FINAL

GEOTECHNICAL INVESTIGATION REPORT

BUILDING EXPANSION - OTTAWA CARLETON DETENTION CENTRE

2244 INNES ROAD

CITY OF OTTAWA

ONTARIO

Prepared for:

Colliers Project Leaders Inc.
1900 City Park Drive, Suite 402
Ottawa, Ontario
K1J 1A3

August 11, 2017

DST File No.: GV-SO-029092

DST Consulting Engineers Inc.

2150 Thurston Drive, Suite 203, Ottawa, Ontario, K1G 5T9
Tel.: 613-748-1415 Fax: 613-748-1356
E-mail: www.dstgroup.com

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APPENDICES

1. INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed expansion to the existing Ottawa Carleton Detention Centre located at Innes Road, East of Anderson Road in Ottawa, Ontario. The site location is shown on the Key Plan, Figure No. 1 in Appendix B. The new construction consists of prefabricated steel buildings, access roads and parking lot expansion.

The geotechnical work was carried out in general accordance with our proposal number GV-SO-029092 dated April 3, 2017. Authorization to carry out work was received from Mr. Michael Nimchuk by email, on April 3, 2017.

This report has been prepared specifically and solely for the project described herein. This report presents the factual results of the geotechnical investigation as well as recommendations for the design and construction of the addition of new buildings and associated infrastructure.

2. PROJECT DESCRIPTION

It is understood that the proposed construction between the existing facility and Innes Road includes three (3) new buildings, parking lots and a drive aisle on the north and west side of facility. Three new buildings include a building for Admitting and Discharge, a building for new single occupancy cell units, and a building for regional intermittent centre.

The three new buildings are proposed to be configured in an “L” shape, occupying an approximate area of 4,200 square meters. New buildings consist of one (1) to two (2) storeys with tension membrane structure on shallow foundation with slab-on-grade. There will be no basement in the new buildings. It should be noted that the Renovation of existing Admitting and Discharge building is a part of this project.

New paved areas and underground service lines will also be part of this project. The expansion of the parking areas includes addition of parking lots and heavy duty access roads around the new buildings in North and West side of construction. Currently, these areas are covered by spaced trees. The borehole location plan at the site is shown in Figure No. 2 in appendix B.

3. SCOPE OF THE WORK

The scope of the work for this geotechnical investigation are as follow:

- Advancing Eight (8) boreholes (approximately 30 m apart) to be located within the proposed building footprints. Each borehole will be advanced to approximately 6 m depth;
- Advancing One (1) borehole to a depth of 30 m for site seismic classification.
- The installation of two (2) standpipe piezometers to allow for the monitoring of the groundwater level;
- Advancing Four (4) shallow boreholes to be located within the proposed expansion to the pavement. Each borehole will be advanced to approximately 1.5 m depth;
- Conducting Standard Penetration Test (SPT) while collecting soil samples at regular intervals throughout the test;
- Conducting field vane shear tests at regular intervals within cohesive materials to evaluate undrained shear strength;
- Up to four (4) relatively undisturbed samples of the “softer” portions of the silty clay deposits will be retrieved using a thin walled tube sampler (Shelby tube);
- Surveying ground surface elevations at borehole locations to a nearby Geodetic benchmark provided to us;
- Install standpipe piezometers (19 mm diameter) in two (2) boreholes and measure the groundwater level one (1) week following completion of drilling. Decommissioning of the standpipe piezometers is not included in our scope of work;
- Transporting the recovered soil and granular samples to our Ottawa Laboratory for detailed visual examination and classification testing. Laboratory testing included moisture content determination on all recovered soil samples as well as Atterberg limits (clayey soils) and grain size analysis on selected samples;
- Chemical analyses of one (1) selected soil sample will be undertaken to assess the subsurface soil’s potential for sulphate attack on buried concrete structures and corrosion potential on buried steel structures. This include testing to measure pH, soluble sulphate, and chlorides;

- Conducting an environmental site inspection during the borehole layout to identify potential contaminated areas (if any) including the visual assessment of soil samples as well as laboratory testing using an organic vapour meter;
- Preparing a geotechnical investigation report that includes a borehole e location plan, borehole logs, laboratory test results and discussion on methodology and findings. Report will also provide the following geotechnical engineering comments and recommendations for the proposed expansion. Construction considerations which could affect design decisions:
    1. Foundations input to the structural design of the new building, including foundation system options, bearing resistance at serviceability and ultimate limit states (SLS/ULS);
    2. Pavement design for parking lot and access roads;
    3. Seismic Site Classification in accordance with 2015 National Building Code of Canada (NBCC) and assessment of liquification potential;
    4. Geotechnical input to excavation for buried services;
    5. Pipe bedding and backfill requirements;
    6. Groundwater level and construction dewatering requirements;
    7. Other pertinent applicable items that may affect the design of the project.

4. FIELD INVESTIGATION AND LABORATORY TESTING

4.1 Field Investigation

Prior to commencement of the field investigation DST personnel made arrangements to verify the locations of the underground utilities near the proposed borehole locations. From Jun 5th to 8th, 2017, a total of thirteen (13) borehole locations, BHs 17-01 to 17-13, where advanced within the proposed building foot print, parking lots, and grass areas using a conventional truck mounted drill rig (Model) operated by “drilling contractor used”. The borehole locations are presented on Figure No. 1 in Appendix B.

Seven (7) boreholes (BHs 17-01 to 17-03 and BHs 17-05 to 17-08) located at the approximate location of the new three building footprints. Boreholes were drilled to the approximate depth of 6 m. One (1) borehole (BH 17-09) was drilled close to the foundation of the existing Admitting and Discharge building to the approximate depth of 6 m. One (1) borehole (BH 17-04) was drilled in approximate location of the three new building footprints to the approximate depth of 30 m for site seismic analysis. Also, four (4) shallow probe holes (BHs 17-10 to 17-13) were drilled in the existing

parking lots, drive aisle and grass areas to investigate the subsurface conditions for the proposed pavement design. These four probe holes were drilled to the approximate depth of 1.5 m. Standard Penetration Test (SPT) was carried out at 0.75 m interval for first 3 m depth and 1.5 m interval after 3 m depth and continued up to the borehole termination depths. The SPT sampler was advanced by dropping a 63.5 kg hammer (auto trip) for approximately 760 mm height, in accordance with the Standard Penetration Test (SPT) method (ASTM D1586). The results of these penetration tests are reported as SPT 'N' values on the borehole logs. Relatively undisturbed samples (Shelby tube samples) of the silty clay were retrieved from select depth intervals. In situ field vane tests were conducted at select depth intervals to measure the undrained shear strength of clayey soils. The results of these penetration tests are reported as SPT 'N' values on the borehole logs (Appendix C - Enclosures 1 to 17) at the corresponding depths.

All boreholes located in the grass areas were backfilled with augured materials tamped in place. The boreholes on the asphalt and granular surface were backfilled with auger cutting materials and patched with sand and cold mix asphalt. The subsurface stratigraphy encountered in the boreholes was recorded by the DST's geotechnical representative. Disturbed soil samples were collected from the SPT samplers. All the collected soil samples were inspected upon retrieval and classified the soil types, colour and kept in the airtight plastic bags, labelled the sample identifications and sent back to the DST laboratory using cooler boxes. After arrival of the samples to the laboratory, soil samples were reviewed by a geotechnical engineer and assigned the laboratory tests. The borehole coordinates were referenced to MTM Zone 9 NAD-83 (CSRs) (1997.0) and the borehole elevations are geodetic.

4.2 Surveying

An elevation survey of the borehole locations was carried out by DST's subcontractor, J.D.BARNES Ltd., upon completion of the filed work for this project. Measured elevations are geodetic and established using Global Positioning System (GPS) equipment to measure ellipsoidal height. The ellipsoidal heights were transformed to CGD-1928 Datum (Geodetic) using the federal HT20 height transformation model. The elevations were recorded in accordance with the proposed benchmark in the site and the bearings are derived from Global Navigation Satellite Systems (GNSS) by Real Time Network (RTN) observations, MTM Zone 9, NAD83 (CSRS 2010). The elevations were measured in relation to the proposed benchmark located at the paved driveway of front building at

Northeast. The location of benchmark and its elevation is shown in Figure 2, Appendix B. Also, borehole coordinates and elevations are presented in Table 1 below:

Table 1. Borehole coordinates and elevations

Borehole No.	Easting (m)	Northing (m)	Elevation (m)
BH 17-01	454754.218	5030299.562	68.2
BH 17-02	454730.683	5030300.249	68.4
BH 17-03	454735.990	5030332.910	68.4
BH 17-04	454713.092	5030334.762	68.0
BH 17-05	454733.363	5030365.420	69.6
BH 17-06	454677.545	5030346.362	68.8
BH 17-07	454696.630	5030358.195	68.1
BH 17-08	454651.236	5030343.996	68.7
BH 17-09	454656.961	5030318.029	68.8
BH 17-10	454619.738	5030321.419	68.9
BH 17-11	454602.587	5030257.405	68.5
BH 17-12	454567.682	5030217.208	68.1
BH 17-13	454540.370	5030301.807	67.4

4.3 Laboratory Testing Program

Geotechnical laboratory testing of the soil samples consisted of moisture content determination on all samples, while Grain size analysis, Atterberg Limits determination and corrosion analyses were conducted on selected soil samples. A visual assessment of soil samples using an organic vapour metre was also conducted for all samples in the laboratory.

5. RESULTS OF THE INVESTIGATION

Details of the subsurface conditions encountered in the boreholes are given in the borehole logs shown in Appendix C and are discussed in detail below. The moisture content, grain size analysis, and Atterberg Limit results are shown on the borehole logs in Appendix C and as part of the laboratory test results shown in Appendix D. Details regarding the monitoring well installations are also shown on the borehole logs. Based on the results of the grain size analysis, the soil was classified in accordance with the 2006 Canadian Foundation Engineering Manual, Fourth Edition (CFEM).

5.1 Existing Subsurface Condition

5.1.1 Surface Condition

At the time of the filed work investigation, the site was covered with grass, gravel and paved surface parking lots and roadways. Review of site elevations indicates that the ground surface elevation at the centre of the site is higher with a slope toward the West and East. The maximum elevation difference of approximately 1.3 m, obtained from topographical survey, indicates that there is significant grade change in this site that should be addressed during the site grading.

5.1.2 Topsoil

A surficial topsoil layer was contacted in eight (8) boreholes (BH 17-03, BH 17-04, BH 17-06, BH 17-07, BH 17-08, BH 17-09, BH 17-10, and BH 17-13 ranges between 100 to 255 mm in thickness.

5.1.3 Fill – Sand and Gravel

The fill layer was contacted in the four (4) boreholes consisting of Sand and Gravel. The fill extends to depths of 0.9 to 2.4 m (Elevation 67.6 to 66.0) below existing ground surface. Standard penetration test (SPT) N values range from 4 to 22 indicating the fill is in loose to compact. The moisture content of the fill ranges from 7 to 18 %.

5.1.4 Fill – Clay

In Borehole 17-02, a clay fill was encountered below the Sand and Gravel fill and extends to a depth of 1.8 m (Elevation 66.6 m). The SPT N value is 4 indicating the clay in a soft consistency. Moisture

content of the clay fill is 35 %. The results of the grain size analysis from one (1) sample of the fill are shown in Table 2.

Table 2. Summary of Grain Size Analysis Results

Sample ID	Sample Depth (m)	% Clay	% Silt	% Sand	% Gravel
17-02 SS5	3.0 – 3.6	52	39	9	0

5.1.5 Clay (CH)

A clay deposit was encountered in all boreholes beneath the fill layer. Trace of Gravel and Sand was observed in the clay in BHs 17-02, 17-03 and 17-09. The depth to the clay below the ground surface in BHs 17-02 and 17-09 is approximately 2.8 and 2.4 m (Elevation 65.6 and 66.44 m). In BH 17-05, the clay deposit was found on the ground surface. In all other boreholes, the depth to the clay deposit ranges between 0.2 to 1.2 m. The thickness of clay deposit ranges between 3.6 to 6.0 m.

The SPT N-values obtained for the clay ranges between 1 to 23. Moisture contents of the clay ranges between 4 to 86 %. Atterberg limit test results from one (1) sample of clay is shown in Table 3 and indicates the soil may be classified as a clay of high plasticity.

Table 3. Summary of Atterberg Limits

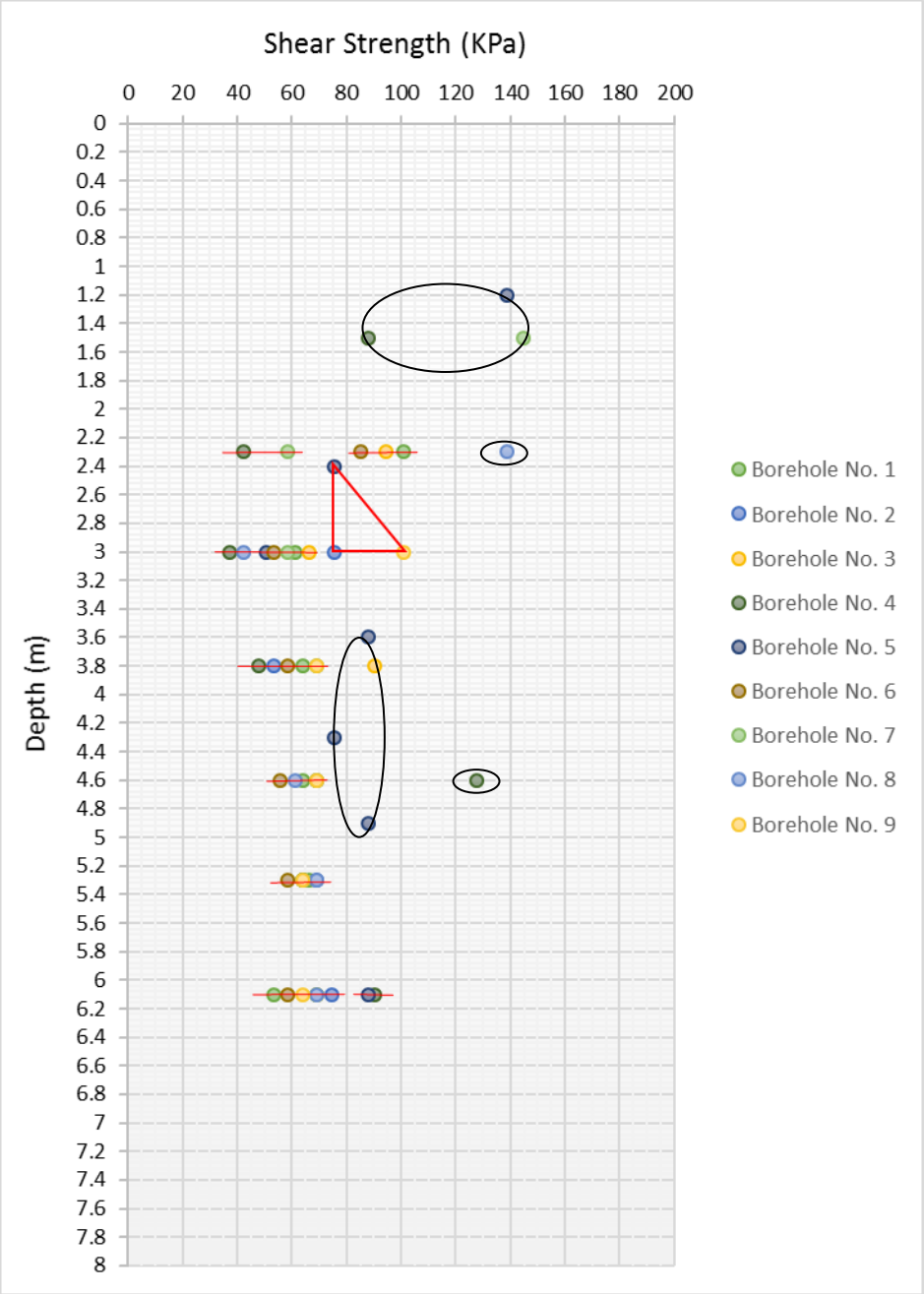
Sample ID	Sample Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
BH17-01 SS3	2.1 – 2.7	83	27	56
BH17-02 SS5	3.1 – 3.7	74	27	47
BH17-03 SS3	1.5 – 2.1	71	26	45
BH17-04 SS4	2.3 – 2.9	74	27	47
BH17-05 SS6	3.1 – 3.7	76	28	48
BH17-06 SS5	4.6 – 5.2	70	27	43
BH17-07 SS8	5.3 – 5.9	78	28	50
BH17-08 SS6	5.3 – 5.9	66	27	39
BH17-09 SS9	6.1 – 6.7	68	29	39

5.2 Shear Strength

Vane in-situ testing was conducted in various depth in order to evaluate shear strength of soil and its variation within the site. The purpose of investigation was to develop an understanding of soil shear variation in both lateral and vertical directions within the site and to advise structural engineers to take into account this variation for final design of foundation.

The shear strength results are presented in below figure. The statistical analysis was conducted to out-layer inconsistent results and to interpret raw data to capture the actual shear strength variation of soil materials in laboratory. Raw shear strength results are presented at the depths of 2.3, 3.0, 3.8, 4.6, 5.3 and 6.1 m and are consistent in the site. Using the minimum value of shear strength for the results obtained for all boreholes No. 1 to 9, the shear strength varies from 37 to 58 KPa for this site.

Cares must be taken into account for design of final dimensions of footings seating in the soil around the Borehole No. 2 and 4. The soil shear strength at approximate depth where footing is seated, 2.3 m, and at the depth of 3.0 m ranges between 37 to 41 KPa. It should be noted that these shear strength results are raw data presented to only evaluate variation in shear strength within the site. Reduced shear strength to account for plasticity and construction time is not applied to this results. Out-layer results are marked with circle and triangle in below figure.



5.3 Bedrock

Bedrock was not encountered during the filed investigation. The Ontario Geological Survey indicates that the area consists of mostly shale bedrock encountered at the approximate depth of 33.2 m below ground surface.

5.4 Groundwater

The groundwater level measurements taken on Jun 8, 2017 are summarized in Table 4.

Table 4. Summary of Groundwater Levels

Borehole No.	Groundwater Depth (m)	Groundwater Elevation (m)
17-04	1.21	67.7
17-08	2.18	66.6

It shall be noted that the groundwater levels measured at the time of geotechnical field investigations may not be representative of the stabilized groundwater conditions at the site during the construction period. It should be noted that the groundwater levels are transient and tend to fluctuate with the seasons and periods of precipitation.

6. GEOTECHNICAL SOIL DESIGN PARAMETERS

Based on the in-situ and laboratory tests carried out, the following parameters shown in Table 6.1 below are suggested as design parameters for the soils encountered in the boreholes. The internal friction angles of granular materials were estimated from standard penetration tests (SPTs) applying Wolff (1989) which provides an empirical correlation between SPT and internal friction angle.

The internal friction angles of cohesive materials were estimated from Atterberg Limits test results applying Kenney (1959) which provides an empirical correlation between plasticity index and internal friction angle. For overconsolidated clay this approach is conservative. Summary of geotechnical soil parameters are presented in Table 5 below:

Table 5. Geotechnical Soil Design Parameters

Material	Total Unit Weight (kN/m^3)	Undrained Shear Strength, c_u (kPa)	Internal Friction Angle, Φ (°)
Fill – Silty Clay	16-18 (18)	-	24-30 (28)
Fill – Sandy Gravel	20 -21 (20)	-	28 – 40 (34)
Native clay	16 – 18 (17)	27- 42 (Reduced for plasticity and construction time)	22-26 (24)

The number presented in brackets can be used for design purposes.

7. DISCUSSION AND RECOMMENDATIONS

The general site stratigraphy across the site consists of fill underlain by discontinuous organic silt layer overlying an extensive deposit of Champlain Sea or Leda clay known to be a sensitive and compressible material. The groundwater levels range from Elevation 66.6 to 67.7 m across the site.

Note that the discussions presented herein are intended for the sole use of the designers/planners of the project and are subject to the limitations in Appendix A.

All recommendations presented in this report are based on the assumption that an adequate level of construction monitoring of excavations and installation will be provided at the time of construction. An adequate level of construction monitoring is considered to be full time monitoring, inspection and compaction testing.

7.1 Site Grading and Preparation

7.1.1 Beneath Spread Footings and Slab-on-Grade

It is recommended that footings and floor slabs be placed on native soils or structural fil (engineering fill) overlaying on the competent native soil. All existing structures, vegetation, topsoil, and existing fill materials should be entirely removed from beneath the building footprint and the influenced zone of the foundation, which is represented by a line drawn at 1 horizontal and 1 vertical outward and downward from the edge of the footing to the competent native soil.

All the revealed soft spot areas during the subgrade inspection should be removed of site and be replace with acceptable OPSS acceptable Granular “B” Type II materials. Geotextile must be installed on the subgrade prior to installation of any granular materials.

7.1.2 Pavement Subgrade Preparation and Drainage Characteristics

It is recommended that all existing structures, vegetation, topsoil, buried concrete units, and defected materials, be entirely removed of site from the beneath of the proposed paved areas. Existing fill materials can be remained in place if it is free of organic materials. The existing fill must be compacted and proof-rolled. All soft spot areas revealed during proof-roll, on existing granular fill and subgrade, must be replaced with OPSS acceptable Granular “B” Type II to a depth of at least 500 mm.

New catch basins are also recommended to be installed on the paved sections of the parking lot at the perimeter of the grass areas and property line along the Innes Road. It is also recommended that during the subgrade preparation, at the location of parking lots, the subgrade to be slopped for positive drainage toward the new proposed catch basins.

The grading and slopping of the subgrade will significantly help in positive drainage of the surfaced and penetrated water into the pavement. It is also recommended that subdrain be installed preferably in the grass side, but it can be installed in the paved section between the new proposed catch basins to redirect any infiltrated water from the grass area into the catch basins. Geotextile must be installed on the subgrade prior to installation of any granular materials.

7.2 Footings

All footings located either on native soils or OPSS acceptable granular materials may be designed using the deign parameters indicated in Table 6.

Unless otherwise noted, the foundation design parameters are given for static, vertically and concentrically loaded foundations in compression. Once the conceptual design of the building has been determined (with or without an equalization tank), DST should be contacted to provide additional geotechnical consultation during final design of the building. Geotechnical items such as dynamic, lateral, eccentric and uplift design parameters can be provided during final design, as required.

Table 6. Geotechnical resistances and reactions for strip footings

Foundation Type	Depth of Footing (m)	Width of Footing (m)	Bearing Capacity (kPa)	ULS (kPa)	SLS (kPa)
Footings Close to Boreholes Nos. 2 and 4 (Shear strength of 27 KPa)					
Strip Footing	1.8	2.0	138	69	58
Strip Footing	1.8	3.0	132	66	56
Square Footing	1.8	2.0	162	81	77
Square Footing	1.8	3.0	154	77	72
Footings Close to Boreholes Nos. 1, 3, and 5, to 9 (Shear strength of 42 KPa)					
Strip Footing	1.8	1.5	224	112	95
Strip Footing	1.8	2.0	214	107	93
Square Footing	1.8	1.5	265	132	101
Square Footing	1.8	2.0	252	126	98

The above factored geotechnical resistances at ULS include a resistance factor of 0.5 in accordance with the 2006 CFEM, Fourth Edition. It should be noted that for the footing design, a minimum embedment depth of 1.8 m was assumed in the design process.

Total settlement at the SLS values noted above is not expected to exceed 25 mm with differential settlement less than 25 mm. In situations where column loads dictate wider footings than those presented in this report, the geotechnical engineer should be contacted to review the column loads and provide foundation options.

Bearing areas will require very careful preparation. Following excavation all bearing surfaces should be cleaned of all fill, organic (such as topsoil), loose, disturbed, or slough material prior to concrete placement. Bearing surfaces should be protected always from rain, freezing temperatures and the ingress of groundwater before, during and after construction. All foundation excavations and bearing surfaces should be inspected by a qualified geotechnical engineer to confirm the integrity of the bearing surface prior to concrete placement.

Concrete and materials casting must be in accordance with the final site drawing and CSA Group A23.1-14. Concrete mix designs and granular must be submitted for our review 14 days prior to casting.

7.2.1 Frost Protection

Based on the Ministry of Environment published data, which is based on an 85% probability, the design freezing index for Ottawa has been estimated to be 1,000 degrees-days Celsius (1,832 degree-days Fahrenheit).

For protection against frost action, perimeter of all footings of heated structures should extend to such a depth to provide a minimum of cover of 1.5 m provided heat (structure heated to 18 degrees Celsius) from within the structure is allowed to radiate to the footing (not protected by insulation along the inside of foundation walls or below the floor slab). For unheated isolated foundations, to prevent frost heave of underlying soils, the foundation should be placed with 1.8 m of soil cover.

In all cases, if the earth cover is less than noted above for the foundations, thermal rigid insulation or a combination of insulation and soil cover should be provided. DST can provide additional information regarding thermal rigid insulation, if required.

7.3 Seismic Site Classification

The calculated average shear strength below the foundation of 27 to 42 kPa is in the seismic site class of “E” thresholds. As such, a seismic site class of “E” must be used for the foundations founded on the clay at this site, as per Table 4.1.8.4 A of the 2012 Ontario Building Code (OBC). The 2015 National Building Code Seismic Hazard Calculation is shown in Appendix E.

7.3.1 Liquefaction Potential of Soils

Based on a review of the borehole information, the subsurface soils at the proposed building location are mostly consists of clay with high plasticity, which is not considered to have a potential to liquefy during a seismic event.

7.4 Slab-on-Grade Construction

It is recommended that a layer of Granular A with a minimum thickness of 250 mm to be placed under the floor slab for levelling and support purposes. The Granular A layer should be packed and compacted to a minimum of 100% SPMDD. At locations where the slab is lower than the final grade around the building, it is recommended that perimeter drain to be installed. Geotex 801 must be used as the geotextile drainage layer.

For the purpose of designing the floor slab, it is recommended to employ a soil modulus of subgrade reaction, k, equal to 30 MPa/m. Expansion joints is recommended to be placed on the floor slab to allow adequate load transfer ratio. If the construction is scheduled to be conducted in winter time, to avoid heave upward pressure of clay and its subsequent shrinkage, it is recommended that the subgrade soil to be protected against freezing.

Concrete materials casting must be in accordance with the final site drawing and CSA Group A23.1-14. Concrete mix designs must be submitted for our review 14 days prior to casting in the field. Granular materials should be submitted to us for our review.

7.5 Pavement Structure Design

7.5.1 Existing Condition

Borehole BH17-10, BH17-11, BH17-12, and BH17-13 were drilled to investigate the subsurface condition for the pavement design purposes. The main objective was to investigate the thickness of pavements' layers and material types on the main access road and the thickness of top soil in the grass area. In average, 175 mm of top soil was recovered in split spoon samples obtained from Boreholes BH 17-10 and BH17-13. A layer of almost 150 mm granular materials was recovered in split spoon samples obtained from Boreholes BH 17-11 and BH17-12.

Immediately beneath the top soil and granular layer, native clay was observed in Boreholes BH17-10, 17-11, 17-12, and 17-13. The visual evaluation of recovered granular materials revealed that the granular material has a poor gradation and is not suitable to be used as competent sub-base materials.

7.5.2 Pavement Design and Construction Recommendations

A subgrade resilient modulus, M_r, equal to 30 MPa was used in the design of the pavement structure. The pavement design was recommended for light and heavy duty sections. Light duty refers to parking lots and the heavy duty refers to the drive aisles. Annual average daily traffic (AADT) of equal to 30,000 and 100,000 ESALs over 20 years was assumed in the pavement design process. The traffic data was not submitted by client at the time of writing this report. However, DST believes that the forecasted traffic volume matches the actual condition over 20 years' design life. Any minor and major changes in traffic volume, DST must be advised for design revision. Table 7 below represents the pavement design, minimum compacted layer thickness, materials type and the OPSS requirements for acceptance of material and compaction requirements.

Table 7. Pavement Structure Design

Pavement Layers	Compaction Requirements	Materials	Parking Areas, Thickness in (mm)	Drive Aisles, Thickness in (mm)
Surface Course, Asphaltic Concrete	92% of MRD PG 58-34	SP 12.5 (OPSS 1151)	40	40
Binder Course, Asphaltic Concrete	91% of MRD PG 58-34	SP 19.0 (OPSS 1151)	50	50
Granular Base Course	100% SPMDD	Granular 'A' (OPSS 1010)	150	150
Granular Sub-base Course	100% SPMDD	Granular 'B', Type II (OPSS 1010)	450	450

Asphalt concrete and granular materials must be submitted for review 14 days prior to installation.

To implement above pavement design in the site, the following construction steps are recommended:

- Excavate and remove of site the existing in place materials including top soil, granular, and native soil to a minimum depth of 500 mm;
- Grade, shape, slope and level subgrade soil to the location of proposed new catch basins. Immediately compact native soil on subgrade to a minimum target density of 98% of SPMDD;
- Sub-excavate, remove of site, and replace wet native soil of the subgrade with Granular B Type II to a depth of minimum 800 mm compacted to 98% SPMDD;
- Conduct proof-roll with at least six (6) passes per strip by a heavy truck, preferably 60 tones loaded truck, to identify any soft spot within the subgrade and replace with minimum of 800 mm Granular B Type II compacted to 98% SPMDD;
- Cover subgrade with filter cloth geotextile and prevent any traffic to move further on the subgrade;
- Supply, install, pack, grade and compact to 100% SPMDD, the acceptable Granular “B” Type II to the layers’ thickness not exceeding 300 mm;
- Conduct proof-roll to identify soft spots on sub-base materials and replace them with Granular B Type II to a minimum depth of 300 mm;
- Supply, install, pack, grade and compact to 100% SPMDD, the acceptable Granular “A”;
- Prevent further traffic movement on the finished surface;
- In less than seven (7) days delay, supply, install, adjust paver grade and compact base asphaltic layer, SP19.0, with PG 58-34 base asphalt to a minimum thickness specified in Table 7.;
- Supply, spray and allow for sufficient cure (minimum 1-hour), allow for sufficient penetration to the base layer, SS-1 Tack Coat, produced by competent emulsion plant, temperature 80 degree of centigrade, stable materials continuous mixed in the tank, spray rate of 0.4 lit/m^2;
- Prevent further traffic movement on the finished surface;
- Supply, install, grade and compact surface asphaltic layer, SP12.5, with PG 58-34 base asphalt to a minimum thickness specified in Table 7.

In Table 7, MRD refers to maximum relative density of bituminous materials. DST office and an independent laboratory should be consulted to implement comprehensive Quality Control (QC) and Quality Assurance (QA) program for all granular and bituminous materials produced in the plant, transfer to the site, and placed in the pavement structure.

All work process must be accurately undergoing our evaluation (samples from granular stockpile, materials source change, dust retained in asphalt, batch samples, mix design review, adjustment of mix design with continuous or batch plant, advise plant operator to adjust discharge rate to produce exact materials as that of specified in the mix design, statistical evaluation of materials delivered to the site during massive production, etc.). Any non-compliance materials must be removed and replaced with competent materials.

Granular layers must be installed, packed and compacted with lift thickness not exceeding 300 mm for Granular B Type II. Any placed materials including granular and bituminous materials must be compacted to the exact target density as explained in Table 7. Over or under-compacted materials are deemed non-compliance.

A full-time DST's inspector must be available on site during the placement of materials. Bituminous materials temperature at the time of placement, compaction procedure, and all construction steps form the subgrade preparation to final finished surface must be inspected and reviewed by DST's inspector.

7.6 Excavations, Dewatering and Backfilling

The excavations for footings construction are expected to be below the groundwater level in locations close to Borehole BH17-04 within the site. It is recommended that groundwater and any surface run-off water to be collected by sump and pump method.

Foundation backfill within inside and exterior of the building must be installed, packed and compacted in layers of not exceeding 150 mm with acceptable Granular "A" materials. The degree of compaction must be to 100% of SPMDD. The degree of compaction should be accurately respected. Compaction work must be supervised and inspected by DST's personnel.

Subgrade for trenches must be prepared using native soil or OPSS Select Subgrade Materials. Bedding materials for utilities must be placed in accordance with the specification outlined in the pipe design drawings. Generally, bedding should be installed, packed, levelled and compacted using Granular "A" with layer thickness not exceeding 150 mm. Degree of compaction should be 100% of SPMDD. A minimum 300 mm side and vertical cover should be respected. Backfill to the pipes should consists of Granular "A" materials compacted to 150 mm thickness.

Loose materials available and stockpiles in the site obtained from excavation of trench may be used as the backfill materials to the service trenches located in the landscape areas. If the service trench extends below paved areas, the trench should be backfilled with OPSS Select Subgrade Material from the top of the pipe cover to 1.2 m of the proposed pavement surface placed in lifts and compacted to 95% of SPMDD. The 3 horizontal to 1 vertical frost taper should be used to minimize the effect of differential frost heaving.

7.7 Corrosion Potential of Sub-Surface Soils

7.7.1 Buried Concrete Structures

One (1) selected soil sample was submitted to Paracel Laboratories Ltd. in Ottawa for chemical analyses (pH and sulphate) to assess the potential for sulphate attack on buried concrete structures.

The results are presented below in Table 8 and a copy of the Laboratory Certificate of Analysis is provided in Appendix F.

Table 8. Chemical Test Results

Sample ID	Sulphate (ug/g;ppm)	Chloride (ug/g;ppm)	pH	Resistivity (ohm - m)
Borehole BH 17-02, SS4 3.1 m	173	657	8.1	7.06

The analytical results of the soil samples were compared with applicable Canadian Standards Association (CSA) standards and are given in Table 9 below.

Table 9. Additional Requirement for Concrete Subjected to Sulphate Attack

Class of Exposer	Degree of Exposure	Water soluble Sulphate in soil sample (%)	Cementing Material to be used
S-1	Very Severe	> 2.0	HS or HSb
S-2	Severe	0.20 – 2.0	HS or HSb
S-3	Moderate	0.10 – 0.20	MS, MSb, LH, HS, or HSb

*Information from Table 3 of CSA Standards A23.1-04

The chemical sulphate content analyses for selected soil samples tested indicate a sulphate concentration ranging from 173 ug/g in soil, as shown in Table 8. The results were compared with Canadian Standards Association (CSA) Standards A23.1 for sulphate attack potential on concrete structures and possesses a "negligible" risk for sulphate attack on concrete material. Accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

7.8 Environmental Screening

An environmental site inspection was conducted during the borehole layout to identify potentially contaminated areas. A visual assessment of soil samples as well as field screening using an organic vapour metre was conducted for all the recovered soil samples. No visual or olfactory evidence of contamination was observed.

8. MONITORING DURING CONSTRUCTION

All foundation design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring by qualified geotechnical personnel during construction will be provided. An adequate level of construction monitoring is considered to be: a) for shallow foundations: full-time monitoring and design review during construction; and b) for earthworks: full-time quality control and compaction testing.

An important purpose of providing an adequate level of monitoring is to check that recommendations, based on data obtained at the discrete borehole and test pit locations, are relevant to other areas of the site.

In order to provide an adequate level of construction monitoring, qualified geotechnical personnel should manage and supervise the following tasks during construction:

Shallow Foundations:

- Confirm that materials and methods meet specifications;
- Inspect foundation subgrades;
- Inspect excavation;

- Review shallow foundation installation/testing methods;
- Review compaction testing records; and
- Provide review comments, including any discrepancies found with respect to specifications as well as this report and the need for any modifications to the design or methods.

Earthworks:

- Confirm that materials and methods meet specifications;
- Inspect subgrade prior to fill placement;
- Quality control of fill material; and
- Review compaction testing records.

9. REFERENCES

Bowles Joseph E., (1988). Foundation Analysis and Design, Fifth Edition, the McGraw-Hill Companies, Inc.

Canadian Foundation Engineering Manual, 4th Edition, 2006. Canadian Geotechnical Society.

City of Ottawa Standards and Drawings.

Occupational Health and Safety Act and Regulations for Construction Projects, Ministry of Labour, Publications Ontario.

10. CLOSURE

A description of limitations which are inherent in carrying out site investigation studies is given in Appendix A and forms an integral part of this report.

We trust this report meets your present requirements. Should you have any questions, please do not hesitate to contact our office.

Sincerely,

For DST CONSULTING ENGINEERS INC.

Masoud Robati, Ph.D., P.Eng.,
Pavement and Materials Specialist

Bernardo Villegas
Senior Project Manager
Senior Associate

APPENDIX A

LIMITATIONS OF REPORT

LIMITATIONS OF REPORT

GEOTECHNICAL STUDIES

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the Client. Note that no scope of work, no matter how exhaustive, can identify all conditions below ground. Subsurface and groundwater conditions between and beyond the boreholes may differ from those encountered at the specific locations tested, and conditions may become apparent during construction which were not detected and could not be anticipated at the time of the site investigation. Conditions can also change with time. It is recommended practice that DST Consulting Engineers Inc. be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the boreholes.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid. Unless otherwise noted, the information contained herein in no way reflects on environmental aspects of either the site or the subsurface conditions.

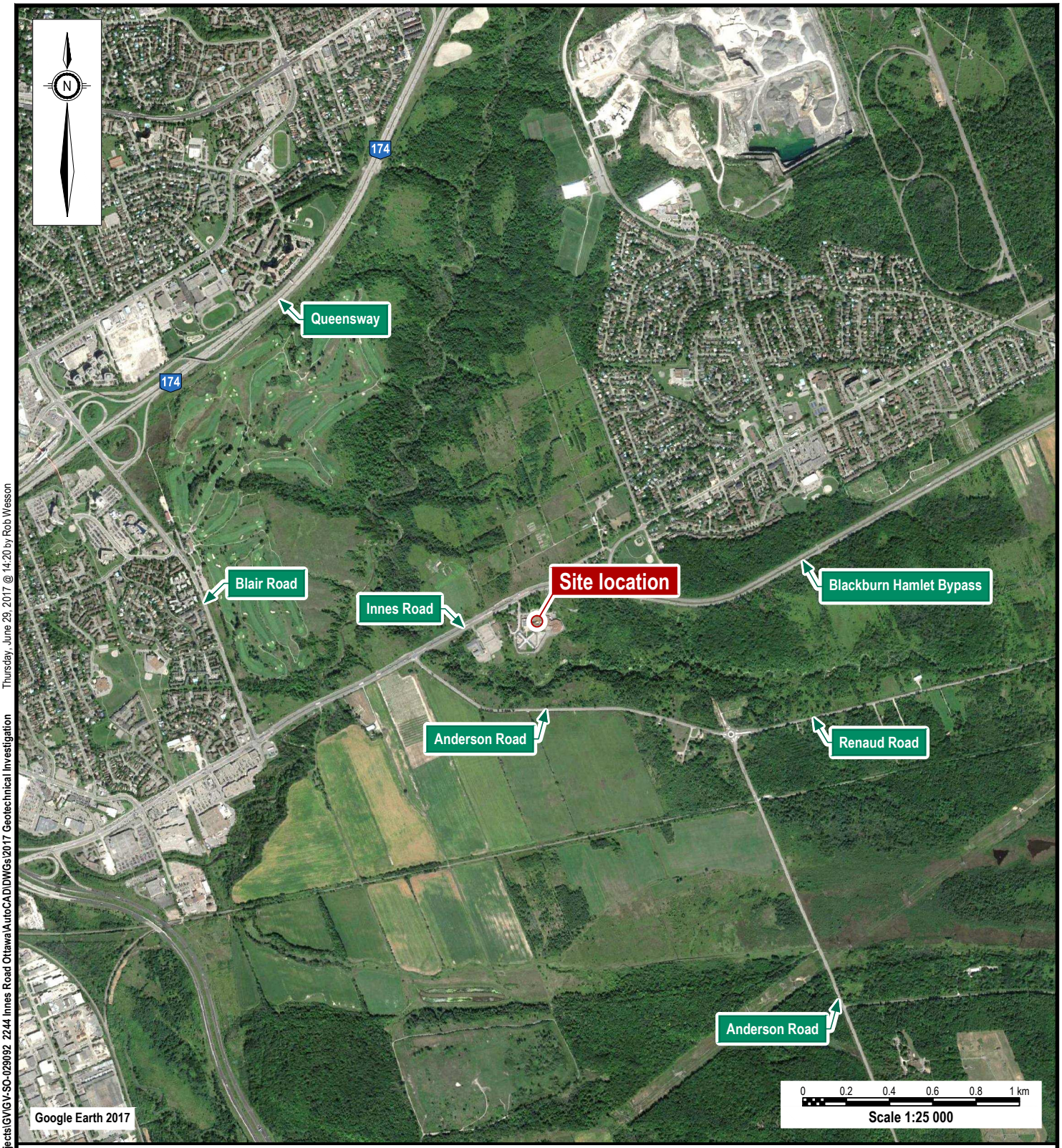
The comments given in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of boreholes may not be sufficient to determine all the factors that may affect construction methods and costs, e.g. the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the Client.

APPENDIX B

SITE LOCATION MAP

BOREHOLE LOCATION PLAN



Note

1. This drawing shall be read in conjunction with the associated technical report.

DRAFT

Revision	Date	Issue	Approval
A	29.06.17	Preliminary	M.R.

Client: Colliers Project Leaders Inc.

Site: 2244 Innes Road, Ottawa, Ontario

DST consulting engineers

Report Title: Geotechnical Investigation
Ottawa Carlton Detention Centre
Building Expansion

Drawing Title: Site Location Plan

Designed By: M.R.	Date: June 2017
Drawn By: R.W.	Project No.: GV-SO-029092
Approved By: M.R.	Figure No.: 1
Scale: As shown	

2150 Thurston Drive, Suite 203, Ottawa, Ontario K1G 5T9 Tel: (613) 748-1415 Fax: (613) 748-1356 Website: www.dstgroup.com

Drawing: 2 borehole location plan.dwg Folder: L:\TS\CADIProjects\GV\GV-SO-029092 2244 Innes Road Ottawa\AutoCAD\DWGs\2017 Geotechnical Investigation Wednesday, July 12, 2017 @ 15:30 by Rob Wesson

DST consulting engineers

Notes

1. This drawing shall be read in conjunction with the associated technical report.
2. Do not scale drawing.

Legend

- Approximate location of borehole
- Site benchmark

0 5 10 20 30 40 50 m

Scale 1:1 000

Revision	Date	Issue	Approval
A	29.06.17	Preliminary	M.R.

Client: Colliers Project Leaders Inc.

Site: 2244 Innes Road, Ottawa, Ontario

Report Title: Geotechnical Investigation
Ottawa Carlton Detention Centre
Building Expansion

Drawing Title: Borehole Location Plan

Designed By: M.R.	Scale: As shown
Drawn By: R.W.	Date: June 2017
Approved By: M.R.	Project No.: GV-SO-029092
Figure No.: 2	DRAFT

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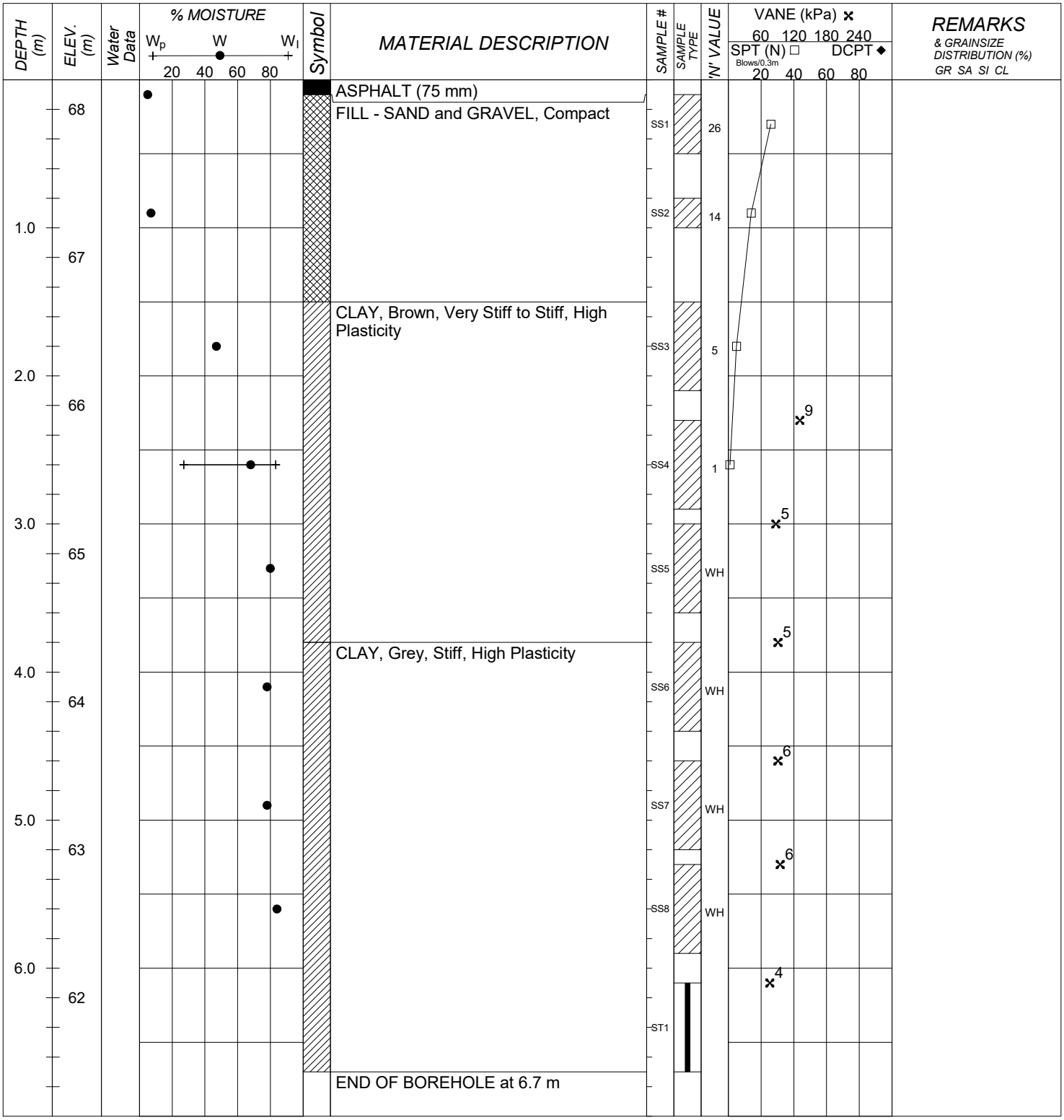
APPENDIX C

BOREHOLE LOGS

LOG OF BOREHOLE BH17-01

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.2 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454754.22** m N, **5030299.56** m E



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DST CONSULTING ENGINEERS INC.
2150 THURSTON DRIVE, SUITE 203
OTTAWA, ON, K1G 5T9
PH: 1-613-748-1415
FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 1

LOG OF BOREHOLE BH17-02

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.4 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454730.68** m N, **5030300.25** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68				ASPHALT (75 mm)					
					FILL - SAND and GRAVEL, Compact to Loose	SS1		22		
1.0						SS2		6		
	67				FILL - CLAY, trace SAND and GRAVEL, Brown, Stiff, High Plasticity	SS3		4		
2.0					FILL - SAND and GRAVEL					
	66				CLAY, Silty Clay seams, trace GRAVEL, trace Rootlets, Brown, Stiff, High Plasticity	SS4		2		
3.0									× 10	
	65					SS5		WH		2 4 24 70
									× 7	
4.0					CLAY, Grey, Stiff to Very Stiff, High Plasticity	SS6		WH		
	64								× 5	
5.0						SS7		WH		
	63								× 4	
						SS8		WH		
6.0									× 6	
	62					SS9		WH		
					END OF BOREHOLE at 6.7 m					

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

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OTTAWA, ON, K1G 5T9
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FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

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- ×3 Numbers refers to Sensitivity

ENCLOSURE 2

LOG OF BOREHOLE BH17-03

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.4 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454735.99** m N, **5030332.91** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68				TOPSOIL, Rootlets	SS1		4		
					SAND, Brown					
1.0	67				CLAY, Silty Clay seams, Brown, Hard to Stiff, High Plasticity	SS2		9	9	>> 328 kPa
2.0	66					SS3		6		0 1 27 72
						SS4		WH	9	
3.0	65					SS5		WH	6	
4.0	64				CLAY, Grey, Stiff, High Plasticity	SS6		WH	7	
						SS7		WH	6	
5.0	63					SS8		WH	5	
6.0	62					SS9		WH	5	
					END OF BOREHOLE at 6.7 m					

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FX: 1-613-748-1356
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
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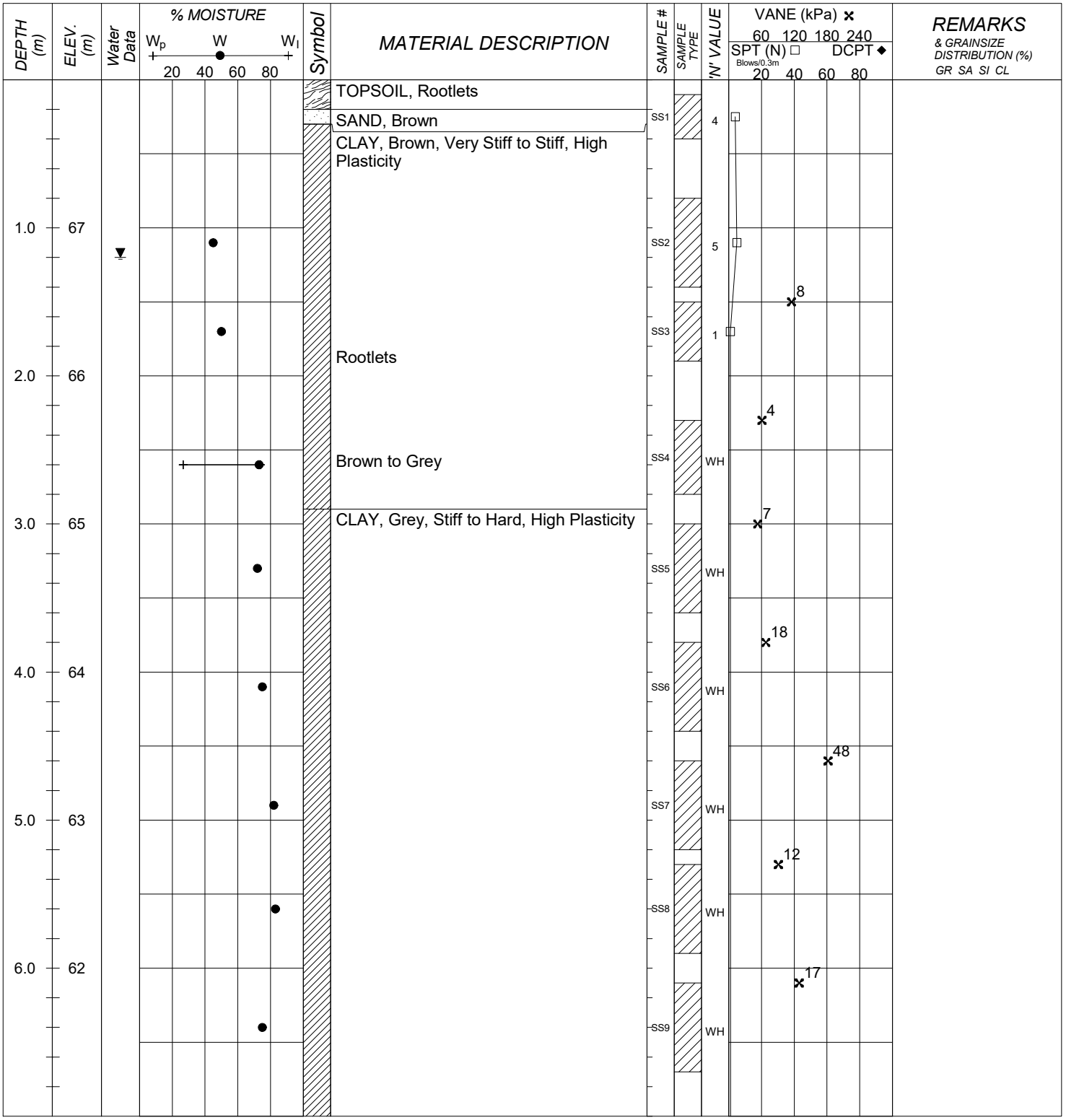
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 3

LOG OF BOREHOLE BH17-04

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.0 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/5/2017**
COMPLETION DATE: **6/5/2017**
COORDINATES: **454713.09** m N, **5030334.76** m E



BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

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OTTAWA, ON, K1G 5T9
PH: 1-613-748-1415
FX: 1-613-748-1356
Email: ottawa@dstgroup.com
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 4

LOG OF BOREHOLE BH17-04

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.0 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/5/2017**
COMPLETION DATE: **6/5/2017**
COORDINATES: **454713.09** m N, **5030334.76** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					CLAY, Grey, Stiff to Hard, High Plasticity					
8.0	60					ST1				
9.0	59		●			SS10		WH	×6	
10.0	58									
11.0	57		●			SS11		WH	×15	
12.0	56					ST2				
13.0	55								×7	
			●							

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FX: 1-613-748-1356
Email: ottawa@dstgroup.com
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 5

LOG OF BOREHOLE BH17-04

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.0 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/5/2017**
COMPLETION DATE: **6/5/2017**
COORDINATES: **454713.09** m N, **5030334.76** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					CLAY, Grey, Stiff to Hard, High Plasticity	SS12		WH		
15.0	53								×4	
						SS13		WH		
16.0	52									
									×6	
17.0	51					SS14		WH		
18.0	50								×7	
						SS15		WH		
19.0	49									
20.0	48									

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2150 THURSTON DRIVE, SUITE 203
OTTAWA, ON, K1G 5T9
PH: 1-613-748-1415
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 6

LOG OF BOREHOLE BH17-04

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.0 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/5/2017**
COMPLETION DATE: **6/5/2017**
COORDINATES: **454713.09** m N, **5030334.76** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					CLAY, Grey, Stiff to Hard, High Plasticity					
			●			SS16		WH	×4	
22.0	46									
23.0	45									
24.0	44								×4	
			●			SS17		WH		
25.0	43									
26.0	42									
27.0	41								×3	
						SS18		WH		

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OTTAWA, ON, K1G 5T9
PH: 1-613-748-1415
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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 7

LOG OF BOREHOLE BH17-04

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.0 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/5/2017**
COMPLETION DATE: **6/5/2017**
COORDINATES: **454713.09** m N, **5030334.76** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
					CLAY, Grey, Stiff to Hard, High Plasticity					
29.0	39									
30.0	38								×6	
						SS19		2	□	
31.0	37				Reddish Band					
					END OF BOREHOLE at 31.1 m					
32.0	36									
33.0	35									
34.0	34									

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2150 THURSTON DRIVE, SUITE 203
OTTAWA, ON, K1G 5T9
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SAMPLE TYPE LEGEND

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- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 8

LOG OF BOREHOLE BH17-05

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **69.6 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/9/2017**
COMPLETION DATE: **6/9/2017**
COORDINATES: **454733.36** m N, **5030365.42** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	69				CLAY, Brown, Very Stiff to Stiff, High Plasticity Rootlets	SS1		18		
1.0						SS2		28	7	
	68					SS3		21		
2.0						SS4		11	13	
	67					SS5		6		
3.0									6	
						SS6		3		
	66				CLAY, Grey, Stiff to Very Stiff, High Plasticity				10	
4.0						SS7		5		
									13	
	65					SS8		4		
5.0									30	
						SS9		3		
	64					SS10		7		
6.0									6	
						SS11		7		
	63				END OF BOREHOLE at 6.7 m					

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SAMPLE TYPE LEGEND

- Auger Sample
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- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 9

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-06

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.8 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/9/2017**
COMPLETION DATE: **6/9/2017**
COORDINATES: **454677.55** m N, **5030346.36** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68.8				TOPSOIL, Rootlets					
0.1					CLAY, Brown, Rootlets	SS1		4		
0.6					SAND, Orange-Brown, Rootlets					
1.0	68				CLAY, Brown, Very Stiff to Stiff, High Plasticity	SS2		6		
1.8	67					SS3		2		
2.0									× 6	
2.6	66					SS4		WH		
3.0									× 5	
3.2						SS5		WH		
3.8	65				CLAY, Grey, Stiff, High Plasticity					
4.0						SS6		WH	× 5	
4.6	64					SS7		WH	× 5	
5.0									× 7	
5.4	63					SS8		WH		
6.0									× 4	
6.4	62					SS9		WH		
6.7					END OF BOREHOLE at 6.7 m					

DST consulting engineers

DST CONSULTING ENGINEERS INC.
2150 THURSTON DRIVE, SUITE 203
OTTAWA, ON, K1G 5T9
PH: 1-613-748-1415
FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 10

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-07

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.1 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/7/2017**
COMPLETION DATE: **6/7/2017**
COORDINATES: **454696.63** m N, **5030358.19** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE W_p W W_l (20 40 60 80)	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ (20 40 60 80)	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68				TOPSOIL, Rootlets					
					SAND, Brown	SS1		5		
					CLAY, Brown, Very Stiff to Stiff, High Plasticity					
1.0	67					SS2		7		
									4	
						SS3		3		
2.0	66								5	
						SS4		WH		
3.0	65								7	
						SS5		WH		
					CLAY, Grey, Stiff, High Plasticity				7	
4.0	64					SS6		WH		
									5	
5.0	63					SS7		WH		
									6	
						SS8		WH		
6.0	62								6	
						SS9		WH		0 0 30 70
					END OF BOREHOLE at 6.7 m					

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Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 11

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-08

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.7 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/7/2017**
COMPLETION DATE: **6/7/2017**
COORDINATES: **454651.24** m N, **5030343.99** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68				TOPSOIL, Rootlets	SS1		16		
1.0					SAND, trace GRAVEL, Brown, Compact	SS2		13		
	67				CLAY, Brown, Very Stiff, High Plasticity	SS3		4		
2.0		▼							× 11	
	66					SS4		1		
3.0					CLAY, Grey, Stiff, High Plasticity				× 6	
	65					SS5		WH		
4.0						ST1				
	64								× 6	
5.0						SS6		WH		
									× 4	
	63					SS7		WH		
6.0									× 5	
	62					SS8		WH		
6.7					END OF BOREHOLE at 6.7 m					

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FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 12

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-09

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.8 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/9/2017**
COMPLETION DATE: **6/9/2017**
COORDINATES: **454656.96** m N, **5030318.03** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68.8				TOPSOIL, Rootlets	SS1		9		
					SAND, Brown, Loose					
1.0	68					SS2		5		
						SS3		2		
2.0	67				CLAY, Brown, Very Stiff, High Plasticity					
					SANDY	SS4		2		0 8 22 71
3.0	66					SS5		WH	× 4	
									× 6	
4.0	65				CLAY, Grey, Stiff, High Plasticity	SS6		WH		
						SS7		WH	× 6	
5.0	64								× 6	
						SS8		WH		
6.0	63								× 5	
						SS9		WH		
	62				END OF BOREHOLE at 6.7 m					

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FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 13

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-10

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.9 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454619.74** m N, **5030321.42** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68.9				TOPSOIL, Rootlets	SS1		4		
					SAND, Orange to Brown, Loose					
1.0	68					SS2		7		
						SS3		10		
					CLAY, Brown					
2.0	67				END OF BOREHOLE at 1.8 m					
3.0	66									
4.0	65									
5.0	64									
6.0	63									
	62									

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SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 14

LOG OF BOREHOLE BH17-11

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.5 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454602.59** m N, **5030257.41** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68.5				ASPHALT (85 mm)					
					FILL - SAND and GRAVEL, Compact	SS1		16		
	68									
						SS2		10		
1.0					SAND, Brown					
	67				CLAY, Brown	SS3		6		
2.0					END OF BOREHOLE at 1.8 m					
	66									
3.0										
	65									
4.0										
	64									
5.0										
	63									
6.0										
	62									

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Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 15

LOG OF BOREHOLE BH17-12

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **68.1 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454567.68** m N, **5030217.21** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240 / SPT (N) □ Blows/0.3m / DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	68		●		FILL - SAND and GRAVEL, Compact	SS1		15		
			●			SS2		9		
1.0	67				SAND, Brown					
					CLAY, Brown, Stiff					
			●			SS3		9		
2.0	66				END OF BOREHOLE at 1.8 m					
3.0	65									
4.0	64									
5.0	63									
6.0	62									

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Web: www.dstgroup.com

SAMPLE TYPE LEGEND

- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 16

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

LOG OF BOREHOLE BH17-13

DST REF. No.: **GV-SO-029092**
CLIENT: **Colliers Project Leaders Inc.**
PROJECT: **OCDC - Geotechnical Drilling**
LOCATION: **2244 Innes Rd, Gloucester, ON**
SURFACE ELEV.: **67.4 metres**

Drilling Data
METHOD: **Hollow Stem Auger**
START DATE: **6/8/2017**
COMPLETION DATE: **6/8/2017**
COORDINATES: **454540.37** m N, **5030301.81** m E

DEPTH (m)	ELEV. (m)	Water Data	% MOISTURE (W_p W W_l) 20 40 60 80	Symbol	MATERIAL DESCRIPTION	SAMPLE #	SAMPLE TYPE	'N' VALUE	VANE (kPa) × 60 120 180 240; SPT (N) □ Blows/0.3m; DCPT ◆ 20 40 60 80	REMARKS & GRAINSIZE DISTRIBUTION (%) GR SA SI CL
0.0	67		●		TOPSOIL, Rootlets					
					SAND, Brown	SS1		3		
1.0	66		●		CLAY, Brown	SS2		4		
					SAND, Brown					
			●		CLAY, Brown	SS3		2		
2.0	65				END OF BOREHOLE at 1.8 m					
3.0	64									
4.0	63									
5.0	62									
6.0	61									

BOREHOLE (OTTAWA) GV-SO-029092.GPJ DATA TEMPLATE.GDT 13/7/17

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FX: 1-613-748-1356
Email: ottawa@dstgroup.com
Web: www.dstgroup.com

SAMPLE TYPE LEGEND

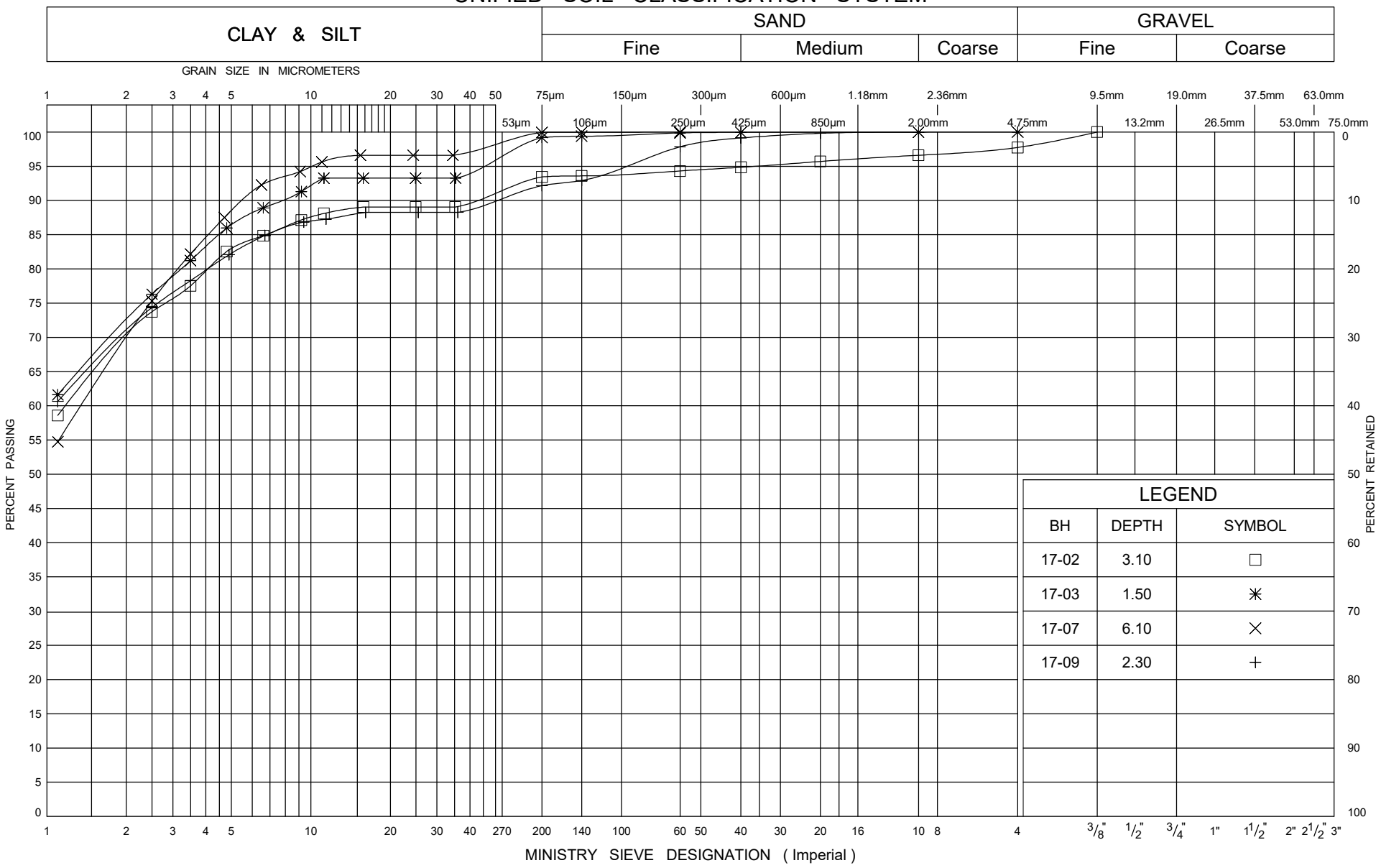
- Auger Sample
- Split Spoon Sample
- Bulk Sample
- Rock Core
- Hiller Peat Sampler
- Shelby Tube
- Bentonite
- Sand
- ×3 Numbers refers to Sensitivity

ENCLOSURE 17

APPENDIX D

GEOTECHNICAL LABORATORY TEST RESULTS

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
BH	DEPTH	SYMBOL
17-02	3.10	□
17-03	1.50	✳
17-07	6.10	×
17-09	2.30	+

consulting engineers

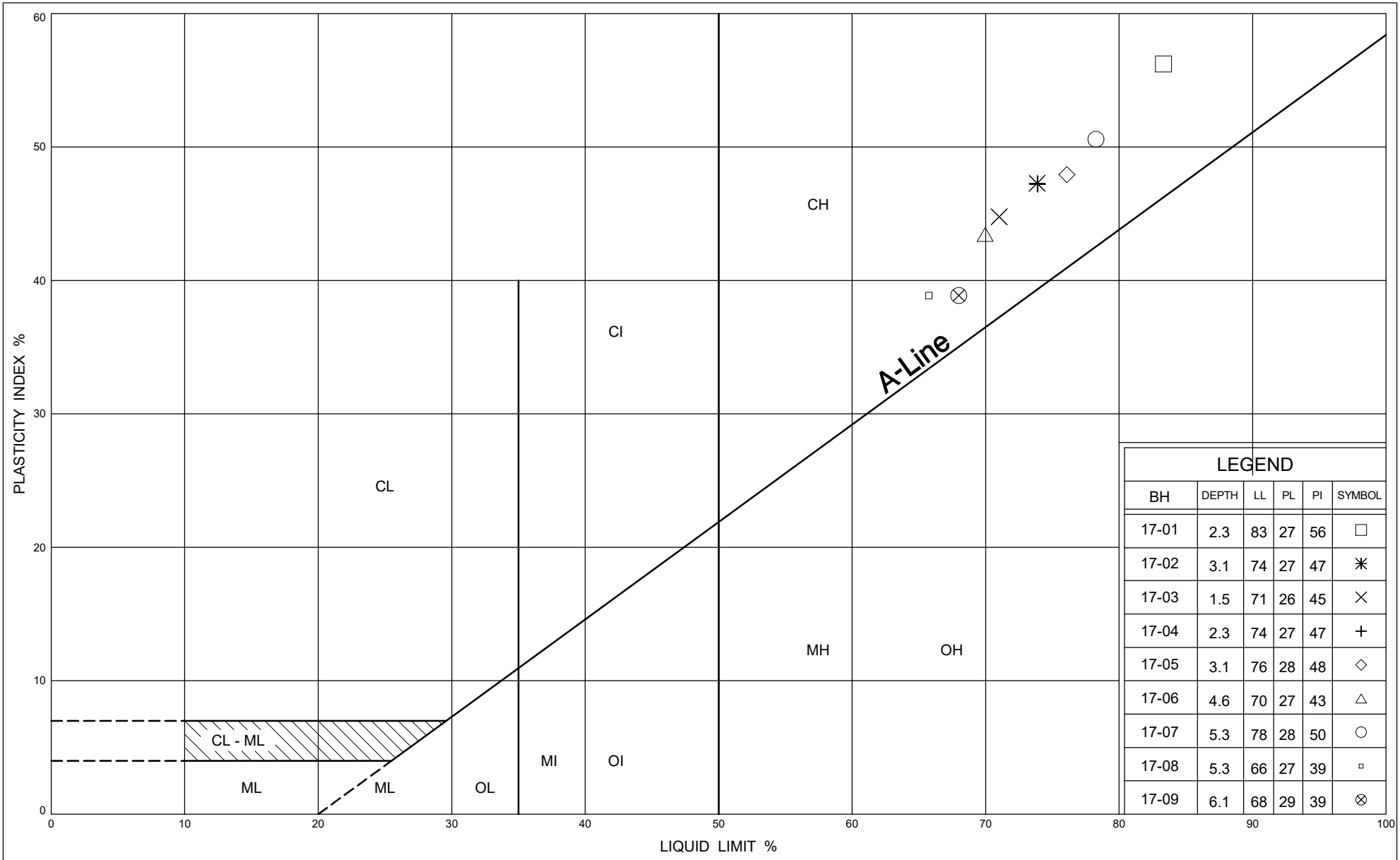
GRAIN SIZE DISTRIBUTION

ENCLOSURE 1

DST REF # GV-SO-029092

Colliers Project Leaders

T-TIME GRAINSIZE GV-SO-029092.GPJ DATA TEMPLATE.GDT 30/6/17



LEGEND					
BH	DEPTH	LL	PL	PI	SYMBOL
17-01	2.3	83	27	56	□
17-02	3.1	74	27	47	✳
17-03	1.5	71	26	45	×
17-04	2.3	74	27	47	+
17-05	3.1	76	28	48	◇
17-06	4.6	70	27	43	△
17-07	5.3	78	28	50	○
17-08	5.3	66	27	39	▫
17-09	6.1	68	29	39	⊗

PLASTICITY CHART

ENCLOSURE 1

DST REF # GV-SO-029092

Colliers Project Leaders

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NON-MTO PASTICITY CHART GV-SO-029092.GPJ DATA TEMPLATE.GDT 30/6/17

APPENDIX E

2015 NATIONAL BUILDING CODE SEISMIC HAZARD CALCULATION

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

June 30, 2017

Site: 45.4251 N, 75.5789 W User File Reference: Ottawa-Carleton Detention Centre

Requested by: Masoud Robati, Ph.D., P.Eng., DST Consulting Engineers Inc.

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	**Sa(0.2)**	Sa(0.3)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**Sa(5.0)**	**Sa(10.0)**	**PGA (g)**	**PGV (m/s)**
0.486	0.565	**0.471**	0.356	**0.251**	**0.123**	**0.058**	**0.015**	**0.0055**	**0.301**	**0.208**

Notes. Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. ***These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.***

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.046	0.160	0.268
Sa(0.1)	0.064	0.199	0.323
Sa(0.2)	0.057	0.171	0.272
Sa(0.3)	0.045	0.131	0.207
Sa(0.5)	0.032	0.092	0.145
Sa(1.0)	0.016	0.046	0.072
Sa(2.0)	0.0062	0.021	0.034
Sa(5.0)	0.0013	0.0048	0.0083
Sa(10.0)	0.0006	0.0019	0.0032
PGA	0.034	0.108	0.175
PGV	0.022	0.071	0.116

References

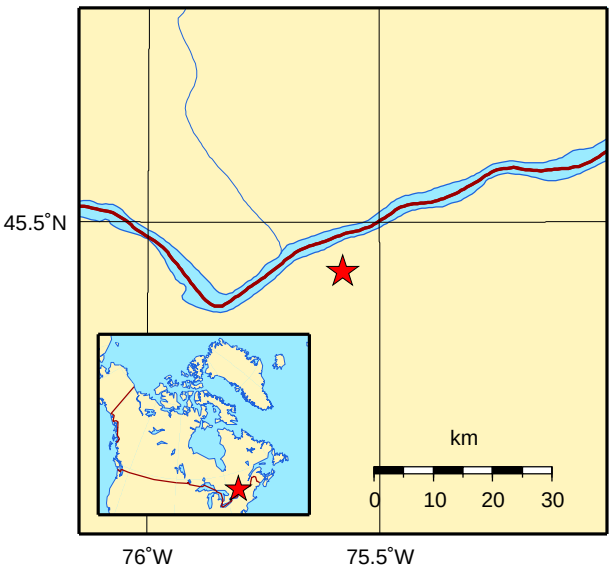
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français



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Canada

APPENDIX F

CORROSION ANALYSES (SOIL) TEST RESULTS

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Certificate of Analysis

DST Consulting Engineers Inc. (Ottawa)

203-2150 Thurston Dr.
Ottawa, ON K1G 5T9
Attn: Sarah Alhajjar

Client PO:
Project: GV SO 029092
Custody:

Report Date: 23-Jun-2017
Order Date: 19-Jun-2017

Order #: 1725102

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1725102-01	BH17-02 (SS-4)

Approved By:

Dale Robertson, BSc
Laboratory Director

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	22-Jun-17	22-Jun-17
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	20-Jun-17	20-Jun-17
Resistivity	EPA 120.1 - probe, water extraction	22-Jun-17	23-Jun-17
Solids, %	Gravimetric, calculation	20-Jun-17	20-Jun-17

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 23-Jun-2017
Order Date: 19-Jun-2017
Project Description: GV SO 029092

	Client ID:	BH17-02 (SS-4)	-	-	-
	Sample Date:	08-Jun-17	-	-	-
	Sample ID:	1725102-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	60.6	-	-	-
General Inorganics					
pH	0.05 pH Units	8.10	-	-	-
Resistivity	0.10 Ohm.m	7.06	-	-	-
Anions					
Chloride	5 ug/g dry	657	-	-	-
Sulphate	5 ug/g dry	173	-	-	-

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 23-Jun-2017
Order Date: 19-Jun-2017
Project Description: GV SO 029092

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	ND	5	ug/g						
Sulphate	ND	5	ug/g						
General Inorganics									
Resistivity	ND	0.10	Ohm.m						

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	16.3	5	ug/g dry	16.5			0.9	20	
Sulphate	24.3	5	ug/g dry	24.3			0.1	20	
General Inorganics									
pH	7.73	0.05	pH Units	7.70			0.4	10	
Resistivity	35.6	0.10	Ohm.m	34.2			4.0	20	
Physical Characteristics									
% Solids	83.5	0.1	% by Wt.	84.9			1.6	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	119	5	ug/g	16.5	103	78-113			
Sulphate	124	5	ug/g	24.3	99.3	78-111			

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 23-Jun-2017
Order Date: 19-Jun-2017
Project Description: GV SO 029092

Qualifier Notes:

Login Qualifiers :

Container(s) - Bottle and COC sample ID don't match -
Applies to samples: BH17-02 (SS-4)

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Paracel ID: 1725102

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Chain of Custody
(Lab Use Only)

Page 1 of 1

Client Name: DST Consulting Engineers Inc.	Project Reference: GV-SO-029092	**Turnaround Time:**
Contact Name: Sarah Al Hajjar	Quote #	☐1 Day ☐3 Day
Address: 203-2150 Thurston Dr.	PO #	☐2 Day ☑Regular
Telephone: 613-296-9014	Email Address: salhajjar@dstgroup.com	Date Required:

Criteria: ☐O. Reg. 153/04 (As Amended) Table __ ☐RSC Filing ☐O. Reg. 558/00 ☐PWQO ☐CCME ☐SUB (Storm) ☐SUB (Sanitary) Municipality: ☐Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analyses

Paracel Order Number: 1725102

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	PH	Sulfates	Chlorides	Soil Resistivity			
1	BH-02 (SS-4)	S			June 8, 2017	12:00 PM	☐	☐	☐	☐	☐	☐	☐	✓	✓	✓	✓	☐	☐	☐
2							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8	* Report as BH17-02 (SS-4) as per Sarah. SC						☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Ziploc BAG

Comments: ↳ Sample on Bag read = BH 17-2 SS 4.

Method of Delivery: Walk-in.

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab: Rachel Subject	Verified By: Rachel Subject
Relinquished By (Print): Sarah Al Hajjar	Date/Time:	Date/Time: June 19/17.	Date/Time: June 20/17
Date/Time: June 19, 2017/ 5:03 PM	Temperature: °C	Temperature: 7.9 °C 5:04	pH Verified ☒ By: N/A 8:47