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REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED LONG TERM CARE FACILITY ADDITION
1541 ST. JOSEPH BOULEVARD
ORLÉANS, ONTARIO

Project # 240798

Submitted to:

Sienna Senior Living
320 Town Centre Boulevard, Suite 300
Markham, Ontario
L3R 0E8

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RE: GEOTECHNICAL INVESTIGATION
PROPOSED LONG TERM CARE FACILITY ADDITION
1541 ST. JOSEPH BOULEVARD, ORLÉANS
OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed long term care facility addition at 1541 St. Joseph Boulevard, Orléans in the 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

The subject site for this assessment consists of about a 2.5 hectare (6.1 acres) property located at 1541 St. Joseph Boulevard, Orléans in the City of Ottawa, Ontario (see Key Plan, Figure 1).

For the purposes of this assessment, project north lies in a direction perpendicular to St. Joseph Boulevard, which is located immediately south of the subject site. The site is currently occupied by

an existing three storey senior living center that is currently not in operation. In addition to the current building at the site, it is understood another former building occupied part of the space of the proposed long term care facility addition for this investigation.

Surrounding land use is residential development, commercial development, and agriculture farm lands. The site is bordered on the north and east by a commercial golf course followed by Highway 174, south by St. Joseph Boulevard followed by a retirement living center and RCMP Technical Operations, and on the west by agricultural farm lands.

The ground surface at the site is currently graded such that surface water drains to the south.

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by shallow Precambrian bedrock, offshore marine deposits consisting of silty clay, and/or glacial till. Bedrock geology maps indicate that the bedrock underlying the site consists of limestone and sandstone of the Simcoe Group of the Rockcliffe Formation.

Based on a review of available borehole information in the vicinity of the site, the overburden at and near the site likely consists of some 2 to 5 metres of overburden overlying bedrock.

2.2 Proposed Development

It is understood that preliminary plans are being prepared for the construction of a two-storey long term care facility addition. The building addition will be supported by conventional concrete spread footing foundations. It is understood at the time of preparation of this report the plans are not finalized. However, based on conversations with the client, it has been proposed that the building addition will include one of the follow options:

- Option 1: The ground floor elevation will match the existing building onsite and will consist of a cast-in-place concrete slab on grade with frost walls and footings, no basement.
- Option 2: The proposed building addition will contain a partial basement with conventional walls and footings. The basement floor will consist of a cast-in-place concrete slab on grade.

It is understood that the proposed building addition will contain an elevator pit and be serviced by municipal water and sanitary services.

It is understood that the existing drainage patterns, including the existing catch basins and storm sewers, are to be retained to service the proposed development.

3.0 PROCEDURE

The field work for this investigation was carried out on September 13, 2024, and on May 8 and 9, 2025 at which time a total of nine (9) boreholes, numbered BH1 to BH5 and BH5A to BH8, were put down at the site using a truck mounted drill rig equipped with solid stem augers and coring equipment owned and operated by Limitless Drilling of Renfrew, Ontario.

On September 13, 2024, five (5) boreholes (BH1, BH2, BH3, BH4 and BH5) were put down at the site. At the time of drilling the building plans had not yet been determined. The five boreholes were all advanced to practical refusal on the surface of large boulders or bedrock at depths of about 3.4, 2.9, 5.4, 1.5 and 2.9 metres, respectively, below existing ground surface.

On May 8 and 9, 2025, four additional boreholes (BH5A, BH6, BH7 and BH8) were put down at the site. At this time, the proposed building addition location was determined and all four boreholes were put down within the addition footprint. The four boreholes were advanced to practical refusal on the surface of large boulders or bedrock at depths of about 4.3, 4.9, 3.7 and 3.4 metres below the existing ground surface. Three boreholes (BH5A, BH6 and BH7) were extended by coring using diamond drilling procedures to prove bedrock.

Sampling of the overburden materials encountered at all of the borehole locations was 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) to practical refusal. The boreholes were advanced below the existing ground surface using 200 mm hollow stem augers.

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) as well as laboratory test results on select samples. The boreholes were loosely backfilled with the auger cuttings upon completion of drilling. The soils were classified using the Unified Soil Classification

System. Groundwater conditions at the test holes were noted at the time of the field work. A standpipe was installed within borehole BH3 for subsequent ground water level monitoring purposes.

The bedrock was cored at three borehole locations (BH5A, BH6 and BH7 using diamond drilling procedures to verify that bedrock was encountered within these boreholes.

Any soil samples from the boreholes, where possible, were recovered from cuttings of the boreholes. The soil samples were classified on site, placed in a sealed plastic bag and transported to our laboratory. Rock samples from boreholes BH5A, BH6 and BH7 were recovered using a core barrel. The rock samples were classified on site, placed in wooden core boxes and transported to our laboratory. The rock cores are shown as RC on the Record of Borehole sheets.

Diamond drilling was carried out at BH5A, BH6 and BH7 to determine the nature and quality of the bedrock. The recovery value and the rock quality designation value (RQD) were calculated for the drilled section (core run) of bedrock. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of sound rock pieces longer than 100 millimetre in one core run over the length of the core run. Both values are indicative of the quality of the bedrock.

Two soil samples (BH3 – SS4 – 2.1 – 2.7 m, BH8 – SS3 – 1.2 – 1.8 m) were delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack on concrete and corrosivity to buried steel.

Three samples (BH1 – SS4 – 3.0 – 3.6 m, BH3 – SS3 – 1.5 to 2.1 m, and BH7 – SS5 – 3.0 – 3.6 m) 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. The soils were classified using the Unified Soil Classification System.
A total of 18 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 Attachments A and B following the text in this report. The approximate locations of the boreholes are shown 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 boreholes is provided in the attached Record of Borehole Sheets following the text of this report. The 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 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

From the surface, a layer of fill materials consisting of asphalt, grey crushed stone, and/or yellow brown silty sand was encountered in all boreholes. The fill materials were about 0.6 to 2.6 metres in thickness. The fill materials were fully penetrated where encountered.

4.3 Glacial Till

A deposit of yellow brown to grey silty sand with some gravel, cobbles, boulders and a trace of clay (glacial till) was encountered beneath the fill material layer in all boreholes. The glacial till was encountered at depths ranging between 0.6 and 2.6 metres below the existing ground surface. The results of standard penetration tests completed in the glacial till gave N values of between 10 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 three hydrometers (ASTM D7928) on soil samples (BH1-SS4 – 3.0 – 3.6 metres, BH3-SS4 – 1.5 – 2.1 metres, and BH7-SS5 – 3.0 – 3.6 m) indicate the samples have the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay	% Moisture Content
BH1 – SS4	3.0 – 3.6	20.2	45.2	27.6	7.0	10.5
BH3 – SS3	1.5 – 2.1	19.1	42.1	31.8	7.0	7.5
BH7 – SS5	3.0 – 3.6	24.9	42.4	26.7	6.0	7.9

4.4 Bedrock

As previously indicated, practical refusal on the surface of large boulders or bedrock was encountered at all of the boreholes. Within the building footprint, practical refusal on the surface of large boulders or bedrock was encountered at BH5A, BH6 and BH7 at depths of about 4.3, 4.9 and 3.7 metres, respectively, below the existing ground surface. Boreholes BH5A, BH6, and BH7 were extended by coring to verify the quality of the upper bedrock.

The boreholes (BH5A, BH6, and BH7) were continued into the bedrock using diamond coring to depths of about 6.3, 6.9, and 6.2 metres below the existing ground surface. A visual assessment of the bedrock indicated that the bedrock is limestone. The total core run lengths were 2.0, 2.0 and 2.5 metres.

A measure of the condition of the bedrock core obtained from the boreholes can be represented as a percentage of Total Core Recovery (T.C.R.), Solid Core Recovery (S.C.R.) and Rock Quality Designation (R.Q.D.).

The T.C.R. average value for the core is 100 percent.
In borehole BH5, the T.C.R. = 100 percent.
In borehole BH6, the T.C.R. = 100 percent.
In borehole BH7, the T.C.R. = 100 percent.

The S.C.R. average value for the core is about 92.8 percent.
In borehole BH5, the S.C.R. = 86.5 percent.
In borehole BH6, the S.C.R. = 100 percent.
In borehole BH7, the S.C.R. = 92.5 percent.

The R.Q.D. average value for the core is about 74.8 percent.
In borehole BH5, the R.Q.D. = 60.5 percent.
In borehole BH6, the R.Q.D. = 85 percent.
In borehole BH7, the R.Q.D. = 79 percent.

Using the classification table, the R.Q.D. index for the rock mass can be classified as fair to good (R.Q.D. = 60 to 87%).

4.5 Groundwater

Some groundwater was observed in boreholes BH3 and BH5A at depths of about 3.0 and 2.7 metres, below the existing ground surface at the time of drilling on September 12, 2024 and May 8, 2025. Groundwater was measured in a standpipe installed within borehole BH3 at a depth of about 2.1 metres below the existing ground surface on September 19, 2024. Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as early spring.

4.6 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of the soil samples (BH3 – SS4 – 2.1 – 2.7 m, BH8 – SS3 – 1.2 – 1.8 m) submitted for chemistry testing related to corrosivity is summarized in the following table.

Item	Threshold of Concern	Test Result		Comment
		BH3 – SS4	BH8 – SS3	
Chlorides (Cl)	Cl > 0.04 %	0.0141	0.0038	Negligible
pH	5.5 > pH	8.02	7.87	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	2,620	3,790	Highly corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0058	0.0061	Negligible concern

The results of the laboratory testing of both soil samples for sulphate gave a percent sulphate of less than 0.0020. The National Research Council of Canada (NRC) recognizes four categories of potential sulphate attack of buried concrete based on percent sulphate in soil as follows.

Sulphate in Soil (%)	Sulphate Rating
0 to 0.10	negligible
0.10 to 0.20	mild
0.20 to 0.50	considerable
>0.50	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 were reported to be at 8.02 and 7.87, 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 samples were also compared with the threshold level and presents negligible concern.

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 2,620 and 3,790 ohm-cm for the samples analyzed making the soil corrosive 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 increasing 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 boreholes 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 Building Addition

The proposed building addition will be supported by a conventional cast-in-place concrete foundation supported by conventional spread footings foundations. Based on information from the client, it is proposed that the building addition will include one of the following options:

- Option 1: The ground floor elevation will match the existing building at the site and the foundation is to consist of frost walls and footings with a concrete slab on grade, no basement.
- Option 2: The proposed building addition will contain a partial basement with conventional walls and footings. The basement floor will be a cast in place concrete slab on grade.

It is understood that the options above will also contain an elevator pit. The proposed footings will bear below the depth of frost penetration. In the absence of a site grading plan, information was provided by Hobin Architecture Incorporated as indicated below from the provided email:

"Option 1: No basement under the addition

1. *Ground floor elevation to match existing building's ground floor: 78.05m*
2. *Assuming 1525mm frost (Kollaard to confirm frost depth); we have assumed underside of footings will be located at 1650mm below ground floor elevation. Elevation of 76.4m (78.05m – 1.65m).*

Option 2: Partial basement under the addition

3. *Elevation of basement floor assumed at 74.25m (78.05m ground floor slab – 3.8m floor to floor height).*
4. *Assume underside of footings to be 800mm below basement floor elevation = 73.45m (74.25m basement top of slab – 0.8m). "*

The allowable bearing pressure for any footings depends on the depth of the footings below original ground surface, the width of the footings, 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.

5.2.1 Proposed Foundation Subgrade

As previously indicated, the subsurface conditions at the site encountered at the boreholes advanced for this investigation consisted of fill materials (asphalt, crushed stone, and/or silty sand) overlying compact to very dense glacial till followed by bedrock. Once the excavation for the foundation is complete, the exposed subgrade should be inspected by a qualified geotechnical person.

Glacial Till Subgrade

For predictable performance and to reduce the potential for differential movement of the proposed foundation (Option 1 – No basement under the addition), all fill materials and any deleterious materials such as fill materials from the former building on site should be removed from within the proposed foundation areas to expose the native glacial till.

Should the subgrade consist of glacial till in a loose state of packing, the subgrade should be sub-excavated to remove the soft/loose material to a depth of 0.6 metres below the underside of footing elevation. The subgrade should be compacted and then raised to the proposed underside of footing level using engineered fill.

Bedrock Subgrade

Excavations for the proposed foundation should be taken through the fill materials, silty sand, and glacial till to expose the bedrock subgrade. It is expected that bedrock removal will be required to achieve the founding level (Option 2 – Partial basement under the addition) to facilitate a partial basement.

5.3 Foundation Bearing Capacity

Glacial Till

Strip and pad footings, a minimum 0.5 metres in width bearing on compact to dense native glacial till or on a suitably constructed engineering pad placed as described above may be designed using a maximum allowable bearing pressure of 200 kilopascals for serviceability limit states and 300 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 2.5 metres and a maximum footing width of 2.0 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.

Bedrock

Strip and pad footings, a minimum 0.5 metres in width bearing on bedrock or on a concrete sub-footing placed on bedrock may be designed using a maximum allowable bearing pressure of 1,000 kilopascals for serviceability limit states and 2,000 kilopascals for the factored ultimate bearing resistance.

No maximum allowable landscape grade raise adjacent to the proposed building addition foundation is required. Total and differential settlement of the footings for the proposed building addition designed and founded based on the above guidelines should be less than 15 millimetres and 10 millimetres, respectively.

5.4 Engineered Fill

Glacial Till Subgrade

Any fill required to raise the footings for the proposed building 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 95 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 200 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 from the edges of the footing then down and out at 1 horizontal to 1 vertical, or flatter. The excavations for the proposed building should be sized to accommodate this fill placement.

Bedrock Subgrade

It is not recommended that the footings be placed on both bedrock and engineered fill or native glacial till at different locations in the building. As such, engineered fill below the footing is not recommended where a portion of the building is founded on bedrock. Should the bedrock surface be below the proposed underside of footing elevation, it is recommended that the bedrock subgrade be raised to the proposed underside of footing using a concrete sub-footing or that the foundation walls be extended.

5.5 Foundation Excavation

5.5.1 Excavation Side Slopes

Glacial Till Excavation

Any excavation for the proposed structure will be carried out through fill materials (asphalt, crushed stone, silty sand) to bear within the native glacial till or bedrock. 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 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 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.

Bedrock Excavation

Based on the quality of the bedrock encountered at the site, it is considered that the bedrock may be removed relatively easily by means of excavation in combination with hoe ramming. It is expected that additional removal of bedrock may require line-drilling in combination with hoe ramming and potentially blasting.

Where larger amounts of bedrock removal are required it may be more economically feasible to use drill and blasting techniques which should be carried out under the supervision of a blasting specialist engineer. Monitoring of the blasting should be carried out throughout the blasting period to ensure that the blasting meets the limiting vibration criteria established by the specialist engineer. Pre-blast condition surveys of nearby structures and existing utilities are essential. It is also considered that were large amounts of bedrock are removed by hoe ramming, the hoe ramming could also introduce significant vibrations through the bedrock. As such, it is considered that pre-excavation surveys of nearby structures and existing utilities should also be completed before extensive hoe ramming.

Should the Pre-construction condition survey indicate sensitive adjacent structures including adjacent buildings or City of Ottawa municipal infrastructure (sewer and water) the number of pieces of equipment used at one time should be limited to reduce the amount of vibration generated on site and to reduce the cumulative effect of the vibration on the sensitive building or infrastructure.

5.5.2 Ground Water in Excavation and Construction Dewatering

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

Groundwater was encountered in boreholes BH3 and BH5 at depths of about 3.0 and 2.7 metres, respectively, below the existing ground surface at the time of drilling on September 12, 2024 and May 8, 2025. Water was measured in a standpipe placed within borehole BH3 at about 2.1 metres below the existing ground surface on September 19, 2024

Based on the results of the boreholes, significant groundwater inflow into the excavation for the proposed development is not expected. However, if groundwater is encountered during excavation for the proposed services or building addition foundation, a Permit to Take Water (PTTW) may be required for pumping rates exceeding 400,000 Litres/day. If groundwater is encountered, at minimum, registration on the Environmental Activity Sector Registry (EASR) as per O.Reg. 63/16 is expected to be required.

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

Bedrock was encountered at about 3.7 to 4.9 metres below the existing ground surface.

The excavation for the proposed building addition may be extended up to 6.5 metres below the existing ground surface and into the bedrock subgrade.

Groundwater was measured in a standpipe placed within borehole BH3 at about 2.1 metres below the existing ground surface, lowering the groundwater level will not result in settlement as bedrock is not susceptible to shrinking and settling due to groundwater lowering.

Any groundwater inflow from the overburden deposits into the excavations should be controlled by pumping from filtered sumps within the excavations. There are no settlement concerns to the adjacent dwellings and other buildings due to groundwater removal from the foundation excavation at this site.

5.6 Frost Protection Requirements for Spread Footing Foundations

In general, all exterior foundation elements and those in any unheated parts of the proposed building 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.

5.7 Foundation Wall Backfill

To prevent possible foundation frost jacking due to frost adhesion, the backfill against the foundation walls and isolated walls 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.

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 above mentioned foundation perimeter drainage and backfill requirements.

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.

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

5.8 Foundation and Under Slab Drainage

A conventional, perforated perimeter drain, with a 150 millimetre surround of 20 millimetre minus crushed stone, should be provided at the founding level for proposed foundation and the cast-in-place concrete elevator pit 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.

The proposed foundation should also be provided with under floor drains consisting of 150 mm diameter perforated pipe with a surround of 20 millimetre minus crushed stone to reduce the potential for build up of hydrostatic pressure below the basement floor. The under floor drains should be placed beginning at the inside edge of the foundation wall and should be spaced a maximum of 5 metres apart. The under floor drain should also be directed to the sump. The sump discharge should be equipped with a backup flow protector.

5.9 Concrete Floor Slab Support

As stated above, it is expected that the proposed building addition will be founded on native glacial till or bedrock or on an engineered pad placed on the glacial till or a concrete sub-footing on bedrock. For predictable performance of the proposed concrete floor slab all existing fill materials, loose glacial till and any otherwise deleterious material should be removed from below the proposed floor slab area. The exposed subgrade surface should then be inspected and approved by geotechnical personnel.

As previously stated, clear stone should be used in place of OPSS Granular A and Granular B Type material beneath the concrete floor slab to facilitate under floor drainage. In order to prepare the clear stone on a glacial till subgrade, a minimum of 6 ounce per square yard nonwoven geotextile filter cloth should be placed on the native subgrade followed by a 200mm thick layer of 20mm stone. A bedrock subgrade does not require a geotextile. The clear crushed stone should be well compacted to prevent future consolidation using a minimum of three passes with a large diesel plate compactor.

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 Building Addition

5.10.1 Seismic Site Classification Ontario Building Code

On May 7, 2025, a multichannel analysis of surface waves (MASW) test was performed at the site by WSP. The results of the test are attached following the text of this report in Attachment D. The report indicates that the average shear wave velocity in the upper soils is 829 and 879 m/s.

For seismic design purposes, in accordance with the 2024 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class B. The subsurface conditions below the proposed foundation design level consist of compact to very dense glacial till followed by bedrock.

5.10.2 National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.300 with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The results of the test are attached following the text of this report.

5.10.3 Potential for Soil Liquefaction

As previously indicated, the soils below the proposed foundation will consist of compact to very dense glacial till or bedrock.

Compact to very dense glacial till materials and bedrock are not considered prone to liquefaction under seismic conditions at the thickness and state of compaction present at the site. As such, there is no potential for soil liquefaction within the subgrade materials below the proposed building.

6.0 SITE SERVICES

6.1 Excavation

The excavations for the site services will be carried out through fill materials (asphalt, crushed stone, silty sand). For the purposes of Ontario Regulation 213/91 the soils at the site can be considered to be Type 2 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 could be carried out

with side slopes of 1 horizontal to 1 vertical to 1.2 metres from the bottom of the trench then vertical. Where space constraints dictate, the excavation and backfilling operations should be carried out within a tightly fitting, braced steel trench box.

Boreholes BH3 and BH5 encountered groundwater at about 3.0 and 2.7 metres, respectively, below the existing ground surface at the time of drilling on September 12, 2024 and May 8, 2025. Water was measured in a standpipe placed within borehole BH3 at about 2.1 metres below the existing ground surface on September 19, 2024. As such, 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 A should also 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 for 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 in accordance with 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 in close proximity to existing or future roadways, driveways, sidewalks, or any other type of permanent structure.

7.0 ACCESS ROADWAY PAVEMENTS

7.1 Subgrade Preparation

For predictable performance of the parking area pavement, the fill materials and any soft, wet or deleterious materials should be removed from the proposed parking areas.

Alternatively, the pavement structure could be constructed over the existing fill. In that case, some total and differential settlement of the fill may occur over time. This settlement could result in cracking and/or unevenness of the asphaltic concrete and require maintenance in the form of, but not limited to, overlays, and/or padding. The fill subgrade material should be properly compacted using suitable heavy equipment.

The exposed subgrade should be inspected and approved by geotechnical personnel and any soft areas evident should be sub excavated and replaced with engineered fill. The subgrade should be shaped and crowned to promote drainage of the access 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 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 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.

7.2 Parking Area Structure

Following approval of the subgrade surface by geotechnical personnel, the engineered fill placed for the parking area(s) should consist of the following;

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
150 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase
(50 or 100 millimetre minus crushed stone)
Non-woven geotextile fabric (6 oz/sqy) such as Terrafix 360R or Thrace-Ling 150EX or approved alternative.

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

40 millimetres of Superpave 12.5 hot mix asphaltic concrete over
50 millimetres of Superpave 19 hot mix asphaltic concrete over
150 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase
(50 or 100 millimetre minus crushed stone)
Non-woven geotextile fabric (6 oz/sy) such as Terrafix 360R or Thrace-Ling 150EX or approved alternative.

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 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.

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.

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 building addition 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.

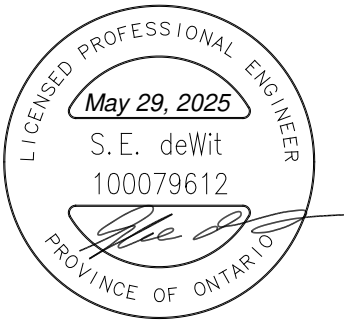
The subgrade for the site services should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the service pipe bedding and backfill materials to ensure the materials meet the specifications from a compaction point of view.

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. Steven deWit, P.Eng.

KEY PLAN	FIGURE 1

NOT TO SCALE

Kollaard Associates
Engineers

Project No. 240798

Date May 2025

DRAWING NUMBER:

SITE PLAN, FIGURE 2

LEGEND:

ELEV. 99.99
BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS

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

REV.	NAME	DATE	DESCRIPTION
1	DT	21/05/25	ADDED NEW BH LOCATIONS

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:
SIENNA SENIOR LIVING

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED ADDITIONAL LONG TERM CARE FACILITY

LOCATION:
1541 ST. JOSEPH BOULEVARD, ORLEANS
OTTAWA, ONTARIO

DESIGNED BY:	*DATE:*
--	SEPTEMBER 3, 2024
DRAWN BY:	*SCALE:*
DT	N.T.S

KOLLAARD FILE NUMBER: 240798

Kollaard Associates
Engineers

BOREHOLE BH1

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2024-09-12
SHEET: 1 of 1
DATUM:

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
	Grey crushed gravel (FILL)	0.00		78.11							
1.0					1	SS	78			3	Borehole dry at time of drilling (Sept 12, 2024)
	Yellow brown to grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.82		76.29	2	SS	16			7	
2.0											
					3	SS	10			14	
3.0											
					4	SS	62				
	Possibly Weathered Shale	3.27		74.84							
	Practical refusal on bedrock or large boulder	3.35		74.76							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH2

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2024-09-12
SHEET: 1 of 1
DATUM:

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
	Grey crushed stone (FILL)	0.00		78.78							
1.0					1	SS	16			2	Borehole dry at time of drilling (Sept 12, 2024)
2.0					2	SS	18			7	
	Yellow brown to grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.05		76.73	3	SS	30			9	
	Practical refusal on bedrock or large boulder	2.92		75.86							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH3

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

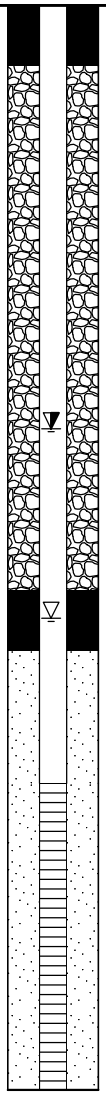
PROJECT NUMBER: 240798
DATE OF BORING: 2024-09-12
SHEET: 1 of 1
DATUM:

DEPTH SCALE (meters)	DESCRIPTION	DEPTH (m)	ELEV. (m)	NUMBER	TYPE	BLOWS/0.3m	MOISTURE CONTENT (%)
	Grey crushed stone (FILL)	0.00	80.09				
	Yellow brown sand and gravel (FILL)	0.03	80.06	1	SS	10	5
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.55	79.54	2	SS	23	8
1.0				3	SS	24	
2.0				4	SS	26	9
3.0				5	SS	25	10
	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	3.04	77.05	6	SS	24	9
4.0				7	SS	15	8
				8	SS	22	12
5.0				9	SS	100	
	Practical refusal on bedrock or large boulder	5.38	74.71				11

UNDIST SHEAR STRENGTH (x, Cu. kPa) / REM SHEAR STRENGTH (o, Cu. kPa): 0 20 40 60 80 100

DYNAMIC CONE PENETRATION TEST, blows/300 mm: 0 20 40 60 80 100

PIEZOMETER OR STANDPIPE INSTALLATION



Groundwater encountered at about 3.0 metres below the existing surface Sept 12, 2024. Ground water measured in standpipe at about 2.1 metres, below ground surface Sept 19,2024.

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH4

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2024-09-12
SHEET: 1 of 1
DATUM:

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
	Grey crushed stone (FILL)	0.00		79.31							
1.0	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.90		78.41	1	SS	6			8	Borehole dry at time of drilling (Sept 12, 2024)
					2	SS	100				
	Practical refusal on bedrock or large boulder	1.52		77.79						14	

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH5

PROJECT: Proposed Additional Long Term Care Facility
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2024-09-12
SHEET: 1 of 1
DATUM:

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
	Yellow brown silty sand, trace gravel, wire and concrete debris (FILL)	0.00		79.68							
1.0					1	SS	19				Borehole dry at time of drilling (Sept 12, 2024)
	Yellow brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.37		78.31							
2.0					2	SS	22			10	
					3	SS	25				
					4	SS	100				
	Practical refusal on bedrock or large boulder	2.94		76.74							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH5A

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2025-05-08
SHEET: 1 of 1
DATUM:

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
	Yellow brown silty sand, some gravel, trace concrete debris and cobbles (FILL)	0.00		79.83							
1.0					1	SS	20				Groundwater encountered at about 2.7 metres below the existing surface May 8, 2025.
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	1.37		78.46							
2.0					2	SS	25				
					3	SS	16				▽
	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.69		77.14							
3.0					4	SS	6				
4.0					5	SS	13				
	Cored through bedrock TCR = 60/60 SCR = 53/60 RQD = 35/60, 58.3%	4.34		75.49							
5.0					1	RC					
6.0	Cored through bedrock TCR = 40/40 SCR = 33.5/40 RQD = 25.5/40, 63.8%	5.86		73.97	2	RC					
	End of borehole in BEDROCK	6.30		73.53							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH6

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2025-05-09
SHEET: 1 of 1
DATUM:

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
	Yellow brown silty sand, trace clay, gravel, and organics (FILL)	0.00		80.12	1	SS	7				Borehole dry at time of drilling (May 9, 2025)
1.0	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.97		79.15	2	SS	11				
					4	SS	22				
2.0											
3.0					5	SS	29				
4.0					6	SS	31				
	Grey silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	4.42		75.70	7	SS	71				
5.0	Cored through bedrock TCR = 60/60 SCR = 60/60 RQD = 48/60, 80%	4.90		75.22	1	RC					
6.0											
	Cored through bedrock TCR = 20/20 SCR = 20/20 RQD = 20/20, 100%	6.42		73.70	2	RC					
	End of borehole in BEDROCK	6.93		73.19							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH7

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2025-05-09
SHEET: 1 of 1
DATUM:

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		78.31							
	Grey crushed gravel (FILL)	0.30		78.01	1	SS	15				
1.0					2	SS	10				Borehole dry at time of drilling (May 9, 2025)
	Grey brown silty sand, trace organics (FILL)	1.20		77.11							
2.0					3	SS	3				
					4	SS	20				
	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	2.59		75.72							
3.0					5	SS	53				
	Cored through bedrock TCR = 60/60 SCR = 54/60, 90% RQD = 47/60, 78%	3.68		74.63							
4.0					1	RC					
5.0											
	Cored through bedrock TCR = 40/40 SCR = 38.5/40, 96% RQD = 32/40, 80%	5.20		73.11							
					2	RC					
6.0											
	End of borehole in BEDROCK	6.22		72.09							

DEPTH SCALE: 1 to 37.5
LOGGED: KH

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

Kollaard Associates
Engineers

BOREHOLE BH8

PROJECT: Proposed Long Term Care Facility Addition
CLIENT: Sienna Senior Living
LOCATION: 1541 St. Joseph Boulevard, Orleans
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 240798
DATE OF BORING: 2025-05-09
SHEET: 1 of 1
DATUM:

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
	Grey crushed gravel (FILL)	0.00		79.65	1	SS	5				
	Yellow brown silty sand, trace organics (FILL)	0.35		79.30	2	SS	14				Borehole dry at time of drilling (May 9, 2025)
1.0	Grey brown silty sand, some gravel, cobbles, boulders, trace clay (GLACIAL TILL)	0.97		78.68	3	SS	21				
2.0					4	SS	30				
					5	SS	42				
3.0					6	SS	59				
	Practical refusal on large boulder or bedrock	3.43		76.22							

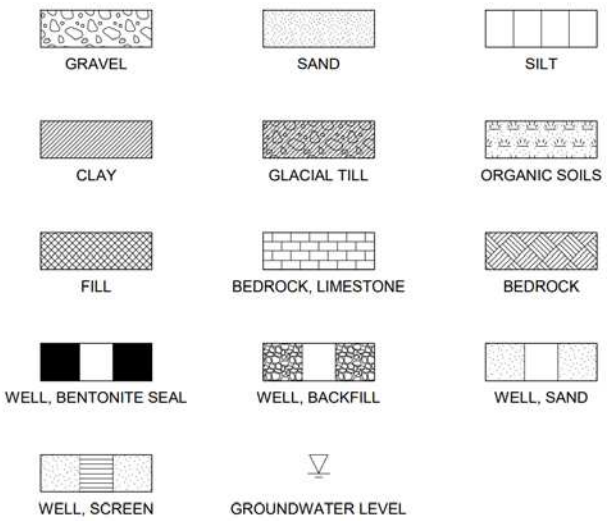
DEPTH SCALE: 1 to 37.5
LOGGED: KH

BORING METHOD: Power Auger and Coring
AUGER TYPE: 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

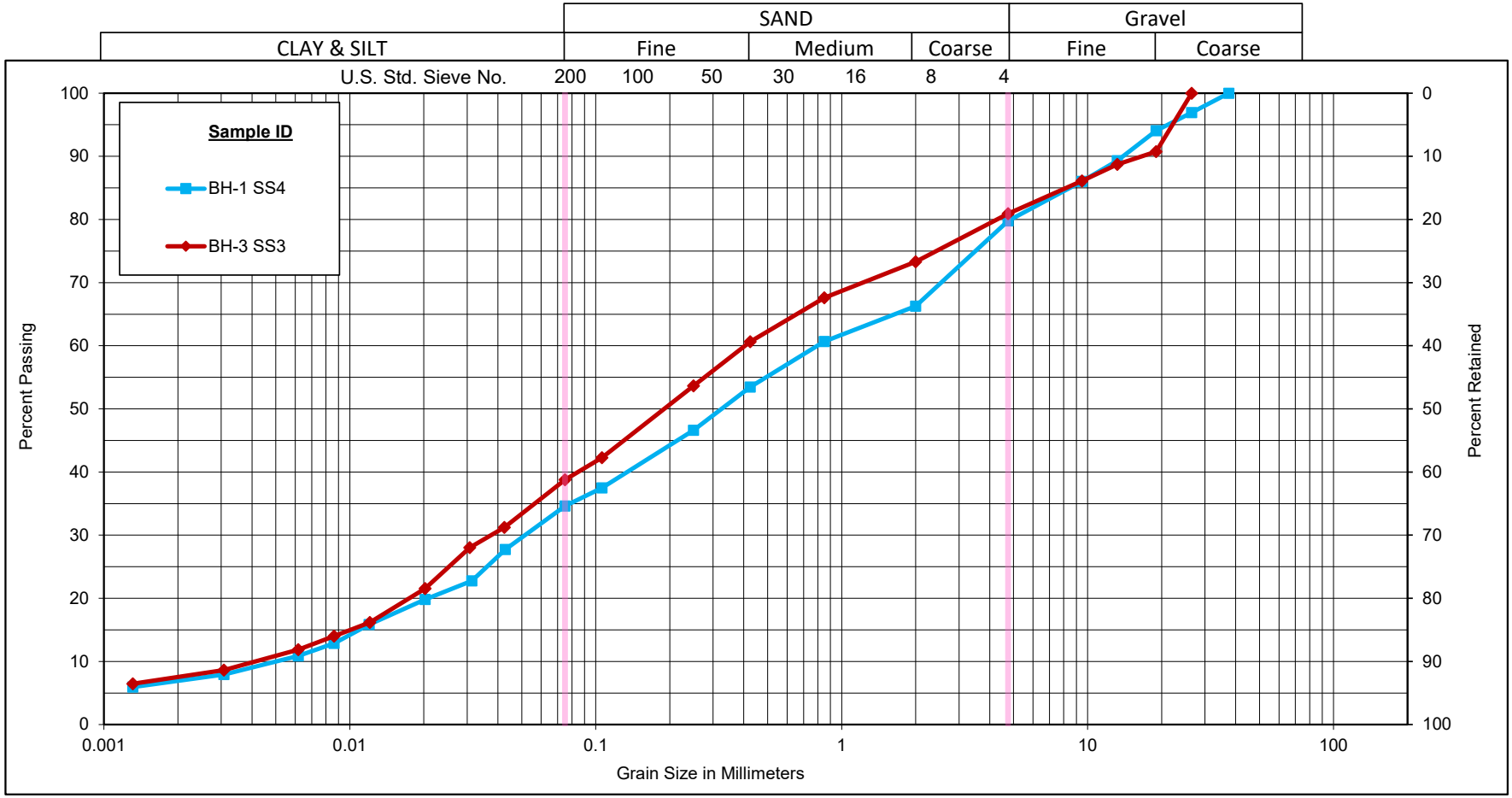
LIST OF COMMON SYMBOLS	
Cu	Undrained Shear Strength
e	Void Ratio
Cc	Compression Index
Cv	Coefficient of Consolidation
k	Coefficient of Permeability
PI	Plasticity Index
n	Porosity
u	Pore Pressure
W	Moisture Content
LL	Liquid Limit
PL	Plastic Limit
r	Unit Weight of Soil
y	Unit Weight of Submerged Soil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

ATTACHMENT A

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-1 SS4	10'-12'	20.2	45.2	27.6	7.0
BH-3 SS3	5'-7'	19.1	42.1	31.8	7.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File #240798

1541 Saint-Joseph Boulevard, Orleans

Figure No.

Project No. 121625581

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kollaard Associates, File #240798**	Project No.:	**121625581**
Project:	**1541 Saint-Joseph Boulevard, Orleans**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kollaard Associates**
Source:	**BH-1**	Date Sampled:	**September 12, 2024**
Sample No.:	**SS4**	Tested By:	**Brian Prevost**
Sample Depth	**10'-12'**	Date Tested:	**September 23, 2024**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	65.49
Sample Weight after Hydrometer and Wash (g)	
Percent Passing No. 200 Sieve (%)	**100.0**
Percent Passing Corrected (%)	**66.27**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**873.40**
Sample Weight After Sieve (g)	**871.80**
Percent Loss in Sieve (%)	**0.18**

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)	189.38
Air Dried Mass (W_a), (g)	190.89
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9921
Air Dried Mass in Analysis (M_a), (g)	66.01
Oven Dried Mass in Analysis (M_o), (g)	65.49
Percent Passing 2.0 mm Sieve (P_{10}), (%)	66.27
Sample Represented (W), (g)	98.82

SIEVE ANALYSIS		
Sieve Size mm	**Cum. Wt. Retained**	**Percent Passing**
75.0		100.0
63.0		100.0
53.0		100.0
37.5	0.0	100.0
26.5	26.9	96.9
19.0	51.9	94.1
13.2	93.2	89.3
9.5	121.9	86.0
4.75	176.5	79.8
2.00	294.6	66.3
Total (C + F)[1]	871.80	
0.850	5.53	60.67
0.425	12.67	53.45
0.250	19.41	46.63
0.106	28.46	37.47
0.075	31.30	34.60
PAN	31.52	34.4

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 10:02 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
23-Sep-24	10:03 AM	1	35.0	7.0	21.5	28.0	27.72	10.78904	9.73081	0.013047	0.04286
23-Sep-24	10:04 AM	2	30.0	7.0	21.5	23.0	22.77	11.56404	9.73081	0.013047	0.03137
23-Sep-24	10:07 AM	5	27.0	7.0	21.5	20.0	19.80	12.02904	9.73081	0.013047	0.02024
23-Sep-24	10:17 AM	15	23.0	7.0	21.5	16.0	15.84	12.64904	9.73081	0.013047	0.01198
23-Sep-24	10:32 AM	30	20.0	7.0	21.5	13.0	12.87	13.11404	9.73081	0.013047	0.00863
23-Sep-24	11:02 AM	60	18.0	7.0	21.5	11.0	10.89	13.42404	9.73081	0.013047	0.00617
23-Sep-24	2:12 PM	250	15.0	7.0	21.5	8.0	7.9204	13.88904	9.73081	0.013047	0.00308
24-Sep-24	10:02 AM	1440	13.0	7.0	20.5	6.0	5.9403	14.19904	9.96839	0.013205	0.00131

Remarks: Moisture Content: 10.5%

Reviewed By: Brian Prevost

Date: September 24, 2024

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Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kollaard Associates, File #240798**	Project No.:	**121625581**
Project:	**1541 Saint-Joseph Boulevard, Orleans**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kollaard Associates**
Source:	**BH-3**	Date Sampled:	**September 12, 2024**
Sample No.:	**SS3**	Tested By:	**Brian Prevost**
Sample Depth	**5'-7'**	Date Tested:	**September 23, 2024**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	66.57
Sample Weight after Hydrometer and Wash (g)	
Percent Passing No. 200 Sieve (%)	**100.0**
Percent Passing Corrected (%)	**73.30**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**991.50**
Sample Weight After Sieve (g)	**990.00**
Percent Loss in Sieve (%)	**0.15**

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)	216.83
Air Dried Mass (W_a), (g)	217.79
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9956
Air Dried Mass in Analysis (M_a), (g)	66.86
Oven Dried Mass in Analysis (M_o), (g)	66.57
Percent Passing 2.0 mm Sieve (P_{10}), (%)	73.30
Sample Represented (W), (g)	90.81

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	0.0	100.0
19.0	91.6	90.8
13.2	111.7	88.7
9.5	137.9	86.1
4.75	189.2	80.9
2.00	264.7	73.3
Total (C + F)[1]	990.00	
0.850	5.19	67.59
0.425	11.49	60.65
0.250	17.86	53.64
0.106	28.17	42.28
0.075	31.37	38.76
PAN	31.82	

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 10:10 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
23-Sep-24	10:11 AM	1	36.0	7.0	21.5	29.0	31.24	10.63404	9.73081	0.013047	0.04255
23-Sep-24	10:12 AM	2	33.0	7.0	21.5	26.0	28.01	11.09904	9.73081	0.013047	0.03074
23-Sep-24	10:15 AM	5	27.0	7.0	21.5	20.0	21.55	12.02904	9.73081	0.013047	0.02024
23-Sep-24	10:25 AM	15	22.0	7.0	21.5	15.0	16.16	12.80404	9.73081	0.013047	0.01205
23-Sep-24	10:40 AM	30	20.0	7.0	21.5	13.0	14.01	13.11404	9.73081	0.013047	0.00863
23-Sep-24	11:10 AM	60	18.0	7.0	21.5	11.0	11.85	13.42404	9.73081	0.013047	0.00617
23-Sep-24	2:20 PM	250	15.0	7.0	21.5	8.0	8.62	13.88904	9.73081	0.013047	0.00308
24-Sep-24	10:10 AM	1440	13.0	7.0	20.5	6.0	6.46	14.19904	9.96839	0.013205	0.00131

Remarks: Moisture Content: 7.5%

Reviewed By: Brian Prevost

Date: September 24, 2024

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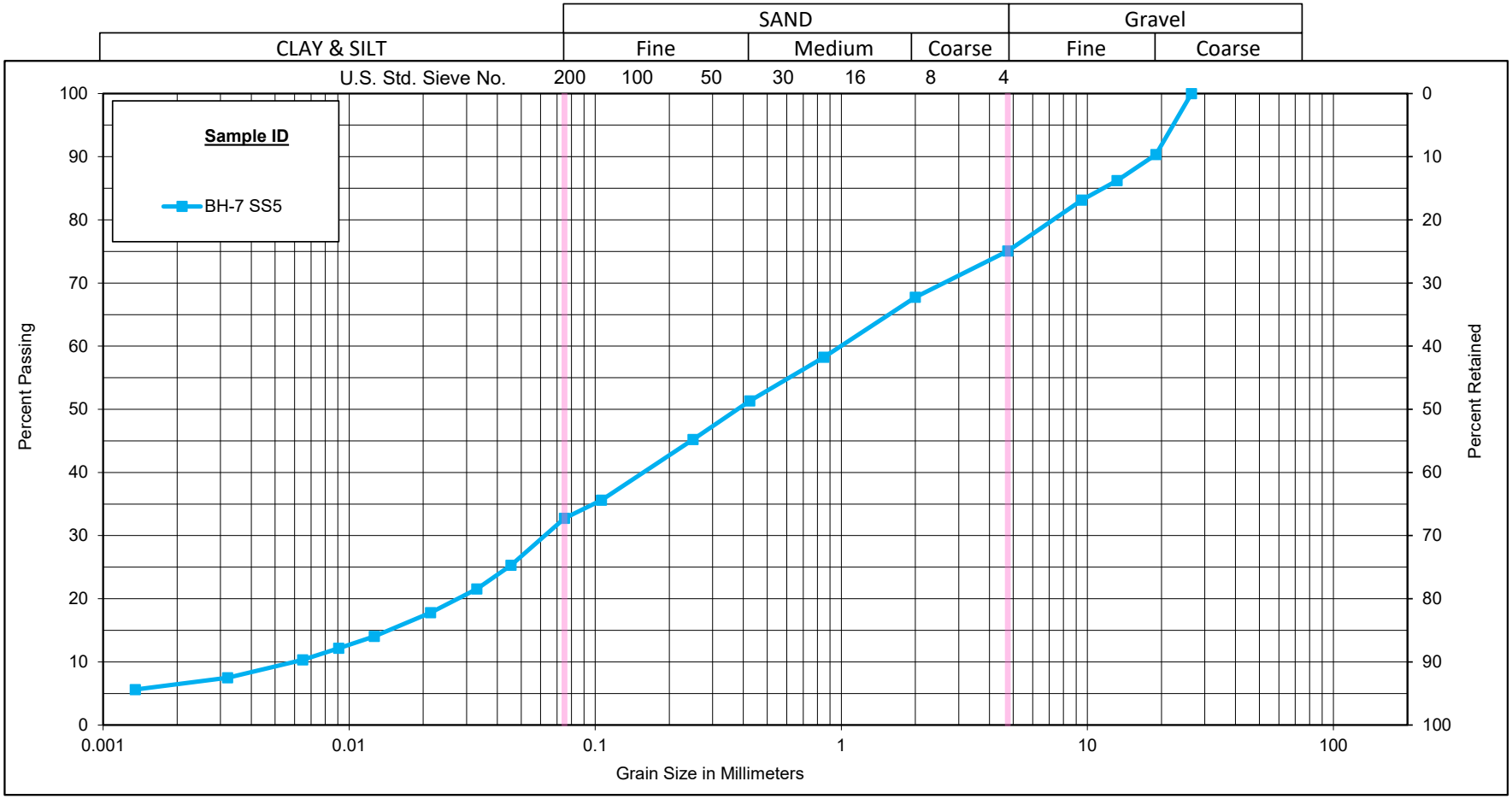
Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-7 SS5	10'-12'	24.9	42.4	26.7	6.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File #240798

1541 St. Joseph Blvd, Ottawa

Figure No.

Project No. 121625581

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS			
Client:	**Kollaard Associates, File #240798**	Project No.:	**121625581**
Project:	**1541 St. Joseph Blvd, Ottawa**	Test Method:	**LS702**
Material Type:	**Soil**	Sampled By:	**Kollaard Associates**
Source:	**BH-7**	Date Sampled:	**May 9, 2025**
Sample No.:	**SS5**	Tested By:	**Brian Prevost**
Sample Depth	**10'-12'**	Date Tested:	**May 21, 2025**

WASH TEST DATA	
Oven Dry Mass In Hydrometer Analysis (g)	70.74
Sample Weight after Hydrometer and Wash (g)	37.05
Percent Passing No. 200 Sieve (%)	**47.6**
Percent Passing Corrected (%)	**32.26**

PERCENT LOSS IN SIEVE	
Sample Weight Before Sieve (g)	**708.70**
Sample Weight After Sieve (g)	**706.70**
Percent Loss in Sieve (%)	**0.28**

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	24	g

CALCULATION OF DRY SOIL MASS	
Oven Dried Mass (W_o), (g)	196.64
Air Dried Mass (W_a), (g)	194.59
Hygroscopic Corr. Factor ($F=W_o/W_a$)	1.0105
Air Dried Mass in Analysis (M_a), (g)	70.00
Oven Dried Mass in Analysis (M_o), (g)	70.74
Percent Passing 2.0 mm Sieve (P_{10}), (%)	67.73
Sample Represented (W), (g)	104.44

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	68.4	90.3
13.2	97.6	86.2
9.5	119.6	83.1
4.75	176.8	75.1
2.00	228.7	67.7
Total (C + F)[1]	706.70	0.3
0.850	9.91	58.24
0.425	17.14	51.32
0.250	23.51	45.22
0.106	33.56	35.60
0.075	36.54	32.74
PAN	36.78	

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

HYDROMETER DETAILS	
Volume of Bulb (V_B), (cm^3)	67.5
Length of Bulb (L_2), (cm)	14.1
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.3
Scale Dimension (h_s), (cm/Div)	0.156
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 10:24 AM **Sedimentation Cylinder No:** 5

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
21-May-25	10:25 AM	1	29.0	2.0	19.0	27.0	25.29	11.43147	10.34409	0.013452	0.04548
21-May-25	10:26 AM	2	25.0	2.0	19.0	23.0	21.55	12.05547	10.34409	0.013452	0.03303
21-May-25	10:29 AM	5	21.0	2.0	19.0	19.0	17.80	12.67947	10.34409	0.013452	0.02142
21-May-25	10:39 AM	15	17.0	2.0	19.0	15.0	14.05	13.30347	10.34409	0.013452	0.01267
21-May-25	10:54 AM	30	15.0	2.0	19.0	13.0	12.18	13.61547	10.34409	0.013452	0.00906
21-May-25	11:24 AM	60	13.0	2.0	19.0	11.0	10.30	13.92747	10.34409	0.013452	0.00648
21-May-25	2:34 PM	250	10.0	2.0	19.5	8.0	7.49	14.39547	10.21619	0.013369	0.00321
22-May-25	10:24 AM	1440	8.0	2.0	19.5	6.0	5.62	14.70747	10.21619	0.013369	0.00135

Remarks: **Moisture Content, 7.9%**

Reviewed By: Brian Prevost

Date: May 22, 2025

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ATTACHMENT B

Laboratory Test Results for Chemical Properties

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CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: **WT2427929**	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, Ontario Canada N2V 2B8
Telephone	: 613 860 0923	Telephone	: 613 225 8279
Project	: 240798	Date Samples Received	: 19-Sep-2024 11:00
PO	: ----	Date Analysis Commenced	: 24-Sep-2024
C-O-C number	: ----	Issue Date	: 30-Sep-2024 11:27
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

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
- Guideline Comparison

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*
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Centralized Prep, Waterloo, Ontario
Kelly Fischer	Technical Specialist	Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Inorganics, 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.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : 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

>: greater than.
<: less than.
Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).
For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit .

Analytical Results

Sub-Matrix: Soil (Matrix: Soil/Solid)				Client sample ID	BH3- SS4					
				Sampling date/time	12-Sep-2024 00:00					
Analyte	Method/Lab	LOR	Unit	WT2427929-001	ON153/04 T6-RPI-C	--	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	5.00	µS/cm	381	700 µS/cm	--	--	--	--	--
Moisture	E144/WT	0.25	%	7.95	--	--	--	--	--	--
Oxidation-reduction potential [ORP]	E125/WT	0.10	mV	286	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	8.02	--	--	--	--	--	--
Resistivity	EC100R/WT	100	ohm cm	2620	--	--	--	--	--	--
Inorganics										
Sulfides, acid volatile	E396-L/WT	0.20	mg/kg	0.36	--	--	--	--	--	--
Leachable Anions & Nutrients										
Chloride, soluble ion content	E236.Cl/WT	5.0	mg/kg	141	--	--	--	--	--	--
Sulfate, soluble ion content	E236.SO4/WT	20	mg/kg	58	--	--	--	--	--	--

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.

No Breaches Found

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T6-RPI-C	153 T6-Soil-Res/Park/Inst. Property Use (Coarse)

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2427929**	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	: 240798	Date Samples Received	: 19-Sep-2024 11:00
PO	: ----	Issue Date	: 30-Sep-2024 11:27
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

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] BH3- SS4	E396-L	12-Sep-2024	25-Sep-2024	14 days	14 days	✓	25-Sep-2024	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH3- SS4	E236.Cl	12-Sep-2024	27-Sep-2024	30 days	16 days	✓	27-Sep-2024	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH3- SS4	E236.SO4	12-Sep-2024	27-Sep-2024	30 days	16 days	✓	27-Sep-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] BH3- SS4	E100-L	12-Sep-2024	28-Sep-2024	30 days	17 days	✓	30-Sep-2024	30 days	18 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH3- SS4	E144	12-Sep-2024	----	----	----		24-Sep-2024	----	12 days	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH3- SS4	E125	12-Sep-2024	25-Sep-2024	180 days	13 days	✓	25-Sep-2024	180 days	14 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH3- SS4	E108A	12-Sep-2024	25-Sep-2024	30 days	13 days	✓	25-Sep-2024	30 days	14 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	1672188	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1669379	1	1	100.0	5.0	✓
Moisture Content by Gravimetry	E144	1669061	1	20	5.0	5.0	✓
ORP by Electrode	E125	1671203	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1671204	1	7	14.2	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1678071	1	6	16.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1678069	1	6	16.6	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1672188	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1669379	2	1	200.0	10.0	✓
Moisture Content by Gravimetry	E144	1669061	1	20	5.0	5.0	✓
ORP by Electrode	E125	1671203	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1671204	1	7	14.2	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1678071	2	6	33.3	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1678069	2	6	33.3	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1672188	1	14	7.1	4.7	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1669379	1	1	100.0	5.0	✓
Moisture Content by Gravimetry	E144	1669061	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1678071	1	6	16.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1678069	1	6	16.6	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	: **WT2427929**	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	: 240798	Date Samples Received	: 19-Sep-2024 11:00
PO	: ----	Date Analysis Commenced	: 24-Sep-2024
C-O-C number	: ----	Issue Date	: 30-Sep-2024 11:32
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2024		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Waterloo Centralized Prep, Waterloo, Ontario
Kelly Fischer	Technical Specialist	Waterloo Inorganics, Waterloo, Ontario
Nik Perkio	Senior Analyst	Waterloo Inorganics, 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: 1669061)											
TY2410558-001	Anonymous	Moisture	----	E144	0.25	%	82.3	73.1	11.8%	20%	----
Physical Tests (QC Lot: 1669379)											
WT2427929-001	BH3- SS4	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	381	394	3.35%	20%	----
Physical Tests (QC Lot: 1671203)											
EO2408257-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	354	362	2.23%	25%	----
Physical Tests (QC Lot: 1671204)											
EO2408257-002	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	4.82	4.63	4.02%	5%	----
Inorganics (QC Lot: 1672188)											
HA2402290-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.22	mg/kg	<0.21	<0.22	0.21	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1678069)											
WT2427758-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	21	<20	0.9	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1678071)											
WT2427758-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	<5.0	<5.0	0	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: 1669061)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1669379)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Inorganics (QCLot: 1672188)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 1678069)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1678071)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

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: 1669061)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 1669379)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	98.2	90.0	110	----
Physical Tests (QCLot: 1671204)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	101	98.0	102	----
Inorganics (QCLot: 1672188)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	78.0	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1678069)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	98.5	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1678071)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	98.2	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: 1669379)									
QC-1669379-003	RM	Conductivity (1:2 leachate)	----	E100-L	3270 µS/cm	108	70.0	130	----
Physical Tests (QCLot: 1671203)									
QC-1671203-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	99.6	90.0	110	----
Leachable Anions & Nutrients (QCLot: 1678069)									
QC-1678069-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	170 mg/kg	98.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1678071)									
QC-1678071-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	402 mg/kg	87.1	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

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.230
	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 ☑ Y ☐ N
	Copy of Invoice with Report ☐ Y ☑ N
Company:	Kollaard Associates Inc.
Contact:	admin@kollaard.ca

Report Format / Distribution

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

Quality Control (QC) Report with Report ☑ Y ☐ N

☑ 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 admin@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: dd-mmm-yy hh:mm

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

Project Information

ALS Account # / Quote #: Q71021

Job #: 240798

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): JD

ALS Contact: 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	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	BH3 - SS4	12-Sep-24		Soil	R			

Environmental Division
Waterloo
Work Order Reference
WT2427929

Telephone : +1 519 886 6910

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

Are samples taken from a Regulated DW System? ☐ Y ☑ N

Are samples for human consumption/ use? ☐ Y ☑ N

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

Ontario Regulation 153/04 - April 15, 2011 Standards

Table 6, Potable, Full depth residential standards, coarse-grained soils

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		
14.2			15.3		

SHIPMENT RELEASE (client use)

Released by: [signature] Date: SEPT 19/24 Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: GSTAFF Date: 19/9/24 Time: 11:00

FINAL SHIPMENT RECEPTION (lab use only)

Received by: [signature] Date: 20 Sept. 24 Time: 9:00

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.**

SOL-372

CERTIFICATE OF ANALYSIS

Work Order	: **WT2511560**		
Client	: **Kollaard Associates Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Dean Tataryn	Account Manager	: Costas Farassoglou
Address	: 210 Prescott Street Unit 1 Kemptville Ontario Canada K0G1J0	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 613 860 0923	E-mail	: costas.farassoglou@alsglobal.com
Project	: 240798	Telephone	: 613 225 8279
PO	: ----	Date Samples Received	: 14-May-2025 12:35
C-O-C number	: ----	Date Analysis Commenced	: 19-May-2025
Sampler	: CLIENT	Issue Date	: 23-May-2025 16:46
Site	: ----		
Quote number	: SOA 2025		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Niral Patel		Centralized Prep, Waterloo, Ontario
Walt Kippenhuck	Supervisor - Inorganic	Inorganics, 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
mg/kg	milligrams per kilogram
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units
µS/cm	microsiemens per centimetre

<: 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 (Matrix: Soil/Solid)					Client sample ID	BH8 SS3 4-6"	----	----	----	----
					Client sampling date / time	09-May-2025 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit		WT2511560-001	----	----	----	----
						Result	----	----	----	----
Physical Tests										
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	µS/cm		264	----	----	----	----
Moisture	----	E144/WT	0.25	%		9.20	----	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV		237	----	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units		7.87	----	----	----	----
Resistivity	----	EC100R/WT	100	ohm cm		3790	----	----	----	----
Inorganics										
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg		<0.22	----	----	----	----
Leachable Anions & Nutrients										
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg		38.9	----	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg		61	----	----	----	----

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

ALS Canada Ltd.

right solutions.
right partner.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2511560**	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	: 240798	Date Samples Received	: 14-May-2025 12:35
PO	: ----	Issue Date	: 23-May-2025 16:46
C-O-C number	: ----		
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2025		
No. of samples received	: 1		
No. of samples analysed	: 1		

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] BH8 SS3 4-6"	E396-L	09-May-2025	23-May-2025	14 days	14 days	✓	23-May-2025	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E236.Cl	09-May-2025	22-May-2025	30 days	14 days	✓	22-May-2025	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E236.SO4	09-May-2025	22-May-2025	30 days	14 days	✓	22-May-2025	28 days	0 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E100-L	09-May-2025	21-May-2025	30 days	13 days	✓	22-May-2025	30 days	13 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E144	09-May-2025	----	----	----		19-May-2025	----	----	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E125	09-May-2025	20-May-2025	180 days	12 days	✓	21-May-2025	180 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH8 SS3 4-6"	E108A	09-May-2025	20-May-2025	30 days	11 days	✓	20-May-2025	30 days	11 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)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	2004358	1	19	5.2	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	2004296	1	20	5.0	5.0	✓
ORP by Electrode	E125	2004363	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	2003929	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2004360	1	19	5.2	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	2004359	1	19	5.2	5.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2011575	1	10	10.0	4.7	✓
Laboratory Control Samples (LCS)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	2004358	2	19	10.5	10.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	2004296	1	20	5.0	5.0	✓
ORP by Electrode	E125	2004363	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	2003929	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2004360	2	19	10.5	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	2004359	2	19	10.5	10.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2011575	1	10	10.0	4.7	✓
Method Blanks (MB)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	2004358	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	2003929	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2004360	1	19	5.2	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	2004359	1	19	5.2	5.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2011575	1	10	10.0	4.7	✓

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	: **WT2511560**	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	: 240798	Date Samples Received	: 14-May-2025 12:35
PO	: ----	Date Analysis Commenced	: 19-May-2025
C-O-C number	: ----	Issue Date	: 23-May-2025 16:45
Sampler	: CLIENT		
Site	: ----		
Quote number	: SOA 2025		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Niral Patel		Waterloo Centralized Prep, Waterloo, Ontario
Walt Kippenhuck	Supervisor - Inorganic	Waterloo Inorganics, 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: 2003929)											
HA2501466-001	Anonymous	Moisture	----	E144	0.25	%	29.5	28.7	2.66%	20%	----
Physical Tests (QC Lot: 2004296)											
WT2511560-001	BH8 SS3 4-6"	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.87	7.91	0.507%	5%	----
Physical Tests (QC Lot: 2004358)											
WT2511560-001	BH8 SS3 4-6"	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	264	255	3.47%	20%	----
Physical Tests (QC Lot: 2004363)											
WT2511830-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	255	254	0.393%	25%	----
Inorganics (QC Lot: 2011575)											
KS2501681-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.24	mg/kg	<0.24	<0.24	0.0007	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 2004359)											
WT2511808-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	83	84	0.7	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 2004360)											
WT2511808-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	16.3	16.0	0.3	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: 2003929)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 2004358)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Inorganics (QCLot: 2011575)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 2004359)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 2004360)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----

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: 2003929)									
Moisture	----	E144	0.25	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 2004296)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	101	98.0	102	----
Physical Tests (QCLot: 2004358)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	97.9	90.0	110	----
Inorganics (QCLot: 2011575)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	77.0	70.0	130	----
Leachable Anions & Nutrients (QCLot: 2004359)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	96.3	80.0	120	----
Leachable Anions & Nutrients (QCLot: 2004360)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	98.1	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: 2004358)									
QC-2004358-003	RM	Conductivity (1:2 leachate)	----	E100-L	3130 µS/cm	99.3	70.0	130	----
Physical Tests (QCLot: 2004363)									
QC-2004363-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	104	90.0	110	----
Leachable Anions & Nutrients (QCLot: 2004359)									
QC-2004359-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	647 mg/kg	94.8	70.0	130	----
Leachable Anions & Nutrients (QCLot: 2004360)									
QC-2004360-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	382 mg/kg	96.7	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

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.230
	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 ☑ Y ☐ N
	Copy of Invoice with Report ☐ Y ☑ N
Company:	Kollaard Associates Inc.
Contact:	admin@kollaard.ca

Report Format / Distribution

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

Quality Control (QC) Report with Report ☑ Y ☐ N

☑ 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: admin@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 #:	240798
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):

ALS Contact:

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	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	BH 8 SS3 4-6"	May 9		Soil	R			

Environmental Division Waterloo

Work Order Reference

WT2511560

Telephone : +1 519 886 6910

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

Are samples taken from a Regulated DW System? ☐ Y ☑ N

Are samples for human consumption/ use? ☐ Y ☑ N

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			
25.2					9.0		

SHIPMENT RELEASE (client use)

Released by: Dallett. Date: May 14 Time:

INITIAL SHIPMENT RECEPTION (lab use only)

Received by: Date: 14 May 2025 Time: 1235

FINAL SHIPMENT RECEPTION (lab use only)

Received by: RS Date: May 15/25 Time: 900

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**.

SOL-945

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: 45.460N 75.560W **User File Reference:** 1541 St. Joesph Boulevard, Orleans 2025-04-15 16:21 UT

Requested by: Kollaard Associates Inc.

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)	0.483	0.268	0.161	0.047
Sa (0.1)	0.561	0.322	0.200	0.065
Sa (0.2)	0.467	0.272	0.171	0.058
Sa (0.3)	0.353	0.207	0.131	0.045
Sa (0.5)	0.249	0.145	0.092	0.032
Sa (1.0)	0.122	0.072	0.046	0.016
Sa (2.0)	0.058	0.034	0.021	0.006
Sa (5.0)	0.015	0.008	0.005	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.300	0.175	0.109	0.034
PGV (m/s)	0.206	0.116	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

ATTACHMENT D

Results of WSP MASW Investigation

TECHNICAL MEMORANDUM

DATE May 29, 2025

Project No. CA0052828.1071

TO Dean Tataryn

FROM Daniel Grindall, Christopher Phillips

EMAIL Daniel.Grindall@wsp.com; Christopher.Phillips@wsp.com

MASW SURVEY RESULTS – 1541 ST. JOSEPH BLVD, OTTAWA, ONTARIO

This technical memorandum presents the processing and results of the Multichannel Analysis of Surface-Waves (MASW) test performed for the purpose of Seismic Site Classification for the site at 1541 St. Joseph Blvd, located in Ottawa, Ontario. The geophysical testing was performed by WSP personnel on April 30th, 2025, along the survey lines shown in Figure 1, below.

Figure 1: MASW Survey Line Locations in red.

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Methodology

The MASW method measures variations in surface-wave velocity with increasing distance and wavelength and can be used to infer the rock/soil types, stratigraphy and soil conditions.

A typical MASW survey requires a seismic source, to generate surface-waves, and a minimum of two geophone receivers, to measure the ground response at some distance from the source. Surface-waves are a special type of seismic wave whose propagation is confined to the near surface medium.

The depth of penetration of a surface-wave into a medium is directly proportional to its wavelength. In a non-homogeneous medium surface-waves are dispersive, i.e., each wavelength has a characteristic velocity owing to the subsurface heterogeneities within the depth interval that wavelength of surface-wave propagates through. The relationship between surface-wave velocity and wavelength is used to obtain the shear-wave velocity and attenuation profile of the medium with increasing depth.

The seismic source used can be either active or passive, depending on the application and location of the survey. Examples of active sources include explosives, weight-drops, sledgehammer and vibrating pads. Examples of passive sources are road traffic, micro-tremors and water-wave action (in near-shore environments).

The geophone receivers measure the wave-train associated with the surface-wave travelling from a seismic source at different distances from the source.

The participation of surface-waves with different wavelengths can be determined from the wave-train by transforming the wave-train results into the frequency domain. The surface-wave velocity profile with respect to wavelength (called the ‘dispersion curve’) is determined by the delay in wave propagation measured between the geophone receivers. The dispersion curve is then matched to a theoretical dispersion curve using an iterative forward-modelling procedure. The result is a shear-wave velocity profile of the tested medium with depth, which can be used to estimate the dynamic shear modulus of the medium as a function of depth.

Field Work

The MASW field work was conducted on April 30th, 2025, by personnel from the WSP Mississauga office. For the MASW lines, a series of 24 low frequency (4.5 Hz) geophones were laid out at 2 metre intervals. An 8-kilogram (kg) sledgehammer and 40 kg seismic weight drop were used as seismic sources for this investigation. Seismic records were collected with seismic sources located 5 and 10 metres from and collinear to the geophone array. An example of an active seismic record collected at the site is shown in Figure 2.

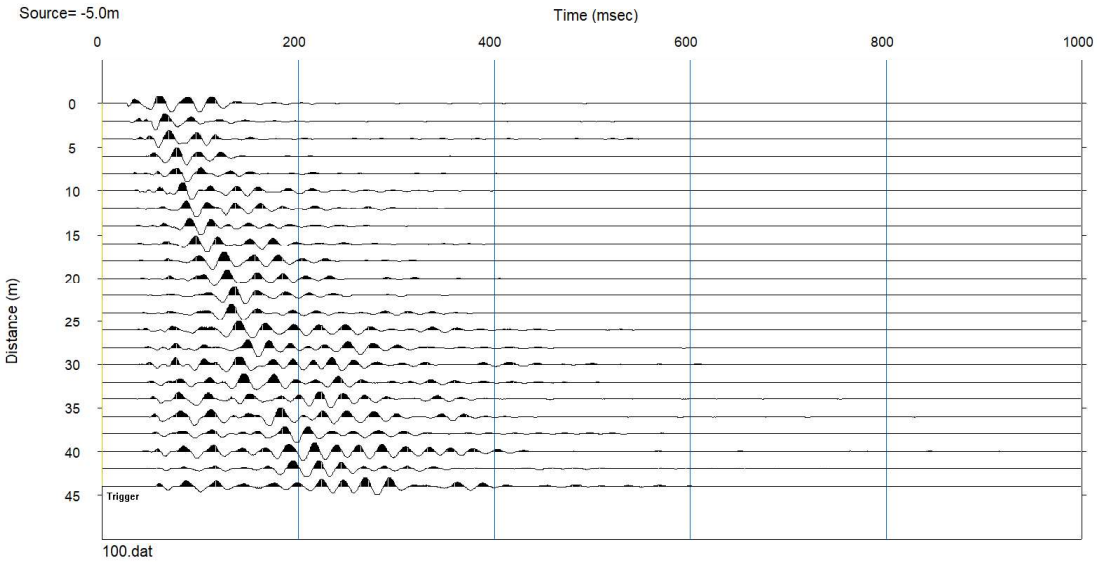


Figure 2: Typical seismic record collected for Line 1

Data Processing

Processing of the MASW test results consisted of the following main steps:

- Transformation of the time domain data into the frequency domain using a Fast-Fourier Transform (FFT) for each source location;
- Calculation of the phase for each frequency component;
- Linear regression to calculate phase velocity for each frequency component;
- Filtering of the calculated phase velocities based on the Pearson correlation coefficient (r^2) between the data and the linear regression best fit line used to calculate phase velocity;
- Generation of the dispersion curve by combining calculated phase velocities for each shot location of a single MASW test; and
- Generation of the stiffness profile, through forward iterative modelling and matching of model data to the field collected dispersion curve.

Processing of the MASW data was completed using the SeisImager/SW software package (Geometrics Inc.). The calculated phase velocities for a seismic shot point were combined and the dispersion curve generated by choosing the minimum phase velocity calculated for each frequency component as shown in Figure 3. Shear-wave velocity (V_s) profiles were generated through inverse modelling to best fit the calculated fundamental mode dispersion curves.

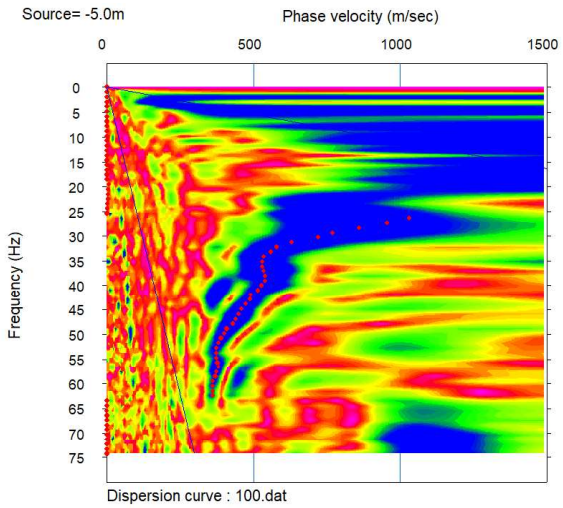


Figure 3: MASW Dispersion Curve Picks (red dots) for Line 1

The minimum measured surface-wave frequency with sufficient signal-to-noise ratio to accurately measure phase velocity was approximately 25 Hz for the MASW lines.

Results

The MASW test result is presented in Figure 4 as the calculated shear-wave velocity profile measured from the MASW Line. There is good correlation between the field collected and model calculated dispersion curves, with a root mean squared error of less than 5%.

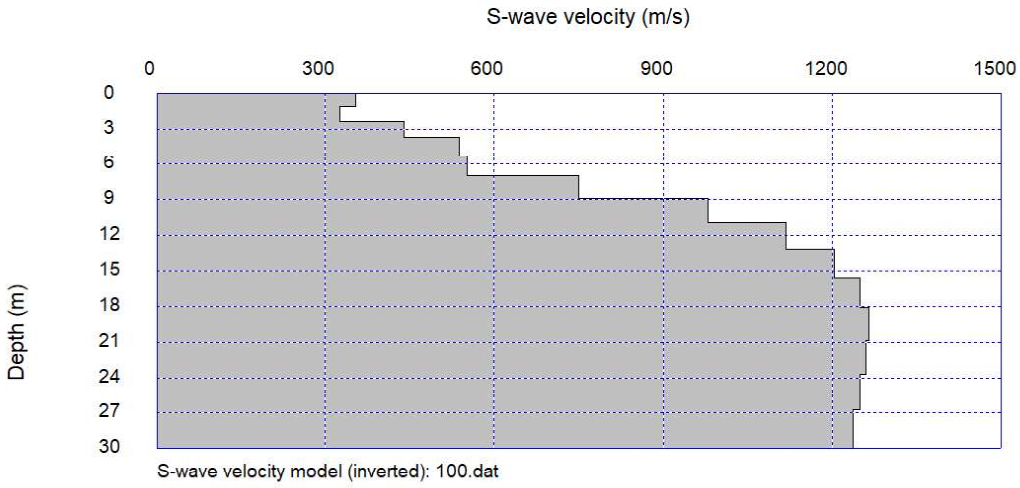
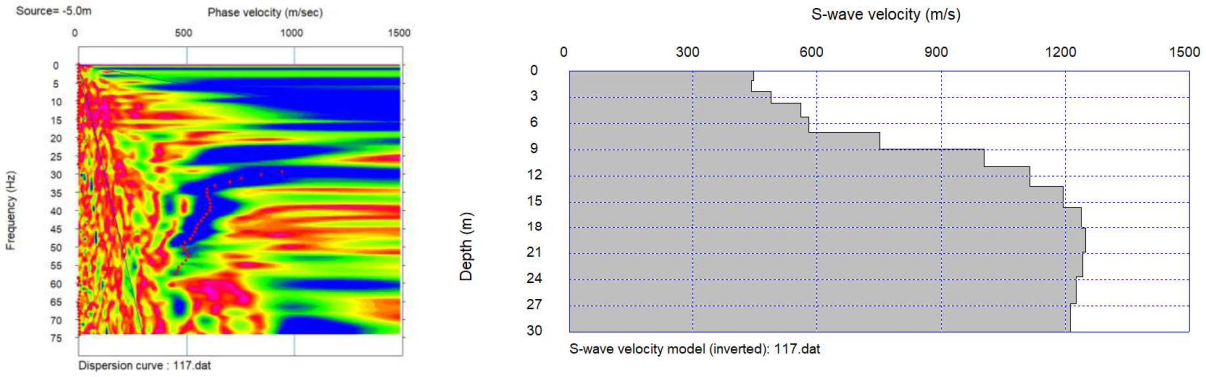


Figure 4: MASW Modelled Shear-Wave Velocity Depth Profile for Line 1

Table 1: Shear-Wave Velocity Profile for Line 1

Model Layer (mbgs)		Layer Thickness (m)	Shear Wave Velocity (m/s)	Shear Wave Travel Time Through Layer (s)
Top	Bottom			
0.0	1.1	1.1	354	0.003029
1.1	2.3	1.2	325	0.003804
2.3	3.7	1.4	440	0.003186
3.7	5.3	1.6	538	0.002912
5.3	7.0	1.7	552	0.003136
7.0	8.9	1.9	750	0.002528
8.9	11.0	2.1	979	0.002104
11.0	13.2	2.2	1118	0.001990
13.2	15.6	2.4	1203	0.001986
15.6	18.1	2.6	1250	0.002043
18.1	20.9	2.7	1265	0.002150
20.9	23.7	2.9	1261	0.002288
23.7	26.8	3.0	1248	0.002443
26.8	30.0	3.2	1236	0.002600
			Vs Average to 30 mbgs (m/s)	829

To calculate the average shear-wave velocity as required by Seismic Site Classification, the results were modelled to 30 metres below ground surface (mbgs). The data and results for Line 2 are shown below.



Figures 5 and 6: Dispersion Curve Picks and Modelled Shear-Wave Velocity Depth Profile for Line 2

Table 2: Shear-Wave Velocity Profile for Line 2

Model Layer (mbgs)		Layer Thickness (m)	Shear Wave Velocity (m/s)	Shear Wave Travel Time Through Layer (s)
Top	Bottom			
0.0	1.1	1.1	446	0.002403
1.1	2.3	1.2	440	0.002807
2.3	3.7	1.4	489	0.002865
3.7	5.3	1.6	561	0.002792
5.3	7.0	1.7	579	0.002988
7.0	8.9	1.9	751	0.002524
8.9	11.0	2.1	1004	0.002052
11.0	13.2	2.2	1114	0.001998
13.2	15.6	2.4	1195	0.002000
15.6	18.1	2.6	1239	0.002062
18.1	20.9	2.7	1250	0.002175
20.9	23.7	2.9	1242	0.002322
23.7	26.8	3.0	1226	0.002487
26.8	30.0	3.2	1213	0.002650
			Vs Average to 30 mbgs (m/s)	879

The time-averaged shear-wave velocity (Vs30) for Line 1 was found to be 829 m/s (Table 1), and for Line 2 was 879 m/s (Table 2). Based on the National Building Code of Canada (2020), this Vs30 value corresponds to seismic site class B.

The seismic site class provided is based solely on the average shear wave velocity derived from this study. There are site specific conditions that may be present, such as liquefiable soils, clay layers with certain properties that have thicknesses of greater than 3 m, etc. that could change this seismic site classification. For more information on these potential conditions the reader should review section 4.1.8.4 of the National Building Code of Canada (2020).

Limitations of Use

The geophysical interpretation presented in this report is based on the use of geophysical surveying techniques. As with any geophysical method, interpretation presented in this report should be confirmed by intrusive methods (boreholes, test pits, etc.).

Assumptions made in the geophysical interpretation have been stated, where applicable, throughout the report.

This geophysical survey was carried out in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services provided. This report provides a professional opinion and therefore no warranty is either expressed, implied, or made as to the conclusions, advice, and recommendations offered.

Any use of the information within this report made by a third party, or any reliance on, or decisions to be made based on it, are the sole responsibility of such third parties. WSP accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this letter.

Closure

We trust that this technical memorandum meets your needs at the present time. If you have any questions or require clarification, please contact the undersigned at your convenience.

WSP Canada Inc.

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DG/CRP/dg