



## Foundation Investigation Report

*New Material Storage Facility at Dunchurch Patrol Yard,  
Highway 124, Dunchurch, ON*

Agreement No. 5021-E-0020

Assignment No. 10

Latitude: 45.658464; Longitude: -79.810954

Geocres No.: 31E12-001

**Type of Document:**

Final Report

**EXP Project Number:**

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**Prepared For:**

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**Date Submitted:**

2024-04-19

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### Issue and Revised Record

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<b>A</b>	March 4, 2024	pdf	C. Alexander D. Mroz S. Micic	T.C. Kim	S. Gonsalves	Draft Report
<b>B</b>	April 19, 2024	pdf	C. Alexander D. Mroz S. Micic	T.C. Kim	S. Gonsalves	Final Report

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# 1 FOUNDATION INVESTIGATION REPORT

## 1.1 Introduction

This report presents the results of the geotechnical investigation completed by EXP Services Inc. (EXP) for the new winter sand/salt storage structure at the Dunchurch Patrol Yard. The patrol yard is located at 6980 Highway 124 in Dunchurch, Ontario (Latitude: 45.658464; Longitude: -79.810954). The Terms of Reference (TOR) was provided by MTO. This report was undertaken under Agreement No. 5021-E-0020, Assignment No. 10.

The purpose of this investigation is to evaluate the subsurface conditions at the proposed location of the structure within the Dunchurch Patrol Yard. The proposed structure will be modelled after a recently constructed building at the Marten River Patrol Yard in Powassan, ON. The new building at the Dunchurch Patrol Yard will be approximately 24 m x 50 m. The site-specific geotechnical investigation consisted of a field investigation including visual inspection, drilling, soil sampling, and laboratory testing.

This foundation investigation report has been prepared specifically and solely for the project described herein. It contains the factual results of the investigation and the laboratory testing completed for this project.

## 1.2 Site Description and Geological Setting

### 1.2.1 Site Description

The Dunchurch Patrol Yard is located at 6980 Highway 124 in Dunchurch, Ontario (Key Map on Drawing 1, Appendix B). In general, the site is bound by undeveloped land consisting of forest in all directions with a residential dwelling nearby to the west.

A paved roadway leads from the site entrance on Highway 124 to five (5) existing buildings/structures, a maintenance garage, two (2) sand domes, a shed, and a storage structure. The maintenance garage, shed, and storage structure are located approximately 46 m northwest, 92 m northwest, and 135 m north of the site entrance, respectively. The two sand domes are located adjacent to one another, about 75 m and 79 m northeast of the site entrance, respectively. The new storage building will be placed at the location of the existing sand dome that is located approximately 5.0 m east of the existing shed. Per the AutoCAD drawing of Dunchurch Patrol Yard provided by MTO, the approximate finish floor (FF) elevations of the existing maintenance garage, sand domes, shed, and storage structure are 282.310 m, 281.800 m, 281.890 m, 281.805 m, and 284.755 m respectively.

The topography of the site is considered generally flat lying with borehole elevations ranging from Elev. 281.7 m to 281.9 m. The ground surface of the Dunchurch Patrol Yard is paved around the existing structures with sand and gravel in other areas along the perimeter of the patrol yard. Photographs of the site are included in Appendix A.

### 1.2.2 Geological Setting

According to the Ministry of Northern Development and Mines Map 2556, Quaternary Geology of Ontario, Southern Sheet, the site generally consists of Precambrian bedrock comprised of undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, and thin layer of drift. According to the Ministry of Northern Development and Mines Map 2544, Bedrock Geology of Ontario, Southern Sheet, the bedrock at the site consists of mafic rocks: amphibolite, gabbro, diorite, and mafic gneisses.

### 1.3 Available Documents of Previous Investigations

The nearest available previous investigation reports in the MTO GEOCREs library for the Dunchurch Patrol Yard are located about 2.7 km west, and 2.8 m east from the location of the site, respectively:

*Geocres No. 31E-322A: "Final Foundation Investigation and Design Report, Highway 124 Rehabilitation, Culvert Replacement, Station 11+225 – Twp. Of Croft, GWP 5467-09-00" prepared by LVM/Merlex Ltd., May 30, 2013.*

*Geocres No. 31E-044: "Foundation Investigation Report, Shadow River, W.P. 87-57; Hwy. 124" prepared by William A. Trow & Associates Ltd., December 1, 1964.*

### 1.4 Investigation Procedures

#### 1.4.1 Fieldwork

The field investigation was performed between January 18 and 19, 2024. The field program consisted of drilling four (4) sampled boreholes (BH23-D-1 to BH23-D-4). The boreholes were strategically located at the proposed location of the new building (i.e., at each corner of the building) to provide subsurface information for the design of the proposed material storage facility. The borehole locations are shown on Drawing 1 in Appendix B.

The borehole locations (referenced to the MTM NAD83 coordinate system) and their ground surface elevations were surveyed by EXP personnel using a Trimble DA2 GNSS receiver with Trimble Catalyst GNSS positioning, having an accuracy of  $\pm 0.1$  m in the horizontal and vertical directions. A reference was made with an existing benchmark (BM), established on the finished floor at the entrance of the existing sand dome located at the center of the property, next to the existing shed, approximately 75 m northeast of the entrance to the patrol yard. The elevation of the BM was Elev. 281.800 m based on the AutoCAD drawing. The BM location is shown on Drawing 1 in Appendix B.

The boreholes were advanced using a truck mounted CME 55 drill rig equipped with hollow stem augers and diamond bit NW casing and NQ coring. All borehole drilling and sampling operations were performed by a specialist drilling contractor, Landcore Drilling Services. The locations, elevations and depths of the boreholes are shown below in Table 1.1.

Table 1.1. Locations, elevations, and depths of boreholes completed by EXP Services Inc.

BH ID	Location	MTM NAD83 Zone 10		Latitude	Longitude	Ground Surface Elevation <sup>1</sup> (m)	Borehole Depth <sup>2</sup> (m)
		Northing	Easting				
BH23-D-1	Southeast corner of proposed bldg.	5057699.7	280536.7	45.658765	-79.811346	281.7	4.5
BH23-D-2	Southwest corner of proposed bldg.	5057688.6	280515.9	45.658665	-79.811612	281.7	5.7
BH23-D-3	Northwest corner of proposed bldg.	5057736.7	280502.0	45.659097	-79.811793	281.8	6.4

BH ID	Location	MTM NAD83 Zone 10		Latitude	Longitude	Ground Surface Elevation <sup>1</sup> (m)	Borehole Depth <sup>2</sup> (m)
		Northing	Easting				
BH23-D-4	Northeast corner of proposed bldg.	5057743.4	280528.5	45.659158	-79.811453	281.9	6.4

**Notes:**

1. The referenced ground surface elevations are geodetic.
2. Depths are relative to ground surface.

During the drilling of the boreholes, soil samples were obtained using a 51 mm outside diameter (O.D.) split-spoon sampler in accordance with Standard Penetration Test (SPT) procedures (ASTM D 1586), at intervals shown on the attached borehole logs (Appendix C). The original field (uncorrected) SPT “N” values were recorded on the borehole logs as recommended in the Canadian Foundation Engineering Manual (CFEM pg. 40) and used to provide an assessment of in-situ consistency of cohesive soils or compactness of non-cohesive soils. When a hard stratum was reached sampling of hard material was performed by diamond core drilling, using a 1.5 m long NQ double tube wireline core barrel.

Groundwater level measurements were carried out in the boreholes before coring procedures and at the completion of the boreholes, in accordance with MTO guidelines. The recorded groundwater levels measured prior to rock coring of the boreholes are presented in the borehole log sheets in Appendix C. The boreholes were decommissioned right after completion of drilling by bentonite/cement mixtures in accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

The fieldwork was supervised by an EXP geotechnical representative who directed the drilling and sampling operations, logged borehole data in accordance with MTO and/or ASTM standards for soils classification, and retrieved soil samples for subsequent laboratory testing and identification.

All recovered soil samples were placed in labelled moisture-proof bags and returned to EXP’s Brampton laboratory for additional visual, textual and olfactory examination, and sampling for laboratory testing.

#### 1.4.2 Laboratory Testing

All samples recovered from boreholes undertaken by EXP during this investigation were returned to EXP’s Brampton laboratory and subjected to visual examination and classification. The laboratory testing program on soil samples included the determination of natural moisture content, particle size distribution, and Atterberg limits tests for approximately 25% of the collected soil samples. One (1) soil sample was selected for chemical analysis and tested at Bureau Veritas Laboratories, a CALA-certified and accredited laboratory. All laboratory tests were carried out in accordance with MTO and/or ASTM standards as appropriate.

The laboratory test results are provided on the attached borehole log sheets in Appendix C. The results of the grain size analyses and Atterberg limits are presented graphically in Appendix D. Appendix D also contains the results of the chemical tests.

### 1.5 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix C. Laboratory test results of grain size analyses and Atterberg limits tests

are provided in Appendix D. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix C forms an integral part of and should be read in conjunction with this report.

A borehole location plan and cross section subsurface profiles are provided in Appendix B. It should be noted that the stratigraphic boundaries indicated on the borehole log and cross section stratigraphic profiles are inferred from semi-continuous sampling, observations of drilling progress and results of Standard Penetration Tests. These boundaries typically represent transitions from one soil type to another and should not be regarded as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

In general, the stratigraphic sequence at the proposed structure site consists of pavement structure at ground surface followed by compact cohesionless fill, underlain by firm to very stiff silty clay to clayey silt, underlain by very loose to very dense silty sand to sand followed by bedrock.

A detailed description of the subsurface conditions encountered is discussed further in subsequent sections. It should be noted that the following sections are based on the geotechnical investigation conducted by EXP.

### 1.5.1 Asphalt

Asphalt, approximately 50 mm thick, was encountered at the surface of boreholes BH23-D-2, and BH23-D-3.

### 1.5.2 Cohesionless Fill: Sand

Cohesionless fill consisting of sand was encountered below the asphalt in boreholes BH23-D-2, and BH23-D-3, and at the surface of boreholes BH23-D-1, and BH23-D-4. The depths and elevations of the fill layer encountered at these borehole locations are listed in Table 1.2.

Table 1.2. Summary of cohesionless fill: sand

Borehole No.	Elevation <sup>1</sup> (m)		Layer Surface Depth <sup>2</sup> (m)	Layer Thickness (m)
	Top	Bottom		
BH23-D-1	281.7	280.9	0.0	0.8
BH23-D-2	281.6	280.6	0.1	1.0
BH23-D-3	281.7	280.3	0.1	1.4
BH23-D-4	281.9	280.3	0.0	1.6

Notes:

1. The elevations referenced are geodetic.
2. Depths are relative to ground surface.

The composition of this fill material generally consisted of sand with trace gravel. The fill was generally brown in colour, and moist. The SPT “N” values obtained within this fill material ranged from 6 to 35 blows per 0.3 m penetration, suggesting that this fill layer was loose to dense in compactness, but generally compact.

Laboratory testing performed on selected samples consisted of seven (7) moisture content tests. The test results are as follows:

Moisture Content:

- 10% to 18%

The results of the moisture content tests are provided on the record of borehole sheets in Appendix C.

### 1.5.3 Silty Clay / Clayey Silt

Native cohesive silty clay / clayey silt was encountered below the cohesionless fill layer in all boreholes. The depths and elevations of this layer encountered at these borehole locations are listed in Table 1.3.

Table 1.3. Summary of silty clay / clayey silt

Borehole No.	Elevation <sup>1</sup> (m)		Layer Surface Depth <sup>2</sup> (m)	Layer Thickness (m)
	Top	Bottom		
BH23-D-1	280.9	280.2	0.8	0.7
BH23-D-2	280.6	280.2	1.1	0.4
BH23-D-3	280.3	279.5	1.5	0.8
BH23-D-4	280.3	279.6	1.6	0.7

Notes:

1. The elevations referenced are geodetic.
2. Depths are relative to ground surface.

The composition of this layer generally consisted of silty clay to clayey silt with trace to some sand, and trace organics. Trace oxidization was encountered in boreholes BH23-D-3, and BH23-D-4. The material was generally grey in colour and moist to wet. The SPT “N” values obtained within this layer ranged from 6 to 25 blows per 300 mm penetration, suggesting that this material was firm to very stiff in consistency, but generally stiff to very stiff in consistency. The Atterberg limits test results suggest that this cohesive layer was of low to medium plasticity, but generally low plasticity.

Laboratory testing performed on selected samples consisted of four (4) moisture content tests, three (3) grain size distribution tests, and three (3) Atterberg limits tests. The test results are as follows:

Moisture Content:

- 22% to 33%

Grain Size Distribution:

- 0% gravel;
- 5% to 11% sand;
- 61% to 69% silt;
- 22% to 32% clay



Atterberg Limits:

- Liquid Limit: 30% to 40%
- Plastic Limit: 17% to 21%
- Plasticity Index: 11% to 19%

The results of the moisture content, grain size distribution, and Atterberg limits tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution, and Atterberg limits tests are also provided on Figure 1, and Figure 3, respectively, in Appendix D.

#### 1.5.4 Silty Sand / Sand

Native silty sand / sand was encountered below the silty clay / clayey silt layer in all boreholes. The depths and elevations of this layer encountered at these borehole locations are listed in Table 1.4.

Table 1.4. Summary of silty sand / sand

Borehole No.	Elevation <sup>1</sup> (m)		Layer Surface Depth <sup>2</sup> (m)	Layer Thickness (m)
	Top	Bottom		
BH23-D-1	280.2	278.9	1.5	1.3
BH23-D-2	280.2	279.0	1.5	1.2
BH23-D-3	279.5	277.8	2.3	1.7
BH23-D-4	279.6	277.7	2.3	1.9

Notes:

3. The elevations referenced are geodetic.
4. Depths are relative to ground surface.

The composition of this layer generally consisted of silty sand to sand with some silt, and trace clay. The material was generally brown to grey in colour and wet. The SPT “N” values within this layer ranged from 2 to 100 blows per 300 mm penetration to 100 blows per 50 mm penetration, suggesting that this material was very loose to very dense in compactness, but generally loose to compact.

Laboratory testing performed on selected samples consisted of ten (10) moisture content tests, and three (3) grain size distribution tests. The test results are as follows:

Moisture Content:

- 19% to 26%

Grain Size Distribution:

- 0% gravel;
- 65% to 88% sand;
- 10% to 32% silt;
- 2% to 3% clay

The results of the moisture content and grain size distribution tests are provided on the record of borehole sheets in Appendix C. The results of the grain size distribution tests are also provided on Figure 2 in Appendix D.

### 1.5.5 Bedrock

Bedrock was encountered below the silty sand / sand layer in all boreholes. The bedrock in these boreholes was investigated by coring approximately 1.7 m to 3.0 m into the stratum. Based on the encountered bedrock, it appears the rock/bedrock slopes towards the north. The bedrock surface depths and elevations encountered at these borehole locations are listed in Table 1.5. Photographs of the rock cores are included in Appendix E.

Table 1.5. Summary of Bedrock

Borehole No.	Elevation <sup>1</sup> (m)		Layer Surface Depth <sup>2</sup> (m)	Uniaxial Compressive Strength – UCS (MPa)
	Top	Bottom		
BH23-D-1	278.9	277.2	2.8	-
BH23-D-2	279.0	276.0	2.7	66.4
BH23-D-3	277.8	275.4	4.0	-
BH23-D-4	277.7	275.5	4.2	-

Notes:

1. The elevations referenced are geodetic.
2. Depths are relative to ground surface.

Based on the bedrock NQ cores (~ core diameter 47 mm) recovered, the bedrock core samples are described as mafic rock (grey) with quartz veining. The Rock Quality Designation (RQD) measured on the core samples ranged from approximately 80% to 100%, indicating a rock mass of good to excellent quality. The total core recovery (TCR) of bedrock cores ranged from 83% to 100%.

The uniaxial compressive strength (UCS) was measured to be approximately 66.4 MPa in Run 1, indicating strong (R4) rock, according to the CFEM. The results of laboratory uniaxial compression test are presented on the borehole records in Appendix C, and in Appendix D.

### 1.6 Groundwater Conditions

Groundwater was encountered in all open boreholes prior to rock coring between approximately Elevations 279.4 to 279.9 m. The groundwater levels measured in the open boreholes prior to rock coring are shown on the borehole logs in Appendix C and are presented below in Table 1.6.

Table 1.6. Summary of groundwater levels

Borehole No.	Date Measured	Ground Surface Elevation (m)	Groundwater Depth <sup>1</sup> /Elevation <sup>2</sup> (m)
Groundwater Measured Prior to Rock Coring			
BH23-D-1	January 19, 2024	281.7	1.8/279.9
BH23-D-2	January 18, 2024	281.7	1.8/279.9

Borehole No.	Date Measured	Ground Surface Elevation (m)	Groundwater Depth <sup>1</sup> /Elevation <sup>2</sup> (m)
BH23-D-3	January 18, 2024	281.8	2.4/279.4
BH23-D-4	January 18, 2024	281.9	2.1/279.8

Notes:

1. Depths are relative to ground surface.
2. The elevations referenced are geodetic.

Seasonal variations in the water table should be expected, with higher levels occurring during wetter periods of the year and lower levels during drier periods.

## 1.7 Chemical Analyses

One (1) soil sample was selected for chemical analyses during field investigation. The soil sample collected by EXP was tested at Bureau Veritas, a CALA-certified and accredited laboratory in Mississauga, Ontario.

The sample SS3 from borehole BH23-D-3 was subjected to corrosivity chemical analyses. The analytical results are summarized in Table 1.7 below and are presented in Appendix D.

Table 1.7. Summary of chemical analysis results

Sample Identification	pH (unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (mS/cm)	Redox Potential (mV)
BH23-D-3 SS3	6.73	430	<20	1200	821	220

## 2 CLOSURE

A subsurface investigation is a limited sampling of a site; the subsurface conditions have been established only at the test hole locations. Should conditions at the site be encountered which differ from those reported at the test locations, we require that we be notified immediately in order to assess this additional information and our recommendations, as appropriate. It may then be necessary to perform additional investigation and analysis.

Contractors bidding on or undertaking any proposed work at this site should, relative to the subsurface conditions, decide on their own investigations, if deemed necessary, as well as their own interpretations of the factual results provided herein, so they may draw their own conclusions as to how the subsurface conditions may affect them.

This Foundation Investigation Report has been prepared by Daniel Mroz, M.E.Sc., EIT, Ciarra Alexander, M.Eng., and Silvana Micic, Ph.D., P.Eng., and reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., MTO Designated Foundation Contact. The field investigation was conducted by Elvis Lu, M.Eng., EIT.

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## REFERENCES

Canadian Geotechnical Society, 2006. Canadian Foundation Engineering Manual, 4th Edition. The Canadian Geotechnical Society, BiTech Publisher Ltd., British Columbia.

Ministry of Northern Development and Mines, Map 2556. Quaternary Geology of Ontario, Southern Sheet, 1991

Ministry of Northern Development and Mines Map 2544. Bedrock Geology of Ontario, Southern Sheet, 1991

Ministry of Transportation, April 2022. Guideline for MTO Foundation Engineering Services, Version 03

### **ASTM International:**

ASTM D1586      Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

### **Ontario Water Resources Act:**

R.R.O 1990, Regulation 903 Wells, under Ontario Water Resources Act, R.S.O. 1990, c. O.40

## LIMITATIONS AND USE OF REPORT

### BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

### RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to EXP by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. EXP has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are

only valid to the extent that there has been no material alteration to or variation from any of the information provided to EXP.

#### **STANDARD OF CARE**

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

#### **COMPLETE REPORT**

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to EXP by its client ("Client"), communications between EXP and the Client, other reports, proposals or documents prepared by EXP for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. EXP is not responsible for use by any party of portions of the Report.

#### **USE OF REPORT**

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of EXP. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. EXP is not responsible for damages suffered by any third party resulting from unauthorised use of the Report.

#### **REPORT FORMAT**

Where EXP has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by EXP have utilized specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are EXP's instruments of professional service and shall not be altered without the written consent of EXP.

## Appendix A – Site Photographs





Photo 1. Dunchurch Patrol Yard – Drilling borehole BH23-D-1, facing southeast (January 19, 2024)



Photo 2. Dunchurch Patrol Yard – Drilling borehole BH23-D-2, facing west (January 18, 2024)



Photo 3. Dunchurch Patrol Yard – Drilling borehole BH23-D-3, facing southeast (January 18, 2024)

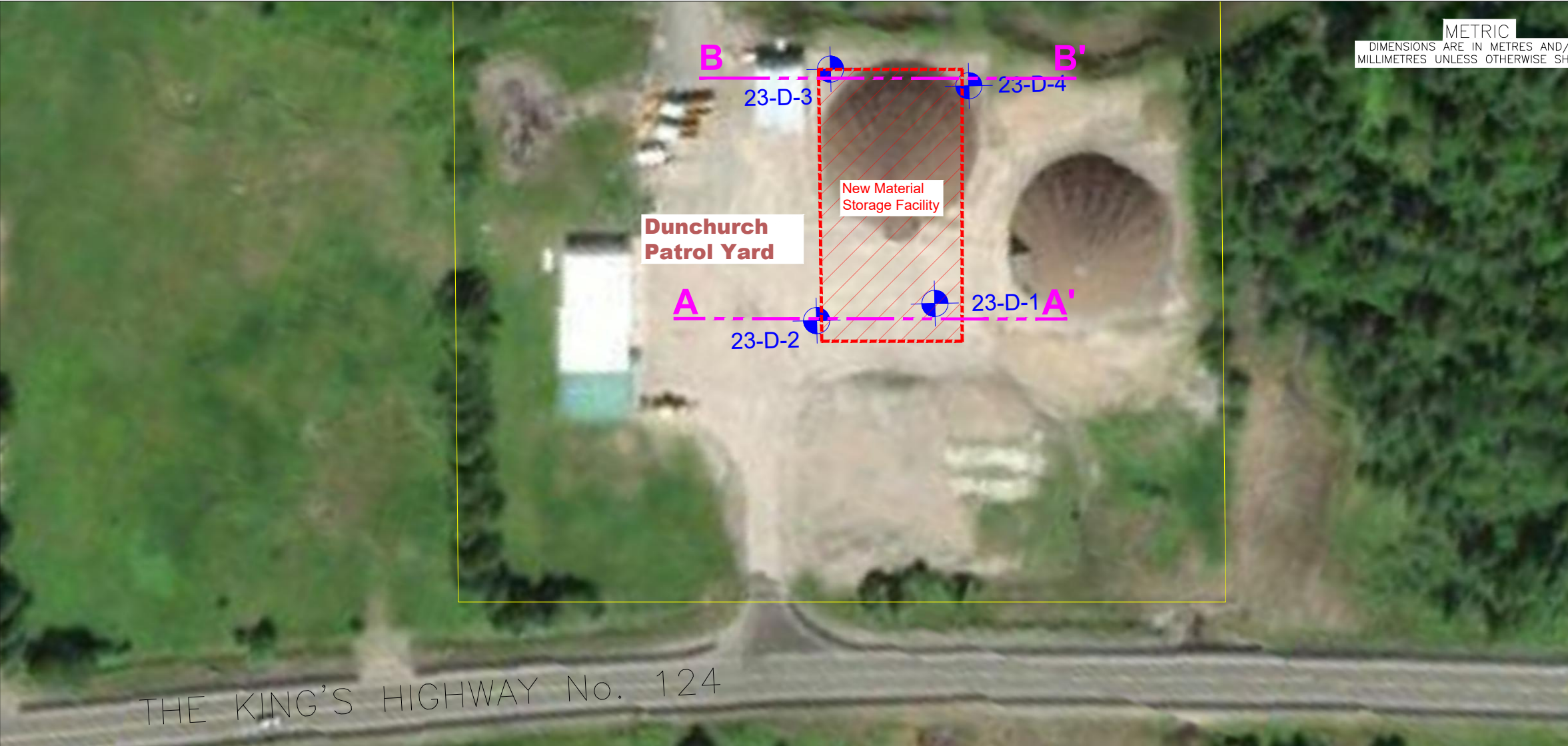


Photo 4. Dunchurch Patrol Yard – Drilling borehole BH23-D-4, facing south (January 18, 2024)

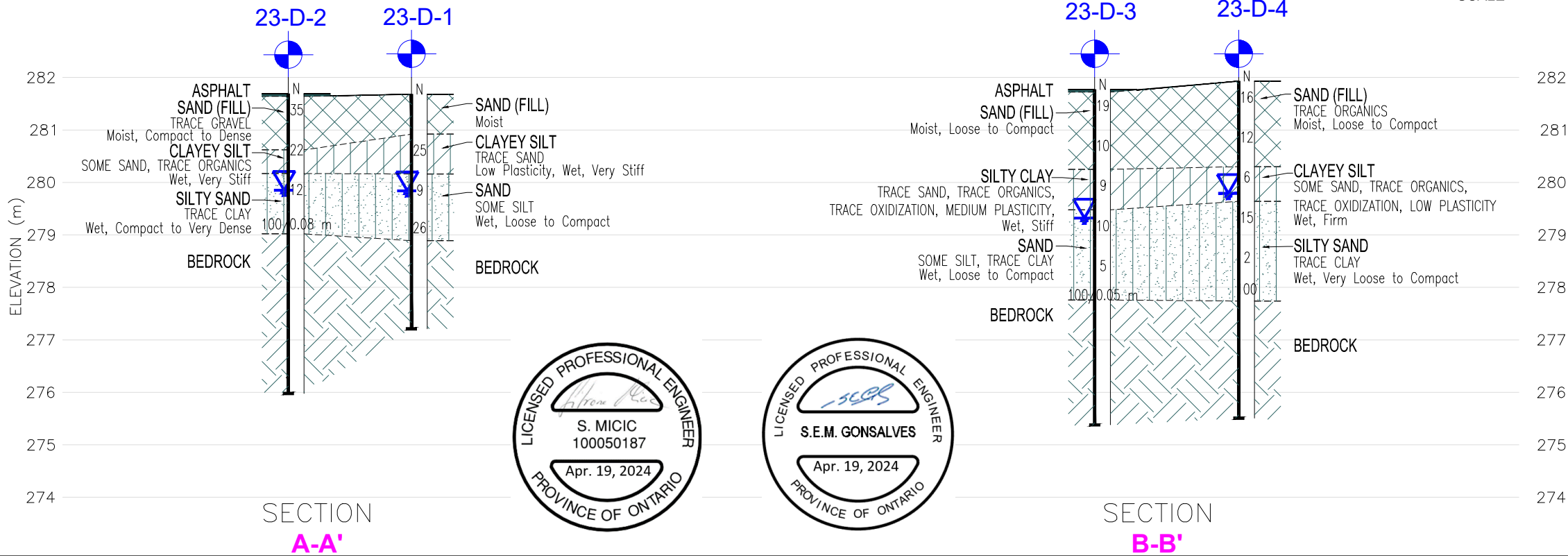
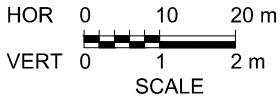
## Appendix B – Drawings



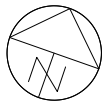
FILE NAME: I:\2003-Brampton\Proposals\Projects\International\WTO Projects\Retainer NER\5021-E-0020\Assignment 10 - Mattawa and Dunchurch Patrol Yards\AutoCAD\Working drawings\Dunchurch Patrol Yard\_plan & profile.dwg  
MODIFIED: 2024-02-26 12:35



PLAN



CONT No. 5021-E-0020  
ASSIG No. 10  
GWP No.

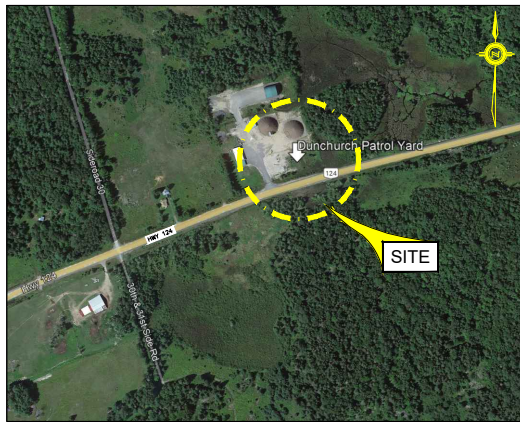


New Material Storage Facility at Dunchurch Patrol Yard,  
Highway 124, Dunchurch, ON  
*Latitude: 45.658464°; Longitude: -79.810954°*  
BOREHOLE LOCATION PLAN & SOIL STRATA

SHEET  
1



EXP SERVICES INC.



KEY PLAN  
N.T.S.

LEGEND

- Borehole Location
- Water Level Upon Completion of Drilling (W. L. NOT STABILIZED)
- N** Blows/0.3m (Std. Pen. Test, 475 J/blow)

SOIL STRATA SYMBOLS

- ASPHALT
- FILL
- CLAYEY SILT/ SILTY CLAY
- SILTY SAND/ SAND
- BEDROCK

BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10

BH No.	ELEV.	NORTHING	EASTING
23-D-1	281.7	5057700	280537
23-D-2	281.7	5057689	280516
23-D-3	281.8	5057737	280502
23-D-4	281.9	5057743	280529

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.

The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in the report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

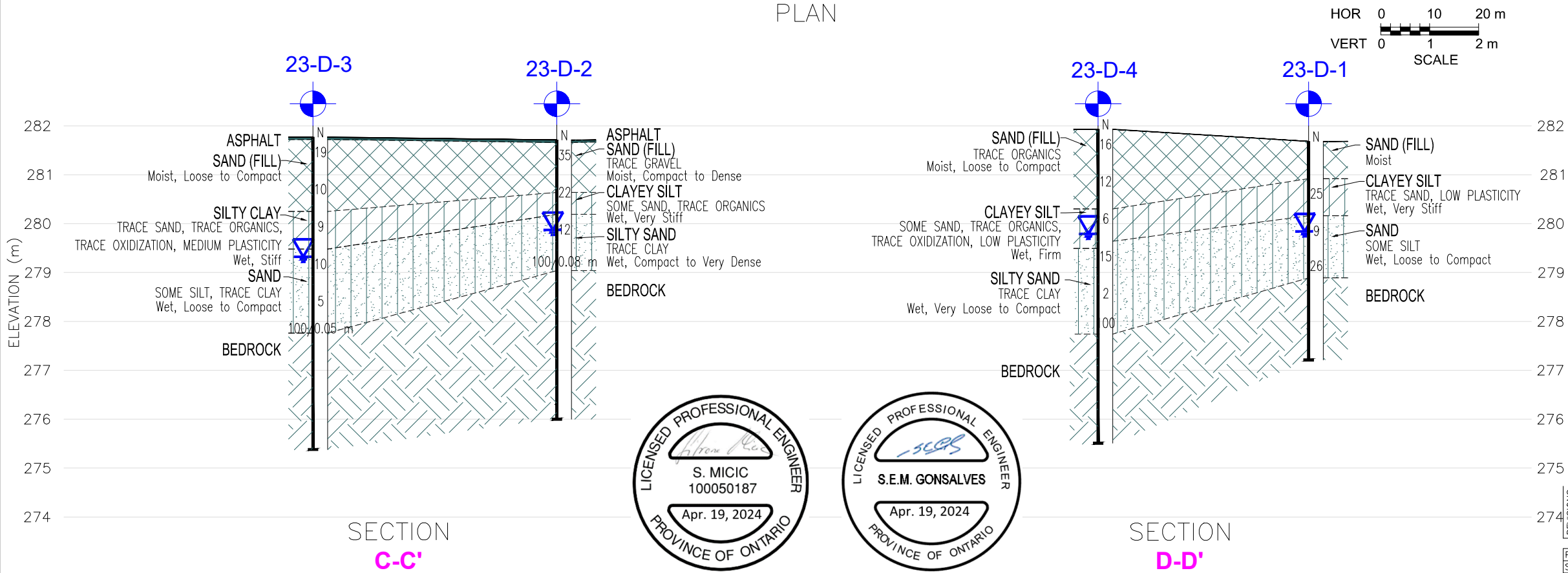
SUBMISSION FOR MTO REVIEW			
NO	DATE	BY	DESCRIPTION
PROJECT No.	ADM-22006096-A9	GEOCREs No.	31E12-001
SUBM'D SH	CHKD. SM	DATE	APR. 19, 2024 SITE-
DRAWN SH	CHKD. TC	APPRD SG	DWG 01



FILE NAME: I:\2003-Brampton\Proposals\Projects\International\WTO Projects\Retainer NER\5021-E-0020\Assignment 10 - Mattawa and Dunchurch Patrol Yards\AutoCAD\Working drawings\Patrol Yard\_plan & profile.dwg  
MODIFIED: 2024-02-26 12:35



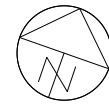
PLAN



SECTION  
C-C'

SECTION  
D-D'

CONT No. 5021-E-0020  
ASSIG No. 10  
GWP No.

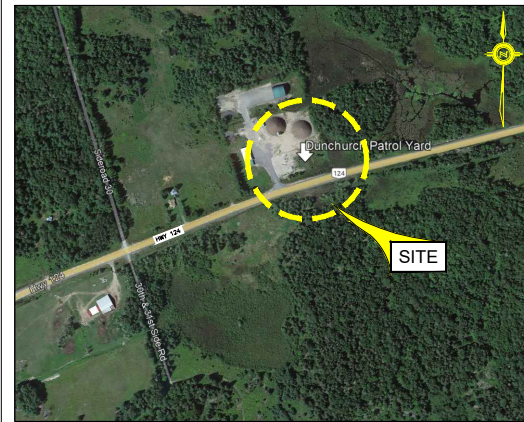


New Material Storage Facility at Dunchurch Patrol Yard,  
Highway 124, Dunchurch, ON  
Latitude: 45.658464°; Longitude: -79.810954°  
BOREHOLE LOCATION PLAN & SOIL STRATA

SHEET  
2



EXP SERVICES INC.



KEY PLAN  
N.T.S.

LEGEND

- Borehole Location
- Water Level Upon Completion of Drilling (W. L. NOT STABILIZED)
- Blows/0.3m (Std. Pen. Test, 475 J/blow)

SOIL STRATA SYMBOLS

- ASPHALT
- FILL
- CLAYEY SILT/ SILTY CLAY
- SILTY SAND/ SAND
- BEDROCK

BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10

BH No.	ELEV.	NORTHING	EASTING
23-D-1	281.7	5057700	280537
23-D-2	281.7	5057689	280516
23-D-3	281.8	5057737	280502
23-D-4	281.9	5057743	280529

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.

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SUBMISSION FOR MTO REVIEW			
NO	DATE	BY	DESCRIPTION

PROJECT No.	ADM-22006096-A9	GEOCREs No.	31E12-001
SUBM'D SH	CHKD. SM	DATE	APR. 19, 2024 SITE.
DRAWN SH	CHKD. TC	APPRD SG	DWG 02

## Appendix C - Borehole Logs

# Explanation of Terms Used on Borehole Records

## SOIL DESCRIPTION

Terminology describing common soil genesis:

*Topsoil:* mixture of soil and humus capable of supporting good vegetative growth.

*Peat:* fibrous fragments of visible and invisible decayed organic matter.

*Fill:* where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc.; none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

*Till:* the term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure:

*Desiccated:* having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

*Stratified:* alternating layers of varying material or color with the layers greater than 6 mm thick.

*Laminated:* alternating layers of varying material or color with the layers less than 6 mm thick.

*Fissured:* material breaks along plane of fracture.

*Varved:* composed of regular alternating layers of silt and clay.

*Slickensided:* fracture planes appear polished or glossy, sometimes striated.

*Blocky:* cohesive soil that can be broken down into small angular lumps which resist further breakdown.



*Lensed:* inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

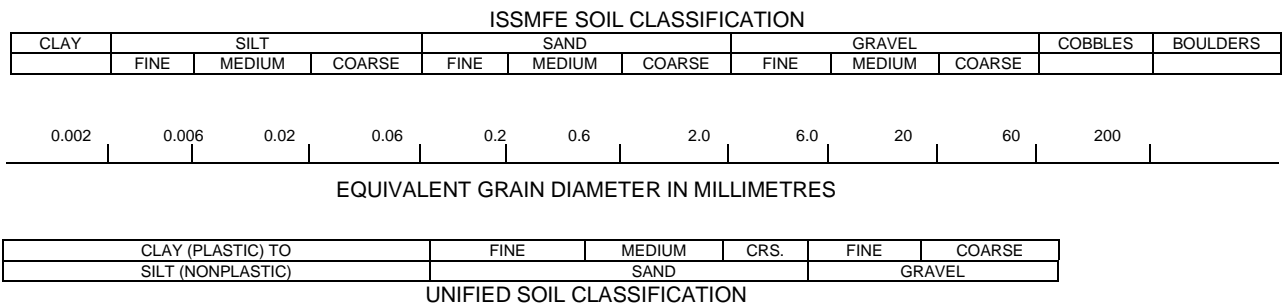
*Seam:* a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

*Homogeneous:* same color and appearance throughout.

*Well Graded:* having wide range in grain sized and substantial amounts of all predominantly on grain size.

*Uniformly Graded:* predominantly on grain size.

All soil sample descriptions included in this report follow generally the ASTM D2487-11 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) with some modification to reflect current MTO practices. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. The system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification. The classification excludes particles larger than 76 mm. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually in accordance with ASTM D2488-09a Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems. Others may use different classification systems; one such system is the ISSMFE Soil Classification.



Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present and as described below in accordance with Canadian Foundation Engineering Manual (CFEM):

Table a: Percent or Proportion of Soil

Term	Description	Criteria
"trace"	trace gravel, trace sand, etc.	1% - 10%
"some"	some gravel, some sand, etc.	10% - 20%
Adjective	gravelly, sandy, silty and clayey	20% - 35%
"and"	and gravel, and sand, etc.	>35%
Noun	gravel, sand, silt, clay	>35% and main fraction

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test 'N' value:

Table b: Apparent Density of Cohesionless Soil

	'N' Value (blows/0.3 m)
Very Loose	N<5
Loose	5≤N<10
Compact	10≤N<30
Dense	30≤N<50
Very Dense	50≤N



The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis, Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils:

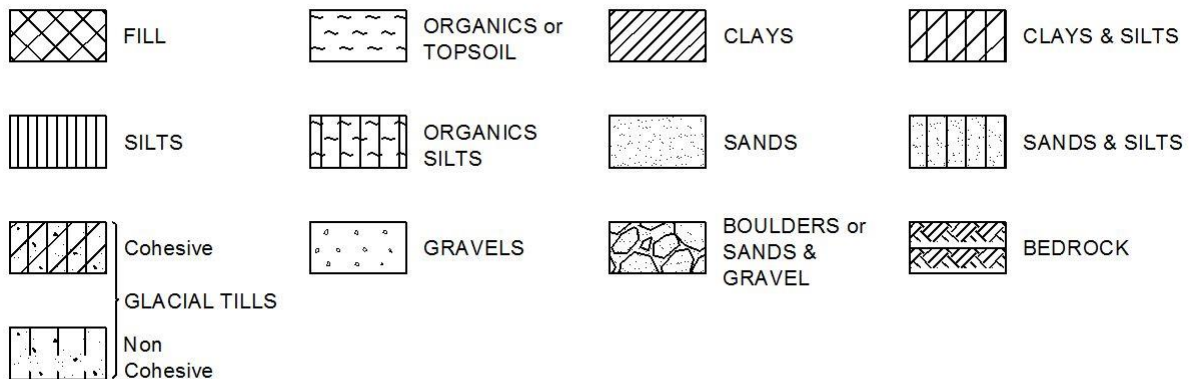
Table c: Consistency of Cohesive Soil

Consistency	Vane Shear Measurement (kPa)	'N' Value
Very Soft	<12.5	<2
Soft	12.5-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

Note: 'N' Value - The Standard Penetration Test records the number of blows of a 140 pound (64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler 1 foot (305mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in meters (e.g. 50/0.15).

## STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



## WATER LEVEL MEASUREMENT



Open Borehole or Test Pit



Monitoring Well, Piezometer or Standpipe

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

SS	Split spoon sample (obtained from the Standard Penetration Test)
WS	Wash sample
BS	Bulk sample
TW	Thin wall sample or Shelby tube
PS	Piston sample
AS	Auger sample
VT	Vane test
GS	Grab sample
HQ, NQ, etc.	Rock core samples obtained with the use of standard size diamond drilling bits

### STRESS AND STRAIN

$u_w$	kPa	Pore water pressure
$r_u$	1	Pore pressure ratio
$\sigma$	kPa	Total normal stress
$\sigma'$	kPa	Effective normal stress
$\tau$	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
$\varepsilon$	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
$\mu$	1	Coefficient of friction

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	Coefficient of volume change
$c_c$	1	Compression index
$c_s$	1	Swelling index
$c_r$	1	Recompression index
$c_v$	m <sup>2</sup> /s	Coefficient of consolidation
H	m	Drainage path
$T_v$	1	Time factor
U	%	Degree of consolidation
$\sigma'_{v0}$	kPa	Effective overburden pressure
$\sigma'_p$	kPa	Preconsolidation pressure
$\tau_f$	kPa	Shear strength
$c'$	kPa	Effective cohesion intercept
$\phi'$	—°	Effective angle of internal friction
$c_u$	kPa	Apparent cohesion intercept
$\phi_u$	—°	Apparent angle of internal friction
$\tau_R$	kPa	Residual shear strength
$\tau_r$	kPa	Remoulded shear strength
$S_t$	1	Sensitivity = $c_u/\tau_r$

### PHYSICAL PROPERTIES OF SOIL

$P_s$	kg/m <sup>3</sup>	Density of solid particles
$\gamma_s$	kN/m <sup>3</sup>	Unit weight of solid particles
$\rho_w$	kg/m <sup>3</sup>	Density of water
$\gamma_w$	kN/m <sup>3</sup>	Unit weight of water
$\rho$	kg/m <sup>3</sup>	Density of soil
$\gamma$	kN/m <sup>3</sup>	Unit weight of soil
$\rho_d$	kg/m <sup>3</sup>	Density of dry soil
$\gamma_d$	kN/m <sup>3</sup>	Unit weight of dry soil
$\rho_{sat}$	kg/m <sup>3</sup>	Density of saturated soil
$\gamma_{sat}$	kN/m <sup>3</sup>	Unit weight of saturated soil
$\rho'$	kg/m <sup>3</sup>	Density of submerged soil
$\gamma'$	kN/m <sup>3</sup>	Unit weight of submerged soil
$e$	1, %	Void ratio
$n$	1, %	Porosity
$w$	1, %	Water content
$S_r$	%	Degree of saturation
$W_L$	%	Liquid limit
$W_P$	%	Plastic limit
$W_s$	%	Shrinkage limit
$I_p$	%	Plasticity index = $(W_L - W_P)$
$I_L$	%	Liquidity index = $(W - W_P)/I_p$
$I_C$	%	Consistency index = $(W_L - W)/I_p$
$e_{max}$	1, %	Void ratio in loosest state
$e_{min}$	1, %	Void ratio in densest state
$I_D$	1	Density index = $(e_{max} - e)/(e_{max} - e_{min})$
D	mm	Grain diameter
$D_n$	mm	N percent - diameter
$C_u$	1	Uniformity coefficient
h	m	Hydraulic head or potential
q	m <sup>3</sup> /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m <sup>3</sup>	Seepage force

Brampton, Ontario

RECORD OF BOREHOLE No 23-D-1

1 OF 1

METRIC

W.P. \_\_\_\_\_

LOCATION 5057700N, 280537E, NAD83 MTM Zone 10

ORIGINATED BY EL

DIST NE HWY 124

BOREHOLE TYPE Continuous Flight HSA, NW Casing, NQ Core Barrel

COMPILED BY CA

DATUM Geodetic

DATE 2024.01.19 - 2024.01.19

LATITUDE 45.658765

LONGITUDE -79.811346

CHECKED BY SM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					W <sub>p</sub>	W	W <sub>L</sub>					
								20 40 60 80 100												
281.7	0.0	SAND (FILL), brown, moist	AS1	AS		$\nabla$	281													
280.9	0.8	CLAYEY SILT, trace sand, grey, low plasticity, wet, very stiff	SS2	SS	25		280													
280.2	1.5	SAND, some silt, brown, wet, loose to compact	SS3	SS	9		279													
278.9	2.8	BEDROCK, dark grey to grey with quartz veining  Run 1: Start/End: 2.8 to 4.3 m Recovery: 100% RQD: 95%  Run 2: Start/End: 4.3 to 4.5 m Recovery: 83% RQD: 83%	RUN 1	NQ			278													
277.2	4.5	BOREHOLE TERMINATED AT ~ 4.5 m DEPTH  Notes: 1. Groundwater measured in open hole at 1.8 m depth prior to rock coring. 2. Borehole backfilled upon completion.	RUN2	NQ																

ONTARIO MTO DUNCHURCH.PY.GPJ ONTARIO MTO.GDT 2/26/24

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity

○ 3% STRAIN AT FAILURE

Brampton, Ontario

## RECORD OF BOREHOLE No 23-D-2

1 OF 1

METRIC

W.P. \_\_\_\_\_ LOCATION 5057689N, 280516E, NAD83 MTM Zone 10 ORIGINATED BY EL  
DIST NE HWY 124 BOREHOLE TYPE Continuous Flight HSA, NW Casing, NQ Core Barrel COMPILED BY CA  
DATUM Geodetic DATE 2024.01.18 - 2024.01.18 LATITUDE 45.658665 LONGITUDE -79.811612 CHECKED BY SM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL P. PENETROMETER									
281.7								20	40	60	80	100					
280.9	ASPHALT, ~ 50 mm thick		SS1	SS	35	▽	281							○			
	SAND (FILL), trace gravel, brown, moist, compact to dense													○			
280.6			SS2	SS	22									○			
1.1	CLAYEY SILT, some sand, trace organics, grey, wet, very stiff													○			
280.2																	
1.5	SILTY SAND, trace clay, grey, wet, compact		SS3	SS	12	280								○			0 71 26 3
	- very dense at ~ 2.3 m depth													○			
279.0			SS4	SS	100/ 0.08 m	279											
2.7	BEDROCK, dark grey to grey with quartz veining and limestone interbeds						278										UCS test on Run 1 = 66.4 MPa
	Run 1: Start/End: 2.7 to 4.2 m Recovery: 97% RQD: 88%		RUN 1	NQ													
	Run 2: Start/End: 4.2 to 5.7 m Recovery: 100% RQD: 100%		RUN 2	NQ		277											
276.0						276											
5.7	BOREHOLE TERMINATED AT ~ 5.7 m DEPTH																
	Notes: 1. Groundwater measured in open hole at 1.8 m depth prior to rock coring. 2. Borehole backfilled upon completion.																

Brampton, Ontario

## RECORD OF BOREHOLE No 23-D-3

1 OF 1

METRIC

W.P. \_\_\_\_\_ LOCATION 5057737N, 280502E, NAD83 MTM Zone 10 ORIGINATED BY EL  
DIST NE HWY 124 BOREHOLE TYPE Continuous Flight HSA, NW Casing, NQ Core Barrel COMPILED BY CA  
DATUM Geodetic DATE 2024.01.18 - 2024.01.18 LATITUDE 45.659097 LONGITUDE -79.811793 CHECKED BY SM

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL P. PENETROMETER								
281.8						▽										
280.9	ASPHALT, ~ 50 mm thick		SS1	SS	19											
	SAND (FILL), brown, moist, loose to compact															
	- grey below ~ 0.8 m depth		SS2	SS	10											
280.3																
1.5	SILTY CLAY, trace sand, trace organics, trace oxidization, grey, medium plasticity, wet, stiff		SS3	SS	9										0 5 63 32	
279.5																
2.3	SAND, some silt, trace clay, grey, wet, loose to compact		SS4	SS	10										Corrosivity Sample	
			SS5	SS	5										0 88 10 2	
277.8	- very dense below ~ 3.8 m depth		SS6	SS	100/ 0.05 m											
4.0	BEDROCK, dark grey to grey with quartz veining															
	Run 1: Start/End: 4.0 to 4.9 m Recovery: 100% RQD: 100%		RUN 1	NQ												
	Run 2: Start/End: 4.9 to 6.4 m Recovery: 100% RQD: 95%		RUN 2	NQ												
275.4																
6.4	BOREHOLE TERMINATED AT ~ 6.4 m DEPTH															
	Notes: 1. Groundwater measured in open hole at 2.4 m depth prior to rock coring. 2. Borehole backfilled upon completion.															

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

ONTARIO MTO: DUNCHURCH.PY.GPJ, ONTARIO MTO.GDT, 2/26/24




Brampton, Ontario

## RECORD OF BOREHOLE No 23-D-4

1 OF 1

METRIC

W.P. \_\_\_\_\_ LOCATION 5057743N, 280529E, NAD83 MTM Zone 10 ORIGINATED BY EL  
DIST NE HWY 124 BOREHOLE TYPE Continuous Flight HSA, NW Casing, NQ Core Barrel COMPILED BY CA  
DATUM Geodetic DATE 2024.01.18 - 2024.01.18 LATITUDE 45.659158 LONGITUDE -79.811453 CHECKED BY SM

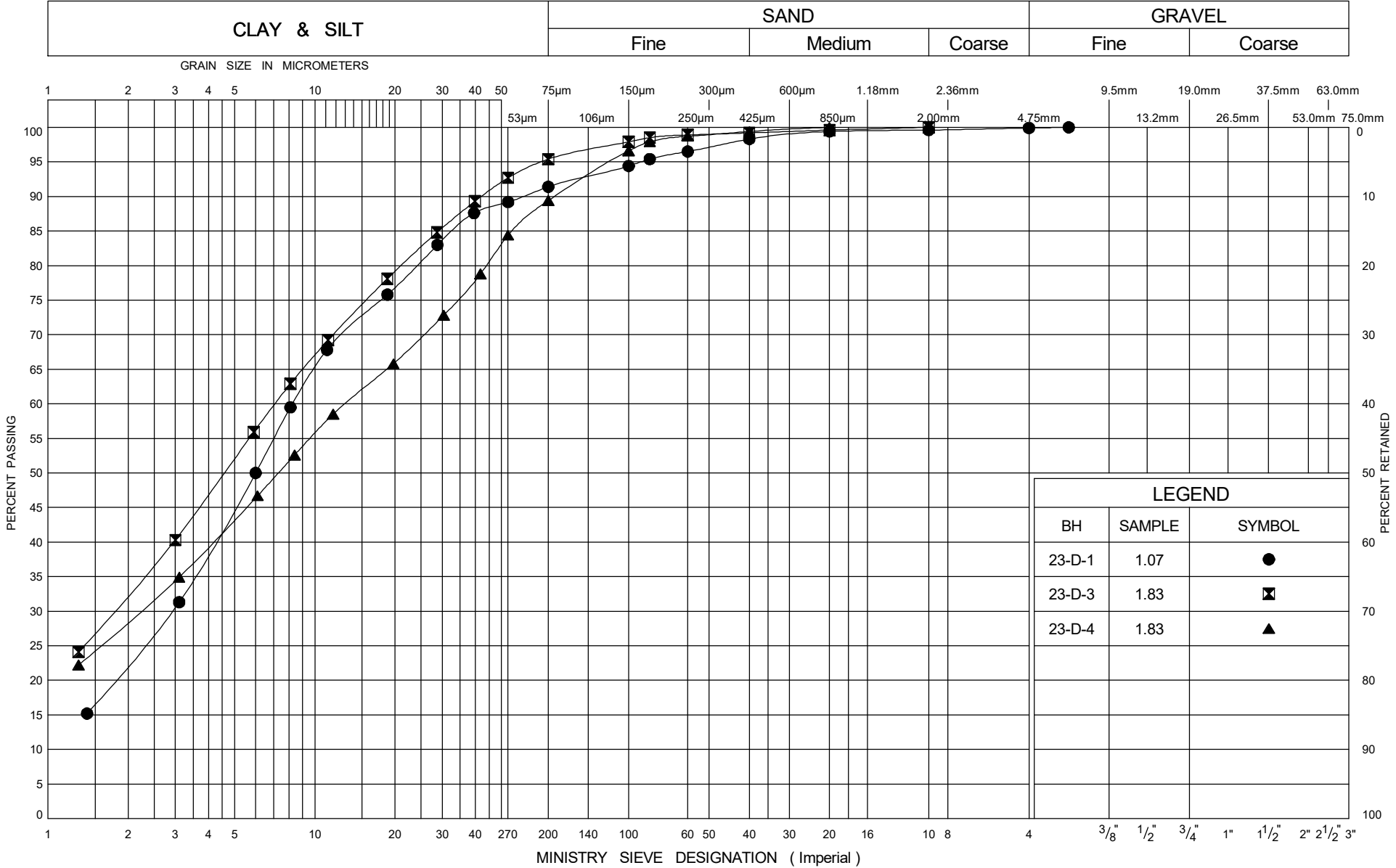
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  <b>γ</b>  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W <sub>P</sub> W                      W <sub>L</sub>				GR	SA	SI	CL		
												20    40    60    80    100									
281.9	0.0	<b>SAND (FILL)</b> , brown, moist, loose to compact		SS1	SS	16		281													
		- trace organics at ~ 1.4 m depth																			
280.3	1.6	<b>CLAYEY SILT</b> , some sand, trace organics, trace oxidization, grey, low plasticity, wet, firm		SS3	SS	6		280											0   11   61   28		
		<b>SILTY SAND</b> , trace clay, brown, wet, very loose to compact		SS4	SS	15		279											0   65   32   3		

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

ONTARIO MTO: DUNCHURCH.PY.GPJ ONTARIO MTO.GDT 2/26/24

## Appendix D - Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM

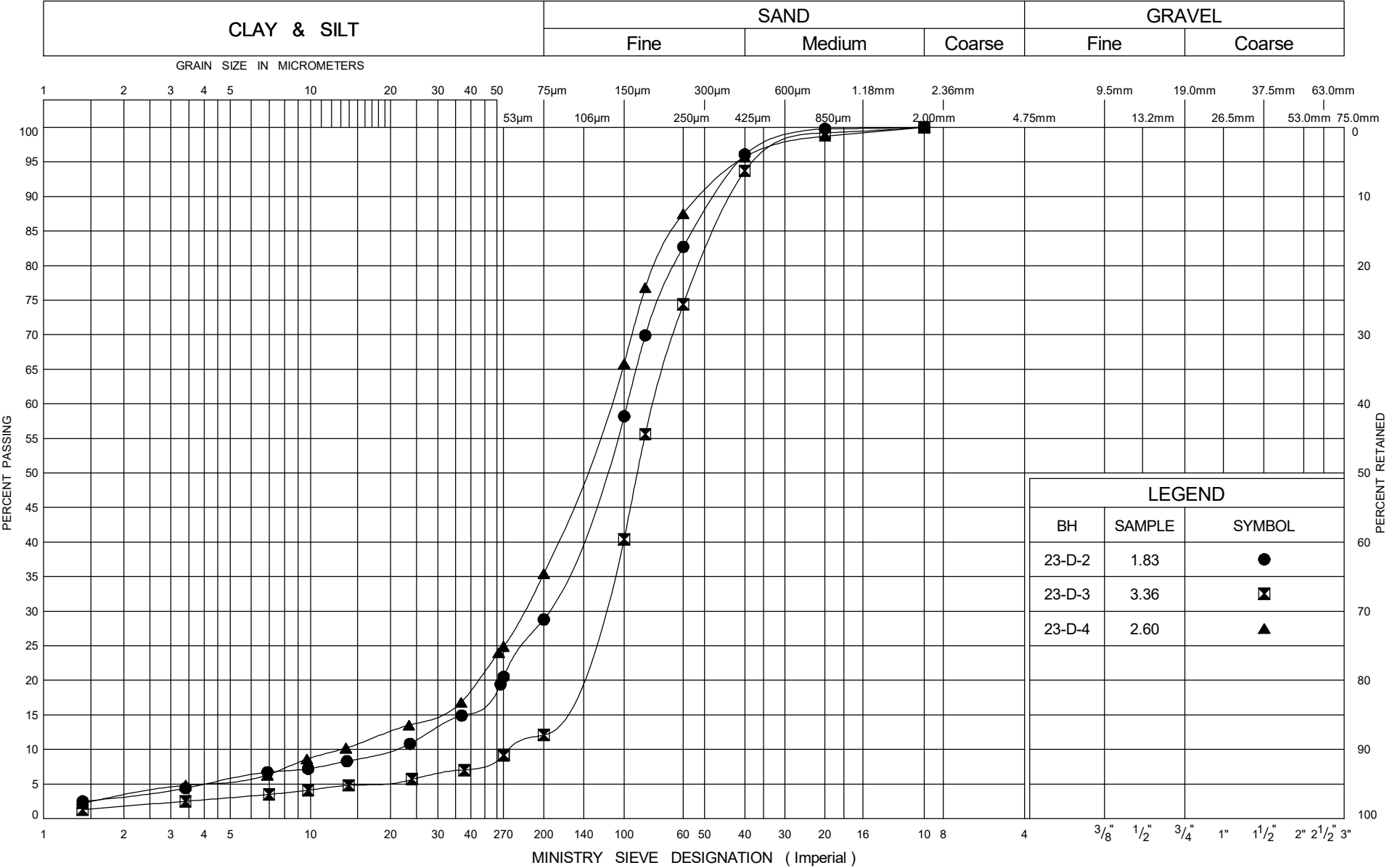


GRAIN SIZE DISTRIBUTION  
Silty Clay / Clayey Silt

FIG No 1  
W P 5021-E-0020 Assign. #10  
Dunchurch Patrol Yard



UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

GRAIN SIZE DISTRIBUTION

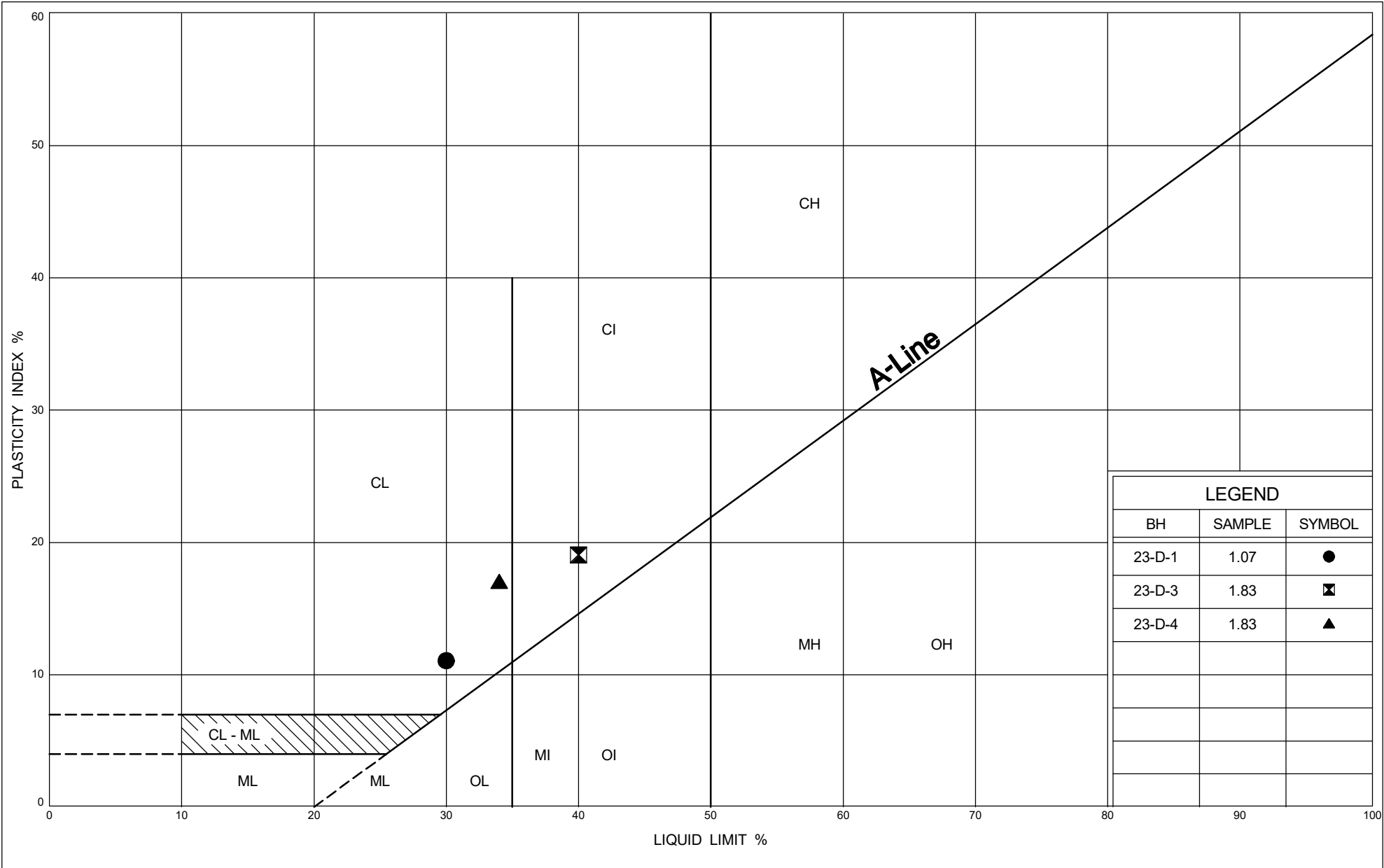
Silty Sand / Sand

FIG No 2

W P 5021-E-0020 Assign. #10

Dunchurch Patrol Yard

ONTARIO MOT PLASTICITY CHART DUNCHURCH.PY.GPJ ONTARIO MOT.GDT 2/16/24





Your Project #: ADM-22006096-A9  
Site Location: DUN CHURCH  
Your C.O.C. #: 137455

**Attention: Silvana Micic**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2024/01/29**  
Report #: R8007706  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C421555**

**Received: 2024/01/22, 14:34**

Sample Matrix: Soil  
# Samples Received: 1

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	1	2024/01/26	2024/01/29	CAM SOP-00463	MOE E3013 m
Conductivity	1	2024/01/26	2024/01/26	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	1	N/A	2024/01/29	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	1	N/A	2024/01/29	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	1	2024/01/25	2024/01/25	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	1	2024/01/26	2024/01/26	CAM SOP-00421	SM 24 2580 B
Resistivity of Soil	1	2024/01/23	2024/01/26	CAM SOP-00414	SM 24 2510 m
Sulphate (20:1 Extract)	1	2024/01/26	2024/01/29	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.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

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 Project #: ADM-22006096-A9  
Site Location: DUN CHURCH  
Your C.O.C. #: 137455

**Attention: Silvana Micic**

exp Services Inc  
Brampton Branch  
1595 Clark Blvd  
Brampton, ON  
CANADA L6T 4V1

**Report Date: 2024/01/29**  
Report #: R8007706  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BUREAU VERITAS JOB #: C421555**

**Received: 2024/01/22, 14:34**

(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



**AUTHORIZED REPORT  
RAPPORT AUTORISÉ**

Bureau Veritas

29 Jan 2024 16:47:17

Please direct all questions regarding this Certificate of Analysis to:

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

This report has been generated and distributed using a secure automated process.

Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Total Cover Pages : 2

Page 2 of 9

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

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

**SOIL CORROSIVITY PACKAGE (SOIL)**

Bureau Veritas ID		YEL757			YEL757		
Sampling Date		2024/01/18 15:00			2024/01/18 15:00		
COC Number		137455			137455		
	<b>UNITS</b>	<b>BH-D-3, SS4</b>	<b>RDL</b>	<b>QC Batch</b>	<b>BH-D-3, SS4 Lab-Dup</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Calculated Parameters</b>							
Resistivity	ohm-cm	1200		9177506			
<b>CONVENTIONALS</b>							
Redox Potential	mV	220	N/A	9184247			
<b>Inorganics</b>							
Soluble (20:1) Chloride (Cl-)	ug/g	430	20	9184283			
Conductivity	umho/cm	821	2	9184309			
Available (CaCl2) pH	pH	6.73		9182015			
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	9184287			
Sulphide	mg/kg	<0.5 (1)	0.5	9188887	<0.5	0.5	9188887
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Matrix spike exceeds acceptance limits due to matrix interference.							



BUREAU  
VERITAS

Bureau Veritas Job #: C421555

Report Date: 2024/01/29

exp Services Inc

Client Project #: ADM-22006096-A9

Site Location: DUN CHURCH

Sampler Initials: EL

### RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		YEL757		
Sampling Date		2024/01/18 15:00		
COC Number		137455		
	UNITS	BH-D-3, SS4	RDL	QC Batch
<b>Physical Testing</b>				
Moisture-Subcontracted	%	20	0.30	9188888
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

Bureau Veritas Job #: C421555

Report Date: 2024/01/29

exp Services Inc

Client Project #: ADM-22006096-A9

Site Location: DUN CHURCH

Sampler Initials: EL

## TEST SUMMARY

**Bureau Veritas ID:** YEL757  
**Sample ID:** BH-D-3, SS4  
**Matrix:** Soil

**Collected:** 2024/01/18  
**Shipped:**  
**Received:** 2024/01/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	SKAL/EC	9184283	2024/01/26	2024/01/29	Massarat Jan
Conductivity	AT	9184309	2024/01/26	2024/01/26	Leily Karimi
Moisture (Subcontracted)	BAL	9188888	N/A	2024/01/29	Joyce Loan Phan
Sulphide in Soil	SPEC	9188887	N/A	2024/01/29	Bailey Morrison
pH CaCl2 EXTRACT	AT	9182015	2024/01/25	2024/01/25	Gurparteek KAUR
Redox Potential	COND	9184247	2024/01/26	2024/01/26	Gurparteek KAUR
Resistivity of Soil		9177506	2024/01/26	2024/01/26	Automated Statchk
Sulphate (20:1 Extract)	SKAL/EC	9184287	2024/01/26	2024/01/29	Massarat Jan

**Bureau Veritas ID:** YEL757 Dup  
**Sample ID:** BH-D-3, SS4  
**Matrix:** Soil

**Collected:** 2024/01/18  
**Shipped:**  
**Received:** 2024/01/22

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	9188887	N/A	2024/01/29	Bailey Morrison



### GENERAL COMMENTS

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

Package 1	9.0°C
-----------	-------

Results relate only to the items tested.





QUALITY ASSURANCE REPORT

exp Services Inc  
Client Project #: ADM-22006096-A9  
Site Location: DUN CHURCH  
Sampler Initials: EL

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
9182015	Available (CaCl2) pH	2024/01/25			100	97 - 103			1.1	N/A
9184247	Redox Potential	2024/01/26			100	95 - 105			5.9	35
9184283	Soluble (20:1) Chloride (Cl-)	2024/01/29	96	80 - 120	102	80 - 120	<20	ug/g	1.8	35
9184287	Soluble (20:1) Sulphate (SO4)	2024/01/29	NC	70 - 130	97	70 - 130	<20	ug/g	0.44	35
9184309	Conductivity	2024/01/26			103	90 - 110	<2	umho/cm	6.1	10
9188887	Sulphide	2024/01/29	41 (1)	75 - 125	101	75 - 125	<0.5	mg/kg	NC	30
9188888	Moisture-Subcontracted	2024/01/29					<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.



BUREAU  
VERITAS

Bureau Veritas Job #: C421555  
Report Date: 2024/01/29

exp Services Inc  
Client Project #: ADM-22006096-A9  
Site Location: DUN CHURCH  
Sampler Initials: EL

### VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

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

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

---

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6740 Campbell Road Mississauga, Ontario L5N 2J8  
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free 800-553-6266  
CAV FCD-01.191/5

RECD IN LONDON

CHAIN OF CUSTODY RECORD

137455

Page 9 of 9

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required	
Company Name: <b>EXP Services Inc.</b>		Company Name: <b>Silvana Micic/Elvisu</b>		Question #: _____		<input type="checkbox"/> Regular TAT (5-7 day) Most analyses	
Contact Name: <b>APC Accounts Payable</b>		Contact Name: _____		P.O. # / A/E/F: <b>ADM-22006096-A9</b>		<input type="checkbox"/> Rush TAT (Surcharges will be applied)	
Address: <b>1595 Decie Blvd. Brampton</b>		Address: _____		Project #: _____		<input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Days <input type="checkbox"/> 3-4 Days	
Phone: <b>905-793-9800</b>		Phone: _____		Site Location: <b>DUNCANBURCH</b>		Date Required: _____	
Email: <b>APC@exp.com</b>		Email: <b>Silvana.micic@exp.com</b>		Site Location Province: _____		Rush Confirmation #: _____	
NOT REQUIRED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS LABORATORIES DRINKING WATER CHAIN OF CUSTODY							
Regulation 153		Other Regulations		Analysis Requested			
<input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Med/Fine		<input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw					
<input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse		<input type="checkbox"/> MSA <input type="checkbox"/> Storm Sewer Bylaw					
<input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other		<input type="checkbox"/> PWQO <input type="checkbox"/> Regcn					
<input type="checkbox"/> Table _____		<input type="checkbox"/> Other (Specify) _____					
FOR RSC (PLEASE CIRCLE) Y / N		<input type="checkbox"/> REG 558 (MIN. 3 DAY TAT REQUIRED)					
Include Criteria on Certificate of Analysis: Y / N							
SAMPLES MUST BE KEPT COOL (< 10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS							
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED		
1	BM-0-3, SBY	2024/01/18	15:00		2		
2							
3							
4							
5							
6							
7							
8							
9							
10							
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Silvana Micic		2024/01/18	14:30	APC-380wmya.rogan		2024/01/22	14:34
				APC-380wmya.rogan		2024/01/22	1840
COOLING MEDIA PRESENT: <input checked="" type="checkbox"/> Y <input type="checkbox"/> N							
COOLER TEMPERATURES: 9/9/9							
LABORATORY USE ONLY							
CUSTOMER SIGNATURE: Present <input checked="" type="checkbox"/> Initial <input type="checkbox"/> 3/3/4							
COMMENTS: EXP STREAM 3							



NONF-2024-01-1188

Unless otherwise agreed to in writing, work submitted on this Chain of Custody is subject to Bureau Veritas Laboratories' standard Terms and Conditions. Signing of this Chain of Custody Document is acknowledgment and acceptance of our terms available at: <http://www.bv.com/terms-and-conditions>

724934 White: Mexican - Yellow Client



**exp Services Inc.**  
1595 Clark Boulevard  
Brampton, Ontario, L6T 4V1  
Tel: (905) 793-9800  
Fax: (905) 793-0641  
[www.exp.com](http://www.exp.com)

## Rock Core Test UCS

Project No.: ADM-22006096-A9

Project Name: Dunchurch

### Uniaxial Compressive Strength of Intact Rock Core Specimens

Core No.	1				
Depth (m)	BH-D-2 2.7				
Date Sampled	January 22 <sup>nd</sup> , 2024				
Date Received	February 20 <sup>th</sup> , 2024				
Date Tested	February 21 <sup>st</sup> , 2024				
Lithology	N/A				
Length - (mm)	104.0				
Average Diameter - (mm)	63.0				
L/D Ratio	2.21				
Rate of Loading (MPa/Sec)	0.30				
Uniaxial Compressive Strength - (MPa)	66.4				
Moisture Condition at Time Of Test	Dry				
Remarks	Tested by R. Chavez				

Tested in accordance with ASTM D7012, unless otherwise indicated.

  
\_\_\_\_\_  
Testing Laboratory Representative Signature  
Eric Jageshur - Concrete Supervisor

February 21<sup>st</sup>, 2024  
\_\_\_\_\_  
Date

## Appendix E – Bedrock Core Photographs





Figure E1. Bedrock core samples, BH23-D-1, Run 1 (top), Run 2 (middle), January 19, 2024



Figure E2. Bedrock core samples, BH23-D-2, Run 1 (top), Run 2 (middle), January 18, 2024



Figure E3. Bedrock core samples, BH23-D-3, Run 1 (top), Run 2 (middle), January 18, 2024



Figure E4. Bedrock core samples, BH23-D-4, Run 1 (top), Run 2 (middle), January 18, 2024