Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923

FAX: (613) 258-0475

REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED INSTITUTIONAL BUILDING ADDITIONS
82 COLONNADE ROAD
OTTAWA, ONTARIO

Project # 250483

Submitted to:

Redeemer Christian High School
82 Colonnade Road
Ottawa, Ontario
K2E 7L2

DISTRIBUTION

1 digital copy Redeemer Christian High School
1 copy Kollaard Associates Inc.

September 15, 2025

TABLE OF CONTENTS

RECORD OF BOREHOLE LOG SHEETS

LIST OF FIGURES

LIST OF ATTACHMENTS

Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923

FAX: (613) 258-0475

September 18, 2025 250483

Redeemer Christian High School
82 Colonnade Road
Ottawa, Ontario
K2E 7L2

RE: GEOTECHNICAL INVESTIGATION
PROPOSED INSTITUTIONAL BUILDING ADDITIONS
82 COLONNADE ROAD
OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for proposed building additions to be located at 82 Colonnade Road, 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 1.2 hectare (3.0 acres) property located at 82 Colonnade Road in the City of Ottawa, Ontario (see Key Plan, Figure 1).

For the purposes of this assessment, project north lies perpendicular to Colonnade Road, which is located immediately north of the subject site. The site is currently occupied by a two-storey institutional building and associated parking lot.

Surrounding land use is residential and commercial development. The site is bordered on the north and east by Colonnade Road followed by mixed use residential and commercial development, and on the south by a hydro easement, and on the west by commercial development.

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

Based on a review of the surficial geology map for the site area, it is expected that the site is underlain by offshore marine deposits consisting of clays and silts. Bedrock geology maps indicate that the bedrock underlying the site consists of sandstone, limestone, and shale 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 is indicted to consist of some 17 to 24 metres of silty clay overlying bedrock.

2.2 Proposed Development

Plans are being prepared to construct a two-storey addition on the north side of the existing building and an addition at the entrance of the existing building. It is understood that the footprint of the additions will be approximately 698 and 123 square metres, respectively.

It is understood that the building addition foundations will consist of a conventional cast-in-place concrete foundation set on footings bearing below the depth of seasonal frost penetration matching the existing building foundation founding level.

3.0 PROCEDURE

Boreholes completed as part of a previous geotechnical investigation completed by Kollaard Associates at the site along with newly placed boreholes were used for this geotechnical report.

On August 29, 2012, three (3) boreholes numbered BH1 to BH3 were put down at the site using a truck mounted drill rig equipped with a hollow stem augers owned and operated by OGS Inc. of Almonte, Ontario. On August 25, 2025, nine (9) boreholes numbered BH4 to BH12 were put down at the site using a truck mounted drill rig equipped with a hollow stem augers owned and operated by Limitless Drilling of Renfrew, Ontario. BH1 to BH3 were put down as part of the previous investigation for a previous gymnasium addition, constructed in 2012. BH4 to BH12 were put down in an area of a proposed parking lot for the site.

Sampling of the overburden materials encountered at the boreholes 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 to depths of between 1.8 and 6.7 metres below the existing ground surface in BH1 to BH12. Borehole BH2 was continued to a depth of 16.46 metres below the existing ground surface using dynamic cone penetration. In-situ vane shear testing was carried out in the cohesive materials encountered at boreholes BH1 to BH3.

The subsurface soil conditions encountered at the boreholes were classified based on visual and tactile examination of the samples recovered (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), standard penetration tests (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils as well as laboratory test results on select samples, In situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil), as well as laboratory test results on select samples. The soils were classified using the Unified Soil Classification System. Groundwater conditions at the boreholes were noted at the time of drilling. The boreholes were loosely backfilled with the auger cuttings upon completion of the fieldwork.

One soil sample (BH12 – SS3 – 1.5 – 2.1 m) was delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack on concrete and corrosivity to buried steel.

One soil sample (BH12 – SS5 – 3.0 – 3.6 m) was submitted for Atterberg Limits (D4318) and one soil sample (BH12 – SS4 – 2.3 – 2.9 m) was 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 field work was supervised throughout by members 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 are 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, 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 hole locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than borehole locations may vary from the conditions encountered at the boreholes.

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

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

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

4.2 Fill Materials

Fill material was encountered from the surface at all twelve boreholes at depths ranging from about 1.1 to 1.9 metres, respectively. The fill was observed to consist of either topsoil, asphalt, grey crushed stone, sand and gravel, or sand and silty clay. The fill materials were fully penetrated at borehole locations BH1 to BH5 and BH9 to BH12.

4.3 Silty Clay

A deposit of grey brown to grey silty clay was encountered below the fill at borehole locations BH1 to BH5 and BH9 to BH12. The silty clay layers were encountered at depths ranging from about 1.1 to 1.9 metres below existing ground surface.

The upper about 1.5 to 3.8 metre portion of the silty clay has been weathered to a stiff to very stiff grey brown crust. Beneath the grey brown crust the silty clay becomes grey and decreases to stiff in consistency. The results of in situ vane shear testing carried out in the softer grey silty clay gave undrained shear strength values ranging from about 56 to 71 kilopascal.

The results of one hydrometer (ASTM D7928) on a sample of soil (BH12 – SS4 – 2.3 – 2.9 m) indicates the sample has the following:

Sample	Depth(metres)	% Gravel	% Sand	% Silt	% Clay
BH12-SS4	2.3 – 2.9	0.0	8.2	23.8	68.0

The results of an Atterberg Limits test (ASTM D422) conducted on a soil sample (BH12-SS5 – 3.0 – 3.6m) of the silty clay is presented in the following table and in Attachment A at the end of the report. The tested silty clay sample classifies as high plasticity in accordance with the Unified Soil Classification System.

Table I – Atterberg Limit and Water Content Results

Sample	Depth(metres)	LL (%)	PL (%)	PI (%)	w (%)
BH12-SS5	3.0 – 3.6	86.1	29.6	56.5	49.6

LL: Liquid Limit PL: Plastic Limit Pl: Plasticity Index w: water content
CH: High Plasticity Clay

4.4 Probe Hole

The dynamic cone penetration tests carried out at borehole BH2 gave values of weight of hammer (WH) to 7 blows per 0.3 metres to a depth of about 11.9 metres below the existing ground surface. The dynamic cone penetration test values increased with depth below 11.9 metres and ranged from

12 to 100 blows per 0.3 metres. At a depth of some 16.5 metres below the existing ground surface refusal to cone penetration was encountered. It is considered likely that the increase in blow count at about 11.9 metres depth indicates the possible presence of glacial till materials and that refusal to cone penetration possibly indicates the upper surface of the bedrock.

4.5 Groundwater

Groundwater seepage was observed in BH1, BH2 and BH3 at the time of drilling at depths of about 3.7, 3.9 and 4.2 metres, respectively, below the existing ground surface at the time of drilling August 29, 2012. Borehole BH12 encountered some groundwater at about 2.4 metres below existing ground surface, August 25, 2025. All other boreholes were dry at the time of drilling.

It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

4.6 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of soil samples (BH2 – SS3 – 1.5 – 2.1) submitted for chemistry testing related to corrosivity is summarized in the following table.

Item	Threshold of Concern	BH12 – SS3	Comment
Chlorides (Cl)	Cl >0.04%	0.00104	Negligible
pH	5.5 > pH	7.24	Basic Negligible concern
Resistivity	R < 20,000 ohm-cm	2,750	Highly corrosive
Sulphates (SO_4)	SO_4 > 0.1%	0.0254	Negligible concern

The results of the laboratory testing of the soil sample for sulphate gave a percent sulphate of 0.0254. 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:

Percent Sulphate (SO_4)	Category
0 – 0.10	Negligible
0.10 – 0.20	Mild
0.20 – 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 sample was reported to be at 7.24, indicating a durable condition against corrosion. This value was evaluated using Table 2 of Building Research Establishment (BRE) Digest 362 (July 1991).The pH is greater than 5.5 indicating the concrete will not be exposed to attack from acids.

The chloride content of the sample was also compared with the threshold level and 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 2,750 ohm-cm for the sample analyzed making the soil highly corrosive for buried steel within below grade concrete walls. 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 (GFRP) 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, increased concrete strength, and minimum cover is required for reinforcement steel within the concrete foundation.

It is noted that the use of a proprietary drainage layer such as “blueskin” or system platon would also aid in protecting the reinforcement by physically separating the concrete foundation from the soil.

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

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

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

5.2 Foundation for Proposed Building Additions

The proposed development will consist of a 698 square metre addition north of the existing gymnasium and a 123 square metre addition at the entrance of the existing institutional building.

It is recommended that the foundations for the proposed building additions are to consist of conventional cast-in-place concrete foundations set on footings bearing below the depth of seasonal frost penetration, at depth matching the existing foundation of the building at site. The footings should bear on an approved undisturbed native subgrade or on engineered fill placed on the approved undisturbed native subgrade.

5.3 Foundation Design and Bearing Capacity

Based on the blow counts and undrained shear strength measurements within the silty clay deposit, the silty clay has a very stiff to stiff consistency and is suitable to support the loads from the proposed foundation footings and adjacent grade raise fill. 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 grade raise adjacent to the foundations and the thickness of the soils deposit beneath the footings. The excavations for the foundations should be taken through any surficial fill, topsoil or otherwise deleterious material to expose the native, undisturbed silty clay.

Strip and pad footings, a minimum 0.5 metres in width bearing, at a founding depth of up to 2.0 metres below the existing ground, on the native undisturbed silty clay or on a suitably constructed engineering pad placed on the native silty clay may be designed using a maximum allowable bearing pressure of 140 kilopascals for serviceability limit states and 210 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 2.0 metres above the existing ground surface and to maximum strip footing width of 1.2 metres and pad footing widths of 1.5 metres.

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

5.4 Engineered Fill

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

5.5 Foundation Excavation

5.5.1 Excavation Side Slopes

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

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

5.5.2 Effect of Foundation Excavation on Adjacent Structures and Municipal Services

As previously indicated, the proposed foundation excavations will be carried out through fill materials (topsoil, asphalt, grey crushed stone, silty sand, and/or sand and gravel) and silty clay materials. There will be no bedrock excavation or removal. As such, there will be no excavation processes which could contribute to vibration which could potentially damage adjacent Municipal Services or Adjacent Structures.

5.5.3 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 BH1 to BH3 at depths ranging from 3.7 to 4.2 metres, below the existing ground surface at the time of drilling on August 29, 2012. Some groundwater seepage was observed in the borehole BH12 at depth of about 2.4 metres below existing ground surface at the time of excavation August 25, 2025.

Given the depth at which water was encountered onsite, it is considered unlikely that a permit to take water will be required prior to excavation. It is considered however that registration under the Environmental Activity and Sector Registry (EASR) may be required.

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

Based on the depths at which water was encountered, it is expected that dewatering is unlikely to occur in significant quantities. In addition, the native high plasticity stiff silty clay is not particularly sensitive to decreasing groundwater levels. As such, dewatering of the foundation excavations, if required, will not have a detrimental impact on the adjacent structures.

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 additions 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 and Drainage

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

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

A perimeter foundation drainage system consisting of conventional weeping tile and clearstone should be placed around the foundation at footing level. The perimeter drainage system should discharge by gravity to the storm sewer. Since there is no basement and the finished grade surface no backup valve is required.

5.8 Slab on Grade Support

For predictable performance of the proposed concrete floor slabs all existing fill material and any otherwise deleterious material should be removed from below the proposed floor slab areas. The exposed native subgrade surfaces should then be inspected and approved by geotechnical personnel. Any soft areas evident should be subexcavated and replaced with suitable engineered fill. Any fill materials consisting of granular material, removed from the proposed concrete floor slab areas, should be stockpiled for possible reuse with approval from the geotechnical engineer.

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

If the concrete floor slab is not intended to support any structural elements or sensitive equipment, the concrete floor slab could be placed on a well consolidated layer of 20 mm clearstone immediately beneath the concrete floor followed by crushed stone meeting the OPSS grading requirements for Granular B Type II or other material approved by the Geotechnical Engineer. The clear stone should be consolidated with a minimum of three passes with a large diesel plate compactor.

The slabs should be structurally independent from walls and columns, which are supported by the foundations. This is to reduce any structural distress that may occur as a result of differential soil movement. If it is intended to place any internal non-load bearing partitions directly on the slab-on-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 slabs should be saw cut at regular intervals to minimize random cracking of the slabs due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding the lesser of 25 times the slab thickness or 4.5 metres. The slabs should be cut as soon as it is possible to work on the slab without damaging the surface of the slabs.

Under slab drainage is not considered necessary provided that the floor slab levels are above the finished exterior ground surface level. If any areas of the proposed building additions are to remain unheated during the winter period, thermal protection of the slab on grade may be required. Further details on the insulation requirements could be provided, if necessary.

5.9 Seismic Design for the Proposed Building Additions

5.9.1 Seismic Site Classification

Based on the information from the boreholes, 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 D.

5.9.2 National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.281 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.

5.9.3 Potential for Soil Liquefaction

As indicated above, the results of the boreholes and information from geological maps indicate that the native soils below the proposed founding level consist of stiff highly plastic silty clay.

C.F.E.M. section 6.6.3.2 (6) recommends that the Bray et al. (2004) criteria be used to determine liquefaction susceptibility of fine-grained soils:

Fine-grained soils with PI ≤ 12 and W_c > 0.85LL are susceptible to liquefaction, soils with 12≤ PI ≤ 20 and W_c > 0.8LL are moderately susceptible to liquefaction and soils with PI > 20 and W_c < 0.8LL are not susceptible to liquefaction.

Seed et al. (2003) proposed liquefaction susceptibility criteria that are similar to those by Bray et al. (2004) except that they include slightly different Wc / LL ratios and include constraints on LL. The criteria by Seed et al. (2003) are described by three zones on the Atterberg limits chart, which are bounded by the following PI and LL values:

Zone A soils have PI ≤ 12 and LL ≤ 37 and are considered potentially susceptible to “classic cyclically induced liquefaction” if the water content is greater than 80% of the LL;

Zone B soils have PI ≤ 20 and LL ≤ 47 and are considered potentially liquefiable with detailed laboratory testing recommended if the water content is greater than 85% of the LL; and

Zone C soils with PI > 20 or LL >47 are considered generally not susceptible to classic cyclic liquefaction, although they should be checked for potential sensitivity.

C.F.E.M. section 6.6.3.2 (7) discusses residual strength for silts and clays, it recommends that the residual strength for silt and clay zones be determined as per the following guidelines given below:
a) W_c/LL ≥ 0.85 and PI ≤ 12: Sr = remolded shear strength,
b) W_c/LL ≥ 0.8 and 12 < PI < 20 Sr = 0.85 Su where Su = static undrained shear strength
c) W_c/LL < 0.80 and PI ≥ 20: Sr = Su

From the laboratory test results, the silty clay sample tested had plasticity index PI = of 56.5, moisture content of 49.6, and a liquid limit of 86.1, resulting in W_c/LL = 0.58. The clay content from the laboratory sample tested was about 68.0% for when clay is defined as grains finer than 0.002 mm. As such, the silty clay is not prone to liquefaction.

6.0 PARKING AREA PAVEMENTS

6.1 Subgrade Preparation

Based on the blow counts within the fill materials there is no concern with building the parking area on the existing fill materials. For predictable performance of the parking area pavement, the topsoil and any soft, wet or deleterious materials should be removed from the proposed parking areas and proof rolled.

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.

The pavement structure should consist of:

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

Performance grade PG 58-34 asphaltic concrete should be specified. Compaction of the granular pavement materials should be carried out in maximum 300 millimetre thick loose lifts to 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment.

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

7.0 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended 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.

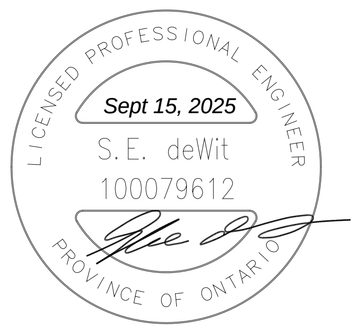
All foundation areas and any engineered fill areas for the proposed building additions should be inspected by Kollaard Associates Inc. to ensure that a suitable sub-grade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected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

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

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

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

Regards,
Kollaard Associates Inc.



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

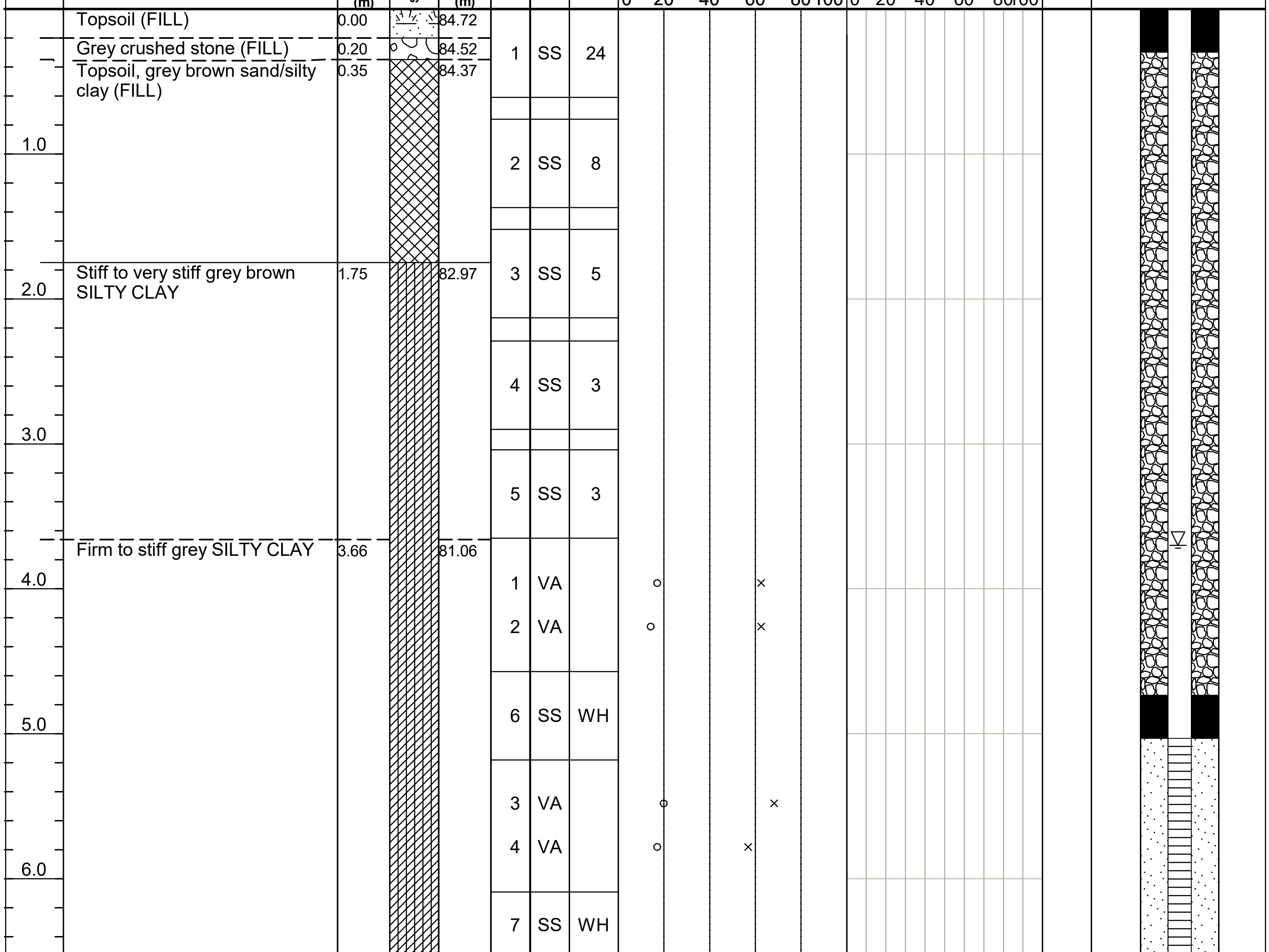
Kollaard Associates Engineers

BOREHOLE BH1

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2012-08-29
SHEET: 1 of 1
DATUM: GEODETIC

SOIL PROFILE – DESCRIPTION	DEPTH (m)	ELEV. (m)	SAMPLE NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa / REM SHEAR STRENGTH o Cu. kPa	DYNAMIC CONE PENETRATION TEST blows/300 mm	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
Topsoil (FILL)	0.00	84.72							
Grey crushed stone (FILL)	0.20	84.52	1	SS	24				
Topsoil, grey brown sand/silty clay (FILL)	0.35	84.37	2	SS	8				
Stiff to very stiff grey brown SILTY CLAY	1.75	82.97	3	SS	5				
			4	SS	3				
			5	SS	3				
Firm to stiff grey SILTY CLAY	3.66	81.06	1	VA					
			2	VA					
			6	SS	WH				
			3	VA					
			4	VA					
			7	SS	WH				
Borehole terminated in SILTY CLAY	6.55	78.17							



Some groundwater observed at about 3.7 metres below existing ground surface, August 29, 2012.

DEPTH SCALE: 1 to 45
LOGGED: DT
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates
Engineers

BOREHOLE BH2

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2012-08-29

DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil, grey crushed stone (FILL), no recovery	0.00		84.70							
	Topsoil, grey brown sand/silty clay (FILL)	0.15		84.55	1	SS	19				
1.0					2	SS	8				Some groundwater observed at about 3.9 metres below existing ground surface, August 29, 2012.
	Stiff to very stiff grey brown SILTY CLAY	1.52		83.18							
2.0					3	SS	10				
					4	SS	5				
3.0					5	SS	3				
	Firm to stiff grey SILTY CLAY	3.81		80.89							∇
4.0					6	SS	2				
					1	VA					
5.0					2	VA					
					7	SS	WH				
6.0					3	VA					
					4	VA					
	Borehole continued as Probe Hole	6.70		78.00							
7.0											
8.0											

DEPTH SCALE: 1 to 45
LOGGED: DT
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

(Continued Next Page)

Kollaard Associates Engineers

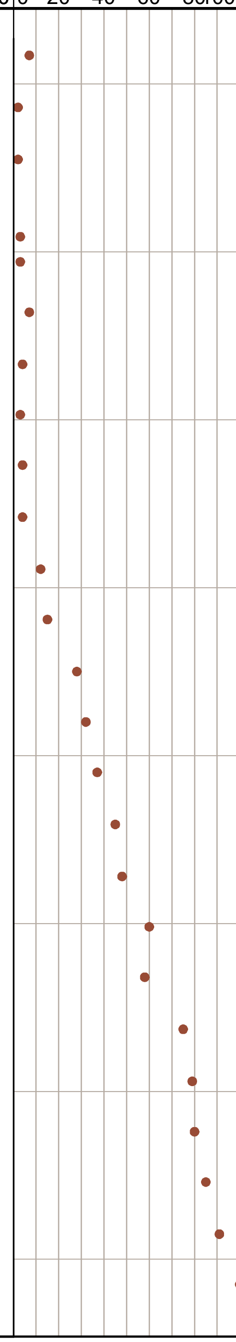
BOREHOLE BH2

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2012-08-29

DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	SOIL PROFILE: DEPTH (m)	SOIL PROFILE: STRATA PLOT	SOIL PROFILE: ELEV. (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
9.0											
10.0											
11.0											
12.0											
13.0											
14.0											
15.0											
16.0											



DEPTH SCALE: 1 to 45
LOGGED: DT
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH3

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2012-08-29
SHEET: 1 of 1
DATUM: GEODETIC

SOIL PROFILE

DESCRIPTION	DEPTH (m)	ELEV. (m)
Topsoil, grey crushed stone, some grey silty clay (possibly FILL)	0.00	84.71
Stiff to very stiff grey brown SILTY CLAY	1.37	83.34
Firm to stiff grey SILTY CLAY	4.26	80.45
Borehole terminated in SILTY CLAY	6.70	78.01

SAMPLES

NUMBER	TYPE	BLOWS/0.3m
1	SS	18
2	SS	15
3	SS	11
4	SS	5
5	SS	3
1	VA	
2	VA	
6	SS	WH
3	VA	
4	VA	
7	SS	WH

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

DEPTH SCALE (meters): 1.0, 2.0, 3.0, 4.0, 5.0, 6.0

Some groundwater observed at about 4.2 metres below existing ground surface, August 29, 2012.

DEPTH SCALE: 1 to 45
LOGGED: DT
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH4

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		84.42							
	Yellow brown silty sand (FILL)	0.10		84.32	1	SS	35				
	Grey crush stone (FILL)	0.30		84.12							
	Yellow brown silty sand (FILL)	0.71		83.71	2	SS	17				
1.0											
	Grey brown SILTY CLAY	1.11		83.31	3	SS	18				
	Borehole terminated in SILTY CLAY	1.83		82.59							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH5

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		84.25							
	Yellow brown sand and gravel (FILL)	0.10		84.15	1	SS	37				
1.0					2	SS	16				
	Grey brown SILTY CLAY	1.16		83.09	3	SS	15				
	Borehole terminated in SILTY CLAY	1.83		82.42							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH6

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25

DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		84.97							
	Yellow brown silty sand, trace gravel (FILL)	0.10		84.87	1	SS	7				
1.0					2	SS	11				
					3	SS	7				
	Borehole terminated in FILL	1.83		83.14							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH7

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		85.32							
	Yellow brown silty sand (FILL)	0.15		85.17	1	SS	16				
1.0					2	SS	14				
	Grey silty sand (FILL)	1.19		84.13	3	SS	9				∇
	Borehole terminated in FILL	1.83		83.49							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH8

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		84.01							
	Yellow brown silty sand (FILL)	0.20		83.81	1	SS	11				
1.0					2	SS	14				
					3	SS	11				
	Borehole terminated in FILL	1.83		82.18							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

BOREHOLE BH9

Kollaard Associates Engineers

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		84.97							
	Yellow brown silty sand (FILL)	0.15		84.82	1	SS	10				
1.0					2	SS	22				
	Grey brown silty sand (FILL)	1.06		83.91							
	Grey SILTY CLAY	1.32		83.65	3	SS	26				
	Borehole terminated in SILTY CLAY	1.83		83.14							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH10

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		85.49							
	Yellow brown silty sand, trace organics (FILL)	0.15		85.34	1	SS	17				
1.0					2	SS	13				
	Grey brown SILTY CLAY	1.57		83.92	3	SS	15				
	Borehole terminated in SILTY CLAY	1.83		83.66							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH11

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	DEPTH (m)	STRATA PLOT	ELEV. (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST SHEAR STRENGTH x Cu. kPa x / REM SHEAR STRENGTH o Cu. kPa o (0 20 40 60 80 100)	DYNAMIC CONE PENETRATION TEST blows/300 mm (0 20 40 60 80 100)	MOISTURE CONTENT (%)	PIEZOMETER OR STANDPIPE INSTALLATION
	Topsoil (FILL)	0.00		85.32							
	Yellow brown silty sand, trace organics (FILL)	0.10		85.22	1	SS	12				
1.0					2	SS	14				
					3	SS	9				
	TOPSOIL	1.59		83.73							
	Grey brown SILTY SAND	1.69		83.63							
	Borehole terminated in SILTY SAND	1.83		83.49							

Borehole dry at time of drilling, August 25, 2025.

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

Kollaard Associates Engineers

BOREHOLE BH12

PROJECT: Proposed Building Additions
CLIENT: Redeemer Christian High School
LOCATION: 82 Colonnade Road, Nepean, ON
PENETRATION TEST HAMMER: 63.5 kg, Drop, 0.76m

PROJECT NUMBER: 250483
DATE OF BORING: 2025-08-25
SHEET: 1 of 1
DATUM: GEODETIC

DESCRIPTION (SOIL PROFILE)	DEPTH (m)	ELEV. (m)
Topsoil, sand and gravel (FILL)	0.00	84.89
Asphalt (FILL)	0.20	84.69
Grey crushed stone (FILL)	0.30	84.59
Yellow brown silty sand, trace organics (FILL)	0.40	84.49
Grey brown SILTY CLAY	1.88	83.01
Grey SILTY CLAY	2.39	82.50
Borehole terminated in SILTY CLAY	3.65	81.24

SAMPLES: NUMBER	TYPE	BLOWS/0.3m
1	SS	22
2	SS	8
3	SS	6
4	SS	4
5	SS	2

Depth scale (meters): 1.0, 2.0, 3.0

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

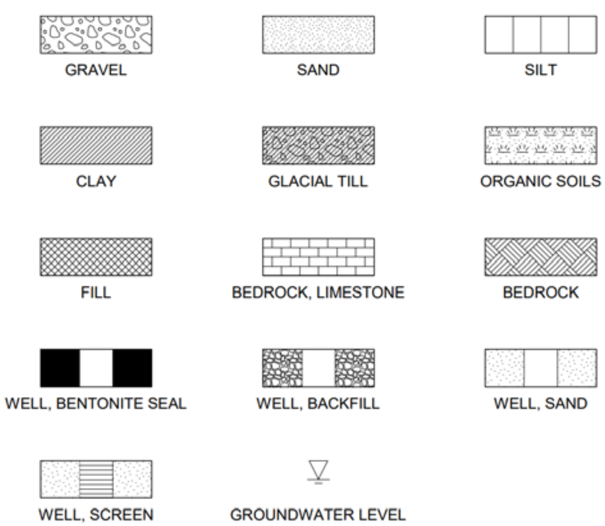
Some groundwater observed at about 2.4 metres below existing ground surface, August 25, 2025

DEPTH SCALE: 1 to 45
LOGGED: KH
BORING METHOD: Power Auger
AUGER TYPE: 200mm Hollow Stem
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES	
AS	Auger Sample
CS	Chunk Sample
DO	Drive Open
MS	Manual Sample
RC	Rock Core
SS	Split Spoon Sample
TO	Thin-Walled Open Shelby Tube
WS	Wash Sample

PENETRATION RESISTANCE	
Standard Penetration Resistance (N) The number of blows by a 63.5 kg hammer dropped 760 millimeters required to drive a 50 mm drive open sampler for a distance of 300 mm.	
Dynamic Penetration Resistance The number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.	
WH	Sampler advanced by static weight of hammer and drill rods.
WR	Sampler advanced by static weight of drill rods.
PH	Sampler advanced by hydraulic pressure from drill rig.
PM	Sampler advanced by manual pressure.



SOIL DESCRIPTIONS

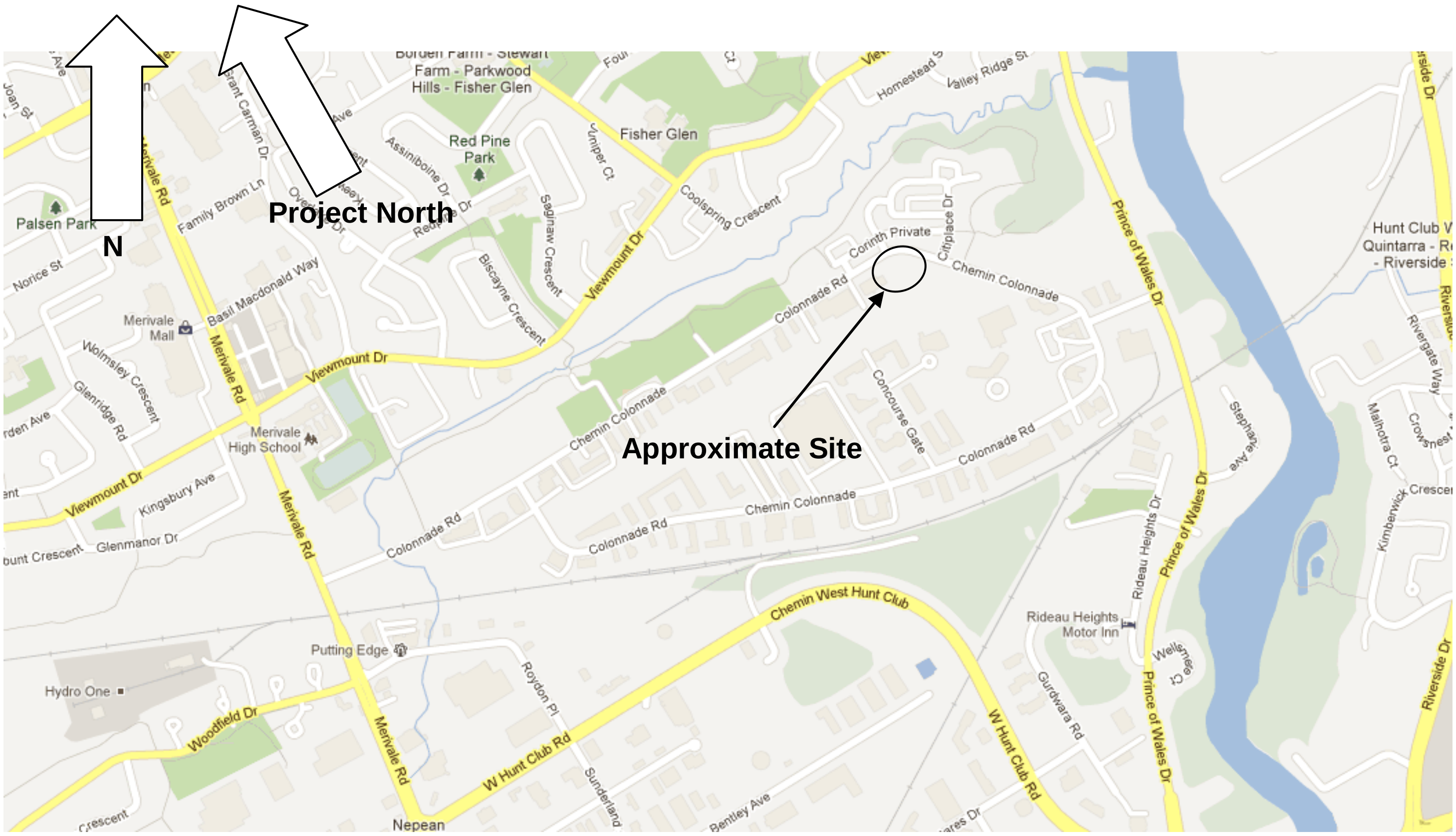
Relative Density	'N' Value
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	>50

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

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

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

KEY PLAN	FIGURE 1



NOT TO SCALE

Kollaard Associates
Engineers

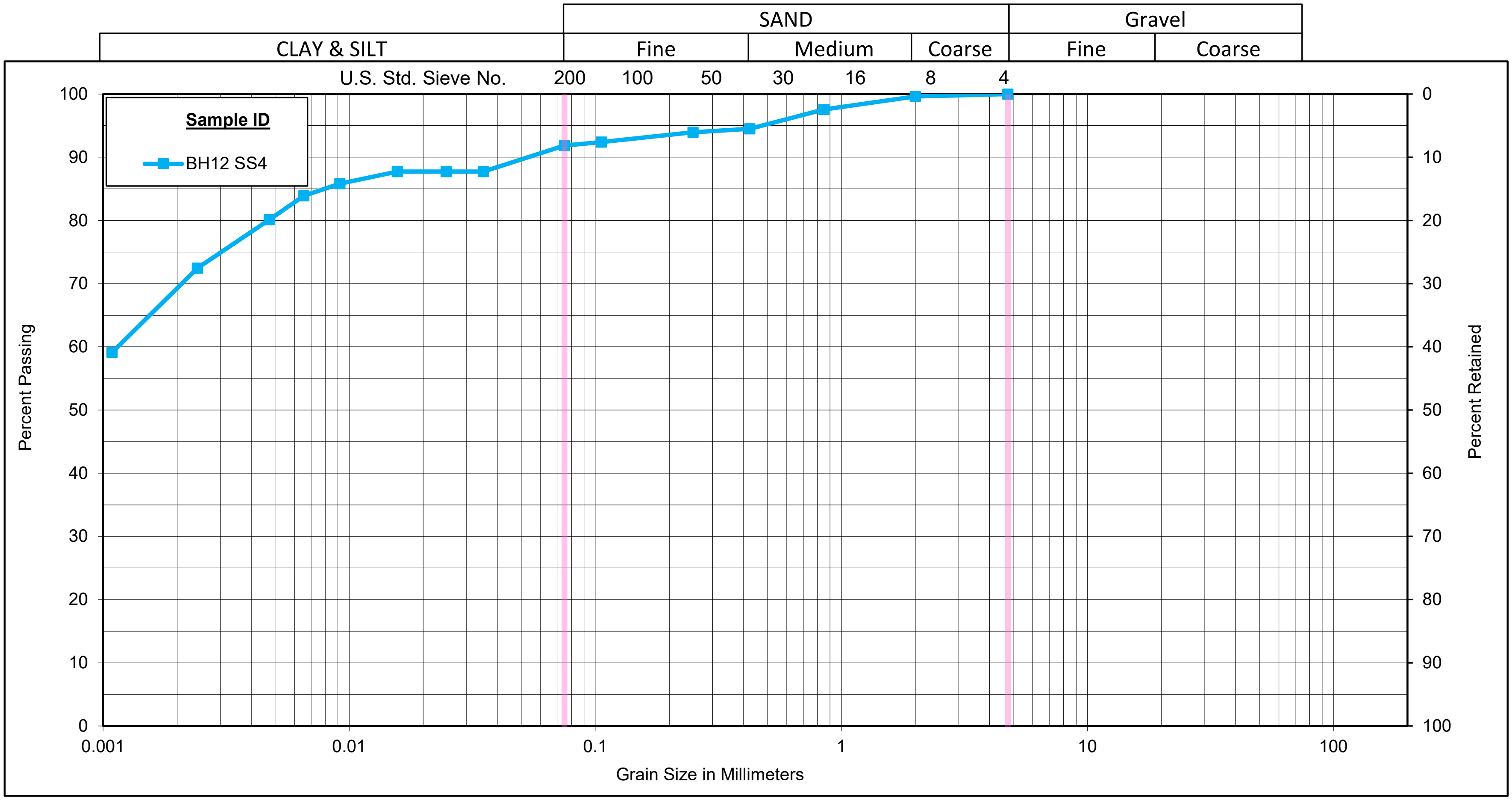
Project No. 120550

Date September 2012

ATTACHMENT A

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH12 SS4	7'6"-9'6"	0.0	8.2	23.8	68.0

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File #250483

85 Colonnade Road, Ottawa, ON

Figure No.

Project No. 121625581

Stantec

Particle-Size Analysis of Soils

LS702

AASHTO T88

PROJECT DETAILS

Client:	Kollaard Associates, File #250483	Project No.:	121625581
Project:	85 Colonnade Road, Ottawa, ON	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates
Source:	BH12	Date Sampled:	August 25, 2025
Sample No.:	SS4	Tested By:	Denis Rodriguez
Sample Depth	7'6"-9'6"	Date Tested:	September 2, 2025

WASH TEST DATA

Oven Dry Mass In Hydrometer Analysis (g)	51.11
Sample Weight after Hydrometer and Wash (g)	4.13
Percent Passing No. 200 Sieve (%)	91.9
Percent Passing Corrected (%)	91.58

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	213.40
Sample Weight After Sieve (g)	213.10
Percent Loss in Sieve (%)	0.14

SOIL INFORMATION

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

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W_o), (g)	58.17
Air Dried Mass (W_a), (g)	59.67
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9749
Air Dried Mass in Analysis (M_a), (g)	52.43
Oven Dried Mass in Analysis (M_o), (g)	51.11
Percent Passing 2.0 mm Sieve (P_{10}), (%)	99.63
Sample Represented (W), (g)	51.30

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75	0.0	100.0
2.00	0.8	99.6
Total (C + F)[1]	213.10	
0.850	1.06	97.6
0.425	2.62	94.5
0.250	2.92	93.9
0.106	3.71	92.4
0.075	3.99	91.8
PAN	4.03	

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

HYDROMETER DETAILS

Volume of Bulb (V_B), (cm^3)	63.3
Length of Bulb (L_2), (cm)	14.2
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.3
Scale Dimension (h_s), (cm/Div)	0.17
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 10:13 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
02-Sep-25	10:14 AM	1	52.0	6.0	21.5	46.0	87.72	7.22798	9.73081	0.013047	0.03508
02-Sep-25	10:15 AM	2	52.0	6.0	21.5	46.0	87.72	7.22798	9.73081	0.013047	0.02480
02-Sep-25	10:18 AM	5	52.0	6.0	21.5	46.0	87.72	7.22798	9.73081	0.013047	0.01569
02-Sep-25	10:28 AM	15	51.0	6.0	21.5	45.0	85.81	7.39798	9.73081	0.013047	0.00916
02-Sep-25	10:43 AM	30	50.0	6.0	21.5	44.0	83.91	7.56798	9.73081	0.013047	0.00655
02-Sep-25	11:13 AM	60	48.0	6.0	21.5	42.0	80.09	7.90798	9.73081	0.013047	0.00474
02-Sep-25	2:23 PM	250	44.0	6.0	21.5	38.0	72.47	8.58798	9.73081	0.013047	0.00242
03-Sep-25	10:13 AM	1440	37.0	6.0	20.5	31.0	59.12	9.77798	9.96839	0.013205	0.00109

Remarks:

Reviewed By: Brian Prevost

Date: September 3, 2025

Stantec

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

September 3, 2025
File: 121625581

Client: Kollaard Associates Engineers, File #250483

Reference: ASTM D4318 Atterberg Limit & D2216 Moisture Content

The following table summarizes Atterberg Limit & Moisture Content results.

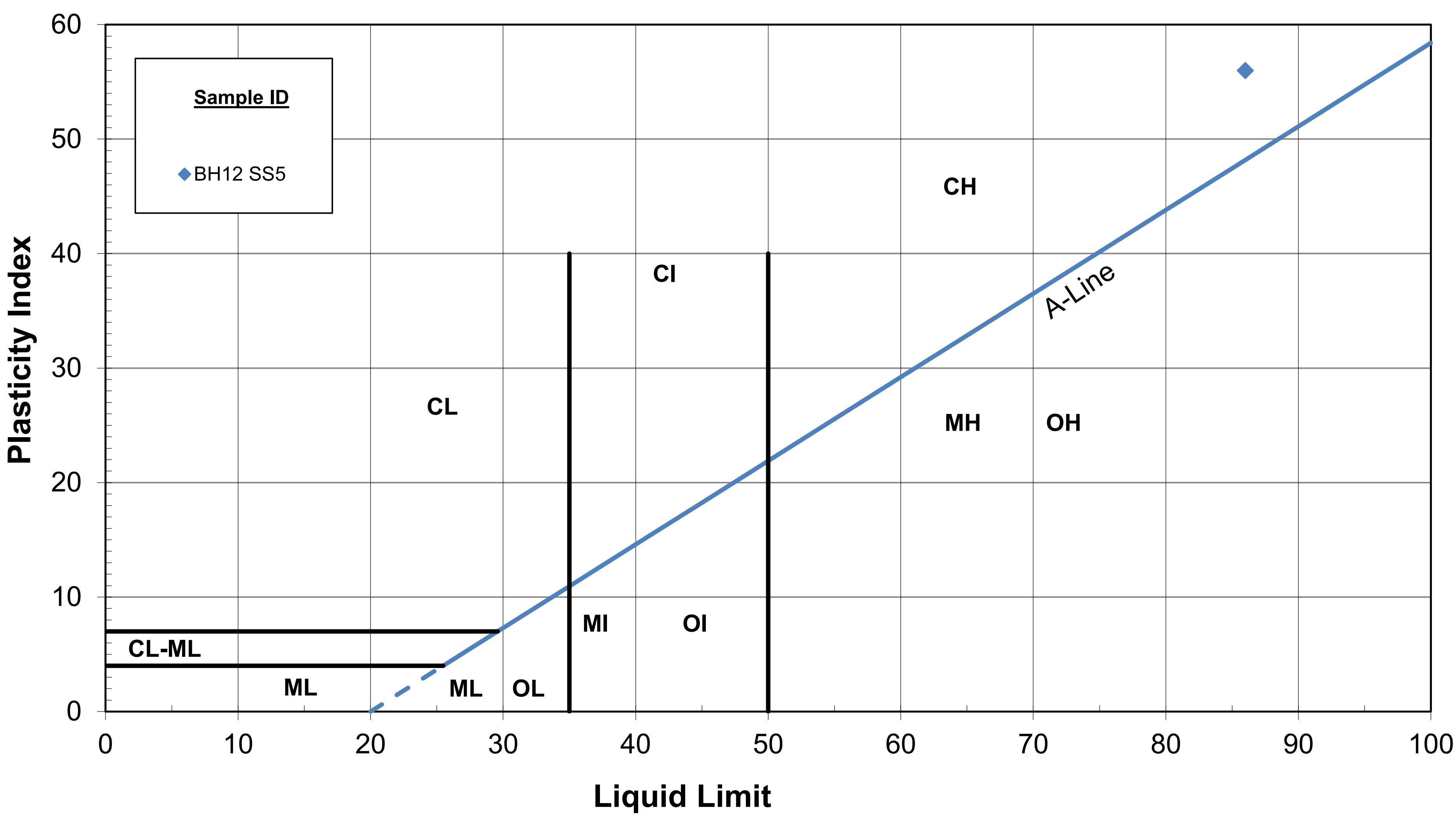
Source	Depth	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH12, SS5	10’-12’	49.6	86.1	29.6	56.5

Sincerely,

Stantec Consulting Ltd.

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

Attachments: Plasticity Chart



Kollaard Associates, File #250483

Redeemer Christian H.S., 82 Colonnade Road, Ottawa. ON

PLASTICITY CHART

Figure No.

Project No. 121625581

ATTACHMENT B

Laboratory Test Results for Chemical Properties

CERTIFICATE OF ANALYSIS

Work Order	:	**WT2523977**			
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	:	250483	Telephone	:	613 225 8279
PO	:	----	Date Samples Received	:	27-Aug-2025 11:54
C-O-C number	:	----	Date Analysis Commenced	:	02-Sep-2025
Sampler	:	----	Issue Date	:	05-Sep-2025 17:07
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		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	BH12 SS3 5-7 ----	----	----	----	----
				Client sampling date / time	25-Aug-2025 00:00	----	----	----	----
Analyte	CAS Number	Method/Lab	LOR	Unit	WT2523977-001	----	----	----	----
					Result	----	----	----	----
Physical Tests									
Conductivity (1:2 leachate)	----	E100-L/WT	5.00	μS/cm	364	----	----	----	----
Moisture	----	E144/WT	0.25	%	30.8	----	----	----	----
Oxidation-reduction potential [ORP]	----	E125/WT	0.10	mV	330	----	----	----	----
pH (1:2 soil:CaCl2-aq)	----	E108A/WT	0.10	pH units	7.24	----	----	----	----
Resistivity	----	EC100R/WT	100	ohm cm	2750	----	----	----	----
Inorganics									
Sulfides, acid volatile	----	E396-L/WT	0.20	mg/kg	<0.29	----	----	----	----
Leachable Anions & Nutrients									
Chloride, soluble ion content	16887-00-6	E236.Cl/WT	5.0	mg/kg	10.4	----	----	----	----
Sulfate, soluble ion content	14808-79-8	E236.SO4/WT	20	mg/kg	254	----	----	----	----

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

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2523977**		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	: 250483		Date Samples Received	: 27-Aug-2025 11:54
PO	: ----		Issue Date	: 05-Sep-2025 17:04
C-O-C number	: ----			
Sampler	: ----			
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: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E396-L	25-Aug-2025	02-Sep-2025	14 days	9 days	✓	02-Sep-2025	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E236.Cl	25-Aug-2025	04-Sep-2025	30 days	10 days	✓	04-Sep-2025	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E236.SO4	25-Aug-2025	04-Sep-2025	30 days	10 days	✓	04-Sep-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] BH12 SS3 5-7	E100-L	25-Aug-2025	04-Sep-2025	30 days	11 days	✓	04-Sep-2025	30 days	11 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E144	25-Aug-2025	----	----	----		03-Sep-2025	----	----	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E125	25-Aug-2025	29-Aug-2025	180 days	5 days	✓	02-Sep-2025	180 days	5 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH12 SS3 5-7	E108A	25-Aug-2025	04-Sep-2025	30 days	11 days	✓	05-Sep-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	2196694	1	5	20.0	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	2199346	1	7	14.2	5.0	✓
ORP by Electrode	E125	2190410	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	2198203	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2196697	1	3	33.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	2196698	1	3	33.3	5.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2194428	1	10	10.0	4.7	✓
Laboratory Control Samples (LCS)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	2196694	2	5	40.0	10.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	2199346	1	7	14.2	5.0	✓
ORP by Electrode	E125	2190410	1	19	5.2	5.0	✓
Moisture Content by Gravimetry	E144	2198203	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2196697	2	3	66.6	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	2196698	2	3	66.6	10.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2194428	1	10	10.0	4.7	✓
Method Blanks (MB)							
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	2196694	1	5	20.0	5.0	✓
Moisture Content by Gravimetry	E144	2198203	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	2196697	1	3	33.3	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	2196698	1	3	33.3	5.0	✓
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	2194428	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	: **WT2523977**	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	: 250483	Date Samples Received	: 27-Aug-2025 11:54
PO	: ----	Date Analysis Commenced	: 29-Aug-2025
C-O-C number	: ----	Issue Date	: 05-Sep-2025 17:05
Sampler	: ----		
Site	: ----		
Quote number	: SOA 2025		
No. of samples received	: 1		
No. of samples analysed	: 1		

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: 2190410)											
EO2507521-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	357	315	12.5%	25%	----
Physical Tests (QC Lot: 2196694)											
WT2523657-007	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	0.0839 mS/cm	82.7	1.44%	20%	----
Physical Tests (QC Lot: 2198203)											
HA2503501-001	Anonymous	Moisture	----	E144	0.25	%	6.60	7.29	9.93%	20%	----
Physical Tests (QC Lot: 2199346)											
WT2523791-010	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	8.09	8.15	0.739%	5%	----
Inorganics (QC Lot: 2194428)											
CG2512025-001	Anonymous	Sulfides, acid volatile	----	E396-L	0.21	mg/kg	0.70	0.79	0.09	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 2196697)											
EO2507557-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 2196698)											
EO2507557-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	203	218	6.89%	30%	----

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: 2196694)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 2198203)						
Moisture	----	E144	0.25	%	<0.25	----
Inorganics (QCLot: 2194428)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Leachable Anions & Nutrients (QCLot: 2196697)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----
Leachable Anions & Nutrients (QCLot: 2196698)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Spike Target Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Physical Tests (QCLot: 2196694)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1410 µS/cm	102	90.0	110	----
Physical Tests (QCLot: 2198203)									
Moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Physical Tests (QCLot: 2199346)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Inorganics (QCLot: 2194428)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	100 mg/kg	76.0	70.0	130	----
Leachable Anions & Nutrients (QCLot: 2196697)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	1000 mg/kg	98.0	80.0	120	----
Leachable Anions & Nutrients (QCLot: 2196698)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	1000 mg/kg	98.3	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:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Physical Tests (QCLot: 2190410)									
QC-2190410-001	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	101	90.0	110	----
Physical Tests (QCLot: 2196694)									
QC-2196694-003	RM	Conductivity (1:2 leachate)	----	E100-L	599 µS/cm	102	70.0	130	----
Leachable Anions & Nutrients (QCLot: 2196697)									
QC-2196697-003	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	382 mg/kg	104	70.0	130	----
Leachable Anions & Nutrients (QCLot: 2196698)									
QC-2196698-003	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	647 mg/kg	113	70.0	130	----

Chain of Custody (COC) / Analytical Request Form

COC Number: **22 -**

Page of

Canada Toll Free: 1 800 668 9878

Environmental Division
Waterloo
Work Order Reference
WT2523977

Telephone : +1 519 886 6910

...mpany name below will appear on the final report	
- KLAI100	
...ow will appear on the final report	
	☑ YES ☐ NO
Report	☑ YES ☐ NO
...ct Information	
KLAI100/WT2022KLAI1000001	
...only): WT2523977	

Reports / Recipients

- Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
- Merge QC/QCI Reports with COA ☐ YES ☐ NO ☐ N/A
- ☐ Compare Results to Criteria on Report - provide details below if box checked
- Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
- Email 1 or Fax dean@kollaard.ca
- Email 2
- Email 3

Invoice Recipients

- Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
- Email 1 or Fax admin@kollaard.ca
- Email 2

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact:	Costas Farassoglou	Sampler:

Turnaround Time (TAT) Re...

- ☒ Routine [R] if received by 3pm M-F - no surcha...
- ☐ 4 day [P4] if received by 3pm M-F - 20% rush ...
- ☐ 3 day [P3] if received by 3pm M-F - 25% rush ...
- ☐ 2 day [P2] if received by 3pm M-F - 50% rush ...
- ☐ 1 day [E] if received by 3pm M-F - 100% rush ...
- ☐ Same day [E2] if received by 10am M-S - 200% ...

Additional fees may apply to rush requests ...

Date and Time Required for all E&P TATs: ...

For all tests with rush TATs requeste... ...nt to confirm availability.

...EL HERE

Analysis Request

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

...ample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Corrosivity														SAMPLES ON HOLD	EXTENDED STORAGE REQUIRED	SUSPECTED HAZARD (see notes)
SS 3 5-7	Aug25		Soil		R																
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		
			Soil																		

...s[1] (client use)

...W System?

...se?

Notes / Specify Limits for result evaluation by selecting from drop-down below (Excel COC only)

SAMPLE RECEIPT DETAILS (ALS use only)

- Cooling Method: ☐ NONE ☒ ICE ☐ ICE PACKS ☐ FROZEN ☐ COOLING INITIATED
- Submission Comments identified on Sample Receipt Notification: ☐ YES ☐ NO
- Cooler Custody Seals Intact: ☐ YES ☐ N/A Sample Custody Seals Intact: ☐ YES ☐ N/A

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
20.8	13.8

...ELEASE (client use)		INITIAL SHIPMENT RECEPTION (ALS use only)			FINAL SHIPMENT RECEPTION (ALS use only)		
Date: Aug 27	Time:	Received by: Costa F	Date: 27-AUG-2025	Time: 11:54	Received by: [illegible]	Date: 28/AUG/25	Time: 8:45

...TIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

...y 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.

...ated Drinking Water (DW) System, please submit using an **Authorized DW COC form.**

FEB 2022 FRONT

Soil - 787

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: 45.347N 75.710W **User File Reference:** Redeemer Christian High School (82 Colonnade Rd, Ottawa) 2025-08-19 12:07 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)	0.449	0.246	0.147	0.043
Sa (0.1)	0.525	0.299	0.185	0.059
Sa (0.2)	0.440	0.254	0.159	0.054
Sa (0.3)	0.334	0.194	0.123	0.043
Sa (0.5)	0.237	0.138	0.087	0.031
Sa (1.0)	0.118	0.069	0.044	0.015
Sa (2.0)	0.056	0.032	0.020	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)	0.281	0.162	0.101	0.032
PGV (m/s)	0.196	0.110	0.067	0.021

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

Natural Resources Canada Ressources naturelles Canada

Canada