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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPEMENT
6622 BANK STREET
CITY OF OTTAWA, ONTARIO

Project # 230156

Submitted to:

CAMM Warehousing and Rentals Inc.
6622 Bank Street
Metcalfe, Ontario
K0A 2P0

DISTRIBUTION

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Date: May 28, 2024

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May 28, 2024 230156

CAMM Warehousing and Rentals Inc.
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RE: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
6622 BANK STREET
CITY OF OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed commercial development to be located at 6622 Bank Street, City of Ottawa, 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 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

For the purposes of this report, Bank Street is considered to be oriented along a north-south axis.

The subject site for this assessment consists of a property located at civic address 6622 Bank Street, in Ottawa, Ontario (see Key Plan, Figure 1). The site consists of about 6.0 hectares (14.8

acres) of land located west of Bank Street, south of the intersection of Bank Street and Greys Creek Road in Ottawa, Ontario.

Currently, the north portion of the site is occupied by an existing single storey building used as a warehouse. The building is serviced with an asphalt parking lot and accessed from Bank Street. The building is serviced by natural gas, Hydro One and by private sewer and water. The south portion of the site is used as a gravel surfaced storage yard for the business.

Surrounding land use is currently commercial and residential development. The site is bordered on the east by Bank Street followed by commercial development, on the north by commercial development followed by residential development, on the west by forested lands followed by residential development and on the south by commercial development.

Based on a review of the surficial geology map for the site area, it is expected that the site is generally underlain by Palaeozoic bedrock and organic deposits. A review of the bedrock geology map indicates that the bedrock underlying the site consists of dolostone with minor shale and sandstone of the Beekmantown Group, in the Oxford Formation.

2.2 Proposed Development

Based on information provided for the development, it is proposed to construct two one storey commercial buildings with associated gravel and asphalt surfaced parking lot.

Preliminary information provided by the client indicates that the proposed buildings will consist of two one-storey steel frame metal clad structures. The proposed buildings will be placed on conventional concrete spread footing foundations with a concrete slab-on-grade construction (no basement, frost wall). The interior layout of the buildings will consist mostly of warehouse space along with some associated office spaces. The existing gravel surfaced parking and storage area will be modified to accommodate the proposed buildings. Two one way driveway entrances will be added to service the proposed buildings as well.

The proposed development will be serviced by private services including a drilled cased well, an onsite septic system, and a stormwater retention pond.

3.0 PROCEDURE

The field work for this investigation was carried out on May 1, 2024, at which time four (4) boreholes numbered BH1 to BH4 were put down at the site using a rubber tire mounted drill rig (CME50) equipped with a hollow stem auger owned and operated by Limitless Drilling Inc of Renfrew, Ontario. BH1 and BH2 were put down within the one of the proposed building footprints. Boreholes BH3 and BH4 were put down within the other proposed building footprint.

The subsurface soil conditions encountered at the boreholes were classified based on visual and tactile examination of the samples recovered (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), standard penetration tests (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils as well as laboratory test results on select samples. In situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil) was not carried out as cohesive materials were not encountered. The soils were classified using the Unified Soil Classification System. Groundwater conditions at the boreholes were noted at the time of drilling. Groundwater was measured at a later date in a standpipe put down within one of the boreholes (BH1). The boreholes were loosely backfilled with the auger cuttings upon completion of the fieldwork.

Two soil samples (BH2 – SS3 – 2.3 – 2.9 metres, BH3 – SS4 – 3.0 – 3.6 metres) were submitted for hydrometer and moisture content (ASTM D7928). The samples were selected based on depth and tactile examination to be representative of the various soil conditions encountered at the site.

Two samples of soil (BH1 – SS2 – 1.5 – 2.1m, BH3 – SS2 – 1.5 – 2.1m) were also delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack and soil corrosion on buried concrete and steel.

A total of 11 soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216).

The field work was supervised throughout by a member of our engineering staff who located the boreholes in the field, logged the boreholes and cared for the samples obtained. A description of the subsurface conditions encountered at the boreholes is given in the attached Record of Borehole

Sheets. The results of the laboratory testing of the soil samples are presented in the Laboratory Test Results section and Attachment B following the text in this report. The approximate locations of the boreholes are shown on the attached Site Plan, Figure 2.

The existing ground surface elevations at the borehole locations were extrapolated from topographic data provided as a part of drawing Kollaard #170035 - CIVIL. The elevations are indicated to be geodetic.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, descriptions of the subsurface conditions encountered at the boreholes are provided in the attached Record of Borehole Sheets following the text of this report. The borehole logs indicate the subsurface conditions at the specific hole 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 borehole 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 boreholes.

4.2 Fill Materials

Fill materials consisting of either grey crushed stone, trace asphalt and/or organics, or asphalt overlying silty sand with trace clay, some gravel and cobbles and organics was encountered from the surface at all boreholes. The fill materials extended to a depth of about 0.9 to 2.4 metres at the borehole locations. The results of standard penetration tests within the fill materials gave N values of between 2 and 20, indicating a very loose to compact state of packing. The measured moisture contents of the fill materials ranged from 9 to 16 percent. The fill materials were fully penetrated in all boreholes.

4.3 Glacial Till

A deposit of yellow brown to grey silty sand with some gravel, cobbles, boulders and trace of clay (glacial till) was encountered beneath the fill materials in all the boreholes. The glacial till was encountered at depths of 1.8, 2.4, 0.9, and 1.0 metres at boreholes BH1 to BH4, respectively, below ground surface. The results of standard penetration tests completed in the glacial till gave N values of between 15 and 100 blows per 0.3 metres, indicating a compact to very dense state of compaction. The measured moisture contents of the glacial till ranged from 7 to 14 percent.

The results of two hydrometers (ASTM D7928) on samples of soil (BH2-SS3 – 2.3 – 2.9 metres, BH3-SS4 – 3.0 – 3.6 metres) indicate the samples have the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH2 – SS3	2.3 – 2.9	3.1	18.7	61.2	17.0
BH3 – SS4	3.0 – 3.6	25.3	35.2	31.5	8.0

4.4 Bedrock

Practical refusal on bedrock or large boulders was encountered in all of the boreholes (BH1 to BH4) at depths of about 3.3, 2.9, 3.8, and 2.1 metres, respectively, below the existing ground surface. BH3 confirmed bedrock by coring 1.5 metres into the bedrock.

4.5 Groundwater

Some groundwater was encountered in boreholes BH1 and BH3 at the time of drilling on May 1, 2024, at depths of about 1.1 and 3.2 metres, respectively, below the existing ground surface. Boreholes BH2 and BH4 were dry at the time of drilling on May 1, 2024. Groundwater was measured in a standpipe installed within borehole BH1 at a depth of about 1.9 metres below the existing ground surface on May 22, 2024. Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as early spring.

The groundwater encountered in BH1 at the time of drilling at a depth of 1.1 m was within the fill material and was significantly higher than that measured in the standpipe on May 22, 2024. For this reason, it is considered that the groundwater encountered at time of drilling in BH1 is not representative of a groundwater level but rather water trapped against a relatively more impermeable fill layer as it percolates downward towards the groundwater level.

4.6 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of a soil sample submitted for chemistry testing related to corrosivity are summarized in the following table.

BH1 – SS2 – 1.5 – 2.1 m

Item	Threshold of Concern	Test Result	Comment
Chlorides (Cl)	Cl > 0.04 %	<0.005	Negligible
pH	pH < 5.5	7.34	Negligible concern
Resistivity	R < 20,000 ohm-cm	5130	Moderately Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0067	Negligible concern

BH3 – SS2 – 1.5 – 2.1 m

Item	Threshold of Concern	Test Result	Comment
Chlorides (Cl)	Cl > 0.04 %	0.0162	Negligible
pH	pH < 5.5	7.88	Negligible concern
Resistivity	R < 20,000 ohm-cm	2350	Highly Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0081	Negligible concern

The results of the laboratory testing of soil samples for sulphate gave a percent sulphate range of 0.0067 to 0.0081. The National Research Council of Canada (NRC) recognizes four categories of potential sulphate attack of buried concrete based on percent sulphate in soil. From 0 to 0.10

percent the potential is negligible, from 0.10 to 0.20 percent the potential is mild but positive, from 0.20 to 0.50 percent the potential is considerable and 0.50 percent and greater the potential is severe. Based on the above, the soils are considered to have a negligible potential for sulphate attack on buried concrete materials and accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

The pH value for the soil samples was reported to be 7.34 and 7.88, indicating a durable condition against corrosion. These values were 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 samples was also compared with the threshold level and present negligible concrete corrosion potential.

Corrosivity Rating for soils ranges from extremely corrosive with a resistivity rating <1000 ohm-cm to non-corrosive with a resistivity of >20,000 ohm-cm 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 2350 ohm-cm and 5310 ohm-cm for the samples analyzed making the soil moderately to highly corrosive for buried steel. Increasing the specified strength and increasing concrete cover and adding air entrainment into any reinforced concrete in contact with the soil is recommended. Alternatively, a glass fiber reinforced plastic product could be used in place of steel reinforcing in below grade applications.

Based on the chemical test results, Type GU General Use Hydraulic Cement may be used for this proposed development. Special protection in the form of air entrainment and minimum cover is required for reinforcement steel within the concrete walls.

The laboratory results are presented in Attachment B following this report.

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 Commercial Buildings

It is understood that the proposed commercial buildings will consist of conventional concrete spread footing foundations complete with cast-in-place concrete foundation walls and concrete slab-on-grade construction. It is understood that the proposed footings will be set below the depth of seasonal frost protection.

5.3 Subsurface Conditions at the Underside of Footing Level

With the exception of the fill materials, the subsurface conditions encountered at the boreholes advanced during the investigation are suitable for the support of the proposed buildings on conventional spread footing foundations placed on the native glacial till or on engineered fill placed on the native glacial till. The excavations for the foundations should be taken through the fill to expose the glacial till.

It is expected that the subgrade immediately below the proposed footing levels will consist of glacial till. Once the excavations for the foundations are complete, the exposed subgrade should be

inspected by a qualified geotechnical person. Should the subgrade consist of loose glacial till, the subgrade should be sub-excavated to remove the loose material to a depth of 0.6 metres below the underside of footing elevation.

5.4 Foundation Excavation

The excavations for the foundations should be taken through any fill or otherwise deleterious material to bear on the fill materials or native, undisturbed yellow brown glacial till 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 fill materials and native soils at the site can be classified as Type 2 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 fill materials and native glacial till to the bottom of the excavation and provided no excavated materials are stockpiled within 3 metres of the top of the excavations.

5.5 Foundation Design and Bearing Capacity

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 foundation.

For the proposed commercial buildings, a maximum allowable bearing pressure of 150 kilopascals using serviceability limit states design and a factored ultimate bearing resistance of 300 kilopascals using ultimate limit states design, may be used for the design of conventional strip footings or pad footings founded on the glacial till or on a suitably constructed engineered pad placed on the glacial till.

The maximum total and differential settlement of the footings are expected to be less than 25 millimetres and 20 millimetres, respectively, using the above allowable bearing pressure and resistance. The above allowable bearing pressure is subject to a maximum grade raise of 2.5 metres above the existing ground surface.

There are no maximum footing depth restrictions associated with the above allowable bearing capacity.

The subgrade surface should be inspected and approved by geotechnical personnel prior to placement of any granulars.

5.6 Engineered Fill

Should the complete removal of all fill materials and any otherwise deleterious material result in a subgrade below the proposed founding level or if an engineered pad is to be placed, any fill required to raise the footings for the proposed buildings to founding level 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 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 foundations, the engineered fill should extend out from the outside edges of the footings for a horizontal distance of 0.5 metres and then down and out at a slope of 1 horizontal to 1 vertical, or flatter. The excavations for the structures 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 A or Granular B Type I or Type II are placed on a glacial till subgrade above the normal ground water 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 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.

5.7 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.

5.8 Foundation Wall Backfill and Drainage

Provided the proposed finished floor surfaces are everywhere above the exterior finished grade, the granular materials beneath the proposed floor slabs are properly compacted and provided the exterior grade is adequately sloped away from the proposed buildings, no perimeter foundation drainage system is required.

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

Any competent granular material encountered during foundation excavations may be stockpiled for reuse as backfill material.

The native glacial till soils encountered at this site are considered to be frost susceptible. As such, to prevent possible foundation frost jacking, the backfill against any unheated or insulated walls or 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 on the exterior with native material in conjunction with the use of an approved proprietary drainage layer system (such as Platon System Membrane) against the foundation wall. 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. To mitigate this potential, the upper approximately 0.6 metres of the foundations should be backfilled with non-frost susceptible granular material.

Where the granular backfill will ultimately support a pavement structure or walkway, it is suggested that the 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.

5.9 Slab on Grade Support

As stated above, it is expected that the proposed buildings will be founded on glacial till or on an engineered pad placed on the native glacial till. For predictable performance of the proposed concrete floor slabs, all existing fill material and any otherwise deleterious material should be removed from below the proposed floor slab areas. 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 grades 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 slabs 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-grades, 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 slabs and foundations can occur freely.

The concrete floor slabs 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 slabs should be cut as soon as it is possible to work on the slabs without damaging the surface of the slabs. Under slab drainage is not considered necessary provided that the floor slab levels are above the finished exterior ground surface level.

5.10 Ground Water in Excavation and Construction Dewatering

Groundwater was measured in boreholes BH1 and BH3 at the time of drilling on May 1, 2024 at about 1.1 to 3.2 metres, respectively, below the existing ground surface. Borehole BH2 and BH4 were dry at the time of drilling. Water was measured in a standpipe placed within borehole BH1 at about 1.9 metres below the existing ground surface on May 22, 2024. As such, it is not expected that the proposed USF for the building foundation will be placed below the water level.

5.11 Seismic Design for the Proposed Commercial Building

5.11.1 Seismic Site Classification Ontario Building Code

For seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class C. The subsurface conditions below the proposed foundations design levels consist of loose to very dense glacial till followed by bedrock.

In accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the average properties of the soils in the top 30 metres will result in an average standard penetration resistance = $15 \leq N(60) \leq 50$. In addition there are no conditions in the profile where there are more than 3 metres of soil with a plasticity index PI ≥ 20; or moisture content ≥ 40%; or undrained strength ≤ 25kPa.

5.11.1 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 0.318 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 C. The results of the calculation are attached in Attachment C following the text of this report.

5.11.2 Potential for Soil Liquefaction

As previously indicated, the soils below the proposed foundations will consist of glacial till overlying bedrock at about 2.1 to 3.8 metres below the existing ground surface.

The native glacial till or bedrock materials are not considered prone to liquefaction under seismic conditions at the thickness and state of compaction present at the site.

Therefore, it is considered that no damage to the proposed buildings will occur due to liquefaction of the native subgrade under seismic conditions.

6.0 ACCESS ROADWAY AND PARKING LOT PAVEMENTS

6.1 Subgrade Preparation

Based on the results of the boreholes, the subsurface conditions in the access roadway and parking lot areas consist of compact fill materials (grey crushed stone, sand with a trace of clay, gravel and cobbles or silty sand with a trace of gravel and/or organics) from the surface to a depth of about 0.9 to 2.4 metres below the existing ground surface.

For predictable performance of the pavement structures, it is considered that all loose fill materials as well as any other soft, wet or deleterious materials will have to be removed in preparation for pavement construction at this site. The existing fill is considered compact and suitable for roadbase. The proposed roadway areas should be excavated to remove the lesser of; all deleterious materials or 0.3 metres of the existing fill. It is considered that any compactable granular fill material that is free of topsoil or organic debris may be stockpiled and upon approval by the engineer used to raise the subgrade of the access roadway and parking areas to the proposed underside of access roadway and subbase elevation.

It is considered that, with approval by the geotechnical engineer, any existing granular fill material meeting the specifications for OPSS Granular "A" may be used within the roadway subbase structure.

6.2 Parking Area Structure

Following approval of the subgrade surface by geotechnical personnel, the granular material (engineered fill) consisting of granular crushed stone meeting OPSS grading requirements as described below.

Granular Surfaced Areas

For granular pavement areas subject to heavy truck loading the pavement should consist of:

300 millimetres of OPSS Granular A base over
Approved Existing fill material

Asphaltic Concrete Surfaced Areas

For pavement areas subject to cars and light trucks the pavement should consist of:

50 millimetres of Superpave 12.5 hot mix asphaltic concrete over
300 millimetres of OPSS Granular A base over
Approved Existing fill material
Performance grade PG 58-30 asphaltic concrete should be specified.

For pavement areas subject to heavy truck loading the pavement should consist of:

50 millimetres of Superpave 12.5 hot mix asphaltic concrete over
50 millimetres of Superpave 19 hot mix asphaltic concrete over
300 millimetres of OPSS Granular A base over
Approved Existing fill material
Performance grade PG 64-34 Traffic Category D asphaltic concrete should be specified.

Where the above pavement structures are of insufficient thickness to raise the subgrade to the bottom of the pavement structure elevation, the subgrade should be built up using Granular B Type II (50 or 100 millimetre minus crushed stone) subbase.

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 subgrade, that is, one where any roadway fill has been adequately compacted. If the roadway subgrade 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.

7.0 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.

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.

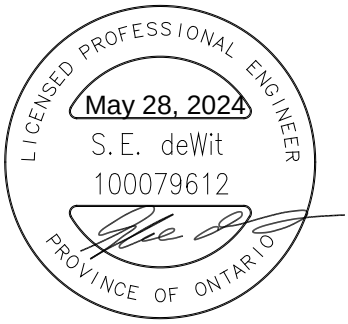
All foundation areas and any engineered fill areas for the proposed buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable subgrade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to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

The subgrade for the access roadway and parking areas should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the access roadway and parking area granular materials to ensure the materials meet the specifications from a compaction point of view.

The native glacial till 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.



Isaac Bacon, P.Eng. Dean Tataryn, B.E.S., EP. Steve deWit, P.Eng.

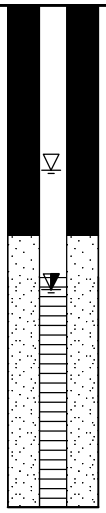
Kollaard Associates
Engineers

BOREHOLE BH1

PROJECT: Proposed Commercial Development
CLIENT: CAMM Warehousing and Rentals Inc.
LOCATION: 6622 Bank St, Ottawa
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 m

PROJECT NUMBER: 230156
DATE OF BORING: 2024-05-02
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH (x Cu. kPa x) / REM SHEAR STRENGTH (o Cu. kPa o)	DYNAMIC CONE PENETRATION TEST blows/300 mm	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Grey crushed gravel, trace asphalt, trace organics (FILL)	0.00		94.48				0 20 40 60 80 100	0 20 40 60 80 100		
		0.10		94.38							
	Grey silty sand, trace organics, trace gravel (FILL)										
1.0					1	SS	2			12	
					2	SS	15			14	
2.0	Yellow brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.83		92.65							
					3	SS	11			14	
3.0											
					4	SS	100				
	Practical refusal on BEDROCK	3.32		91.16							



Groundwater measured at about 1.1m below existing ground surface at time of drillling, Groundwater was measured in a standpipe at about 1.9m below ground surface, May 22, 2024

DEPTH SCALE: 1 to 50
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH2

PROJECT: Proposed Commercial Development
CLIENT: CAMM Warehousing and Rentals Inc.
LOCATION: 6622 Bank St, Ottawa
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 m

PROJECT NUMBER: 230156
DATE OF BORING: 2024-05-02
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	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
	Grey crushed gravel, trace asphalt, trace organics (FILL)	0.00		94.19							
1.0					1	SS	13			14	
	Grey silty clay, trace organics, trace gravel (FILL)	1.37		92.82							
2.0					2	SS	3			16	
	Yellow brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.41		91.78	3	SS	100				
	Practical refusal on BEDROCK	2.89		91.30							

Borehole dry at time of drilling (May 1, 2024)

DEPTH SCALE: 1 to 50
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH3

PROJECT: Proposed Commercial Development
CLIENT: CAMM Warehousing and Rentals Inc.
LOCATION: 6622 Bank St, Ottawa
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 m

PROJECT NUMBER: 230156
DATE OF BORING: 2024-05-02
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	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
	Asphalt (FILL)	0.00		93.96							
	Yellow brown sand and gravel, trace clay (FILL)	0.10		93.86							
1.0	Yellow brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.90		93.06	1	SS	15			14	
					2	SS	44			8	
2.0											
					3	SS	98			8	
3.0											▽ Groundwater measured at about 3.2m below existing ground surface at time of drillling.
					4	SS	83				
4.0	Cored through BEDROCK	3.81		90.15	1	RC					
5.0											
	End of coring in BEDROCK	5.18		88.78							

DEPTH SCALE: 1 to 50
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH4

PROJECT: Proposed Commercial Development
CLIENT: CAMM Warehousing and Rentals Inc.
LOCATION: 6622 Bank St, Ottawa
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76 m

PROJECT NUMBER: 230156
DATE OF BORING: 2024-05-02
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
	Asphalt (FILL)	0.00		94.37							
	Yellow brown sand and gravel, trace clay, trace brick (FILL)	0.10		94.27	1	SS	20				
1.0											
	Yellow brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.99		93.38	2	SS	38			9	
2.0					3	SS	100			8	
	Practical refusal on BEDROCK	2.13		92.24							

Borehole dry at time of drilling (May 1, 2024)

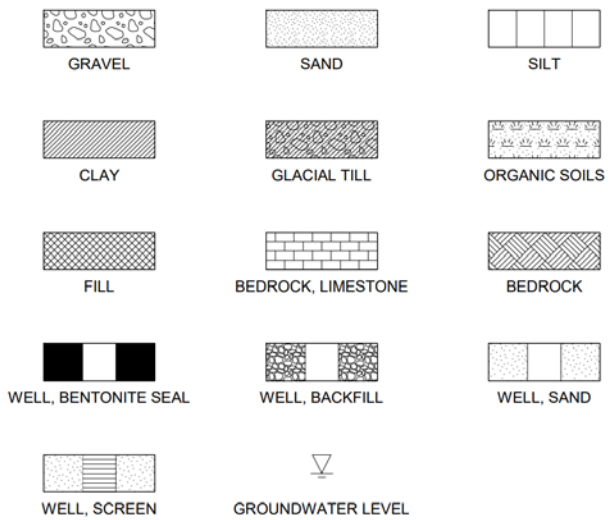
DEPTH SCALE: 1 to 50
LOGGED: KH

BORING METHOD: Power Auger
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
SS	Split Spoon Sample
TO	Thin-Walled Open Shelby Tube
WS	Wash Sample

PENETRATION RESISTANCE	
Standard Penetration Resistance (N) The number of blows by a 63.5 kg hammer dropped 760 millimeters required to drive a 50 mm drive open sampler for a distance of 300 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 DESCRIPTIONS

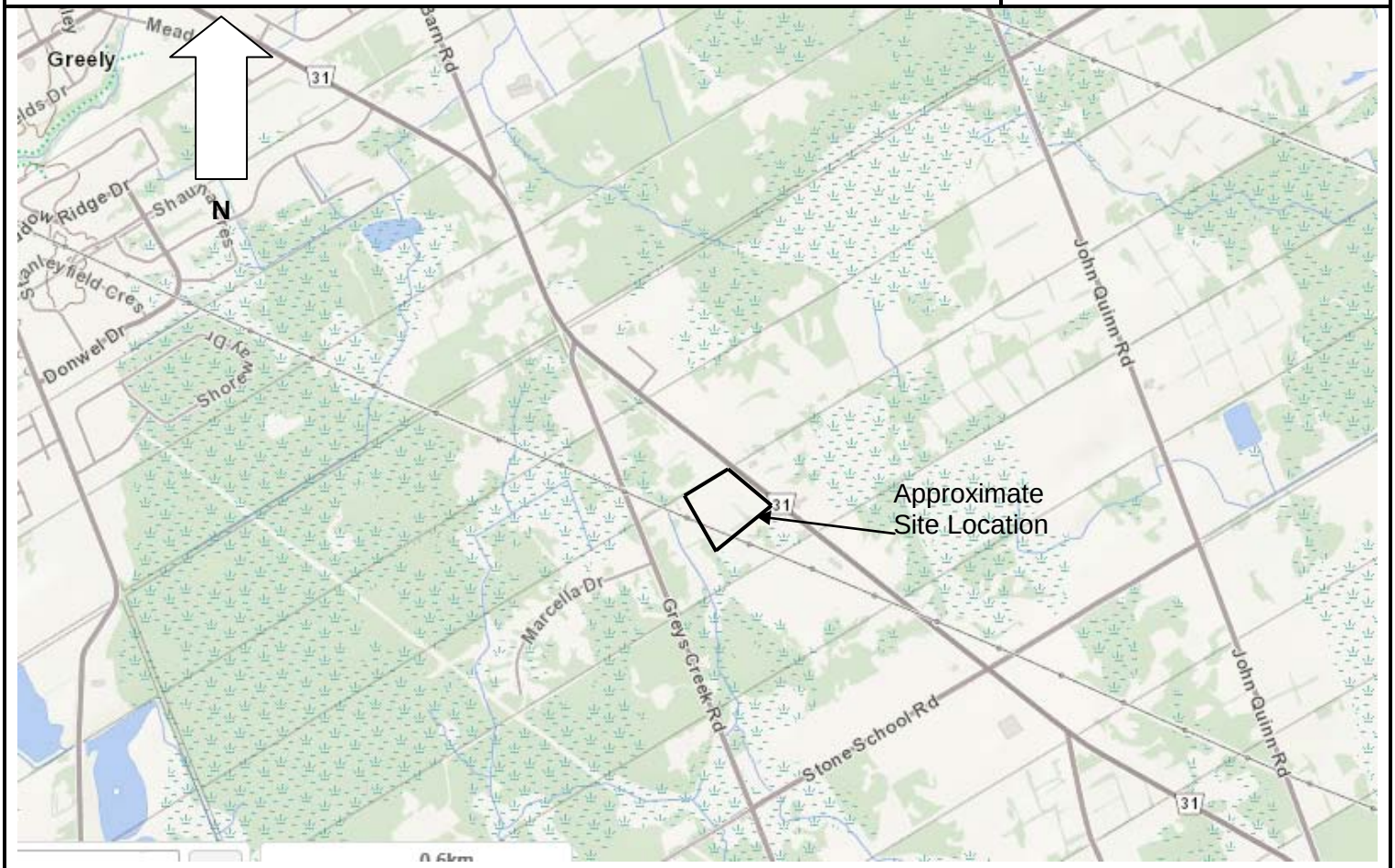
Relative Density	'N' Value
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	>50

Consistency	Cu, kPa
Very Soft	0 – 12
Soft	12 – 25
Firm	25 – 50
Stiff	50 – 100
Very Stiff	>100

LIST OF COMMON SYMBOLS	
Cu	Undrained Shear Strength
e	Void Ratio
Cc	Compression Index
Cv	Coefficient of Consolidation
k	Coefficient of Permeability
PI	Plasticity Index
n	Porosity
u	Pore Pressure
W	Moisture Content
LL	Liquid Limit
PL	Plastic Limit
r	Unit Weight of Soil
y	Unit Weight of Submerged Soil
cr	Normal Stress

SOIL TESTS	
C	Consolidation Test
H	Hydrometer Analysis
M	Sieve Analysis
MH	Sieve and Hydrometer Analysis
U	Unconfined Compression Test
Q	Undrained Triaxial Test
VA	Field Vane, Undisturbed and Remolded Shear Strength

KEY PLAN	FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

Project No. 230156

Date May 2024

DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY COSINE

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
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca

(613) 860-0923
info@kollaard.ca

CLIENT:
CAMM WAREHOUSING AND RENTALS INC.

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED WAREHOUSE BUILDINGS

LOCATION:
6622 BANK STREET
CITY OF OTTAWA, ONTARIO

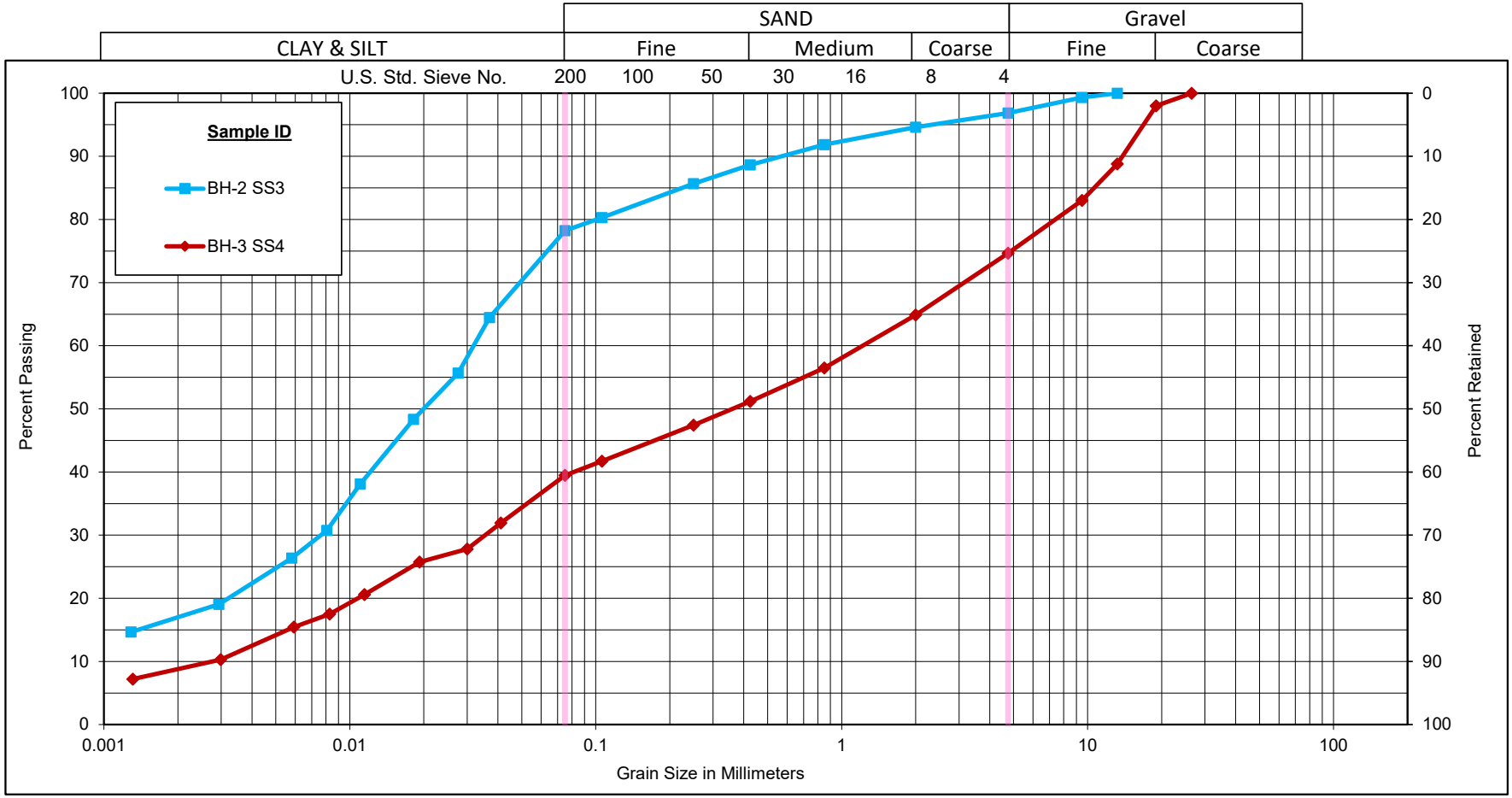
DESIGNED BY:	*DATE:*
--	APRIL 8, 2024
DRAWN BY:	*SCALE:*
DT	N.T.S

KOLLAARD FILE NUMBER:
230156

ATTACHMENT A

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-2 SS3	7'6"-9'6"	3.1	18.7	61.2	17.0
BH-3 SS4	10'-12'	25.3	35.2	31.5	8.0

Stantec

GRAIN SIZE DISTRIBUTION

Kolaard Associates, File #230156

Camm Machinery

Figure No.

Project No. 121625581

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kolaard Associates, File #230156**	Project No.:	**121625581**
Project:	**Camm Machinery**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kolaard Associates**
Source:	**BH-2**	Date Sampled:	**May 1, 2024**
Sample No.:	**SS3**	Tested By:	**Brian Prevost**
Sample Depth	**7'6"-9'6"**	Date Tested:	**May 6, 2024**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	63.19
Sample Weight after Hydrometer and Wash (g)	11.20
Percent Passing No. 200 Sieve (%)	**82.3**
Percent Passing Corrected (%)	**77.85**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**191.60**
Sample Weight After Sieve (g)	**191.50**
Percent Loss in Sieve (%)	**0.05**

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)	115.44
Air Dried Mass (W_a), (g)	117.16
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9853
Air Dried Mass in Analysis (M_a), (g)	64.13
Oven Dried Mass in Analysis (M_o), (g)	63.19
Percent Passing 2.0 mm Sieve (P_{10}), (%)	94.62
Sample Represented (W), (g)	66.78

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	1.3	99.3
4.75	6.0	96.9
2.00	10.3	94.6
Total (C + F)[1]	191.50	
0.850	1.86	91.84
0.425	3.98	88.66
0.250	5.97	85.68
0.106	9.56	80.31
0.075	10.95	78.23
PAN	11.07	

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 10:05 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
06-May-24	10:06 AM	1	51.0	7.0	23.0	44.0	64.46	8.30904	9.39251	0.012818	0.03695
06-May-24	10:07 AM	2	45.0	7.0	23.0	38.0	55.67	9.23904	9.39251	0.012818	0.02755
06-May-24	10:10 AM	5	40.0	7.0	23.0	33.0	48.35	10.01404	9.39251	0.012818	0.01814
06-May-24	10:20 AM	15	33.0	7.0	23.0	26.0	38.09	11.09904	9.39251	0.012818	0.01103
06-May-24	10:35 AM	30	28.0	7.0	23.0	21.0	30.77	11.87404	9.39251	0.012818	0.00806
06-May-24	11:05 AM	60	25.0	7.0	23.0	18.0	26.37	12.33904	9.39251	0.012818	0.00581
06-May-24	2:15 PM	250	20.0	7.0	23.0	13.0	19.0463	13.11404	9.39251	0.012818	0.00294
07-May-24	9:16 AM	1391	17.0	7.0	21.5	10.0	14.6510	13.57904	9.73081	0.013047	0.00129

Remarks:

Reviewed By: Brian Prevost

Date: May 8, 2024

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Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kolaard Associates, File #230156**	Project No.:	**121625581**
Project:	**Camm Machinery**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kolaard Associates**
Source:	**BH-3**	Date Sampled:	**May 1, 2024**
Sample No.:	**SS4**	Tested By:	**Brian Prevost**
Sample Depth	**10'-12'**	Date Tested:	**May 6, 2024**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	61.66
Sample Weight after Hydrometer and Wash (g)	24.49
Percent Passing No. 200 Sieve (%)	**60.3**
Percent Passing Corrected (%)	**39.11**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**432.70**
Sample Weight After Sieve (g)	**431.70**
Percent Loss in Sieve (%)	**0.23**

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)	216.14
Air Dried Mass (W_a), (g)	217.30
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9947
Air Dried Mass in Analysis (M_a), (g)	61.99
Oven Dried Mass in Analysis (M_o), (g)	61.66
Percent Passing 2.0 mm Sieve (P_{10}), (%)	64.87
Sample Represented (W), (g)	95.05

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	8.6	98.0
13.2	48.4	88.8
9.5	73.5	83.0
4.75	109.6	74.7
2.00	152.0	64.9
Total (C + F)[1]	431.70	
0.850	7.97	56.49
0.425	13.01	51.18
0.250	16.59	47.42
0.106	22.01	41.71
0.075	24.13	39.48
PAN	24.21	

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 10:05 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
6-May-24	10:06 AM	1	38.0	7.0	23.0	31.0	31.91	10.32404	9.39251	0.012818	0.04119
6-May-24	10:07 AM	2	34.0	7.0	23.0	27.0	27.79	10.94404	9.39251	0.012818	0.02999
6-May-24	10:10 AM	5	32.0	7.0	23.0	25.0	25.73	11.25404	9.39251	0.012818	0.01923
6-May-24	10:20 AM	15	27.0	7.0	23.0	20.0	20.59	12.02904	9.39251	0.012818	0.01148
6-May-24	10:35 AM	30	24.0	7.0	23.0	17.0	17.50	12.49404	9.39251	0.012818	0.00827
6-May-24	11:05 AM	60	22.0	7.0	23.0	15.0	15.44	12.80404	9.39251	0.012818	0.00592
6-May-24	2:15 PM	250	17.0	7.0	23.0	10.0	10.29	13.57904	9.39251	0.012818	0.00299
7-May-24	9:17 AM	1392	14.0	7.0	21.5	7.0	7.21	14.04404	9.73081	0.013047	0.00131

Remarks:

Reviewed By: Brian Prevost

Date: May 8, 2024

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Moisture Content

LS - 701 / ASTM D 2216

PROJECT NO.: 230156	DATE SAMPLED: May 1, 2024	DATE TESTED: May 9, 2024
CLIENT: CAMM Warehousing and Rentals	DATE RECEIVED:	TESTED BY: CI
LOCATION: 6622 Bank Street	DATE REQUESTED:	FILE NO.:

METHOD A ■ METHOD B □

Water Content Recorded to +/- 1%

Sieve Size, mm	Specimen Mass	Balance Readability, g
75.0	5 kg	10
37.5	1 kg	10
19	250 g	0.1
9.5	50 g	0.1
4.75	20 g	0.1
2.00	20 g	0.1

Water Content Recorded to +/- 0.1%

Sieve Size, mm	Specimen Mass	Balance Readability, g
75.0	5 kg	10
37.5	1 kg	10
19	250 g	0.1
9.5	50 g	0.1
4.75	20 g	0.1
2.00	20 g	0.1

ASTM D 2216 TABLE 1

Bore Hole:	BH1	BH1	BH1	BH2	BH2	BH3	BH3	BH3	BH4
Sample No.:	SS1	SS2	SS3	SS1	SS2	SS1	SS2	SS3	SS1
Depth:	0.8-1.4	1.5-2.1	2.3-2.9	0.8-1.4	1.5-2.1	0.8-1.4	1.5-2.1	2.3-2.9	0.8-1.4
Tare No.:	1	2	3	4	5	6	7	8	9
Tare +Wet Soil (gms)	104.54	96.96	86.99	89.34	91.37	83.95	97.10	92.71	96.15
Tare + Dry Soil (gms)	95.53	87.42	79.14	80.94	81.54	76.43	91.21	87.29	90.13
Mass of Water (gms)	9.01	9.54	7.85	8.40	9.83	7.52	5.89	5.42	6.02
Mass of Tare (gms)	20.97	21.16	21.38	22.12	21.92	21.55	21.23	21.45	21.55
Mass of Solids (gms)	74.56	66.26	57.76	58.82	59.62	54.88	69.98	65.84	68.58
WATER CONTENT (%)	12	14	14	14	16	14	8	8	9
Drying Tempterature (ºC), if other than 110 ±5ºC									

Bore Hole:	BH4	BH4							
Sample No.:	SS2	SS3							
Depth:	0.8-1.4	1.5-2.1							
Tare No.:	10	11							
Tare +Wet Soil (gms)	98.35	104.22							
Tare + Dry Soil (gms)	93.25	97.84							
Mass of Water (gms)	5.10	6.38							
Mass of Tare (gms)	21.33	21.04							
Mass of Solids (gms)	71.92	76.80							
WATER CONTENT (%)	7	8							
Drying Tempterature (ºC), if other than 110 ±5ºC									

ATTACHMENT B

Laboratory Test Results for Chemical Properties

CERTIFICATE OF ANALYSIS

Work Order	: **WT2411021**	Page	: 1 of 3
Client	: **Kollaard Associates Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 230156	Date Samples Received	: 03-May-2024 12:55
PO	: ----	Date Analysis Commenced	: 07-May-2024
C-O-C number	: 20-1010447	Issue Date	: 10-May-2024 14:44
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Jon Fisher	Production Manager, Environmental	Inorganics, Waterloo, Ontario
Kelly Fischer	Technical Specialist	Inorganics, Waterloo, Ontario
Niral Patel		Centralized Prep, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: **Soil/Solid**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID: BH1 SS2 5'-7'	BH3 SS2 5'-7'	----	----	----
					Client sampling date / time: 01-May-2024 00:00	01-May-2024 00:00	----	----	----
					WT2411021-001	WT2411021-002	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm	195	426	----	----	----
Moisture	----	E144/WT	0.25	%	15.9	8.39	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	331	339	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.34	7.88	----	----	----
Resistivity	----	EC100R/WT	100	ohm cm	5130	2350	----	----	----
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	<0.23	<0.22	----	----	----
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	<5.0	162	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	67	81	----	----	----

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2411021**	Page	: 1 of 7
Client	: **Kollaard Associates Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 230156	Date Samples Received	: 03-May-2024 12:55
PO	: ----	Issue Date	: 10-May-2024 14:46
C-O-C number	: 20-1010447		
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E396-L	01-May-2024	07-May-2024	14 days	7 days	✓	07-May-2024	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E396-L	01-May-2024	07-May-2024	14 days	7 days	✓	07-May-2024	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E236.Cl	01-May-2024	09-May-2024	30 days	9 days	✓	09-May-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E236.Cl	01-May-2024	09-May-2024	30 days	9 days	✓	09-May-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E236.SO4	01-May-2024	09-May-2024	30 days	9 days	✓	09-May-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E236.SO4	01-May-2024	09-May-2024	30 days	9 days	✓	09-May-2024	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E100-L	01-May-2024	09-May-2024	30 days	8 days	✓	09-May-2024	30 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E100-L	01-May-2024	09-May-2024	30 days	8 days	✓	09-May-2024	30 days	9 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E144	01-May-2024	----	----	----		07-May-2024	----	6 days	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E144	01-May-2024	----	----	----		07-May-2024	----	6 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E125	01-May-2024	09-May-2024	180 days	8 days	✓	10-May-2024	180 days	10 days	✓
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E125	01-May-2024	09-May-2024	180 days	8 days	✓	10-May-2024	180 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH1 SS2 5'-7'	E108A	01-May-2024	09-May-2024	30 days	8 days	✓	10-May-2024	30 days	9 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP]										
BH3 SS2 5'-7'	E108A	01-May-2024	09-May-2024	30 days	8 days	✓	10-May-2024	30 days	9 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1431747	1	7	14.2	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1431003	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1431010	1	20	5.0	5.0	✓
ORP by Electrode	E125	1434440	1	13	7.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1434438	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1434950	1	12	8.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1434951	1	12	8.3	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1431747	1	7	14.2	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1431003	2	20	10.0	10.0	✓
Moisture Content by Gravimetry	E144	1431010	1	20	5.0	5.0	✓
ORP by Electrode	E125	1434440	1	13	7.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1434438	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1434950	2	12	16.6	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1434951	2	12	16.6	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1431747	1	7	14.2	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1431003	1	20	5.0	5.0	✓
Moisture Content by Gravimetry	E144	1431010	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1434950	1	12	8.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1434951	1	12	8.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L ALS Environmental - Waterloo	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A ALS Environmental - Waterloo	Soil/Solid	MECP E3530	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, 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 by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode. This method is equivalent to ASTM D4972 and is acceptable for topsoil analysis.
ORP by Electrode	E125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Oxidation Redution Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 ALS Environmental - Waterloo	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO4 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.
Resistivity Calculation for Soil Using E100-L	EC100R ALS Environmental - Waterloo	Soil/Solid	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.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 ALS Environmental - Waterloo	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A ALS Environmental - Waterloo	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, 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 by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 ALS Environmental - Waterloo	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 ALS Environmental - Waterloo	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.
Distillation for Acid Volatile Sulfide in Soil	EP396-L ALS Environmental - Waterloo	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.

QUALITY CONTROL REPORT

Work Order	: **WT2411021**	Page	: 1 of 5
Client	: Kollaard Associates Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville ON Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 230156	Date Samples Received	: 03-May-2024 12:55
PO	: ----	Date Analysis Commenced	: 07-May-2024
C-O-C number	: 20-1010447	Issue Date	: 10-May-2024 14:44
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 2		
No. of samples analysed	: 2		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Jon Fisher	Production Manager, Environmental	Waterloo Inorganics, Waterloo, Ontario
Kelly Fischer	Technical Specialist	Waterloo Inorganics, Waterloo, Ontario
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include 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 predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 1431003)											
WT2410806-001	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	1.14 mS/cm	1210	5.89%	20%	----
Physical Tests (QC Lot: 1431010)											
WT2410806-001	Anonymous	Moisture	----	E144	0.25	%	6.48	6.35	1.96%	20%	----
Physical Tests (QC Lot: 1434438)											
WT2409305-003	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	8.07	8.02	0.622%	5%	----
Physical Tests (QC Lot: 1434440)											
WT2410956-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	352	357	1.41%	25%	----
Inorganics (QC Lot: 1431747)											
WT2411021-001	BH1 SS2 5'-7'	Sulfides, acid volatile	----	E396-L	0.23	mg/kg	<0.23	<0.23	0.001	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1434950)											
EO2403227-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1434951)											
EO2403227-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	59	67	8	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Result*	*Qualifier*
Physical Tests (QCLot: 1431003)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1431010)						
Moisture	----	E144	0.25	%	<0.25	----
Inorganics (QCLot: 1431747)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1434950)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----
Leachable Anions & Nutrients (QCLot: 1434951)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Target Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1431003)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	97.1	90.0	110	----
Physical Tests (QCLot: 1431010)									
Moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Physical Tests (QCLot: 1434438)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	101	98.0	102	----
Inorganics (QCLot: 1431747)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	77.0	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1434950)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	100	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1434951)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	100	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 1431003)									
QC-1431003-003	RM	Conductivity (1:2 leachate)	----	E100-L	3460 µS/cm	102	70.0	130	----
Physical Tests (QCLot: 1434440)									
QC-1434440-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	105	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1434950)									
QC-1434950-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	601 mg/kg	90.9	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1434951)									
QC-1434951-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	172 mg/kg	110	70.0	130	----

SG1-868

Chain of Custody (COC) / Analytical Request Form

COC Number: 20 - 1010447

Canada Toll Free: 1 800 668 9878

Page

www.alsglobal.com

Environmental Division Waterloo
Work Order Reference
WT2411021

Telephone : +1 519 886 6910

Report To	Contact and company name below will appear on the final report
Company:	Kollaard
Contact:	Dean Tataryn
Phone:	613-860-0923 ext. 230
	Company address below will appear on the final report
Street:	210 Prescott Street, Unit 1 P.O. Box 189
City/Province:	Kemptville, ON
Postal Code:	K0G 1J0
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☑ NO
Company:	Kollaard Associates Inc.
Contact:	admin@kollaard.ca

Reports / Recipients	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Merge QC/QCI Reports with COA	☑ YES ☐ NO ☐ N/A
☑ 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 Recipients	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	admin@kollaard.ca
Email 2	

Turnaround Time (TAT) Requested
☑ Routine [R] if received by 3pm M-F - no surcharges apply
☐ 4 day [P4] if received by 3pm M-F - 20% rush surcharge minimu
☐ 3 day [P3] if received by 3pm M-F - 25% rush surcharge minim
☐ 2 day [P2] if received by 3pm M-F - 50% rush surcharge minim
☐ 1 day [E] if received by 3pm M-F - 100% rush surcharge minim
☐ Same day [E2] if received by 10am M-S - 200% rush surcharge. Ad may apply to rush requests on weekends, statutory holidays and non-
Date and Time Required for all E&P TATs:
For all tests with rush TATs requested, please

Analysis R

Project Information	
ALS Account # / Quote #:	
Job #:	230156
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 # (ALS use only):

ALS Contact:

Sampler:

ALS Sample # (ALS use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
	BH1 SS2 5'-7'	May1		Soil	1	corrosivity			
	BH3 SS2 5'-7'	May1		"	1	"			

Drinking Water (DW) Samples[1] (client use)	Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE RECEIPT DETAILS (ALS use only)

Cooling Method: ☑ NONE ☐ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED

Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO

Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☑ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
18.1				12.4			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Released by: K. Hallett	Date: May 3	Time:	Received by: LR	Date: 03/05/24	Time: 12:55	Received by: FA	Date: 4 May 24	Time: 11:45

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

AUG 2020 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**.

ATTACHMENT C

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: 45.245N 75.528W

2024-05-06 20:24 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)	0.522	0.281	0.163	0.045
Sa (0.1)	0.603	0.336	0.202	0.062
Sa (0.2)	0.498	0.282	0.173	0.056
Sa (0.3)	0.374	0.213	0.132	0.044
Sa (0.5)	0.261	0.149	0.093	0.031
Sa (1.0)	0.126	0.073	0.046	0.015
Sa (2.0)	0.059	0.034	0.021	0.006
Sa (5.0)	0.015	0.008	0.005	0.001
Sa (10.0)	0.006	0.003	0.002	0.001
PGA (g)	0.318	0.181	0.110	0.033
PGV (m/s)	0.216	0.119	0.071	0.022

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