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Geotechnical Investigation for Pleasant View Library Expansion at 575 Van Horne Avenue, Toronto, ON.

Prepared For:
Toronto Public Library

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Project Number:
ET23-1017A

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Engtec's subcontractors who have carried out on-site or laboratory work are duly assessed according to the purchase procedures of our quality system. For further information, please contact our project manager.

EXECUTIVE SUMMARY

Engtec Consulting Inc. ('Engtec') was retained by Toronto Public Library ('TPL') to carry out a geotechnical investigation for a side expansion of the existing building. This submission discusses the investigation findings and provides geotechnical recommendations for the design and construction of the project.

The field work comprised three (3) boreholes and three (3) test pits. The boreholes were advanced to depths ranging from 3.5m to 9.0m below the existing grade. Based on the conditions encountered in the boreholes, subsurface soil profile consisted of topsoil cover underlain by earth fill soils which is in turn underlain by sandy silt till to the depth of termination.

From the investigation findings, it is Engtec's opinion that use of shallow foundation is feasible. However, the founding grade must be extended to competent undisturbed ground and certified by a geotechnical engineer.

1 Introduction

Engtec Consulting Inc. (Engtec) was retained by QuadReal Property Group to conduct a geotechnical investigation for the Pleasant View Library Renovation and Addition project at 575 Van Horne Avenue, Toronto, Ontario. The project includes an expansion to the south of the existing Library building. The investigation site / project area is shown in Drawing No. 1 placed in Appendix A.

The purpose of the geotechnical investigation is to obtain information on the prevailing sub-surface soil and groundwater information at the subject site by means of drilling three (3) boreholes, in-situ tests and laboratory tests. Based on Engtec's interpretation of the data obtained, geotechnical engineering recommendations pertaining to the design and construction of the project.

The geotechnical investigation was carried out in compliance with TPL's RFQ No. 324-22-TPL-RFQ dated January 5, 2023. Authorization to proceed with this geotechnical investigation was given by Mr. Ming Wong, Purchasing Agent, Toronto Public Library, Toronto, Ontario under PO No. PO0031497 dated January 23, 2023.

2 The Site and Project Description

The site is located at the northeast quadrant of Van Horne Avenue and Brian Drive, Toronto, Ontario. At the time of field work, the site was covered with landscaping/about 100mm snow carpet.

Based on information in the submitted TPL's RFQ document, the existing Pleasant View Library is a single-storey slab-on-grade structure with a footprint of 650 sq.m. The project involves construction of an new single-storey building abutting the existing structure on the east (plan area of new building is 280 sq.m.). According to the RFQ, the anticipated column load of the new building would be 400 kN at SLS and 600 kN at ULS.

The RFQ document included a site plan illustrating the locations of three (3) boreholes and 3 test pits at the site.

3 Investigation Procedure

The field work was carried out on March 21, 2023, during which time, three (3) boreholes and three (3) test pits were advanced at the locations shown on the Borehole and Test Pit Location Plan in Appendix A. The boreholes were drilled to depths ranging from 6.6 m to 8.1 m and test pits were excavated to depths ranging from 1.5 m to 1.8 m below the existing ground surface.

The boreholes were advanced on the asphalt pavement using a D-50 truck-mount drill rig supplied by a drilling specialist subcontracted to Engtec. All boreholes were advanced using solid stem continuous flight augers, and soil samples were retrieved with a 51mm (2 inches) O.D. split-barrel (split spoon) sampler driven with a hammer weighing 624N with a drop height of 760mm (30 inches), which is in accordance with the Standard Penetration Test (SPT) Method (ASTM D1586) and protocols.

The test pit excavations were carried out using a rubber tired back-hoe at the outside face of the existing building walls to expose the footing and founding soils. The purpose of the test pits was to inspect and determine the type of foundation, establish the depth of existing footings, obtaining the footing dimensions and carry out an assessment of bearing capacity of founding soil.

The field work for this investigation was monitored by a member of our engineering staff who also logged the boreholes and cared for the recovered samples. The boreholes were located and marked on the asphalt pavement by Engtec. One flush-mount monitoring well was installed in one borehole (BH1). Observations for shallow groundwater conditions were made in open boreholes on completion. The boreholes were backfilled upon completion of drilling along with the site cleanup. All soil samples, obtained during borehole drilling and sampling, were brought to our laboratory for further examination and moisture content determination on all soil samples.

The ground surface elevation at each borehole location and top of slab was determined by Engtec, and referenced to a temporary benchmark (TBM). The TBM, on top of the finished floor slab, elevation was arbitrarily taken as 100.00m and shown on the site plan/borehole logs. It should be noted that the borehole surface elevations shown in the borehole logs are approximate only, for the purpose of relating the soil stratigraphy, and should not be used or relied on for any other purpose.

4 Subsurface and Groundwater Conditions

The subsurface and groundwater conditions encountered in the boreholes as well as field and laboratory testing results are presented on the Record of Boreholes in Appendix C. The Appendix also includes the 'Notes on Sample Descriptions and Explanation of the Terms', used to assist in the interpretation of the Record of Borehole sheets.

The following is a summarized account of the subsurface conditions encountered in the boreholes. It should be noted that soil and groundwater conditions might vary between the borehole locations.

4.1 Topsoil

Topsoil was encountered at the existing grade at all borehole locations. The measured thickness of the topsoil ranged from 115mm to 130mm. Topsoil thickness may vary with locations.

4.2 Earth Fill

Earth fill was encountered in all three boreholes below the pavement. The fill comprised predominantly sandy silt mixed with clayey silt. Traces of gravel and organic matter were found in the fill material. The earth fill materials extended to ± 1.2 m depth in Boreholes BH2 and BH3. In Borehole BH 1, the fill extended to about 3.5m. The SPT N-values (blows/0.3m) were recorded from 4 blows to well over 50 blows, revealing loose to compact compactness condition. The measured moisture contents in the sandy silt fill ranged from 9% to 10%.

4.3 Sandy Silt Till

Sandy silt till was encountered beneath the earth fill soils at all borehole locations extending to the termination depth. The measured SPT N-values of sandy silt till ranged from 12 blows to 30 blows per 300 mm penetration indicating a compact to very dense compactness condition. The measured moisture contents in the sandy silt till ranged from 6% to 16%.

Three (3) representative samples of sandy silt till recovered from the SPT spoons were selected for complete grain size analysis. The results are shown in Table 1 below.

Table 1: Results of Grain Size Analysis.

BH No.	Sample ID	Depth (m)	Size Distribution Grain (%)			
			Gravel	Sand	Silt	Clay
BH1	SS3	1.5m - 2.1m	3	36	44	17
BH2	SS3	2.5m - 3.1m	6	34	50	10
BH3	SS4	2.2m - 2.8m	3	36	42	19

The grain size distribution curves are shown in Appendix D.

4.4 Groundwater Conditions

Observations for groundwater were made in the open boreholes. All boreholes were dry on completion of drilling work. However, seasonal variations in the water table should be anticipated.

5 Discussion and Recommendations

At the time of this field work for this investigation, the site was lying vacant with turf and snow cover. Based on visual inspection, the site topography was fairly flat.

The following conclusions and recommendations are based on the findings from the field SPT tests and laboratory tests carried out for this project.

5.1 Site Preparation

The final site grading plan was not available at this time. The proposed expansion would likely have access from Brian Drive. Some cutting/filling operations are anticipated for the site preparation.

The site development would require the stripping of all topsoil, any soil containing excessive organic matter, deleterious material and soft/wet/sponge/loose spots. After completion of site cleaning operations, the entire area should be inspected and approved by a geotechnical engineer. The exposed surface should be proof-rolled with a suitable roller to identify the weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced. Replacement of existing fill loose/soft surficial soils at the site should be achieved by placing an engineered fill (Section 5.5).

5.2 Existing Building Foundation

Three (3) Test Pits (TP1 to TP3) were dug adjacent to the perimeter foundation walls of the existing building, two (2) at east side and one at northwest corner. All test pits (approximately 1m by 1m in plan) were extended to underside of the footings. The measured footing thicknesses and lateral projection are shown in Table 2.

Table 2: Existing Strip Footing Details.

Test Pit No.	Depth to Underside of Footing ⁽¹⁾	Footing Thickness (mm)	Lateral Projection (mm)
TP1	1.38m	180mm	150mm
TP2	1.20m	100mm	100mm
TP3	1.30m	200mm	125mm

Note: ⁽¹⁾. Below the existing grade.

The Photographs of the test pits are attached to this report in Appendix C

5.3 Foundation Design

The existing fill materials are unsuitable to support the proposed structure. Based on the results of this investigation, the proposed building additions may be founded on conventional shallow spread and/or continuous strip footings bearing in the undisturbed competent native soil (sandy silt till). The geotechnical reaction at Serviceability Limit States (SLS) and a factored bearing resistance at Ultimate Limit States (ULS) together with the corresponding founding depths at the borehole locations are provided in Table 3.

Table 3: Bearing Capacity Recommendations for New Building Addition.

BH No.	Minimum Foundation Depth ⁽¹⁾	Geotechnical Reaction at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)
BH1	1.5m	175	250
BH2	1.5m	175	250
BH3	1.8m	175	250

Note: ⁽¹⁾. Below the existing grade.

For spread/strip footings, minimum footing sizes, footing thickness, excavations and other footing requirements should comply the latest edition of the Ontario Building Code. For design purposes, the friction between concrete and till soils may be taken as 0.30. All footings exposed to seasonal freezing conditions must have at least 1.2m of soil cover for frost protection.

Based on the loading information provided in the RFQ dated October 20, 2022 – Geotechnical investigation Section 1(II), anticipated column load of the new building would be 400 kN at SLS and 600 kN. With the allowable soil bearing pressure value of 150 kPa recommended in the Table 3 (above) at about 1.5 m below the existing grade, the footing size at the borehole locations would be $\pm 1.5\text{m} \times \pm 1.5\text{m}$.

New footings constructed adjacent to the existing footings should be founded at the same levels as the existing footings. Where it is necessary to place foundations at different levels, the upper foundation must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower foundation. The lower footing must be installed first to help minimize the risk of undermining the upper footing. We recommend that the new footings adjacent to the existing building should not be structurally connected to the existing footings.

The recommended soil bearing pressures assume that prior to pouring concrete, all soft/disturbed/loose soil /debris, if any, is completely removed from the excavated grade. Regardless, the footing subgrade should be inspected and evaluated by a geotechnical engineer prior to placing concrete to ensure that footings are founded on competent subgrade capable of supporting the recommended design pressure.

5.4 Floor Slab

Concrete floor slab-on-grade may be built on properly prepared subgrade or engineered fill. The engineered fill placement is discussed in Section 5.5. Regardless, prior to commencing the floor slab construction, excavated subgrade surface should be proof-rolled with a heavy roller or partially loaded truck and examined by a geotechnical engineer. Any soft areas detected during proof-rolling process should be sub-excavated and replaced with approved material and compacted to 100 percent standard Proctor maximum dry density. The floor slab, if constructed as above, may be designed using a soil modulus of subgrade reaction (k_s) of 30 MPa/m.

Underneath the slab, a minimum 150mm thick base course consisting of 19mm clear crushed stone or Granular A (OPSS 1010) should be placed for levelling and drainage purposes. The base course should be compacted using vibratory equipment to at least 100 percent standard Proctor maximum dry density. If the subgrade is wet, Granular A should be separated from the subgrade by an approved filter fabric (e.g., Terrafix 270R or equivalent). It should be noted that crushed concrete products are not permitted to be installed underneath the slab on grade. Ground surfaces should be sloped away from the building to promote surface water run-off and reduce groundwater infiltration adjacent to the foundations.

5.5 Engineered Fill

Prior to placing engineered fill, the exposed subgrade should be proof rolled in conjunction with an inspection by qualified geotechnical personnel, to confirm that the exposed soils are native, undisturbed and competent, and have been adequately cleaned of existing fills, ponded water and all disturbed, loosened, softened, organic and other deleterious material. The area can then be brought up to the final subgrade level with approved on-site or imported material placed in lifts not exceeding 200 mm in thickness and compacted to a minimum 98% of materials' Standard Proctor Maximum Dry Density (SPMDD). The native soils (with all obvious topsoil seams or layers removed) is considered suitable for reuse as backfill. Some moisture content adjustments may be required for efficient compaction depending upon weather conditions at the time of construction. Any organic, excessively wet, or otherwise deleterious material should not be used for backfilling purposes. Any shortfall of suitable on-site excavated material can be made up with imported OPSS Granular 'B' or equivalent.

Removal of the existing fills and placement of compacted fills must be carried out under full time monitoring by the geotechnical engineer from Engtec. The final lift directly beneath the floor slabs should consist of a minimum of 200mm of OPSS Granular A material, uniformly compacted to at least 100% of SPMDD. This should provide a modulus of subgrade reaction of approximately 30MPa/m.

5.6 Excavations and Groundwater Control

It is anticipated that excavations to competent native founding soils for footings would continue to minimum depths of about 1.5 m below the existing ground surface. The excavations are anticipated to be carried out in earth fill (sandy silt to clayey silt) and compact sandy silt till.

All excavations shall be carried out in accordance with the latest version of Occupational Health and Safety Act and Regulations for Construction Projects. The site soils to be excavated can be classified as follows.

Existing fill/possible fill:	Type 3
Compact sand silt till:	Type 2

Accordingly, a bank slope of 1H:1V is required for excavations in Type 2 & 3 soils in accordance with the Ontario Health and Safety Regulations (Appendix C). For Type 2 soils, a 1.2m high vertical cut at the bottom of excavation may generally be constructed. Near the ground surface, occasional 2H:1V slope may be required due to loose/soft surficial soils.

Normal excavation equipment would be suitable for excavation of overburden. The till is non-sorted sediment and cobbles and boulders should be anticipated during construction. Cobbles and boulders any influence the

progress of excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by limestone lenses, boulders, obstructions, etc.

Based on the conditions encountered during the investigation/anticipated excavation depth, no significant groundwater is anticipated during construction. Minor perched water seepage, if any encountered during excavation could be managed by pumping from conventional sump pump arrangement at the base of the excavation.

Excavations for the building addition foundations located immediately adjacent to the existing foundations should be carried out in a manner which does not result in loss of subgrade support for the existing building foundations (i.e. excavations immediately adjacent to the existing foundations should not extend deeper than the existing foundations).

5.7 Seismic Considerations

In conformance with the criteria in Table 4.1.8.4.A, Part 4, Division B of the 2016 Building Code (Ontario), the project site may be classified as “Site Class D, Stiff Soil” for footings founded on till soils.

The four values of the spectral response acceleration, S_a (T), for different periods and the Peak Ground Acceleration (PGA) can be obtained from Table C-2 in Appendix C, Division B of the National Building Code (2015). The design values of F_a and F_v for the project site should be determined in accordance with Table 4.1.8.4.B in Part 4, Division B of the 2020 Building Code (Ontario).

5.8 Limited Chemical Testing of Soils

Engtec submitted a selected soil sample retrieved from borehole BH3 on March 16, 2023 (during drilling) for a limited soil chemical testing program. The purpose of the limited soil chemical testing program is to assist in the preliminary assessment of the quality of the excess fill at the subject site and assess the presence or absence of any contamination. The soil sample was submitted by Engtec to Eurofins Laboratories, which is accredited by the Canadian Association of Laboratory Accreditation (CALA) to undertake soil chemical testing. Sampling locations were chosen to ensure testing of both the pavement and landscape areas. It should be noted that based on the design, and volume of excess soil generated, further chemical testing analysis may be required for excess soil disposal.

The sample reported under this submission has the following identification information:

- BH3: collected from BH3 from 0.6 m to 1.6 m

The soil samples along with the required tests submitted for chemical analysis are summarized in Table 4.

Table 4: Sample Identification and Requested Chemical Testing.

Parameter	BH3
Metal and Inorganics	YES
Organochlorine Pesticides	YES
TCLP (Metals and Inorganics and VOCs)	YES

The Standards with which the results were compared provided in Ontario Ministry of the Environment, Conservation, and Parks (MECP) documents titled "Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environment Protection Act of the Environment Protection Act", dated April 15, 2011, in accordance with Ontario Regulation (O. Reg.) 153/04 (as amended) and "Rules for Soil Management and Excess Soil Standards", dated 2022 in accordance with O.Reg. 406 (as amended).

- Table 1 Full Depth Background Site Condition Standards for Residential/Parkland/Institutional/Industrial, Commercial, Community property use (Table 1);
- Table 2.1: Excess Soil Quality Standards (ESQS) for Industrial/Commercial/Community Property use (Table 2.1);
- Table 3.1: Excess Soil Quality Standards (ESQS) for Industrial/Commercial/Community Property use (Table 3.1).

Table 5: Comparison to Applicable Specifications and Exceedances (Table 1 as applicable for comparison).

Parameter	BH3
Metal and Inorganics	PASS
OCPs	PASS
TCLP (Metals and Inorganics and VOCs)	PASS

RED Colour Indicates Exceedance of MOECP Table 1 Criterion.

Table 6: Comparison to Applicable Specifications and Exceedances (Table 2.1 as applicable for comparison).

Parameter	BH3
Metal and Inorganics	PASS
OCPs	PASS
TCLP (Metals and Inorganics and VOCs)	PASS

RED Colour Indicates Exceedance of MOECP Table 2 ICC Criterion.

Table 7: Comparison to Applicable Specifications and Exceedances (Table 3.1 as applicable for comparison).

Parameter	BH3
Metal and Inorganics	PASS
OCPs	PASS
TCLP (Metals and Inorganics and VOCs)	PASS

RED Colour Indicates Exceedance of MOECP Table 3 ICC Criterion.

The results of the chemical analyses are as follows:

- The collected soil sample BH3 in this submission showed no exceedances in Metals and Inorganics and OCPs for Table 1, Table 2.1, and Table 3.1 site condition standards.

5.9 Toxicity Characteristics Leachate Procedure (TCLP)

The results of the Metals and Inorganics, and VOCs for Toxicity Characteristics Leachate Procedure (TCLP) for the collected soil samples BH3 did not indicate it as a leachate toxic waste as per O.Reg. 558 Schedule 4 Leachate Quality Criteria (LQC).

Based on the TCLP analysis the soil is non-hazardous and thus can be disposed of at a landfill or reused at the site accepting soil with the abovementioned soil chemical testing.

Detailed chemical test results are attached in Appendix D of this submission.

6 Concluding Remarks

This report has been prepared for the exclusive use of Toronto Public Library and its authorized users for the specific application outlined in this report. This report has been prepared within generally accepted geotechnical engineering practice.

We trust that this submission meets your requirements. Should you have any questions, please don't hesitate to contact this office.

Yours truly,



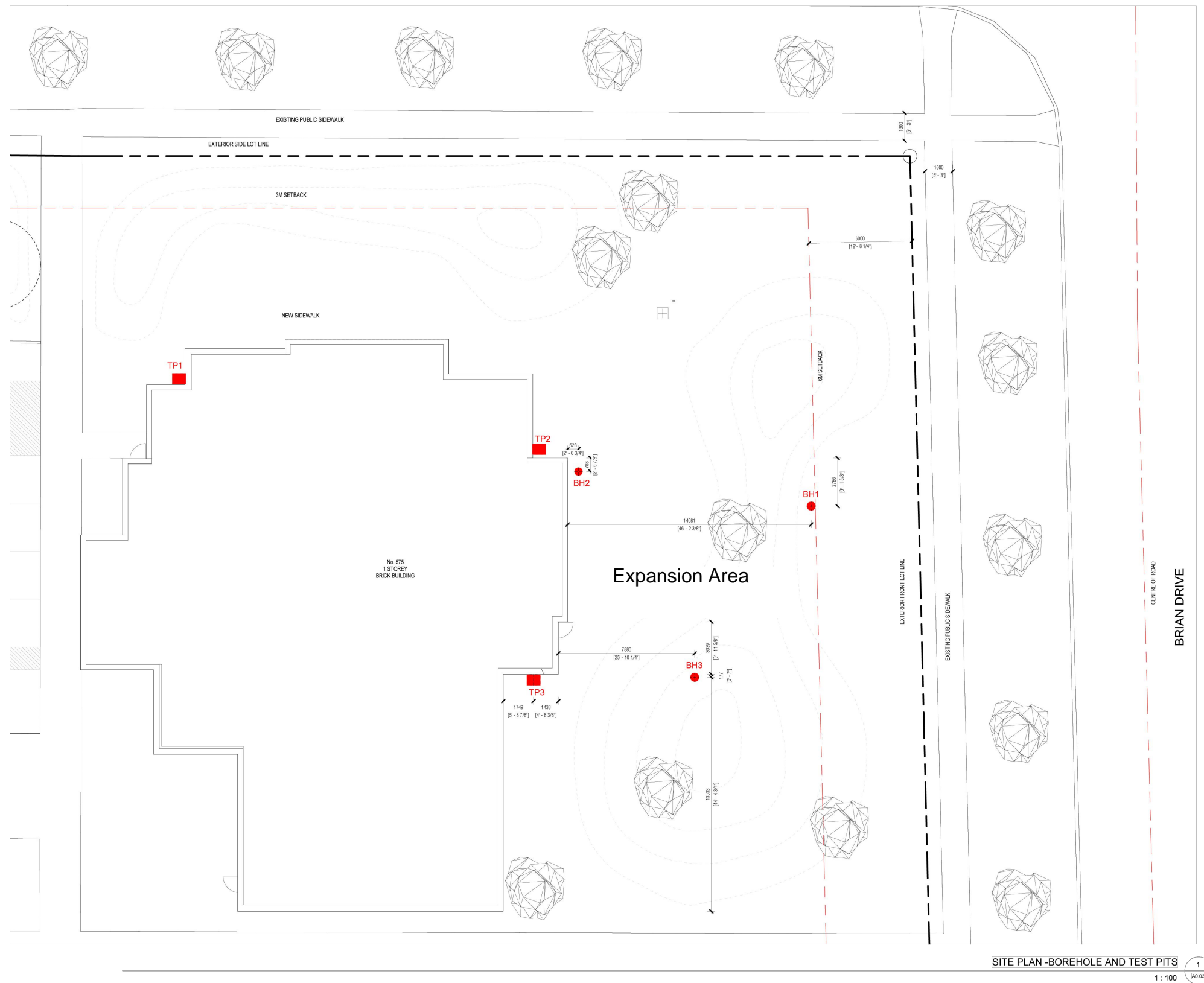
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Appendix A:

Key Plan and Site Plan Showing the Borehole Locations



Adopted from : Borehole
and Test Pit Locations
A0.03 - Pleasant View
Library

Project Name: Geotechnical Investigation

Project Location: 575 Van Horne Avenue, North York

Drawing Title: Borehole and Test Pit Plan

Drawing No. 01

Project No. ET23-1017A

Contract No.

Drawn By: L.W Checked By: M.M

Date: April 18, 2023 Scale: NTS

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Appendix B:

Site Photographs



Picture 1: BH1 (March 2, 2023).



Picture 2: BH2 (March 2, 2023).



Picture 3: TP 3 (March 2, 2023).



Picture 3: Test Pit TP1 (March 17, 2023).



Picture 3: Test Pit TP2 (March 17, 2023).



Picture 3: Test Pit TP3 (March 17, 2023).

Appendix C:

Borehole Logs

Enclosure 1A: Notes on Sample Descriptions

1. Each soil stratum is described according to the *Modified Unified Soil Classification System*. The compactness condition of cohesionless soils (SPT) and the consistency of cohesive soils (undrained shear strength) are defined according to Canadian Foundation Engineering Manual, 4th Edition. Different soil classification systems may be used by others. Please note that a description of the soil strata is based on visual and tactile examination of the samples augmented with field and laboratory test results, such as a grain size analysis and/or Atterberg Limits testing. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.
2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Enclosure 1B: Explanation of Terms Used in the Record of Boreholes

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube Sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) required to drive a 50 mm (2 in) drive open sampler for a distance of 300 mm (12 in).

PM – Samples advanced by manual pressure

WR – Samples advanced by weight of sampler and rod

WH – Samples advanced by static weight of hammer

Dynamic Cone Penetration Resistance, N_d :

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to “A” size drill rods for a distance of 300 mm (12 in).

Piezo-Cone Penetration Test (CPT):

An electronic cone penetrometer with a 60 degree conical tip and a projected end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurement of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

Textural Classification of Soils (ASTM D2487)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm – 4.75 mm
Silt	0.002 mm-0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency Value	Undrained Shear Strength (kPa)	SPT “N”
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction

1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT “N” value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT “N” Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w _p	Plastic limit
w _l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D _R	Relative density (specific gravity, G _s)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

SOIL TYPES

As defined in Part III: Excavations - Occupational Health and Safety Act and regulations for Construction Projects

March 2017

Type 1 Soil

- A. is hard, very dense, and only able to be penetrated with difficulty by a small, sharp, object;
- B. has a low natural moisture content, and a high degree of internal strength;
- C. has no signs of water seepage; and
- D. can be excavated only by mechanical equipment

Type 2 Soil

- A. is very stiff, dense, and can be penetrated with moderate difficulty by a small, sharp object;
- B. has a low to medium natural moisture content and medium degree of internal strength; and
- C. has a damp appearance after it is excavated

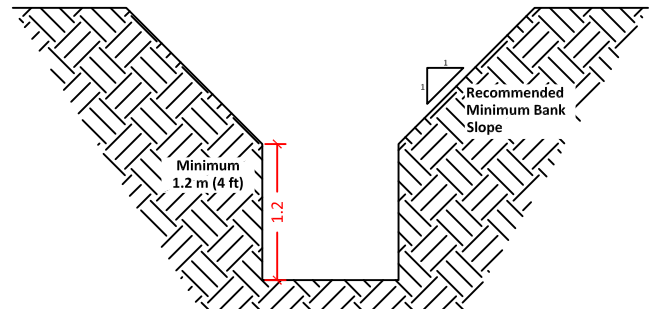
Type 3 Soil

- A. is stiff to firm, and compact to loose in consistency, or is previously excavated soil;
- B. exhibits signs of surface cracking;
- C. exhibits signs of water seepage
- D. if it is dry, may run easily into a well-defined conical pile; and
- E. has a low degree of internal strength

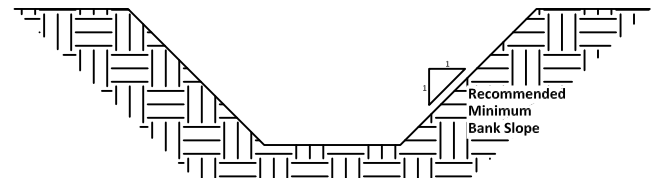
Type 4 Soil

- A. is soft to very soft, and very loose in consistency, very sensitive, and upon disturbance, is significantly reduced in natural strength;
- B. runs easily or flows, unless it is completely supported before excavating procedures;
- C. has almost no internal strength;
- D. is wet or muddy; and
- E. exerts substantial fluid pressure on its supporting system

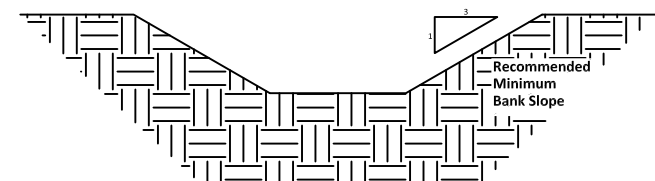
GOOD SOIL



FAIRLY GOOD SOIL



BAD SOIL



*If an excavation contains more than one type of soil, the soil shall be classified as the type with the highest soil type

Log of Borehole BH1

Project No. ET23-1017A

Figure No. 2

Project: Pleasant View Library Renovation + Addition

Sheet No. 1 of 1

Location: 575 Van Horne Avenue, Toronto, Ontario

Date Drilled: 16 March, 2023

☒ Auger Sample

Combustible Vapour Reading ☐

Drill Type: D-50

SPT (N) Value ☐ ☒

Natural Moisture ✕

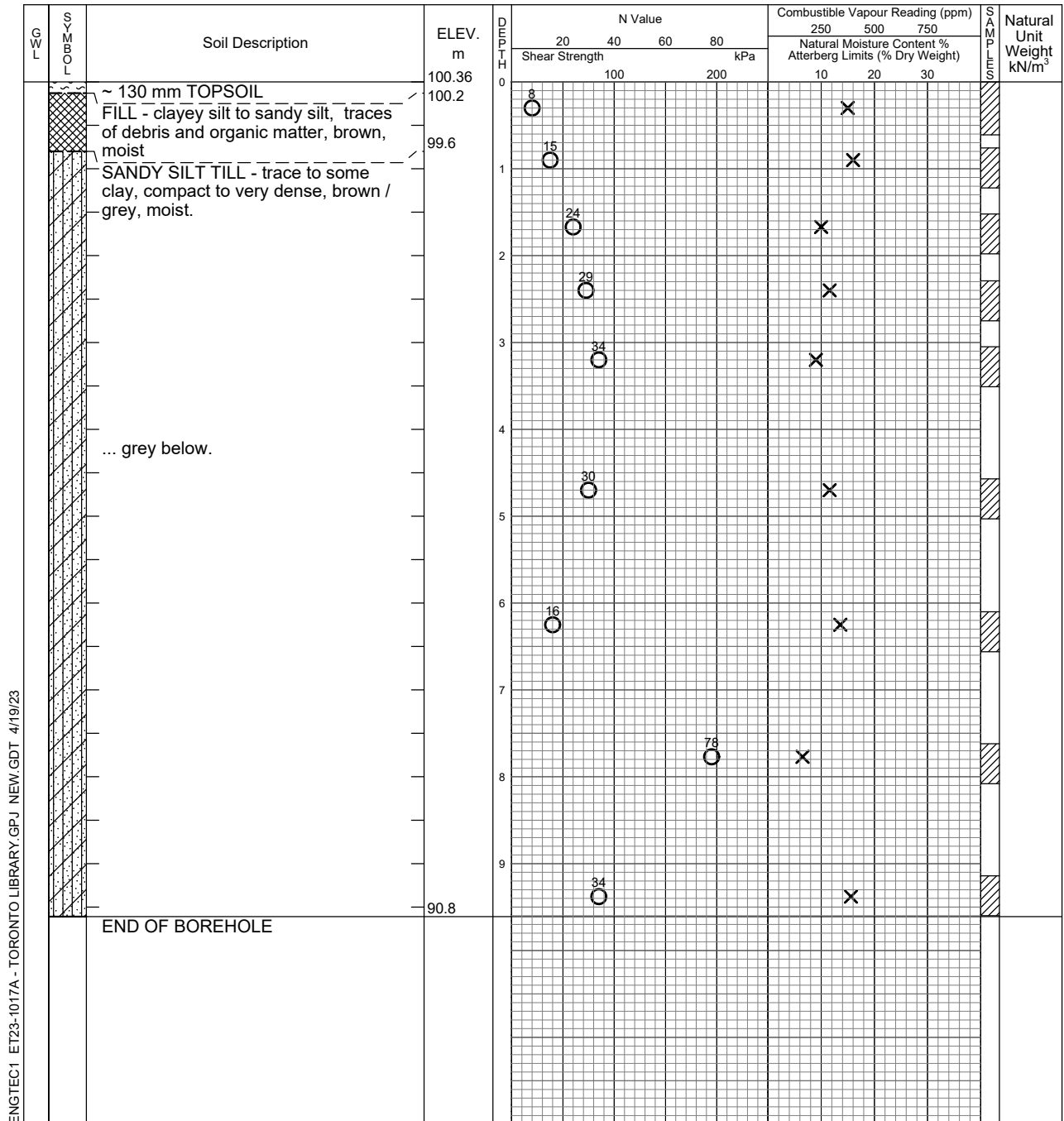
Datum: TBM (Assumed 100.00m)

Dynamic Cone Test _____

Plastic and Liquid Limit

Shelby Tube Undrained Triaxial at $\sigma_3 = 100$ kPa Field Vane Test 

% Strain at Failure	σ_{max}
0.0000	0.0000
0.0001	0.0000
0.0002	0.0000
0.0003	0.0000
0.0004	0.0000
0.0005	0.0000
0.0006	0.0000
0.0007	0.0000
0.0008	0.0000
0.0009	0.0000
0.0010	0.0000
0.0011	0.0000
0.0012	0.0000
0.0013	0.0000
0.0014	0.0000
0.0015	0.0000
0.0016	0.0000
0.0017	0.0000
0.0018	0.0000
0.0019	0.0000
0.0020	0.0000
0.0021	0.0000
0.0022	0.0000
0.0023	0.0000
0.0024	0.0000
0.0025	0.0000
0.0026	0.0000
0.0027	0.0000
0.0028	0.0000
0.0029	0.0000
0.0030	0.0000
0.0031	0.0000
0.0032	0.0000
0.0033	0.0000
0.0034	0.0000
0.0035	0.0000
0.0036	0.0000
0.0037	0.0000
0.0038	0.0000
0.0039	0.0000
0.0040	0.0000
0.0041	0.0000
0.0042	0.0000
0.0043	0.0000
0.0044	0.0000
0.0045	0.0000
0.0046	0.0000
0.0047	0.0000
0.0048	0.0000
0.0049	0.0000
0.0050	0.0000
0.0051	0.0000
0.0052	0.0000
0.0053	0.0000
0.0054	0.0000
0.0055	0.0000
0.0056	0.0000
0.0057	0.0000
0.0058	0.0000
0.0059	0.0000
0.0060	0.0000
0.0061	0.0000
0.0062	0.0000
0.0063	0.0000
0.0064	0.0000
0.0065	0.0000
0.0066	0.0000
0.0067	0.0000
0.0068	0.0000
0.0069	0.0000
0.0070	0.0000
0.0071	0.0000
0.0072	0.0000
0.0073	0.0000
0.0074	0.0000
0.0075	0.0000
0.0076	0.0000
0.0077	0.0000
0.0078	0.0000
0.0079	0.0000
0.0080	0.0000
0.0081	0.0000
0.0082	0.0000
0.0083	0.0000
0.0084	0.0000
0.0085	0.0000
0.0086	0.0000
0.0087	0.0000
0.0088	0.0000
0.0089	0.0000
0.0090	0.0000
0.0091	0.0000
0.0092	0.0000
0.0093	0.0000
0.0094	0.0000
0.0095	0.0000
0.0096	0.0000
0.0097	0.0000
0.0098	0.0000
0.0099	0.0000
0.0100	0.0000
0.0101	0.0000
0.0102	0.0000
0.0103	0.0000
0.0104	0.0000
0.0105	0.0000
0.0106	0.0000
0.0107	0.0000
0.0108	0.0000
0.0109	0.0000
0.0110	0.0000
0.0111	0.0000
0.0112	0.0000
0.0113	0.0000
0.0114	0.0000
0.0115	0.0000
0.0116	0.0000
0.0117	0.0000
0.0118	0.0000
0.0119	0.0000
0.0120	0.0000
0.0121	0.0000
0.0122	0.0000
0.0123	0.0000
0.0124	0.0000
0.0125	0.0000
0.0126	0.0000
0.0127	0.0000
0.0128	0.0000
0.0129	0.0000
0.0130	



Log of Borehole BH2

Figure No. 3

Sheet No. 1 of 1

Location: 575 Van Horne Avenue, Toronto, Ontario

Auger Sample ☒

Natural Moisture ✕

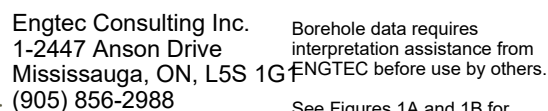
SPT (N) Value ☐ ☒

Undrained Triaxial at $\sigma_3 = 100$ kPa

Dynamic Cone Test

Shelby Tube

Undrained Triaxial at
% Strain at Failure

Field Vane Test Penetrometer 

Borehole data requires interpretation assistance from ENGTEC before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions and Terminology.

Time	Water Level (m)	Depth to Cave (m)
28 March, 2023	dry	3.48

Log of Borehole BH3

Project No. ET23-1017A

Figure No. 4

Project: Pleasant View Library Renovation + Addition

Sheet No. 1 of 1

Location: 575 Van Horne Avenue, Toronto, Ontario

Date Drilled: 16 March, 2023

Auger Sample



SPT (N) Value



Dynamic Cone Test



Shelby Tube



Field Vane Test



Combustible Vapour Reading



Natural Moisture



Plastic and Liquid Limit



Undrained Triaxial at % Strain at Failure

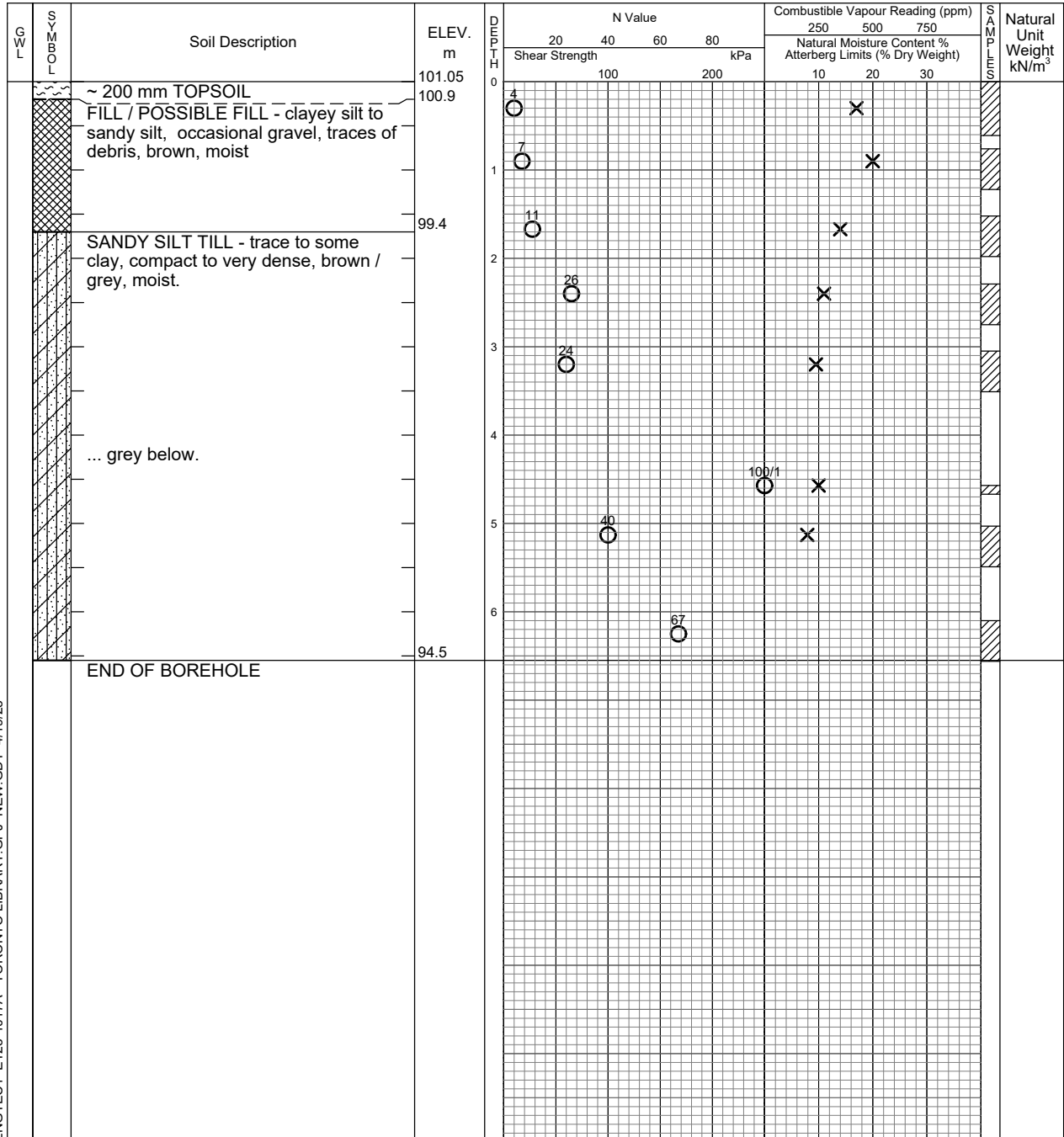


Penetrometer



Drill Type: D-50

Datum: TBM (Assumed 100.00m)



ENGTEC1 ET23-1017A - TORONTO LIBRARY.GPJ NEW.GDT 4/19/23



Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, ON, L5S 1G9
(905) 856-2988

Borehole data requires interpretation assistance from ENGTEC before use by others.

See Figures 1A and 1B for Notes on Sample Descriptions and Terminology.

Time	Water Level (m)	Depth to Cave (m)
28 March, 2023	dry	6.20

Appendix D:

Laboratory Test Results

**Grain Size Analysis
& Hydrometer
LS - 702**

Lab Sample No.: G08687

Project Name: Geotechnical Investigation - Toronto Library

Date Reported: April 11, 2023

Project No: ET23-1017A

Grain Size Proportion (%)	
Gravel - Coarse	0.0
Gravel - Fine	3.4
Sand - Coarse	3.2
Sand - Medium	6.5
Sand - Fine	25.7
Silt (> 2mm), < 75mm):	44.3
Clay (< 2mm):	16.8
Total	100.0

Sample Information	
Borehole No.:	BH#1, SS3
Sample Method:	Split Spoon
Depth:	1.5m. to 2.1m. depth
Sample Description:	Clayey Sand & Silt with Gravel - Brown
Sampled By:	Engtec
Sampling Date:	March 31, 2023
Client Sample ID:	N/A
Comments:	Clayey Sand & Silt with Gravel - Brown

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
37.5	100.0	0.0427	39.7
26.5	100.0	0.0306	36.9
19	100.0	0.0196	34.0
16	100.0	0.0117	28.4
13.2	100.0	0.0084	24.1
9.5	99.2	0.0059	24.1
4.75	96.6	0.0030	18.4
2	93.4	0.0013	15.6
0.85	90.4	0.0000	0.0
0.425	86.8		
0.25	81.7		
0.106	68.4		
0.075	61.1		

Review Status - Laboratory Manager

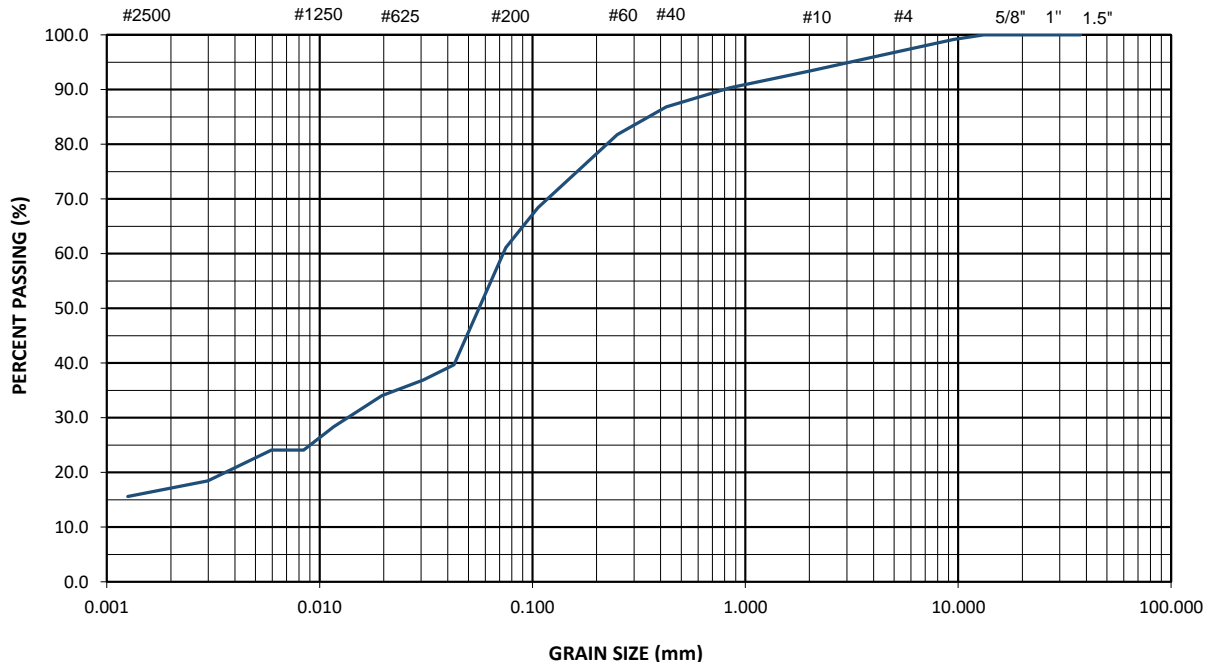
☐ Reviewed

☐ Not Reviewed

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL	
			Fine	Medium	Coarse	Fine	Coarse
%	16.8	44.3	25.7	6.5	3.2	3.4	0.0

SIEVE DESIGNATION (Imperial)



Reported By:

Leonardo Pilapil, C.E.T.
Laboratory Supervisor

Approved By:

Salman Bhutta, Ph.D., P.Eng.
Project Manager

**Grain Size Analysis
& Hydrometer
LS - 702**

Lab Sample No.: G08687

Project Name: Geotechnical Investigation - Toronto Library

Date Reported:

April 11, 2023

Project No:

ET23-1017A

Grain Size Proportion (%)	
Gravel - Coarse	0.0
Gravel - Fine	5.6
Sand - Coarse	4.4
Sand - Medium	7.3
Sand - Fine	23.4
Silt (> 2mm), < 75mm):	49.7
Clay (< 2mm):	9.5
Total	100.0

Sample Information	
Borehole No.:	BH#2, SS3
Sample Method:	Split Spoon
Depth:	2.5m. to 2.8m. depth
Sample Description:	Clayey Silt & Sand with Gravel - Brown
Sampled By:	Engtec
Sampling Date:	March 31, 2023
Client Sample ID:	N/A
Comments:	Clayey Silt & Sand with Gravel - Brown

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
37.5	100.0	0.0449	29.3
26.5	100.0	0.0324	25.2
19	100.0	0.0207	23.8
16	100.0	0.0121	21.0
13.2	100.0	0.0086	18.2
9.5	97.9	0.0062	15.4
4.75	94.4	0.0031	11.2
2	89.9	0.0013	8.4
0.85	86.2	0.0000	0.0
0.425	82.6		
0.25	77.5		
0.106	65.1		
0.075	59.2		

Review Status - Laboratory Manager

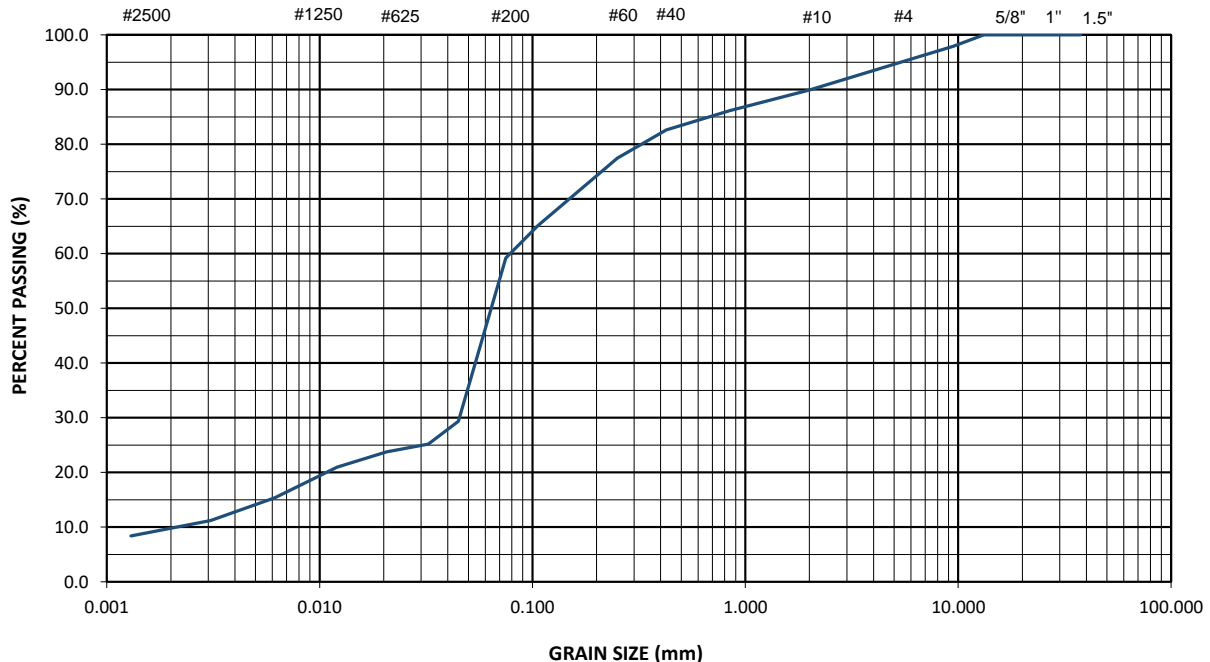
☐ Reviewed

☐ Not Reviewed

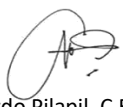
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL	
			Fine	Medium	Coarse	Fine	Coarse
%	9.5	49.7	23.4	7.3	4.4	5.6	0.0


SIEVE DESIGNATION (Imperial)



Reported By:


Leonardo Pilapil, C.E.T.
Laboratory Supervisor

Approved By:


Salman Bhutta, Ph.D., P.Eng.
Project Manager

**Grain Size Analysis
& Hydrometer
LS - 702**

Lab Sample No.: G08687

Project Name: Geotechnical Investigation - Toronto Library

Date Reported: April 11, 2023

Project No: ET23-1017A

Grain Size Proportion (%)	
Gravel - Coarse	0.0
Gravel - Fine	3.0
Sand - Coarse	3.1
Sand - Medium	6.3
Sand - Fine	26.6
Silt (> 2mm), < 75mm):	42.4
Clay (< 2mm):	18.5
Total	100.0

Sample Information	
Borehole No.:	BH#3, SS4
Sample Method:	Split Spoon
Depth:	2.2m. to 2.8m. depth
Sample Description:	Clayey Sand & Silt with Gravel - Brown
Sampled By:	Engtec
Sampling Date:	March 31, 2023
Client Sample ID:	N/A
Comments:	Clayey Sand & Silt with Gravel - Brown

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
37.5	100.0	0.0407	45.9
26.5	100.0	0.0295	41.7
19	100.0	0.0190	38.9
16	100.0	0.0114	30.6
13.2	100.0	0.0082	27.8
9.5	100.0	0.0059	25.0
4.75	97.0	0.0029	22.3
2	93.9	0.0012	15.3
0.85	90.9	0.0000	0.0
0.425	87.5		
0.25	82.1		
0.106	68.2		
0.075	60.9		

Review Status - Laboratory Manager

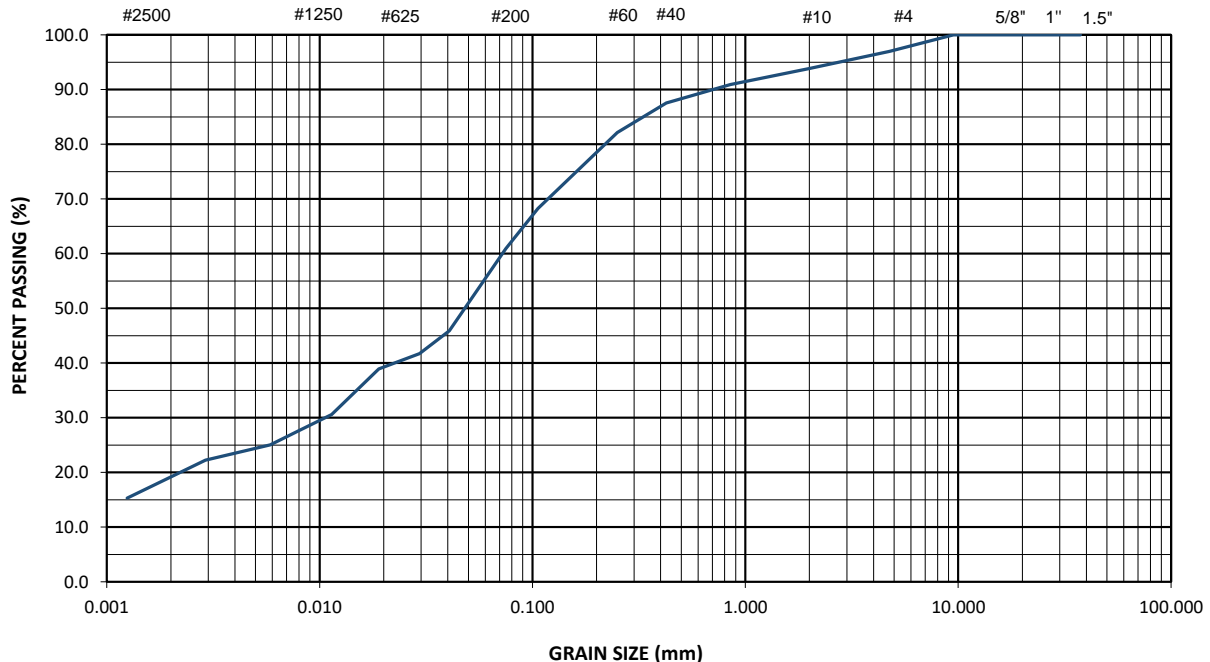
☐ Reviewed

☐ Not Reviewed

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT			SAND			GRAVEL	
			Fine	Medium	Coarse	Fine	Coarse
%	18.5	42.4	26.6	6.3	3.1	3.0	0.0

SIEVE DESIGNATION (Imperial)



Reported By:

Leonardo Pilapil, C.E.T.
Laboratory Supervisor

Approved By:

Salman Bhutta, Ph.D., P.Eng.
Project Manager

Appendix E:

Results of Chemical Analysis of Soils

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

Page 1 of 6

Dear Hammad Din:

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

Report Comments:

APPROVAL:

Raheleh Zafari, Environmental Chemist

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

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

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

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

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

Certificate of Analysis

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
					1678388 R347 2023-03-16 BH#3
Group	Analyte	MRL	Units	Guideline	
Anions	F	0.10	mg/L	LQC 150.0	0.16
General Chemistry	Cyanide (free)	0.05	mg/L	LQC 20.0	<0.05
Leachate	Zero Headspace Extraction				y
Mercury	Hg	0.001	mg/L	LQC 0.1	<0.001
Metals	Ag	0.01	mg/L	LQC 5	<0.01
	As	0.02	mg/L	LQC 2.5	<0.02
	B	0.1	mg/L	LQC 500.0	<0.1
	Ba	0.01	mg/L	LQC 100.0	0.51
	Cd	0.008	mg/L	LQC 0.5	<0.008
	Cr	0.05	mg/L	LQC 5.0	<0.05
	Pb	0.01	mg/L	LQC 5.0	<0.01
	REG 558 Leach		ug/L		y
	Se	0.02	mg/L	LQC 1.0	<0.02
	U	0.01	mg/L	LQC 10.0	<0.01
Moisture	Moisture-Humidite	0.1	%		14.8
Others	NO2 + NO3 as N	1.0	mg/L	LQC 1000	<1.0
VOCs Surrogates	1,2-dichloroethane-d4	0	%		112
	4-bromofluorobenzene	0	%		80
	Toluene-d8	0	%		96
Volatiles	1,1-dichloroethylene	0.5	ug/L	LQC 1400	<0.5
	1,2-dichlorobenzene	0.4	ug/L	LQC 20000	<0.4
	1,2-dichloroethane	0.5	ug/L	LQC 500	<0.5
	1,4-dichlorobenzene	0.4	ug/L	LQC 500	<0.4
	Benzene	0.5	ug/L	LQC 500	<0.5
	Carbon Tetrachloride	0.2	ug/L	LQC 500	<0.2

Guideline = REG 558

*** = Guideline Exceedence**

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

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

Certificate of Analysis

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

					Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.
					1678388 R347 2023-03-16 BH#3
Group	Analyte	MRL	Units	Guideline	
Volatiles	Chloroform	0.5	ug/L	LQC 10000	<0.5
	Dichloromethane	4.0	ug/L	LQC 5000	<4.0
	Methyl Ethyl Ketone (MEK)	2	ug/L	LQC 200000	<2
	Monochlorobenzene	0.5	ug/L	LQC 8000	<0.5
	Tetrachloroethylene	0.3	ug/L	LQC 3000	<0.3
	Trichloroethylene	0.3	ug/L	LQC 5000	<0.3
	Vinyl Chloride	0.2	ug/L	LQC 200	<0.2

Guideline = REG 558

* = Guideline Exceedence

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

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Certificate of Analysis

Client: Engtec Consulting Inc.
1-2447 Anson Drive
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L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 439199 Analysis/Extraction Date 2023-03-27 Analyst AA Method EPA 200.8 Reg 153			
REG 558 Leach			
Run No 439200 Analysis/Extraction Date 2023-03-26 Analyst AA Method ASTM 2216			
Moisture-Humidite			80-120
Run No 439232 Analysis/Extraction Date 2023-03-27 Analyst Z S Method SM4500-CNC/MOE E3015			
Cyanide (CN-)	<0.05 mg/L	94	75-125
Run No 439240 Analysis/Extraction Date 2023-03-27 Analyst AaN Method M SM3112B-3500B			
Mercury	<0.001 mg/L	102	76-123
Run No 439266 Analysis/Extraction Date 2023-03-28 Analyst IP Method EPA 1311/O. Reg 347			
Zero Headspace Extraction			
Run No 439272 Analysis/Extraction Date 2023-03-28 Analyst SKH Method C SM4500-NO3-F			
NO2 + NO3 as N	<1.0 mg/L	106	80-120

Guideline = REG 558

* = Guideline Exceedence

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

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

Certificate of Analysis

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 439276 Analysis/Extraction Date 2023-03-28 Analyst SD Method EPA 200.8			
Silver	<0.01 mg/L	100	70-130
Arsenic	<0.02 mg/L	98	70-130
Boron (total)	<0.1 mg/L	88	70-130
Barium	<0.01 mg/L	94	70-130
Cadmium	<0.008 mg/L	99	70-130
Chromium Total	<0.05 mg/L	105	70-130
Lead	<0.01 mg/L	95	70-130
Selenium	<0.02 mg/L	91	70-130
Uranium	<0.01 mg/L	85	70-130
Run No 439341 Analysis/Extraction Date 2023-03-29 Analyst AET Method C SM4500-FC			
F	<0.10 mg/L	103	90-110
Run No 439348 Analysis/Extraction Date 2023-03-28 Analyst PJ Method EPA 8260			
Dichloroethylene, 1,1-	<0.5 ug/L	81	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	94	60-130
Dichloroethane, 1,2-	<0.5 ug/L	92	60-130

Guideline = REG 558

* = Guideline Exceedence

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

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

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
PO#:
Invoice to: Engtec Consulting Inc.

Report Number: 1994922
Date Submitted: 2023-03-20
Date Reported: 2023-03-29
Project: ET23-1017A
COC #: 221313

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Dichlorobenzene, 1,4-	<0.4 ug/L	90	60-130
Benzene	<0.5 ug/L	94	60-130
Carbon Tetrachloride	<0.2 ug/L	93	60-130
Chloroform	<0.5 ug/L	93	60-130
Methylene Chloride	<4.0 ug/L	97	60-130
Methyl Ethyl Ketone	<2 ug/L	110	60-130
Chlorobenzene	<0.5 ug/L	93	60-130
Tetrachloroethylene	<0.3 ug/L	90	60-130
Trichloroethylene	<0.3 ug/L	89	60-130
Vinyl Chloride	<0.2 ug/L	79	60-130

Guideline = REG 558

*** = Guideline Exceedence**

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[illegible]

Client: Engtec Consulting Inc.
1-2447 Anson Drive
Mississauga, Ontario
L5S 1G1
Attention: Hammad Din
Invoice to: Engtec Consulting Inc.
PO#:

Report Number: 1994921
Date Submitted: 2023-03-20
Date Reported: 2023-03-27
Project: ET23-1017A
COC #: 220941
Temperature (C): 7
Custody Seal:

Page 1 of 10

Dear Hammad Din:

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

Report Comments:

Raheleh Zafari, Environmental Chemist

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

Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at <https://directory.cala.ca/>

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

Environment Testing

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Exceedence Summary

Sample I.D.	Analyte	Result	Units	Criteria

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COC #: 220941

Guideline = O.Reg 153-T1-All Other Soils - Res/Par/Ins/Ind/Com/Prop

Metals

Lab I.D. 1678387
Sample Matrix Soil153
Sample Type
Sample Date 2023-03-16
Sampling Time 10:00
Sample I.D. BH#3

Analyte	Batch No	MRL	Units	Guideline	
Antimony	439202	1	ug/g	STD 1.3	<1
Arsenic	439202	1	ug/g	STD 18	4
Barium	439202	1	ug/g	STD 220	71
Beryllium	439202	1	ug/g	STD 2.5	<1
Boron (Hot Water Soluble)	439236	0.5	ug/g		<0.5
Boron (total)	439202	5	ug/g	STD 36	<5
Cadmium	439202	0.4	ug/g	STD 1.2	<0.4
Chromium Total	439202	1	ug/g	STD 70	39
Chromium VI	439196	0.20	ug/g	STD 0.66	<0.20
Cobalt	439202	1	ug/g	STD 21	7
Copper	439202	1	ug/g	STD 92	16
Lead	439202	1	ug/g	STD 120	11
Mercury	439202	0.1	ug/g	STD 0.27	<0.1
Molybdenum	439202	1	ug/g	STD 2	2
Nickel	439202	1	ug/g	STD 82	25
Selenium	439202	0.5	ug/g	STD 1.5	1.3
Silver	439202	0.2	ug/g	STD 0.5	<0.2
Thallium	439202	1	ug/g	STD 1	<1
Uranium	439202	0.5	ug/g	STD 2.5	<0.5
Vanadium	439202	2	ug/g	STD 86	34
Zinc	439202	2	ug/g	STD 290	48

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Guideline = O.Reg 153-T1-All Other Soils - Res/Par/Ins/Ind/Com/Prop

OCP/PCB

Lab I.D. 1678387
Sample Matrix Soil153
Sample Type
Sample Date 2023-03-16
Sampling Time 10:00
Sample I.D. BH#3

Analyte Batch No MRL Units Guideline

Aldrin	439192	0.002	ug/g	STD 0.05	<0.002
Chlordane	439192	0.006	ug/g	STD 0.05	<0.006
Chlordane, alpha-	439192	0.002	ug/g		<0.002
Chlordane, gamma-	439192	0.002	ug/g		<0.002
DDD	439192	0.002	ug/g	STD 0.05	<0.002
DDE	439192	0.002	ug/g	STD 0.05	<0.002
DDT	439192	0.002	ug/g	STD 1.4	<0.002
Dieldrin	439192	0.002	ug/g	STD 0.05	<0.002
Endosulfan	439192	0.004	ug/g	STD 0.04	<0.004
Endosulfan I	439192	0.002	ug/g		<0.002
Endosulfan II	439192	0.002	ug/g		<0.002
Endrin	439192	0.002	ug/g	STD 0.04	<0.002
Heptachlor	439192	0.002	ug/g	STD 0.05	<0.002
Heptachlor Epoxide	439192	0.002	ug/g	STD 0.05	<0.002
Hexachlorobenzene	439192	0.002	ug/g	STD 0.01	<0.002
Hexachlorobutadiene	439192	0.002	ug/g	STD 0.01	<0.002
Hexachlorocyclohexane Gamma-	439192	0.002	ug/g	STD 0.01	<0.002
Hexachloroethane	439192	0.002	ug/g	STD 0.01	<0.002
Methoxychlor	439192	0.002	ug/g	STD 0.05	<0.002

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Guideline = O.Reg 153-T1-All Other Soils - Res/Par/Ins/Ind/Com/Prop

Inorganics

Lab I.D. 1678387
Sample Matrix Soil153
Sample Type
Sample Date 2023-03-16
Sampling Time 10:00
Sample I.D. BH#3

Analyte Batch No MRL Units Guideline

Cyanide (CN-)	439232	0.005	ug/g	STD 0.051	<0.005
Electrical Conductivity	439227	0.05	mS/cm	STD 0.57	0.21
pH - CaCl2	439248	2.00			7.51
Sodium Adsorption Ratio	439235	0.01		STD 2.4	0.38

PCB Surrogate

Lab I.D. 1678387
Sample Matrix Soil153
Sample Type
Sample Date 2023-03-16
Sampling Time 10:00
Sample I.D. BH#3

Analyte Batch No MRL Units Guideline

Decachlorobiphenyl	439193	0	%		77
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Report Number: 1994921
Date Submitted: 2023-03-20
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Project: ET23-1017A
COC #: 220941

Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
439192	Chlordane, alpha-	<0.002 ug/g	68	50-140	84	50-140	0	0-40
439192	Aldrin	<0.002 ug/g	69	50-140	80	50-140	0	0-40
439192	Chlordane	<0.006 ug/g					0	
439192	Dieldrin	<0.002 ug/g	73	50-140	80	50-140	0	0-40
439192	Endosulfan	<0.004 ug/g					0	
439192	Endosulfan I	<0.002 ug/g	67	50-140	84	50-140	0	0-40
439192	Endosulfan II	<0.002 ug/g	75	50-140	86	50-140	0	0-40
439192	Endrin	<0.002 ug/g	73	50-140	84	50-140	0	0-40
439192	Hexachlorocyclohexane Gamma-	<0.002 ug/g	72	50-140	83	50-140	0	0-40
439192	Chlordane, gamma-	<0.002 ug/g	65	50-140	80	50-140	0	0-40
439192	Heptachlor	<0.002 ug/g	73	50-140	81	50-140	0	0-40
439192	Heptachlor Epoxide	<0.002 ug/g	69	50-140	80	50-140	0	0-40
439192	Hexachlorobenzene	<0.002 ug/g	102	50-140		50-140	0	0-40
439192	Hexachlorobutadiene	<0.002 ug/g	95				0	
439192	Hexachloroethane	<0.002 ug/g	93				0	
439192	Methoxychlor	<0.002 ug/g	78	50-140	84	50-140	0	0-40
439192	DDD	<0.002 ug/g	75	50-140	82	50-140	0	0-40
439192	DDE	<0.002 ug/g	75	50-140	85	50-140	0	0-40
439192	DDT	<0.002 ug/g	85	50-140	82	50-140	0	0-40
439196	Chromium VI	<0.20 ug/g	101	70-130	89	70-130	0	0-35
439202	Silver	<0.2 ug/g	107	70-130	102	70-130	0	0-20
439202	Arsenic	<1 ug/g	96	70-130	105	70-130	0	0-20
439202	Boron (total)	<5 ug/g	101	70-130	140	70-130	0	0-20
439202	Barium	<1 ug/g	101	70-130	137	70-130	2	0-20
439202	Beryllium	<1 ug/g	99	70-130	103	70-130	0	0-20
439202	Cadmium	<0.4 ug/g	104	70-130	114	70-130	0	0-20
439202	Cobalt	<1 ug/g	104	70-130	104	70-130	0	0-20
439202	Chromium Total	<1 ug/g	109	70-130	133	70-130	20	0-20
439202	Copper	<1 ug/g	110	70-130	107	70-130	0	0-20
439202	Mercury	<0.1 ug/g	90	70-130	104	70-130	0	0-20
439202	Molybdenum	<1 ug/g	107	70-130	105	70-130	0	0-20
439202	Nickel	<1 ug/g	108	70-130	110	70-130	11	0-20

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Project: ET23-1017A
COC #: 220941

Quality Assurance Summary

Batch No	Analyte	Blank	QC % Rec	QC Limits	Spike % Rec	Spike Limits	Dup % RPD	Duplicate Limits
439202	Lead	<1 ug/g	104	70-130	100	70-130	2	0-20
439202	Antimony	<1 ug/g	81	70-130	108	70-130	0	0-20
439202	Selenium	<0.5 ug/g	103	70-130	113	70-130	0	0-20
439202	Thallium	<1 ug/g	105	70-130	100	70-130	0	0-20
439202	Uranium	<0.5 ug/g	95	70-130	100	70-130	0	0-20
439202	Vanadium	<2 ug/g	107	70-130	146	70-130	4	0-20
439202	Zinc	<2 ug/g	100	70-130	118	70-130	1	0-20
439227	Electrical Conductivity	<0.05	103	90-110			1	0-10
439232	Cyanide (CN-)	<0.005 ug/g	94	75-125	101	70-130	0	0-20
439235	Sodium Adsorption Ratio	<0.01					1	
439236	Boron (Hot Water Soluble)	<0.5 ug/g	99	70-130	104	60-140	0	0-30
439248	pH - CaCl2	6.12	101	90-110			0	

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Test Summary

Batch No	Analyte	Instrument	Preparation Date	Analysis Date	Analyst	Method
439192	Chlordane, alpha-	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Aldrin	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Chlordane	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Dieldrin	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Endosulfan	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Endosulfan I	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Endosulfan II	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Endrin	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Hexachlorocyclohexane Gamma-	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Chlordane, gamma-	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Heptachlor	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Heptachlor Epoxide	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Hexachlorobenzene	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Hexachlorobutadiene	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Hexachloroethane	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	Methoxychlor	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	DDD	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	DDE	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439192	DDT	GC/ECD	2023-03-27	2023-03-27	R_G	EPA 8081B/8082A
439196	Chromium VI	FAA	2023-03-27	2023-03-27	MW	M US EPA 3060A
439202	Silver	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Arsenic	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Boron (total)	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Barium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Beryllium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Cadmium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Cobalt	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Chromium Total	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Copper	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Mercury	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Molybdenum	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Nickel	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020

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Report Number: 1994921
Date Submitted: 2023-03-20
Date Reported: 2023-03-27
Project: ET23-1017A
COC #: 220941

Test Summary

Batch No	Analyte	Instrument	Preparation Date	Analysis Date	Analyst	Method
439202	Lead	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Antimony	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Selenium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Thallium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Uranium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Vanadium	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439202	Zinc	ICAPQ-MS	2023-03-27	2023-03-27	SD	EPA 200.8/6020
439227	Electrical Conductivity	Electrical Conductivity Meter	2023-03-27	2023-03-27	Z_S	Cond-Soil
439232	Cyanide (CN-)	Skalar CN Analyzer	2023-03-27	2023-03-27	Z_S	MOECC E3015
439235	Sodium Adsorption Ratio	iCAP OES	2023-03-27	2023-03-27	Z_S	Ag Soil
439236	Boron (Hot Water Soluble)	iCAP OES	2023-03-27	2023-03-27	Z_S	MOECC E3470
439248	pH - CaCl2	pH Meter	2023-03-27	2023-03-27	IP	Ag Soil

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CWS for Petroleum Hydrocarbons in Soil - Tier 1**Notes:**

1. The laboratory method complies with CCME Tier 1 reference method for PHC in soil. It is validated for laboratory use.
2. Where the F1 fraction (C6 to C10) and BTEX are both measured, F1-BTEX is reported.
3. Where the F2 fraction (C10 to C16) and naphthalene are both measured, F2-naphthalene is reported.
4. Where the F3 fraction (C16 to C34) and PAHs* are both measured, F3-PAH is reported.
5. F4G is analyzed if the chromatogram does not descend to baseline before C50. Where F4 (C34 to C50) and F4G are both reported, the higher result is compared to the standard.
6. Unless otherwise stated in the sample comments, the following criteria have been met where applicable:
 - nC6 and nC10 response factors within 30% of response factor for toluene;
 - nC10, nC16, and nC34 response factors within 10% of each other;
 - C50 response factors within 70% of nC10 + nC16 + nC34 average; and,
 - Linearity is within 15%.
7. Unless otherwise stated in the sample comments, sampling requirements and analytical holding times have been met.
8. Gravimetric heavy hydrocarbons (F4G) cannot be added to the C6 and C50 hydrocarbons.
9. *PAHs = phenanthrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-c,d)pyrene and pyrene.

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