



Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road - **Superstructure Replacement at Markham Road Overpass Eastbound Core and Collectors Structure (Site 37X-0218/B1 & B3)**

Assignment No. 2021-E-0018

MTO Central Region

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*Foundation Investigation Report
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Superstructure Replacement at Markham Road Overpass
Eastbound Core and Collectors Structure (Site 37X-0218/B1 & B3)
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Part I: Foundation Investigation Report

Highway 401 Eastbound Express and Collector Lanes between Victoria Park Avenue and Neilson Road – Markham Road Overpass (Site 37X-0218/B1 & B3)

1.0 Introduction

EXP Services Inc. (EXP) was retained by AECOM on behalf of the Ministry of Transportation (MTO) to provide detailed foundation investigation and engineering services for the proposed Highway 401 Eastbound rehabilitation and construction project. The findings, analyses, and recommendations are presented in a Foundation Investigation Design Report created for each structure along the proposed highway. The work was undertaken under Assignment No. 2021-E-0018. The terms of reference (TOR) and the scope of work for the foundation investigation are outlined in the Ministry of Transportation Ontario's (MTO) Request for Proposal, dated June 2021. The scope of this report is specifically limited to the proposed location of the Markham Road Overpass structure (Site 37X-0218/B1 & B3).

The General Arrangement drawings (GA) for the bridge structure were provided to EXP by AECOM. The purpose of the investigation was to evaluate the subsurface conditions along the structure alignment to permit a detailed design for the proposed superstructure replacement.

The site-specific geotechnical investigation consisted of borings, soil sampling, borehole logging, and field and laboratory testing. The field and laboratory work for this structure was performed by EXP. Based on collected geotechnical data, this report provides an assessment of the geotechnical issues, geotechnical design parameters, and geotechnical foundation design recommendations for the proposed structure. Geotechnical-related construction recommendations are also provided.

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.

2.0 Structure Description

The GA drawing titled "*Hwy 401 EB Core & Collector Lane Markham Rd OP Bridge Rehabilitation*", prepared by AECOM, dated August 2024, shows the preliminary configuration of the Markham Road Overpass structure. Foundation Investigation and Design Reports (FIDR) by Golder Associates Ltd., "*Bridge Widening and Replacement Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O.07-20012*," dated March 2012, and "*Markham Road Overpass Rehabilitation and Northward Widening (Site No. 37-218), Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00*," dated January 17, 2019, were reviewed. A summary of the proposed structure is as follows:

1. The existing structure is a 37.28 m long two-span bridge. It is understood that the existing abutments, piers, and retaining wall foundations are supported on spread footings. However, it is assumed that they are similar to the Westbound Core and Collectors Structure. Based on the previous FIDRs, the existing abutments are supported on 3.9 m wide footings found at about Elevation 155.7 m and the centre piers are supported on 3.4 m wide footings found at about Elevation 155.8 m.
2. The existing structure is proposed to undergo superstructure replacement, which includes replacement of the existing bridge deck and girders, conversion to semi-integral abutment and rehabilitation of wingwalls/retaining walls. The existing foundations will remain to support the abutments and retaining walls.
3. No widening of Highway 401 is proposed on the Eastbound side.

The previous FIDRs and GA drawing by AECOM, in addition to contract package drawings titled *Hwy 401 WB Core & Collector Lanes – Markham Road Overpass – Bridge Rehabilitation (Cont. No. 2019-2011, WP No. 2392/2391-15-01)*, produced by WSP Global Inc., dated March 2019, were reviewed as part of this report. These background documents are used for initial context to

address the nature and scope of the investigation. It is understood that some changes might occur because of normal refinement or the findings of the geotechnical report.

3.0 Site Description and Geological Setting

3.1 Site Description

The site is located at the intersection of Highway 401 and Markham Road, approximately 8 km east of Highway 404 in the City of Toronto, Ontario. The site is adjacent to industrial zones to the south and northeast, and residential zones to the northwest of the site. In general, the terrain in this area is relatively flat, with the natural ground surface sloping gently toward the south. The Highway 401 pavement grade ranges between about Elevation 164 m and 165 m while, the Markham Road pavement grade is an Elevation approximately 158 m to 159 m at the structure site. Based on the FIDRs by Golder Associates Ltd., the fill thickness is assumed to be about 7 to 8 m.

A site location plan is presented as Drawing 1 in Appendix C.

3.2 Geological Setting

Based on a review of geological maps of Southern Ontario (Chapman and Putnam, 1984; 2007), the site is situated within the South Slope physiographic region where the predominant landforms are Till Plains (Drumlinized) and Drumlins. The South Slope represents the southern slope of the Oak Ridges Moraine but also includes a strip south of the Peel Plain, extending from the Niagara Escarpment to the Trent River. The South Slope gradually, fairly, and uniformly slopes down toward Lake Ontario.

According to the Ministry of Northern Development and Mines, Map 2556 (Quaternary Geology of Ontario, Southern Sheet, 1991) the surface conditions in the vicinity of the project area consists of Halton Till which is predominately silt to silty clay matrix, high in matrix carbonate content and clast poor with occasional sand to silt zones. In addition, Map 2544 (Bedrock Geology of Ontario, Southern Sheet, 1991), the bedrock geology at the site consist of shale, limestone, dolostone and siltstone: Georgian Bay Formation, Blue Mountain Formation, Bilings Formation, Collingwood Member, Eastview Member.

4.0 Previous Geotechnical Investigation

During the tender design for the project, three (3) previous reports were issued which contain relevant information to the proposed Markham Road Overpass structure (Site 37X-0218/B1 & B3), as follows:

1. Geocres No. 30M14-69 *"Foundation Investigation Report for Proposed New Structure at Markham Rd. and Hwy #401, District #6 (Toronto), W.J. 67-F-40, W.P. 262-61."* by Department of Highways Ontario - Foundation Section, dated June 9, 1967.
2. Geocres No. 30M14-338 *"Bridge Widening and Replacement Highway 401 Rehabilitation from Warden Avenue to Brock Road, Toronto, Ontario, W.O.07-20012."* by Golder Associates Ltd., dated April 2012.
3. Geocres No. 30M14-484 *"Markham Road Overpass Rehabilitation and Northward Widening (Site No. 37-218), Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, G.W.P No. 2162-11-00."* by Golder Associates Ltd., dated January 17, 2019.

The applicable previous MTO borehole logs are attached as Appendix F in this report. The details of the applicable boreholes completed by the MTO are also outlined in Table 1.1.

Table 1.1: Summary of Applicable Borehole Completed by MTO

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
32-1	East Abutment, South Side (EBL Collector)	4849502.2	326139.3	43.785174	-79.234873	157.7	9.6
32-2	Centre Pier, South Side (EBL Collector)	4849511.6	326117.1	43.785259	-79.235148	157.4	9.6
32-3	West Abutment, South Side (EBL Collector)	4849489.1	326104.6	43.785057	-79.235304	157.3	9.6

5.0 Field Investigation and Laboratory Analyses

5.1 Site Investigation and Field Testing

A site-specific investigation was undertaken by EXP between September 13, 2022, and September 19, 2022, and it included the following:

1. A walkover site assessment was carried out by a Geotechnical Engineer from EXP.
2. Subsequent to the borehole layouts in the field, existing utilities were cleared by public utility companies.
3. At the time of this report, four (4) boreholes have been completed for this structure (BH22-6-1 to BH22-6-4) as part of the additional investigation. A summary of boreholes completed by EXP is listed in Table 1.2 below. The borehole was drilled using a truck-mounted CME-75 machine (owned and operated by Drilltech drilling Ltd.) equipped with solid and hollow stem augers, mud rotary equipment, and fitted with capability for Standard Penetration Testing (SPT);
4. Boreholes were set back at least 14 m from the abutment to avoid drilling through the reinforced approach slab.
5. Soil samples in the boreholes were taken at frequent intervals of depth by the Standard Penetration Test method (SPT), in general accordance with ASTM D1586. The test consists of freely dropping a 63.5 kg hammer a vertical distance of 0.76 m to drive a 51 mm O.D. split barrel (SS-split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m is recorded as the Standard Penetration Resistance, or the N-value, of the soil which is indicative of the compactness of granular (or cohesionless) soils (gravels, sands and silts) or the consistency of cohesive soils (clays and clayey soils).
6. The fieldwork was supervised by a member of EXP's engineering staff who directed the drilling and sampling operation, logged borehole data in accordance with MTO and/or ASTM Standards for Soils Classification, and retrieved soil samples for subsequent laboratory testing and identification.
7. All spoon samples obtained in the Standard Penetration Tests (SPT, ASTM D-1586) were placed in moisture proof bags after field classification. Samples were allocated from the spoon samples for moisture content testing without delay. They were subsequently re-examined under controlled laboratory conditions prior to assigning other laboratory tests.
8. Selected soil samples for corrosivity testing were sent to the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The selected soil samples for the analytical testing were placed in a laboratory prepared glass jar, labelled, and stored in a secure cooler.

9. The borehole locations and their ground surface elevations were surveyed by EXP using a Trimble DA2 GNSS receiver with Trimble Catalyst GNSS positioning, having an accuracy of ± 0.10 m horizontal and vertical directions. MTM NAD83 Zone 10 coordinates and the geodetic elevation for the boreholes are listed in Table 1.2 below. It can also be found on the Record of Borehole Sheet (Appendix D); and
10. Upon completion of drilling and field testing, the boreholes were backfilled with a mixture of bentonite and auger cuttings. The borehole decommissioning was in general accordance with the Ministry of the Environment Regulation 903, as amended by Regulation 128/03 (the well regulation under the Ontario Water Resources Act).

Table 1.2: Summary of boreholes completed by EXP

Borehole No.	Borehole Location	Location (MTM NAD83 Zone 10)		Latitude	Longitude	Borehole Elevation (m)	Borehole Depth (m)
		Northing	Easting				
BH22-6-1	~14 m west of West Abutment, b/w EBL and WBL Express	4849527.5	326078.3	43.785404	-79.235629	165.3	12.0 ¹
BH22-6-2	~14 m east of East Abutment, b/w EBL and WBL Express	4849551.7	326140.5	43.785620	-79.234856	164.6	12.8 ¹
BH22-6-3	~29 m west of West Abutment, b/w EBL and WBL Express	4849521.4	326063.7	43.785349	-79.235811	165.4	14.3 ¹
BH22-6-4	~29 m east of East Abutment, b/w EBL and WBL Express	4849559.0	326153.7	43.785685	-79.234692	164.3	12.0 ¹

Note:

1.0 Terminated at refusal ($N > 100$ blows over 1.5 m interval)

5.2 Laboratory Testing

All obtained samples were submitted for natural moisture content testing. Additionally, unit weight, Atterberg limits and grain size analysis (sieve and hydrometer) tests were performed on a minimum of 25% of all obtained soil samples (performed by EXP). Chemical analyses were also carried out on two soil samples selected by EXP. The samples were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario. The results of the laboratory tests are shown in table 1.3.

Table 1.3: List of Laboratory Test Completed by EXP

Borehole No.	Moisture Content	Atterberg Limits	Sieve	Hydrometer	Unit Weight	Corrosivity
BH22-6-1	12	2	3	3	6	1
BH22-6-2	12	1	3	3	3	1
BH22-6-3	14	1	3	2	5	-
BH22-6-4	13	1	3	3	2	-

The laboratory test results are provided on the attached borehole log sheets in Appendix D as well as graphically in Appendix E.

6.0 Subsurface Conditions

The detailed subsurface conditions encountered in the boreholes advanced during this investigation are presented on the borehole log sheets in Appendix D. The “Explanation of Terms Used in Report” preceding the borehole logs in Appendix D forms an integral part of and should be read in conjunction with this report.

A borehole location plan and stratigraphic sections are provided in Appendix C. It should be noted that the stratigraphic boundaries indicated on the borehole log and stratigraphic sections 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 interpreted as exact planes of geological change. Furthermore, subsurface conditions may vary between and beyond the borehole locations.

In general, the subsurface conditions below the roadway/pavement structure encountered within the depths of EXP’s geotechnical investigation consists of layers of cohesionless and cohesive fill followed by native layers of clayey silt and sand/sandy silt/sand and silt.

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

6.1 Subsoils

6.1.1 Pavement Structure

A pavement structure consisting of asphalt and concrete was encountered at the surface of boreholes BH22-6-1, BH22-6-2, BH22-6-3 and BH22-6-4. The thickness of the structure ranged between 400 mm and 465 mm.

6.1.2 Cohesionless Fill: Sand and Gravel

During EXP’s geotechnical investigation, sand and gravel fill was encountered below the pavement structure (asphalt/concrete) in boreholes BH22-6-1, BH22-6-3 and BH22-6-4. The approximate elevations of the surface and base of each fill layer, thickness, description and SPT “N” Values encountered in the boreholes are summarized in Table 1.4 below:

Table 1.4: Summary of Cohesionless Fill: Sand and Gravel Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-6-1	164.8	164.5	0.4	0.3	Sand and Gravel	N/A ¹
BH22-6-3	165.0	163.1	0.5	1.9	Sand and Gravel	54 – 102/100 mm
BH22-6-4	163.8	163.3	0.5	0.5	Sand and Gravel	N/A ¹

Note:

1. No SPT sampling within layer, only auger samples retrieved.

This layer consists of mainly sand and gravel with some silt. The material was greyish brown to brown in colour and moist to wet. SPT “N” values obtained within this layer range from 54 blows per 300 mm penetration to 102 blows per 100 mm penetration, corresponding to very dense in compactness.

Laboratory testing performed on selected samples consisted of moisture content tests. The test results are as follow:

Moisture Content: (EXP)

- 5% to 14%

The results of the moisture content performed by EXP are provided on the record of borehole sheets in Appendix D.

6.1.3 Cohesionless Fill: Sand/Sand and Silt/Sandy Silt

During EXP's geotechnical investigation, sand/sand and silt/sandy silt fill was encountered below the pavement structure (asphalt/concrete) in borehole BH22-6-2 and below the sand and gravel fill in boreholes BH22-6-1 and BH22-6-3. The approximate elevations of the surface and base of each fill layer, thickness, description and SPT "N" Values encountered in the boreholes are summarized in Table 1.5 below:

Table 1.5: Summary of Cohesionless Fill: Sand/Sand and Silt/Sandy Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-6-1	164.5	163.4	0.8	1.1	Sand	52
BH22-6-2	164.1	162.3	0.5	1.8	Sand to Sandy Silt	45 – 100
BH22-6-3	163.1	160.8	2.3	2.3	Sand and Silt	14 – 47
	159.3	157.8	6.1	1.5	Sandy Silt	16

This layer predominately consists of sand and silt with trace to some gravel and some clay. In addition, asphalt inclusions and topsoil/organics were encountered within this material. The material was greyish brown to grey with black inclusions in colour and slightly moist to moist. The SPT "N" values within this layer ranged from 14 to 100 blows per 300 mm penetration, corresponding to compact to very dense in compactness.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution and unit weight tests. The test results are as follow:

Moisture Content: (EXP)

- 5% to 12%

Grain Size Distribution: (EXP)

- 5% gravel;
- 37% sand;
- 40% silt;
- 18% clay;

Unit Weight: (EXP)

- 22.3 kN/m³ to 23.1 kN/m³

The results of the moisture content, grain size distribution and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution tests are also provided on Figure 1 in Appendix E.

6.1.4 Cohesive Fill: Clayey Silt

During EXP's geotechnical investigation, a cohesive fill was encountered below the cohesionless fill layers in all boreholes (BH22-6-1 to BH22-6-4). The approximate elevations of the surface and base of each fill layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.6 below:

Table 1.6: Summary of Cohesive Fill: Clayey Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-6-1	163.4	158.4	1.8	5.1	Clayey Silt	5 – 24
BH22-6-2	162.3	158.2	2.3	4.1	Clayey Silt	9 – 14
BH22-6-3	160.8	159.3	4.6	1.5	Clayey Silt	7
BH22-6-4	163.3	158.2	1.1	5.1	Clayey Silt	10 – 35

This layer predominately consists of silt and clay and can be considered some sand to sandy with trace gravel. Trace organics/rootlets were also encountered within this material. The material was brown to grey with black inclusions in colour and slightly moist to moist. The SPT "N" value within this layer ranged between 7 to 35 blows per 300 mm penetration, corresponding to firm to hard, but generally stiff in consistency. Atterberg limits tests suggest that this cohesive fill material is low plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

Moisture Content (EXP):

- 7% to 16%

Grain Size Distribution: (EXP)

- 2% to 7% gravel;
- 38% to 52% sand;
- 33% to 42% silt;
- 13% to 15% clay;

Atterberg Limits: (EXP)

- Liquid Limit: 17% to 19%.
- Plastic Limit: 11% to 12%.

- Plasticity Index: 5% to 8%

Unit Weight: (EXP)

- 21.0 kN/m³ to 23.1 kN/m³

The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits tests are also provided on Figure 2 and 5 in Appendix E.

6.1.5 Clayey Silt

During EXP's geotechnical investigation, a native clayey silt layer was encountered below the cohesive fill layer in borehole BH22-6-1. Native clayey silt was also encountered at the surface in boreholes 32-1 and 32-2 and below a native sandy silt layer in borehole 32-3 during MTO's geotechnical investigation in 1967. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.7 below:

Table 1.7: Summary of Clayey Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-6-1	158.4	153.2	6.9	5.2 ¹	Clayey Silt	11 – 155/225 mm
MTO (1967)						
32-1	157.7	148.1	0	9.6 ¹	Clayey Silt	17 – 175/150 mm
32-2	157.4	147.8	0	9.6 ¹	Clayey Silt	55 – 186
32-3	154.4	147.7	2.9	6.7 ¹	Clayey Silt	50/13 mm – 200/115 mm

Note:

1.0 End of borehole terminated within this layer.

This layer predominately consists of silt and clay mixed with varying amounts of sand (trace to sandy) and trace gravel. The material was grey to light brown in colour and slightly moist. The SPT "N" value within this layer ranged between 11 to 186 blows per 300 mm penetration and up to 200 blows per 115 mm, corresponding to stiff to hard, but generally hard in consistency. Atterberg limits tests suggest that this layer is low plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

Moisture Content (EXP and MTO):

- 7% to 18%

Grain Size Distribution: (EXP and MTO)

- 0% gravel.
- 3% to 35% sand.

- 51% to 81% silt.
- 13% to 18% clay.

Atterberg Limits: (EXP and MTO)

- Liquid Limit: 20% to 24%.
- Plastic Limit: 12% to 17%.
- Plasticity Index: 5% to 8%

Unit Weight: (EXP)

- 21.9 kN/m³ to 22.8 kN/m³

The results of the moisture content, grain size distribution, Atterberg limits and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution and Atterberg limits tests are also provided on Figure 3 and 6 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

6.1.6 Sand/Sand and Silt/Sandy Silt

During EXP's geotechnical investigation, a native sand/sand and silt/sandy silt layer below the fill in boreholes BH22-6-2, BH22-6-3 and BH22-6-4. Additionally, native sand and silt was encountered at the ground surface in borehole 32-3 during MTO's geotechnical investigation in 1967. The approximate elevations of the surface and base of each layer, thickness, description and SPT (N Value) encountered in the boreholes are summarized in Table 1.8 below:

Table 1.8: Summary of Sand/Sand and Silt/Sandy Silt Layers

Borehole	Elevation (m)		Layer Surface Depth (m)	Layer Thickness (m)	Layer Description	SPT “N” Value Range
	Top	Bottom				
EXP (2022)						
BH22-6-2	158.2	151.8	6.4	6.4 ¹	Sandy Silt to Sand	16 – 136
BH22-6-3	157.8	151.1	7.6	6.7	Sand to Sandy Silt	8 – 117/125 mm
BH22-6-4	158.2	152.3	6.1	5.9 ¹	Sand and Silt to Sand	13 – 150
MTO (1966)						
32-3	157.3	154.4	0	2.9	Sand and Silt	60 – 150/200 mm

Note:

1. The end of borehole terminated within this layer.

This layer predominately consists of sand and/or silt with varying amounts of gravel (trace to gravelly) and trace clay. The material was grey in colour and moist to wet. The SPT "N" values within this layer ranged from 8 to 150 blows per 300 mm penetration, corresponding to loose to very dense but generally compact to very dense in compactness. Atterberg limits test results suggest that the latter is non-plastic.

Laboratory testing performed on selected samples consisted of moisture content, grain size distribution, Atterberg limits and unit weight tests. The test results are as follow:

Moisture Content (EXP and MTO):

- 7% to 21%

Grain Size Distribution: (EXP and MTO)

- 0% to 11% gravel;
- 30% to 85% sand;
- 12% to 60% silt;
- 3% to 9% clay;
- 23% to 48% silt and clay

Atterberg Limits: (EXP)

- Non-plastic

Unit Weight: (EXP)

- 20.1 kN/m³ to 23.5 kN/m³

The results of the moisture content, grain size distribution and unit weight tests performed by EXP are provided on the record of borehole sheets in Appendix D. The results of grain size distribution tests are also provided on Figure 4 in Appendix E. The results of tests performed by MTO are shown on the borehole logs attached in Appendix F.

6.2 Groundwater Conditions

Groundwater levels were observed upon completion of some of the boreholes. Groundwater levels measured on completion of boreholes may not be considered stabilized and therefore may not represent the established long-term average groundwater table (phreatic surface).

A summary of the groundwater levels encountered during the investigations are summarized in Table 1.9 and are also presented on the Record of Borehole Sheets attached in Appendix D and Appendix F.

Table 1.9: Summary of observed groundwater levels

Borehole	Ground Surface Elevation (m)	Water level Depth/ Elevation (m)	Date
EXP (2022)			
BH22-6-2	164.6	7.2/157.4 ¹	September 18, 2022
BH22-6-3	165.4	8.1/157.3	September 14, 2022
BH22-6-4	164.3	8.7/155.6	September 19, 2022
MTO (1966)			
32-1	157.7	0.5/157.2	May 15, 1967
32-2	157.4	0.6/156.8	May 15, 1967

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Borehole	Ground Surface Elevation (m)	Water level Depth/ Elevation (m)	Date
32-3	157.3	1.5/155.8	May 16, 1967

Note:

1. Groundwater level inferred from split spoon observations.

It should be noted that fluctuations in the level of the groundwater may occur due to seasonal variations, (precipitation, snowmelt, rainfall), local soil permeability, construction remediation activities, and other related factors.

6.3 Chemical Analyses

Two (2) soil samples were selected for chemical analysis during current investigation. The soils samples collected by EXP were tested at the Bureau Veritas Laboratories (formerly Maxxam Analytics), a CALA-certified and accredited laboratory in Mississauga, Ontario.

The analytical results are summarized in Table 1.10 below and are presented in Appendix E.

Table 1.10. Summary of chemical analysis results

Sample Identification	pH (Unitless)	Soluble Chloride (ppm)	Soluble Sulphate (ppm)	Resistivity (ohm-cm)	Conductivity (umho/cm)	Redox Potential (mV)
BH22-6-1, SS5	7.24	1000	<20	540	1870	180
BH22-6-2, SS10	7.84	90	34	4100	246	93

*Foundation Investigation and Design Report
Highway 401 Eastbound from Victoria Park Avenue to Neilson Road
Superstructure Replacement at Markham Road Overpass
Eastbound Core and Collectors Structure (Site 37X-0218/B1 & B3)
Assignment No. 2021-E-0018
Date: December 20, 2024*

7.0 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 investigations and analyses.

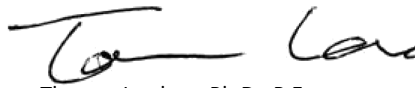
Details of the limitations of this report are presented as Appendix A, "Limitations and Use of Report".

This Foundation Investigation Report has been prepared by Elvis Lu, M.Eng., EIT., and Thomas Lardner, Ph.D., P.Eng. It was reviewed by TaeChul Kim, M.E.Sc., P.Eng. and Stan E. Gonsalves, M.Eng., P.Eng., Designated MTO Foundation Contact. The field investigation was supervised by Elvis Lu, M.Eng.

Yours truly,


EXP Services Inc.

Elvis Lu, M.Eng., EIT
Technical Specialist


Thomas Lardner, Ph.D., P.Eng.
Senior Geotechnical Engineer




TaeChul Kim, M.E.Sc., P.Eng.
Senior Foundation/ Geotechnical Specialist


Stan E. Gonsalves, M.Eng., P.Eng.
Executive Vice-President
Designated MTO Foundation Contact



Encl.

References

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- Golder Associates Ltd., Foundation Investigation and Design Report, Markham Road Overpass Rehabilitation and Northward Widening (Site No. 37-218), Highway 401 Westbound Core and Collector Lanes, Neilson Road to Warden Avenue, City of Toronto, Ontario, Ministry of Transportation, Ontario, G.W.P. No. 2162-11-00, Geocres No. 30M14-484, dated January 17, 2019
- Ministry of Transportation, April 2014. MTO Gravity Pipe Design Guidelines. Circular Culverts and Storm Sewers.
- Ministry of Transportation, April 2022. Guideline for MTO Foundation Engineering Services, Version 03.
- Molinas, A., and Mommandi, A., 2009. Development of New Corrosion/Abrasion Guidelines for Selection of Culvert Pipe Materials, Report No. CDOT-2009-11. Colorado Department of Transportation, DTD Applied Research and Innovation Branch.
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Appendix A – Limitations and Use of Report



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.

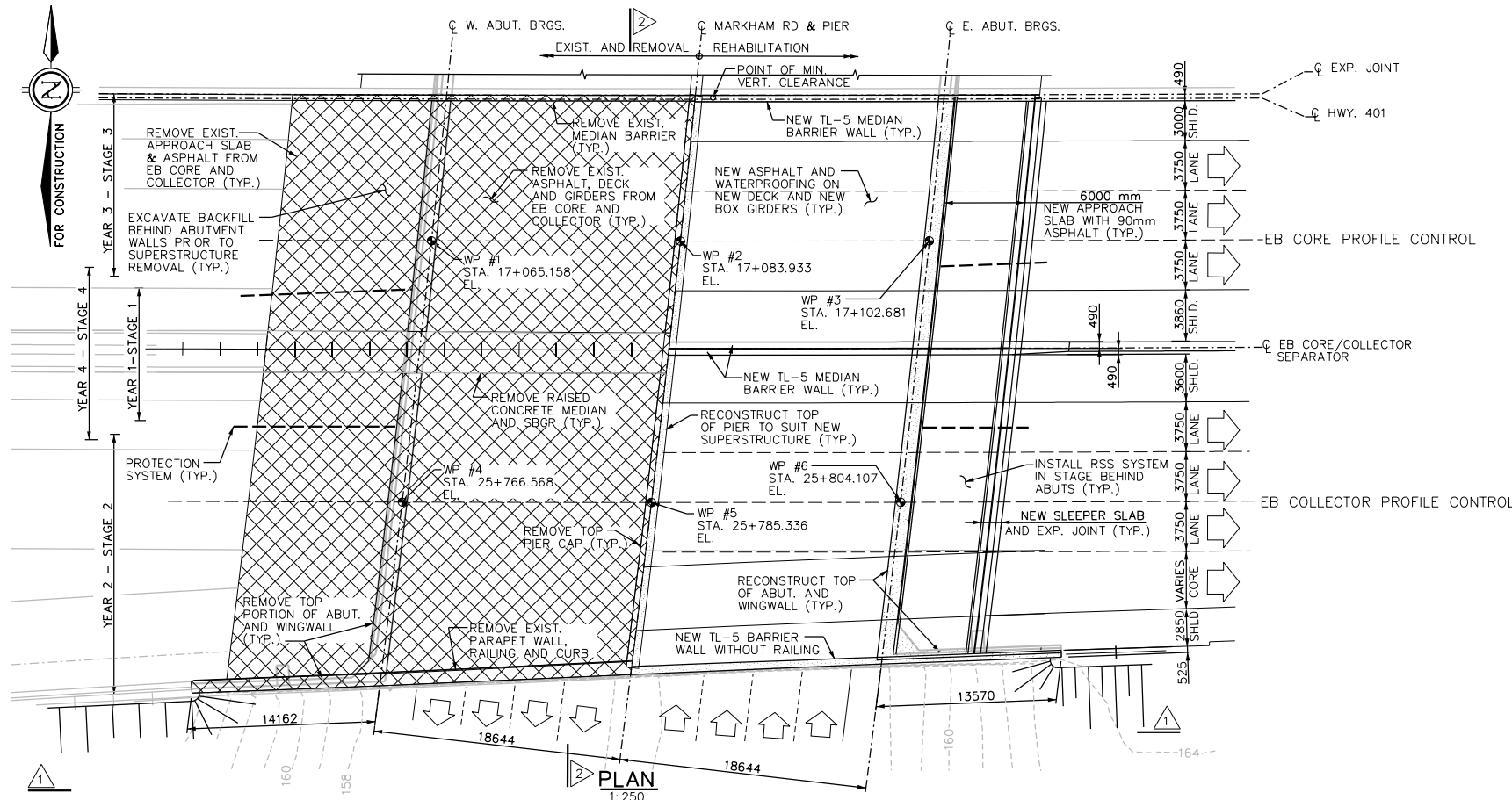
REPORT FORMAT

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 utilize 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 B – General Arrangement Drawings

CADD FILE NAME : C:\Users\yolto.zheng\Desktop\Hwy401_Victoria to Neach\Site 37X-0218-B1&B3_Markham Rd OP EB EB_ga.dgn

MINISTRY OF TRANSPORTATION, ONTARIO
ANS-D
2017-08



METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN
DRAWING NOT TO BE SCALED
100mm ON ORIGINAL DRAWING

Ontario

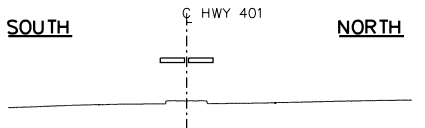
Ministry of Transportation

CONT
WP

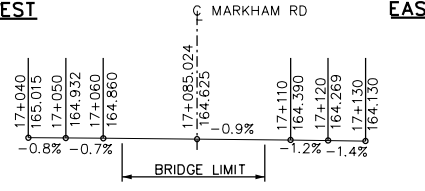
HWY 401 EB CORE & COLLECTOR LANE
MARKHAM RD OP BRIDGE REHABILITATION
GENERAL ARRANGEMENT

SHEET
S127

- GENERAL NOTES:**
- CLASS OF CONCRETE.....30 MPa
PRECAST GIRDERS.....50 MPa
 - CLEAR COVER TO REINFORCING STEEL:
-DECK - TOP.....70±20
-DECK - BOTTOM.....40±10
-REMAINDER.....70±20
UNLESS NOTED OTHERWISE.
 - REINFORCING STEEL:
- REINFORCING STEEL SHALL BE GRADE 500W UNLESS OTHERWISE SPECIFIED.
- BAR MARKS WITH PREFIX 'S' DENOTE STAINLESS STEEL BARS.
- STAINLESS REINFORCING STEEL SHALL BE TYPE 316LN OR DUPLEX 2205 AND HAVE MINIMUM YIELD STRENGTH OF 500 MPa.
- BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS, WHILE STIRRUPS AND SADDLES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWINGS SS12-1 UNLESS INDICATED OTHERWISE.
- UNLESS SHOWN OTHERWISE TENSION LAP SPLICES SHALL BE CLASS B.



PROFILE OF MARKHAM ROAD
GENERAL TEXT
FONT 188, LEVEL 11
PLOTED SIZE 2.5mm



PROFILE OF HWY 401 & MEDIAN

LIST OF DRAWINGS:

- GENERAL ARRANGEMENT
- CONSTRUCTION STAGING - 1
- CONSTRUCTION STAGING - 2
- WEST ABUTMENT REMOVAL DETAILS
- EAST ABUTMENT REMOVAL DETAILS
- PIER REMOVAL DETAILS
- WEST ABUTMENT REHABILITATION DETAILS
- EAST ABUTMENT REHABILITATION DETAILS
- PIER REHABILITATION DETAILS
- PRESTRESSED BOX GIRDERS & BEARING LAYOUT
- PRESTRESSED BOX GIRDERS AND BEARING
- PRESTRESSED BOX GIRDERS DETAILS
- DECK LAYOUT AND SCREED ELEVATIONS
- DECK REINFORCEMENT DETAILS - I
- DECK REINFORCEMENT DETAILS - II
- SOUTH BARRIER WALL WITHOUT RAILING TL-5
- 6000mm APPROACH SLAB
- EXPANSION JOINT (TYPE C) AND SLEEPER SLAB
- STRIP SEAL EXPANSION JOINT - TYPE C DETAILS
- SEQUENCE OF EXPANSION JOINT INSTALLATION
- MISCELLANEOUS AND STANDARD DETAILS
- ELECTRICAL EMBEDDED WORKS
- TYPICAL AREAS OF REPAIRS ARE INDICATED ON THE DRAWINGS. WHERE REPAIR LIMITS ARE NOT SHOWN, LIMITS SHALL BE IDENTIFIED BY THE CONTRACT ADMINISTRATOR.
- THE CONTRACTOR SHALL ADJUST THE BEARING SEAT ELEVATIONS AND REINFORCING STEEL TO SUIT THE ACTUAL HEIGHT OF THE BEARING SUPPLIED. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING FULL BEARING CONTACT TO ORDER SOFT AND BEARING SEAT, ADDITIONAL COST DUE TO ANY CHANGES IN ELEVATIONS OF THE TOP OF BEARINGS BY THE CONTRACTOR SHALL BE AT HIS OWN EXPENSE.
- PROTECTION SYSTEM SHALL MEET REQUIREMENTS FOR PERFORMANCE LEVEL 2. EXACT LOCATIONS AND LIMITS OF PROTECTION SYSTEM SHALL BE DETERMINED BY CONTRACTOR.
- BACKFILL SHALL NOT BE PLACED BEHIND THE NEW SEMI-INTEGRAL ABUTMENTS UNTIL THE NEW CONCRETE HAS ACHIEVED 75% OF DESIGN COMPRESSIVE STRENGTH.
- SAWCUT IN CONCRETE, WHERE DESIGNATED, SHALL BE 25mm DEEP OR TO THE FIRST LAYER OF REINFORCING STEEL, WHICHEVER IS LESS.
- ANY DAMAGE DURING CONSTRUCTION TO THE EXISTING STRUCTURES UTILITIES AND ADJACENT PROPERTIES NOT DESIGNATED FOR REPAIR SHALL BE REPAIRED GOOD BY THE CONTRACTOR TO THE SATISFACTION OF THE CONTRACT ADMINISTRATOR AND AT NO COST TO THE OWNER.
- THE CONTRACTOR IS FULLY RESPONSIBLE FOR ADEQUATE PROTECTION OF ALL UTILITIES, SERVICES, ROADWAYS, ETC., DURING CONSTRUCTION OPERATIONS.
- THE CONTRACTOR SHALL PROVIDE DEBRIS PLATFORMS AND NECESSARY CONTAINMENT MEASURES TO COLLECT FALLING CONCRETE AND CONSTRUCTION DEBRIS SUCH THAT NO DEBRIS OR MATERIALS RESULTING FROM THE REMOVAL WORK FALLS IN AREAS BELOW THE BRIDGE.
- THE CONTRACTOR SHALL NOT REMOVE THE EXISTING SUPERSTRUCTURE WITHIN EACH STAGE UNTIL EXISTING APPROACH SLABS AND BACKFILL BEHIND BOTH ABUTMENTS ARE REMOVED TO THE SPECIFIED DEPTH. BACKFILL SHALL BE REMOVED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.
- BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH DECK ENDS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 300mm.

LIST OF ABBREVIATIONS

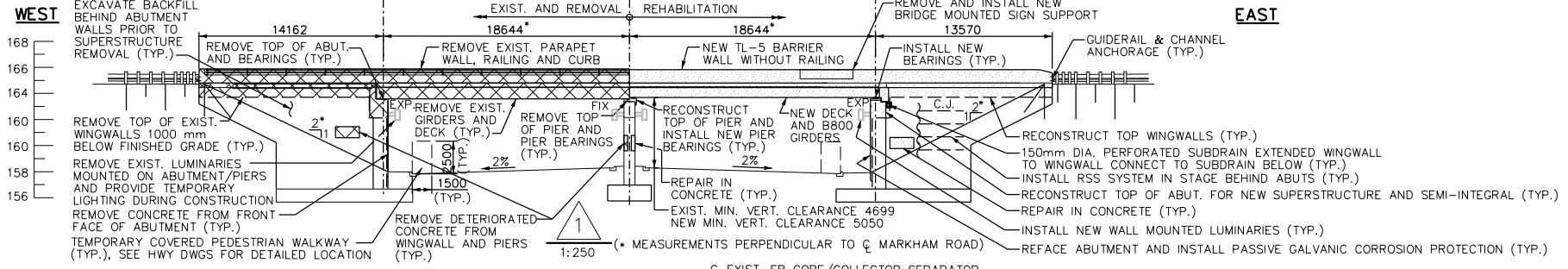
- | | |
|--------|-------------------------------|
| ABUT. | DENOTES ABUTMENT |
| BRGS. | DENOTES BEARINGS |
| C.J. | DENOTES CONSTRUCTION JOINT |
| DIA. | DENOTES DIAMETER |
| E. | DENOTES EAST |
| EB | DENOTES EAST BOUND |
| EL. | DENOTES ELEVATION |
| EXIST. | DENOTES EXISTING |
| EXP. | DENOTES EXPANSION |
| HWY | DENOTES HIGHWAY |
| SBGR | DENOTES STEEL BEAM GUIDE RAIL |
| S.E. | DENOTES SOUTH EAST |
| SHLD. | DENOTES SHOULDER |
| STA. | DENOTES STATION |
| S.W. | DENOTES SOUTH WEST |
| TYP. | DENOTES TYPICAL |
| WP. | DENOTES WORKING POINT |

APPLICABLE STANDARD DRAWINGS:

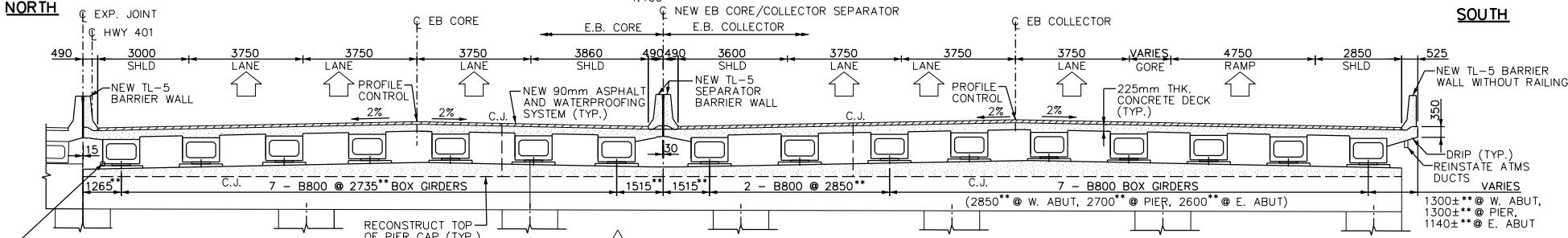
- OPSD 0914.430 GUIDE RAIL SYSTEM, STEEL BEAM STRUCTURE CONNECTION
- OPSD 3370.100 DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE WITH PROTECTION BOARD DETAILS
- OPSD 3370.101 DECK WATERPROOFING, HOT APPLIED ASPHALT MEMBRANE AT ACTIVE CRACKS GREATER THAN 2mm WIDE AND CONSTRUCTION JOINTS
- OPSD 3390.150 FALSE WORK CLEARANCE TO TRAFFIC LANES
- OPSD 3419.100 BARRIER AND RAILINGS STEEL BEAM GUIDE RAIL AND CHANNEL ANCHORAGE
- OPSD 3941.200 FIGURES IN CONCRETE SITE NUMBER AND DATE LAYOUT

LEGEND:

- | | | | |
|--|---------------------------|--|--------------|
| | EXIST. CONCRETE TO REMAIN | | NEW CONCRETE |
| | CONCRETE REMOVAL | | NEW ASPHALT |



EXISTING SECTION
1:100



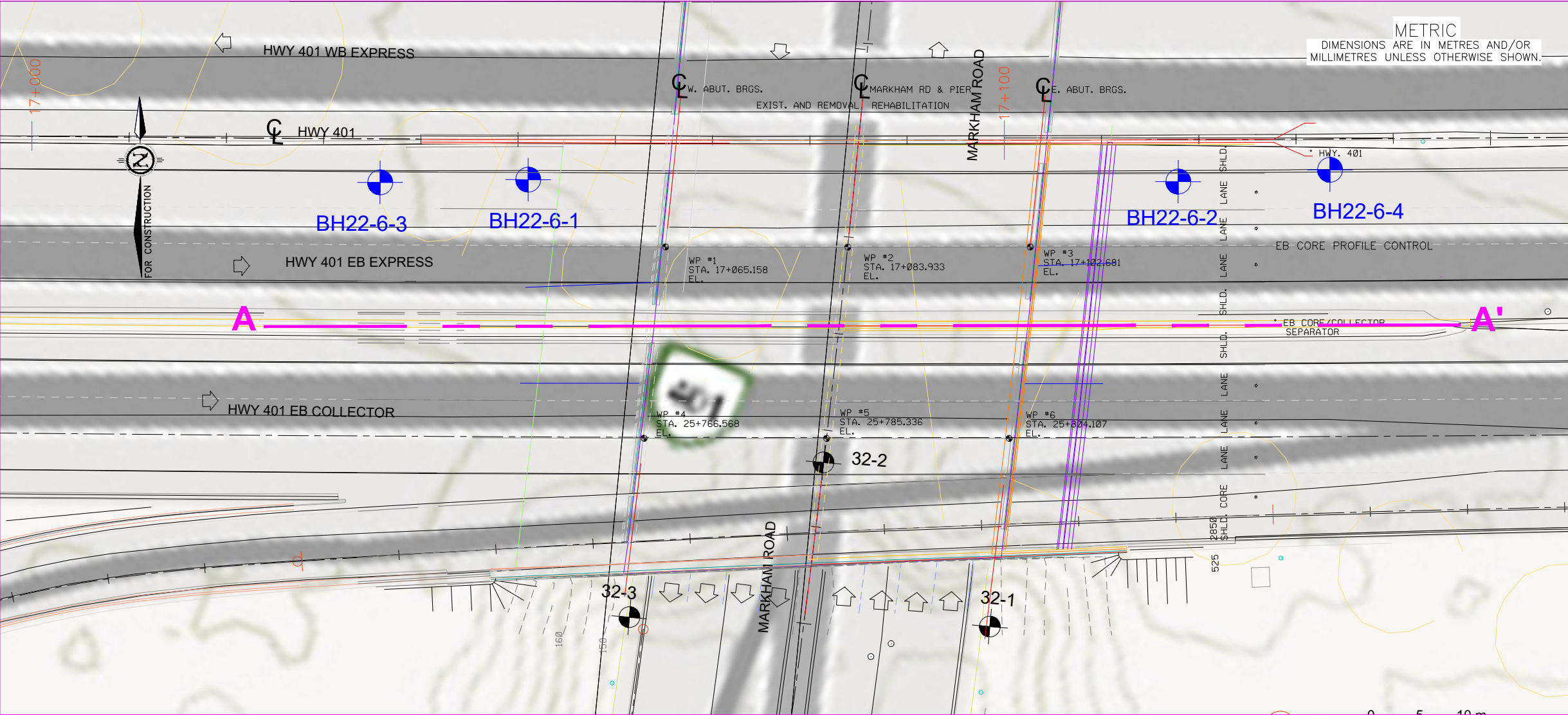
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(** MEASUREMENTS PERPENDICULAR TO C/PIER & ABUTMENT BRGS)

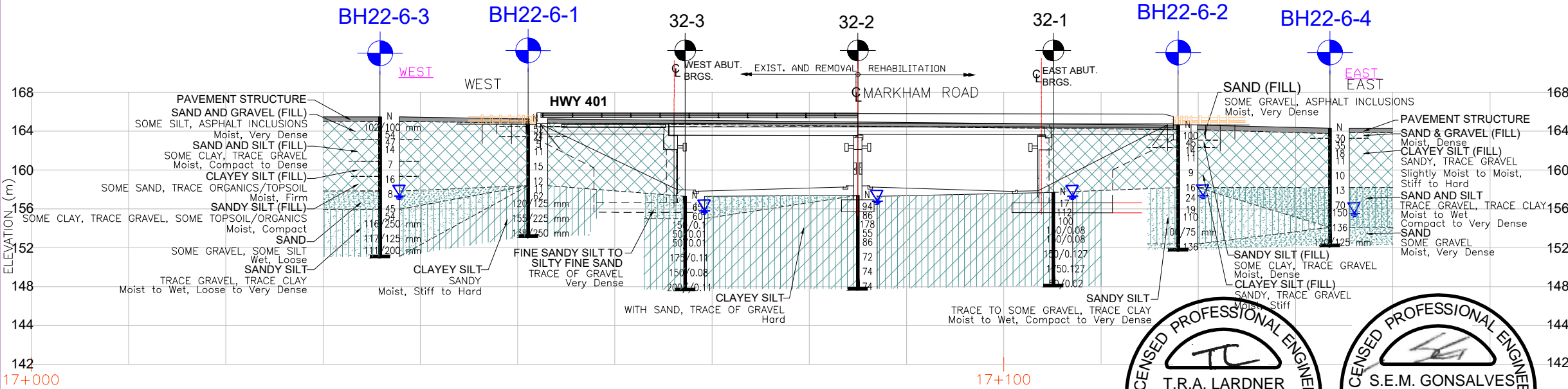
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DESIGN S.S.	CHK U.P.	CODE CAN/CSA S6-19	LOAD CL 625-ONT
DRAWN O.Z.	CHK S.S.	SITE 37X-0218/B1&B3	DWG R5-01

Appendix C – Borehole Location Plan and Stratigraphic Profile

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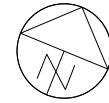


PLAN



SECTION A-A'

CONT No.
ASSIG No. 2021-E-0018
GWP No.



Superstructure Replacement at Markham Road Overpass
Eastbound Core and Collectors Structure
Latitude: 43.785377°; Longitude: -79.235209°
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)
- Blows/0.3m (Std. Pen. Test, 475 J/blow)

SOIL STRATA SYMBOLS

- PAVEMENT STRUCTURE
- SAND AND GRAVEL (FILL)
- SANDY SILT
- SILT
- SAND
- SILT AND SAND
- SANDY SILT
- SILTY SAND
- CLAY
- CLAYEY SILT
- SILTY CLAY

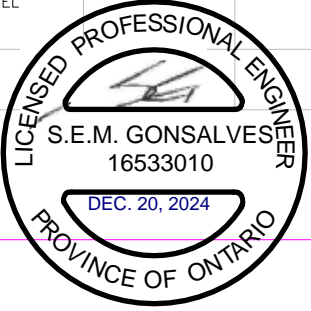
BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10

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BH22-6-1	165.3	4849527	326078
BH22-6-2	164.6	4849552	326140
BH22-6-3	165.4	4849521	326064
BH22-6-4	164.3	4849559	326154
32-1	157.7	4849502	326139
32-2	157.4	4849511	326117
32-3	157.3	4849489	326105

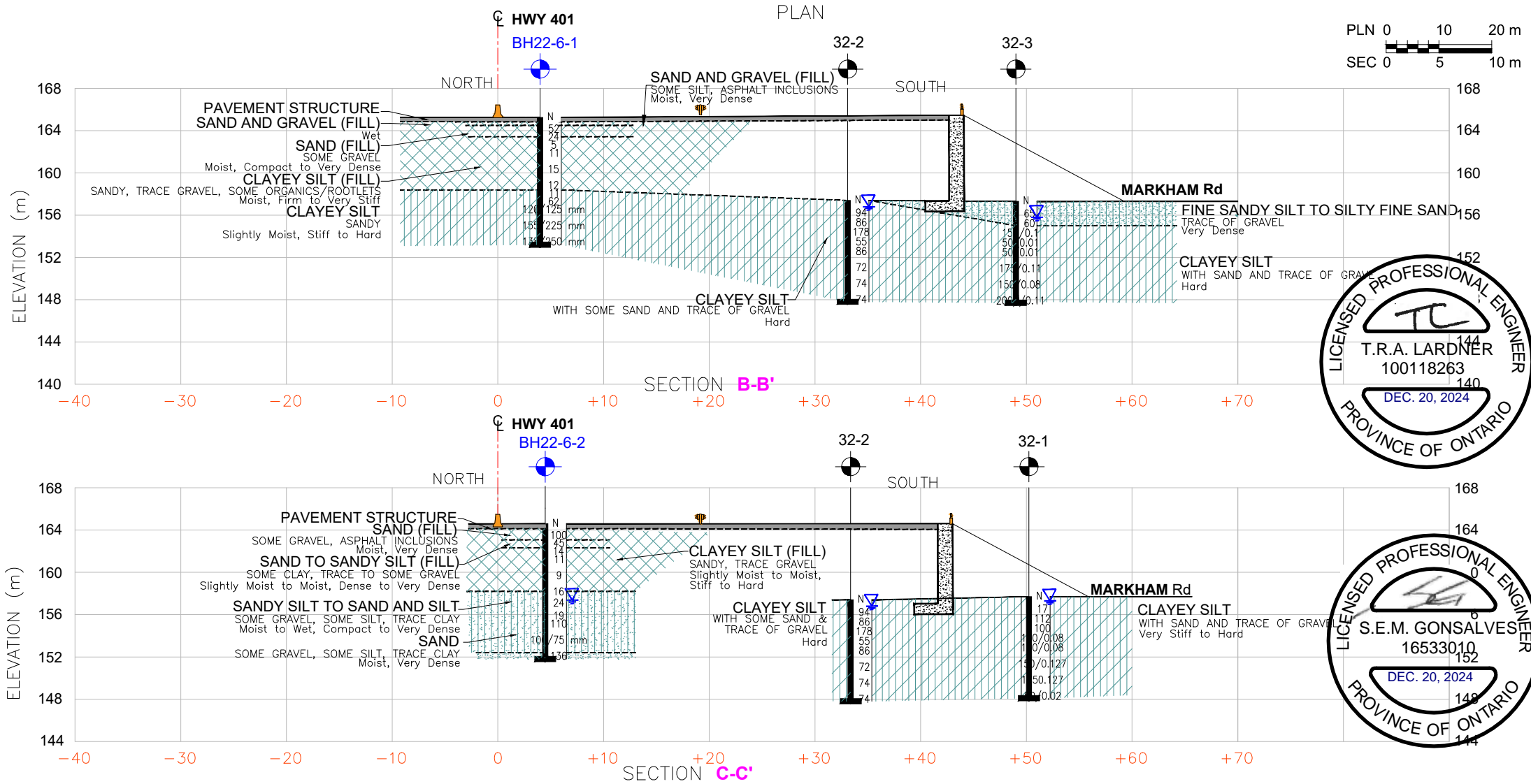
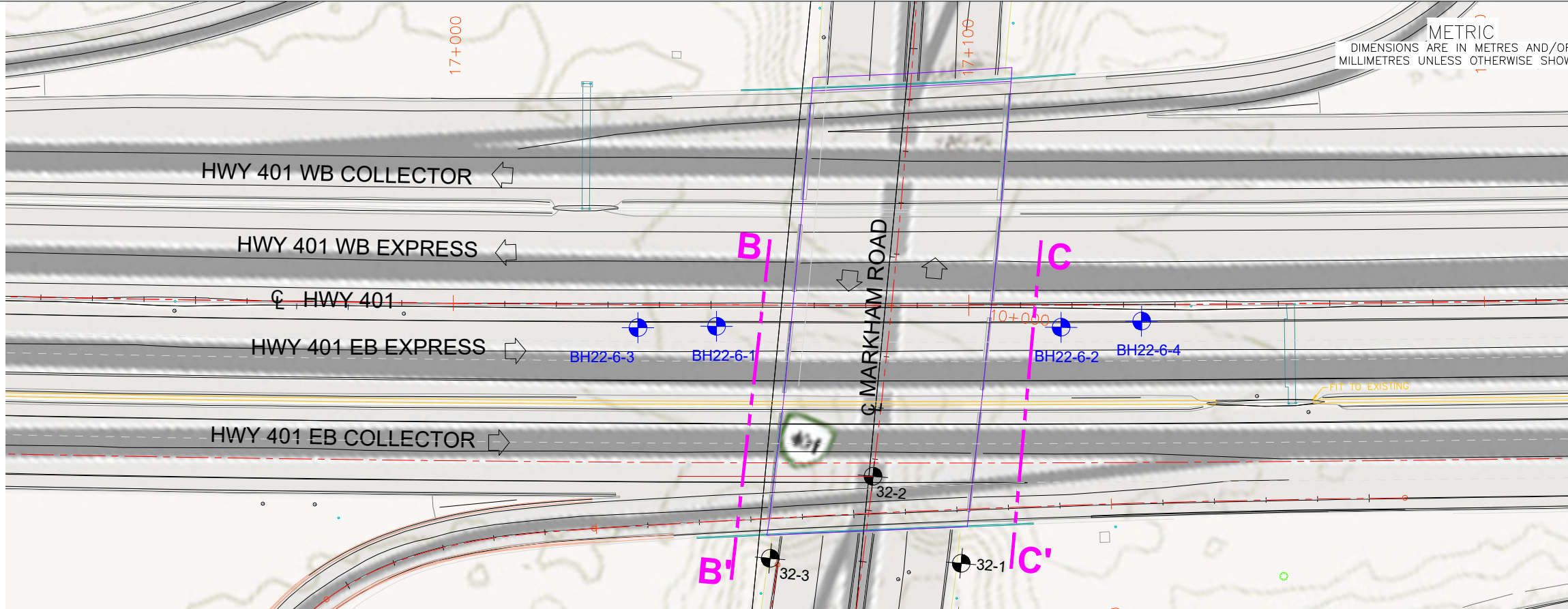
NOTES

- 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-22000797-A0	GEOCREs No.	30M14-554
SUBM'D SH	CHKD. SM	DATE	NOV. 29, 2024
DRAWN SH	CHKD. TC	APPRD SG	SITE 37X-0218/B1 & B3
			DWG 01






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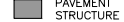
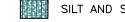


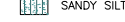

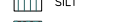
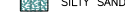

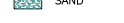


CONT No. 2001-E-0018	
ASSIGNMENT No.	
GWP No.	
Superstructure Replacement at Markham Road Overpass Eastbound Core and Collectors Structure Latitude: 43.785377°; Longitude: -79.235209°	
BOREHOLE LOCATION PLAN & SOIL STRATA	
SHEET 2	



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			
			
			
			
			

BOREHOLE CO-ORDINATES/ NAD 83/ MTM ON-10			
BH No.	ELEV.	NORTHING	EASTING
BH22-6-1	165.3	4849527	326078
BH22-6-2	164.6	4849552	326140
BH22-6-3	165.4	4849521	326064
BH22-6-4	162.8	4849559	326154
32-1	157.7	4849502	326139
32-2	157.4	4849511	326117
32-3	157.3	4849489	326105

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 O.P.S. Gen. Cond.

SUBMISSION FOR MTO REVIEW			
NO	DATE	BY	DESCRIPTION
PROJECT No.	ADM-22000797-A0	GEOCREs No.	30M14-554
SUBM'D SH	CHKD. SM	DATE	JULY 04, 2023
DRAWN SH	CHKD. TC	APPRD SG	SITE 37X-0218/B1 & B3
			DWG 02

Appendix D – 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.

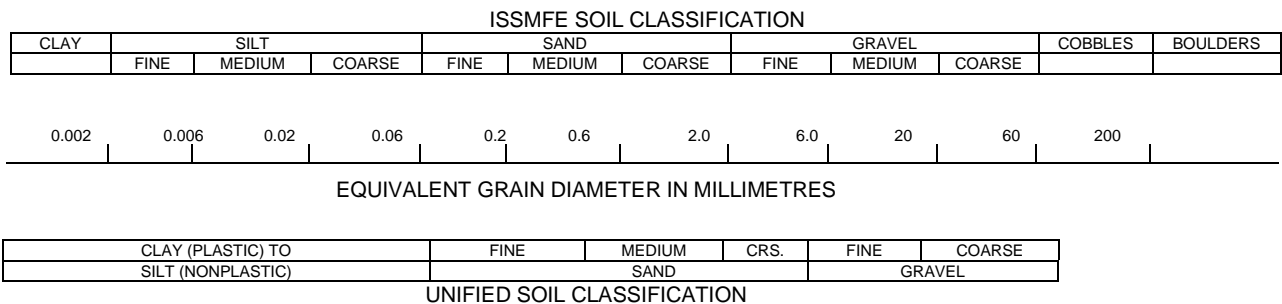
Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

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:

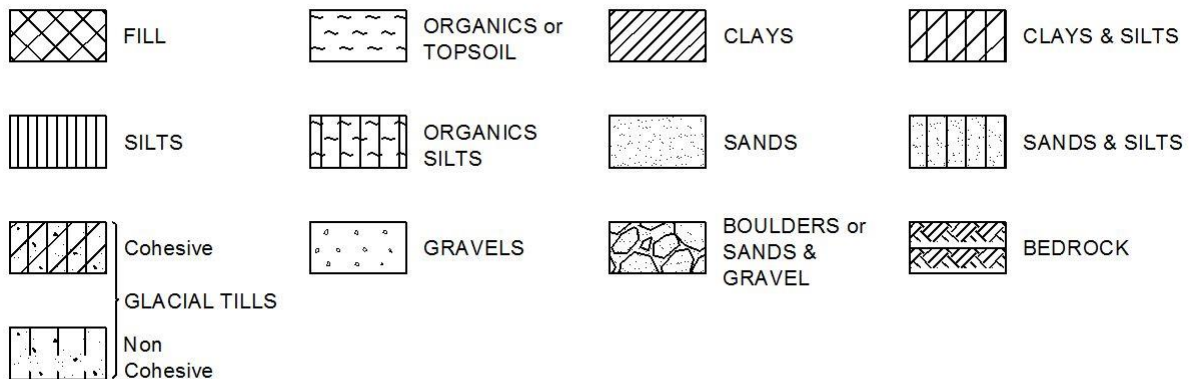
Table c: Consistency of Cohesive Soil

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
σ	kPa	Total normal stress
σ'	kPa	Effective normal stress
τ	kPa	Shear stress
$\sigma_1, \sigma_2, \sigma_3$	kPa	Principal stresses
ε	%	Linear strain
$\varepsilon_1, \varepsilon_2, \varepsilon_3$	%	Principal strains
E	kPa	Modulus of linear deformation
G	kPa	Modulus of shear deformation
μ	1	Coefficient of friction

MECHANICAL PROPERTIES OF SOIL

m_v	kPa ⁻¹	Coefficient of volume change
c_c	1	Compression index
c_s	1	Swelling index
c_r	1	Recompression index
c_v	m ² /s	Coefficient of consolidation
H	m	Drainage path
T_v	1	Time factor
U	%	Degree of consolidation
σ'_{v0}	kPa	Effective overburden pressure
σ'_p	kPa	Preconsolidation pressure
τ_f	kPa	Shear strength
c'	kPa	Effective cohesion intercept
ϕ'	—°	Effective angle of internal friction
c_u	kPa	Apparent cohesion intercept
ϕ_u	—°	Apparent angle of internal friction
τ_R	kPa	Residual shear strength
τ_r	kPa	Remoulded shear strength
S_t	1	Sensitivity = c_u/τ_r

PHYSICAL PROPERTIES OF SOIL

P_s	kg/m ³	Density of solid particles
γ_s	kN/m ³	Unit weight of solid particles
ρ_w	kg/m ³	Density of water
γ_w	kN/m ³	Unit weight of water
ρ	kg/m ³	Density of soil
γ	kN/m ³	Unit weight of soil
ρ_d	kg/m ³	Density of dry soil
γ_d	kN/m ³	Unit weight of dry soil
ρ_{sat}	kg/m ³	Density of saturated soil
γ_{sat}	kN/m ³	Unit weight of saturated soil
ρ'	kg/m ³	Density of submerged soil
γ'	kN/m ³	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 ³ /s	Rate of discharge
v	m/s	Discharge velocity
i	1	Hydraulic gradient
k	m/s	Hydraulic conductivity
j	kN/m ³	Seepage force

1 OF 1

METRIC

W.P.	Site 37X-0218/B1 & B3	LOCATION	Hwy 401 - Markham Rd. O/P, Toronto, ON, MTM ON-10 326078.3E 4849527.5N	ORIGINATED BY	EL				
DIST	Toronto	HWY	401	BOREHOLE TYPE	Truck Mount CME 75 / SSA	COMPILED BY	EL		
DATUM	Geodetic	DATE	2022.09.13 - 2022.09.13	LATITUDE	43.785404	LONGITUDE	-79.235629	CHECKED BY	SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER												
165.3 0.0	PAVEMENT STRUCTURE - 75 mm of asphalt and 325 mm of concrete SAND AND GRAVEL (FILL) - brown, wet SAND (FILL) - some gravel, greyish brown, slightly moist, compact to very dense CLAYEY SILT (FILL) - sandy, trace gravel, trace organics/rootlets, brownish grey to grey with black inclusions, slightly moist to moist, firm to very stiff																			
164.8 0.4																				
164.5 0.8			AS1	AS																
			SS2	SS	52															
163.4 1.8			SS3	SS	24															
			SS4	SS	5															
			SS5	SS	11															
			SS6	SS	15															
			SS7	SS	12															
158.4 6.9			CLAYEY SILT - sandy, light brown to grey, slightly moist, stiff to hard		SS8	SS	11													
	SS9	SS			62															
	SS10	SS			120/ 125 mm															
	SS11	SS			155/ 225 mm															
153.2 12.0	END OF BOREHOLE		SS12	SS	138/ 250 mm															
NOTES: 1) Borehole terminated at 12.0 m depth at refusal (N>100 blows over 1.5 m interval). 2) No groundwater was encountered in open borehole upon completion of drilling.																				

ONTARIO MTO H401 - MARKHAM.GPJ ONTARIO MTO.GDT 6/29/23

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

Brampton, Ontario

RECORD OF BOREHOLE No BH22-6-2

1 OF 1

METRIC

W.P. Site 37X-0218/B1 & B3 LOCATION Hwy 401 - Markham Rd. O/P, Toronto, ON, MTM ON-10 326140.5E 4849551.7N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.18 - 2022.09.18 LATITUDE 43.78562 LONGITUDE -79.234856 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER									WATER CONTENT (%)
164.6								20	40	60	80	100					
0.0	PAVEMENT STRUCTURE - 100 mm of asphalt and 350 mm of concrete																
164.1																	
0.5	SAND (FILL) - some gravel, asphalt inclusions encountered, greyish brown, slightly moist to moist, very dense		AS1	AS			164							○			
163.1			SS2	SS	100									○			
1.5	SANDY SILT (FILL) - some clay, trace gravel, greyish brown, slightly moist, dense		SS3	SS	45		163							○			23.1
162.3			SS4	SS	14		162							○			
2.3	CLAYEY SILT (FILL) - sandy, trace gravel, dark brown to grey, slightly moist to moist, stiff		SS5	SS	11		161							○			
							160							○			
			SS6	SS	9		159							○			
	- Topsoil/organics observed in soil cuttings from 4.6 m to 6.3 m						158							○			
158.2			SS7	SS	16		157							○			23.3
6.4	SANDY SILT - trace to some gravel, trace clay, grey, moist to wet, compact to very dense		SS8	SS	24		156							○			
							155							○			
			SS9	SS	19		154							○			
			SS10	SS	110		153							○			
							152							○			
152.4																	22.9
12.2	SAND - some silt, trace clay, grey, moist, very dense		SS12	SS	136									○			
151.8																	
12.8	END OF BOREHOLE																
	NOTES: 1) Borehole terminated at 12.8 m depth at refusal (N>100 blows over 1.5 m interval). 2) Groundwater inferred at a depth of 7.2 m (Elev. 157.4 m) based on wet split spoon retrieved during drilling.																

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

ONTARIO MTO H401 - MARKHAM.GPJ ONTARIO MTO.GDT 6/29/23

Brampton, Ontario

RECORD OF BOREHOLE No BH22-6-3

1 OF 1

METRIC

W.P. Site 37X-0218/B1 & B3 LOCATION Hwy 401 - Markham Rd. O/P, Toronto, ON, MTM ON-10 326063.7E 4849521.4N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.14 - 2022.09.14 LATITUDE 43.785349 LONGITUDE -79.235811 CHECKED BY SM/TL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X P. PENETROMETER									
165.4								20	40	60	80	100					
0.0	PAVEMENT STRUCTURE - 75 mm of asphalt and 375 mm of concrete						165										
165.0																	
0.5	SAND AND GRAVEL (FILL) - some silt, asphalt inclusions encountered, greyish brown, moist, very dense		AS1	AS													
			SS2	SS	102/100 mm		164										
			SS3	SS	54												
163.1							163									23.0	
2.3	SAND AND SILT (FILL) - some clay, trace gravel, brownish grey, slightly moist, compact to dense		SS4	SS	47												
			SS5	SS	14		162									22.3	5 37 40 18
160.8							161										
4.6	CLAYEY SILT (FILL) - some sand, trace organics/topsoil, grey with light brown and black inclusions, slightly moist, firm		SS6	SS	7		160										
159.3							159										
6.1	SANDY SILT (FILL) - some clay, trace gravel, trace topsoil/organics, grey with black inclusions, slightly moist, compact		SS7	SS	16												
							158										
157.8	SAND - some gravel, some silt, grey, wet, loose		SS8	SS	8		157									11 66 (23)	
156.0							156										
9.5	SANDY SILT - trace gravel, trace clay, grey, slightly moist to wet, dense to very dense		SS9	SS	45											23.5	Non-plastic
			SS10	SS	54		155									22.6	1 30 60 9
			SS11	SS	116/250 mm		154										
			SS12	SS	117/125 mm		153										
			SS13	SS	111/200 mm		152									20.1	
151.1																	
14.3	END OF BOREHOLE																
	NOTES: 1) Borehole terminated at 14.3 m depth at refusal (N>100 blows over 1.5 m interval). 2) Groundwater level measured at a depth of 8.1 m (Elev. 157.3 m) below the ground surface upon completion of drilling.																

ONTARIO MTO H401 - MARKHAM.GPJ ONTARIO MTO.GDT 6/29/23

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

Brampton, Ontario

RECORD OF BOREHOLE No BH22-6-4

1 OF 1

METRIC

W.P. Site 37X-0218/B1 & B3 LOCATION Hwy 401 - Markham Rd. O/P, Toronto, ON, MTM ON-10 326153.7E 4849559.0N ORIGINATED BY EL
 DIST Toronto HWY 401 BOREHOLE TYPE Truck Mount CME 75 / SSA COMPILED BY EL
 DATUM Geodetic DATE 2022.09.19 - 2022.09.19 LATITUDE 43.785685 LONGITUDE -79.234692 CHECKED BY SM/TL

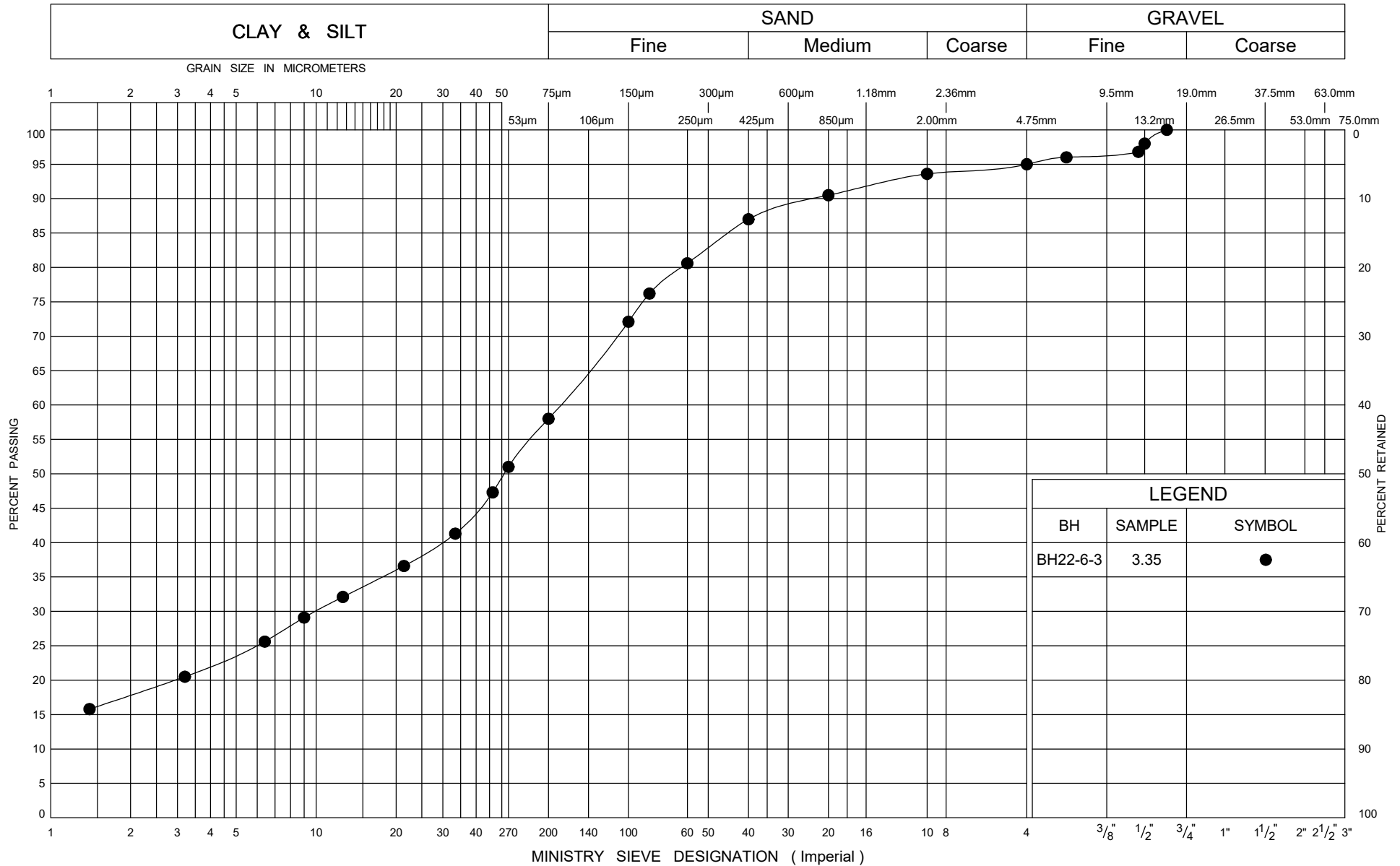
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIALX P. PENETROMETER												
164.3								20	40	60	80	100		20	40	60				
0.0	PAVEMENT STRUCTURE - 90 mm of asphalt and 375 mm of concrete						164													
163.8																				
0.5	SAND AND GRAVEL (FILL) - brown, moist, dense		AS1	AS																
163.3																				
1.1	CLAYEY SILT(FILL) - sandy, trace gravel, brown to grey, slightly moist to moist, stiff to hard		SS2	SS	30		163													
			SS3	SS	35															
							162													
			SS4	SS	18															
			SS5	SS	11		161													
							160													
			SS6	SS	10		159													
158.2																				
6.1	SAND AND SILT - trace gravel, trace clay, grey, moist to wet, compact to very dense		SS7	SS	13		158													
							157													
			SS8	SS	70															
			SS9	SS	150		156													
							155													
154.1	- becoming gravelly		SS10	SS	136		154													
10.2	SAND - some gravel, grey, moist, very dense																			
			SS11	SS	120/ 125 mm		153													
152.3																				
12.0	END OF BOREHOLE																			
	NOTES: 1) Borehole terminated at 12.0 m depth at refusal (N>100 blows over 1.5 m interval). 2) Groundwater level measured at a depth of 8.7 m (Elev. 155.6 m) below the ground surface upon completion of drilling.																			

ONTARIO MTO H401 - MARKHAM.GPJ ONTARIO MTO.GDT 6/29/23

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

Appendix E – Laboratory Data

UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of
Transportation

GRAIN SIZE DISTRIBUTION

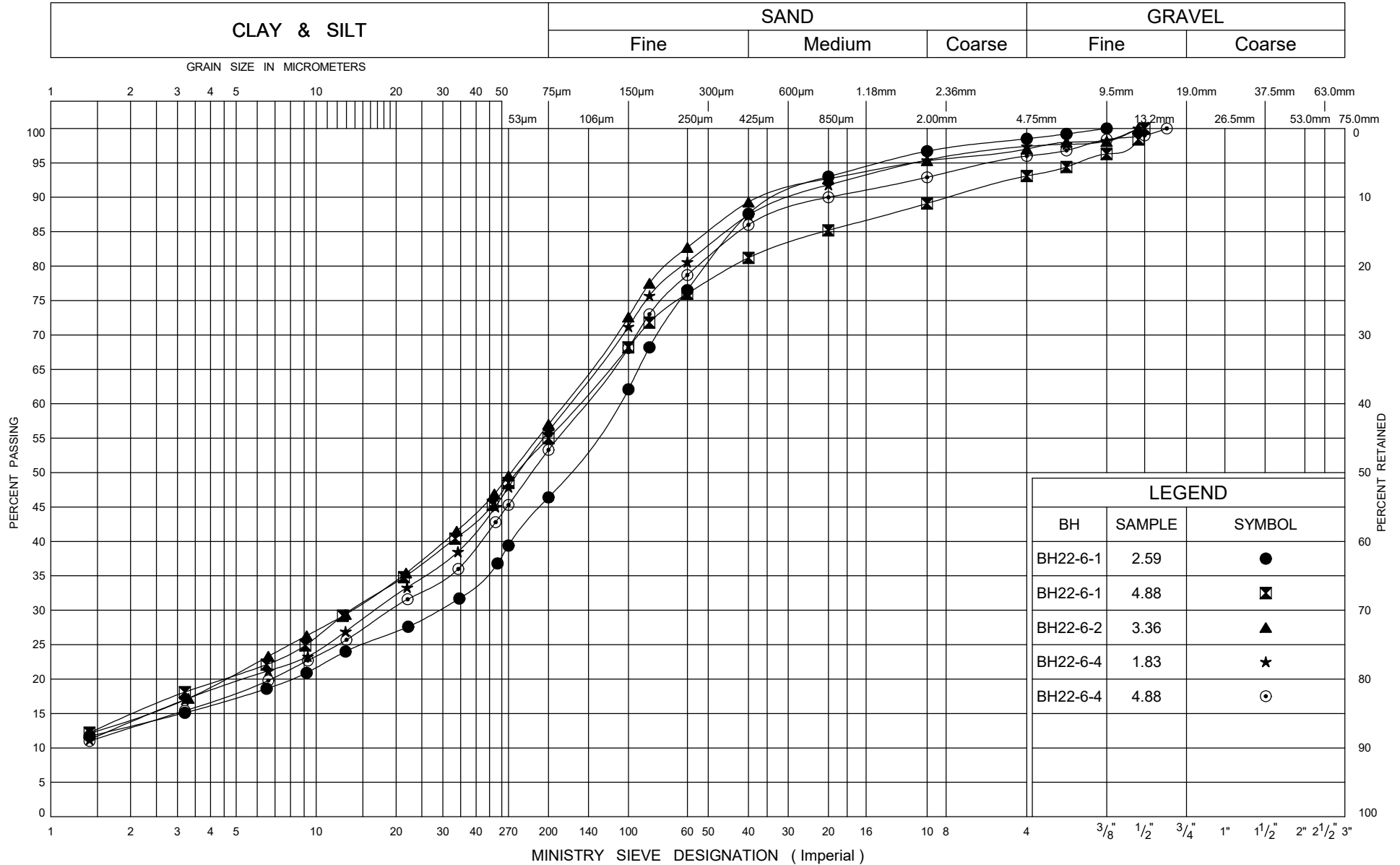
Cohesionless Fill: Sand/Sand and Silt/Sandy Silt

FIG No 1

W P Site 37X-0218/B1 & B3

Hwy 401 - Markham Rd. O/P

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

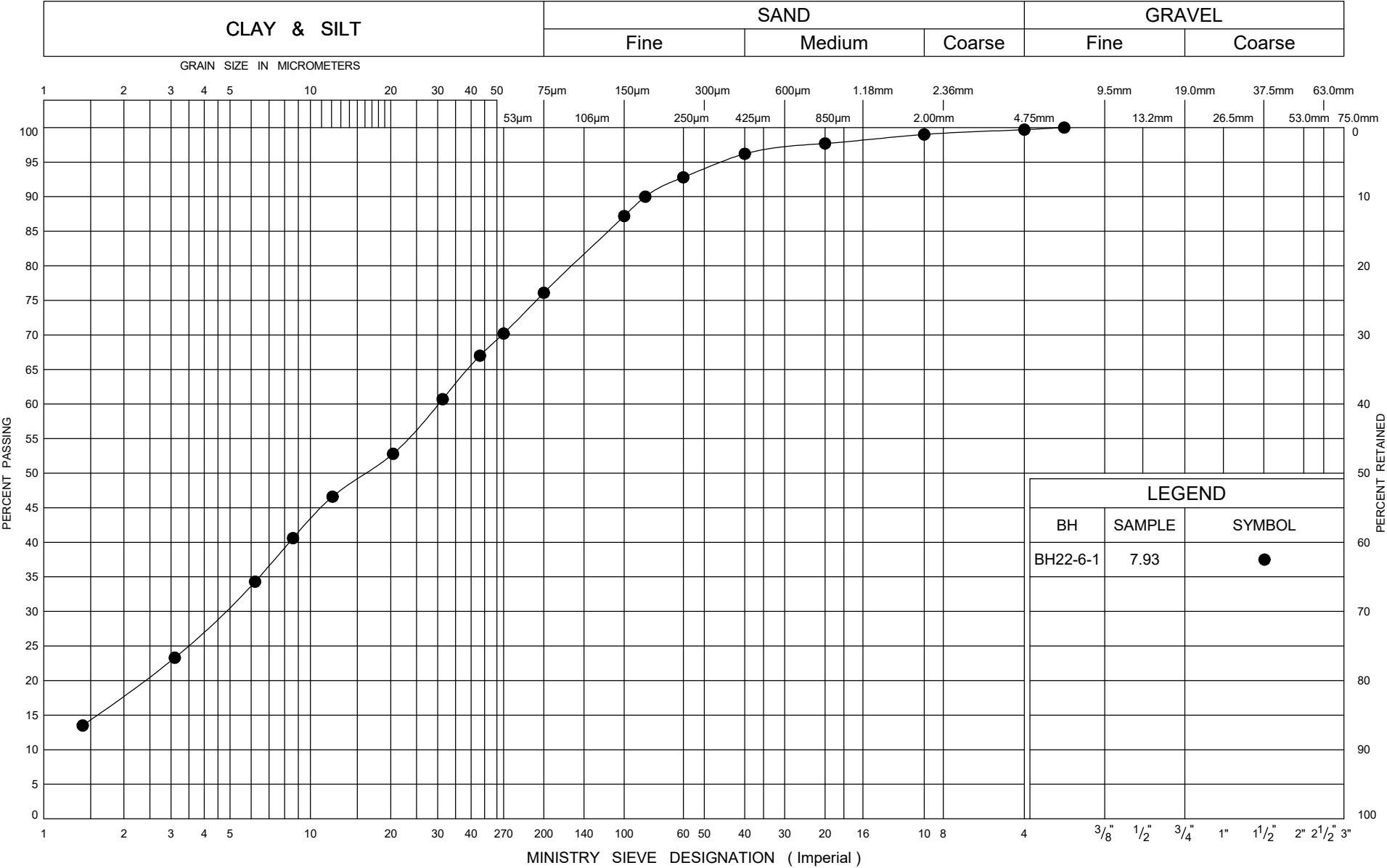
Cohesive Fill: Clayey Silt

FIG No 2

W P Site 37X-0218/B1 & B3

Hwy 401 - Markham Rd. O/P

UNIFIED SOIL CLASSIFICATION SYSTEM

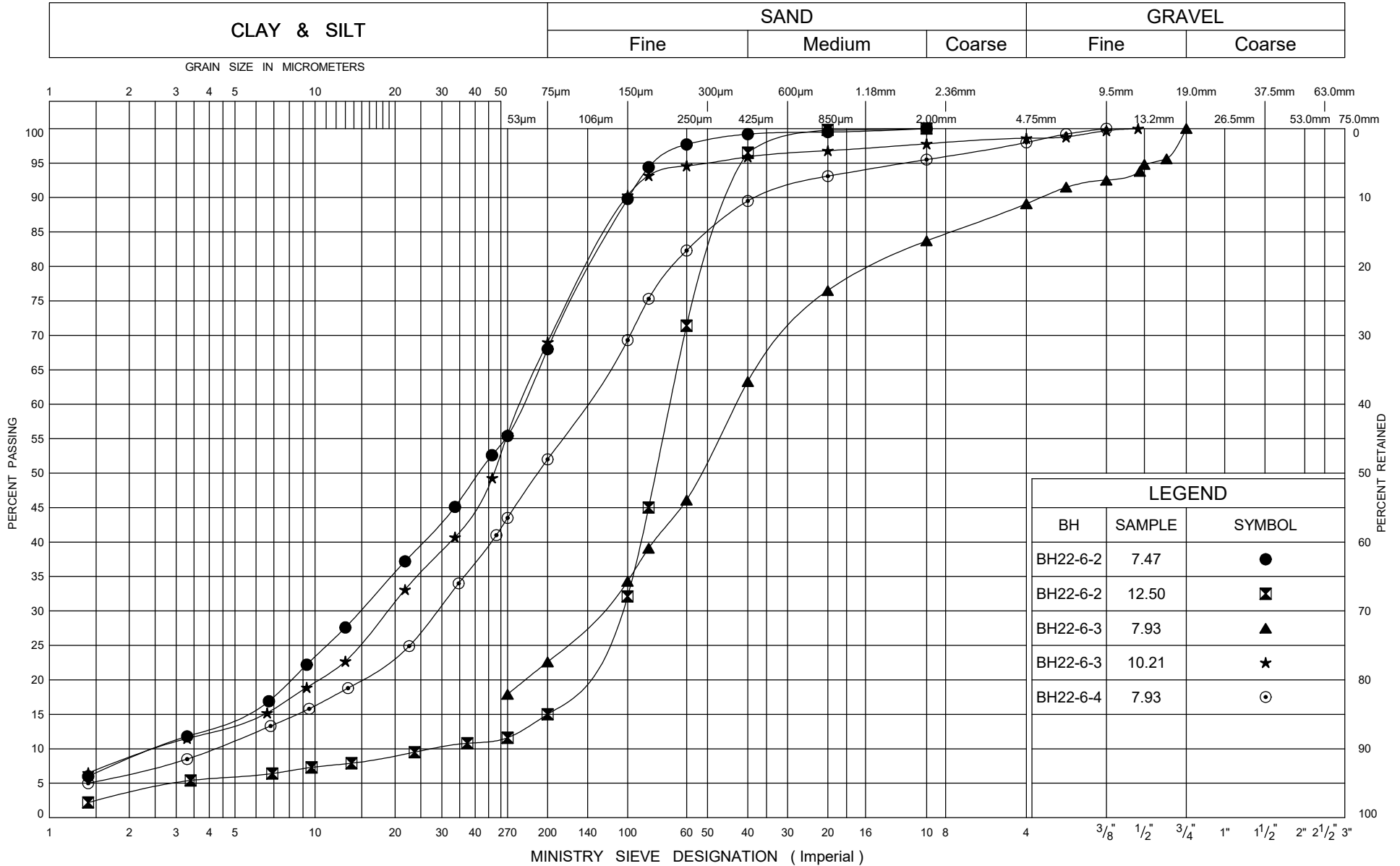


GRAIN SIZE DISTRIBUTION

Clayey Silt

FIG No 3
W P Site 37X-0218/B1 & B3
Hwy 401 - Markham Rd. O/P

UNIFIED SOIL CLASSIFICATION SYSTEM



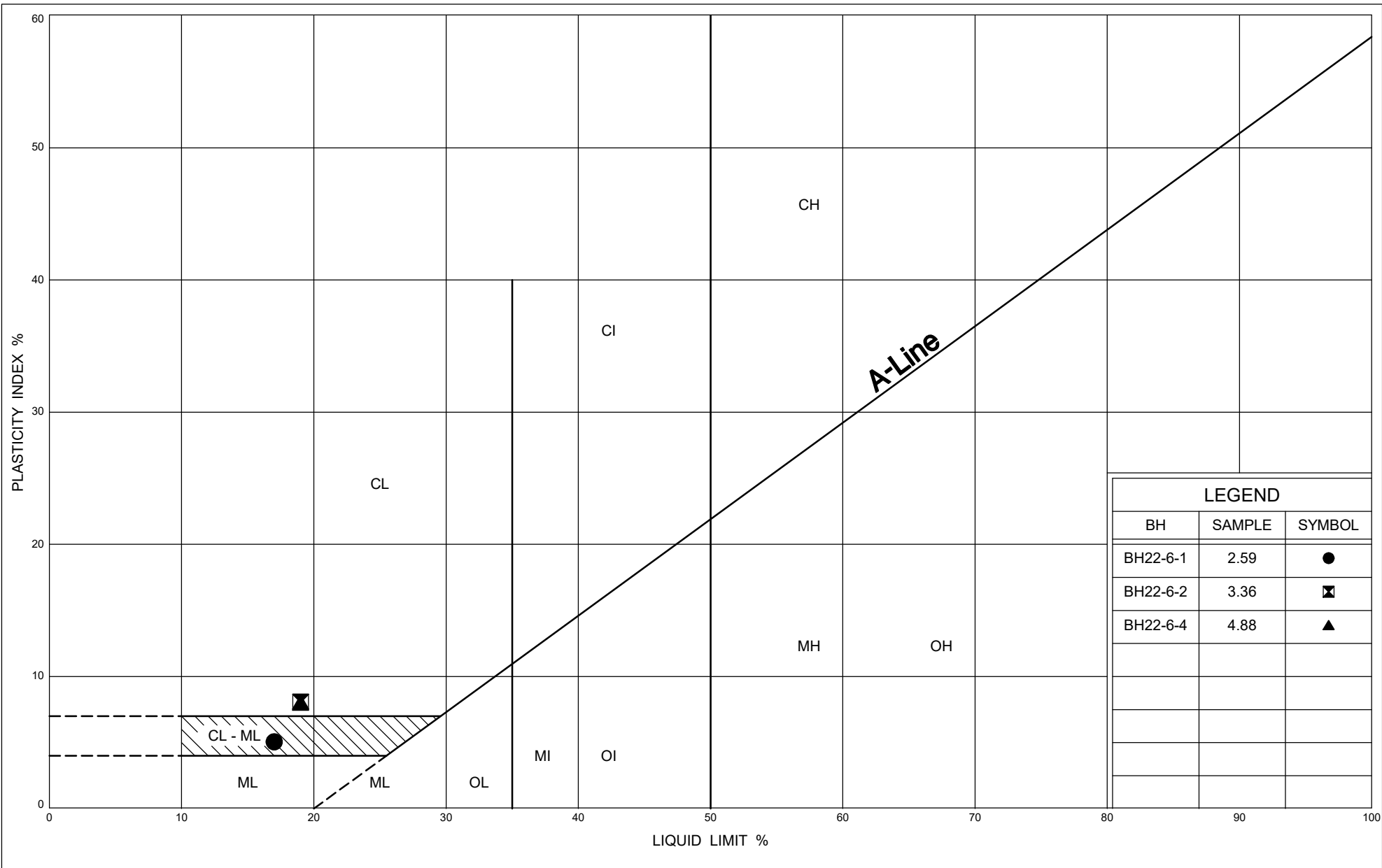
GRAIN SIZE DISTRIBUTION

Sand/Sand and Silt/Sandy Silt

FIG No 4

W P Site 37X-0218/B1 & B3

Hwy 401 - Markham Rd. O/P



Ministry of
Transportation

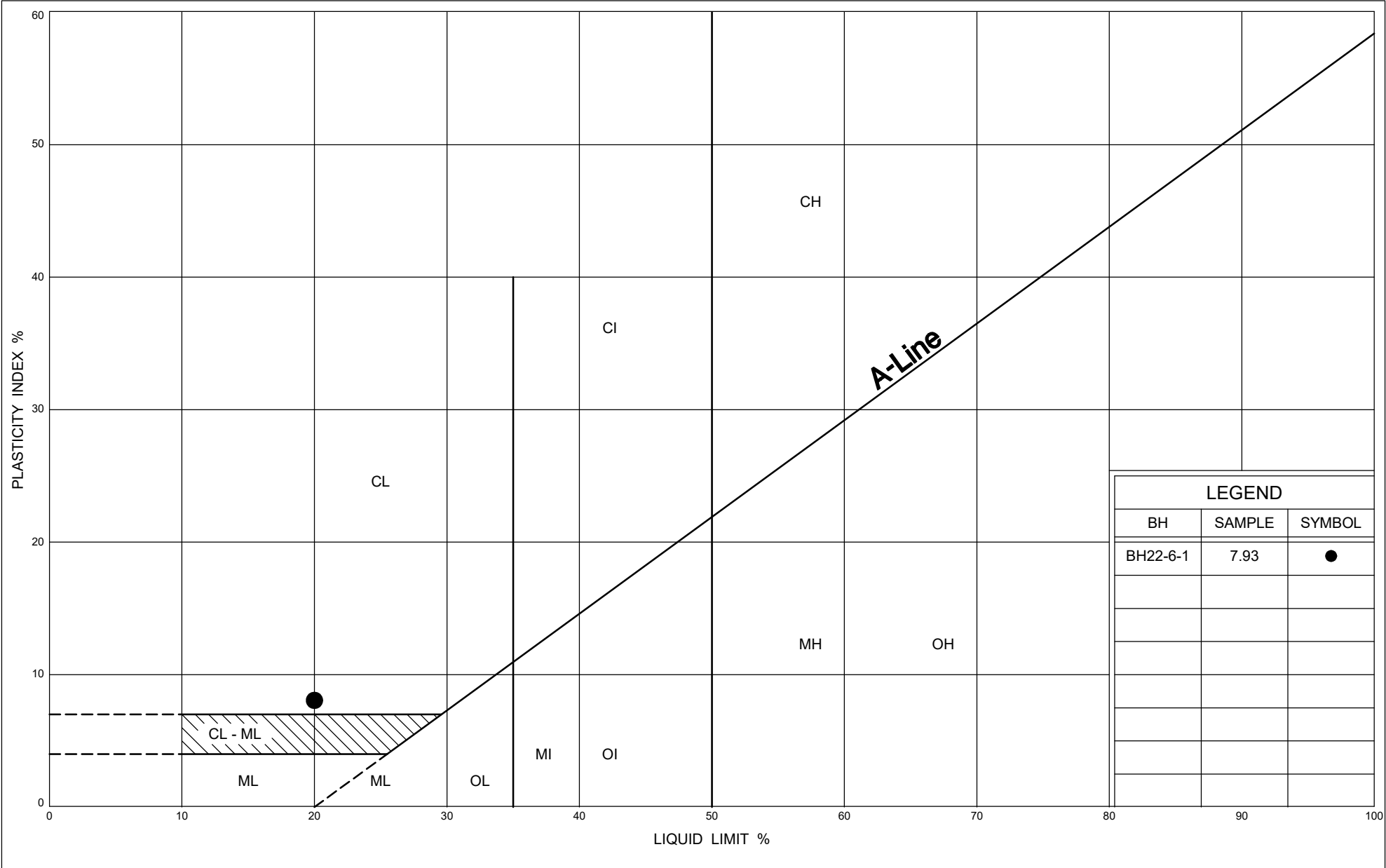
PLASTICITY CHART

Cohesive Fill: Clayey Silt

FIG No 5

W P Site 37X-0218/B1 & B3

Hwy 401 - Markham Rd. O/P



LEGEND		
BH	SAMPLE	SYMBOL
BH22-6-1	7.93	●



Your Project #: ADM-22000797-A0
Site#: Hwy 401 from Victoria to Nelso
Site Location: Hwy 401 from Victoria to Nelson Ave, ON
Your C.O.C. #: 893860-02-01

Attention: Nimesh Tamrakar

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

Report Date: 2022/10/04
Report #: R7328399
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2R8525

Received: 2022/09/27, 08:33

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	2	2022/10/03	2022/10/04	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2022/10/03	2022/10/03	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	2	N/A	2022/10/01	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	2	N/A	2022/09/30	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	2	2022/09/30	2022/09/30	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	2	2022/10/03	2022/10/04	CAM SOP-00421	SM 2580 B
Resistivity of Soil	2	2022/09/27	2022/10/03	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2022/10/03	2022/10/03	CAM SOP-00464	EPA 375.4 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, MELCC, EPA, APHA.

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.

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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-22000797-A0
Site#: Hwy 401 from Victoria to Nelso
Site Location: Hwy 401 from Victoria to Nelson Ave, ON
Your C.O.C. #: 893860-02-01

Attention: Nimesh Tamrakar

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

Report Date: 2022/10/04
Report #: R7328399
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2R8525

Received: 2022/09/27, 08:33

(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 your Project Manager.

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.

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For Service Group specific validation please refer to the Validation Signature Page.



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		TVP610			TVP610			TVP611		
Sampling Date		2022/09/18 03:00			2022/09/18 03:00			2022/09/23 01:00		
COC Number		893860-02-01			893860-02-01			893860-02-01		
	UNITS	BH22-6-2 SS10	RDL	QC Batch	BH22-6-2 SS10 Lab-Dup	RDL	QC Batch	BH22-3-4 SS5	RDL	QC Batch

Calculated Parameters

Resistivity	ohm-cm	4100		8249951				1100		8249951
-------------	--------	------	--	---------	--	--	--	------	--	---------

CONVENTIONALS

Redox Potential	mV	93	N/A	8260394	77	N/A	8260394	190	N/A	8260394
-----------------	----	----	-----	---------	----	-----	---------	-----	-----	---------

Inorganics

Soluble (20:1) Chloride (Cl ⁻)	ug/g	90	20	8260593				480	20	8260593
Conductivity	umho/cm	246	2	8260420				945	2	8260420
Available (CaCl ₂) pH	pH	7.84		8257456				7.75		8257456
Soluble (20:1) Sulphate (SO ₄)	ug/g	34	20	8260601	31	20	8260601	<20	20	8260601
Sulphide	mg/kg	2.1 (1)	0.5	8259069				2.6	0.5	8259069

Physical Testing

Moisture-Subcontracted	%	15	0.30	8264759				10	0.30	8264759
------------------------	---	----	------	---------	--	--	--	----	------	---------

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

N/A = Not Applicable

(1) Analyzed past method specified hold time



BUREAU
VERITAS

Bureau Veritas Job #: C2R8525

Report Date: 2022/10/04

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: NT

TEST SUMMARY

Bureau Veritas ID: TVP610
Sample ID: BH22-6-2 SS10
Matrix: Soil

Collected: 2022/09/18
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8260593	2022/10/03	2022/10/04	Alina Dobreanu
Conductivity	AT	8260420	2022/10/03	2022/10/03	Roya Fathitil
Moisture (Subcontracted)	BAL	8264759	N/A	2022/10/01	Simranjeet Batth
Sulphide in Soil	SPEC	8259069	N/A	2022/09/30	Dafne Strozake Maximo
pH CaCl2 EXTRACT	AT	8257456	2022/09/30	2022/09/30	Taslina Aktar
Redox Potential	COND	8260394	2022/10/03	2022/10/04	Surinder Rai
Resistivity of Soil		8249951	2022/10/03	2022/10/03	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8260601	2022/10/03	2022/10/03	Samuel Law

Bureau Veritas ID: TVP610 Dup
Sample ID: BH22-6-2 SS10
Matrix: Soil

Collected: 2022/09/18
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Redox Potential	COND	8260394	2022/10/03	2022/10/04	Surinder Rai
Sulphate (20:1 Extract)	KONE/EC	8260601	2022/10/03	2022/10/03	Samuel Law

Bureau Veritas ID: TVP611
Sample ID: BH22-3-4 SS5
Matrix: Soil

Collected: 2022/09/23
Shipped:
Received: 2022/09/27

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8260593	2022/10/03	2022/10/04	Alina Dobreanu
Conductivity	AT	8260420	2022/10/03	2022/10/03	Roya Fathitil
Moisture (Subcontracted)	BAL	8264759	N/A	2022/10/01	Simranjeet Batth
Sulphide in Soil	SPEC	8259069	N/A	2022/09/30	Dafne Strozake Maximo
pH CaCl2 EXTRACT	AT	8257456	2022/09/30	2022/09/30	Taslina Aktar
Redox Potential	COND	8260394	2022/10/03	2022/10/04	Surinder Rai
Resistivity of Soil		8249951	2022/10/03	2022/10/03	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8260601	2022/10/03	2022/10/03	Samuel Law



BUREAU
VERITAS

Bureau Veritas Job #: C2R8525

Report Date: 2022/10/04

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: NT

GENERAL COMMENTS

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

Package 1	7.0°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C2R8525

Report Date: 2022/10/04

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: NT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8257456	Available (CaCl ₂) pH	2022/09/30			100	97 - 103			0.13	N/A
8259069	Sulphide	2022/09/30	124	75 - 125	85	75 - 125	<0.5	mg/kg	NC	30
8260394	Redox Potential	2022/10/04			100	95 - 105			18	N/A
8260420	Conductivity	2022/10/03			101	90 - 110	<2	umho/cm	0.67	10
8260593	Soluble (20:1) Chloride (Cl ⁻)	2022/10/04	130	70 - 130	101	70 - 130	<20	ug/g	NC	35
8260601	Soluble (20:1) Sulphate (SO ₄)	2022/10/03	NC	70 - 130	104	70 - 130	<20	ug/g	9.1	35
8264759	Moisture-Subcontracted	2022/10/01					<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).



BUREAU
VERITAS

Bureau Veritas Job #: C2R8525

Report Date: 2022/10/04

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: Hwy 401 from Victoria to Nelson Ave, ON

Sampler Initials: NT

VALIDATION SIGNATURE PAGE

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

Anastassia Hamanov, Scientific Specialist

Ghayasuddin Khan, M.Sc., P.Chem., QP, Scientific Specialist, Inorganics

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Janet Gao, B.Sc., QP, Supervisor, Organics

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

27-Sep-22 08:33

Patricia Legette

C2R8525

Page of

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name: #17488 exp Services Inc		Company Name:		Quotation #: C20328	
Attention: Accounts Payable		Attention: Nimesh Tamrakar		P.O. #:	
Address: 1595 Clark Blvd		Address:		Project: ADM-22000797-A0 MUM ENV-1743	
Brampton ON L6T 4V1				Project Name:	
Tel: (905) 793-9800 Fax: (905) 793-0641		Tel: (905) 796-3200 Ext: 3026 Fax:		Site #:	
Email: AP@exp.com; Karen.Burke@exp.com		Email: Nimesh.Tamrakar@exp.com		Sampled By:	

ly:

Bottle Order #:

893860

Project Manager:

Patricia Legette

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)			Other Regulations		Special Instructions
<input type="checkbox"/> Table 1	<input type="checkbox"/> Res/Park	<input type="checkbox"/> Medium/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"/> Reg 558	<input type="checkbox"/> Storm Sewer Bylaw	
<input type="checkbox"/> Table 3	<input type="checkbox"/> Agri/Other	<input type="checkbox"/> For RSC	<input type="checkbox"/> MISA	<input type="checkbox"/> Municipality	
<input type="checkbox"/> Table			<input type="checkbox"/> PWQO	<input type="checkbox"/> Reg 406 Table	
<input type="checkbox"/> Table			<input type="checkbox"/> Other		

Include Criteria on Certificate of Analysis (Y/N)?

Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Soil Corrosivity Package	ANALYSIS REQUESTED (PLEASE BE SPECIFIC)	Turnaround Time (TAT) Required: Please provide advance notice for rush projects
1	BH22-6-2 S910	2022-09-27	5:30 AM	SOIL	✓			Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
2	BH22-3-4 SSS	2022-09-23	1:00 AM	SOIL	✓			Job Specific Rush TAT (if applies to entire submission) Date Required: Time Required: <input type="checkbox"/> Rush Confirmation Number: (call lab for #)
3				SOIL				# of Bottles Comments
4				SOIL				
5				SOIL				
6				SOIL				
7				SOIL				
8				SOIL				
9				SOIL				
10				SOIL				

* RELINQUISHED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)		Date: (YY/MM/DD)	Time	# jars used and not submitted	Laboratory Use Only				
Nimesh Tamrakar		2022-09-27		2 VITRIN		2024/09/27	08:37		Time Sensitive	Temperature (°C) on Receipt	Custody Seal Present	Yes	No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT WWW.BVNA.COM/RESOURCES/CHAIN-OF-CUSTODY-FORMS.

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

White: Bureau Veritas Yellow: Client

6/9/6



Your Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Your C.O.C. #: n/a

Attention: Silvana Micic

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

Report Date: 2022/09/22
Report #: R7308420
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5822

Received: 2022/09/15, 10:29

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	2	2022/09/20	2022/09/21	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	2	2022/09/20	2022/09/20	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	2	N/A	2022/09/21	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	2	N/A	2022/09/21	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	2	2022/09/21	2022/09/21	CAM SOP-00413	EPA 9045 D m
Redox Potential (3)	2	2022/09/20	2022/09/20	CAM SOP-00421	SM 2580 B
Resistivity of Soil	2	2022/09/16	2022/09/20	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	2	2022/09/20	2022/09/20	CAM SOP-00464	EPA 375.4 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, MELCC, EPA, APHA.

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-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Your C.O.C. #: n/a

Attention: Silvana Micic

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

Report Date: 2022/09/22
Report #: R7308420
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2Q5822

Received: 2022/09/15, 10:29

(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 your Project Manager.

Patricia Legette, Project Manager

Email: Patricia.Legette@bureauveritas.com

Phone# (905)817-5799

=====

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For Service Group specific validation please refer to the Validation Signature Page.



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822
Report Date: 2022/09/22

exp Services Inc
Client Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Sampler Initials: EL

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		TSY134			TSY134			TSY135		
Sampling Date		2022/09/12 13:00			2022/09/12 13:00			2022/09/13 13:00		
COC Number		n/a			n/a			n/a		
	UNITS	BH22-5-4 SS5	RDL	QC Batch	BH22-5-4 SS5 Lab-Dup	RDL	QC Batch	BH22-6-1 SS5	RDL	QC Batch
Calculated Parameters										
Resistivity	ohm-cm	1500		8229384				540		8229384
CONVENTIONALS										
Redox Potential	mV	110	N/A	8234488				180	N/A	8234488
Inorganics										
Soluble (20:1) Chloride (Cl ⁻)	ug/g	330	20	8234709				1000	40	8234709
Conductivity	umho/cm	660	2	8235211				1870	2	8235211
Available (CaCl ₂) pH	pH	8.17		8237272				7.24		8237272
Soluble (20:1) Sulphate (SO ₄)	ug/g	<20	20	8234714				<20	20	8234714
Sulphide	mg/kg	2.0 (1)	0.5	8241140	2.6	0.5	8241140	<0.5 (1)	0.5	8241140
Physical Testing										
Moisture-Subcontracted	%	5.6	0.30	8241139				15	0.30	8241139
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time										

Bureau Veritas ID		TSY135		
Sampling Date		2022/09/13 13:00		
COC Number		n/a		
	UNITS	BH22-6-1 SS5 Lab-Dup	RDL	QC Batch
Inorganics				
Conductivity	umho/cm	1850	2	8235211
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate				



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822
Report Date: 2022/09/22

exp Services Inc
Client Project #: ADM-22000797-A0
Site Location: MIDLAND/MARKHAM - 401 HWY
Sampler Initials: EL

TEST SUMMARY

Bureau Veritas ID: TSY134
Sample ID: BH22-5-4 SS5
Matrix: Soil

Collected: 2022/09/12
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8234709	2022/09/20	2022/09/21	Samuel Law
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil
Moisture (Subcontracted)	BAL	8241139	N/A	2022/09/21	Eric Tse
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu
pH CaCl2 EXTRACT	AT	8237272	2022/09/21	2022/09/21	Taslina Aktar
Redox Potential	COND	8234488	2022/09/20	2022/09/20	Surinder Rai
Resistivity of Soil		8229384	2022/09/20	2022/09/20	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8234714	2022/09/20	2022/09/20	Samuel Law

Bureau Veritas ID: TSY134 Dup
Sample ID: BH22-5-4 SS5
Matrix: Soil

Collected: 2022/09/12
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu

Bureau Veritas ID: TSY135
Sample ID: BH22-6-1 SS5
Matrix: Soil

Collected: 2022/09/13
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8234709	2022/09/20	2022/09/21	Samuel Law
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil
Moisture (Subcontracted)	BAL	8241139	N/A	2022/09/21	Eric Tse
Sulphide in Soil	SPEC	8241140	N/A	2022/09/21	Ly Vu
pH CaCl2 EXTRACT	AT	8237272	2022/09/21	2022/09/21	Taslina Aktar
Redox Potential	COND	8234488	2022/09/20	2022/09/20	Surinder Rai
Resistivity of Soil		8229384	2022/09/20	2022/09/20	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8234714	2022/09/20	2022/09/20	Samuel Law

Bureau Veritas ID: TSY135 Dup
Sample ID: BH22-6-1 SS5
Matrix: Soil

Collected: 2022/09/13
Shipped:
Received: 2022/09/15

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8235211	2022/09/20	2022/09/20	Roya Fathitil



GENERAL COMMENTS

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

Package 1	1.3°C
-----------	-------

Results relate only to the items tested.

BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822

Report Date: 2022/09/22

QUALITY ASSURANCE REPORT

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: MIDLAND/MARKHAM - 401 HWY

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
8234488	Redox Potential	2022/09/20			100	95 - 105			21	N/A
8234709	Soluble (20:1) Chloride (Cl-)	2022/09/21	116	70 - 130	108	70 - 130	<20	ug/g	NC	35
8234714	Soluble (20:1) Sulphate (SO4)	2022/09/20	NC	70 - 130	99	70 - 130	<20	ug/g	NC (1)	35
8235211	Conductivity	2022/09/20			101	90 - 110	<2	umho/cm	1.1	10
8237272	Available (CaCl2) pH	2022/09/21			100	97 - 103			1.1	N/A
8241139	Moisture-Subcontracted	2022/09/21					<0.30	%		
8241140	Sulphide	2022/09/21	113	75 - 125	114	75 - 125	<0.5	mg/kg	25	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) Due to colour interferences, sample required dilution. Detection limit was adjusted accordingly.



BUREAU
VERITAS

Bureau Veritas Job #: C2Q5822

Report Date: 2022/09/22

exp Services Inc

Client Project #: ADM-22000797-A0

Site Location: MIDLAND/MARKHAM - 401 HWY

Sampler Initials: EL

VALIDATION SIGNATURE PAGE

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

Cristina Carriere, Senior 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 Campobello Road, Mississauga, Ontario L5N 2L8
Phone: 905-817-5700 Fax: 905-817-5779 Toll Free: 800-563-6266CHAIN OF CUSTODY RECORD
ENV COC - 00014v3

Page 1 of 1

Invoice Information				Report Information (if differs from invoice)				Project Information			
Company: EXP Services				Company: EXP SERVICES				Quotation #:			
Contact Name: ELVIS LU				Contact Name: ELVIS LU				P.O. #/ A/E/R:			
Street Address: 1595 CLARK BLVD				Street Address:				Project #: ADH-22000797-A0			
City: BROMPTON		Prov: ON		City:		Prov:		Site #:		Site Location: 401 HWY 4	
Phone: 519 870 4510		Postal Code: L6T 4M1		Phone:		Postal Code:		Site Location:		Province: ON	
Email: Elvis.Lu@EXP.COM				Email:				Sampled By: ELVIS LU			
Copies:				Copies:							

Regulatory Criteria				Regular Turnaround Time (TAT)																																					
REG 153 <input type="checkbox"/> Table 1 <input type="checkbox"/> Table 2 <input type="checkbox"/> Table 3 <input type="checkbox"/> Table				Res/Park <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Agri/other				Med/Fine <input type="checkbox"/> Course <input type="checkbox"/> For RSC				OTHER <input type="checkbox"/> CMCE <input type="checkbox"/> Reg 558* <input type="checkbox"/> *min 3 day TAT <input type="checkbox"/> MISA <input type="checkbox"/> PWQO <input type="checkbox"/> Other:				Reg 406, Table: <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> Municipality				<input type="checkbox"/> 5 to 7 Day <input type="checkbox"/> 10 Day <input type="checkbox"/> Rush Turnaround Time (TAT) Surcharges apply <input type="checkbox"/> Same Day <input type="checkbox"/> 1 Day <input type="checkbox"/> 2 Day <input type="checkbox"/> 3 Day <input type="checkbox"/> 4 Day																					
Include Criteria on Certificate of Analysis (check if yes): <input type="checkbox"/>																																									
SAMPLES MUST BE KEPT COOL (<10°C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS																																									
Sample Identification				Date Sampled			Time (24hr)		Matrix																																
				YY	MM	DD	HH	MM																																	
1 ADH-BH22-5-4 SSS				22	09	12																																			
2 BH22-5-4 SSS				22	09	12																																			
3 BH22-6-1 SSS				22	09	13																																			
4 BH22-6-1 SSS				22	09	13																																			
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*UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS AND CONDITIONS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS OR BY CALLING THE LABORATORY LISTED ABOVE TO OBTAIN A COPY.

LAB USE ONLY				LAB USE ONLY				LAB USE ONLY				LAB USE ONLY			
Seal present				Seal present				Seal present				Seal present			
Seal intact				Seal intact				Seal intact				Seal intact			
Cooling media present				Cooling media present				Cooling media present				Cooling media present			
Relinquished by: (Signature/Print)				Received by: (Signature/Print)				Special Instructions							
Date: 22 09 15 Time: 10 24				Date: 22 09 15 Time: 10 29				Date: 22 09 15 Time: 10 29							

Appendix F – Previous Investigation - BH logs

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-40

LOCATION Co-ordinates 62.143 N. 102.822 E.

ORIGINATED BY AMS

W.P. 262-61

BORING DATE May 15, 1967

COMPILED BY _____ AMS

DATUM _____ Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _P WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.				w _p ——— w ——— w _L WATER CONTENT %				
											10	20	30		
517.5	GROUND LEVEL														
0.0	Clayey silt with sand and trace of gravel.					510								Gr.Ss.Si.Cl 516.0 0 25 62 13	
	Very Stiff to Hard		1	SS	17										
			2	SS	112										
			3	SS	100										
			4	SS	150/3"										
			5	SS	150/3 1/2"	500									
			6	SS	150/6"										
			7	SS	175/6"	490									
486.0			8	SS	50/3 1/4"										
31.5	End of Borehole														

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-E-40

LOCATION Co-ordinates 62.170 N: 102.750 E.

ORIGINATED BY AMS

W. P. 262-61

BORING DATE May 15, 1967

COMPILED BY AMS

DATUM _____ Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY AK.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 67-F-10

LOCATION CoOrdinates 62.098 N: 102.710 E.

ORIGINATED BY AMS

W. P. 262-61

BORING DATE May 16, 1967

COMPILED BY _____ AMS

DATUM Geodetic

BOREHOLE TYPE Continuous Flight Auger

CHECKED BY

[illegible]