PROJECT NO.: SM 177359-G

JUNE 27, 2017

GEOTECHNICAL INVESTIGATION
PROPOSED AGRI-BUSINESS CENTRE AGRICULTURAL YARD
NIAGARA COLLEGE – NIAGARA-ON-THE-LAKE CAMPUS
NIAGARA-ON-THE-LAKE, ONTARIO

PREPARED FOR:

NIAGARA COLLEGE OF APPLIED ARTS AND TECHNOLOGY

Soil-Mat

BY

SOIL-MAT ENGINEERS & CONSULTANTS LTD.
HAMILTON: 130 LANCING DRIVE L8W 3A1
MILTON: PO BOX 40012, DERRY HEIGHTS PO L9T 7W4

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PROJECT NO.: SM 177359-G

June 27, 2017

NIAGARA COLLEGE OF APPLIED ARTS AND TECHNOLOGY
Purchasing Department
300 Woodlawn Road
Welland, Ontario
L3C 7L3

Attention: Tom Mussari
Project Manager

GEOTECHNICAL INVESTIGATION
PROPOSED AGRI-BUSINESS CENTRE AGRICULTURAL YARD
NIAGARA COLLEGE – NIAGARA-ON-THE-LAKE CAMPUS
NIAGARA-ON-THE-LAKE, ONTARIO

Dear Mr. Mussari,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork, laboratory testing, and report preparation in connection with the above noted project. The investigation and reporting were undertaken in general accordance with our proposal P6466, dated October 11, 2016. Our comments and recommendations, based on our findings at the ten [10] borehole locations are presented herein.

1. INTRODUCTION

We understand that the project will involve the construction of the Agri-Lab Business Centre, including the header house, low-bay and high-bay greenhouses, as well as windrow composting and storage facilities. The structures are anticipated to be largely concrete slab on grade with no basement level. Construction will also include the installation of associated municipal services and asphalt paved access road and parking areas. The purpose of this geotechnical investigation work was to assess the subsurface soil conditions, and to provide our comments and recommendations with respect to the design and construction of the proposed concrete platform, from a geotechnical point of view.

This report is based on the above summarised project description, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project

design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation. With the exception of the limited background environmental testing detailed below, the information contained in this report does not reflect upon the environmental aspects of the site.

2. PROCEDURE

A total of ten [10] sampled boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The boreholes were advanced using continuous flight power auger equipment under the direction and supervision of a representative of SOIL-MAT ENGINEERS, to depths of approximately 3.5 and 5.0 metres beneath the existing ground surface. Upon completion of drilling the boreholes were backfilled in general accordance with Ontario Regulation 903.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings, with hand penetrometer testing conducted on all cohesive samples.

In addition, four [4] representative samples of the recovered subsurface soils were submitted for background testing. The selected samples were submitted to AGAT Laboratories, an independent Canadian accredited testing laboratory, for a standard panel of metal and inorganic parameters. The results of this testing were compared to the relevant Standards under Ontario Regulation 153/04 [as amended] in order to provide comments regarding the handling and off-site disposal of surplus soil during construction.

The boreholes were located in the field by a representative of SOIL-MAT ENGINEERS. The ground surface elevation at the borehole locations were referenced to a site specific temporary benchmark described as the top of the manhole to the south of the existing brewery building. This benchmark has an elevation of 121.61 metres as noted on a survey plan provided to our office for previous investigations at the campus [prepared by Chambers and Associates Surveying Ltd., File No. 97-66-15].

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Borehole Nos. 1 to 10, inclusive, following the text of this report. It is noted that boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact planes of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The subject site is located at the southeast corner of the Niagara College Campus in Niagara-on-the-Lake, Ontario. The study area is vacant land, with trees covering much of the site. The site is relatively flat and even, with a total approximate relief as measured across the boreholes of 1.4 metres

The subsurface conditions encountered at the borehole locations are summarised as follows:

Topsoil / Organic Mulch

A surficial veneer of topsoil approximately 150 to 450 millimetres in thickness was encountered at Borehole Nos. 3, 4, 5, and 10. It is noted that the depth of topsoil may vary across the site and from the borehole locations. It is also noted that the term 'topsoil' has been used from a geotechnical point of view, and does not necessarily reflect its nutrient content or ability to support plant life.

Borehole Nos. 1 and 2 were advanced through a ground cover of organic mulch, approximately 50 to 75 millimeters in thickness.

Granular Fill

Borehole No. 9 was advanced through a granular pathway, which was found to consist of approximately 200 millimeters of loose to compact sand and gravel fill.

Silty Clay Fill

Silty Clay fill was encountered at the surface in Borehole No. 8. This cohesive fill is brown with organic staining, contains trace gravel and organics, and is generally firm to stiff in consistency. The fill was proven to a depth of 1.8 metres.

Silty Clay

Native silty clay was encountered beneath the topsoil or organic mulch in Borehole Nos. 1, 2, 3, 4, 5, and 10, beneath the granular fill in Borehole No. 9 and the silty clay fill in Borehole No. 8, and directly at the surface in all other locations. This native cohesive material is brown, contains trace gravel, and is generally soft to firm at the surface, and stiff to very stiff below. The upper levels of the silty clay were noted to have a 'reworked' appearance in some locations, suggesting possible fill. Hand penetrometer testing conducted on the recovered cohesive soil samples measured unconfined compressive strengths from 3.5 to greater than 4.5 kilograms per square centimetre [~ tons per square foot]. Native silty clay was proven to termination at all borehole locations.

Groundwater Observations

All boreholes were recorded as 'dry' upon completion of drilling, with the exception of Borehole Nos. 1 and 2, which were noted to have free standing groundwater at depths of approximately 0.6 and 2.1 metres, respectively. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. However, based on the recorded moisture contents and field observations, and past experience in the area and on the campus, the static ground water level is estimated to be approximately 4 to 6 metres below grade, likely below the anticipated depths of construction.

4. FOUNDATION CONSIDERATIONS

The soil conditions encountered at the boreholes are considered suitable for support of the proposed structures on conventional spread footings founded in the undisturbed native silty clay, below any fill or otherwise unsuitable material. This may require locally lowering the footings to approximately 1.8 metres below the existing grade in select locations, or greater where the depth of fill is greater than encountered in Borehole No. 8. Spread footings founded in the native silty clay, may be designed using a factored Ultimate Limit State [ULS] bearing capacity of 300 kPa [~6,000 psf]. The allowable bearing stress at Serviceability Limit State [SLS] should be limited to 200 kPa [~4,000 psf], based on the total and differential settlements not exceeding 25 and 20 millimetres, respectively.

It is noted that the SLS value represents the Serviceability Limit State, which is governed by the tolerable deflection [settlement] based on the proposed building type, using unfactored load combinations. The ULS value represents the Ultimate Limit State and is intended to reflect an upper limit of the available bearing capacity of the founding soils in terms of geotechnical design, using factored load combinations. There is no direct

relationship between ULS and SLS, rather they are a function of the soil type and the tolerable deflections for serviceability, respectively. The above dissertation assumes a typical building. Evidently, the bearing capacity values would be lower for very settlement sensitive structures and larger for more flexible buildings.

The native silty clay soils are sensitive to moisture and disturbance, such as from construction traffic. Consideration should be given to the placement of a thin, lean-mix concrete 'mud slab' to protect the base of excavations. This will serve to protect the founding soils from disturbance and provide a clean working surface for the placement of reinforcing steel. In any event, whether mud slab or footing, concrete should be placed over the prepared founding level as soon as possible, ideally within the same day it is excavated.

The support conditions afforded by the founding soils are usually not uniform across the site, neither are the loads on the various foundation elements. It is therefore recommended that the footings and foundation walls be structurally reinforced to account for potential variable support and loading conditions.

All footings or grade beams exposed to the environment must be provided with a minimum of 1.2 metres of earth cover or equivalent insulation to protect against frost damage. This frost protection would also be required if construction were undertaken during the winter months. All footings and foundations should be designed and constructed in accordance with the current Ontario Building Code.

With foundations designed as outlined above and as required by the Building Code, and with careful attention paid to construction detail, total and differential settlements should be well within normally tolerated limits of 25 and 20 millimetres, respectively, for the type of building and occupancy expected.

It is imperative that a soils engineer be retained from this office to provide geotechnical engineering services during the excavation and foundation construction phases of the project. This is to observe compliance with the design concepts and recommendations of this report and to allow changes to be made in the event that subsurface conditions differ from the conditions identified at the Borehole locations.

5. SEISMIC DESIGN CONSIDERATIONS

The structure shall be designed according to Section 4.1.8 of the Ontario Building Code, Ontario Regulation 332/12. Based on the subsurface soil conditions encountered in this

investigation the applicable Site Classification for the seismic design is Site Class D – Stiff Soil, based on the average soil characteristics for the site.

The seismic data, from Supplementary Standard SB-1 of the Ontario Building Code, for Niagara-on-the-Lake is as follows.

$S_a(0.2)$	$S_a(0.5)$	$S_a(1.0)$	$S_a(2.0)$	PGA
0.340	0.190	0.069	0.023	0.200

6. FLOOR SLAB AND PERMANENT DRAINAGE

The building floor slabs may be constructed using conventional slab-on-grade techniques on a prepared subgrade. The exposed subgrade surface should be well compacted in the presence of a representative of SOIL-MAT ENGINEERS. Any soft 'spots' delineated during this work must be sub-excavated and replaced with quality backfill material compacted to 100 per cent of its standard Proctor maximum dry density. The subgrade level can then be raised to the design level with granular soils compacted to 100 per cent of its standard Proctor maximum dry density [SPMDD]. Granular fill, such as an imported Ontario provincial Standard Specification [OPSS] Granular 'B' Type II, is preferred over the excavated native soils within the building footprint due to its relative insensitivity to weather conditions, its relative ease in achieving the required degree of compaction and its quick response to applied stresses.

As with all concrete floor slabs, there is a tendency for the floor slabs to crack. The slab thickness, concrete mix design, the amount of steel and/or fibre reinforcement and/or wire mesh placed into the concrete slab, if any, will therefore be a function of the owner's tolerance for cracks in, and movements of, the slabs-on-grade, etc. The 'saw-cuts' in the concrete floors, for crack control, should extend to a minimum depth of 1/3 of the thickness of the slab.

A moisture barrier will be required under the floor slabs such as the placement of at least 200 millimetres of well-compacted 20 millimetre clear crushed stone. At a minimum the moisture barrier material should contain no more than 10 per cent passing the No. 4 sieve. Where 'non-damp' floor slabs are required, as for instance under sheet vinyl floor coverings, etc., extra efforts will be required to damp proof the floor slab, as with the additional provisions of a heavy 'poly' sheet, damp proofing sprays/membranes, drainage board products, etc. Where 'poly' sheets are used care should be taken to prevent puncturing and tearing and/or sufficiently heavy gauge sheeting specified.

Curing of the slab-on-grade must be carefully specified to ensure that slab curl is minimised. This is especially critical during the hot summer months of the year when the surface of the slab tends to dry out quickly while high moisture conditions in the moisture barrier or water trapped on top of any 'poly' sheet at the saw cut joints and cracks, and at the edges of the slabs, maintains the underside of the slab in a moist condition.

It is important that the concrete mix design provide a limiting water/cement ratio and total cement content, which will mitigate moisture related problems with low permeance floor coverings, such as debonding of vinyl and ceramic tile. It is equally important that excess free water not be added to the concrete during its placement as this could increase the potential for shrinkage cracking and curling of the slab.

Where the interior finished floor level is less than 300 millimetres above the finished exterior grade the provision of a perimeter weeping tile system should be considered to prevent the build-up of water against foundations and under the slab on grade. Where provided the perimeter drainage system should consist of a 150 millimetre diameter perforated pipe, surrounded with 200 millimetres of a 20 millimetre clear crushed stone product, and the clear crushed stone in turn entirely encased by a heavy filter geotextile product. The suppliers of the filter geotextile should be consulted as to the type best suited for this project. This office should examine the installation of the drains. Even a small break in the filtering materials could result in loss of fines into the drains with attendant performance difficulties, including settlements of the ground surface. The perimeter drains should outlet to a gravity sewer connection or a sump pit a minimum of 150 millimetres below the underside of finished floor. The exterior grade around the structure should be sloped away from the structure to prevent the ponding of water against the foundation walls.

7. EXCAVATIONS

Excavations for the installation of foundations and associated services are expected to extend to depths of up to approximately 2 to 4 metres below the existing grade. Excavations through the silty clay fill and native silty clay should be relatively straightforward, with the sides remaining stable for the short construction period in the fill at 45 degrees to the horizontal. Excavations in the native silty clay will remain stable at slopes of up to 60 degrees to the horizontal or steeper. Notwithstanding the above, all excavations must comply with the current Occupational Health and Safety Act and Regulations for Construction Projects. The contractor should expect to encounter buried services which may slow their rate of excavation.

Some minor infiltration of groundwater through the more permeable seams, as well as surface runoff into open excavations, should be anticipated. It should be possible to adequately control groundwater infiltration for the short construction period using conventional construction dewatering methods, such as pumping from sumps in the base of the excavation. More groundwater control should be anticipated when connections are made to existing services. Surface water should be directed away from the excavations.

The base of excavations in the native silty clay should remain firm and stable. As such, standard pipe bedding as typically specified by the Town of Niagara-on-the-Lake or Niagara Region should suffice. The bedding material should be uniformly compacted to 95 percent of the materials standard Proctor maximum dry density. Special attention should be paid to compaction under the pipe haunches.

8. BACKFILL CONSIDERATIONS

The excavated soil will consist predominantly of the native silty clay, and to a lesser extent the silty clay fill, as encountered in the boreholes and described above. These materials are generally considered suitable for use as engineered fill and service trench backfill, provided the moisture content can be controlled within 3 per cent of standard Proctor optimum value, and they are free of any organic or otherwise deleterious materials. Some select sorting of the fill may be required. Depending on the weather at the time of construction, some moisture conditioning of the excavated materials may be required to achieve acceptable compaction densities and minimise long-term settlement.

The silty clay fill and native silty clay soils are not considered to be free draining and are difficult to effectively compact in areas of restricted access. As such these materials are not recommended for use as backfill against foundations or beneath concrete slabs on grade. The use of free draining, well-graded granular material such as an Ontario Provincial Standard Specification [OPSS] Granular B, Type II (crushed bedrock), is often preferred for backfill against foundation walls, within the building area, or to raise the interior grade to the design subgrade level. This material is more readily compacted in restricted access areas, and generally presents a more positive support condition for concrete floor slabs and exterior pavement.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long-term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. It is therefore very important that the placement moisture content of the backfill soils be within 3 percent of its standard Proctor optimum moisture content during placement and compaction to

minimise long term subsidence [settlement] of the fill mass. Any imported fill required in service trenches or to raise the subgrade elevation should have its moisture content within 3 percent of its optimum moisture content and meet the necessary environmental guidelines.

A representative of SOIL-MAT should be on-site during the backfilling and compaction operations to monitor uniform compaction of the backfill material to project specification requirements. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs'. All backfill should be placed in lifts of no more than 300 millimetres thick. The service trench backfill should be compacted to a minimum of 95 per cent standard Proctor maximum dry density [SPMDD], with the upper one metre of roadway subgrade material compacted to 100 per cent SPMDD. All structural fill within the building and foundation backfill should be compacted to 100 per cent SPMDD. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction.

9. PAVEMENT STRUCTURE DESIGN CONSIDERATIONS

All areas to be paved must be cleared of all topsoil and unsuitable materials and the exposed subgrade proof rolled with 3 to 4 passes of a loaded tandem-axle truck in the presence of a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means should be sub-excavated and replaced with suitable backfill material and/or additional depth of granular sub-base material provided.

The need for sub-excavations of softened subgrade materials will be reduced if construction is undertaken during dry periods of the year and careful attention is paid to the compaction operations. As noted above the on-site soils are sensitive to disturbance and moisture and may present difficulty for roadway construction during 'wet' periods of the year. Should pavement construction be undertaken during 'wet' periods of the year it should be anticipated that greater stabilisation efforts will be required and/or additional depth of OPSS Granular B, Type II sub-base course material may be required.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface

water and to prevent softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction, therefore precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. SOIL-MAT should be given the opportunity to review the final pavement structure design and subdrain scheme prior to construction to ensure that they are consistent with the recommendations of this report.

The suggested pavement structures outlined in Table A are based on subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience. The outlined pavement structure may be expected to have an approximate ten-year life, assuming that regular maintenance is performed. Should a more detailed pavement structure design be required, then site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

TABLE A
RECOMMENDED PAVEMENT STRUCTURES

LAYER DESCRIPTION	COMPACTION REQUIREMENTS	LIGHT DUTY SECTIONS	HEAVY DUTY [TRUCK ROUTE]
Asphaltic Concrete Wearing course OPSS HL 3 or HL 3A	97 percent Marshall	65 millimetres	40 millimetres
Binder Course OPSS HL 8	97 percent Marshall		65 millimetres
Base Course OPSS Granular A	100% SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% SPMDD	200 millimetres	350 millimetres

* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

Depending on the arrangement of light duty and heavy duty pavement sections, the transition between sections may present some difficulty for contractors. In this regard, consideration might be given to a slightly increased light duty pavement structure consisting of 50 millimetres of HL8 binder course and 40 millimetres of HL3 surface course asphaltic concrete. This structure will provide for a continuous depth of surface

course asphalt allowing for ease of construction. As well such a structure would have an improved performance over an increased design life. Such an arrangement of asphalt layers would also allow for future rehabilitation with a 'mill and pave' type operation.

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honeycomb surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

10. ENVIRONMENTAL RESULTS

As noted above, four [4] selected samples were submitted for analytical testing in order to assess the background environmental characteristics of the overburden soils and provide comments with respect to handling of surplus material for off-site disposal. The soil samples were submitted to AGAT Laboratories, a Canadian accredited independent testing laboratory, for background chemical analysis. The testing program consisted of a standard panel of Metals and Inorganic parameters. Field olfactory screening of the recovered soil samples yielded no evidence of potential impact (i.e. staining, petroleum odour, etc.).

The laboratory test results received were compared to the applicable standard from the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*, as follows:

- **Table 1**: Full Depth Background Site Condition Standards Residential/Parkland/Institutional and Industrial/Commercial/Community land use.
- **Table 2**: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for a Residential/ Parkland/ Institutional property use, [RPI], as well as for an Industrial/ Commercial/ Community [ICC] property use.
- **Table 3**: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for a Residential/ Parkland/ Institutional property use, [RPI], as well as for an Industrial/ Commercial/ Community [ICC] property use.

The results of this laboratory testing are presented in the attached AGAT Certificate of Analysis [17H199883].

Based on SOIL-MAT'S field observations and the analytical test results from AGAT, SOIL-MAT offers the following comments:

1. The tested samples were found to be within the Table 1 [ALL] Standards for the tested parameters.
2. The tested samples were found to also be within the less strict Table 2 and 3 RPI and ICC Standards for the tested parameters.
3. The soil samples secured for analytical testing are believed to be representative of the soil conditions within the site. If any significant changes are noted, i.e., odours, staining etc., SOIL-MAT ENGINEERS & CONSULTANTS LTD. should be contacted to reassess the environmental characteristics of the soil.

Given the above test results the following disposal options are applicable under Regulation 153/04 [amended by Regulation 511/09 effective July 1, 2011].

- As the tested material has been shown to meet the Table 1 Standards, surplus material may be accepted at an off-site property subject to a Record of Site Condition of MOE Certificate of Authorisation, subject to approval of the receiving property owner.
- As the tested material has been shown to be within the Table 2 and 3 RPI and ICC Standards, surplus material may be accepted at an off-site RPI or ICC property in a potable or non-potable groundwater condition, subject to approval of the receiving property owner.
- Excavated soil may be reused on the subject property.

11. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are only intended to describe conditions at the borehole locations. Contractors placing bids or undertaking this project should carry out due diligence in order to verify the results of this investigation and to determine how the subsurface conditions will effect their operations.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Matt LiVecchi, P. Eng.



Ian Shaw., P. Eng.
Senior Engineer

Enclosures: Drawing No.1, Borehole Location Plan
Log of Borehole Nos. 1 to 10, inclusive
AGAT Certificate of Analysis 17H199883

Distribution: Niagara College of Applied Arts and Technology [2, plus pdf]



LEGEND

BH# Borehole Location

BM Benchmark [Top of manhole, geodetic elevation of 121.61 metres]

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 177359-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Geotechnical Investigation
Agri-Business Centre Agricultural Yard
Niagara College – NOTL Campus
Niagara-on-the-Lake, Ontario

Borehole Location Plan

Project No. SM 177359-G

Date: January 2017

Drawn: ML | Checked: -

SM 177359-G Borehole Location Plan

Drawing No. 1

Log of Borehole No. 01

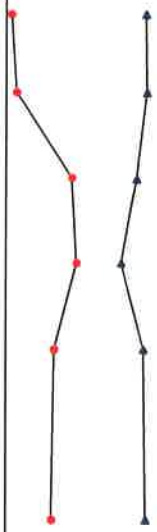
Project No: SM 177359-G
Project Manager: Ian Shaw P. Eng.
Project: NOTL Agricultural Yard
Borehole Location: See Drawing No.1
Location: 300 Woodlawn Road, Welland
UTM Coordinates - N: 17649318
Client: Niagara College of Applied Arts and Technology
E: 4779228

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Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	122.14	Ground Surface							
		Organic Mulch Approximately 50 millimetres.	SS	1	1,1,1,3	2			
		Silty Clay Brown, with trace gravel, reworked with increased organics in upper level, soft to very stiff.	SS	2	2,2,2	4		3.5	
			SS	3	6,9,17	26		>4.5	
			SS	4	7,11,17	28		>4.5	
			SS	5	5,8,11	19		4.5	
16 / 5	117.10	End of Borehole	SS	6	3,7,11	18		3.5	

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Freeflowing water measured at a depth of 0.6 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 02

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

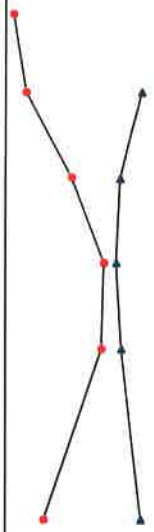
Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649322
E: 4779176

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Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	122.11	Ground Surface							
0 / 0		**Organic Mulch** Approximately 75 millimetres.							
		Silty Clay Brown, with trace gravel, reworked with organics in upper level, firm to hard.	SS	1	0,1,2,3	3			
3 / 1			SS	2	1,3,5	8		3.5	
6 / 2			SS	3	5,10,16	26		>4.5	
9 / 3			SS	4	5,13,26	39		>4.5	
11 / 3			SS	5	6,16,22	38		>4.5	
16 / 5	117.10		SS	6	3,6,9	15		4.0	
17 / 5		End of Borehole							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Freeflowing water measured at a depth of 2.1 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 03

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649323
E: 4779134

Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	122.24		Ground Surface								
		122.04		**Topsoil** Approximately 200 millimetres.		SS	1	0,1,3,4	4			
				Silty Clay Brown, with trace gravel, reworked with organics in upper level, stiff to very stiff.		SS	2	5,8,13	21		>4.5	
						SS	3	8,12,14	26		>4.5	
						SS	4	4,9,14	23		>4.5	
						SS	5	3,7,10	17		4.0	
		117.20		End of Borehole		SS	6	2,4,7	11		4.0	

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.

2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 04

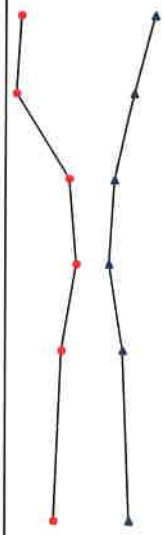
Project No: SM 177359-G
Project Manager: Ian Shaw P. Eng.
Project: NOTL Agricultural Yard
Borehole Location: See Drawing No.1
Location: 300 Woodlawn Road, Welland
UTM Coordinates - N: 17649319
Client: Niagara College of Applied Arts and Technology
E: 4779103

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	122.43		Ground Surface								
0–1 / 0			**Topsoil** Approximately 125 millimetres.		SS	1	1,3,3,4	6		4.0	
1–3 / 1			**Silty Clay** Brown, with trace gravel, reworked with organics in upper level, firm to very stiff.		SS	2	1,1,3	4		4.0	
3–6 / 1–2					SS	3	6,10,15	25		>4.5	
6–9 / 2–3					SS	4	4,10,18	28		>4.5	
9–11 / 3					SS	5	3,8,14	22		>4.5	
11–16 / 3–5					SS	6	3,7,12	19		4.5	
16 / 5	117.40		End of Borehole								
17–33 / 6–9			NOTES: 1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres. 2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 05

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649382
E: 4779133

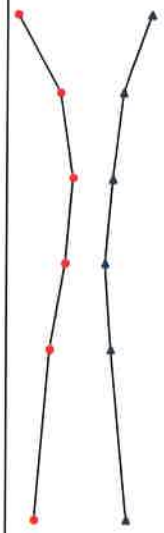
Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	122.22	Ground Surface							
		122.02	**Topsoil** Approximately 200 millimetres.							
			Silty Clay Brown, with trace gravel, occasional organics in the upper level, stiff to very stiff.	SS	1	0,3,4,7	7		>4.5	
	1			SS	2	2,4,5	9		4.5	
	2			SS	3	4,8,11	19		>4.5	
	3			SS	4	3,8,17	25		>4.5	
				SS	5	7,12,17	29		>4.5	
	4			SS	6	5,7,10	17			
	5	117.20	End of Borehole							
	6									
	7									
	8									
	9									

Well Data

Moisture Content w%: 10 20 30 40

Standard Penetration Test blows/300mm: 20 40 60 80



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

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Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 06

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649380
E: 4779145

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	122.50		Ground Surface								
0–5 / 0–1.5	122.50–120.75		**Silty Clay** Brown, with trace gravel, occasional organics in the upper level, stiff to hard.		SS	1	2,5,6	11		4.5	
					SS	2	6,6,7	13		3.5	
5–10 / 1.5–3	120.75–117.50		Thin layer of silty sand.		SS	3	5,13,18	31		>4.5	
					SS	4	6,9,12	21		4.5	
16 / 5	117.50		End of Borehole		SS	5	3,6,9	15		3.5	

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

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130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 07

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649368
E: 4779191

Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0	0	122.29	Ground Surface							
0–16	0–5	122.29–117.30	**Silty Clay** Brown, with trace gravel, occasional organics in the upper level, stiff to very stiff.							
				SS	1	1,6,9	15		>4.5	
				SS	2	6,12,16	28		>4.5	
				SS	3	6,11,12	23		>4.5	
				SS	4	4,9,12	21		>4.5	
				SS	5	4,8,11	19		4.5	
16	5	117.30	End of Borehole							

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
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Datum: Geodetic Benchmark
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Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 08

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649372
E: 4779248

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	122.74		Ground Surface								
0–6 / 0–1.8			**Silty Clay Fill** Brown, with organics and organics and organic staining, trace gravel, firm to stiff.		SS	1	3,4,4	8		4.5	
					SS	2	3,4,5	9		3.5	
6–16 / 1.8–5	120.90		**Silty Clay** Brown, with trace gravel, occasional organics in the upper level, stiff to very stiff.		SS	3	5,7,8	15		4.0	
					SS	4	6,9,12	21		>4.5	
16 / 5	117.70		End of Borehole		SS	5	4,6,10	16		4.5	

NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 5.0 metres.
2. Borehole was found to be dry and open at a depth of 5.0 metres upon completion and borehole backfilled as per Ontario Regulation 903.
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
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E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 09

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649341
E: 4779290

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	121.33		Ground Surface								
	121.13		**Granular Fill** Approximately 200 millimetres of sand and gravel fill.								
1 / 1			**Silty Clay** Brown, with trace gravel, occasional organics in the upper level, stiff to very stiff.		SS	1	7,11,14	25		>4.5	
2 / 2					SS	2	6,11,17	28		>4.5	
3 / 3					SS	3	5,9,12	21		4.0	
	117.80				SS	4	4,7,11	18		4.0	
4 / 4			End of Borehole								
5 / 5											
6 / 6											
7 / 7											
8 / 8											
9 / 9											

Moisture Content w%: 10 20 30 40

Standard Penetration Test blows/300mm: 20 40 60 80



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 3.5 metres.

2. Borehole was found to be dry and open at a depth of 3.5 metres upon completion and borehole backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Geodetic Benchmark
Field Logged by: RM
Checked by: ML
Sheet: 1 of 1

Log of Borehole No. 10

Project No: SM 177359-G
Project: NOTL Agricultural Yard
Location: 300 Woodlawn Road, Welland
Client: Niagara College of Applied Arts and Technology

Project Manager: Ian Shaw P. Eng.
Borehole Location: See Drawing No.1
UTM Coordinates - N: 17649320
E: 4779337

Soil-Mat

Depth (ft)	Depth (m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	SAMPLE PP (kgf/cm2)	SAMPLE U.Wt.(kN/m3)	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
0	0	121.43		Ground Surface									
1				**Topsoil** Approximately 100 millimetres.		SS	1	2,3,3,5	6		3.5		
2				**Silty Clay** Brown, with trace gravel, occasional organics in upper level, stiff to very stiff.									
3	1					SS	2	3,7,10	17		4.0		
4													
5													
6	2					SS	3	12,14,15	29				
7													
8													
9						SS	4	3,10,16	26		>4.5		
10	3												
11		117.90				SS	5	4,8,12	20		>4.5		
12				End of Borehole									
13	4												
14													
15													
16													
17	5												
18													
19				NOTES:									
20	6			1. Borehole was advanced using solid stem auger equipment on March 23, 2017 to termination at a depth of 3.5 metres.									
21													
22				2. Borehole was found to be dry and open at a depth of 3.5 metres upon completion and borehole backfilled as per Ontario Regulation 903.									
23	7												
24													
25				3. Soil samples will be discarded after 3 months unless otherwise directed by our client.									
26	8												
27													
28													
29	9												
30													
31													
32													
33													



Drill Method: Solid Stem Auger
Drill Date: March 23, 2017
Hole Size: 150 mm
Drilling Contractor: Elite

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT
130 LANCING DRIVE
HAMILTON, ON L8W3A1
(905) 318-7440

ATTENTION TO: Matt Livecchi

PROJECT: SM-177359-G

AGAT WORK ORDER: 17H199883

SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Coordinator

DATE REPORTED: Mar 31, 2017

PAGES (INCLUDING COVER): 5

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

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Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

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Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

AGAT Laboratories

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CANADA L4Z 1Y2
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http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17H199883

PROJECT: SM-177359-G

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

SAMPLING SITE:Niagara-on-the-Lake

ATTENTION TO: Matt Livecchi

SAMPLED BY:RM

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2017-03-24

DATE REPORTED: 2017-03-31

		SAMPLE DESCRIPTION:		BH2 SS2 - 2.5'	BH6 SS2 - 5'	BH8 SS1 - 2.5'	BH9 SS1 - 2.5'
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2017-03-21	2017-03-21	2017-03-21	2017-03-21
Parameter	Unit	G / S	RDL	8280107	8280110	8280116	8280117
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	10	3	4	4
Barium	µg/g	220	2	216	73	93	137
Beryllium	µg/g	2.5	0.5	1.4	0.5	0.7	0.8
Boron	µg/g	36	5	<5	<5	6	7
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.10	0.10	0.31	0.10
Cadmium	µg/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	70	2	32	15	22	26
Cobalt	µg/g	21	0.5	19.5	8.9	12.4	15.0
Copper	µg/g	92	1	38	16	23	24
Lead	µg/g	120	1	13	5	10	9
Molybdenum	µg/g	2	0.5	1.1	<0.5	<0.5	<0.5
Nickel	µg/g	82	1	49	18	26	31
Selenium	µg/g	1.5	0.4	0.5	<0.4	<0.4	<0.4
Silver	µg/g	0.5	0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	1	0.4	<0.4	<0.4	<0.4	<0.4
Uranium	µg/g	2.5	0.5	0.5	<0.5	0.7	0.9
Vanadium	µg/g	86	1	47	20	29	33
Zinc	µg/g	290	5	73	38	67	60
Chromium VI	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2
Cyanide	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity	mS/cm	0.57	0.005	0.383	0.262	0.348	0.357
Sodium Adsorption Ratio	NA	2.4	NA	0.596	0.354	0.551	0.624
pH, 2:1 CaCl2 Extraction	pH Units		NA	7.26	7.48	7.45	7.65

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

8280107-8280117 EC & SAR were determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio.

Certified By: Amanjot Bhela

Results relate only to the items tested and to all the items tested

AGAT Laboratories

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MISSISSAUGA, ONTARIO
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http://www.agatlabs.com

Quality Assurance

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

PROJECT: SM-177359-G

SAMPLING SITE:Niagara-on-the-Lake

AGAT WORK ORDER: 17H199883

ATTENTION TO: Matt Livecchi

SAMPLED BY:RM

Soil Analysis

RPT Date: Mar 31, 2017			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	8280335		<0.8	<0.8	NA	< 0.8	108%	70%	130%	98%	80%	120%	77%	70%	130%
Arsenic	8280335		3	3	NA	< 1	110%	70%	130%	92%	80%	120%	94%	70%	130%
Barium	8280335		87	89	2.3%	< 2	101%	70%	130%	99%	80%	120%	90%	70%	130%
Beryllium	8280335		<0.5	<0.5	NA	< 0.5	94%	70%	130%	103%	80%	120%	99%	70%	130%
Boron	8280335		<5	<5	NA	< 5	75%	70%	130%	94%	80%	120%	92%	70%	130%
Boron (Hot Water Soluble)	8280335		0.31	0.30	NA	< 0.10	108%	60%	140%	99%	70%	130%	100%	60%	140%
Cadmium	8280335		<0.5	<0.5	NA	< 0.5	110%	70%	130%	103%	80%	120%	99%	70%	130%
Chromium	8280335		26	27	3.8%	< 2	100%	70%	130%	93%	80%	120%	95%	70%	130%
Cobalt	8280335		9.0	9.3	3.3%	< 0.5	103%	70%	130%	92%	80%	120%	90%	70%	130%
Copper	8280335		19	20	5.1%	< 1	98%	70%	130%	94%	80%	120%	84%	70%	130%
Lead	8280335		7	7	0.0%	< 1	103%	70%	130%	93%	80%	120%	85%	70%	130%
Molybdenum	8280335		<0.5	<0.5	NA	< 0.5	111%	70%	130%	95%	80%	120%	99%	70%	130%
Nickel	8280335		21	21	0.0%	< 1	104%	70%	130%	93%	80%	120%	91%	70%	130%
Selenium	8280335		<0.4	<0.4	NA	< 0.4	129%	70%	130%	93%	80%	120%	94%	70%	130%
Silver	8280335		<0.2	<0.2	NA	< 0.2	122%	70%	130%	109%	80%	120%	105%	70%	130%
Thallium	8280335		<0.4	<0.4	NA	< 0.4	104%	70%	130%	101%	80%	120%	97%	70%	130%
Uranium	8280335		0.7	0.7	NA	< 0.5	104%	70%	130%	101%	80%	120%	95%	70%	130%
Vanadium	8280335		27	28	3.6%	< 1	101%	70%	130%	92%	80%	120%	102%	70%	130%
Zinc	8280335		43	44	2.3%	< 5	101%	70%	130%	105%	80%	120%	90%	70%	130%
Chromium VI	8280116	8280116	<0.2	<0.2	NA	< 0.2	93%	70%	130%	91%	80%	120%	94%	70%	130%
Cyanide	8280335		<0.040	<0.040	NA	< 0.040	102%	70%	130%	108%	80%	120%	103%	70%	130%
Mercury	8280335		<0.10	<0.10	NA	< 0.10	110%	70%	130%	86%	80%	120%	86%	70%	130%
Electrical Conductivity	8280144		0.152	0.152	0.0%	< 0.005	94%	90%	110%	NA			NA		
Sodium Adsorption Ratio	8280482		0.271	0.266	1.9%	NA	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	8275713		7.32	7.38	0.8%	NA	100%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Amanjot Bhela

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: SOIL MAT ENGINEERS & CONSULTANTS LT

AGAT WORK ORDER: 17H199883

PROJECT: SM-177359-G

ATTENTION TO: Matt Livecchi

SAMPLING SITE:Niagara-on-the-Lake

SAMPLED BY:RM

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium VI	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Electrical Conductivity	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010B	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER

Results relate only to the items tested and to all the items tested

AGAT Laboratories

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Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only
Work Order #: 17H199883
Cooler Quantity: 1 BAG
Arrival Temperatures: 12.0 12.8 13.2 / 8.4 8.6 8.6
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes: OK ICE

Report Information:
Company: Soil-Mat Engineers
Contact: Matt Lavecchi
Address: 130 Lancing Dr. Hamilton
Phone: 9053187440 Fax:
Reports to be sent to:
1. Email: MATT LAVECCHI
2. Email: IAN SIGAL

Regulatory Requirements: ☐ No Regulatory Requirement
(Please check all applicable boxes)

☑ Regulation 153/04 Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☐ Coarse
☑ Fine

☐ Sewer Use
☐ Sanitary
☐ Storm
Region (Indicate One)

☐ Regulation 558
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on Certificate of Analysis ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:
Project: SM 177359-C
Site Location: NIAGARA ON THE LAKE
Sampled By: Rob McQueen
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:
Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Sample Matrix Legend
B Biota
GW Ground Water
O Oil
P Paint
S Soil
SD Sediment
SW Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics (Check Applicable)	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐B-HWS ☐Cr ☐CN⁻ ☐Cr⁶⁺ ☐EC ☐FOC ☐NO₃/NO₂ ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH₃ ☐TKN ☐NO₂ ☐NO₃/NO₂	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use
BH2 SS2 - 2.5'	AM	3/24/17	1			X														
BH6 SS2 - 5'	3/24/17	PM	1			X														
BH8 SS1 - 2.5'	3/24/17	PM	1			X														
BH9 SS1 - 2.5'	3/24/17	PM	1			X														

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Ryan Haven RH.	3/24/17	2:10pm	Daniella Jail DJ/KN	3/24/17	2:10pm
Daniella Jail DJ/KN	3/24/17	2:30pm			

Page 1 of 1

White Copy - Client | Yellow Copy - AGAT | White Copy - AGAT