedrock at Surface	0.00			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld

PROJECT NUMBER: 45804

CLIENT: Orgaworld Canada Real Estate Ltd.

LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP11-08

DATE COMPLETED: June 17, 2008

TEST PIT METHOD: Hydraulic Shovel

FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.30m BGS	0.30			
0.5	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP12-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.30m BGS	0.30			
0.5	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP13-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.30m BGS	0.30			
0.5	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP14-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	END OF TEST PIT @ 0.00m BGS Bedrock at Surface	0.00			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP15-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist	0.30			
0.5	ML - SANDY SILT, dense brown, moist				
1.0					
1.5					
				G 1.52 - 2.13	7.2
2.0					
	- water infiltration at 2.13m BGS	2.13			
	END OF TEST PIT @ 2.13m BGS				
2.5	End of Test Pit on Bedrock				
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP16-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	FILL - sand and gravel with trace of concrete, trace plastics, trace steel, trace asphalt, compact to loose, dark brown, moist				
0.5					
1.0					
1.5				G 1.22 - 1.83	6.8
2.0					
2.5	- root mat at 2.44m BGS				
	ML - SILT WITH TRACE OF SAND, trace of clay, soft to firm, wet, brown	2.74			
3.0				G 2.74 - 3.35	5.5
	END OF TEST PIT @ 3.35m BGS	3.35			
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP18-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	93.21			
	FILL - sand and gravel with trace of concrete, trace asphalt, compact to loose, dark brown with black streaks, moist				
0.5					
1.0					
1.5	- water infiltration at 1.63m BGS		G	1.22 - 1.68	16.3
	END OF TEST PIT @ 1.68m BGS	91.53			
2.0	End of Test Pit on Bedrock				
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP18A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	93.14			
	FILL - sand and gravel with trace of concrete, trace plastics, trace steel, trace asphalt, compact to loose, dark brown, moist				
0.5					
1.0					
1.5	- water infiltration at 1.52m BGS			G 1.22 - 1.83	19.9
2.0					
2.5					
3.0					
3.5	ML - SILT with trace of sand, trace clay, soft to firm, grey, wet	89.79			
4.0					
4.5					
5.0					
5.5	END OF TEST PIT @ 5.49m BGS	87.65		G 5.18 - 5.49	6.3

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP19-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	FILL - sand and gravel with trace of concrete, compact to loose, dark brown, moist				
0.5					
1.0					
1.5					
2.0					
2.5					
3.0	- root mat at 3.05m BGS				
	- water infiltration at 3.35m BGS	3.35			
3.5	ML - SILT WITH TRACE OF SAND, trace of clay, firm to stiff, grey, wet			G 3.35 - 3.66	5.9
	END OF TEST PIT @ 3.66m BGS	3.66			
4.0	End of Test Pit on Bedrock				
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP19A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	92.75			
	FILL - sand and gravel with trace of concrete, trace asphalt, trace of cobbles and boulders, compact to loose, dark brown, moist				
0.5					
1.0	- 300mm clay seam, tan, wet at 0.91m BGS		G	0.61 - 1.22	14.8
	- water infiltration at 1.22m BGS				
1.5					
2.0					
2.5	ML - SILT with trace sand, trace clay, firm, grey, wet	90.32			
3.0					
3.5					
4.0					
4.5					
5.0			G	4.57 - 5.18	21.2
	END OF TEST PIT @ 5.18m BGS	87.57			
5.5	Testpit terminated due to undermining.				

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP20-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
0.5	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
1.0	SM - SILTY SAND TILL, with some gravel, trace clay, compact to dense, brown, moist - water infiltration at 0.76m BGS	0.61		G 0.61 - 1.22	22.1
1.5	END OF TEST PIT @ 1.22m BGS End of Test Pit on Bedrock	1.22			
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP21-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, saturated				
0.5		0.61			
	END OF TEST PIT @ 0.61m BGS				
	End of Test Pit on Bedrock				
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP22-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
0.5	ML - SANDY SILT with trace of clay, very stiff, brown, moist	0.30		G 0.30 - 0.91	12.7
1.0	END OF TEST PIT @ 0.91m BGS End of Test Pit on Bedrock	0.91			
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP23-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	93.49			
	TOPSOIL - fine silty sand with some gravel, some organic material, loose, dark brown, moist				
0.5					
1.0				G 0.61 - 1.22	6.5
	END OF TEST PIT @ 1.22m BGS	92.27			
1.5	End of Test Pit on Bedrock				
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP24-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some gravel, some organic material, loose, dark brown, moist				
0.5					
1.0					
	END OF TEST PIT @ 1.22m BGS	1.22			
1.5	End of Test Pit on Bedrock				
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP25-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	SM - SILTY SAND with some gravel, compact, brown, moist	0.30			
0.5			G	0.30 - 0.91	14.0
	END OF TEST PIT @ 0.91m BGS	0.91			
1.0					
	End of Test Pit on Bedrock				
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld

PROJECT NUMBER: 45804

CLIENT: Orgaworld Canada Real Estate Ltd.

LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP27-08

DATE COMPLETED: June 17, 2008

TEST PIT METHOD: Hydraulic Shovel

FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	FILL - sand and gravel with trace clay, trace wood, cobbles and boulders				
0.5					
1.0			G	0.61 - 1.22	1.0
	- organic layer, dark brown to black at 1.22m BGS				
1.5		1.52			
	END OF TEST PIT @ 1.52m BGS				
	End of Test Pit on Bedrock				
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP27A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	92.29			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
0.5	FILL - sand and gravel with trace of concrete, trace asphalt, trace wood, trace bricks, compact to loose, dark brown, moist	91.83			
1.0	- water infiltration at 0.91m BGS			G 0.61 - 1.22	5.6
1.5					
2.0					
2.5	- root mat at 2.44m BGS				
	SM - SANDY SILT, trace clay, trace gravel, grey to brown, layered, oxidized, wet	89.70			
3.0					
3.5					
4.0					
4.5	- cobbles/boulders at 4.57m BGS END OF TEST PIT @ 4.57m BGS				
5.0				G 4.88 - 5.18	9.0
		87.11			
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP28-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	91.69			
0.5 1.0 1.5 2.0	FILL - sand and gravel with trace of concrete, trace asphalt, trace wood, trace cobbles/boulders, compact to loose, dark brown, moist - root mat at 2.13m BGS - water infiltration at 2.29m BGS			G 0.61 - 1.22	2.1
2.5 3.0	SM - SILTY SAND TILL, trace clay, trace gravel, cobbles/boulders, loose to compact, grey to brown, wet	89.25			
3.5 4.0 4.5 5.0 5.5	END OF TEST PIT @ 3.35m BGS End of Test Pit on Bedrock	88.33			

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP30-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	93.39			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
0.5	SM - SILTY SAND with trace clay, grey/brown	93.09			
1.0 1.5	SM - SILTY SAND TILL with gravel and cobbles/boulders, trace clay, oxidized, dense, wet	92.48		G 1.22 - 1.83	3.4
2.0	END OF TEST PIT @ 1.83m BGS End of Test Pit on Bedrock	91.56			
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP31-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	
	GROUND SURFACE	93.03			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.15m BGS End of Test Pit on Bedrock	92.88			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT LOG 45804-00(JULY-2008)TP-OT004.GPJ CRA_CORP.GDT 1/30/09

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP32-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	
	GROUND SURFACE	93.30			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.15m BGS End of Test Pit on Bedrock	93.14			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP33-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.15m BGS End of Test Pit on Bedrock	0.15			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

<u>NOTES:</u> MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP34A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	91.75			
	FILL - sand and gravel, trace asphalt, trace brick, trace glass, trace wood				
0.5					
	- water infiltration at 0.91m BGS			G 0.61 - 1.22	13.7
1.0					
1.5					
	- root mat at 1.83m BGS				
2.0					
	- sand seam at 2.13m BGS				
2.5	SM - SILTY SAND TILL, trace clay, trace gravel, loose to compact, grey, wet	89.31			
				G 2.44 - 3.05	6.4
3.0					
	END OF TEST PIT @ 3.35m BGS	88.40			
3.5	End of Test Pit on Bedrock				
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP35A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	FILL - sand and gravel, trace asphalt, trace concrete, cobbles/boulders, trace wood, grey to dark brown, loose to compact, moist		G	0.00 - 1.22	2.4
		2.59	G	2.13 - 2.59	2.3
	SM - SILTY SAND TILL, trace clay, trace gravel, cobbles/boulders, loose to compact, grey to brown, wet - water infiltration at 2.74m BGS		G	2.59 - 3.51	1.3
		3.51		3.51	1.2
	END OF TEST PIT @ 3.51m BGS End of Test Pit on Bedrock				

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP37-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE NUMBER	SAMPLE INTERVAL	
	GROUND SURFACE	93.37			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
	END OF TEST PIT @ 0.30m BGS End of Test Pit on Bedrock	93.06			
0.5					
1.0					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP38-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	91.69			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist				
			G	0.61 - 1.22	6.3
	- water infiltration at 1.22m BGS	90.47			
	END OF TEST PIT @ 1.22m BGS				
	End of Test Pit on Bedrock				

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP40A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	DEPTH m BGS	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE PID (ppm)
	FILL - sand and gravel with trace of concrete, trace asphalt, trace brick, trace wood, trace cobbles/boulders, compact to loose, dark brown, moist				
0.5					
1.0				G 0.30 - 1.52	1.3
1.5					
	SM - SILTY SAND TILL, with gravel, trace clay, trace organics, cobbles/boulders, loose to compact, grey to brown, moist to wet	1.83			
2.0					
				G 1.83 - 2.90	1.4
2.5					
	- water infiltration at 2.74m BGS				
	END OF TEST PIT @ 2.90m BGS	2.90			
3.0					
	End of Test Pit on Bedrock				
3.5					
4.0					
4.5					
5.0					
5.5					

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP41-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS		ELEV. m	SAMPLE		
				NUMBER	INTERVAL	
	GROUND SURFACE		121.00			
	TOPSOIL - fine silty sand with some organic material, loose, dark brown, moist	▨				
0.5	END OF TEST PIT @ 0.46m BGS		120.55			
	End of Test Pit on Bedrock					
1.0						
1.5						
2.0						
2.5						
3.0						
3.5						
4.0						
4.5						
5.0						
5.5						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP41A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	SAMPLE		
			NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE	91.66			
	FILL - sand and gravel with trace of concrete, trace asphalt, trace brick, trace rebar, trace wood, trace cobbles/boulders, compact to loose, dark brown, moist			G 0.00 - 0.61	2.5
				G 1.83 - 1.98	1.9
2.0	END OF TEST PIT @ 1.98m BGS End of Test Pit on Bedrock	89.68			

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

TEST PIT STRATIGRAPHIC LOG

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorn and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: TP46A-08
DATE COMPLETED: June 17, 2008
TEST PIT METHOD: Hydraulic Shovel
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS		ELEV. m	SAMPLE		
				NUMBER	INTERVAL	PID (ppm)
	GROUND SURFACE		91.45			
0.5 1.0 1.5 2.0	FILL - sand and gravel with trace of concrete, trace asphalt, trace organics, trace cobbles/boulders, compact to loose, dark brown, moist	▨			G 1.52 - 2.13	1.8
2.5 3.0 3.5 4.0 4.5 5.0 5.5	END OF TEST PIT @ 2.29m BGS End of Test Pit on Bedrock		89.17			

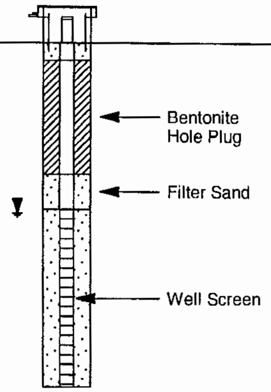
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW1-08
DATE COMPLETED: July 7, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

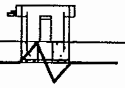
DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE	SAMPLE PID (ppm)
	TOP OF RISER GROUND SURFACE	92.93 91.76						
	OVERBURDEN - organic mat	91.61						
	FILL - sand and gravel with trace asphalt, trace concrete, trace brick, compact to dense, dark grey to dense, moist							
1				SS1	☒	35		0.0
2				SS2	☒	27		0.0
3	END OF BOREHOLE @ 2.97m BGS Auger Refusal On Assumed Bedrock	88.79	WELL DETAILS Screened interval: 90.32 to 88.79m 1.45 to 2.97m BGS Length: 1.52m Diameter: 51mm Slot Size: 10 Material: PVC Seal: 91.61 to 90.62m 0.15 to 1.14m BGS Material: Bentonite Sand Pack: 90.62 to 88.79m 1.14 to 2.97m BGS Material: Silica Sand					
4								
5								
6								
7								
8								
9								
10								
11								

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW2-08
DATE COMPLETED: July 8, 2008
DRILLING METHOD: HQ CORING
FIELD PERSONNEL: F. Laforge

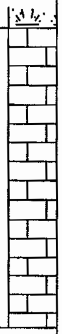
DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
	TOP OF RISER GROUND SURFACE	93.99 93.06					
	OVERBURDEN - organic mat						
	END OF OVERBURDEN HOLE @ 0.18m BGS						
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							

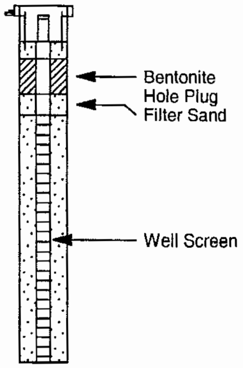
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW2-08
DATE COMPLETED: July 8, 2008
DRILLING METHOD: HQ CORING
FIELD PERSONNEL: F. Laforge





DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	RUN NUMBER	CORE RECOVERY %	RQD %
0	OVERBURDEN - organic mat	92.89				
1	BEDROCK - fractured limestone, becoming sound at 0.6m BGS			RC1	94	75
2				RC2	100	93
3	END OF BOREHOLE @ 2.77m BGS Note: The top of the risor at MW2-08 was cut on July 29, 2008 to permit the installation of the steel protective casing. The new top of risor Elevation is 93.696m	90.29	WELL DETAILS Screened interval: 92.43 to 90.29m 0.63 to 2.77m BGS Length: 2.13m Diameter: 51mm Slot Size: 10 Material: PVC Seal: 92.91 to 92.61m 0.15 to 0.46m BGS Material: Bentonite Sand Pack: 92.61 to 90.29m 0.46 to 2.77m BGS Material: Silica Sand			
4						
5						
6						
7						
8						
9						
10						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

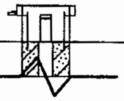
STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

Page 1 of 3

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW3-08
DATE COMPLETED: July 9, 2008
DRILLING METHOD: Tamroc D-1
FIELD PERSONNEL: F. Laforge

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
	TOP OF RISER GROUND SURFACE	104.11 103.44					
	OVERBURDEN - organic mat						
	END OF OVERBURDEN HOLE @ 0.30m BGS						
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							

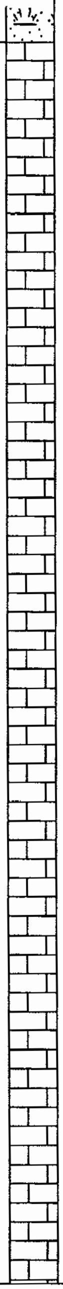
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008

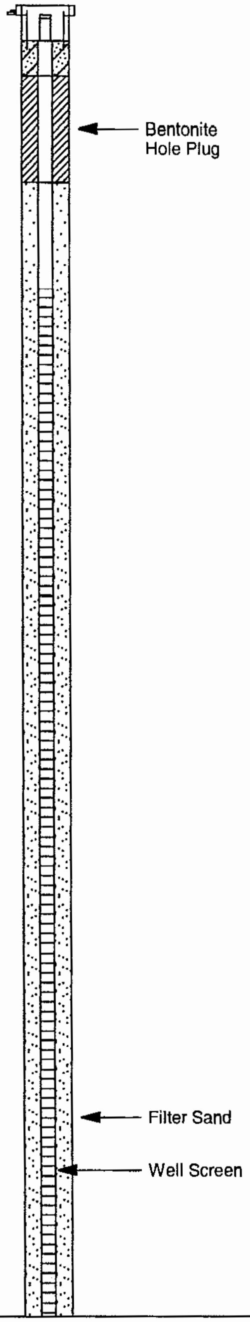
STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW3-08
DATE COMPLETED: July 9, 2008
DRILLING METHOD: Tamroc D-1
FIELD PERSONNEL: F. Laforge

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	RUN NUMBER	CORE RECOVERY %	RQD %
0	OVERBURDEN - organic mat					
	BEDROCK - fractured limestone	103.14				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						





NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG (BEDROCK)

PROJECT NAME: Orgaworld

PROJECT NUMBER: 45804

CLIENT: Orgaworld Canada Real Estate Ltd.

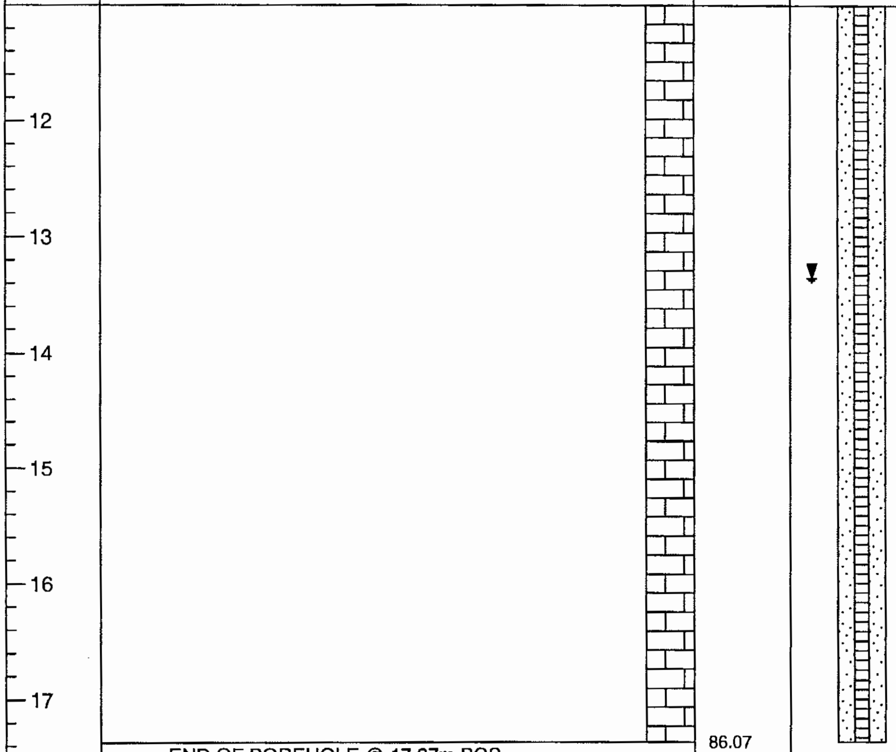
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW3-08

DATE COMPLETED: July 9, 2008

DRILLING METHOD: Tamroc D-1

FIELD PERSONNEL: F. Laforge



DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	RUN NUMBER	CORE RECOVERY %	RQD %	
	END OF BOREHOLE @ 17.37m BGS Borehole advanced with a Tamroc D-1 Paultera 900	86.07	WELL DETAILS Screened interval: 101.31 to 86.07m 2.13 to 17.37m BGS Length: 15.24m Diameter: 51mm Slot Size: 10 Material: PVC Seal: 103.14 to 102.22m 0.30 to 1.22m BGS Material: Bentonite Sand Pack: 102.22 to 86.07m 1.22 to 17.37m BGS Material: Silica Sand				

Depth scale continues: 18, 19, 20, 21, 22

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

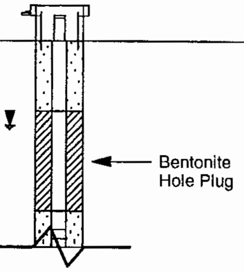
STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW4-08
DATE COMPLETED: July 8, 2008
DRILLING METHOD: HQ CORING
FIELD PERSONNEL: F. Laforge

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE REC (%)	SAMPLE 'N' VALUE
	TOP OF RISER GROUND SURFACE	96.35 95.18					
	FILL - sand and silt with some concrete and gravel, loose, brown and moist			SS1		40	9
1	- becoming wet at 0.91m BGS			SS2			7
	SILTY SAND TILL, with gravel, dense, brown, moist - becoming very dense at 1.68m BGS	93.96					
2	END OF OVERBURDEN HOLE @ 1.78m BGS						
3							
4							
5							
6							
7							
8							
9							
10							
11							



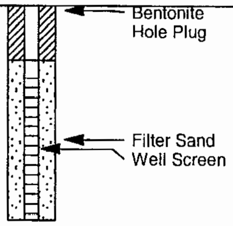
NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(BEDROCK)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW4-08
DATE COMPLETED: July 8, 2008
DRILLING METHOD: HQ CORING
FIELD PERSONNEL: F. Laforge

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	RUN NUMBER	CORE RECOVERY %	RQD %
	SILTY SAND TILL, with gravel, dense, brown, moist - becoming very dense at 1.68m BGS	93.96				
2	FRACTURED LIMESTONE, grey, greatest level of fracture between 1.9m to 2.4m depth	93.40		RC1	93	63
3	END OF BOREHOLE @ 2.84m BGS	92.33	WELL DETAILS Screened interval: 93.55 to 92.33m 1.63 to 2.84m BGS Length: 1.22m Diameter: 51mm Slot Size: 10 Material: PVC Seal: 94.57 to 93.70m 0.61 to 1.47m BGS Material: Bentonite Sand Pack: 93.70 to 92.33m 1.47 to 2.84m BGS Material: Silica Sand			
4						
5						
6						
7						
8						
9						
10						
11						
12						

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

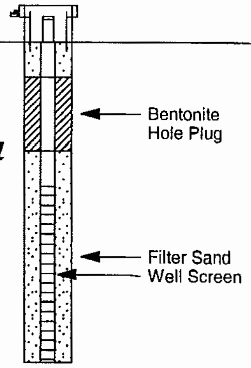
STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW5-08
DATE COMPLETED: July 7, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m	MONITOR INSTALLATION	SAMPLE			
				NUMBER	INTERVAL	REC (%)	'N' VALUE
	TOP OF RISER GROUND SURFACE	93.89 92.94					
	OVERBURDEN - organic mat, wet	92.78					
	FILL - sand and silt with trace asphalt, trace concrete, trace brick, compact to dense, dark grey to black, moist						
1				SS1	☒	54	13
2				SS2	☒	83	74
				SS3	☒	0	7
3	END OF BOREHOLE @ 2.77m BGS	90.17					
4							
5							
6							
7							
8							
9							
10							
11							

WELL DETAILS
Screened interval:
91.69 to 90.17m
1.24 to 2.77m BGS
Length: 1.52m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
92.63 to 92.00m
0.30 to 0.94m BGS
Material: Bentonite
Sand Pack:
92.00 to 90.17m
0.94 to 2.77m BGS
Material: Silica Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STATIC WATER LEVEL ▼ July 17, 2008

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

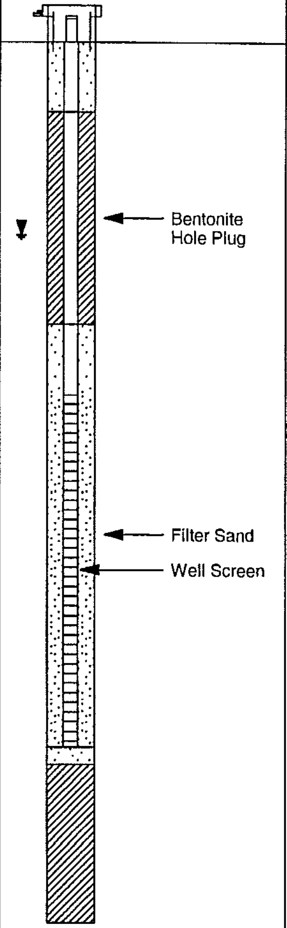
Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW6-08
DATE COMPLETED: July 14, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m
	TOP OF RISER GROUND SURFACE	94.98 93.83
	FILL - (dredged sediment from adjacent settling pond), very fine sand and silt, dense, grey to brown, moist	
1	FILL - very fine sand and silt, trace clay, trace gravels, trace asphalt, trace concrete, trace organics, dense, slightly green in upper levels, brown to dark brown, black organic layer at 4.6m, moist	93.07
2		
3		
4		
5	SM - SAND with silt, very fine grained, compact, oxidized, grey to brown, moist to wet	89.26
6	SM - TILL - silty sand with some gravel, medium grained, well graded, brown, moist to wet	87.89
7		
8	END OF BOREHOLE @ 7.62m BGS	86.21
9		
10		
11		

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
90.78 to 87.73m
3.05 to 6.10m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
93.22 to 91.39m
0.61 to 2.44m BGS
Material: Bentonite
Sand Pack:
91.39 to 87.58m
2.44 to 6.25m BGS
Material: Silica Sand

SAMPLE

NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
SS1	☒	83	43	13.1
SS2	☒	86		17.1
SS3	☒	75	29	21.3
SS4	☒	33	16	23.9
SS5	☒	17	7	2.3
SS6	☒	100	20	0.0
SS7	☒	83	26	0.0
SS8	☒	57		0.0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008
CHEMICAL ANALYSIS ○

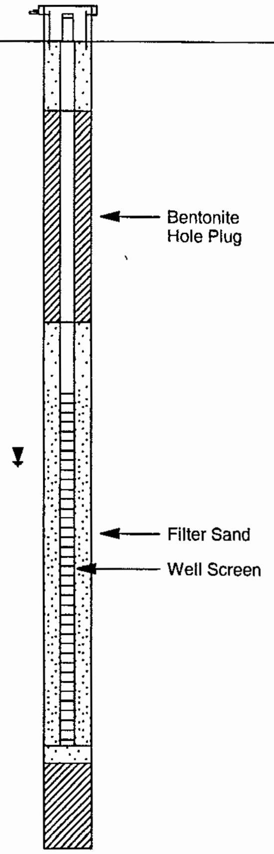
STRATIGRAPHIC AND INSTRUMENTATION LOG (OVERBURDEN)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW7-08
DATE COMPLETED: July 14, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m
	TOP OF RISER	94.82
	GROUND SURFACE	93.81
	FILL - silty sand with some gravel, trace asphalt, trace concrete, trace clay, compact to dense, grey to brown, moist	
	- becoming wet at 3.65m BGS	
	SM - TILL - silty sand with some gravel, brown, moist to wet	88.32
	END OF BOREHOLE @ 6.98m BGS	86.83

MONITOR INSTALLATION



NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
SAMPLE				
SS1		50	38	0.0
SS2		35		4.6
SS3		50	13	0.0
SS4		25	15	4.3
SS5		100		
SS6		42	54	0.0
SS7		50	15	0.0
SS8		100		1.5
SS9		100		0.0

WELL DETAILS
Screened interval:
90.76 to 87.72m
3.05 to 6.10m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
93.20 to 91.37m
0.61 to 2.44m BGS
Material: Bentonite
Sand Pack:
91.37 to 87.72m
2.44 to 6.10m BGS
Material: Silica Sand

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE

STATIC WATER LEVEL ▼ July 17, 2008

CHEMICAL ANALYSIS ○

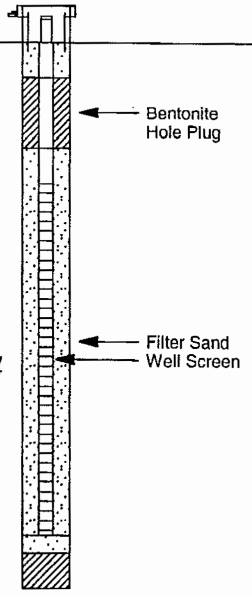
STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW8-08
DATE COMPLETED: July 15, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m
	TOP OF RISER	91.69
	GROUND SURFACE	90.69
	FILL - silty sand with gravel, trace asphalt, trace concrete, compact to dense, moist	
	- trace organics, loose, black, wet at 3.05m BGS	
	SM - TILL - fine sand and silt with some gravel, compact, wet	86.12
		85.96
	END OF BOREHOLE @ 4.72m BGS	

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
89.47 to 86.42m
1.22 to 4.27m BGS
Length: 3.05m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
90.38 to 89.77m
0.30 to 0.91m BGS
Material: Bentonite
Sand Pack:
89.77 to 86.42m
0.91 to 4.27m BGS
Material: Silica Sand

SAMPLE				
NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
SS1	☒	25	15	48.1
SS2	☒	0		
SS3	☒	33	39	11.7
SS4	☒	17	4	4.5
SS5	☒	25	65	0.0
SS6	☒	33		0.0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008
CHEMICAL ANALYSIS ○

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

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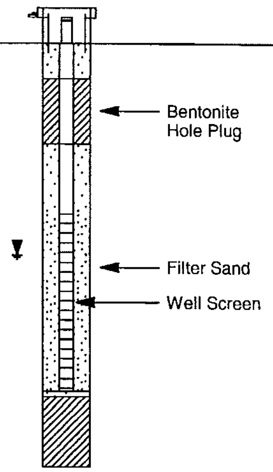
PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW9-08
DATE COMPLETED: July 15, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m
TOP OF RISER	83.96
GROUND SURFACE	82.94
TOPSOIL	82.79
SM - SILTY SAND, fine grained, loose, brown to grey, moist	82.64
CL - SILTY CLAY, grey, blocky, oxidized, moist, soft to very soft - becoming wet, very soft and plastic at 1.52m BGS - becoming moist to dry and blocky at 3.51m BGS	79.29
END OF BOREHOLE @ 3.66m BGS	

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
81.47 to 79.95m
1.47 to 3.00m BGS
Length: 1.52m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
82.64 to 82.08m
0.30 to 0.86m BGS
Material: Bentonite
Sand Pack:
82.08 to 79.95m
0.86 to 3.00m BGS
Material: Silica Sand

SAMPLE				
NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
SS1	☒	75	8	0.0
SS2	☒	100	3	0.0
SS3	☒	100		0.0
SS4	☒	100		

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008
CHEMICAL ANALYSIS ○

STRATIGRAPHIC AND INSTRUMENTATION LOG
(OVERBURDEN)

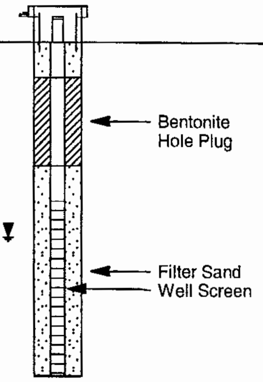
Page 1 of 1

PROJECT NAME: Orgaworld
PROJECT NUMBER: 45804
CLIENT: Orgaworld Canada Real Estate Ltd.
LOCATION: Hawthorne and Rideau Road, Ottawa, Ontario

HOLE DESIGNATION: MW10-08
DATE COMPLETED: July 15, 2008
DRILLING METHOD: HSA
FIELD PERSONNEL: T. Saunders

DEPTH m BGS	STRATIGRAPHIC DESCRIPTION & REMARKS	ELEV. m
	TOP OF RISER	84.00
	GROUND SURFACE	83.10
	TOPSOIL	82.95
1	SM - SILTY SAND, fine to medium grained, grey, compact, moist - trace clay at 0.91m BGS	81.42
2	ML - SAND AND SILT, very fine grained, compact, grey, wet - becoming saturated at 1.98m BGS	80.20
3	END OF BOREHOLE @ 2.90m BGS	
4		
5		
6		
7		
8		
9		
10		
11		

MONITOR INSTALLATION



WELL DETAILS
Screened interval:
81.73 to 80.20m
1.37 to 2.90m BGS
Length: 1.52m
Diameter: 51mm
Slot Size: 10
Material: PVC
Seal:
82.79 to 82.03m
0.30 to 1.07m BGS
Material: Bentonite
Sand Pack:
82.03 to 80.20m
1.07 to 2.90m BGS
Material: Silica Sand

SAMPLE

NUMBER	INTERVAL	REC (%)	'N' VALUE	PID (ppm)
SS1		83	15	0.0
SS2		50	25	0.0
SS3		100	27	0.0

NOTES: MEASURING POINT ELEVATIONS MAY CHANGE; REFER TO CURRENT ELEVATION TABLE
STATIC WATER LEVEL ▼ July 17, 2008
CHEMICAL ANALYSIS ○

APPENDIX A

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Soil Description
TP1	0.00 - 0.15	TOPSOIL
	0.15 - 0.91	Brown fine to medium SAND, trace to some gravel, trace clay
	0.91 - 1.82	Brown SILTY SAND and GRAVEL, some cobbles
	1.82 - 2.13	Grey CLAYEY SILT, trace to some sand, gravel, cobbles, occasional boulder
		End of test pit Water seepage at 1.25 metre depth
TP2	0.00 - 0.15	TOPSOIL
	0.15 - 0.76	Brown fine SAND, trace gravel and clay
	0.76 - 1.98	Brown fine SILTY SAND and GRAVEL, some cobbles
	1.98 - 2.13	Grey SILTY SAND, trace to some gravel, cobbles, occasional boulder
	2.13	BEDROCK
		End of test pit Refusal on bedrock surface Water seepage at 1.89 metre depth
TP3	0.00 - 0.15	TOPSOIL
	0.15 - 0.76	Grey brown SILTY SAND some clay, trace to some gravel, cobbles, occasional boulder
	0.76	BEDROCK
		End of test pit Refusal on bedrock surface Test pit dry
TP4	0.00 - 0.27	PEAT TOPSOIL
	0.27 - 0.37	Grey brown SILTY SAND
	0.37 - 1.98	Grey brown SILTY CLAY
		End of test pit Surface water flowing into test pit

APPENDIX A (continued)

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Soil Description
TP5	0.00 - 0.30	PEAT TOPSOIL
	0.30 - 0.76	Grey brown SILTY SAND
	0.76 - 1.52	Grey brown SILTY CLAY
	1.52	BEDROCK
		End of test pit Refusal on bedrock surface Surface water flowing into test pit
TP6	0.00 - 0.21	TOPSOIL
	0.21 - 1.31	Brown fine to medium SAND, trace to some gravel, cobbles, some clay and silt
	1.31 - 1.37	Grey brown SILTY SAND with gravel and cobbles
	1.37	BEDROCK
		End of test pit Refusal on bedrock surface Test pit dry
TP7	0.00 - 1.83	Sand, gravel, clay, asphalt, wood, concrete, boulders (FILL)
	1.83 - 2.44	Grey brown SILTY CLAY, trace gravel
		End of test pit Water seepage at 2.13 metre depth
TP8	0.00 - 2.59	Clay, sand, gravel, cobbles, wood (FILL)
	2.59 - 2.74	PEAT TOPSOIL
	2.74 - 3.29	Brown SILTY SAND
	3.29 - 3.51	Brown SILTY SAND and grey SAND
		End of test pit Surface water flowing into test pit Water seepage at 2.59 metre depth

APPENDIX A (continued)

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Soil Description
TP9	0.00 - 0.09	PEAT TOPSOIL
	0.09 - 1.37	Brown SILTY SAND, trace to some clay
	1.37 - 1.98	Grey brown fine SAND, trace silt
		End of Test Pit Surface water flowing into test pit
TP10	0.00 - 0.06	TOPSOIL
	0.06 - 1.68	Brown SILTY SAND with gravel, cobbles, occasional boulder
	1.68 - 2.13	Grey SILTY SAND with gravel, cobbles
		End of Test Pit Water at 1.98 metre depth
TP11	0.00 - 0.30	PEAT TOPSOIL
	0.30 - 1.22	Brown SILTY SAND and GRAVEL, occasional cobble and boulder
	1.22 - 1.98	Brown SILTY SAND, trace gravel
	1.98	BEDROCK
		End of Test Pit Refusal on bedrock surface Water seepage at 1.22 to 1.37 metre depth
TP12	0.00 - 2.70	Asphalt, wood, sand, gravel, concrete (FILL) PEAT TOPSOIL
	2.70 - 3.00	Brown SILTY SAND
	3.00 - 3.20	Possibly Bedrock
		End of Test Pit Refusal Surface water flowing into test pit

APPENDIX A (continued)

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Soil Description
TP13	0.00 - 0.98	Asphalt, wood, rock, concrete (FILL)
	0.98 - 1.07	PEAT TOPSOIL
	1.07 - 1.22	Brown SILTY SAND
	1.22	BEDROCK
		End of Test Pit Refusal on bedrock surface Surface water flowing into test pit
TP14	0.00 - 0.34	PEAT TOPSOIL
	0.34 - 1.34	Grey brown SILTY SAND and GRAVEL, trace clay
	1.34 - 2.13	Grey SILTY SAND and GRAVEL, some silt, trace clay, cobbles
	2.13	BEDROCK
		End of Test Pit Refusal on bedrock surface Surface water flowing into test pit
TP15	0.00 - 0.24	PEAT TOPSOIL
	0.24 - 1.52	Brown fine SAND some gravel, becoming brown SAND and GRAVEL between 1.3 and 1.5 metre depth
	1.52 - 2.13	Grey SAND and GRAVEL
		End of Test Pit Water inflow at 1.5 metre depth
TP16	0.00 - 0.34	PEAT TOPSOIL
	0.34 - 0.67	Brown SILT, some sand, trace clay
	0.67 - 0.98	Brown SILTY SAND, trace to some gravel, trace clay
	0.98	BEDROCK
		End of Test Pit Refusal on bedrock surface Water inflow at 0.8 metre depth

APPENDIX A (continued)

RECORD OF TEST PITS

Test Pit Number	Depth (metres)	Soil Description
TP17	0.00 - 0.30	PEAT TOPSOIL
	0.30 - 1.10	Brown SILTY SAND
	1.10 - 1.31	Brown SILTY SAND, trace to some gravel, trace clay
	1.31	BEDROCK
		End of Test Pit Refusal on bedrock surface Water inflow at 1.2 metre depth
TP18	0.00 - 0.24	PEAT TOPSOIL
	0.24 - 0.49	Red brown SILTY SAND
	0.49 - 0.76	Grey brown CLAYEY SILT
	0.76 - 1.98	Grey brown SILTY CLAY
	1.98 - 2.44	Grey SILTY SAND/SANDY SILT
		End of Test Pit Surface water flowing into test pit
TP19	0.00 - 0.24	PEAT TOPSOIL
	0.24 - 0.70	Grey brown CLAYEY SILT
	0.70 - 1.83	Grey brown SILTY CLAY
	1.83 - 1.92	Grey SILTY SAND/SANDY SILT
		End of Test Pit

APPENDIX C

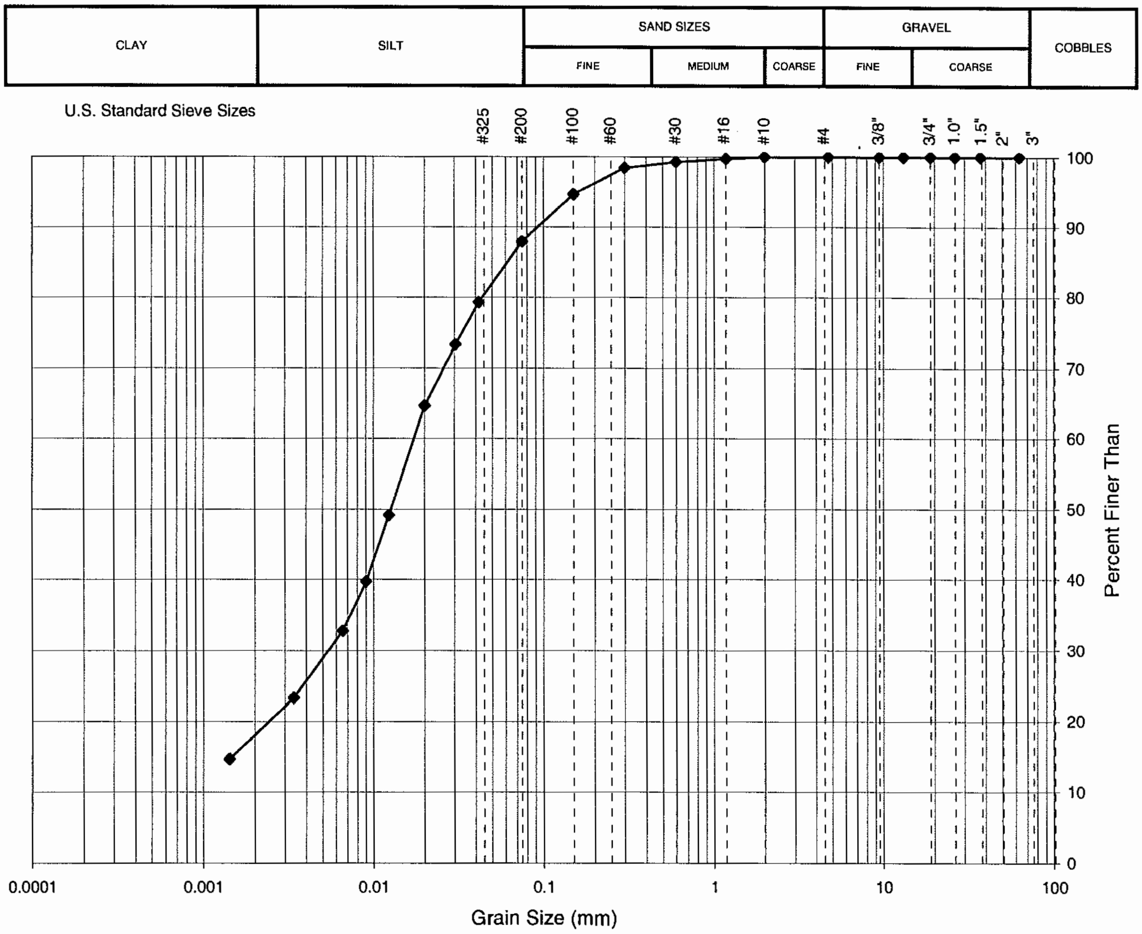
SOIL GRADATION DATA

INSPEC-SOL INC.
179 Colonade Road, Suite 400, Ottawa, Ontario, K2E 7J4
Tel: (613) 727-0895
Fax: (613) 727-0581

GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 5.3 m - 5.9 m
SAMPLE LOCATION: BH4-1-(SS 7)
DATE SAMPLED: October 31, 2008
TEST DATE: November 18, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

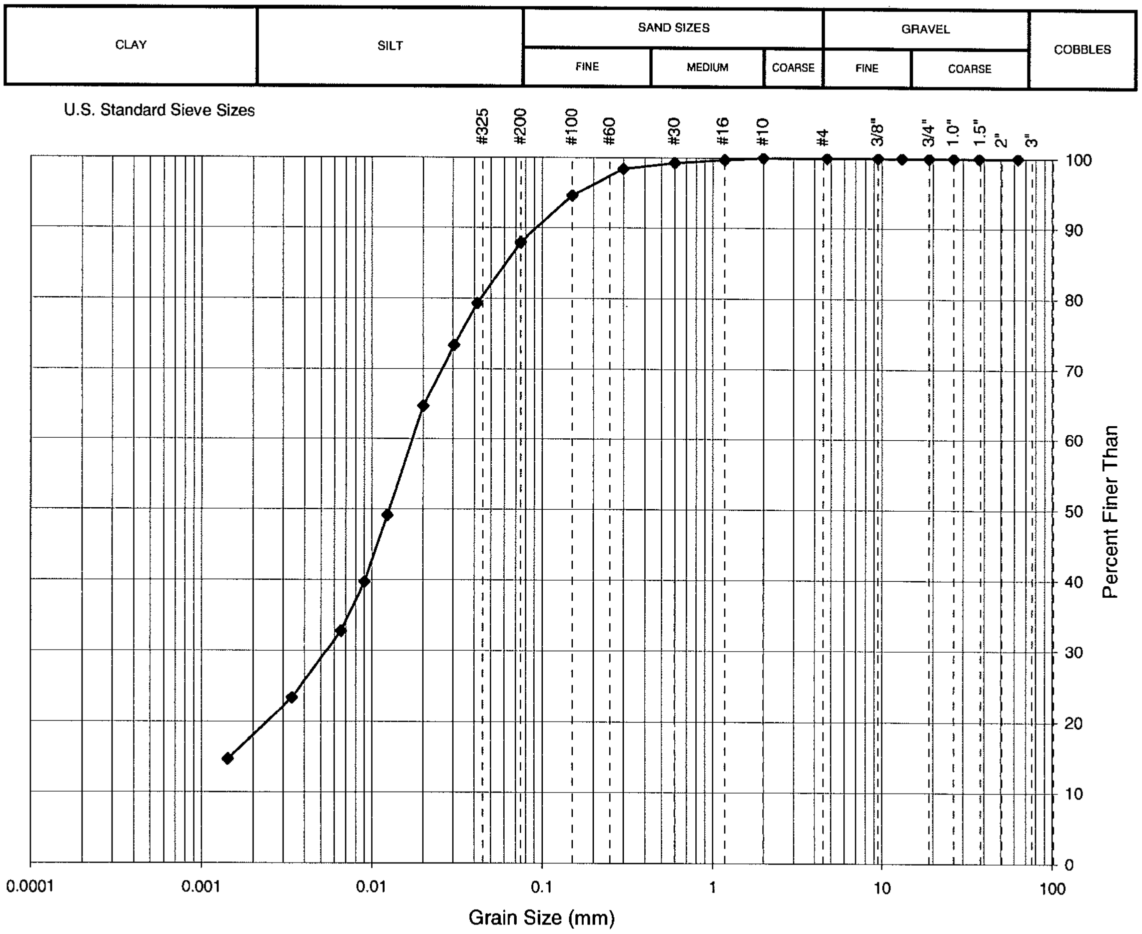
DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY
Silt, some sand, trace clay	AND	36 - 50 %	GRAVEL 0 %
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND 12 %
	SOME	11 - 20 %	SILT + CLAY 88 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %	X

INSPEC-SOL INC.
179 Colonade Road, Suite 400, Ottawa, Ontario, K2E 7J4
Tel: (613) 727-0895
Fax: (613) 727-0581

GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 5.3 m - 5.9 m
SAMPLE LOCATION: BH4-1-(SS 7)
DATE SAMPLED: October 31, 2008
TEST DATE: November 18, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY
Silt, some sand, trace clay	AND	36 - 50 %	GRAVEL 0 %
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND 12 %
	SOME	11 - 20 %	SILT + CLAY 88 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %	X

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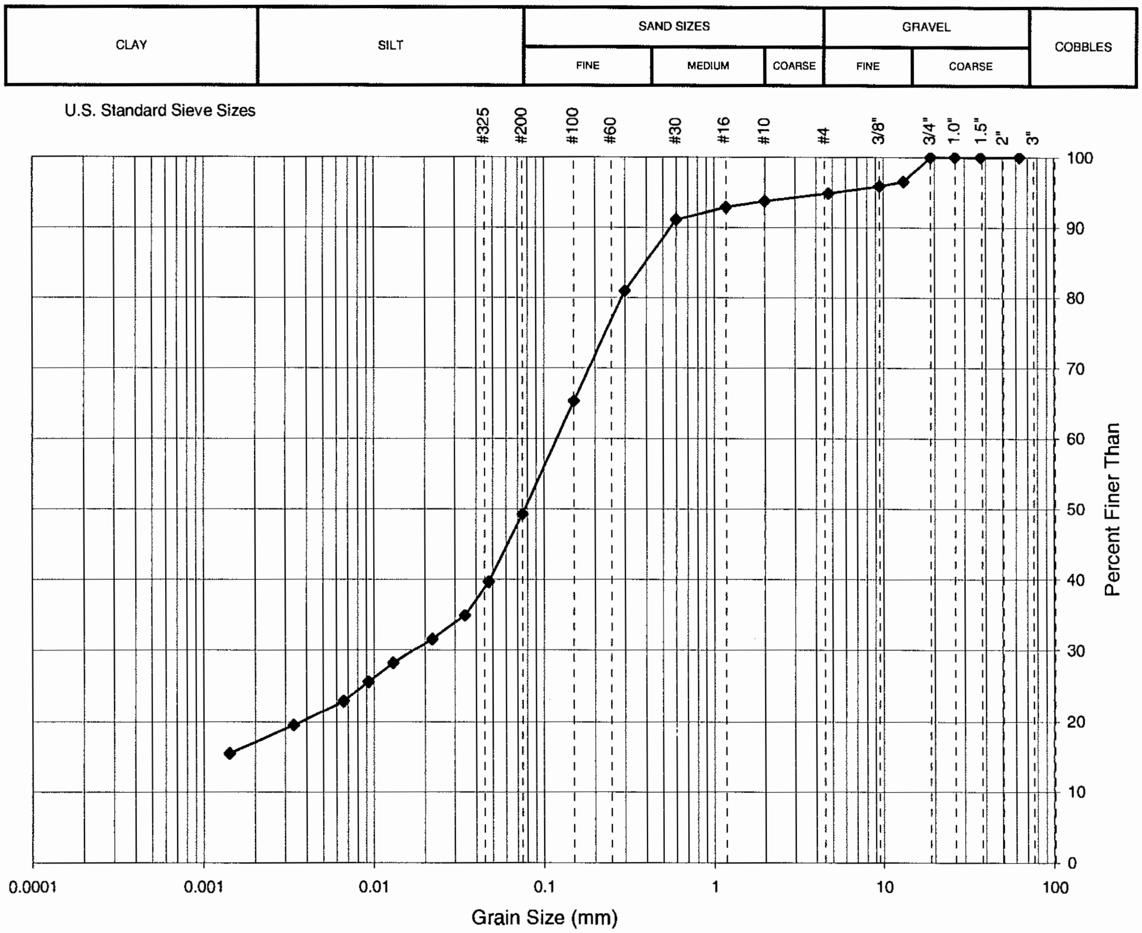
Fax: (613) 727-0581

GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 4.6 m - 5.2 m
SAMPLE LOCATION: BH6-3-(SS 6)
DATE SAMPLED: October 31, 2008
TEST DATE: November 21, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	**SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS**		SUMMARY	
Silt and Sand, trace clay, trace gravel	AND	36 - 50 %	GRAVEL	5 %
SM	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	46 %
	SOME	11 - 20 %	SILT + CLAY	49 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %		

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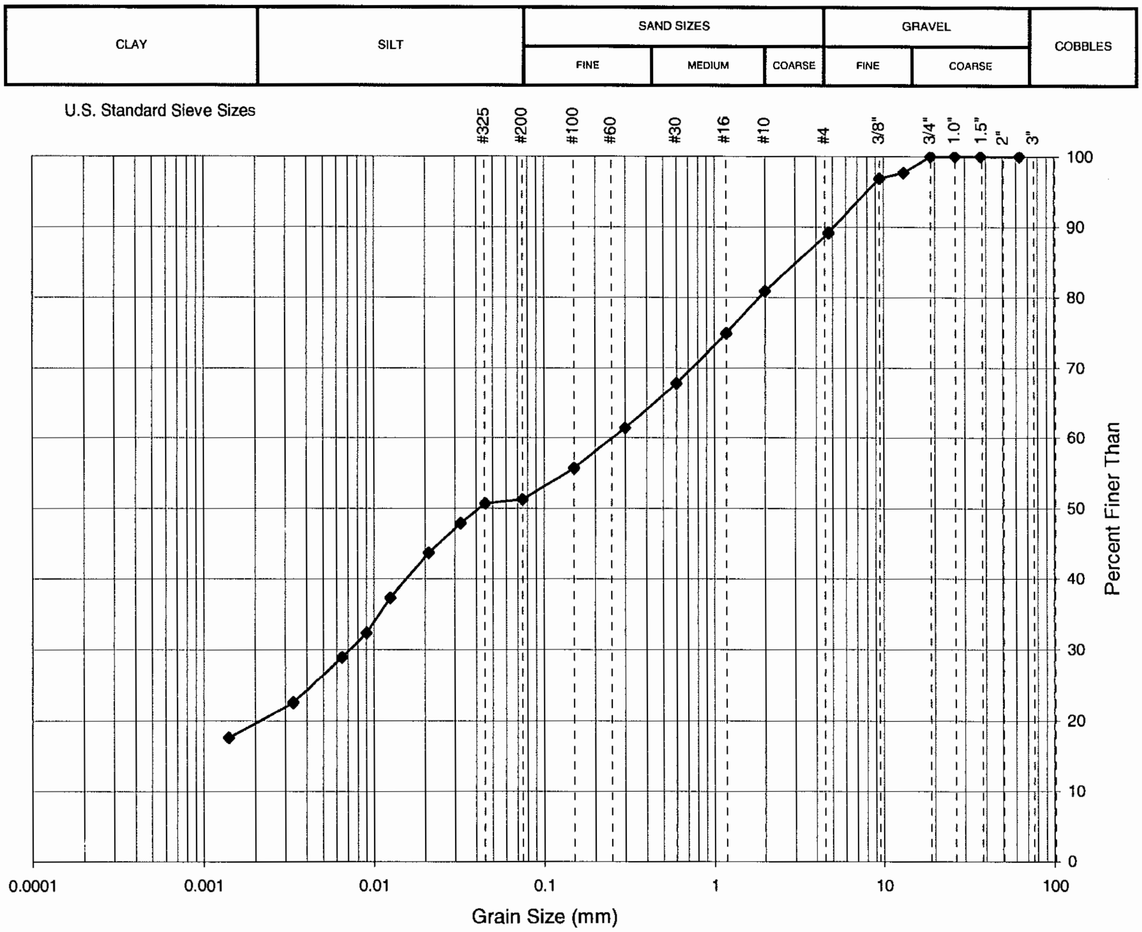
GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 9.2 m - 9.8 m
SAMPLE LOCATION: BH 5-1-(SS 12)
DATE SAMPLED: October 30, 2008
TEST DATE: November 21, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
Silt and Sand, some gravel, trace clay	AND	36 - 50 %	GRAVEL	11 %
SM	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	38 %
	SOME	11 - 20 %	SILT + CLAY	51 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %		

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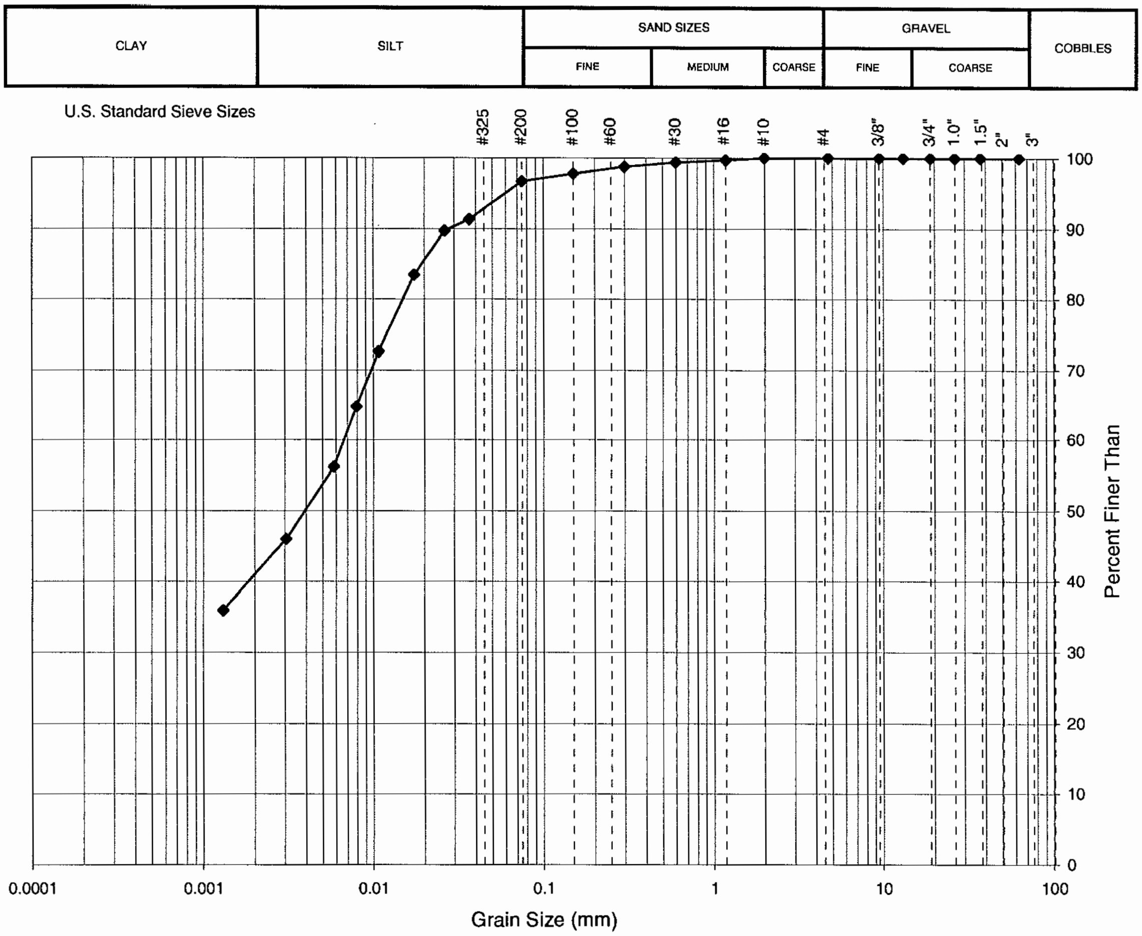
GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 3.8 m - 4.4 m
SAMPLE LOCATION: BH7-2-(SS 5)
DATE SAMPLED: October 31, 2008
TEST DATE: November 18, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY		
Silt, trace sand, trace clay	AND	36 - 50 %	GRAVEL	0	%
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	3	%
	SOME	11 - 20 %	SILT + CLAY	97	%
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %			

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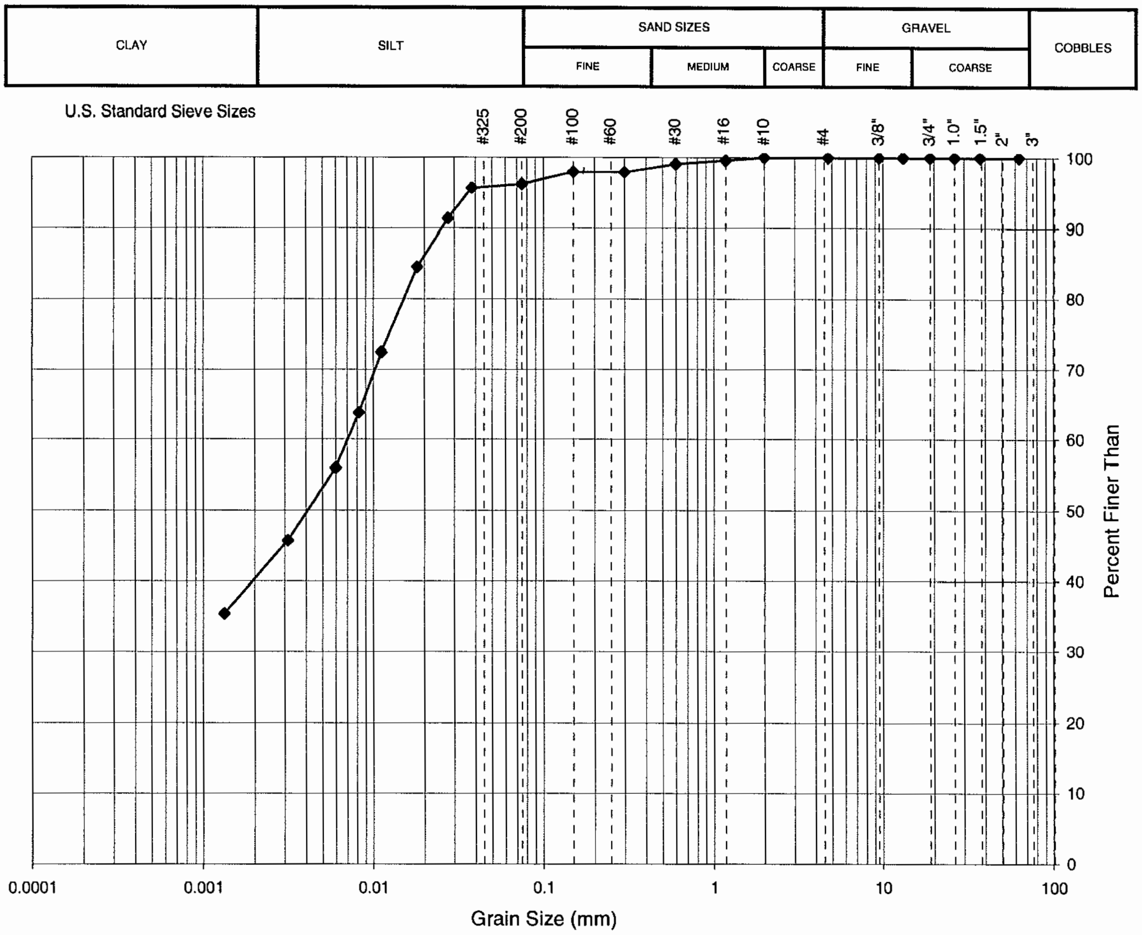
GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 1.5 m - 2.1 m
SAMPLE LOCATION: SWM3-10-(SS 2)
DATE SAMPLED: November 3, 2008
TEST DATE: November 18, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
Silt, trace clay, trace sand	AND	36 - 50 %	GRAVEL	0 %
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	4 %
	SOME	11 - 20 %	SILT + CLAY	96 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %		

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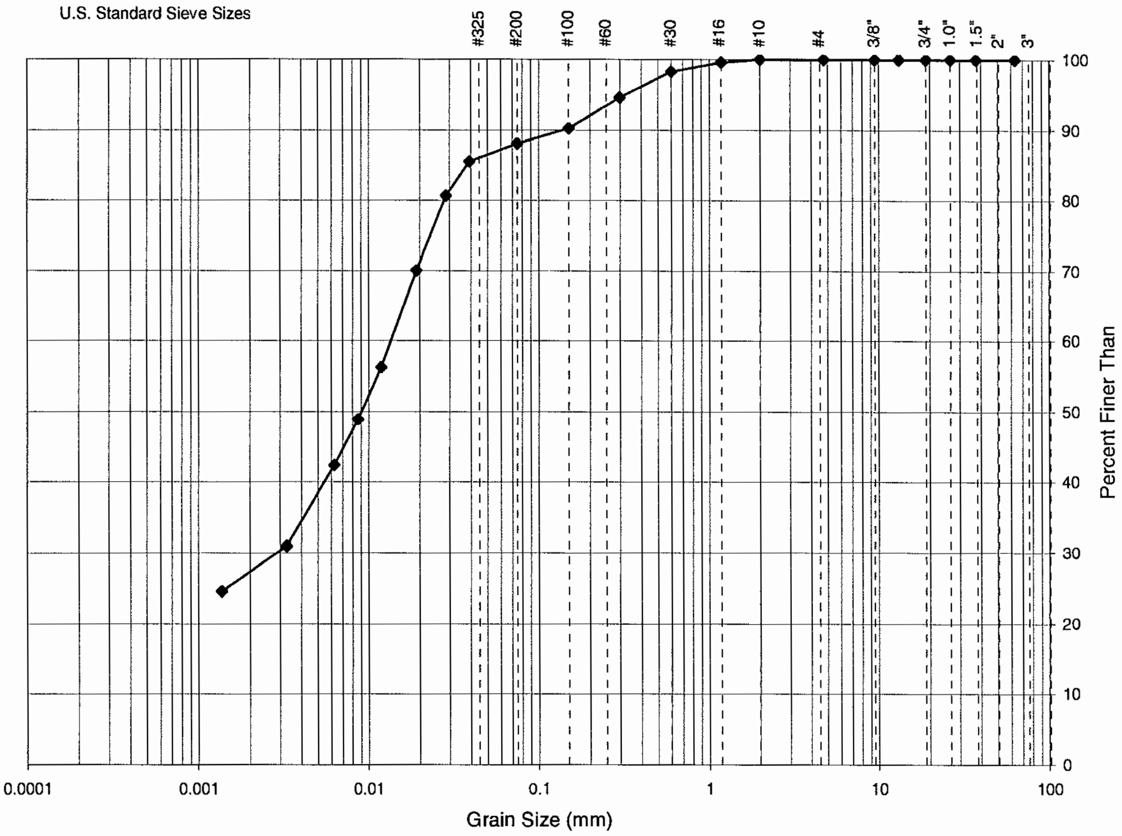
GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 1.0 m - 1.2 m
SAMPLE LOCATION: TP10-01-(SS1)
DATE SAMPLED: November 3, 2008
TEST DATE: November 18, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1

CLAY	SILT	SAND SIZES			GRAVEL		COBBLES
		FINE	MEDIUM	COARSE	FINE	COARSE	



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY		
Silt, some sand, trace clay	AND	36 - 50 %	GRAVEL	0	%
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	12	%
	SOME	11 - 20 %	SILT + CLAY	88	%
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %			

INSPEC-SOL INC.
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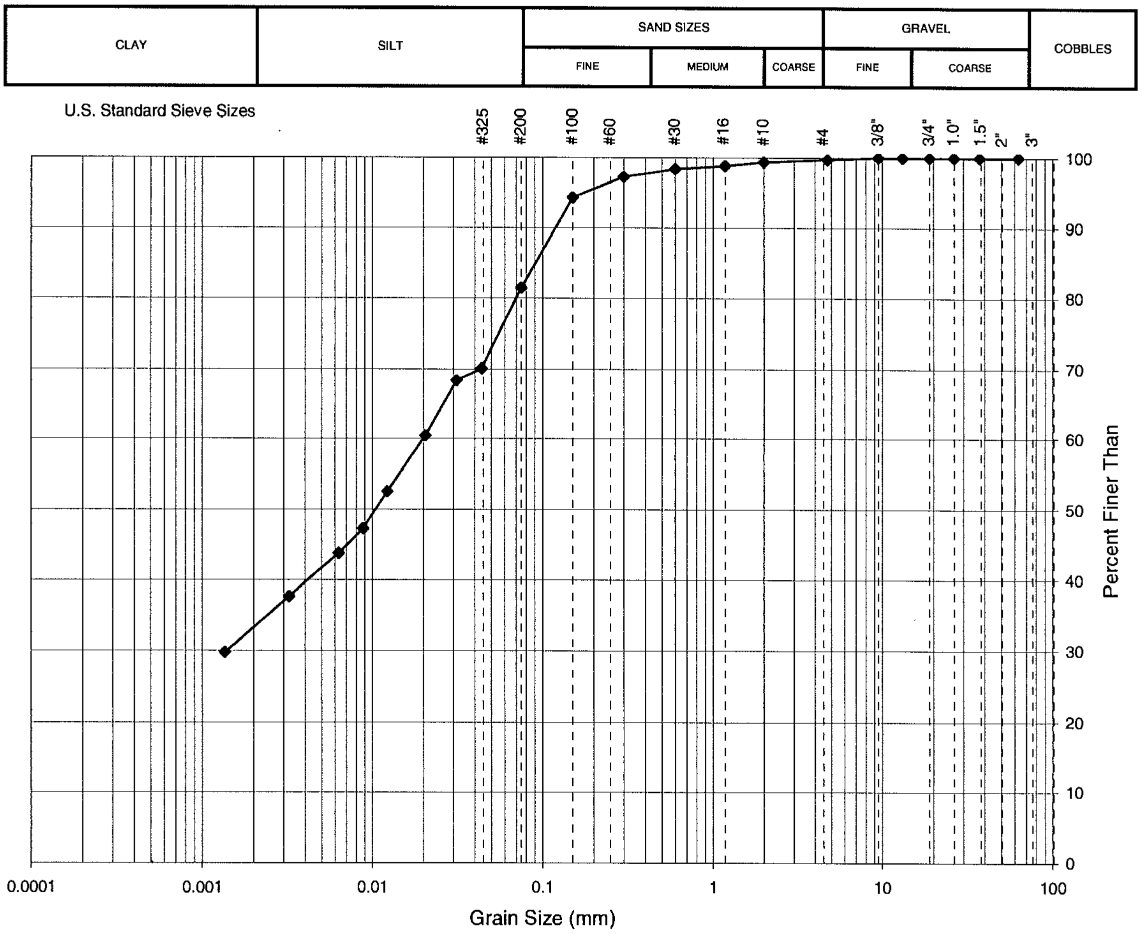
Tel: (613) 727-0895
Fax: (613) 727-0581

GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 0.5 m - 1.1 m
SAMPLE LOCATION: TP10-02-(SS1)
DATE SAMPLED: October 30, 2008
TEST DATE: November 21, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
Silt, some sand, trace clay	AND	36 - 50 %	GRAVEL	0 %
ML	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	18 %
	SOME	11 - 20 %	SILT + CLAY	81 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %		

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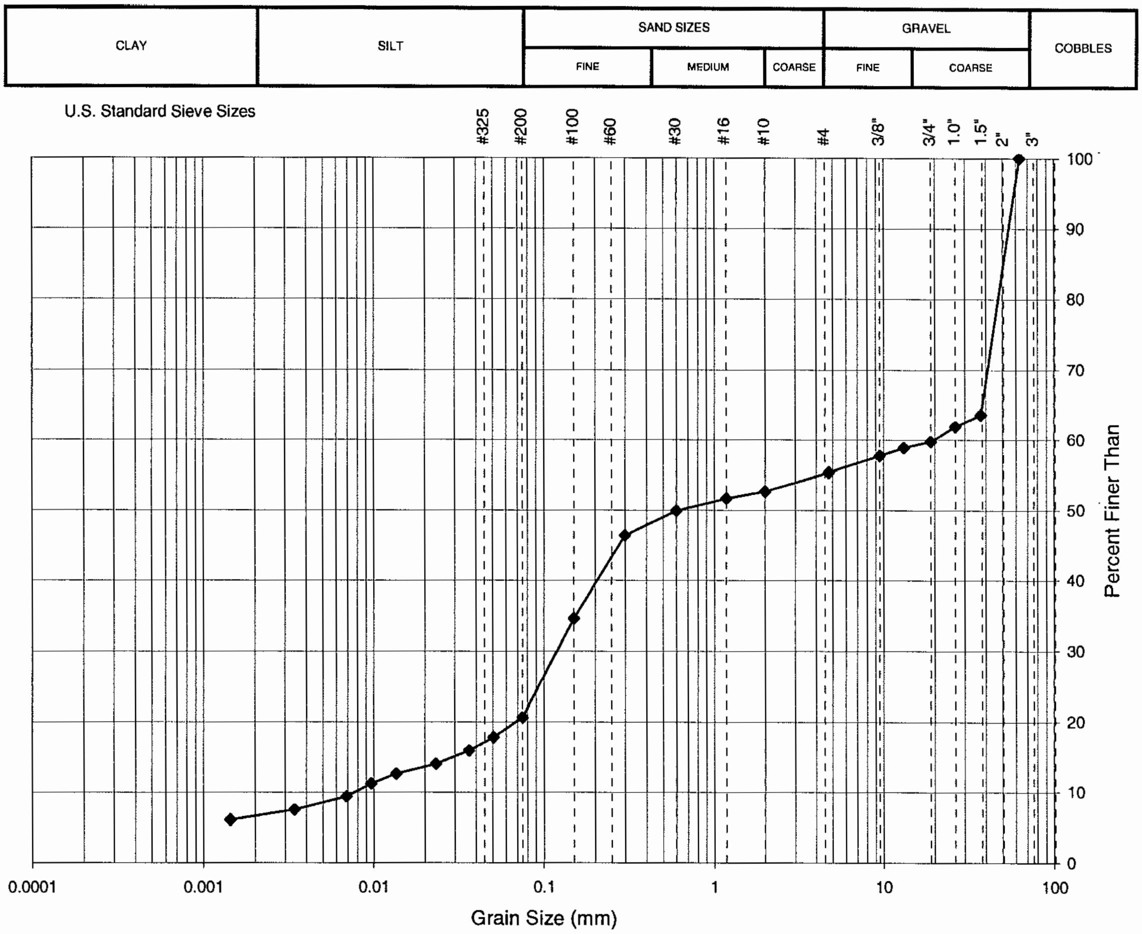
Fax: (613) 727-0581

GRAIN SIZE ANALYSIS

LAB SAMPLE No.: 651
SAMPLE DEPTH: 1.1m - 1.2 m
SAMPLE LOCATION: TP10-02-(SS2)
DATE SAMPLED: October 30, 2008
TEST DATE: November 21, 2008
TESTED BY: Daniel B.
PROJECT SAMPLE No.: 1

PROJECT: Hawthorne Industrial Park
ORIGIN: 5123 Hawthorne
CLIENT: R.W.Tomlinson
PROJECT NO.: T020556-B1



PARTICLE SIZE DISTRIBUTION

DESCRIPTION	SOIL CLASSIFICATION DESCRIPTIVE MODIFIERS		SUMMARY	
Sandy Gravel, some Silt, trace Clay	AND	36 - 50 %	GRAVEL	45 %
GM	ADJECTIVE (e.g. sandy)	21 - 35 %	SAND	35 %
	SOME	11 - 20 %	SILT + CLAY	21 %
NOTE: UNIFIED SOIL CLASSIFICATION SYSTEM-ASTM D2487	TRACE	1 - 10 %		

APPENDIX D

NOTES ON BOREHOLE LOGS

INSPEC•SOL

NOTES ON BOREHOLE AND TEST PIT REPORTS

SOIL DESCRIPTION:

Each subsoil stratum is described using the following terminology. The relative density of granular soils is determined by the standard penetration index ("N" value), while the consistency of clayey soils is measured by the value of the undrained shear strength (Cu).

CLASSIFICATION (UNIFIED SYSTEM)

Clay	< 0,002mm		
Silt	0,002 to 0,075mm		
Sand	0,075 to 4,75mm	fine	0,075 to 0,425mm
		medium	0,425mm to 2,0mm
		coarse	2,0 to 4,75mm
Gravel	4,75 to 75mm	fine	4,75mm to 19mm
		coarse	19 to 75mm
Cobbles	75 to 300mm		
Boulders	> 300mm		

TERMINOLOGY

"traces"	1 - 10%
"some"	10 - 20%
adjective (silty, sandy)	20 - 35%
"and"	35 - 50%

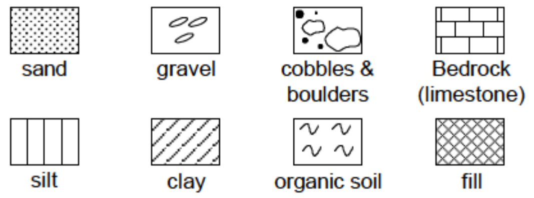
RELATIVE DENSITY OF GRANULAR SOILS	STANDARD PENETRATION INDEX "N" VALUE (BLOWS/ft - 300mm)
Very loose	0 - 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very dense	> 50

CONSISTANCY OF COHESIVE SOILS	UNDRAINED SHEAR STRENGTH (Cu)	
	(P.S.F.)	(kPa)
Very soft	< 250	< 12
Soft	250 - 500	12 - 25
Medium	500 - 1000	25 - 50
Stiff	1000 - 2000	50 - 100
Very stiff	2000 - 4000	100 - 200
Hard	> 4000	> 200

ROCK QUALITY DESIGNATION

"RQD" (%) VALUE	QUALIFICATIVE
< 25	very poor
25 - 50	poor
50 - 75	fair
75 - 90	good
> 90	excellent

STRATIGRAPHIC LEGEND



SAMPLES:

TYPE AND NUMBER

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon
SSE, GSE, AGE: Environnemental sampling
ST: Shelby tube
PS: Piston sample (Osterberg)
AG: Auger
RC: Rock core
GS: Grab sample

RECOVERY

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil.

RQD

The "Rock Quality Designation" or "RQD" value, expressed as a percentage, is the ratio of the total length of all core fragments of 4 inches (10cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index
R: Refusal to penetration
N_C: Dynamic cone penetration index
Cu: Undrained shear strength
Pr: Pressuremeter
k: Permeability
ABS: Absorption (Packer test)

LABORATORY TESTS:

I_p: Plasticity index
W_l: Liquid limit
W_p: Plastic limit
H: Hydrometer analysis
GSA: Grain size analysis
A: Atterberg limits
w: Water content
g: Unit weight
C: Consolidation
CS: Swedish fall cone
CHEM: Chemical analysis
O.V.: Organic vapor