FINAL REPORT

Foundation Investigation Report

Detailed Design Proposed Arnprior Maintenance Patrol Yard
Location 12 - Highway 417 and Ottawa Road 29,
Arnprior, Ontario
MTO Agreement No. 4020-E-0012-32

Submitted to:

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GEOCRES No.: 31F08-001

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Distribution List

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Foundation Investigation Report

Detailed Design Proposed
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1.0 INTRODUCTION

WSP Canada Inc. (WSP, formerly Golder Associates Ltd., amalgamated with WSP in 2023) has been retained by Dillon Consulting Limited (Dillon) on behalf of the Ministry of Transportation, Ontario (MTO) to carry out a detailed foundation investigation associated with the proposed Arnprior Maintenance Patrol Yard (MPY) under Assignment No. 32 of the Eastern Region Retainer Mega 16 (Assignment No. 4019-E-0019).

In July 2022 WSP carried out a preliminary foundation investigation for the proposed Arnprior MPY development at the Highway 417 and Ottawa Road 29 (OR29) site. The results of the preliminary foundation investigation are contained in the following report:

- **MTO GEOCRES No. 31F-244**: "Foundation Investigation Report, Proposed Arnprior Maintenance Patrol Yard Location 12 - Highway 417 and Ottawa Road 29, Arnprior, Ontario" dated April 2023, prepared by Golder Associates Ltd.

This report presents the combined results of the preliminary and detailed design foundation investigation carried out for the preferred site of proposed for the MPY.

The scope of work for the foundation engineering services associated with the detail design and construction of the proposed MPY was outlined in Change in Scope - Sub-Consultant for Assignment 32 dated August 22, 2023. The detail design investigation program was developed to provide one (1) additional borehole for the revised Storm Water Management Pond and provide soil sampling for environmental testing for Dillon to develop an Excess Soil Management plan. The detailed design investigation report for the proposed MPY structures is based on the information gathered during the preliminary and detailed investigations.

All work has been carried out in accordance with WSP's Quality Control Plan for foundation engineering services for the project dated April 2021 provided to Dillon.

2.0 SITE DESCRIPTION AND GEOLOGY

2.1 Site Description

The proposed Arnprior MPY site is to be located between Upper Dwyer Hill Road and OR29, in the southeast quadrant of the Highway 417 / OR29 interchange southeast of Arnprior, Ontario. Site photographs showing the general conditions at the site during the field investigation in July 2022 and October 2023 are presented in Appendix D.

In the area of the MPY site, Highway 417 is divided with a four-lane cross-section with two eastbound and two westbound through lanes, plus speed change lanes at the interchange ramps. The existing underpass structure carries the two through lanes of OR29 over Highway 417. Upper Dwyer Hill Road is located to the south of the site and is a rural roadway with one through lane in each direction and gravel shoulders.

The proposed site is undeveloped, with generally flat to rolling topography and is covered with grass and bush with several low-lying areas.

2.2 Regional Geology

As delineated in *The Physiography of Southern Ontario*, the MPY site lies within the minor physiographic region known as the Ottawa Valley Clay Plain, which lies within the major physiographic region of the Ottawa-St. Lawrence Lowland.

The Ottawa Valley Clay Plain region is characterized by relatively thick deposits of sensitive marine clay, silt and silty clay that were deposited within the former Champlain Sea basin. These deposits, known as the Champlain Sea clay or Leda clay, overlie relatively thin, commonly reworked glacial till and glaciofluvial deposits, that in turn overlie bedrock[1]. Bedrock in this region is within the geological boundaries between carbonate meta-sedimentary rocks consisting of marble of the Grenville Supergroup and Flinton Group, and limestone, dolostone and sandstone of the Ottawa Group and Simcoe Group.

3.0 INVESTIGATION PROCEDURES

The fieldwork for the preliminary investigation was carried out between June 27 and July 11, 2022, and included advancing eight boreholes, numbered 22-01 to 22-08 for the proposed buildings, and two boreholes, numbered SWMP1 and SWMP2 for the proposed Stormwater Management Pond (SWMP) at that time. Boreholes 22-01 to 22-04 were located at the four corners of the footprint for the proposed Vehicle Maintenance Garage (VMG), while boreholes 22-05 to 22-08 were located in the four corners of the footprint for the proposed Material Storage Building (MSB). The SWMP boreholes were located within the footprint of the then proposed stormwater management pond.

The fieldwork for the detailed design investigation, including the environmental sampling, was carried out between October 16 and 18, 2023. The investigation included advancing one borehole for the revised SWMP design (23-03) and ten boreholes for environmental sampling (23-201 to 23-210). The information gathered for the environmental sampling, including the field borehole logs, were provided to Dillon and are not discussed further in this report.

The locations of the proposed structures were provided by Dillon on November 29, 2023, and are shown in Drawings 1 to 3.

The preliminary and detailed design boreholes were advanced with a CME850 track-mounted drilling rig. The drilling equipment was supplied and operated by CCC Geotechnical & Environmental Drilling Ltd. (CCC) of Ottawa, Ontario and Marathon Underground Constructors Corporation of Greely, Ontario, respectively.

Soil samples were obtained using a 50 mm outer diameter split-spoon sampler in general accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). Soil samples were obtained at vertical sampling intervals of about 0.76 m. Relatively undisturbed samples of the clay were also retrieved from within the cohesive deposit using a fixed-piston sampler and thin-walled Shelby tubes.

In-situ vane testing was carried out within the cohesive deposits using an MTO N-size vane, with the reaction (torque) measured by a pair of calibrated scales, to measure undrained shear strengths. After measuring the undrained shear strength, remoulded shear strengths were also measured at selected intervals.

After sampling to a depth of approximately 3.0 m, Boreholes 22-02, 22-03, 22-05 and 22-08 were advanced to refusal without sampling using Dynamic Cone Penetration Testing (DCPT).

HQ- or NQ-sized sized bedrock core samples were obtained using the rotary diamond drilling technique and a triple-tube core-barrel at Boreholes 22-01, 22-04, 22-06, 22-07, and 23-03.

[1] Belanger, J.R. “Urban Geology of Canada’s National Capital Area”, in Urban Geology of Canadian Cities, Geological Association of Canada Special Paper 42, Ed. P.F. Karrow and O.L. White, 1998.

A monitoring well was installed in Boreholes 22-01 and 23-03, to observe the stabilised groundwater level at the site. The monitoring wells consist of 32 mm outside diameter PVC tubing with 1.5 m long slotted screens installed within the silty clay (22-01) and till/bedrock (23-03) The groundwater levels were measured in the wells on July 15, 2022, October 4, 2022, and on December 12, 2023.

All boreholes without a monitoring well were backfilled with bentonite within the bedrock, and bentonite mixed with soil cuttings within the overburden. The boreholes containing monitoring wells were backfilled with bentonite mixed with cuttings to the underside of the well screen depth, followed by a sand pack to 0.6 m above the top of the well screen, followed by a minimum 1.5 m thick layer of bentonite to form a “cap” over the well screen, followed by a layer of bentonite mixed with cuttings to ground surface. All boreholes were backfilled in general accordance with the intent of O.Reg 903, as amended. The site conditions were restored following completion of the fieldwork.

The fieldwork was supervised on a full-time basis by members of WSP’s technical staff who located the boreholes in the field, directed the drilling, sampling, and in-situ testing operations, logged the boreholes. The soil and bedrock samples were identified in the field, placed in labelled containers, and transported to WSP’s laboratory in Ottawa for further examination and testing. Index and classification tests consisting of water content determinations, grain size distribution analyses, and Atterberg limits testing were carried out on selected soil samples at WSP’s and Stantec’s Ottawa laboratories. Two undisturbed Shelby tube soil samples were submitted to Stantec’s Ottawa laboratory for one-dimensional consolidation testing of the sensitive silty clay. The uniaxial compressive strength (UCS) testing was carried out on selected samples of the bedrock at Stantec’s Ottawa laboratory. The laboratory tests were carried out to MTO LS and/or ASTM Standards, as appropriate.

One groundwater and two soil samples were sent to Eurofins Environmental Testing Canada Inc. (Eurofins) for basic chemical analysis related to potential corrosion of buried steel elements and sulfate attack on buried concrete elements (corrosion and sulphate attack).

The borehole locations and elevations were surveyed by WSP using a Trimble R10 GPS unit referenced to the NAD83 CSRS CBNv6-2010.0 MTM Zone 9 geodetic datum. The borehole locations, including northing and easting coordinates, ground surface elevations, and drilled depths are summarized in Table 1.

Table 1: Summary of Borehole Locations

Borehole	NAD83 CSRS CBNv6-2010.0 MTM Zone 9		Ground Surface Elevation (m)	Drilled Depths (m)	Comments
	Northing (m)	Easting (m)			
22-01	5030649.6	318064.8	104.9	17.1	Bedrock Cored
22-02	5030669.0	318085.3	104.7	10.4[1]	DCPT Refusal
22-03	5030628.4	318084.5	106.7	16.3[1]	DCPT Refusal
22-04	5030646.3	318104.3	106.1	21.6	Bedrock Cored
22-05	5030718.7	318161.1	105.4	10.5[1]	DCPT Refusal
22-06	5030751.7	318198.0	105.7	21.4	Bedrock Cored
22-07	5030694.9	318182.5	106.3	15.3	Bedrock Cored
22-08	5030734.8	318215.0	105.8	15.8[1]	DCPT Refusal
SWMP1	5030544.4	317965.7	104.4	8.2[2]	-
SWMP2	5030562.4	317992.2	103.8	8.8[2]	-
23-03	5030591.3	317977.7	104.0	11.2	Bedrock Cored

Notes:
[1] Borehole terminated at DCPT refusal
[2] Borehole terminated within grey clay.

4.0 DESCRIPTION OF SUBSURFACE CONDITIONS

4.1 General

The subsurface soil, bedrock and groundwater conditions encountered in the boreholes and the results of in-situ testing from the investigation are shown on the Record of Borehole, and Drillhole sheets presented in Appendix A. The results of the laboratory testing carried out during the investigation are presented on the Record of Borehole sheets as well as in Figures B1 to B10 in Appendix B. The borehole locations and the interpreted stratigraphic profiles projected along the proposed MPY buildings and SWMP are provided in Drawings 1 to 3, respectively.

Photographs of the core samples recovered from the underlying bedrock are shown in Figures A1 to A10, provided in Appendix A. The results of the basic chemical testing/analysis completed on select groundwater and soil samples are provided in Appendix C.

The stratigraphic boundaries shown on the Record of Borehole sheets and on the interpreted stratigraphic sections in Drawings 1 and 2, are inferred from observations of the drilling progress and noncontinuous sampling and therefore, represent transitions between soil types rather than exact planes of geological change. The subsoil conditions will vary between and beyond the borehole locations.

4.2 Site Stratigraphy Overview

At the boreholes, the subsurface conditions generally consist of topsoil and/or fill, overlying a very stiff weathered clay crust, transitioning to a firm to stiff grey silty clay to clay, underlain by bedrock. A layer of silty sand/sandy silt (till) to clayey silt-silt/silt (till) was encountered overlying the bedrock at some locations.

A more detailed description of the overburden soil deposits, and bedrock geology conditions encountered during the field investigation is provided in the following sections.

4.2.1 Surface Cover/ Surficial Materials

Topsoil with thickness ranging from 100 mm to 600 mm but more typically 200 mm was encountered at surface at all boreholes, except Borehole 22-06.

4.2.2 Fill

Fill consisting of silty sand to sandy silt to gravel and sand was encountered below the topsoil at Boreholes 22-03, 22-04, 22-07 and at ground surface at Borehole 22-06. The top of this layer was encountered at elevations ranging from 105.5 m to 106.6 m. The total thickness of this layer ranges from about 0.6 m to 2.0 m. The SPT N-values recorded in the fill range from 5 to 32 blows per 0.3 m of penetration but more typically 5 to 23 blows per 0.3 m indicating a loose to compact state of compactness. The measured moisture contents of four samples tested ranged from 5% to 29%. The results of grain size analysis testing carried out on four samples of fill material are provided in Figure B2 in Appendix B.

4.2.3 Clay to Silty Clay

A clay deposit was encountered beneath the surficial topsoil and or fill layers at all boreholes locations. The measured engineering properties of the clay deposit are shown on the plots in Figure B1 provided in Appendix B.

The upper portion of the clay deposit has a weathered, stiff to very stiff crust. The top of this layer was encountered at elevations ranging from 103.8 m to 105.6 m. The thickness of this layer at Boreholes 22-01, 22-04, 22-06, 22-07, SWMP 1, SWMP 2, and 23-03 where fully penetrated ranges from about 3.8 m to 5.3 m. The SPT N-values recorded in this layer range from 1 to 18 blows per 0.3 m of penetration but more typically 5 to 10 blows per 0.3 m. In-situ shear vane test results indicate the undrained shear strength of the grey-brown weathered clay ranges from 84 kPa to greater than 96 kPa, indicating a stiff to very stiff consistency. The ratio of the measured in-situ natural undrained shear strength to the remolded undrained shear strength ranges from about 5 to 10, as such the clay crust is classified as sensitive to extra sensitive in accordance with Section 3.1.3.4 the Canadian Foundation Engineering Manual (CFEM 2006).

The water content of fifteen samples of the clay crust ranges from 33% to 53%. The results of grain size analysis testing carried out on eleven samples of this material are illustrated in Figures B3 and B4 in Appendix B. The results of Atterberg limits testing completed on twelve samples of weathered clay crust indicate liquid limits ranging from 59 to 74, plastic limits ranging from 19 to 26 and plasticity indices ranging from 38 to 50. These Atterberg limits test results indicate a clay of high plasticity (CH). The Atterberg limits test results are illustrated in Figure B5 in Appendix B.

The silty clay to clay encountered below the weathered crust is grey. The top of this layer was encountered at elevations ranging from 99.2 m to 100.5 m. The thickness of this layer where fully penetrated ranges from about 5.0 m to 11.6 m. Boreholes SWMP1 and SWMP2 were terminated in this layer. The SPT N-values range from weight of rod (WR) to 4 blows per 0.3 m of penetration, but more typically WR to 1 blow per 0.3 m. In-situ shear vane test results measured the undrained shear strength of the grey silty clay to clay ranging from 38 kPa to 77 kPa, but more typically 38 kPa to 58 kPa, indicating a firm to stiff consistency. The ratio of the measured in-situ natural undrained shear strength to the remolded undrained shear strength ranges from 2 to 31, but more typically 5 to 13; indicating sensitivity to extra sensitive clay in accordance with Section 3.1.3.4 of CFEM (2006).

The water contents of the nine samples of the grey silty clay to clay range from 38% to 54%. The results of grain size analysis testing carried out on seven samples of this material are illustrated in Figure B6 in Appendix B. The results of Atterberg limits testing completed on eight samples of the grey clayey soils indicate liquid limits ranging from 37 to 57, plastic limits ranging from 17 to 22 and plasticity indices ranging from 18 to 36. These Atterberg limits test results indicate silty clay to clay of intermediate to high plasticity, but more typically intermediate plasticity silty clay (CI). The Atterberg limits test results are illustrated in Figure B7 in Appendix B.

Laboratory oedometer consolidation testing was carried out on two samples of the grey silty clay deposit. The preconsolidation pressures were estimated from the void ratio versus logarithmic stress plot (e-logσ') using the Casagrande method as well as using the work method (after Becker et al., 1987). The results of the testing are provided in the Consolidation Test Results report provided in Appendix B and are summarized in Table 2.

Table 2: Summary of Consolidation Testing

Borehole	Sample	Ground Surface Elevation (m)	Test Elevation (m)	Unit Weight (kN/m^3)	e_o	σ'_p (kPa)	σ_{vo}' (kPa)	$\sigma_p' - \sigma_{vo}'$ (kPa)	Cc	Cr	OCR
22-04	ST-11	106.1	95.1	16.9	1.406	155	90	65	0.719	0.016	1.7
22-07	ST-09	106.3	98.4	17.1	1.329	225	75	150	1.043	0.010	3.0

Notes:
σ'_P Estimated preconsolidation stress
σ'_{VO} Estimated in-situ vertical effective stress
Cc Compression index
Cr Recompression index
e_o Initial void ratio
OCR Overconsolidation ratio

4.2.4 Clayey Silt

Clayey silt containing varying amounts of sand was encountered below the grey silty clay stratum at Borehole 22-01. The top of this layer was encountered at Elevation 93.6 m and the layer is 1.5 m thick. The measured SPT N-value within this layer is weight of hammer (WH). In-situ shear vane test results measured undrained shear strengths of 50 kPa and 58 kPa, indicating a stiff consistency within the clayey silt. The ratio of the measured in-situ undrained natural shear strength to the undrained remolded shear strength was 3 and 4, as such the clayey silt is classified as medium sensitive to sensitive in accordance with Section 3.1.3.4 of CFEM (2006).

The measured water content of a single sample of the clayey silt was 25%. The results of grain size analysis testing carried out on a single sample of this material is provided in Figure B8 in Appendix B. The results of Atterberg limits testing completed on a single sample of the clayey silt indicates a liquid limit of 25, a plastic limit of 14, and a plasticity index of 11. The Atterberg limits test results are shown in Figure B9 in Appendix B and indicate a clayey silt of low plasticity (CL).

4.2.5 Clayey Silt-Silt to Silt of Slight Plasticity (Till)

Clayey silt-silt to silt of slight plasticity (till) containing varying amounts of sand was encountered below the grey silty clay stratum at Borehole 23-03. The top of this layer was encountered at Elevation 95.0 m and the layer is 0.4 m thick. The recorded SPT N-value within this layer was 56 blows/0.25 m, suggesting a hard consistency, however the blow count has likely been influenced by the proximity to the bedrock surface rather than the actual consistency of the soil matrix.

The measured water content of a single sample from this layer was 12%. The results of Atterberg limits testing completed on a single sample of this material indicates a liquid limit of 16, a plastic limit of 11, and a plasticity index of 4. The Atterberg limits test results are shown in Figure B10 in Appendix B and indicate a clayey silt-silt to silt of slight plasticity (CL-ML/ML).

4.2.6 Silty Sand to Sandy Silt (Till)

A granular till layer was encountered below the clayey silt at Borehole 22-01, and below the silty clay at Boreholes 22-04 and 22-06. The till is described as consisting of silty sand to gravelly silty sand to gravelly sandy silt with trace to some clay and containing cobbles. Given the nature of tills in this area, it is anticipated that the glacial till layer likely also contains boulders. The top of this layer was encountered at Elevations 92.1 m and 90.4 m in Boreholes 22-01 and 22-04, respectively, and interpreted to be at Elevation 88.9 m in Borehole 22-06, and the layer is 0.4 m to 1.6 m thick. The recorded SPT N-values within this layer range from 50 blows/0.03 m to 50 blows/0.15 m, suggesting a very dense compactness, however the blow counts have likely been influenced by the presence of cobbles, boulders, or the proximity to the bedrock surface rather than the actual compactness of the soil matrix.

4.3 Bedrock/DCPT Refusal

The overburden materials are underlain by marble, dolostone, or sandstone bedrock with crystalline calcarenite limestone interbeds.

HQ or NQ-sized bedrock core samples were obtained using rotary diamond drilling technique and a triple-tube core-barrel at Boreholes 22-01, 22-04, 22-06, 22-07 and 23-03.

Table 3 summarizes the depths and the elevations of the bedrock surface as encountered at the borehole locations.

Table 3: Summary of Bedrock Surface Depths and Elevations

Borehole	Existing Ground Surface Elevation (m)	Depth to Bedrock Surface (m)	Bedrock Surface Elevation[1] (m)
22-01	104.9	13.2	91.7
22-04	106.1	16.8	89.3
22-06	105.7	18.4	87.3
22-07	106.3	11.8	94.5
23-03	104.0	9.4	94.6

Note(s):
1. Bedrock surface elevation confirmed by rock coring.

Marble bedrock was encountered below the till at Boreholes 22-01, 22-04 and 23-03. The top of the marble bedrock was encountered between Elevations 94.6 m and 89.3 m in the boreholes. Rock Quality Designation (RQD) values measured on the recovered marble bedrock core samples range from about 0% to 98%, but are typically 44% to 98%, indicating a poor to excellent rock quality. The result of uniaxial compressive strength (UCS) testing carried out on a single marble bedrock core sample gave a UCS value of 206 MPa, indicating a very strong bedrock.

Dolostone bedrock was encountered below the marble bedrock at Borehole 22-04, and below the grey silty clay in Borehole 22-07. The top of the dolostone bedrock was encountered at Elevations 86.3 m and 94.5 m in Boreholes 22-04 and 22-07, respectively. RQD values measured on the recovered dolostone bedrock core samples range from about 60% to 89%, indicating a fair to good rock quality. The result of UCS testing carried out on a single dolostone bedrock core sample gave an UCS value of 186 MPa, indicating a very strong bedrock.

Sandstone was encountered below the till at Borehole 22-06. Crystalline calcarenite-limestone interbeds are present in the bedrock core. The top of the sandstone bedrock was encountered at Elevation 87.3 m. RQD values measured for the sandstone bedrock range from about 39% to 77%, indicating a poor to good rock quality. The result of UCS testing carried out on a single sandstone bedrock core sample gave a UCS value of 26 MPa, indicating a medium strong bedrock.

The results of the laboratory UCS testing are attached in Appendix B.

Below a depth of approximately 3.0 m, Boreholes 22-02, 22-03, 22-05 and 22-08 were advanced to refusal without sampling, using Dynamic Cone Penetration Testing (DCPT). Table 4 summarizing the DCPT refusal elevations encountered during the investigation. DCPT refusal is defined where a blow-count of 100 blows/0.3 m (or greater) is measured in the test and is not necessarily indicative of top of bedrock surface since it is possible that the DCPT could reach refusal on cobbles and/or boulders within the till overlying the bedrock. For top of bedrock elevations, reference should be made to the bedrock elevations confirmed by coring as provided in Table 3.

Table 4: Summary of DCPT Refusal Elevations

Borehole	Existing Ground Surface Elevation (m)	DCPT Refusal Elevation (m)
22-02	104.7	94.3
22-03	106.7	90.4
22-05	105.4	94.9
22-08	105.8	90.0

4.4 Groundwater Condition

Monitoring wells were installed in Boreholes 22-01 and 23-03 to measure the groundwater level at the site. Table 5 summarizes the groundwater levels measured in the monitoring wells.

It is expected that the groundwater levels will be subject to fluctuations both seasonally and as a result of precipitation events.

Table 5: Summary of Groundwater Conditions

Borehole	Screened Interval	Ground Surface Elevation (m)	Ground Water Depth (m)	Ground Water Elevation (m)	Date
22-01	Grey Silty Clay	104.9	1.3	103.6	July 15, 2022
			0.9	104.0	October 4, 2022
			2.4	102.5	December 12, 2023
23-03	Till / Bedrock	104.0	0.8	103.2	October 19, 2023
			5.2	98.8	December 12, 2023

4.5 Steel Corrosion and Sulphate Attack, Chemical Analysis

One groundwater sample and two soil samples were submitted to Eurofins for chemical testing/analysis related to potential corrosion of exposed buried steel and potential sulphate attack on buried concrete elements (corrosion and sulphate attack). The test results are provided in Appendix C and are summarized in Table 6 and Table 7.

Table 6: Steel Corrosion and Sulphate Attack, Chemical Analysis – Water Sample

Borehole	Chloride (mg/L)	Sulphate (mg/L)	Electrical Conductivity (mS/cm)	pH	Resistivity (Mohm-cm)
22-01	13	62	425	8.26	<0.2

Table 7: Steel Corrosion and Sulphate Attack, Chemical Analysis – Soil Samples

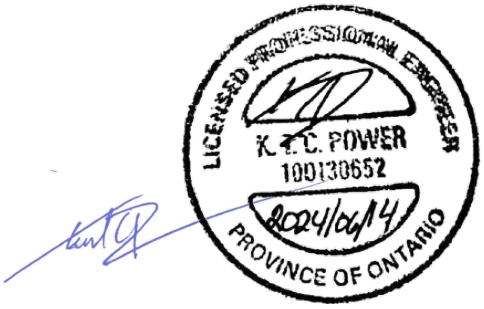
Borehole	Sample Depth (m)	Chloride (%)	Sulphate (%)	Electrical Conductivity (mS/cm)	pH	Resistivity (ohm-cm)
22-06	3.1-3.7	0.003	0.06	0.13	8.29	7,690
22-07	4.6-5.2	0.003	0.04	0.17	8.14	5,880

5.0 CLOSURE

This report was prepared by Kinjal Gajjar a Geotechnical Consultant with WSP and Kenton Power, P.Eng. The report was reviewed by Paul Dittrich, P.Eng. a Geotechnical Engineering Fellow and MTO Principal Foundations Contact for WSP conducted an independent technical and quality review of this report.

WSP Canada Inc.

Kinjal Gajjar
Geotechnical Consultant



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Paul Dittrich, P.Eng.
MTO Principal Foundations Contact

KG/KCP/JPD/yj

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DRAWINGS

Drawings 1 and 2 – Borehole Locations and Soil Strata

Drawing 3 – Grade Raise Contour Plan

MINISTRY OF TRANSPORTATION, ONTARIO

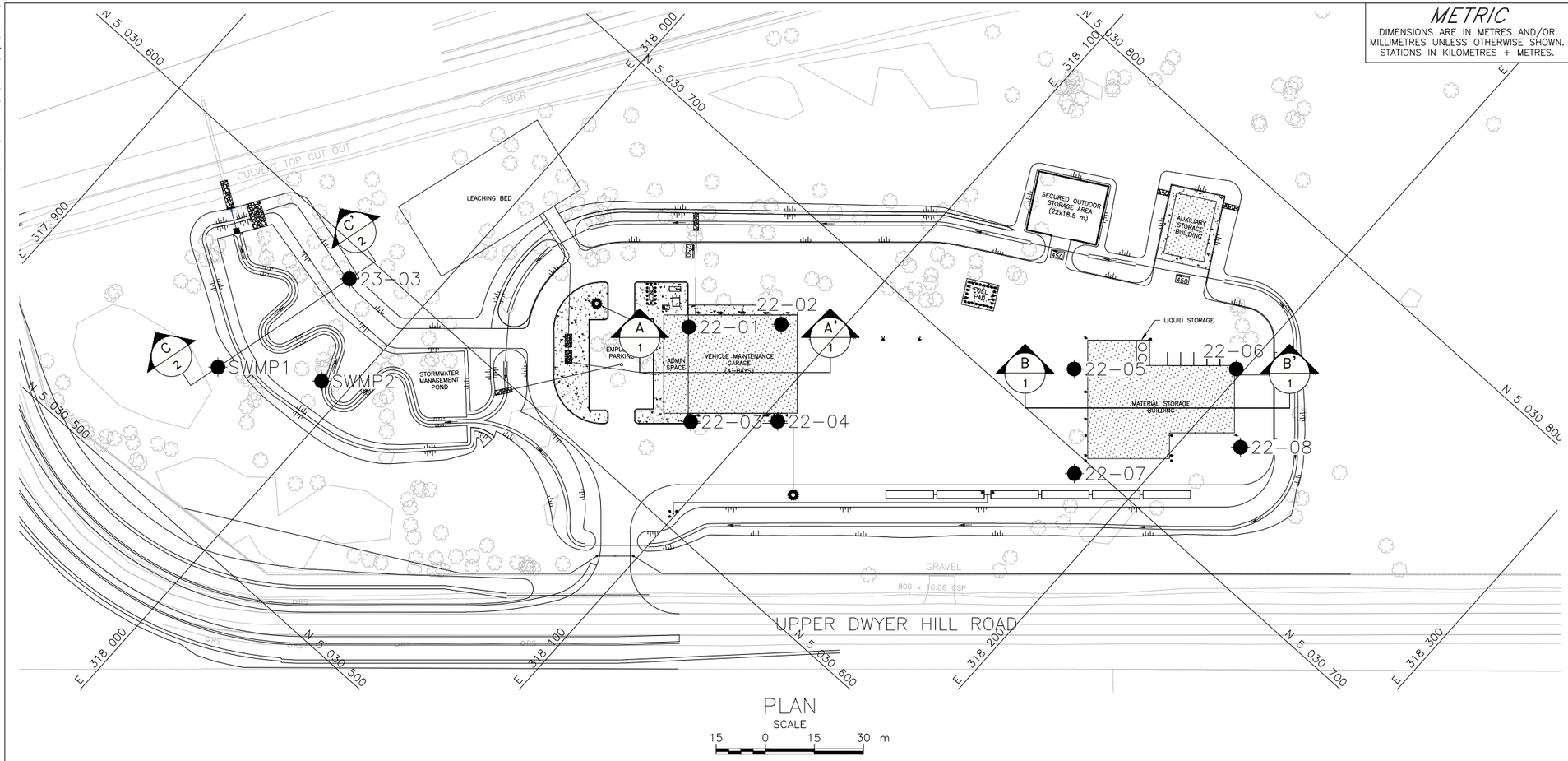
METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS IN KILOMETRES + METRES.

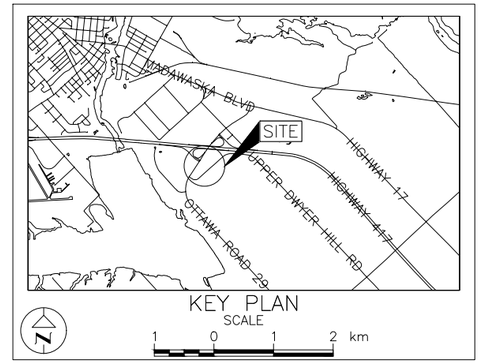
CONT No. 2024-4033
GWP No. 4024-22-00

HIGHWAY 417 AT OTTAWA ROAD 29
ARNPRIOR MAINTENANCE PATROL YARD
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET 134



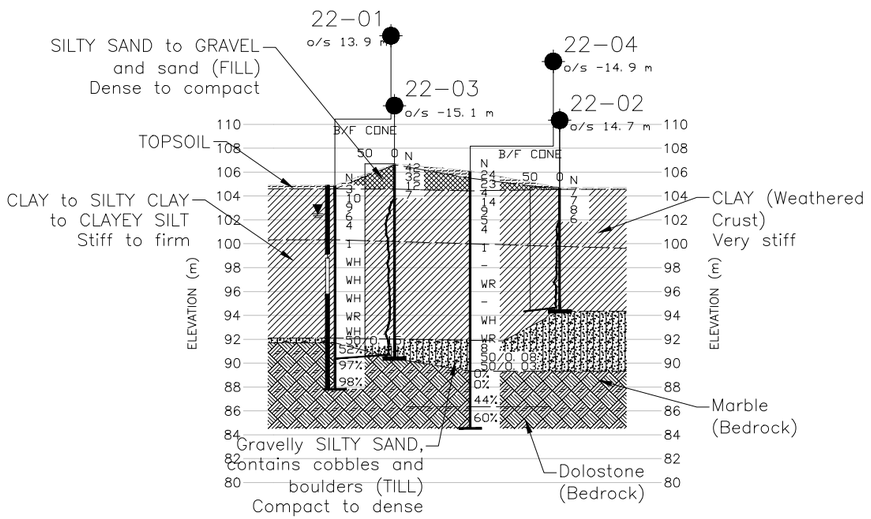
PLAN
SCALE
15 0 15 30 m



KEY PLAN
SCALE
1 0 1 2 km

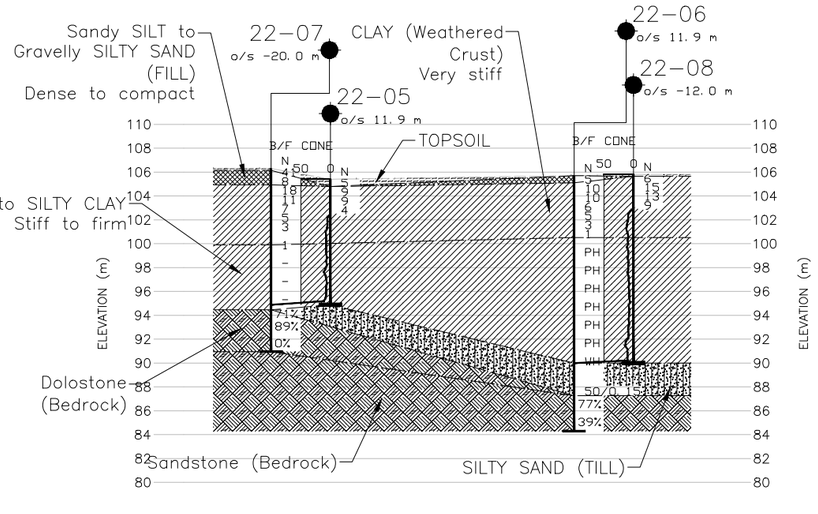
LEGEND

- Borehole – Current Investigation
- Seal
- Piezometer
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% — Rock Quality Designation (RQD)
- WL in piezometer, measured on Dec. 12, 2023



HOR. SCALE 1:500 A-A' CROSS-SECTION
VERT. SCALE 1:250 1

HOR. SCALE
10 0 10 20 m
5 0 5 10 m
VERT. SCALE



HOR. SCALE 1:500 B-B' CROSS-SECTION
VERT. SCALE 1:250 1

HOR. SCALE
10 0 10 20 m
5 0 5 10 m
VERT. SCALE

BOREHOLE CO-ORDINATES (NAD 83 MTM ZONE 9)			
No.	ELEVATION	NORTHING	EASTING
22-01	104.9	5030649.6	318064.8
22-02	104.7	5030669.0	318085.3
22-03	106.7	5030628.4	318084.5
22-04	106.1	5030646.3	318104.3
22-05	105.4	5030718.7	318161.1
22-06	105.7	5030751.7	318198.0
22-07	106.3	5030694.9	318182.5
22-08	105.8	5030734.8	318215.0
23-03	104.0	5030591.3	317977.7

Structure Location: Latitude: 45.415665 ; Longitude: -76.330521

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

1. Base plans provided in digital format by Dillon Consulting Ltd., drawing file no. 4059 – CAD for Golder.dwg, received November 29, 2023.

LICENSED PROFESSIONAL ENGINEER K.T.C. POWER 100130652 Jun. 14, 2024 PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER J.J.P. DITTRICH Jun.14, 2024 PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 31F08-001

HWY. 417	PROJECT NO. CA0012298.4565		DIST. EASTERN
SUBM'D. KG	CHKD. KG	DATE: 6/11/2024	SITE: –
DRAWN: JM	CHKD. KCP	APPD. JPD	DWG. 1

PLOT DATE: June 14, 2024
FILENAME: S:\Clients\MTO\Hwy_17_417_Arnprior\09_PROJ\CA0012298_4565\40_PROD\0003_Geotech\CA0012298_4565-0003-BG-0001.dwg

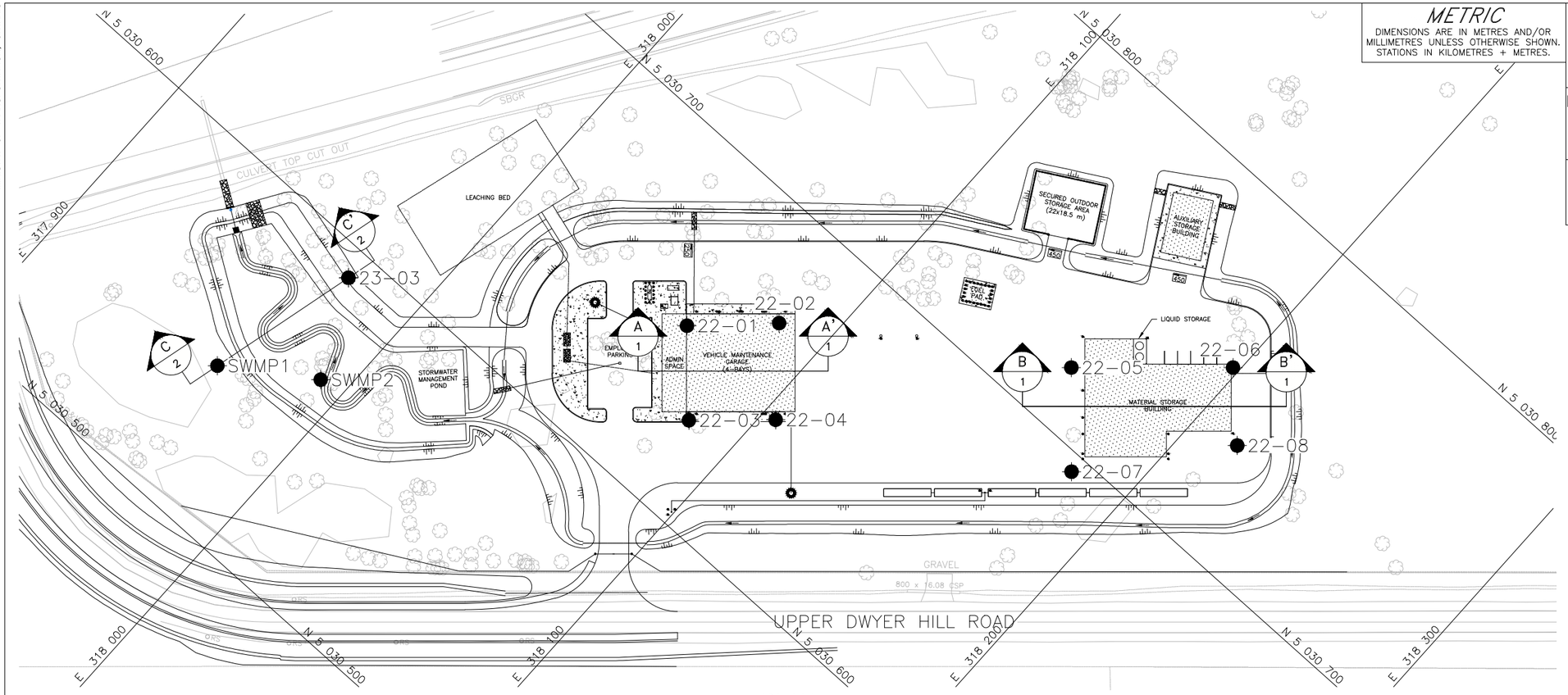
MINISTRY OF TRANSPORTATION, ONTARIO

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

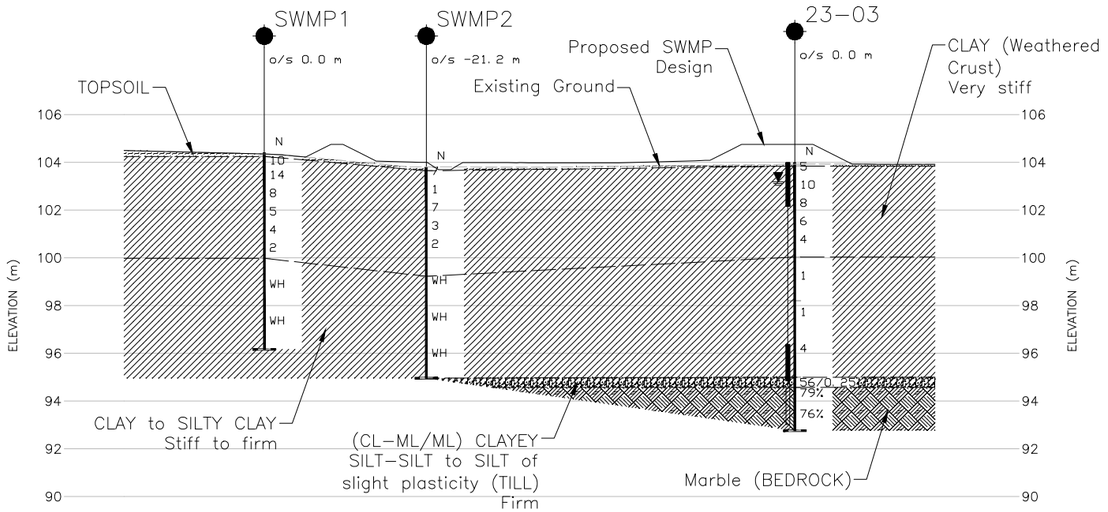
CONT No. 2024-4033
GWP No. 4024-22-00

HIGHWAY 417 AT OTTAWA ROAD 29
ARNPRIOR MAINTENANCE PATROL YARD
STORM WATER MANAGEMENT POND
BOREHOLE LOCATIONS AND SOIL STRATA

SHEET 135

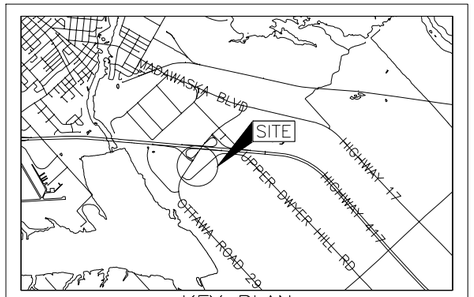


PLAN
SCALE
15 0 15 30 m



HOR. SCALE 1:250 / VERT. SCALE 1:125
C-C (1) CROSS-SECTION

HOR. SCALE
5 0 5 10 m
2.5 0 2.5 5 m
VERT. SCALE



KEY PLAN
SCALE
1 0 1 2 km

LEGEND

- Borehole – Current Investigation
- Seal
- Piezometer
- N — Standard Penetration Test Value
- 16 — Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- 100% — Rock Quality Designation (RQD)
- WL in piezometer, measured on Oct. 19, 2023

BOREHOLE CO-ORDINATES (NAD 83 MTM ZONE 9)			
No.	ELEVATION	NORTHING	EASTING
23-03	104.0	5030591.3	317977.7
SWMP1	104.4	5030544.4	317965.7
SWMP2	103.8	5030562.4	317992.2

Structure Location: Latitude: 45.415665 ; Longitude: -76.330521

NOTES

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LICENSED PROFESSIONAL ENGINEER K.T.C. POWER 100130652 PROVINCE OF ONTARIO Jun. 14, 2024

LICENSED PROFESSIONAL ENGINEER J.P. DITTRICH PROVINCE OF ONTARIO Jun.14, 2024

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 31F08-001

HWY. 417	PROJECT NO. CA0012298.4565		DIST. EASTERN
SUBM'D. KG	CHKD. KG	DATE: 6/14/2024	SITE: –
DRAWN: JM	CHKD. KCP	APPD. JPD	DWG. 2

PLOT DATE: June 14, 2024
FILENAME: S:\Clients\MTO\Hwy_17_417_Arnprior\09_PROJ\CA0012298_4565\40_PROD\0003_Geotech\CA0012298_4565-0003-BG-0002.dwg

MINISTRY OF TRANSPORTATION, ONTARIO

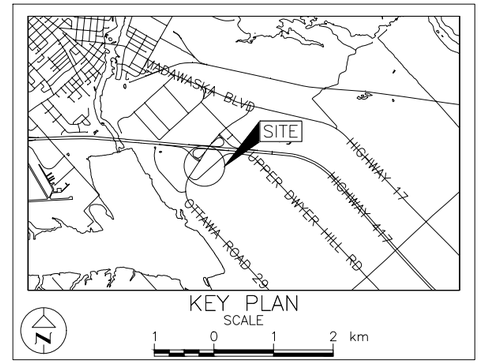
METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. 2024–4033
GWP No. 4024-22-00

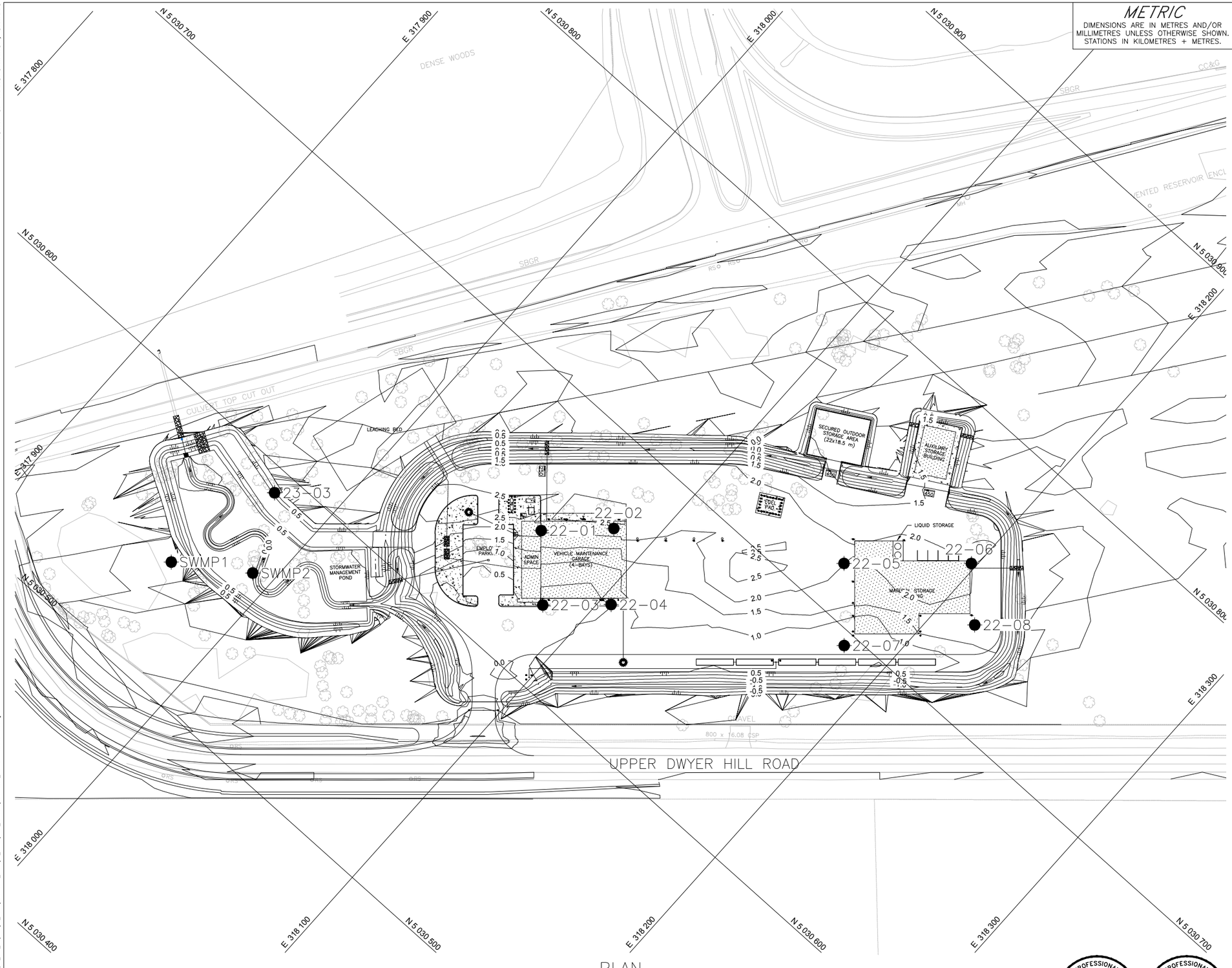
HIGHWAY 417 AT OTTAWA ROAD 29
ARNPRIOR MAINTENANCE PATROL YARD
GRADE RAISE CONTOUR PLAN

SHEET
136

wsp



KEY PLAN
SCALE
1 0 1 2 km



PLAN
SCALE
15 0 15 30 m

BOREHOLE CO–ORDINATES (NAD 83 MTM ZONE 9)			
No.	ELEVATION	NORTHING	EASTING
22–01	104.9	5030649.6	318064.8
22–02	104.7	5030669.0	318085.3
22–03	106.7	5030628.4	318084.5
22–04	106.1	5030646.3	318104.3
22–05	105.4	5030718.7	318161.1
22–06	105.7	5030751.7	318198.0
22–07	106.3	5030694.9	318182.5
22–08	105.8	5030734.8	318215.0
23–03	104.0	5030591.3	317977.7

Structure Location: Latitude: 45.415665 ; Longitude: –76.330521

NOTES

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The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

1. Base plans provided in digital format by Dillon Consulting Ltd., drawing file no. 4059 – CAD for Golder.dwg, received November 29, 2023.

2. Grade raise contour plans provided in digital format by Dillon Consulting Ltd., drawing file no. 4059–02–SRF–DES.dwg, received November 29, 2023.

LICENSED PROFESSIONAL ENGINEER
K.T.C. POWER
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Jun. 14, 2024
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
J.P. DITTRICH
Jun.14, 2024
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
.	.	.	.

Geocres No. 31F08–001

HWY. 417		PROJECT NO. CA0012298_4565	DIST. EASTERN
SUBM'D. KG	CHKD. KG	DATE: 6/14/2024	SITE: –
DRAWN: JM	CHKD. KCP	APPD. JPD	DWG. 3

PLOT DATE: June 14, 2024
FILENAME: S:\Clients\MTO\Hwy_17_417_Arnprior\99_PROJ\CA0012298_4565\40_PROD\0003_Geotech\CA0012298_4565–0003–BG–0003.dwg

APPENDIX A

Borehole Records

Lists of Abbreviations and Symbols

Lithological and Geotechnical Rock Description Terminology

Records of Boreholes and Drill Holes 22-01 to 22-08, SWMP1, SWMP2 and 23-02

Bedrock Core Photographs, Figures A1 to A10

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS
MINISTRY OF TRANSPORTATION, ONTARIO

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>200	>8
COBBLES	Not Applicable	75 to 200	3 to 8
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
FINES	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY COMPONENTS[1,2]

Percentage by Mass	Modifier
> 35	Use 'and' to combine primary and secondary component (*i.e.,* SAND and gravel)
> 20 to 35	Primary soil name prefixed with "gravelly, sandy" as applicable
> 10 to 20	some (*i.e.,* some sand)
≤ 10	trace (*i.e.,* trace fines)

1. Only applicable to components not described by Primary Group Name.
2. Classification of Primary Group Name based on Unified Soil Classification System (ASTM D2487) for coarse-grained soils; fine-grained soils described per current MTO Soil Classification System.

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)
An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve friction (f_s) are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC / SC	Rock core / Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample
OD / ID	Outer Diameter / Inner Diameter
HSA / SSA	Hollow-Stem Augers / Solid-Stem Augers

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COARSE-GRAINED SOILS

Compactness[1]

Term	SPT 'N' (blows/0.3m)[2]
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

1. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grainsize. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.
2. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

FINE-GRAINED SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1,2] (blows/0.3m)
Very Soft	< 12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	> 200	> 30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.
2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ. where $\gamma = \rho \cdot g$ (i.e., mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_L or LL	liquid limit
w_P or PL	plastic limit
I_P or PI	plasticity index = $(w_l - w_p)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
$C_{\alpha(e)}$	secondary compression index
C_α	rate of secondary compression
$C_{\alpha(\varepsilon)}$	modified secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
c′	effective cohesion
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q or q'	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$
2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERING CLASSIFICATION

Fresh (W1): no visible sign of rock material weathering.

Slightly Weathered (W2): discoloration indicates weathering of rock mass material on discontinuity surfaces. **Less than 5%** of rock mass is altered or weathered.

Moderately Weathered (W3): less than 50% of the rock mass is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones.

Highly Weathered (W4): more than 50% of the rock mass is decomposed and/or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as corestones.

Completely Weathered (W5): 100% of the rock mass is decomposed and/or disintegrated to a soil. The original mass structure is still largely intact.

Residual Soil (W6): all rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye

CORE CONDITION

Total Core Recovery (TCR)

The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)

The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)

The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, as measured along the centerline axis of the core, relative to the length of the total core run. RQD varies from 0% for completely broken core to 100% for core in solid segments.

DISCONTINUITY DATA

Fracture Index

A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to Core Axis

The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole, a discontinuity with a 90° angle is horizontal.

Description and Notes

An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

AXJ Axial Joint
BD Bedding
BC Broken Core
CC Continuous Core
CL Closed
CO Contact
CU Curved
CT Coated
FLT Fault
FOL Foliation
FR Fracture
GO Gouge
IN Infilled
IR Irregular
JN Joint
KV Karstic Void
K Slickensided
LC Lost Core
MB Mechanical Break
PL Planar
PO Polished
RO Rough
SA Slightly Altered
SH Shear
SM Smooth
SR Slightly Rough
SY Stylolite
UN Undulating
VN Vein
VR Very Rough

ISRM Intact Rock Material Strength Classification

Grade	Description	Approx. Range of Uniaxial Compressive Strength (MPa)
R0	Extremely weak rock	0.25 – 1.0
R1	Very weak rock	1.0 – 5.0
R2	Weak rock	5.0 – 25
R3	Medium strong rock	25 – 50
R4	Strong rock	50 -100
R5	Very strong rock	100 -250
R6	Extremely strong rock	>250

RECORD OF BOREHOLE No 22-01

SHEET 1 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030649.6; E 318064.8 MTM NAD 83 ZONE 9 (LAT. 45.415665; LONG. -76.330521)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring
DATE June 27, 2022

ORIGINATED BY KG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
104.9	GROUND SURFACE				
0.0 / 104.6	(CL/ML) SILTY CLAY to CLAYEYS SILT (TOPSOIL) Grey-brown Moist	1	SS	3	
0.3	(CH) CLAY (WEATHERED CRUST) Very stiff Grey-brown w>PL	2	SS	10	
		3	SS	9	
		4	SS	6	0 0 41 59
		5	SS	4	
100.3				>96 >96	
4.6	(CI) SILTY CLAY Stiff to Firm Grey w>PL	6	SS	1	
		7	SS	WH	
		8	SS	WH	0 1 50 49
		9	SS	WH	
93.6		10	SS	WR	
11.3	(CL) Sandy CLAYEY SILT Firm Grey W>PL	11	SS	WH	1 29 47 23
92.1					
91.7	(SM) Gravelly SILTY SAND, some clay (TILL)	12	SS	50/0.15	
13.2	Grey Moist Marble (BEDROCK) Bedrock cored from depths 13.2 m to 17.1 m. For bedrock coring details refer to Record of Drillhole 22-01.	1	RC	REC 85%	RQD = 52%
		2	RC	REC 100%	RQD = 97%

GROUND WATER CONDITIONS

ELEVATION SCALE: 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94, 93, 92, 91, 90

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
25 50 75

UNIT WEIGHT γ kN/m³

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity
$\circ^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-01

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030649.6; E 318064.8 MTM NAD 83 ZONE 9 (LAT. 45.415665; LONG. -76.330521)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring
DATE June 27, 2022

ORIGINATED BY KG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
	Marble (BEDROCK) Bedrock cored from depths 13.2 m to 17.1 m. For bedrock coring details refer to Record of Drillhole 22-01.		2	RC	REC 100%						RQD = 97%
			3	RC	REC 100%		89				RQD = 98%
87.8							88				
17.1	END OF BOREHOLE NOTE: Date Depth (m) Elev. (m) 04-Oct-22 0.9 104.0 11-Oct-23 1.2 103.7 12-Dec-23 2.4 102.5										

+ 3, × 3: Numbers refer to Sensitivity
○ 3% STRAIN AT FAILURE

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PROJECT: 21480555

RECORD OF DRILLHOLE: 22-01

SHEET 1 OF 1

LOCATION: N 5030649.60 ;E 318064.78

DRILLING DATE: June 29, 2022

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850 Track Mount

DRILLING CONTRACTOR: CCC Geotechnical & Environmental Drilling Ltd.

NOTE:
For abbreviations, symbols and descriptions refer to
LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATH-ERING INDEX	Diametral Point Load Index (MPa)	FEATURES	PIEZOMETER
		Borehole continued from Record of Borehole 22-01		91.70															
		Weathered bedrock		13.20 91.19	1	Grey 100													
14		Marble Fresh Light grey Fine grained		13.71															UCS = 206.2 MPa
15					2	Grey 100													Bentonite
16					3	Grey 100													
17				87.82															
		END OF DRILLHOLE		17.08															
18																			
19																			
20																			
21																			
22																			
23																			

DEPTH SCALE
1 : 50

LOGGED: KG
CHECKED: KCP

GTA-RCK 046 S:\CLIENTS\MTO\HWY_17_417_ARNPRIOR\02_DATA\GINT\HWY_17_417_ARNPRIOR.GPJ GAL-MISS.GDT 6/4/24

RECORD OF BOREHOLE No 22-02

SHEET 1 OF 1 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030669.0; E 318085.3 MTM NAD 83 ZONE 9 (LAT. 45.415839; LONG. -76.330258)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 8, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
104.7	GROUND SURFACE										
0.0	(SM) SILTY SAND (TOPSOIL)										
0.2	Brown Moist		1	SS	7						
	(CH) CLAY, slightly fissured (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	7						
			3	SS	8						0 0 40 60
101.8			4	SS	6						
2.9	START OF DCPT										
94.3	END OF DCPT										
10.4	END OF BOREHOLE										

ELEVATION SCALE: 104, 103, 102, 101, 100, 99, 98, 97, 96, 95

$+^3$, $\times^3$: Numbers refer to Sensitivity
$\circ^{3\%}$ STRAIN AT FAILURE

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RECORD OF BOREHOLE No 22-03

SHEET 1 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030628.4; E 318084.5 MTM NAD 83 ZONE 9 (LAT. 45.415474; LONG. -76.330269)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 8, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS
106.7	GROUND SURFACE					
0.0 / 0.1	(SM) SILTY SAND, with rootlets (TOPSOIL) Brown Moist		1	SS	42	
	(GP-GM) GRAVEL and sand, asphalt fragments (FILL) Dense		2	SS	32	
105.3 / 1.4	Grey-brown-dark black Dry					
	(SM) SILTY SAND, fine to medium grained, trace clay (FILL)		3	SS	12	
104.6 / 2.1	Compact Grey-light brown Moist					
	(CH) CLAY, trace rootlets (WEATHERED CRUST)		4	SS	7	
103.8 / 2.9	Very stiff Grey-brown w>PL					
	START OF DCPT					

ELEVATION SCALE: 106, 105, 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94, 93, 92

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
25 50 75

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
49	40		(11)

Continued Next Page

$+^3, \times^3$: Numbers refer to Sensitivity
$\circ^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-03

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030628.4; E 318084.5 MTM NAD 83 ZONE 9 (LAT. 45.415474; LONG. -76.330269)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 8, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	25 50 75		
							91				
90.4											
16.3	END OF BOREHOLE DCPT Refusal at 16.3 m										

+³, ×³: Numbers refer to Sensitivity
○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-04

SHEET 1 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030646.3; E 318104.3 MTM NAD 83 ZONE 9 (LAT. 45.415634; LONG. -76.330016)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring
DATE June 29 & 30, 2022

ORIGINATED BY KG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
106.1	GROUND SURFACE							
0.0 / 105.5	(SM) SILTY SAND and gravel (TOPSOIL) Brown Moist		1	SS	24			
0.6 / 104.4	(SM) SILTY SAND (FILL) Compact Brown to grey-brown Moist		2	SS	23			0 79 (21)
1.7	(CH) CLAY, trace rootlets (WEATHERED CRUST) Very stiff Grey-brown w>PL		3	SS	4			
			4	SS	14			
			5	SS	9			0 1 38 61
			6	SS	5			
			7	SS	4			
99.4			8	SS	1			0 0 42 58
6.7	(CH) CLAY Stiff to firm Grey w>PL		9	TO	-			
			10	SS	WR			
95.4								
10.7	(CI) SILTY CLAY Firm Grey w>PL		11	TO	-			0 2 52 46
			12	SS	WH			
			13	SS	WR			0 4 55 41

ELEVATION SCALE: 106, 105, 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94, 93, 92

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa
○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × REMOULDED
20 40 60 80 100

>96+
>96+

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
25 50 75

Continued Next Page

+3, ×3: Numbers refer to Sensitivity
○3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-04

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030646.3; E 318104.3 MTM NAD 83 ZONE 9 (LAT. 45.415634; LONG. -76.330016)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring
DATE June 29 & 30, 2022

ORIGINATED BY KG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
90.4			14	SS	8		91				
15.7	(ML) gravelly sandy SILT to sandy SILT, some gravel, trace to some clay, contains cobbles (TILL) Dense Grey w>PL		15	SS	50/0.08		90				
89.3			16	SS	50/0.03						
16.8	Marble (BEDROCK) Bedrock cored from depths 16.8 m to 21.6 m. For bedrock coring details refer to Record of Drillhole 22-04. - No bedrock retrieved in core barrel in RC2 due to core barrel malfunction		1	RC	REC 72%		89				RQD = 0%
			2	RC	REC 0%		88				RQD = 0%
86.3			3	RC	REC 100%		87				RQD = 44%
19.8	Dolostone (BEDROCK)		4	RC	REC 97%		86				RQD = 60%
84.5							85				
21.6	END OF BOREHOLE										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

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PROJECT: 21480555

RECORD OF DRILLHOLE: 22-04

SHEET 1 OF 1

LOCATION: N 5030646.26 ;E 318104.25

DRILLING DATE: June 30, 2022

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850 Track Mount

DRILLING CONTRACTOR: CCC Geotechnical & Environmental Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATH-ERING INDEX	Diametral Point Load Index (MPa)	FEATURES	PIEZOMETER
		Borehole continued from Record of Borehole 22-04		89.32															
17		Marble, crystalline structure Light grey Fine grained - No bedrock retrieved in core barrel in Run No. 2 due to mechanical problem.		16.78	1														
18					2														
19					3														
				86.34															
20		Dolostone Fine grained Light grey		19.76	4														
21				84.53															
		END OF DRILLHOLE		21.57															
22																			
23																			
24																			
25																			
26																			

NOTE:
For abbreviations, symbols and descriptions refer to
LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATH-ERING INDEX: W1 W2 W3 W4 W5 W6

DEPTH SCALE

1 : 50

LOGGED: KG

CHECKED: KCP

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RECORD OF BOREHOLE No 22-05

SHEET 1 OF 1 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030718.7; E 318161.1 MTM NAD 83 ZONE 9 (LAT. 45.416285; LONG. -76.329288)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 7, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
105.4	GROUND SURFACE										
0.0 / 104.8	(SM) SILTY SAND, trace rootlets (TOPSOIL) Brown Moist		1	SS	5		105				
0.6	(CH) CLAY (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	9		104				
			3	SS	9		103				0 1 40 59
102.5			4	SS	4		102				
2.9	START OF DCPT						101				
							100				
							99				
							98				
							97				
							96				
94.9							95				
10.5	END OF BOREHOLE DCPT Refusal at 10.5 m										

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100
WATER CONTENT (%): 25 50 75

+³, ×³: Numbers refer to Sensitivity
○ 3% STRAIN AT FAILURE

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PROJECT 21480555

RECORD OF BOREHOLE No 22-06

SHEET 1 OF 2

METRIC

G.W.P. 4024-22-00 LOCATION N 5030751.7; E 318198.0 MTM NAD 83 ZONE 9 (LAT. 45.416581; LONG. -76.328815) ORIGINATED BY DG

DIST Eastern HWY 417 BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring COMPILED BY TR

DATUM Geodetic DATE July 6, 2022 CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS
105.7	GROUND SURFACE					
0.0 / 105.1	(ML) Sandy SILT (FILL) Loose Dark brown Moist		1	SS	5	
0.6	(CH) CLAY (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	10	
			3	SS	10	
			4	SS	6	
			5	SS	5	
			6	SS	3	
100.5			7	SS	1	
5.2	(CH) CLAY Firm to stiff Grey w>PL		8	TO	PH	
			9	TO	PH	
			10	TO	PH	
			11	TO	PH	
93.5						
12.2	(CI) SILTY CLAY Firm Grey w>PL		12	TO	PH	
			13	TO	PH	

ELEVATION SCALE: 105, 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94, 93, 92, 91

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 25 50 75

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	24	(76)	
0	0	40	60
0	0	38	62

Continued Next Page

+³, ×³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-06

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030751.7; E 318198.0 MTM NAD 83 ZONE 9 (LAT. 45.416581; LONG. -76.328815)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring
DATE July 6, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---							20 40 60 80 100	25 50 75		
	(CI) SILTY CLAY Firm Grey w>PL		14	SS	WH		90				0 17 50 33
88.9											
16.8	(SM) SILTY SAND (TILL) Grey Wet						89				
							88				
87.3			15	SS	50/0.15						
18.4	SANDSTONE (BEDROCK) Bedrock cored from depths 18.4 m to 21.4 m. For bedrock coring details refer to Record of Drillhole 22-06.		1	RC	REC 100%		87				RQD = 77%
			2	RC	REC 100%		86				RQD = 39%
84.3							85				
21.4	END OF BOREHOLE										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT: 21480555

RECORD OF DRILLHOLE: 22-06

SHEET 1 OF 1

LOCATION: N 5030751.70 ;E 318198.04

DRILLING DATE: July 6, 2022

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850 Track Mount

DRILLING CONTRACTOR: CCC Geotechnical & Environmental Drilling Ltd.

NOTE:
For abbreviations, symbols and descriptions refer to
LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE % (80 60 40 20)	RECOVERY SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER (5 10 15 20)	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATH-ERING INDEX (W1 W2 W3 W4 W5 W6)	Diametral Point Load Index (MPa) (2 4 6)	FEATURES	PIEZOMETER
		Borehole continued from Record of Borehole 22-06		87.26															
		Weathered SANDSTONE with crystline calcarenite-limestone interbeds		18.44	1														UCS = 26.0 MPa
19																			
20					2														
21				84.29															
		END OF DRILLHOLE		21.41															
22																			
23																			
24																			
25																			
26																			
27																			
28																			

DEPTH SCALE

1 : 50

LOGGED: DG

CHECKED: KCP

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PROJECT 21480555

RECORD OF BOREHOLE No 22-07

SHEET 1 OF 2

METRIC

G.W.P. 4024-22-00 LOCATION N 5030694.9; E 318182.5 MTM NAD 83 ZONE 9 (LAT. 45.416071; LONG. -76.329016) ORIGINATED BY KG

DIST Eastern HWY 417 BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring COMPILED BY TR

DATUM Geodetic DATE July 5, 2022 CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
106.3	GROUND SURFACE						106				
0.0	(SM/GM) Silty sand and gravel (TOPSOIL) Brown Dry		1	SS	41						
0.2	(SM/GM) Gravelly SILTY SAND (FILL) Dense to loose Brown		2	SS	8		105		○		30 45 (25)
104.9	Moist										
1.4	(CH) CLAY (WEATHERED CRUST) Very stiff to stiff Grey-brown w>PL		3	SS	18						
			4	SS	11		104				
			5	SS	7		103				
			6	SS	5				⊢○⊣		0 0 47 53
			7	SS	3		102				
							101	× + × +			
99.6			8	SS	1		100				
6.7	(CI) SILTY CLAY Firm Grey w>PL										
			9	TP	-		99	× + × +	⊢○⊣		0 1 49 50
							98	× + × +			
			10	TP	-		97				
							96	× + × +			
			11	TP	-						
94.5							95	× +			
11.8	Dolostone (BEDROCK) Bedrock cored from depths 11.8 m to 15.3 m. For bedrock coring details refer to Record of Drillhole 22-07.		1	RC	REC 100%		94				RQD = 71%
			2	RC	REC 100%		93				RQD = 89%
			3	RC	REC 100%		92				RQD = 49%

Continued Next Page

+ ³, × ³: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-07

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030694.9; E 318182.5 MTM NAD 83 ZONE 9 (LAT. 45.416071; LONG. -76.329016) ORIGINATED BY KG
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring COMPILED BY TR
DATE July 5, 2022 CHECKED BY KCP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	--- CONTINUED FROM PREVIOUS PAGE ---										
91.0			3	RC			91				RQD = 49%
15.3	END OF BOREHOLE										

+ 3, × 3: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT: 21480555

RECORD OF DRILLHOLE: 22-07

SHEET 1 OF 1

LOCATION: N 5030694.90 ;E 318182.47

DRILLING DATE: July 5, 2022

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850 Track Mount

DRILLING CONTRACTOR: CCC Geotechnical & Environmental Drilling Ltd.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE % (80 60 40 20)	RECOVERY: SOLID CORE % (80 60 40 20)	R.Q.D. % (80 60 40 20)	FRACT. INDEX PER (5 10 15 20)	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATHERING INDEX (W1 W2 W3 W4 W5 W6)	Diametral Point Load Index (MPa) (2 4 6)	FEATURES	PIEZOMETER
		Borehole continued from Record of Borehole 22-07		94.46															
12		Dolostone (BEDROCK) Finegrained Light grey		11.84	1														
13					2														UCS = 185.8 MPa
14					3														
15				90.96															
		END OF DRILLHOLE		15.34															
16																			
17																			
18																			
19																			
20																			
21																			

NOTE:
For abbreviations, symbols and descriptions refer to
LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

DEPTH SCALE

1 : 50

LOGGED: KG

CHECKED: KCP

GTA-RCK 046 S:\CLIENTS\MTO\HWY_17_417_ARNPRIOR\02_DATA\GINT\HWY_17_417_ARNPRIOR.GPJ GAL-MISS.GDT 6/4/24

RECORD OF BOREHOLE No 22-08

SHEET 1 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030734.8; E 318215.0 MTM NAD 83 ZONE 9 (LAT. 45.416429; LONG. -76.328599)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 7, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
105.8	GROUND SURFACE										
0.0	(SM) SILTY SAND, contains rootlets (TOPSOIL) Brown Moist		1	SS	6						
0.2	(CH) CLAY, mottled, trace rootlets (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	15						
			3	SS	13						
			4	SS	9						0 0 30 70
102.9											
2.9	START OF DCPT										

ELEVATION SCALE: 105, 104, 103, 102, 101, 100, 99, 98, 97, 96, 95, 94, 93, 92, 91

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

WATER CONTENT (%): 25 50 75

Continued Next Page

+^{3}, ×^{3}: Numbers refer to Sensitivity ○$^{3\%}$ STRAIN AT FAILURE

RECORD OF BOREHOLE No 22-08

SHEET 2 OF 2 **METRIC**

PROJECT 21480555
G.W.P. 4024-22-00
DIST Eastern HWY 417
DATUM Geodetic

LOCATION N 5030734.8; E 318215.0 MTM NAD 83 ZONE 9 (LAT. 45.416429; LONG. -76.328599)
BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem)
DATE July 7, 2022

ORIGINATED BY DG
COMPILED BY TR
CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	--- CONTINUED FROM PREVIOUS PAGE ---										
90.0											
15.8	END OF BOREHOLE DCPT refusal at 15.8 m						90				

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\circ^{3\%}$ STRAIN AT FAILURE

PROJECT 21480555

RECORD OF BOREHOLE No SWMP1

SHEET 1 OF 1

METRIC

G.W.P. 4024-22-00 LOCATION N 5030544.4; E 317965.7 MTM NAD 83 ZONE 9 (LAT. 45.414721; LONG. -76.331789) ORIGINATED BY DG

DIST Eastern HWY 417 BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem) COMPILED BY TR

DATUM Geodetic DATE July 11, 2022 CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (25 50 75)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
104.4	GROUND SURFACE										
0.0	(SM) SILTY SAND (TOPSOIL)										
0.2	Brown Moist		1	SS	10		104				
	(CH) CLAY (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	14		103				0 1 28 71
			3	SS	8		102				
			4	SS	5		101				
100.0			5	SS	4		100				
4.4	(CH) CLAY Stiff to firm Grey w>PL		6	SS	2		99				
			7	SS	WH		98				
			8	SS	WH		97				0 1 48 51
96.2											
8.2	END OF BOREHOLE										

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

PROJECT 21480555

RECORD OF BOREHOLE No SWMP2

SHEET 1 OF 1

METRIC

G.W.P. 4024-22-00 LOCATION N 5030562.4; E 317992.2 MTM NAD 83 ZONE 9 (LAT. 45.414882; LONG. -76.331451) ORIGINATED BY DG

DIST Eastern HWY 417 BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem) COMPILED BY TR

DATUM Geodetic DATE July 11, 2022 CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
103.8	GROUND SURFACE										
0.0	(SM) SILTY SAND, contains rootlets (TOPSOIL) Brown Moist		1	SS	7						
0.2	(CH) CLAY, mottled, trace rootlets (WEATHERED CRUST) Very stiff Grey-brown w>PL		2	SS	1		103				
			3	SS	7		102				
			4	SS	3		101				0 0 36 64
			5	SS	2		100				
99.2											
4.6	(CH) CLAY Stiff to firm Grey w>PL		6	SS	WH		99				
			7	SS	WH		98				0 0 49 51
			8	SS	WH		97				
95.0							96				
8.8	End of Borehole						95				

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

PROJECT CA0012298.4565

RECORD OF BOREHOLE No 23-03

SHEET 1 OF 1

METRIC

G.W.P. 4024-22-00 LOCATION N 5030591.3; E 317977.7 MTM NAD 83 ZONE 9 (LAT. 45.415130; LONG. -76.331630) ORIGINATED BY JS

DIST Eastern HWY 417 BOREHOLE TYPE Power Auger, 200 mm Dia. (Hollow Stem), NQ Coring COMPILED BY IS

DATUM Geodetic DATE October 16, 2023 CHECKED BY KCP

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
104.0	GROUND SURFACE						
0.0	TOPSOIL						
0.2	(CH) CLAY, trace sand, fissured (WEATHERED CRUST) Very Stiff Brownish grey, mottled w>PL		1	SS	5		
			2	SS	10		103
			3	SS	8		102
			4	SS	6		
			5	SS	4		101
100.0							
4.0	(CI) SILTY CLAY, trace sand Stiff to firm Grey w>PL		6	SS	1		100
			7	SS	1		99
	- Sand seams from 7.2 m to 9.0 m		8	SS	4		98
95.0							97
9.0	(CL-ML/ML) CLAYEY SILT-SILT to SILT of slight plasticity, some sand, some gravel (TILL) Grey w=PL		9	SS	56/0.25		96
94.6							95
9.4	Marble (BEDROCK) Bedrock cored from depths 9.4 m to 11.2 m. For bedrock coring details refer to Record of Drillhole BH23-03.		1	RC	REC 98%		94
			2	RC	REC 100%		93
92.8							
11.2	END OF BOREHOLE NOTE: Date Depth (m) Elev. (m) 19-Oct-23 0.8 103.2 12-Dec-23 5.2 98.8						

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × REMOULDED; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 25 50 75

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

RQD = 79%

RQD = 76%

$+^3$, $\times^3$: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

GTA-MTO 001 S:\CLIENTS\MTO\HWY_17_417_ARNPRIOR\02_DATA\GINT\HWY_17_417_ARNPRIOR.GPJ GAL-GTA.GDT 6/4/24

PROJECT: CA0012298.4565

RECORD OF DRILLHOLE: 23-03

SHEET 1 OF 1

LOCATION: N 5030591.33 ;E 317977.66

DRILLING DATE: October 16, 2023

DATUM: Geodetic

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: CME 850

DRILLING CONTRACTOR: MARATHON

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	Jcon	WEATH-ERING INDEX	Diametral Point Load Index (MPa)	FEATURES	PIEZOMETER
		Borehole continued from Record of Borehole 23-03		94.57															
10	Rotary Drill NQ Core	Fresh, slightly weathered, bedded, noduler, grey to white, fine to medium grained, slightly to moderately porous, medium strong MARBLE		9.42	1														
11					2														
				92.76															
		END OF DRILLHOLE		11.23															

NOTE:
For abbreviations, symbols and descriptions refer to
LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

RECOVERY: TOTAL CORE % (80 60 40 20); SOLID CORE % (80 60 40 20)
R.Q.D. % (80 60 40 20)
FRACT. INDEX PER (5 10 15 20)
DISCONTINUITY DATA: DIP w.r.t. CORE AXIS (0 30 60 90)
WEATH-ERING INDEX (W1 W2 W3 W4 W5 W6)
Diametral Point Load Index (MPa) (2 4 6)

DEPTH SCALE
1 : 50

LOGGED: CR

CHECKED:

GTA-RCK 046 S:\CLIENTS\MTO\HWY_17_417_ARNPRIOR\02_DATA\GINT\HWY_17_417_ARNPRIOR.GPJ GAL-MISS.GDT 6/4/24

BH 22-01 (Dry)

Core Box 1 to 2 of 2

Note:
1. Elevation 91.2 m to 87.8 m - Marble Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A1**

BH 22-01 (Wet)

Core Box 1 to 2 of 2

Note:
1. Elevation 91.2 m to 87.8 m - Marble Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A2**

BH 22-04 (Dry)

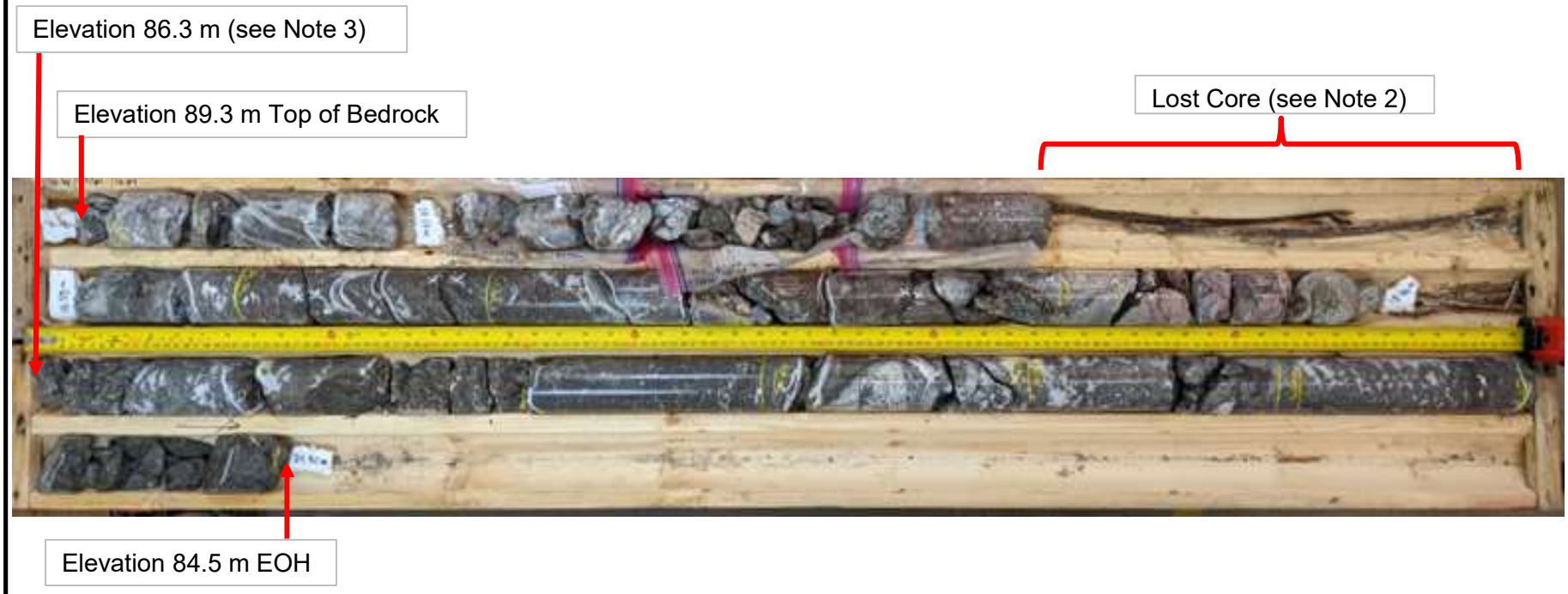
Core Box 1 to 2 of 2

Note:
1. Elevation 89.3 m to 86.3 m - Marble Bedrock
2. Lost core due to mechanical malfunction between Elevation 88.6 m and 87.5 m (Run no. 2)
3. Elevation 86.3 m to 84.5 m - Dolostone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A3**

BH 22-04 (Wet)

Core Box 1 to 2 of 2



Note:
1. Elevation 89.3 m to 86.3 m - Marble Bedrock
2. Lost core due to mechanical malfunction between Elevation 88.6 m and 87.5 m (Run no. 2)
3. Elevation 86.3 m to 84.5 m - Dolostone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A4**

BH 22-06 (Dry)

Core Box 1 of 1

Elevation 87.3 m Top of Bedrock

Elevation 84.3 m EOH

Note:
1. Elevation 87.3 m to 84.3 m - Sandstone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A5**

BH 22-06 (Wet)

Core Box 1 of 1

Elevation 87.3 m Top of Bedrock

Elevation 84.3 m EOH

Note:
1. Elevation 87.3 m to 84.3 m - Sandstone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A6**

BH 22-07 (Dry)

Core Box 1 to 2 of 2

Elevation 94.5 m Top of Bedrock

Elevation 91.0 m EOH

Note:
1. Elevation 94.5 m to 91.0 m - Dolostone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A7**

BH 22-07 (Wet)

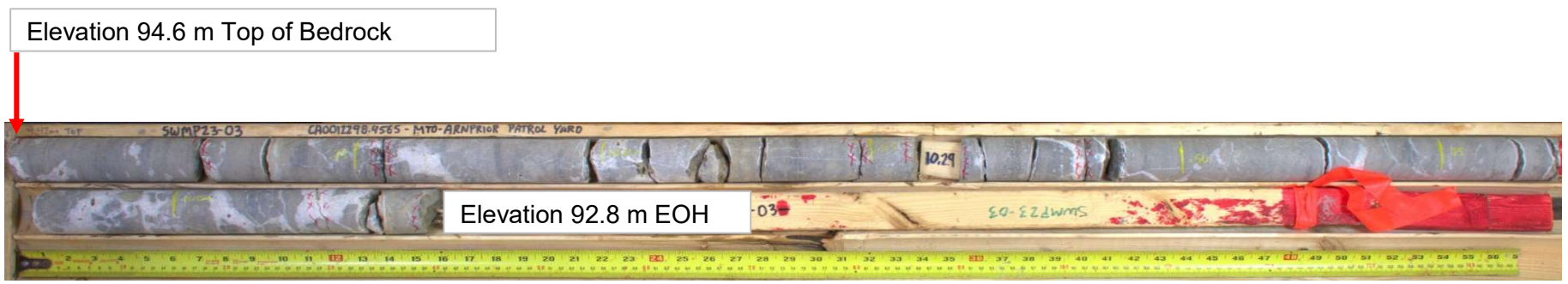
Core Box 1 to 2 of 2

Note:
1. Elevation 94.5 m to 91.0 m - Dolostone Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. 21480555-2000 Drawn: BW Date: 2022-07-12 Checked: KCP Review: JPD	**Figure A8**

BH 23-03 (Dry)

Core Box 1 to 1



Note:
1. Elevation 94.6 m to 92.8 m - Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. CA0012298.4565 Drawn: BW Date: 2023-12-15 Checked: KCP Review: JPD	**Figure A9**

BH 23-03 (Wet)

Core Box 1 to 1

Elevation 94.6 m Top of Bedrock

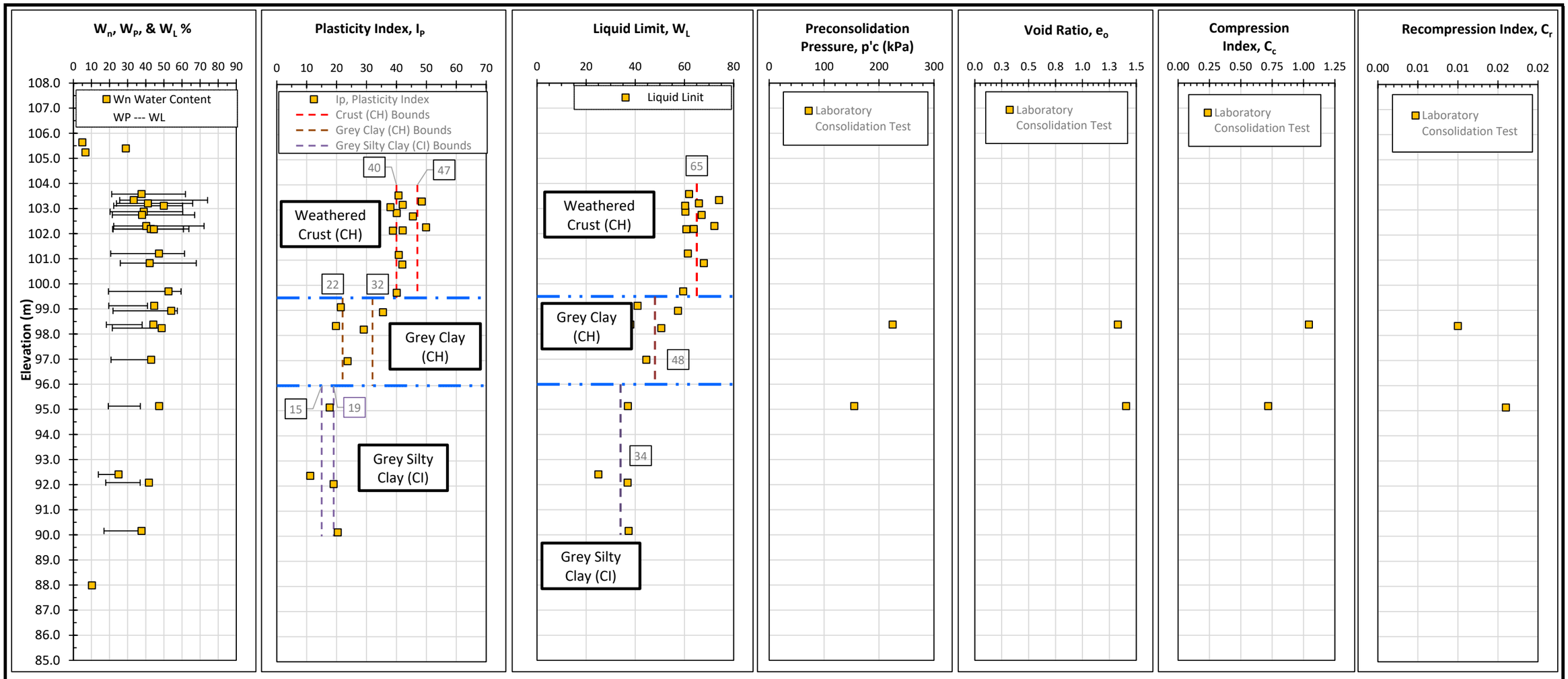
Elevation 92.8 m EOH

Note:
1. Elevation 94.6 m to 92.8 m - Bedrock

wsp	**Foundation Investigation and Design** **Proposed Arnprior Maintenance Patrol Yard** **Location 12 - Highway 417 & OR 29, Arnprior, Ontario**	Project No. CA0012298.4565 Drawn: BW Date: 2024-01-16 Checked: KCP Review: JPD	**Figure A10**

APPENDIX B

Geotechnical Laboratory Test Results



Foundation Investigation and Design

Arnprior Maintenance Patrol Yard
Location 12- Highway 417 and Ottawa Road 29, Arnprior, Ontario

Engineering Properties from Laboratory Testing

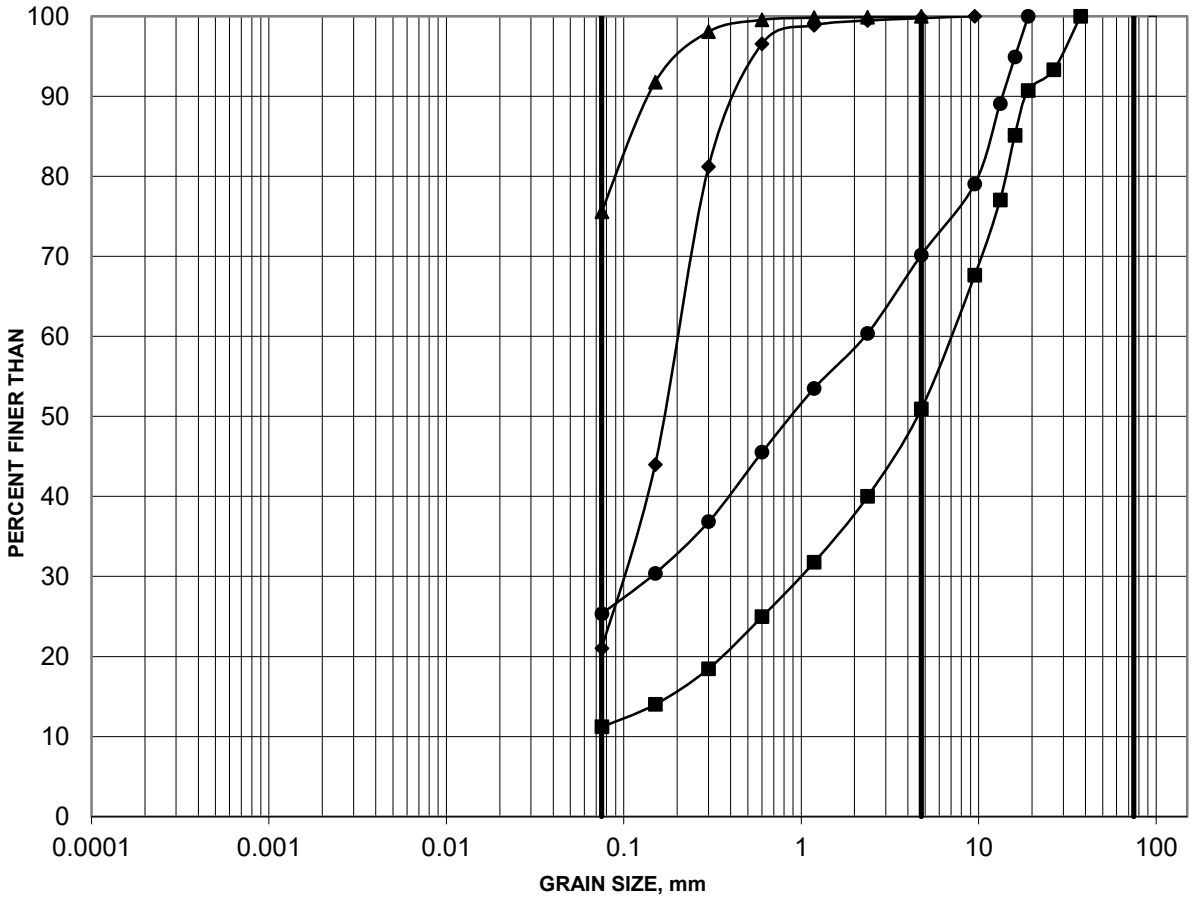
Project No.:	21480555 - 12298.4565
Date:	January 2, 2024
Drawn:	KCP
Review:	JPD

Figure B1

GRAIN SIZE DISTRIBUTION

FIGURE B2

(ML to GP-GM) Sandy SILT to GRAVEL and sand (FILL)



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

	Borehole	Sample	Depth (m)	Constituents (%) Gravel	Sand	Silt	Clay
■	22-03	2	0.76-1.37	49	40	11	
◆	22-04	2	0.76-1.37	0	79	21	
▲	22-06	1	0.00-0.61	0	24	76	
●	22-07	2	0.76-1.37	30	45	25	

Project: 21480555/2000

GOLDER
MEMBER OF WSP

Created by: MI
Checked by: JB

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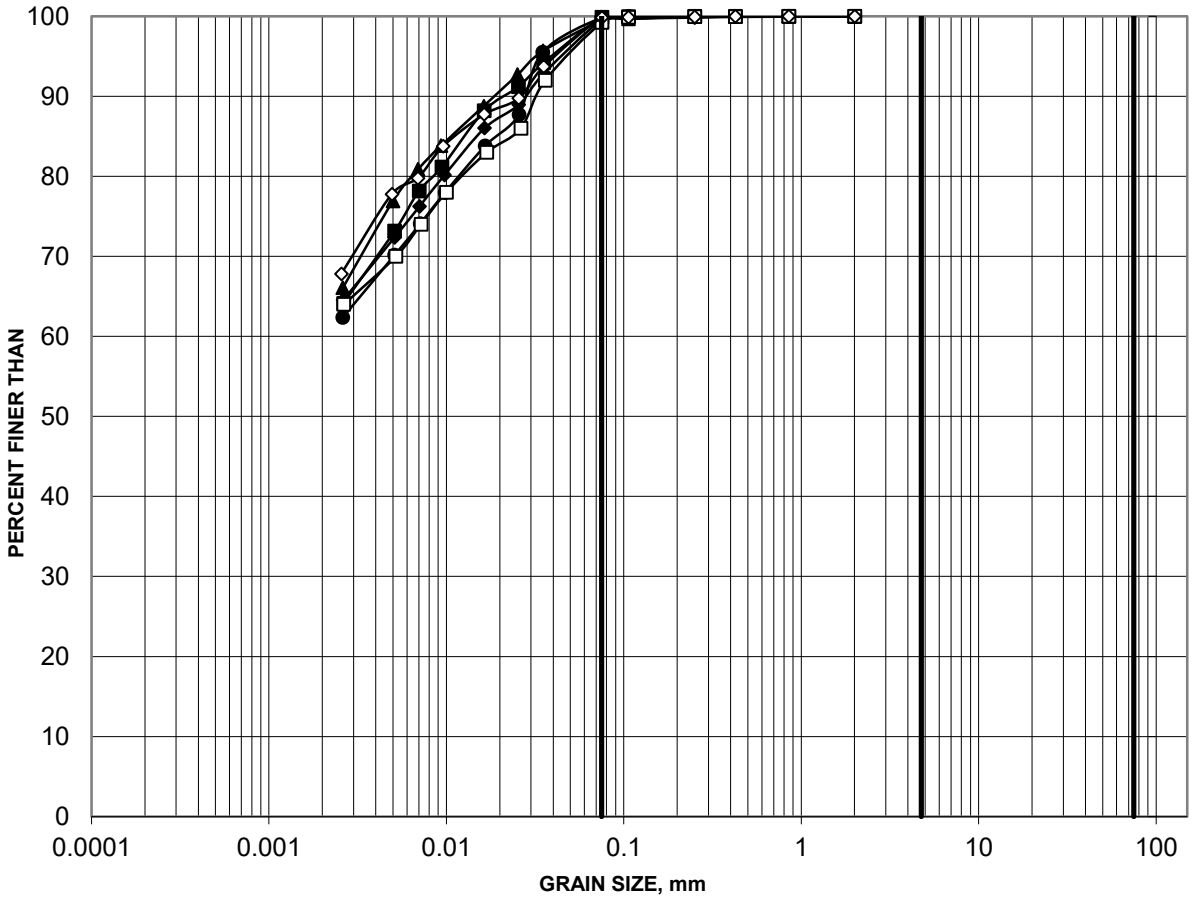
GRAIN SIZE DISTRIBUTION

FIGURE B3

(CH) CLAY - Weathered Crust



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

	Borehole	Sample	Depth (m)	Constituents (%) Gravel	Sand	Silt	Clay
■	22-01	4	2.29-2.90	0	0	41	59
◆	22-02	3	1.52-2.13	0	0	40	60
▲	22-04	5	3.05-3.66	0	1	38	61
●	22-04	8	6.10-6.71	0	0	42	58
□	22-05	3	1.52-2.13	0	1	40	59
◇	22-06	4	2.29-2.90	0	0	40	60

Project: 21480555/2000

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Checked by: JB

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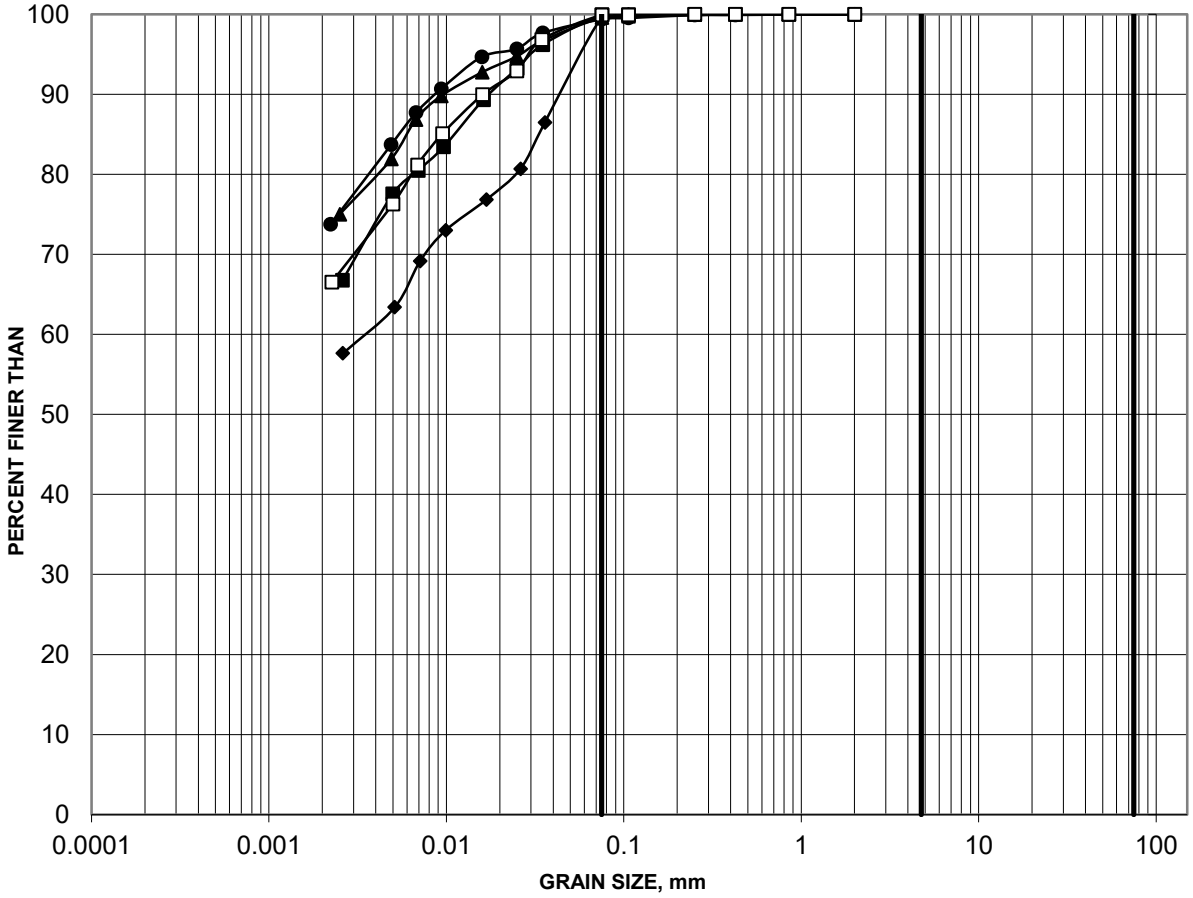
GRAIN SIZE DISTRIBUTION

FIGURE B4

(CH) CLAY - Weathered Crust



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

	Borehole	Sample	Depth (m)	Constituents (%) Gravel	Sand	Silt	Clay
■	22-06	7	4.57-5.18	0	0	38	62
◆	22-07	6	3.81-4.42	0	0	47	53
▲	22-08	4	2.29-2.90	0	0	30	70
●	SWMP1	2	0.76-1.37	0	1	28	71
□	SWMP2	4	2.29-2.90	0	0	36	64

Project: 21480555/2000

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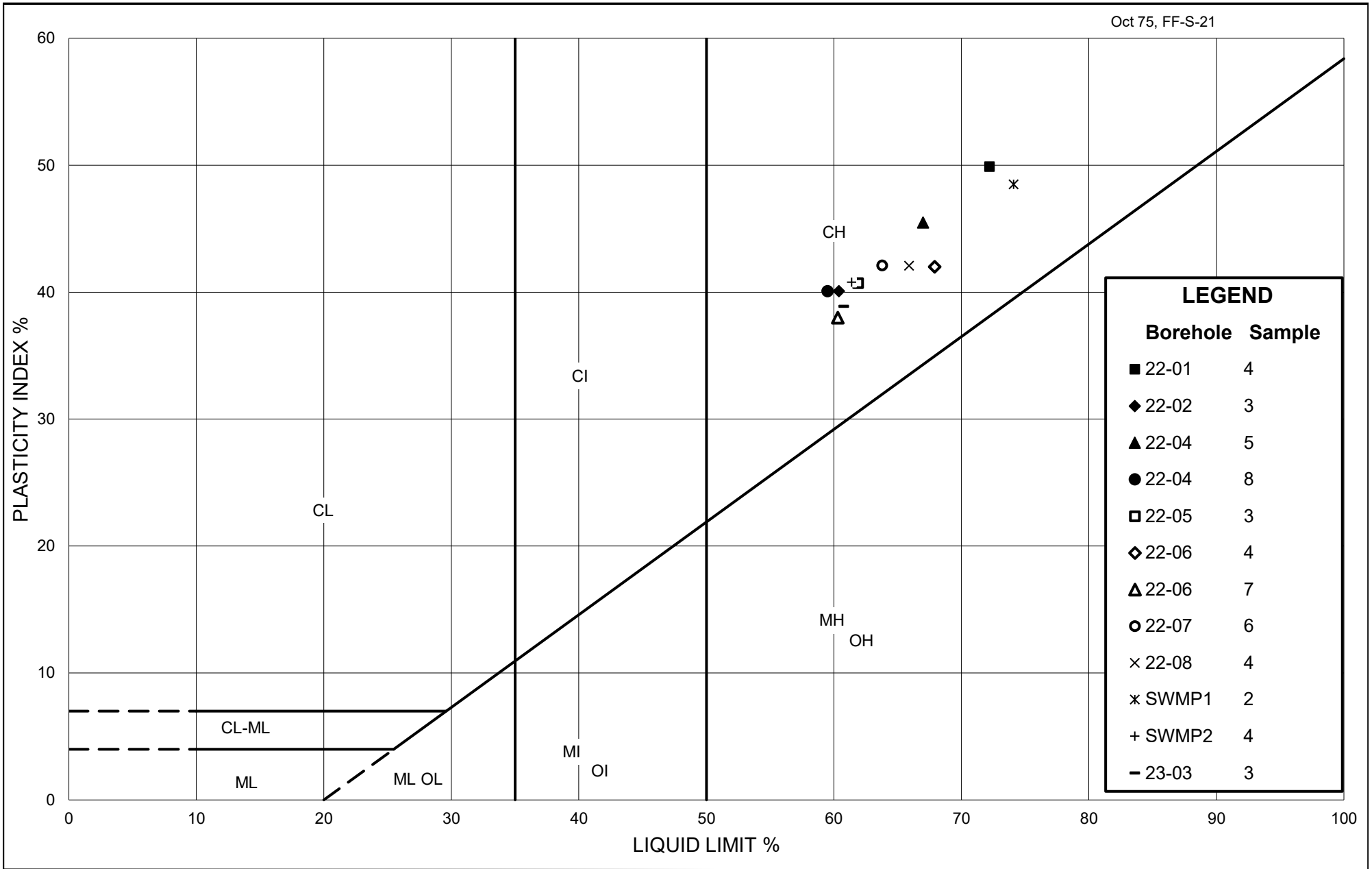
MEMBER OF WSP

Created by: MI
Checked by: JB

https://golderassociates.sharepoint.com/sites/35409g/Shared Documents/Active/2021/21480555/Figures/



Ministry of Transportation
Ontario

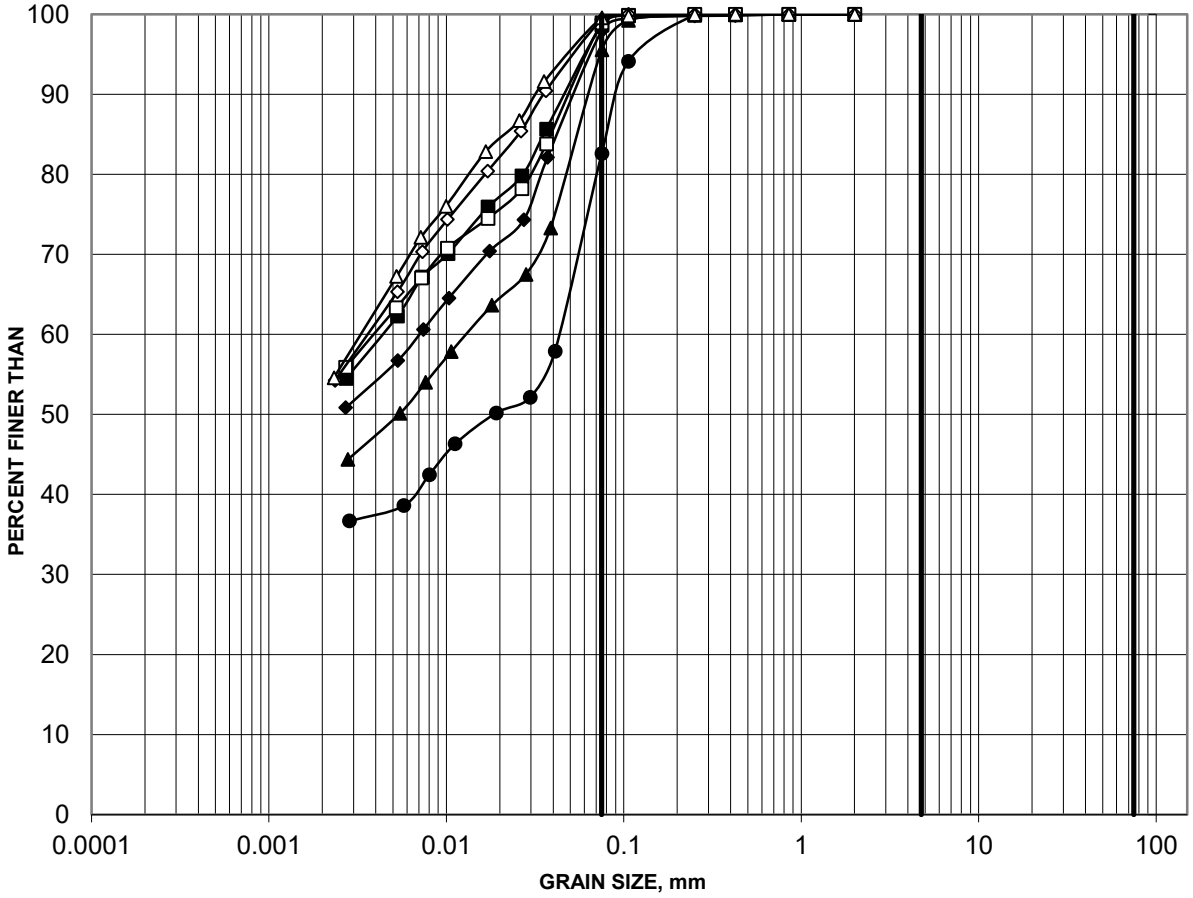
PLASTICITY CHART
WEATHERED CLAY CRUST

Figure:	B5
Project:	21480555/2000 / 12298.4565
Created By:	MI / KCP Checked By: JB / MI

GRAIN SIZE DISTRIBUTION

FIGURE B6

(Cl to CH) SILTY CLAY TO CLAY



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

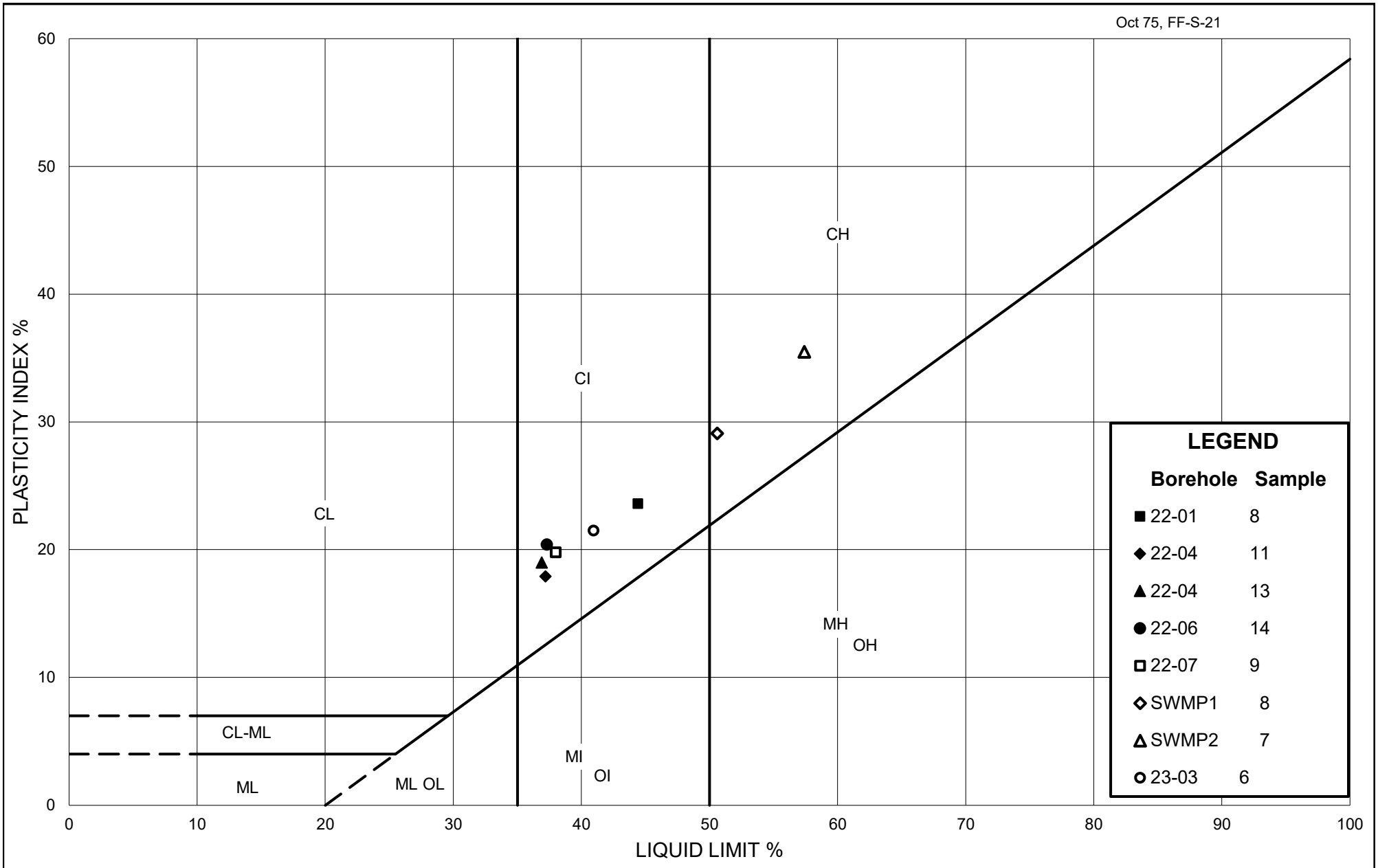
	Borehole	Sample	Depth (m)	Constituents (%) Gravel	Sand	Silt	Clay
■	22-01	8	7.62-8.23	0	1	50	49
◆	22-04	11	10.67-11.28	0	2	52	46
▲	22-04	13	13.72-14.33	0	4	55	41
●	22-06	14	15.24-15.85	0	17	50	33
□	22-07	9	7.62-8.23	0	1	49	50
◇	SWMP1	8	6.86-7.47	0	1	48	51
△	SWMP2	7	4.57-5.18	0	0	49	51

Project: 21480555/2000

GOLDER
MEMBER OF WSP

Created by: MI
Checked by: JB

https://golderassociates.sharepoint.com/sites/35409g/Shared Documents/Active/2021/21480555/Figures/



Ministry of Transportation
Ontario

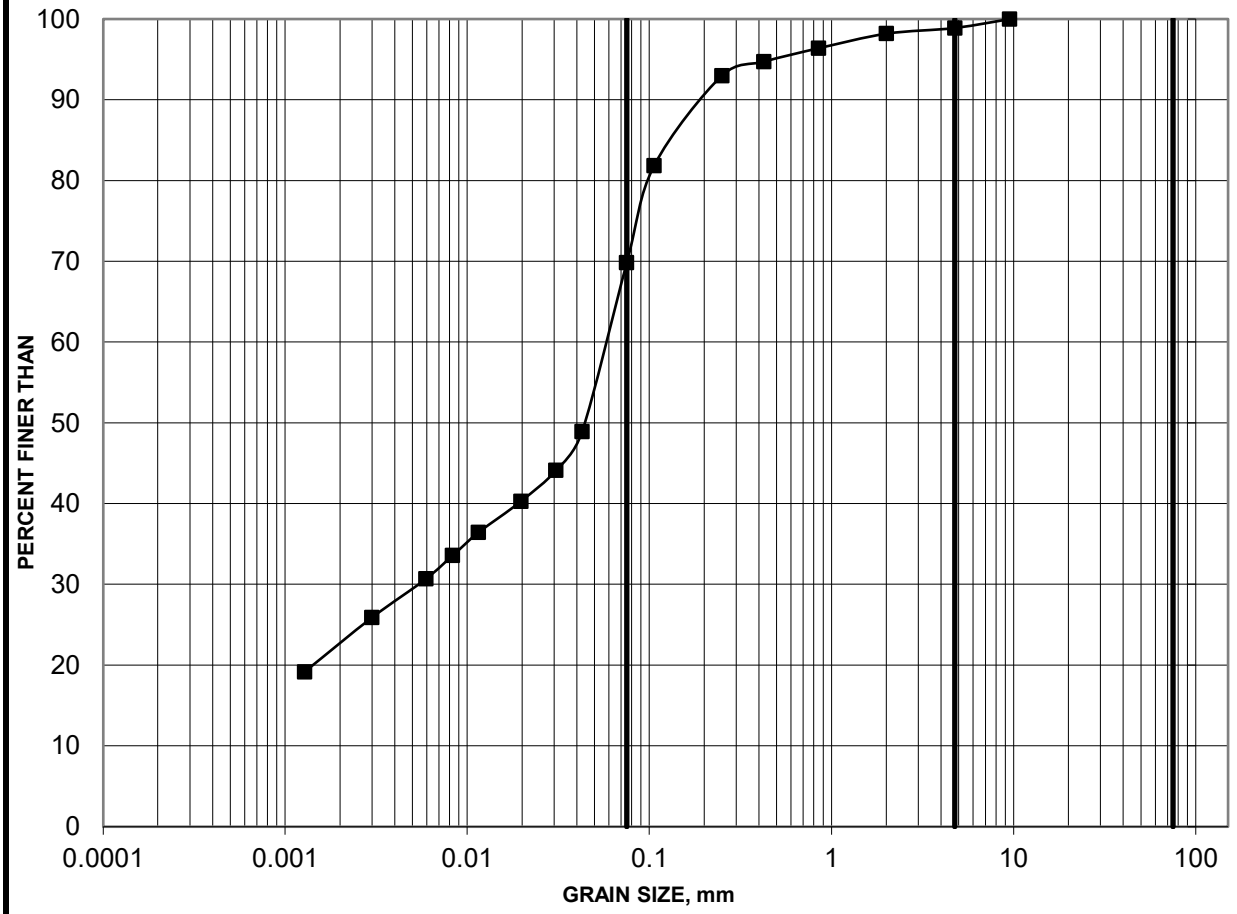
PLASTICITY CHART
SILTY CLAY TO CLAY

Figure:	B7
Project:	21480555/2000 / 12298.4565
Created By:	MI / KCP Checked By: JB / MI

GRAIN SIZE DISTRIBUTION

FIGURE B9

(CL) CLAYEY SILT



SILT AND CLAY	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
	SAND SIZE			GRAVEL SIZE		

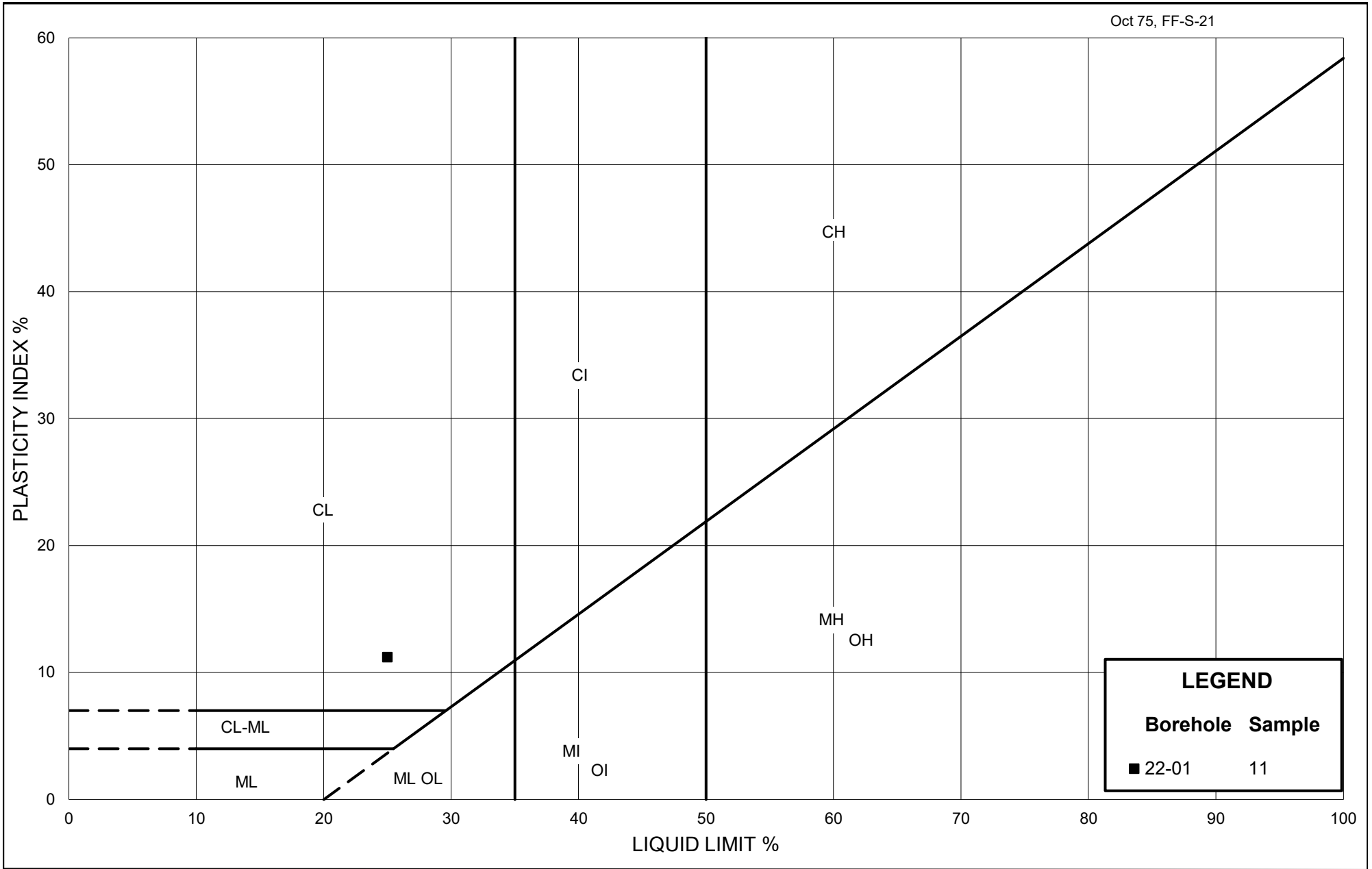
	Borehole	Sample	Depth (m)	Constituents (%) Gravel	Sand	Silt	Clay
■	21-01	11	12.19-12.80	1	29	47	23

Project: 21480555/2000

GOLDER
MEMBER OF WSP

Created by: MI

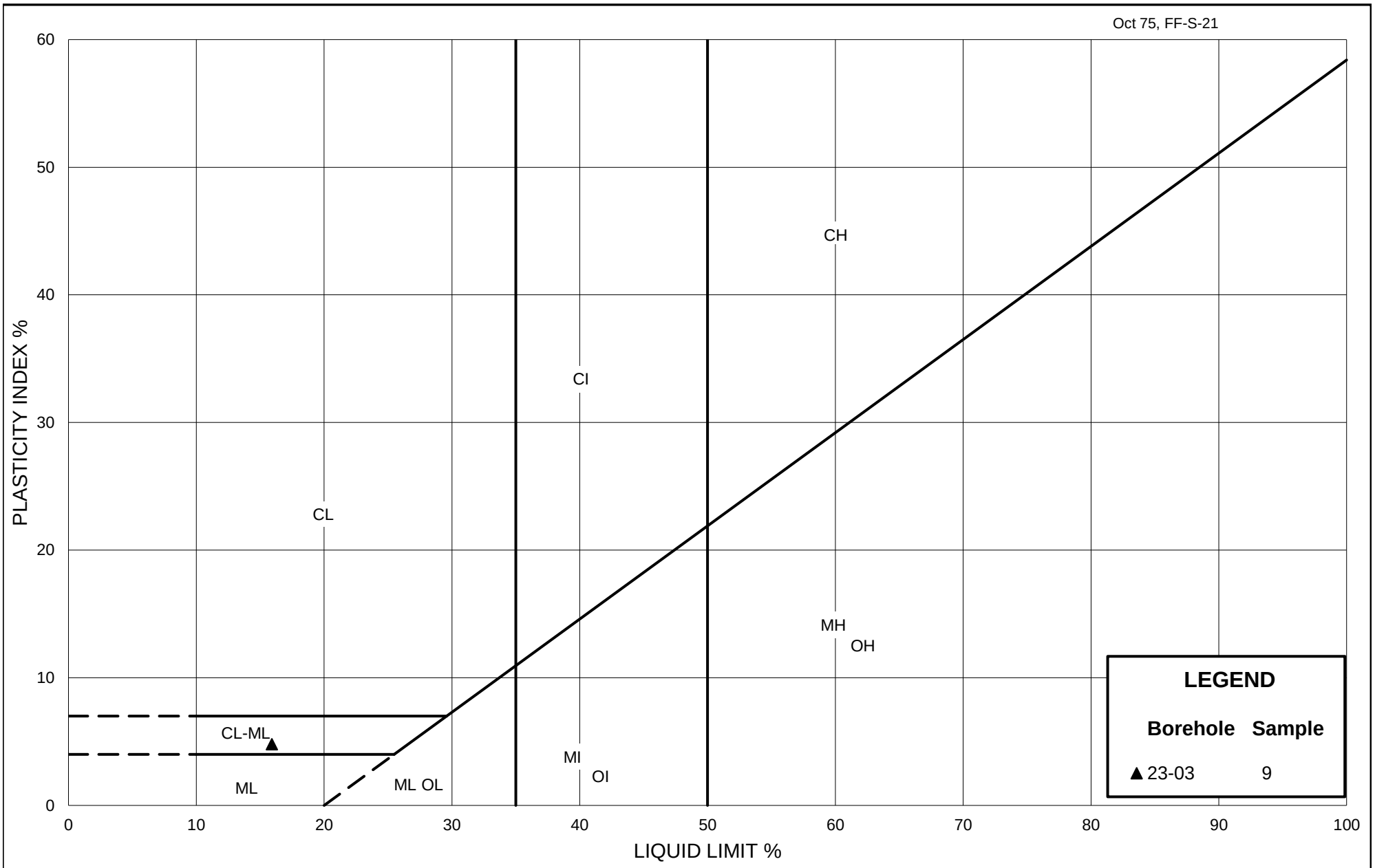
Checked by: JB



Ministry of Transportation
Ontario

PLASTICITY CHART
(CL) CLAYEY SILT

Figure:	B9
Project:	21480555/2000
Created By: MI	Checked By: JB



Ministry of Transportation

Ontario

PLASTICITY CHART

(CL-ML / ML) Clayey-Silt-Silt to Silt of Slight Plasticity

Figure:	B10
Project:	CA0012298.4565
Created By: KCP	Checked By: MI

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

August 4, 2022
File: 121623407

Attention: Kenton Power, P.Eng., MASc
Wsp GOLDER
1931 Robertson Road
Ottawa, Ontario, Canada, K2H 5B7
Tel: 1-613-592-9600
E-mail: kpower@golder.com

Dear Mr. Power,

Reference: Consolidation Test Results: Arnprior MPY, Golder, Member of WSP, File # 21480555-2000

This letter presents the results of one-dimensional consolidation test carried out on two shelby tubes samples in accordance with ASTM D2435/D2435M – 11(2020). The test results are provided in the attached tables and figures.

Summary of samples tested

Sample ID	Depth (ft)	Date sampled
BH 22-04 ST-11	35-37	June 29, 2022
BH 22-07 ST-09	25-27	July 5, 2022

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

Stantec Consulting Ltd.

Ramin Ghassemi Ph.D., P.Eng.
Geotechnical Engineer
Direct: 613 722-4420
Mobile: 437 775-7625
Ramin.ghassemi@stantec.com

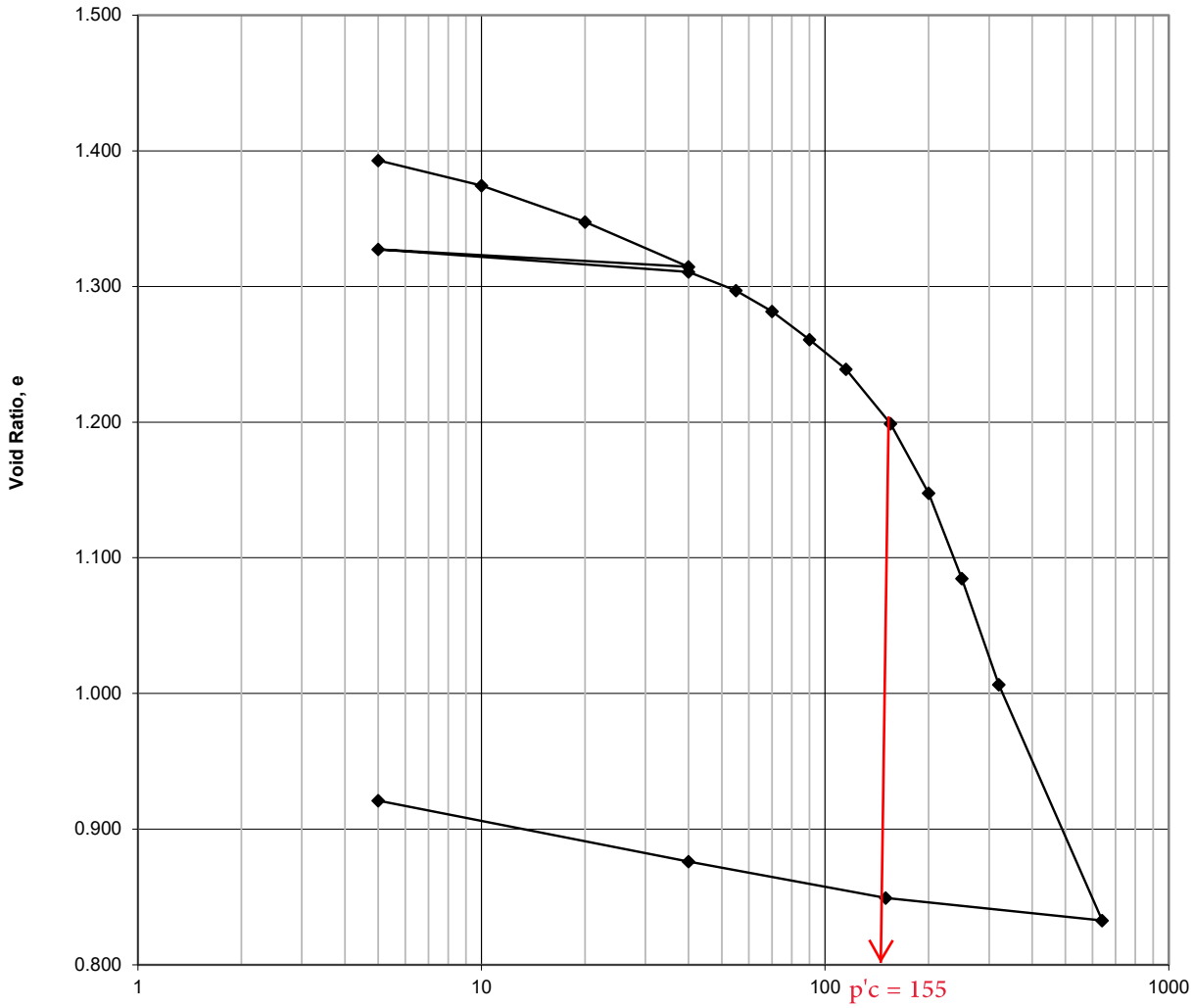
v:\01216\active\laboratory_standing_offers\2022-laboratory standing offers\121623407 golder associates\soils\2 consols, 5 mc,, 7 hydros, limits, 2 sg, 3 ucs, file#21480555-2000\121623407_let_consolidation_bh 22-04 st 11 & 22-07 st 9.docx

Stantec

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D2435/D2435M - 11(2020)

Project	**wsp Golder, File# 21480555-2000**
Project No.	**121623407**
Borehole No.	**BH-04**
Sample No.	**ST 11**
Sample Depth	**35-37 ft**



Stantec

Stantec Consulting Ltd.

August 4, 2022 Date: D. Boateng

August 4, 2022 Date: R. Ghassemi

Checked by:

Approved by:

One-Dimensional Consolidation Test using Incremental Loading

ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	wsp Golder, File# 21480555-2000
Project Location	Arnprior, ON
Borehole	BH-04
Sample No.	ST 11
Depth	35-37 ft
Sample Date	June 29, 2022
Test Number	One
Technician Name	Daniel Boateng

Soil Description & Classification

Lean clay, grey, wet-CI		
Specific Gravity of Solids		2.758
Liquid Limit	%	37.2
Plastic Limit	%	19.3
Plasticity Index	%	17.9
Average water content of trimmings	%	47.37

Additional Notes (information source, occurence and size of large isolated particles etc.)

1. Sample flows with minimal disturbance (extremely sensitive) 2. Consolidation specimen taken @ 36'6"- 36'7"
3. Loading schedule was provided by the Client

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm^2	1963
Volume	mm^3	39270
Mass	g	67.73
Dry Mass	g	45.01
Density	Mg/m^3	1.725
Dry Density	Mg/m^3	1.146
Water Content	%	50.48
Degree of Saturation	%	99.0
Height of Solids	mm	8.31
Initial Void Ratio		1.406

Final Specimen Conditions

Water Content	%	35.30
Final Void Ratio		0.921
Final Height	mm	15.97

Stantec

Stantec Consulting Ltd.

Filename: V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers\121623
Date: August 4, 2022
Checked by: D. Boateng Date: August 4, 2022
Approved by: R. Ghassemi Date: August 4, 2022

One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	wsp Golder, File# 21480555-2000
Project Location	Arnprior, ON
Borehole	BH-04
Sample No.	ST 11
Depth	35-37 ft
Sample Date	June 29, 2022
Test Number	One
Technician Name	Daniel Boateng

Test Procedure

Date Started		July 26, 2022
Date Finished		July 27, 2022
Machine Number		Frame C
Cell Number		C
Ring Number		C
Trimming Procedure		Trimming turntable/Cutting ring
Moisture Condition		Inundated
Axial Stress at Inundation	kPa	5
Water Used		Deaired tap water
Test Method		B
Interpretation Procedure for c_v		2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ε_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.406
1	30.0	5	0.1007	19.8993	0.55	1.393
2	33.3	10	0.2439	19.7561	1.32	1.374
3	40.0	20	0.4535	19.5465	2.44	1.348
4	45.0	40	0.7071	19.2929	3.81	1.315
5	30.0	5	0.6543	19.3457	3.28	1.327
6	30.0	40	0.7781	19.2219	3.97	1.311
7	45.0	55	0.8743	19.1257	4.54	1.297
8	55.3	70	1.0007	18.9993	5.18	1.282
9	68.5	90	1.1544	18.8456	6.04	1.261
10	67.0	115	1.3294	18.6706	6.95	1.239
11	97.5	155	1.6123	18.3877	8.62	1.199
12	151.8	200	2.0187	17.9813	10.75	1.148
13	171.0	250	2.5978	17.4022	13.37	1.085
14	206.5	320	3.1447	16.8553	16.61	1.007
15	133.0	640	4.4535	15.5465	23.84	0.833
16	30.0	150	4.6267	15.3733	23.14	0.849
17	45.3	40	4.4052	15.5948	22.03	0.876
18	91.0	5	4.0449	15.9551	20.17	0.921

Stantec

Stantec Consulting Ltd.

Filename: V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers
Date: August 4, 2022
Checked by: D. Boateng Date: August 4, 2022
Approved by: R. Ghassemi Date: August 4, 2022

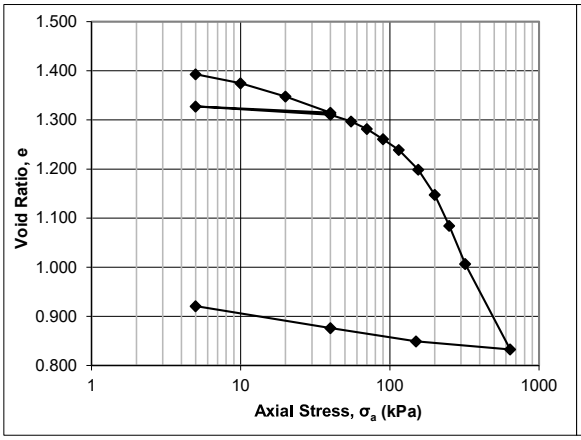
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

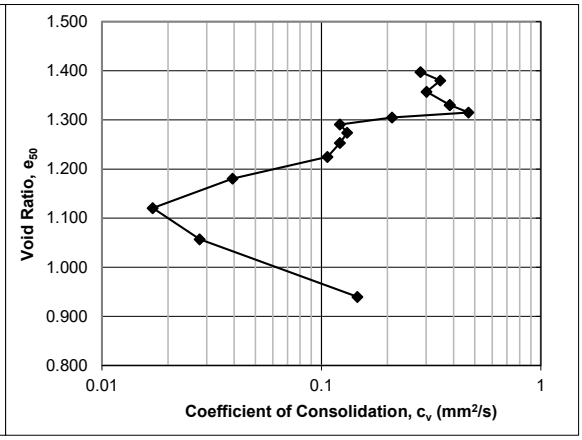
Specimen Details

Job Ref.	wsp Golder, File# 21480555-2000
Job Location	Arnprior, ON
Borehole	BH-04
Sample No.	ST 11
Depth	35-37 ft
Sample Date	June 29, 2022
Test Number	One
Technician Name	Daniel Boateng

Calculations

		Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
Load Increment	Axial Stress $\sigma_{a,\ average}$ kPa	Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\varepsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm^2/s	Time t_{90} sec	Coeff. Consol. c_v mm^2/s
Seating	0								
1	3	0.0737	19.9263	0.37	1.397			297	2.83E-01
2	8	0.2163	19.7837	1.08	1.380			238	3.49E-01
3	15	0.4058	19.5942	2.03	1.357			270	3.01E-01
4	30	0.6323	19.3677	3.16	1.330			207	3.84E-01
5	23	0.6802	19.3198	3.40	1.324			680	1.16E-01
6	23	0.7556	19.2444	3.78	1.315				
7	48	0.8403	19.1597	4.20	1.305			370	2.10E-01
8	63	0.9583	19.0417	4.79	1.291			633	1.21E-01
9	80	1.0990	18.9010	5.50	1.274			578	1.31E-01
10	103	1.2742	18.7258	6.37	1.253			612	1.21E-01
11	135	1.5085	18.4915	7.54	1.225			680	1.07E-01
12	178	1.8756	18.1244	9.38	1.181			1766	3.94E-02
13	225	2.3739	17.6261	11.87	1.121			3867	1.70E-02
14	285	2.9033	17.0967	14.52	1.057			2223	2.79E-02
15	480	3.8778	16.1222	19.39	0.940			378	1.46E-01
16	395	4.6626	15.3374	23.31	0.845				
17	95	4.5023	15.4977	22.51	0.865				
18	23	4.2186	15.7814	21.09	0.899				





Stantec	Project No.: 121623407 Project Name: wsp Golder, File# 21480555-2000	Photo Log

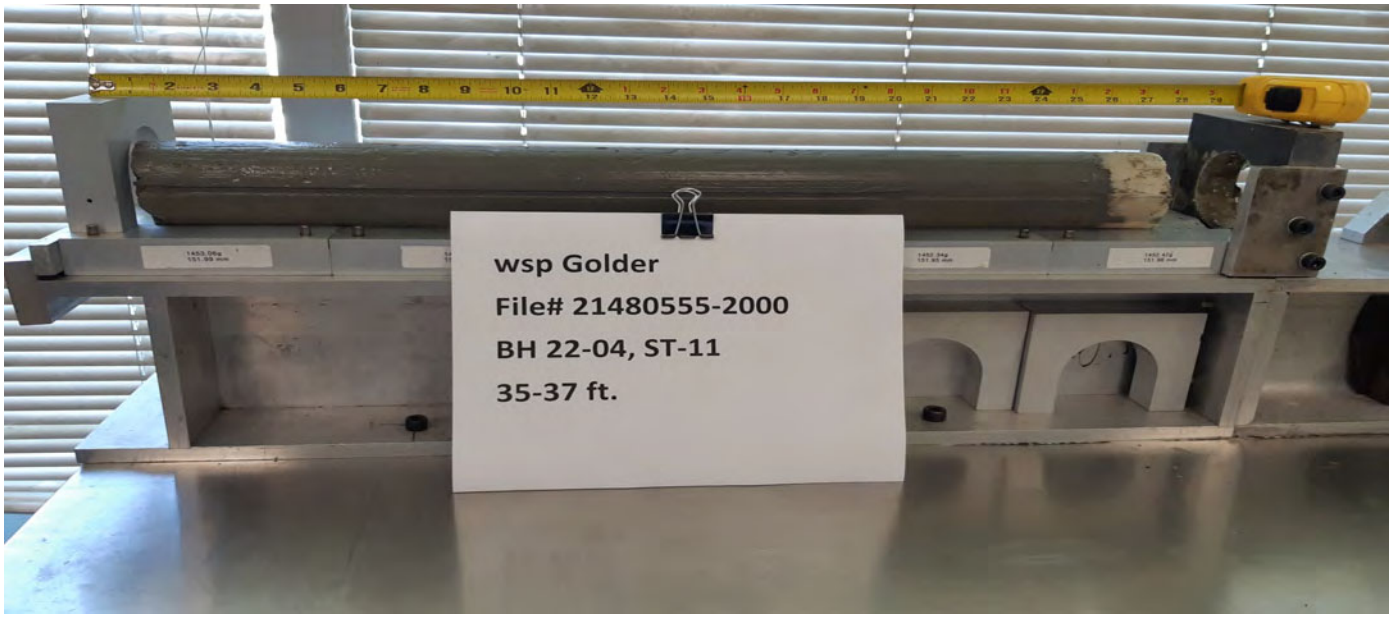


Photo No.: 1	Borehole: BH 22-04 ST-11	Depth: 35 – 37 ft

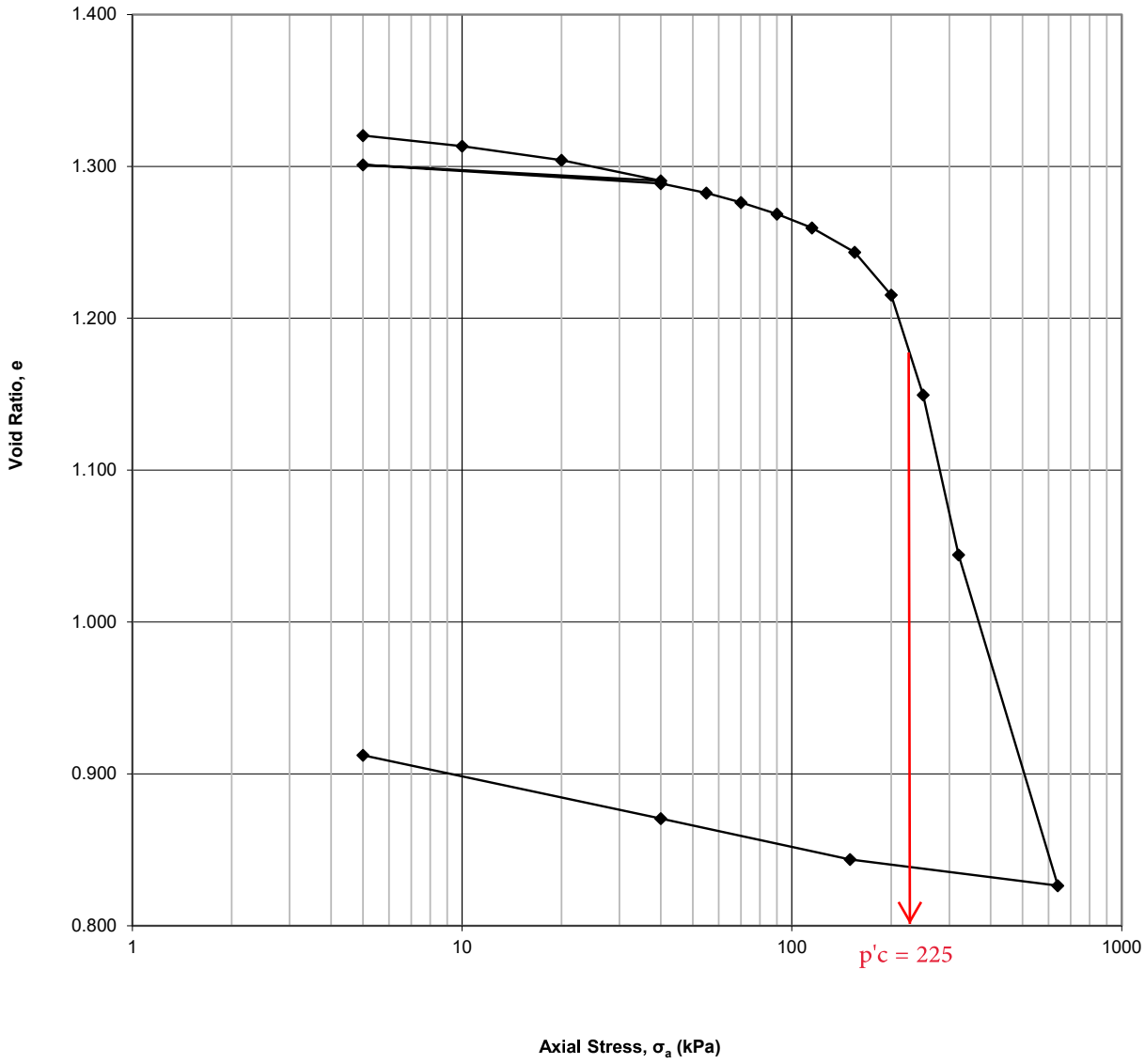
Photo No.: 2	Borehole: BH 22-04 ST-11	Depth: 35 – 37 ft

Stantec

One-Dimensional Consolidation Properties of Soils Using Incremental Loading

ASTM D2435/D2435M - 11(2020)

Project	**wsp Golder, File# 21480555-2000**
Project No.	**121623407**
Borehole No.	**BH-07**
Sample No.	**ST 9**
Sample Depth	**25-27 ft**



Stantec

Stantec Consulting Ltd.

August 4, 2022 August 4, 2022

Date: Date:

D. Boateng R. Ghassemi

Checked by: Approved by:

One-Dimensional Consolidation Test using Incremental Loading

ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	wsp Golder, File# 21480555-2000
Project Location	Arnprior, ON
Borehole	BH-07
Sample No.	ST 9
Depth	25-27 ft
Sample Date	July 5, 2022
Test Number	Two
Technician Name	Daniel Boateng

Soil Description & Classification

Lean clay, brown/grey, friable, very moist-CI		
Specific Gravity of Solids		2.747
Liquid Limit	%	38.0
Plastic Limit	%	18.2
Plasticity Index	%	19.8
Average water content of trimmings	%	44.20
Additional Notes (information source, occurence and size of large isolated particles etc.)		
1. Sample flows with some disturbance (sensitive) 2. Consolidation specimen taken @ 25'6"- 25'7"		
3. Loading schedule was provided by the Client		

Initial Specimen Conditions

Height	mm	20.00
Diameter	mm	50.00
Area	mm^2	1963
Volume	mm^3	39270
Mass	g	68.45
Dry Mass	g	46.32
Density	Mg/m^3	1.743
Dry Density	Mg/m^3	1.180
Water Content	%	47.78
Degree of Saturation	%	98.8
Height of Solids	mm	8.59
Initial Void Ratio		1.329

Final Specimen Conditions

Water Content	%	34.84
Final Void Ratio		0.912
Final Height	mm	16.42

Stantec

Stantec Consulting Ltd.

Filename: V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers\121623
Date: August 4, 2022
Checked by: D. Boateng Date: August 4, 2022
Approved by: R. Ghassemi Date: August 4, 2022

One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Project Name	wsp Golder, File# 21480555-2000
Project Location	Arnprior, ON
Borehole	BH-07
Sample No.	ST 9
Depth	25-27 ft
Sample Date	July 5, 2022
Test Number	Two
Technician Name	Daniel Boateng

Test Procedure

Date Started		July 26, 2022
Date Finished		July 27, 2022
Machine Number		Frame D
Cell Number		D
Ring Number		D
Trimming Procedure		Trimming turntable/Cutting ring
Moisture Condition		Inundated
Axial Stress at Inundation	kPa	5
Water Used		Deaired tap water
Test Method		B
Interpretation Procedure for c_v		2

All Departures from Outlined ASTM D2435/D2435M-11 (2020) Procedure

Calculations

Load Increment	Increment Duration min	Axial Stress σ_a kPa	Corrected Deformation ΔH mm	Specimen Height H mm	Axial Strain ε_a %	Void Ratio e
Seating	0.0	0	0.0000	20.0000	0.00	1.329
1	30.0	5	0.0642	19.9358	0.37	1.320
2	30.0	10	0.1233	19.8767	0.67	1.313
3	30.0	20	0.2018	19.7982	1.06	1.304
4	30.0	40	0.3163	19.6837	1.65	1.291
5	30.0	5	0.2390	19.7610	1.20	1.301
6	30.0	40	0.3365	19.6635	1.72	1.289
7	30.0	55	0.3873	19.6127	1.99	1.283
8	30.0	70	0.4417	19.5583	2.26	1.276
9	33.3	90	0.4972	19.5028	2.59	1.269
10	36.8	115	0.5763	19.4237	2.98	1.260
11	48.5	155	0.6877	19.3123	3.67	1.243
12	97.3	200	0.8731	19.1269	4.87	1.215
13	226.3	250	1.3439	18.6561	7.70	1.149
14	250.0	320	2.3042	17.6958	12.22	1.044
15	142.8	640	3.9133	16.0867	21.58	0.826
16	30.0	150	4.1651	15.8349	20.84	0.844
17	43.3	40	3.9366	16.0634	19.68	0.871
18	76.5	5	3.5865	16.4135	17.89	0.912

Stantec

Stantec Consulting Ltd.

Filename: V:\01216\active\laboratory_standing_offers\2022-Laboratory Standing Offers
Date: August 4, 2022
Checked by: D. Boateng
Date: August 4, 2022
Approved by: R. Ghassemi
Date: August 4, 2022

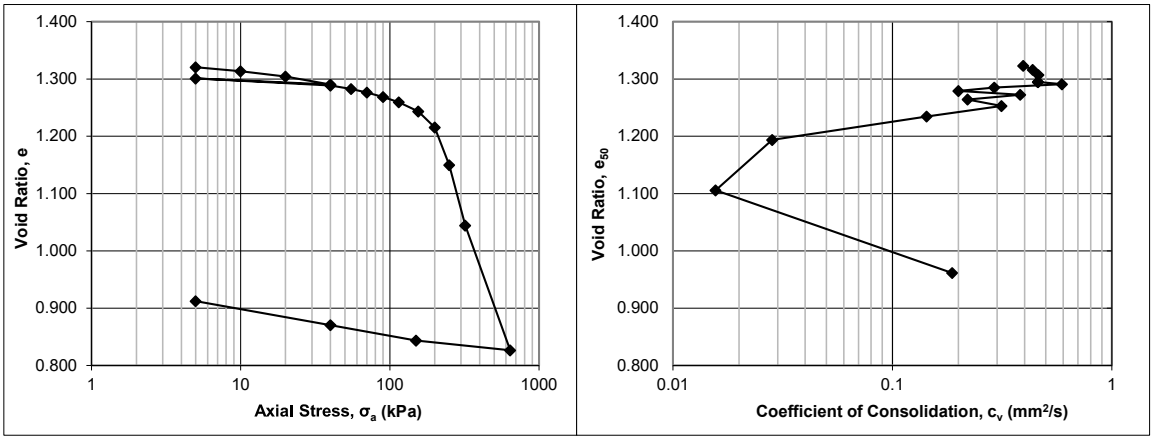
One-Dimensional Consolidation Test using Incremental Loading
ASTM D2435/D2435M - 11(2020)

Specimen Details

Job Ref.	wsp Golder, File# 21480555-2000
Job Location	Arnprior, ON
Borehole	BH-07
Sample No.	ST 9
Depth	25-27 ft
Sample Date	July 5, 2022
Test Number	Two
Technician Name	Daniel Boateng

Calculations

		Calculated using Interpretation Procedure 2				Interpretation Procedure 1		Interpretation Procedure 2	
Load Increment	Axial Stress $\sigma_{a,\ average}$ kPa	Corrected Deformation ΔH_{50} mm	Specimen Height H_{50} mm	Axial Strain $\varepsilon_{a,50}$ %	Void Ratio e_{50}	Time t_{50} sec	Coeff. Consol. c_v mm^2/s	Time t_{90} sec	Coeff. Consol. c_v mm^2/s
Seating	0								
1	3	0.0520	19.9480	0.26	1.323			214	3.94E-01
2	8	0.1111	19.8889	0.56	1.316			192	4.36E-01
3	15	0.1872	19.8128	0.94	1.307			180	4.63E-01
4	30	0.2948	19.7052	1.47	1.295			178	4.61E-01
5	23	0.2555	19.7445	1.28	1.299				
6	23	0.3277	19.6723	1.64	1.291			138	5.93E-01
7	48	0.3757	19.6243	1.88	1.285			280	2.91E-01
8	63	0.4274	19.5726	2.14	1.279			407	2.00E-01
9	80	0.4825	19.5175	2.41	1.273			211	3.83E-01
10	103	0.5562	19.4438	2.78	1.264			364	2.20E-01
11	135	0.6539	19.3461	3.27	1.253			252	3.14E-01
12	178	0.8102	19.1898	4.05	1.235			545	1.43E-01
13	225	1.1609	18.8391	5.80	1.194			2655	2.83E-02
14	285	1.9177	18.0823	9.59	1.106			4431	1.56E-02
15	480	3.1558	16.8442	15.78	0.961			321	1.87E-01
16	395	4.2038	15.7962	21.02	0.839				
17	95	4.0372	15.9628	20.19	0.859				
18	23	3.7542	16.2458	18.77	0.892				



Stantec	Project No.: 121623407 Project Name: wsp Golder, File# 21480555-2000	Photo Log

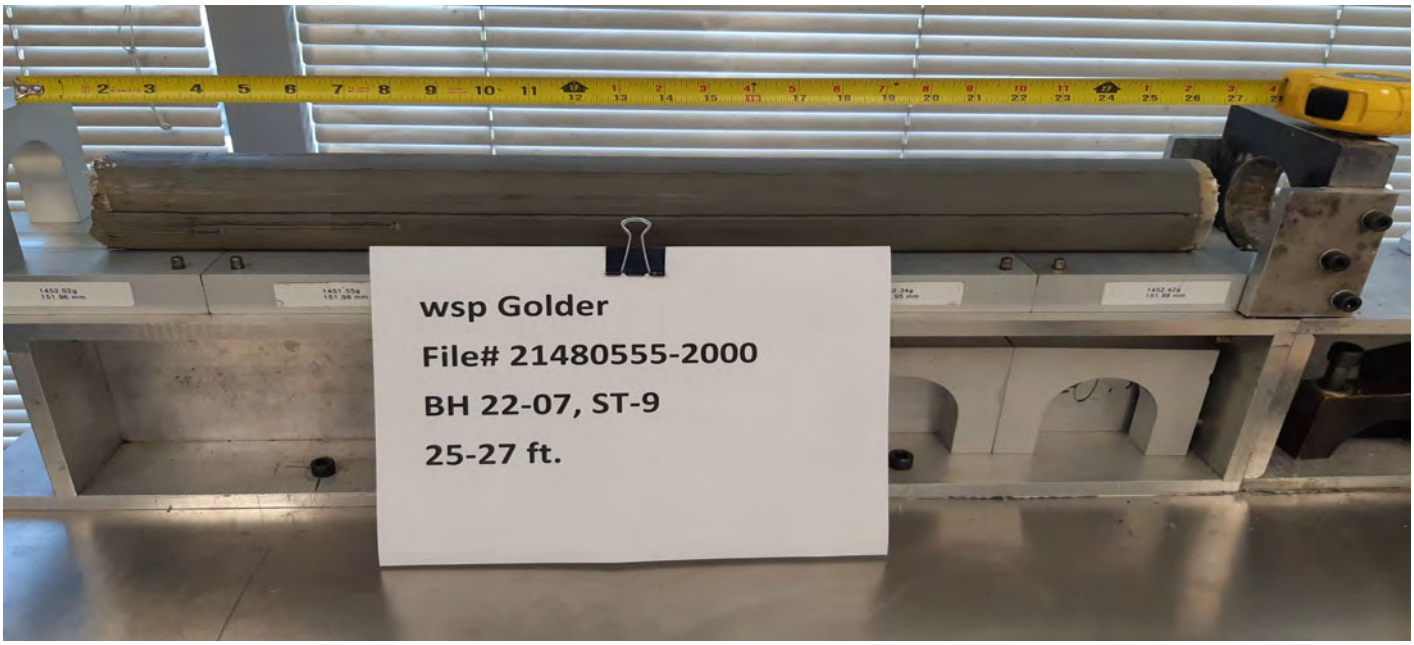


Photo No.: 1	Borehole: BH 22-07 ST-9	Depth: 25 – 27 ft

Photo No.: 2	Borehole: BH 22-07 ST-9	Depth: 25 – 27 ft

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

August 9, 2022
File: 121623407

Client: WSP-Golder, File #21480555-2000

Reference: ASTM D7012, Method C, Unconfined Compressive Strength of Intact Rock Core, Arnprior MPY Project

The following table summarizes unconfined compressive strength results for three intact rock cores.

Location	Sample Depth (m)	Compressive Strength (MPa)	Description of Break
BH 22-07	12.40 - 13.25	185.8	Well-formed cone
BH 22-06	18.87 - 19.80	26.0	Well-formed cone
BH 22-01	13.91 - 14.28	206.2	End to end fracture

Sincerely,

Stantec Consulting Ltd.

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

APPENDIX C

Results of Chemical Analysis

Eurofins Environmental Testing Report Number 1987297 & 1982044

Certificate of Analysis

Client: Golder Associates Ltd (Ottawa)
1931 Robertson Road,
Ottawa, Ontario
K2H 5B7
Attention: Mr. Kenton Power
PO#:
Invoice to: Golder Associates Ltd

Report Number: 1982044
Date Submitted: 2022-07-20
Date Reported: 2022-07-27
Project: 21480555
COC #: 893738

Dear Kenton Power:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Sarah Horner, Inorganics Technician

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

eurofins | Environment Testing

Client: Golder Associates Ltd (Ottawa)
1931 Robertson Road,
Ottawa, Ontario
K2H 5B7
Attention: Mr. Kenton Power
PO#:
Invoice to: Golder Associates Ltd

Report Number: 1982044
Date Submitted: 2022-07-20
Date Reported: 2022-07-27
Project: 21480555
COC #: 893738

				Lab I.D.	1639006	1639007
				Sample Matrix	Soil	Soil
				Sample Type		
				Sampling Date	2022-07-05	2022-07-06
				Sample I.D.	22-07 Sa 7 / 15-17'	22-06 Sa 5 / 10-12'
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
Anions	Cl	0.002	%		0.003	0.003
	SO4	0.01	%		0.04	0.06
General Chemistry	Electrical Conductivity	0.05	mS/cm		0.17	0.13
	pH	2.00			8.14	8.29
	Resistivity	1	ohm-cm		5880	7690

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

eurofins | Environment Testing

Client: Golder Associates Ltd (Ottawa)
1931 Robertson Road,
Ottawa, Ontario
K2H 5B7
Attention: Mr. Kenton Power
PO#:
Invoice to: Golder Associates Ltd

Report Number: 1982044
Date Submitted: 2022-07-20
Date Reported: 2022-07-27
Project: 21480555
COC #: 893738

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 426257 **Analysis/Extraction Date** 2022-07-26 **Analyst** IP **Method** AG SOIL			
SO4	<0.01 %	97	70-130
Run No 426367 **Analysis/Extraction Date** 2022-07-27 **Analyst** AsA **Method** C CSA A23.2-4B			
Chloride	<0.002 %		90-110
Run No 426369 **Analysis/Extraction Date** 2022-07-27 **Analyst** IP **Method** Cond-Soil			
Electrical Conductivity	<0.05 mS/cm	100	90-110
pH	6.14	101	90-110
Resistivity			

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: Golder Associates Ltd (Ottawa)
1931 Robertson Road,
Ottawa, Ontario
.
Attention: Mr. Kenton Power
PO#:
Invoice to: Golder Associates Ltd

Report Number: 1987297
Date Submitted: 2022-10-04
Date Reported: 2022-10-12
Project:
COC #: 900931

Dear Kenton Power:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Emma-Dawn Ferguson, Chemist

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: https://directory.cala.ca/.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

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				Lab I.D.	1654424
				Sample Matrix	Water
				Sample Type	
				Sampling Date	2022-10-04
				Sample I.D.	BH22-01
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	Cl	1	mg/L		13
	SO4	1	mg/L		62
General Chemistry	Conductivity	5	uS/cm		425
	pH	1.00			8.26
	Resistivity	0.2	Mohm-cm		<0.2

Guideline = *** = Guideline Exceedence**

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Project:
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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 430930 **Analysis/Extraction Date** 2022-10-06 **Analyst** AaN **Method** SM 4110			
Chloride	<1 mg/L	100	90-110
SO4	<1 mg/L	100	90-110
Run No 430996 **Analysis/Extraction Date** 2022-06-10 **Analyst** ACG **Method** SM2320,2510,4500H/F			
Conductivity	<5 uS/cm	101	90-110
pH		100	90-110
Run No 431191 **Analysis/Extraction Date** 2022-10-12 **Analyst** AET **Method** Resistivity - water			
Resistivity			

Guideline = *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

APPENDIX D

Site Photographs

Photograph 1: Looking northwest from the proposed Vehicle Maintenance Building area across the site towards Highway 417 / OR29 Interchange; July 17, 2022

Photograph 2: Looking southwest across the site towards the location of the proposed Vehicle Maintenance Building; July 17, 2022

Photograph 3: Looking southwest across from the location of the proposed Vehicle Maintenance Building towards OR29, Borehole 23-03 and the proposed location of the SWMP; August 17, 2023

Photograph 4: Looking southwest along Upper Dwyer Hill Road; July 17, 2022

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