Geotechnical Investigation

Proposed Residential Subdivision
Part of East Half and West Half Lot 9, Concession 5, W.H.S
Belfountain, Caledon, Ontario

Attention: Mr. John Spina

Project Number
BRM-00603505-D0

Prepared By:
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1 Introduction

This report presents the results of a Geotechnical Investigation carried out for the proposed residential subdivision development in the Hamlet of Belfountain, Town of Caledon, Ontario. The subject property is owned by the Manors of Belfountain Corporation. The work was authorized by Mr. John Spina.

The site occupies an area between Shaws Creek Road and Mississauga Road, approximately 320 m south of Bush Street in Belfountain. The subject site covers a total area of approximately 70.3 hectares (~174 acres), out of which development area is approximately 50.2 hectares (~124 acres). It is our understanding that the residential subdivision development will include 67 units of estate residential lands, internal access roads and open space lands. Based on the provided information, separate potable water supply well and septic system will be installed for each residential unit. The storm water will be controlled by means of surface water and probably seepage. Therefore, the proposed residential subdivision will not be serviced by municipal watermain and sewer systems. The exact structural details for proposed residential units and internal access roads were not available at the time of preparation of this report.

Previously, **exp** Services Inc. (**exp**) had conducted a geotechnical investigation for the slopes on the north portion of the subject site. The relevant investigation that is within the proposed development area is listed below:

- Slope Stability, Part Lot 9, Concession 5 WHS, Belfountain, Town of Caledon, Ontario. **exp** Project No. BRM-00603505-B0, dated July 22, 2014.

The above cited report is included in Appendix A. The relevant information from the slope stability report have been incorporated in this report.

The purpose of this investigation was to determine the subsurface conditions at the site by drilling a limited number of sampled boreholes and based on the factual borehole data, to provide geotechnical engineering guidelines for the design and construction of the proposed development. Specifically, recommendations and/or comments regarding site grading, foundation type, design geotechnical resistances/reactions, lateral earth pressure, excavation and backfill, groundwater control, permanent drainage requirements, earthquake considerations, and pavement structures were to be provided.

The comments and recommendations given in this report are based on the terms of reference presented above and on the assumption that design will be in accordance with applicable codes and standards. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field

or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2 Site Description

The site is located in a rural area, just south of the Hamlet of Belfountain. Based on the available topographic information and relevant borehole data, the site is generally flat, except for downward slopes to the north at the north portion of the site. There is no watercourse near the toes of the slopes.

The subject site is located at confluence of the physiographic regions known as the Guelph Drumlin Field and Horseshoe Moraines. The top portion of overburden at the site is characterized by glaciofluvial outwash gravel and sand. However, the presence of boulders, silty sand and gravelly interlayers indicates that the deposits are most likely ice contact stratified drift. The ice contact drift overlies a deposit of sandy silt till. These overburden soils are underlain by bedrock consisting typically of white to blue-grey, thick- to massive-bedded dolostones of the Amabel Formation, which belong to the Lower Silurian Period. Previous geotechnical investigations, Ontario Geotechnical Borehole database, Ontario Groundwater records and regional drift thickness mapping indicates that the depth to bedrock in the area of the site may be greater than 16 m. No major waterbody was observed within about 300 m from the site.

Credit River is identified as the nearby major watercourse, about 100 m north from the open space at the north side of the subject site.

3 Investigation Procedure

Drilling and sampling operations, carried out on August 28 and 29, 2017, were completed by a combination of solid/hollow stem continuous flight auger and split-spoon techniques using truck mounted CME-55 drill rig owned and operated by a specialist contractor.

For the current investigation, a total of seven (7) boreholes (BHs 101 through 107) were drilled to depths of 4.6 to 8.2 m below the proposed residential subdivision area. The approximate borehole locations of the current investigation are shown on the attached Borehole Location Plan (Drawing No. 1).

Table 1: Borehole Details

Borehole No.	Ground Surface Elevation (m)	Depth / Bottom Elevation (m)	Northing Coordinate	Easting Coordinate
101	402.51	7.8 / 394.7	4848703	579174
102	404.72	7.9 / 396.8	4848447	579438
103	402.86	8.2 / 394.7	4848772	579471
104	401.92	8.2 / 393.7	4848695	579738
105	404.02	7.9 / 396.1	4849029	579642
106	402.73	4.6 / 398.1	4848971	579880
107	404.40	7.7 / 396.7	4849205	579995

The location and ground surface elevation of the boreholes were determined in the field by **exp**. The borehole locations were established prior to the drilling works by **exp** personnel using hand-held Global Positioning System (GPS) units – Garmin eTrex Legend H. The exploratory boreholes were also located in the field by **exp** in accordance with proposed borehole location plan and existing site features. The top elevations of the boreholes were established by Sokkia GRX2 with GNSS Receiver.

Prior to the commencement of drilling operations, underground services were cleared to minimize the risk of encountering any such services during the drilling operations.

A representative of **exp** was present throughout the drilling operations to monitor and direct the drill operations, and to record borehole information. Representative samples of the subsurface soils were recovered at regular intervals using conventional 50 mm O.D. split spoon sampling equipment driven in accordance with the procedures of Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM D1586). All split spoon

samples were returned to **exp**'s Brampton laboratory for further geotechnical testing, which included moisture content and grain size distribution determinations on selected samples.

Water levels were observed in the open boreholes during the course of the fieldwork. Subsequent water level monitoring was carried out in piezometers installed in Boreholes 102, 105 and 107.

4 Subsurface Conditions

The detailed soil profiles encountered in each borehole and the results of geotechnical laboratory testing are indicated on the attached borehole logs (Drawings Nos. 2 through 8). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

Drawing No. 1A Notes on Sample Description preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The following is a brief description of the soil conditions encountered during the current investigation.

4.1 Soil Conditions

Topsoil

Topsoil was encountered from ground surface in all boreholes. The thickness of topsoil found in the borehole locations ranged from 200 to 500 mm.

It should be noted that the topsoil quantity should not be established from the information provided at the borehole locations only. If required, a more detailed analysis which involves shallow test pits should be carried out to accurately quantify the amount of topsoil to be removed for construction purpose.

Reworked Materials

Underneath the topsoil, reworked materials were encountered in all boreholes. The materials predominantly consisted of dark brown to brown sandy silt to silty sand mixed with trace clay to clayey, trace to some gravel, trace rootlets, occasional boulder fragments. The reworked materials extended to depths varying from 0.6 to 1.4 m below the existing ground surface or to elevations ranging from 404.1 to 400.5 m.

The compactness status of the reworked materials was loose to compact as suggested by SPT N-values of 5 to 15 blows/0.3 m. The moisture contents within the materials were found to range from 6 to 17 percent of dry weight, indicating a moist condition.

Sand and Gravel

A layer of sand and gravel was encountered beneath the reworked materials in all boreholes. This deposit extended to borehole termination depths of between 4.6 and 8.2 m below existing grade or to elevations ranging from 398.1 to 393.7 m. This ice contact drift contains sand, silty sand, sandy silt and clayey silt stratified interlayers. Occasional to frequent cobble and boulder fragments were also observed in the boreholes.

Grain size analyses were carried out in the geotechnical laboratory on selected sand and gravel samples and sandy silt interlayer samples. The test results are summarized in Table 2 below, and are included in Appendix B of this report.

Table 2: Grain Size Distributions of Sand and Gravel

Sample No.	Sample Description (m)	Gravel (%)	Sand (%)	Silt + Clay (%)
101 / SS7	Sandy silt interlayer	2	41	57
105 / SS6	Sand, some silt, trace gravel	5	83	12
107 / SS4	Sand and Gravel, some silt	49	37	14

SPT conducted in this brown non-cohesive deposit, recorded N-values in the range of 13 to in excess of 50 blows/0.3 m, indicating a compact to very dense compactness condition, typically dense to very dense. In general, the compactness condition of this deposit increases with the increasing depth. This deposit was moist, with natural moisture contents ranging from 2 to 8 percent of dry weight. An elevated moisture content of 17 percent of dry weight was found at the silty sand interlayer in Borehole 102.

The presence of cobbles and boulders should always be anticipated in the ice contact drift, owing to their mode of deposition. In fact, auger grinding was noted within this deposit during this investigation in Boreholes 102, 103, 104, 106 and 107, indicating the presence of cobbles and/or boulders.

4.2 Groundwater Conditions

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork and in piezometers installed in selected boreholes. Short-term observations are recorded on the attached borehole logs and summarized in Table 3 below.

Table 3: Summary of Observed Groundwater Levels

Borehole No.	Groundwater Monitoring		
	Depth / Elevation of the Tip of Piezometer	Measurement Date	Measured Water Level Depth / Elevation
101	N/A	August 28, 2017	Dry
102	7.6 / 397.1	August 28, 2017 September 8, 2017	Dry Dry
103	N/A	August 28, 2017	Dry
104	N/A	August 28, 2017	Dry
105	7.6 / 396.4	August 29, 2017 September 8, 2017	Dry Dry
106	N/A	August 29, 2017	Dry
107	7.6 / 396.8	August 29, 2017 September 8, 2017	Dry Dry

Based on the configurations of the piezometers and the observation of groundwater, the groundwater level at the time of the investigation generally below an approximate depth of 7.6 m, corresponding to Elevations from 397.1 to 396.4 m. For design purposes, it is our opinion that groundwater level can be considered at an approximate geodetic Elevation 396.5 m.

These short term observations may not represent the long term groundwater table at the site, due to the short period of observation. In the long term, it should be noted that the groundwater levels can vary seasonally and are subject to fluctuations in response to major weather events. Furthermore, perched groundwater should be expected at the clayey silt interlayer in the sand and gravel.

5 Geotechnical Recommendations

The proposed development involves the design and construction of residential units with the anticipated one level basement and internal access roads. However, it is understood that the final founding levels of the residential units and roads had not been established at the time of the current investigation.

5.1 Residential Units

5.1.1 *Site Grading*

With consideration of the topographic features of this site, site grading may need to be carried out. It is anticipated that cutting of topsoil, reworked materials and the upper portion of the native sand and gravel, and filling at weak or low zones may be required.

The following procedures are recommended for the construction of cutting and filling for residential units and internal access roads, where required.

- Piezometers at the site should be properly decommissioned in accordance with MOE regulations.
- Foundations and slabs associated with the abandoned structures should be removed and disposed off site.
- All vegetation, topsoil, topsoil-stained, reworked materials and loose/soft native soils should be removed from the proposed building and pavement areas.
- The exposed subgrade surface should be proof rolled with a heavy roller and examined by a geotechnical engineer. Any soft areas detected during the proof rolling process should be sub-excavated and replaced with approved material.
- Low areas can then be brought up to final subgrade level with approved on-site or imported material placed in lifts not exceeding 300 mm and compacted to 100 percent standard Proctor maximum dry density (SPMDD) within building areas (“engineered fill”) and 95 percent SPMDD up to 600 mm below the final subgrade level and 98 percent SPMDD for the upper 600 mm in pavement areas. The moisture content of the fill to be placed should be at or just less than its optimum moisture content in order to assure the specified densities can be achieved with reasonable compactive effort. Any organic or excessively wet or otherwise deleterious material should not be used for backfilling purposes.
- Fill and cut slopes should not be steeper than 1 horizontal to 1 vertical and should be protected from surface erosion.

- All imported borrow fill material from local sources should be free from organic material and foreign objects (i.e. tree roots, debris, etc.) and should be tested geotechnically by **exp** prior to transport to the site. In addition, the chemical quality of the borrow fill material should be assessed by **exp** in accordance with applicable soil criteria listed in the Ministry of the Environment standards (O.Reg. 511/09) dated April 15, 2011.

- All excavation, backfilling and compaction operations should be monitored on a full-time basis by geotechnical staff to approve materials and to ensure the specified degrees of compaction have been obtained.

- No engineered fill is expected to exceed 3 m in thickness for this site. However, if engineered fill exceeds 3 m in thickness, it must be monitored with settlement points to determine when compaction due to self-weight has completed. Structures should not be placed on the engineered fill until it is confirmed that the settlements have finished.

5.1.2 *Foundation Considerations*

For the proposed residential units with the assumption of one level of basement, it is anticipated that the foundations will be set at about 2 m below the existing grade. The use of spread and strip footings to support the proposed structures is considered feasible, based on the results of the investigation.

The proposed structures can be supported on conventional shallow foundations founded on the undisturbed dense to very dense sand and gravel. The recommended highest founding levels, geotechnical reaction at serviceability limit states (SLS) and factored geotechnical resistance at ultimate limit states (ULS) are summarized in Table 4.

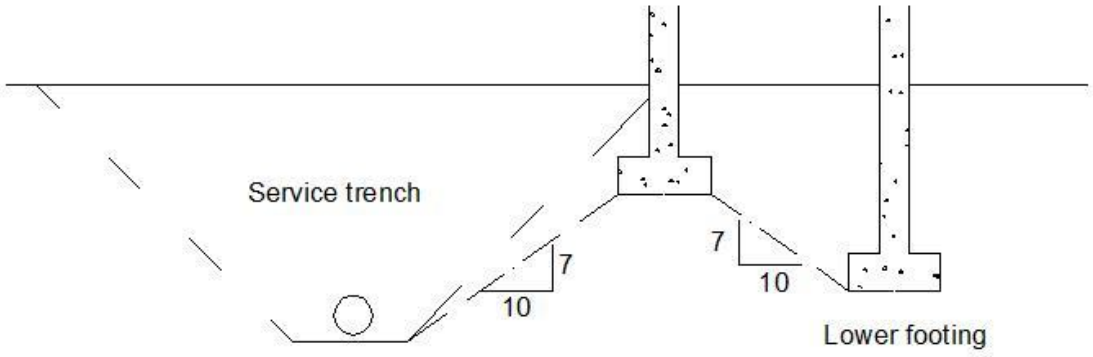
Table 4: Highest Founding Depths/Elevations and Allowable Bearing Pressures for Spread and Strip Footings

Borehole No.	Highest Founding Depth / Elevation (m)	Bearing Pressure SLS / ULS (kPa)	Soil Type
101	1.5 / 401.0	300 / 450	Compact sand and gravel
102	1.5 / 403.2	300 / 450	Dense sand and gravel
103	1.5 / 401.4	300 / 450	Dense sand and gravel
104	1.7 / 400.2	300 / 450	Dense sand and gravel
105	1.5 / 402.5	300 / 450	Dense sand and gravel
106	1.5 / 401.2	300 / 450	Very dense sand and gravel
107	1.5 / 402.9	300 / 450	Dense sand and gravel

It is anticipated that the foundations of the proposed structures will to be founded on native undisturbed sand and gravel. The required geotechnical resistance/reaction values are likely well within the recommendations provided in the above table.

5.1.3 *Foundations General*

Adjacent footings at different elevations should be located such that higher footings are set below a line drawn up at ten (10) Horizontal to seven (7) Vertical (10H:7V) from the near edge of the lower footing. This concept should also be applied to excavations for new foundations in relation to existing footings or underground services. This concept is illustrated in the following sketch.



FOOTINGS NEAR SERVICE TRENCHES OR AT DIFFERENT ELEVATIONS

All footing caps exposed to freezing conditions must be provided with a minimum of 1.5 m of earth cover or equivalent insulation for frost protection, depending on the final grade requirements.

The total and differential settlements of well designed and constructed footings on native soil and on engineered fill placed in accordance with the above recommendations are expected to be less than normally tolerated limits of 25 and 19 mm, respectively.

The recommended geotechnical resistances/reactions have been calculated by **exp** from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of underground conditions becomes available. For example, it should be appreciated that modifications to bearing levels may be required if unforeseen subsoil conditions are revealed after the excavation is exposed to full view or if

final design decisions differ from those assumed in this report. For this reason, this office should be retained to review final foundation drawings and to provide field inspections during the construction stage.

5.1.4 *Lateral Earth Pressure*

The lateral earth pressure acting on basement walls for the proposed buildings may be calculated from the following equation:

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

where p = lateral earth pressure in kPa acting at depth h
K = earth pressure coefficient, recommend 0.4 for soil
γ = unit weight above groundwater table, recommend 20 kN/m^3 for soil
h = depth to point of interest in m
q = equivalent value of surcharge on the ground surface in kPa (minimum of 12 kPa)

5.1.5 *Excavations and Groundwater Control*

Excavation for the proposed structures can be carried out utilizing conventional hydraulic type backhoe. No major problem is anticipated during foundation excavation, as the reworked materials and native soils at the site are generally non-cohesive. Note that the native sand and gravel is a non-sorted sediment and therefore the presence of cobbles and boulders may influence the progress of excavation. Consequently, provisions should be made in the excavation contract documents to cover any delays caused by cobbles and boulders in the sand and gravel.

All excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). The soil encountered at this site can be classified as follows:

Reworked materials (loose to compact)	Type 3 above water level
Sand and gravel (dense to very dense)	Type 2 above water level

The borehole data revealed that the reworked materials and native sand and gravel were typically in a moist state. The excavation of the proposed structures would be above groundwater table. It is anticipated that groundwater seepage or surface runoff entering the excavation can likely be controlled by gravity drainage and conventional pumping.

5.1.6 *Backfill Considerations*

On-site verification of the excavated soils for re-use as backfill by suitably qualified personnel, during construction, would be required. The existing reworked materials that contain organics and boulder fragments should be removed from the site. The excavated soils free from topsoil, organics, cobbles, boulders, frozen soils, etc. can be used as general

construction backfill. Based on visual and tactile examination, the on-site excavated native deposits are considered to be suitable for re-use as general construction backfill provided their moisture contents at the time of construction are at or near optimum. Some water content adjustment may be required for efficient compaction.

Backfill used to satisfy basement wall, underfloor slab requirements, in footings and service trenches, etc., should be compactible fill, i.e., inorganic soil with its moisture content close to its optimum moisture content as determined in the Standard Proctor Maximum Dry Density (SPMDD) test. For ease of compaction and quality control in confined areas, granular fill, such as OPSS 1010 Granular B is recommended. The backfill should be placed in lifts not more than 200 mm thick in the loose state, each lift being compacted to at least 98 percent SPMDD, before subsequent lifts are placed. The degree of compaction achieved in the field should be checked by in-place density tests. Heavy compact equipment should not be used adjacent to the basement walls.

The on-site excavated soils are not considered to be free draining. Where free-draining backfill is required, or in confined areas, imported granular such as OPSS Granular B is recommended.

Note that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should therefore be compacted at the surface and/or be covered with tarpaulins to help minimize moisture ingress.

Stockpiles should be placed well away from the edge of excavation and their height should be controlled so that they do not surcharge the sides of the excavation. Surface drainage should be controlled to prevent flow of surface water into the excavations.

5.1.7 *Floor Slabs and Permanent Drainage*

For the proposed building structures, the floor slab may be constructed as a slab-on-grade on native soils. No special problems are anticipated for slab-on-grade construction provided the procedures outlined in the Section 5.1.1 - Site Grading of the report are adhered to.

For the structural design of the concrete slab-on-grade, a combined modulus of subgrade / granular base reaction coefficient of 20 MPa/m can be used on the native compact to very dense non-cohesive soils.

A minimum of 200 mm thick layer of 19 mm clear crushed stone should be placed between the prepared subgrade and the floor slab to serve as a moisture barrier.

The slab-on-grade level is anticipated to be above the groundwater table at this site. As such, no permanent underfloor drainage is required.

5.1.8 *Earthquake Considerations*

The recommendations for the geotechnical aspects to determine the earthquake loading for design using the Ontario Building Code (OBC) 2012 are presented below.

Subsoil Conditions

The subsoil and groundwater information at this site have been examined in relation to Section 4.1.8.4 of the OBC. The subsoils at this subject site generally consist of reworked materials and native sand and gravel. It is anticipated that the proposed structures will be founded on conventional spread and strip footings on the undisturbed dense to very dense sand and gravel.

Depth of Boreholes

Table 4.1.8.4.A Site Classification for Seismic Site Response of the OBC indicated that to determine the site classification, the average properties in the top 30 m (below the lowest basement level) are to be used. The deepest borehole advanced at this site was at about 8.2 m in depth. Therefore, the site classification recommendation would be based on the available information as well as our interpretation of conditions below the boreholes based on our knowledge of the soil conditions in the area.

Site Classification

Based on the above assumptions, interpretations and the general understanding of soil conditions of the area, the seismic class for the proposed structures at this site is Class C, as per the Table 4.1.8.4.A of the OBC. Accordingly, the foundation factors F_a and F_v can be obtained from Tables 4.1.8.4.B and 4.1.8.4.C of the OBC, respectively, for the design of the structure.

5.2 Internal Access Roads

The recommended pavement structures are presented in Series 200 Drawings – Road Standards in the Town of Caledon Development Standards, Policies and Design Requirements. The anticipated subgrade material for the pavement structure will primarily consist of typically compact to very dense sand and gravel or compacted engineered fill consisting of the on-site native soils. The recommended pavement structures provided in Table 5 below are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of ten years has been used to establish the pavement recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements which will

involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soil, as well as specific data input from the Client.

Table 5: Recommended Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Local Roadway
Asphaltic Concrete (OPSS 310/1150)	92 to 96.5% MRD[1]	40 mm HL3 65 mm HL8
OPSS Granular A Base (OPSS 1010)	100% SPMDD[2]	150 mm
OPSS Granular B Subbase (OPSS 1010)	100% SPMDD[2]	300 mm

Notes: 1. MRD – Maximum relative density
2. Denotes standard Proctor maximum dry density, MTO LS-706 (Procedure 3)

The subgrade should be compacted to 98 percent SPMDD for at least the upper 300 mm.

The foregoing design assumes that construction is carried out during dry periods and that the subgrade is stable under the load of construction equipment. If construction is carried out during wet weather, and heaving or rolling of the subgrade is experienced, additional thickness of granular material may be required.

The long-term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure that uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum gradient of three percent) to provide effective surface drainage toward catch basins or road edges. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and to prevent subgrade softening.

Additional comments on the construction of the internal access road are as follows:

- As part of the subgrade preparation, internal access road should be stripped of topsoil and other obviously unsuitable material. Fill required to raise the grades to design elevations should be organic-free and at a moisture content which will permit compaction to the densities indicated. The subgrade should be properly shaped, crowned, then proof-rolled in the full-time presence of a representative of this office. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98 percent SPMDD.

- The location and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed site grading. In view of the significant silt content of the subgrade soils, we recommend perimeter subdrains be provided on both sides of the roadway at least 300 mm below the granular subbase. In addition, subdrains extending from and between catchbasins should also be installed. This will ensure no water collects in the granular course which could result in pre-mature pavement failure during the spring thaw.

- To minimize the problems of differential movement between the pavement and catchbasins / manholes due to frost action, the backfill around the structures should consist of free-draining granular. In addition, the catchbasin should be perforated just above the drain and the holes screened with filter cloth.

- The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavorable weather.

- To prevent water ponding at the lower pavement areas, it is recommended that catchbasins should be provided to drain the surface run-offs.

It is recommended that **exp** be retained to review the final pavement structure design and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

6 Environmental Considerations

The terms of reference included chemical testing of soil for general soil quality. Accordingly, five (5) soil samples were submitted for chemical testing. The samples were submitted to an independent analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA). The soil samples were analyzed for following parameters listed in the Ministry of the Environment and Climate Change (MOECC) document "*Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act*" dated April 15, 2011 (MOECC Standards):

- Metals and general inorganics (5 samples)
- Volatile organic compounds (VOCs) and petroleum hydrocarbons (PHCs) F1 to F4 fractions (2 samples)
- One (1) composite sample was also analyzed for TCLP (Toxicity Characterization Leaching Procedure) inorganic and PCB parameters for waste classification purposes in accordance with Ontario Regulation 558/00.

The chemical testing was carried out to assist in the selection of disposal options for excess material to be generated during proposed construction activities including site grading. Based on the soil stratigraphy as revealed in the boreholes, the soil encountered is visually assessed as coarse textured and therefore the criteria for coarse textured soils from the MOECC Standards were applied to the site.

Sample location data is shown below and Certificates of Analyses for the selected inorganic parameters are attached in Appendix C for your reference.

Table 6: Sample and Test Performed

Sample Identification	Sample Depth (m)	Material	Test Performed
101 / SS1	0.0 – 0.6	Reworked materials	Metals and inorganic parameters
102 / SS3	1.5 – 2.1	Native	Metals and inorganic parameters
104 / SS2	0.8 – 1.4	Reworked materials	Metals and inorganic parameters
105 / SS3	1.5 – 2.1	Native	Metals and inorganic parameters
107 / SS2	0.8 – 1.4	Native	Metals and inorganic parameters

Comparison with the criteria in Table 2 (potable groundwater) from the above mentioned MOECC document was selected as being most appropriate for the purpose of this study. The selection of Table 2 was based on the following site conditions:

- The property has not been identified as a sensitive site.
- The groundwater will be in use for potable purposes.
- Full restoration of contamination (if encountered) is assumed.

Based on the proposed property use of the site (residential subdivision), residential/parkland/institutional (RPI) property use criteria under the Standards were considered to be applicable.

All of the analytical test results indicate conformance with the Table 2 RPI property use criteria adopted for the Site.

Based on the chemical test results, excess soil from the site is considered suitable for re-use on site or for off-site disposal at any land based sites being developed.

Alternatively, the excess material from the site can be disposed of at licensed landfill sites.

7 General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation.

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

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

More specific information, with respect to the conditions between samples, or the lateral and vertical extent of materials, may become apparent during excavation operations. The interpretation of the borehole information must, therefore, be validated during excavation operation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, **exp** Services Inc. should be contacted to assess the situation and additional testing and reporting may be required. **exp** Services Inc. has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

exp Services Inc.

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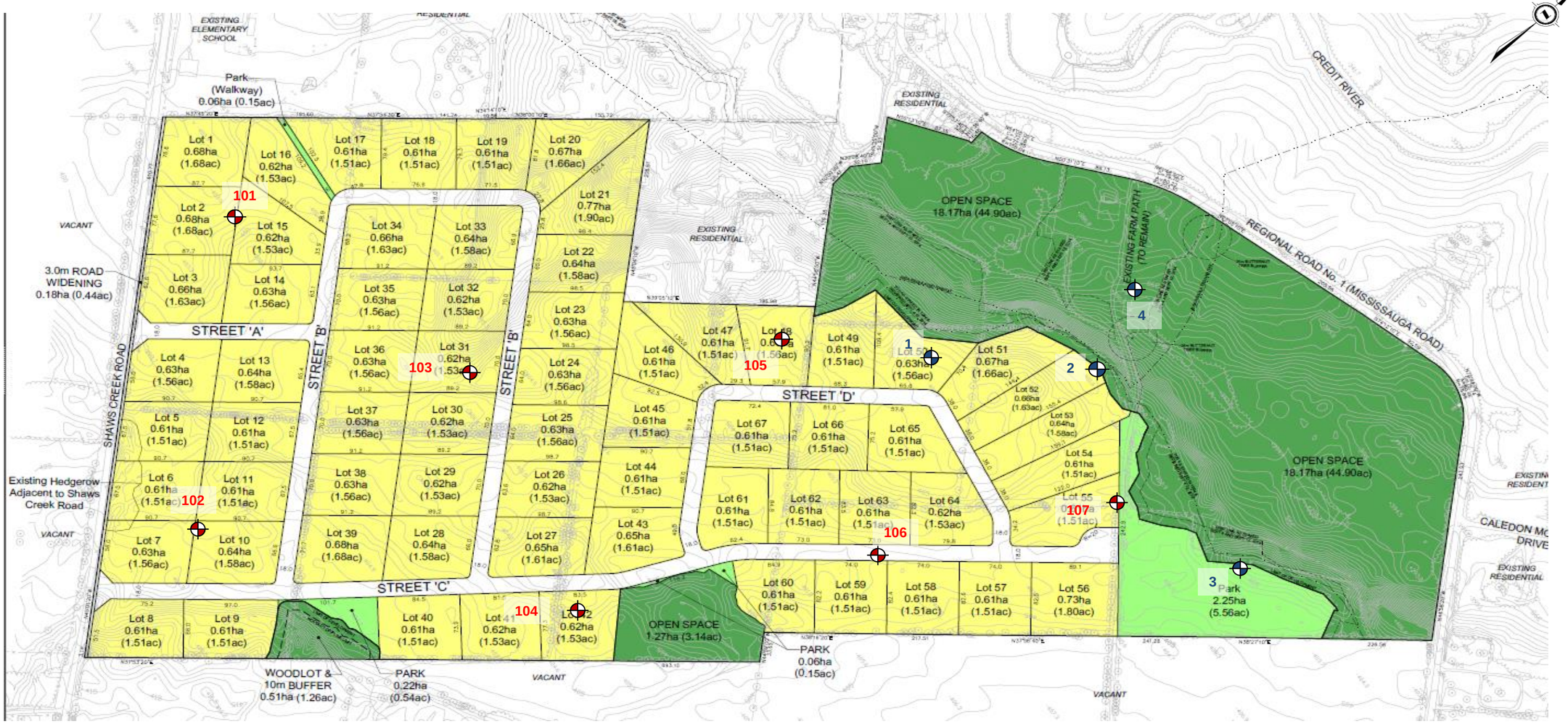
DRAWINGS



LEGEND:

- Current Approximate Borehole Location
- Previous Approximate Borehole Location (exp 2014)

exp Services Inc.

DRAWN :	HW
CHECKED :	AA
P.M. :	AA
SCALE :	NFS
PAPER SIZE :	11 x 17

BOREHOLE LOCATION PLAN

Proposed Residential Subdivision Development

Part of East Half and West Half Lot 9, Concession 5, W.H.S.

Belfountain, Town of Caledon, Region Municipality of Peel

REFERENCE : BRM-00603505-D0

DRAWING NO. : 1

I:\2003-Brampton\Projects\Geotechnical Engineering\06000006030001603505-D0\Geo\GEO Report (Revisions to plan)\Drawing_603505-D0 (revised plan).xls

Notes on Sample Descriptions and Soil Types — Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** also follow the same system. Others may use different classification systems; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETERS

CLAY (PLASTIC) TO SILT (NONPLASTIC)	FINE	MEDIUM	COARSE	FINE	COARSE
	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

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 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.

4. Excerpt from "OHSA Regulations for Construction Projects," Part III, Section 226:

- **Soil Types**

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 a 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.

O. Reg. 213/91, s. 226

Log of Borehole 101

Project No. BRM-00603505-D0 Drawing No. 2

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 28, 2017

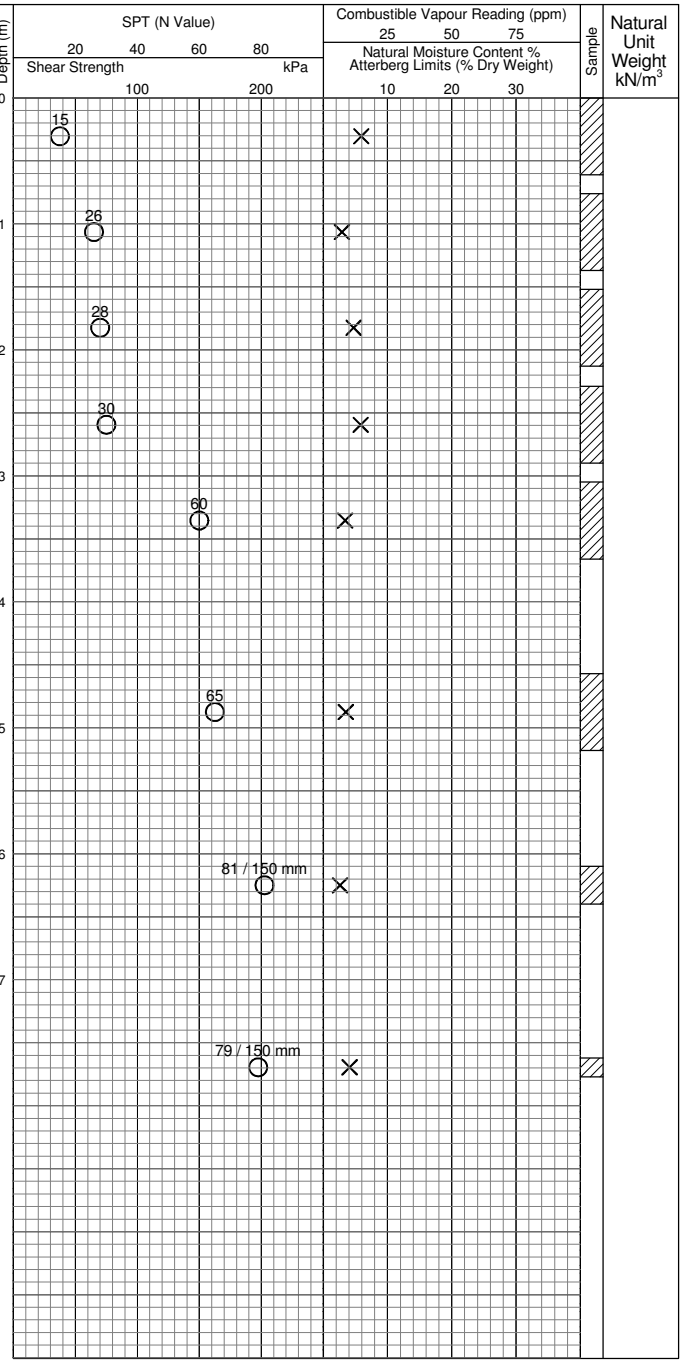
Drill Type: CME 55, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL 230mm	402.51
REWORKED MATERIAL: sandy silt to silty sand, trace to some gravel, trace rootlets, dark brown to brown, moist	~402.3
SAND AND GRAVEL: trace silt, occasional cobble and boulder fragments, brown, compact to very dense, moist	~401.9
sandy silt	
END OF BOREHOLE	~394.7



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.6

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/7/17

Log of Borehole 102

Project No. BRM-00603505-D0 Drawing No. 3

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 28, 2017

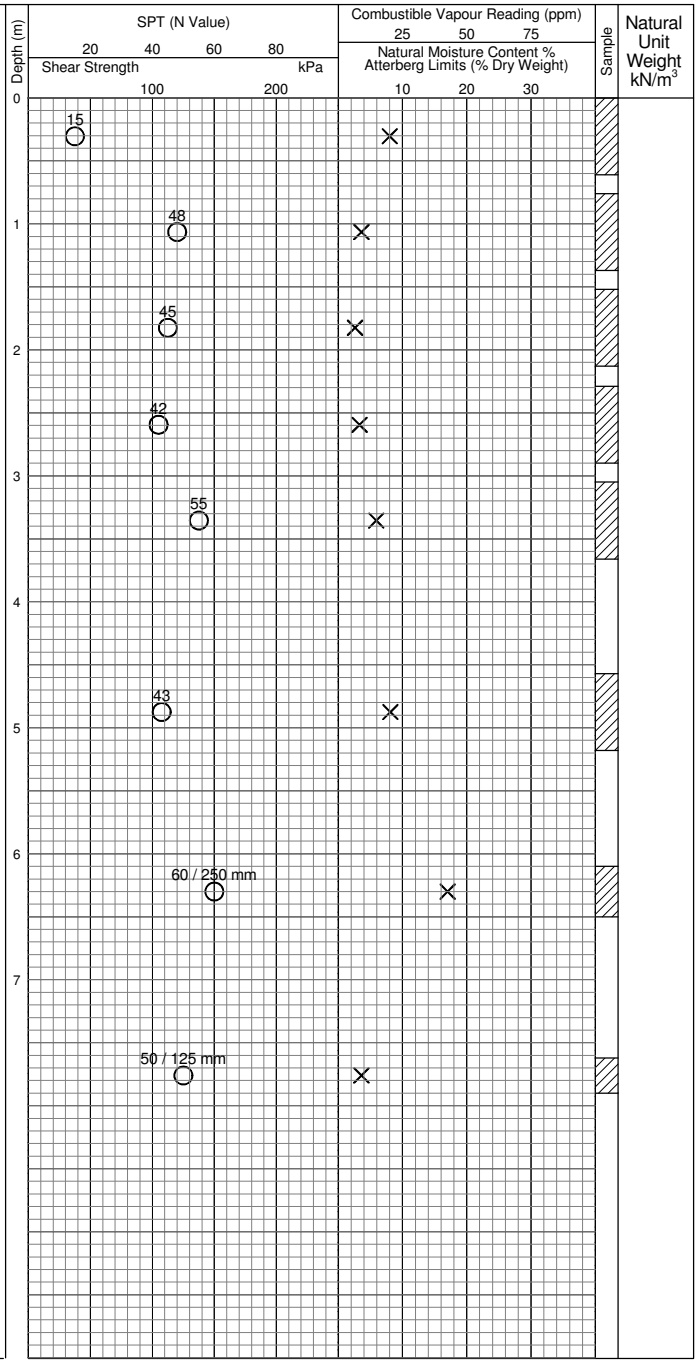
Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		TOPSOIL 280mm	404.72
		REWORKED MATERIAL: sandy silt to silty sand, some to trace clay, trace gravel, trace rootlets, reddish brown to brown, moist	~404.4
		SAND AND GRAVEL: some silt, occasional cobble and boulder fragments, brown, dense to very dense, moist	~404.1
		---------- silty sand, trace gravel ---------- auger grinding	~396.8
		END OF BOREHOLE	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	-
Sep. 8, 2017	Dry	

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/8/17

Log of Borehole 103

Project No. BRM-00603505-D0 Drawing No. 4

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 28, 2017

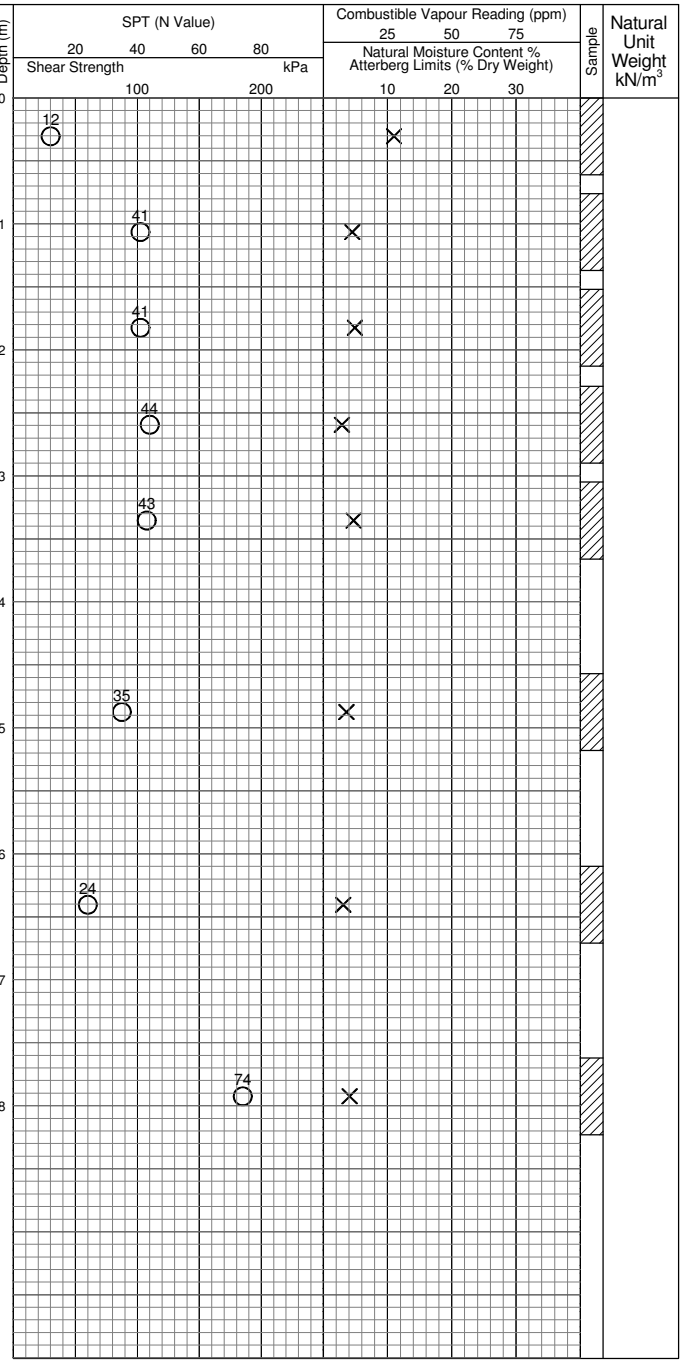
Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
	402.86
TOPSOIL 200mm	~402.7
REWORKED MATERIAL: sandy silt to silty sand, some clay, trace gravel, trace rootlets, dark brown to reddish brown, moist	~402.3
SAND AND GRAVEL: some silt, occassional cobble and boulder fragments, brown, dense to very dense, moist	
auger grinding	
compact	
	~394.6
END OF BOREHOLE	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.4

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/5/17

Log of Borehole 104

Project No. BRM-00603505-D0 Drawing No. 5

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 28, 2017

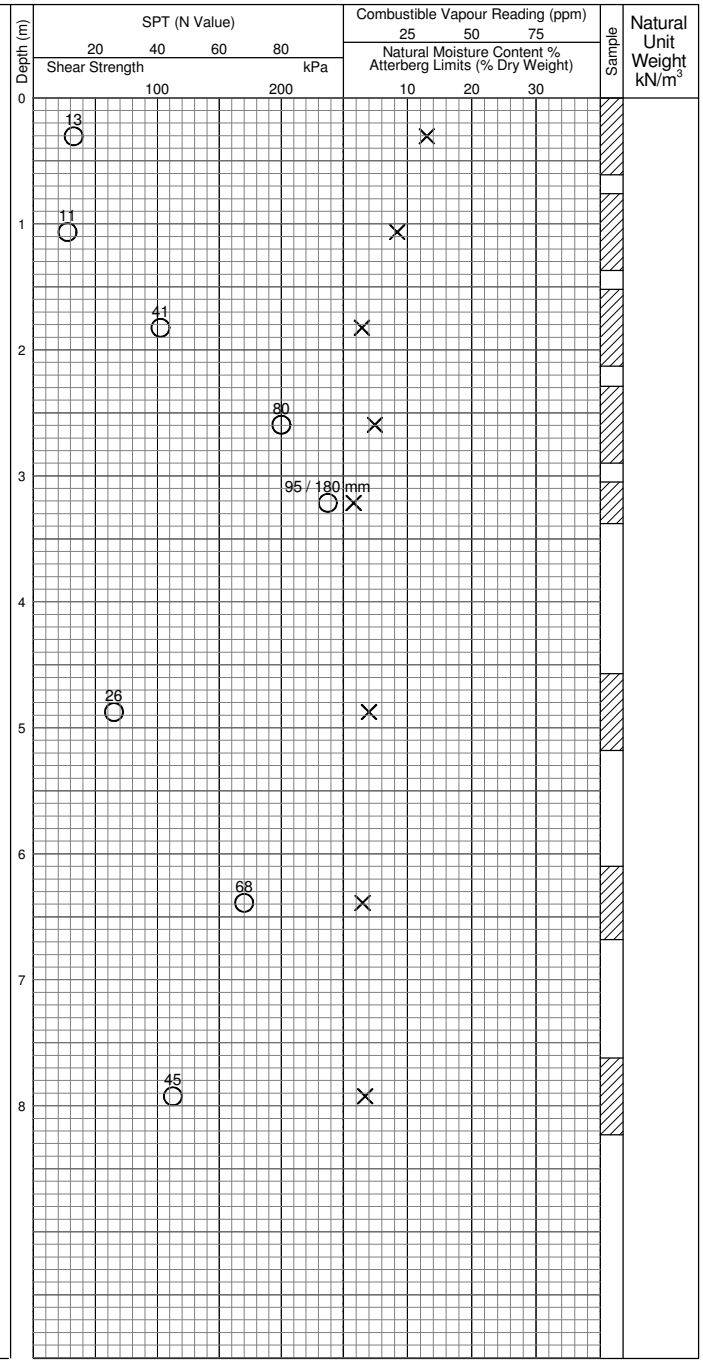
Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL 300mm	401.92
REWORKED MATERIAL: sandy silt to silty sand, clayey to some clay, trace gravel, trace rootlets, reddish brown to brown, moist	~401.6
SAND AND GRAVEL: some silt, frequent cobble and boulder fragments, brown, dense to very dense, moist	~400.5
auger grinding	
auger grinding	
compact	
END OF BOREHOLE	~393.7



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.3

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/5/17

Log of Borehole 105

Project No. BRM-00603505-D0 Drawing No. 6

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 29, 2017

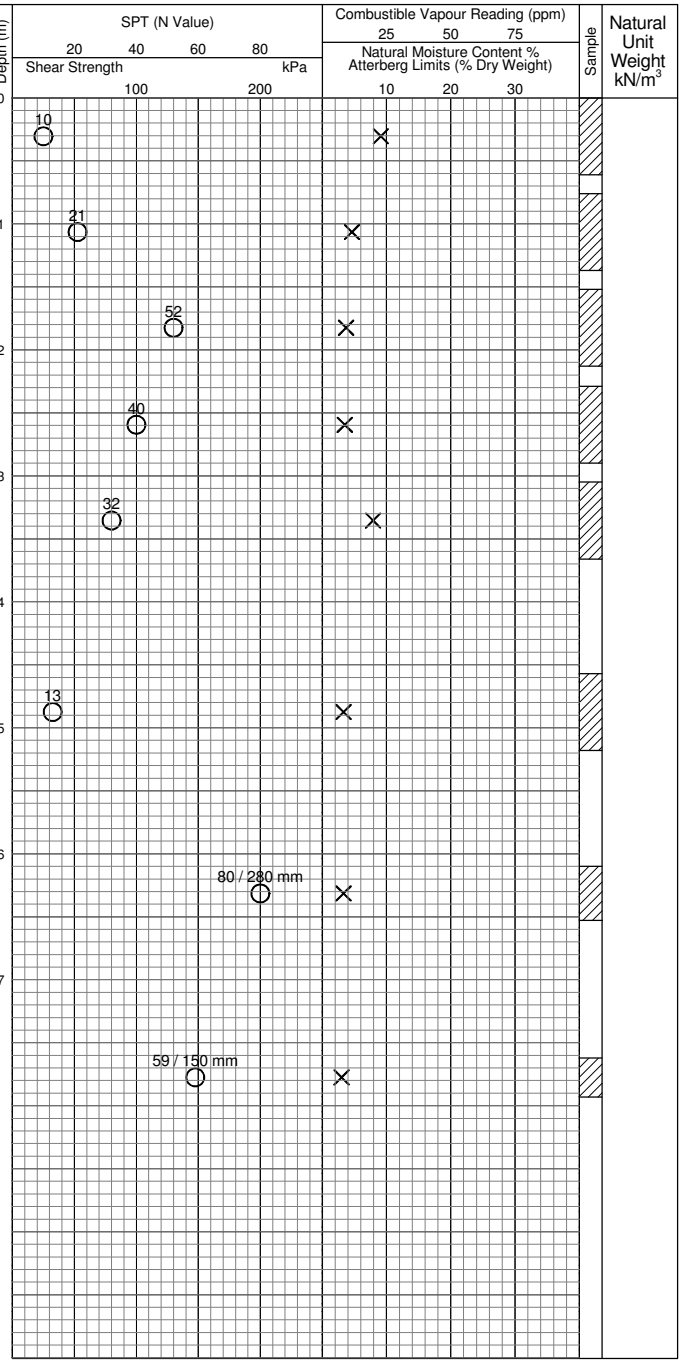
Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL 300mm	404.02
REWORKED MATERIAL: sandy silt to silty sand, clayey to trace clay, trace to some gravel, trace rootlets, dark brown to brown, moist	~403.7
SAND AND GRAVEL: silty to some silt, occasional cobble and boulder fragments, brown, compact to very dense, moist	~403.4
clayey silt	
sand, trace gravel, grey	
END OF BOREHOLE	~396.1



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	-
Sep. 8, 2017	Dry	

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/8/17

Log of Borehole 106

Project No. BRM-00603505-D0 Drawing No. 7

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

Date Drilled: August 29, 2017

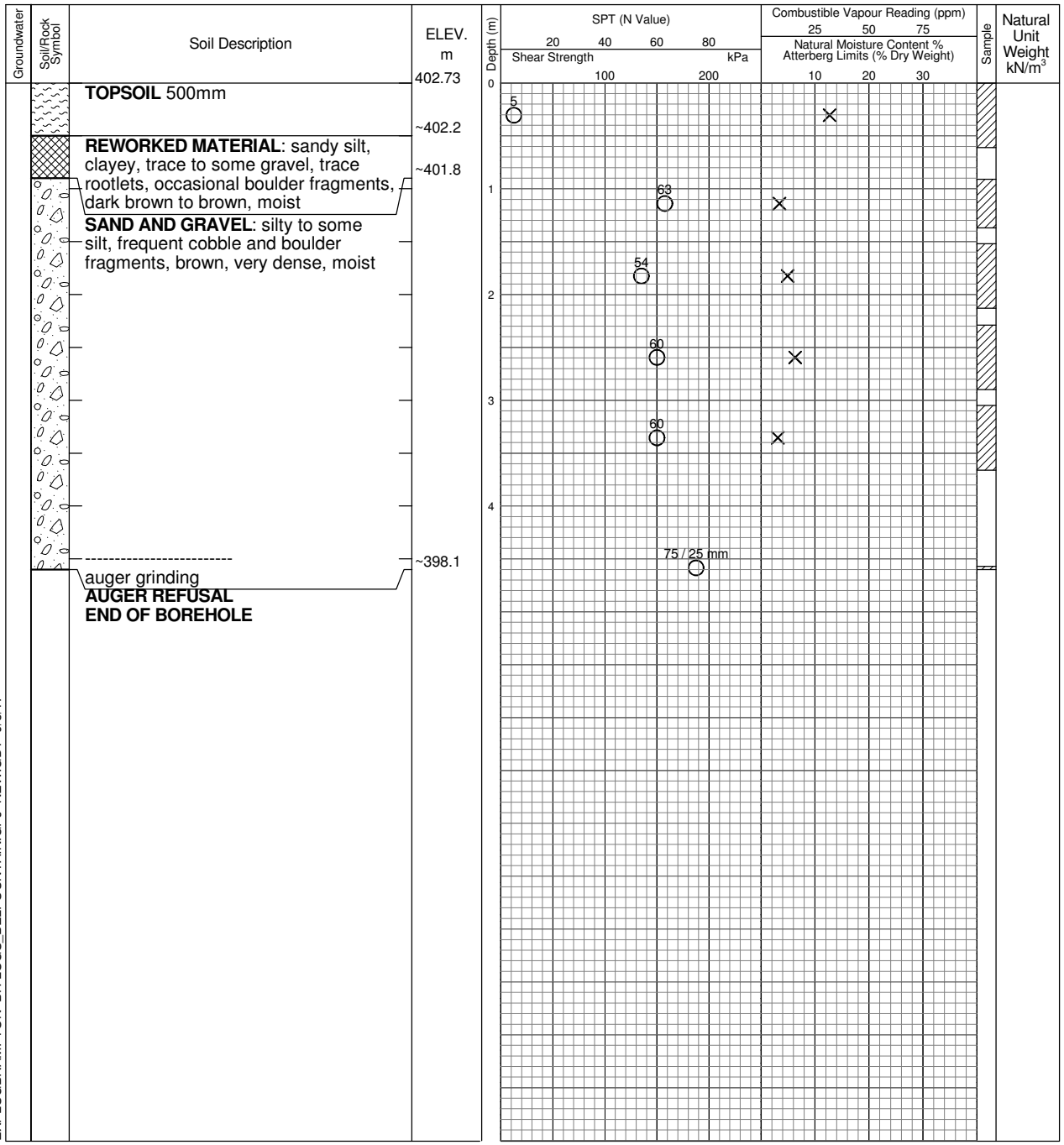
Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
TOPSOIL 500mm	402.73
	~402.2
REWORKED MATERIAL: sandy silt, clayey, trace to some gravel, trace rootlets, occasional boulder fragments, dark brown to brown, moist	~401.8
SAND AND GRAVEL: silty to some silt, frequent cobble and boulder fragments, brown, very dense, moist	
auger grinding	~398.1
AUGER REFUSAL	
END OF BOREHOLE	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	-

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/5/17

Log of Borehole 107

Project No. BRM-00603505-D0 Drawing No. 8

Project: Preliminary Geotechnical Investigation Sheet No. 1 of 1

Location: Part of East Half and West Half Lot 9, Concession 5, W.H.S., Belfountain, Town of Caledon

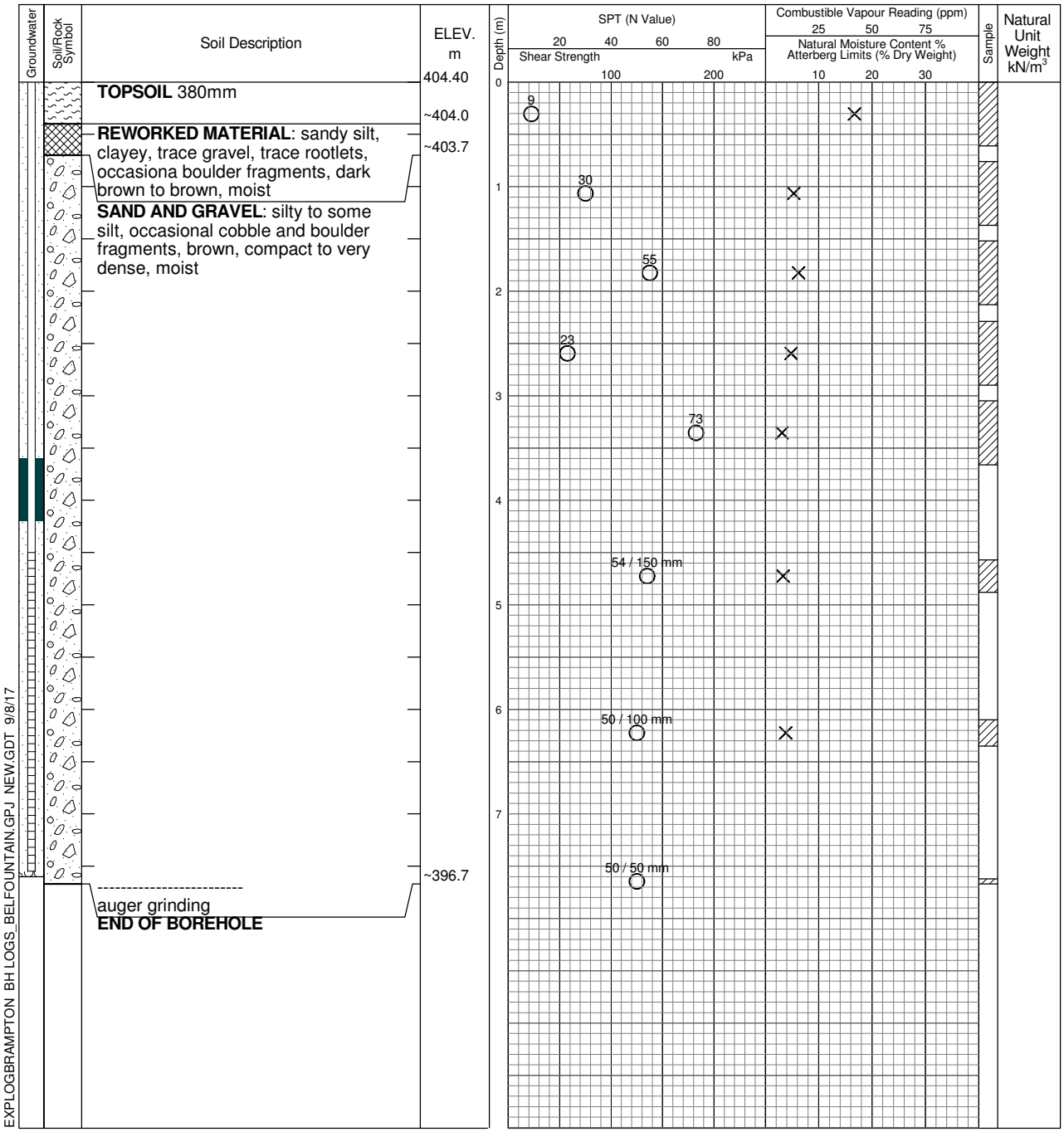
Date Drilled: August 29, 2017

Drill Type: CME 55, Hollow Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	-
Sep. 8, 2017	Dry	

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 9/8/17

APPENDICES

APPENDIX A

Slope Stability Report -2014

Slope Stability
Part Lot 9
Concession 5 WHS
Belfountain
Town of Caledon, Ontario

Client
Orb Property Corporation.

Project Number
BRM-00603505-B0

Prepared By:
Exp Services Inc.
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada

Date Submitted
July 22, 2014

Table of Contents

Drawings

Appendices

1. Introduction

This report presents the results of a slope stability analysis carried out for the slope located at the rear of Part of Lot 9, Concession 9 Belfountain, Town of Caledon, Ontario. The work was authorized by Ms. Karen Bennett of Glen Schnarr & Associates Inc. on behalf of Orb Property Corporation.

It is understood that the location of the Long Term Stable Top of Slope is required. The Long Term Stable Top of Slope is defined as an imaginary slope with a factor of safety of 1.5 as well as an allowance for toe erosion. At this location, toe erosion is not considered to be an issue.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Procedure

The fieldwork was carried out on June 12 and 13, 2014. At that time four boreholes were advanced to depths ranging from 4.9 to 12 m by a drilling subcontractor using a bombardier mounted drill rig. Initially three boreholes about 15 m deep were proposed; however the presence of numerous boulders in the glacial deposit at this site prevented drilling to the proposed depths and therefore an additional borehole(Borehole 4) was drilled at the base of the slope.

The boreholes were advanced with solid stem continuous flight augers. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 623 N and dropping 760 mm. The fieldwork was supervised by a geotechnical engineer from **exp** Services Inc. All samples were logged in the field and then returned to the laboratory for testing and detailed examination by the project engineer.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. The borehole locations were laid out by **exp** Services Inc. personnel, as shown on Drawing 1. The ground surface elevation was interpolated from the site topographic survey plan provided by the client.

As well as visual examination in the laboratory, all of the soil samples were tested for natural moisture content. In addition grain size analyses were carried out on six samples. The results of the testing are presented in Appendix A.

3. Site and Geology

The site is located south and west of Mississauga Road, just east of the village of Belfountain at the top of the Niagara Escarpment.

The slope at this site is about 10 to 12 m high and lies at an angle of about 10 to 20 degrees to the horizontal. The slope is covered by mature trees and bushes with some grassed areas, such as the pastures near Borehole 1. Water seepage was not observed from the slope and there are no signs of distress. There are no water courses near the base of the slope.

Geological mapping indicates that the soil deposit in the slope consists of glacial outwash sand and gravel. However, the presence of boulders and silty sand and gravel indicates that the deposits are most likely ice contact stratified drift. The ice contact drift overlies a deposit of sandy silt till and then bedrock. Bedrock in this area is dolostone of the Amabel Formation.

4. Subsurface Conditions

The borehole locations are shown on Drawing 1 and detailed subsurface conditions are presented on the borehole logs, Drawings 2 to 5. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The following is a brief description of the soil conditions encountered during the investigation:

The site is underlain by a surficial layer of ploughed material in Boreholes 1 to 3. This material varies from sand and gravel to sandy silt and has varying amounts of topsoil. In Borehole 4, about 400 mm of topsoil was found over weathered till.

Below the surficial layer, the soil in Boreholes 1 to 3 consists of sand and gravel to sand with varying amounts of silt. Boulders and cobbles are common in this deposit. The standard penetration test N values indicate that this deposit is in a compact to very dense condition.

A deposit of very dense sandy silt till was found below the granular deposit in Borehole 3 at about 7 m and below surficial topsoil and weathered till layer in Borehole 4.

Possible dolostone bedrock was found at a depth of about 3.2 m in Borehole 4.

All of the boreholes were dry and open to almost their full depths at the completion of drilling. Water seepage was not observed during drilling.

5. Slope Stability

Stability analyses were undertaken for the three sections shown on Drawing 1, using the PC Slope/W program. The Morgenstern-Price Method was applied for the stability analysis. Effective stress analysis, which is indicative of long term stability, was carried out.

The average stratigraphy for the site and the soil properties assumed for the analysis are given on Table 1. Groundwater was assumed to be in the bedrock well below the base of the slope.

Table 1: Interpreted Stratigraphy

Elevation (m)	Material	Effective Stress Parameters
Surface to 392	Compact to dense sand and gravel, and sand	γ = 20.0 kN/m^3 c' = 0 ϕ' = 35 degrees
392 to 389	Very dense sandy silt till	γ = 22.0 kN/m^3 c' = 5 ϕ' = 25 degrees
Below 389.0	bedrock	Failure prevented through bedrock

The results of the stability analyses are shown on Drawings S1 to S3, in Appendix B. The analyses for the existing slope show that the stability of the existing natural varies from about 2.2 to 3.3 for a surficial failure surface. Deeper failure surfaces would have a higher factor of safety

Based on these analyses, the physical top of slope is considered to be the Long Term Stable Slope.

The staked top of bank shown on Drawing 1 corresponds closely with the physical top of slope and should be considered to be the Long Term Stable Slope.

6. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation.

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

The comments given in this report are intended only for the guidance of design engineers. The number of boreholes required to determine the localized underground conditions between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

More specific information, with respect to the conditions between samples, or the lateral and vertical extent of materials, may become apparent during excavation operations. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, **exp** Services Inc. should be contacted to assess the situation and additional testing and reporting may be required. **Exp** Services Inc. has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

exp Services Inc.

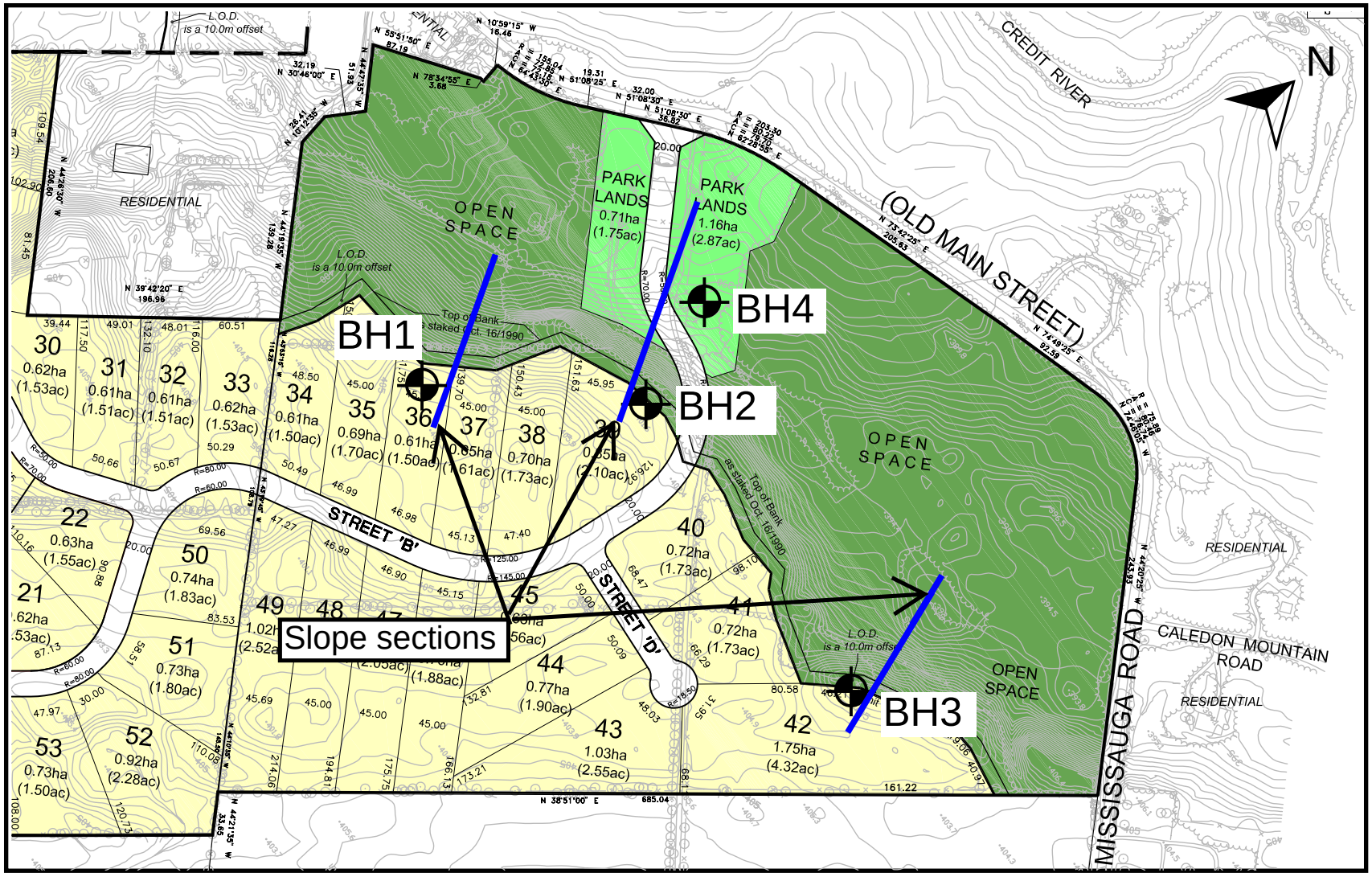
Holger Lohse, P. Eng.
Senior Geotechnical Engineer
Geotechnical Services

Stephen S. M. Cheng, P. Eng.
Discipline Manger
Geotechnical Services

KWYL/kl//I:\2003-Brampton\Projects\Geotechnical Engineering\0600000\603000\603505-B0_slope_belfountain\REPORT.doc

Urbancorp
836 St. Clair Ave West, Toronto, Ontario
BRM-00603339-A0

Drawings



0 100 200 m

Exp Services Inc.
1595 Clark Boulevard
Brampton, Ontario
L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

SCALE: As Shown

DATE: 21 July 2014

BOREHOLE LOCATION PLAN
Slope Stability Evaluation
Belfountain, Ontario

DWN.:	CHKD.:	PROJECT NO.:	DRAWING NO.:
R.G	H.L	BRM-00603505-B0	1

Notes On Sample Descriptions Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by exp Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

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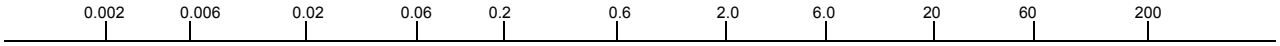

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

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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.

Log of Borehole 1

Project No. BRM-00603505-B0

Drawing No. 2

Project: Slope Stability

Sheet No. 1 of 1

Location: Part Lot 9, Concession 5 WHS, Belfountain, Town of Caledon, Ontario

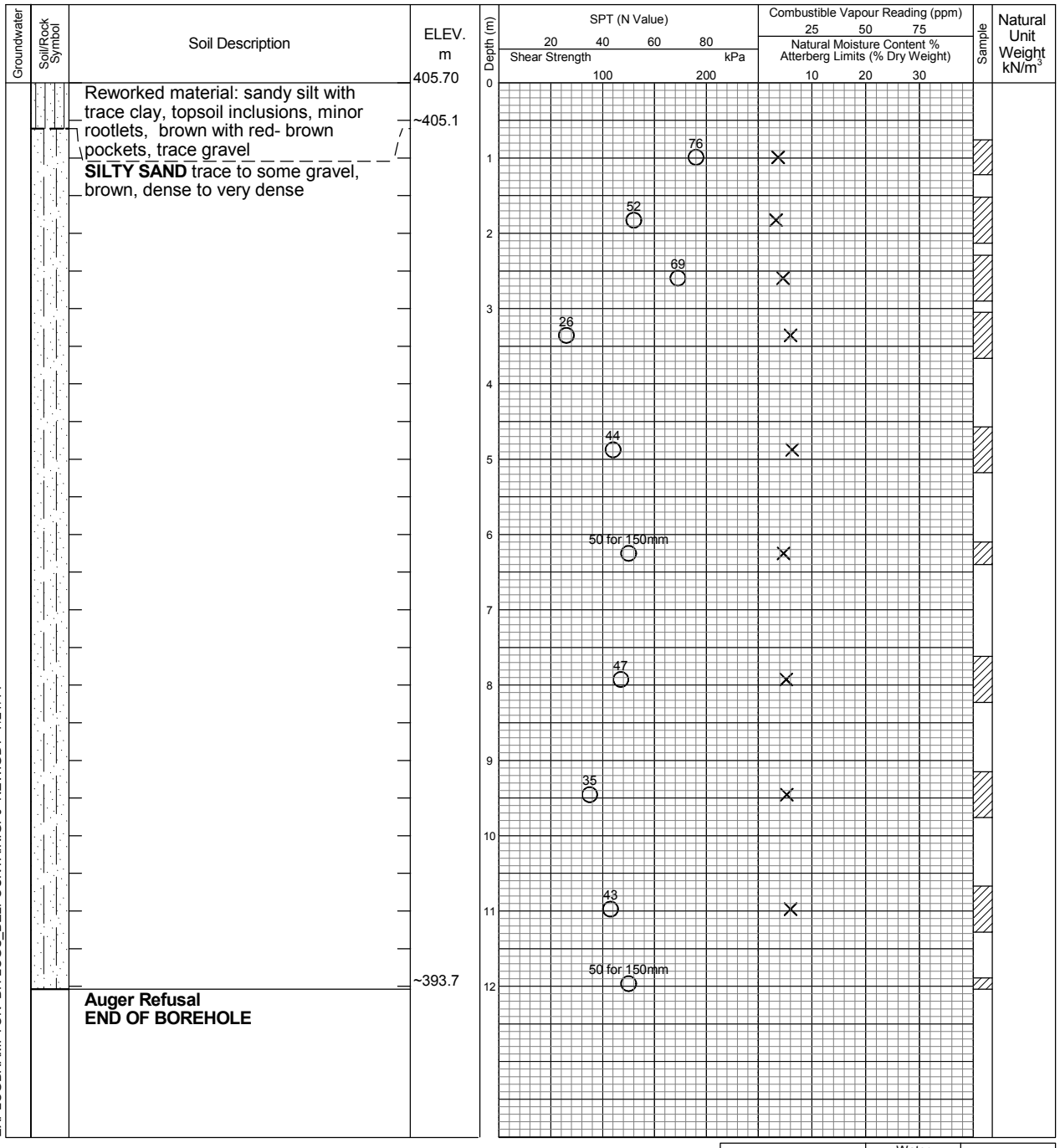
Date Drilled: June 12/13, 2014

Drill Type: CME 55, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	11.9

Log of Borehole 2

Project No. BRM-00603505-B0

Drawing No. 3

Project: Slope Stability

Sheet No. 1 of 1

Location: Part Lot 9, Concession 5 WHS, Belfountain, Town of Caledon, Ontario

Date Drilled: June 12, 2014

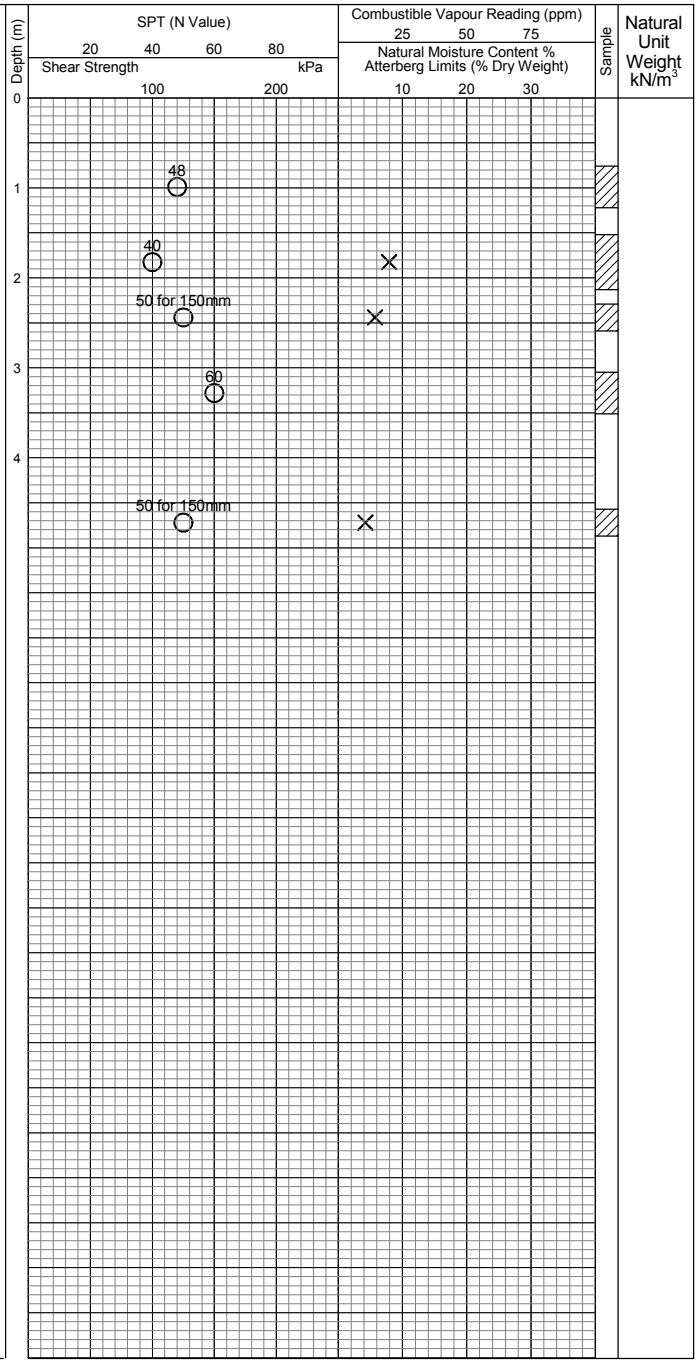
Drill Type: CME 55, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
Surficial sand and gravel mixed with topsoil	401.70
	~401.2
SAND AND GRAVEL: some silt, brown, dense to very dense	
	~397.7
WELL GRADED SAND: some silt, trace of gravel, brown, very dense	
	~396.8
Auger Refusal **END OF BOREHOLE**	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	3.4

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 7/21/14

Log of Borehole 3

Project No. BRM-00603505-B0

Drawing No. 4

Project: Slope Stability

Sheet No. 1 of 1

Location: Part Lot 9, Concession 5 WHS, Belfountain, Town of Caledon, Ontario

Date Drilled: June 12, 2014

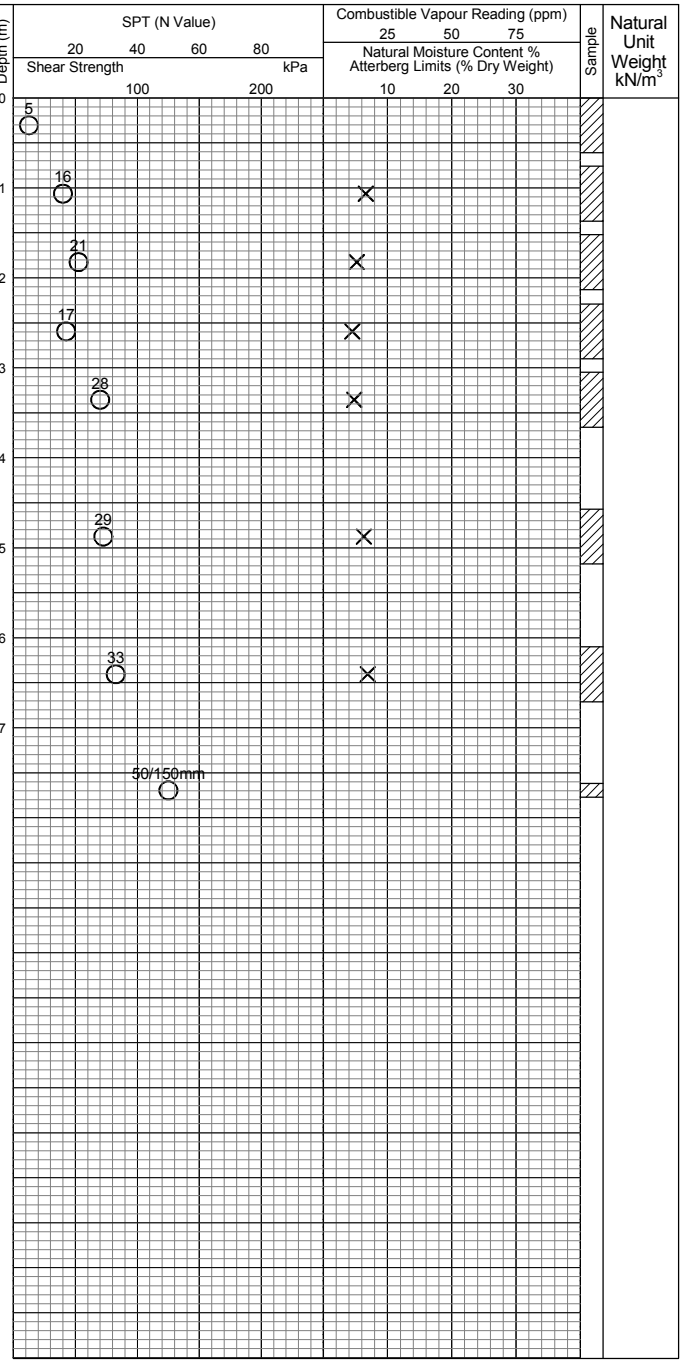
Drill Type: CME 55, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
sand and gravel	406.50
	~405.9
SAND AND GRAVEL:some silt, trace cobbles and boulder fragments, brown, compact to dense	
	~399.8
SANDY SILT TILL: some gravel, red-brown, very dense	
	~398.7
Auger Refusal **END OF BOREHOLE**	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.0

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 7/21/14

Log of Borehole 4

Project No. BRM-00603505-B0

Drawing No. 5

Project: Slope Stability

Sheet No. 1 of 1

Location: Part Lot 9, Concession 5 WHS, Belfountain, Town of Caledon, Ontario

Date Drilled: June 13, 2014

Drill Type: CME 55, Solid Stem Augers

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		Sand and Gravel	392.20	0
			~391.6	
		SANDY SILT TILL: trace clay, trace to some gravel, occasional sand seams, brown, compact to dense		1
				2
			~389.0	3
		Auger Refusal; likely on Dolostone bedrock **END OF BOREHOLE**		

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

48
20
28
42
50 for 150mm

Sample | Natural Unit Weight kN/m³

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	3.0

EXPLOGBRAMPTON BH LOGS_BELFOUNTAIN.GPJ NEW.GDT 7/21/14

Appendix A:
Laboratory Testing

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

Sample Test No.: 209451-2 **Report No.:** 1 **Date Reported:** 30-Jun-2014

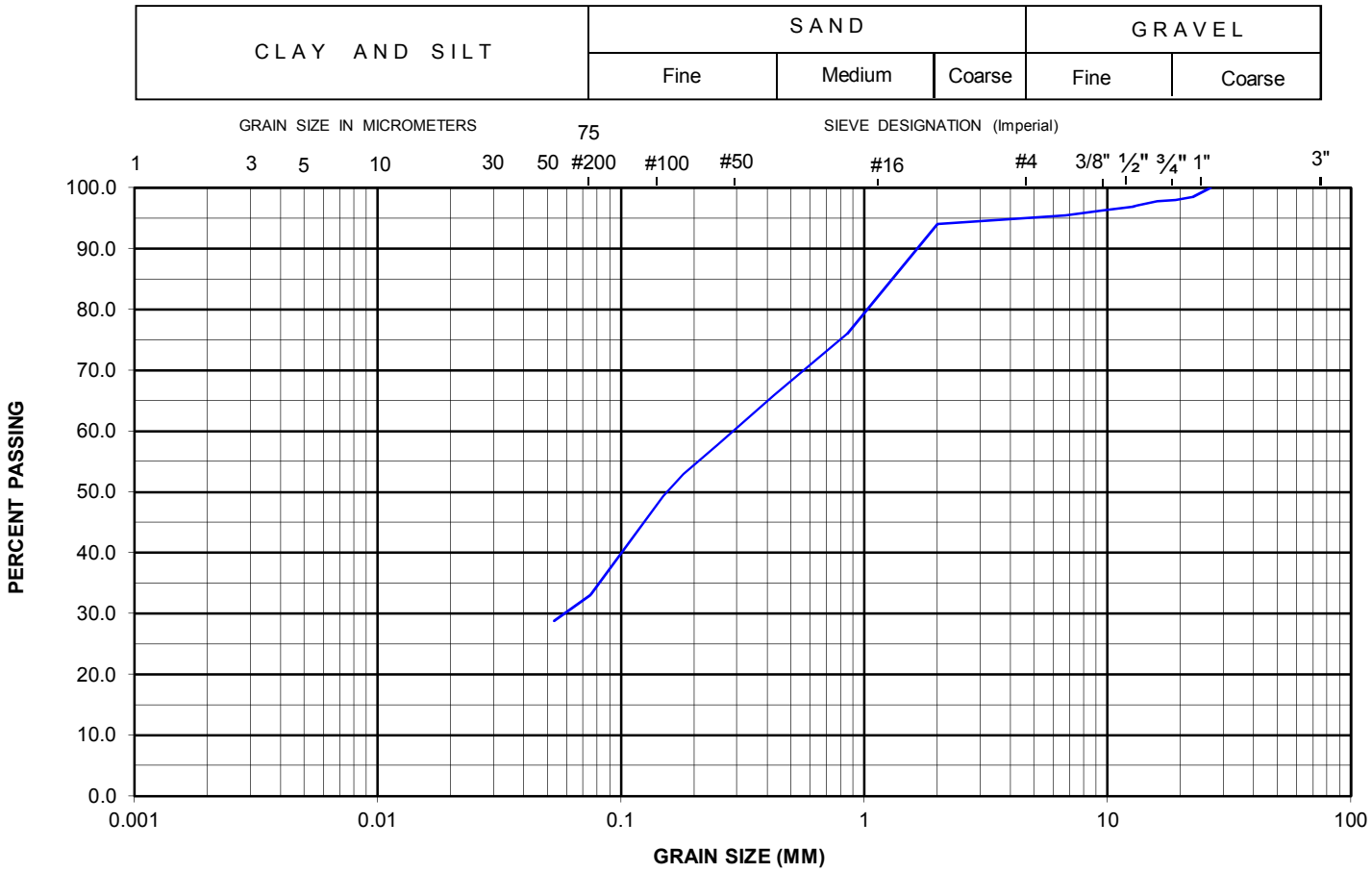
Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

Sample Information
Borehole No.: BH 1
Sample Method: SS
Sample No.: 3
Depth: 2.3 - 2.9m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	98.6
19.0	98.1
16.0	97.8
13.2	97.1
12.7	96.9
9.5	96.3
6.7	95.5
4.75	95.0
2.00	94.1
0.850	76.0
0.425	65.9
0.250	57.8
0.180	52.9
0.150	49.4
0.075	33.0
0.053	28.8

Notes: *Out of Specification

UNIFIED SOIL CLASSIFICATION SYSTEM



Project Manager: Holger Lohse **Approved By:** *Original Signed By* Willie Rodych **Date Approved:** 30-Jun-2014

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

Sample Test No.: 209455-2 **Report No.:** 2 **Date Reported:** 30-Jun-2014

Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

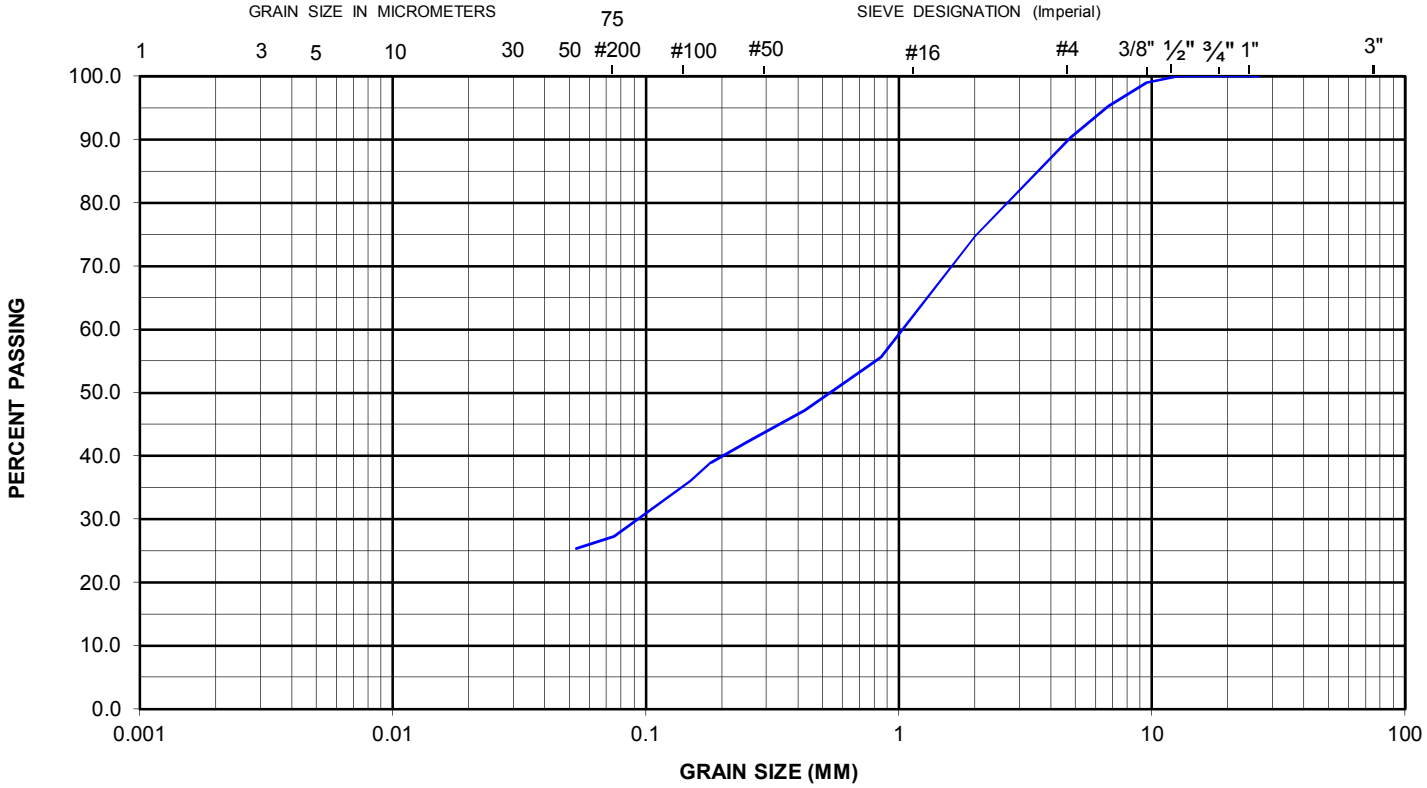
Sample Information
Borehole No.: BH 1
Sample Method: SS
Sample No.: 6
Depth: 6.1 - 6.7m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	100.0
19.0	100.0
16.0	100.0
13.2	100.0
12.7	100.0
9.5	99.0
6.7	95.3
4.75	90.3
2.00	74.8
0.850	55.6
0.425	47.2
0.250	42.2
0.180	39.0
0.150	36.0
0.075	27.3
0.053	25.3

Notes: *Out of Specificatior

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Project Manager: Holger Lohse **Approved By:** *Original Signed By* Willie Rodych **Date Approved:** 30-Jun-2014

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

Sample Test No.: 209460-2 **Report No.:** 3 **Date Reported:**

Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

Sample Information

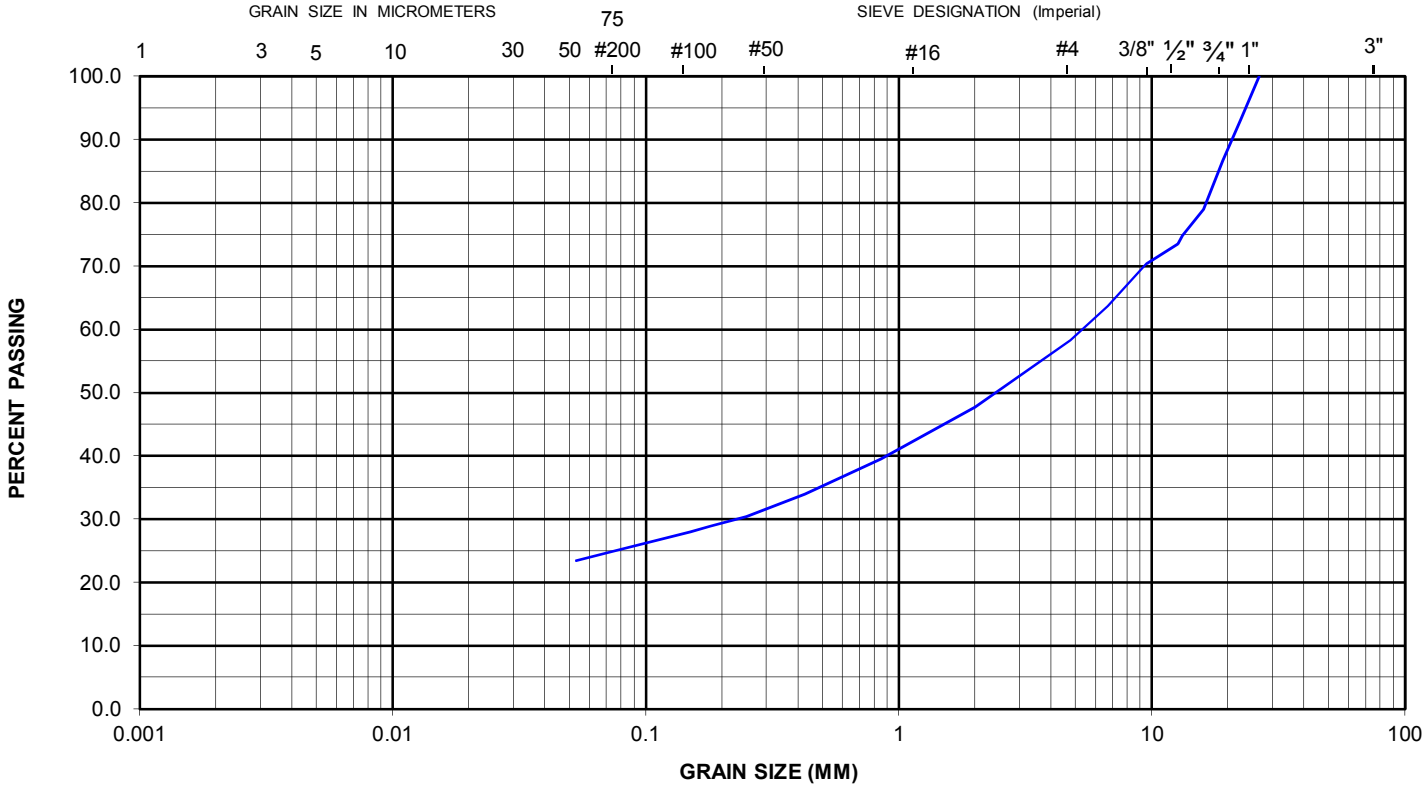
Borehole No.: BH 2
Sample Method: SS
Sample No.: 2
Depth: 1.5 - 2.0m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	93.1
19.0	86.7
16.0	79.0
13.2	74.9
12.7	73.6
9.5	70.4
6.7	63.7
4.75	58.3
2.00	47.7
0.850	39.5
0.425	33.9
0.250	30.5
0.180	28.9
0.150	28.0
0.075	25.0
0.053	23.5

Notes: *Out of Specificatior

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



Project Manager: Holger Lohse **Approved By:** **Date Approved:**

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

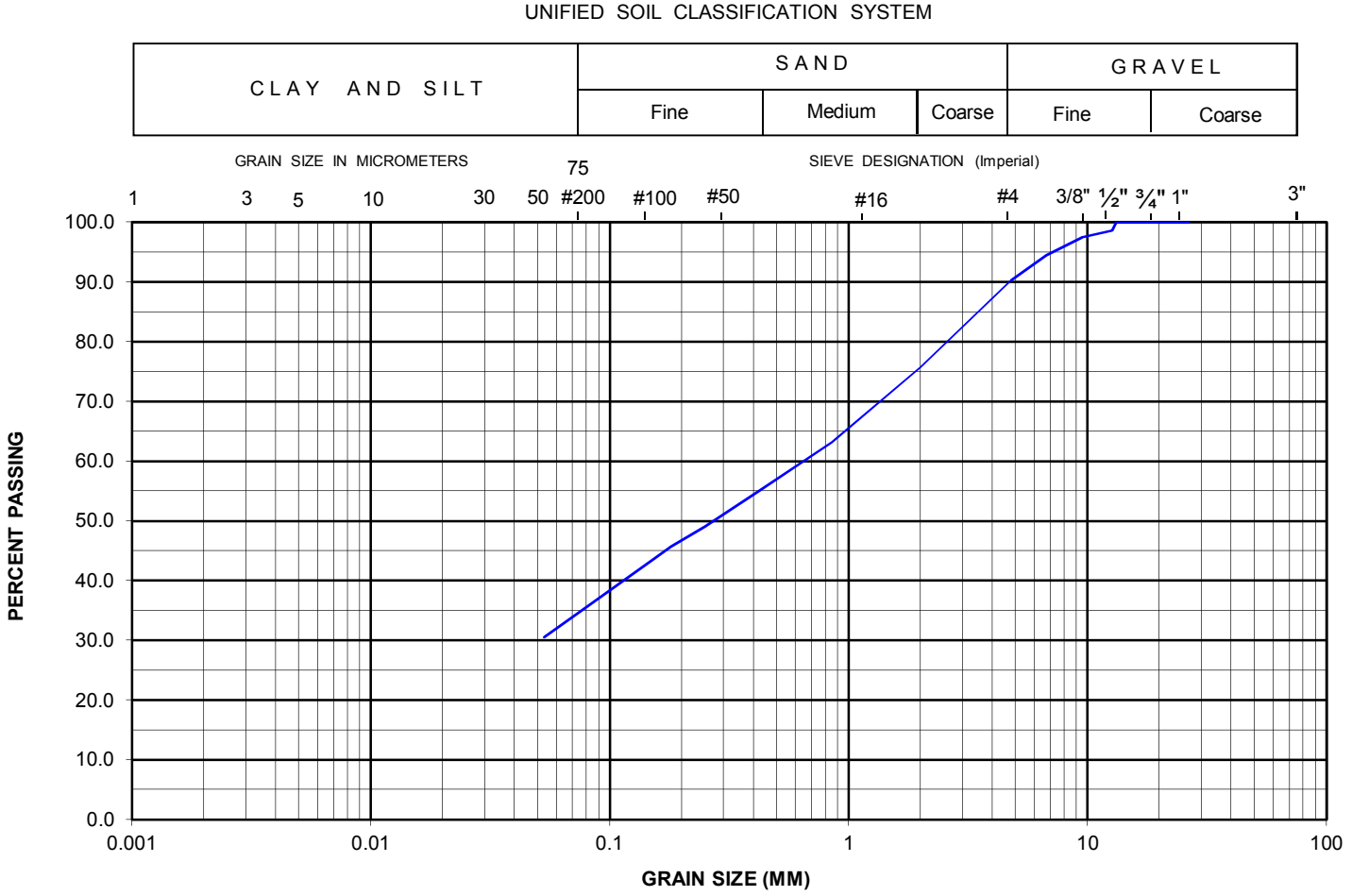
Sample Test No.: 209463-2 **Report No.:** 4 **Date Reported:** 30-Jun-2014

Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

Sample Information
Borehole No.: BH 2
Sample Method: SS
Sample No.: 5
Depth: 4.6 - 5.2m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	100.0
19.0	100.0
16.0	100.0
13.2	100.0
12.7	98.6
9.5	97.6
6.7	94.5
4.75	90.3
2.00	75.7
0.850	63.1
0.425	55.1
0.250	49.0
0.180	45.7
0.150	43.4
0.075	34.7
0.053	30.5

Notes: *Out of Specificatior



Project Manager: Holger Lohse **Approved By:** *Original Signed By* Willie Rodych **Date Approved:** 30-Jun-2014

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

Sample Test No.: 209465-2 **Report No.:** 5 **Date Reported:** 30-Jun-2014

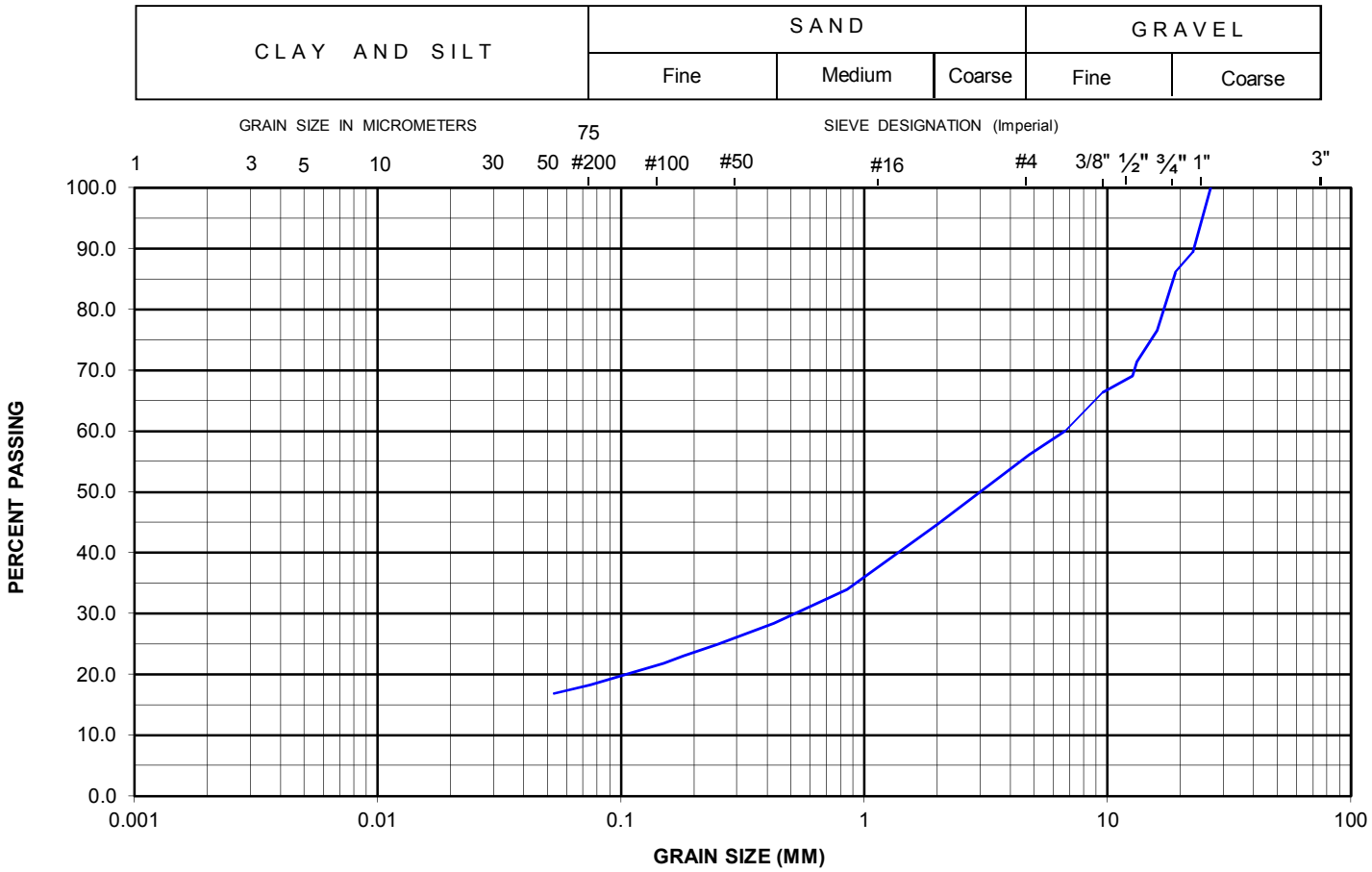
Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

Sample Information
Borehole No.: BH 3
Sample Method: SS
Sample No.: 2
Depth: 1.5 - 2.1m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	89.4
19.0	86.2
16.0	76.5
13.2	71.4
12.7	69.1
9.5	66.3
6.7	60.1
4.75	56.1
2.00	44.7
0.850	34.0
0.425	28.4
0.250	24.9
0.180	23.1
0.150	21.8
0.075	18.3
0.053	16.9

Notes: *Out of Specificatior

UNIFIED SOIL CLASSIFICATION SYSTEM



Project Manager: Holger Lohse **Approved By:** *Original Signed By* Willie Rodych **Date Approved:** 30-Jun-2014

exp Services Inc.
1595 Clark Boulevard, Brampton
Ontario, Canada, L6T 4V1
Telephone: (905) 793-9800
Fax: (905) 793-0641

Grain Size Analysis Test Report

ST06-Soil

Sample Test No.: 209468-2 **Report No.:** 6 **Date Reported:** 30-Jun-2014

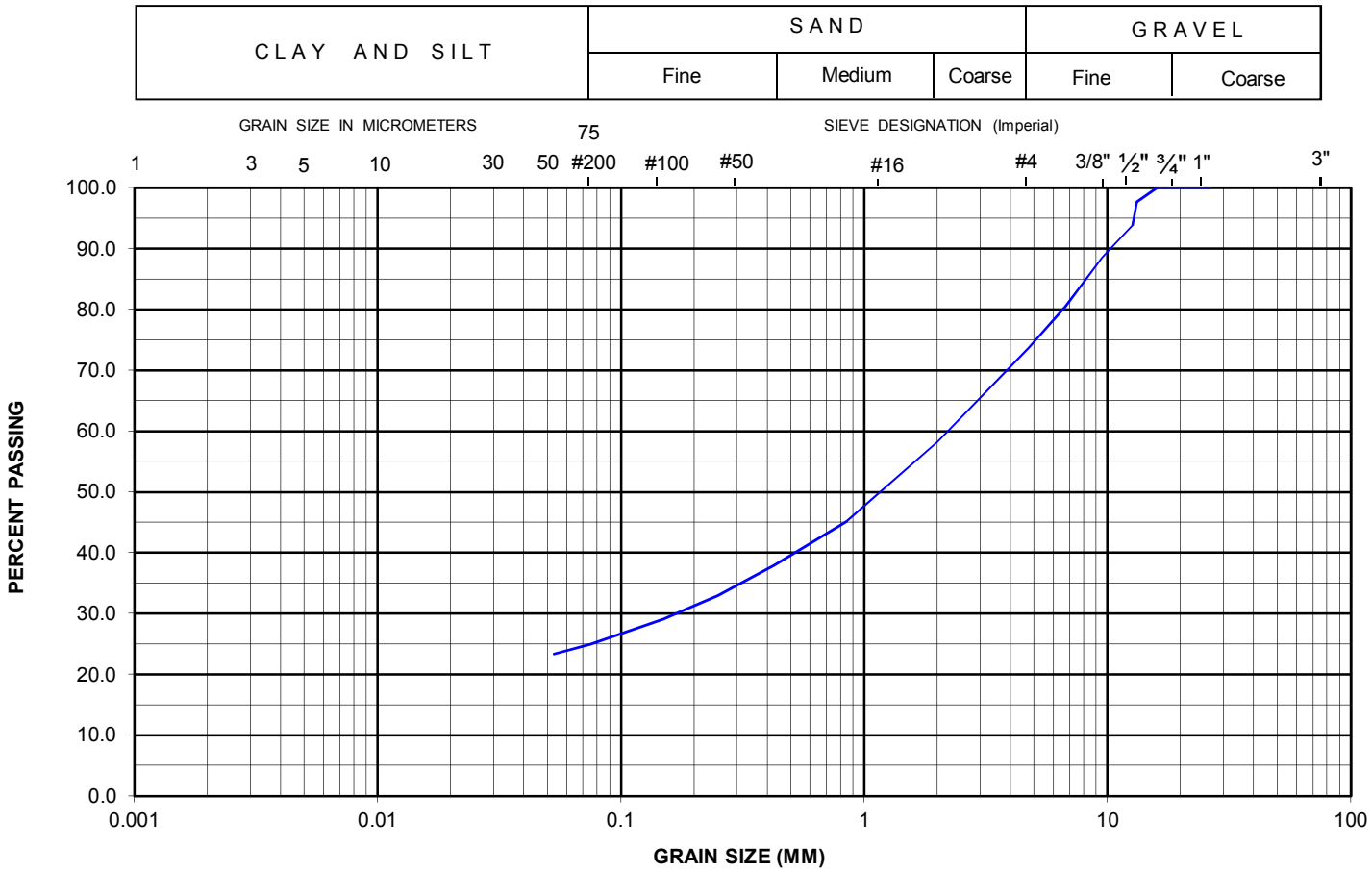
Project No.: brm-00603505-b0
Project Name: GEO HL-Part Lot 9, Concession 5 WHS, Belfountain,ON-Slope Stability Evaluation

Sample Information
Borehole No.: BH 3
Sample Method: SS
Sample No.: 5
Depth: 4.6 - 5.2m
Sample Description:
Sampled By: R. G.
Sampling Date: 12-Jun-2014
Date Received: 13-Jun-2014
Client Sample ID:
Comments:

Sieve Size (mm)	% Passing Sample
26.5	100.0
22.4	100.0
19.0	100.0
16.0	100.0
13.2	97.7
12.7	93.9
9.5	88.6
6.7	80.6
4.75	73.7
2.00	58.2
0.850	45.2
0.425	37.9
0.250	33.0
0.180	30.6
0.150	29.1
0.075	24.9
0.053	23.4

Notes: *Out of Specification

UNIFIED SOIL CLASSIFICATION SYSTEM

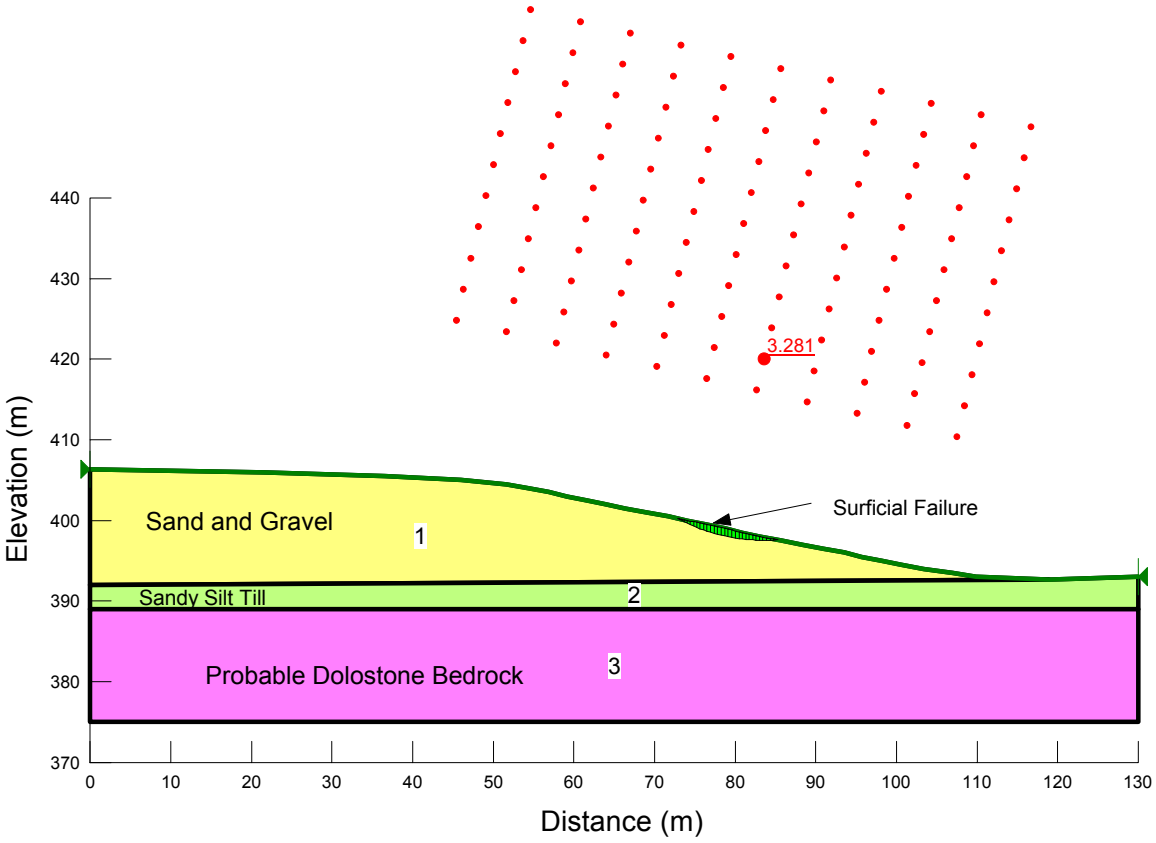


Project Manager: Holger Lohse **Approved By:** *Original Signed By* Willie Rodych **Date Approved:** 30-Jun-2014

Appendix B:
Slope Stability Sections

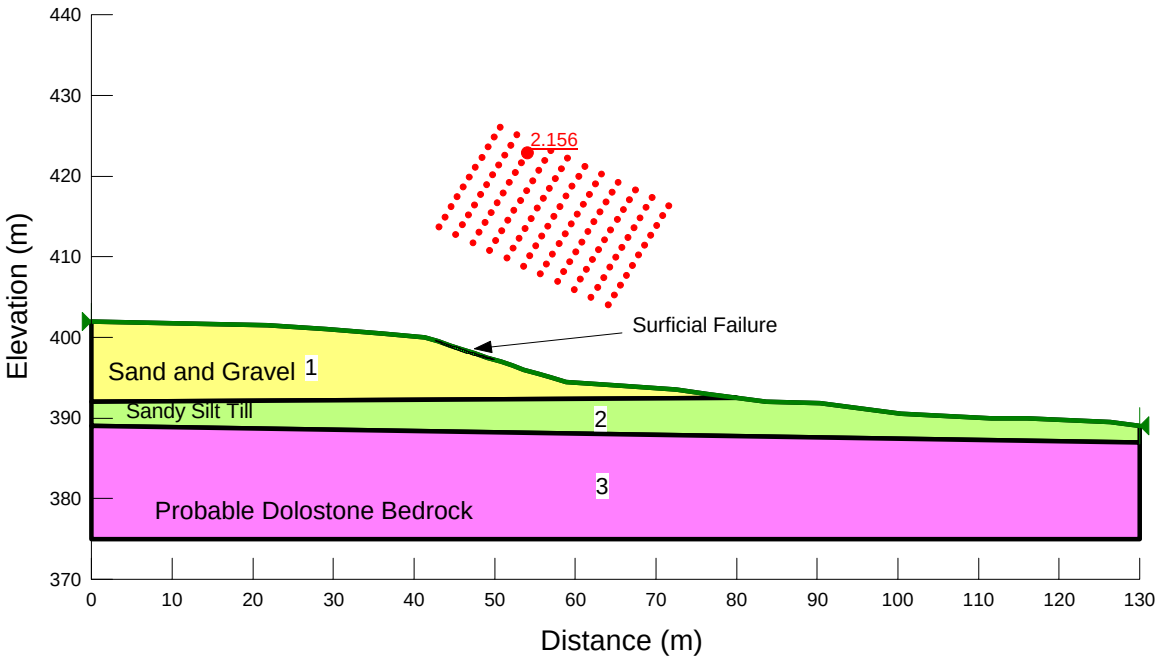
Project: BRM-00603505-B0
Belfountain, Ontario

Drawing S1
Borehole 1 Section



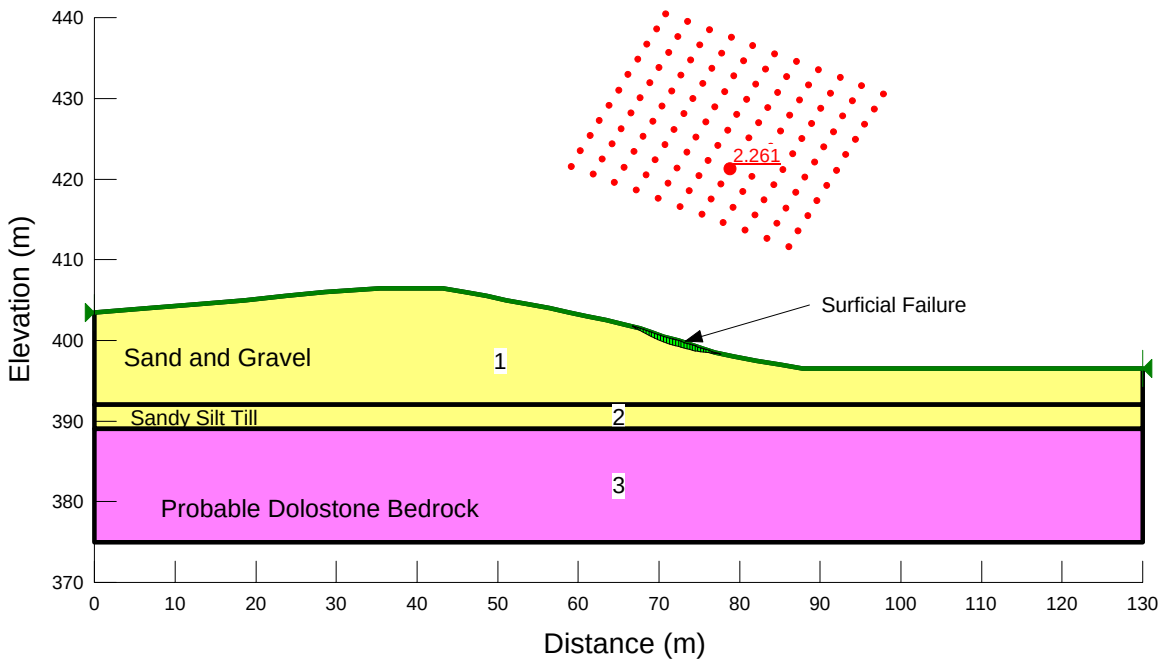
Project: BRM-00603505-B0
Belfountain, Ontario

Drawing S2
Borehole 2 Section



Project: BRM-00603505-B0
Belfountain, Ontario

Drawing S3
Borehole 3 Section



APPENDIX B

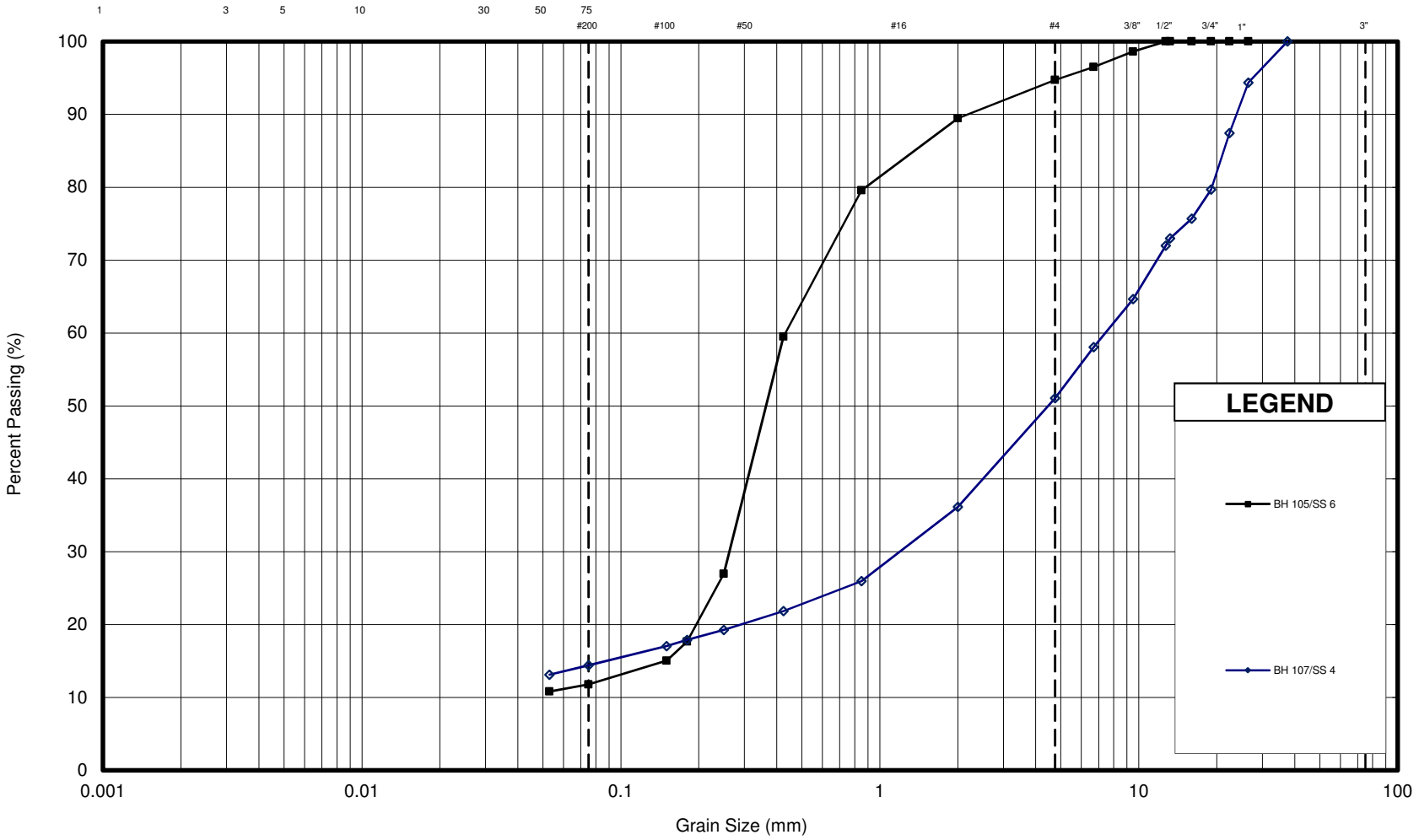
Geotechnical Laboratory Testing Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



exp.	GRAIN SIZE DISTRIBUTION **SAND AND GRAVEL**	FIGURE No. 1 REF. No. BRM-00603505-D0 DATE September 2017

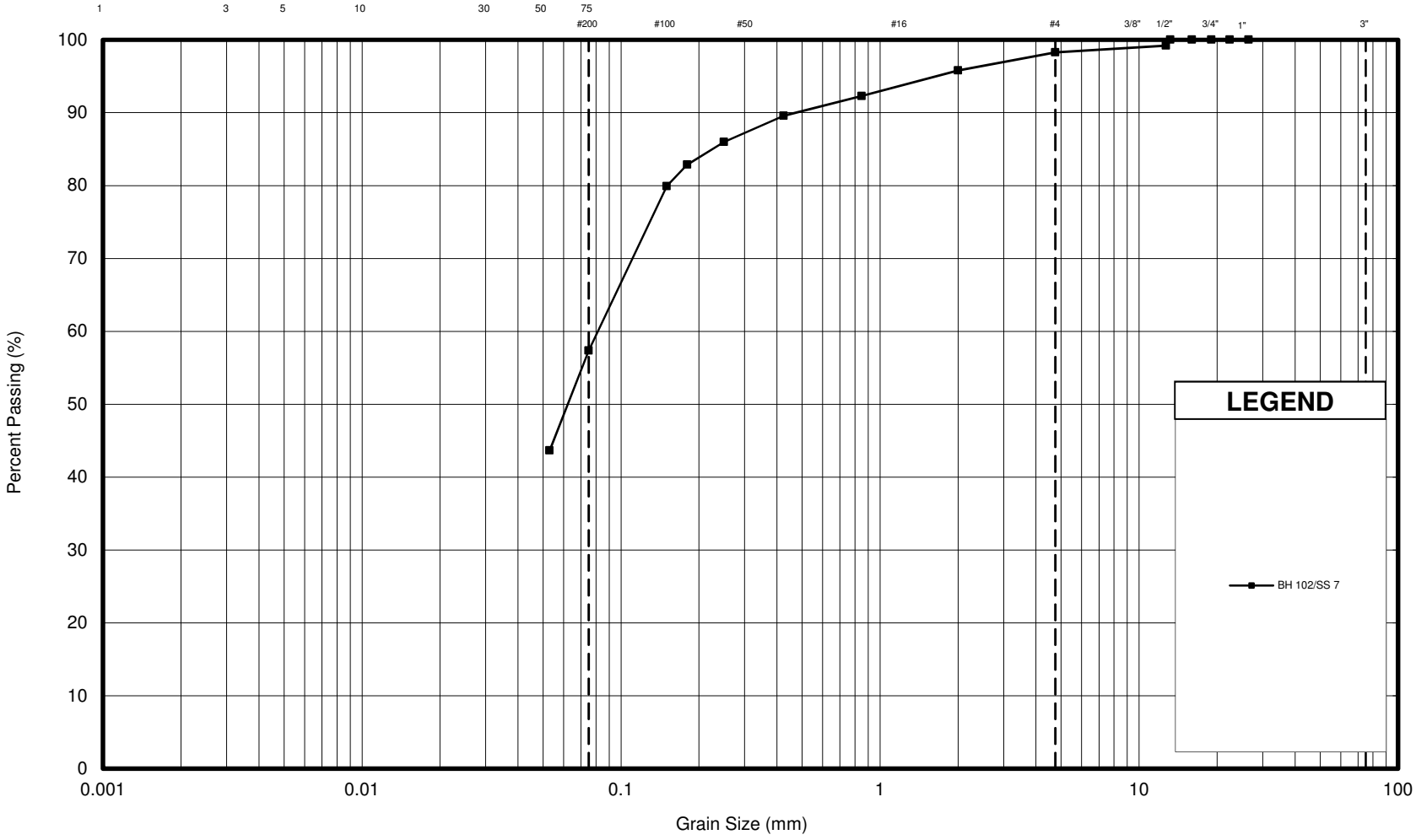
I:\2003-Brampton\Projects\Geotechnical Engineering\06000\06030\00\603505-D0\Gex\Grain Size Distribution_603505-D0.xls

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS: 1, 3, 5, 10, 30, 50, 75

SIEVE DESIGNATION (IMPERIAL): #200, #100, #50, #16, #4, 3/8", 1/2", 3/4", 1", 3"



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exp.

GRAIN SIZE DISTRIBUTION

Sandy Silt Interlayer, SAND AND GRAVEL

FIGURE No.	2
REF. No.	BRM-00603505-D0
DATE	September 2017

APPENDIX C

Soil Chemistry Results

Maxxam
A Bureau Veritas Group Company

Your P.O. #: BRM-GEO
Your Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your C.O.C. #: 81417

Attention:Aamna Arora

exp Services Inc
Brampton Branch
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/09/08
Report #: R4691447
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7J0147
Received: 2017/08/31, 15:45

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Hot Water Extractable Boron	1	2017/09/05	2017/09/05	CAM SOP-00408	R153 Ana. Prot. 2011
Hot Water Extractable Boron	4	2017/09/05	2017/09/06	CAM SOP-00408	R153 Ana. Prot. 2011
1,3-Dichloropropene Sum	2	N/A	2017/09/07		EPA 8260C m
Free (WAD) Cyanide	5	2017/09/06	2017/09/07	CAM SOP-00457	OMOE E3015 m
Cyanide (WAD) in Leachates	1	N/A	2017/09/07	CAM SOP-00457	OMOE 3015 m
Conductivity	5	2017/09/07	2017/09/07	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	5	2017/09/05	2017/09/07	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydrocarbons F2-F4 in Soil (2)	2	2017/09/02	2017/09/05	CAM SOP-00316	CCME CWS m
Fluoride by ISE in Leachates	1	2017/09/07	2017/09/07	CAM SOP-00449	SM 22 4500-F- C m
Mercury (TCLP Leachable) (mg/L)	1	N/A	2017/09/07	CAM SOP-00453	EPA 7470A m
Strong Acid Leachable Metals by ICPMS	4	2017/09/05	2017/09/07	CAM SOP-00447	EPA 6020B m
Strong Acid Leachable Metals by ICPMS	1	2017/09/05	2017/09/08	CAM SOP-00447	EPA 6020B m
Total Metals in TCLP Leachate by ICPMS	1	2017/09/07	2017/09/07	CAM SOP-00447	EPA 6020B m
Moisture	4	N/A	2017/09/02	CAM SOP-00445	Carter 2nd ed 51.2 m
Moisture	3	N/A	2017/09/05	CAM SOP-00445	Carter 2nd ed 51.2 m
Nitrate(NO3) + Nitrite(NO2) in Leachate	1	N/A	2017/09/07	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Polychlorinated Biphenyl in Leachate	1	2017/09/07	2017/09/07	CAM SOP-00309	EPA 8082A m
pH CaCl2 EXTRACT	5	2017/09/07	2017/09/07	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	5	N/A	2017/09/07	CAM SOP-00102	EPA 6010C
SAR - ICP Metals	5	2017/09/07	2017/09/07	CAM SOP-00408	EPA 6010D m
TCLP - % Solids	1	2017/09/06	2017/09/07	CAM SOP-00401	EPA 1311 Update I m
TCLP - Extraction Fluid	1	N/A	2017/09/07	CAM SOP-00401	EPA 1311 Update I m
TCLP - Initial and final pH	1	N/A	2017/09/07	CAM SOP-00401	EPA 1311 Update I m
Volatile Organic Compounds and F1 PHCs	2	N/A	2017/09/07	CAM SOP-00230	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using

Maxxam
A Bureau Veritas Group Company

Your P.O. #: BRM-GEO
Your Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your C.O.C. #: 81417

Attention:Aamna Arora

exp Services Inc
Brampton Branch
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/09/08
Report #: R4691447
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7J0147
Received: 2017/08/31, 15:45

accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following “Alberta Environment’s Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003”. Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Deepthi Shaji, Project Manager
Email: dshaji@maxxam.ca
Phone# (905)817-5700 Ext:5807

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam
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Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		FAY349		FAY350	FAY351	FAY352	FAY353		
Sampling Date		2017/08/28 17:00		2017/08/28 17:00	2017/08/28 17:00	2017/08/29 17:00	2017/08/29 17:00		
COC Number		81417		81417	81417	81417	81417		
	UNITS	**101 SS1**	**QC Batch**	**102 SS3**	**104 SS2**	**105 SS3**	**107 SS2**	**RDL**	**QC Batch**
Calculated Parameters									
Sodium Adsorption Ratio	N/A	0.25	5146583	0.32	0.34	0.33	0.27		5146583
Inorganics									
Conductivity	mS/cm	0.18	5151425	0.22	0.095	0.11	0.17	0.002	5151290
Moisture	%	5.3	5149616	3.9	8.2	5.1	6.2	1.0	5148646
Available (CaCl2) pH	pH	7.80	5149710	8.26	8.00	8.01	8.00		5149710
WAD Cyanide (Free)	ug/g	<0.01	5151209	<0.01	<0.01	<0.01	<0.01	0.01	5151209
Metals									
Soluble Calcium (Ca)	mg/L	24.5	5151406	16.9	14.3	15.8	20.3	0.5	5151277
Soluble Magnesium (Mg)	mg/L	3.4	5151406	8.4	1.2	0.9	3.2	0.5	5151277
Soluble Sodium (Na)	mg/L	<5	5151406	6	<5	<5	<5	5	5151277
Inorganics									
Chromium (VI)	ug/g	<0.2	5149643	<0.2	<0.2	<0.2	<0.2	0.2	5149643
Metals									
Hot Water Ext. Boron (B)	ug/g	0.17	5149333	<0.050	<0.050	0.090	0.11	0.050	5149685
Acid Extractable Antimony (Sb)	ug/g	<0.20	5149372	<0.20	<0.20	<0.20	<0.20	0.20	5149831
Acid Extractable Arsenic (As)	ug/g	3.8	5149372	2.8	3.1	5.2	5.7	1.0	5149831
Acid Extractable Barium (Ba)	ug/g	44	5149372	20	22	41	25	0.50	5149831
Acid Extractable Beryllium (Be)	ug/g	0.34	5149372	<0.20	0.23	0.28	0.21	0.20	5149831
Acid Extractable Boron (B)	ug/g	<5.0	5149372	8.1	5.5	6.8	8.1	5.0	5149831
Acid Extractable Cadmium (Cd)	ug/g	0.13	5149372	0.25	<0.10	<0.10	<0.10	0.10	5149831
Acid Extractable Chromium (Cr)	ug/g	11	5149372	7.1	8.7	13	7.4	1.0	5149831
Acid Extractable Cobalt (Co)	ug/g	6.4	5149372	3.1	4.1	6.3	3.8	0.10	5149831
Acid Extractable Copper (Cu)	ug/g	36	5149372	17	20	100	33	0.50	5149831
Acid Extractable Lead (Pb)	ug/g	8.9	5149372	41	6.6	7.5	6.9	1.0	5149831
Acid Extractable Molybdenum (Mo)	ug/g	0.50	5149372	<0.50	<0.50	<0.50	0.89	0.50	5149831
Acid Extractable Nickel (Ni)	ug/g	9.6	5149372	6.7	7.8	13	6.8	0.50	5149831
Acid Extractable Selenium (Se)	ug/g	<0.50	5149372	<0.50	<0.50	<0.50	<0.50	0.50	5149831
Acid Extractable Silver (Ag)	ug/g	<0.20	5149372	<0.20	<0.20	<0.20	<0.20	0.20	5149831
Acid Extractable Sodium (Na)	ug/g	90	5149372	170	130	150	200	50	5149831
Acid Extractable Thallium (Tl)	ug/g	0.11	5149372	0.097	<0.050	0.10	0.20	0.050	5149831

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID		FAY349		FAY350	FAY351	FAY352	FAY353		
Sampling Date		2017/08/28 17:00		2017/08/28 17:00	2017/08/28 17:00	2017/08/29 17:00	2017/08/29 17:00		
COC Number		81417		81417	81417	81417	81417		
	UNITS	**101 SS1**	**QC Batch**	**102 SS3**	**104 SS2**	**105 SS3**	**107 SS2**	**RDL**	**QC Batch**
Acid Extractable Uranium (U)	ug/g	0.42	5149372	0.32	0.40	0.35	0.23	0.050	5149831
Acid Extractable Vanadium (V)	ug/g	32	5149372	14	19	18	11	5.0	5149831
Acid Extractable Zinc (Zn)	ug/g	49	5149372	110	32	39	23	5.0	5149831
Acid Extractable Mercury (Hg)	ug/g	<0.050	5149372	<0.050	<0.050	<0.050	<0.050	0.050	5149831

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Maxxam ID		FAY354	FAY355		
Sampling Date		2017/08/28 17:00	2017/08/29 17:00		
COC Number		81417	81417		
	UNITS	**103 SS2**	**106 SS2**	**RDL**	**QC Batch**
Inorganics					
Moisture	%	4.1	3.9	1.0	5149366
Calculated Parameters					
1,3-Dichloropropene (cis+trans)	ug/g	<0.050	<0.050	0.050	5146808
Volatile Organics					
Acetone (2-Propanone)	ug/g	<0.50	<0.50	0.50	5151692
Benzene	ug/g	<0.020	<0.020	0.020	5151692
Bromodichloromethane	ug/g	<0.050	<0.050	0.050	5151692
Bromoform	ug/g	<0.050	<0.050	0.050	5151692
Bromomethane	ug/g	<0.050	<0.050	0.050	5151692
Carbon Tetrachloride	ug/g	<0.050	<0.050	0.050	5151692
Chlorobenzene	ug/g	<0.050	<0.050	0.050	5151692
Chloroform	ug/g	<0.050	<0.050	0.050	5151692
Dibromochloromethane	ug/g	<0.050	<0.050	0.050	5151692
1,2-Dichlorobenzene	ug/g	<0.050	<0.050	0.050	5151692
1,3-Dichlorobenzene	ug/g	<0.050	<0.050	0.050	5151692
1,4-Dichlorobenzene	ug/g	<0.050	<0.050	0.050	5151692
Dichlorodifluoromethane (FREON 12)	ug/g	<0.050	<0.050	0.050	5151692
1,1-Dichloroethane	ug/g	<0.050	<0.050	0.050	5151692
1,2-Dichloroethane	ug/g	<0.050	<0.050	0.050	5151692
1,1-Dichloroethylene	ug/g	<0.050	<0.050	0.050	5151692
cis-1,2-Dichloroethylene	ug/g	<0.050	<0.050	0.050	5151692
trans-1,2-Dichloroethylene	ug/g	<0.050	<0.050	0.050	5151692
1,2-Dichloropropane	ug/g	<0.050	<0.050	0.050	5151692
cis-1,3-Dichloropropene	ug/g	<0.030	<0.030	0.030	5151692
trans-1,3-Dichloropropene	ug/g	<0.040	<0.040	0.040	5151692
Ethylbenzene	ug/g	<0.020	<0.020	0.020	5151692
Ethylene Dibromide	ug/g	<0.050	<0.050	0.050	5151692
Hexane	ug/g	<0.050	<0.050	0.050	5151692
Methylene Chloride(Dichloromethane)	ug/g	<0.050	<0.050	0.050	5151692
Methyl Ethyl Ketone (2-Butanone)	ug/g	<0.50	<0.50	0.50	5151692

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 153 VOCS BY HS & F1-F4 (SOIL)

Maxxam ID		FAY354	FAY355		
Sampling Date		2017/08/28 17:00	2017/08/29 17:00		
COC Number		81417	81417		
	UNITS	**103 SS2**	**106 SS2**	**RDL**	**QC Batch**
Methyl Isobutyl Ketone	ug/g	<0.50	<0.50	0.50	5151692
Methyl t-butyl ether (MTBE)	ug/g	<0.050	<0.050	0.050	5151692
Styrene	ug/g	<0.050	<0.050	0.050	5151692
1,1,1,2-Tetrachloroethane	ug/g	<0.050	<0.050	0.050	5151692
1,1,2,2-Tetrachloroethane	ug/g	<0.050	<0.050	0.050	5151692
Tetrachloroethylene	ug/g	<0.050	<0.050	0.050	5151692
Toluene	ug/g	<0.020	<0.020	0.020	5151692
1,1,1-Trichloroethane	ug/g	<0.050	<0.050	0.050	5151692
1,1,2-Trichloroethane	ug/g	<0.050	<0.050	0.050	5151692
Trichloroethylene	ug/g	<0.050	<0.050	0.050	5151692
Trichlorofluoromethane (FREON 11)	ug/g	<0.050	<0.050	0.050	5151692
Vinyl Chloride	ug/g	<0.020	<0.020	0.020	5151692
p+m-Xylene	ug/g	<0.020	<0.020	0.020	5151692
o-Xylene	ug/g	<0.020	<0.020	0.020	5151692
Total Xylenes	ug/g	<0.020	<0.020	0.020	5151692
F1 (C6-C10)	ug/g	<10	<10	10	5151692
F1 (C6-C10) - BTEX	ug/g	<10	<10	10	5151692
F2-F4 Hydrocarbons					
F2 (C10-C16 Hydrocarbons)	ug/g	<10	<10	10	5148181
F3 (C16-C34 Hydrocarbons)	ug/g	<50	<50	50	5148181
F4 (C34-C50 Hydrocarbons)	ug/g	<50	<50	50	5148181
Reached Baseline at C50	ug/g	Yes	Yes		5148181
Surrogate Recovery (%)					
o-Terphenyl	%	91	92		5148181
4-Bromofluorobenzene	%	94	94		5151692
D10-o-Xylene	%	96	93		5151692
D4-1,2-Dichloroethane	%	105	107		5151692
D8-Toluene	%	98	97		5151692

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 558 TCLP INORGANICS PACKAGE (SOIL)

Maxxam ID		FAY356		
Sampling Date		2017/08/29 17:00		
COC Number		81417		
	UNITS	**COMPOSITE (101,104, 105, 107)**	**RDL**	**QC Batch**
Inorganics				
Leachable Fluoride (F-)	mg/L	0.17	0.10	5153235
Leachable WAD Cyanide (Free)	mg/L	<0.010	0.010	5153230
Leachable Nitrite (N)	mg/L	<0.10	0.10	5153240
Leachable Nitrate (N)	mg/L	<1.0	1.0	5153240
Leachable Nitrate + Nitrite (N)	mg/L	<1.0	1.0	5153240
Metals				
Leachable Mercury (Hg)	mg/L	<0.0010	0.0010	5153150
Leachable Arsenic (As)	mg/L	<0.2	0.2	5153211
Leachable Barium (Ba)	mg/L	0.2	0.2	5153211
Leachable Boron (B)	mg/L	0.1	0.1	5153211
Leachable Cadmium (Cd)	mg/L	<0.05	0.05	5153211
Leachable Chromium (Cr)	mg/L	<0.1	0.1	5153211
Leachable Lead (Pb)	mg/L	<0.1	0.1	5153211
Leachable Selenium (Se)	mg/L	<0.1	0.1	5153211
Leachable Silver (Ag)	mg/L	<0.01	0.01	5153211
Leachable Uranium (U)	mg/L	<0.01	0.01	5153211

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 558 TCLP LEACHATE PREPARATION (SOIL)

Maxxam ID		FAY356		
Sampling Date		2017/08/29 17:00		
COC Number		81417		
	UNITS	**COMPOSITE (101,104, 105, 107)**	**RDL**	**QC Batch**
Inorganics				
Final pH	pH	6.41		5153265
Initial pH	pH	9.51		5153265
TCLP - % Solids	%	100	0.2	5153262
TCLP Extraction Fluid	N/A	FLUID 1		5153264

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

O.REG 558 TCLP PCBS (SOIL)

Maxxam ID		FAY356		
Sampling Date		2017/08/29 17:00		
COC Number		81417		
	UNITS	**COMPOSITE (101,104, 105, 107)**	**RDL**	**QC Batch**
PCBs				
Leachable Total PCB	ug/L	<3.0	3.0	5153173
Surrogate Recovery (%)				
Leachable Decachlorobiphenyl	%	94		5153173

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

TEST SUMMARY

Maxxam ID: FAY349
Sample ID: 101 SS1
Matrix: Soil

Collected: 2017/08/28
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5149333	2017/09/05	2017/09/05	Jolly John
Free (WAD) Cyanide	TECH	5151209	2017/09/06	2017/09/07	Louise Harding
Conductivity	AT	5151425	2017/09/07	2017/09/07	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	5149643	2017/09/05	2017/09/07	Sally Coughlin
Strong Acid Leachable Metals by ICPMS	ICP/MS	5149372	2017/09/05	2017/09/08	John Bowman
Moisture	BAL	5149616	N/A	2017/09/05	Min Yang
pH CaCl2 EXTRACT	AT	5149710	2017/09/07	2017/09/07	Tahir Anwar
Sodium Adsorption Ratio (SAR)	CALC/MET	5146583	N/A	2017/09/07	Automated Statchk
SAR - ICP Metals	ICP	5151406	2017/09/07	2017/09/07	Jolly John

Maxxam ID: FAY350
Sample ID: 102 SS3
Matrix: Soil

Collected: 2017/08/28
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5149685	2017/09/05	2017/09/06	Jolly John
Free (WAD) Cyanide	TECH	5151209	2017/09/06	2017/09/07	Louise Harding
Conductivity	AT	5151290	2017/09/07	2017/09/07	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	5149643	2017/09/05	2017/09/07	Sally Coughlin
Strong Acid Leachable Metals by ICPMS	ICP/MS	5149831	2017/09/05	2017/09/07	Thao Nguyen
Moisture	BAL	5148646	N/A	2017/09/02	Chun Yan
pH CaCl2 EXTRACT	AT	5149710	2017/09/07	2017/09/07	Tahir Anwar
Sodium Adsorption Ratio (SAR)	CALC/MET	5146583	N/A	2017/09/07	Automated Statchk
SAR - ICP Metals	ICP	5151277	2017/09/07	2017/09/07	Jolly John

Maxxam ID: FAY351
Sample ID: 104 SS2
Matrix: Soil

Collected: 2017/08/28
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5149685	2017/09/05	2017/09/06	Jolly John
Free (WAD) Cyanide	TECH	5151209	2017/09/06	2017/09/07	Louise Harding
Conductivity	AT	5151290	2017/09/07	2017/09/07	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	5149643	2017/09/05	2017/09/07	Sally Coughlin
Strong Acid Leachable Metals by ICPMS	ICP/MS	5149831	2017/09/05	2017/09/07	Thao Nguyen
Moisture	BAL	5148646	N/A	2017/09/02	Chun Yan
pH CaCl2 EXTRACT	AT	5149710	2017/09/07	2017/09/07	Tahir Anwar
Sodium Adsorption Ratio (SAR)	CALC/MET	5146583	N/A	2017/09/07	Automated Statchk
SAR - ICP Metals	ICP	5151277	2017/09/07	2017/09/07	Jolly John

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Maxxam Job #: B7J0147
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exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

TEST SUMMARY

Maxxam ID: FAY352
Sample ID: 105 SS3
Matrix: Soil

Collected: 2017/08/29
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5149685	2017/09/05	2017/09/06	Jolly John
Free (WAD) Cyanide	TECH	5151209	2017/09/06	2017/09/07	Louise Harding
Conductivity	AT	5151290	2017/09/07	2017/09/07	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	5149643	2017/09/05	2017/09/07	Sally Coughlin
Strong Acid Leachable Metals by ICPMS	ICP/MS	5149831	2017/09/05	2017/09/07	Thao Nguyen
Moisture	BAL	5148646	N/A	2017/09/02	Chun Yan
pH CaCl2 EXTRACT	AT	5149710	2017/09/07	2017/09/07	Tahir Anwar
Sodium Adsorption Ratio (SAR)	CALC/MET	5146583	N/A	2017/09/07	Automated Statchk
SAR - ICP Metals	ICP	5151277	2017/09/07	2017/09/07	Jolly John

Maxxam ID: FAY353
Sample ID: 107 SS2
Matrix: Soil

Collected: 2017/08/29
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hot Water Extractable Boron	ICP	5149685	2017/09/05	2017/09/06	Jolly John
Free (WAD) Cyanide	TECH	5151209	2017/09/06	2017/09/07	Louise Harding
Conductivity	AT	5151290	2017/09/07	2017/09/07	Neil Dassanayake
Hexavalent Chromium in Soil by IC	IC/SPEC	5149643	2017/09/05	2017/09/07	Sally Coughlin
Strong Acid Leachable Metals by ICPMS	ICP/MS	5149831	2017/09/05	2017/09/07	Thao Nguyen
Moisture	BAL	5148646	N/A	2017/09/02	Chun Yan
pH CaCl2 EXTRACT	AT	5149710	2017/09/07	2017/09/07	Tahir Anwar
Sodium Adsorption Ratio (SAR)	CALC/MET	5146583	N/A	2017/09/07	Automated Statchk
SAR - ICP Metals	ICP	5151277	2017/09/07	2017/09/07	Jolly John

Maxxam ID: FAY354
Sample ID: 103 SS2
Matrix: Soil

Collected: 2017/08/28
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	5146808	N/A	2017/09/07	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5148181	2017/09/02	2017/09/05	Zhiyue (Frank) Zhu
Moisture	BAL	5149366	N/A	2017/09/05	Chun Yan
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5151692	N/A	2017/09/07	Karen Hughes

Maxxam ID: FAY355
Sample ID: 106 SS2
Matrix: Soil

Collected: 2017/08/29
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
1,3-Dichloropropene Sum	CALC	5146808	N/A	2017/09/07	Automated Statchk
Petroleum Hydrocarbons F2-F4 in Soil	GC/FID	5148181	2017/09/02	2017/09/05	Zhiyue (Frank) Zhu
Moisture	BAL	5149366	N/A	2017/09/05	Chun Yan
Volatile Organic Compounds and F1 PHCs	GC/MSFD	5151692	N/A	2017/09/07	Karen Hughes

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Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

TEST SUMMARY

Maxxam ID: FAY356
Sample ID: COMPOSITE (101,104, 105, 107)
Matrix: Soil

Collected: 2017/08/29
Shipped:
Received: 2017/08/31

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Cyanide (WAD) in Leachates	SKAL/CN	5153230	N/A	2017/09/07	Louise Harding
Fluoride by ISE in Leachates	ISE	5153235	2017/09/07	2017/09/07	Surinder Rai
Mercury (TCLP Leachable) (mg/L)	CV/AA	5153150	N/A	2017/09/07	Ron Morrison
Total Metals in TCLP Leachate by ICPMS	ICP1/MS	5153211	2017/09/07	2017/09/07	Arefa Dabhad
Nitrate(NO3) + Nitrite(NO2) in Leachate	LACH	5153240	N/A	2017/09/07	Chandra Nandlal
Polychlorinated Biphenyl in Leachate	GC/ECD	5153173	2017/09/07	2017/09/07	Dawn Alarie
TCLP - % Solids	BAL	5153262	2017/09/06	2017/09/07	Jian (Ken) Wang
TCLP - Extraction Fluid		5153264	N/A	2017/09/07	Jian (Ken) Wang
TCLP - Initial and final pH	PH	5153265	N/A	2017/09/07	Jian (Ken) Wang

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.7°C

Cooler custody seal was present and intact.

Sample FAY349 [101 SS1] : SAR Analysis: Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

Sample FAY351 [104 SS2] : SAR Analysis: Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

Sample FAY352 [105 SS3] : SAR Analysis: Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

Sample FAY353 [107 SS2] : SAR Analysis: Sodium was not detected. To report SAR the sodium detection limit was used in the calculation. This value represents a maximum ratio.

Results relate only to the items tested.

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Maxxam Job #: B7J0147
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QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5148181	o-Terphenyl	2017/09/05	87	60 - 130	85	60 - 130	91	%				
5151692	4-Bromofluorobenzene	2017/09/07	98	60 - 140	97	60 - 140	95	%				
5151692	D10-o-Xylene	2017/09/07	100	60 - 130	95	60 - 130	91	%				
5151692	D4-1,2-Dichloroethane	2017/09/07	100	60 - 140	101	60 - 140	98	%				
5151692	D8-Toluene	2017/09/07	102	60 - 140	103	60 - 140	99	%				
5153173	Leachable Decachlorobiphenyl	2017/09/07	94	30 - 130	89	30 - 130	90	%				
5148181	F2 (C10-C16 Hydrocarbons)	2017/09/05	93	50 - 130	85	80 - 120	<10	ug/g	NC	30		
5148181	F3 (C16-C34 Hydrocarbons)	2017/09/05	99	50 - 130	91	80 - 120	<50	ug/g	NC	30		
5148181	F4 (C34-C50 Hydrocarbons)	2017/09/05	97	50 - 130	85	80 - 120	<50	ug/g	NC	30		
5148646	Moisture	2017/09/02							0	20		
5149333	Hot Water Ext. Boron (B)	2017/09/05	101	75 - 125	96	75 - 125	<0.050	ug/g	NC	40		
5149366	Moisture	2017/09/05							0.76	20		
5149372	Acid Extractable Antimony (Sb)	2017/09/07	87	75 - 125	102	80 - 120	<0.20	ug/g	NC	30		
5149372	Acid Extractable Arsenic (As)	2017/09/07	102	75 - 125	106	80 - 120	<1.0	ug/g	5.2	30		
5149372	Acid Extractable Barium (Ba)	2017/09/07	NC	75 - 125	98	80 - 120	<0.50	ug/g	1.6	30		
5149372	Acid Extractable Beryllium (Be)	2017/09/07	105	75 - 125	102	80 - 120	<0.20	ug/g	3.7	30		
5149372	Acid Extractable Boron (B)	2017/09/07	91	75 - 125	98	80 - 120	<5.0	ug/g	0.87	30		
5149372	Acid Extractable Cadmium (Cd)	2017/09/07	102	75 - 125	99	80 - 120	<0.10	ug/g	12	30		
5149372	Acid Extractable Chromium (Cr)	2017/09/07	NC	75 - 125	104	80 - 120	<1.0	ug/g	1.7	30		
5149372	Acid Extractable Cobalt (Co)	2017/09/07	100	75 - 125	106	80 - 120	<0.10	ug/g	0.39	30		
5149372	Acid Extractable Copper (Cu)	2017/09/07	NC	75 - 125	103	80 - 120	<0.50	ug/g	0.30	30		
5149372	Acid Extractable Lead (Pb)	2017/09/07	103	75 - 125	105	80 - 120	<1.0	ug/g	2.9	30		
5149372	Acid Extractable Mercury (Hg)	2017/09/07	102	75 - 125	108	80 - 120	<0.050	ug/g	NC	30		
5149372	Acid Extractable Molybdenum (Mo)	2017/09/07	100	75 - 125	100	80 - 120	<0.50	ug/g	NC	30		
5149372	Acid Extractable Nickel (Ni)	2017/09/07	NC	75 - 125	106	80 - 120	<0.50	ug/g	4.1	30		
5149372	Acid Extractable Selenium (Se)	2017/09/07	105	75 - 125	106	80 - 120	<0.50	ug/g	NC	30		
5149372	Acid Extractable Silver (Ag)	2017/09/07	99	75 - 125	102	80 - 120	<0.20	ug/g	NC	30		
5149372	Acid Extractable Sodium (Na)	2017/09/07	102	75 - 125	104	80 - 120	<50	ug/g				
5149372	Acid Extractable Thallium (Tl)	2017/09/07	99	75 - 125	103	80 - 120	<0.050	ug/g	2.6	30		
5149372	Acid Extractable Uranium (U)	2017/09/07	102	75 - 125	103	80 - 120	<0.050	ug/g	7.0	30		

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Maxxam Job #: B7J0147
Report Date: 2017/09/08

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5149372	Acid Extractable Vanadium (V)	2017/09/07	NC	75 - 125	106	80 - 120	<5.0	ug/g	0.82	30		
5149372	Acid Extractable Zinc (Zn)	2017/09/07	NC	75 - 125	108	80 - 120	<5.0	ug/g	1.5	30		
5149616	Moisture	2017/09/05							5.7	20		
5149643	Chromium (VI)	2017/09/07	74 (1)	75 - 125	88	80 - 120	<0.2	ug/g	NC	35		
5149685	Hot Water Ext. Boron (B)	2017/09/06	101	75 - 125	94	75 - 125	<0.050	ug/g	4.1	40		
5149710	Available (CaCl2) pH	2017/09/07			99	97 - 103			0.085	N/A		
5149831	Acid Extractable Antimony (Sb)	2017/09/07	96	75 - 125	102	80 - 120	<0.20	ug/g	10	30		
5149831	Acid Extractable Arsenic (As)	2017/09/07	99	75 - 125	100	80 - 120	<1.0	ug/g	6.9	30		
5149831	Acid Extractable Barium (Ba)	2017/09/07	NC	75 - 125	106	80 - 120	<0.50	ug/g	1.9	30		
5149831	Acid Extractable Beryllium (Be)	2017/09/07	106	75 - 125	105	80 - 120	<0.20	ug/g	0.45	30		
5149831	Acid Extractable Boron (B)	2017/09/07	100	75 - 125	109	80 - 120	<5.0	ug/g	NC	30		
5149831	Acid Extractable Cadmium (Cd)	2017/09/07	98	75 - 125	101	80 - 120	<0.10	ug/g	NC	30		
5149831	Acid Extractable Chromium (Cr)	2017/09/07	100	75 - 125	102	80 - 120	<1.0	ug/g				
5149831	Acid Extractable Cobalt (Co)	2017/09/07	100	75 - 125	101	80 - 120	<0.10	ug/g	4.6	30		
5149831	Acid Extractable Copper (Cu)	2017/09/07	101	75 - 125	102	80 - 120	<0.50	ug/g	0.37	30		
5149831	Acid Extractable Lead (Pb)	2017/09/07	98	75 - 125	99	80 - 120	<1.0	ug/g	4.7	30		
5149831	Acid Extractable Mercury (Hg)	2017/09/07	103	75 - 125	103	80 - 120	<0.050	ug/g	16	30		
5149831	Acid Extractable Molybdenum (Mo)	2017/09/07	100	75 - 125	100	80 - 120	<0.50	ug/g	NC	30		
5149831	Acid Extractable Nickel (Ni)	2017/09/07	101	75 - 125	101	80 - 120	<0.50	ug/g	0.90	30		
5149831	Acid Extractable Selenium (Se)	2017/09/07	102	75 - 125	104	80 - 120	<0.50	ug/g	NC	30		
5149831	Acid Extractable Silver (Ag)	2017/09/07	100	75 - 125	100	80 - 120	<0.20	ug/g	NC	30		
5149831	Acid Extractable Sodium (Na)	2017/09/07	106	75 - 125	106	80 - 120	<50	ug/g				
5149831	Acid Extractable Thallium (Tl)	2017/09/07	97	75 - 125	97	80 - 120	<0.050	ug/g				
5149831	Acid Extractable Uranium (U)	2017/09/07	99	75 - 125	100	80 - 120	<0.050	ug/g	10	30		
5149831	Acid Extractable Vanadium (V)	2017/09/07	100	75 - 125	101	80 - 120	<5.0	ug/g	7.3	30		
5149831	Acid Extractable Zinc (Zn)	2017/09/07	NC	75 - 125	101	80 - 120	<5.0	ug/g	3.0	30		
5151209	WAD Cyanide (Free)	2017/09/07	94	75 - 125	95	80 - 120	<0.01	ug/g	NC	35		
5151277	Soluble Calcium (Ca)	2017/09/07			92	80 - 120	<0.5	mg/L	1.6	30		
5151277	Soluble Magnesium (Mg)	2017/09/07			96	80 - 120	<0.5	mg/L	NC	30		
5151277	Soluble Sodium (Na)	2017/09/07			92	80 - 120	<5	mg/L	1.9	30		

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Maxxam Job #: B7J0147
Report Date: 2017/09/08

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5151290	Conductivity	2017/09/07			100	90 - 110	<0.002	mS/cm	2.1	10		
5151406	Soluble Calcium (Ca)	2017/09/07			94	80 - 120	<0.5	mg/L	5.6	30		
5151406	Soluble Magnesium (Mg)	2017/09/07			97	80 - 120	<0.5	mg/L	0.52	30		
5151406	Soluble Sodium (Na)	2017/09/07			91	80 - 120	<5	mg/L	5.2	30		
5151425	Conductivity	2017/09/07			100	90 - 110	<0.002	mS/cm	0.81	10		
5151692	1,1,1,2-Tetrachloroethane	2017/09/07	101	60 - 140	100	60 - 130	<0.050	ug/g	NC	50		
5151692	1,1,1-Trichloroethane	2017/09/07	96	60 - 140	94	60 - 130	<0.050	ug/g	NC	50		
5151692	1,1,2,2-Tetrachloroethane	2017/09/07	100	60 - 140	98	60 - 130	<0.050	ug/g	NC	50		
5151692	1,1,2-Trichloroethane	2017/09/07	97	60 - 140	95	60 - 130	<0.050	ug/g	NC	50		
5151692	1,1-Dichloroethane	2017/09/07	105	60 - 140	102	60 - 130	<0.050	ug/g	NC	50		
5151692	1,1-Dichloroethylene	2017/09/07	112	60 - 140	110	60 - 130	<0.050	ug/g	NC	50		
5151692	1,2-Dichlorobenzene	2017/09/07	93	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	1,2-Dichloroethane	2017/09/07	95	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	1,2-Dichloropropane	2017/09/07	95	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	1,3-Dichlorobenzene	2017/09/07	94	60 - 140	93	60 - 130	<0.050	ug/g	NC	50		
5151692	1,4-Dichlorobenzene	2017/09/07	93	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	Acetone (2-Propanone)	2017/09/07	101	60 - 140	99	60 - 140	<0.50	ug/g	NC	50		
5151692	Benzene	2017/09/07	102	60 - 140	99	60 - 130	<0.020	ug/g	NC	50		
5151692	Bromodichloromethane	2017/09/07	95	60 - 140	93	60 - 130	<0.050	ug/g	NC	50		
5151692	Bromoform	2017/09/07	100	60 - 140	97	60 - 130	<0.050	ug/g	NC	50		
5151692	Bromomethane	2017/09/07	105	60 - 140	103	60 - 140	<0.050	ug/g	NC	50		
5151692	Carbon Tetrachloride	2017/09/07	96	60 - 140	94	60 - 130	<0.050	ug/g	NC	50		
5151692	Chlorobenzene	2017/09/07	95	60 - 140	93	60 - 130	<0.050	ug/g	NC	50		
5151692	Chloroform	2017/09/07	96	60 - 140	94	60 - 130	<0.050	ug/g	NC	50		
5151692	cis-1,2-Dichloroethylene	2017/09/07	97	60 - 140	94	60 - 130	<0.050	ug/g	NC	50		
5151692	cis-1,3-Dichloropropene	2017/09/07	90	60 - 140	88	60 - 130	<0.030	ug/g	NC	50		
5151692	Dibromochloromethane	2017/09/07	100	60 - 140	97	60 - 130	<0.050	ug/g	NC	50		
5151692	Dichlorodifluoromethane (FREON 12)	2017/09/07	104	60 - 140	103	60 - 140	<0.050	ug/g	NC	50		
5151692	Ethylbenzene	2017/09/07	95	60 - 140	93	60 - 130	<0.020	ug/g	NC	50		
5151692	Ethylene Dibromide	2017/09/07	101	60 - 140	99	60 - 130	<0.050	ug/g	NC	50		

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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5151692	F1 (C6-C10) - BTEX	2017/09/07					<10	ug/g	NC	30		
5151692	F1 (C6-C10)	2017/09/07	104	60 - 140	99	80 - 120	<10	ug/g	NC	30		
5151692	Hexane	2017/09/07	107	60 - 140	105	60 - 130	<0.050	ug/g	NC	50		
5151692	Methyl Ethyl Ketone (2-Butanone)	2017/09/07	102	60 - 140	100	60 - 140	<0.50	ug/g	NC	50		
5151692	Methyl Isobutyl Ketone	2017/09/07	96	60 - 140	93	60 - 130	<0.50	ug/g	NC	50		
5151692	Methyl t-butyl ether (MTBE)	2017/09/07	96	60 - 140	94	60 - 130	<0.050	ug/g	NC	50		
5151692	Methylene Chloride(Dichloromethane)	2017/09/07	105	60 - 140	103	60 - 130	<0.050	ug/g	NC	50		
5151692	o-Xylene	2017/09/07	95	60 - 140	93	60 - 130	<0.020	ug/g	NC	50		
5151692	p+m-Xylene	2017/09/07	98	60 - 140	95	60 - 130	<0.020	ug/g	NC	50		
5151692	Styrene	2017/09/07	94	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	Tetrachloroethylene	2017/09/07	92	60 - 140	90	60 - 130	<0.050	ug/g	NC	50		
5151692	Toluene	2017/09/07	96	60 - 140	94	60 - 130	<0.020	ug/g	NC	50		
5151692	Total Xylenes	2017/09/07					<0.020	ug/g	NC	50		
5151692	trans-1,2-Dichloroethylene	2017/09/07	103	60 - 140	99	60 - 130	<0.050	ug/g	NC	50		
5151692	trans-1,3-Dichloropropene	2017/09/07	95	60 - 140	93	60 - 130	<0.040	ug/g	NC	50		
5151692	Trichloroethylene	2017/09/07	94	60 - 140	92	60 - 130	<0.050	ug/g	NC	50		
5151692	Trichlorofluoromethane (FREON 11)	2017/09/07	107	60 - 140	105	60 - 130	<0.050	ug/g	NC	50		
5151692	Vinyl Chloride	2017/09/07	94	60 - 140	94	60 - 130	<0.020	ug/g	NC	50		
5153150	Leachable Mercury (Hg)	2017/09/07	108	75 - 125	100	80 - 120	<0.0010	mg/L	NC	25	<0.0010	mg/L
5153173	Leachable Total PCB	2017/09/07	100	30 - 130	97	30 - 130	<3.0	ug/L	NC	40		
5153211	Leachable Arsenic (As)	2017/09/07	102	80 - 120	95	80 - 120			NC	35	<0.2	mg/L
5153211	Leachable Barium (Ba)	2017/09/07	109	80 - 120	98	80 - 120			1.2	35	<0.2	mg/L
5153211	Leachable Boron (B)	2017/09/07	96	80 - 120	95	80 - 120			NC	35	<0.1	mg/L
5153211	Leachable Cadmium (Cd)	2017/09/07	99	80 - 120	93	80 - 120			NC	35	<0.05	mg/L
5153211	Leachable Chromium (Cr)	2017/09/07	97	80 - 120	92	80 - 120			NC	35	<0.1	mg/L
5153211	Leachable Lead (Pb)	2017/09/07	95	80 - 120	91	80 - 120			NC	35	<0.1	mg/L
5153211	Leachable Selenium (Se)	2017/09/07	102	80 - 120	95	80 - 120			NC	35	<0.1	mg/L
5153211	Leachable Silver (Ag)	2017/09/07	93	80 - 120	89	80 - 120			NC	35	<0.01	mg/L
5153211	Leachable Uranium (U)	2017/09/07	97	80 - 120	91	80 - 120			NC	35	<0.01	mg/L
5153230	Leachable WAD Cyanide (Free)	2017/09/07	98	80 - 120	98	80 - 120	<0.0020	mg/L	NC	20	<0.010	mg/L

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Maxxam Job #: B7J0147
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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		Leachate Blank	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	Value	UNITS
5153235	Leachable Fluoride (F-)	2017/09/07	93	80 - 120	103	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L
5153240	Leachable Nitrate (N)	2017/09/07	94	80 - 120	94	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
5153240	Leachable Nitrate + Nitrite (N)	2017/09/07	96	80 - 120	96	80 - 120	<1.0	mg/L	NC	25	<1.0	mg/L
5153240	Leachable Nitrite (N)	2017/09/07	103	80 - 120	102	80 - 120	<0.10	mg/L	NC	25	<0.10	mg/L

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Leachate Blank: A blank matrix containing all reagents used in the leaching procedure. Used to determine any process contamination.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7J0147
Report Date: 2017/09/08

exp Services Inc
Client Project #: BRM-00603505-D0
Site Location: SHAWSCREEK RD, BELFOUNTAIN
Your P.O. #: BRM-GEO
Sampler Initials: AA

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Cristina Carriere

Cristina Carriere, Scientific Service Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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