FINAL

Foundation Investigation Report

Bovaird Drive Culvert Extension, Brampton, Ontario
Highway 413 Project, Ministry of Transportation, Ontario
GWP 2034-24-00

Submitted to:

Ministry of Transportation Ontario
159 Sir William Hearst Avenue
Toronto, ON M3M 0B6

Submitted by:

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14M-00321-01-Culvert-Extension-FIR-Rev2

May 8, 2026

GEOCRES No.: 30M12-556

Lat. 43.664659°
Long. -79.831903°

Distribution List

1 e-Copy - Ministry of Transportation, Central Region

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1.0 INTRODUCTION

WSP Canada Inc. (WSP) has been retained by the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the proposed Bovaird Drive Underpass and associated Bovaird Drive West culvert extension as part of the Highway 413 Project (Early Works Contract), in the City of Brampton, Ontario. This report addresses the proposed southern extension of the existing CIP open footing culvert located at about Station 10+615.

This report summarizes the results of previous and current foundation investigations (including field investigation procedures, borehole stratigraphy, bedrock lithology, and geotechnical and analytical laboratory test results) carried out at the site, and provides a description of the interpreted subsurface soil, bedrock and groundwater conditions at the proposed culvert extension.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Orientation and Datum

The orientation (i.e., north, south, east, and west) stated in the text of this report is referenced to project north and therefore may differ from magnetic north shown on Drawing 1. For this report, the existing culvert in the vicinity of the project site is considered oriented in a north-south direction and Bovaird Drive West is considered oriented in an east-west direction.

This report has been developed based on the following horizontal and vertical datums:

- Horizontal datum: Ontario MTM Zone 10, NAD83 (CSRS), CBNV6-2010
- Vertical datum: CGVD28 (1978)

2.2 Project Scope

The purpose of the project is to construct the Bovaird Drive Underpass Structure and approach embankments to support the future Highway 413 and Bovaird Drive interchange. The scope of work includes the new Bovaird Drive Underpass Structure, the full reconstruction of Bovaird Drive from a 2-lane undivided roadway to a 6-lane divided roadway and profile grade raise of up to 11 m for the approach embankments.

The future proposed Highway 413 / Bovaird Drive interchange will be located along the existing Bovaird Drive West (Bovaird Drive) between Heritage Road and Mississauga Road in the City of Brampton, Regional Municipality of Peel, Ontario. The proposed Bovaird Drive underpass structure will cross over the future Highway 413 at about Station 10+000 and will require new approach embankments up to about 11 m in height to be constructed between about Stations 9+650 and 10+300. The proposed structure will encompass the full width of the existing roadway and extend north and south of the existing roadway into the neighbouring farmlands.

The project also includes roadway widening beyond the MTO Controlled Access Highway (CAH) limits, on behalf of the Region of Peel, and as a result includes the culvert extension at Station 10+615. The culvert extension is the focus of this report.

2.3 Site Description

The existing culvert to be extended southward, is located along Bovaird Drive West, immediately east of Coolhurst Avenue, at approximately Station 10+615, and approximately 315 m west of Mississauga Road in the City of Brampton. At the site location, the Bovaird Drive road grade is at about Elevation 241.2 m, with an existing embankment height of approximately 2.7 m relative to the ground surface at the toe of the embankment slope. The existing embankment is grass covered and inclined at about 2 Horizontal to 1 Vertical (2H:1V), with no visible signs of erosion or instability.

As per the General Arrangement drawing for the proposed culvert extension (dated April 2026), the existing CIP open footing culvert is about 30.9 m long, with an opening 0.9 m wide and 0.9 m high, with a culvert invert at about Elevation 238.0 m (at south outlet), founded on footings at about Elevation 237 m (at south outlet). The culvert carries stormwater from the north side of Bovaird Drive to the south side of Bovaird Drive. The culvert was previously extended to the north as part of the land development works in the area. No further extension to the north is required as part this project.

In general, the topography in the vicinity of the existing culvert consists of relatively flat terrain surrounded by a developing residential subdivision to the north and undeveloped farmland to the south. Photographs of the existing site conditions at the proposed southward culvert extension location are provided below. At the time of the current investigation (September 2025), the existing culvert outlet and surrounding ground surface was observed to be dry.

Figure 1: Proposed Culvert Extension Location (Looking South)

Figure 2: Proposed Culvert Extension Location (Looking West)

3.0 INVESTIGATION PROCEDURES

3.1 2020 Investigation

A previous investigation was carried out in the vicinity of the existing culvert in 2020 by SNC-Lavalin Inc. Ontario Inc., on behalf of the Region of Peel as presented in the following report:

- Geotechnical Investigation and Pavement Design for Bovaird Drive W Widening Project", Reference No. 672432, prepared by SNC-Lavalin Inc., dated January 26, 2021.

The 2020 investigation consisted of two boreholes (designated as Boreholes BHC-5 and D-8) located near the existing culvert. Borehole BHC-5 was advanced through the eastbound Bovaird Drive road shoulder. It is noted that the Record of Borehole indicates the drilling location "westbound shoulder", however the provided coordinates indicate the borehole was located in the eastbound shoulder. A standpipe piezometer was installed in Borehole BHC-5. Borehole D-8 was advanced to a shallow depth via a hand auger at the ditch south of Bovaird Drive near the outlet of the existing culvert.

The borehole locations, ground surface elevations and drilled depths are shown on the borehole records in Appendix A, on Drawing 1 following the text of this report, and are summarized in the table below. It is noted that the geodetic datum referenced in the 2020 investigation report has been assumed to be the project datum referenced in Section 2.1 of this report.

Borehole No.	MTM NAD83 Northing (Latitude, °)	MTM NAD83 Easting (Longitude, °)	Ground Surface Elevation (m)	Borehole Depth (m)
BHC-5	4,836,143.3 (43.664761)	278,025.4 (-79.831995)	241.2	6.5
D-8	4,836,137.1 (43.664706)	278,034.5 (-79.831882)	237.9	0.8

3.2 Current Investigation (2025)

The current foundation investigation was carried out by WSP on September 10, 2025, during which time one borehole (designated as Borehole 25-C1) was advanced to a depth of 6.2 m at the location of the proposed culvert extension. The borehole was advanced at the toe of the road embankment (south of Bovaird Drive) near the outlet of the existing culvert.

The investigation was carried out using limited access equipment consisting of a Hilti drill rig supplied and operated by Pontil Drilling Services Inc. The borehole was advanced through the overburden via a mud-rotary drilling method using a 98 mm tri-cone bit and a manual half-weight hammer.

The field work was observed by members of WSP's engineering and technical staff, who marked the borehole location, arranged for the clearance of underground utilities, observed the drilling, sampling, and in-situ testing operations, and logged the borehole.

Soil samples were generally obtained at 0.75 m and 1.5 m intervals of depth, using a 50 mm outer diameter (O.D.) split-spoon sampler driven by a manual half-weight hammer, in general accordance with the Standard Penetration Test (SPT) procedures of ASTM D1586. The split-spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 35 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions. The borehole was backfilled upon completion of drilling with bentonite in general accordance with Ontario Regulation 903 (Wells), as amended.

The soil samples were identified in the field, placed in appropriate containers, labelled and transported to WSP's Mississauga geotechnical laboratory where the samples underwent further visual examination and laboratory testing in accordance with MTO and/or ASTM Standards, as appropriate. Classification testing (water content determination, grain size distributions and Atterberg limits) was carried out on select soil samples. One selected

soil sample from the current investigation was submitted to Bureau Veritas, an accredited analytical testing laboratory, for testing of a suite of parameters related to corrosivity and sulphate attack.

The as-drilled borehole location and ground surface elevation at Borehole 25-C1 was surveyed by WSP using a Trimble Catalyst DA2 GNSS Receiver. The as-drilled borehole location, ground surface elevation, and drilled depth for the current investigation is shown on the borehole record in Appendix B, on Drawing 1 following the text of this report, and is summarized in the table below.

Borehole No.	MTM NAD83 Northing (Latitude, °)	MTM NAD83 Easting (Longitude, °)	Ground Surface Elevation (m)	Borehole Depth (m)
25-C1	4,836,135.7 (43.664693)	278,034.1 (-79.831887)	238.5	6.2

4.0 SUBSURFACE CONDITIONS

4.1 Regional Geology

The site is located within the South Slope physiographic region comprised of calcareous clay till with lacustrine clay and silt reworked by glaciers, with numerous scattered drumlins and deep valley cuts caused by flowing streams towards Lake Ontario. The overburden within the majority of the South Slope region is underlain by shale bedrock of the Queenston and Georgian Bay formations which contains Limestone interbeds. The entire area has a fairly uniform slope toward Lake Ontario.

Surficial geology maps indicate the surficial material at the site is composed of glacial clay and silt till deposits. Water well records show the subsurface conditions consist of a layer of cohesive soil underlain by shale bedrock encountered at about 6 m below ground surface.

Bedrock Geology maps indicate that the bedrock at the site is described to consist of red shale of the Queenston Formation.

4.2 Subsurface Conditions

The subsurface soil, bedrock, and groundwater conditions as encountered in the boreholes advanced during the previous and current investigations are presented on the borehole records in Appendix A and B, respectively. “Method of Soil Classification”, “Abbreviations and Terms Used on Records of Boreholes and Test Pits”, “List of Symbols” and “Lithological and Geotechnical Rock Description Terminology” sheets are provided in Appendix B to assist in the interpretation of the borehole records from the current investigation. The results of the geotechnical laboratory testing and the results of the analytical laboratory testing from the current investigation are provided in Appendix C and D, respectively.

The results of the in-situ tests (i.e., SPT ‘N’-values) as presented on the borehole records and in Section 4.2 are uncorrected for overburden pressure and energy transfers. The ‘N’-values obtained at Borehole 25-C1 are based on SPT sampling procedures carried out with a half-weight (i.e., 31.8 kg) manual hammer. As such, the ‘N’-values presented on the Record of Borehole 25-C1 have been halved to account for the half-weight hammer. The ‘N’-values presented on the borehole records for Boreholes BHC-5 are based on SPT sampling procedures carried out with a standard weight (i.e., 63.5 kg) automatic hammer.

The stratigraphic boundaries shown on the borehole records and on the stratigraphic profile on Drawing 1 are inferred from non-continuous sampling, observations of drilling progress and the results of Standard Penetration Tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change and are simplifications of the subsurface conditions. Variation in the stratigraphic boundaries between and beyond boreholes exists and is to be expected.

In summary, the subsurface conditions at the site consist of surficial topsoil / granular fill, underlain by either clayey silt fill (below the Bovaird Drive embankment) or a native sandy clayey silt deposit (at the toe of the Bovaird Drive embankment). The fill / native clayey silt is underlain by a glacial till deposit, a residual soil deposit, and

finally shale bedrock. A more detailed description of the subsurface conditions encountered in the boreholes during the field investigations is provided in the following sections.

4.2.1 Topsoil

An approximately 100 mm and 150 mm thick layer of surficial topsoil was encountered at ground surface in Boreholes D-8 and 25-C1, respectively. These materials were classified solely on visual and textural evidence. Testing of organic content or other nutrients was not carried out.

4.2.2 Gravelly Sand Fill

An approximately 0.9 m thick layer of gravelly sand fill was encountered at ground surface in Borehole BHC-5, extending to about Elevation 240.2 m.

The SPT 'N'-value measured within the gravelly sand fill was 36 blows per 0.3 m of penetration, indicating a dense state of compactness.

The natural water content measured on two samples of the granular fill was about 8% and 21%.

4.2.3 Silty Clay Fill

An approximately 1.4 m thick layer of silty clay fill was encountered below the gravelly sand fill in Borehole BHC-5. The silty clay fill was encountered at a depth of about 0.9 m below ground surface (Elevation 240.2 m) and extends to a depth of about 2.3 m below ground surface (Elevation 238.9 m).

Two SPT 'N' values measured within the silty clay fill were 12 blows per 0.3 m of penetration and 50 blows per 0.15 m, indicating a stiff to hard consistency.

The natural water content measured on two samples of the silty clay fill was 14% and 4%.

4.2.4 Sandy Clayey Silt

An approximately 1.2 m thick deposit of sandy clayey silt, trace gravel was encountered below the surficial topsoil in Borehole 25-C1. The cohesive deposit was encountered at a depth of about 0.2 m below ground surface (Elevation 238.3) and extends to a depth of about 1.4 m below ground surface (Elevation 237.1 m). The cohesive deposit was observed to contain rootlets and mottling, as noted on the borehole record.

The SPT 'N' values measured within the sandy clayey silt deposit were 2 blows and 6 blows per 0.3 m of penetration, indicating a soft to firm consistency.

As part of the current investigation, grain size distribution testing and Atterberg limits testing was carried out on one sample of the sandy clayey silt deposit and the results are presented on Figure C-1 and C-2 in Appendix C, respectively. The Atterberg limit testing measured a liquid limit of 29%, plastic limit of 17%, and plastic index of 12%, indicating that the deposit is of low plasticity. The natural water content measured on one sample of the sandy clayey silt was about 20%, which is above the materials plastic limit.

4.2.5 Glacial Till

An approximately 1.5 m to 1.8 m thick glacial till deposit was encountered underlying the surficial topsoil in Borehole D-8, underlying the granular fill in Borehole BHC-5, and underlying the sandy clayey silt deposit in Borehole 25-C1. The till deposit was encountered at depths ranging from about 0.1 m to 2.3 m below ground surface (Elevations 238.9 m to 237.1 m) and, where fully penetrated, extends to depths of about 2.9 m and 4.1 m below ground surface (Elevations 237.0 m and 235.6 m). Borehole D-8 was terminated within the till deposit, penetrating it for a thickness of about 0.7 m. The till deposit ranges from sandy silt to silty sand, trace to some gravel, trace clay to sandy clayey silt, trace to some gravel. At Borehole 25-C1 an approximately 0.2 m thick interlayer of sand was encountered within the glacial till deposit at a depth of about 2.0 m below ground surface (Elevation 236.5 m).

The SPT 'N' values measured within the till deposit range from about 11 blows to 28 blows per 0.3 m of penetration, indicating a compact state of compactness / very stiff consistency.

As part of the current investigation, grain size distribution testing was carried out on one sample of the glacial till deposit and the results are presented on Figure C-3 in Appendix C. The natural water content measured on six samples of the glacial till deposit ranged from about 14% to 25%.

4.2.6 Residual Soil

A deposit of residual soil consisting of clayey silt-silt to clayey silt with shale fragments was inferred from split spoon sampling below the glacial till deposit in Boreholes 25-C1 and BHC-5. It is noted that this deposit is classified as "silty clay some sand to sandy, trace weathered shale fragments" at Borehole BHC-5, however, based on WSP's interpretation of the grain size distribution results and understanding of the site conditions, it is inferred to be residual soil.

The residual soil deposit was encountered at depths of about 2.9 m and 4.1 m below ground surface (Elevation 235.6 m and 237.0 m) and, where fully penetrated, extends to a depth of about 5.3 m below ground surface (Elevation 233.2 m). Borehole BHC-5 was terminated within the residual soil deposit, penetrating it for a thickness of about 2.4 m.

The SPT 'N' values measured within the residual soil deposit range from about 15 blows per 0.3 m to 92 blows per 275 mm of penetration, indicating a very stiff to hard (but generally hard) consistency.

As part of the previous investigation, grain size distribution testing was carried out on two samples of the residual soil and Atterberg Limit testing was carried out on one sample of the residual soil. The previous investigation laboratory results are presented on the Record of Borehole BHC-5 in Appendix A. As part of the current investigation, Atterberg limits testing was carried out on one sample of the residual soil and the results are presented on Figure C-4 in Appendix C. The previous and current Atterberg limit testing results measured liquid limits of 19% and 21%, plastic limits of 14%, and plastic indices of 5% and 7%, indicating that the clayey silt is of low plasticity. The natural water content measured six samples of the residual soil deposit range from about 7% to 14%.

4.2.7 Shale Bedrock

Shale Bedrock (inferred from split spoon sampling and auger grinding) was encountered below the residual soil in Borehole 25-C1 at a depth of about 5.3 m (Elevation 233.2 m).

4.3 Groundwater Conditions

The groundwater levels were generally measured within the open boreholes, and a monitoring well was installed in Borehole BHC-5 from the previous investigation. The groundwater conditions are summarized on the borehole records and the water levels measured inside the standpipe piezometer are presented in the table below. It is noted that the 2020 groundwater levels were obtained by others, and the 2025 groundwater level at BHC-5 was measured by WSP. Groundwater and surface water levels in the area are subject to season fluctuations and variations due to precipitation events.

Borehole No.	Date of Water Level Reading	Depth of Water Level (m)	Water Level Elevation (m)	Notes
BHC-5	Sep 22, 2020	4.1	237.1	Upon completion of drilling
	Oct 7, 2020	Dry	-	Measured in Standpipe Piezometer
	Sept 30, 2025	3.1	238.1	Measured in Standpipe Piezometer

4.4 Analytical Testing

One soil sample obtained from Borehole 25-C1 was submitted to Bureau Veritas (an accredited analytical laboratory) for corrosivity testing to assess the potential for the soil to cause corrosion to buried steel and

concrete. Detailed laboratory test reports (Certificate of Analysis) are included in Appendix D and are summarized in the table below.

Borehole and Sample No.	Sample Depth / Elevation (m)	Soil Type	Parameters						
			Redox Potential (mv)	Sulphide (mg/kg)	Chloride (µg/g)	Sulphate (µg/g)	pH	Conductivity (µmho/cm)	Resistivity (ohm-cm)
25-C1 Sample 1	0.40 / 238.1	Clayey Silt	190	1.16	120	120	7.4	533	1900

5.0 CLOSURE

This Foundation Investigation Report was prepared by Mr. Maor Levy, an Engineer-In-Training with WSP, and was reviewed by Ms. Anastasia Poliacik, P.Eng., a Senior Geotechnical Engineer with WSP and an MTO Principal Foundations Contact. Mr. David Staseff, P.Eng., a Senior Principal and MTO Principal Foundations Contact with WSP conducted a technical review of this report. Mr. Kevin Bentley, P.Eng. and MTO Principal Foundations Contact with WSP provided an independent quality control review of this report.

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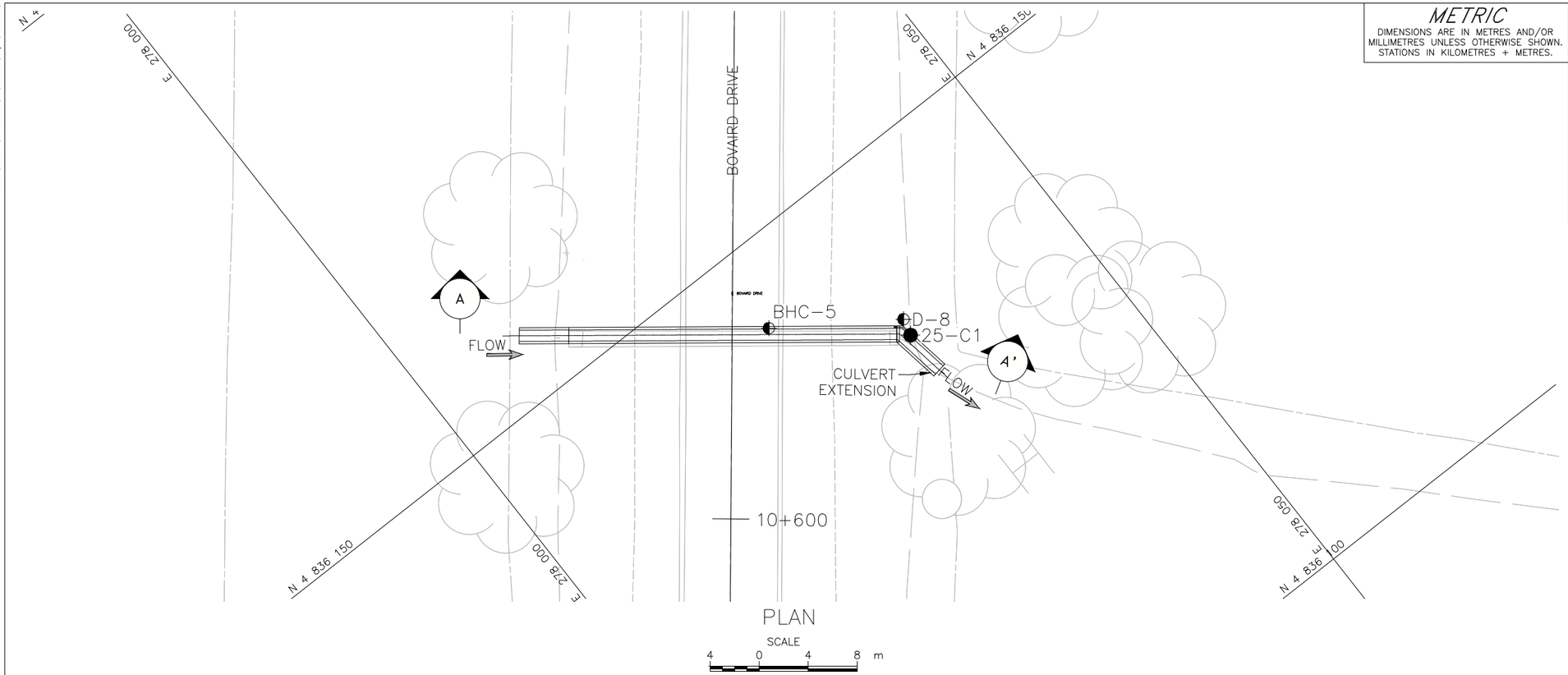
ML/AMP/DS/KJB/al

https://wsponline.sharepoint.com/sites/ca-14m-00321-01/technical/07. early works - contract 3 - bovaird dr/04-foudations/7. deliverables/culvert extension fidr/5. final/14m-00321-01-hwy 413 bovaird culvert ext-fidr-rev0-08may2026.docx

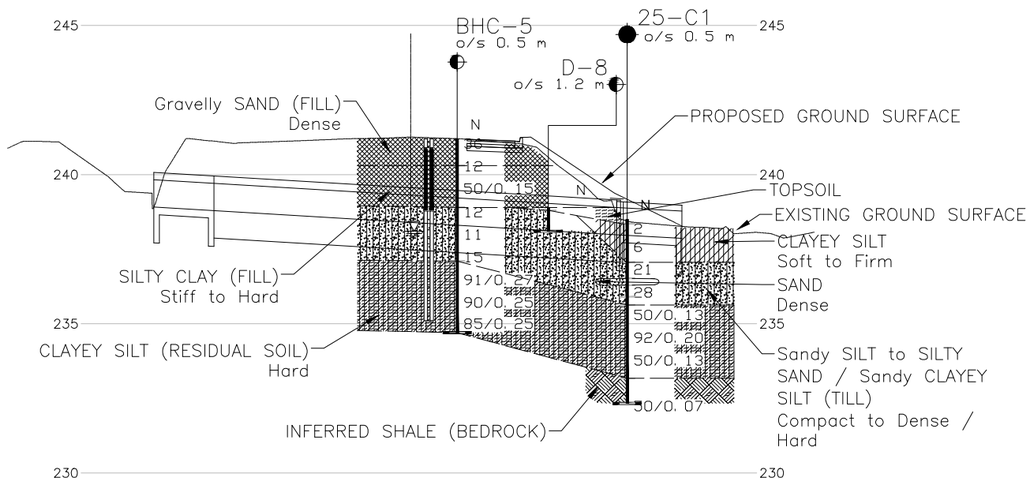
MINISTRY OF TRANSPORTATION, ONTARIO



PLAN

SCALE 4 0 4 8 m

℄ BOVAIRD DRIVE



PROFILE A–A'

VERTICAL SCALE 2 0 2 4 m

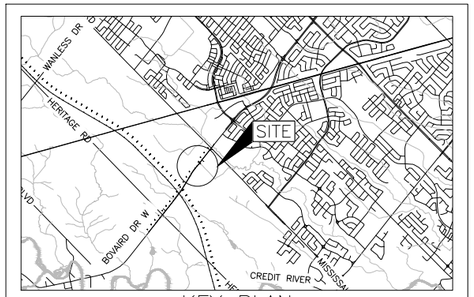
HORIZONTAL SCALE 4 0 4 8 m

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

CONT No.
GWP No. 2034–24–00

HIGHWAY 413 PROJECT
CULVERT EXTENSION
BOREHOLE LOCATIONS PLAN AND SOIL STRATA

SHEET



LEGEND

- Borehole – Current Investigation
- Borehole – Previous 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 upon completion of drilling
- WL in piezometer, measured on September 29, 2025

BOREHOLE CO–ORDINATES			
No.	ELEVATION	NORTHING	EASTING
25–C1	238.5	4836135.7	278034.1
BHC–5	241.2	4836143.3	278025.4
D–8	239.0	4836137.1	278034.5

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

Base plan provided in digital format by WSP, drawing file No. X–Base_West.dwg, received April 27, 2022.
Link to GA file No. GA (10+615.0.29).dwg Projectwise, received April 29, 2026.
Alignment provided by WSP, file No. H14M–00321–01–XA01.dwg.

LICENSED PROFESSIONAL ENGINEER A. M. POLLOCK 100168821 PROVINCE OF ONTARIO 08May2026

LICENSED PROFESSIONAL ENGINEER K. J. BENTLEY PROVINCE OF ONTARIO 08May2026

NO.	DATE	BY	REVISION
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Geocres No. 30M12–556

HWY. 413		PROJECT NO. CA–WSP–14M–00321–01	DIST. CENTRAL
SUBM'D. .	CHKD. ML	DATE: 05/08/2026	SITE: .
DRAWN: SA	CHKD. AMP	APPD. KB	DWG. 1

PLOT DATE: May 8, 2026
FILENAME: S:\Clients\MTO\GTA_West_Corridor\06_PROJ\CA–WSP–14M–00321–01\40_PROD\0005_Hwy_413_Early_Works–Culvert_Ext\14M–00321–01–0005–BD–0001.dwg

APPENDIX A

2020 Investigation - Borehole Records

SNC·LAVALIN

NOTES TO RECORD OF BOREHOLES

DRILLING DATA

Method:

SolSt Auguring	-	Solid Stem Auguring
HolSt Auguring	-	Hollow Stem Auguring
WB	-	Washed Boring

SAMPLES TYPE

SS	-	Split Spoon
AS	-	Auger Sample
TW	-	Thin wall Open
TP	-	Thin wall Piston
WS	-	Washed Sample
BS	-	Block Sample
RC	-	Rock Core
PH	-	Sample Advanced Hydraulically
PM	-	Sample Advanced Manually

LABORATORY DATA

W_P	-	Plastic Limit
W	-	Water Content (%)
W_L	-	Liquid Limit
γ	-	Natural Unit Weight (kN/m^3)
UNDR STRNG or c_u	-	Undrained Shear Strength (kPa) Field Vane: St-sensitivity
pp	-	Pocket Penetrometer
UC	-	Unconfined Compression
UU	-	Unconsolidated Undrained at Overburden Pressure
CU	-	Consolidated Undrained
CD	-	Consolidated Drained
TOV	-	Total Organic Vapors

Standard Penetration Test, 'N'- Values: The Standard Penetration Test (SPT) 'N'-values are the number of blows required to cause a standard 51 millimeters o.d. split barrel sampler to penetrate 0.3 meter into undisturbed ground in a borehole when driven by a hammer with a mass of 63.5 kilograms falling freely a distance of a 0.76 meter. For penetrations of less than 0.3 meter, N-values are indicated as the number of blows for the penetration achieved (e.g. 50/25: 50 blows for 25 centimeters penetration).

Dynamic Cone Penetration Test: Continuous penetration of a conical steel point (51 millimeters o.d. 60° cone angle) driven by 475 J impact energy on a size drill rods. The resistance to cone penetration is measured as the number of blows for each 0.3 meter advance of the conical point into the undisturbed ground.

Soils are described by their composition and consistency or relative density

CONSISTENCY: Cohesive soils are described on the basis of their undrained shear strength (c_u) or 'N'-values as follows:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*
N (blows/0.3 meter)	0 - 2	2 - 4	4 - 8	8 - 15	15 - 30	>30

COMPACTNESS CONDITION: Cohesionless soils are described on the basis of compactness condition as indicated by 'N'–values as follows:

N (blows/0.3 meters)	0 - 4	4 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

Rocks are described by their composition and structural features and/or strength

RECOVERY: Sum of all recovered rock core pieces from a coring run expressed as a percent of the total length of the coring run.

ROCK QUALITY DESIGNATION (RQD): Sum of those intact core pieces, 100 millimeters in length expressed as a percent of the length of the coring run. Classification of a rock based on the RQD value as follows:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	*POOR*	*FAIR*	*GOOD*	*EXCELLENT*

JOINTING AND BEDDING:

SPACING	50 mm	50 - 300 mm	0.3 - 1.0 m	1.0 - 3.0 m	>3.0 m
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

RECORD OF BOREHOLE No. BHC-5

Project Number:	672432	Drilling Location:	Westbound Shoulder	Logged by:	MA
Client:	Region of Peel	Drilling Method:	100 mm Solid Stem Augering	Compiled by:	MA
Project Name:	Bovaird Drive W - Geotechnical Investigation and Pavement Analysis	Drilling Machine:	Truck Mounted Drill D25	Reviewed by:	AK
Location:	Bovaird Dr W, Brampton	Date Started:	Sep 22, 2020 Date Completed: Sep 22, 2020	Revision No.:	0

EASTING: 594170
NORTHING: 4835301.52

Lithology Plot	DESCRIPTION (Local Ground Surface Elevation: 241.15 m)	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	FIELD TESTING: Penetration Testing (○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80)	LAB TESTING: ★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL) ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L	INSTRUMENTATION INSTALLATION	COMMENTS
	PAVEMENT GRANULAR Grey, dense to compact, gravelly SAND, some silt, moist	SS	01	75	36		241	○	8		
	240.2										
	Brownish grey, stiff, silty CLAY, some sand, trace gravel, some asphalt particles, moist 0.9	SS	02	100	12	1	240	○	21 14		
	becomes hard										
		SS	03	100	50 / 150 mm	2	239		4		
	238.9										
	NATIVE TILL Brown, compact, sandy SILT, trace to some clay, trace to some gravel, moist 2.3	SS	04	75	12			○	25		Top of Existing Culvert = 238.2 m Visible depth = 0.92 m (All dimensions are approx.)
						3	238				
		SS	05	38	11			○	18		
	becomes wet										
	237.0					4			18		
	Reddish brown, very stiff, silty CLAY, some sand to sandy, trace weathered shale fragments, moist 4.1 GR: 10%; SA: 10%; FA: 80%	SS	06	100	15		237	○	14		
								■			
	becomes hard	SS	07	91	91/ 275 mm	5	236		9		
		SS	08	100	90 / 250 mm				7		
						6	235				
	GR: 14%; SA: 47%; SI: 29%; CL: 10%	SS	09	100	85 / 250 mm				11		
	234.6										
	End of Borehole. 6.5										
	1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay.										

▽ Groundwater depth on completion of drilling: 4.1 m ■ Cave in depth recorded on completion of drilling: 4.6 m.

▼ Groundwater depth observed on 07/10/2020 at a depth of: dry m.

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401 Hanlan Rd
Vaughan, Ontario L4L 3T1
Tel: 905-851-0090

RECORD OF BOREHOLE No. D-8

Project Number:	**672432**	Drilling Location:	**Eastbound Ditch**	Logged by:	**FS**
Client:	**Region of Peel**	Drilling Method:	**75 mm Hand Augering**	Compiled by:	**MA**
Project Name:	**Bovaird Drive W - Geotechnical Investigation and Pavement Analysis**	Drilling Machine:	**Hand Auger**	Reviewed by:	**AK**
Location:	**Bovaird Dr W, Brampton**	Date Started:	**Sep 24, 2020** Date Completed: **Sep 24, 2020**	Revision No.:	**0**

LITHOLOGY PROFILE		SOIL SAMPLING						FIELD TESTING	LAB TESTING	INSTRUMENTATION INSTALLATION	**EASTING:** 594179.2 **NORTHING:** 4835295.47
Lithology Plot	**DESCRIPTION** **Local Ground Surface Elevation: 237.98 m**	Sample Type	Sample Number	Recovery (%)	SPT 'N' Value	DEPTH (m)	ELEVATION (m)	Penetration Testing: ○ SPT ● DCPT; MTO Vane* △ Intact ▲ Remould; Nilcon Vane* ◇ Intact ◆ Remould; * Undrained Shear Strength (kPa) 20 40 60 80	★ Rinse pH Values 2 4 6 8 10 12; Soil Vapour Reading △ parts per million (ppm) 100 200 300 400; ▲ Lower Explosive Limit (LEL); ✱ Passing 75 um (%); ○ Moisture Content (%); Atterberg Limits W_P 20 40 60 80 W_L		**COMMENTS**
	Topsoil ~ 100 mm 237.9										
	NATIVE TILL 0.1 Brown to dark grey, silty CLAY, some sand, trace gravel, moist 237.2	AS	01						○ 22		
	End of Borehole 0.8										
	Notes: 1. GA, SA, SI and CL denote Gravel, Sand, Silt and Clay										

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Vaughan, Ontario L4L 3T1
Tel: 905-851-0090

▽ **No freestanding groundwater measured in open borehole upon completion of drilling.**

APPENDIX B

Current Investigation - Borehole Records

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

PROJECT 14M-00321-00

RECORD OF BOREHOLE No 25-C1

SHEET 1 OF 1

METRIC

G.W.P. 2034-24-00 LOCATION N 4836135.7; E 278034.1 MTM NAD 83 ZONE 10 (LAT. 43.664693; LONG. -79.831887) ORIGINATED BY ML

DIST Central HWY 413 BOREHOLE TYPE 98 mm O.D. Tri-cone with Manual Half-weight Hammer COMPILED BY

DATUM CGVD28:78 DATE September 10, 2025 CHECKED BY AMP

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 (%) (10 20 30)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
238.5	GROUND SURFACE										
0.0 / 238.4	TOPSOIL (150 mm)										
0.2	Sandy CLAYEY SILT (CL), trace gravel Soft to firm Brown Moist - Rootlets at a depth of 0.2 m to 0.7 m - Mottling in sample 2 at a depth of 0.7 m to 1.5 m		1	SS	2		238				
			2	SS	6						5 23 53 19
237.1											
1.4	Sandy SILT (ML), trace gravel, trace clay (TILL) Compact Brown Moist		3A 3B	SS	21		237				9 40 48 3
236.5											
2.0 / 236.3	SAND (SP), trace fines, trace gravel Brown Moist										
2.2 / 235.9	Sandy CLAYEY SILT (CL), trace gravel (TILL) Very stiff Brown Moist		4A 4B 4C	SS	28		236				
2.6 / 235.6	SILTY SAND (SM), trace gravel (TILL) Very dense Reddish brown Moist		5	SS	50/0.13						
2.9	CLAYEY SILT (CL), trace sand, contains shale fragments (INFERRED RESIDUAL SOIL) Hard Red Moist - Hard drilling from a depth of 2.9 m to 5.3 m		6	SS	92/0.20		235				
233.2			7	SS	50/0.13		234				
5.3	Inferred red SHALE (BEDROCK) - Grinding at a depth of about 5.3 m						233				
232.3			8	SS	50/0.07						
6.2	NOTES: 1. The presented SPT "N-Values" have been halved due to use of halfweight hammer. 2. Borehole open upon completion of drilling. 3. Water level could not be measured due to introduction of water via mud rotary method. *Water level not representative due to introduction of water via mud rotary method.										

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

GTA-MTO 001 S:\CLIENTS\MTO\HWY_413\02_DATA\GINT\HWY_413.GPJ GAL-GTA.GDT 10/22/25

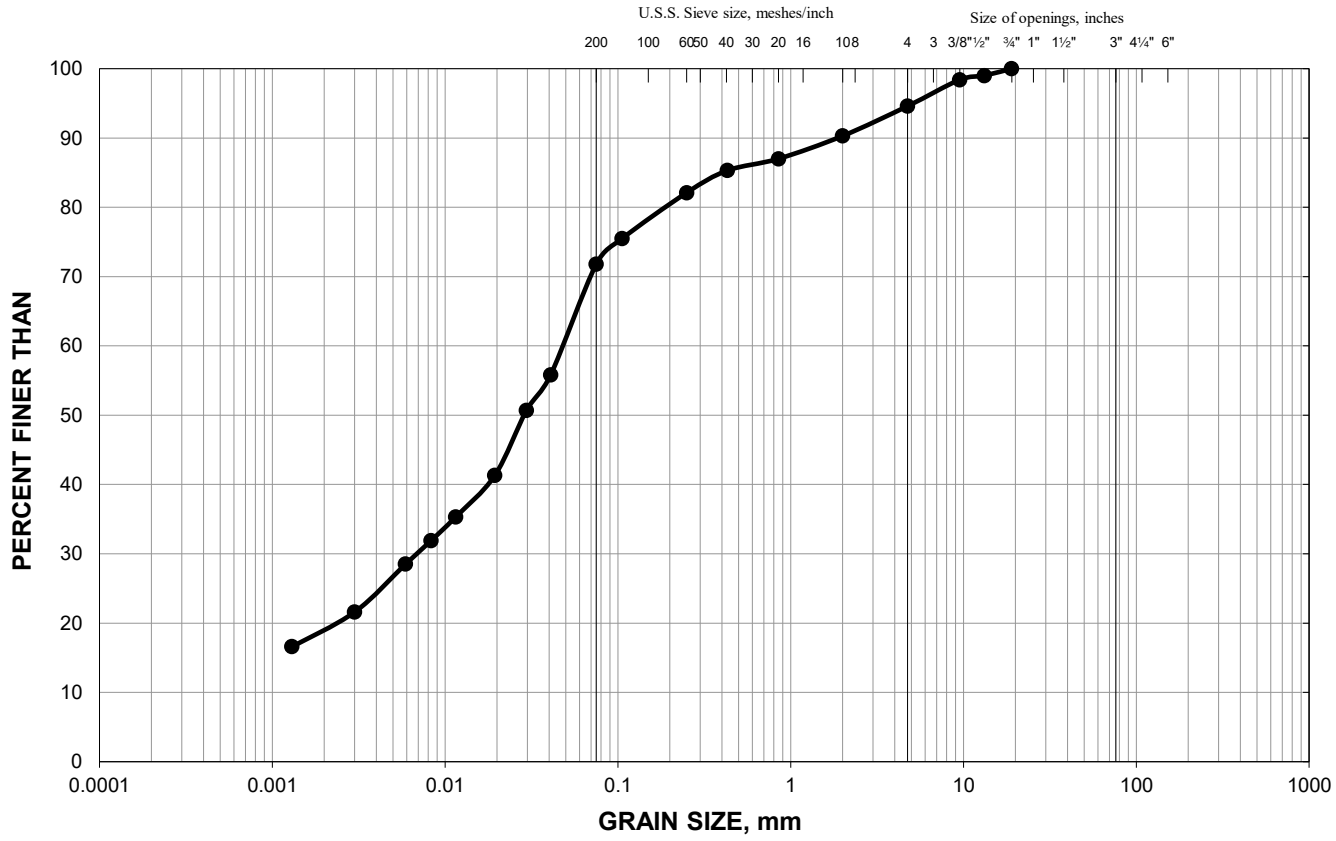
APPENDIX C

Geotechnical Laboratory Test Results

GRAIN SIZE DISTRIBUTION

Sandy CLAYEY SILT (CL)

FIGURE C-1



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE SIZE
FINE GRAINED	**SAND SIZE**			**GRAVEL SIZE**		

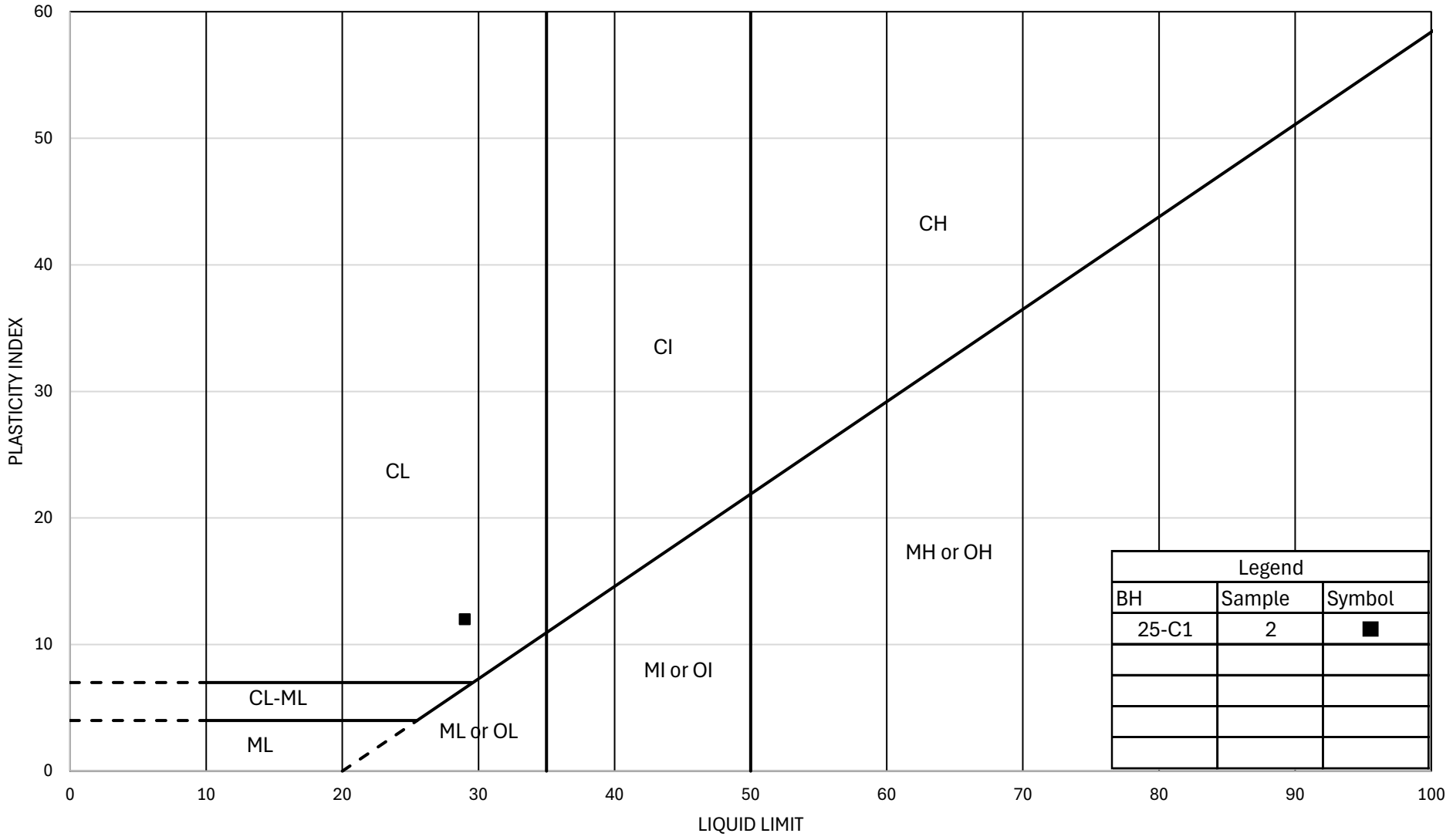
LEGEND

SYMBOL	BOREHOLE	SAMPLE	Elevation (m)
—●—	25-C1	2	237.4

Date: October 17, 2025
Project: 14M-00321-01

WSP Canada Inc.

Drawn by: ML
Checked by: AMP

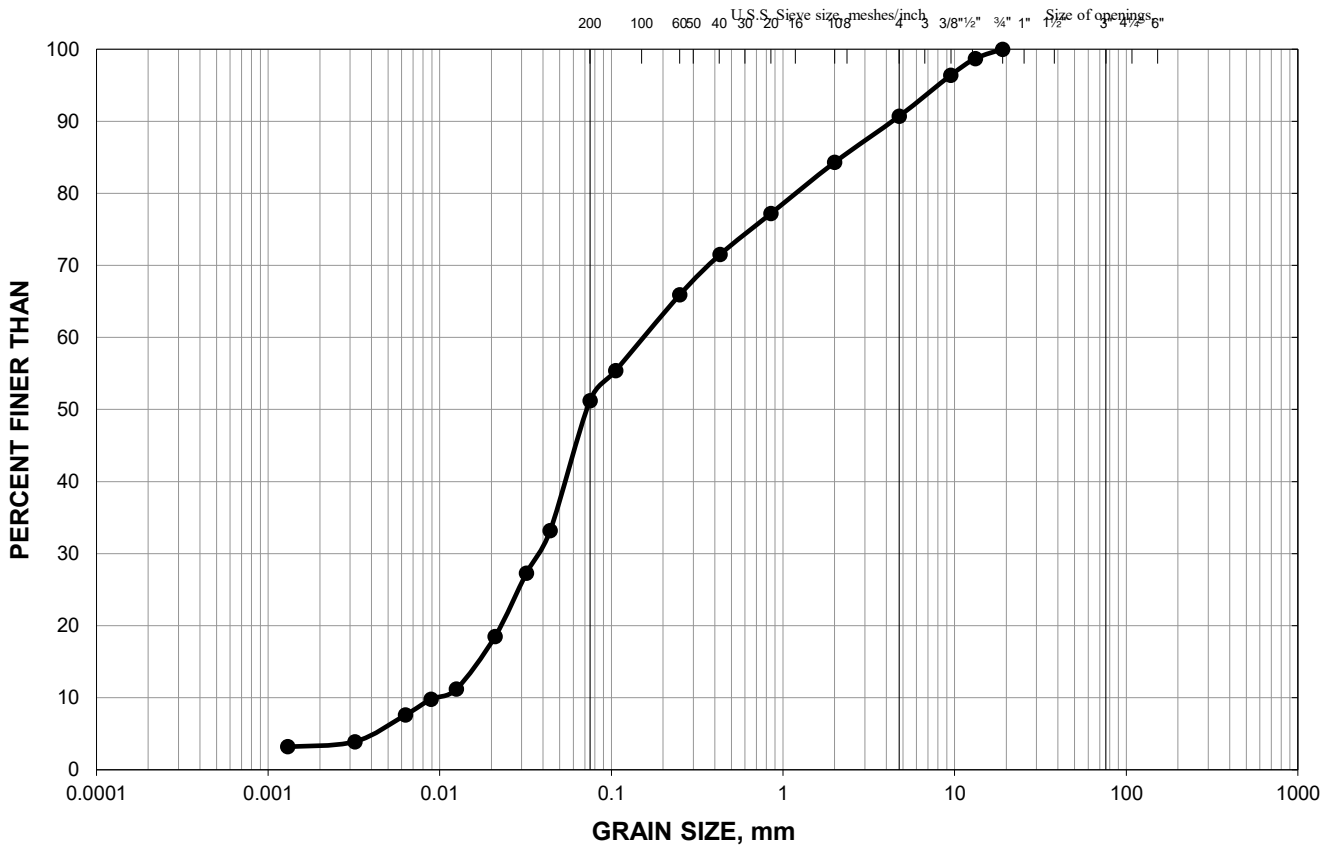


Ministry of Transportation Ontario	PLASTICITY CHART Sandy CLAYEY SILT (CL)	Figure No.:	C-2
		Project No.:	14M-00321-01
		Produced by:	ML
		Checked by:	AMP

GRAIN SIZE DISTRIBUTION

Glacial Till

FIGURE C-3



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

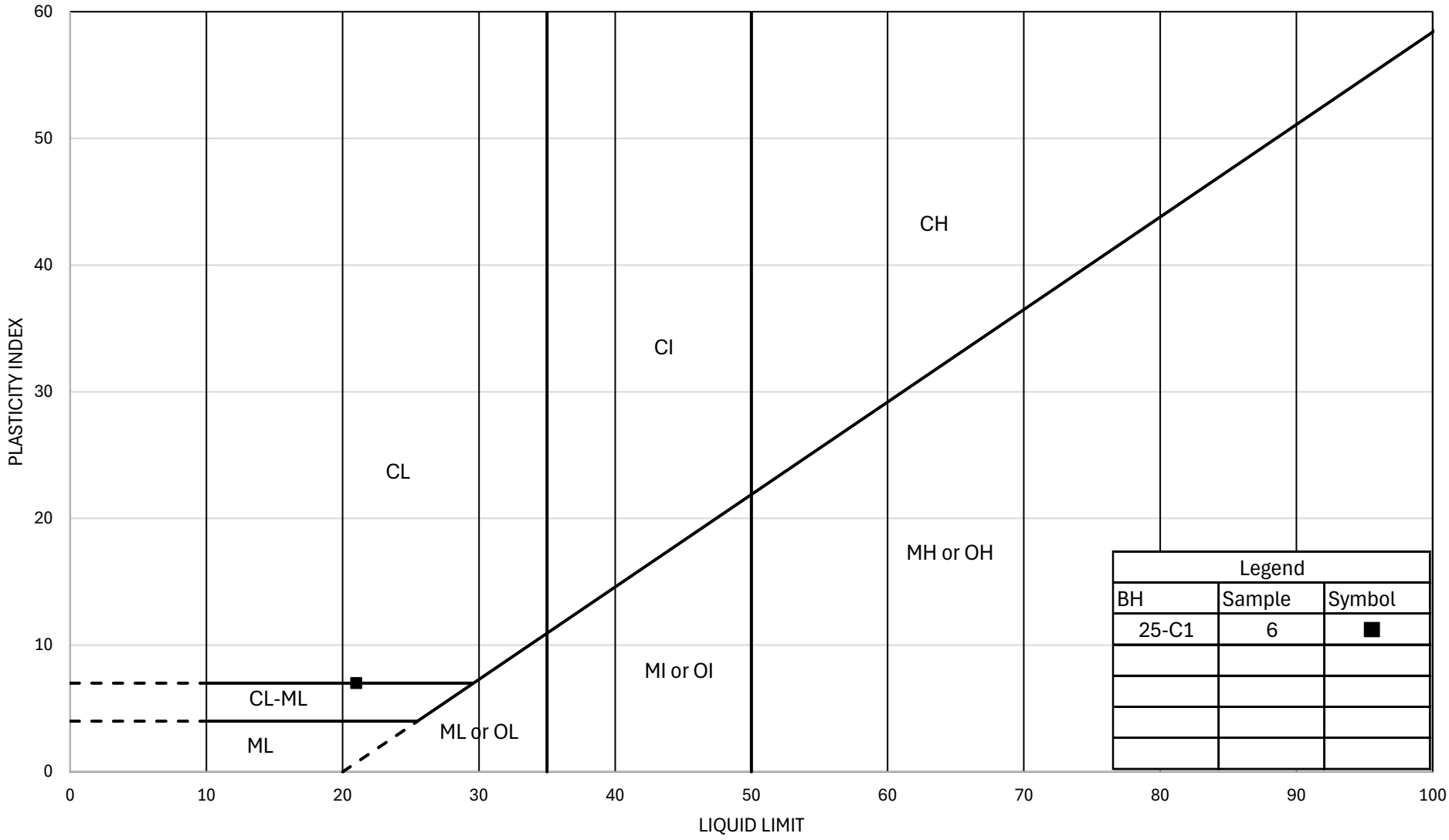
LEGEND

SYMBOL	BOREHOLE	SAMPLE	Elevation (m)
—●—	25-C1	3A	236.8

Date: October 17, 2025
Project: 14M-00321-01

WSP Canada Inc.

Drawn by: ML
Checked by: AMP



Ministry of Transportation Ontario	PLASTICITY CHART Residual Soil	Figure No.:	C-4
		Project No.:	14M-00321-01
		Produced by:	ML
		Checked by:	AMP

APPENDIX D

Analytical Laboratory Test Results

Your P.O. #: 14M-00321-01 TASK 1003.904
Your Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your C.O.C. #: MB-041

Attention: Maor Levy

WSP Canada Inc.
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2025/10/15
Report #: R8631318
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C2461
Received: 2025/09/30, 17:28

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride (20:1 extract)	1	2025/10/06	2025/10/06	CAM SOP-00463	MOE E3013 m
Conductivity	1	2025/10/06	2025/10/06	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	1	N/A	2025/10/06	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	1	N/A	2025/10/06	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	1	2025/10/04	2025/10/04	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	1	2025/10/06	2025/10/07	CAM SOP-00421	SM 24 2580 B
Resistivity of Soil	1	2025/09/30	2025/10/06	CAM SOP-00414	SM 24 2510 m
Sulphate (20:1 Extract)	1	2025/10/06	2025/10/06	CAM SOP-00464	MOE E3013 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, EPA, APHA or the Quebec Ministry of Environment.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE , Calgary, AB, T2E 6P8
(2) Offsite analysis requires that subcontracted moisture be reported.

Your P.O. #: 14M-00321-01 TASK 1003.904
Your Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your C.O.C. #: MB-041

Attention: Maor Levy

WSP Canada Inc.
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2025/10/15
Report #: R8631318
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C5C2461

Received: 2025/09/30, 17:28

(3) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode. The test is therefore, not SCC accredited for this matrix.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Keshani Vijh, Sr. Project Manager
Email: keshani.vijh@bureauveritas.com
Phone# (905) 817-5700

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Bureau Veritas Job #: C5C2461
Report Date: 2025/10/15

WSP Canada Inc.
Client Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your P.O. #: 14M-00321-01 TASK 1003.904
Sampler Initials: ML

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		AVSJ92		
Sampling Date		2025/09/30		
COC Number		MB-041		
	UNITS	**25-C1 SS1**	**RDL**	**QC Batch**
Calculated Parameters				
Resistivity	ohm-cm	1900		A021785
CONVENTIONALS				
Redox Potential	mV	190	N/A	A025765
Inorganics				
Soluble (20:1) Chloride (Cl-)	ug/g	120	20	A025864
Conductivity	umho/cm	533	2	A025795
Available (CaCl2) pH	pH	7.42		A025544
Soluble (20:1) Sulphate (SO4)	ug/g	120	20	A025878
Sulphide	mg/kg	1.16 (1)	0.50	A027191

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable
(1) Sample contained greater than 10% headspace at time of extraction.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Bureau Veritas Job #: C5C2461
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WSP Canada Inc.
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Site Location: BRAMPTON, ONTARIO
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Sampler Initials: ML

RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		AVSJ92		
Sampling Date		2025/09/30		
COC Number		MB-041		
	UNITS	**25-C1 SS1**	**RDL**	**QC Batch**
Physical Testing				
Moisture-Subcontracted	%	16	0.30	A027192

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Bureau Veritas Job #: C5C2461
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WSP Canada Inc.
Client Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your P.O. #: 14M-00321-01 TASK 1003.904
Sampler Initials: ML

TEST SUMMARY

Bureau Veritas ID: AVSJ92
Sample ID: 25-C1 SS1
Matrix: Soil

Collected: 2025/09/30
Shipped:
Received: 2025/09/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	SKAL/EC	A025864	2025/10/06	2025/10/06	Massarat Jan
Conductivity	AT	A025795	2025/10/06	2025/10/06	Gurparteek KAUR
Moisture (Subcontracted)	BAL	A027192	N/A	2025/10/06	Amsaveni Murugesan
Sulphide in Soil	SPEC	A027191	N/A	2025/10/06	Naitik Jigneshbhai Desai
pH CaCl2 EXTRACT	AT	A025544	2025/10/04	2025/10/04	Sreena Thekkoot
Redox Potential	COND	A025765	2025/10/06	2025/10/07	Gurparteek KAUR
Resistivity of Soil		A021785	2025/10/06	2025/10/06	Automated Statchk
Sulphate (20:1 Extract)	SKAL/EC	A025878	2025/10/06	2025/10/06	Massarat Jan

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.3°C

Results relate only to the items tested.

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Bureau Veritas Job #: C5C2461
Report Date: 2025/10/15

QUALITY ASSURANCE REPORT

WSP Canada Inc.
Client Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your P.O. #: 14M-00321-01 TASK 1003.904
Sampler Initials: ML

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
A025544	Available (CaCl2) pH	2025/10/04			99	97 - 103			1.5	N/A
A025765	Redox Potential	2025/10/07			100	95 - 105			12	35
A025795	Conductivity	2025/10/06			101	90 - 110	<2	umho/cm	0.33	10
A025864	Soluble (20:1) Chloride (Cl-)	2025/10/06	NC	70 - 130	99	70 - 130	<20	ug/g	1.3	35
A025878	Soluble (20:1) Sulphate (SO4)	2025/10/06	NC	70 - 130	100	70 - 130	<20	ug/g	12	35
A027191	Sulphide	2025/10/06	151 (1)	75 - 125	118	75 - 125	<0.50	mg/kg	NC	30
A027192	Moisture-Subcontracted	2025/10/06					<0.30	%		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Bureau Veritas Job #: C5C2461
Report Date: 2025/10/15

WSP Canada Inc.
Client Project #: 14M-00321-01 TASK 1003.904
Site Location: BRAMPTON, ONTARIO
Your P.O. #: 14M-00321-01 TASK 1003.904
Sampler Initials: ML

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Veronica Falk, B.Sc., P.Chem., QP, Scientific Specialist, Organics

Louise Harding, Scientific Specialist

Suwan (Sze Yeung) Fock, B.Sc., Scientific Specialist

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C5C2461
2025/09/30 17:28

BUREAU VERITAS

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266
CAM FCD-01191/6

WORK ORDER

CHAIN OF CUSTODY RECORD

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	WSP Canada Inc	Company Name:	WSP Canada Inc	Quotation #:		[X] Regular TAT (5-7 days) Most analyses
Contact Name:	Canada Accounts Payable	Contact Name:	Maor Levy	P.O. #/ AFE#:	14M-00321-01 task 1003.904	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	6925 Century Ave. Suite 100	Address:	6925 Century Ave. Suite 100	Project #:		Rush TAT (Surcharges will be applied)
	Mississauga, ON		Mississauga, ON L5N 7K2	Site Location:	Brampton, Ontario	[ ] 1 Day [ ] 2 Days [ ] 3-4 Days
Phone:	905-567-4444 Fax: 905-567-6561	Phone:	289-838-4608 Fax: 905-567-6561	Site #:		
Email:	CAPayablesInvoice@wsp.com	Email:	maor.levy@wsp.com;	Site Location Province:	Ontario	Date Required:
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY				Sampled By:	ML	Rush Confirmation #:

Regulation 153	Other Regulations
[X] Table 1 [ ] Res/Park [ ] Med/ Fine	[ ] CCME [ ] Sanitary Sewer Bylaw
[ ] Table 2 [ ] Ind/Comm [ ] Coarse	[ ] MISA [ ] Storm Sewer Bylaw
[ ] Table 3 [ ] Agri/ Other	[ ] PWQO Region
[ ] Table ____	[ ] Other (Specify)
FOR RSC (PLEASE CIRCLE) Y / N	[ ] REG 558 (MIN. 3 DAY TAT REQUIRED)
	[ ] REG 406 Table ____

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS

Analysis Requested

	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	Corrosivity Package (+ Sulphide)							HOLD- DO NOT ANALYZE
1	25-C1 SS1	2025-09-30	PM	SOIL	2								X								
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
Y	Y	7/7/8

COOLING MEDIA PRESENT: (Y) / N

COMMENTS

2 Jars

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Maor Levy	2025/09/30	17:25	TREVOR RODRIGUES	2025/09/30	17:28

NONT-2025-09-6564

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