



Foundation Investigation and Design Report
Slope Stability of Proposed Embankment Fill and Excavation Cut Areas
Highway 7 & 6th Line, Township of Guelph Eramasa, Ontario (MTO GEOCREs No. 40P9-66)

Type of Document:

Part A – Geotechnical Investigation Report

Submitted to:

James Dick Construction Limited

Project Number:

HAM-00802002-B0

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1. Introduction

EXP Services Inc. (EXP) was retained by James Dick Construction Limited to provide geotechnical services in support of the proposed road widening near the intersection of Highway 7 and 6th Line in Township of Guelph Eramasa, Ontario. It is understood that embankment fill and excavation cut along the following road sections will be carried out.

- Highway 7 – Stations 10+132 - 10+746, approximate length 614 m
- 6th Line – Stations 20+000 - 20+256, approximate length 256 m

The identified embankment fill and excavation cut areas are summarized in the following table.

Table 01: Embankment Fill and Excavation Cut Areas

Fill / Cut	Approximate Station
Excavation Cut	Highway 7, 10+132 to 10+240
Embankment Fill	Highway 7, 10+240 to 6 th Line
Excavation Cut	Highway 7, 6 th Line to 10+660
Embankment Fill	Highway 7, 10+660 to 10+746
Excavation Cut	6 th Line, Highway 7 to 20+256

This report addresses the geotechnical findings of the cut and fill areas, as shown in the attached Drawing Nos. 1 - 3. This report consists of a Geotechnical Investigation (Part A) section and a Geotechnical Design (Part B) section, consistent with the Ministry of Transportation (MTO) standards. Part A of this report summarizes the factual results of field and laboratory work (including site description and regional geology, field investigation procedures, borehole stratigraphy, and geotechnical laboratory test results) as well as a description of the interpreted subsurface soil and groundwater conditions. Part B of this report presents global slope stability analysis results for selected critical cross sections.

The factual data contained in this report pertain to a specific project as described in this report and is not applicable to any other project or site location. If changes are made either in the design phase or during construction in concept, location or elevation, EXP must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Site Description and Regional Geology

It is understood that embankment fill and excavation cut will be involved in the proposed road widening, with part of the road sections within the MTO ROW. Within the project limits, Highway 7 is comprised of one (1) paved westbound lane, one (1) paved eastbound lane and granular shoulders on the both sides. 6th Line is an unpaved road. Farmland occupies the majority area near the intersection of Highway 7 and 6th Line, except industrial buildings located at the southeast quadrant of the intersection.

The subject site is located in the Horseshoe Moraines physiographic region of Southern Ontario. Near the site, the overburden is typically ice-contact stratified deposits of sand and gravel, minor silt, clay and till. The overburden soils are anticipated to extend to about 6 – 9 m, underlain by Lower Silurian Amabel Formation bedrock. The Amabel Formation is characterized by white to blue-grey, thick- to massive-bedded dolostones. No major waterbody was founded within 500 m from the project limit.

3. Investigation Procedures

The current investigation was carried out by EXP between May 9 and 10, 2022. During this period, a total of eight (8) boreholes (designated as Boreholes 1 through 8) were drilled to depths ranging from 3.6 to 6.7 m below existing ground surface. Boreholes 1 to 5 were advanced along the alignment of Highway 7, while Boreholes 6 to 8 were drilled along the alignment of 6th Line. The approximate borehole locations are shown on the attached Drawing Nos. 1 to 3.

For the current investigation, the borehole locations and ground surface elevations (geodetic) were established prior to the drilling works by EXP personnel using Global Positioning System (GPS) equipment - Sokkia GCX3 GPS unit. The horizontal and vertical positioning accuracies of the instrument are ± 3 and ± 5 mm, respectively. The exploratory boreholes were also located in the field by EXP from adjacent surface features.

Prior to the commencement of drilling operations, underground services were cleared to minimize the risk of encountering any such services during the drilling operations.

Drilling and sampling operations were completed by a solid-stem continuous flight auger and split-spoon techniques using CME 55 truck mounted drill rigs owned and operated by specialist contractors.

A representative of EXP was present throughout the drilling operations to monitor and direct the drill operations, and to record borehole information. Representative samples of the subsurface soils were recovered at regular intervals using nominal 50 mm O.D. split spoon sampling equipment driven in accordance with the procedures of Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils (ASTM D1586).

All split spoon samples were returned to EXP's Brampton laboratory for further geotechnical testing. The following tests were performed on selected soil samples.

- moisture content
- unit weight
- grain size distribution

Where the drilling method allowed, groundwater levels were observed in the open boreholes during the course of the fieldwork. Monitoring wells were installed in Boreholes 2, 4, 5 and 6. The wells were installed to permit subsequent monitoring of the groundwater level at the well locations. The monitoring well consists of nominal 50 mm diameter PVC pipe with a slotted screen sealed at a selected depth within the borehole / monitoring well. Above the monitoring well screens, the annulus surrounding the pipes was grouted to the surface with cement / bentonite grout.

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HAM-00802002-B0*

The ground surface elevations, and the as-drilled northing and easting (MTM Zone ON-10) for the borehole for the current investigation are provided in the following table.

Table 02: Borehole Locations, Elevations and Depths

Borehole No.	Survey Information			Borehole Termination Depth / Elevation (m)
	Northing	Easting	Ground Surface Elevation (m)	
1	4,830,056.89	255,723.95	354.58	4.4 / 350.2
2	4,830,087.03	255,749.23	354.96	4.1 / 350.9
3	4,830,224.92	255,849.55	356.71	3.9 / 352.8
4	4,830,299.89	255,911.77	356.99	6.1 / 350.9
5	4,830,392.36	255,989.20	357.41	6.7 / 350.7
6	4,830,212.63	255,723.67	360.59	6.7 / 353.9
7	4,830,255.29	255,680.93	363.11	5.2 / 357.9
8	4,830,288.83	255,645.64	361.84	3.6 / 358.2

4. Subsurface Conditions

The following geotechnical report is available, which includes borehole data along the subject road sections. However, as the previous investigation was for pavement design purpose, the geotechnical data from the report is considered to be a reference only for the current study.

- Pavement Design Report, Proposed Hidden Quarry Turning Lanes, Guelph Eramosa, Ontario. EXP Project No. HAM-00802002-A0.

For the current study, the detailed soil profiles encountered in each borehole and the results of geotechnical laboratory testing are indicated on the attached borehole and core logs. It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change.

Notes on Sample Description (Drawing No. 1A) preceding the borehole logs form an integral part of and should be read in conjunction with this report.

The following is a brief description of the subsurface conditions encountered during the current investigation.

4.1 Highway 7 – Stations 10+132 to 10+746

Five (5) boreholes (designated as Boreholes 1 through 5) were advanced along the road alignment of Highway 7.

Surficial Covers

Different configurations of asphalt and granular base were encountered from ground surface in all boreholes. The configurations of the structures are summarized in the following table.

Table 03: Surficial Covers (Highway 7)

Borehole No.	1	2	3	4	5
Asphalt (mm)	-	-	-	-	110
Granular B (mm)	900	860	700	850	750
Sand and Gravel (mm)	380	300	-	-	3,250

It should be noted that the thickness of the asphaltic pavement structure explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of asphaltic concrete at the site.

The granular materials of Granular B and sand and gravel were in a typical dense compactness, with SPT N-values between 11 and 68 blows/0.3 m. The moisture contents of these materials were found to range from 3 to 10 percent of dry weight, indicating generally a moist condition.

Fill Materials

General fill materials were encountered below the surficial covers in Boreholes 1 to 4. The fill consisted of clayey silt to silty sand. Occasional rock fragment inclusions were observed in this fill. This layer extended to depths varying from 2.1 to 3.8 m below the existing ground surface or to elevations ranging from 354.9 to 350.9 m.

The dark brown to brown fill materials were in a loose to compact state of compaction as suggested by SPT N-values between 4 and 23 blows/0.3 m. The moisture contents within the fill were found to range from 4 to 15 percent of dry weight, indicating generally a moist condition. The unit weight of a cohesive fill sample was about 21.8 kN/m³.

Silty Sand

A layer of silty sand was encountered beneath the surficial covers in Borehole 5. This non-cohesive deposit extended to a depth of 5.5 m below the ground surface or to an elevation of 351.9 m. The brown soil unit contains trace contents of gravel and clay.

Grain size analyses were carried out in the geotechnical laboratory on a silty sand sample. The test results are summarized in the following table, and are included in Figure 1, Appendix A of this report.

Table 04: Grain Size Distributions – Silty Sand (Highway 7)

Sample No.	Sample Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
5 / SS 6	Silty sand, trace gravel, trace clay	4	68	26	2

SPT was conducted in this soil unit with a recorded N-value of 16 blows/0.3 m, indicating a compact compactness condition. This deposit was moist, with a natural moisture content of 13 percent of dry weight.

Silty Sand Till

A layer of silty sand till was encountered beneath the fills in Boreholes 1 to 4 or the silty sand in Borehole 5. This non-cohesive glacial till extended to borehole termination depths between 3.9 and 6.7 m below the ground surface or to elevations ranging from approximately 352.8 to 350.2 m. The brown soil unit typically contains some gravel to gravelly, trace clay contents and occasional rock fragments.

Grain size analyses were carried out in the geotechnical laboratory on selected silty sand till samples. The test results are summarized in the following table, and are included in Figure 2, Appendix A of this report.

Table 05: Grain Size Distributions – Silty Sand Till (Highway 7)

Sample No.	Sample Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1 / SS 6	Silty Sand Till, some gravel to gravelly, trace clay	31	42	22	5
4 / SS 4		19	48	27	6
4 / SS 5		13	48	32	7
5 / SS 7		12	51	34	3

SPT was conducted in this soil unit with the recorded N-values ranged from 9 to in excess of 50 blows/0.3 m, indicating a typical compact to dense compactness condition. This deposit was moist, with natural moisture contents ranging from 3 to 8 percent of dry weight. The measured unit weight of this till was about 21.9 kN/m³.

Due to its mode of deposition, the presence of cobbles and boulders should be anticipated in this glacial till deposit. Based on the practical refusal, bedrock may be inferred underlying the silty sand till in Boreholes 2 to 4.

Groundwater

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork and in monitoring wells installed in the selected boreholes (designated as Boreholes 2, 4 and 5). Short-term observations in the monitoring wells are recorded on the attached borehole logs and summarized in Table 06 below.

Table 06: Observed Groundwater Levels (Highway 7)

Borehole No.	Depth / Elevation of Monitoring Well Tip (m)	Screened Strata	Date of Water Level Measurement (mm/dd/yyyy)	Measured Water Level Depth/Elevation (m)
2	4.0 / 350.9	Fill	05/20/2022	Dry
			05/25/2022	Dry
4	6.1 / 350.9	Silty sand till	05/20/2022	Dry
			05/25/2022	Dry
5	6.7 / 350.7	Fill, silty sand and silty sand till	05/20/2022	Dry
			05/25/2022	Dry

Based on the configurations of the monitoring wells and the observation of groundwater, the groundwater level is considered to be below the explored depths.

4.2 6th Line – Stations 20+000 to 20+256

Three (3) boreholes (designated as Boreholes 6 through 8) were advanced along the alignment of 6th Line.

Surficial Covers

Different configurations of granular base were encountered from ground surface in all boreholes. The configurations of the structures are summarized in the following table.

Table 07: Surficial Covers (6th Line)

Borehole No.	6	7	8
Granular B (mm)	600	310	550
Sand and Gravel (mm)	-	200	-

The granular materials of Granular B and sand and gravel were in a compact to very dense compactness status, with SPT N-values between 12 and in excess of 50 blows/0.3 m. The moisture contents of these materials were found to range from 3 to 7 percent of dry weight, indicating generally a moist condition.

Fill Materials

General fill materials were encountered below the surficial covers in all boreholes. The fill consisted of silty sand to sandy silt. Occasional rock fragment inclusions were observed in this fill. This layer extended to depths varying from 1.0 to 4.0 m below the existing ground surface or to elevations ranging from 361.7 to 356.6 m.

The dark brown to brown fill materials were in a very loose to compact state of compaction as suggested by SPT N-values between 2 and 26 blows/0.3 m. The moisture contents within the fill were found to range from 5 to 26 percent of dry weight, indicating generally a moist condition.

Silty Sand

A layer of silty sand was encountered beneath the fill materials in Boreholes 7 and 8. This non-cohesive deposit extended to depths from 3.4 to 4.8 m below the ground surface or to elevation between 358.4 and 358.3 m. The brown soil unit contains trace content of clay.

Grain size analyses were carried out in the geotechnical laboratory on the selected silty sand samples. The test results are summarized in the following table, and are included in Figure 3, Appendix A of this report.

Table 08: Grain Size Distributions – Silty Sand (6th Line)

Sample No.	Sample Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
7 / SS 3	Silty sand, trace clay	0	68	29	3
7 / SS 5		0	40	56	4
8 / SS 2		0	67	31	2
8 / SS 4		0	67	31	2

SPT was conducted in this soil unit with recorded N-values ranged from 10 to 25 blows/0.3 m, indicating a compact condition. This deposit was moist, with natural moisture contents between 6 and 13 percent of dry weight.

Silty Sand Till

A layer of silty sand till was encountered beneath the fills in Borehole 6 or the silty sand in Boreholes 7 and 8. This non-cohesive glacial till extended to borehole termination depths between 3.6 and 6.7 m below the ground surface or to elevations ranging from approximately 358.2 to 353.9 m. The brown soil unit typically contains some gravel, trace clay contents, occasional rock fragments and occasional sand seams.

Grain size analyses were carried out in the geotechnical laboratory on selected silty sand till samples. The test results are summarized in the following table, and are included in Figure 4, Appendix A of this report.

Table 09: Grain Size Distributions – Silty Sand Till (6th Line)

Sample No.	Sample Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
6 / SS 7	Silty Sand Till, some gravel, trace clay	18	74	6	2
8 / SS 5		10	56	27	7

SPT was conducted in this soil unit with the recorded N-values ranged from 25 to 72 blows/0.3 m, indicating a typical compact to dense compactness condition. This deposit was moist, with natural moisture contents ranging from 2 to 11 percent of dry weight.

Due to its mode of deposition, the presence of cobbles and boulders should be anticipated in this glacial till deposit.

Groundwater

Groundwater conditions were assessed by taking readings in open holes during the course of the fieldwork and in monitoring wells installed in a selected borehole (designated as Borehole 6). Short-term observations in the monitoring well are recorded on the attached borehole logs and summarized in Table 10 below.

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HAM-00802002-B0*

Table 10: Observed Groundwater Levels (6th Line)

Borehole No.	Depth / Elevation of Monitoring Well Tip (m)	Screened Strata	Date of Water Level Measurement (mm/dd/yyyy)	Measured Water Level Depth/Elevation (m)
6	6.1 / 354.5	Fill and silty sand till	05/20/2022 05/25/2022	Dry Dry

Based on the configurations of the monitoring wells and the observation of groundwater, the groundwater level is considered to be below the explored depths.

5. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an overall assessment of the current geotechnical conditions of the subject property. The conclusions presented in this report reflect site conditions existing at the time of the investigation.

EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in the report.

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

EXP Services Inc.



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DRAWINGS

METRIC

DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS + METERS

PROPOSED CONSTRUCTION ON HIGHWAY 7 & 6TH LINE GUELPH ERAMASA, ON

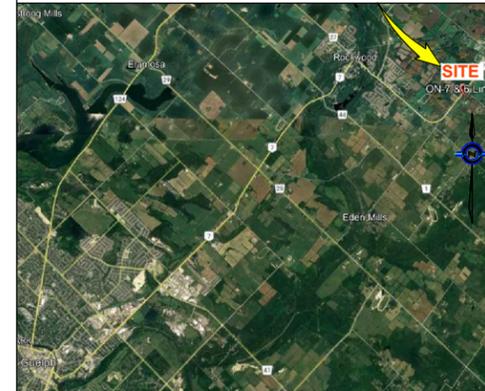


SHEET -

BOREHOLE LOCATION PLAN AND PROFILE

exp. **EXP Services Inc.**

KEY PLAN



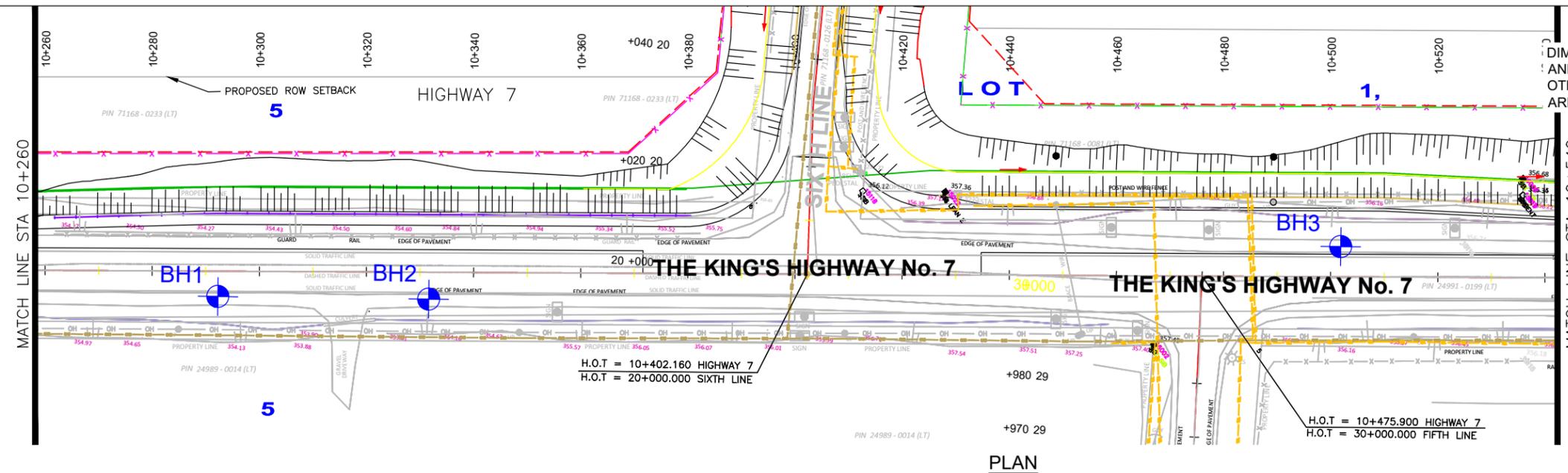
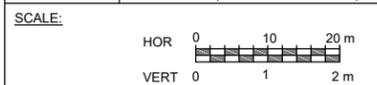
LEGEND

- Boreholes Location
- Standard Penetration Test (Blows/0.3 m)
- Water Level in Piezometer (most recent) (W. L. STABILIZED)
- Piezometer

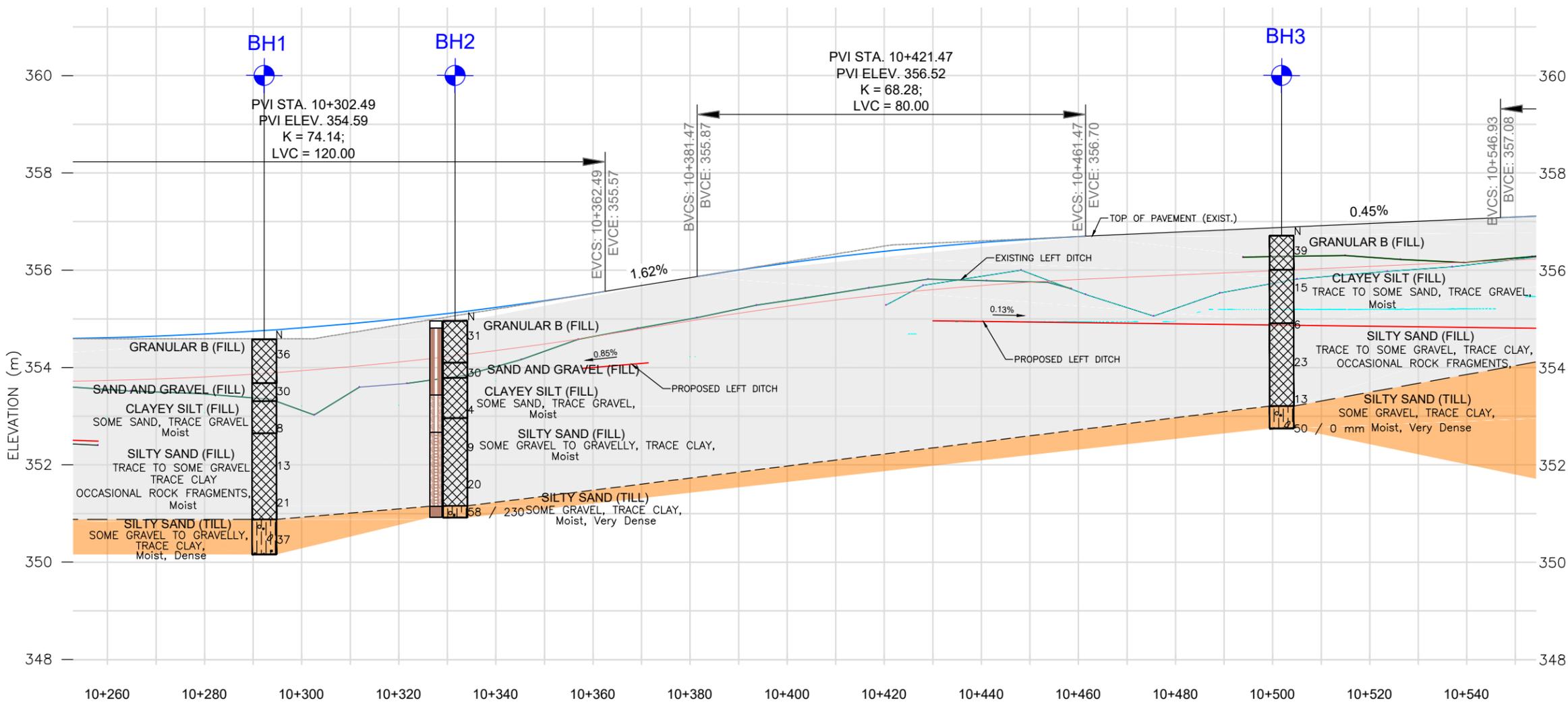
SOIL STRATA SYMBOLS

- ASPHALT
- FILL
- SAND AND SILT (TILL)
- SILTY SAND

BH No.	ELEV. (m)	MTM CO-ORDINATES NAD 83 (ZONE ON-10)	
		NORTHING	EASTING
BH1	354.6	4830056.89	255723.95
BH2	355.0	4830087.03	255749.23
BH3	356.7	4830224.92	255849.55
BH4	357.0	4830299.89	255911.77
BH5	357.4	4830392.36	255989.2
BH6	360.6	4830212.63	255723.67
BH7	363.1	4830255.29	255680.93
BH8	361.8	4830288.83	255645.64

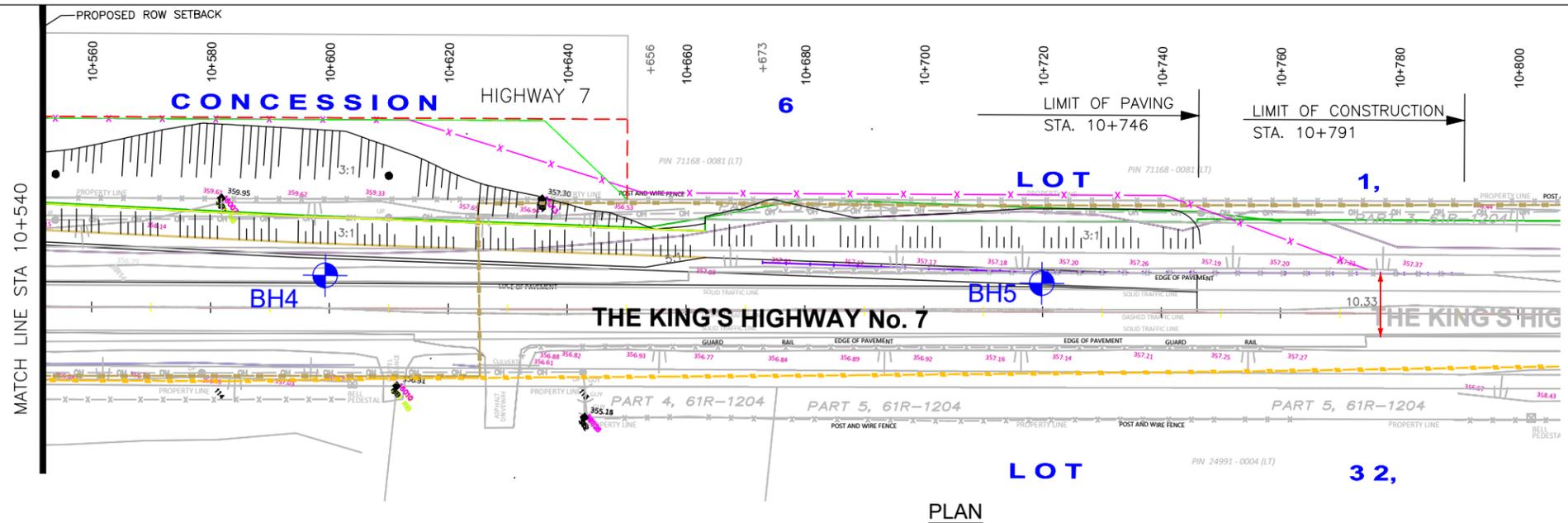


PLAN



PROFILE ALONG C/L THE KING'S HIGHWAY No. 7

GEOCRETS NO. 40P9-66	
PROJECT NO. HAM-00802002-B0	
SUBM'D SH	CHECKED HW
DATE	05/08/2022
DRAWN SH	CHECKED HW
APPROVED JG	DWG. 1



METRIC
 DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS + METERS

PROPOSED CONSTRUCTION ON HIGHWAY 7 & 6TH LINE GUELPH ERAMASA, ON

BOREHOLE LOCATION PLAN AND PROFILE

exp. **EXP Services Inc.**

KEY PLAN

LEGEND

- Boreholes Location
- N Standard Penetration Test (Blows/0.3 m)
- Water Level in Piezometer (most recent) (W. L. STABILIZED)
- Piezometer

SOIL STRATA SYMBOLS

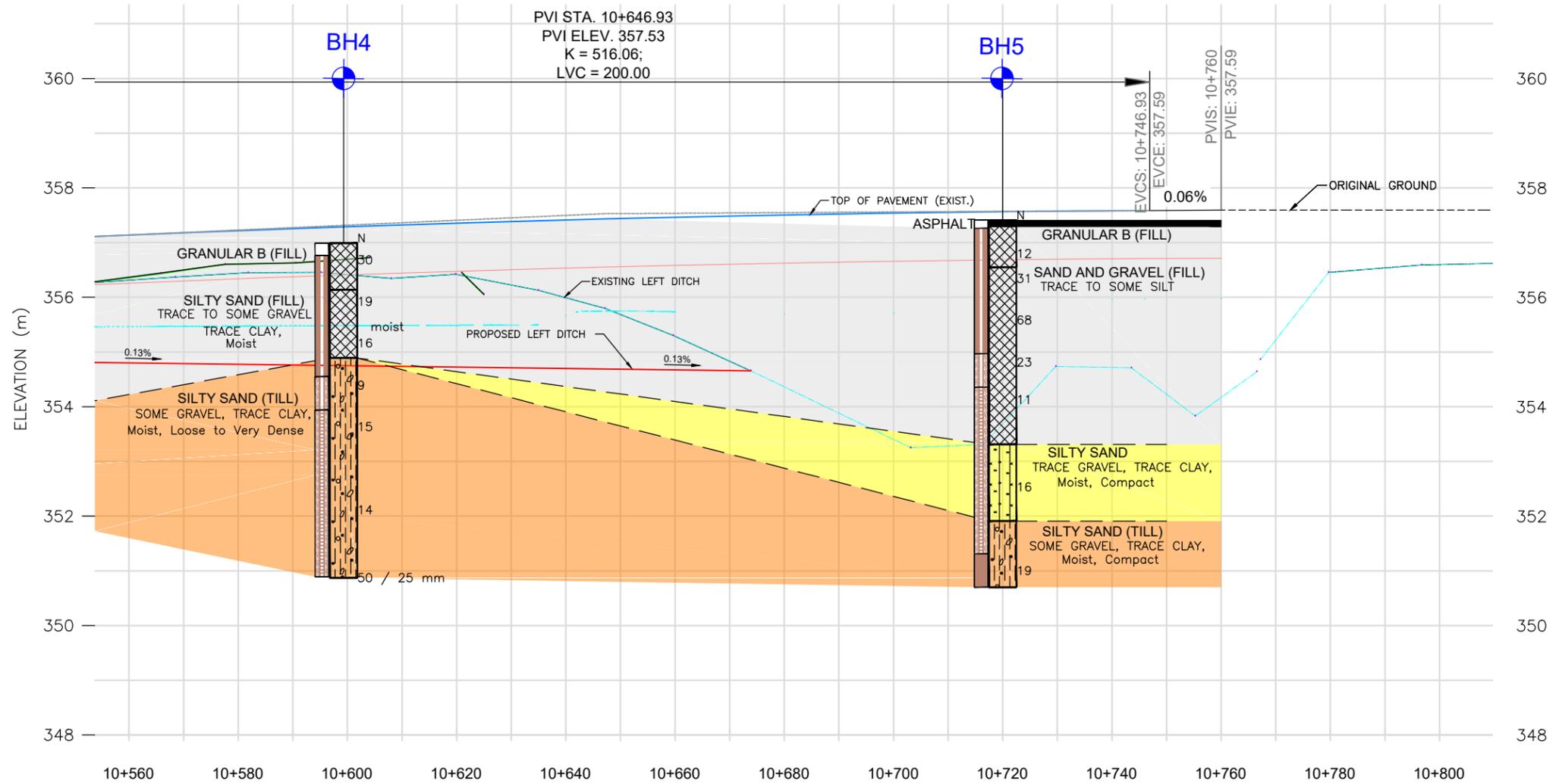
- ASPHALT
- FILL
- SAND AND SILT (TILL)
- SILTY SAND

BH No.	ELEV. (m)	MTM CO-ORDINATES NAD 83 (ZONE ON-10)	
		NORTHING	EASTING
BH1	354.6	4830056.89	255723.95
BH2	355.0	4830087.03	255749.23
BH3	356.7	4830224.92	255849.55
BH4	357.0	4830299.89	255911.77
BH5	357.4	4830392.36	255989.2
BH6	360.6	4830212.63	255723.67
BH7	363.1	4830255.29	255680.93
BH8	361.8	4830288.83	255645.64

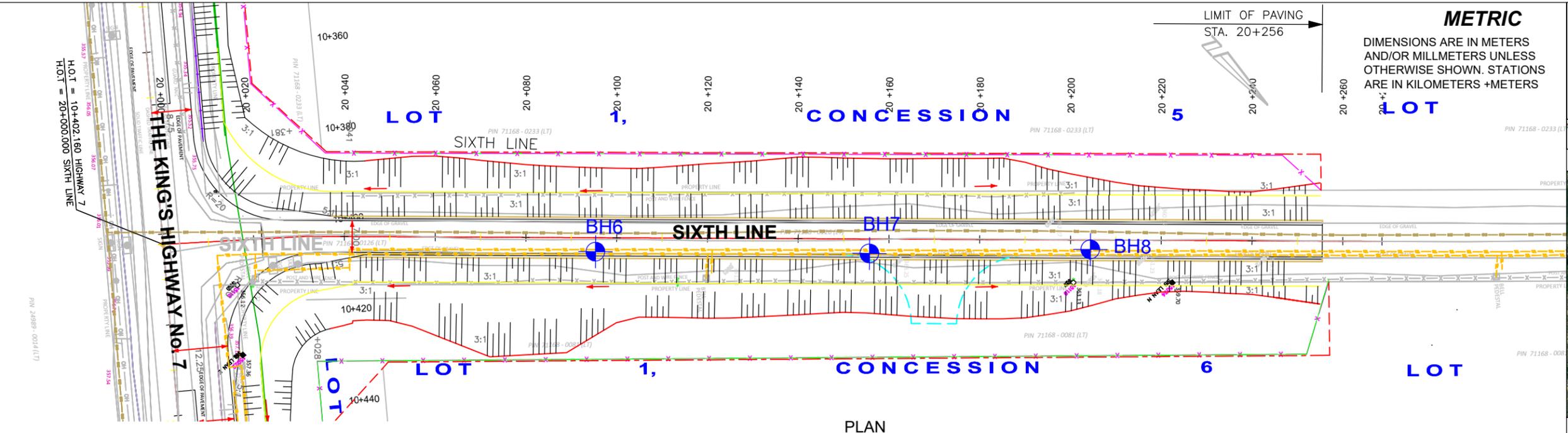
SCALE:
 HOR 0 10 20 m
 VERT 0 1 2 m

GEOCRETS NO. 40P9-66
 PROJECT NO. HAM-00802002-B0

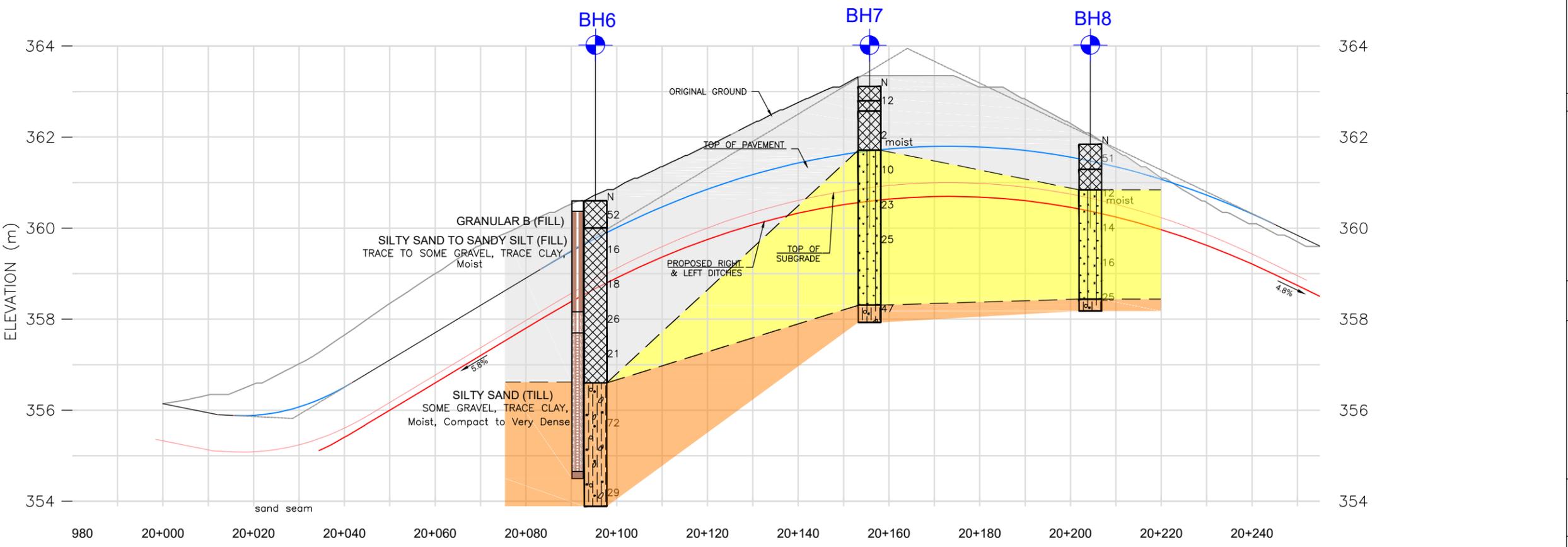
SUBM'D SH	CHECKED HW	DATE	05/08/2022
DRAWN SH	CHECKED HW	APPROVED JG	DWG. 1



PROFILE ALONG C/L THE KING'S HIGHWAY No. 7



PLAN



PROFILE ALONG C/L SIXTH LINE

METRIC

DIMENSIONS ARE IN METERS AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETERS + METERS

PROPOSED CONSTRUCTION ON HIGHWAY 7 & 6TH LINE GUELPH ERAMASA, ON

BOREHOLE LOCATION PLAN AND PROFILE

exp. **EXP Services Inc.**

KEY PLAN

LEGEND

- Boreholes Location
- N Standard Penetration Test (Blows/0.3 m)
- Water Level in Piezometer (most recent) (W. L. STABILIZED)
- Piezometer

SOIL STRATA SYMBOLS

- ASPHALT
- FILL
- SAND AND SILT (TILL)
- SILTY SAND

BH No.	ELEV. (m)	MTM CO-ORDINATES NAD 83 (ZONE ON-10)	
		NORTHING	EASTING
BH1	354.6	4830056.89	255723.95
BH2	355.0	4830087.03	255749.23
BH3	356.7	4830224.92	255849.55
BH4	357.0	4830299.89	255911.77
BH5	357.4	4830392.36	255989.2
BH6	360.6	4830212.63	255723.67
BH7	363.1	4830255.29	255680.93
BH8	361.8	4830288.83	255645.64

SCALE:

HOR 0 10 20 m

VERT 0 1 2 m

GEOCRETS NO. 40P9-66

PROJECT NO. HAM-00802002-B0

SUBM'D SH CHECKED HW DATE 05/08/2022

DRAWN SH CHECKED HW APPROVED JG DWG. 1

Notes on Sample Descriptions and Soil Types

Drawing 1A

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** also follow the same system. Others may use different classification systems; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		
	0.002	0.006	0.02	0.06	0.2	0.6	2.0	6.0	20	60	200

EQUIVALENT GRAIN DIAMETER IN MILLIMETERS

CLAY (PLASTIC) TO SILT (NONPLASTIC)	SAND			GRAVEL	
	FINE	MEDIUM	COARSE	FINE	COARSE

UNIFIED SOIL CLASSIFICATION

2. **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.
3. **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.

4. Excerpt from "OHSWA Regulations for Construction Projects," Part III, Section 226:

- **Soil Types**

Type 1 Soil

- a) is hard, very dense and only able to be penetrated with difficulty by a small sharp object;
- b) has a low natural moisture content and a high degree of internal strength;
- c) has no signs of water seepage; and
- d) can be excavated only by mechanical equipment.

Type 2 Soil

- a) is very stiff, dense and can be penetrated with moderate difficulty by a small sharp object;
- b) has a low to medium natural moisture content and a medium degree of internal strength; and
- c) has a damp appearance after it is excavated.

Type 3 Soil

- a) is stiff to firm and compact to loose in consistency or is previously excavated soil;
- b) exhibits signs of surface cracking;
- c) exhibits signs of water seepage;
- d) if it is dry, may run easily into a well-defined conical pile; and
- e) has a low degree of internal strength.

Type 4 Soil

- a) is soft to very soft and very loose in consistency, very sensitive and upon disturbance is significantly reduced in natural strength;
- b) runs easily or flows, unless it is completely supported before excavating procedures;
- c) has almost no internal strength;
- d) is wet or muddy; and
- e) exerts substantial fluid pressure on its supporting system.

Brampton, Ontario

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

W.P. _____ LOCATION Hwy 7 ORIGINATED BY HW
 DIST Central HWY 7 BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.09 - 2022.05.09 LATITUDE 43.608826 LONGITUDE -80.107958 CHECKED BY SC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W _p	W			W _L	GR
354.6	Granular		1	SS	36													
0.0	FILL: Granular B 900 mm																	
355.5	FILL: sand and gravel			2	SS	30												
0.9																		
355.8	FILL: clayey silt, some sand, trace gravel, dark brown, moist			3	SS	8												
1.3																		
356.5	FILL: silty sand, trace to some gravel, trace clay, occasional rock fragments, brown, moist		4	SS	13													
1.9																		
358.2	auger grinding		5	SS	21													
3.7	SILTY SAND TILL: some gravel to gravelly, trace clay, brown, moist, dense		6	SS	37													
358.9																		
4.4	END OF BOREHOLE																	

ONTARIO MTO LOGS_MTO_HAM-00802002-BO.GPJ ONTARIO MTO.GDT 5/30/22

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

Brampton, Ontario

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

W.P. _____ LOCATION Hwy 7 ORIGINATED BY HW
 DIST Central HWY 7 BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.09 - 2022.05.09 LATITUDE 43.609102 LONGITUDE -80.107644 CHECKED BY SC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			GR
355.0	Granular FILL: Granular B 860 mm	1	SS	31													
354.1	FILL: sand and gravel	2	SS	30													
353.8	FILL: clayey silt, some sand, trace gravel, black to dark brown, moist	3	SS	4													
353.0	FILL: silty sand, some gravel to gravelly, trace clay, brown, moist	4	SS	9													
351.2	SILTY SAND TILL: some gravel, trace clay, brown, moist, very dense	5	SS	20													
350.9		6	SS	58 / 230 mm													
4.0	END OF BOREHOLE TERMINATED UPON PRACTICAL REFUSAL TO SAMPLING EQUIPMENT																

ONTARIO MTO LOGS_MTO_HAM-00802002-B0.GPJ ONTARIO MTO.GDT 5/30/22

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

Brampton, Ontario

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

W.P. _____ LOCATION Hwy 7 ORIGINATED BY HW
 DIST Central HWY 7 BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.10 - 2022.05.10 LATITUDE 43.610344 LONGITUDE -80.106424 CHECKED BY SC

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa									WATER CONTENT (%)	
						20	40	60	80	100								
356.7 0.0	Granular FILL: Granular B 700 mm		1	SS	39													
356.0 0.7	FILL: clayey silt, trace to some sand, trace gravel, dark brown to brown, moist		2	SS	15													
354.9 1.8	FILL: silty sand, trace to some gravel, trace clay, occasional rock fragments, brown, moist		3	SS	6													
			4	SS	23													
353.2 3.5	SILTY SAND TILL: some gravel, trace clay, brown, moist, very dense		5	SS	13													
352.8 4.0	END OF BOREHOLE TERMINATED UPON PRACTICAL REFUSAL TO SAMPLING EQUIPMENT		6	SS	50 / 0 mm													

ONTARIO MTO LOGS_MTO_HAM-00802002-B0.GPJ ONTARIO MTO.GDT 5/30/22

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

Brampton, Ontario

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. _____ LOCATION Hwy 7 ORIGINATED BY HW
 DIST Central HWY 7 BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.09 - 2022.05.09 LATITUDE 43.611032 LONGITUDE -80.105658 CHECKED BY SC

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	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20	40	60
357.0 0.0	Granular FILL: Granular B 850 mm	1	SS	30															
356.1 0.9	FILL: silty sand, trace to some gravel, trace clay, dark brown to brown, moist	2	SS	19															
354.9 2.1	SILTY SAND TILL: some gravel, trace clay, brown, moist, loose to very dense	3	SS	16															
		4	SS	9												19	48	27	6
		5	SS	15															
		6	SS	14												13	48	32	7
350.9 6.1	END OF BOREHOLE TERMINATED UPON PRACTICAL REFUSAL TO SAMPLING EQUIPMENT	7	SS	50 / 25 mm															

ONTARIO MTO LOGS_MTO_HAM-00802002-B0.GPJ ONTARIO MTO.GDT 5/30/22

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

Brampton, Ontario

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

W.P. _____ LOCATION Hwy 7 ORIGINATED BY HW
 DIST Central HWY 7 BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.09 - 2022.05.09 LATITUDE 43.611862 LONGITUDE -80.104704 CHECKED BY SC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	T _N VALUES			20	40	60	80	100	W _p	W	W _L			20	40	60	GR
357.4	Asphalt																			
357.0	ASPHALT: 110 mm																			
0.1	FILL: Granular B 750 mm																			
		1	SS	12																
356.6	FILL: sand and gravel, trace to some silt																			
0.9		2	SS	31																
		3	SS	68																
		4	SS	23																
		5	SS	11																
353.3	SILTY SAND: trace gravel, trace clay, brown, moist, compact																			
4.1		6	SS	16																4 68 26 2
351.9	SILTY SAND TILL: some gravel, trace clay, brown, moist, compact																			
5.5		7	SS	19																12 51 34 3
350.7	END OF BOREHOLE																			
6.7																				

ONTARIO MTO LOGS_HAM_00802002-B0.GPJ ONTARIO MTO.GDT 5/30/22

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

Brampton, Ontario

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

W.P. _____ LOCATION 6th Line ORIGINATED BY HW
 DIST Central HWY N/A BOREHOLE TYPE CME55-Truck Mount COMPILED BY HW
 DATUM Geodetic DATE 2022.05.10 - 2022.05.10 LATITUDE 43.61023 LONGITUDE -80.107975 CHECKED BY SC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L			20	40	60	GR	SA
360.6 0.0	Granular FILL: Granular B 600 mm	1	SS	52																	
360.0 0.6	FILL: silty sand to sandy silt, trace to some gravel, trace clay, brown, moist ----- frequent rock fragments	2	SS	16																	
		3	SS	18																	
		4	SS	26																	
		5	SS	21																	
356.6 4.0	SILTY SAND TILL: some gravel, trace clay, brown, moist, compact to very dense ----- frequent rock fragments ----- sand seam	6	SS	72																	
		7	SS	29																	18 74 6 2
353.9 6.7	END OF BOREHOLE																				

ONTARIO MTO LOGS_HAM_00802002-B0.GPJ ONTARIO MTO.GDT 5/30/22

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

*Slope Stability of Proposed Embankment Fill and Excavation Cut Areas
Highway 7 & 6th Line, Township of Guelph Eramasa, Ontario (MTO GEOCREs No. 40P9-66)
HAM-00802002-B0*

APPENDICES

*Slope Stability of Proposed Embankment Fill and Excavation Cut Areas
Highway 7 & 6th Line, Township of Guelph Eramasa, Ontario (MTO GEOCREs No. 40P9-66)
HAM-00802002-B0*

APPENDIX A

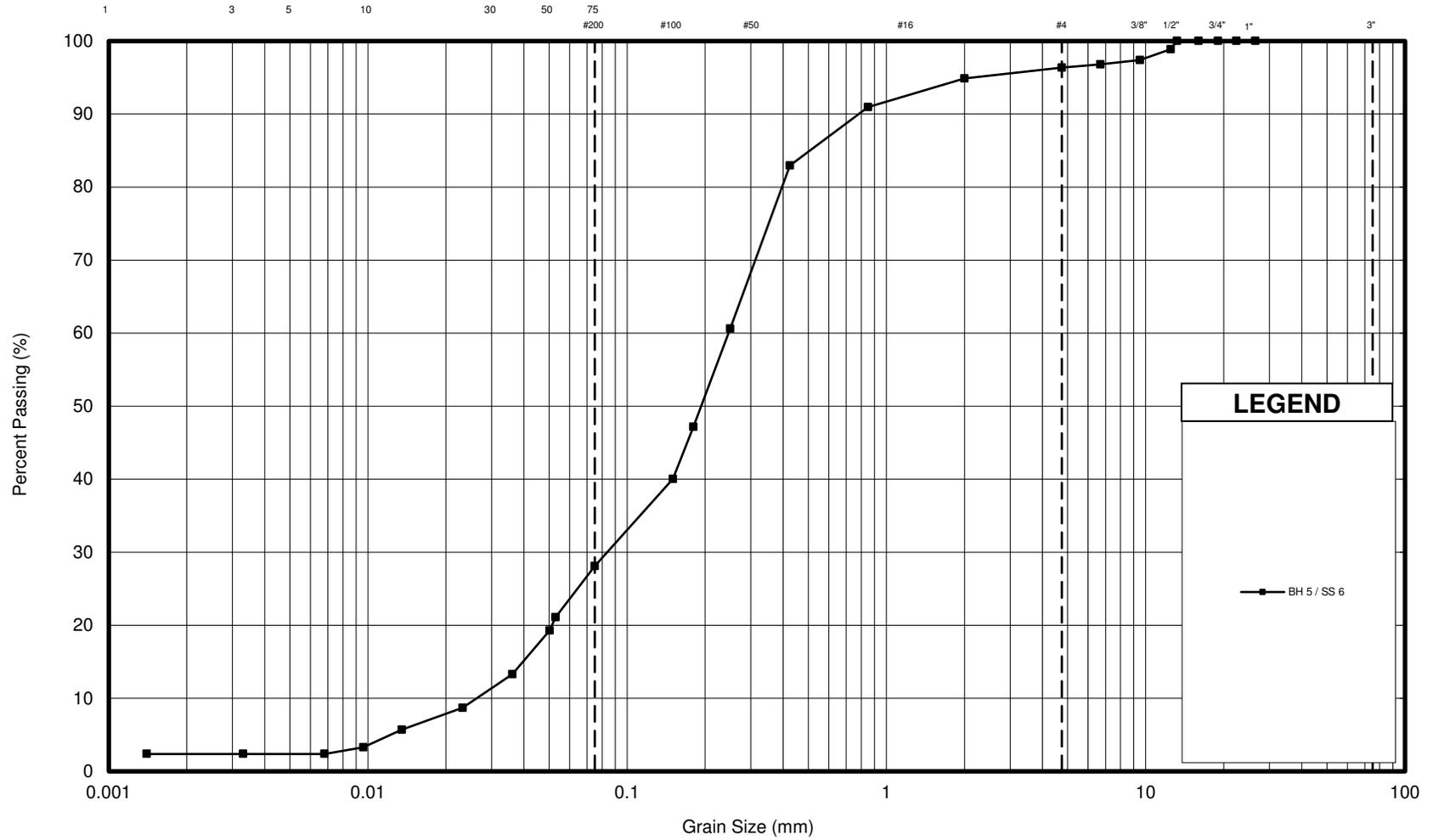
Geotechnical Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse

GRAIN SIZE IN MICROMETERS

SIEVE DESIGNATION (IMPERIAL)



GRAIN SIZE DISTRIBUTION
 HIGHWAY 7 - SILTY SAND
 trace clay, trace gravel

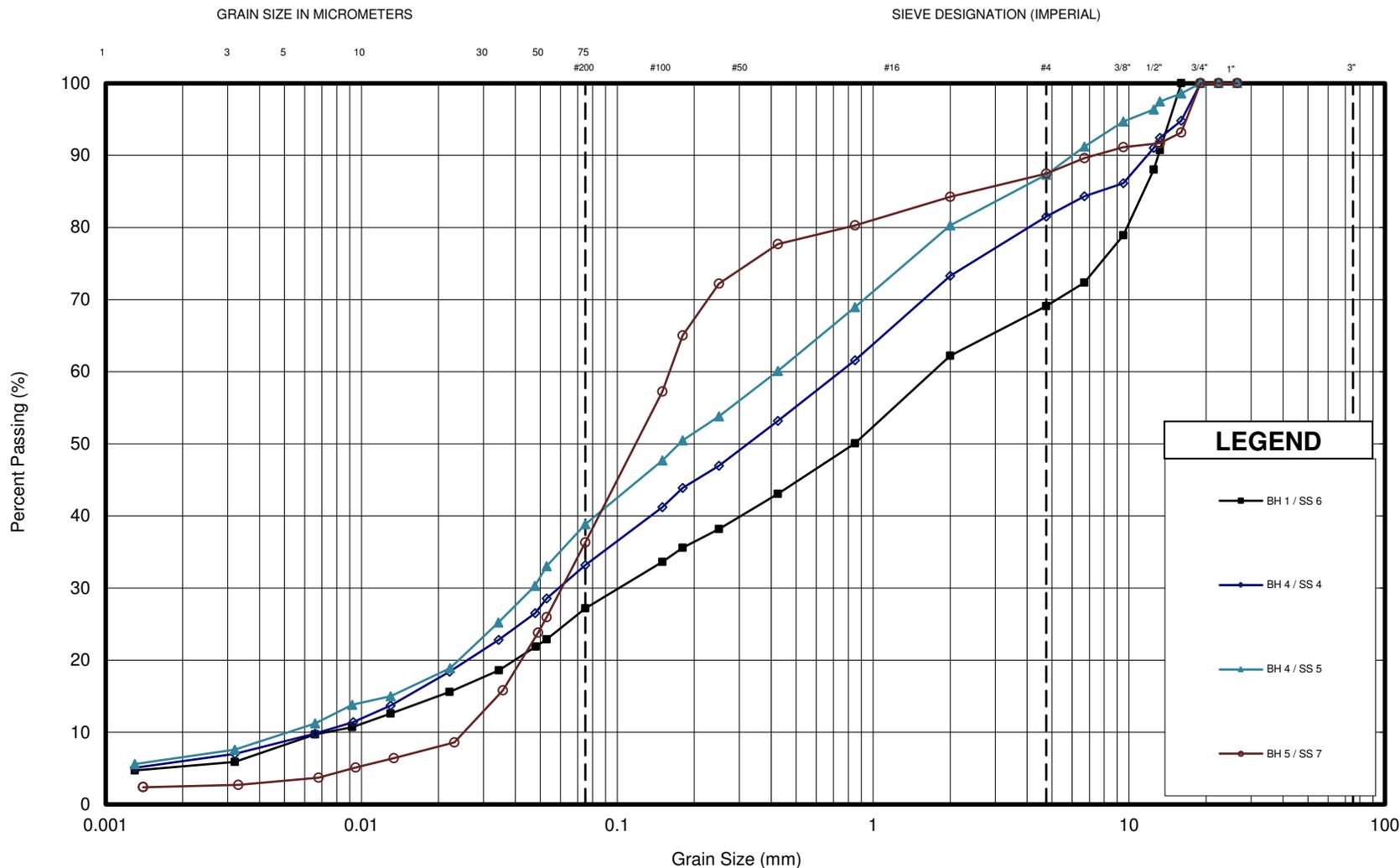
FIGURE No. 1

REF. No. HAM-00802002-B0

DATE May 2022

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



I:\PRM\FSG001\Data_Zeus\2003-Brampson\Projects\Geotechnical Engineering\Hamilton Projects\HAM-00802002-B0_Hwy 7 & 6th Line_Guelph Eramasa\Grain Size Distribution_HAM-00802002-B0.xlsx

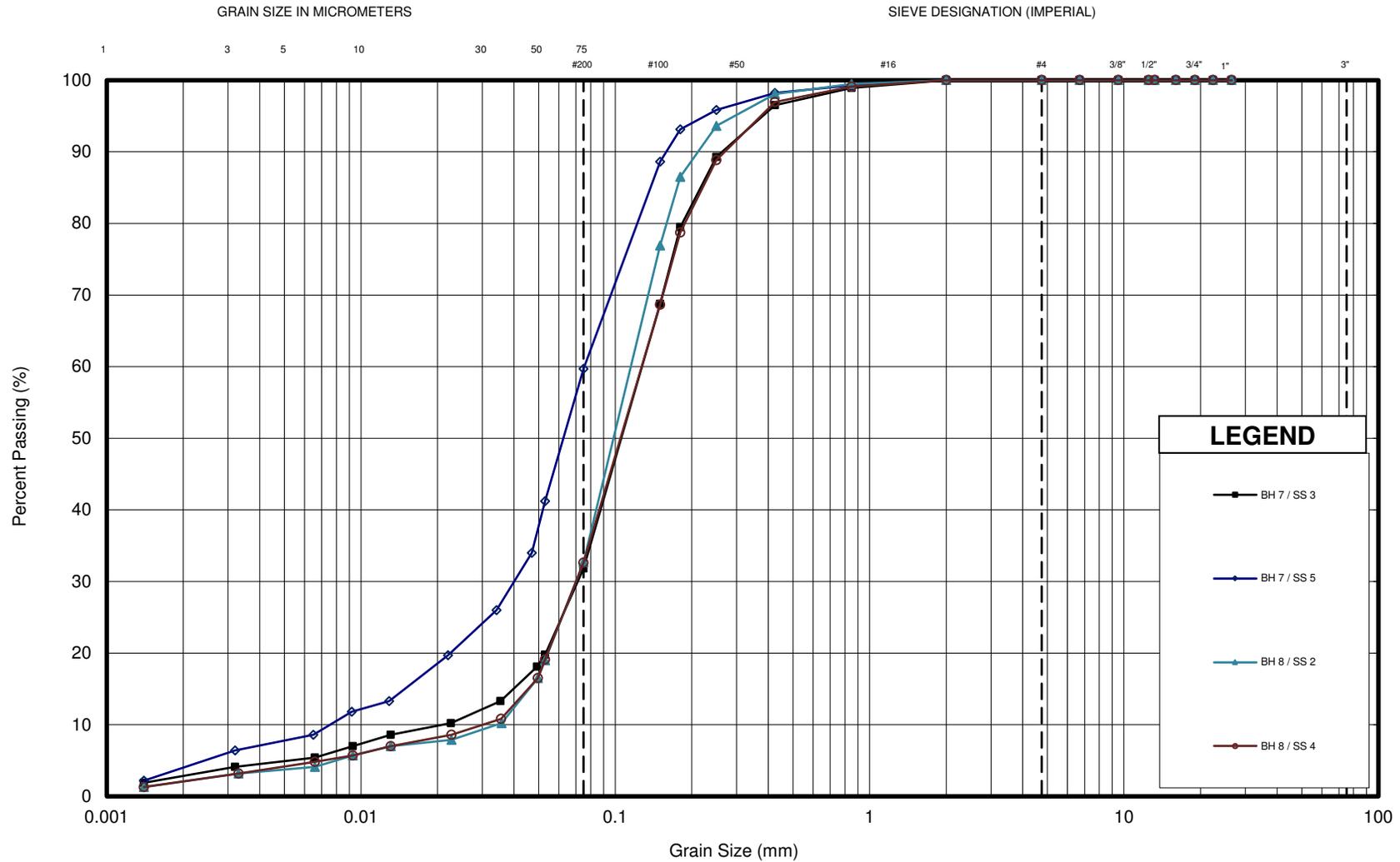


GRAIN SIZE DISTRIBUTION
 HIGHWAY 7 - SILTY SAND TILL
 some gravel, trace clay

FIGURE No.	2
REF. No.	HAM-00802002-B0
DATE	May 2022

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



GRAIN SIZE DISTRIBUTION
 6TH LINE - SILTY SAND
 trace clay, trace gravel

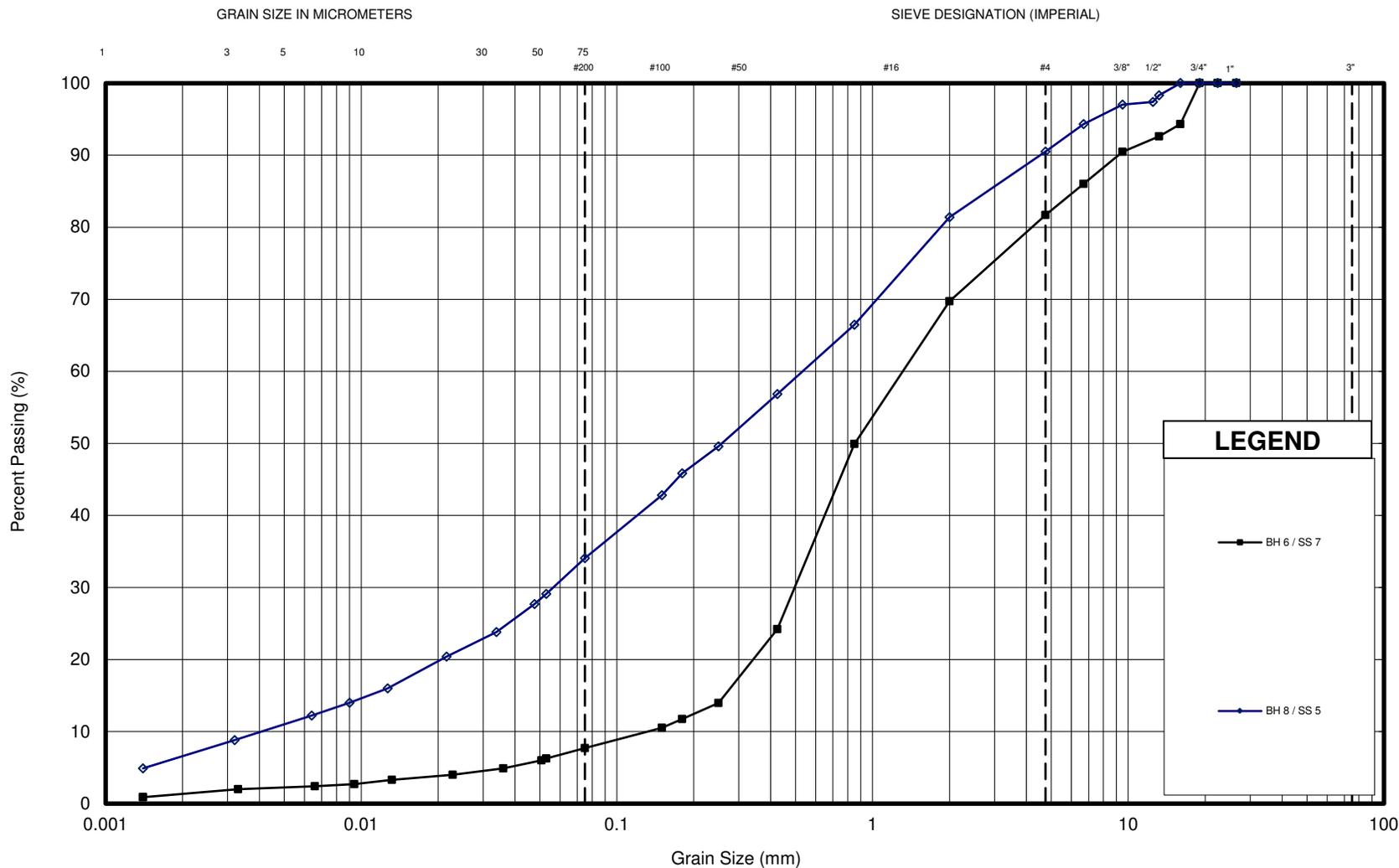
FIGURE No. 3

REF. No. HAM-00802002-B0

DATE May 2022

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



GRAIN SIZE DISTRIBUTION
 6TH LINE - SILTY SAND TILL
 some gravel, trace clay

FIGURE No. 4
 REF. No. HAM-00802002-B0
 DATE May 2022