Geotechnical Investigation Report

Metcalfe Agricultural Society
2821 8th Line Road, Metcalfe, ON

Prepared for:
Metcalfe Agricultural Society

Prepared by:
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Project No. 121625761

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1.0 INTRODUCTION

1.1 GENERAL

It is understood that the Metcalfe Agricultural Society is planning to construct a new single-storey, slab on grade building with associated exterior infrastructure and parking lot. The site is located at 2821 8th Line Road, Metcalfe, ON and is currently occupied with a single storey building.

The report contains the information gathered and recommendations for the proposed work. This work was carried out in general accordance with the Stantec proposal dated April 15, 2024.

This report has been prepared specifically and solely for the proposed work described above.

Limitations associated with the contents of this report are provided in the Statement of General Conditions included in Appendix A.

1.2 EXISTING SITE CONDITIONS AND PROPOSED DEVELOPMENT

The subject site is located at 2821 8th Line Road, Metcalfe, ON and is currently occupied with a single storey building. The building has a grassed area to the north and paved parking and access roads on the other sides. The footprint of the proposed building is in the same location as the existing building with a larger building area totaling 768 m^2. It is understood that surrounding paved parking and access roads will be reinstated.

The proposed building layout is shown on Drawing No. 2 in Appendix B.

2.0 SCOPE OF WORK

The scope of work for this Geotechnical Investigation includes the following scope of work:

- Drill four (4) boreholes to a maximum depth of 6 m using a truck mounted drill rig.
- If refusal is encountered shallower than 6 m, a maximum of two boreholes may be cored up to 1.5 m for bedrock confirmation.
- Standard Penetration Tests (SPT) will be completed at intervals of 750 mm using a standard split-spoon sampler. Split-spoons will be alternated with shear vane tests where soft clays are encountered.
- A survey of the borehole in the field will be carried out by our on-site technician.
- Soil descriptions and identifications shall be based on the Unified Soil Classification System (USCS), logged in the field in accordance with ASTM Standard D2488 (Visual Manual Procedure).
- Prepare a geotechnical report and recommendations for the following:
  - A brief project and site description.
  - Factual description of the investigative procedure.

- Investigation borehole records and laboratory results.
- A summary of subsurface soil types and pertinent geotechnical properties encountered.
- Groundwater level estimated during drilling.
- Frost penetration depths, anticipated effects associated with frost, and recommended frost mitigation measures.
- Soil bearing resistance to be used for foundation design.
- Recommendations for slab-on-grade construction.
- Excavation / backfilling recommendations.
- Earthworks recommendations and recommendations for suitable material types for construction.
- Soil resistivity data and corrosion protection requirements.
- Recommend cement type.
- Sub-base and base design recommendations for roads and paved areas.
- Embedment, bedding, cover and backfill materials during pipe installation.

3.0 INVESTIGATION PROCEDURES

3.1 FIELD INVESTIGATION

Prior to carrying out the field investigation, Stantec contacted the public utility authorities to clear the borehole locations of public and private utilities.

A geotechnical field investigation consisting of four (4) boreholes was carried out for this assignment. The boreholes were designated BH24-1A', BH-2A', BH24-3 and BH24-4A'. The investigation locations are shown on Drawing No. 2 of Appendix B.

The field drilling program was carried out on May 9, 2024. The boreholes were advanced using a truck-mounted CME drill rig equipped for soil and bedrock sampling.

The subsurface stratigraphy encountered in each borehole was recorded in the field by an experienced field personnel. Split spoon samples were collected at regularly spaced intervals in all boreholes. Bedrock coring (NQ-size) was carried out in BH24-1A' and BH24-3 to confirm the presence of bedrock.

All samples recovered were returned to Stantec's Ottawa laboratory for detailed classification and testing. Rock core samples were logged and photographed, and the Rock Quality Designation (RQD) was estimated for recovered samples.

3.2 LOCATION AND ELEVATION SURVEY

The coordinates of the boreholes were determined using a GPS navigation device. The approximate borehole elevations were inferred from the topo survey provided. The elevations are shown on the borehole records.

3.3 LABORATORY TESTING

All samples were taken to Stantec's Ottawa laboratory where they were subjected to a detailed visual examination by a Geotechnical Engineer.

The geotechnical laboratory testing program for the borehole samples is summarized in Table 3.1.

Table 3.1: Geotechnical Laboratory Testing Program

Test Description	Number of Tests
Moisture Content	9
Grain Size Distribution	2
Unconfined Compressive Strength – Rock	1
Chemical Testing (pH, soluble sulphate content, chloride content & resistivity)	1

Samples remaining after testing will be placed in storage for a period of one month after issuance of the final report. After the storage period, the samples will be discarded.

4.0 SUMMARY OF SUBSURFACE CONDITIONS

The geotechnical investigation at the site indicated a stratigraphy that generally consists of fill over bedrock.

The locations of the boreholes are shown on Drawing No. 2 in Appendix B. The Borehole Records are provided in Appendix C.

4.1 SURFICIAL MATERIAL

Surficial materials at the four boreholes consisted of paved and landscaped surfaces.

4.1.1 Pavement Structure

Boreholes BH24-3 and BH24-4A' were advanced though a paved surface. The observed asphalt thickness ranged from 50 mm to 75 mm.

4.1.2 Topsoil

Boreholes BH24-1A' and BH24-2A' were advanced through landscaped surface. The observed topsoil thickness was 50 mm.

4.2 FILL

Fill was encountered beneath the surficial material. The depth of the fill extended to approximately 0.8 m to 1.1 m below ground surface. The fill consisted of silty sand with gravel and trace topsoil and organics.

The Standard Penetration Test (SPT) blow count (N-value) for the fill material was 0 to 50 blows per 0.2 m indicating a very loose to very dense state.

Grain size analysis testing carried out on two representative samples of the fill material yielded the following results:

Gravel: 20 to 42%

Sand: 39 to 45%

Fines (silt and clay): 13 to 41%

Moisture Content: 7 to 57%

The grain size analysis results are included in Figure 1 of Appendix D. The Unified Soil Classification (USCS) group symbol for the fill ranged is SM (silty sand with gravel).

4.3 BEDROCK

Bedrock was confirmed by coring in boreholes BH24-1A' and BH24-3 at depths 0.9 m and 0.8 m, respectively. Bedrock was inferred from split spoon refusal in boreholes BH24-2A' and BH24-4A' at depths 1.1 m and 0.8 m, respectively.

The sampled bedrock consisted of grey limestone with a thin layer of sandstone. The rock has been noted as being horizontally bedded and extremely close to close spaced joints. The Rock Quality Designation (RQD) value ranged from 6% to 33%, indicating a very poor to poor quality.

The strength of the intact rock core was determined by conducting Unconfined Compressive Strength (UCS) testing on a select rock core sample. A summary of the results of the laboratory testing carried out on the bedrock is presented below. Based on the UCS test findings, the bedrock was found to be very strong.

Table 4.1: Laboratory Results on Limestone Bedrock

BOREHOLE ID	SAMPLE	DEPTH (m)	RQD AT TEST DEPTH	UNCONFINED COMPRESSIVE STRENGTH (MPa)
BH24-1A'	NQ-3	1.7	6%	108.1

A detailed description of the rock core is provided in Field Core Logs in Appendix C. Rock core photographs are also provided in Appendix C.

4.4 GROUNDWATER

Groundwater was not encountered at the time of drilling.

It should be noted that groundwater levels can be expected to fluctuate during periods of heavy precipitation associated with seasonal weather trends, in response to specific rain events, site use, adjacent site use, and construction activity.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 GENERAL

It is understood that the Metcalfe Agricultural Society is planning to construct a new single-storey, slab on grade building with associated exterior infrastructure and parking lot. The site is currently occupied with a single storey building.

The results of the geotechnical investigation indicate that the overburden material within the building footprint generally includes fill material extending to bedrock. The fill material generally consisted of silty sand with gravel. The bedrock consisted of very poor to poor quality limestone with sandstone at depths ranging from 0.8 m to 1.1 m below ground surface. Prior to construction of the proposed building, the existing building will be demolished and the existing footings and fill material will be excavated to expose the bedrock.

The existing subsurface condition is not expected to pose significant constraints to the proposed structures.

5.2 FROST PENETRATION

The typical design frost penetration depth for Ottawa is 1.8 m. It is recommended that all foundation elements that are sensitive to movement (i.e. heave and subsequent settlement) be provided with a minimum of 1.8 m of earth cover. Equivalent insulation to 1.8 m of soil cover is required to protect the soil beneath the footings from frost penetration if the full soil cover is not provided.

If the footing is founded directly on sound bedrock, protection against frost action is not anticipated.

5.3 SITE GRADING AND PREPARATION

There is currently an existing building within the proposed footprint of the building. Underground services have been located around the building. All existing utilities will have to be removed or relocated from the footprint of the proposed building. The extent of foundations for the existing structure and the thickness of fill materials that may have been placed prior to construction is unknown. The existing building and foundations will have to be removed from the footprint of the proposed building.

All existing topsoil, asphalt, concrete foundations, services, fill and any deleterious materials should be removed from beneath the footprint of the building, the footings, and the zone of influence of all footings. The zone of influence is defined by a line drawn at 1 horizontal to 1 vertical, outward and downward from the edge of the footings.

Prepared subgrade surfaces should be inspected by experienced geotechnical personnel prior to the placement of either Structural Fill or concrete. All soft or disturbed areas revealed during subgrade excavation or inspection should be removed and replaced with approved Structural Fill, as defined below.

Structural Fill should conform to the requirements of OPSS Granular B Type II or OPSS Granular A. Structural Fill placed beneath buildings should contain no recycled materials such as concrete or asphalt. It should be compacted in lifts no thicker than 300 mm to at least 100% Standard Proctor Maximum Dry Density (SPMDD), as per ASTM D698. This material should be tested and approved by a Geotechnical Engineer prior to delivery to the site.

Earth removals should be inspected by a geotechnical engineer to ensure that all unsuitable materials are removed prior to placement of fill or concrete.

Imported fill materials should be tested and approved by a Geotechnical Engineering firm prior to delivery/use. Monitoring of fill placement and in situ compaction testing should be carried out to confirm that all fill is placed and compacted to the required degree.

Temporary frost protection should be provided for all footings if construction is carried out under winter conditions.

5.4 FOUNDATIONS

The foundations for the proposed building are anticipated to be founded on shallow foundations.

Shallow Foundations

Works supported on shallow foundations should follow the foundation preparation work described in Section 5.3 above. Spread footings should be placed directly on bedrock.

The recommended factored Ultimate Limit State (ULS) resistance for footing foundations founded on bedrock are presented below.

Table 5.1: Geotechnical Bearing Resistance for Shallow Foundations

Foundation Type	Footing Width (m)	Geotechnical Resistance, ULS, (kPa)	Geotechnical Resistance, SLS, (kPa)
Strip Footing	0.5 to 2.0	1000	-
Square Footing	1.0 to 3.0	1000	-

The factored geotechnical bearing resistance at ultimate limit states (ULS) incorporates a resistance factor of 0.5. The settlement of foundations founded on bedrock is expected to be negligible and therefore, the geotechnical reaction at Serviceability Limit States (SLS) is not provided for footings on bedrock.

There are no documented faults at the building site. In the event that a fault impacted area is observed during inspection of the footing excavations, the requirement for special treatment, if any, would be

assessed at the time of inspection. Although not anticipated, treatment could include excavation of the fault breccia fragments and backfilling with mass concrete.

Where construction is undertaken during winter conditions, all footing subgrades should be protected from freezing. Foundation walls and columns should be protected against heave due to soil adfreeze at the interface of the foundation backfill and foundation surfaces.

5.4.1 Coefficient of Sliding Friction

The coefficient of friction between concrete and sound bedrock, estimated in accordance with the Canadian Foundation Engineering Manual is provided below.

Sliding resistance can be calculated using the following unfactored friction coefficients:

Condition	Unfactored Friction Coefficient
Between Concrete and clean sound rock	0.7
Between Concrete and Structural Fill	0.55

A resistance factor of 0.8 should be used when calculating the ULS resistance to sliding.

5.5 CONCRETE FLOOR SLABS

A slab-on-grade construction is anticipated for the proposed building. Conventional slab-on-grade units are suitable for use for the proposed structures provided the floor slab areas are prepared as outlined in Section 5.3. A layer of free-draining granular material such as OPSS Granular A, at least 200 mm in thickness should be placed immediately beneath the floor slab for leveling and support purposes. This material should be compacted to at least 100% SPMDD. The installation of a vapor barrier below the floor slab is recommended.

The floor slabs constructed as recommended above may be designed using a soil modulus of subgrade reaction, k, of 75 MPa/m, based on a loaded area of 0.3 m by 0.3 m. The slab-on-grade units should float independently of all load-bearing walls and columns.

5.6 EXCAVATION AND BACKFILLING

5.6.1 Excavations in Soil

Temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects.

Based on OHSA, the FILL encountered at the borehole location can be classified as a Type 3 soil. Unsupported side slopes for excavations developed entirely within Type 3 soils, if applicable, may be sloped at 1 horizontal to 1 vertical (1H:1V) from the base of the excavation.

Although not observed at the borehole location, soils excavated below the groundwater table and in loose/soft conditions, must be considered Type 4. OHSA requires that excavations in Type 4 soils be excavated to a maximum slope of 3 horizontal to 1 vertical (3H:1V) where workers enter the trench.

Where Type 3 and Type 4 soils are encountered, the maximum excavation side slope should be consistent with that of a Type 4 soil, in accordance with OHSA, or appropriate temporary support systems could be used.

The side slopes of excavations should be protected from exposure to precipitation and associated ground surface runoff, to prevent further softening and loss of strength of the soils that could lead to additional sloughing and caving. No free groundwater was observed within the overburden soils at the time of drilling; however, if encountered, control of groundwater will be required to allow the placement of concrete and/or structural fill under dry conditions. If seepage, infiltration, or surface run-off water is encountered during excavation and construction, the water should be manageable using conventional sump pits and pumps, provided that the excavations do not remain open beyond 1 to 2 days and precipitation does not occur during this period.

Soil removed from the excavation should not be stockpiled (even temporarily) at and/or near the crest of the excavations as the weight of the stockpiled soil could lead to slope instability of unsupported excavations.

Temporary shoring/protection systems are required where there is insufficient space to develop the excavations in open cut. The temporary support/shoring systems should be designed and installed in accordance with the OHSA and Ontario Provincial Standard Specification (OPSS) OPSS.PROV 539.

5.6.2 Excavations in Bedrock

If required, the temporary excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA) and Regulations for Construction Projects. Unsupported side slopes for excavations developed within sound bedrock may be sloped at 1 horizontal to 10 vertical (1H:10V) from the bottom of the excavation.

5.6.3 Groundwater

Groundwater was not encountered in the boreholes. If water is encountered during construction, it is anticipated that dewatering will be possible using conventional sump and pump techniques. However, it should be noted that these groundwater elevations may fluctuate seasonally.

Dewatering activities may require either registration of the Ministry of Environment and Climate Change (MOECC) Environmental Activity and Sector Registry (EASR) or obtaining a Permit to Take Water (PTTW) from the MOECC depending on the anticipated groundwater removal rates.

Groundwater that is pumped from excavations during construction must be handled and disposed of appropriately. In order for pumped water to be discharged to a City sewer, it needs to meet the City of Ottawa Sewer Use By-law criteria, and a separate sewer discharge permit must be obtained. The

construction contractor has the responsibility to obtain a permit under the City of Ottawa Sewer Program and testing/discharge of water to sanitary or storm sewer.

5.6.4 Pre-Construction Survey and Vibration Control

The construction of the proposed building is not anticipated to cause any significant vibration related impact to surrounding buildings. No vibration monitoring measures are required.

If bedrock excavation is carried out, vibrations will be generated. It is recommended that a pre-construction survey of all the existing structures and utilities be carried out. It is recommended that construction vibrations generally be limited to a maximum peak particle velocity as outlined in OPSS 120 "General Specifications for the Use of Explosives".

5.6.5 Foundation Backfill

Interior foundation backfill should be placed and compacted in lifts and should consist of Structural Fill placed as described in Section 5.3. Care should be taken immediately adjacent to walls to avoid over compaction of the soil which could result in damage to the walls.

Exterior foundation backfill should be consistent with the foundation drainage design requirements; it is anticipated that a granular drainage zone (clear stone), or synthetic drainage sheets, connected to a perimeter drainage system will be placed directly adjacent to the foundation walls. Beyond the granular drainage zone or drainage sheets, backfill should consist of a material meeting the requirements of OPSS Granular B Type I and should be placed in lifts no thicker than 300 mm and compacted using light compaction equipment to at least 95% of SPMDD.

5.6.6 Pipe Bedding and Backfill

Bedding for utilities should be placed in accordance with the pipe design requirements. It is recommended that a minimum of 150 mm to 200 mm of OPSS Granular A be placed below the pipe invert as bedding material. Granular pipe backfill placed above the invert should consist of Granular A material. A minimum of 300 mm vertical and side cover should be provided. Above and below the springline, these materials should be compacted to at least 95% of SPMDD (as defined in Section 5.3).

Backfill for service trenches in landscaped areas may consist of excavated material replaced and compacted in lifts. Where the service trenches extend below paved areas, the trench should be backfilled with subgrade fill material, meeting the requirements for OPSS Select Subgrade Material, from the top of the pipe cover to within 1.2 m of the proposed pavement surface, placed in lifts and compacted to at least 95% of SPMDD. The material used within the upper 1.2 m and below the subgrade line should be similar to that exposed in the trench walls to prevent differential frost heave, placed in lifts and compacted to at least 95% of SPMDD. Different abutting materials within this zone will require a 3H:1V frost taper in order to minimize the effects of differential frost heaving.

Excavations for manholes (if applicable) should be backfilled with compacted granular material. A 3H:1V frost taper should be built within the upper 1.2 m.

Backfill should be compacted in lifts not exceeding 300 mm.

5.6.7 Material Reuse

Excavations for this project are anticipated to extend through fill. The fill material present at the site is granular in nature and may be reused as subgrade fill beneath landscaped areas. The fill may be variable from location to location and therefore will require a more extensive laboratory program to support the on-site compaction control and testing.

All recommendations regarding material reuse are specific to the geotechnical feasibility of the reuse of the existing site fill and do not consider environmental restrictions. The excess soil anticipated to be generated at the site should be characterized in accordance with the Ontario Regulation.

5.7 LATERAL EARTH PRESSURES

Support methods may be required for service trenches excavated as part of the cut and cover operations and should be designed using the lateral earth parameters provided in Table 5.2.

Table 5.2: Recommended Static Earth Pressure Parameters (Horizontal Backfill)

Material	K_o (at rest)	K_a (active)	K_p (passive)	ϕ (friction angle)	Unit Weight
OPSS Granular A	0.43	0.27	3.69	35°	22 kN/m^3
OPSS Granular B Type II	0.47	0.31	3.25	32°	22 kN/m^3
Existing Fills	0.5	0.33	3.00	30°	21 kN/m^3

The design of the shoring systems or walls should be carried out by a Professional Engineer specialized in shoring design. The design should consider load effects from the adjacent embankments, existing structures, and construction equipment.

5.8 SEISMIC SITE CLASS AND LIQUEFACTION

As outlined in Table 4.1.8.1-A of the Ontario Building Code (OBC, 2020), buildings and their foundations must be designed to resist a minimum earthquake force for the site. Based on the results of the investigation, a Seismic Site Class C can be considered for this site.

To change the site classification from C to either A or B, a shear-wave velocity profile within the overburden and bedrock to a depth of 30 m below foundation elevation will be required.

The soils at this site are not considered liquefiable.

5.9 PAVEMENTS

The existing pavement will be affected by the proposed building and will require pavement reinstatement.

When reinstating pavements, it is common practice to match existing pavement thicknesses. The boreholes advanced through the pavement surrounding the existing building encountered an asphalt thickness of 50 mm to 75 mm.

The traffic levels for the existing roadway is not known but has been assumed to consist of light traffic (primarily light delivery vehicles).

The pavement structures presented in Table 5.3 should be used for pavement reinstatement within the parking lot and construction of access roads that will be used by heavy duty vehicles.

Table 5.3: Recommended Pavement Design

Parameter	Access Road	Pavement Reinstatement
Asphalt Surface	50 mm SP 12.5	50 mm SP 12.5
Asphalt Binder	50 mm SP 19	
Base	150 mm OPSS Granular A	150 mm OPSS Granular A
Subbase	450 mm OPSS Granular B Type II	450 mm OPSS Granular B Type II

The following material types are recommended for this project:

- Asphalt performance grade PG 58-34.
- The Superpave mix designs and properties should be in accordance with OPSS. Muni 1151 Material Specifications for Superpave and Stone Mastic Asphalt Mixtures.
- All granular materials should be in accordance with the requirements of OPSS. Muni 1010 Material Specification for Aggregates - Base, Subbase, Select Subgrade, and Backfill Materials. Both base and subbase layers should be compacted to 100% SPMDD.
- Tack coat is recommended between all asphalt layers and should meet OPSS 308 Construction Specifications for Tack Coating and Joint Painting.

Proper drainage of the pavement structure must be provided in order to ensure satisfactory performance. The subgrade and granular base/subbase should be graded to ensure positive drainage. Precipitation event should be anticipated.

5.10 CHEMICAL TESTING

One (1) representative soil sample was submitted to Paracel Laboratories in Ottawa, Ontario, for analysis of pH, water soluble sulphate, chloride concentrations and resistivity. The testing was completed to determine the potential for degradation of the concrete in the presence of soluble sulphates and the potential for corrosion of exposed steel used in foundations and buried infrastructure.

The analysis results are summarized in the following table.

Table 5.4: Chemical Testing Results

Borehole No.	Sample No.	Depth (m)	pH	Chloride (µg/g)	Sulphate (µg/g)	Resistivity (Ohm-m)
BH24-2A	BS-1	0 - 0.8 m	6.93	33	65	29.6

The results of the tests are provided in Appendix D.

The pH, resistivity, and chloride concentration provide an indication of the degree of corrosiveness of the subsurface environment.

The neutral pH value is 7.0 and the normal range of soils is from 4.0 to 8.5. The pH value of 6.93 measured on the soil sample is within the normal range.

The chloride concentration threshold value of 500 µg/g is typically used to designate soil or water as being corrosive. The chloride concentration for the sample is 33 µg/g, indicating low corrosivity.

A general scale of soil corrosiveness based on resistivity is as follows:

- Mildly Corrosive Resistivity > 100 Ω-m
- Moderately Corrosive 50 < Resistivity < 100 Ω-m
- Corrosive 30 < Resistivity < 50 Ω-m
- Highly Corrosive 10 < Resistivity < 30 Ω-m
- Extremely Corrosive Resistivity < 10 Ω-m

The resistivity of the soil as measured at the borehole location was found to be 29.6 Ω-m indicating a highly corrosive soil.

The pH, chloride and resistivity values presented may be used by structural designers in assessing the potential for chemical attacks on buried steel and as an aid in selecting coating and corrosion protection systems for buried steel objects.

The concentration of soluble sulfate provides an indication of the degree of sulfate attack that is expected for concrete in contact with soil and groundwater. Soluble sulfate concentrations less than 1000 µg/g generally indicates that a low degree of sulfate attack is expected for concrete in contact with soil and groundwater. The results of the tests for soluble sulfate in the sample referenced in the preceding section yielded a concentration of less than 65 µg/g.

Based on the test results, there is a low degree of potential sulfate attack for concrete in contact with the soil. Type GU Portland Cement can therefore be considered suitable for use in buried concrete.

5.11 GENERAL PRECAUTIONS FOR WINTER CONSTRUCTION

5.11.1 General

If earthwork is conducted during freezing conditions, special procedures and precautions must be exercised to minimize the risk of future problems.

If construction timelines are to be projected into the winter season, a site meeting should be held in the fall to discuss the schedules of the various contractors in relation to the winter-specific geotechnical recommendations provided herein.

5.11.2 Excavation

Should construction be completed during the winter months, care should be taken to confirm that bearing soils remain free of frost penetration prior to, and following, the casting of concrete. The foundation subgrade must be protected from freezing.

Excavations and exposed subgrade should be maintained in a dry and unfrozen condition throughout construction. Soils that become disturbed/softened during construction should be over-excavated and replaced with structural fill as described.

The topsoil layer and overlying snow will reduce the frost penetration. Conducting only the excavation work required for each day of work is recommended to minimize freezing of the soil in the foundation areas.

Excavated material to be used as subgrade fill should not be stockpiled but should be placed and compacted immediately after excavation.

5.11.3 Fill Placement

Based on our experience, it is generally impractical to place well-graded gravel, sand, or fine-grained soils in temperatures lower than about -5 degrees Celsius. On very cold days, loose material starts to freeze within about 15 minutes. At temperatures below -5 degrees Celsius, placement of engineered fill should be halted, and the existing fill materials must be protected from frost penetration.

The following procedures for structural fill types are recommended:

- Structural fill placement should be conducted in small areas. Depending on the temperature, this may allow for continuous placement of fill lifts during the workday without the requirement for excavation of frozen material prior to the placement of the next lift.
- For intermediate fill lifts, frost protection (e.g., straw, insulated tarp, etc.) should be provided at the end of the workday, or alternatively, fill that freezes overnight should be removed in the morning. Also, any snow or ice should also be removed. Fill surfaces should be sloped to prevent ponding of water during milder weather.
- The final fill surface, the base of footing excavations and slab subgrade should be protected from freezing. If the final fill surface is exposed to freezing temperatures, heat will be required to thaw the soil. Test pits and temperature readings could be completed to determine if the soil is above freezing.
- Loose edges of the structural fill lifts should be avoided to reduce frost penetration. Edges of fill lifts should be tapered and compacted.
- Regular checks of the temperature of the fill should be made. The soil temperature should be greater than +2°C to allow for compaction to the specified degree.

5.11.4 Concrete Construction

The following procedures for concrete construction in winter conditions are recommended:

- The concrete foundations should not be placed on frozen material.

- Following construction of concrete, temporary frost protection must be provided for protection of the concrete during curing.
- Foundations should be backfilled with a free-draining granular material and drainage provided to prevent adfreeze of foundations, particularly during construction.
- Freshly deposited cast-in-place concrete should be protected from freezing during colder weather conditions as per CSA A23.1.

Concrete curing requirements are based on the exposure class of the concrete, as presented in Table 2 of CSA A23.1. As outlined in Table 20 (CSA A23.1), for basic curing, Type 1, the concrete is to be cured for a minimum of 3 days at >10 degrees Celsius, or the time necessary to attain 40% of the specified strength. For other exposure classes, additional curing is required as outlined in Table 20 (CSA A23.1).

During cold weather, adequate protection of the concrete shall be provided for the duration of the curing period by means of heated enclosures, coverings, insulation, or a suitable combination of these methods. Cold weather is defined as when the air temperature is at or below 5 degrees Celsius within 24 hours of placement.

5.11.5 Geotechnical Inspection and Testing

Full-time inspection and testing by experienced geotechnical personnel is important during earthworks in winter conditions, due to the importance of validating the quality and state of the exposed subgrade, construction materials, and procedures during placement and/or excavation, and immediately prior to insulating.

6.0 CLOSURE

Use of this report is subject to the Statement of General Conditions provided in Appendix A. This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential liabilities associated with the identified property.

This report provides an evaluation of selected geotechnical conditions associated with the identified portion of the property that was assessed at the time the work was conducted and is based on information obtained by and/or provided to Stantec at that time. There are no assurances regarding the accuracy and completeness of this information. All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report and are based solely on the scope of work described in the report, the limited data available and the results of the work. They are not a certification of the property's environmental condition. This report should not be construed as legal advice.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities, or claims, howsoever arising, from third party use of this report.

Should additional information become available which differs significantly from our understanding of conditions presented in this report, Stantec requests that this information be brought to our attention so that we may reassess the conclusions provided herein.

We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report or if we can be of any other assistance, please contact us at your convenience.

Respectfully submitted;

Stantec Consulting Ltd.

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APPENDIX A

A.1 STATEMENT OF GENERAL CONDITIONS

Stantec

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This professional work product ("hereinafter referred to as the Report") has been prepared for the sole benefit of the Client in accordance with Stantec's contract with the Client. While the Report may be provided by the Client to applicable authorities having jurisdiction and to other third parties in connection with the project, Stantec disclaims any legal duty based upon warranty, reliance, or any other theory to any third party, and will not be liable to such third party for any damages or losses of any kind that may result.

BASIS OF THIS REPORT: This Report relates solely to the site-specific project for which Stantec was retained and the stated purpose for which the Report was prepared. The information, opinions, conclusions and/or recommendations made in this Report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time the scope of work was conducted and do not take into account any subsequent changes. If the proposed site-specific project differs or is modified from what is described in this Report or if the site conditions are altered, this Report is no longer valid unless Stantec is requested by the Client to review and revise the Report to reflect the differing or modified project specifics and/or the altered site conditions. This Report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose or site, and any unauthorized use or reliance is at the recipient's own risk.

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PROVIDED INFORMATION: Stantec has assumed all information received from the Client and third parties in the preparation of this Report to be correct. While Stantec has exercised a customary level of judgment or due diligence in the use of such information, Stantec assumes no responsibility for the consequences of any error or omission contained therein.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this Report are based on site conditions encountered by Stantec at the time of the scope of work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in-situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this Report or encountered at the test and/or sample locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the Report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or subsurface conditions are present upon becoming aware of such conditions.

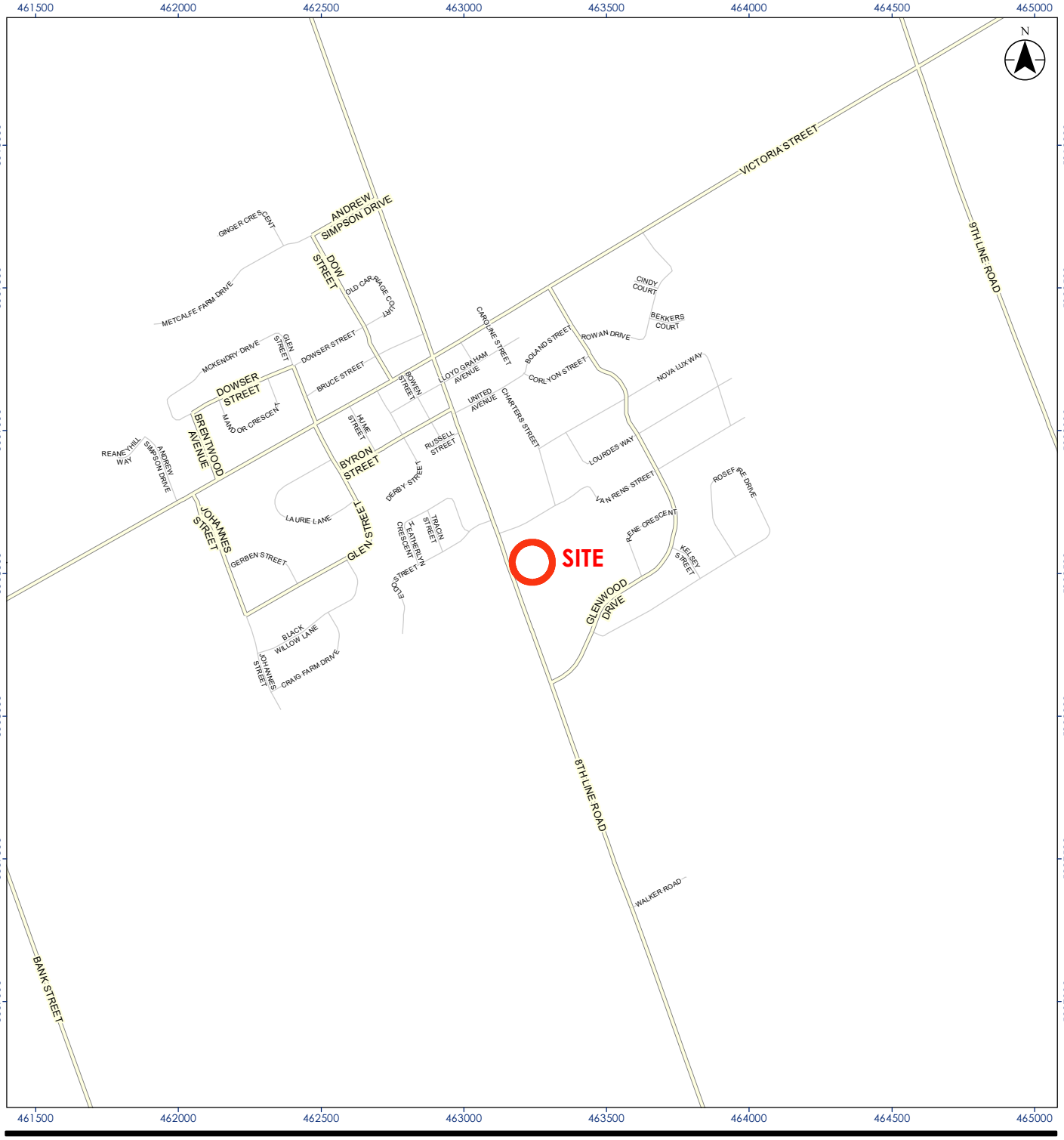
PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec geotechnical engineers, sufficiently ahead of initiating the next project stage (e.g., property acquisition, tender, construction, etc.), to confirm that this Report completely addresses the elaborated project specifics and that the contents of this Report have been properly interpreted. Specialty quality assurance services (e.g., field observations and testing) during construction are a necessary part of the evaluation of subsurface conditions and site work. Site work relating to the recommendations included in this Report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

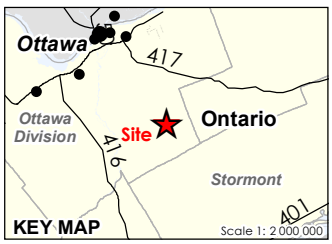
APPENDIX B

B.1 KEY PLAN

B.2 BOREHOLE LOCATION PLAN

T:\Autocad\Drawings\Project Drawings\2024\121625761\Key Plan\121625761_Key Plan.mxd Revised: 2024-05-27 By: gbriones





Legend

- Expressway / Highway
- Major Road
- Minor Road

0 200 400 600 800 metres

1:20,000 (at original document size of 8.5x11)

Stantec

Notes

1. Coordinate System: NAD 1983 CSRS UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2023.
3. Imagery provided by Esri ©2023.

Project Location
2821 8th Line Road
Metcalfe, Ontario

Project No. 121625761
Prepared by G. Briones
on 2024-05-27

Client/Project
METCALFE AGRICULTURAL SOCIETY
GEOTECHNICAL INVESTIGATION

Drawing No.
1

Title
KEY PLAN

Stantec
300 - 1331 Clyde Avenue
Ottawa, ON, Canada K2C 3G4
www.stantec.com

LEGEND

BOREHOLE (STANTEC, 2024)

NOTES

1. COORDINATE SYSTEM: NAD 1983 UTM ZONE 18.
2. BASEPLAN: PDF COPY OF A PLAN ENTITLED PROPOSED SITE PLAN BY DEIMLING, DWG. No. SP-A01, DATED MARH 11, 2024.
3. IMAGERY: © 2024 MICROSOFT CORPORATION © 2024 MAXAR © CNES (2024) DISTRIBUTION AIRBUS DS.

10m 0 10 20m
1 : 1000

MAY 2024
Project No. 121625761

Client/Project
METCALFE AGRICULTURAL SOCIETY
GEOTECHNICAL INVESTIGATION
2821 8TH LINE ROAD, METCALFE, ONTARIO

Drawing No.
2

Title
BOREHOLE LOCATION PLAN

T:\Autocad\Drawings\Project Drawings\2024\121625761\121625761_2821 Metcalfe_Borehole Locations.dwg
Printed: May 27, 2024 By: G. Briones

APPENDIX C

C.1 SYMBOLS AND TERMS USED ON BOREHOLE RECORDS

C.2 STANTEC BOREHOLE RECORDS

C.3 BEDROCK CORE LOGS

C.4 BEDROCK CORE PHOTOGRAPHS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

BOREHOLE RECORD

BH24-1A'

CLIENT: **Metcalfe Agricultural Society**
PROJECT NO. : **121625761**
PROJECT: **Metcalfe Agricultural Society - New Building**
BH ELEVATION: **86.4m**
LOCATION: **2821 8th Line Road, Ottawa, ON**
DATUM: **Geodetic**
DATE BORED: **May 9, 2024 to May 9, 2024**
WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	86.4							
	86.4	50 mm TOPSOIL						
		FILL: silty sand (SM) with gravel, dark to light brown, moist - trace roots		BS	1			
	85.5			SS	2	205	50	
1		LIMESTONE with a thin bed (roughly 100 mm) of sandstone with sandy filling. - Light grey - Slightly to moderately weathered - Poor quality - Very strong (UCS = 108 MPa) (Refer to Field Bedrock Core Log)		NQ	3	100%	33%	Sieve at 0.9 m G S Fines 20% 39% 41%
2	83.9							
		End of borehole						
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

50/25 mm >>

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 86 85 84 83 82 81 80 79 78 77

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Downing | Logged By: OE
Drilling Method: Hollow stem | Reviewed By: KF
Completion Depth: 2.52 m | Page 1 of 1

Stantec

BOREHOLE RECORD

BH24-2A'

CLIENT: **Metcalfe Agricultural Society**
PROJECT NO. : **121625761**
PROJECT: **Metcalfe Agricultural Society - New Building**
BH ELEVATION: **86.3m**
LOCATION: **2821 8th Line Road, Ottawa, ON**
DATUM: **Geodetic**
DATE BORED: **May 9, 2024 to May 9, 2024**
WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	86.3							
	86.3	50 mm TOPSOIL						
		FILL: silty sand (SM) with gravel, dark brown, moist - trace organic material		BS	1			
1	85.2			SS	2	180	50	
		End of Borehole Refusal on Inferred Bedrock						
2								
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80
50, /175 mm >>

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 86 85 84 83 82 81 80 79 78 77

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Downing | Logged By: OE
Drilling Method: Hollow stem | Reviewed By: KF
Completion Depth: 1.09 m | Page 1 of 1

Stantec

BOREHOLE RECORD

BH24-3

CLIENT: **Metcalfe Agricultural Society**
PROJECT NO. : **121625761**
PROJECT: **Metcalfe Agricultural Society - New Building**
BH ELEVATION: **86.1m**
LOCATION: **2821 8th Line Road, Ottawa, ON**
DATUM: **Geodetic**
DATE BORED: **May 9, 2024 to May 9, 2024**
WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	86.1							
	86.0	75 mm Ashphalt						
		FILL: Light brown to brown silty sand (SM) with gravel, moist		BS	1			Sieve at 0.5 m G S Fines 42% 45% 13%
	85.3			SS	2		0	
1		LIMESTONE with a thin bed (roughly 100 mm) of sandstone with sandy filling. - Grey to light grey - Slightly to moderately weathered - Very poor quality - Very strong (Refer to Field Bedrock Core Log)		NQ	3	100%	6%	
2	83.8							
		End of borehole						
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 86 85 84 83 82 81 80 79 78 77

BACKFILL SYMBOL
ASPHALT GROUT CONCRETE
BENTONITE DRILL CUTTINGS SAND SLOUGH

Drilling Contractor: Downing | Logged By: OE
Drilling Method: Hollow stem | Reviewed By: KF
Completion Depth: 2.34 m | Page 1 of 1

Printed Jun 20 2024 11:31:10 STANTEC GEO 2016 121625761_METCALFE_AGRICULTURAL_SOCIETY.GPJ GINT_1233_SOIL_2018_DATA_TEMP_REV2.GDT 6/20/24

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BOREHOLE RECORD

BH24-4A'

CLIENT: **Metcalfe Agricultural Society**
PROJECT NO. : **121625761**
PROJECT: **Metcalfe Agricultural Society - New Building**
BH ELEVATION: **86.3m**
LOCATION: **2821 8th Line Road, Ottawa, ON**
DATUM: **Geodetic**
DATE BORED: **May 9, 2024 to May 9, 2024**
WATER LEVEL: **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (USCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
0	86.3							
	86.2	50 mm Ashphalt						
		FILL: Brown silty sand (SM) with gravel, moist		BS	1			
	85.5	End of Borehole						
1		Refusal on Inferred Bedrock						
2								
3								
4								
5								
6								
7								
8								
9								
10								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 86 85 84 83 82 81 80 79 78 77

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: Downing | Logged By: OE
Drilling Method: Hollow stem | Reviewed By: KF
Completion Depth: 0.76 m | Page 1 of 1

Bedrock Core Log

Client: Metcalfe Agricultural Society
Project: Metcalfe Agricultural Society
Contractor: George Downing Estate Drilling Ltd

Project No.: 121624761
Date: May 9, 2024
Borehole No.: BH24-1A'
Logger: Omar El-Ghazal

DEPTH FROM	RUN NO.	% CORE RECOVERY	% RQD	DEPTH TO	GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)	STRENGTH	WEATHERING	DISCONTINUITIES							OCCASIONAL FEATURES	DRILLING OBSERVATIONS
								NO. OF SETS	TYPE/S	ORIENTATION	SPACING	ROUGHNESS	APERTURE	FILLING		
0.94 m	NQ2	100%	33%	2.52 m	LIMESTONE with a thin bed (roughly 100 mm) of sandstone with sandy filling. Slightly to moderately weathered, poor quality, very strong, light grey (UCS = 108 MPa)	R5	W2 - W3	1	BD	F	EC-VC-C	RP-RU	C-G	T-O-S	- Sandy filling observed	No issues encountered

STRENGTH (MPa)

Grade/Classification	Est. Strength (MPa)
R0 Extremely Week	0.25 - 1.0
R1 Very Weak	1.0 - 5.0
R2 Weak	5.0 - 25.0
R3 Medium Strong	25.0 - 50.0
R4 Strong	50.0 - 100.0
R5 Very Strong	100.0 - 250.0
R6 Extremely Strong	>250.0

JOINT TYPE
BD = Bedding
JN = Joint
FOL = Foliation
CON = Contact
FLT = Fault
VN = Vein

ORIENTATION
F = Flat = 0-20^0
D = Dipping = 20-50^0
V = n-Vertical = >50^0

JOINT APERTURE
C = Closed = < 0.5 mm
G = Gapped = 0.5 to 10 mm
O = Open = > 10 mm

FILLING
T = Tight, Hard
O = Oxidized
SA = Slightly Altered, Clay Free
S = Sandy, Clay Free
Si = Sandy, Silty, Minor Clay
NC = Non-softening Clay
SC = Swelling, Soft Clay

WEATHERING

Grade/Classification	Description
W1 Fresh	No Visible Signs of Weathering
W2 Slightly	Discoloration, Weathering on Discontinuities
W3 Moderately	<50% of Rock Material is Decomposed, Fresh Core Stones
W4 Highly	>50% Decomposed to soil: Fresh Core Stones
W5 Completely	100% Decomposed to Soil: Original Structure Intact
W6 Residual Soil	All Rock Converted to Soil, Structure and Fabric Destroyed

DISCONTINUITY SPACING

Spacing (mm)	
EW = >6000	Extremely Wide
VW = 2000 - 6000	Very Wide
W = 600 - 2000	Wide
M = 200 - 600	Moderate
C = 60 - 200	Close
VC = 20 - 60	Very Close
EC = <20	Extremely Close

JOINT ROUGHNESS

Jr	Description
4	DJ = Discontinuous Joints
3	RU = Rough, Irregular, Undulating
1.5	SU = Smooth, Undulating
1.5	LU = Slickensided, Undulating
1.0	RP = Rough or Irregular, Planar
0.5	SP = Smooth, Planar
2	LP = Slickensided, Planar

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Bedrock Core Log

Client:	Metcalfe Agricultural Society	**Project No.:**	121624761
Project:	Metcalfe Agricultural Society	**Date:**	May 9, 2024
Contractor:	George Downing Estate Drilling Ltd	**Borehole No.:**	BH24-3
		Logger:	Omar El-Ghazal

DEPTH FROM	RUN NO.	% CORE RECOVERY	% RQD	DEPTH TO	GENERAL DESCRIPTION (Rock Type/s, %, Colour, Texture, etc.)	STRENGTH	WEATHERING	DISCONTINUITIES							OCCASIONAL FEATURES	DRILLING OBSERVATIONS
								NO. OF SETS	TYPE/S	ORIENTATION	SPACING	ROUGHNESS	APERTURE	FILLING		
0.81 m	NQ3	100%	6%	2.34 m	LIMESTONE with a thin bed (roughly 100 mm) of sandstone with sandy filling. Slightly to moderately weathered, very poor quality, very strong, grey to light grey	R5	W2 - W3	1	BD	F	VC-C	RP	G	T-O-S	- Sandy filling observed	No issues encountered

STRENGTH (MPa)

Grade/Classification	Est. Strength (MPa)
R0 Extremely Week	0.25 - 1.0
R1 Very Weak	1.0 - 5.0
R2 Weak	5.0 - 25.0
R3 Medium Strong	25.0 - 50.0
R4 Strong	50.0 - 100.0
R5 Very Strong	100.0 - 250.0
R6 Extremely Strong	>250.0

JOINT TYPE

BD = Bedding
JN = Joint
FOL = Foliation
CON = Contact
FLT = Fault
VN = Vein

ORIENTATION

F = Flat = 0-20^0
D = Dipping = 20-50^0
V = n-Vertical = >50^0

JOINT APERTURE

C = Closed = < 0.5 mm
G = Gapped = 0.5 to 10 mm
O = Open = > 10 mm

FILLING

T = Tight, Hard
O = Oxidized
SA = Slightly Altered, Clay Free
S = Sandy, Clay Free
Si = Sandy, Silty, Minor Clay
NC = Non-softening Clay
SC = Swelling, Soft Clay

WEATHERING

Grade/Classification	Description
W1 Fresh	No Visible Signs of Weathering
W2 Slightly	Discoloration, Weathering on Discontinuities
W3 Moderately	<50% of Rock Material is Decomposed, Fresh Core Stones
W4 Highly	>50% Decomposed to soil: Fresh Core Stones
W5 Completely	100% Decomposed to Soil: Original Structure Intact
W6 Residual Soil	All Rock Converted to Soil, Structure and Fabric Destroyed

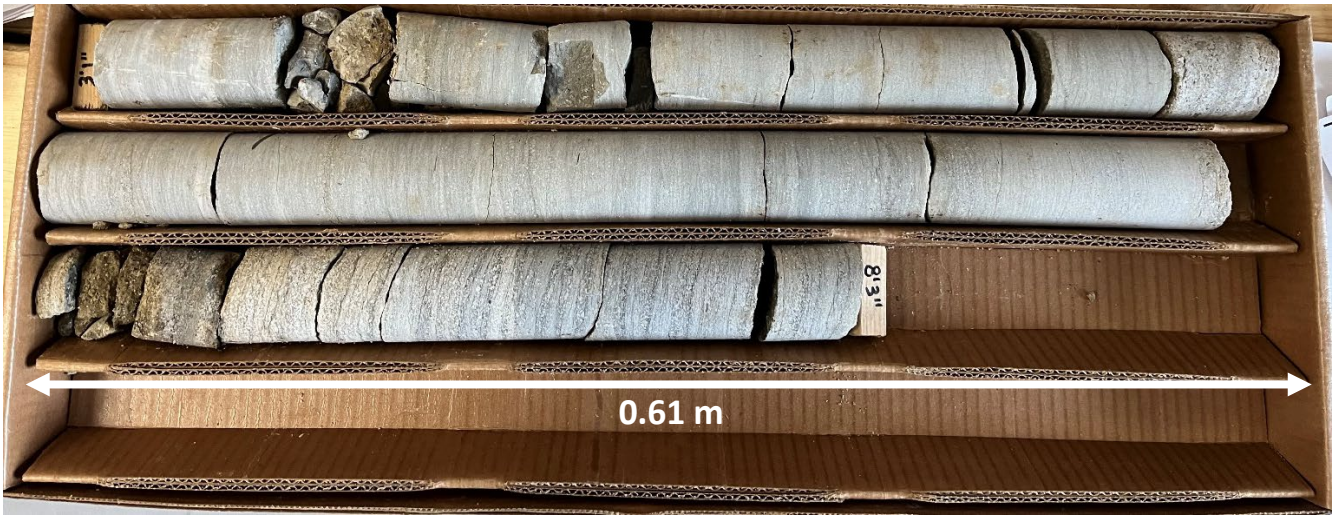
DISCONTINUITY SPACING

Spacing (mm)	
EW = >6000	Extremely Wide
VW = 2000 - 6000	Very Wide
W = 600 - 2000	Wide
M = 200 - 600	Moderate
C = 60 - 200	Close
VC = 20 - 60	Very Close
EC = <20	Extremely Close

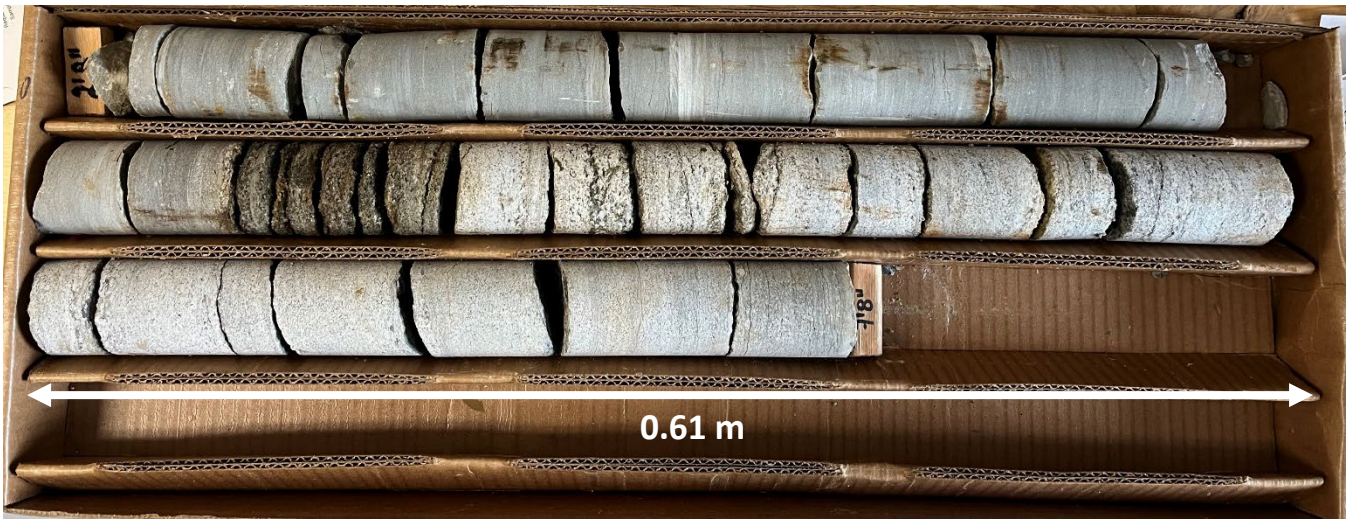
JOINT ROUGHNESS

Jr	Description
4	DJ = Discontinuous Joints
3	RU = Rough, Irregular, Undulating
1.5	SU = Smooth, Undulating
1.5	LU = Slickensided, Undulating
1.0	RP = Rough or Irregular, Planar
0.5	SP = Smooth, Planar
2	LP = Slickensided, Planar

Stantec	Project No.: 121625761 Project Name: Metcalfe Agricultural Society	Rock Core Photographs



Rock Core Photo No.: 1	Borehole: BH24-1A'	Depth: 0.9 m to 2.5 m

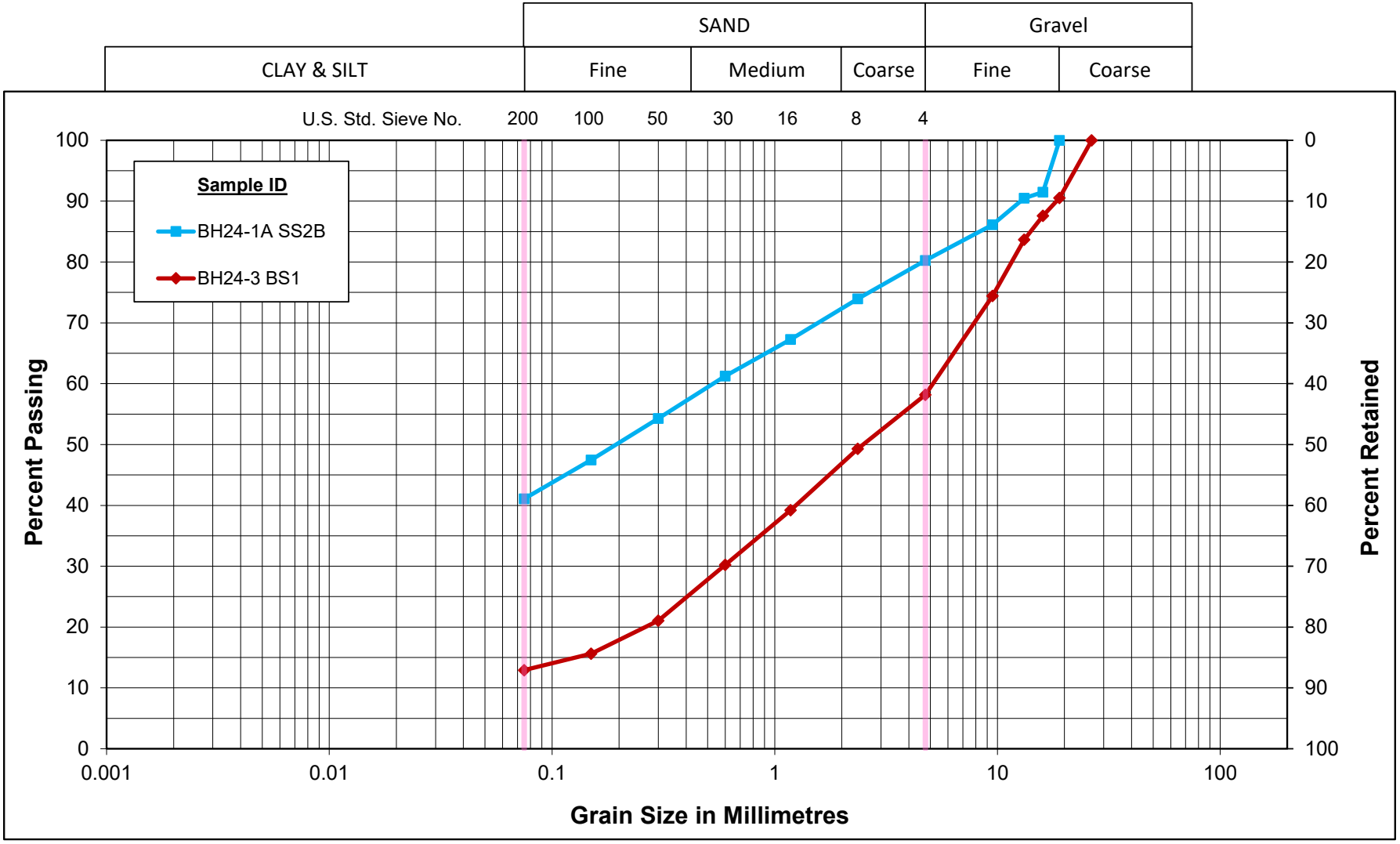


Rock Core Photo No.: 2	Borehole: BH24-3	Depth: 0.8 m to 2.3 m

APPENDIX D

D.1 LABORATORY TEST RESULTS

Unified Soil Classification System



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GRAIN SIZE DISTRIBUTION

FILL: Silty Sand with Gravel (SM)

Figure No. 1

Project No. 121625761

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Compressive Strength & Elastic Moduli of Intact Rock Core Speciments under Varying States of Stress and Temperatures

Method C

ASTM D7012 & D4543

Client:	NA	Project No.:	121625761/200
Project:	Metcalfe Agricultural Society		
Material Type:	Rock Core; Diameter ≥ 47.0 mm	Date Received:	May 10, 2024
Sampled By:	Omar El-Ghazal	Tested By:	Sagar Khatri
Date Sampled:	May 2, 2024	Date Tested:	May 17, 2024

Sample Information				
Borehole Location	**BH24-1A**	**0**	**0**	**0**
Sample Number	NQ3	0	0	0
Sample Depth	5'5"	0	0	0
Compressive Strength Test Data				
Physical Description	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report	As per Geotechnical Report
Average Sample Diameter (mm) (≥47.0)	47			
Average Sample Length (mm)	119			
Density (kg/m^3)	2570			
Unit Weight (kN/m^3)	**25.2**	**#VALUE!**	**#VALUE!**	**#VALUE!**
L/D Ratio (2.0-2.5)	2.51	#VALUE!	#VALUE!	#VALUE!
Failure Load (lbs)	42910	0	0	0
Compressive Strength (MPa)	**108.1**	**#VALUE!**	**#VALUE!**	**#VALUE!**
Straightness by Procedure S1 (≤0.02inch)	<0.02	<0.02	<0.02	<0.02
Flatness by Procedure FP2 (≤0.001inch)	<0.001	<0.001	<0.001	<0.001
Parallelism by Procedure FP2 (≤0.25°)	0.110	#N/A	#N/A	#N/A
Perpendicularity by Procedure P2 (≤0.0043)	<0.0043	<0.0043	<0.0043	<0.0043
Moisture Condition	As-Received	As-Received	As-Received	As-Received
Description of Break D7012/11.1.13	Reasonably well formed cones on both ends.	0	0	0.00
Note	Sample cracked from the middle while preparation.	0	0	0.00

Remarks:

Reviewed by: _____ Date: May 17, 2024

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Certificate of Analysis

Stantec Consulting Ltd. (Ottawa)
1331 Clyde Avenue Suite 400
Ottawa, ON K2C 3G4
Attn: Katurah Firdawsi

Client PO: Metcalfe Agriculture Society
Project: 121625761.200
Custody:

Report Date: 24-May-2024
Order Date: 17-May-2024

Order #: 2420446

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2420446-01	BH24-2A, BS-1, 0-2.5'

Approved By:

Dale Robertson, BSc
Laboratory Director

Certificate of Analysis

Report Date: 24-May-2024

Client: **Stantec Consulting Ltd. (Ottawa)**

Order Date: 17-May-2024

Client PO: **Metcalfe Agriculture Society**

Project Description: 121625761.200

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	22-May-24	22-May-24
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	22-May-24	22-May-24
Resistivity	EPA 120.1 - probe, water extraction	21-May-24	21-May-24
Solids, %	CWS Tier 1 - Gravimetric	23-May-24	24-May-24

Certificate of Analysis

Report Date: 24-May-2024

Client: **Stantec Consulting Ltd. (Ottawa)**

Order Date: 17-May-2024

Client PO: **Metcalfe Agriculture Society**

Project Description: 121625761.200

	Client ID:	BH24-2A, BS-1, 0-2.5'	-	-	-		
	Sample Date:	09-May-24 09:00	-	-	-	-	-
	Sample ID:	2420446-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	75.4	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	6.93	-	-	-	-	-
Resistivity	0.1 Ohm.m	29.6	-	-	-	-	-
Anions							
Chloride	10 ug/g	33	-	-	-	-	-
Sulphate	10 ug/g	65	-	-	-	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	10	ug/g					
Sulphate	ND	10	ug/g					
General Inorganics								
Resistivity	ND	0.1	Ohm.m					

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	831	10	ug/g	837			0.7	35	
Sulphate	212	10	ug/g	209			1.6	35	
General Inorganics									
pH	7.12	0.05	pH Units	7.10			0.3	2.3	
Resistivity	31.0	0.1	Ohm.m	32.1			3.7	20	
Physical Characteristics									
% Solids	77.9	0.1	% by Wt.	75.4			3.3	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	927	10	ug/g	837	89.4	82-118			
Sulphate	304	10	ug/g	209	94.8	80-120			

Certificate of Analysis

Report Date: 24-May-2024

Client: **Stantec Consulting Ltd. (Ottawa)**

Order Date: 17-May-2024

Client PO: **Metcalfe Agriculture Society**

Project Description: 121625761.200

Qualifier Notes:

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unlesss otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

Paracel ID: 2420446

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Page ___ of ___

Client Name:	**Stantec Consulting Ltd.**	Project Reference:	**Metcalfe Agricultural Society**
Contact Name:	**Katurah Firdawsi**	Task #:	**200**
Address:	**2781 Lancaster Road., Suite 101. Ottawa ON. K1B-1A7**	PO #	**121625761**
Telephone:	**613-738-6075**	Email Address:	katurah.firdawsi@stantec.com

TAT: **[ ] Regular** [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required: _____

Criteria: [ ] O. Reg. 153/04 Table __ [ ] O. Reg. 153/11 (Current) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [ ] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality:_____ [ ] Other: _____

Matrix Type: S (Soil/Sed.) **GW** (Ground Water) **SW** (Surface Water) **SS** (Storm/Sanitary Sewer) **P** (Paint) **A** (Air) **O** (Other)

Paracel Order Number: 2420446

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Resistivity	PH	Sulphate & Chloride								
1	BH24-2A, BS-1, 0-2.5'				24/05/09		x	x	x								
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Swift

Relinquished By (Print & Sign):	Received by Driver/Depot:	Received at Lab: SD	Verified By: SS
Date/Time:	Date/Time:	Date/Time: May 17, 2024 8:54am	Date/Time: 17 May 24 1139
	Temperature: _____ °C	Temperature: 22.6 °C	pH Verified [ ] By: N/A