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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
LOT 13, CONCESSION 10
MCBAIN LAND SUBDIVISION
CRYSLER, ONTARIO

Project # 220210

Submitted to:

G & E Renovations
236 Centenaire Street
Embrun, ON
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June 2022

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RE: GEOTECHNICAL INVESTIGATION
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed residential development to be located east of SDG County Road 12 and north of the South Nation River in Crysler, Ontario (see Key Plan, Figure 1).

The purpose of the investigation was to:

- Identify the subsurface conditions at the site by means of a limited number of test pits and boreholes;
- Based on the factual information obtained, provide recommendations and guidelines on the geotechnical engineering aspects of the project design; including bearing capacity and other construction considerations, which could influence design decisions.

2.0 BACKGROUND INFORMATION AND SITE GEOLOGY

2.1 Existing Conditions and Site Geology

The subject site for this assessment consists of about a 18.2 hectare (45 acres) irregular-shaped property located east of SDG County Road 12 and north of the South Nation River in Crysler, Ontario (see Key Plan, Figure 1).

For the purposes of this assessment, project north lies in a direction parallel to County Road 12, located west of the site.

Surrounding land use is currently a mixture of residential development and agricultural land. The site is bordered on the north by agricultural land, on the east and south by the South Nation River followed by agricultural land, and on the west by SDG County Road 12 followed by residential developments. The site is currently agricultural land.

The ground surface at the site is sloped to the southeast towards the South Nation River.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by silty clay and glacial till. Bedrock geology maps indicate that the bedrock underlying the site consists of limestone with shaley partings of the Ottawa formation.

Based on a review of overburden thickness mapping for the site area, the overburden is estimated to be between about 0 to 6 metres in thickness above bedrock.

Groundwater flow often reflects topographic features and typically flows toward nearby lakes, rivers and wetland areas. Based on the topography of the area, it is expected that the local shallow groundwater flow is to the south toward the South Nation River.

2.2 Proposed Development

It is understood that preliminary plans are being prepared for the construction of a residential subdivision at the site. It is understood that the residential development will consist of a combination of single family dwellings, semi-detached and townhouses. It is understood that the buildings will be wood framed with some brick veneer and cast-in-place concrete construction with conventional concrete spread footing foundations with basements. The proposed buildings will be provided with an asphaltic concrete driveway. The proposed buildings will be serviced by municipal water and sanitary services.

It is understood the proposed development will include the construction of a new sanitary pumping station. The pumping station will likely be located in the southeastern corner of the site. It is understood the base of the proposed pump station will likely extend to between 5 and 8 metres below the existing ground surface.

It is also understood that a future residential development is also proposed for the property located north of this site.

Surface drainage for the proposed buildings will be by means of swales, catch basins and storm sewers.

3.0 PROCEDURE

The field work for this investigation was carried out on March 24, March 25, May 11 and May 12, 2022, at which time seventeen test pits and four boreholes were put down at the site. The test pits and borehole locations and numbers were provided by EVB Engineering prior to the field work in conjunction with proposed civil works being completed for the proposed development. Seventeen test pits numbered TP1 to TP5 and TP 7 to TP 17 and four boreholes numbered BH6, BH19, BH24 and BH30 were put down at the site. Boreholes BH6, BH19, BH24 and BH30 were put down on March 24 and March 25, 2022. Borehole BH6 and BH19 were put down on the site, whereas boreholes BH24 and Bh30 were put down in the future development north of the site. Boreholes BH24 and BH30 are not considered in this report, with the exception of samples submitted for laboratory testing. Borehole BH6 was put down in the proposed location of the pumping station. The boreholes were put down using a track mounted drill rig equipped with a hollow stem auger owner and operated by CCC Drilling of Ottawa, Ontario. On May 11 and May 12, 2022, seventeen (17) test pits numbered TP1 to TP5 and TP7 to TP18 were put down within the area of the proposed residential development using a track mounted excavator owned and operated by a local excavation contractor.

The test pits and boreholes put down during the subsurface investigation were for geotechnical purposes only. Identification of the presence or absence of surface or subsurface contamination was

outside the scope of work for the investigation. As such, an environmental technician was not on site for environmental sampling or assessment purposes.

The test pits were advanced to depths of about 3.7 to 6.0 metres below the existing ground surface. The boreholes were advanced to depths of about 5.2 to 8.9 metres below the existing ground surface using 200 mm hollow stem augers. Sampling of the overburden materials encountered at the borehole locations were carried out at regular 0.75 metre depth intervals using a 50 millimetre diameter drive open conventional split spoon sampler in conjunction with standard penetration testing (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils) and in situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil).

The subsurface conditions encountered at the test pits and boreholes were classified based on visual and tactile examination of the materials exposed on the sides and bottom of the test pits (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), an assessment of the difficulty of digging, standard penetration tests (ASTM D-1586) as well as laboratory test results on select samples recovered from the test pits and boreholes. The soils were classified using the Unified Soil Classification System. The groundwater conditions were observed in the open test pits and the boreholes at the time of excavating and drilling. Groundwater was measured at a later date in standpipes put down within the boreholes. The test pits and boreholes were loosely backfilled with the excavated materials and auger cuttings upon completion of the fieldwork.

Three soil samples (BH6 – SS8 – 6.9 – 7.5 m, BH19 – SS5 – 4.6 – 5.2 m and BH24 – SS1 – 0.8 – 1.4 m) were submitted for Particle Size Analysis (ASTM D422). One soil sample (BH19–SS5–4.6–5.2 m) was submitted for Atterberg Limits (D4318) and Moisture Content (ASTM D2216). The samples were selected based on depth and tactile examination to be representative of the various soil conditions encountered at the site. The soils were classified using the Unified Soil Classification System.

A total of three soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216).

Three soil samples (BH6 – SS2 – 1.5 – 2.1 m, BH19 – SS2 – 1.5 – 2.1 m, BH24 – SS2 – 1.5 – 2.1 m) were delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack on concrete and corrosivity to buried steel.

The field work was supervised throughout by a member of our engineering staff who located the test pits and the boreholes in the field, logged the test pits and boreholes and cared for the samples obtained. A description of the subsurface conditions encountered at the test pits and boreholes given in the attached Table I, Record of Test Pits and Boreholes sheets following this report. The results of the laboratory testing of the soil samples are presented in the Laboratory Test Results section and Attachment A and B following the text in this report. The approximate locations of the test pits and boreholes are shown on the attached Site Plan, Figure 2.

The location of the seventeen (17) test pits, four boreholes and ground surface elevations were provided by EVB Engineering prior to the field work for the test pits. All of the test holes are indicated on the attached Site Plan, Figure 2.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, a description of the subsurface conditions encountered at the test pits and boreholes is provided in the attached Record of Test Pit and Borehole Sheets following the text of this report. The test pit and borehole logs indicate the subsurface conditions at the specific drill locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than borehole locations may vary from the conditions encountered at the boreholes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the test hole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The following is a brief overview of the subsurface conditions encountered at the test pits and boreholes.

4.3 Topsoil

About a 0.15 to 0.5 metre thickness of topsoil was encountered below the ground surface at all of the test holes. The material was classified as topsoil based on the colour and the presence of organic materials. The identification of the topsoil layer is for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustainable plant growth.

4.5 Silty Clay

Beneath the topsoil, a deposit of red brown to grey brown to grey silty clay was encountered at all of the test pits and boreholes. In situ vane shear tests carried out in the silty clay deposit in the test pits gave undrained shear strength values ranging from about 36 to 110 kilopascals in the test pits. In situ vane shear tests carried out in the silty clay deposit in the boreholes gave undrained shear strength values ranging from about 33 to 72 kilopascals in the boreholes BH6 and BH19. The results of the in situ vane shear testing and tactile examination carried out for the silty clay material indicate that the silty clay is firm to very stiff in consistency.

Test pits TP1 to TP4, TP7 to TP12, TP14, TP15, TP17, TP18 and borehole BH19 were terminated within the silty clay deposit at depths ranging from 4.0 to 6.0 metres below the existing ground surface. The silty clay was fully penetrated in test pits TP5, TP13, TP16 and borehole BH6. The thickness of the silty clay, where fully penetrated, ranged between about 1.8 to 6.9 metres.

The results of Atterberg Limits tests and moisture content (ASTM D422) conducted on two soil samples (BH19 – SS5 – 4.6 – 5.2 metres and BH6 – SS4 – 3.0 – 3.6 metres) of the silty clay are

presented in the following table and in Attachment A at the end of the report. The tested silty clay samples classify as medium plasticity in accordance with the Unified Soil Classification System.

Table I – Atterberg Limit and Water Content Results

Sample	Depth(metres)	LL (%)	PL (%)	PI (%)
BH19 – SS5	4.6 – 5.2	43.3	20.9	22.4
BH6 – SS7	5.9 – 6.6	34.7	18.8	15.9

LL: Liquid Limit PL: Plastic Limit PI: Plasticity Index w: water content
CI: Inorganic Medium Plastic Clays

The results of hydrometer tests (ASTM D422 and D2216) on four samples of soil (BH19 – SS5 – 4.6 – 5.2 metres, BH24 – SS1 – 0.8 – 1.4 metres, BH6 – SS4 – 3.0 – 3.6 metres & BH6 – SS7 – 5.9 – 6.6 metres) indicate the samples have the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH19 – SS5	4.6 – 5.2	7.9	13.5	38.6	40.0
BH24 – SS1	0.8 – 1.4	0.0	0.6	25.4	74.0
BH6 – SS4	3.0 – 3.6	0.0	1.9	27.1	71.0
BH6 – SS7	5.9 – 6.6	0.0	2.8	62.2	35.0

The results of the laboratory testing are located in Attachment A.

4.6 Glacial Till

A deposit of grey silty sand glacial till was encountered beneath the silty clay at test pits TP5, TP13, and TP16, as well as in borehole BH6. The glacial till consists of gravel in a matrix of silty sand with some clay, gravel and cobbles. The glacial till was encountered at depths ranging between 2.1 and 7.0 metres below the existing ground surface. Practical refusal on large boulders was encountered within the glacial till in borehole BH6, giving an N value of greater than 100 blows per 0.3 metres. Borehole BH6 was terminated within the glacial till at a depth of 8.9 metres, and test pits TP5, TP13 and TP16 were terminated within the glacial till at depths of about 3.7, 5.0 and 5.0 metres, respectively, below the ground surface.

The results of a hydrometer test (ASTM D422 and D2216) on a sample of soil (BH6 – SS8 – 6.9 – 7.5 metres) indicate the sample has the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH6 – SS8	6.9 – 7.5	23.4	17.4	46.2	13.0

The results are located in Attachment A.

4.7 Moisture Contents

A total of eight soil samples recovered from the test pits and boreholes were tested for moisture content (ASTM D2216). The measured moisture contents of the soil samples ranged from about 19 to 45 percent. The results of the moisture content are located on the Record of Test Pit and Borehole sheets following the text of this report.

4.8 Groundwater

Some groundwater seepage was encountered within some of the test pits and at borehole BH6 at the time of the field work. The groundwater levels ranged from about 2.2 to 5.0 metres below the existing ground surface. On May 11, 2022, groundwater was measured within standpipes installed within both boreholes BH6 and BH19 at depths of about 2.0 and 0.5 metres, respectively, below the existing ground surface. It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

4.9 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of soil samples submitted for chemistry testing related to corrosivity is summarized in the following tables.

BH6 – SS2 – 1.5 – 2.1 metres

Item	**Threshold of Concern**	**Test Result**	**Comment**
Chlorides (Cl)	Cl > 0.04 %	0.00052	Negligible concern
pH	pH < 5.0	7.74	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	5550	Moderately Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	<0.0020	Negligible concern

BH19 – SS2 – 1.5 – 2.1 metres

Item	Threshold of Concern	Test Result	Comment
Chlorides (Cl)	Cl > 0.04 %	0.00200	Negligible concern
pH	pH < 5.0	7.73	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	5910	Moderately Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0023	Negligible concern

BH24 – SS2 – 1.5 – 2.1 metres

Item	Threshold of Concern	Test Result	Comment
Chlorides (Cl)	Cl > 0.04 %	0.00052	Negligible concern
pH	pH < 5.0	7.85	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	5430	Moderately Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	<0.0020	Negligible concern

The results were compared with Canadian Standards Association (CSA) Standards A23.1 for sulphate attack potential on concrete structures and posses a "negligible" risk for sulphate attack on concrete materials and accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

The pH values for the soil samples were reported to be between 7.74 and 7.85, indicating a durable condition against corrosion. This value was evaluated using Table 2 of Building Research Establishment (BRE) Digest 362 (July 1991).The pH is greater than 5.5 indicating the concrete will not be exposed to attack from acids.

The chloride content of the sample was also compared with the threshold level and present negligible concrete corrosion potential.

Corrosivity Rating for soils ranges from extremely corrosive to non-corrosive as follows:

Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	non- corrosive
10,000 to 20,000	mildly corrosive
5,000 to 10,000	moderately corrosive
3,000 to 5,000	corrosive

1,000 to 3,000	highly corrosive
< 1,000	extremely corrosive

The Soil resistivity was found to be between 5430 and 5910 ohm-cm for the samples analyzed making the soil moderately corrosive for buried steel. Consideration to increasing the specified strength and/or adding air entrainment into any reinforced concrete in contact with the soil should be given. Consideration should also be given to increasing the minimum concrete cover over reinforcing steel.

Based on the chemical test results, Type GU General use Hydraulic Cement may be used for this proposed development. Special protection is required for reinforcement steel within the concrete walls.

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the information from the test holes and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this report.

5.2 Foundations for Proposed Residential Buildings

As previously indicated, the subsurface conditions encountered at the test pits and boreholes advanced during the investigation consisted of topsoil followed by silty clay overlying glacial till with depth. Based on the undrained shear strength measurements within the silty clay deposit, the silty clay has a firm to very stiff consistency and may have a limited capacity to support loads from footings and grade raise fill in some areas. The allowable bearing pressure for any footings depends on the depth of the footings below original ground surface, the width of the footings, and the height above the original ground surface of any landscape grade raise adjacent to the foundations and the thickness of the soils deposit beneath the footings.

5.3 Foundation Design and Bearing Capacity for Proposed Residential Buildings

With the exception of the topsoil, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed buildings on conventional spread footing foundations placed on a native subgrade or on engineered fill placed on the native subgrade. The excavations for the foundations should be taken through any topsoil or otherwise deleterious material to expose the native, undisturbed grey brown silty clay. It is suggested that the buildings be founded either directly on the underlying silty clay or on engineered fill placed on the silty clay.

Strip and pad footings, a minimum 0.5 metres in width bearing on the native undisturbed silty clay at a founding depth of about 1.5 metres below the existing ground surface and above the groundwater level or on a suitably constructed engineering pad placed on the native silty clay may be designed using a maximum allowable bearing pressure of 90 kilopascals for serviceability limit states and 180 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 1.5 metres above the existing ground surface in and within 2.4 metres of proposed garages and infilled entrance/decks. A maximum of 1.8 metres of grade raise is allowed around the remainder of the building units. The above allowable bearing pressure is subject to maximum strip footing widths of 1 metre and pad footing widths of 1.5 metres.

Provided that any loose and/or disturbed soil is removed from the bearing surfaces prior to pouring concrete, the total and differential settlement of the footings should be less than 25 millimetres and 20 millimetres, respectively.

5.4 Foundation Design Considerations for Proposed Sanitary Pumping Station

The subsurface conditions at the site encountered at the borehole for the proposed sanitary pumping station (BH6) advanced during the investigation consisted of a thin layer of topsoil followed by native silty clay then by glacial till at a depth of about 7.0 metres. The borehole was terminated in very dense glacial till at a depth of about 8.9 metres. With the exception of the topsoil, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed sanitary pumping station building on conventional spread footing or raft foundation placed on a native subgrade or on engineered fill placed on the native subgrade.

A geotechnical bearing resistance at Serviceability Limit State (SLS) of kPa to limit settlement to 25 mm and a factored bearing resistance at Ultimate Limit State (ULS) of kPa are considered appropriate for preliminary design and should be re-assessed when the final footing/raft type/size/elevation are known. It is likely that bearing resistances will not govern foundation design since pumping station construction will result in a net unloading of the ground (the removed ground may weigh more than the weight of the SPS, sewage and pumps).

The sanitary pumping station foundation walls should be designed to resist the earth pressure, P, acting against the walls at any depth, h, calculated using the following equation.

$$P = k_0 (\gamma h + q) + \gamma_w H$$

Where:

	P	=	the pressure, at any depth, h, below the finished ground surface
	k_0	=	earth pressure at-rest coefficient, 0.5
	γ	=	unit weight of soil to be retained, estimated at 22 kN/m^3
	q	=	surcharge load (kPa) above backfill material
	h	=	the depth, in metres, below the finished ground surface at which the pressure, P, is being computed
	γ_w	=	unit weight of water (9.81 kN/m^3)
	H	=	height of water level, in metres, from bottom of the foundation

This expression assumes that the water table adjacent the foundation will not be controlled once the foundation excavation and backfill is complete.

The SPS should be designed for uplift based on the stabilized groundwater level at the site. Resistance to uplift resulting from the friction between the backfill and foundation walls of the SPS should be calculated using a coefficient of friction of 0.35. If sufficient resistance with a suitable factor of safety cannot be achieved by using dead loads and sidewall friction, additional capacity can be achieved by extending the base of the SPS beyond the limits of the walls. Alternatively, grouted earth anchors or concrete dead weights could be installed to provide additional uplift capacity.

An uplift assessment should be carried out for the proposed SPS. The factor of safety against uplift is estimated as:

$$\textit{Factor of Safety against uplift} = \frac{\textit{Weight of Concrete Walls/Base + Side Friction Resistance}}{\textit{Uplift Forces due to Groundwater (buoyancy)}}$$

Only the weight of the SPS concrete walls and base should be considered in the assessment. The weight of all other proposed connected structures should be neglected. For this methodology, a minimum factor of safety against hydraulic uplift of about 1.3 should be used. If, however, resistance against uplift is based solely on gravity (weight of the structure and dead weights), a factor of safety of 1.1 is considered appropriate. For design purposes, the groundwater levels should be assumed equal to the ground surface to account for full saturation of any backfill.

5.5 Engineered Fill

Any fill required to raise the footings for the proposed buildings to founding level should consist of imported granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standards Specifications (OPSS) requirements for Granular A or Granular B Type II and should be compacted in maximum 300 millimetre thick loose lifts to at least 98 percent of the standard Proctor maximum dry density. It is considered that the engineered fill should be compacted using dynamic compaction with a large diameter vibratory steel drum roller or diesel plate compactor. If a diesel plate compactor is used, the lift thickness may need to be

restricted to less than 300 mm to achieve proper compaction. Compaction should be verified by a suitable field compaction test method.

To allow the spread of load beneath the footings, the engineered fill should extend out 0.5 metres horizontally and then down and out from the edges of the footing at 1 horizontal to 1 vertical, or flatter. The excavations for the proposed buildings should be sized to accommodate this fill placement.

The first lift of engineered fill material should have a thickness of 300 millimetres in order to protect the subgrade during compaction. It is considered that the placement of a geotextile fabric between the engineered fill and the subgrade is not necessary where granular materials meeting the grading requirements for OPSS Granular B Type II or OPSS Granular A are placed on a silty clay subgrade above the normal groundwater level. It is recommended that trucks are not used to place the engineered fill on the subgrade. The fill should be dumped at the edge of the excavation and moved into place with a tracked bulldozer or excavator.

The native silty clay and glacial till soils at this site will be sensitive to disturbance from construction operations and from rainwater or snowmelt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

5.6 Excavation Considerations

5.6.1 Foundation Excavation for Proposed Residential Buildings

Any excavation for the proposed structures will likely be carried out through topsoil and silty clay to bear within the native silty clay subgrade. The sides of the excavations should be sloped in accordance with the requirements of Ontario Regulation 213/91, s. 226 under the Occupational Health and Safety Act. According to the Act, the native soils at the site can be classified as Type 3 soil, however this classification should be confirmed by qualified individuals as the site is excavated and if necessary, adjusted.

It is expected that the side slopes of the excavation will be stable in the short term provided the walls are sloped at 1H:1V through the topsoil and silty clay to 1.2 metres or less from the bottom of the excavation and provided no excavated materials are stockpiled within 3 metres of the top of the excavations.

5.6.2 Foundation Excavation for Proposed Pumping Station

Based on the assumed founding elevation, the bottom of the Sanitary Pumping Station (SPS) will be within the silty clay stratum at a depth between 5 and 7 metres or within the glacial till at a depth between 7 and 8 metres below the existing ground surface. The groundwater level was measured on May 11, 2022 at about 2.0 metres below the existing ground surface in a standpipe installed in BH6. As such, it is expected that the SPS will be founded below the groundwater level and the excavation for the SPS will extend below the groundwater level.

To avoid significant pumping of groundwater, it is recommended that the pumping station be founded at a maximum depth of 6.5 metres below the existing ground surface.

Given the relatively uniform nature and medium plasticity of the silty clay soils encountered with depth at the proposed SPS location, the excavation for the SPS is not expected to yield significant volumes of water. As such, it is expected that any dewatering required can be handled with a submersible pump at the base of the excavation. It is expected that a Permit to Take Water will not be required for this construction work. There is a potential that registration for construction dewatering may be required under the Environmental Activity and Sector Registry.

5.6.3 Effect of Foundation Excavation on Adjacent Structures and Municipal Services

As previously indicated, the proposed foundation excavations will be carried out through topsoil and silty clay. There will be no bedrock excavation or removal. As such, there will be no excavation processes which could contribute to vibration which could potentially damage adjacent municipal services.

5.6.4 Groundwater in Excavation and Construction Dewatering

Groundwater inflow from the native soils into the excavations during construction, if any should be handled by pumping from sumps within the excavation.

Groundwater was observed within the test pits and boreholes at depths ranging between about 0.5 to 5.0 metres below the existing ground surface. Based on the groundwater levels observed, it is expected that the excavation for the new buildings at the site may extend below the existing seasonally high groundwater level. However, given the medium plasticity clays present onsite, it is considered unlikely that a permit to take water will be required prior to excavation. It is considered however that registration under the Environmental Activity and Sector Registry may be required.

5.6.5 Effect of Dewatering of Foundation or Site Services Excavations on Adjacent Structures

Since the existing normal groundwater level at the site will be below the expected underside of footing elevations, dewatering of the excavation will not remove water from historically saturated soils. As such dewatering of the foundations or site services excavations, if required, will not have a detrimental impact on any adjacent structures.

5.7 Frost Protection Requirements for Spread Footing Foundations

In general, all exterior foundation elements and those in any unheated parts of the proposed buildings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated foundation elements adjacent to surfaces, which are cleared of snow cover during winter months should be provided with a minimum 1.8 metres of earth cover for frost protection purposes.

Where less than the required depth of soil cover can be provided, the foundation elements should be protected from frost by using a combination of earth cover and extruded polystyrene rigid insulation. A typical frost protection insulation detail could be provided upon request, if required.

5.8 Foundation Wall Backfill and Drainage

The native soils encountered at this site are considered to be frost susceptible. As such, to prevent possible foundation frost jacking due to frost adhesion, the backfill against the foundation walls and isolated walls or piers should consist of free draining, non-frost susceptible material. If imported material is required, it should consist of sand or sand and gravel meeting OPSS Granular B Type I grading requirements. Alternatively, foundations could be backfilled with native material in conjunction with the use of an approved proprietary drainage layer system such as "System Platon" against the foundation wall. It is pointed out that there is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. This could be mitigated by backfilling the upper approximately 0.6 metres with non-frost susceptible granular material.

Where the backfill material will ultimately support a pavement structure or walkway, it is suggested that the foundation wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor dry density value. In that case any native material proposed for foundation backfill should be inspected and approved by the geotechnical engineer.

The basement foundation walls should be designed to resist the earth pressure, P, acting against the walls at any depth, h, calculated using the following equation.

$$P = k_0 (\gamma h + q)$$

Where:

	P	=	the pressure, at any depth, h, below the finished ground surface
	k_0	=	earth pressure at-rest coefficient, 0.5
	γ	=	unit weight of soil to be retained, estimated at 22 kN/m^3
	q	=	surcharge load (kPa) above backfill material
	h	=	the depth, in metres, below the finished ground surface at which the pressure, P, is being computed

This expression assumes that the water table would be maintained at the founding level by the foundation perimeter drainage and backfill requirements.

A conventional, perforated perimeter drain, with a 150 millimetre surround of 20 millimetre minus crushed stone, should be provided at the founding level for the cast-in-place concrete basement floor slab and should lead by gravity flow to the Storm Sewer or to a sump. If the perimeter drain tile

is discharged by gravity to the Storm Sewer a backup flow valve must be used. If a sump is used, the sump should be equipped with a backup pump and generator. The sump discharge should be equipped with a backup flow protector.

5.9 Basement Floor Slab Support

As stated above, it is expected that the proposed buildings will be founded on native silty clay or on an engineered pad placed on the native subgrade. For predictable performance of the proposed concrete basement floor slab all topsoil and any otherwise deleterious material should be removed from below the proposed floor slab area. The exposed native subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be subexcavated and replaced with suitable engineered fill.

The fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The fill materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density.

The slab should be structurally independent from walls and columns, which are supported by the foundations. This is to reduce any structural distress that may occur as a result of differential soil movement. If it is intended to place any internal non-load bearing partitions directly on the slab-on-grade, such walls should also be structurally independent from other elements of the building founded on the conventional foundation system so that some relative vertical movement between the floor slab and foundation can occur freely.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding the lesser of 25 times the slab thickness or 4.5 metres. The slab should be cut as soon as it is possible to work on the slab without damaging the surface of the slab.

5.10 Seismic Design for the Proposed Residential Buildings

5.10.1 Seismic Site Classification

Based on the limited information from the boreholes, for seismic design purposes, in accordance with the 2017 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class D.

The assumed underside of footing level is at a maximum of about 1.5 metres below the existing ground surface. The footings will be bearing on silty clay with a plasticity index of greater than 20 and a moisture content of greater than 40%.

5.11 National Building Code Seismic Hazard Calculation

The online 2015 National Building Code Seismic Hazard Calculation was used to verify the seismic conditions at the site. The design Peak Ground Acceleration (PGA) for the site was calculated as 0.373 with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The seismic site classification for the site is indicated to be Seismic Site Class D. The results of the calculation are attached following the text of this report.

5.11.1 Potential for Soil Liquefaction

As previously indicated, the subsurface soils in general consist of medium plasticity clay followed by glacial till at depth of about 2.1 to 7.0 metres. Soils of this nature are not considered to be susceptible to liquefaction under seismic conditions. As such there is no risk to the buildings or services at the site resulting from seismic liquefaction.

6.0 SITE SERVICES

6.1 Excavation

The excavations for the site services will be carried out through topsoil and silty clay. For the purposes of Ontario Regulation 213/91 the soils at the site can be considered to be Type 3 soil.

The sides of the excavations in overburden materials should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Ontario Occupational Health and Safety Act. That is, open cut excavations with overburden deposits should be carried out with side slopes of 1 horizontal to 1 vertical, or flatter. Where space constraints dictate, the excavation and backfilling operations should be carried out within a tightly fitting, braced steel trench box.

Based on the depths at which groundwater was measured within the test pits and at boreholes BH6 and BH19, significant groundwater flow into any excavation is unlikely. Any groundwater inflow into the service trenches should be handled by pumping from sumps from within the excavations.

6.2 Pipe Bedding and Cover Materials

It is suggested that the service pipe bedding material consist of at least 150 millimetres of granular material meeting OPSS requirements for Granular A. A provisional allowance should, however, be made for sub-excavation of any existing fill or disturbed material encountered at sub-grade level. Granular material meeting OPSS specifications for Granular B Type II could be used as a sub-bedding material. The use of clear crushed stone as bedding or sub-bedding material should not be permitted.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The sub-bedding, bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

6.3 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway areas, acceptable native materials should be used as backfill between the roadway sub-

grade level and the depth of seasonal frost penetrations (i.e. 1.8 metres below finished grade) in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway.

Where native backfill is used, it should match the native materials exposed on the trench walls. Some of the native materials from the lower part of the trench excavations may be wet of optimum for compaction. Depending on the weather conditions encountered during construction, some drying of materials and/or recompaction may be required. Any wet materials that cannot be compacted to the required density should either be wasted from the site or should be used outside of existing or future roadway areas. Any boulders larger than 300 millimetres in size should not be used as service trench backfill. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. If the native material is not suitable for backfill, imported granular material may have to be used. If imported granular materials are used, suitable frost tapers should be used OPSD 802.013.

To minimize future settlement of the backfill and achieve an acceptable sub-grade for the roadways, sidewalks, etc., the trench should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. The specified density may be reduced where the trench backfill is not located or in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

7.0 ROADWAY PAVEMENTS

7.1 Subgrade Preparation

In preparation for pavement construction at this site any topsoil and any soft, wet or deleterious materials should be removed from the proposed roadway areas. The exposed subgrade surface should then be proof rolled, inspected and approved by geotechnical personnel. Based on the results of the boreholes, the subsurface conditions in the roadway areas in general consist of topsoil followed by silty clay. Any soft or unacceptable areas evident should be subexcavated and replaced with suitable earth borrow material. The subgrade should be shaped and crowned to promote drainage of the roadway and parking area granulars. Following approval of the preparation of the subgrade, the pavement granulars may be placed.

For any areas of the site that require the subgrade to be raised to proposed roadway and parking area subgrade level, the material used should consist of OPSS select subgrade material or OPSS Granular B Type I or Type II. Materials used for raising the subgrade to proposed roadway and parking area subgrade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

If the subgrade surface consists of native silty clay, the proposed roadway pavement should consist of:

40 millimetres of Superpave 12.5 asphaltic concrete over
50 millimetres of Superpave 19 asphaltic concrete over
150 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase over
(50 or 100 millimetre minus crushed stone)

Performance grade PG 58-34 asphaltic concrete should be specified. Compaction of the granular pavement materials should be carried out in maximum 300 millimetre thick loose lifts to 100 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

The above pavement structures will be adequate on an acceptable sub-grade, that is, one where any roadway fill and service trench backfill has been adequately compacted. If the roadway sub-grade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase and/or incorporate a non-woven geotextile separator between the roadway sub-grade surface and the granular subbase material. The adequacy of the design of the pavement thickness should be assessed by the geotechnical personnel at the time of construction.

8.0 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended and to re-evaluate the guidelines provided in the report with respect to the actual project plans. Items such as actual foundation wall/column loads, whether or

not the basement or below grade parking structure is heated, etc could have significant impacts on foundation type, frost protection requirements, etc.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All foundation areas and any engineered fill areas for the proposed residential buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable sub-grade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to ensure that the materials used conform to the grading and compaction specifications.

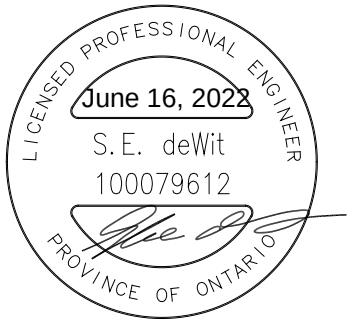
The subgrade for the site services, access roadways and driveway should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the service pipe bedding and backfill and the pavement granular materials to ensure the materials meet the specifications from a compaction point of view.

The native silty clay and glacial till deposits at this site will be sensitive to disturbance from construction operations, from rainwater or snow melt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Regards,

Kollaard Associates Inc.



Dean Tataryn, B.E.S., EP.

Steve DeWit, P.Eng.

RECORD OF TEST PIT TP01

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.93							
	Red brown SILTY CLAY	0.40		65.53							Some groundwater intrusion at about 3.0 metres below the existing ground surface, May 12, 2022.
1.0											
	Grey brown SILTY CLAY	1.20		64.73							
2.0											
3.0											▽
	Grey SILTY CLAY	3.60		62.33							
4.0											
	End of test pit in SILTY CLAY	4.00		61.93							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

RECORD OF TEST PIT TP02

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.60							
	Red brown SILTY CLAY	0.30		65.30							Test pit dry, May 12, 2022.
1.0											
	Grey brown SILTY CLAY	1.20		64.40							
2.0											
3.0											
4.0											
	End of test pit in SILTY CLAY	4.00		61.60							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP03

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.73							
	Red brown SILTY CLAY, one large boulder	0.30		65.43							Some groundwater intrusion at about 3.5 metres below the existing ground surface, May 12, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		64.13							
2.0											
3.0											
4.0											
	End of test pit in SILTY CLAY	4.00		61.73							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP04

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		63.98							
	Red brown SILTY CLAY	0.30		63.68							Some groundwater intrusion at about 3.7 metres below the existing ground surface, May 11, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		62.38							
2.0											
3.0											
	Grey SILTY CLAY	3.50		60.48							▽
4.0											
5.0											
6.0											
	End of test pit in SILTY CLAY	6.00		57.98							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

RECORD OF TEST PIT TP05

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		60.93							
	Red brown SILTY CLAY	0.30		60.63							Test pit dry, May 11, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		59.33							
2.0											
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.10		58.83							
3.0											
	Practical refusal on large boulder	3.70		57.23							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP07

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.64							
	Red brown SILTY CLAY	0.50		65.14							Test pit dry, May 11, 2022.
1.0								×			
	Grey brown SILTY CLAY	1.20		64.44							
2.0								×			
								×			
3.0											
	Grey SILTY CLAY	3.30		62.34							
4.0								×			
5.0								×			
	Practical refusal on large boulder	5.00		60.64							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP08

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.05							Some groundwater intrusion at about 2.5 metres below the existing ground surface, May 11, 2022. ▽
1.0	Red brown SILTY CLAY	0.60		65.45							
2.0	Grey brown SILTY CLAY	1.60		64.45							
3.0											
	Grey SILTY CLAY	3.20		62.85							
4.0											
5.0											
	End of test pit in SILTY CLAY	5.10		60.95							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

RECORD OF TEST PIT TP09

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.03							Some groundwater intrusion at about 2.7 metres below the existing ground surface, May 12, 2022. ▽
	Red brown SILTY CLAY	0.50		65.53							
1.0								×			
	Grey brown SILTY CLAY	1.50		64.53					×		
2.0									×		
3.0	Grey SILTY CLAY	2.90		63.13					×		
4.0								×			
								×			
	End of test pit in SILTY CLAY	4.60		61.43							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP10

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.32							Some groundwater intrusion at about 2.6 metres below the existing ground surface, May 12, 2022.
1.0	Red brown SILTY CLAY	0.60		65.72							
	Grey brown SILTY CLAY	1.30		65.02							
2.0											
	Grey SILTY CLAY	2.50		63.82							▽
3.0											
4.0											
	End of test pit in SILTY CLAY	4.50		61.82							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

RECORD OF TEST PIT TP11

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.52							
	Red brown SILTY CLAY	0.50		66.02							
1.0	Grey brown SILTY CLAY	1.00		65.52							
2.0	Grey SILTY CLAY	2.10		64.42							
3.0											
4.0											
	End of test pit in SILTY CLAY	4.60		61.92							

Some groundwater intrusion at about 2.2 metres below the existing ground surface, May 12, 2022.

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP12

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.19							Some groundwater intrusion at about 3.0 metres below the existing ground surface, May 12, 2022.
1.0	Red brown SILTY CLAY	0.60		65.59							
	Grey brown SILTY CLAY	1.60		64.59							
2.0											
3.0	Grey SILTY CLAY	2.80		63.39							▽
4.0											
	End of test pit in SILTY CLAY	4.50		61.69							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP13

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.08							
	Red brown SILTY CLAY	0.50		65.58							Some groundwater intrusion at about 4.9 metres below the existing ground surface, May 11, 2022.
1.0											
2.0	Grey brown SILTY CLAY	1.80		64.28							
	Grey SILTY CLAY	2.50		63.58							
3.0											
4.0											
5.0	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	4.90		61.18							
	End of test pit in GLACIAL TILL	5.00		61.08							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP14

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.58							
	Red brown SILTY CLAY	0.50		65.08							Some groundwater intrusion at about 2.5 metres below the existing ground surface, May 11, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		63.98							
2.0											
	Grey SILTY CLAY	2.40		63.18							▽
3.0											
4.0											
5.0											
	End of test pit in SILTY CLAY	5.50		60.08							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP15

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.71							
	Red brown SILTY CLAY	0.40		65.31							Test pit dry, May 11, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		64.11							
2.0											
	Grey SILTY CLAY	2.50		63.21							
3.0											
4.0											
5.0											
	Practical refusal on large boulder	5.50		60.21							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP16

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-11
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.04							Some groundwater intrusion at about 4.1 metres below the existing ground surface, May 11, 2022.
	Red brown SILTY CLAY	0.50		65.54							
1.0											
	Grey brown SILTY CLAY	1.20		64.84							
2.0											
	Grey SILTY CLAY	2.80		63.24							
3.0											
	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	3.80		62.24							▽
4.0											
5.0											
	End of test pit in GLACIAL TILL	5.00		61.04							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

RECORD OF TEST PIT TP17

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH (x Cu. kPa x) / REM SHEAR STRENGTH (o Cu. kPa o) 0 20 40 60 80 100	WATER CONTENT (%) 0 20 40 60 80 100	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.39							
	Red brown SILTY CLAY	0.50		65.89							Some groundwater intrusion at about 2.3 metres below the existing ground surface, May 12, 2022.
1.0											
	Grey brown SILTY CLAY	1.60		64.79							
2.0											
	Grey SILTY CLAY	2.60		63.79							
3.0											
4.0											
	End of test pit on large boulder	4.50		61.89							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

RECORD OF TEST PIT TP18

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario

PROJECT NUMBER: 220210
DATE OF EXCAVATING: 22-5-12
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	WATER CONTENT (%) (0 20 40 60 80 100)	ADDITIONAL LAB RESULTS	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.53							
	Red brown SILTY CLAY	0.50		66.03							
1.0	Grey brown SILTY CLAY	0.90		65.63							Some groundwater intrusion at about 2.8 metres below the existing ground surface, May 12, 2022.
2.0											
	Grey SILTY CLAY	2.40		64.13							
3.0											
4.0											
	End of test pit in SILTY CLAY	4.50		62.03							

DEPTH SCALE: 1 to 50
LOGGED: CI

EXCAVATOR TYPE: Track-Mounted Excavator
CHECKED: SD

GEOTECH TP KOLLAARD 220210-BOREHOLES-MARCH2022.GPJ GINT STD CANADA.GDT 22-6-3

BOREHOLE BH06

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 mm

PROJECT NUMBER: 220210
DATE OF BORING: 22-3-24
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		65.07							
	Red brown SILTY CLAY	0.15		64.92							
1.0					1	SS	12				
										28	
2.0					2	SS	14				
					3	SS	13				
3.0											
					4	SS	9				
	Grey brown SILTY CLAY	3.52		61.55							
4.0					5	SS	6				
					6	SS	4			43	
5.0											
					1	VA		o			
6.0					2	VA		o	×	46	
					7	SS	2				
7.0					8	SS	100			20	
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	7.01		58.06							
8.0						RC					
	End of borehole in GLACIAL TILL	8.86		56.21							

Some groundwater observed at about 5.0 metres below existing ground surface, March 24, 2022. Groundwater was measured at about 2.0 metres below the existing ground surface on May 11, 2022.

DEPTH SCALE: 1 to 50
LOGGED: CI

BORING METHOD: Power Auger and Coring
AUGER TYPE: 200 mm Hollow Stem
CHECKED: SD

BOREHOLE BH19

PROJECT: Proposed Residential Subdivision
CLIENT: G & E Renovations
LOCATION: Crysler, Ontario
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 mm

PROJECT NUMBER: 220210
DATE OF BORING: 22-3-25
SHEET 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	TOPSOIL	0.00		66.57							
	Red brown SILTY CLAY	0.15		66.42							
1.0					1	SS	11				
	Grey brown SILTY CLAY	1.07		65.5							
					2	SS	6			29	
2.0											
					3	SS	3				
3.0											
					4	SS	3				
4.0					1	VA		o			
					2	VA		o	×		
5.0					5	SS	0			45	
	End of borehole in SILTY CLAY	5.18		61.39							

Groundwater unable to be assessed due to significant ponded surface water, March 25, 2022. Groundwater was measured at about 0.5 metres below the existing ground surface, May 11, 2022.

DEPTH SCALE: 1 to 50
LOGGED: CI

BORING METHOD: Casing
AUGER TYPE: 200 mm Hollow Stem
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube .
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance, N ,
The number of blows by a 63.5 kg hammer dropped 760 millimeter required to drive a 50 mm drive open . sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

Dynamic Penetration Resistance
The number .of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

WH
_Sampler advanced by static weight of hammer and drill rods.

WR
Sampler advanced by static weight of drill rods.

PH
Sampler advanced by hydraulic pressure from drill rig.

PM
Sampler advanced by manual pressure.

SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remolded shear strength

SOIL DESCRIPTIONS

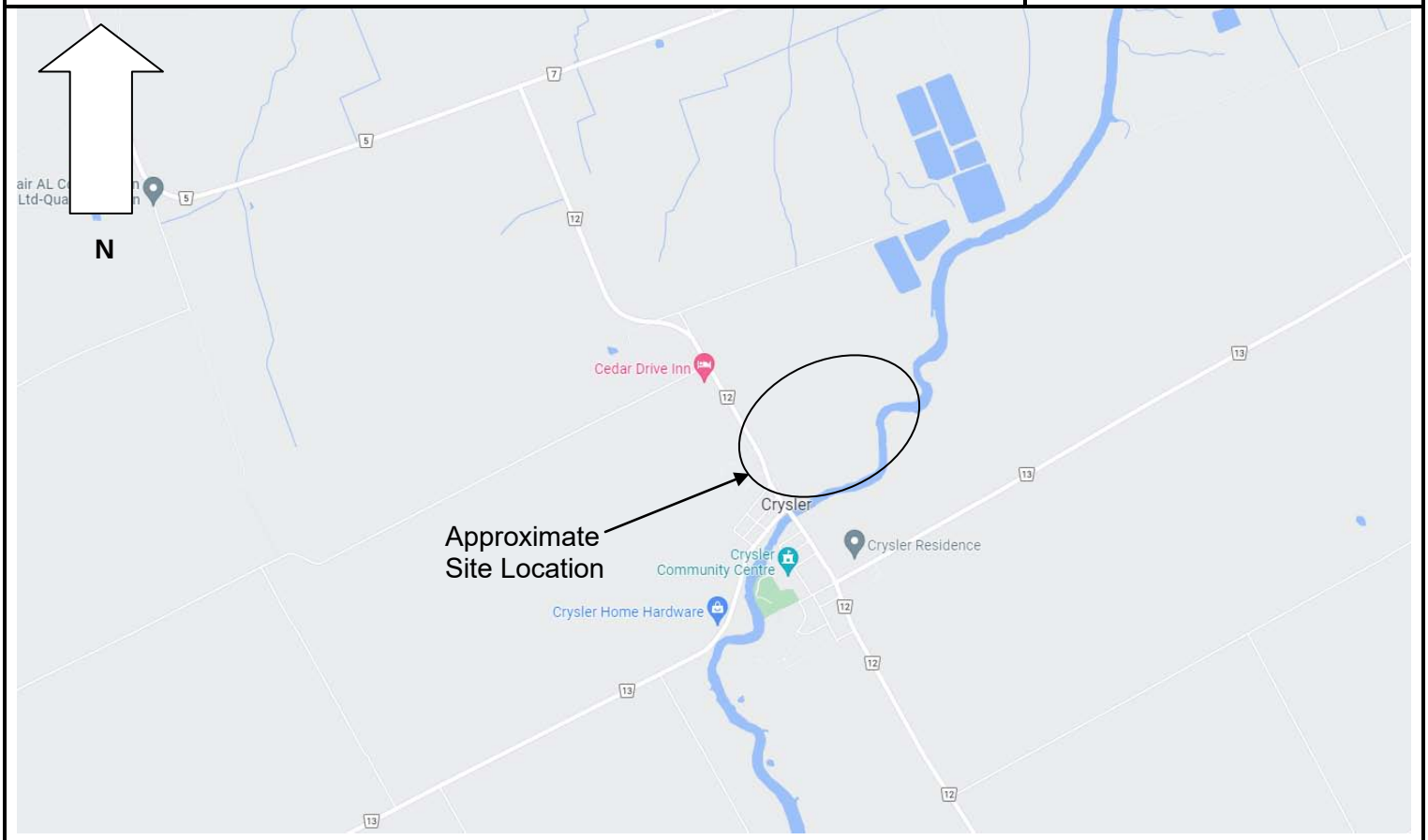
Relative Density	'N' Value
Very Loose	0 to 4
Loose	4 to10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Consistency	Undrained Shear Strength (kPa)
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50 ,
Stiff	50 to100
Very Stiff	over100

LIST OF COMMON SYMBOLS

c_u undrained shear strength
e void ratio
C_c compression index
C_v coefficient of consolidation
k coefficient of permeability
Ip plasticity index
n porosity
u pore pressure
w moisture content
w_L liquid limit
w_p plastic limit
ϕ^1 effective angle of friction
r unit weight of soil
γ^1 unit weight of submerged soil
σ_r normal stress

KEY PLAN	FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 220210

Date June 2022

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

TP1 APPROXIMATE TEST PIT LOCATION

REFERENCE: PLAN SUPPLIED BY GOOGLE MAPS.

SPECIAL NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers
PO, BOX 189, 210 PRESCOTT ST
KEMPTVILLE ONTARIO
KOG 1J0 FAX (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT:
G & E RENOVATIONS

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL DEVELOPMENT

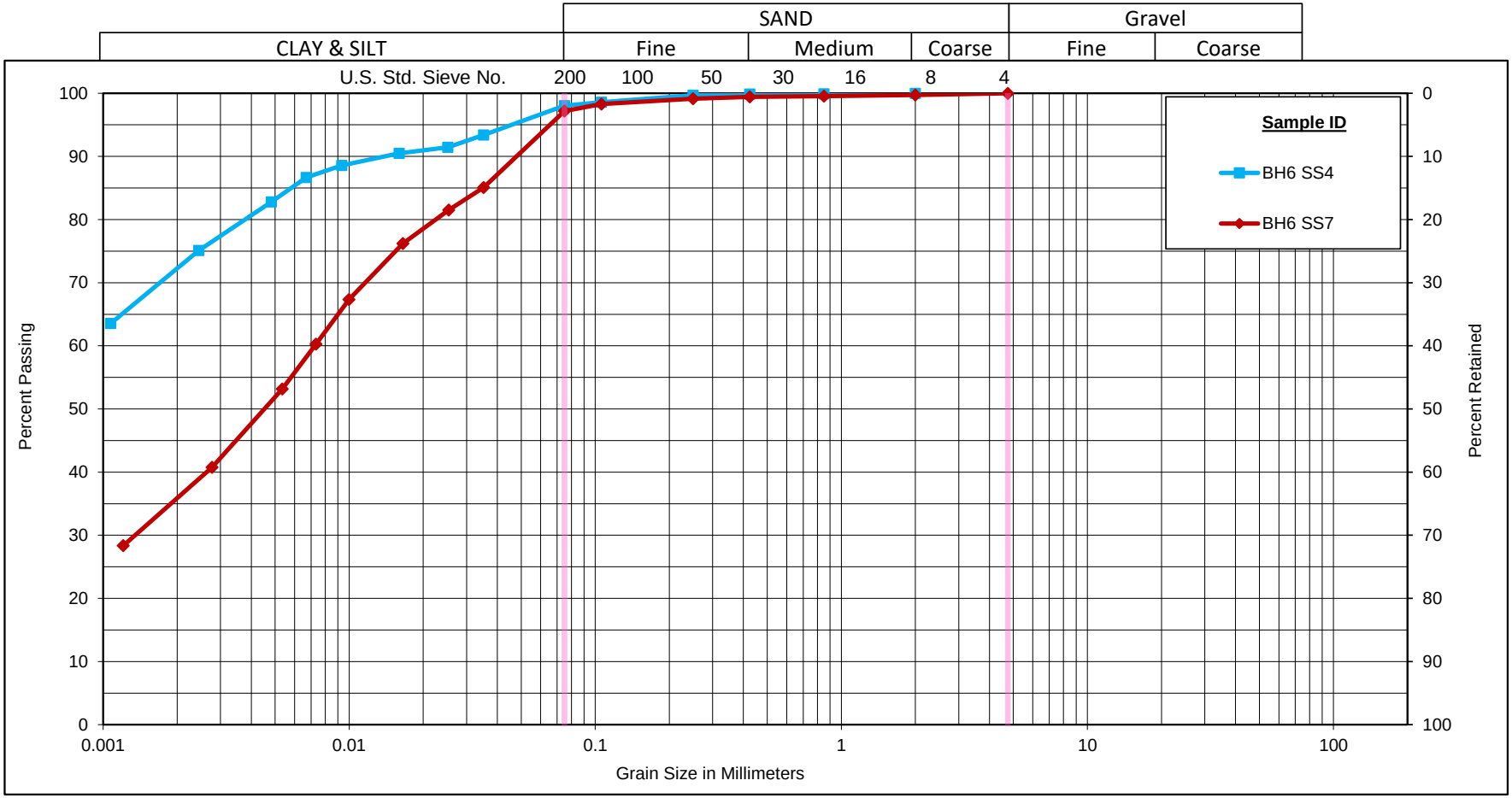
LOCATION:
McBAIN LAND SUBDIVISION
LOT 13, CONCESSION 10
CRYSLER, ONTARIO

DESIGNED BY:	*DATE:*
--	JUNE 16, 2022
DRAWN BY:	*SCALE:*
DT	N.T.S

KOLLAARD FILE NUMBER:
220210

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH6 SS4	SS4	0.0	1.9	27.1	71.0
BH6 SS7	SS7	0.0	2.8	62.2	35.0

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GRAIN SIZE DISTRIBUTION

Kollard Associates Inc., File #220210

McBain Land Subdivision, Crysler, ON

Figure No.

Project No. 122410003

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	Kollard Associates Inc., File #220210	Project No.:	122410003
Project:	McBain Land Subdivision, Crysler, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollard Associates Inc.
Source:	BH6	Date Sampled:	March 24, 2022
Sample No.:	SS4	Tested By:	Daniel Boateng
Sample Depth	SS4	Date Tested:	June 27, 2022

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	50.81
Sample Weight after Hydrometer and Wash (g)	1.02
Percent Passing No. 200 Sieve (%)	98.0
Percent Passing Corrected (%)	97.99

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	176.00
Sample Weight After Sieve (g)	176.00
Percent Loss in Sieve (%)	0.00

SOIL INFORMATION		
Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	48	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	118.58
Air Dried Mass (W_a), (g)	123.20
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9625
Air Dried Mass in Analysis (M_a), (g)	52.79
Oven Dried Mass in Analysis (M_o), (g)	50.81
Percent Passing 2.0 mm Sieve (P_{10}), (%)	100.00
Sample Represented (W), (g)	50.81

SIEVE ANALYSIS		
Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75		100.0
2.00	0.0	100.0
Total (C + F)[1]	176.00	0.0
0.850	0.04	99.92
0.425	0.06	99.88
0.250	0.15	99.70
0.106	0.72	98.58
0.075	0.99	98.05
PAN	1.01	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 9:37 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
27-Jun-22	9:38 AM	1	56.5	8.0	22.5	48.5	93.39	7.45654	9.50295	0.012894	0.03521
27-Jun-22	9:39 AM	2	55.5	8.0	22.5	47.5	91.46	7.61154	9.50295	0.012894	0.02515
27-Jun-22	9:42 AM	5	55.0	8.0	22.5	47.0	90.50	7.68904	9.50295	0.012894	0.01599
27-Jun-22	9:52 AM	15	54.0	8.0	22.5	46.0	88.57	7.84404	9.50295	0.012894	0.00932
27-Jun-22	10:07 AM	30	53.0	8.0	22.0	45.0	86.65	7.99904	9.61570	0.012970	0.00670
27-Jun-22	10:37 AM	60	51.0	8.0	22.0	43.0	82.80	8.30904	9.61570	0.012970	0.00483
27-Jun-22	1:47 PM	250	47.0	8.0	22.0	39.0	75.0959	8.92904	9.61570	0.012970	0.00245
28-Jun-22	9:37 AM	1440	41.0	8.0	22.0	33.0	63.5426	9.85904	9.61570	0.012970	0.00107

Remarks:

Reviewed By: Brian Prew

Date: June 29, 2022

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Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	Kollard Associates Inc., File #220210	Project No.:	122410003
Project:	McBain Land Subdivision, Crysler, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollard Associates Inc.
Source:	BH6	Date Sampled:	March 24, 2022
Sample No.:	SS7	Tested By:	Daniel Boateng
Sample Depth	SS7	Date Tested:	June 27, 2022

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	55.06
Sample Weight after Hydrometer and Wash (g)	1.44
Percent Passing No. 200 Sieve (%)	97.4
Percent Passing Corrected (%)	97.12

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	223.70
Sample Weight After Sieve (g)	223.60
Percent Loss in Sieve (%)	0.04

SOIL INFORMATION		
Liquid Limit (LL)	34.7	
Plasticity Index (PI)	15.9	
Soil Classification	CL	
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	48	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	96.95
Air Dried Mass (W_a), (g)	98.57
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9836
Air Dried Mass in Analysis (M_a), (g)	55.98
Oven Dried Mass in Analysis (M_o), (g)	55.06
Percent Passing 2.0 mm Sieve (P_{10}), (%)	99.73
Sample Represented (W), (g)	55.21

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

SIEVE ANALYSIS		
Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75	0.0	100.0
2.00	0.6	99.7
Total (C + F)[1]	223.60	
0.850	0.11	99.53
0.425	0.17	99.42
0.250	0.32	99.15
0.106	0.79	98.30
0.075	1.41	97.18
PAN	1.44	

Note 1: (C + F) = Coarse + Fine

START TIME 9:39 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
27-Jun-22	9:40 AM	1	56.0	8.0	23.0	48.0	85.06	7.53404	9.39251	0.012818	0.03518
27-Jun-22	9:41 AM	2	54.0	8.0	23.0	46.0	81.52	7.84404	9.39251	0.012818	0.02539
27-Jun-22	9:44 AM	5	51.0	8.0	23.0	43.0	76.20	8.30904	9.39251	0.012818	0.01652
27-Jun-22	9:54 AM	15	46.0	8.0	23.0	38.0	67.34	9.08404	9.39251	0.012818	0.00998
27-Jun-22	10:09 AM	30	42.0	8.0	22.5	34.0	60.25	9.70404	9.50295	0.012894	0.00733
27-Jun-22	10:39 AM	60	38.0	8.0	22.5	30.0	53.16	10.32404	9.50295	0.012894	0.00535
27-Jun-22	1:49 PM	250	31.0	8.0	22.0	23.0	40.76	11.40904	9.61570	0.012970	0.00277
28-Jun-22	9:39 AM	1440	24.0	8.0	22	16.0	28.35	12.49404	9.61570	0.012970	0.00121

Remarks:

Reviewed By: Brian Prowse

Date: June 29, 2022

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Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

June 6, 2022
File: 122410003

Client: Kollaard Associates Inc., File #220210

Reference: ASTM D4318 Atterberg Limit & D2216 Moisture Content
McBain Land Subdivision, Crysler, ON

The following table summarizes Atterberg Limit & Moisture Content results.

Source	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH19 SS5	44.6	43.3	20.9	22.4
BH6 SS8	19.5			
BH24 SS1	37.8			

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

Attachments: Plasticity Chart

Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

June 29, 2022
File: 122410003

Client: Kollaard Associates Inc., File #220210

Reference: ASTM D4318 Atterberg Limit & D2216 Moisture Content
McBain Land Subdivision, Crysler, ON

The following table summarizes Atterberg Limit & Moisture Content results.

Source	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH6 SS4	42.5			
BH6 SS7	45.9	34.7	18.8	15.9

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

Attachments: Plasticity Chart

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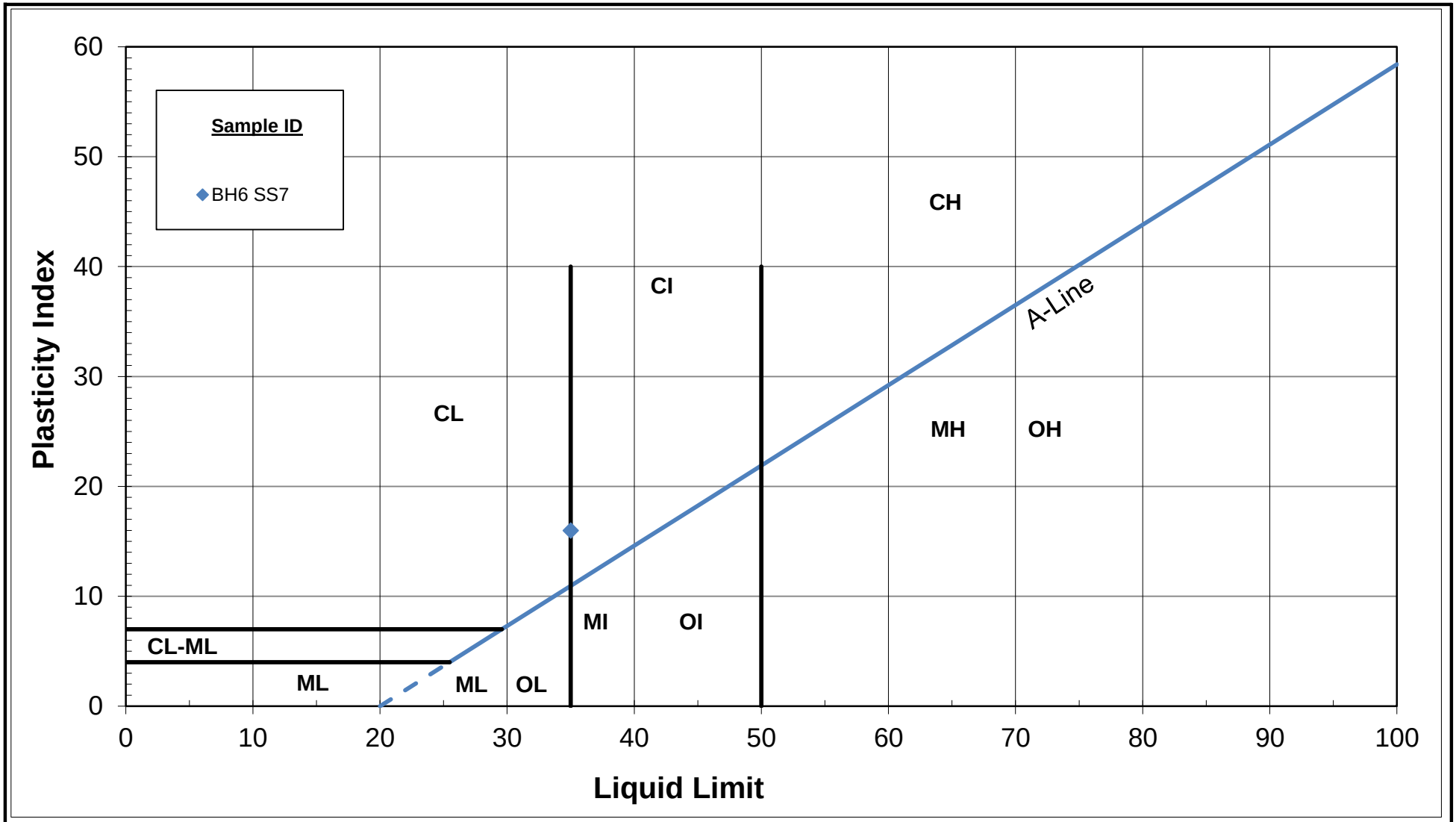


Stantec

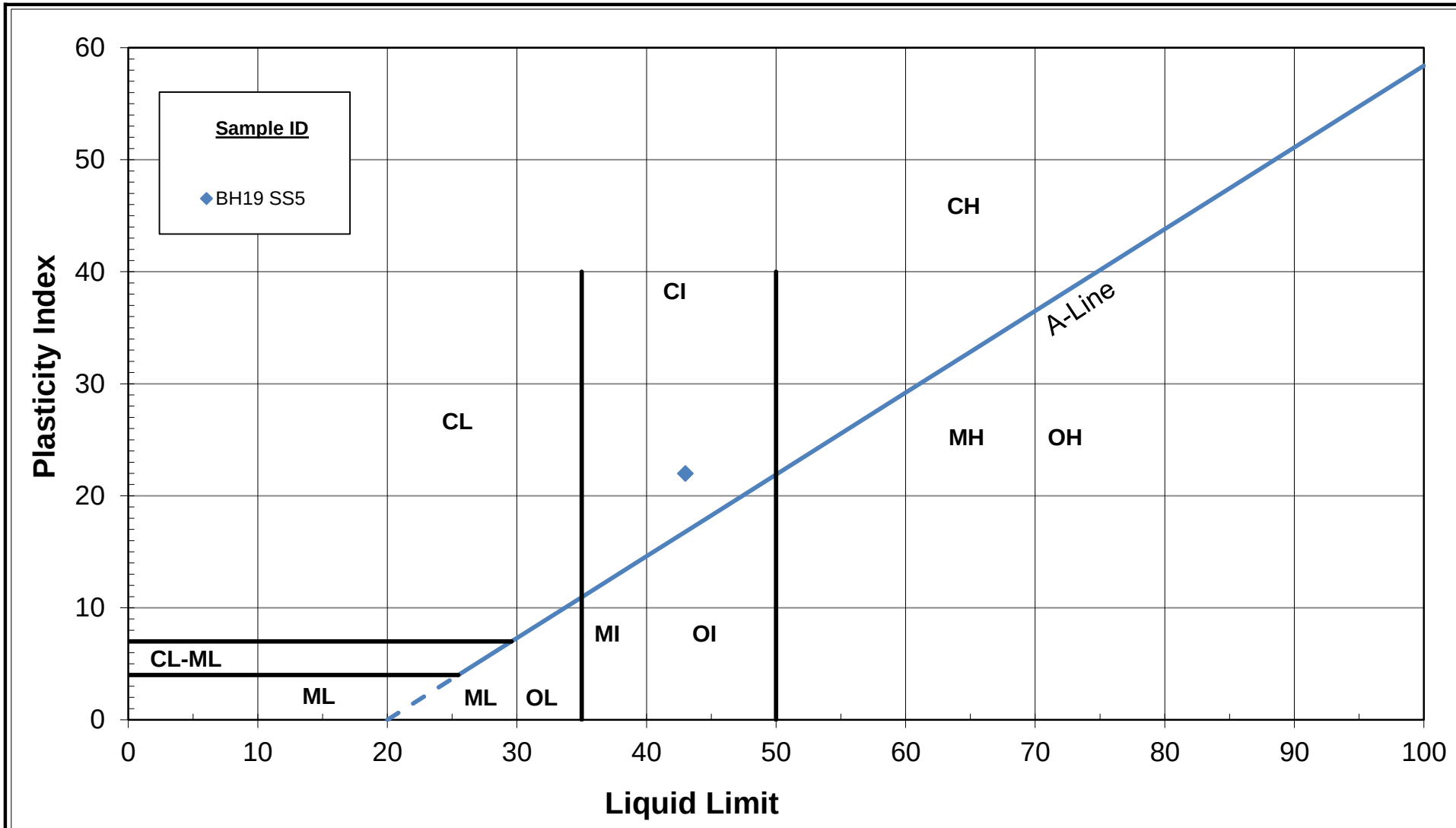
Kollaard Associates Inc., File #220210

McBain Land Subdivision, Crysler, ON

PLASTICITY CHART

Figure No.

Project No. 122410003



Kollaard Associates Inc., File #220210

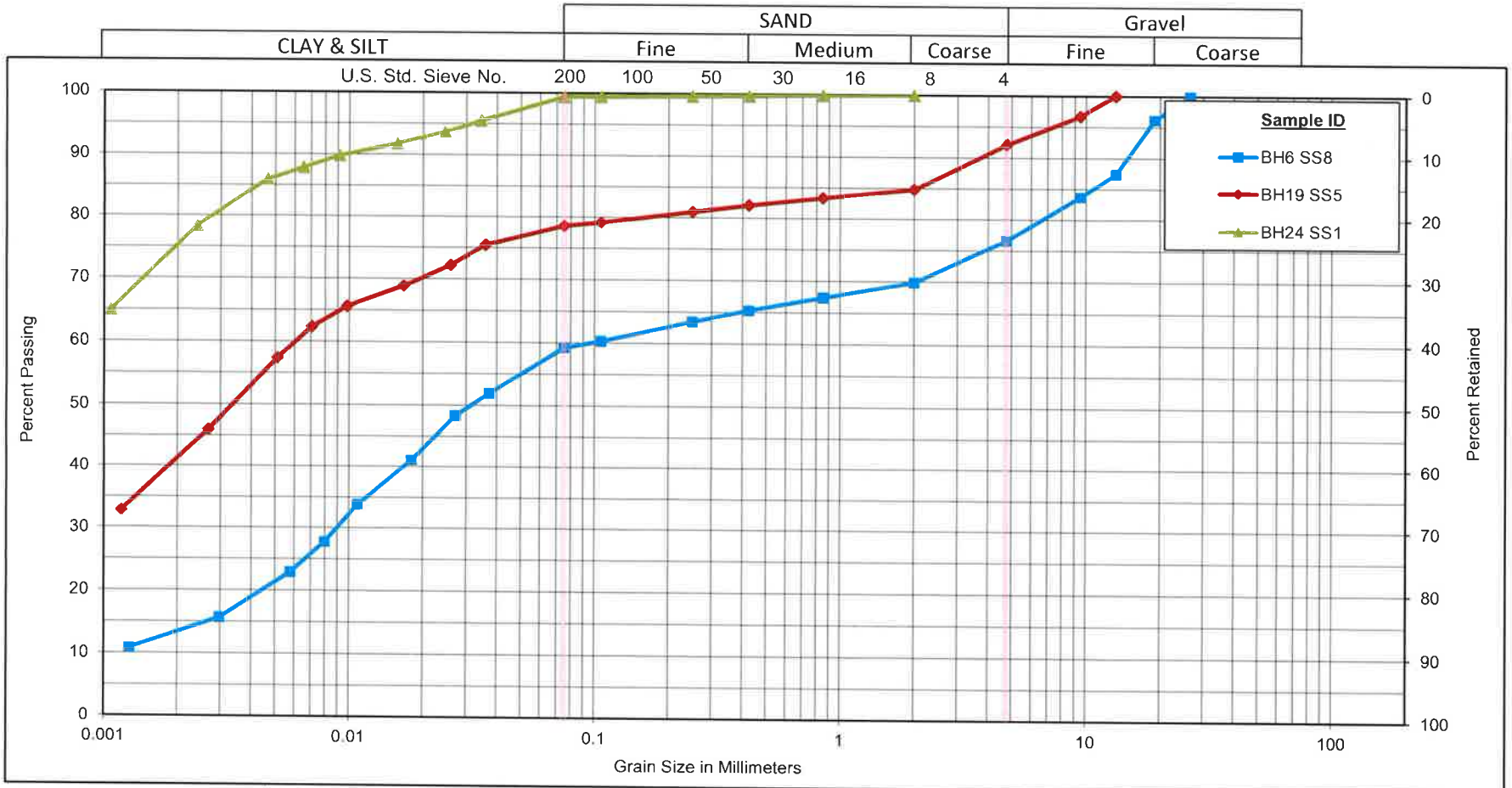
McBain Land Subdivision, Crysler, ON

PLASTICITY CHART

Figure No.

Project No. 122410003

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH6 SS8	N/A	23.4	17.4	46.2	13.0
BH19 SS5	N/A	7.9	13.5	38.6	40.0
BH24 SS1	N/A	0.0	0.6	25.4	74.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollard Associates Inc., File #220210

McBain Land Subdivision, Crysler, ON

Figure No.

Project No. 122410003

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	Kollard Associates Inc., File #220210	Project No.:	122410003
Project:	McBain Land Subdivision, Crysler, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollard Associates Inc.
Source:	BH6	Date Sampled:	May 25, 2022
Sample No.:	SS8	Tested By:	Daniel Boateng
Sample Depth	N/A	Date Tested:	May 31, 2022

WASH TEST DATA	
Oven Dry Mass in Hydrometer Analysis (g)	56.58
Sample Weight after Hydrometer and Wash (g)	8.64
Percent Passing No. 200 Sieve (%)	84.7
Percent Passing Corrected (%)	59.20

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	545.00
Sample Weight After Sieve (g)	544.60
Percent Loss in Sieve (%)	0.07

SOIL INFORMATION		
Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	40	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	71.28
Air Dried Mass (W_a), (g)	71.81
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9926
Air Dried Mass in Analysis (M_a), (g)	57.00
Oven Dried Mass in Analysis (M_o), (g)	56.58
Percent Passing 2.0 mm Sieve (P_{10}), (%)	69.87
Sample Represented (W), (g)	80.98

SIEVE ANALYSIS		
Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5	0.0	100.0
19.0	20.6	96.2
13.2	68.3	87.5
9.5	88.8	83.7
4.75	127.4	76.6
2.00	164.2	69.9
Total (C + F)[1]	544.60	0.1
0.850	2.00	67.40
0.425	3.69	65.31
0.250	5.17	63.49
0.106	7.75	60.30
0.075	8.61	59.24
PAN	8.64	59.2

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 10:44 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
31-May-22	10:45 AM	1	50.0	7.0	23.0	43.0	51.95	8.46404	9.39251	0.012818	0.03729
31-May-22	10:46 AM	2	47.0	7.0	23.0	40.0	48.33	8.92904	9.39251	0.012818	0.02708
31-May-22	10:49 AM	5	41.0	7.0	23.0	34.0	41.08	9.85904	9.39251	0.012818	0.01800
31-May-22	10:59 AM	15	35.0	7.0	23.0	28.0	33.83	10.78904	9.39251	0.012818	0.01087
31-May-22	11:14 AM	30	30.0	7.0	23.0	23.0	27.79	11.56404	9.39251	0.012818	0.00796
31-May-22	11:44 AM	60	26.0	7.0	23.0	19.0	22.96	12.18404	9.39251	0.012818	0.00578
31-May-22	2:54 PM	250	20.0	7.0	22.0	13.0	15.7069	13.11404	9.61570	0.012970	0.00297
01-Jun-22	10:44 AM	1440	16.0	7.0	21.5	9.0	10.8740	13.73404	9.73081	0.013047	0.00127

Remarks:

Reviewed By: Brian Prieur

Date: June 6/2022

V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers\122410003 Kollaard Associates Inc\May 25, Three hydros & mc, one limit, Kollaard# 220210\Hydrometer-Lab Standing Offers.xlsx

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	Kollard Associates Inc., File #220210	Project No.:	122410003
Project:	McBain Land Subdivision, Crysler, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollard Associates Inc.
Source:	BH19	Date Sampled:	May 25, 2022
Sample No.:	SS5	Tested By:	Daniel Boateng
Sample Depth	N/A	Date Tested:	May 31, 2022

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	50.60
Sample Weight after Hydrometer and Wash (g)	3.72
Percent Passing No. 200 Sieve (%)	92.6
Percent Passing Corrected (%)	78.55

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	223.40
Sample Weight After Sieve (g)	223.10
Percent Loss in Sieve (%)	0.13

SOIL INFORMATION		
Liquid Limit (LL)	43.3	
Plasticity Index (PI)	20.9	
Soil Classification	CI	
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	48	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	82.82
Air Dried Mass (W_a), (g)	84.59
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9791
Air Dried Mass in Analysis (M_a), (g)	51.68
Oven Dried Mass in Analysis (M_o), (g)	50.60
Percent Passing 2.0 mm Sieve (P_{10}), (%)	84.78
Sample Represented (W), (g)	59.68

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

SIEVE ANALYSIS		
Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2	0.0	100.0
9.5	7.3	96.7
4.75	17.6	92.1
2.00	34.0	84.8
Total (C + F)[1]	223.10	
0.850	0.88	83.31
0.425	1.63	82.05
0.250	2.31	80.91
0.106	3.35	79.17
0.075	3.70	78.58
PAN	3.72	

Note 1: (C + F) = Coarse + Fine

START TIME 11:04 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
31-May-22	11:05 AM	1	54.0	8.0	23.0	46.0	75.41	7.84404	9.39251	0.012818	0.03590
31-May-22	11:06 AM	2	52.0	8.0	23.0	44.0	72.13	8.15404	9.39251	0.012818	0.02588
31-May-22	11:09 AM	5	50.0	8.0	23.0	42.0	68.85	8.46404	9.39251	0.012818	0.01668
31-May-22	11:19 AM	15	48.0	8.0	23.0	40.0	65.57	8.77404	9.39251	0.012818	0.00980
31-May-22	11:34 AM	30	46.0	8.0	23.0	38.0	62.29	9.08404	9.39251	0.012818	0.00705
31-May-22	12:04 PM	60	43.0	8.0	23.0	35.0	57.38	9.54904	9.39251	0.012818	0.00511
31-May-22	3:14 PM	250	36.0	8.0	22.0	28.0	45.90	10.63404	9.61570	0.012970	0.00267
1-Jun-22	11:04 AM	1440	28.0	8.0	21.5	20.0	32.79	11.87404	9.73081	0.013047	0.00118

Remarks:

Reviewed By: Brian Prevost

Date: June 6/2022

V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers\122410003 Kollaard Associates Inc\May 25, Three hydros & mc, one limit, Kollaard# 220210\Hydrometer-Lab Standing Offers.xlsx

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	Kollard Associates Inc., File #220210	Project No.:	122410003
Project:	McBain Land Subdivision, Crysler, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollard Associates Inc.
Source:	BH24	Date Sampled:	May 25, 2022
Sample No.:	SS1	Tested By:	Daniel Boateng
Sample Depth	N/A	Date Tested:	May 31, 2022

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	51.19
Sample Weight after Hydrometer and Wash (g)	0.29
Percent Passing No. 200 Sieve (%)	99.4
Percent Passing Corrected (%)	99.43

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	196.50
Sample Weight After Sieve (g)	196.50
Percent Loss in Sieve (%)	0.00

SOIL INFORMATION		
Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	40	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	74.15
Air Dried Mass (W_a), (g)	77.20
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9605
Air Dried Mass in Analysis (M_a), (g)	53.30
Oven Dried Mass in Analysis (M_o), (g)	51.19
Percent Passing 2.0 mm Sieve (P_{10}), (%)	100.00
Sample Represented (W), (g)	51.19

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.2
Meniscus Correction (H_m), (g/L)	1.0

SIEVE ANALYSIS		
Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75		100.0
2.00	0.0	100.0
Total (C + F)[1]	196.50	
0.850	0.06	99.88
0.425	0.15	99.71
0.250	0.19	99.63
0.106	0.27	99.47
0.075	0.29	99.43
PAN	0.29	

Note 1: (C + F) = Coarse + Fine

START TIME 11:06 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
31-May-22	11:07 AM	1	58.0	8.0	23.5	50.0	95.55	7.22191	9.28431	0.012744	0.03425
31-May-22	11:08 AM	2	57.0	8.0	23.5	49.0	93.64	7.37691	9.28431	0.012744	0.02448
31-May-22	11:11 AM	5	56.0	8.0	23.5	48.0	91.73	7.53191	9.28431	0.012744	0.01564
31-May-22	11:21 AM	15	55.0	8.0	23.5	47.0	89.82	7.68691	9.28431	0.012744	0.00912
31-May-22	11:36 AM	30	54.0	8.0	23.5	46.0	87.91	7.84191	9.28431	0.012744	0.00652
31-May-22	12:06 PM	60	53.0	8.0	23.5	45.0	86.00	7.99691	9.28431	0.012744	0.00465
31-May-22	3:16 PM	250	49.0	8.0	22	41.0	78.35	8.61691	9.61570	0.012970	0.00241
1-Jun-22	11:06 AM	1440	42.0	8.0	21.5	34.0	64.98	9.70191	9.73081	0.013047	0.00107

Remarks:

Reviewed By: Brian Prince

Date: June 6/2022

V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers\122410003 Kollaard Associates Inc\May 25, Three hydros & mc, one limit, Kollaard# 220210\Hydrometer-Lab Standing Offers.xlsx

Laboratory Test Results for Chemical Properties

Kollaard Associates (Kemptville)
ATTN: Dean Tataryn
210 Prescott Street Unit 1
P.O. Box 189
Kemptville ON K0G 1J0

Date Received: 27-MAY-22
Report Date: 09-JUN-22 09:11 (MT)
Version: FINAL

Client Phone: 613-860-0923

Certificate of Analysis

Lab Work Order #: L2710265

Project P.O. #: NOT SUBMITTED
Job Reference: 220210
C of C Numbers:
Legal Site Desc:

Costas Farassoglou
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2710265-1 BH6-SS2 5-7'							
Sampled By: CLIENT on 24-MAY-22 @ 09:00							
Matrix: SOIL							
Physical Tests							
Conductivity	0.180		0.0040	mS/cm		07-JUN-22	R5795118
% Moisture	27.6		0.25	%	03-JUN-22	03-JUN-22	R5793879
pH	7.74		0.10	pH units		03-JUN-22	R5794079
Resistivity	5550		1.0	ohm*cm		07-JUN-22	
Leachable Anions & Nutrients							
Chloride	0.00052		0.00050	%	07-JUN-22	08-JUN-22	R5795929
Anions and Nutrients							
Sulphate	<0.0020		0.0020	%	07-JUN-22	08-JUN-22	R5795929
L2710265-2 BH19-SS2 5-7'							
Sampled By: CLIENT on 24-MAY-22 @ 15:00							
Matrix: SOIL							
Physical Tests							
Conductivity	0.169		0.0040	mS/cm		07-JUN-22	R5795118
% Moisture	28.5		0.25	%	03-JUN-22	03-JUN-22	R5793879
pH	7.73		0.10	pH units		03-JUN-22	R5794079
Resistivity	5910		1.0	ohm*cm		07-JUN-22	
Leachable Anions & Nutrients							
Chloride	0.00200		0.00050	%	07-JUN-22	08-JUN-22	R5795929
Anions and Nutrients							
Sulphate	0.0023		0.0020	%	07-JUN-22	08-JUN-22	R5795929
L2710265-3 BH24-SS2 5-7'							
Sampled By: CLIENT on 25-MAY-22 @ 15:00							
Matrix: SOIL							
Physical Tests							
Conductivity	0.184		0.0040	mS/cm		07-JUN-22	R5795118
% Moisture	30.6		0.25	%	03-JUN-22	03-JUN-22	R5793879
pH	7.85		0.10	pH units		03-JUN-22	R5794079
Resistivity	5430		1.0	ohm*cm		07-JUN-22	
Leachable Anions & Nutrients							
Chloride	0.00052		0.00050	%	07-JUN-22	08-JUN-22	R5795929
Anions and Nutrients							
Sulphate	<0.0020		0.0020	%	07-JUN-22	08-JUN-22	R5795929

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011 and as of November 30, 2020), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

"Soil Resistivity (calculated)" is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.

SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2710265 Report Date: 09-JUN-22

Client: Kollaard Associates (Kemptville)
210 Prescott Street Unit 1 P.O. Box 189
Kemptville ON K0G 1J0
Contact: Dean Tataryn

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-R511-WT	**Soil**							
Batch R5795929								
WG3736502-3 CRM		**AN-CRM-WT**						
Chloride			95.8		%		70-130	08-JUN-22
WG3736502-4 DUP		**L2710188-6**						
Chloride		14.7	14.4		ug/g	2.2	30	08-JUN-22
WG3736502-2 LCS								
Chloride			99.1		%		80-120	08-JUN-22
WG3736502-1 MB								
Chloride			<5.0		ug/g		5	08-JUN-22
EC-WT	**Soil**							
Batch R5795118								
WG3736179-4 DUP		**WG3736179-3**						
Conductivity		0.266	0.270		mS/cm	1.5	20	07-JUN-22
WG3736179-2 IRM		**WT SAR4**						
Conductivity			100.7		%		70-130	07-JUN-22
WG3736503-1 LCS								
Conductivity			94.0		%		90-110	07-JUN-22
WG3736179-1 MB								
Conductivity			<0.0040		mS/cm		0.004	07-JUN-22
MOISTURE-WT	**Soil**							
Batch R5793879								
WG3734977-3 DUP		**L2710205-5**						
% Moisture		21.5	20.0		%	7.1	20	03-JUN-22
WG3734977-2 LCS								
% Moisture			100.4		%		90-110	03-JUN-22
WG3734977-1 MB								
% Moisture			<0.25		%		0.25	03-JUN-22
PH-WT	**Soil**							
Batch R5794079								
WG3734976-1 DUP		**L2710265-2**						
pH		7.73	7.70	J	pH units	0.03	0.3	03-JUN-22
WG3735085-1 LCS								
pH			7.09		pH units		6.9-7.1	03-JUN-22
SO4-WT	**Soil**							
Batch R5795929								
WG3736502-3 CRM		**AN-CRM-WT**						
Sulphate			97.4		%		60-140	08-JUN-22
WG3736502-4 DUP		**L2710188-6**						

Quality Control Report

Client: Kollaard Associates (Kemptville)
210 Prescott Street Unit 1 P.O. Box 189
Kemptville ON K0G 1J0
Contact: Dean Tataryn

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-WT	**Soil**							
Batch R5795929								
WG3736502-4 DUP		**L2710188-6**						
Sulphate		55	55		ug/g	0.5	25	08-JUN-22
WG3736502-2 LCS								
Sulphate			99.4		%		70-130	08-JUN-22
WG3736502-1 MB								
Sulphate			<20		ug/g		20	08-JUN-22

Quality Control Report

Workorder: L2710265 Report Date: 09-JUN-22

Client: Kollaard Associates (Kemptville)
210 Prescott Street Unit 1 P.O. Box 189
Kemptville ON K0G 1J0
Contact: Dean Tataryn

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2710265-COFC

COC Number: 17 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Kollaard Associates (27196)
Contact:	Dean Tataryn
Phone:	613.860.0923, ext.225
	Company address below will appear on the final report
Street:	210 Prescott Street, Unit 1 P.O. Box 189
City/Province:	Kemptville, Ontario
Postal Code:	K0G 1J0
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☒ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: dean@kollaard.ca

Email 2:

Email 3:

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: mary@kollaard.ca

Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R]: ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q71021

Job #: 220210

PO / AFE:

LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Lab Work Order # (lab use only): L2710265

ALS Contact: Melanie M. | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Corrosivity (KOLLAARD-CORR-WT)	VOC, F1-F4 (Vac-BSH-511-WT)	Metals & Inorganics (BSH-INORG)	PAH (PAH-511-WT)	BTEX / F1-F4	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	BH6-SS2 5-7'	Mar 24, 2022	9:00	SOIL	✓							1
	BH19-SS2 5-7'	Mar 24, 2022	3:00	SOIL	✓							1
	BH24-SS2 5-7'	Mar 25, 2022	3:00	SOIL	✓							1

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations: Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ | Custody seal intact: Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
17.1					

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date: May 25, 2022	Time: 3:45	Received by:	Date: 27 MAY 22	Time: 1125	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

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

Site: 45.223N 75.151W **User File Reference:** McBain Land Subdivision 2022-05-27 18:40 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.625	0.341	0.198	0.052
Sa (0.1)	0.715	0.402	0.242	0.071
Sa (0.2)	0.586	0.333	0.203	0.063
Sa (0.3)	0.438	0.249	0.153	0.049
Sa (0.5)	0.304	0.171	0.105	0.034
Sa (1.0)	0.144	0.082	0.051	0.017
Sa (2.0)	0.066	0.037	0.023	0.007
Sa (5.0)	0.017	0.009	0.005	0.001
Sa (10.0)	0.006	0.003	0.002	0.001
PGA (g)	0.373	0.215	0.130	0.038
PGV (m/s)	0.250	0.137	0.081	0.024

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

References

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

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

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

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