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FOUNDATION INVESTIGATION REPORT

NOISE BARRIER WALL, NORTHEAST OF CUBERT STREET AND HIGHWAY 401 OVERPASS
CITY OF OSHAWA, ONTARIO
G.W.P. 2555-17-00
GEOCRES No. 30M15-351

Client Name: Egis Canada Ltd.
Date: July 26, 2024
File: 30915

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PART 1: FACTUAL INFORMATION

1. INTRODUCTION

This report presents the factual findings obtained from a foundation investigation carried out by Thurber Engineering Ltd. (Thurber) for the detailed design of a noise barrier wall to be constructed on the northeast side of the proposed Highway 401 and Cubert Street overpass structure located in the City of Oshawa, Ontario.

The purpose of this investigation was to explore the subsurface conditions near the alignment of the noise barrier wall and, based on the data obtained, to provide a borehole location plan and soil strata drawing, 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 the data obtained from the investigation, to describe the geotechnical conditions influencing design and construction of the noise barrier wall. Selected boreholes from another aspect of this interchange reconstruction project are also utilized.

Thurber was retained by McIntosh Perry (MP) to carry out this foundation investigation under the Ministry of Transportation Ontario (MTO) Agreement Number 2019-E-0076. The overall assignment includes replacement of the Highway 401 at Park Road South and Cubert Street overpass structures, new and proposed retaining walls and noise barrier walls on both sides of the highway, and overhead signs. This report addresses the proposed noise barrier wall to be located to the northeast side of the Cubert Street bridges.

Reference has been made to information on subsurface conditions contained in a previous foundation report prepared by Thurber for the bridge site. The titles of this report is:

- Draft Foundation Investigation Report, Cubert Street Overpass Replacement, Highway 401, Site No. 22X-174/B1&B2, Highway City of Oshawa, Ontario, G.W.P. 2555-17-00, prepared by Thurber Engineering Ltd., Job 30915, dated October 17, 2023 (Reference 1).

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

2. SITE DESCRIPTION

The site is located on the northeast side of the existing Cubert Street overpass EBL and WBL structures, which are approximately 1 km east of Stevenson Road in the City of Oshawa, Ontario. Cubert Street generally runs in a north-south direction and the two bridges carry the two directions of traffic on Highway 401 over the street. The highway grade at this location is at approximate Elevation 110. The new noise barrier wall will extend from the new Cubert WBL bridge easterly for about 400 m to end just west of Oshawa Creek.

The overall surface topography in the vicinity of the site is relatively flat with the ground surface gently sloping towards the south. Beyond the highway right-of-way, all four quadrants adjacent to the bridge crossing are currently occupied by residential developments. The easterly portion of the new wall borders with Storie Park located immediately to the east of the residences.

Based on published geological information, the site area is located within the Iroquois Plain physiographic region. This region extends around the western shores of Lake Ontario and consists of lakebed and beaches of the former glacial Lake Iroquois. The subsoils in this area are typically comprised of glacial tills and glaciolacustrine clays, silts and sands. Limestone bedrock underlies the soil deposits.

3. SITE INVESTIGATION AND FIELD TESTING

The site investigation and field testing program completed for the noise barrier wall was carried out on July 7 and 8, 2023 and consisted of drilling and sampling four (4) boreholes, designated as Boreholes NBW-07 to NWB-10. The boreholes were located along the proposed noise barrier wall alignment. Boreholes NBW-08 to NBW10 were terminated at depths ranging from 9.6 m to 9.8 m (Elevations 90.0 to 94.1), and sample in Borehole NBW-07 was terminated at 12.8 m depth (Elevation 94.0).

A Dynamic Cone Penetration Test (DCPT) was advanced below the sampled depth in Borehole

NBW-07 to practical refusal, which was encountered at 16.8 m depth (Elevation 90.0). The Record of Borehole sheets of the present investigation are provided in Appendix B.

Reference has been made to a previous Borehole CS-08 which was located near the westerly limit of the wall. Borehole CS-08 was terminated at 14.6 m (Elevation 95.3) upon auger refusal (Reference 1). The Record of Borehole sheet of this borehole is provided in Appendix D.

Approximate locations of the five relevant boreholes (previous and present investigations) are shown on the Borehole Locations Plan and Stratigraphic Drawing in Appendix A.

Thurber obtained the co-ordinates of the as-drilled borehole locations in the field using a Trimble R10 GPS survey equipment and forwarded them to MP, who then provided the ground surface elevations. It is understood that the horizontal and vertical accuracy of the survey results meet the MTO terms of reference requirements. The coordinates and elevations of the boreholes are given on the drawings and Record of Borehole sheets in Appendices A and B, respectively.

Traffic control was implemented for drilling each borehole for the current and previous investigations. Prior to commencement of drilling, utility clearances were obtained for all borehole locations.

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

The current field investigation was supervised on a full-time basis by a member of Thurber's technical staff who marked/staked the boreholes in the field, directed 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.

All boreholes were backfilled upon completion of drilling in general accordance with O.Reg. 903. The asphalt surface was reinstated as much as practicable in boreholes drilled on the road platform.

4. LABORATORY TESTING

The recovered soil samples were subjected to visual identification (VI) and natural moisture content determination. Selected soil samples were subjected to grain size distribution analyses (sieve and/or hydrometer), and Atterberg Limits testing. Geotechnical laboratory testing results of the current investigation are summarized on the Record of Borehole sheets in Appendix B and

are presented on the figures in Appendix C.

5. DESCRIPTION OF SUBSURFACE CONDITIONS

Details of the encountered subsurface stratigraphy from the boreholes are presented on the Record of Borehole sheets included in Appendices B and D, and on the Borehole Locations and Soil Strata drawing 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 subsurface stratigraphy encountered at the site consists of pavement structure or topsoil overlying embankment and surficial fill. Below the fill, the native soils consist of an extensive deposit of very stiff to hard clayey silt till and silty clay till, and layers of compact to very dense sand and silt till to silty sand till. An occasional layer of very stiff silty clay was found underlying the hard till. The groundwater levels observed in the boreholes upon completion of drilling ranged from 2.3 m to 5.2 m depths below existing ground surface where the boreholes were located.

More detailed descriptions of the individual stratum are presented below.

5.1 Topsoil

Topsoil was encountered surficially in Boreholes NBW-09 and NBW10 that were drilled just north of the Highway 401 westbound lanes (WBL). The thickness of the topsoil was 50 mm at those locations.

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

5.2 Pavement Structure

Pavement structure consisting of approximately 125 mm and 75 mm of asphalt overlying granular (sand) road base was encountered in Boreholes NBW-07 and NBW-08 drilled at the cul-de-sac of Burton Road and Oxford Street, just north of Highway 401 WBL. The granular fill was 1.3 m and 0.9 m thick in Boreholes NBW-07 and NBW-08, respectively.

Borehole CS-08, drilled through the Highway 401 WBL embankment, on the east side of Cubert Street revealed that the pavement structure consisted of 130 mm of asphalt over about 700 mm of granular (gravelly sand) road base.

SPT ‘N’ values recorded in the granular fill ranged from 6 to 19 blows per 0.3 m of penetration indicating a loose to compact condition. The moisture contents measured on samples of the granular fill ranged approximately from 2 percent to 20 percent.

The results of grain size analyses conducted on a sample of the gravelly sand fill are provided on the Record of Borehole sheets in Appendix B and illustrated on Figure C1 in Appendix C. The results are summarized as follows:

Soil Particle	Granular Fill (Percent)
Gravel	34
Sand	50
Silt and clay	16

5.3 Fill

Embankment fill was encountered underlying the pavement structure in Borehole CS-08 and below the topsoil in Boreholes NBW-09 and NBW-10. The embankment fill in Borehole CS-08 consisted of brown sand and silt, trace gravel and trace clay. Occasional rootlets and organics were encountered between 1.4 m and 3.0 m depths. In Boreholes NBW-09 and NBW-10, the fill typically consisted of brown to grey silty sand and gravelly sand, trace to some clay, trace to some gravel. Occasional brick pieces were encountered in the silty sand fill in Borehole NBW-10. A layer of brown to grey sandy, silty clay containing occasional rootlets was found just below the topsoil in Borehole NBW-09. In general, the overall fill thickness varied from 2.9 to 4.0 m.

SPT ‘N’ values recorded in the cohesionless sand and silt fill typically ranged from 4 to 78 blows per 0.3 m of penetration indicating a loose to very dense condition. An SPT ‘N’ value of 100 blows for less than 0.3 m of penetration, indicating a very dense state or an oversize obstruction, was measured in Borehole NBW-10 near Elevation 96.5. SPT ‘N’ values of 3 and 6 blows per 0.3 m of penetration were measured in the cohesive silty clay fill indicating a soft to firm consistency.

The natural moisture contents measured on samples of the cohesionless fill generally ranged from 6 percent to 12 percent. Moisture contents of 27 and 33 percent were measured in the cohesive fill.

Results of grain size analyses conducted on samples of the cohesionless and cohesive fill are provided on the Record of Borehole sheets in Appendix B and illustrated on Figures C2 and C3, respectively in Appendix C. The results are summarized as follows:

Soil Particle	Cohesive Fill (Percent)	Cohesionless Fill (Percent)
Gravel	0	7 to 11
Sand	24	45 to 53
Silt	43	28 to 39
Clay	33	5 to 12

The results of Atterberg Limits tests conducted on a sample of the silty clay fill are presented on the Record of Borehole sheets in Appendix B and illustrated in Figure C8 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	41
Plasticity Index	20

The results of the Atterberg Limits testing indicate that the silty clay fill has medium plasticity with a group symbol of CI.

5.4 Clayey Silt Till to Silty Clay Till

An extensive deposit of native brown to grey clayey silt till to silty clay till with sand and containing trace gravel and possible cobbles and boulders was encountered below the fill and native sand and silt to silty sand till. The cohesive till deposits were contacted at depths ranging from 1.0 m to 4.1 m in Boreholes NBW-07, NBW-08 and NBW-10, and at 7.0 m and 8.5 m depths in Boreholes NBW-09 and CS-08, respectively. This till deposit was fully penetrated in Borehole NBW-07 indicating a thickness of 10.3 m.

Boreholes NBW-08, NBW-09 and NBW-10 were terminated within the clayey silt till to silty clay till at depths ranging from 9.6 m to 9.8 m (Elevations 90.0 to 94.1). Borehole CS-08 was terminated at 14.6 m depth (Elevation 95.3) within the clayey silt till.

SPT ‘N’ values measured in the cohesive till typically increased with depth from 17 blows per 0.3m penetration to greater than 100 blows for less than 0.3 m of penetration, indicating a very stiff to predominantly hard consistency. Some of the higher “N” values may be attributed to the presence of cobbles and boulders.

Moisture contents measured in the cohesive till ranged approximately from 5 percent to 24 percent.

The results of grain size distribution analyses carried out on selected samples of the clayey silt

till and silty clay till are presented on the Record of Borehole sheets included in Appendix B. Grain size distribution curves of samples tested are presented on Figures C4 and C5 in Appendix C. The results of the grain size distribution analyses are summarized below:

Soil Particle	Clayey Silt Till (Percent)	Silty Clay Till (Percent)
Gravel	0 to 8	1 to 5
Sand	36 to 49	36 to 43
Silt	31 to 47	35 to 37
Clay	11 to 20	21 to 24

The results of Atterberg Limits tests conducted on samples of the clayey silt till to silty clay till are presented on the Record of Borehole sheets in Appendix B and illustrated in Figure C9 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	15 to 22
Plasticity Index	5 to 11

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

Augers grinding and/or split spoon sampler refusal were noted in the cohesive till in Borehole NBW-08. These occurrences are indication of possible obstructions such as cobbles or boulders.

Glacial tills inherently contain cobbles and boulders.

5.5 Silty Sand to Sand and Silt Till

A deposit of brown to grey silty sand to sand and silt till containing trace gravel and trace clay was encountered below the fill at 3.0 m depth in Borehole NBW-09 and at 4.1 m depth in Borehole CS-08. The thickness of the cohesionless glacial till was 4.4 m and 4.0 m in Boreholes CS-08 and NBW-09, respectively.

The depth to the base of the silty sand to sand and silt till were 8.5 m and 7.0 m (Elevations 101.4 and 94.3) in Boreholes CS-08 and NBW-09, respectively.

The SPT ‘N’ values recorded in the cohesionless till ranged from 25 to 66 blows per 0.3 m of penetration, and greater than 100 blows for less than 0.3 m of penetration, indicating a compact to very dense state. Some of the higher “N” values may be attributed to the presence of cobbles

and boulders. The natural moisture contents measured on samples of the cohesionless till ranged from 6 percent to 11 percent.

The results of grain size distribution analyses carried out on selected samples of the silty sand to sand and silt till are shown on Figure C6 in Appendix C. The results are summarized as follows:

Soil Particle	Silty Sand to Sand and Silt Till (Percent)
Gravel	6 to 9
Sand	42 to 62
Silt	27 to 41
Clay	5 to 8

The results of Atterberg Limits tests conducted on a sample of the sand and silt till are presented on the Record of Borehole sheets in Appendix B and illustrated in Figure C10 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	14
Plasticity Index	4

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

Glacial tills inherently contain cobbles and boulders.

5.6 Silty Clay

A layer of grey silty clay was encountered below the silty clay till at 11.7 m in Borehole NBW-07.

Sampling in Borehole NBW-07 was terminated within the silty clay at 12.8 m (Elevation 94.0). A DCPT was then conducted below the sampling depth, and the test was terminated on encountering a blow count of 60 at 16.8 m depth (Elevation 90.0).

An SPT ‘N’ value measured in the silty clay was 23 blows per 0.3 m of penetration indicating a very stiff consistency. Moisture content measured in the silty clay was 26 percent.

The results of grain size distribution analyses carried out on a sample of the silty clay are presented on the Record of Borehole sheets included in Appendix B. Grain size distribution curves of samples tested are presented on Figure C7 in Appendix C. The results of the grain

size distribution analyses are summarized below:

Soil Particle	Silty Clay (Percent)
Gravel	0
Sand	0
Silt	39
Clay	61

The results of Atterberg Limits tests conducted on a sample of the silty clay are presented on the Record of Borehole sheets in Appendix B and illustrated in Figure C11 of Appendix C. The results are summarized as follows:

Index Property	Percentage (%)
Liquid Limit	56
Plasticity Index	31

The results of the Atterberg Limits testing indicate that the silty clay is of high plasticity with a group symbol of CH.

5.7 Groundwater Conditions

Groundwater levels in the boreholes were observed during the drilling operations and upon completion of drilling. Water levels measured in open boreholes are presented in Table 5.2 below.

Table 5.1: Groundwater Level Measurements

Borehole	Date	Groundwater Level		Comments
		Depth (m)	Elevation (m)	
NBW-07	July 5, 2023	5.2	101.6	Open borehole upon completion
NBW-09	July 5, 2023	3.7	97.6	Open borehole upon completion
CS-08	October 20, 2023	2.3	107.6	Open borehole upon completion

The groundwater levels may be at a higher elevation after periods of significant or prolonged precipitation. Seasonal fluctuations of the groundwater levels are to be expected.

6. MISCELLANEOUS

Thurber staked and/or marked the borehole locations in the field and obtained utility clearances prior to drilling. Thurber surveyed the as-drilled boreholes in the field, and forwarded the borehole coordinates to McIntosh Perry who provided the ground surface elevations.

Landshark Drilling of Brantford, Ontario supplied and operated the drilling and sampling equipment for the field program.

Full time supervision of the field activities was carried out by Mr. Sergey Gladkiy of Thurber. Overall supervision of the field program was performed by Messrs. Rod de Castro, P.Eng. and Cory Zanatta, P.Eng. of Thurber.

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

Thurber Engineering Ltd.

Rocio Palomeque Reyna, P. Eng.
Associate, Senior Geotechnical Engineer

Sydney Pang, P. Eng.
Senior Associate, Senior Foundation Engineer

Date: ***July 26, 2024***
File: ***30915***

P.K. Chatterji, P. Eng.
Review Principal, Designated MTO Contact

THURBER

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This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

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5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

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The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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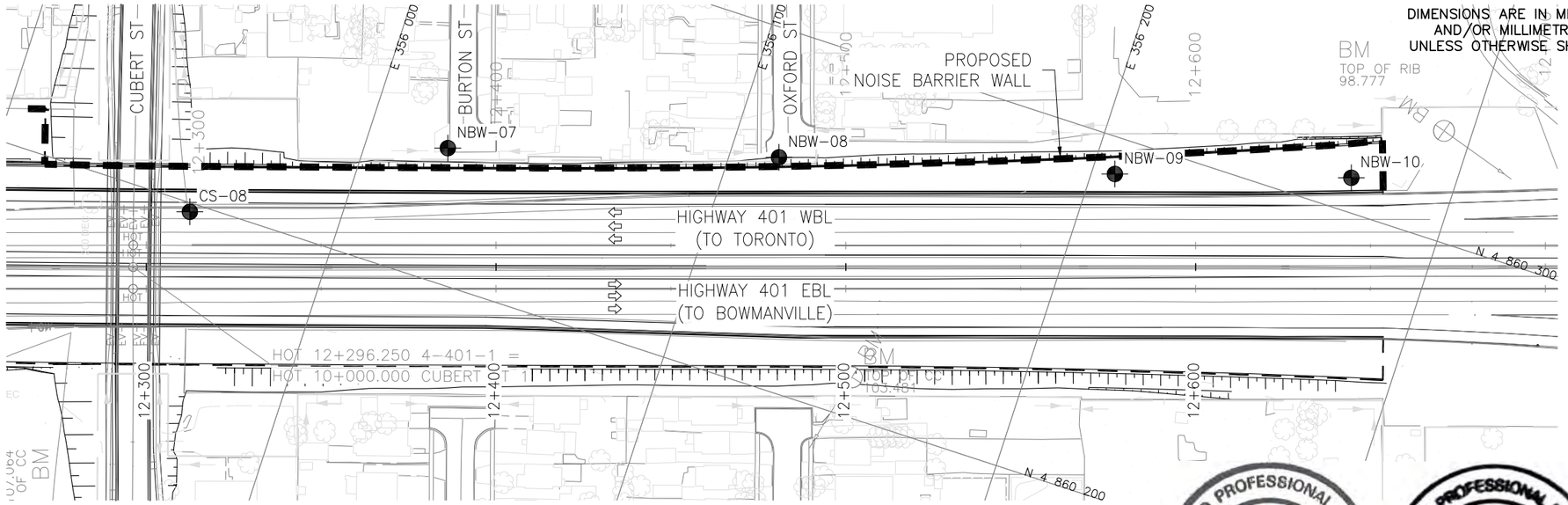
APPENDIX A

Drawing 1 - Borehole Locations and Soil Strata

MINISTRY OF TRANSPORTATION, ONTARIO

METRIC

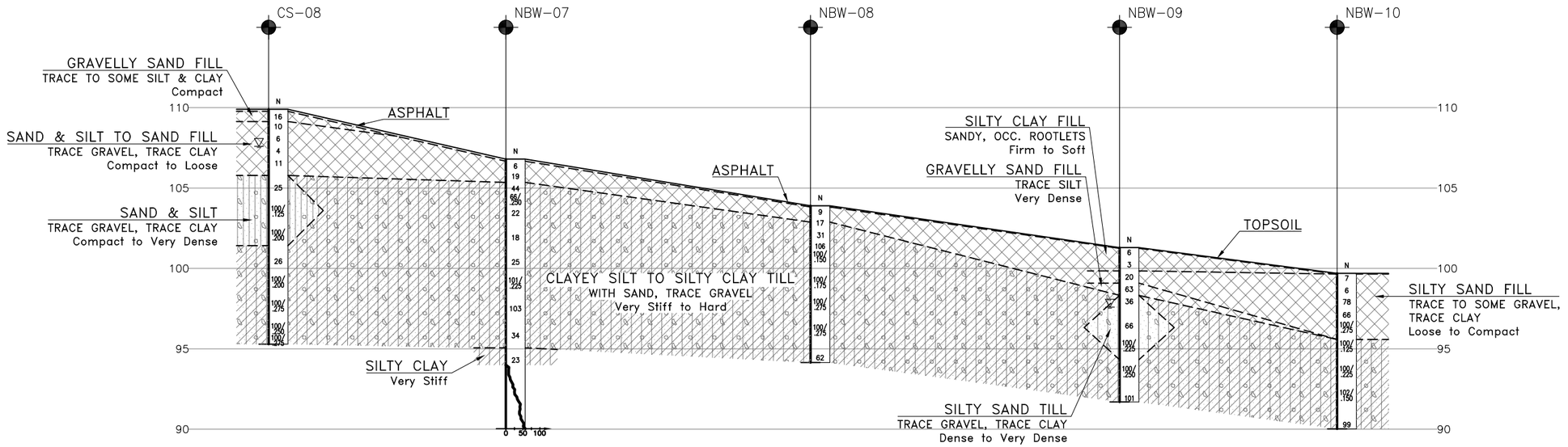
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN



PLAN

30 0 30 60m

SCALE 1:1500



PROFILE ALONG PROP. NOISE BARRIER WALL

30 0 30 60m H 1:1500

6 0 6 12m V 1:300

LICENSED PROFESSIONAL ENGINEER
P. K. CHATTERJI
2024/07/26
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
S. PANG
35314509
2024/07/26
PROVINCE OF ONTARIO

CONT No
WP No

SHEET

NOISE BARRIER WALL
NORTHEAST SIDE OF CUBERT ST. AND HIGHWAY 401 OVERPASS
BOREHOLE LOCATIONS AND SOIL STRATA

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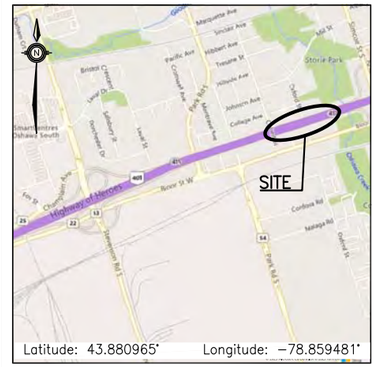

KEYPLAN

	LEGEND
●	Borehole
⊕	Borehole and Cone
N	Blows /0.3m (Std Pen Test, 475J/blow)
CONE	Blows /0.3m (60° Cone, 475J/blow)
PH	Pressure, Hydraulic
▽	Water Level Upon Completion of Drilling
▼	Water Level in Monitoring Well/Piezometer
	Monitoring Well/Piezometer Screen
90%	Rock Quality Designation (RQD)
A/R	Auger Refusal

NO	ELEVATION	NORTHING	EASTING
CS-08	109.9	4 860 197.5	355 958.4
NBW-07	106.8	4 860 237.7	356 022.9
NBW-08	103.9	4 860 264.5	356 113.7
NBW-09	101.3	4 860 289.7	356 206.5
NBW-10	99.7	4 860 309.7	356 271.1

-NOTES-

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

GEOCRES No. 30M15-351

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN	RPR	CHK	SKP	CODE	LOAD
DRAWN	AN	CHK	RPR	SITE	STRUCT

DATE JUL 2024
DWG 1

FILENAME: H:\Drafting\30000\30915\TES-30915-PLPR-NE CUBERT ST NBW.dwg
PLOTDATE: 8/8/2024 2:26 PM

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APPENDIX B

Record of Boreholes - Current 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

C_{pen} 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

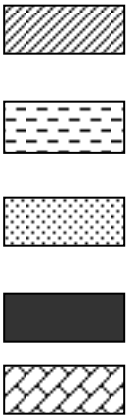
MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well-graded gravels or gravel-sand mixtures, little or no fines.
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines.
		GM	Silty gravels, gravel-sand-silt mixtures.
		GC	Clayey gravels, 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

ROCK WEATHERING CLASSIFICATION

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

SYMBOLS



CLAYSTONE

SILTSTONE

SANDSTONE

COAL

Bedrock (general)

DISCONTINUITY SPACING

Bedding	Bedding Plane Spacing
Very thickly bedded	Greater than 2m
Thickly bedded	0.6 to 2m
Medium bedded	0.2 to 0.6m
Thinly bedded	60mm to 0.2m
Very thinly bedded	20 to 60mm
Laminated	6 to 20mm
Thinly Laminated	Less than 6mm

TERMS

Total Core Recovery: (TCR)	Core recovered as a percentage of total core run length.
Solid Core Recovery: (SCR)	Percent Ratio of solid core of full cylindrical shape recovered. Expressed with respect to the total length of core run.
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.
Uniaxial Compressive Strength (UCS)	Axial stress required to break the specimen
Fracture Index: (FI)	Frequency of natural fractures per 0.3m of core run.

STRENGTH CLASSIFICATION

Rock Strength	Approximate Uniaxial Compressive Strength (MPa)	(psi)	Field Estimation of Hardness*
Extremely Strong	Greater than 250	Greater than 36,000	Specimen can only be chipped with a geological hammer
Very Strong	100-250	15,000 to 36,000	Requires many blows of geological hammer to break
Strong	50-100	7,500 to 15,000	Requires more than one blow of geological hammer to break
Medium Strong	25.0 to 50.0	3,500 to 7,500	Breaks under single blow of geological hammer.
Weak	5.0 to 25.0	750 to 3,500	Can be peeled by a pocket knife with difficulty
Very Weak	1.0 to 5.0	150 to 750	Can be peeled by a pocket knife, crumbles under firm blows of geological pick.
Extremely Weak (Rock)	0.25 to 1.0	35 to 150	Indented by thumbnail

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RECORD OF BOREHOLE No NBW-07 1 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 237.7 E 356 022.9 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880335 LONGITUDE -78.862577 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
106.8	GROUND SURFACE							20 40 60 80 100	20 40 60		
0.0	**ASPHALT:** (125mm)										
0.1	**SAND**, some gravel, some silt, trace to some clay Loose to Compact Brown Moist to Wet (FILL)		1	SS	6				○		
			2	SS	19		106		○		
105.4											
1.4	Clayey **SILT**, with sand, trace gravel Hard Brown Moist (TILL)		3	SS	44		105		○		8 44 32 16
			4	SS	66/ 0.250				○		
104.0							104				
2.8	Very Stiff		5	SS	22		103		○		
102.7											
4.1	Silty **CLAY**, with sand, trace gravel Very Stiff Grey Wet (TILL)		6	SS	18	▽	102		⊖		4 39 39 18
			7	SS	25		101		○		
99.6							100				
7.2	Hard		8	SS	101/ 0.225		99		○		
			9	SS	103		98		⊖		1 43 35 21
							97				

Continued Next Page

+ ^{3}, × ^{3}: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No NBW-07 2 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 237.7 E 356 022.9 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers/Dynamic Cone Penetration Test COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880335 LONGITUDE -78.862577 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued From Previous Page							20 40 60 80 100	20 40 60		
	Silty **CLAY**, with sand, trace gravel Hard Grey Wet (TILL)						96		○		
			10	SS	34						
95.1							95				
11.7	Silty **CLAY** Very Stiff Grey Wet										
			11	SS	23				⊢●⊣		0 0 39 61
94.0							94				
12.8	End of sampling and start of DCPT at 12.8m						93				
							92				
							91				
90.0											
16.8	END OF BOREHOLE AT 16.8m. WATER LEVEL IN OPEN BOREHOLE AT 5.2m DEPTH UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS FROM 16.8m TO 0.2m, THEN ASPHALT COLD PATCH TO GROUND SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No NBW-08 1 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 264.5 E 356 113.7 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.04 - 2023.07.04 LATITUDE 43.880570 LONGITUDE -78.861444 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa (○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
103.9	GROUND SURFACE										
0.0 / 0.1	**ASPHALT:** (75mm)										
	SAND, some gravel, some silt, trace clay Loose Brown Moist (FILL)		1	SS	9						
102.9 / 1.0	Silty **CLAY**, with sand, trace gravel Very Stiff to Hard Brown Moist (TILL)		2	SS	17		103				
			3	SS	31		102				
			4	SS	106						5 36 37 22
	Augers grinding at 2.9m Possible cobbles and boulders		5	SS	100/ 0.150		101				
			6	SS	100/ 0.175		99				
			7	SS	100/ 0.275		98				
			8	SS	100/ 0.275		96				3 37 36 24
			9	SS	62		95				
94.1 / 9.8	END OF BOREHOLE AT 9.8m.										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 ⊕ 5 / 10 (%) STRAIN AT FAILURE

Ministry of Transportation
Ontario

THURBER

RECORD OF BOREHOLE No NBW-08 2 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 264.5 E 356 113.7 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.04 - 2023.07.04 LATITUDE 43.880570 LONGITUDE -78.861444 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS FROM 9.8m TO 0.2m, THEN ASPHALT COLD PATCH TO GROUND SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

15 (20, 10) 5 (%) STRAIN AT FAILURE

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RECORD OF BOREHOLE No NBW-09 1 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 289.7 E 356 206.5 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880790 LONGITUDE -78.860287 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
101.3	GROUND SURFACE										
0.0	**TOPSOIL:** (50mm)										
0.0	Silty **CLAY**, sandy, occasional rootlets Firm to Soft Brown to Grey Wet (FILL)		1	SS	6		101				
			2	SS	3						0 24 43 33
99.9							100				
1.4	Silty **SAND**, trace to some gravel, trace clay Compact Brown Wet		3	SS	20						
99.1	(FILL)						99				
2.2	Gravelly **SAND**, trace silt Very Dense Brown Wet		4	SS	63						
98.3	(FILL)						98				
3.0	Silty **SAND**, trace gravel, trace clay Dense to Very Dense Brown Wet (TILL)		5	SS	36	▽					6 62 27 5
	Occasional oxidized stains and sand pockets		6	SS	66		97				
							96				
			7	SS	100/ 0.225		95				
94.3											
7.0	Clayey **SILT**, with sand, trace gravel Hard Brown Moist (TILL)						94				
			8	SS	100/ 0.250		93				
							92				
91.7			9	SS	101						7 49 31 13
9.6	END OF BOREHOLE AT 9.6m.										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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Ontario

THURBER

RECORD OF BOREHOLE No NBW-09 2 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 289.7 E 356 206.5 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880790 LONGITUDE -78.860287 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						
	Continued From Previous Page										
	WATER LEVEL IN OPEN BOREHOLE AT 3.7m DEPTH UPON COMPLETION OF DRILLING. BOREHOLE CAVED-IN TO 5.2m UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG FROM 5.2m TO GROUND SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \quad 5}$ (%) STRAIN AT FAILURE
$\frac{}{10}$

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RECORD OF BOREHOLE No NBW-10 1 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 309.7 E 356 271.1 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880965 LONGITUDE -78.859481 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
99.7	GROUND SURFACE										
0.0	**TOPSOIL:** (50mm)										
0.0	Silty **SAND**, some clay, trace gravel Loose Brown Moist to Wet (FILL)		1	SS	7				○		
	Occasional red brick pieces		2	SS	6		99		○		7 53 28 12
98.3											
1.4	Very Dense		3	SS	78		98		○		
	Occasional red brick pieces		4	SS	66		97		○		
	Occasional oxidized stains		5	SS	100/ 0.275		96		○		
95.6											
4.1	Clayey **SILT**, with sand, trace gravel Hard Grey Moist (TILL)		6	SS	100/ 0.125		95		○		1 43 39 17
			7	SS	100/ 0.225		94		○		
							93				
			8	SS	102/ 0.150		92		○		0 42 38 20
							91				
			9	SS	99				○		
90.0											
9.7	END OF BOREHOLE AT 9.7m.										

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No NBW-10 2 OF 2 METRIC

WP# 2555-17-00 LOCATION Noise Barrier Wall - NE Cubert St.; MTM83-10: N 4 860 309.7 E 356 271.1 ORIGINATED BY SG

DIST Central HWY 401 BOREHOLE TYPE Solid Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2023.07.05 - 2023.07.05 LATITUDE 43.880965 LONGITUDE -78.859481 CHECKED BY RPR

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES						GR SA SI CL
	Continued From Previous Page										
	BOREHOLE DRY UPON COMPLETION OF DRILLING. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG AND AUGER CUTTINGS TO GROUND SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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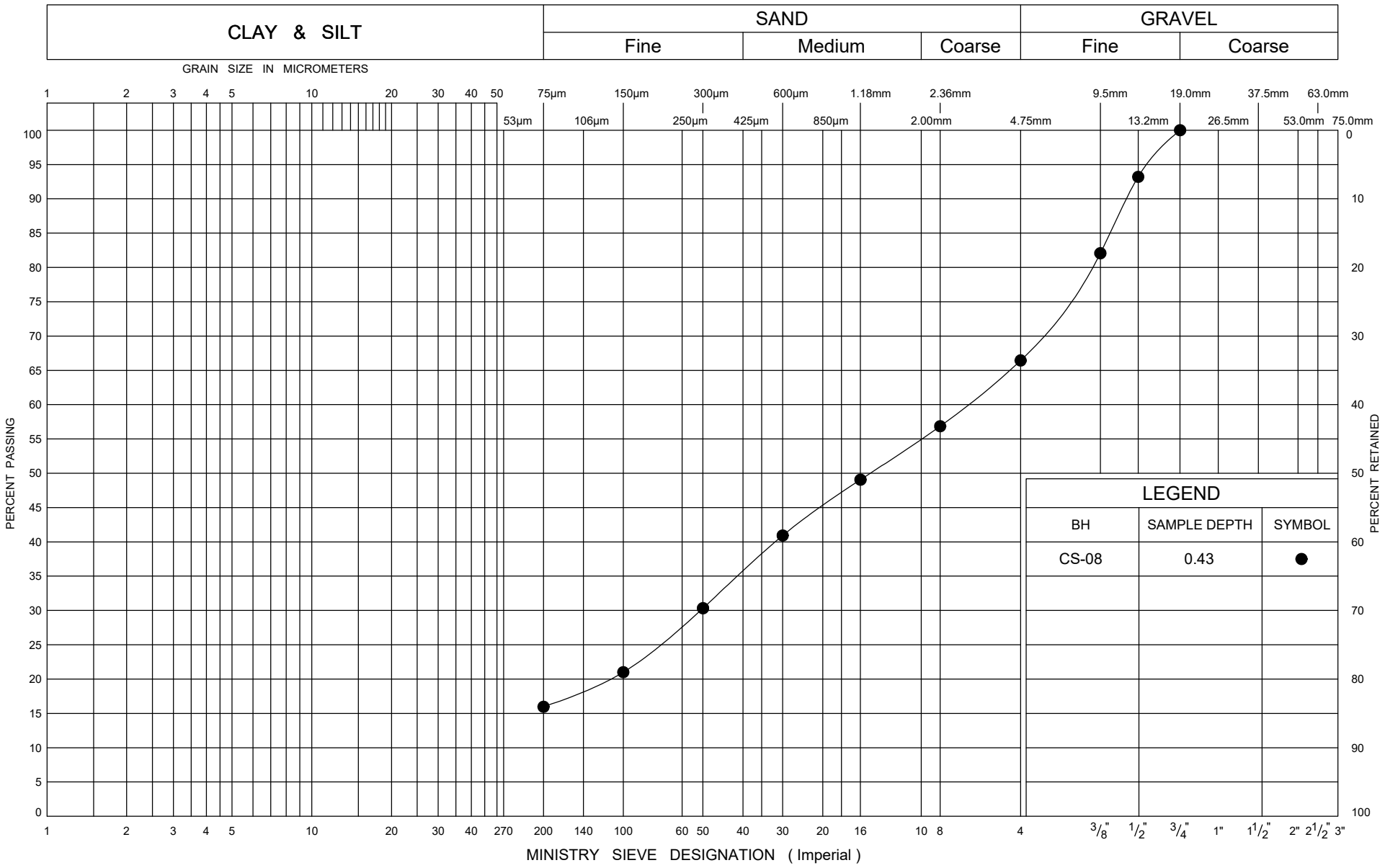
APPENDIX C

Geotechnical Laboratory Test Results



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GRAIN SIZE DISTRIBUTION

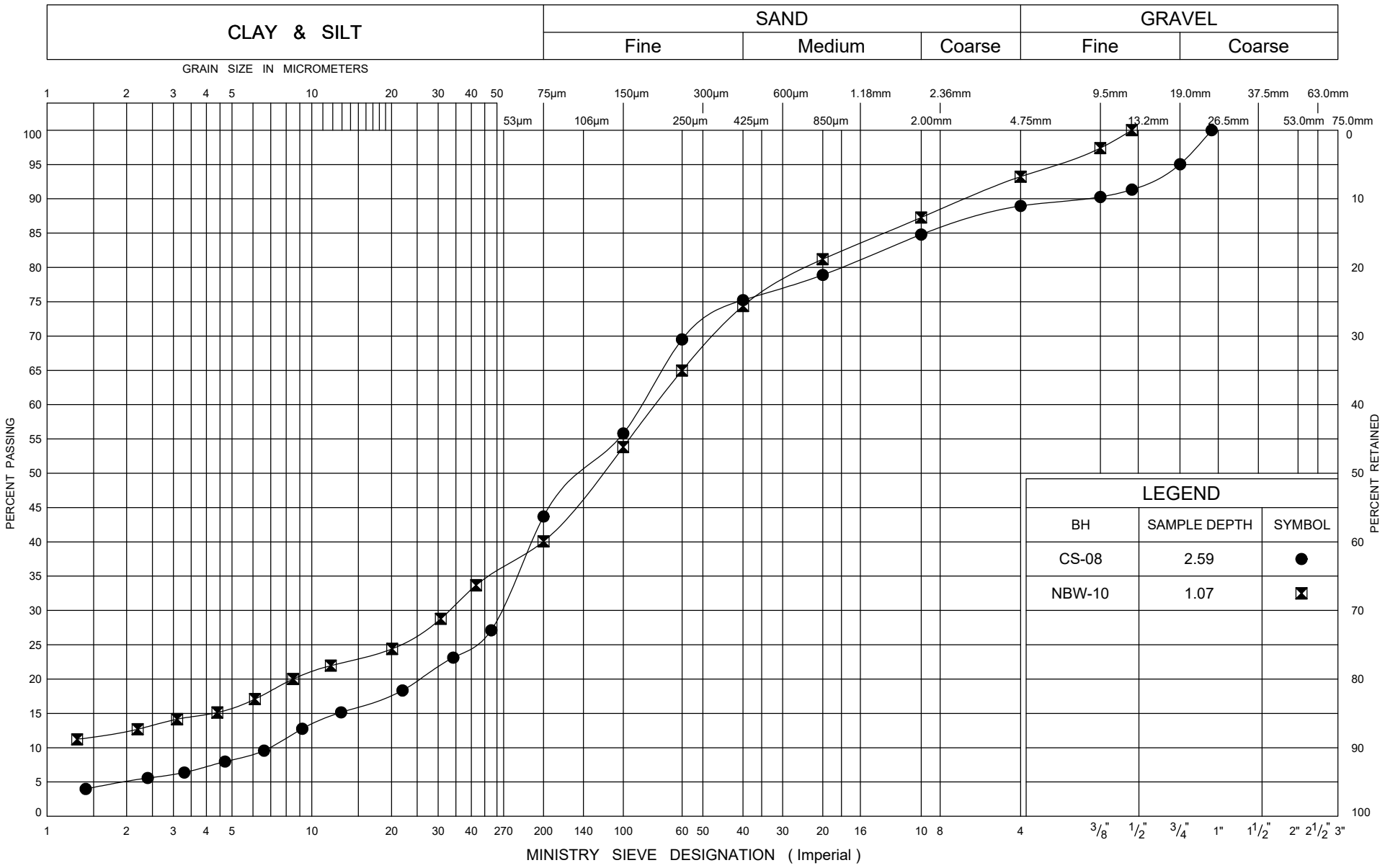
Granular FILL (Gravelly SAND)

FIG No C1

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 12/15/23



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GRAIN SIZE DISTRIBUTION

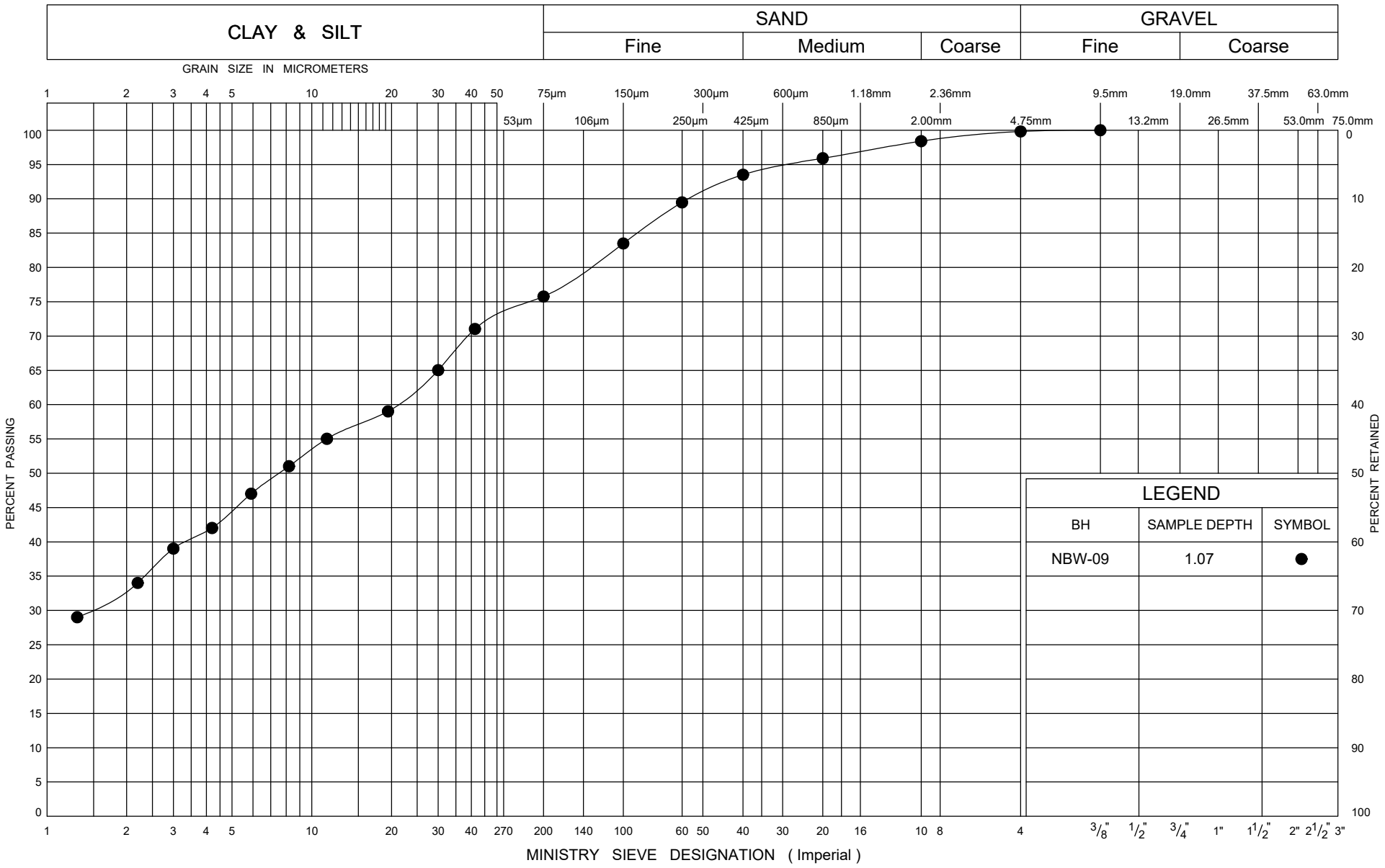
Silty SAND FILL/SAND and SILT FILL

FIG No C2

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 11/21/23



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GRAIN SIZE DISTRIBUTION

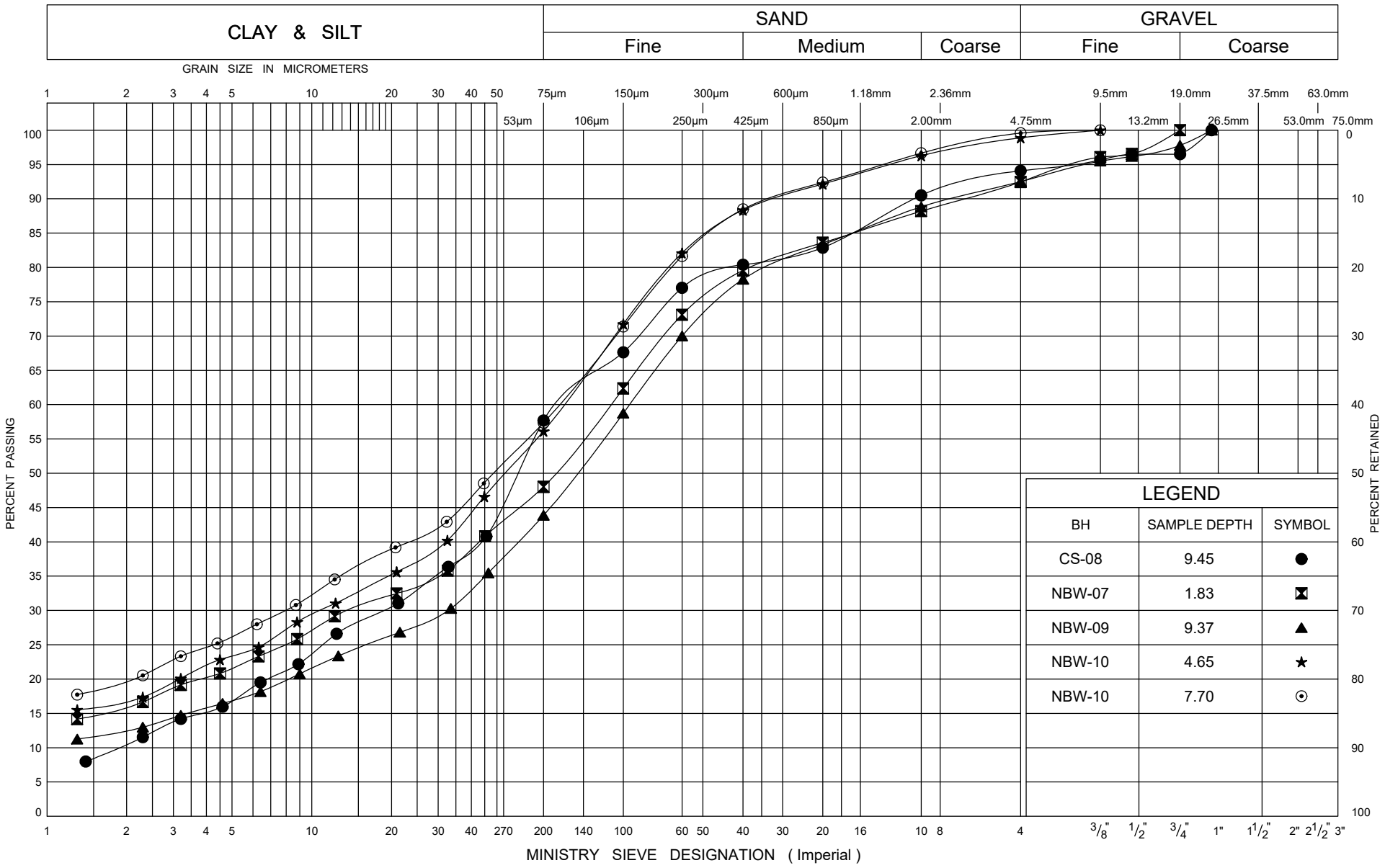
Silty CLAY FILL

FIG No C3

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 11/21/23



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GRAIN SIZE DISTRIBUTION

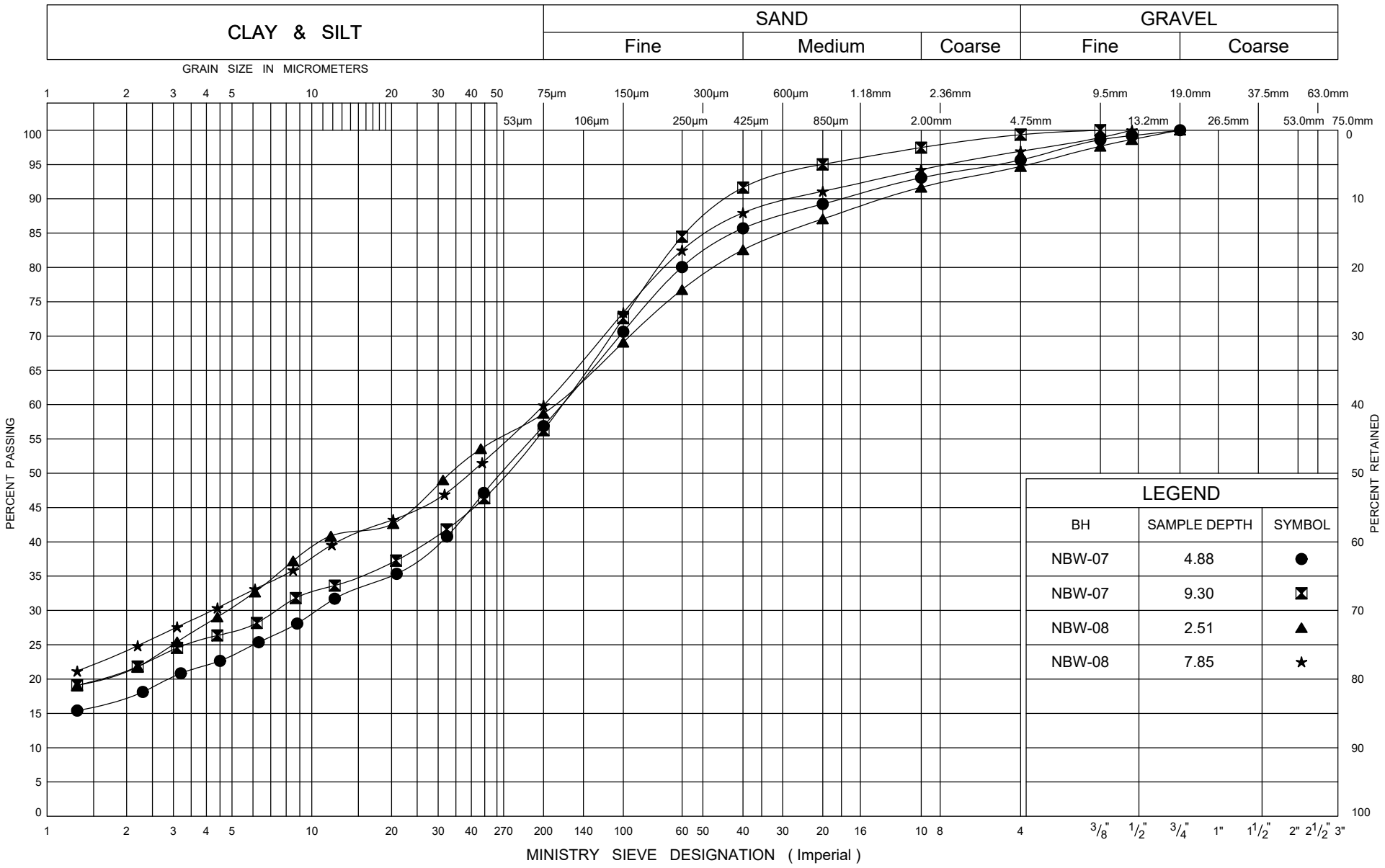
Clayey SILT TILL

FIG No C4

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 12/15/23



ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 12/15/23

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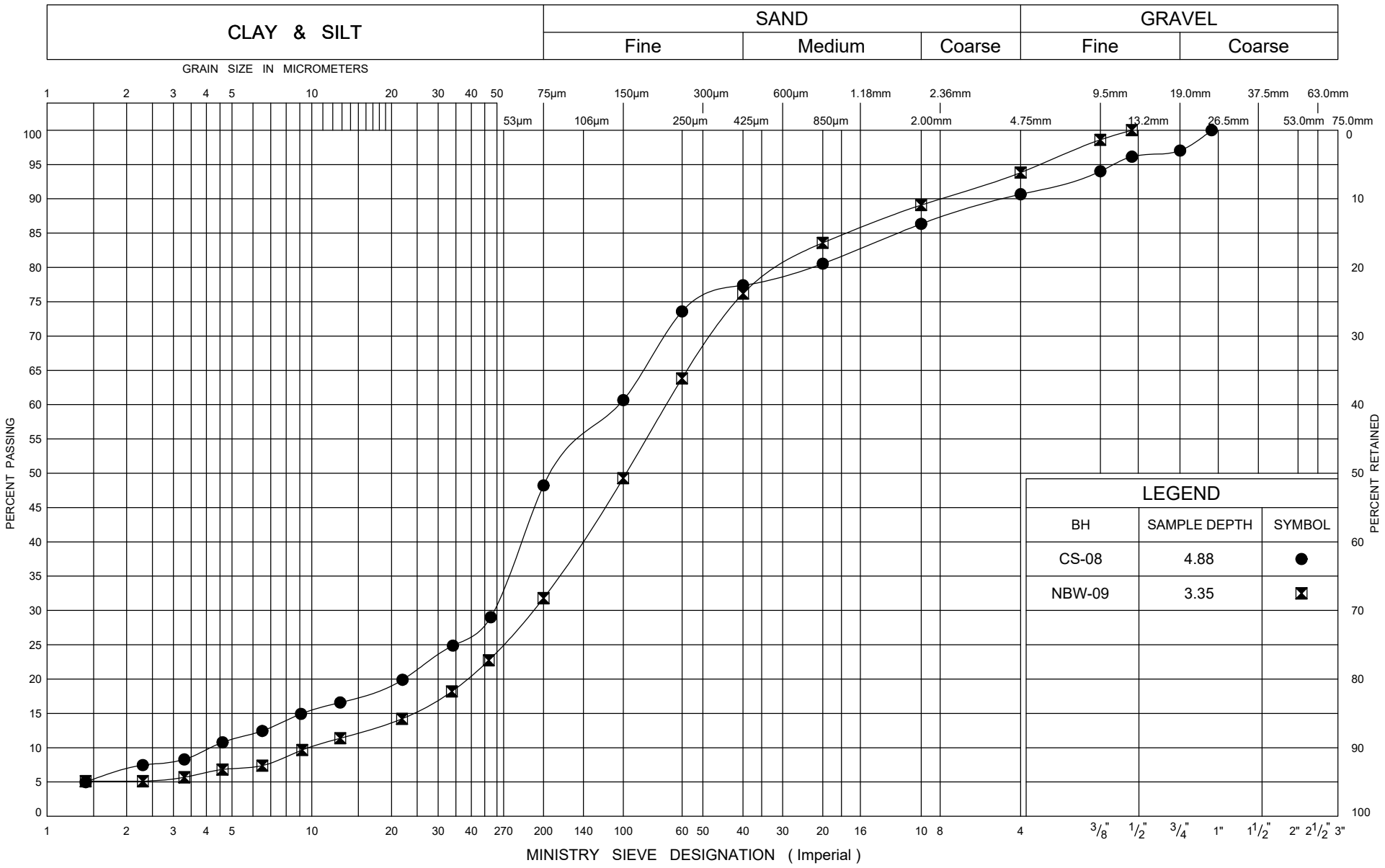
GRAIN SIZE DISTRIBUTION

Silty CLAY TILL

FIG No C5

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.



ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 11/17/23

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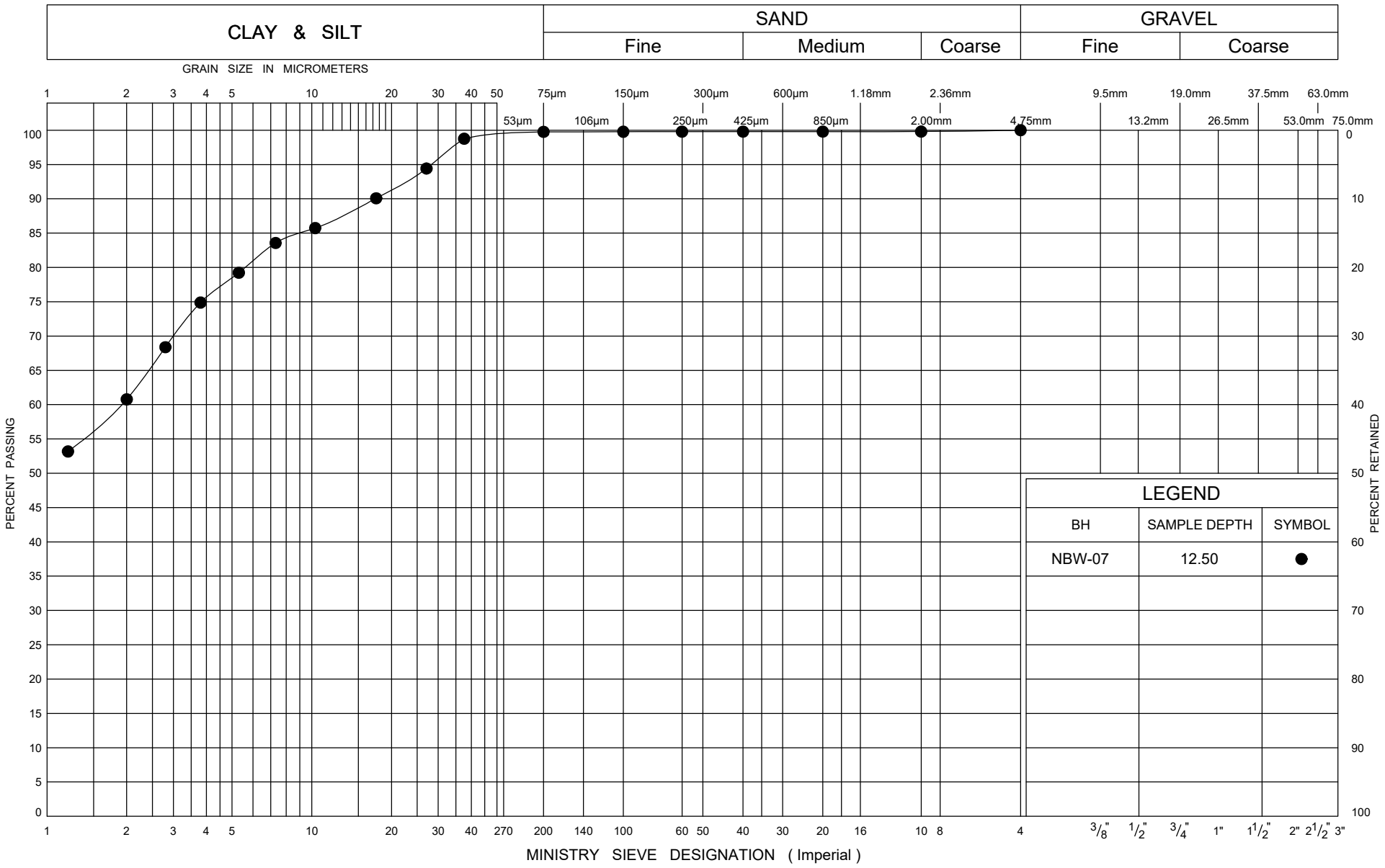
GRAIN SIZE DISTRIBUTION

Silty SAND TILL/SAND and SILT TILL

FIG No C6

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.



ONTARIO MOT GRAIN SIZE 3 MTO-30915.GPJ ONTARIO MOT.GDT 11/17/23

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GRAIN SIZE DISTRIBUTION

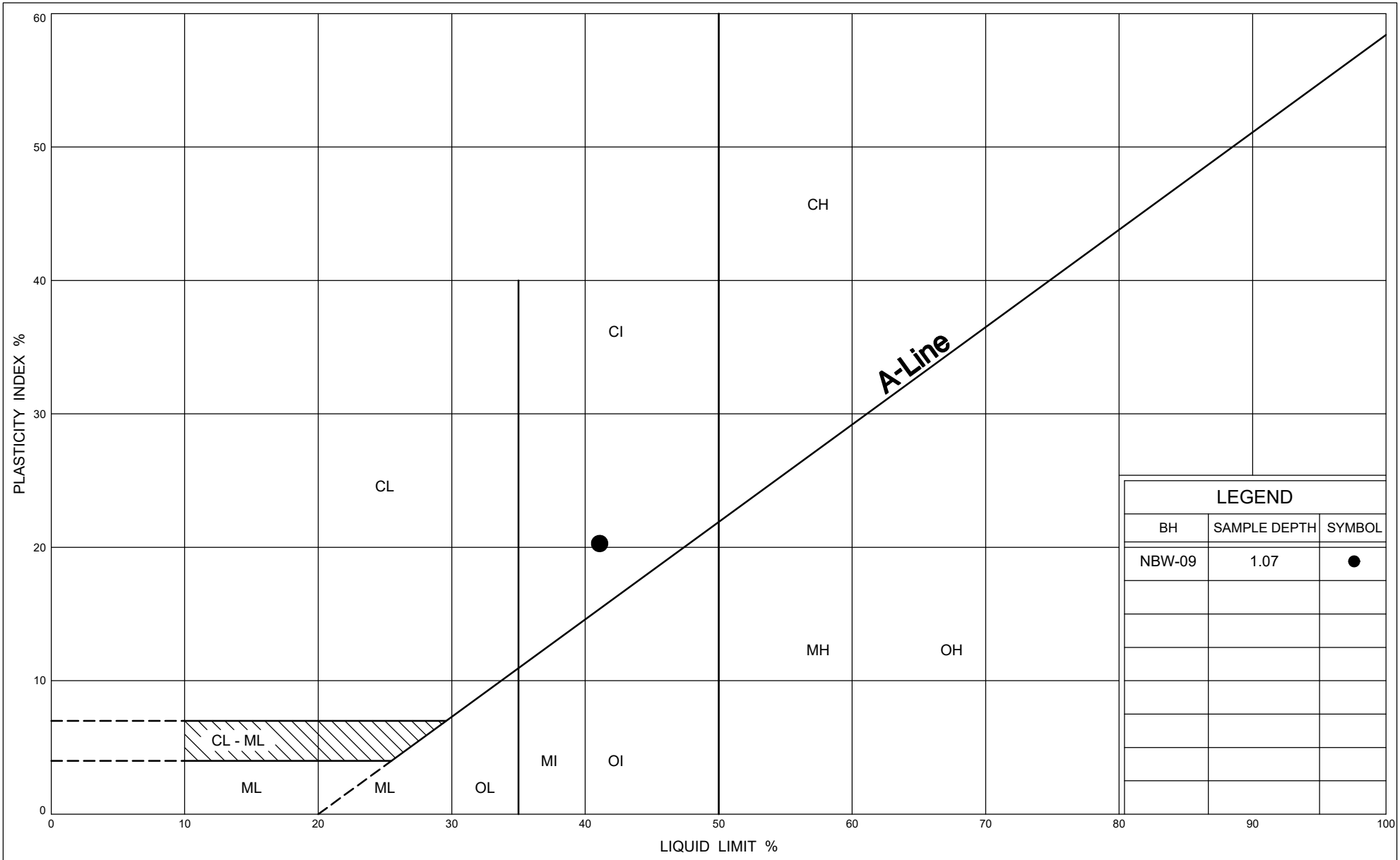
Silty CLAY

FIG No C7

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 2 MTO-30915.GPJ ONTARIO MOT.GDT 11/21/23

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PLASTICITY CHART

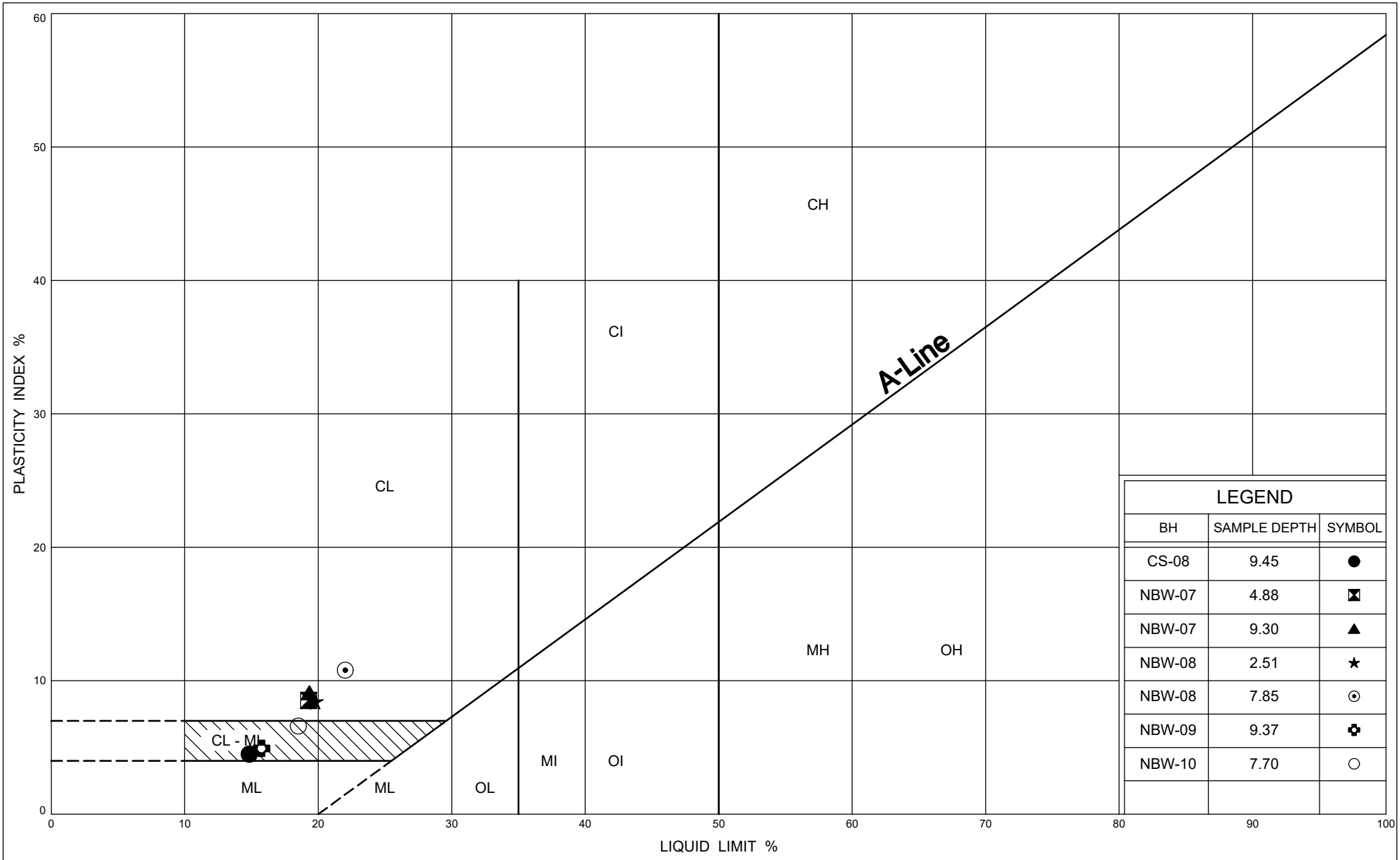
Silty CLAY FILL

FIG No C8

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

Oct 75, FF - S - 21



ONTARIO MOT PLASTICITY CHART 2 MTO-30915.GPJ ONTARIO MOT.GDT 11/21/23

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PLASTICITY CHART

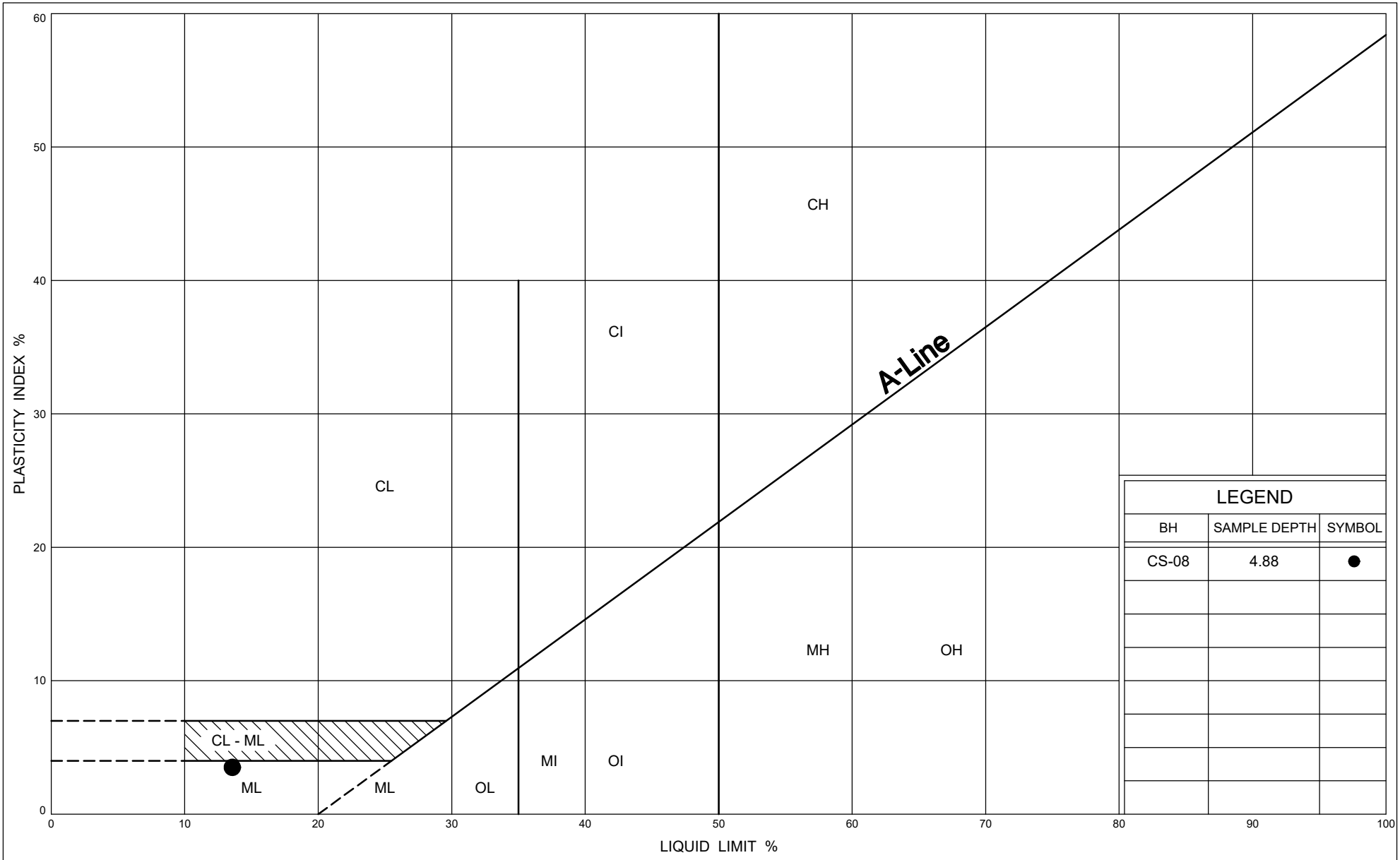
Clayey SILT TILL to Silty CLAY TILL

FIG No C9

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

Oct 75, FF - S - 21



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PLASTICITY CHART

SAND and SILT TILL

FIG No C10

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

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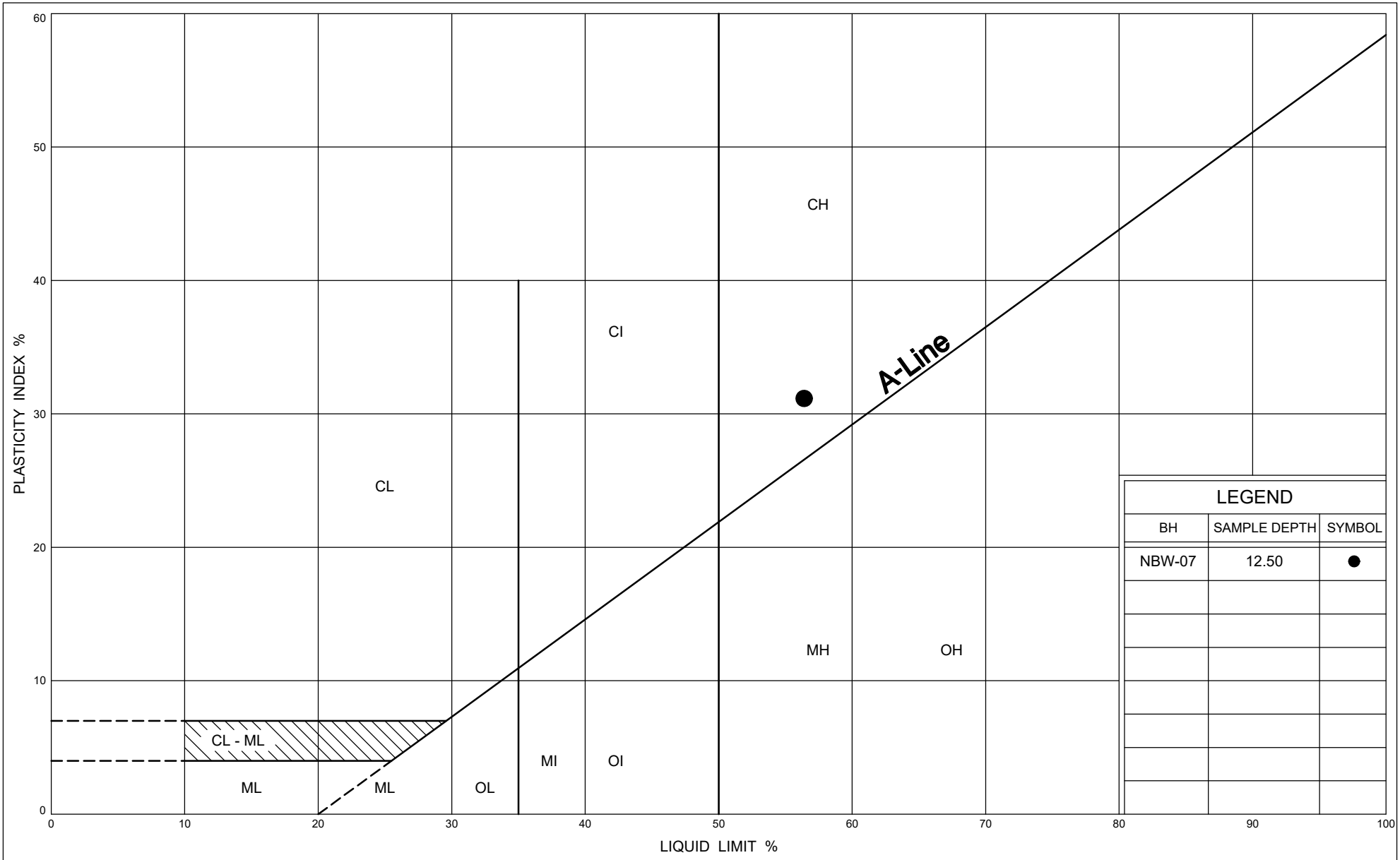

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PLASTICITY CHART

Silty CLAY

FIG No C11

WP# 2555-17-00

Noise Barrier Wall - NE Cubert St.

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APPENDIX D

Record of Boreholes - Previous Investigation

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RECORD OF BOREHOLE No CS-08 1 OF 2 METRIC

WP# 2555-17-00 LOCATION Cubert Street Bridge: MTM83-10; N 4 860 197.5 E 355 958.4 ORIGINATED BY SG

DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2022.10.19 - 2022.10.20 LATITUDE 43.879978 LONGITUDE -78.863383 CHECKED BY RPR

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
109.9	GROUND SURFACE										
0.0	**ASPHALT:** (130mm)										
0.1	Gravelly **SAND**, trace to some silt and clay Compact Brown		1	SS	16				○		34 50 16 (SI+CL)
109.1											
0.8	Moist (FILL)		2	SS	10		109		○		
	SAND and **SILT** trace gravel, trace clay Compact to Loose Brown Moist (FILL)		3	SS	6		108		○		
	Occasional rootlets and organics between 1.4m and 3.0m		4	SS	4	▽	107		○		11 45 39 5
			5	SS	11		106		○		
105.8											
4.1	**SAND** and **SILT**, trace gravel, trace clay Compact to Very Dense Grey Moist (TILL)		6	SS	25		105		○		9 42 41 8
			7	SS	100/ .125		104		○		
			8	SS	100/ .200		103				
101.4							102				
8.5	Clayey **SILT**, with sand, trace gravel Very Stiff Grey Wet (TILL)		9	SS	26		101		○		6 36 47 11
							100				

Continued Next Page

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

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THURBER

RECORD OF BOREHOLE No CS-08 2 OF 2 METRIC

WP# 2555-17-00 LOCATION Cubert Street Bridge: MTM83-10; N 4 860 197.5 E 355 958.4 ORIGINATED BY SG

DIST HWY 401 BOREHOLE TYPE Hollow Stem Augers COMPILED BY AN

DATUM Geodetic DATE 2022.10.19 - 2022.10.20 LATITUDE 43.879978 LONGITUDE -78.863383 CHECKED BY RPR

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	Continued From Previous Page										
	Clayey **SILT**, with sand, trace gravel Hard Grey Wet (TILL)										
			10	SS	100/.200		99		○		
			11	SS	100/.275		98		○		
			12	SS	100/.250		97		○		
95.3			13	SS	100/.275		96		○		
14.6	END OF BOREHOLE AT 14.6m UPON AUGER REFUSAL. WATER LEVEL IN BOREHOLE AT ABOUT 2.3m DEPTH UPON COMPLETION. BOREHOLE BACKFILLED WITH BENTONITE HOLEPLUG TO 0.3m, THEN CONCRETE TO 0.2m, THEN ASPHALT TO GROUND SURFACE.										

$+^3$, $\times^3$: Numbers refer to Sensitivity

$\frac{20}{15 \oplus 5}$ (%) STRAIN AT FAILURE
$\frac{}{10}$

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APPENDIX E

Selected Site Photographs

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Photo 1- North Side of Highway 401 and Cubert St. Overpass
Date: July 2023

Photo 2- North Side of Highway 401 WBL and Cubert St. Overpass