



THURBER ENGINEERING LTD.

**FOUNDATION INVESTIGATION REPORT
DEEP CUTS
APPROXIMATE STATIONS 12+585 TO 12+750
HIGHWAY 400 NEAR SUNNIDALE ROAD
CITY OF BARRIE, ONTARIO
G.W.P. 2445-15-00**

GEOCRES NO. 31D-770

Latitude: 44.392898

Longitude: -79.703493

Report

to

McIntosh Perry

Date: October 20, 2021

File: 22424



TABLE OF CONTENTS

PART 1: FACTUAL INFORMATION

1.	INTRODUCTION	1
2.	project and SITE DESCRIPTION	2
2.1	Site Reconnaissance Visit.....	3
3.	site investigation and field testing	4
4.	LABORATORY TESTING.....	6
5.	DESCRIPTION OF SUBSURFACE CONDITIONS	7
5.1	Topsoil.....	7
5.2	Fill.....	8
5.3	Silty Sand to Sandy Silt.....	8
5.4	Silty Sand to Sand and Silt Till	9
5.5	Silty Clay to Clayey Silt Till.....	10
5.6	Sand	11
5.7	Clayey Silt	12
5.8	Groundwater Levels	12
6.	MISCELLANEOUS	14

APPENDICES

Appendix A	Record of Borehole Sheets – Present Investigation
Appendix B	Geotechnical Laboratory Test Results – Present Investigation
Appendix C	Record of Borehole Sheets – Previous Investigation by Thurber
Appendix D	Record of Borehole Sheets – Previous Investigation by Others
Appendix E	Selected Site Photographs
Appendix F	Borehole Locations and Soil Strata Drawings



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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation conducted for the proposed deep cuts along Highway 400 on the east side of the northbound lanes (NBL) and the west side of the southbound lanes (SBL), just to the north and south of Sunnidale Road in the City of Barrie, Ontario.

The purpose of this investigation was to explore the subsurface conditions in the vicinity the proposed deep cuts, and based on the data obtained, to provide borehole location and soil strata drawings, records of boreholes, laboratory test results, and a written description of the subsurface conditions. A model of the subsurface conditions was developed for the site, based on data obtained from the present investigation and selected data from previous investigations by Thurber and others, to describe the geotechnical conditions influencing design and construction of the deep cuts.

Thurber was retained by McIntosh Perry (MP) to carry out this foundation investigation under the Ministry of Transportation Ontario (MTO) Assignment Number 2017-E-0032. The overall assignment includes replacement of three underpass structures on Highway 400; at Dunlop Street, at Anne Street and at Sunnidale Road. It also includes reconstruction of the Highway 400 and Dunlop Street interchange, noise barrier and retaining walls, pavement rehabilitation, culvert replacements, drainage improvements (sewers and stormwater management ponds) and illumination (high mast lighting). This report addresses the proposed deep cuts in the vicinity of Sunnidale Road.



In preparation of this report, reference has been made to information on subsurface conditions contained in previous foundation reports prepared by Thurber and others for this site. The titles of these reports are:

- Foundation Investigation Report for Sunnidale Road Underpass, Highway 400, City of Barrie, Ontario, Site 30-173, G.W.P. 2445-15-00, prepared by Thurber Engineering Ltd., dated August 31, 2020 (Reference 1).
- Pre-Draft Foundation Investigation and Design Report for Proposed Sunnidale Road Watermain Crossing, Highway 400, City of Barrie, Ontario, PML Ref. 19BF005, Pre-Draft Report 1, prepared by Peto McCallum Ltd., dated August 7, 2019 (Reference 2).

2. PROJECT AND SITE DESCRIPTION

The proposed deep cuts are located along Highway 400 on the east side of NBL and west side of SBL, from approximately 65 m south to 100 m north of Sunnidale Road in the City of Barrie, Ontario.

The general locations of the proposed deep cuts along Highway 400 on the north and south sides of Sunnidale, are shown on the Borehole Location Plan drawing in Appendix F.

The deep cuts are required for the proposed widening of Highway 400 and for the replacement of the existing underpass structure at Sunnidale Road, and will extend from approximate Stations 12+585 to 12+750. This is a part of the overall scheme to accommodate 10-lane configuration in the future. The maximum depths of the cuts are about 14 m below the original ground surface (plateau) on the west side, and up to about 6 m on the east side.

It is understood that the relocation of some existing underground utilities in the area will be required due to the highway widening. Two new watermains will be installed within a casing on the north side of the underpass. This work is being designed by others and will involve construction of launching and exit shafts on either side of Highway 400, and trenchless crossing of the casing under the highway. The currently proposed location of the west shaft is only several metres away from the slope surface of the proposed cut. Preliminary assessment of this shaft on cut slope stability is included in this report. A detail assessment cannot be made at this time until information on the proposed shaft design, construction methodology and sequence are made known to McIntosh Perry and Thurber.



Available information indicates that underground utilities (825 mm diameter storm sewer pipe and 300 mm diameter sanitary sewer pipe) will be installed at the west plateau some 25 m away from the crest of the proposed cut, running in a north-south direction, and approximately 3.5 m to 4.0 m below ground surface.

Beyond the highway cut, the overall surface topography in the vicinity of the site is relatively flat and consists of residential and commercial properties to the east and west of Highway 400. Sunnidale Park occupies the lands on the northwest side of Highway 400 and Sunnidale Road underpass. These lands are generally covered with grass, bushes, trees and other vegetation. A gravel walkway runs along the top of the cut, parallel to Highway 400. The width is approximately 2.0 m.

At the existing Sunnidale Road underpass, Highway 400 was constructed in a cut of up to approximately 8.5 m deep, with side slopes of 2H : 1V. The existing grade of Highway 400 is at approximate Elevation 248.5. The Sunnidale Road grade rises from approximate Elevations 254.0 to 257.6, east to west.

Selected photographs of the site are presented in Appendix E.

Based on published geological mapping, the study area is located within the Simcoe Lowlands physiographic region. This region borders Georgian Bay and Lake Simcoe and can generally be separated into two major divisions: the Nottawasaga basin to the west, consisting of plains draining into Nottawasaga Bay, and the Lake Simcoe basin to the east, consisting of the lowlands which surround Lake Simcoe. These two basins are connected at Barrie by a flat-floored valley. The Simcoe Lowlands region is generally comprised of sand, silt and clay deposits of deltaic and lacustrine origin.

2.1 Site Reconnaissance Visit

Observations made on the slopes during our site reconnaissance visit and during our borehole investigation are summarized below.

- The existing slopes on the west and east sides of Highway 400, within the area of investigation, are generally well vegetated and in good condition, and do not show any visible signs of instability or seepage zones.
- A treed zone was noted along the top of the slope, immediately southwest of the existing Sunnidale Road underpass. There were a few fallen trees amongst the generally upright trees.



- Some trees were noted along the slope at the northwest side of the Sunnidale Road underpass.
- On the northeast side, the slope is covered by tall grass with a few trees near its toe.

Selected photographs of the site are attached in Appendix E.

3. SITE INVESTIGATION AND FIELD TESTING

The borehole investigation and field testing program for this project was carried out from December 3, 2020 to January 26, 2021, and consisted of drilling and sampling four (4) boreholes (numbered NBL 12+685, SBL 12+725, SBL 12+685 and SBL 12+595) at selected locations within the proposed east and west deep cuts. Boreholes SBL 12+725, SBL 12+685 and SBL 12+595 were drilled along the west side of Highway 400 SBL to depths ranging from 18.6 m to 18.9 m (Elevations 236.7 to 239.0) below existing grade. Borehole NBL 12+685 was drilled within the proposed deep cut on the northeast side of Highway 400 and Sunnidale Road underpass, and terminated at 15.8 m depth (Elevation 238.0). The record of borehole sheets of the present investigation are provided in Appendix A.

It is important to note that the following boreholes were relocated due to various reasons including sloping ground, thick vegetation and proximity of existing boreholes etc.

<u>Borehole Designation</u>	<u>Actual Location</u>
SBL 12+595	SBL 12+613
SBL 12+685	SBL 12+691
NBL 12+685	NBL 12+678

Reference has been made to four boreholes (numbered SUN-01 and SUN-03 to SUN-05), drilled during a previous investigation (Reference 1) for the proposed replacement of the Sunnidale Road underpass at Highway 400. Boreholes SUN-01 and SUN-05 were drilled near the locations of the proposed foundation elements (abutments) and were terminated at 24.7 m depth (Elevations 227.9 and 232.7). Boreholes (SUN-03 and SUN-04) were drilled for the immediate approaches and terminated at 9.5 m to 9.8 m depths (Elevations 244.6 and 247.9). The Record of Borehole sheets are included in Appendix C.

Boreholes 101 and 102 drilled by others for the proposed trenchless watermain crossing to the north of the bridge were incorporated in this report (Reference 2). Boreholes 101 and 102



were terminated at 20.3 m depth (Elevations 238.2 and 230.9). The Record of Borehole sheets of Boreholes 101 and 102 are included in Appendix D.

The approximate locations of the previous and current boreholes are shown on the Borehole Locations Plan and Soil Strata Drawing in Appendix F.

Shoulder closures with traffic control were implemented during drilling of the boreholes for the investigation. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

The boreholes were advanced using a track-mounted drill rig with hollow stem augers. Soil samples were obtained at selected intervals using a 50 mm outside diameter split-spoon sampler driven in conjunction with the Standard Penetration Test (SPT) in general accordance with ASTM D1586.

Thurber obtained the borehole coordinates in the field using an in-house GPS unit, and McIntosh Perry provided the ground surface elevations. The coordinates and elevations are referenced to MTM Zone 10 NAD 83 (Original) and the Canadian Geodetic Vertical Datum (CGVD 1928: 1978 Adjustment).

The field investigation was supervised on a full-time basis by a member of Thurber's technical staff who marked the boreholes in the field, arranged for the clearance of subsurface utilities, supervised the drilling, sampling and in-situ testing operations, logged the boreholes and processed the recovered soil samples for transport to Thurber's laboratory for further examination and testing.

Groundwater conditions in the open boreholes were observed throughout the drilling operations. Three standpipe piezometers (25 mm diameter) and one piezometer (31.75 mm) were installed with the screened portion enclosed in a filter sand column in Boreholes NBL 12+685, SBL 12+595 and SBL 12+725 during the present investigation. As per the request of McIntosh Perry, one monitoring well (50 mm diameter) was installed with the screened portion enclosed in a filter sand column in Borehole SBL 12+595. It is understood that this monitoring well was installed to facilitate environmental groundwater sampling to be carried out by others. Details of the piezometer and monitoring well installations are shown in Table 3.1.

Table 3.1 – Piezometer and Monitoring Well Details

Borehole	Borehole Depth / Base Elevation (m)	Piezometer / Monitoring Well Tip Depth / Elevation (m)	Completion Details
NBL 12+685	15.8 / 238.0	15.2 / 238.6	Piezometer with 3 m slotted screen installed within sand filter from 15.8 m to 11.6 m, bentonite holeplug from 11.6 m to 10.9 m, grout from 10.9 m to ground surface.
SBL 12+595 ⁽¹⁾ MW	18.9 / 236.7	17.2 / 238.4	Monitoring well with 3 m slotted screen installed within sand filter from 18.9 m to 13.7 m, bentonite holeplug from 13.7 m to 10.7 m, filter sand from 10.7 m to 5.9 m, holeplug from 5.9 m to 4.8 m, then holeplug and auger cuttings to ground surface.
SBL 12+595	18.9 / 236.7	9.8 / 245.8	Piezometer with sand filter from 18.9 m to 13.7m, bentonite holeplug from 13.7 m to 10.7m, 3 m slotted screen installed within filter sand from 10.7 m to 5.9 m, holeplug from 5.9 m to 4.8, then holeplug and auger cuttings to ground surface.
SBL 12+725	18.6 / 239.0	18.3 / 239.3	Piezometer with 3 m slotted screen installed within sand filter from 18.6 m to 14.6 m, bentonite holeplug from 14.6 m to 14.0 m, grout from 14.0 m to ground surface.
SBL 12+685 ⁽²⁾ Piezo	9.9 / 246.4	9.9 / 246.4	Piezometer with 3 m slotted screen installed within sand filter from 9.9 m to 6.4 m, bentonite holeplug from 6.4 m to ground surface.

⁽¹⁾ 50-mm diameter monitoring well

⁽²⁾ Piezometer (31.75-mm diameter) installed approximately 4.5 m west of Borehole SBL 12+685

Borehole SBL 12+685 without piezometer installation was backfilled upon completion of drilling in general conformance with O.Reg. 903 as amended by O.Reg.128/03. The installed piezometers and monitoring well will be decommissioned once groundwater level monitoring is completed as per the terms of reference.

4. LABORATORY TESTING

The recovered soil samples were subjected to Visual Identification (VI) and to natural moisture content determination. Selected samples were also subjected to grain size analysis and



Atterberg Limits testing. All the laboratory tests were carried out in accordance to MTO and/or ASTM Standards, as appropriate. Geotechnical laboratory testing results for the present investigation are summarized on the Record of Borehole sheets included in Appendix A and are presented on the figures included in Appendix B.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered soil stratigraphy are presented on the Record of Borehole sheets included in Appendix A. A general description of the stratigraphy is given in the following paragraphs. However, the factual data presented in the Record of Borehole Sheets governs any interpretation of the site conditions. It must be recognized and anticipated that soil conditions may vary between and beyond the borehole locations.

In general, the soil stratigraphy encountered in Boreholes NBL 12+685, SBL 12+725, SBL 12+685 and SBL 12+595 drilled during the present investigation, and Boreholes 101 and 102 drilled during the previous investigation (Reference 2), along the proposed deep cuts, consists of topsoil overlying loose to dense sand to sand and silt fill and firm to stiff clayey silt to silty clay fill. Underlying the fill, native soils were encountered typically comprising of interlayered compact to very dense silty sand to silt, compact to very dense silty sand / sand and silt till. The site is generally underlain at depth by a deposit of compact to very dense sand. Within the cohesionless deposits, there are some embedded layers or lenses of firm to hard silty clay/clayey silt to silty clay/clayey silt till. On the east side of Highway 400, measured groundwater levels ranged from about 7 m to 10 m depths below existing grade. On the west side of Highway 400, measured groundwater levels ranged from about 10.5 m to 11.5 m depths.

More detailed descriptions of the stratigraphy are presented below.

5.1 Topsoil

Topsoil was encountered surficially in the four boreholes drilled during the present investigation for the proposed deep cuts. The thickness of the topsoil ranged from 75 mm to 100 mm.

The topsoil thickness may vary between and beyond the borehole locations, and the data is not intended for the purpose of estimating quantities.

Fill was encountered underlying the topsoil in Borehole NBL 12+685 of the current investigation. The fill consisted of brown sand containing some silt and occasional clay pockets. The thickness of the fill was 2.4 m.

Boreholes 101 and 102 drilled by others (Reference 2) revealed the presence of surficial firm clayey silt and loose sand/sandy silt fill. The thickness of the fill was 1.4 m.

The depth to the base of the sand fill encountered in Borehole NBL 12+685 was at 2.5 m (Elevation 251.3).

The SPT 'N' values recorded in this fill during the present investigation were 1 and 3 blows per 0.3 m of penetration indicating a very loose condition. The natural moisture contents measured on samples of the fill were 13 percent and 25 percent.

5.3 Silty Sand to Sandy Silt

An upper layer of native brown silty sand containing trace to some clay, trace gravel, occasional clay pockets and occasional roots was contacted below the topsoil in Boreholes SBL 12+685 and SBL 12+725. A layer of sandy silt was encountered at 14.7 m depth in Borehole SBL 12+725. The thickness of the upper silty sand layer was 1.3 m and 2.2 m.

The depth to the base of the silty sand was at 1.4 m and 2.3 m (Elevations 255.5 and 255.3) in Boreholes SBL 12+685 and SBL 12+725, respectively. Borehole SBL 12+725 was terminated within the sandy silt at 18.6 m depth (Elevation 239.0).

In Boreholes 101 and 102 drilled by others (Reference 2), layers of native compact to very dense silty sand and compact silt were encountered below the fill at 1.4 m depth. The thickness of the silty sand to silt were 0.8 m to 1.5 m.

The SPT 'N' values recorded in the surficial silty sand during the present investigation varied from 8 to 13 blows per 0.3 m of penetration, indicating a loose to compact state. SPT 'N' values greater than 100 blows for less than 0.3 m of penetration were measured in the lower sandy silt layer, indicating a very dense condition. The natural moisture contents measured on samples of the silty sand to sandy silt in the present investigation ranged from 10 percent to 19 percent.

The results of grain size distribution analyses carried out during the present investigation on a sample of the sandy silt are presented on Record of Borehole Sheets in Appendix A and on



Figure B1 in Appendix B. The results of the laboratory gradation test are summarized as follows:

Soil Particle	Sandy Silt (Percent)
Gravel	0
Sand	31
Silt	69
Clay	0

5.4 Silty Sand to Sand and Silt Till

Brown silty sand to sand and silt till containing trace gravel, trace clay and occasional cobbles were encountered below the fill at 2.5 m depth in Borehole NBL 12+685, and below the surficial sand, silty sand and silty clay till at depths ranging from 0.5 m to 3.0 m in the three SBL boreholes. The thickness of the silty sand to sand and silt till typically varied from 4.9 m to 7.0 m, except in Borehole SBL 12+595 where it was 12.8 m.

The depth to base of the silty sand to sand and silt till ranged from 7.2 m to 13.3 m (Elevations 242.3 to 250.4).

Compact to very dense silty sand till was contacted in Boreholes 101 and 102 at 2.9 m and 2.2 m depth during the previous investigation (Reference 2), with a thickness of 10.1 m and 7.9 m.

SPT 'N' values recorded in the silty sand to sand and silt till during the present investigation ranged from 17 to 98 blows per 0.3 m penetration, indicating a compact to very dense state. An SPT 'N' value of 5 blows per 0.3 m of penetration, indicating a loose zone, was measured in Borehole NBL 12+685 just below the fill. SPT 'N' values greater than 100 blows for less than 0.3 m of penetration were measured in Boreholes NBL 12+685 and SBL 12+685 near 8.0 m to 9.5m depths, respectively. The grinding of augers and these high blow counts at several locations are indicative of the possible presence of cobbles and boulders. The measured moisture contents of samples of these cohesionless tills ranged from 5 percent to 16 percent.

Grain size distribution results for silty sand to sand and silt till samples carried out during the present investigation are presented on the Record of Borehole sheets in Appendix A and on Figure B2 Appendix B. The results of the laboratory gradation test are summarized as follows:



Soil Particles	Silty Sand to Sand and Silt Till Percentage (%)
Gravel	1 to 8
Sand	45 to 62
Silt	26 to 40
Clay	8 to 13

The results of Atterberg Limits tests conducted on a silty sand till sample are presented on the Record of Borehole sheets in Appendix A, and illustrated in Figure B5 of Appendix B. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	13
Plasticity Index	2

The results of the Atterberg Limits testing indicate that the silty sand till is non-plastic with a group symbol of ML.

Glacial tills inherently contain cobbles and boulders.

5.5 Silty Clay to Clayey Silt Till

Brown silty clay till with sand containing trace gravel was contacted below the silty sand at 1.4 m depth in Borehole SBL 12+685. A lower layer of brown clayey sandy silt till containing occasional cobbles and boulders was contacted at 10.0 m below the silty sand till in Borehole SBL 12+685. The thickness of two silty clay to clayey silt till layers were 1.6 m and 1.7 m.

The depths to the base of the silty clay to clayey silt till were at 3.0 m and 11.7 m (Elevations 253.9 and 245.2), respectively.

Measured SPT 'N' values in the silty clay till were 8 and 28 blows per 0.3 m of penetration indicating a stiff to very stiff consistency. An SPT 'N' value of 100 blows for less than 0.3 m of penetration was measured in the lower clayey silt till, indicating a hard consistency. Moisture contents measured in the silty clay to clayey silt till during the present investigation were 15 percent and 19 percent.

The results of grain size distribution analyses carried out on samples of the silty clay till and clayey silt till are presented on the Record of Borehole sheets included in Appendix A. Grain



size distribution curves of the samples tested are presented on Figure B3 in Appendix B. The results of the grain size distribution analyses are summarized below:

Soil Particle	Silty Clay to Clayey Silt Till (Percent)
Gravel	0
Sand	24 to 30
Silt	40 to 55
Clay	21 to 30

The results of Atterberg Limits tests conducted on silty clay to clayey silt till samples are presented on the Record of Borehole sheets in Appendix A, and illustrated in Figure B6 of Appendix B. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	15 to 19
Plasticity Index	4 to 8

The results of the Atterberg Limits testing indicate that the silty clay to clayey silt till have low to slight plasticity with a group symbol of CL-ML.

Glacial tills inherently contain cobbles and boulders.

5.6 Sand

An extensive deposit of native brown sand containing trace to some silt and trace clay were contacted below the cohesionless and cohesive tills at depths ranging from 7.2 m to 13.3 m in boreholes drilled during the present investigation. An upper 400 mm thick layer of sand was also contacted below the topsoil in Borehole SBL 12+595. The thickness of the sand was 7.5 m in Borehole SBL 12+725.

The depth to the base of the sand was at 14.7 m (Elevations 242.9) in Borehole SBL 12+725. Boreholes NBL 12+685, SBL 12+595 and SBL 12+685 were terminated within the sand at depths ranging from 15.8 m to 18.9 m (Elevations 236.7 to 238.2).

During the previous investigation (Reference 2), a 1.4 m thick layer of very dense sand was encountered in Borehole 102 at 10.1 m depth. In Borehole 101, dense to very dense sand



was contacted at 13.0 m depth. Borehole 101 was terminated within the sand at 20.3 m depth (Elevation 238.2).

SPT 'N' values recorded in the sand deposit during the present investigation typically ranged from 13 blows to 89 blows per 0.3 m penetration indicating compact to very dense conditions. SPT 'N' values of 100 blows and greater for less than 0.3 m of penetration, indicating a very dense state, were measured in Boreholes SBL 12+685 and SBL 12+725. An SPT 'N' value of 4 blows per 0.3 m of penetration was measured in the surficial sand layer in Borehole SBL 12+595 indicating a loose state. The measured moisture contents of the sand varied between 3 percent and 20 percent.

The results of grain size distribution analyses carried out on sand samples from the present investigation are presented on Record of Borehole Sheets in Appendix A and on Figure B4 in Appendix B. The results of laboratory gradation tests are summarized as follows:

Soil Particle	Sand (Percent)
Gravel	0 to 2
Sand	77 to 89
Silt	10 to 17
Clay	0 to 6

5.7 Clayey Silt

A layer of grey clayey silt was contacted below the sand, at 11.5 m depth, in Borehole 102 drilled during the previous investigation (Reference 2). The clayey silt was described as hard in consistency with SPT 'N' values ranging from 34 to 74 blows per 0.3 m of penetration.

Borehole 102 was terminated within the clayey silt at 20.3 m (Elevations 230.9).

5.8 Groundwater Levels

The groundwater levels in the open boreholes were observed and noted during and upon completion of drilling. The water levels measured in the open boreholes are summarized in Table 5.1.



Table 5.1 - Observed Groundwater Levels

Location Relative to Highway 400	Borehole	Date	Groundwater Level		Comments
			Depth (m)	Elev. (m)	
East side of Hwy 400 NBL	NBL 12+685	January 6, 2021	8.5	245.3	Piezometer
		March 4, 2021	7.8	246.0	
		April 19, 2021	7.6	246.2	
		April 30, 2021	7.6	246.2	
		May 18, 2021	7.6	246.2	
	SUN-03	July 4, 2019	Dry	-	Open borehole
	SUN-05	July 20, 2019	-	-	Open borehole (caved to 12.2 m)
		August 27, 2019	9.5	243.1	Piezometer
		March 4, 2021	10.2	242.4	
		April 19, 2021	9.9	242.7	
April 30, 2021		9.9	242.7		
102	April 25, 2019	6.9	244.3	Monitoring well	
	August 6, 2019	7.0	244.2		
West side of Hwy 400 SBL	SBL 12+595 MW	February 10, 2021	Dry	-	Monitoring well
		March 4, 2021	Dry	-	
		April 19, 2021	Dry	-	
		April 30, 2021	Dry	-	
	SBL 12+595	February 10, 2021	11.3	244.3	Piezometer
		March 4, 2021	11.4	244.2	
		April 19, 2021	11.1	244.5	
		April 30, 2021	11.1	244.5	
	SBL 12+685	December 3, 2020	11.5	245.4	Open borehole
	SBL 12+685 Piezo	April 30, 2021	9.7	246.6	Piezometer
SBL 12+725	January 6, 2021	10.5	247.1	Piezometer	
	March 4, 2021	10.7	246.9		
	April 19, 2021	10.4	247.2		
	April 30, 2021	10.3	247.3		
	May 18, 2021	11.3	246.3		



Table 5.1 - Observed Groundwater Levels

Location Relative to Highway 400	Borehole	Date	Groundwater Level		Comments
			Depth (m)	Elev. (m)	
West side of Hwy 400 SBL	SUN-01	June 18, 2019	-	-	Open borehole (caved to 18.3 m)
		July 4, 2019	10.6	246.8	Piezometer
		August 27, 2019	10.9	246.5	
		March 4, 2021	11.2	246.2	
		April 19, 2021	10.9	246.5	
		April 30, 2021	10.9	246.5	
		June 22, 2021	11.0	246.4	
	SUN-04	July 4, 2019	Dry	-	Open borehole
	101	April 25, 2019	11.3	247.2	Monitoring well
		August 6, 2019	11.4	247.1	

Based on the above readings, it is apparent that the groundwater level decreases from west to east across the site.

The values shown in Table 5.1 are short-term readings, and seasonal fluctuations of the groundwater level are to be expected. In particular, the groundwater level may be at a higher elevation after periods of significant or prolonged precipitation.

6. MISCELLANEOUS

Thurber marked the borehole locations in the field and obtained utility clearances prior to drilling. McIntosh Perry surveyed the boreholes in the field and provided to Thurber the borehole coordinates and ground surface elevations.

Altech Drilling and Investigative Services from Cambridge, Ontario and Walker Drilling of Utopia, Ontario supplied and operated the drill rigs to carry out the drilling, sampling and in-situ testing operations for the boreholes.

The field operations were supervised on a full-time basis by Mr. Amir Fereidouni, Mr. Greg Forrest and Mr. George Azzopardi, C.Tech. of Thurber. Geotechnical laboratory testing was carried out by Thurber in its MTO approved laboratory. Overall supervision of the field program was carried out by Mr. Stephane Loranger, C.E.T.

Interpretation of the field data and preparation of the report were carried out by Ms. Rocio Palomeque Reyna, P.Eng. The report was reviewed by Dr. Sydney Pang, P.Eng. and Dr. P.K. Chatterji, P.Eng., a Designated Principal Contact for MTO Foundations Projects.



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Appendix A

Record of Borehole Sheets

Present Investigation

SYMBOLS, ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES

1. TEXTURAL CLASSIFICATION OF SOILS

CLASSIFICATION	PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	Greater than 200mm	same
Cobbles	75 to 200mm	same
Gravel	4.75 to 75mm	5 to 75mm
Sand	0.075 to 4.75mm	Not visible particles to 5mm
Silt	0.002 to 0.075mm	Non-plastic particles, not visible to the naked eye
Clay	Less than 0.002mm	Plastic particles, not visible to the naked eye

2. COARSE GRAIN SOIL DESCRIPTION (50% greater than 0.075mm)

TERMINOLOGY	PROPORTION
Trace or Occasional	Less than 10%
Some	10 to 20%
Adjective (e.g. silty or sandy)	20 to 35%
And (e.g. sand and gravel)	35 to 50%

3. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH (kPa)	APPROXIMATE SPT ⁽¹⁾ 'N' VALUE
Very Soft	12 or less	Less than 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	Greater than 200	Greater than 30

NOTE: Hierarchy of Soil Strength Prediction

- 1) Laboratory Triaxial Testing
- 2) Field Insitu Vane Testing
- 3) Laboratory Vane Testing
- 4) SPT value
- 5) Pocket Penetrometer



4. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

DESCRIPTIVE TERM	SPT "N" VALUE
Very Loose	Less than 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Greater than 50

5. LEGEND FOR RECORDS OF BOREHOLES

SYMBOLS AND ABBREVIATIONS FOR SAMPLE TYPE	SS Split Spoon Sample	WS Wash Sample	AS Auger (Grab) Sample
	TW Thin Wall Shelby Tube Sample	TP Thin Wall Piston Sample	
	PH Sampler Advanced by Hydraulic Pressure	PM Sampler Advanced by Manual Pressure	
	WH Sampler Advanced by Self Static Weight	RC Rock Core	SC Soil Core

$$\text{Sensitivity} = \frac{\text{Undisturbed Shear Strength}}{\text{Remoulded Shear Strength}}$$


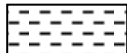



 Water Level
 Shear Strength Determination by Pocket Penetrometer

- (1) SPT 'N' Value Standard Penetration Test 'N' Value – refers to the number of blows from a 63.5kg hammer free falling a height of 0.76m to advance a standard 50 mm outside diameter split spoon sampler for 0.3 m depth into undisturbed ground.
- (2) DCPT Dynamic Cone Penetration Test – Continuous penetration of a 50 mm outside diameter, 60° conical steel point attached to "A" size rods driven by a 63.5 kg hammer free falling a height of 0.76 m. The resistance to cone penetration is the number of hammer blows required for each 0.3 m advance of the conical point into undisturbed ground.

UNIFIED SOILS CLASSIFICATION

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, gravel-sand-clay mixtures.
	SAND AND SANDY SOILS	SW	Well-graded sands or gravelly sands, little or no fines.
		SP	Poorly-graded sands or gravelly sands, little or no fines.
		SM	Silty sands, sand-silt mixtures.
		SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS	SILTS AND CLAYS W _L < 50%	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. (W _L < 30%).
		CI	Inorganic clays of medium plasticity, silty clays. (30% < W _L < 50%).
		OL	Organic silts and organic silty-clays of low plasticity.
	SILTS AND CLAYS W _L > 50%	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
		CH	Inorganic clays of high plasticity, fat clays.
		OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils.
CLAY SHALE			
SANDSTONE			
SILTSTONE			
CLAYSTONE			
COAL			

EXPLANATION OF ROCK LOGGING TERMS

<u>ROCK WEATHERING CLASSIFICATION</u>		<u>SYMBOLS</u>	
Fresh (FR)	No visible signs of weathering.		
Fresh Jointed (FJ)	Weathering limited to the surface of major discontinuities.		CLAYSTONE
Slightly Weathered (SW)	Penetrative weathering developed on open discontinuity surfaces, but only slight weathering of rock material.		SILTSTONE
Moderately Weathered (MW)	Weathering extends throughout the rock mass, but the rock material is not friable.		SANDSTONE
Highly Weathered (HW)	Weathering extends throughout the rock mass and the rock is partly friable.		COAL
Completely Weathered (CW)	Rock is wholly decomposed and in a friable condition, but the rock texture and structure are preserved.		Bedrock (general)

<u>DISCONTINUITY SPACING</u>		<u>STRENGTH CLASSIFICATION</u>			
Bedding	Bedding Plane Spacing	Rock Strength	Approximate Uniaxial Compressive Strength		Field Estimation of Hardness*
			(MPa)	(psi)	
Very thickly bedded	Greater than 2m	Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Thickly bedded	0.6 to 2m				
Medium bedded	0.2 to 0.6m	Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Thinly bedded	60mm to 0.2m	Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Very thinly bedded	20 to 60mm				
Laminated	6 to 20mm	Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Thinly Laminated	Less than 6mm				

<u>TERMS</u>					
Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.	Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.	Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Rock Quality Designation: (RQD)	Total length of sound core recovered in pieces 0.1m in length or larger as a percentage of total core run length.	Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen				
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.				

RECORD OF BOREHOLE No NBL 12+685 1 OF 2 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 916 978.5 E 288 615.7 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2020.12.11 - 2020.12.11 LATITUDE 44.392633 LONGITUDE -79.703148 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WATER CONTENT (%) w _p w w _L					kN/m ³
253.8	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (100mm)							20	40	60	80	100					
0.1	SAND, some silt Very Loose Brown Moist (FILL)		1	SS	3		253							○			
	Occasional clay pockets		2	SS	1		252							○			
251.3			3	SS	5		251							○			
2.5	Silty SAND, trace gravel, trace clay, occasional cobbles Loose to Dense Brown Moist (TILL)		4	SS	35		250							○			
	Augers grinding at 2.9m		5	SS	46		249							○			8 58 26 8
248.0			6	SS	55		248							○			
5.8	Augers grinding from 5.5m to 6.1m		7	SS	100/ 0.275		246							○			
	Very Dense						247										
	Augers grinding from 7.0m to 8.2m						245							○			
245.0			8	SS	22		244										
8.8	SAND, some silt, trace clay Compact Brown Wet																

Continued Next Page

+ 3, x 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No NBL 12+685 2 OF 2 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 916 978.5 E 288 615.7 ORIGINATED BY AF
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2020.12.11 - 2020.12.11 LATITUDE 44.392633 LONGITUDE -79.703148 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L		
	Continued From Previous Page							SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE		WATER CONTENT (%)			
	SAND , some silt, trace clay Compact to Dense Brown Wet		9	SS	29		243						0 77 17 6
							242						
			10	SS	35		241						
							240						0 89 10 1
							239						
			12	SS	52								
238.0	Very Dense						238						
15.8	END OF BOREHOLE AT 15.8m. Piezometer installation consists of 50mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2021.01.06 8.5 245.3 2021.03.04 7.8 246.0 2021.04.19 7.6 246.2 2021.04.30 7.6 246.2 2021.05.18 7.6 246.2												

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SBL 12+595 1 OF 3 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnisdale Road N 4 916 959.3 E 288 519.3 ORIGINATED BY GA
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2021.01.26 - 2020.01.26 LATITUDE 44.392457 LONGITUDE -79.704358 CHECKED BY RPR

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									WATER CONTENT (%)
255.6	GROUND SURFACE							20	40	60	80	100					
0.0	TOPSOIL: (75mm)																
0.1	SAND, trace silt, trace clay		1	SS	4								○				
255.1	Loose																
0.5	Brown																
	Moist																
	SAND and SILT, some clay, trace gravel		2	SS	17								○				
	Compact to Dense																
	Brown																
	Moist																
	(TILL)		3	SS	18								○				
			4	SS	30								○				
			5	SS	41								○				
			6	SS	98								○				
	Very Dense																
250.1	Silty SAND, some clay, trace gravel																
5.5	Very Dense																
	Brown																
	Moist																
	(TILL)		7	SS	81								○	II			
	Slow augering from 6.1m to 7.6m																
	Occasional clay pockets																

Continued Next Page

+ 3, X 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+595 2 OF 3 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 916 959.3 E 288 519.3 ORIGINATED BY GA
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2021.01.26 - 2020.01.26 LATITUDE 44.392457 LONGITUDE -79.704358 CHECKED BY RPR

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE								
242.3	Continued From Previous Page Silty SAND , some clay, trace gravel Compact to Very Dense Brown Moist (TILL)		10	SS	21		245									1 62 27 10
			11	SS	76		244									
							243									
13.3	SAND , some silt, trace clay Compact to Dense Brown Wet		12	SS	13		242									
							241									
			13	SS	28		240									0 87 12 1
							239									
			14	SS	24		238									
							237									
236.7			15	SS	50											
18.9	END OF BOREHOLE AT 18.9m. A monitoring well of 50mm diameter and a piezometer of 25mm diameter were installed at this borehole. Both consist of Schedule 40 PVC pipes with 3.05m slotted length.															

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+ 3, × 3 : Numbers refer to
Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SBL 12+595 3 OF 3 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 916 959.3 E 288 519.3 ORIGINATED BY GA
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2021.01.26 - 2020.01.26 LATITUDE 44.392457 LONGITUDE -79.704358 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
	25mm Piezometer Readings:																
	WATER LEVEL READINGS																
	DATE DEPTH(m) ELEV.(m)																
	2021.02.10 Dry -																
	2021.03.04 Dry -																
	2021.04.19 Dry -																
	2021.04.30 Dry -																
	50mm Monitoring Well Readings																
	WATER LEVEL READINGS:																
	DATE DEPTH (m) ELEV. (m)																
	2021.02.10 11.3 244.3																
	2021.03.04 11.4 244.2																
	2021.04.19 11.1 244.5																
	2021.04.30 11.1 244.5																

RECORD OF BOREHOLE No SBL 12+685 1 OF 2 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 028.6 E 288 555.6 ORIGINATED BY AF
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2020.12.03 - 2020.12.03 LATITUDE 44.392457 LONGITUDE -79.704358 CHECKED BY RPR

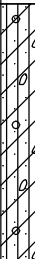


SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
								20 40 60 80 100					
256.9	GROUND SURFACE							20 40 60 80 100					
0.0 0.1	TOPSOIL: (75mm) Silty SAND , some clay, occasional roots and rootlets Compact Brown Moist		1	SS	13		256						
255.5													
1.4	Silty CLAY , with sand, trace gravel Stiff to Very Stiff Brown Moist (TILL)		2	SS	8		255						
			3	SS	28		254						
253.9													
3.0	Silty SAND , trace gravel, trace clay, occasional cobbles and boulders Dense to Very Dense Brown Moist (TILL)		4	SS	35		253						
			5	SS	92		252						
							251						
			6	SS	92		250						
			7	SS	70		249						
							248						
			8	SS	100/ 0.100								
246.9							247						

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+685 2 OF 2 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 028.6 E 288 555.6 ORIGINATED BY AF
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2020.12.03 - 2020.12.03 LATITUDE 44.392457 LONGITUDE -79.704358 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				GR	SA	SI	CL		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	20	40	60	80	100	W _P		W	W _L				
10.0	Continued From Previous Page Clayey SILT , some sand to sandy, occasional cobbles and boulders Hard Brown Moist (TILL)		9	SS	100/ 0.100		246											0	24	55	21
245.2																					
11.7	SAND , some silt Very Dense Brown Wet		10	SS	100/ 0.275		245						○								
							244														
			11	SS	100/ 0.225		243						○					0	88	12	0
							242														
			12	SS	100/ 0.200		241						○								
							240						○								
			13	SS	59		239														
238.2			14	SS	100/ 0.275								○								
18.7	END OF BOREHOLE AT 18.72m. WATER LEVEL AT 11.53m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO SURFACE.																				

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RECORD OF BOREHOLE No SBL 12+685 Piezo1 OF 2

METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 030.7 E 288 551.6 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Tripod/Casing COMPILED BY AN
 DATUM Geodetic DATE 2021.04.20 - 2021.04.20 LATITUDE 44.393101 LONGITUDE -79.703954 CHECKED BY RPR

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			20	40	60	80					
256.3	GROUND SURFACE															
0.0	Borehole augered to 9.9m depth below ground surface for Piezometer installation. No soil samples collected. For soils conditions refer to Borehole SBL 12+685.						256									
							255									
							254									
							253									
							252									
							251									
							250									
							249									
							248									
							247									
246.4																

Continued Next Page

+³, ×³: Numbers refer to Sensitivity
 20
15
10
5
0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+685 Piezo2 of 2

METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 030.7 E 288 551.6 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Tripod/Casing COMPILED BY AN
 DATUM Geodetic DATE 2021.04.20 - 2021.04.20 LATITUDE 44.393101 LONGITUDE -79.703954 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
9.9	Continued From Previous Page Piezometer installation consists of 31.75mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2021.04.30 9.7 246.6																

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SBL 12+685 Piezo1 of 2

METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 030.7 E 288 551.6 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Tripod/Casing COMPILED BY AN
 DATUM Geodetic DATE 2021.04.20 - 2021.04.20 LATITUDE 44.393101 LONGITUDE -79.703954 CHECKED BY RPR

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 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE									WATER CONTENT (%)
256.3	GROUND SURFACE						20	40	60	80	100	20	40	60			
0.0	Borehole augered to 9.9m depth below ground surface for Piezometer installation. No soil samples collected. For soils conditions refer to Borehole SBL 12+685.						256										
							255										
							254										
							253										
							252										
							251										
							250										
							249										
							248										
							247										
246.4																	

Continued Next Page

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+685 Piezo2 of 2

METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 030.7 E 288 551.6 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Tripod/Casing COMPILED BY AN
 DATUM Geodetic DATE 2021.04.20 - 2021.04.20 LATITUDE 44.393101 LONGITUDE -79.703954 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
9.9	Continued From Previous Page Piezometer installation consists of 31.75mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2021.04.30 9.7 246.6																

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SBL 12+725 1 OF 3 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnidale Road N 4 917 061.6 E 288 556.2 ORIGINATED BY AF
 DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2020.12.04 - 2020.12.04 LATITUDE 44.393379 LONGITUDE -79.703898 CHECKED BY RPR

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									
257.6	GROUND SURFACE							20	40	60	80	100					GR SA SI CL
0.0 0.1	TOPSOIL: (75mm) Silty SAND , trace gravel, trace clay, occasional roots Loose to Compact Brown Moist																
	Occasional clay pockets		1	SS	8												
			2	SS	12												
255.3																	
2.3	Silty SAND , trace clay, trace gravel, occasional cobbles Dense to Very Dense Brown Moist (TILL)		3	SS	44												
			4	SS	64												4 59 29 8
			5	SS	67												
			6	SS	63												
250.4																	
7.2	SAND , trace to some silt, trace gravel Very Dense Brown Moist		7	SS	100/ 0.175												
			8	SS	131/ 0.275												

Continued Next Page

+ 3, X 3: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SBL 12+725 2 OF 3 METRIC

GWP# 2445-15-00 LOCATION Deep Cut at Sunnisdale Road N 4 917 061.6 E 288 556.2 ORIGINATED BY AF
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2020.12.04 - 2020.12.04 LATITUDE 44.393379 LONGITUDE -79.703898 CHECKED BY RPR

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 × LAB VANE											
	Continued From Previous Page						20 40 60 80 100												
	SAND , trace to some silt, trace gravel Very Dense Brown Moist		9	SS	89											2 81 17 0			
			10	SS	100/ 0.275														
			11	SS	100/ 0.250														
242.9																			
14.7	Sandy SILT Very Dense Brown Wet		12	SS	100/ 0.225											0 31 69 0			
239.0			13	SS	146/ 0.275														
18.6	END OF BOREHOLE AT 18.57m. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2021.01.06 10.5 247.1 2021.03.04 10.7 246.9																		

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity 20
15 10 5
(%) STRAIN AT FAILURE

ONTMT4S2 MTO-22424 GPJ 2017TEMPLATE(MTO) GDT 5/27/21

3 OF 3

GWP#	2445-15-00	LOCATION	Deep Cut at Sunnidale Road N 4 917 061.6 E 288 556.2			ORIGINATED BY	AF			
DIST	Central	HWY	400	BOREHOLE TYPE	Hollow Stem Augers			COMPILED BY	AN	
DATUM	Geodetic		DATE	2020.12.04 - 2020.12.04	LATITUDE	44.393379	LONGITUDE	-79.703898	CHECKED BY	RPR

+³, ×³: Numbers refer to Sensitivity

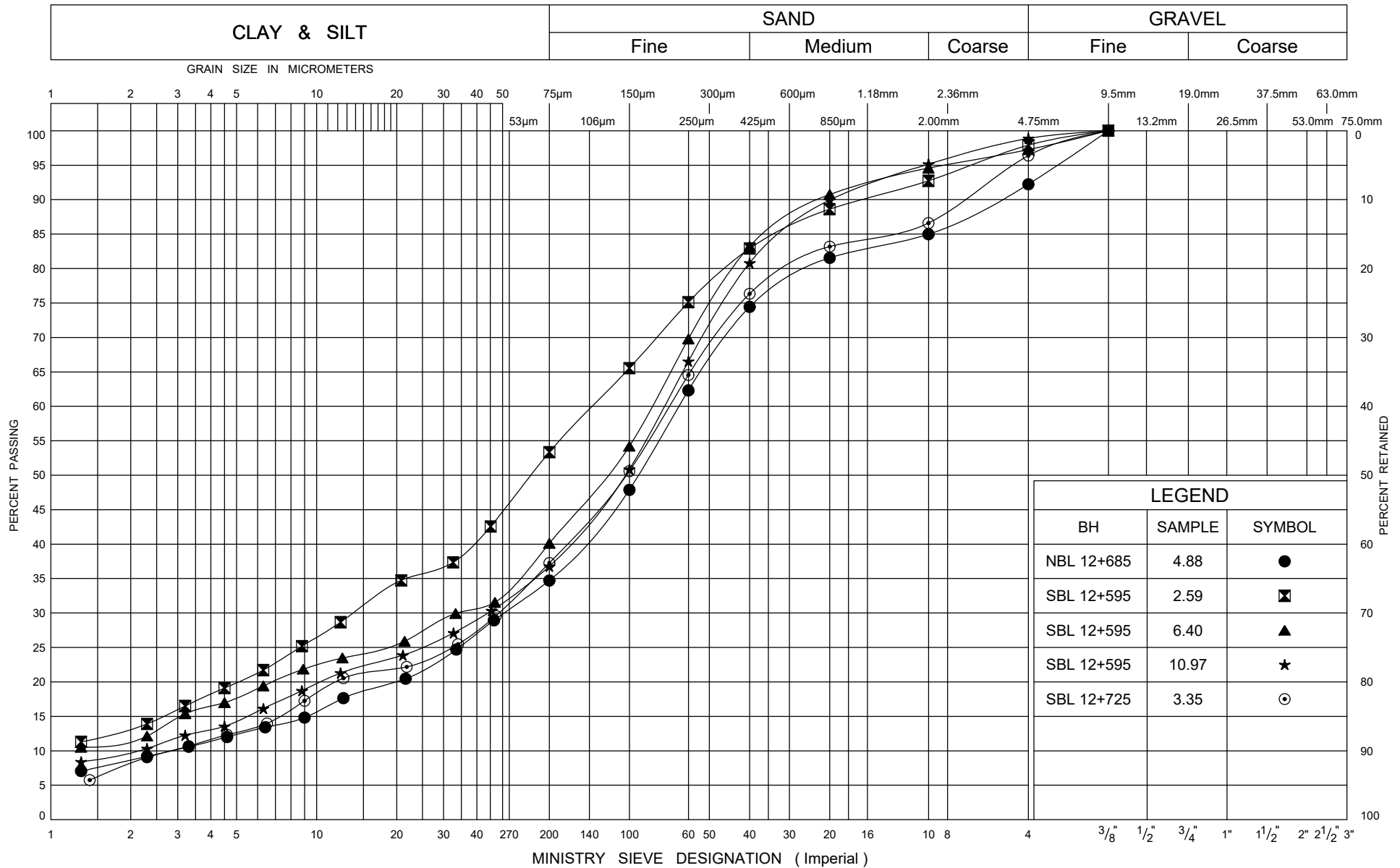


Appendix B

Geotechnical Laboratory Test Results Present Investigation



FIG No B1
W P 2445-15-00
Deep Cut at Sunnidale Road



Ministry of
Transportation

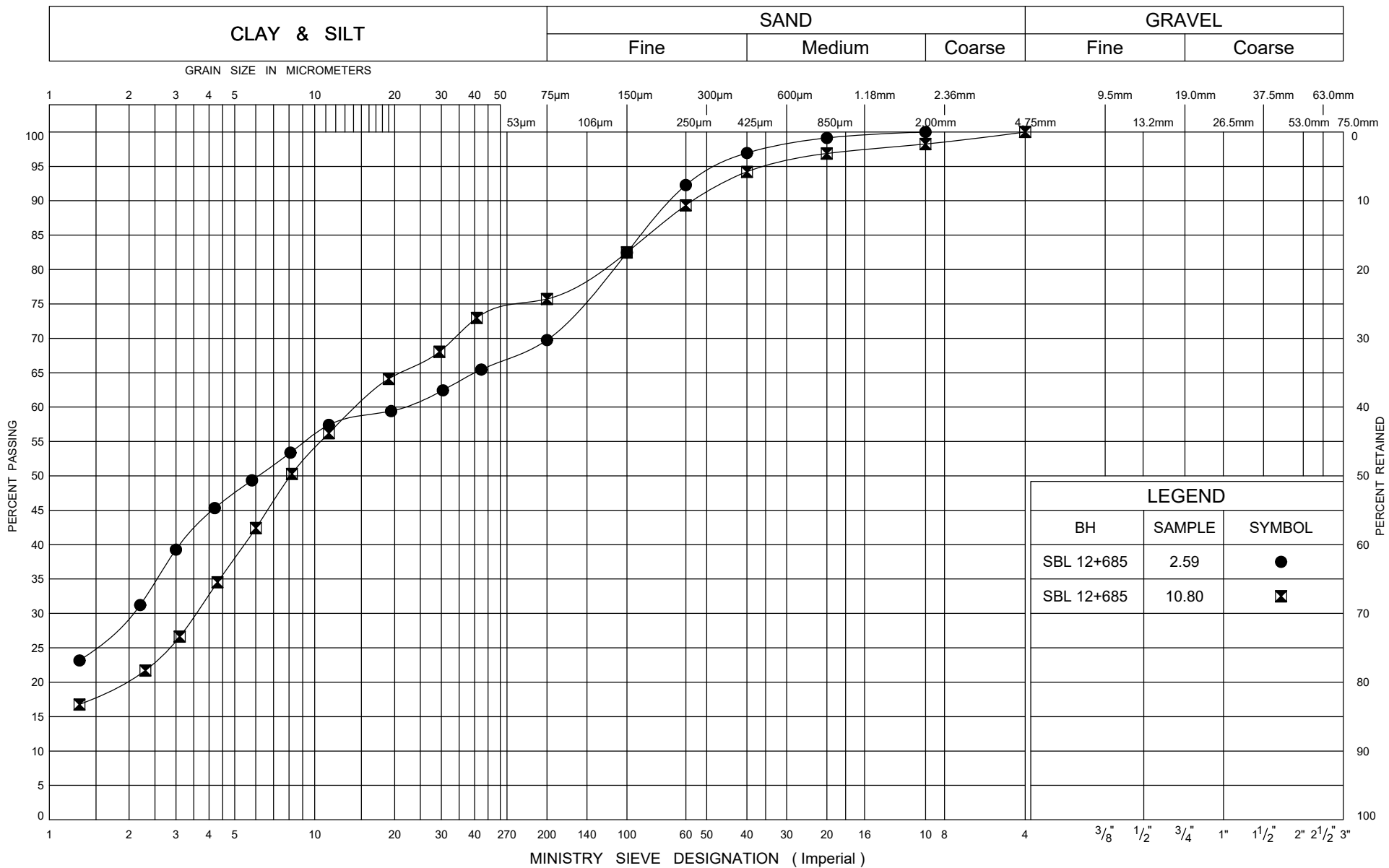
GRAIN SIZE DISTRIBUTION

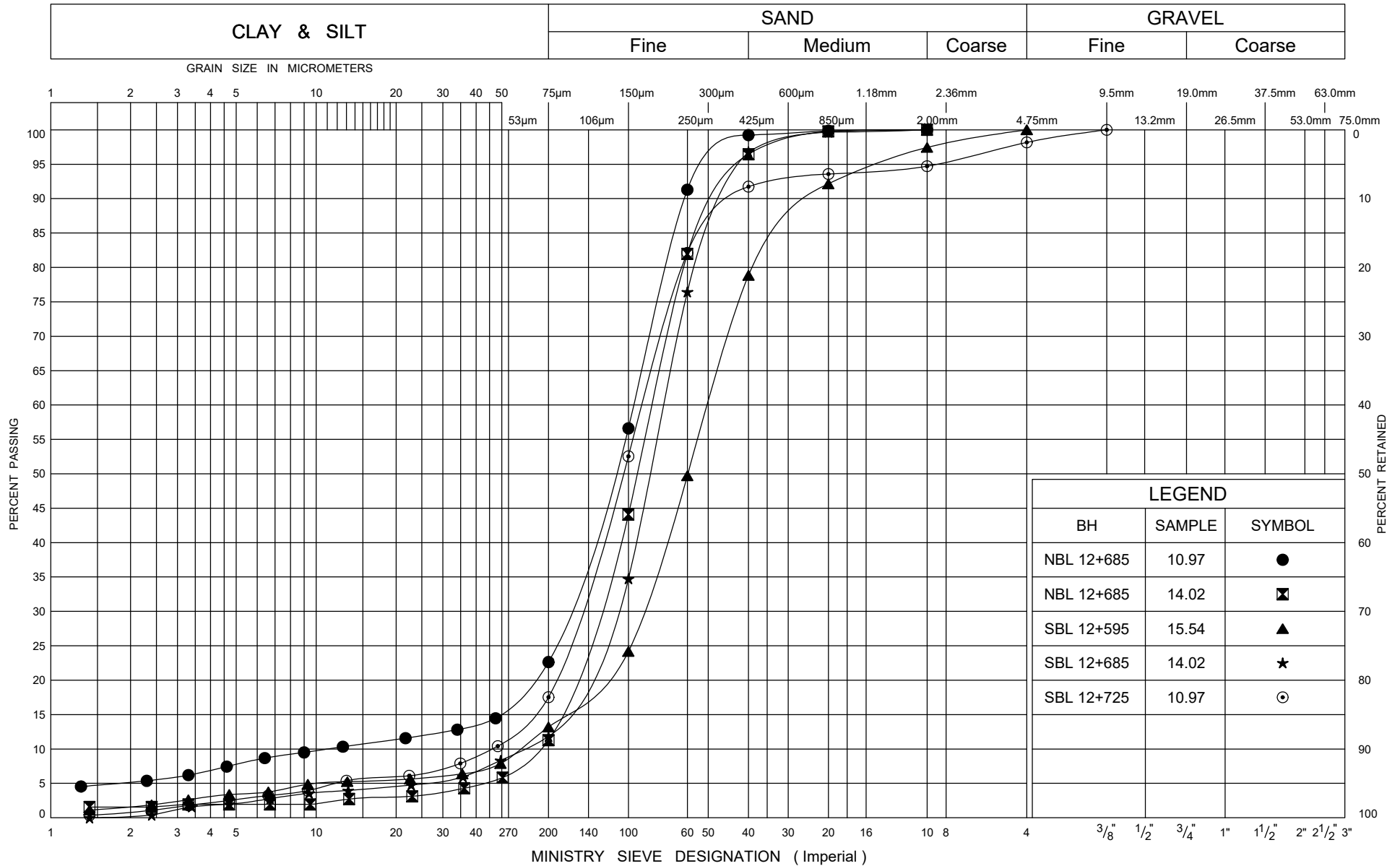
Silty SAND TILL/SAND and SILT TILL

FIG No B2

W P 2445-15-00

Deep Cut at Sunnidale Road





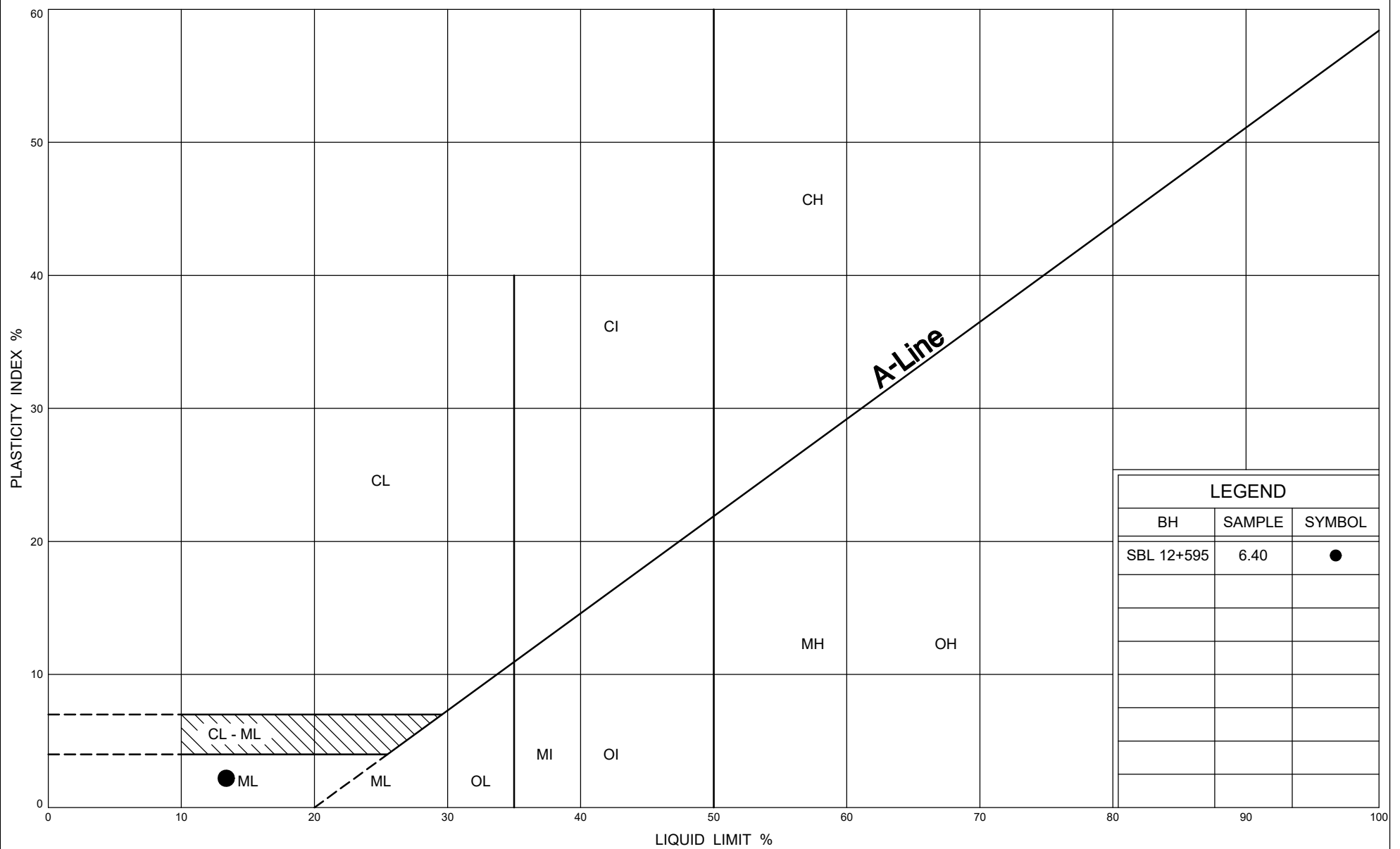
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION SAND

FIG No B4

W P 2445-15-00

Deep Cut at Sunnidale Road



Ministry of
Transportation

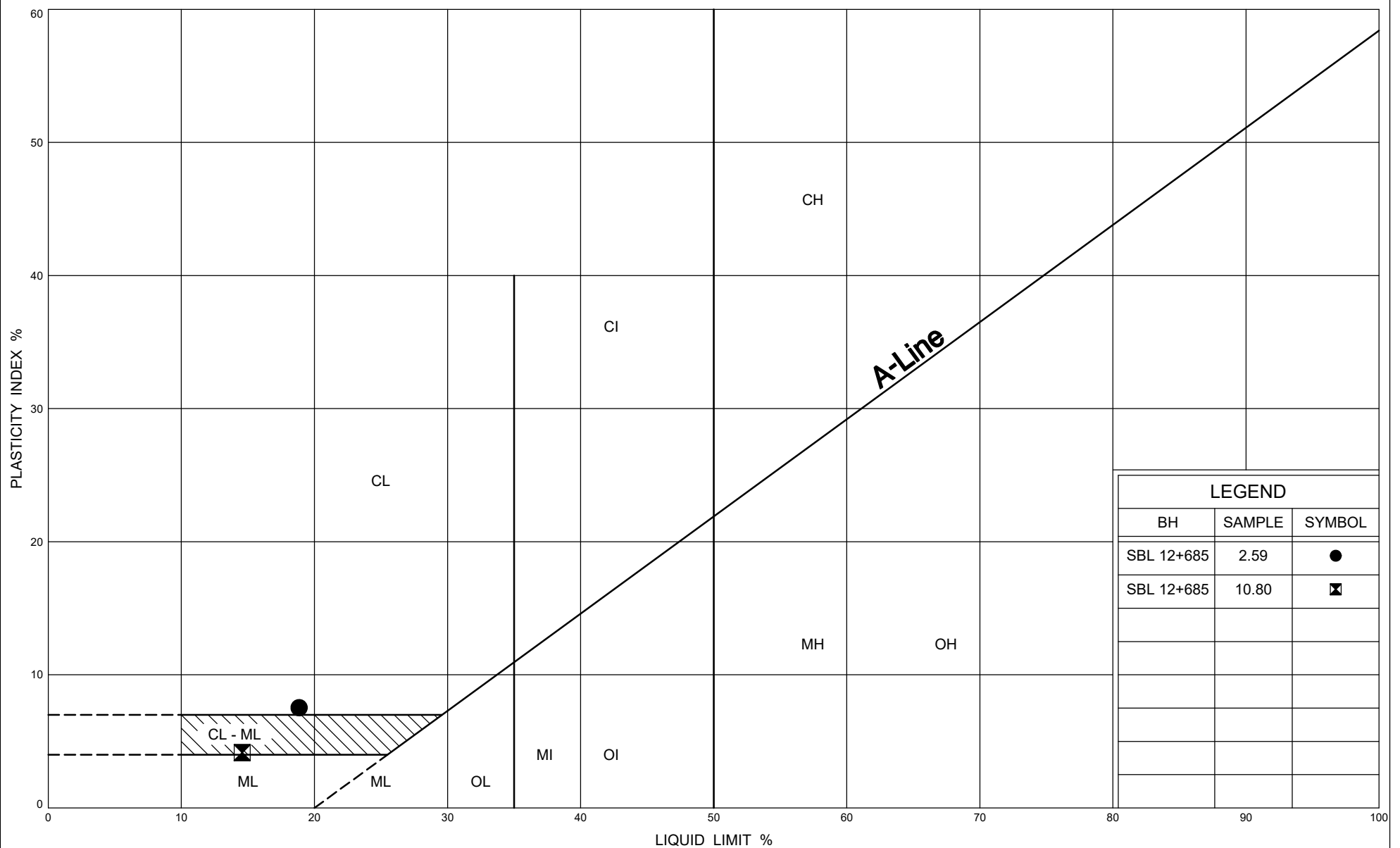
PLASTICITY CHART

Silty SAND TILL

FIG No B5

W P 2445-15-00

Deep Cut at Sunnidale Road



Ministry of
Transportation

PLASTICITY CHART

Silty CLAY TILL/Clayey SILT TILL

FIG No B6

W P 2445-15-00

Deep Cut at Sunnidale Road



Appendix C

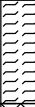

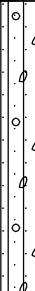
Record of Borehole Sheets Previous Investigation by Thurber

RECORD OF BOREHOLE No SUN-01

1 OF 3

METRIC

GWP# 2445-15-00 LOCATION Sunnisdale Road N 4 916 997.6 E 288 541.5 ORIGINATED BY BL
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers and Tricone COMPILED BY AN
DATUM Geodetic DATE 2019.06.17 - 2019.06.18 LATITUDE 44.392803 LONGITUDE -79.704080 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				WATER CONTENT (%)				
257.4	GROUND SURFACE						20	40	60	80	100	W _P	W	W _L	kN/m ³	GR SA SI CL
0.0	TOPSOIL , some silt and sand, trace gravel, occasional organics Compact Dark Brown Moist		1	SS	11											
256.8																
0.7	SAND and SILT , trace gravel, some clay Compact to Dense Brown Moist (FILL) Clayey silt layer at 1.2m (200mm)		2	SS	15											
			3	SS	28											
			4	SS	30											
			5	SS	49											
253.3																
4.1	Silty SAND , trace gravel, trace clay, occasional cobbles Very Dense Brown Moist (TILL)		6	SS	100											
			7	SS	100/ 0.050											
			8	SS	100/ 0.225											
			9	SS	100/ 0.225											

Continued Next Page

+³, ×³: Numbers refer to Sensitivity

20
15
10
(%) STRAIN AT FAILURE

METRIC

[illegible]

+³, ×³: Numbers refer to Sensitivity

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SUN-01

3 OF 3

METRIC

GWP# 2445-15-00 LOCATION Sunnidale Road N 4 916 997.6 E 288 541.5 ORIGINATED BY BL
 DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers and Tricone COMPILED BY AN
 DATUM Geodetic DATE 2019.06.17 - 2019.06.18 LATITUDE 44.392803 LONGITUDE -79.704080 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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						
								20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE						
	Continued From Previous Page		16	SS	100/ 0.250									
236.6	SAND , trace to some gravel, trace to some silt Very Dense Brown to Grey Wet						237							
20.9	Silty SAND , trace to some gravel, trace clay Very Dense Brown Moist (TILL)		17	SS	100/ 0.275		236							
235.0							235							
22.4	SAND , trace to some silt, trace clay Very Dense Brown Wet		18	SS	100/ 0.275		234							
233.4							233							
24.0	Silty SAND , trace clay Very Dense Brown Moist (TILL)		19	SS	100/ 0.175									
232.7														
24.7	END OF BOREHOLE AT 24.7m. BOREHOLE CAVED TO 18.3m AND WATER LEVEL NOT OBSERVED. Piezometer installation consists of 25mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2019.07.04 10.6 246.8 2019.08.27 10.9 246.5 2021.03.04 11.2 246.2 2021.04.19 10.9 246.5 2021.04.30 10.9 246.5													

+³, ×³: Numbers refer to Sensitivity 20 15 10 5 0 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SUN-03

1 OF 2

METRIC

GWP# 2445-15-00 LOCATION Sunnisdale Road N 4 916 957.8 E 288 605.2 ORIGINATED BY KK
DIST Central HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2019.07.04 - 2019.07.04 LATITUDE 44.392447 LONGITUDE -79.703280 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				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					
								20 40 60 80 100					
254.0	GROUND SURFACE												
0.0	ASPHALT: (100mm)												
0.1	SAND and GRAVEL Loose Brown Moist (FILL)		1	GS									
252.9			1	SS	8								
1.1	Silty CLAY, some sand, trace gravel, occasional cobbles Firm to Stiff Brown Moist (FILL)		2	SS	11								
251.8													
2.2	SAND and SILT, trace gravel, trace clay, occasional cobbles Dense to Very Dense Brown Moist (TILL)		3	SS	39								
			4	SS	32								
			5	SS	70								
			6	SS	87								
246.9													
7.2	Silty SAND, trace clay Very Dense Brown Moist		7	SS	72								
			8	SS	100/ 0.175								
244.6													
9.5	END OF BOREHOLE AT 9.5m. BOREHOLE OPEN AND DRY UPON COMPLETION.												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10

(%) STRAIN AT FAILURE

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 2/17/21

RECORD OF BOREHOLE No SUN-03

2 OF 2


METRIC

GWP# 2445-15-00 LOCATION Sunnidale Road N 4 916 957.8 E 288 605.2 ORIGINATED BY KK
 DIST Central HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2019.07.04 - 2019.07.04 LATITUDE 44.392447 LONGITUDE -79.703280 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
	BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.1m, THEN ASPHALT TO SURFACE.																

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 2/17/21

+³, ×³: Numbers refer to Sensitivity


 20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SUN-04

1 OF 2

METRIC

GWP# 2445-15-00 LOCATION Sunnisdale Road N 4 916 985.9 E 288 533.3 ORIGINATED BY KK
 DIST Central HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2019.07.04 - 2019.07.04 LATITUDE 44.392697 LONGITUDE -79.704182 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					
257.6	GROUND SURFACE												
0.0	ASPHALT: (125mm)												
0.1	SAND and GRAVEL Dense Brown Moist (FILL)		1	GS			257						
256.5			1	SS	34								
1.1	SAND, some gravel, trace to some silt and clay Compact Brown Moist (FILL)		2	SS	21		256						
			3	SS	23		255						
254.7													
3.0	SAND, trace silt, trace clay Compact to Dense Brown Moist		4	SS	29		254						
			5	SS	36		253						
252.0													
5.6	Silty SAND, trace gravel, trace clay, occasional stains Very Dense Brown Moist (TILL)		6	SS	94		252						
							251						
			7	SS	96		250						
							249						
			8	SS	73		248						
247.9													
9.8	END OF BOREHOLE AT 9.8m.												

Continued Next Page

+³, ×³: Numbers refer to
Sensitivity

20
15
10
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No SUN-04

2 OF 2


METRIC

GWP# 2445-15-00 LOCATION Sunnidale Road N 4 916 985.9 E 288 533.3 ORIGINATED BY KK
 DIST Central HWY 400 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN
 DATUM Geodetic DATE 2019.07.04 - 2019.07.04 LATITUDE 44.392697 LONGITUDE -79.704182 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W _p	W	W _L		
	Continued From Previous Page																
	BOREHOLE OPEN AND DRY UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO 0.125m, THEN ASPHALT TO SURFACE.																

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 2/17/21

+³, ×³: Numbers refer to Sensitivity


 20
15
10
(%) STRAIN AT FAILURE

METRIC

GWP#	2445-15-00	LOCATION	Sunnidale Road N 4 916 945.5 E 288 599.7			ORIGINATED BY	BL			
DIST	Central	HWY	400	BOREHOLE TYPE	Hollow Stem Augers			COMPILED BY	AN	
DATUM	Geodetic		DATE	2019.07.19 - 2019.07.20	LATITUDE	44.392336	LONGITUDE	-79.703348	CHECKED BY	GRL

[illegible]

+³, ×³: Numbers refer to Sensitivity

CONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

METRIC

GWP#	2445-15-00	LOCATION	Sunnidale Road N 4 916 945.5 E 288 599.7			ORIGINATED BY	BL		
DIST	Central	HWY	400	BOREHOLE TYPE	Hollow Stem Augers			COMPILED BY	AN
DATUM	Geodetic	DATE	2019.07.19 - 2019.07.20	LATITUDE	44.392336	LONGITUDE	-79.703348	CHECKED BY	GRL

[illegible]

+³, ×³: Numbers refer to Sensitivity

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21

RECORD OF BOREHOLE No SUN-05

3 OF 3

METRIC

GWP# 2445-15-00 LOCATION Sunnidale Road N 4 916 945.5 E 288 599.7 ORIGINATED BY BL
DIST Central HWY 400 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN
DATUM Geodetic DATE 2019.07.19 - 2019.07.20 LATITUDE 44.392336 LONGITUDE -79.703348 CHECKED BY GRL

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					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										
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE										
	Continued From Previous Page		16	SS	100/ 0.225		232											
	SAND , trace silt, trace clay Very Dense Brown Moist to Wet						231											
			17	SS	100/ 0.225													
							230											
							229											
							228											
227.9			18	SS	100/ 0.250													
			19	SS	100/ 0.200													
24.7	END OF BOREHOLE AT 24.7m. BOREHOLE CAVED TO 12.2m AND WATER LEVEL NOT OBSERVED UPON COMPLETION. Piezometer installation consists of 30mm diameter Schedule 40 PVC pipe with a 3.05m slotted screen. WATER LEVEL READINGS DATE DEPTH(m) ELEV.(m) 2019.08.27 9.5 243.1 2021.03.04 10.2 242.4 2021.04.19 9.9 242.7 2021.04.30 9.9 242.7																	

ONTMT4S2 MTO-22424.GPJ 2017TEMPLATE(MTO).GDT 5/27/21



Appendix D

Record of Borehole Sheets Previous Investigation by Others

RECORD OF BOREHOLE No 101

1 OF 2

METRIC

G.W.P. _____ LOCATION Co-ordinates: 4 916 364.6 N; 603 199.3 E ORIGINATED BY DP
 DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY RB
 DATUM Geodetic DATE 2019.04.19 LATITUDE 44.39322 LONGITUDE -79.70423 CHECKED BY GW

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						
258.5	GROUND SURFACE							20 40 60 80 100	20 40 60					
0.0	CLAYEY SILT, trace sand, trace gravel, trace organics		1	SS	4		258							
	Firm Brown Moist (FILL)		2	SS	5									
257.1							257							1 10 73 16
1.4	SILT, some clay, trace sand, trace gravel		3	SS	21									
256.4	Compact Brown Moist													
2.1	SILTY SAND, trace gravel		4	SS	60		256							
	Very dense Brown Moist													
255.6			5	SS	41		255							
2.9	SILTY SAND, trace to some gravel, trace to some clay, occasional cobbles and boulders						254							
	Dense to very dense, Brown to grey, Moist (TILL)		6	SS	50		253							5 57 29 9
			7	SS	79		252							
							251							
			8	SS	50/75mm		250							
							249							
							248							
			10	SS	50/125mm		247							
							246							13 68 17 2
			11	SS	67		245							
245.5							244							
13.0	SAND, trace silt													
	Dense Brown to Wet Grey		12	SS	50									

Continued Next Page

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

ONTARIO MTO 19BF005 2019-07-17 BH LOGS.GPJ ONTARIO MTO.GDT 22/7/19

RECORD OF BOREHOLE No 101

2 OF 2

METRIC

G.W.P. _____ LOCATION Co-ordinates: 4 916 364.6 N; 603 199.3 E ORIGINATED BY DP
 DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY RB
 DATUM Geodetic DATE 2019.04.19 LATITUDE 44.39322 LONGITUDE -79.70423 CHECKED BY GW

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			20 40 60 80 100	20 40 60 80 100					
243.5	SAND, trace silt													
	Dense Brown to Wet (Cont'd) Grey		13	SS	95		243							
							242							
			14	SS	50/125mm		241							0 95 5 0
							240							
			15	SS	78		239							
238.2 20.3	BOREHOLE TERMINATED AT 20.3 m		16	SS	42									
<p>Notes:</p> <p>First water strike noted at 15.3 m during drilling.</p> <p>Water measured in well on April 25, 2019 at 11.3 m.</p> <p>Water measured in well on August 6, 2019 at 11.4 m.</p> <p>Monitoring well installed prior to extraction of the augers.</p>														

RECORD OF BOREHOLE No 102

1 OF 2

METRIC

G.W.P. _____ LOCATION Co-ordinates: 4 916 306.9 N; 603 324.7 E ORIGINATED BY DP
 DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY RB
 DATUM Geodetic DATE 2019.04.08 LATITUDE 44.39268 LONGITUDE -79.70266 CHECKED BY GW

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		20 40 60 80 100	20 40 60 80 100					
251.2	GROUND SURFACE												
0.0	SAND, trace to some silt, trace organics		1	SS	4	251							
250.6	Dark brown, Moist (FILL)												
0.6	SANDY SILT, trace clay, trace gravel		2	SS	9	250							
249.7	Light grey to brown, Moist to very moist (FILL)												
1.4	SILTY SAND, trace clay, trace gravel		3	SS	11	249							
249.0	Compact, light grey to brown, Moist to very moist												
2.2	SILTY SAND, trace to some gravel, trace to some clay, occasional cobbles and boulders		4	SS	26	249							
	Compact to very dense, Brown to grey, Moist to wet (TILL)		5	SS	39	248							
			6	SS	58	247							19 53 21 7
			7	SS	36	245							
			8	SS	50/125mm	243							
			9	SS	50/100mm	242							
241.1	SAND, trace gravel, trace silt					241							
10.1	Very dense, Light brown, Wet		10	SS	50	240							4 93 3 0
239.7	CLAYEY SILT, trace sand												
11.5	Hard, Grey, Moist		11	SS	67	239							0 2 66 32
			12	SS	61	237							0 1 54 45

Continued Next Page

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

RECORD OF BOREHOLE No 102

2 OF 2

METRIC

G.W.P. _____ LOCATION Co-ordinates: 4 916 306.9 N; 603 324.7 E ORIGINATED BY DP
 DIST Central HWY 400 BOREHOLE TYPE Continuous Flight Hollow Stem Augers COMPILED BY RB
 DATUM Geodetic DATE 2019.04.08 LATITUDE 44.39268 LONGITUDE -79.70266 CHECKED BY GW

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		20 40 60 80 100	20 40 60 80 100					
236.2	CLAYEY SILT, trace sand Hard, Grey, Moist (Cont.d)		13	SS	74	236							0 1 59 40
			14	SS	34	235							
			15	SS	51	234							
			16	SS	45	233							0 0 60 40
230.9 20.3	BOREHOLE TERMINATED AT 20.3 m					232							
	Notes: First water strike noted at 10.7 m during drilling. Water measured in wells on April 25, 2019 at 6.9 m. Water measured in well on August 6, 2019 at 7.0 m. Monitoring well installed prior to extraction of the augers.					231							

ONTARIO MTO 19BF005 2019-07-17 BH LOGS.GPJ ONTARIO MTO.GDT 22/7/19



Appendix E

Selected Site Photographs



Photo 1. – Southwest side of Highway 400 and Sunnidale Road Underpass



Photo 2. – Southwest side of Highway 400 and Sunnidale Road Underpass



Photo 3. – Northwest side of Highway 400 and Sunnidale Road Underpass



Photo 4. – Northwest side of Highway 400 and Sunnidale Road Underpass, (May 18, 2021)

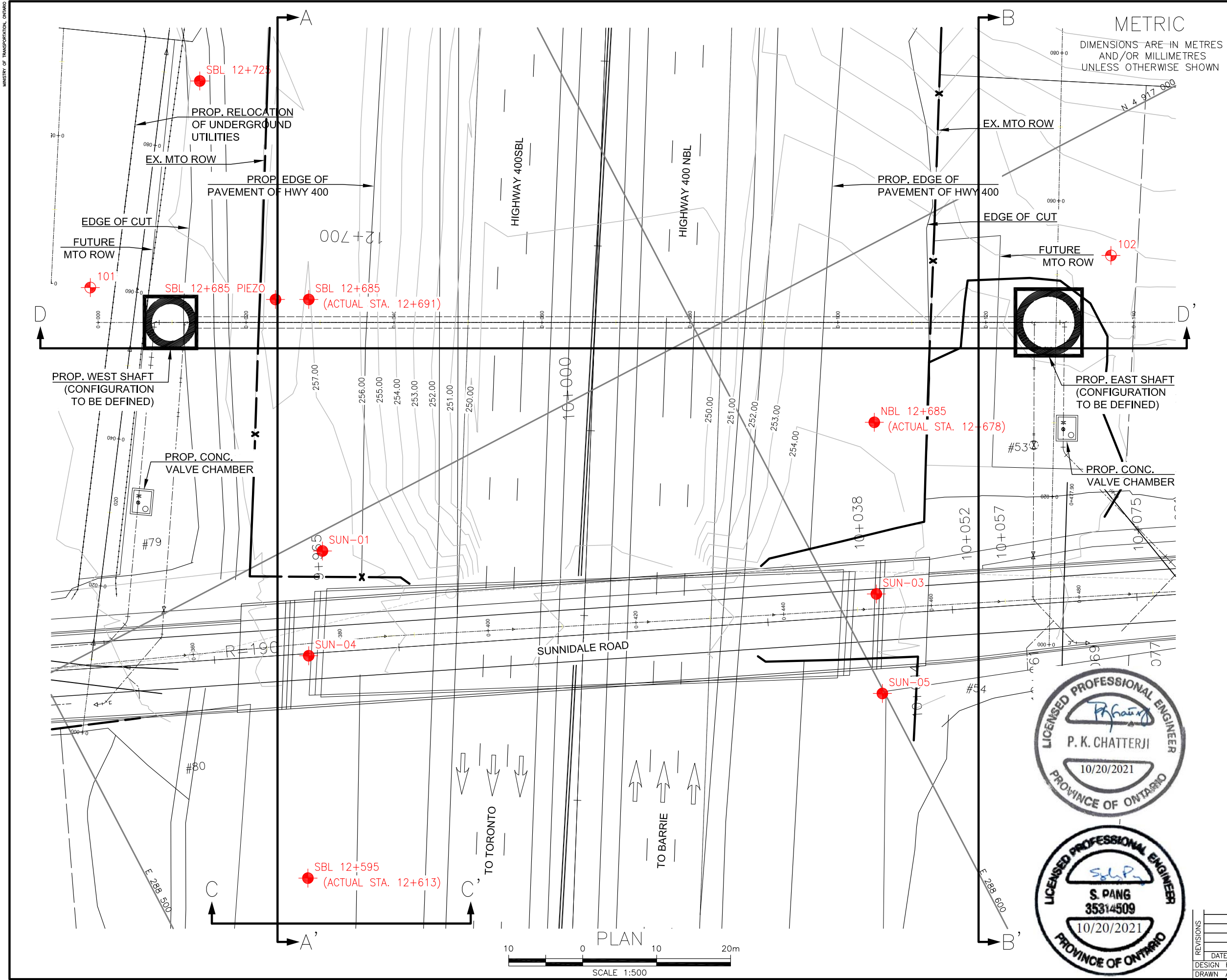


Photo 5. – Northeast side of Highway 400 and Sunnidale Road Underpass



Appendix F

Borehole Locations and Soil Strata Drawings



METRIC

DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 2445-15-00
HWY 400 & SUNNIDALE RD.
DEEP CUTS
APPROX. STA. 12+585 TO 12+750
BOREHOLE LOCATIONS PLAN



SHEET

McINTOSH PERRY



KEYPLAN

LEGEND

●	Borehole (By Thurber)
●	Borehole (By Other)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
≡	Water Level
≡	Head Artesian Water
≡	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	258.5	4 917 043.7	288 530.2
102	251.2	4 916 983.7	288 654.5
NBL 12+685	253.8	4 916 978.5	288 615.7
SBL 12+595	255.6	4 916 959.3	288 519.3
SBL 12+685	256.9	4 917 028.6	288 555.6
SBL 12+685 PIEZO	256.3	4 917 030.7	288 551.6
SBL 12+725	257.6	4 917 061.6	288 556.2
SUN-01	257.4	4 916 997.6	288 541.5
SUN-03	254.0	4 916 957.8	288 605.2
SUN-04	257.6	4 916 985.9	288 533.3
SUN-05	252.6	4 916 945.5	288 599.7

-NOTES-

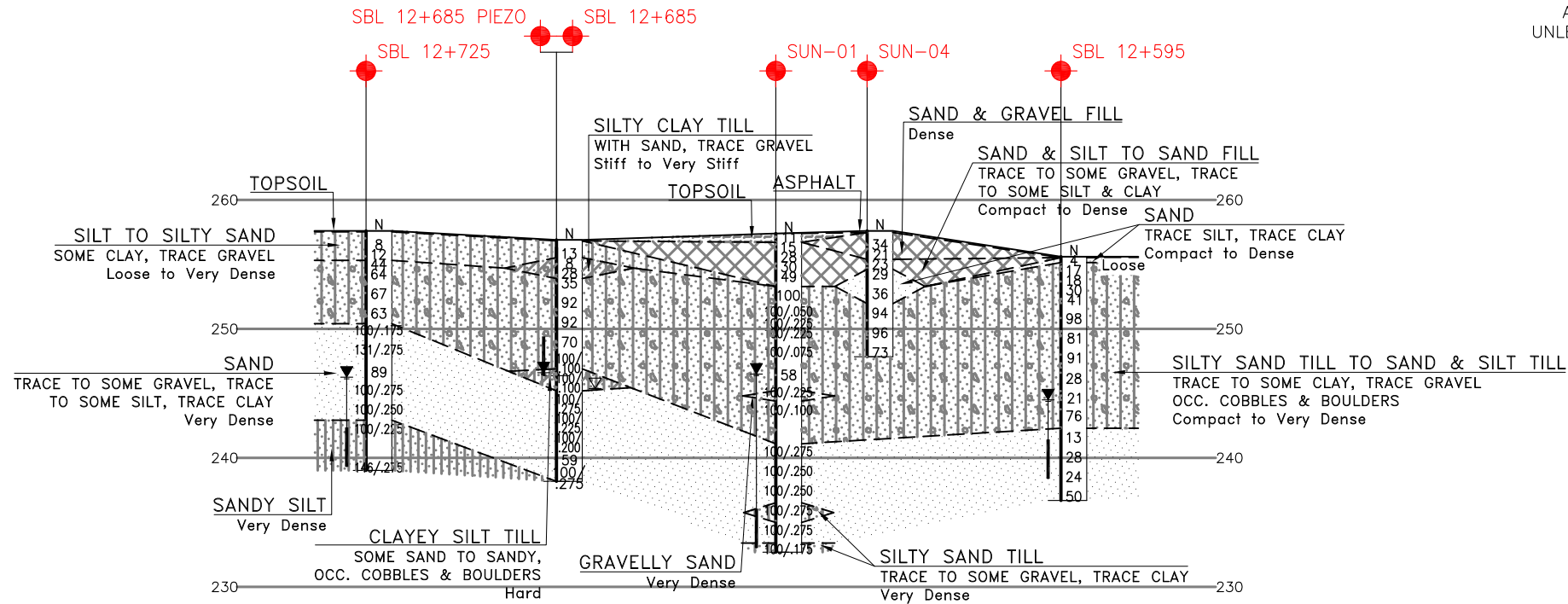
- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
- This drawing is for subsurface information only. Surface details and features are for conceptual illustration.
- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 31D-770

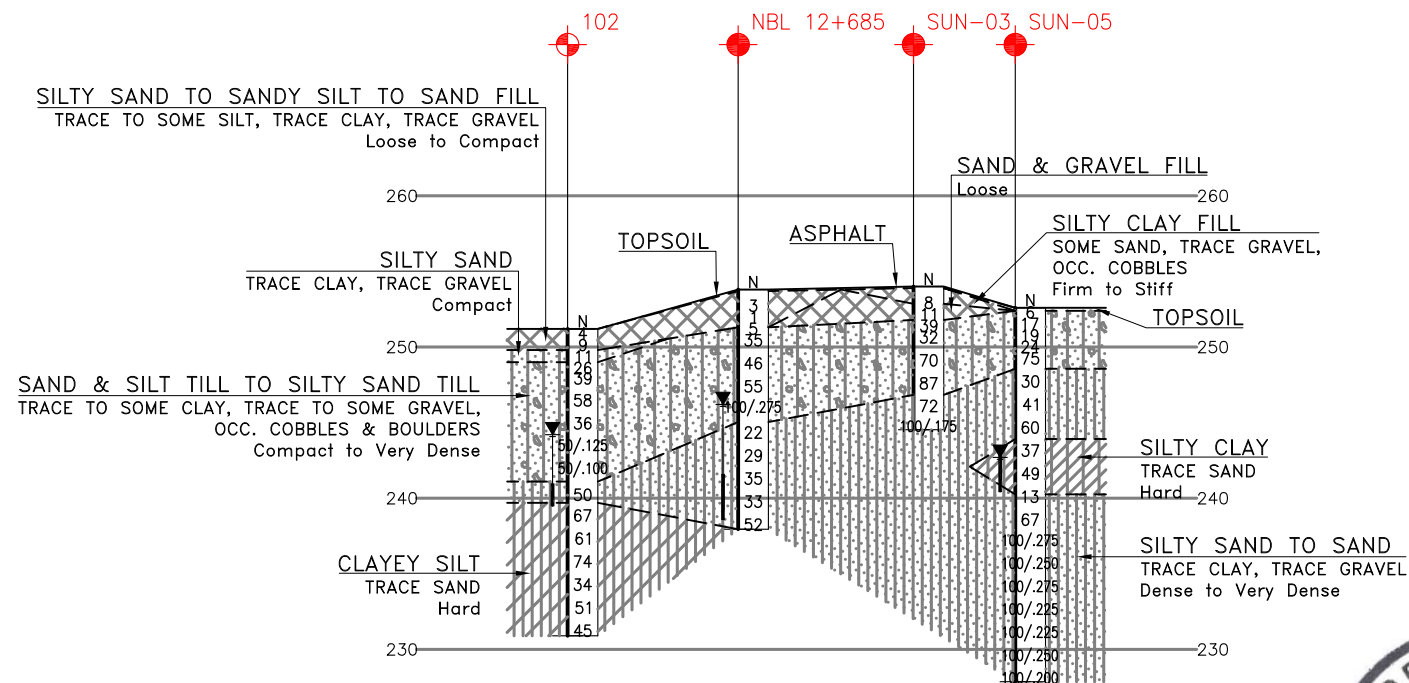


REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE C-78
LOAD		STRUCT	DWG 1
DATE	OCT 2021		

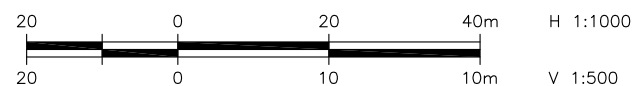
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN



SECTION ALONG A-A'



SECTION ALONG B-B'



CONT No
GWP No 2445-15-00

HWY 400 & SUNNIDALE RD.
DEEP CUTS
APPROX. STA. 12+585 TO 12+750
BOREHOLE LOCATIONS PROFILES

SHEET

McINTOSH PERRY



KEYPLAN

LEGEND

	Borehole (By Thurber)
	Borehole (By Other)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	258.5	4 917 043.7	288 530.2
102	251.2	4 916 983.7	288 654.5
NBL 12+685	253.8	4 916 978.5	288 615.7
SBL 12+595	255.6	4 916 959.3	288 519.3
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SBL 12+725	257.6	4 917 061.6	288 556.2
SUN-01	257.4	4 916 997.6	288 541.5
SUN-03	254.0	4 916 957.8	288 605.2
SUN-04	257.6	4 916 985.9	288 533.3
SUN-05	252.6	4 916 945.5	288 599.7

-NOTES-

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- Coordinate system is MTM NAD 83 Zone 10.

GEOCRES No. 31D-770

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE C-78
			LOAD
			DATE OCT 2021
			STRUCT
			DWG 2

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 2445-15-00
HWY 400 & SUNNIDALE RD.
DEEP CUTS
APPROX. STA. 12+585 TO 12+750
BOREHOLE LOCATIONS SECTIONS

SHEET

McINTOSH PERRY



KEYPLAN

LEGEND

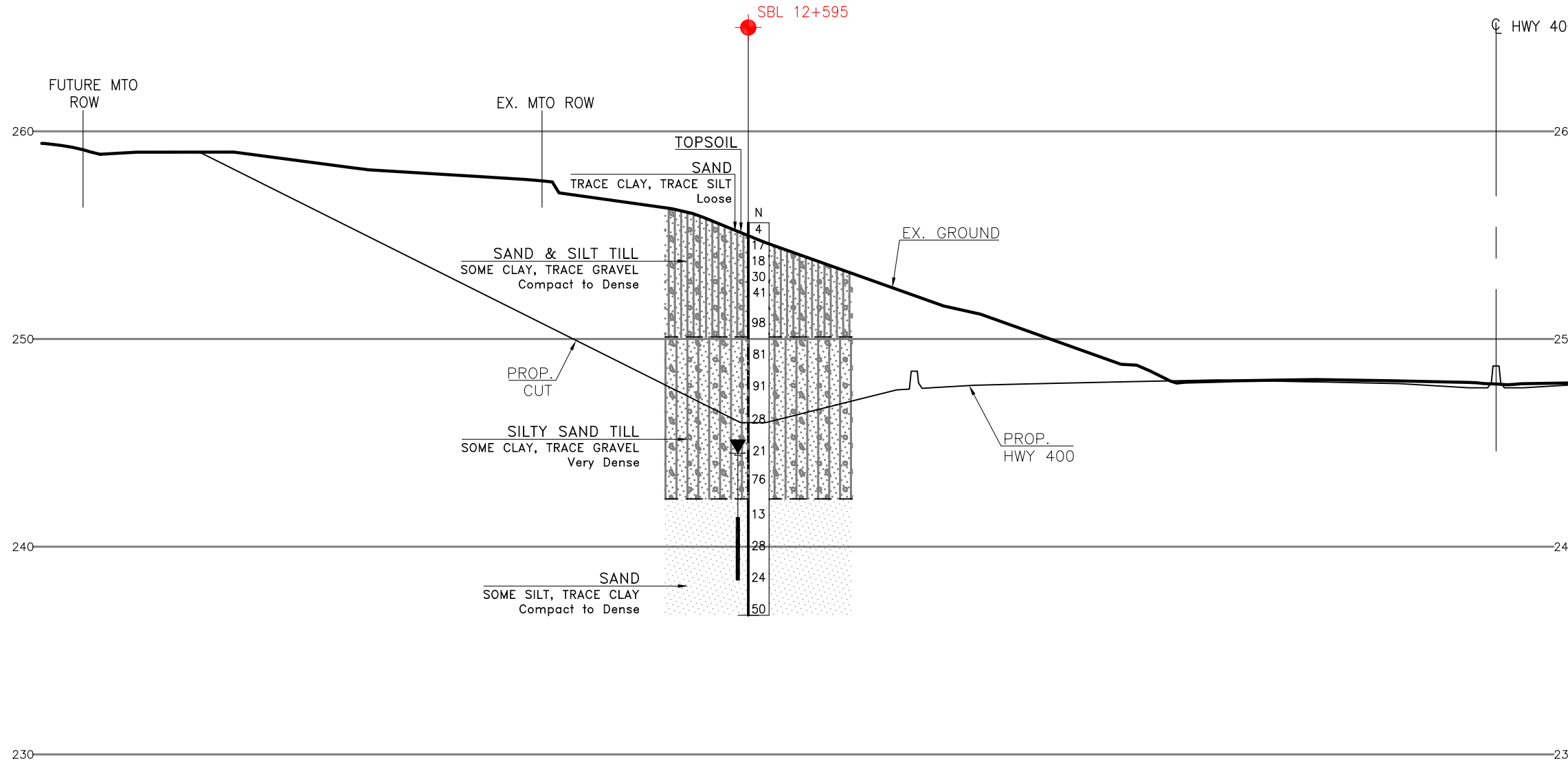
	Borehole (By Thurber)
	Borehole (By Other)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
	Water Level
	Head Artesian Water
	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	258.5	4 917 043.7	288 530.2
102	251.2	4 916 983.7	288 654.5
NBL 12+685	253.8	4 916 978.5	288 615.7
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SBL 12+685	256.9	4 917 028.6	288 555.6
SBL 12+685 PIEZO	256.3	4 917 030.7	288 551.6
SBL 12+725	257.6	4 917 061.6	288 556.2
SUN-01	257.4	4 916 997.6	288 541.5
SUN-03	254.0	4 916 957.8	288 605.2
SUN-04	257.6	4 916 985.9	288 533.3
SUN-05	252.6	4 916 945.5	288 599.7

-NOTES-

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GEOCRES No. 31D-770



SECTION ALONG C-C' WEST SIDE
(APPROX. STA. 12+608.3)



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK	SKP
DRAWN	AN	CHK	RPR
CODE	LOAD	DATE	OCT 2021
SITE	C-78	STRUCT	DWG 3

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 2445-15-00
HWY 400 & SUNNIDALE RD.
DEEP CUTS
APPROX. STA. 12+585 TO 12+750
BOREHOLE LOCATIONS SECTIONS

SHEET

McINTOSH PERRY



KEYPLAN

LEGEND

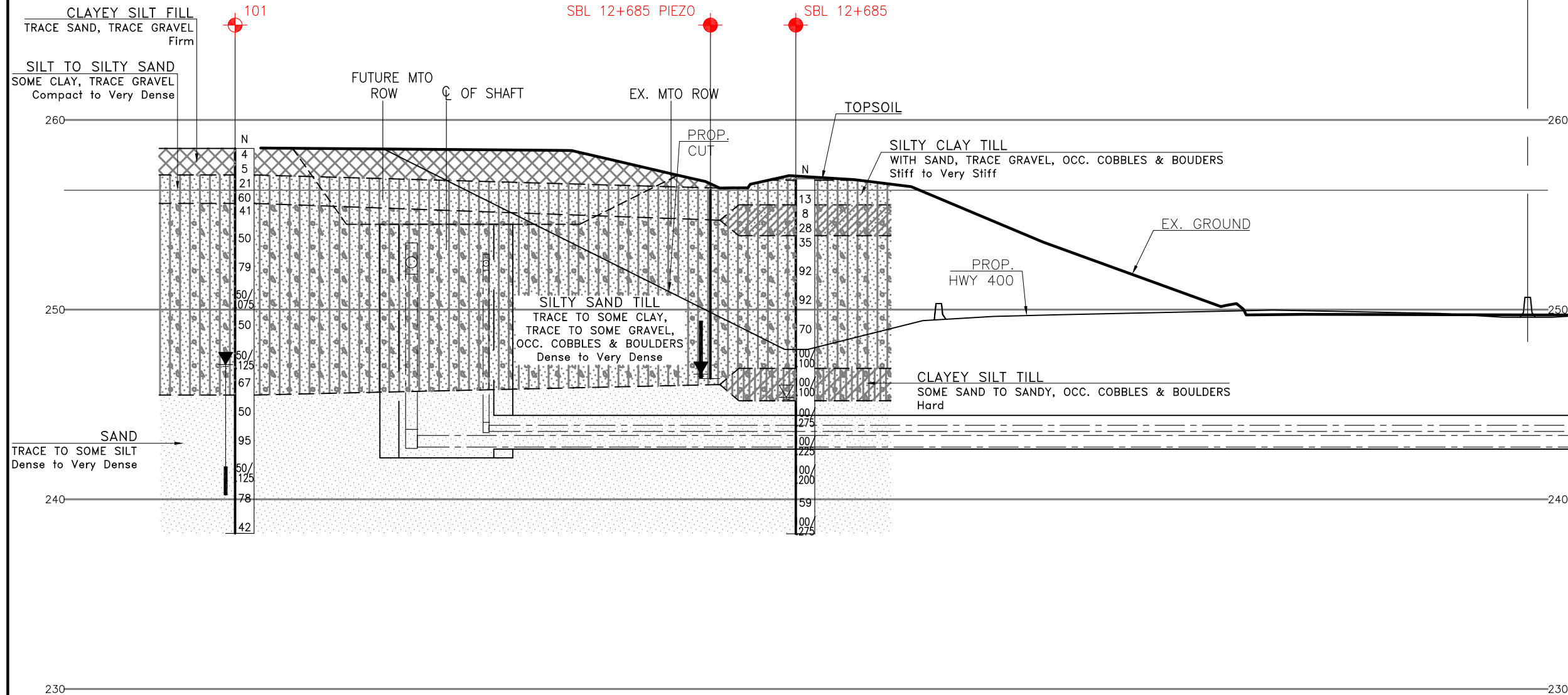
●	Borehole (By Thurber)
○	Borehole (By Other)
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level
▽	Head Artesian Water
↓	Piezometer
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	258.5	4 917 043.7	288 530.2
102	251.2	4 916 983.7	288 654.5
NBL 12+685	253.8	4 916 978.5	288 615.7
SBL 12+595	255.6	4 916 959.3	288 519.3
SBL 12+685	256.9	4 917 028.6	288 555.6
SBL 12+685 PIEZO	256.3	4 917 030.7	288 551.6
SBL 12+725	257.6	4 917 061.6	288 556.2
SUN-01	257.4	4 916 997.6	288 541.5
SUN-03	254.0	4 916 957.8	288 605.2
SUN-04	257.6	4 916 985.9	288 533.3
SUN-05	252.6	4 916 945.5	288 599.7

-NOTES-

- The boundaries between soil strata have been established only at Borehole locations. Between Boreholes the boundaries are assumed from geological evidence.
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GEOCRES No. 31D-770



SECTION ALONG D-D' WEST SIDE
(APPROX. STA. 12+686.2)



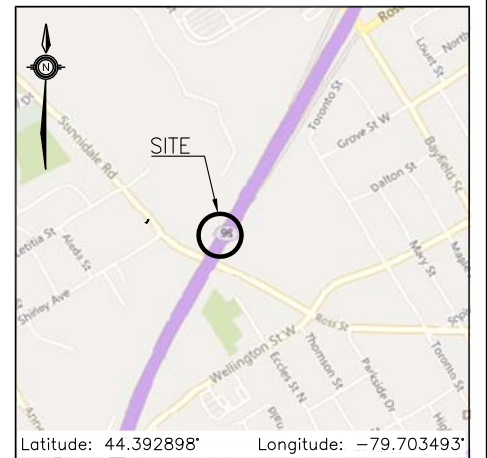
REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK SKP	CODE
DRAWN	AN	CHK RPR	SITE C-78
LOAD	DATE	OCT 2021	DWG 4

METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

CONT No
GWP No 2445-15-00
HWY 400 & SUNNIDALE RD.
DEEP CUTS
APPROX. STA. 12+585 TO 12+750
BOREHOLE LOCATIONS SECTIONS

SHEET

McINTOSH PERRY



KEYPLAN

LEGEND

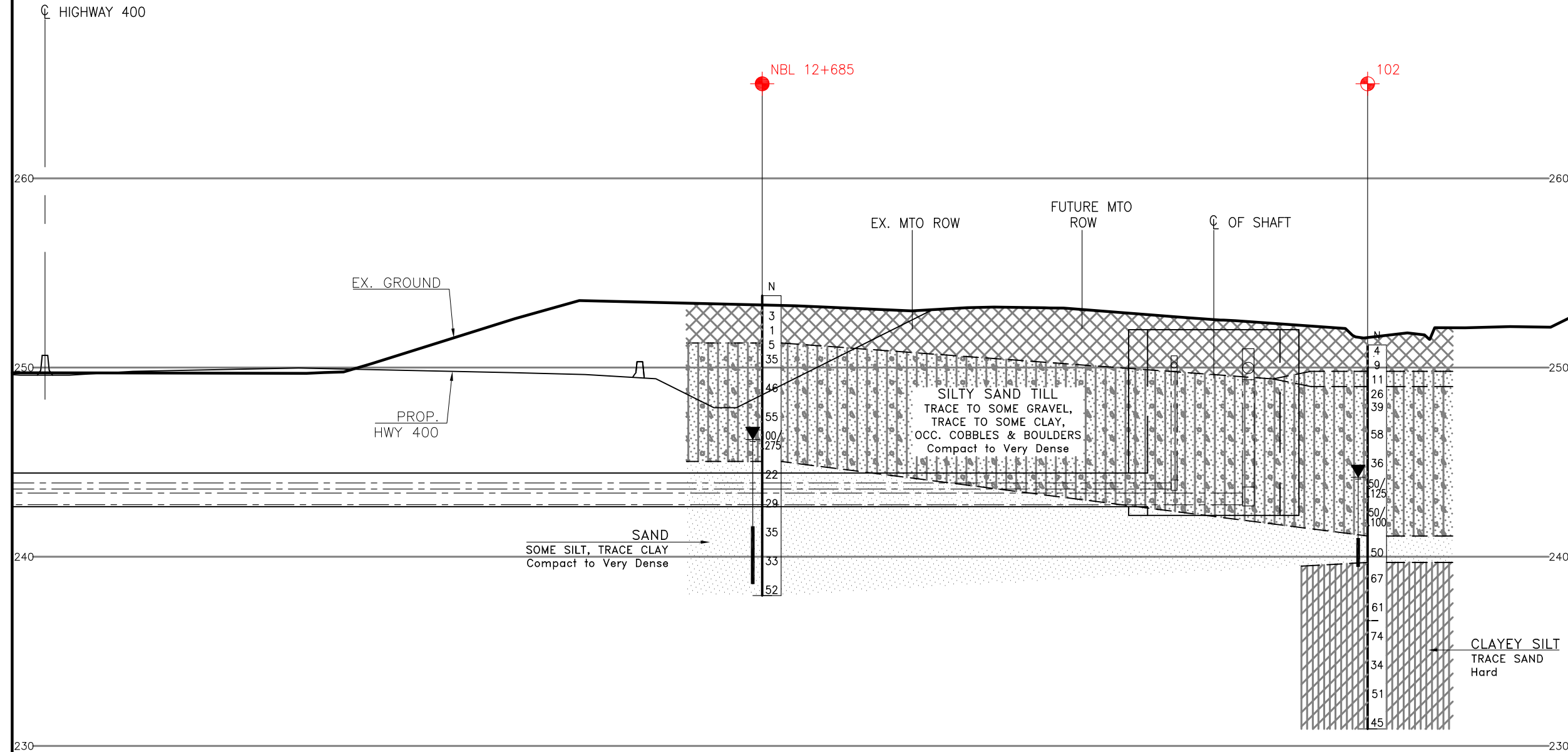
- Borehole (By Thurber)
- Borehole (By Other)
- N Blows /0.3m (Std Pen Test, 475J/blow)
- CONE Blows /0.3m (60° Cone, 475J/blow)
- PH Pressure, Hydraulic
- Water Level
- Head Artesian Water
- Piezometer
- 90% Rock Quality Designation (RQD)
- A/R Auger Refusal

NO	ELEVATION	NORTHING	EASTING
101	258.5	4 917 043.7	288 530.2
102	251.2	4 916 983.7	288 654.5
NBL 12+685	253.8	4 916 978.5	288 615.7
SBL 12+595	255.6	4 916 959.3	288 519.3
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SUN-01	257.4	4 916 997.6	288 541.5
SUN-03	254.0	4 916 957.8	288 605.2
SUN-04	257.6	4 916 985.9	288 533.3
SUN-05	252.6	4 916 945.5	288 599.7

-NOTES-

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GEOCRES No. 31D-770



SECTION ALONG D-D' EAST SIDE
(APPROX. STA. 12+686.2)



REVISIONS	DATE	BY	DESCRIPTION
DESIGN	RPR	CHK	SKP
DRAWN	AN	CHK	RPR
CODE	LOAD	DATE	OCT 2021
SITE	C-78	STRUCT	DWG 5