



REPORT

Foundation Investigation and Design Report

Median Storm Sewers

Highway 400 Widening from Langstaff Road to Major Mackenzie Drive

Vaughan, Ontario

GWP 2836-02-00

Submitted to:

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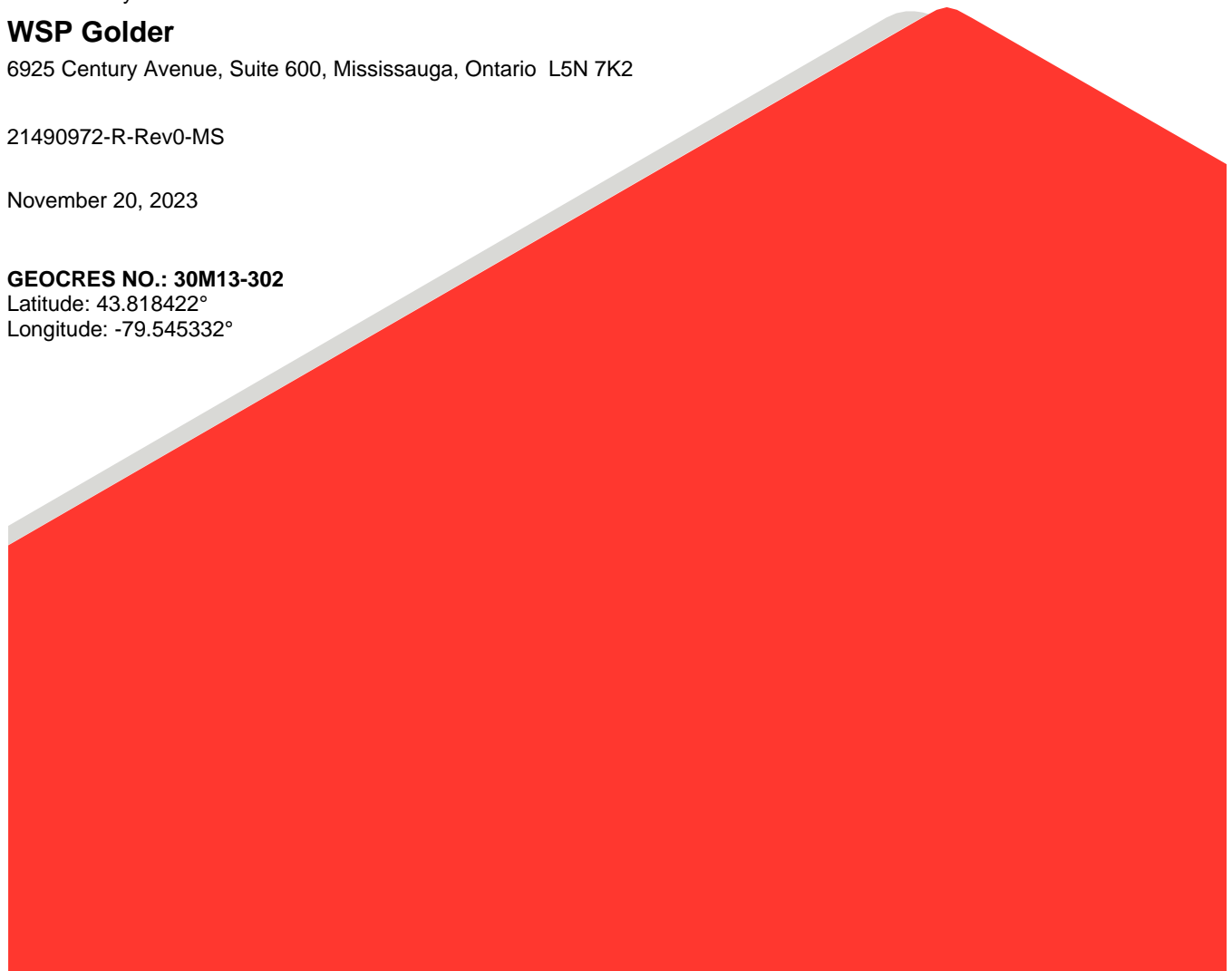
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GEOCRES NO.: 30M13-302

Latitude: 43.818422°

Longitude: -79.545332°



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Table of Contents

PART A – FOUNDATION INVESTIGATION REPORT

1.0 INTRODUCTION	1
2.0 SITE DESCRIPTION	1
3.0 INVESTIGATION PROCEDURES	1
3.1 Previous Investigations	1
3.2 Current Investigation	2
4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS	5
4.1 Regional Geology	5
4.2 Subsurface Conditions	5
4.2.1 Asphalt and Concrete	5
4.2.2 Granular Fill (Pavement Structure)	5
4.2.3 CLAYEY SILT (CL) to SILTY CLAY (CI) (FILL)	6
4.2.4 Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Upper Deposit	6
4.2.5 SILT (ML) to SAND (SP) and Silt to SILTY SAND (SM)	7
4.2.6 Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Lower Deposit	7
4.3 Groundwater Conditions	8
4.4 Analytical Testing	9
5.0 CLOSURE	10

PART B – FOUNDATION DESIGN REPORT

6.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS	11
6.1 General	11
6.2 Cut-and-Cover Construction	11
6.2.1 Founding Depth and Subgrade Conditions	11
6.2.2 Pipe Bedding, Cover, and Trench Backfill	12
6.2.2.1 Bedding and Cover	12
6.2.2.2 Trench Backfill	12
6.3 Construction Considerations	13

6.3.1	Excavations.....	13
6.3.2	Temporary Excavation Support Systems	13
6.3.2.1	Trench Boxes.....	14
6.3.2.2	Engineered Support Systems	15
6.3.3	Groundwater Control.....	15
6.3.4	Corrosion Assessment and Protection	15
7.0	CLOSURE.....	16

REFERENCES

DRAWINGS

Drawings 1 to 5 Borehole Locations and Soil Strata

APPENDICES

APPENDIX A – Previous Borehole Records (GEOCREs No. 30M13-142 and 30M13-143)

Record of Boreholes BH2 to BH9 (renamed herein 142-2 to 142-9, from GEOCREs 30M13-142)
Record of Boreholes BH4 and BH5 (renamed herein as 143-4 and 143-5, from GEOCREs 30M13-143)

APPENDIX B – Current Borehole Records

Lists of Symbols and Abbreviations
Record of Boreholes MS-1 to MS-31

APPENDIX C – Geotechnical Laboratory Test Results

Figure C-1	Grain Size Distribution – Granular Fill (Pavement Structure)
Figure C-2A and 2B	Grain Size Distribution – CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)
Figure C-3A to 3C	Plasticity Chart – CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)
Figure C-4A to 4D	Grain Size Distribution – Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Upper
Figure C-5A to 5C	Plasticity Chart – Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Upper
Figure C-6A to 6D	Grain Size Distribution – Non-Cohesive Deposits – SILT (ML), SILT (ML) and Sand, SILTY SAND (SM)
Figure C-7	Grain Size Distribution – Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Lower
Figure C-8	Plasticity Chart – Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Lower

APPENDIX D – Analytical Laboratory Test Results

Certificate of Analysis Report No. R7200498 (Boreholes MS-1 to MS-23)
Certificate of Analysis Report No. R7641570 (Boreholes MS-24 to MS-31)

APPENDIX E – Notice to Contractor

PART A

**Foundation Investigation Report
Median Storm Sewers
Highway 400 Widening
Langstaff Road to Major Mackenzie Drive
Vaughan, Ontario
MTO GWP 2836-02-00**

1.0 INTRODUCTION

WSP Golder (formerly Golder Associates Ltd., now a member of WSP Canada Inc.) has been retained by Parsons Inc. (Parsons) on behalf of the Ministry of Transportation, Ontario (MTO) to provide foundation engineering services for the detail design of the widening of Highway 400, extending from 1.3 km south of the Langstaff Road interchange to 1.5 km north of Major Mackenzie Drive (a length of approximately 7.3 km) in the City of Vaughan, Ontario. As part of the Highway 400 widening and rehabilitation, various median storm sewers and one mainline storm sewer are to be constructed across the project limits.

This report presents the results of the foundation investigation for the proposed median / mainline storm sewers to be constructed along Highway 400. The purpose of this investigation is to establish the subsurface soil conditions at the location of the proposed sewers, through borehole drilling and laboratory testing of selected soil samples.

This report was developed based on information from the current foundation investigation, supplemented with relevant information from previous foundation investigations carried out within the project limits. The results of the previous foundation investigations are presented in the following reports:

- **GEOCRES Report No. 30M13-142:** “Foundation Investigation Report for High Mast Lighting, Highway 400 from north of Langstaff Road northerly to just south of Major Mackenzie Drive, Station 15+000 – 17+000, and Rutherford Road Interchange Area, W.P 475-91-00”, by Strata Engineering Corp., dated December 1998.
- **GEOCRES No. 30M13-143:** “Foundation Investigation Report for Major Mackenzie Drive Bridge Replacement, Highway 400, W.P. 474-91-00, Site 37-128, Central Region”, by MTO, dated July 14, 2000.

2.0 SITE DESCRIPTION

The proposed storm sewers extend along Highway 400 from the Major Mackenzie Drive to Langstaff Road interchanges. This section of Highway 400 is currently an eight-lane, urban freeway with paved shoulders divided by a concrete median barrier.

Throughout the project limits, Highway 400 has generally been constructed near the existing ground surface, with no significant sections of cut or high fill; the crossing roads (Langstaff Road, Bass Pro Mills Drive, Rutherford Road and Major Mackenzie Drive) and associated interchange ramps throughout the project limits have been constructed on embankment fill adjacent to the Highway 400 corridor. The Highway 400 grade along the proposed storm sewers varies from approximately Elevation 204 m near the south limit to approximately Elevation 230 m near Major Mackenzie Drive, generally rising northward, as shown on the profiles on Drawings 1 to 5. The surrounding terrain is generally flat to gently undulating on both sides of Highway 400. Land use is primarily commercial and recreational.

3.0 INVESTIGATION PROCEDURES

3.1 Previous Investigations

Previous foundation investigations were carried out in the vicinity of the proposed sewers in 1998 by Strata Engineering Corp. (GEOCRES No. 30M13-142) and in 2000 by MTO (GEOCRES No. 30M13-143). Eight boreholes from GEOCRES No. 30M13-142 (designated as Boreholes 142-2 to 142-9) and two boreholes from GEOCRES No. 30M13-143 (designated as Boreholes 143-4 to 143-5) are located along the existing highway median and are considered relevant to the design and future construction of the median sewers. The borehole records from these previous investigations are provided in Appendix A.

The borehole locations, ground surface elevations, and borehole depths associated with these investigations are summarized in the table below and provided on Drawings 1 to 5.

Borehole No.	Location (MTM NAD 83)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m) (Latitude, °)	Easting (m) (Longitude, °)		
142-2	4,853,310 (43.819755)	301,141 (-79.545490)	211.1	9.6
142-3	4,853,609 (43.822446)	301,120 (-79.545753)	215.9	8.1
142-4	4,853,909 (43.825147)	301,099 (-79.546016)	222.4	8.1
142-5	4,854,606 (43.831420)	301,052 (-79.546605)	224.4	9.6
142-6	4,854,906 (43.834120)	301,030 (-79.546881)	223.0	7.7
142-7	4,855,205 (43.836811)	301,008 (-79.547157)	222.2	8.1
142-8	4,855,504 (43.839503)	300,986 (-79.547432)	224.5	8.1
142-9	4,855,804 (43.842203)	300,966 (-79.547683)	227.1	8.1
143-4	4,856,314 (43.846793)	300,895 (-79.548570)	229.8	14.2
143-5	4,856,349 (43.847108)	300,889 (-79.548645)	230.2	15.7

3.2 Current Investigation

The current investigation was carried out between June 1, 2022, and April 27, 2023, during which time a total of thirty-one boreholes were advanced across the project limits as follows:

- Twenty-three boreholes, designated as Boreholes MS-1 to MS-23 with numbers increasing from south to north, were advanced for the proposed median (Highway 400 core) sewer alignments as shown on Drawings 1 to 5.
- Four boreholes, designated as Boreholes MS-24 to MS-27, were advanced for the proposed mainline (Highway 400 core, northbound direction along the outside road shoulder) sewer alignment. This alignment extends north of the Rutherford Road underpass as shown on Drawing 4B.
- Four boreholes, designated as Boreholes MS-28 to MS-31, were advanced for the proposed median (Highway 400 collector, southbound direction) sewer alignment. This alignment extends across the Langstaff Road underpass as shown on Drawing 2B.

The boreholes were advanced using a truck-mounted CME 75 drill rig supplied and operated by 3D Drilling of Whitchurch-Stouffville, Ontario. The boreholes were advanced through the overburden using 156 mm diameter solid stem augers or 168 mm outside diameter hollow stem augers. Soil samples were obtained at 0.75 m and 1.5 m intervals of depth, using a 50 mm outside diameter split spoon sampler driven by an automatic hammer in accordance with Standard Penetration Test (SPT) procedures. The split-spoon samplers used in the investigation

limit the maximum particle size that can be sampled and tested to about 35 mm. Therefore, particles or objects that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions.

The groundwater conditions were noted in the boreholes during and upon completion of drilling and were backfilled with bentonite in accordance with Ontario Regulation 903 (Wells, as amended), and the ground surface restored to near original condition as practicable.

The field work was observed by members of WSP Golder's engineering and technical staff, who located the boreholes, arranged for the clearance of underground services, observed the drilling, sampling and in situ testing operations, and logged the boreholes. The samples were identified in the field, placed in appropriate containers, labelled, and transported to WSP Golder's Whitby laboratory where the samples underwent further visual examination. Geotechnical laboratory testing (water content, grain size distribution, and Atterberg limits) was carried out on select soil samples, in accordance with MTO and / or ASTM Standards, as appropriate. In addition, select soil samples were submitted to Bureau Veritas Laboratories of Mississauga, Ontario for analysis of select parameters to assess for the potential corrosion and to buried steel and deterioration of concrete.

The borehole locations are provided on Drawings 1 to 5 and the coordinates are also shown on the borehole records in Appendix B. Boreholes from the current investigation were surveyed by WSP Golder using a Trimble Geo 7x GPS unit. The locations are positioned relative to MTM NAD 83 northing and easting (Zone 10 CSRS CBNv6-2010.0) coordinates and the ground surface elevations are referenced to CGVD28 Geodetic datum benchmark. The borehole locations, including geographic coordinates, ground surface elevations, and borehole depths are summarized below.

Borehole No.	MTM NAD83 Northing (Latitude, °)	MTM NAD83 Easting (Longitude, °)	Ground Surface Elevation (m)	Borehole Depth (m)
MS-1	4,850,855.6 (43.797665)	301,515.2 (-79.540823)	204.2	6.7
MS-2	4,851,046.9 (43.799387)	301,482.0 (-79.541237)	204.9	6.7
MS-3	4,851,245.3 (43.801172)	301,447.9 (-79.541661)	205.7	6.7
MS-4	4,851,444.2 (43.802962)	301,413.8 (-79.542087)	206.4	6.7
MS-5	4,851,642.8 (43.804750)	301,380.0 (-79.542508)	207.2	6.7
MS-6	4,851,843.9 (43.806560)	301,343.3 (-79.542965)	207.5	6.7
MS-7	4,852,041.7 (43.808339)	301,311.8 (-79.543358)	206.8	6.7
MS-8	4,852,243.5 (43.810156)	301,276.9 (-79.543793)	206.9	6.7
MS-9	4,852,430.2 (43.811837)	301,245.1 (-79.544189)	207.7	6.7
MS-10	4,852,629.8 (43.813633)	301,211.1 (-79.544614)	208.4	6.7
MS-11	4,852,826.9 (43.815407)	301,179.4 (-79.545009)	209.1	6.7

Borehole No.	MTM NAD83 Northing (Latitude, °)	MTM NAD83 Easting (Longitude, °)	Ground Surface Elevation (m)	Borehole Depth (m)
MS-12	4,853,161.9 (43.818422)	301,153.6 (-79.545332)	210.2	6.7
MS-13	4,853,459.1 (43.821097)	301,133.3 (-79.545587)	211.8	6.7
MS-14	4,853,761.6 (43.823820)	301,112.5 (-79.545847)	218.6	6.7
MS-15	4,854,110.0 (43.826956)	301,079.5 (-79.546260)	223.6	6.7
MS-16	4,854,304.8 (43.828709)	301,066.1 (-79.546428)	224.3	6.7
MS-17	4,854,500.2 (43.830467)	301,052.9 (-79.546594)	223.7	6.7
MS-18	4,854,765.9 (43.832860)	301,034.5 (-79.546825)	222.4	6.7
MS-19	4,855,067.6 (43.835575)	301,013.6 (-79.547086)	220.9	6.7
MS-20	4,855,326.1 (43.837901)	300,995.9 (-79.547308)	221.9	6.7
MS-21	4,855,655.6 (43.840867)	300,973.3 (-79.547591)	224.9	6.7
MS-22	4,855,994.0 (43.843913)	300,941.2 (-79.547993)	227.1	6.7
MS-23	4,856,186.1 (43.845642)	300,912.1 (-79.548357)	227.9	6.7
MS-24	4,854,733.9 (43.832572)	301,062.5 (-79.546476)	223.7	6.7
MS-25	4,854,577.6 (43.831157)	301,075.7 (-79.546308)	224.4	6.7
MS-26	4,854,444.4 (43.829958)	301,085.3 (-79.546188)	225.1	6.7
MS-27	4,854,315.2 (43.828794)	301,095.9 (-79.546054)	225.2	6.7
MS-28	4,852,350.3 (43.811109)	301,223.3 (-79.544457)	207.7	6.7
MS-29	4,852,219.8 (43.809935)	301,246.0 (-79.544175)	207.1	6.7
MS-30	4,852,065.3 (43.808544)	301,272.2 (-79.543848)	206.9	6.7
MS-31	4,851,927.8 (43.807307)	301,296.7 (-79.543542)	207.4	6.7

4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

4.1 Regional Geology

As delineated in *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)¹, this section of Highway 400 lies within the region known as the Peel Plain and consists of level to undulating tracts of clayey glacial till soils, which are presumed to have been derived from moraines, interspersed with non-cohesive silts and sands from interstadial stages of Wisconsinan glaciation.

Bedrock at the site is mapped as the Dundas-Meaford shale, and occurs at depths of over 70 m.

4.2 Subsurface Conditions

The subsurface soil and groundwater conditions as encountered in the boreholes are presented on the borehole records in Appendices A and B for the previous and current investigations, respectively. *Method of Soil Classification, Abbreviations and Terms Used on Records of Boreholes and Test Pits* and *List of Symbols* sheets are provided in Appendix B to assist in the interpretation of the borehole records. The geotechnical and analytical laboratory test results are presented in Appendix C and Appendix D, respectively.

The results of the in situ field tests (i.e., SPT “N”-values) as presented on the borehole records and in Section 4.2 are uncorrected. The boundaries between deposits on the borehole records have been inferred from drilling observations and non-continuous sampling and, therefore, these boundaries represent transitions between soil types rather than exact planes of geological change. The interpreted stratigraphic profiles along the proposed sewer alignments, as shown on Drawings 1 to 5, are a simplification of the subsurface conditions. Variation in the stratigraphic boundaries between and beyond boreholes will exist and is to be expected.

In general, the subsurface conditions consist of the existing pavement structure underlain by various cohesive fill materials (clayey silt, silty clay, and clay and silt fill). The cohesive fill is generally underlain by an upper cohesive till deposit that varies in composition from clayey silt-silt to silty clay, underlain by non-cohesive deposits varying from silt to silty sand, in turn underlain by lower cohesive till deposits that also vary from clayey silt-silt to silty clay.

4.2.1 Asphalt and Concrete

A layer of asphalt between 130 mm and 450 mm thick was encountered at ground surface in all boreholes. In Boreholes MS-1, MS-28, MS-29, MS-30, and MS-31, an approximately 200 mm to 460 mm thick layer of concrete was encountered underlying the asphalt.

4.2.2 Granular Fill (Pavement Structure)

A 0.3 m to 2.0 m thick layer of granular fill was encountered underlying the concrete in Boreholes MS-1, MS-28, MS-29, MS-30, and MS-31, and underlying the asphalt in the other boreholes. The granular fill was encountered at depths ranging from approximately 0.1 m to 0.6 m below ground surface (approximately Elevations 203.7 m to 227.6 m, generally rising northward) and extended to depths ranging from 0.6 m to 2.2 m below ground surface (approximately Elevations 203.3 m to 226.7 m, also generally rising northward).

The SPT “N”-values measured within the granular fill range from approximately 7 blows to 55 blows per 0.3 m of penetration, indicating a loose to very dense state of compactness. In one instance in Borehole MS-30, the

¹ Chapman, L.J. and Putnam, D.F., 1984, *The Physiography of Southern Ontario*, Ontario Geological Society, Special Volume 2, Third Edition. Accompanied by Map p. 2715, Scale 1:600,000.)

split-spoon sampler did not penetrate the entire SPT sample depth due to refusal conditions (100 blows for less than 0.3 m of penetration) within the granular fill.

Grain size distribution testing was carried out on five samples of the granular fill and the results are presented on Figure C-1 in Appendix C. The water content measured on samples of the granular fill ranges from about 4% to 11%.

4.2.3 CLAYEY SILT (CL) to SILTY CLAY (CI) (FILL)

A 0.4 m to 2.6 m thick layer of cohesive fill consisting of clayey silt to silty clay was encountered underlying the non-cohesive fill in all boreholes. The surface of the cohesive fill was encountered at depths ranging from 0.7 m to 2.2 m below ground surface (approximately Elevation 203.3 m to 226.7 m, generally rising northward along the highway alignment) and extended to depths ranging from 1.4 m to 3.7 m below ground surface (approximately Elevation 202.0 m to 225.7 m, rising northward).

The SPT “N”-values measured within the cohesive fill range from 3 blows to 39 blows per 0.3 m of penetration; the values typically about 7 to 8 blows up to approximately 15 blows per 0.3 m of penetration, indicating a generally stiff to very stiff consistency. Softer zones with SPT “N”-values of less than 7 blows per 0.3 m of penetration generally occur over a single sample in the fill in six of the thirty-one boreholes.

Grain size distribution testing was carried out on fourteen samples of the cohesive fill and the results are presented on Figures C-2A and C-2B in Appendix C. Atterberg limits testing was carried out on twenty-two samples of the cohesive fill and the results are presented on Figures C-3A to C-3C in Appendix C. The Atterberg limits tests measured liquid limits ranging from 21% to 51%, plastic limits ranging from 13% to 20%, and corresponding plasticity indices ranging from 7% to 34%. The Atterberg limits tests generally indicate a clayey silt of low plasticity to a silty clay of intermediate plasticity, with the exception of one test (Borehole MS-11, Sample 3), which indicates a clay of high plasticity. Based on the Atterberg limits results, together with the results of the grain size distribution testing, one sample of the cohesive fill (Borehole MS-29, Sample 2) is classified as clayey sand of low plasticity. The water content measured on samples of the cohesive fill ranges from about 8% to 29%, generally near or above the plastic limit for the material.

4.2.4 Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Upper Deposit

An upper glacial till deposit varying in composition from sandy clayey silt-silt to silty clay was encountered underlying the cohesive fill in all boreholes except Boreholes MS-11, MS-14, MS-17, MS-23 and MS-26. The upper sandy clayey silt to silty clay till deposit was encountered at depths ranging from 1.4 m to 3.7 m below ground surface (approximately Elevations 202.0 m to 224.9 m, generally rising northward) and extended to the termination depth of 6.7 m below ground surface (Elevation 200.2 m to 218.5 m) in Boreholes MS-19, MS-20, MS-21, MS-27, MS-28, MS-30 and MS-31, and to depths of 2.2 m to 5.6 m below ground surface (Elevations 200.5 m to 223.4 m, generally rising northward) in the other boreholes. Where fully penetrated in the boreholes, the upper clayey silt to silty clay deposit was approximately 0.7 m to 3.4 m thick. The upper sandy clayey silt to silty clay deposit in Borehole MS-13 contained rootlets and organics.

The SPT “N”-values measured within the upper sandy clayey silt to silty clay till deposit range from 6 to 67 blows per 0.3 m of penetration, indicating a variable, firm to hard consistency. Auger grinding was noted within the deposit between depths of 2.3 m and 2.9 m in Borehole MS-6 and are interpreted to represent the presence of cobbles and/or boulders, which are to be expected within these glacially-derived soils. In addition, in one instance in the sandy clayey silt-silt to silty clay till, the split-spoon sampler did not penetrate the entire SPT sample depth

due to refusal conditions (i.e., 100 blows for less than 0.3 m of penetration), which further indicates the presence of cobbles and/or boulders.

Grain size distribution testing was carried out on twenty-seven samples of the upper sandy clayey silt to silty clay deposit and the results are presented on Figures C-4A to C-4D in Appendix C. Atterberg limit testing was carried out on twenty-six samples of the deposit and the results are presented on Figures C-5A to C-5D in Appendix C. The Atterberg limits tests measured liquid limits ranging from 17% to 47%, plastic limits ranging from 11% to 21%, and corresponding plasticity indices ranging from 5% to 27%, indicating the deposit ranges from a clayey silt-silt of low plasticity to a silty clay of intermediate plasticity. The water content measured on samples of the deposit range from 8% to 28%.

4.2.5 SILT (ML) to SAND (SP) and Silt to SILTY SAND (SM)

A non-cohesive deposit varying in composition from silt to silt and sand to silty sand was encountered underlying the cohesive fill and/or upper cohesive till deposit (where present) in all boreholes except Boreholes MS-19, MS-20, MS-21, MS-27, MS-28, MS-30 and MS-31; at some locations, this deposit has been interpreted as till or till-like based on its relatively broad grain size distribution. The surface of the deposit was encountered at depths ranging from 1.8 m to 5.6 m below ground surface (approximately Elevations 200.5 m to 225.7 m, generally rising northward). Boreholes MS-1, MS-4, MS-6, MS-7, MS-9 to MS-18, MS-22 to MS-26 and MS-29 were terminated in the deposit after penetrating it for 1.1 m to 4.5 m. Where fully penetrated in the other boreholes, the silt to silt and sand deposit was 0.7 m to 1.9 m thick and extended to depths ranging from 2.5 m to 5.6 m below ground surface (Elevations 199.3 m to 209.3 m, generally rising northward).

The SPT “N”-values measured within this non-cohesive deposit range from 10 to 98 blows per 0.3 m of penetration, indicating a variable, compact to very dense state of compactness. In one instance, the split-spoon sampler did not penetrate the entire SPT depth due to refusal conditions (i.e., split-spoon bouncing) on an inferred cobble and/or boulder obstruction. Auger grinding was noted within the silty sand to sand and silt deposit between depths of 5.0 m and 5.6 m in Borehole MS-1; this condition is also interpreted to represent the presence of cobbles and boulders, which should be expected within these glacially-derived soils.

Grain size distribution testing was carried out on twenty-two samples of the silt to silt and sand deposit and the results are presented on Figures C-6A to C-6D in Appendix C. Atterberg limit testing was carried out on five samples of the silt to silty sand deposit and the results generally indicate a non-plastic material. The water content measured on samples of the silt to silty sand deposit range from 7% to 25%.

4.2.6 Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) – Lower Deposit

A lower glacial till deposit varying in composition from sandy clayey silt-silt to silty clay was encountered underlying the silt to silty sand deposit in Boreholes MS-2, MS-3, MS-5 and MS-8. The lower clayey silt to silty clay deposit was encountered at a depth of approximately 5.6 m in each borehole (Elevations 199.3 m to 201.6 m, generally rising northward) and the boreholes were terminated in this lower till deposit after penetrating about 1.1 m into the deposit.

The SPT “N”-values measured within the lower sandy clayey silt to silty clay till deposit range from 28 to 76 blows per 0.3 m of penetration, indicating a very stiff to hard consistency.

Grain size distribution testing was carried out on three samples of the deposit and the results are presented on Figure C-6 in Appendix C. Atterberg limits testing was carried out on three samples of the lower sandy clayey silt to silty clay till deposit and the results are presented on Figure C-7 in Appendix C. The Atterberg limits tests

measured liquid limits of 18% to 21%, plastic limits of 11% to 13%, and corresponding plasticity indices of 5% to 10%, indicating a clayey silt-silt to clayey silt of low plasticity. The water content measured on samples of the lower sandy clayey silt to silty clay till deposit range from about 12% and 14%.

4.3 Groundwater Conditions

Details of the water levels observed in the open boreholes upon completion of drilling are summarized on the borehole records in Appendix B and below. Boreholes MS-2, MS-14, MS-15, MS-16, MS-18, and MS-19 were dry upon completion of drilling, and no seepage into the open boreholes was observed. The observed water levels within the other boreholes upon completion of drilling ranged from about Elevation 200.2 m to 223.7 m, rising northward as the ground surface rises. Observations made upon completion of drilling do not reflect the stabilized groundwater conditions, and therefore the groundwater conditions are provided for information purposes only and should be expected to vary from and potentially be higher than those provided below.

Borehole No.	Depth to Groundwater in Open Borehole (m)	Non-Stabilized Groundwater Elevation (m)	Date of Reading
MS-1	5.5	198.7	June 1, 2022
MS-2	Dry	N/A	June 1, 2022
MS-3	5.5	200.2	June 1, 2022
MS-4	5.8	200.6	June 2, 2022
MS-5	5.0	202.2	June 2, 2022
MS-6	3.1	204.4	June 2, 2022
MS-7	2.7	204.1	June 7, 2022
MS-8	5.6	201.3	June 12, 2022
MS-9	3.4	204.3	June 12, 2022
MS-10	3.4	205.0	June 12, 2022
MS-11	3.0	206.1	June 12, 2022
MS-12	2.9	207.3	June 13, 2022
MS-13	5.0	206.8	June 13, 2022
MS-14	Dry	N/A	June 13, 2022
MS-15	Dry	N/A	June 16, 2022
MS-16	Dry	N/A	June 16, 2022
MS-17	5.6	218.1	June 14, 2022
MS-18	Dry	N/A	June 15, 2022
MS-19	Dry	N/A	June 15, 2022
MS-20	5.7	216.2	June 15, 2022
MS-21	4.3	220.6	June 14, 2022
MS-22	5.6	221.5	June 14, 2022

Borehole No.	Depth to Groundwater in Open Borehole (m)	Non-Stabilized Groundwater Elevation (m)	Date of Reading
MS-23	4.2	223.7	June 14, 2022
MS-24	2.6	221.1	April 24, 2023
MS-25	5.4	219.0	April 23, 2023
MS-26	4.7	220.4	April 23, 2023
MS-27	Dry	N/A	April 23, 2023
MS-28	5.5	202.2	April 26, 2023
MS-29	5.3	201.8	April 26, 2023
MS-30	Dry	N/A	April 27, 2023
MS-31	Dry	N/A	April 27, 2023

Based on the colour transition from brown to grey in recovered soil samples from these boreholes, it is interpreted that the stabilized groundwater elevation is approximately 2.5 m to 4.5 m below the highway surface within the project limits. Groundwater levels are subject to seasonal fluctuations and precipitation events and should be expected to be higher during wet periods of the year.

4.4 Analytical Testing

Thirty-one soil samples (one soil sample from each borehole) were collected and submitted for analyses of parameters used to assess corrosion potential and sulphate attack. A summary of the results of the analysis is presented below and the detailed test results and Certificates of Analysis are presented in Appendix D.

Borehole	Sample	Sample Depth / Elevation (m)	Soil Type	Parameters				
				Chloride (µg/g)	Sulphate (µg/g)	pH	Conductivity (umho/cm)	Resistivity (ohm-cm)
MS-1	4	3.4 / 200.8	Silty Clay Till	980	100	7.94	1750	570
MS-2	3	2.6 / 202.3	Clayey Silt Till	610	30	7.71	1070	940
MS-3	2	1.8 / 203.9	Silty Clay Fill	1100	<20	7.61	1880	530
MS-4	4	3.4 / 203.0	Clayey Silt Till	1400	100	7.96	2490	400
MS-5	4	3.4 / 203.8	Clayey Silt Till	1600	120	7.93	2710	370
MS-6	3	2.6 / 204.9	Clayey Silt Till	1500	99	7.89	2630	380
MS-7	2	1.8 / 205.0	Silty Clay Fill	1400	<20	7.64	2350	430
MS-8	3	2.6 / 204.3	Silty Clay Fill	2900	<20	7.44	4810	210
MS-9	3	2.6 / 205.1	Clayey Silt Fill	920	<20	7.51	1610	620
MS-10	2	1.8 / 206.6	Clayey Silt Fill	1800	<20	7.60	2560	390
MS-11	4	3.4 / 205.7	Clay and Silt Fill	1500	<20	7.72	2650	380
MS-12	3	2.6 / 207.6	Sandy Clayey Silt-Silt Till	1300	76	7.80	2350	430
MS-13	2A	1.7 / 210.1	Clayey Silt Fill	1400	<20	7.78	2420	410

Borehole	Sample	Sample Depth / Elevation (m)	Soil Type	Parameters				
				Chloride (µg/g)	Sulphate (µg/g)	pH	Conductivity (umho/cm)	Resistivity (ohm-cm)
MS-14	3	2.6 / 216.0	Sandy Silt to Silt	710	<20	7.74	1280	780
MS-15	4	3.4 / 220.2	Sandy Silt	570	<20	7.79	944	1100
MS-16	3	2.6 / 223.0	Sandy Clayey Silt-Silt Till	690	<20	7.52	1230	820
MS-17	2	1.8 / 221.9	Silty Clay Fill	1500	<20	7.77	2660	380
MS-18	3	2.6 / 219.8	Silty Clay Till	1500	<20	7.70	2550	390
MS-19	2	1.8 / 219.2	Clayey Silt Till	920	110	7.88	1920	520
MS-20	4	3.4 / 218.5	Sandy Clayey Silt-Silt Till	410	<20	7.56	793	1300
MS-21	3	2.6 / 222.3	Clayey Silt Fill	1300	<20	7.73	2180	460
MS-22	4	3.4 / 223.7	Sandy Clayey Silt-Silt Till	590	33	8.03	1110	900
MS-23	3	2.6 / 225.3	Sandy Silt	950	<20	7.95	1880	530
MS-24	2	1.8 / 221.9	Clayey Silt Fill	1000	200	7.97	1820	550
MS-25	3	2.6 / 221.8	Clayey Silt-Silt Fill	1100	47	7.71	1880	530
MS-26	4	3.4 / 221.7	Sandy Clayey Silt Fill	590	31	7.76	1110	900
MS-27	4	3.4 / 221.8	Silty Clay Fill	490	37	7.74	933	1100
MS-28	2	1.8 / 205.9	Sandy Clayey Silt Fill	1400	190	7.79	2550	390
MS-29	3	2.6 / 204.5	Clayey Sand Fill	720	34	7.79	1260	790
MS-30	4	3.4 / 203.5	Clayey Silt Till	460	99	7.73	993	1000
MS-31	3	2.6 / 204.8	Sandy Clayey Silt Fill	1200	100	7.80	1780	560

5.0 CLOSURE

This Foundation Investigation Report was prepared by Mr. Mark Henderson, P.Eng., a geotechnical engineer with WSP Golder and Lisa Coyne, P.Eng., a Geotechnical Engineering Fellow and MTO Principal Foundations Contact for WSP Golder, conducted an independent technical and quality control review of this report.

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[https://golderassociates.sharepoint.com/sites/152126/Project Files/6 Deliverables/3. Foundations/2. Reports/04. Median Sewers and Laterals/3. Final/21490972-R-Rev0_FIDR_MS_2023'11'20.docx](https://golderassociates.sharepoint.com/sites/152126/Project%20Files/6%20Deliverables/3.%20Foundations/2.%20Reports/04.%20Median%20Sewers%20and%20Laterals/3.%20Final/21490972-R-Rev0_FIDR_MS_2023'11'20.docx)

PART B

Foundation Design Report
Median Storm Sewers
Highway 400 Widening
Langstaff Road to Major Mackenzie Drive
Vaughan, Ontario
MTO GWP 2836-02-00

6.0 DISCUSSION AND ENGINEERING RECOMMENDATIONS

6.1 General

This section of the report provides geotechnical/foundation design recommendations for the proposed median sewer installations along Highway 400, from south of Langstaff Road to Major Mackenzie Drive in the City of Vaughan, Ontario.

These recommendations are based on interpretation of the data obtained from the boreholes advanced during the previous and current field investigations. The discussion and recommendations presented are intended to provide the designers with information to carry out the design of the proposed storm sewer installations. The discussion and recommendations in this Foundation Design Report are intended for the use of MTO and its designers and shall not be used or relied upon for any other purpose or by any other parties, including the construction contractor. Contractors must make their own interpretation based on the factual data presented in the Foundation Investigation Report (Part A of this report). Where comments are made on construction, they are provided to highlight those aspects that could affect the design of the project and for which special provisions may be required in the Contract Documents. Those requiring information on aspects of construction must make their own interpretation of the data provided as such interpretation may affect equipment selection, proposed construction methods, scheduling and the like.

The proposed median storm sewer alignments and mainline storm sewer alignment are shown on Drawings 1 to 5. The median and mainline storm sewers, which are parallel to the highway, will be installed by open-cut excavation methods. Design details related to the storm sewers are provided in the table below; the sewer depths/elevations are variable and only the maximum (deepest) invert depth is summarized in the table below.

Location of Sewer	Range of Pipe Diameters (mm)	Maximum Invert Depth (m)
Highway 400 (Core) Mainline Sewer – Northbound Outside Shoulder (STA 16+300 to 16+700)	375 to 450	3.1
Highway 400 Southbound Collector Median (STA 13+900 to 14+500)	375 to 450	2.7
Highway 400 (Core) Median (STA 13+900 to 18+300)	300 to 675	3.6

6.2 Cut-and-Cover Construction

6.2.1 Founding Depth and Subgrade Conditions

The anticipated founding conditions along the proposed storm sewer alignments vary from generally stiff to hard clayey silt-silt to silty clay till, to compact to very dense silt to silty sand, as shown on the interpreted stratigraphic profiles on Drawings 1 to 5. The open-cut excavations are expected to be maintained above the groundwater level, although some seepage may occur from water perched within the fill above the cohesive upper till, or from water-bearing lenses/layers within the till. The existing soils at the anticipated founding depths are considered

suitable for supporting the pipes, provided the integrity of the base of the excavation is maintained during construction.

The sewer pipe should be installed in accordance with OPSS.PROV 401 (*Trenching, Backfilling and Compacting*) and OPSS.PROV 410 (*Pipe Sewer Installation in Open Cut*). Where softened/loosened zones are present at the subgrade level, these zones should be sub-excavated and replaced with granular backfill meeting OPSS.PROV 1010 (*Aggregates*) Granular 'A' or Granular 'B' Type II. The granular backfill for any subexcavated areas should be placed in maximum 300 mm thick loose lifts and be compacted to 98% of the material's SPMDD in accordance with OPSS.PROV 501 (*Compacting*).

6.2.2 Pipe Bedding, Cover, and Trench Backfill

The bedding, cover, and backfill for the storm sewer pipe should be compatible with the type and class of pipe, the surrounding subsoil conditions and anticipated loading conditions and should be designed using Class B Bedding as presented in OPSS 802.030, 802.031 and 802.032 (*Rigid Pipe Bedding, Cover, and Backfill*), for earth excavation in Type 2, Type 3, and Type 4 soil, as applicable. The soil types as defined by Occupational Health and Safety Act and Regulations for Construction Projects that are along the proposed storm sewer alignment are discussed in Section 6.3.1.

6.2.2.1 Bedding and Cover

The bedding and cover material should consist of the material as specified in OPSS.PROV 401 (*Trenching, Backfilling, and Compacting*). It is recommended that bedding consist of OPSS.PROV 1010 (*Aggregates*) Granular 'A'; such material may also be used for pipe cover, or alternatively unshrinkable fill per OPSS.PROV 578 (*Unshrinkable Fill*) may be used for cover material. All bedding and cover material should be placed in maximum 200 mm thick loose lifts and uniformly compacted to at least 98% of the material's Standard Proctor Maximum Dry Density (SPMDD), in accordance with OPSS.PROV 501 (*Compacting*).

6.2.2.2 Trench Backfill

The existing fill and native site soils may be used for trench backfill, provided they are free of organic material or other deleterious materials. If water contents of the site soils at the time of construction are too high, or if there is a shortage of suitable in situ material, then an approved imported material which meets the requirements for OPSS.PROV 1010 (*Aggregates*) Select Subgrade Material (SSM) or Granular 'B' Type I could be used. Unshrinkable fill per OPSS.PROV 578 is also suitable for use as trench backfill. Backfill should be placed in maximum 300 mm thick loose lifts and compacted in accordance with OPSS.PROV 501 (*Compacting*). The existing fill and native soils shall be compacted to 95% of the material's Standard Proctor Modified Dry Density (SPMDD), whereas the granular fill materials (including SSM) shall be compacted to 98% of the material's SPMDD.

Where the existing fill and/or native soils are re-used for trench backfill, some settlement of the compacted trench backfill should be anticipated, the majority of which should take place within approximately three to six months following the completion of trench backfilling operations. The magnitude of settlement is anticipated to range from 0.5% to 1% of the trench backfill thickness, assuming the compaction levels noted above achieved during construction. This settlement will be reflected at the ground surface and may be compensated by placing additional granular material as required. Alternatively, if the asphalt binder course is placed shortly following the completion of trench backfilling operations in these areas, any settlement that may be reflected by subsidence of the surface of the binder asphalt can be compensated for by placing an additional thickness of binder asphalt or

by padding. Where granular materials are used as trench backfill, post-construction settlement is anticipated to be negligible provided the above noted compaction levels are achieved during construction.

The design frost depth in the area is estimated to be 1.4 m below ground surface, as interpreted from OPSD 3090.101 (*Frost Penetration Depths for Southern Ontario*). To avoid undue differential movements of ground surface adjacent to and over the trench, the backfill materials should match, as practically as possible, the native or fill material exposed in the trench walls, or granular materials should be used as backfill as it will undergo most of the settlement during construction.

6.3 Construction Considerations

6.3.1 Excavations

All excavations should be carried out in accordance with the guidelines outlined in the Occupational Health and Safety Act and its Regulations (OHSA), and as outlined in OPSS.PROV 401 (*Trenching, Backfilling and Compacting*). According to OHSA, the soil classification and corresponding excavation side slopes of the soils anticipated to be excavated are provided below. However, depending upon the construction procedures adopted by the contractor, actual groundwater seepage conditions, the success of the contractor's groundwater control methods and weather conditions at the time of construction, some flattening and/or blanketing of the slopes may be required.

Soil Description	Above/Below Groundwater	OHSA Soil Type	Maximum Foundation Excavation Side Slopes
Granular fill Soft to stiff cohesive fill and Firm sandy clayey silt-silt to silty clay till	Above	Type 3	1 Horizontal:1 Vertical
	Below	Type 4	3H:1V
Stiff to very stiff sandy clayey silt-silt to silty clay till and Compact to very dense silt to silty sand	Above	Type 2	1H:1 V to within 1.2 m of the bottom of the excavation
	Below	Type 3	1H:1V

Where sufficient space is not available for stockpiling excavated material, off-site storage of the excavated material intended for reuse is required. Care must also be taken during excavation to ensure that during excavation operations, adequate support should be provided for any existing structures, roadways and underground services located adjacent to the excavations.

6.3.2 Temporary Excavation Support Systems

Temporary excavation support systems will be required to facilitate trench excavations where space restrictions limit open-cut excavation. Temporary excavation support systems may consist of but are not limited to the following:

- Prefabricated or Hydraulic Support Systems (i.e., trench boxes): to protect workers and can be used in areas which can tolerate lateral movement of the soil deposits adjacent to the support system; and,
- Engineered Support Systems (i.e., soldier pile and lagging, sheet piles, etc.): to protect workers, and can be used in areas where sensitive underground services / structures require restricted lateral movements.

The design and construction of all temporary excavation support systems is the responsibility of the Contractor and must be in accordance with the latest version of the *Ontario Occupational Health and Safety Act for Construction Projects (OHSa)*, as amended. Recommended values of the geotechnical parameters for use in design of temporary protection systems are provided below. Where both total stress and effective stress parameters are provided, the temporary excavation support system design should be verified using each independent analytical method (i.e., total stress versus effective stress).

Stratigraphic Unit	Unit Weight of Material, γ (kN/m ³)	Angle of Internal Friction, ϕ (°)	Coefficient of Static Lateral Earth Pressure		
			Active, K_a	At Rest, K_o	Passive, K_p
Granular fill	21	32	0.31	0.47	3.25
Firm to stiff cohesive fill and sandy clayey silt to silty clay till	19	30	0.33	0.50	3.00
Very stiff to hard sandy clayey silt to silty clay till	19	33	0.29	0.46	3.39
Compact to very dense silt to silty sand	20	35	0.27	0.43	3.69

Notes:

1. The lateral earth pressure coefficients presented above are based on a horizontal surface adjacent to the excavation. If sloped surfaces are expected, the coefficients showed need to be corrected accordingly.
2. The total passive resistance below the base of the excavation (i.e., within the shored excavation and / or adjacent to the temporary protection system), may be calculated based on the value of K_p indicated above but reduced by an appropriate factor that considers the allowable wall movement in accordance with Figure C6.27 of the CHBDC (2019) to account for the fact that a large strain would be required for mobilization of the full passive resistance.

The long-term stabilized groundwater levels along the proposed sewer alignments are anticipated be at a depth of about 2.5 m to 4.5 m below the existing pavement surface, based on interpretation from the colour change from brown to grey in the native soils encountered in the boreholes.

6.3.2.1 Trench Boxes

Prefabricated support systems (e.g., trench boxes) provide protection for construction personnel but do not provide a close-fit for lateral support against the adjacent excavation walls. As a result, any underground services or existing structures (including pavement structure) located within the zone of influence should be assessed by the Contractor for potential ground movements based on the chosen support system. Any services / structures that cannot tolerate the estimated ground movements should be accurately located prior to construction such that adequate additional support can be provided, or other mitigation measures adopted, as required.

The trench boxes should be designed and constructed in accordance with OPSS.PROV 404 (*Support Systems*). It is understood that the proposed sewers will be installed sequentially within each trench box section and therefore, it is anticipated that a short section of the trench excavation will be open at any one time. The trench excavations should be backfilled as soon as practical and must be completely backfilled at the end of each working day/shift.

To limit ground movements / disturbance during and after construction, OPSS.PROV 1010 (*Aggregates*) Granular 'A' or 'B' (Type I or II) should be placed and compacted between the excavated face/side-slope and the exterior of trench box. Depending on the workmanship and care exercised in the excavation and trench box

installation / removal sequencing and backfill operations, disturbance to the pavement structure and underlying soils within the zone of influence may occur and future rehabilitation / repairs to the roadway may be required.

6.3.2.2 Engineered Support Systems

Where feasible and applicable to limit ground movements, temporary protection systems could consist of sheet piles, soldier pile and lagging, and/or slide-rail system. The presence of cobbles / boulders / gravelly soils within the till deposits could impede installation of the temporary protection systems and therefore, pre-drilling and/or removal of obstructions to facilitate construction of the temporary protection systems may be required.

The temporary protection systems should be designed and constructed in accordance with OPSS.PROV 539 (*Temporary Protection Systems*). The lateral movement of the protection systems should meet Performance Level 2 as specified in OPSS.PROV 539 within the roadway, provided that adjacent utilities and structures can tolerate this magnitude of deformation. Depending on the Contractors sequence of operations / excavation, the temporary global stability of the bridge embankments / abutment walls should be checked as per OPSS.PROV 539 and the applicable loads / pressures must be incorporated into the design of the temporary protection system. The owners of utilities located adjacent to or that cross the proposed excavation should be contacted to understand their owner's requirements and tolerances for movement.

6.3.3 Groundwater Control

The groundwater level along the proposed sewer alignments is estimated to be at a depth of about 2.5 m to 4.5 m below the existing pavement surface. In general, the open-cut excavations for the proposed sewers will be maintained above the groundwater level along the alignment. However, perched groundwater conditions may be present within non-cohesive fill layers or within non-cohesive interlayers atop or within cohesive fills and native soils. It is anticipated that groundwater seepage or flow into the open-cut excavations will be relatively minor and will be able to be controlled by pumping from sumps and/or longitudinal collection trenches at the base of the temporary excavations.

Surface water should be directed away from open excavation areas to prevent ponding of water that could result in disturbance and weakening of the founding soils and/or affect construction, as applicable. Unwatering of all excavations should be carried out in accordance with OPSS.PROV 517 (Dewatering), as amended by SP 517F01. Given the encountered subsurface conditions, it is recommended that the foundation designer fill-in for Table A of SP 517F01 should indicate that the preconstruction survey distance is not applicable ("N/A").

6.3.4 Corrosion Assessment and Protection

The results of the analytical testing on thirty-one soil samples are summarized in Section 4.3 and the analytical laboratory test reports are included in Appendix C. The potential for sulphate attack and corrosion are discussed below, however it is ultimately up to the designer to determine the appropriate construction materials, including exposure class and ensuring that all aspects of CSA A23.1 Section 4.1.1 "Durability Requirements" are followed when designing concrete elements.

The analytical test results for sulphate were compared to CSA A23.1 Table 3 (*"Additional requirements for concrete subjected to sulphate attack"*) to assess the potential severity of sulphate attack on concrete during its service life. The sulphate concentration measured on the submitted soil samples are less than 0.1%, which is below the Moderate degree of exposure (i.e., below the Class S3 exposure limits) and the degree of sulphate attack is considered 'Negligible' according to Table 7.2 in MTO's *Gravity Pipe Design Guidelines* (2014). Therefore, based on the soil samples tested, when the designer is selecting the exposure class for concrete

structures, the effects of sulphates from within the site soils in contact with any portion of the proposed structures constructed below the ground surface may not need to be considered. However, given the proximity of the sewers to de-icing salt, consideration should be given by the designer to designing for a “C” type exposure class as defined by CSA A23.1 Table 1.

According to MTO’s *Gravity Pipe Design Guidelines* (2014), the pH is not considered detrimental to steel durability as it is less than a pH of 8.5.

The resistivity measured in the tested soil samples (210 ohm-cm to 1,300 ohm-cm) indicates that the soil corrosiveness is “severe” ($R < 2,000$ ohm-cm) as per Table 3.2 of MTO’s *Gravity Pipe Design Guidelines* (2016), and therefore, some level of corrosion protection should be applied to the storm sewer.

7.0 CLOSURE

This Foundation Design Report was prepared by Mr. Mark Henderson, P.Eng., a geotechnical engineer with WSP Golder. Ms. Lisa Coyne, P.Eng., a Geotechnical Engineering Fellow and MTO Principal Foundations Contact for WSP Golder, conducted an independent technical and quality control review of this report.

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MH/DAM/LCC/al

[https://golderassociates.sharepoint.com/sites/152126/project files/6 deliverables/3. foundations/2. reports/04. median sewers and laterals/3. final/21490972-r-rev0_fid_r_ms_2023'11'20.docx](https://golderassociates.sharepoint.com/sites/152126/project%20files/6%20deliverables/3.%20foundations/2.%20reports/04.%20median%20sewers%20and%20laterals/3.%20final/21490972-r-rev0_fid_r_ms_2023'11'20.docx)

REFERENCES

Canadian Standard Association (CSA) Group. *Canadian Highway Bridge Design Code (CHBDC (2019)) and Commentary on CAN/CSA-S6-14*.

Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of Southern Ontario*, Ontario Geological Survey, Special Volume 2, Third Edition. Accompanied by Map P.2715, Scale 1:600,000.

Ministry of Transportation, Ontario. 2014. *Gravity Pipe Design Guidelines*.

Ontario Occupational Health and Safety Act:

Ontario Reg. 213 Construction Projects (as amended)

Ontario Provincial Standard Specifications (OPSS)

OPSS.PROV 401	Construction Specification for Trenching, Backfilling, and Compacting
OPSS.PROV 404	Construction Specification for Support Systems
OPSS.PROV 410	Construction Specification for Pipe Sewer Installation in Open Cut
OPSS.PROV 501	Construction Specification for Compacting
OPSS.PROV 517	Construction Specification for Dewatering
OPSS.PROV 539	Construction Specification for Temporary Protection Systems
OPSS.PROV 578	Construction Specification for The Placement of Unshrinkable Fill
OPSS.PROV 1010	Construction Specification for Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material

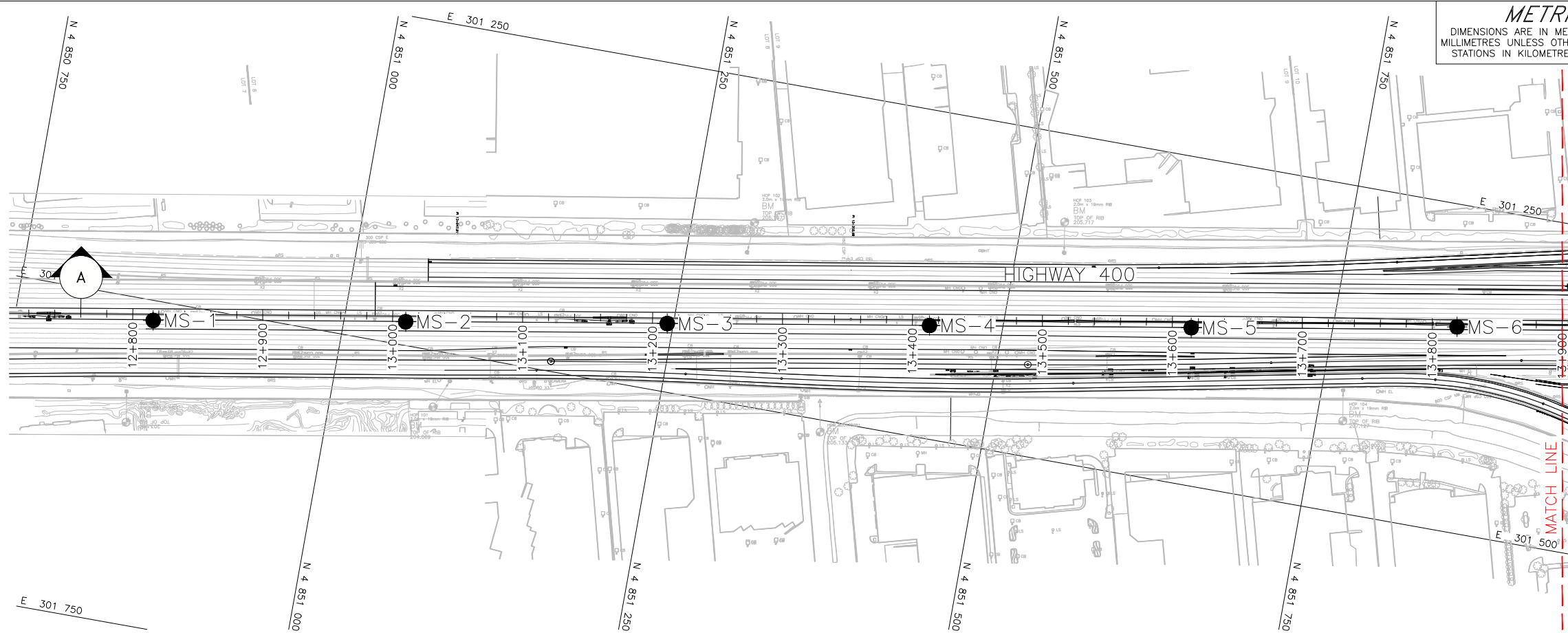
Ontario Provincial Standard Drawings (OPSD)

OPSD 802.030	Rigid Pipe Bedding, Cover and Backfill – Type 1 or 2 Soil – Earth Excavation
OPSD 802.031	Rigid Pipe Bedding, Cover and Backfill – Type 3 Soil – Earth Excavation
OPSD 802.032	Rigid Pipe Bedding, Cover and Backfill – Type 4 Soil – Earth Excavation
OPSD 3090.101	Foundation, Frost Penetration Depths for Southern Ontario

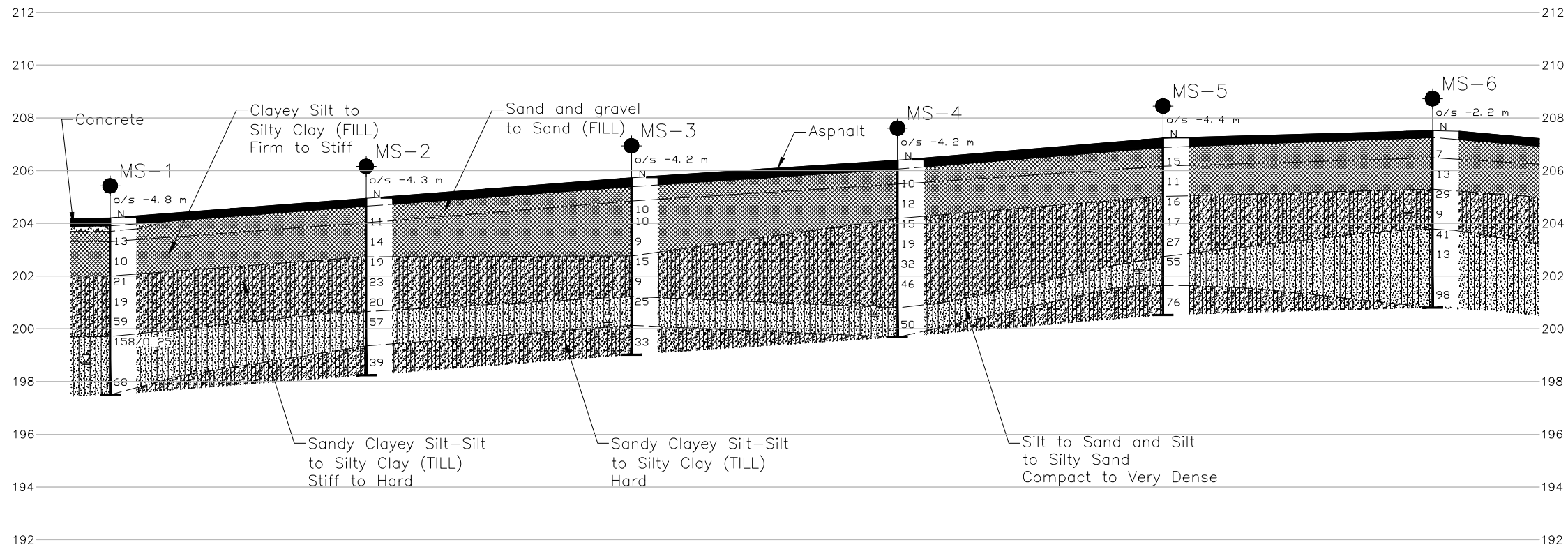
Ontario Water Resources Act

Ontario Regulation 903 Wells (as amended)

DRAWINGS



PLAN
SCALE
40 0 40 80 m



PROFILE
VERTICAL SCALE
2 0 2 4 m
HORIZONTAL SCALE
40 0 40 80 m

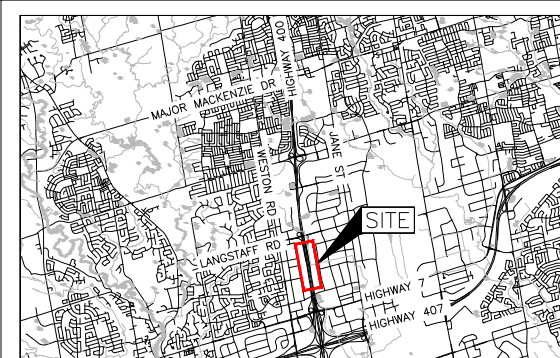
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00



HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 12+800 TO STA. 13+900
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



KEY PLAN
SCALE
2 0 2 4 km

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - GEOCRES 30M13-142
- ⊕ Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
MS-1	204.2	4850855.6	301515.2
MS-2	204.9	4851046.9	301482.0
MS-3	205.7	4851245.3	301447.9
MS-4	206.4	4851444.2	301413.8
MS-5	207.2	4851642.8	301380.0
MS-6	207.5	4851843.9	301343.3

NOTES

This drawing is for subsurface information only. The proposed structure details/works are shown for illustration purposes only and may not be consistent with the final design configuration as shown elsewhere in the Contracts Documents.

The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

Base plans provided in digital format by Parsons, drawing file nos. Hwy400_Extsting_Survey-Topo.dwg, H400-ROD-PLN.dwg, 73-400.xml, received June 1, 2022.
Design plan provided by Parsons, file no. H400-478918-ROD-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.



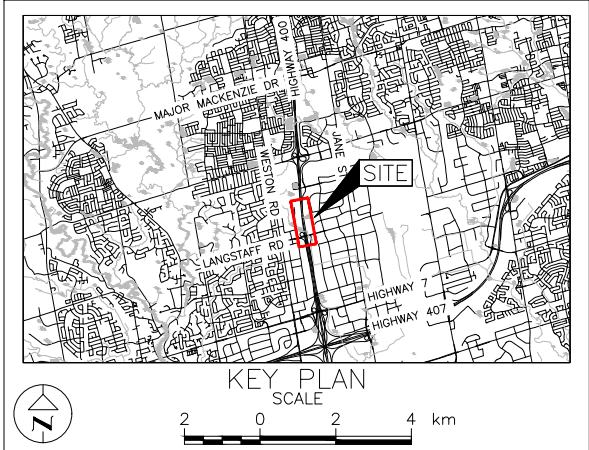
NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400	PROJECT NO. 21490972	DIST. .	
SUBM'D. AMP	CHKD. AMP	DATE: 11/13/2023	SITE: .
DRAWN: DD	CHKD. MH	APPD. LCC	DWG. 1

METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00

HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 13+900 TO STA. 15+100
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



LEGEND

- Borehole - Current Investigation
- Borehole - GEOCRES 30M13-142
- Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10			
No.	ELEVATION	NORTHING	EASTING
MS-7	206.8	4852041.7	301311.8
MS-8	206.9	4852243.5	301276.9
MS-9	207.7	4852430.2	301245.1
MS-10	208.4	4852629.8	301211.1
MS-11	209.1	4852826.9	301179.4
MS-28	207.7	4852350.3	301223.3
MS-29	207.1	4852219.8	301246.0
MS-30	206.9	4852065.3	301272.2
MS-31	207.4	4851927.8	301296.7

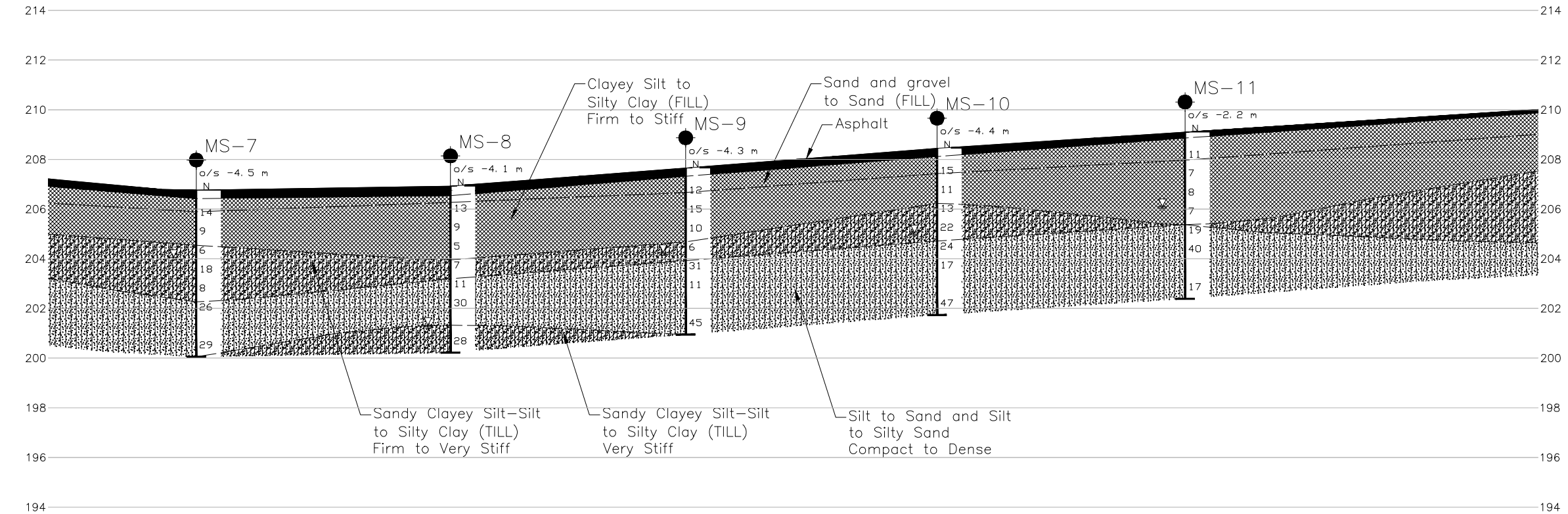
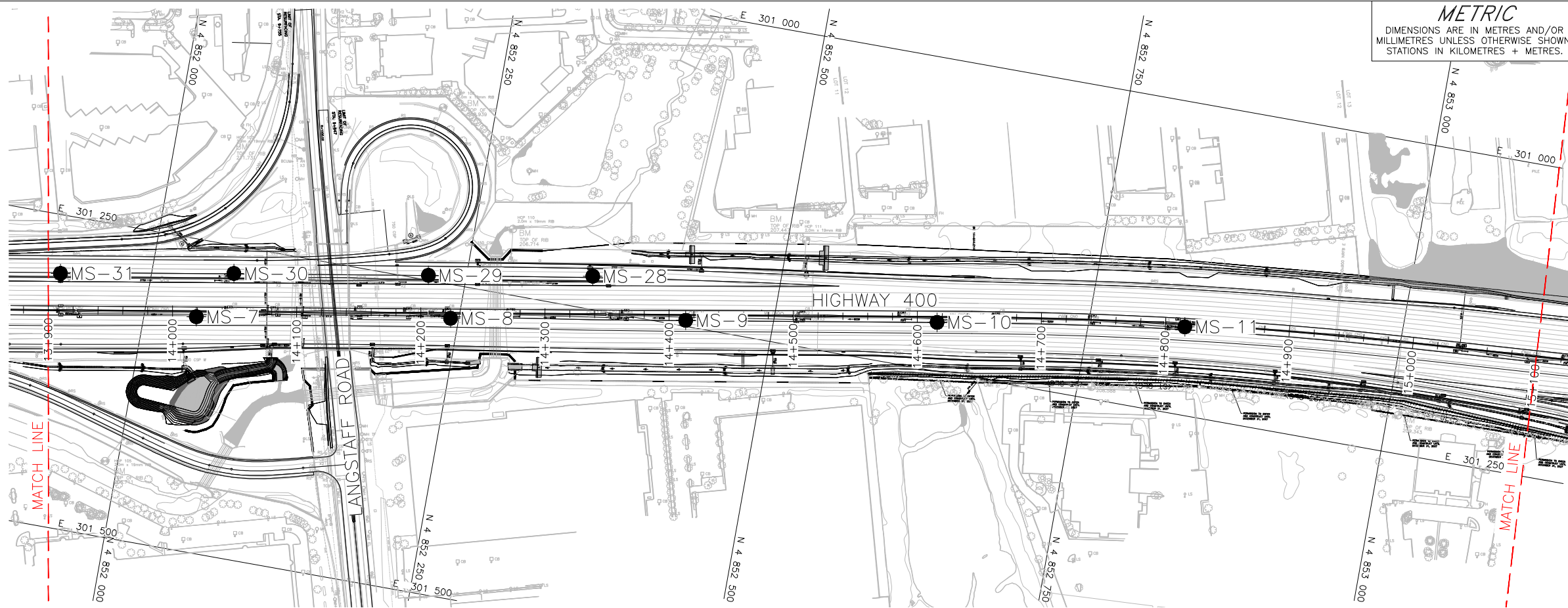
NOTES

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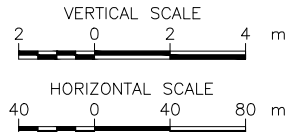
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

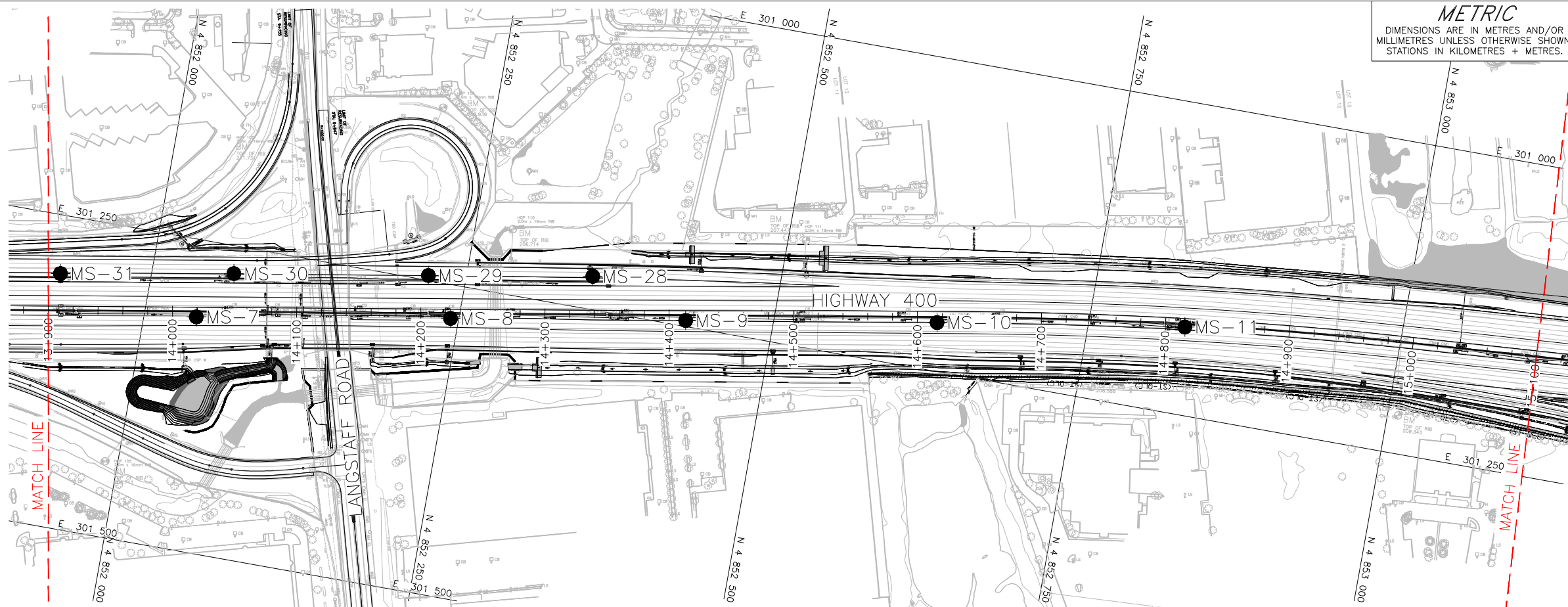
Base plans provided in digital format by Parsons, drawing file nos. Hwy400_Extstg Survey-Topo.dwg, H400-ROD-PLN.dwg, 73-400.xml, received June 1, 2022.
Design plan provided by Parsons, file no. H400-478918-ROD-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.



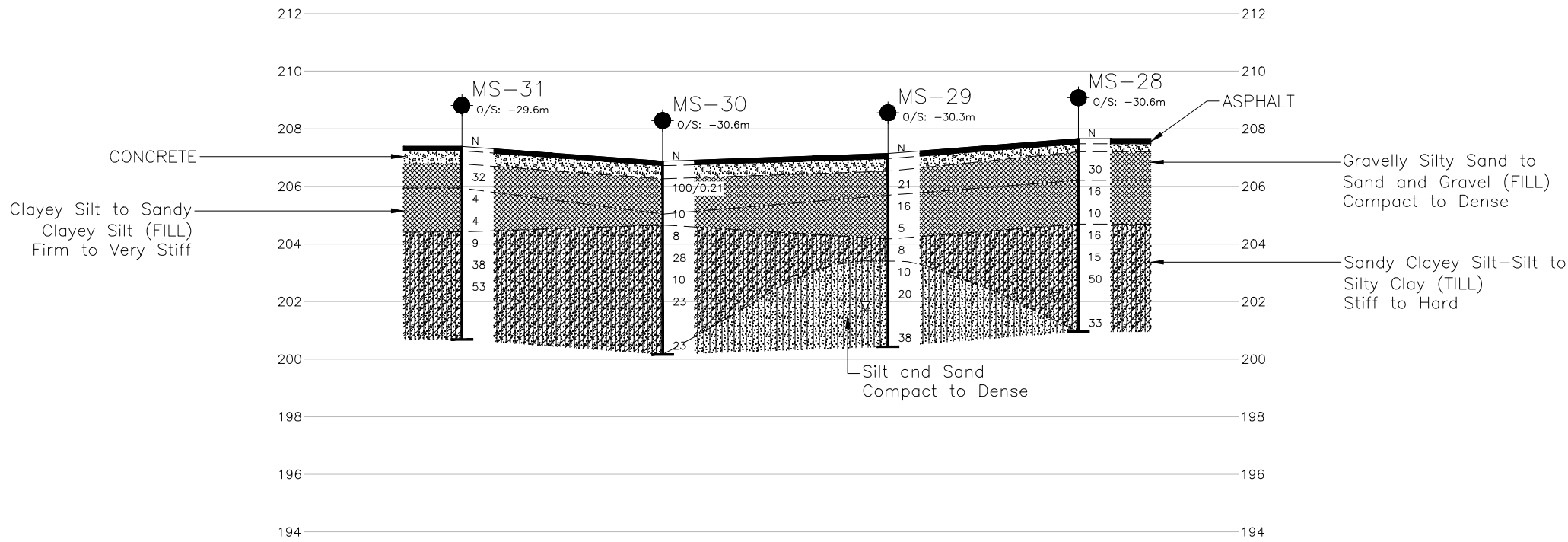
PROFILE ALONG HWY 400



NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400	PROJECT NO. 21490972	DIST.	
SUBM'D. AMP	CHKD. AMP	DATE: 11/13/2023	SITE:
DRAWN: DD/SA	CHKD. MH	APPD. LCC	DWG. 2A



PLAN
SCALE
40 0 40 80 m



PROFILE
VERTICAL SCALE
2 0 2 4 m
HORIZONTAL SCALE
40 0 40 80 m

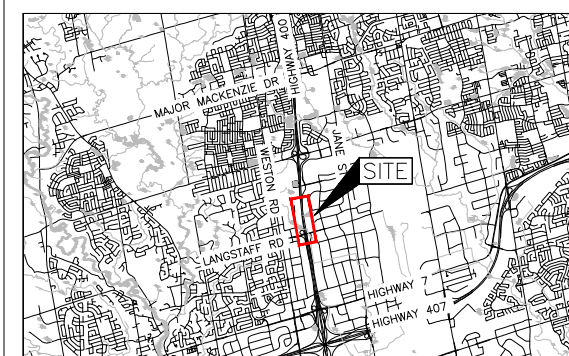
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00



HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 13+900 TO STA. 15+100
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



KEY PLAN
SCALE
2 0 2 4 km

LEGEND

- Borehole - Current Investigation
- Borehole - GEOCRES 30M13-142
- ⊕ Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
MS-7	206.8	4852041.7	301311.8
MS-8	206.9	4852243.5	301276.9
MS-9	207.7	4852430.2	301245.1
MS-10	208.4	4852629.8	301211.1
MS-11	209.1	4852826.9	301179.4
MS-28	207.7	4852350.3	301223.3
MS-29	207.1	4852219.8	301246.0
MS-30	206.9	4852065.3	301272.2
MS-31	207.4	4851927.8	301296.7

NOTES

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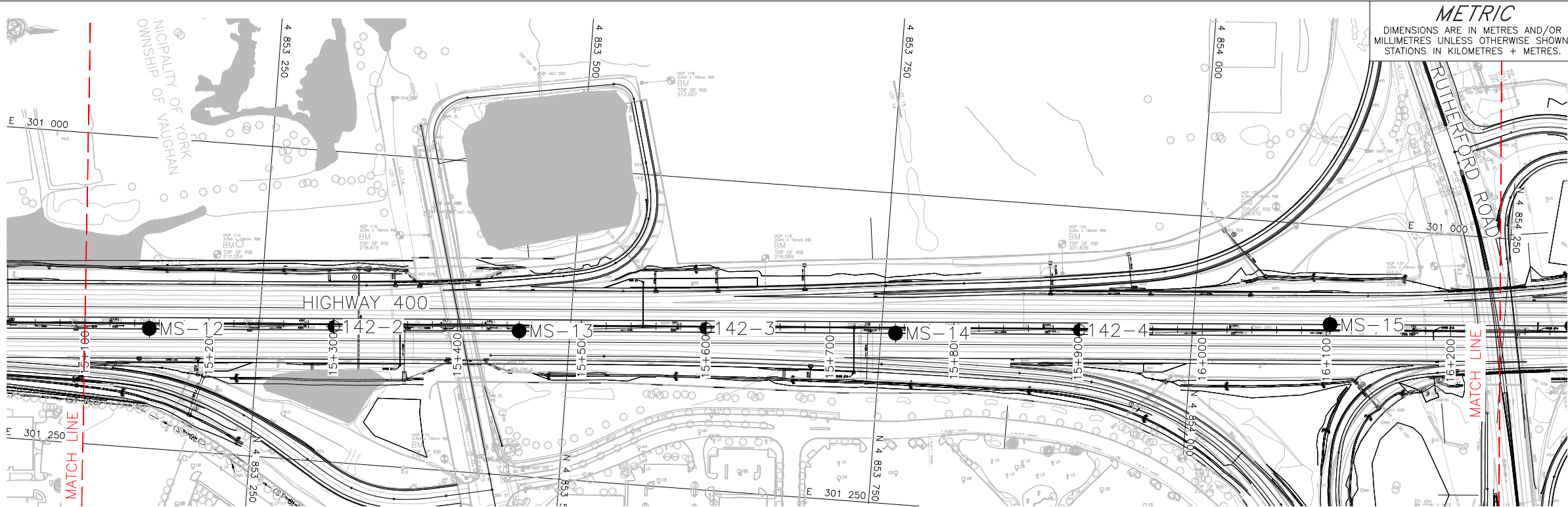
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REFERENCE

Base plans provided in digital format by Parsons, drawing file nos. Hwy400_Extsting Survey-Topo.dwg, H400-ROD-PLN.dwg, 73-400.xml, received June 1, 2022.
Design plan provided by Parsons, file no. H400-478918-ROD-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.



NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400		PROJECT NO. 21490972	DIST. .
SUBM'D. AMP	CHKD. AMP	DATE: 11/13/2023	SITE: .
DRAWN: DD/SA	CHKD. MH	APPD. LCC	DWG. 2B

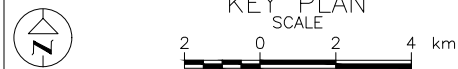
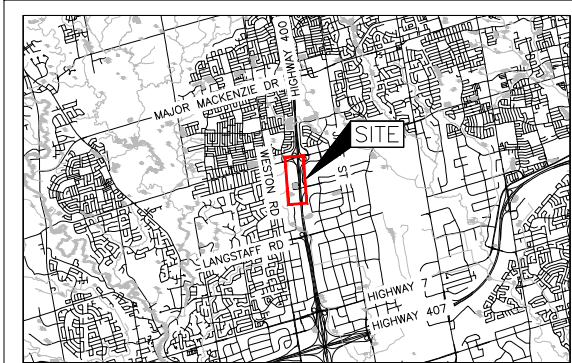


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00

HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 15+100 TO STA. 16+240
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



LEGEND

- Borehole – Current Investigation
- ⊕ Borehole – GEOCRES 30M13-142
- ⊕ Borehole – GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
142-2	211.1	4853310.0	301141.0
142-3	215.9	4853609.0	301120.0
142-4	222.4	4853909.0	301099.0
MS-12	210.2	4853161.9	301153.6
MS-13	211.8	4853459.1	301133.3
MS-14	218.6	4853761.6	301112.5
MS-15	223.6	4854110.0	301079.5

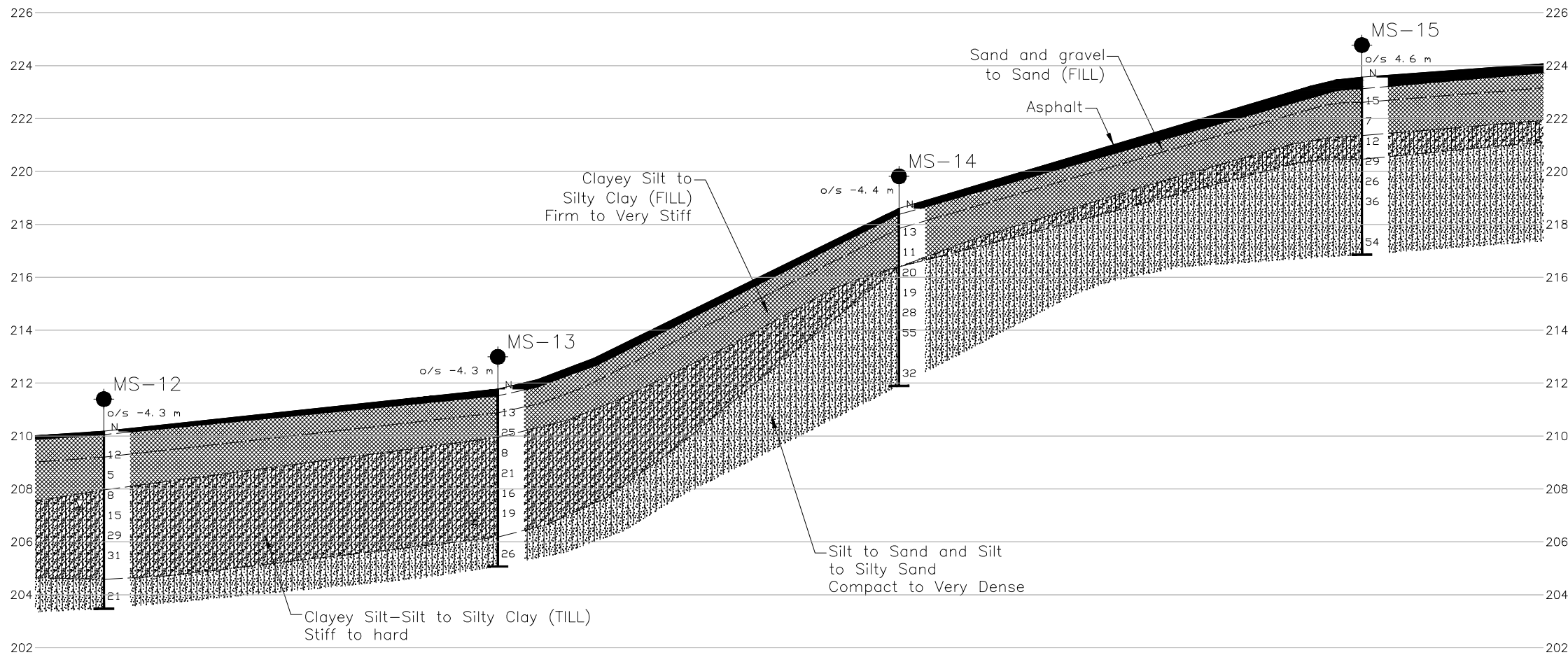
NOTES

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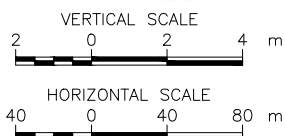
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

REFERENCE

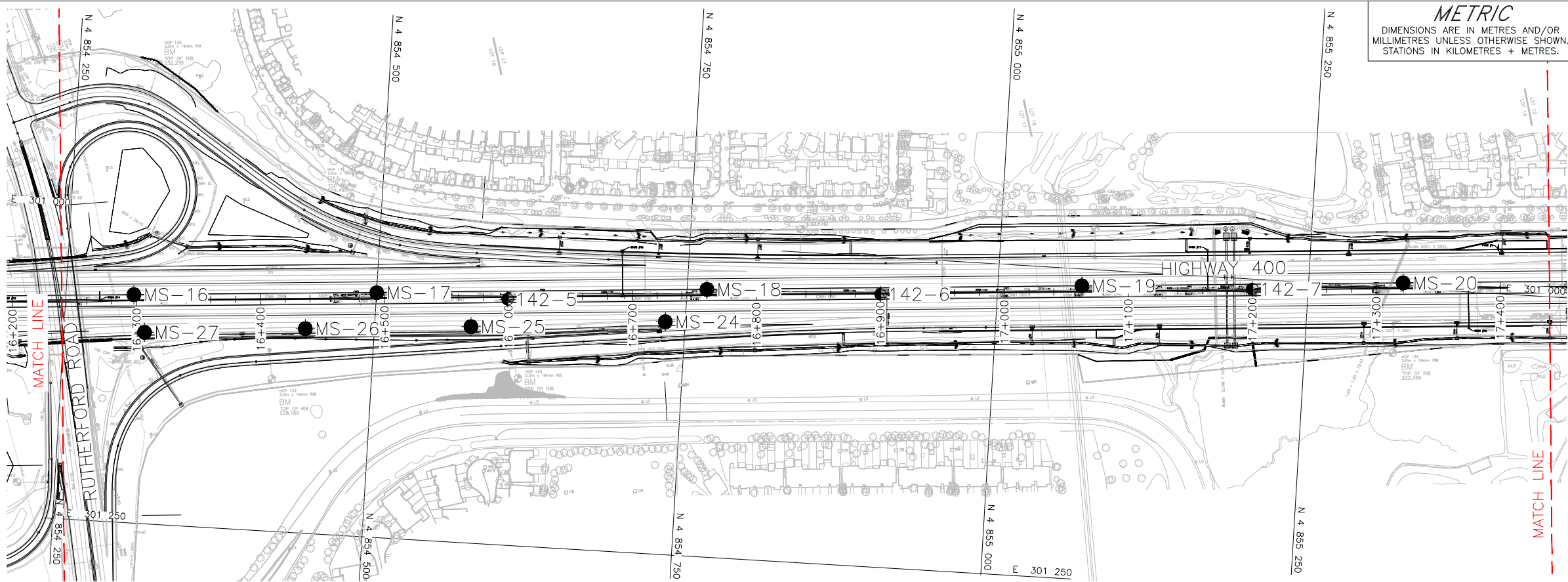
Base plans provided in digital format by Parsons, drawing file nos. Hwy400_Extsting Survey-Topo.dwg, H400-ROD-PLN.dwg, 73-400.xml, received June 1, 2022.
Design plan provided by Parsons, file no. H400-478918-ROD-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.



PROFILE



NO.	DATE	BY	REVISION
Geocres No. 30M13-302		PROJECT NO. 21490972	DIST. .
HWY. 400	CHKD. AMP	DATE: 11/13/2023	SITE: .
SUBM'D. AMP	CHKD. MH	APPD. LCC	DWG. 3



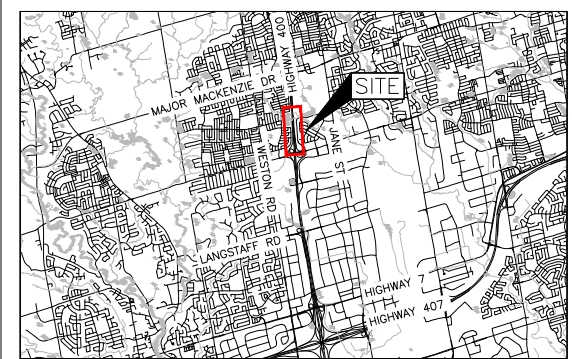
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No. _____
GWP No. 2836-02-00



HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 16+240 TO STA. 17+440
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



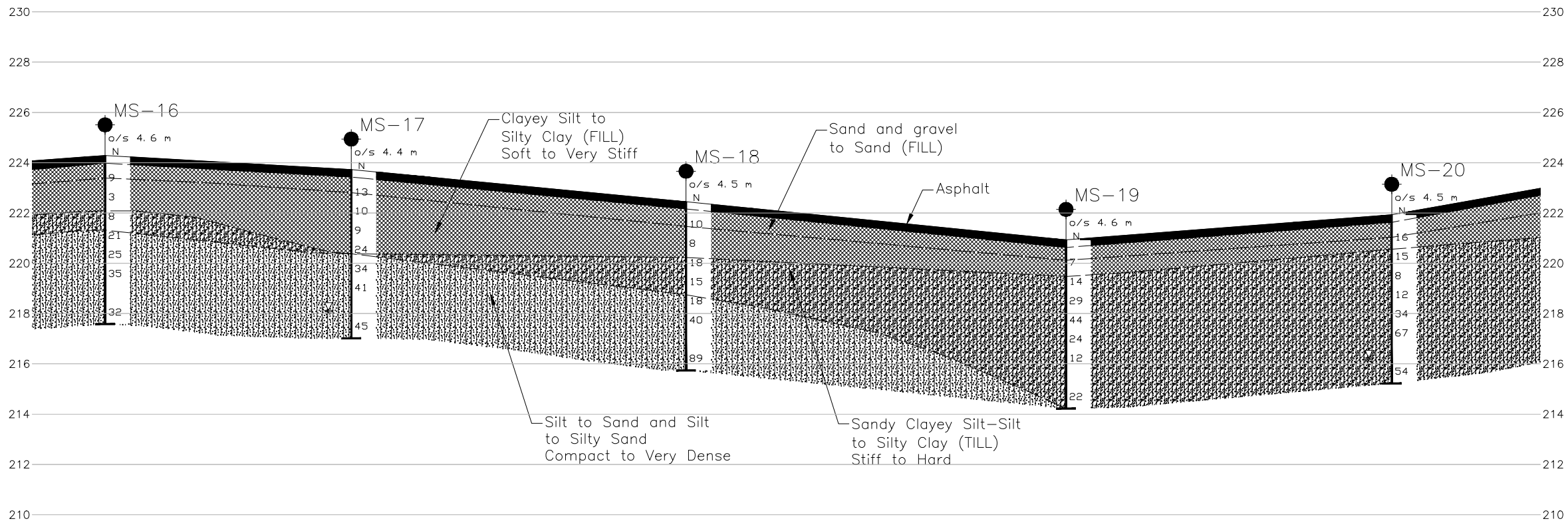
KEY PLAN
SCALE
2 0 2 4 km

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - GEOCRES 30M13-142
- ⊕ Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
142-5	222.4	4854606.0	301052.0
142-6	223.0	4854906.0	301030.0
142-7	222.2	4855205.0	301008.0
MS-16	224.3	4854304.8	301066.1
MS-17	223.7	4854500.2	301052.9
MS-18	222.4	4854765.9	301034.5
MS-19	220.9	4855067.6	301013.6
MS-20	221.9	4855326.1	300995.9
MS-24	223.7	4854733.9	301062.5
MS-25	224.4	4854577.6	301075.7
MS-26	225.1	4854444.4	301085.3
MS-27	225.2	4854315.2	301095.9



NOTES

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PROFILE

VERTICAL SCALE



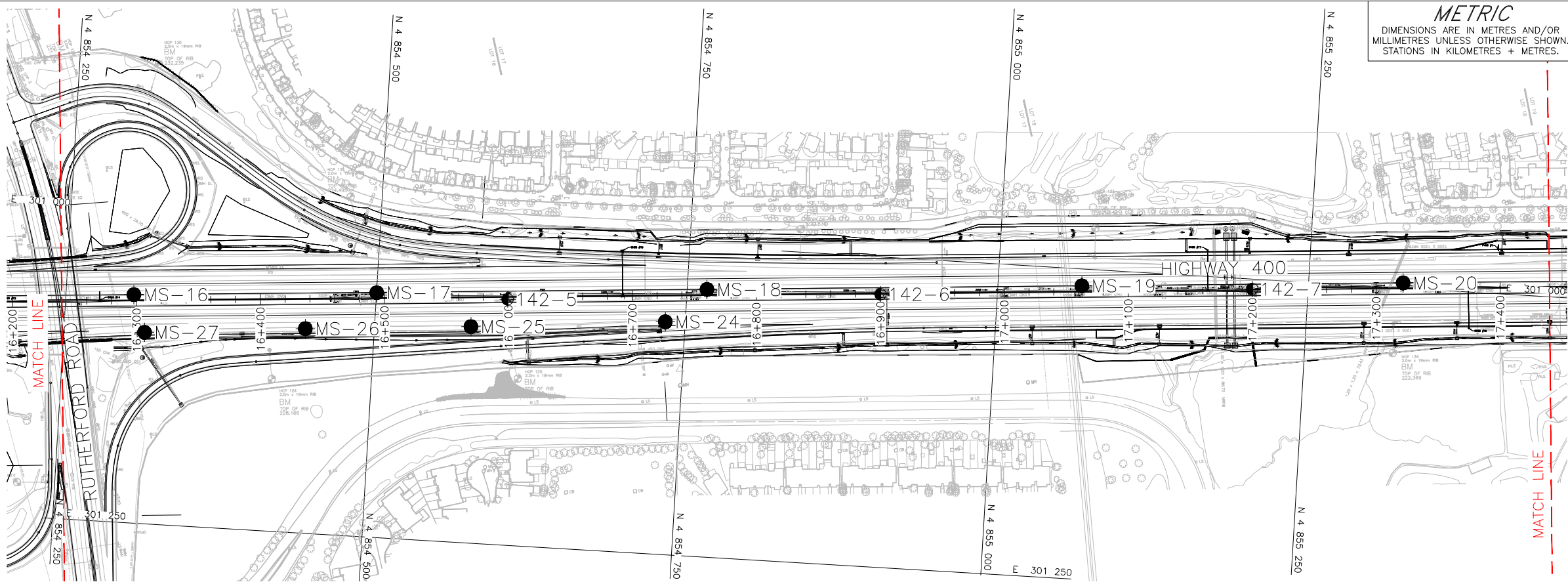
HORIZONTAL SCALE



REFERENCE

Base plans provided in digital format by Parsons, drawing file nos. Hwy400_Extsting Survey-Topo.dwg, H400-R0D-PLN.dwg, 73-400.xml, received June 1, 2022.
Design plan provided by Parsons, file no. H400-478918-R0D-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.

NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400		PROJECT NO. 21490972	
SUBM'D. AMP		DATE: 11/13/2023	
DRAWN: DD/SA		DWG. 4A	



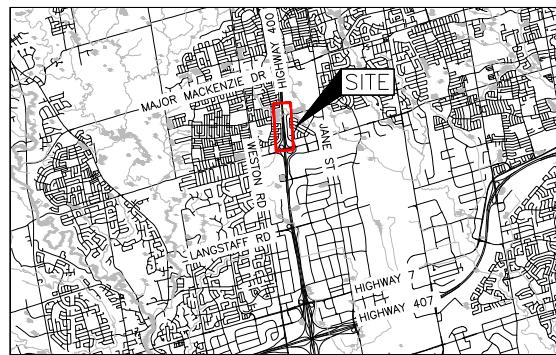
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00



HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 16+240 TO STA. 17+440
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



KEY PLAN
SCALE
2 0 2 4 km

LEGEND

- Borehole - Current Investigation
- ⊕ Borehole - GEOCRES 30M13-142
- ⊕ Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated (Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

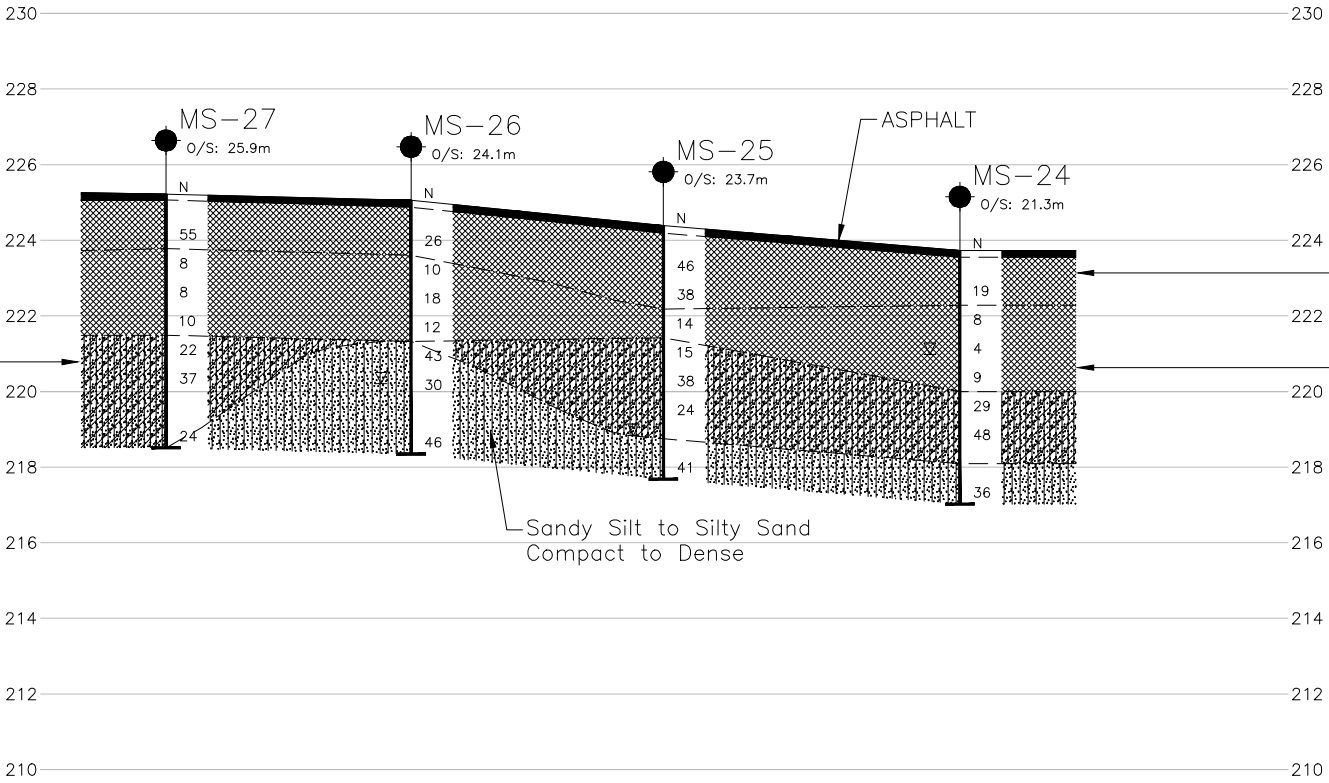
BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
142-5	222.4	4854606.0	301052.0
142-6	223.0	4854906.0	301030.0
142-7	222.2	4855205.0	301008.0
MS-16	224.3	4854304.8	301066.1
MS-17	223.7	4854500.2	301052.9
MS-18	222.4	4854765.9	301034.5
MS-19	220.9	4855067.6	301013.6
MS-20	221.9	4855326.1	300995.9
MS-24	223.7	4854733.9	301062.5
MS-25	224.4	4854577.6	301075.7
MS-26	225.1	4854444.4	301085.3
MS-27	225.2	4854315.2	301095.9

REFERENCE

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Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.

Sandy Clayey Silt-Silt to
Sandy Clayey Silt (TILL)
Very Stiff to Hard



Gravelly Sand to
Sand and Gravel (FILL)
Compact to Very Dense

Clayey Silt-Silt to Silty Clay (FILL)
Firm to Stiff

PLAN
SCALE
40 0 40 80 m

PROFILE
VERTICAL SCALE
2 0 2 4 m
HORIZONTAL SCALE
40 0 40 80 m

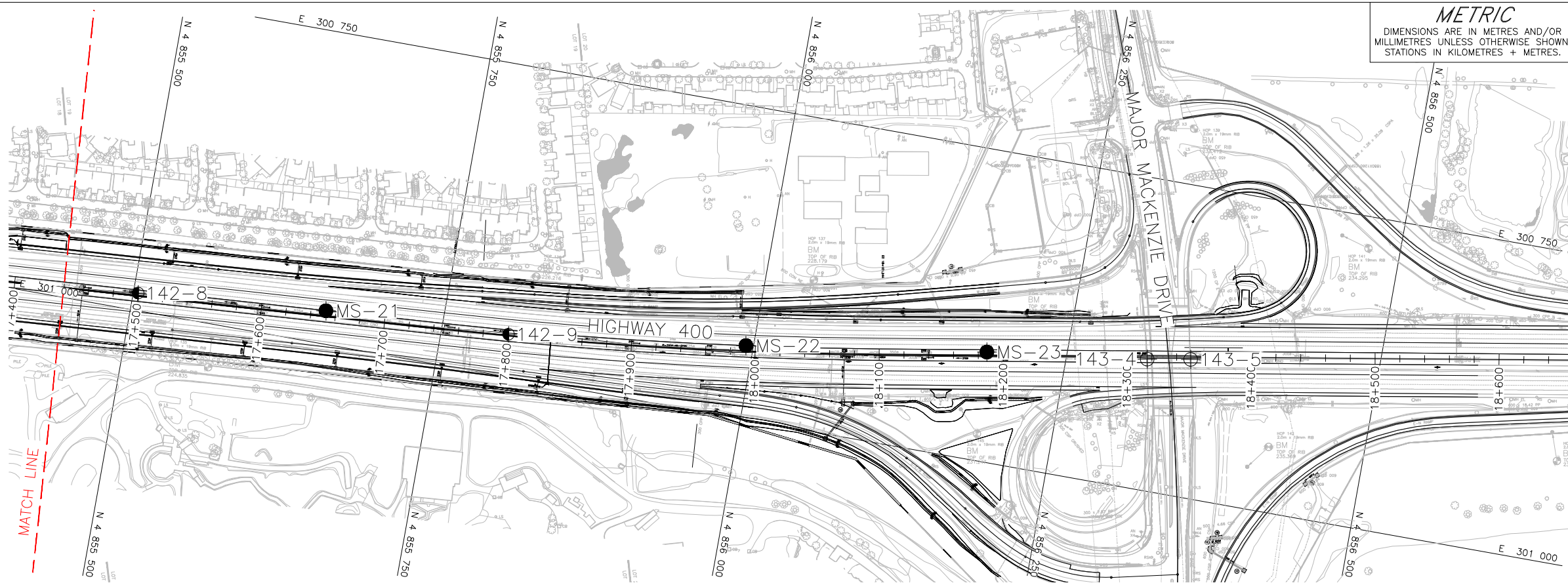
NOTES

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NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400	PROJECT NO. 21490972		DIST. .
SUBM'D. AMP	CHKD. AMP	DATE: 11/13/2023	SITE: .
DRAWN: DD/SA	CHKD. MH	APPD. LCC	DWG. 4B



PLAN
SCALE
40 0 40 80 m

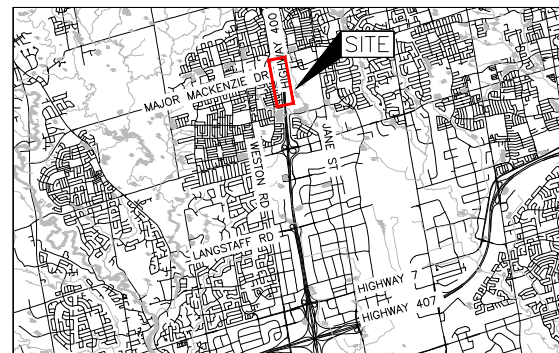
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES.

CONT No.
GWP No. 2836-02-00



HIGHWAY 400 WIDENING
MEDIAN SEWERS STA. 17+440 TO STA. 18+500
BOREHOLE LOCATIONS AND SOIL
STRATA

SHEET



KEY PLAN
SCALE
2 0 2 4 km

LEGEND

- Borehole - Current Investigation
- Borehole - GEOCRES 30M13-142
- ⊕ Borehole - GEOCRES 30M13-143
- N Standard Penetration Test Value
- 16 Blows/0.3m unless otherwise stated
(Std. Pen. Test, 475 j/blow)
- ≡ WL upon completion of drilling

BOREHOLE CO-ORDINATES NAD 83 MTM Zone 10

No.	ELEVATION	NORTHING	EASTING
142-8	224.5	4855504.0	300986.0
142-9	227.1	4855804.0	300966.0
143-4	229.8	4856314.5	300895.0
143-5	230.2	4856349.0	300889.0
MS-21	224.9	4855655.6	300973.3
MS-22	227.1	4855994.0	300941.2
MS-23	227.9	4856186.1	300912.1

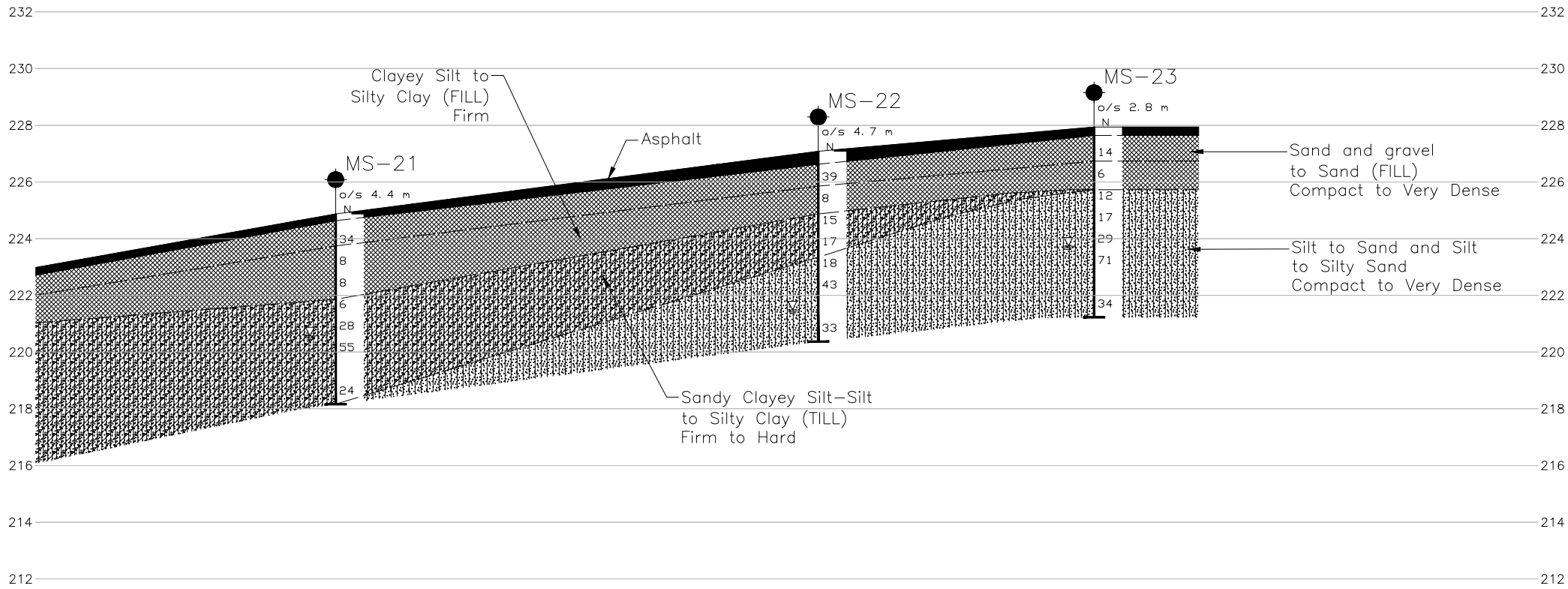
NOTES

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Design plan provided by Parsons, file no. H400-478918-ROD-PLN-S_Binded 2023-10-18.dwg, received October 18, 2023.
Horizontal alignment provided in digital format by Parsons, drawing file no. Hwy 400 Alignments.xml, received October 24, 2023.



PROFILE
VERTICAL SCALE
2 0 2 4 m
HORIZONTAL SCALE
40 0 40 80 m



NO.	DATE	BY	REVISION
Geocres No. 30M13-302			
HWY. 400	PROJECT NO. 21490972		DIST. .
SUBM'D. AMP	CHKD. AMP	DATE: 11/13/2023	SITE: .
DRAWN: DD/SA	CHKD. MH	APPD. LCC	DWG. 5

APPENDIX A

**Previous Borehole Records
(Geocres No. 30M13-142
and 30M13-143)**

RECORD OF BOREHOLE No 2

METRIC

W P 475-91-00 LOCATION Sta. 15+300 1.5 m Rt. N: 4 853 310; E: 301 141 ORIGINATED BY GL
 DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
 DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W _p	W	W _L		
211.1	Paved Shoulder															GR SA SI CL
0.0	280 mm Asphalt															
	Brown Silty sand, Tr. Gravel		1	SS	20											3 73 (24)
209.9																
1.2	FILL		2	SS	18											
	Brown Clayey Silt and Silt, some sand Compact or V. Stiff															
207.8			3	SS	57											1 14 78 7
3.3	Brown															
	Grey		4	SS	29										23.2	
	Clayey Silt with some sand, occ. gravel (Glacial Till)		5	SS	38											
	Very Stiff - Hard		6	SS	36											4 25 55 16
			7	SS	42											
201.5																
9.6	End of Borehole															
	* Water Level on 1998 09 03															

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 475-91-00 LOCATION Sta. 15+600 1.4 m Rt. N: 4 853 609; E: 301 120 ORIGINATED BY GL
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

OFFICE REPORT ON SOIL EXPLORATION

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 (%)				
215.9	Paved Shoulder							20	40	60	80	100					
0.0	200 mm Asphalt					*											
215.4	Sand and Gravel																
0.5	Brwon Fine Sand																
214.9	Loose		1	SS	12												
1.0																	
	FILL																
	150 mm Topsoil		2	SS	16		214										
	Brown Clayey Silt to Silt, with sand, occ. gravel																
212.9	Stiff - V. Stiff																
3.0																	
	Brown Clayey Silt to Silt, with some sand, occ. gravel (Glacial Till)		3	SS	40		212										
	Hard		4	SS	78											22.6	
	Grey		5	SS	77		210										0 16 69 15
	occ. wet sand seams																
207.8			6	SS	87		208									23.3	
8.1	End of Borehole																
	* Borehole wet upon completion. No free standing water.																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

METRIC

W P 475.91-00 LOCATION Sta. 15+900 1.5 Rt. N: 4 853 909; E: 301 099 ORIGINATED BY GL
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				NATURAL MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	W _p	W	W _L	
222.4	Paved Shoulder														
0.0	250 mm Asphalt/Gravel														
	FILL					*									
	Brown Fine Sand, Tr. Gravel, Compact		1	SS	18										
221.0	Topsoil		2	SS	15										
1.4	Brown Clayey Silt (Fill Material)														
	Stiff														
	mixed with some sand trace organics		3	SS	11										
218.8	Hard														
3.6	Brown Clayey Silt to Silt, Tr. Sand (Glacial Till)		4	SS	50/8	cm									
217.4	Very Dense														
5.0	Brown														
	Sandy Silt		5	SS	50/13	cm									
	occ. fine sand seams														
	Very Dense														
214.3			6	SS	63										
8.1	End of Borehole														
	* Borehole dry upon completion														

+3, x5: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 5

METRIC

W P 475-91-00 LOCATION Sta. 16+600 1.5 m Rt. N: 4 854 606; E: 301 052 ORIGINATED BY GL
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 04 CHECKED BY CM

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W _p	W	W _L		
224.4	Paved Shoulder																GR SA SI CL
0.0	50 mm Asphalt																
224.0	Sand and Gravel						224										
0.4	Brown Fine Sand																
223.3	Loose		1	SS	8												
1.1	100 mm topsoil																
	FILL		2	SS	12												
	Brown Clayey silt with sand, mixed with occ. topsoil		3	SS	9		222										
	Firm - Stiff		4	SS	7												
220.4	Brown						220										
4.0	Grey		5	SS	28											20.9	
	Clayey Silt with some sand, occ. gravel (Glacial Till)		6	SS	12		218										21.3
	Stiff to V. Stiff		7	SS	26												
215.9	Grey Sandy Silt to Silty Sand, Dense						216										
8.5																	
214.8			8	SS	43												2 38 45 15
9.6	End of Borehole																
	* Water level on 1998 09 04																

+3, x⁵; Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 6

METRIC

W P 475-91-00 LOCATION Sta. 16+900 1.5 m Rt. N: 4 854 906; E: 301 030 ORIGINATED BY GL
 DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
 DATUM Geodetic DATE 1998 09 04 CHECKED BY CM

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT \geq					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			20	40	60	80	100					
223.0	Paved Shoulder																
0.0	200 mm Asphalt																
222.6	Sand and Gravel					*											
0.4	Brown Silty Sand																
222.0	Loose		1	SS	9		222										2 58 32 8
1.0	FILL																
	Brown Clayey Silt with mixed topsoil		2	SS	15												
220.4	Firm - Stiff		3	SS	10												
2.6							220										
	Brown		4	SS	36												
	Clayey Silt with some sand, occ.																
	gravel		5	SS	103		218										
	(Glacial Till)																
	Grey		6	SS	67												
	Hard						216										
215.3			7	SS	507	cm											
7.7	End of Borehole																
	* Borehole dry upon completion																

+3, x5: Numbers refer to
Sensitivity

20
15 \div 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 7

METRIC

W P 475-91-00 LOCATION Sta. 17+200 1.5 m Lt. N: 4 855 205: E: 301 008 ORIGINATED BY GI
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

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										SHEAR STRENGTH kPa			WATER CONTENT (%)
																		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE			
222.2	Paved Shoulder														10. 20 30	kN/m³	GR SA SI CL				
0.0	250 mm Asphalt						222														
221.7	Sand and Gravel																				
0.5	Brown Fine Sand		1	SS	13																
221.0	FILL																				
1.2	Topsoil		2	SS	17																
	Brown Clayey Silt						220														
	Very Stiff																				
219.2																					
3.0	Brown Clayey Silt with some sand, occ. gravel (Glacial Till)		3	SS	34											22.2					
							218														
			4	SS	61											22.1					
	Very Hard																				
	Grey						216														
			5	SS	50/15 cm																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 8

METRIC

W P 475-91-00 LOCATION Sta. 17+500 1.5 m Lt. N: 4 855 504; E: 300 986 ORIGINATED BY GL
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Soil Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

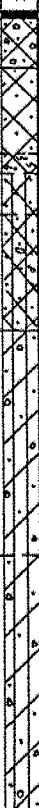
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
224.5	Paved Shoulder																
0.0	200 mm Asphalt																
	Loose to Compact					*	224										
223.3	Sand & Gravel		1	SS	12												0 84 (16)
1.2	Clayey Silt occ. Topsoil incl. Firm		2	SS	7												
222.1							222										
2.4	Brown Clayey Silt with some sand, occ. gravel (Glacial Till)		3	SS	59											22.6	
	Hard						220										
	Grey		4	SS	82											22.4	
							218									23.0	
			5	SS	43												
216.7	Grey Silt, V. Dense		6	SS	87												0 10 80 10
8.1	End of Borehole * Borehole dry upon completion																

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 9

METRIC

W P 475-91-00 LOCATION Sta. 17+800 1.5 m Lt. N: 4 855 804; E: 300 966 ORIGINATED BY GL
DIST CR HWY 400 BOREHOLE TYPE Truck Mount Solid Stem Auger COMPILED BY JP
DATUM Geodetic DATE 1998 09 03 CHECKED BY CM

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										SHEAR STRENGTH kPa			WATER CONTENT (%)
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE													
227.1	Paved Shoulder					*	226														
0.0	75 mm Asphalt																				
226.5	Sand and Gravel																				
0.6	FILL																				
	Brown Sand		1	SS	29																
	Compact																				
	Topsoil																				
	Brown Clayey silt		2	SS	13																
	Brown Silty Sand, occ. fine gravel																				
	Compact - Dense																				
223.9			3	SS	42		224									23.3					
3.2	Brown																				
	Clayey Silt with some sand, occ. gravel																				
	(Glacial Till)		4	SS	50/15	cm	222														
	Hard																				
	Grey		5	SS	63		220									22.9					
219.0			6	SS	82											23.2					
8.1	End of Borehole																				
	* Borehole dry upon completion																				

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 474-91-00 LOCATION N 4 856 314.5; E 300 895 ORIGINATED BY BB
DIST CR HWY 400 BOREHOLE TYPE SS Auger, Automatic Hammer COMPILED BY DT/BB
DATUM Geodetic DATE 1999 03 22 CHECKED BY BB

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT Σ					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	100					
229.8	Asphalt																
0.0	SAND					*	229										
228.4	Trace Gravel, Trace Silt Compact (FILL MATERIAL)		1	SS	27												
1.4	CLAYEY SILT		2	SS	25												1 29 (70)
	Some Sand		3	SS	37		227										
			4	SS	46												
			5	SS	44												
			6	SS	38		225										
	Very Stiff to Hard		7	SS	45												
			8	SS	52												
							223										
			9	SS	50												
							221										
			10	SS	42												
218.4			11	SS	23		219										
11.4	SAND to SILTY SAND		12	SS	154		217										0 15 (85)
	Dense																
215.6			13	SS	34**												
14.2	End of Borehole																
	* Groundwater level not established																
	** disturbed																

RECORD OF BOREHOLE No 5

1 OF 1 METRIC

W.P. 474-91-00 LOCATION N 4 856 349; E 300 889 ORIGINATED BY BB
DIST CR HWY 400 BOREHOLE TYPE SS Auger, Manual Hammer COMPILED BY QT
DATUM Geodetic DATE 1999 03 23 CHECKED BY BB

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				NATURAL MOISTURE CONTENT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
230.2	Asphalt												
0.0													
228.8	SAND, Trace Gravel, Trace Silt (Fill Material), Compact		1	SS	22								
1.4			2	SS	22								
			3	SS	13								
			4	SS	15								
	CLAYEY SILT Trace to Some Sand Trace Gravel Stiff to Hard		5	SS	54								
			6	SS	95								
			7	SS	82								
			8	SS	95								
	Brown Grey		9	SS	68								
			10	SS	54								
			11	SS	31								
218.8			12	SS	152	/23cm							
11.8	SAND TO SILTY SAND Very Dense		13	SS	158								
214.5			14	SS	151	/24cm							
15.7	End of Borehole												

APPENDIX B

Current Borehole Records

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

MINISTRY OF TRANSPORTATION, ONTARIO

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>200	>8
COBBLES	Not Applicable	75 to 200	3 to 8
GRAVEL	Coarse	19 to 75	0.75 to 3
	Fine	4.75 to 19	(4) to 0.75
		2.00 to 4.75	(10) to (4)
SAND	Coarse	0.425 to 2.00	(40) to (10)
	Medium	0.075 to 0.425	(200) to (40)
	Fine		
FINES	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY COMPONENTS^{1,2}

Percentage by Mass	Modifier
> 35	Use 'and' to combine primary and secondary component (<i>i.e.</i> , SAND and gravel)
> 20 to 35	Primary soil name prefixed with "gravelly, sandy" as applicable
> 10 to 20	some (<i>i.e.</i> , some sand)
≤ 10	trace (<i>i.e.</i> , trace fines)

1. Only applicable to components not described by Primary Group Name.

2. Classification of Primary Group Name based on Unified Soil Classification System (ASTM D2487) for coarse-grained soils; fine-grained soils described per current MTO Soil Classification System.

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.). Values reported are as recorded in the field and are uncorrected.

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm² pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (*q_t*), porewater pressure (*u*) and sleeve friction (*f_s*) are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure

PM: Sampler advanced by manual pressure

WH: Sampler advanced by static weight of hammer

WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DD	Diamond Drilling
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
GS	Grab Sample
MC	Modified California Samples
MS	Modified Shelby (for frozen soil)
RC / SC	Rock core / Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size (Shelby tube)
TP	Thin-walled, piston – note size (Shelby tube)
WS	Wash sample
OD / ID	Outer Diameter / Inner Diameter
HSA / SSA	Hollow-Stem Augers / Solid-Stem Augers

SOIL TESTS

w	water content
PL, w _p	plastic limit
LL, w _L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test ¹
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement ¹
D _R	relative density (specific gravity, G _s)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO ₄	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests anisotropically consolidated prior to shear are shown as CAD, CAU.

COARSE-GRAINED SOILS

Compactness¹

Term	SPT 'N' (blows/0.3m) ²
Very Loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	> 50

1. Definition of compactness terms are based on SPT 'N' ranges as provided in Terzaghi, Peck and Mesri (1996). Many factors affect the recorded SPT 'N' value, including hammer efficiency (which may be greater than 60% in automatic trip hammers), overburden pressure, groundwater conditions, and grain size. As such, the recorded SPT 'N' value(s) should be considered only an approximate guide to the soil compactness. These factors need to be considered when evaluating the results, and the stated compactness terms should not be relied upon for design or construction.

2. SPT 'N' in accordance with ASTM D1586, uncorrected for the effects of overburden pressure.

FINE-GRAINED SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N' ^{1,2} (blows/0.3m)
Very Soft	< 12	0 to 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	> 200	> 30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

2. SPT 'N' values should be considered ONLY an approximate guide to consistency; for sensitive clays (e.g., Champlain Sea clays), the N-value approximation for consistency terms does NOT apply. Rely on direct measurement of undrained shear strength or other manual observations.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

LIST OF SYMBOLS

MINISTRY OF TRANSPORTATION, ONTARIO

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
$\ln x$	natural logarithm of x
\log_{10}	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
FoS	factor of safety

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
ν	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
$\sigma_1, \sigma_2, \sigma_3$	principal stress (major, intermediate, minor)

σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ . Unit weight symbol is γ .
where $\gamma = \rho \cdot g$ (i.e., mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_L or LL	liquid limit
w_P or PL	plastic limit
I_P or PI	plasticity index $= (w_L - w_P)$
NP	non-plastic
w_s	shrinkage limit
I_L	liquidity index $= (w - w_P) / I_P$
I_C	consistency index $= (w_L - w) / I_P$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index $= (e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
$C_{a(e)}$	secondary compression index
C_a	rate of secondary compression
$C_{a(e)}$	modified secondary compression index
m_v	coefficient of volume change
C_v	coefficient of consolidation (vertical direction)
C_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio $= \sigma'_p / \sigma'_{vo}$

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
c'	effective cohesion
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction $= \tan \delta$
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q or q'	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1
2

$\tau = c' + \sigma' \tan \phi'$
shear strength = (compressive strength)/2



PROJECT		21490972		RECORD OF BOREHOLE		No MS-1		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4850855.6; E 301515.2 MTM NAD 83 ZONE 10 (LAT. 43.797665; LONG. -79.540823)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 1, 2022		CHECKED BY		DAM						
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								
204.2	GROUND SURFACE															
0.0	ASPHALT (300 mm)															
203.9	CONCRETE (200 mm)															
203.4	SAND (SW) and gravel, trace silt (FILL)		1A	SS	13											
0.9	Brown Moist		1B													
	SAND (SW), trace gravel, trace silt (FILL)		2	SS	10											
	Brown Moist															
202.0	SILTY CLAY (CI), some sand, trace gravel, trace organics (FILL)		3	SS	21											
2.2	Stiff Brown to grey to black Moist															
	SILTY CLAY (CI), some sand (TILL)		4	SS	19											
	Very stiff Brown to grey Moist															
200.5	SANDY SILT (ML), some clay, trace gravel		5	SS	59											
3.7	Very dense Brown Moist															
199.7	SILTY SAND (SM), some clay, trace gravel		6	SS	58/0.25											
4.5	Very dense Grey Moist															
	- Spoon bouncing between 4.5 m and 4.9 m depth.															
	- Auger grinding between 5.0 m and 5.6 m depth.															
197.5	END OF BOREHOLE		7	SS	68											
6.7	NOTES:															
	1. Borehole open upon completion of drilling.															
	2. Water measured inside open borehole at a depth of 5.5 m below ground surface (Elevation 198.7 m) upon completion of drilling.															



PROJECT		21490972		RECORD OF BOREHOLE		No MS-2		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4851046.9; E 301482.0 MTM NAD 83 ZONE 10 (LAT. 43.799387; LONG. -79.541237)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 1, 2022		CHECKED BY		DAM						
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								
204.9	GROUND SURFACE															
0.0	ASPHALT (300 mm)															
0.3	SAND (SW) and gravel, trace silt (FILL)															
204.2	Brown Moist															
0.9	SAND (SW), trace gravel, trace silt (FILL)		1A	SS	11											
	Brown Moist		1B													
	SANDY CLAYEY SILT (CL) (FILL)		2	SS	14											
202.7	Stiff Brown Moist															
2.2	CLAYEY SILT (CL), some sand to sandy CLAYEY SILT (CL), trace gravel (TILL)		3	SS	19											
	Very stiff Brown Moist		4	SS	23											
			5	SS	20											
200.6	Sandy SILT (ML)															
4.3	Very dense Grey Moist		6	SS	57											
199.3	CLAYEY SILT-SILT (CL-ML), some sand, trace gravel (TILL)															
5.6	Dense Grey Moist		7	SS	39											
198.2																
6.7	END OF BOREHOLE															
	NOTE: 1. Borehole open and dry upon completion of drilling.															



PROJECT		21490972		RECORD OF BOREHOLE		No MS-3		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4851245.3; E 301447.9 MTM NAD 83 ZONE 10 (LAT. 43.801173; LONG. -79.541662)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 1, 2022		CHECKED BY		DAM						
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								
205.7	GROUND SURFACE															
0.0	ASPHALT (340 mm)															
205.4																
204.8	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A 1B	SS	10											
0.9	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2	SS	10											
	SILTY CLAY (CI), some sand, trace gravel (FILL) Stiff Brown Moist		3	SS	9											
202.7			4	SS	15											
3.0			5	SS	9											
201.2	Sandy SILT (ML), some gravel Compact Grey Moist		6	SS	25											
200.1																
5.6	CLAYEY SILT (CL) to SILTY CLAY (CI), trace gravel, trace sand (TILL) Hard Grey Moist		7	SS	33											
199.0																
6.7	END OF BOREHOLE															
NOTES:																
1. Borehole caved to a depth of 5.9 m (Elevation 199.8 m) upon completion of drilling.																
2. Water measured inside open borehole at a depth of 5.5 m below ground surface (Elevation 200.2 m) upon completion of drilling.																



PROJECT		21490972		RECORD OF BOREHOLE		No MS-4		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4851444.2; E 301413.8 MTM NAD 83 ZONE 10 (LAT. 43.802963; LONG. -79.542087)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 2, 2022		CHECKED BY		DAM						
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								
206.4	GROUND SURFACE															
0.0	ASPHALT (340 mm)															
206.1																
205.5	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A 1B	SS	10											
0.9	SAND (SW), trace gravel, trace silt (FILL) Brown Moist															
204.2	SILTY CLAY (CI), some gravel, trace sand to sandy (FILL) Stiff to very stiff Brown to grey Moist		2	SS	12											
2.2	SANDY CLAYEY SILT (CL) to CLAYEY SILT (CL) and sand, trace gravel (TILL) Very stiff to hard Brown to grey Moist		3	SS	15											
			4	SS	19											
			5	SS	32											
			6	SS	46											
	- Grey below 4.5 m															
200.8	SILT (ML), some sand, some clay, trace gravel Dense Grey Moist		7	SS	50											
5.6																
199.7	END OF BOREHOLE															
6.7	NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.8 m below ground surface (Elevation 200.6 m) upon completion of drilling.															



PROJECT 21490972			RECORD OF BOREHOLE No MS-5			SHEET 1 OF 1			METRIC							
G.W.P. 2836-02-00			LOCATION N 4851642.8; E 301380.0 MTM NAD 83 ZONE 10 (LAT. 43.804750; LONG. -79.542509)			ORIGINATED BY JNS										
DIST CENTRAL HWY 400			BOREHOLE TYPE Power Auger; 156 mm O.D. Solid Stem Auger			COMPILED BY MH										
DATUM Geodetic			DATE June 2, 2022			CHECKED BY DAM										
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								
207.2	GROUND SURFACE															
0.0	ASPHALT (350 mm)															
206.9																
0.6	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	15											
206.1			1B													
1.1	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2	SS	11											
205.0	Organic Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff to very stiff Grey to black Moist		3	SS	16											
205.2			4	SS	17											
204.5	Sandy CLAYEY SILT (CL), trace gravel (TILL) Stiff to very stiff Brown to grey Moist		5	SS	27											
202.7			6	SS	55											
4.5	SILTY SAND (SM), some gravel Very dense Brown Moist															
201.6																
5.6	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Very dense Grey Moist		7	SS	76											
200.5																
6.7	END OF BOREHOLE															
NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.0 m below ground surface (Elevation 202.2 m) upon completion of drilling.																



PROJECT		21490972		RECORD OF BOREHOLE		No MS-6		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4851843.9; E 301343.3 MTM NAD 83 ZONE 10 (LAT. 43.806560; LONG. -79.542966)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 2, 2022		CHECKED BY		DAM						
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								
207.5	GROUND SURFACE															
0.0	ASPHALT (260 mm)															
0.5	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	7											
206.5	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		1B													
1.0	SANDY CLAYEY SILT (CL), trace gravel (FILL) Firm to stiff Brown Moist		2	SS	13											
205.3	SANDY CLAYEY SILT (CL), trace gravel (TILL) Stiff to very stiff Brown Moist		3	SS	29											
2.2	- Auger grinding between 2.3 m and 2.9 m depth.		4	SS	9											
203.8	SAND (SP) and silt, trace clay Compact to very dense Brown to grey Wet		5	SS	41											
3.7			6	SS	13											
			7	SS	98											
200.8	END OF BOREHOLE															
6.7	NOTES: 1. Borehole caved to a depth of 3.1 m (Elevation 204.4 m) upon completion of drilling. 2. Borehole dry to the caved depth of 3.1 m below ground surface (Elevation 204.4 m) upon completion of drilling.															



PROJECT		21490972		RECORD OF BOREHOLE		No MS-7		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4852041.7; E 301311.8 MTM NAD 83 ZONE 10 (LAT. 43.808340; LONG. -79.543359)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 7, 2022		CHECKED BY		DAM						
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								
206.8	GROUND SURFACE															
0.0	ASPHALT (340 mm)															
206.5																
	SAND (SW) and gravel, trace silt (FILL)															
0.9	Brown Moist		1A	SS	14											
	SAND (SW), trace gravel, trace silt (FILL)		1B													
	Brown Moist															
	SAND (SW) and gravel, trace silt (FILL)		2	SS	9											
204.6	Brown Moist															
2.2	SAND (SW) and gravel, trace silt (FILL)															
	Brown Moist															
	SAND (SW), trace gravel, trace silt (FILL)		3	SS	6											
	Brown Moist															
	SILTY CLAY (CI), some sand, trace gravel, trace organics (FILL)		4	SS	18											
	Stiff Grey to black Moist															
	CLAYEY SILT (CL), trace gravel, some sand to sandy CLAYEY SILT (CL), trace gravel (TILL)		5	SS	8											
202.3	Firm to very stiff Brown to grey (mottled) Moist															
4.5	- Grey below 3.7 m		6	SS	26											
	Sandy SILT (ML), some gravel Compact Grey Moist															
	- Wet below 6.1 m															
200.1			7	SS	29											
6.7	END OF BOREHOLE															
NOTES:																
1. Borehole open upon completion of drilling.																
2. Water measured inside open borehole at a depth of 2.7 m below ground surface (Elevation 204.1 m) upon completion of drilling.																



PROJECT		21490972		RECORD OF BOREHOLE		No MS-8		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4852243.5; E 301276.9 MTM NAD 83 ZONE 10 (LAT. 43.810156; LONG. -79.543794)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 12, 2022		CHECKED BY		DAM						
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								
206.9	GROUND SURFACE															
0.0	ASPHALT (380 mm)															
206.5																
0.7	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1	SS	13											
	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2	SS	9											
	CLAYEY SILT (CL), some sand to Sandy CLAYEY SILT (CL), trace gravel (FILL) Firm to stiff Brown to grey Moist		3	SS	5											
203.9																
3.0	SILTY CLAY (CI), some sand (TILL) Firm Brown to grey (mottled) Moist		4	SS	7											
203.2																
3.7	Sandy SILT (ML), some gravel Compact Brown Moist		5	SS	11											
			6	SS	30											
201.3																
5.6	Sandy CLAYEY SILT (CL) (TILL) Very stiff Grey Moist		7	SS	28											
200.2																
6.7	END OF BOREHOLE															
NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.6 m below ground surface (Elevation 201.3 m) upon completion of drilling.																



PROJECT		21490972		RECORD OF BOREHOLE		No MS-9		SHEET 1 OF 1		METRIC									
G.W.P.		2836-02-00		LOCATION		N 4852430.2; E 301245.1 MTM NAD 83 ZONE 10 (LAT. 43.811837; LONG. -79.544190)		ORIGINATED BY		JNS									
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH									
DATUM		Geodetic		DATE		June 12, 2022		CHECKED BY		DAM									
SOIL PROFILE				SAMPLES			GROUND WATER CONDITIONS		ELEVATION SCALE		DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT		UNIT WEIGHT		REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV	DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES													
207.7	0.0	GROUND SURFACE																	
207.4	0.3	ASPHALT (330 mm)																	
		SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	12													
	1.0	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		1B															
		SAND (SW) and gravel, trace silt (FILL) Brown Moist		2	SS	15													
		Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff to very stiff Brown to grey Moist		3	SS	10													
204.7	3.0	SILTY CLAY (CI), trace gravel, trace sand (TILL) Firm Brown to grey (mottled) Moist		4	SS	6													
204.0	3.7	SILT (ML) and sand, trace gravel, trace clay Compact to dense Brown to grey Moist		5	SS	31													
				6	SS	11													
				7	SS	45													
201.0	6.7	END OF BOREHOLE																	
<p>NOTES:</p> <p>1. Borehole open upon completion of drilling.</p> <p>2. Water measured inside open borehole at a depth of 3.4 m below ground surface (Elevation 204.3 m) upon completion of drilling.</p>																			

[illegible]

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



PROJECT		21490972		RECORD OF BOREHOLE No MS-11		SHEET 1 OF 1		METRIC							
G.W.P.		2836-02-00		LOCATION		N 4852826.9; E 301179.4 MTM NAD 83 ZONE 10 (LAT. 43.815407; LONG. -79.545010)		ORIGINATED BY JNS							
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY MH							
DATUM		Geodetic		DATE		June 12, 2022		CHECKED BY DAM							
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							
209.1	GROUND SURFACE														
0.0	ASPHALT (240 mm)														
	SAND (SW) and gravel, trace silt (FILL) Brown Moist														
208.0	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		1A	SS	11										
1.1	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1B												
	SAND (SW) and gravel, trace silt (FILL) Brown Moist		2	SS	7										
	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		3	SS	8										
	CLAY (CH), some sand, trace organics (FILL) Firm		4	SS	7										
205.4	Brown to grey Moist														
3.7	SILT (ML) and sand to sandy SILT (ML), some gravel, some clay Compact to dense Brown Moist		5	SS	19										
			6	SS	40										
			7	SS	17										
202.4	END OF BOREHOLE														
6.7	NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 3.0 m below ground surface (Elevation 206.1 m) upon completion of drilling.														



PROJECT		21490972		RECORD OF BOREHOLE		No MS-12		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4853161.9; E 301153.6 MTM NAD 83 ZONE 10 (LAT. 43.818423; LONG. -79.545332)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 13, 2022		CHECKED BY		DAM						
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								
<div>210.2 GROUND SURFACE</div> <div>0.0 ASPHALT (130 mm)</div> <div>209.8 SAND (SW) and gravel, trace silt (FILL) Brown Moist</div> <div>209.2 SAND (SW), trace gravel, trace silt (FILL) Brown Moist</div> <div>208.0 CLAYEY SILT (CL), trace sand to sandy CLAYEY SILT (CL), some gravel (FILL) Firm to very stiff Brown to grey Moist</div> <div>207.0 Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Stiff to hard Brown to grey Moist</div> <div>204.6 SILT (ML), some clay, trace sand Compact Grey Moist</div> <div>203.5 END OF BOREHOLE</div>																
210			1A	SS	12											
209			1B													
208			2	SS	5											
207			3	SS	8											
206			4	SS	15											1 33 49 17
205			5	SS	29											
204			6	SS	31											
203			7	SS	21											0 1 82 17
<div>NOTES:</div> <div>1. Borehole open upon completion of drilling.</div> <div>2. Water measured inside open borehole at a depth of 2.9 m below ground surface (Elevation 207.3 m) upon completion of drilling.</div>																



PROJECT		21490972		RECORD OF BOREHOLE No MS-13		SHEET 1 OF 1		METRIC							
G.W.P.		2836-02-00		LOCATION		N 4853459.1; E 301133.3 MTM NAD 83 ZONE 10 (LAT. 43.821097; LONG. -79.545588)		ORIGINATED BY JNS							
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY MH							
DATUM		Geodetic		DATE		June 13, 2022		CHECKED BY DAM							
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							
211.8	GROUND SURFACE														
0.0	ASPHALT (210 mm)														
0.5	SAND (SW) and gravel, trace silt (FILL)														
210.9	Brown Moist		1A	SS	13										
0.9	SAND (SW), trace gravel, trace silt (FILL)		1B												
	Brown Moist														
210.0	CLAYEY SILT (CL), some sand, some gravel, trace organics (FILL)		2A	SS	25										
1.8	Stiff to very stiff Brown to grey Moist		2B												
	Sandy SILTY CLAY (CI) to SILTY CLAY, some sand, trace gravel (TILL)		3A	SS	8										
	Stiff to very stiff Brown to black Moist		3B												
	- Trace organics in sample no. 3B														
			4	SS	21										
			5	SS	16										
			6	SS	19										
206.2	Sandy SILT (ML), some gravel Compact Grey Moist														
5.6															
205.1	END OF BOREHOLE		7	SS	26										
6.7	NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.0 m below ground surface (Elevation 206.8 m) upon completion of drilling.														









PROJECT		RECORD OF BOREHOLE		No MS-14		SHEET 1 OF 1		METRIC					
G.W.P. 2836-02-00		LOCATION		N 4853761.6; E 301112.5 MTM NAD 83 ZONE 10 (LAT. 43.823820; LONG. -79.545848)		ORIGINATED BY		JNS					
DIST CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH					
DATUM Geodetic		DATE		June 13, 2022		CHECKED BY		DAM					
SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION RESISTANCE PLOT			REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	GR SA SI CL
218.6 0.0	GROUND SURFACE ASPHALT (230 mm)												
217.8 0.8	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	13		218						
	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		1B										
216.4 2.2	SILTY CLAY (CI), trace sand to sandy SILTY CLAY (CI), trace to some gravel (FILL) Stiff Brown to grey Moist		2	SS	11		217						
	Sandy SILT (ML), some clay, trace gravel to SILT (ML), trace clay, trace gravel Compact Brown Moist		3	SS	20		216						
			4	SS	19		215						4 30 53 13
			5	SS	28		214						
			6	SS	55		213						0 1 88 9
			7	SS	32		212						
211.9 6.7	END OF BOREHOLE NOTE: 1. Borehole open and dry upon completion of drilling.												



PROJECT		21490972		RECORD OF BOREHOLE		No MS-15		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4854110.0; E 301079.5 MTM NAD 83 ZONE 10 (LAT. 43.826956; LONG. -79.546260)		ORIGINATED BY		KC						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 16, 2022		CHECKED BY		DAM						
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								
223.6	GROUND SURFACE															
0.0	ASPHALT (430 mm)															
223.2																
222.8	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A 1B	SS	15											2 23 42 33
1.0	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2	SS	7											
221.4	Sandy CLAYEY SILT (CL), trace gravel (FILL) Firm to stiff Brown to black Moist		3	SS	12											
2.2	Sandy CLAYEY SILT (CL), trace gravel (TILL) Stiff Brown Moist		4	SS	29											
220.5	Sandy SILT (ML), trace clay Compact to very dense Brown Moist		5	SS	26											0 23 72 5
3.1			6	SS	36											
			7	SS	54											
216.9	END OF BOREHOLE															
6.7	NOTE: 1. Borehole open and dry upon completion of drilling.															

[illegible]

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

PROJECT			21490972						RECORD OF BOREHOLE No MS-17								SHEET 1 OF 1				METRIC							
G.W.P.			2836-02-00						LOCATION								N 4854500.2; E 301052.9 MTM NAD 83 ZONE 10 (LAT. 43.830468; LONG. -79.546594)								ORIGINATED BY JNS			
DIST			CENTRAL HWY 400						BOREHOLE TYPE								Power Auger; 156 mm O.D. Solid Stem Auger								COMPILED BY MH			
DATUM			Geodetic						DATE								June 14, 2022								CHECKED BY DAM			
SOIL PROFILE										SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT W _p W W _L			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION								STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED					WATER CONTENT (%)								
															20 40 60 80 100					10 20 30								
223.7	GROUND SURFACE												223									kN/m³	GR SA SI CL					
0.0 223.4	ASPHALT (300 mm)																											
0.5	SAND (SW) and gravel, trace silt (FILL) Brown Moist									1A	SS	13																
222.8	SAND (SW), trace gravel, trace silt (FILL) Brown Moist									1B	SS																	
0.9	SILT CLAY (CI), some sand (FILL) Stiff Brown Moist									2	SS	10																
										3	SS	9																
																												
										4A	SS	24																
220.4	SILT (ML) trace clay Compact to dense Brown Moist									4B	SS																	
3.4										5	SS	34																
																												
										6	SS	41																
	- Wet below 6.1 m																											
										7	SS	45																
217.0																												
6.7	END OF BOREHOLE																											
NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.6 m below ground surface (Elevation 218.1 m) upon completion of drilling.																												

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



PROJECT		21490972		RECORD OF BOREHOLE No MS-18		SHEET 1 OF 1		METRIC							
G.W.P.		2836-02-00		LOCATION		N 4854765.9; E 301034.5 MTM NAD 83 ZONE 10 (LAT. 43.832860; LONG. -79.546825)		ORIGINATED BY JNS							
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY MH							
DATUM		Geodetic		DATE		June 15, 2022		CHECKED BY DAM							
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							
222.4	GROUND SURFACE														
222.0	ASPHALT (280 mm)														
1.0	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	10										
2.0	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		1B												
2.2	SAND (SW) and gravel, trace silt (FILL) Brown Moist		2	SS	8										
2.2	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		3	SS	18										
2.2	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		4A												
2.2	CLAYEY SILT (CL), trace to some sand (CL) (FILL) Stiff to very stiff Brown to grey Moist		4B	SS	15										0 12 37 51
2.7	SILTY CLAY (CI), some sand (TILL) Very stiff Brown to grey Moist		5	SS	18										0 25 57 18
3.7	SANDY SILT, some clay Compact to very dense Brown to grey Moist		6	SS	40										
7			7	SS	89										
215.7	END OF BOREHOLE														
6.7	NOTE: 1. Borehole open and dry upon completion of drilling.														



PROJECT		21490972		RECORD OF BOREHOLE		No MS-19		SHEET 1 OF 1		METRIC						
G.W.P.		2836-02-00		LOCATION		N 4855067.6; E 301013.6 MTM NAD 83 ZONE 10 (LAT. 43.835575; LONG. -79.547087)		ORIGINATED BY		JNS						
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY		MH						
DATUM		Geodetic		DATE		June 15, 2022		CHECKED BY		DAM						
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								
220.9	GROUND SURFACE															
0.0	ASPHALT (300 mm)															
220.6																
220.1	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	7											
0.8			1B													
219.5	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2	SS	14											
1.5																
	CLAYEY SILT (CL), trace sand to sandy CLAYEY SILT (CL), trace gravel (FILL) Firm to stiff Brown Moist		3	SS	29											
	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel to CLAYEY SILT-SILT (CL-ML), some sand (TILL) Stiff to very stiff Brown Moist - Grey below 3.8 m depth		4	SS	44											
			5	SS	24											
			6	SS	12											
			7	SS	22											
214.2	END OF BOREHOLE															
6.7																
	NOTE: 1. Borehole open and dry upon completion of drilling.															

[illegible]

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



PROJECT		21490972		RECORD OF BOREHOLE No MS-21		SHEET 1 OF 1		METRIC							
G.W.P.		2836-02-00		LOCATION		N 4855655.6; E 300973.3 MTM NAD 83 ZONE 10 (LAT. 43.840867; LONG. -79.547592)		ORIGINATED BY JNS							
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger		COMPILED BY MH							
DATUM		Geodetic		DATE		June 14, 2022		CHECKED BY DAM							
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							
224.9	GROUND SURFACE														
0.0	ASPHALT (230 mm)														
	SAND (SW) and gravel, trace silt (FILL) Brown Moist		1A	SS	34										
224.0			1B												
1.1	SAND (SW), trace gravel, trace silt (FILL) Brown Moist														
	SAND (SW) and gravel, trace silt (FILL) Brown Moist		2	SS	8										
	SAND (SW), trace gravel, trace silt (FILL) Brown Moist		3	SS	8										
221.9															
3.0	Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff Brown to grey Moist		4	SS	6										
	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Firm to hard		5	SS	28										
			6	SS	55										
			7	SS	24										
218.2															
6.7	END OF BOREHOLE														
NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 4.3 m below ground surface (Elevation m) upon completion of drilling.															









PROJECT		RECORD OF BOREHOLE		SHEET 1 OF 1		METRIC																																																																																																																																																																																																																																																			
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Water measured inside open borehole at a depth of 5.6 m below ground surface (Elevation 221.5 m) upon completion of drilling. </td> </tr> </tbody> </table> </div></div>								ELEV DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT	REMARKS & GRAIN SIZE DISTRIBUTION (%)				NUMBER TYPE "N" VALUES			20 40 60 80 100	W _p W W _L		γ	GR SA SI CL	227.1	GROUND SURFACE										0.0	ASPHALT (450 mm)				227						226.7												SAND (SW) and gravel, trace silt (FILL) Brown Moist		1 SS 39		226						1.2												SAND (SW), trace gravel, trace silt (FILL) Brown Moist		2 SS 8								224.9					225						2.2												SAND (SW) and gravel, trace silt (FILL) Brown Moist		3 SS 15		224					3 32 49 16		SAND (SW), trace gravel, trace silt (FILL) Brown Moist		4 SS 17								223.4					223						3.7												SILTY CLAY (CI), trace sand (FILL) Stiff Grey Moist		5 SS 18									Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Very stiff Brown Moist		6 SS 43		222					4 24 55 17													Sandy SILT (ML), some clay, trace gravel Compact to dense Brown Moist				221							- Grey below 4.57 m depth										220.4			7 SS 33								6.7	END OF BOREHOLE										NOTES: 1. 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+³, ×³: Numbers refer to Sensitivity ○^{3%} STRAIN AT FAILURE

PROJECT		21490972		RECORD OF BOREHOLE No MS-23						SHEET 1 OF 1		METRIC					
G.W.P.		2836-02-00		LOCATION		N 4856186.1; E 300912.1 MTM NAD 83 ZONE 10 (LAT. 43.845643; LONG. -79.548357)						ORIGINATED BY JNS					
DIST		CENTRAL HWY 400		BOREHOLE TYPE		Power Auger; 156 mm O.D. Solid Stem Auger						COMPILED BY MH					
DATUM		Geodetic		DATE		June 14, 2022						CHECKED BY DAM					
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			20 40 60 80 100								
227.9	GROUND SURFACE																
0.0 227.6	ASPHALT (300 mm)																
0.6	SAND (SW) and gravel, trace silt (FILL) Brown Moist			1A	SS	14											
226.7 1.2	SAND (SW), trace gravel, trace silt (FILL) Brown Moist			1B	SS												
2	CLAYEY SAND (SC), trace gravel (FILL) Loose Brown to grey Moist			2	SS	6											
225.7 2.2	sandy SILT (ML), some clay, trace gravel Compact to very dense Brown to grey Moist			3	SS	12											
4				4	SS	17											
5				5	SS	29											
6				6	SS	71											
- Grey below 6.1 m depth																	
221.2 6.7	END OF BOREHOLE			7	SS	34											
NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 4.2 m below ground surface (Elevation 223.7 m) upon completion of drilling.																	

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

PROJECT	21490972		RECORD OF BOREHOLE		No. MS-24	Sheet 1 of 1	METRIC	
G.W.P.	2836-02-00		LOCATION	N 4854733.9; E 301062.5 NAD83 / MTM Zone 10 (LAT. 43.832572; LONG. -79.546476)			ORIGINATED BY	T.T.
DIST	CENTRAL	HWY 400	BOREHOLE TYPE	Power Auger; 168 mm O.D. Hollow Stem Augers			COMPILED BY	M.L.
DATUM	Surface Elevation:223.7 m		DATE	Apr 24, 2023			CHECKED BY	M.H





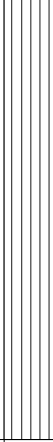
SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y	GR	SA	SI	CL	REMARKS
ELEV. ----- DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL	NMC	LL						
								Field Vane	Remoulded	Pocket Pen	Quick Triaxial	Unconfined	W _p	W	W _L						
							20	40	60	80	100	20	40	60	NP Nonplastic						
0.0	ASPHALT (175 mm)																				
223.6 0.2	Gravelly SAND (SP-SM), some silt, trace clay (FILL) Compact Light brown to brown Dry to wet		1	SS	19										○			22	66	11 1	
222.3 1.4	CLAYEY SILT (CL), some sand, trace gravel, trace organics (FILL) Firm to stiff Black Moist		2	SS	8																
221.5 2.2	Sandy CLAYEY SILT (CL), trace gravel (FILL) Fir to stiff Brown Moist		3	SS	4										├─┤			1	33	43 23	
			4	SS	9										○						
220.0 3.7	Sandy CLAYEY SILT (CL), trace gravel (TILL) Very stiff to hard Brown with oxidation staining Moist		5	SS	29																
			6	SS	48										○├─┤			1	22	60 17	
218.1 5.6	Sandy SILT (ML), trace clay Dense Brown Wet		7	SS	36										○			0	33	65 2	
217.0 6.7	End of Borehole NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 2.6 m below ground surface (Elevation 221.1 m) upon completion of drilling.																				

PROJECT 21490972		RECORD OF BOREHOLE No. MS-25		Sheet 1 of 1		METRIC	
G.W.P. 2836-02-00		LOCATION N 4854577.6; E 301075.7 NAD83 / MTM Zone 10 (LAT.43.831157; LONG. -79.546308)		ORIGINATED BY T.T.			
DIST CENTRAL HWY 400		BOREHOLE TYPE Power Auger; 168 mm O.D. Hollow Stem Augers		COMPILED BY M.L.			
DATUM Surface Elevation:224.4 m		DATE Apr 23, 2023		CHECKED BY M.H			

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT					REMARKS
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL W _p	NMC W	LL W _L		GR	SA	SI	CL	
								Field Vane Remoulded Pocket Pen Quick Triaxial Unconfined													
0.0	ASPHALT (200 mm)							20 40 60 80 100					20 40 60								
224.2	SAND (SP) and gravel, some non-plastic fines (FILL) Dense Light brown to brown Moist						224														
0.2			1	SS	46																
							223														
			2	SS	38												37	50	11	2	
222.2	CLAYEY SILT-SILT (CL-ML), trace sand, trace gravel, trace organics (FILL) Stiff Black Moist						222														
2.2			3	SS	14																
221.4	Sandy CLAYEY SILT (CL), trace gravel (TILL) Stiff to hard Brown Moist						221														
3.0			4	SS	15																
							220										1	25	50	24	
			5	SS	38																
							219														
			6	SS	24																
218.8	SILTY SAND (SM) Dense Brown Wet						218														
5.6			7	SS	41												0	56	44	0	
217.7	End of Borehole																				
6.7	NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.4 m below ground surface (Elevation 219.0 m) upon completion of drilling.																				

+³, x³ : Numbers refer to Sensitivity o³⁰% STRAIN AT FAILURE

PROJECT	21490972	RECORD OF BOREHOLE	No. MS-26	Sheet 1 of 1	METRIC
G.W.P.	2836-02-00	LOCATION	N 4854444.4; E 301085.3 NAD83 / MTM Zone 10 (LAT. 43.829958; LONG. -79.546188)	ORIGINATED BY	T.T.
DIST	CENTRAL HWY 400	BOREHOLE TYPE	Power Auger; 168 mm O.D. Hollow Stem Augers	COMPILED BY	M.L.
DATUM	Surface Elevation:225.1 m	DATE	Apr 23, 2023	CHECKED BY	M.H

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y kN/m³	GR	SA	SI	CL	REMARKS	
ELEV. ----- DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL W _p	NMC W	LL W _L							
								Field Vane Remoulded Pocket Pen Quick Triaxial Unconfined														
									20	40	60	80	100		20	40	60					
0.0	ASPHALT (180 mm)						224															
224.9 0.2	SAND (SP) and Gravel, trace silt (FILL) Compact Light brown Moist		1	SS	26																	
223.6																						
1.4	Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff to very stiff Brown Moist		2	SS	10																	
			3	SS	18														2	30	47	21
			4	SS	12																	
221.3																						
3.7	SILT (ML), trace to some sand, trace clay Compact to dense Brown Moist to wet		5	SS	43																	
			6	SS	30																	
			7	SS	46																	
218.3																						
6.7	End of Borehole																					
	NOTES: 1. Borehole open upon completion of drilling. 2. Water measured inside open borehole at a depth of 4.7 m below ground surface (Elevation 220.4m) upon completion of drilling.																					

PROJECT 21490972

RECORD OF BOREHOLE No. MS-27

Sheet 1 of 1

METRIC

G.W.P. 2836-02-00

LOCATION N 4854315.2; E 301095.9 NAD83 / MTM Zone 10 (LAT. 43.828794; LONG. -79.546054)

ORIGINATED BY T.T.

DIST CENTRAL HWY 400




BOREHOLE TYPE Power Auger; 168 mm O.D. Hollow Stem Augers

COMPILED BY M.L.

DATUM Surface Elevation:225.2 m










DATE Apr 23, 2023

CHECKED BY M.H.

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y kN/m³	GR	SA	SI	CL	REMARKS
ELEV. ----- DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL	NMC	LL						
								Field Vane	Remoulded	Pocket Pen	Quick Triaxial	Unconfined	W _p	W	W _L						
							20	40	60	80	100	20	40	60							
0.0	ASPHALT (200 mm)																				
225.1 0.2	SAND (SP) and gravel (FILL) Very Dense Light brown Moist		1	SS	55																
223.8																					
1.4	SILTY CLAY (CI), some sand (FILL) Firm to stiff Dark brown to brown Moist		2	SS	8																
	- 3.0 to 3.4 m: Sand interlayer		3	SS	8												0	20	43	37	
			4	SS	10																
221.5																					
3.7	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel to CLAYEY SILT-SILT, trace sand (TILL) Very stiff to hard Brown Moist		5	SS	22												3	30	53	14	
				6	SS	37															
	- Grey below 5.6 m																				
			7	SS	24												0	5	78	17	
218.5																					
6.7	End of Borehole																				
	NOTES: 1. Borehole open upon completion of drilling.																				

+³, x³ : Numbers refer to Sensitivity o³⁰% STRAIN AT FAILURE

PROJECT 21490972		RECORD OF BOREHOLE No. MS-28		Sheet 1 of 1		METRIC	
G.W.P. 2836-02-00		LOCATION N 4852350.3 ; E 301223.3 NAD83 / MTM Zone 10 (LAT. 43.811109; LONG. -79.544457)		ORIGINATED BY T.T.			
DIST CENTRAL HWY 400		BOREHOLE TYPE Power Auger; 168 mm O.D. Hollow Stem Augers		COMPILED BY M.L.			
DATUM Surface Elevation:207.7 m		DATE Apr 26, 2023		CHECKED BY M.H			

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y	GR	SA	SI	CL	REMARKS
ELEV. ----- DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL	NMC	LL						
								Field Vane	Remoulded	Pocket Pen	Quick Triaxial	Unconfined	W _p	W	W _L						
								20	40	60	80	100	20	40	60						
0.0	ASPHALT (180 mm)																				
207.5 0.2	CONCRETE (280 mm)																				
207.2 0.5	SAND (SW-SM), some gravel, trace silt, trace clay (FILL) Compact to dense Brown Moist		1	SS	30		207											13	77	9 1	
206.2 1.4	Sandy CLAYEY SILT (CL) (FILL) Stiff to very stiff Brown Moist		2	SS	16		206														
			3	SS	10		205											0	34	35 31	
204.7 3.0	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Stiff to hard Grey Wet		4	SS	16		204														
			5	SS	15													2	24	56 18	
			6	SS	50		203														
			7	SS	33		202														
201.0 6.7	End of Borehole NOTES: 1. Borehole caved to a depth of 6.2 m below ground surface (Elevation 201.5 m) upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.5 m below ground surface (Elevation 202.2 m) upon completion of drilling.						201														

PROJECT	21490972	RECORD OF BOREHOLE	No. MS-29	Sheet 1 of 1	METRIC
G.W.P.	2836-02-00	LOCATION	N 4852219.8; E 301246 NAD83 / MTM Zone 10 (LAT. 43.809935; LONG. -79.544175)	ORIGINATED BY	T.T.
DIST	CENTRAL HWY 400	BOREHOLE TYPE	168 mm O.D. Hollow Stem Augers	COMPILED BY	M.L.
DATUM	Surface Elevation:207.1 m	DATE	Apr 26, 2023	CHECKED BY	M.H

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT					REMARKS
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL W _p	NMC W	LL W _L		GR	SA	SI	CL	
								Field Vane Remoulded Pocket Pen Quick Triaxial Unconfined													
								20 40 60 80 100					20 40 60								
0.0	ASPHALT (180 mm)						207														
207.0 0.2	CONCRETE (350 mm)																				
206.5																					
0.6	SAND (SP) and gravel (FILL) Compact Brown Moist		1	SS	21		206														
205.7																					
1.4	CLAYEY SAND (SC), trace gravel (FILL) Firm to very stiff Brown and grey Moist		2	SS	16		205										10	48	30	12	
			3	SS	5																
204.2																					
3.0	SILTY CLAY (CI), trace sand, trace gravel (TILL) Firm to stiff Brown (mottled) Moist		4	SS	8		204										1	10	36	53	
3.7																					
203.4	SILT (ML) and sand of slight plasticity, trace gravel, trace clay Compact to dense Brown to grey Moist		5	SS	10		203														
			6	SS	20		202										5	37	48	10	
							201														
			7	SS	38																
200.4																					
6.7	End of Borehole																				
	NOTES: 1. Borehole caved to a depth of 5.5 m below ground surface (Elevation 201.6 m) upon completion of drilling. 2. Water measured inside open borehole at a depth of 5.3 m below ground surface (Elevation 201.8 m) upon completion of drilling.																				

PROJECT	21490972	LOCATION	N 4852065.3; E 301272.2 NAD83 / MTM Zone 10 (LAT. 43.808544; LONG. -79.543848)	ORIGINATED BY	T.T.
G.W.P.	2836-02-00	BOREHOLE TYPE	Power Auger; 168 mm O.D. Hollow Stem Augers	COMPILED BY	M.L.
DIST	CENTRAL HWY 400	DATE	Apr 27, 2023	CHECKED BY	M.H
DATUM	Surface Elevation:206.9 m				

RECORD OF BOREHOLE No. MS-30 Sheet 1 of 1 METRIC

SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y kN/m³	GR	SA	SI	CL	REMARKS
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL W _p	NMC W	LL W _L						
								Field Vane Remoulded Pocket Pen Quick Triaxial Unconfined													
0.0	ASPHALT (150 mm)							20	40	60	80	100	20	40	60						
206.7 0.2	CONCRETE (460 mm)																				
206.3																					
0.6	Gravelly SILTY SAND (SM), trace clay (FILL) Compact to very dense Brown Moist		1	SS	100/0.21		206														
205.0			2A	SS	10		205										25	60	13	2	
1.8	Sandy CLAYEY SILT (CL), trace gravel (FILL) Stiff Brown		2B														2	29	46	23	
204.7 2.2	Moist CLAYEY SILT (CL), some sand, trace gravel (TILL) Firm to very stiff Brown Moist																				
			3	SS	8		204														
			4	SS	28																
							203														
			5	SS	10												2	14	41	43	
			6	SS	23		202														
							201														
			7	SS	23																
6.7 200.2	End of Borehole																				
NOTES: 1. Borehole open and dry upon completion of drilling.																					

+³, x³ : Numbers refer to Sensitivity o³% STRAIN AT FAILURE

PROJECT 21490972

RECORD OF BOREHOLE No. MS-31

Sheet 1 of 1

METRIC

G.W.P. 2836-02-00

LOCATION N 4851927.8; E 301296.7 NAD83 / MTM Zone 10 (LAT. 43.807307; LONG. -79.543542)

ORIGINATED BY T.T.

DIST CENTRAL HWY 400

BOREHOLE TYPE Power Auger; 168 mm O.D. Hollow Stem Augers

COMPILED BY M.L.

DATUM Surface Elevation:207.4 m

DATE Apr 27, 2023

CHECKED BY M.H.

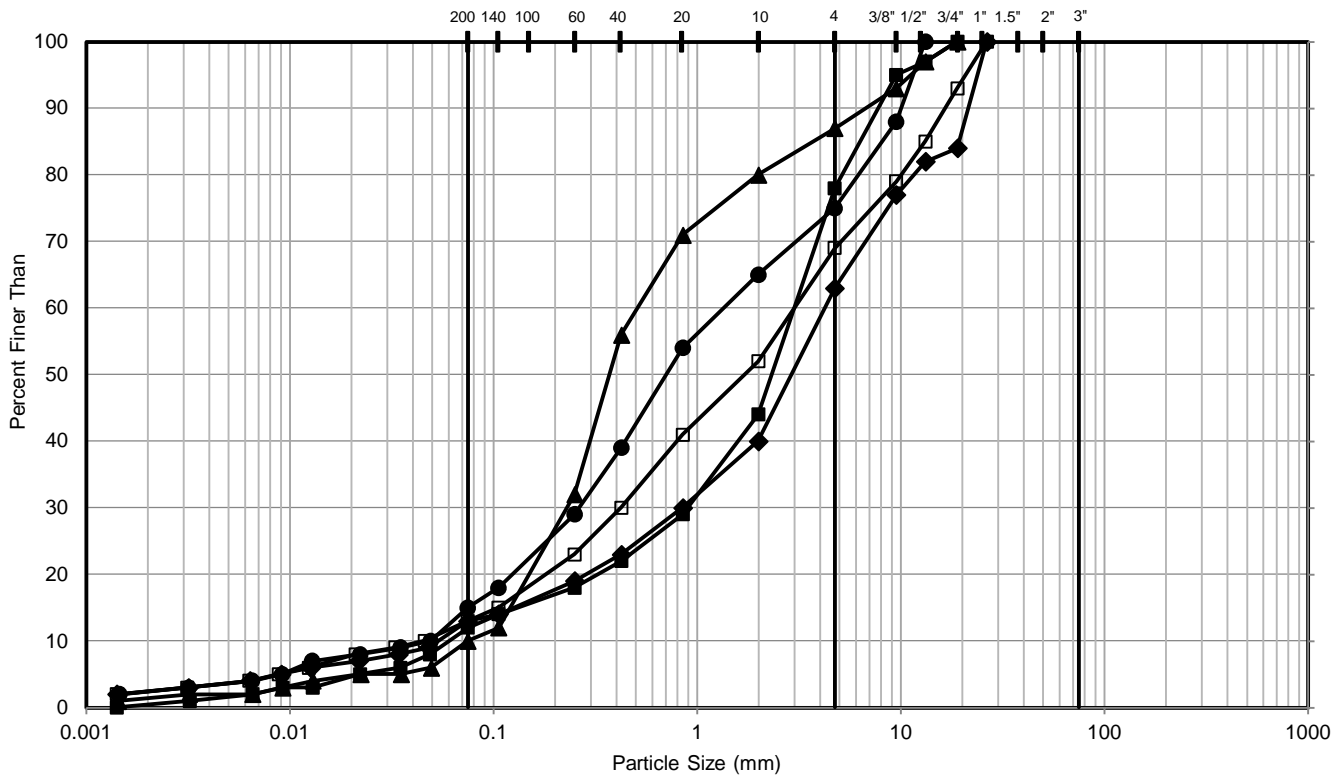
SOIL PROFILE			SAMPLES			GROUNDWATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					WATER CONTENT (%)			UNIT WEIGHT Y	GR	SA	SI	CL	REMARKS
ELEV. DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH (kPa)					PL W _p	NMC W	LL W _L						
0.0	ASPHALT (150 mm)							20	40	60	80	100	20	40	60						
207.2 0.2	CONCRETE (460 mm)						207														
206.8																					
0.6	Gravelly SILTY SAND (SM) (FILL) Dense Brown Moist		1	SS	32													31	56	11	2
205.9							206														
1.4	Sandy CLAYEY SILT (CL), trace gravel (FILL) Soft to firm Brown Moist		2	SS	4													3	34	46	17
			3	SS	4		205														
204.4																					
3.0	Sandy CLAYEY SILT-SILT (CL-ML), trace gravel (TILL) Stiff to hard Brown Moist		4	SS	9		204														
	- Grey below 3.7 m		5	SS	38		203											2	27	55	16
	- 4.5 to 5.6 m: Sandy silt interlayer		6	SS	53		202														
	- 6.1 m: No recovery		7A	SS	100/0.3		201														
			7B	AS	-																
6.7 200.7	End of Borehole NOTES: 1. Borehole open and dry upon completion of drilling.																				

+³, x³ : Numbers refer to Sensitivity o³⁰% STRAIN AT FAILURE

APPENDIX C

**Geotechnical Laboratory Test
Results**

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	MS-24	1	0.8 - 1.4	223.0 to 222.4
◆	MS-25	2	1.5 - 2.1	222.9 to 222.3
▲	MS-28	1	0.8 - 1.4	206.9 to 206.3
●	MS-30	2A	1.5 - 1.8	205.3 to 205.0
□	MS-31	1	0.8 - 1.4	206.6 to 206.0

CLIENT

PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)

CONSULTANT



YYYY-MM-DD 2023-02-08

DESIGNED NA

PREPARED T.T.

REVIEWED M.L.

APPROVED M.H.

PROJECT

Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00
Median Storm Sewers

TITLE

Granular Fill (Pavement Structure)

PROJECT NO.

21490972

CONTROL

0

REV.

0

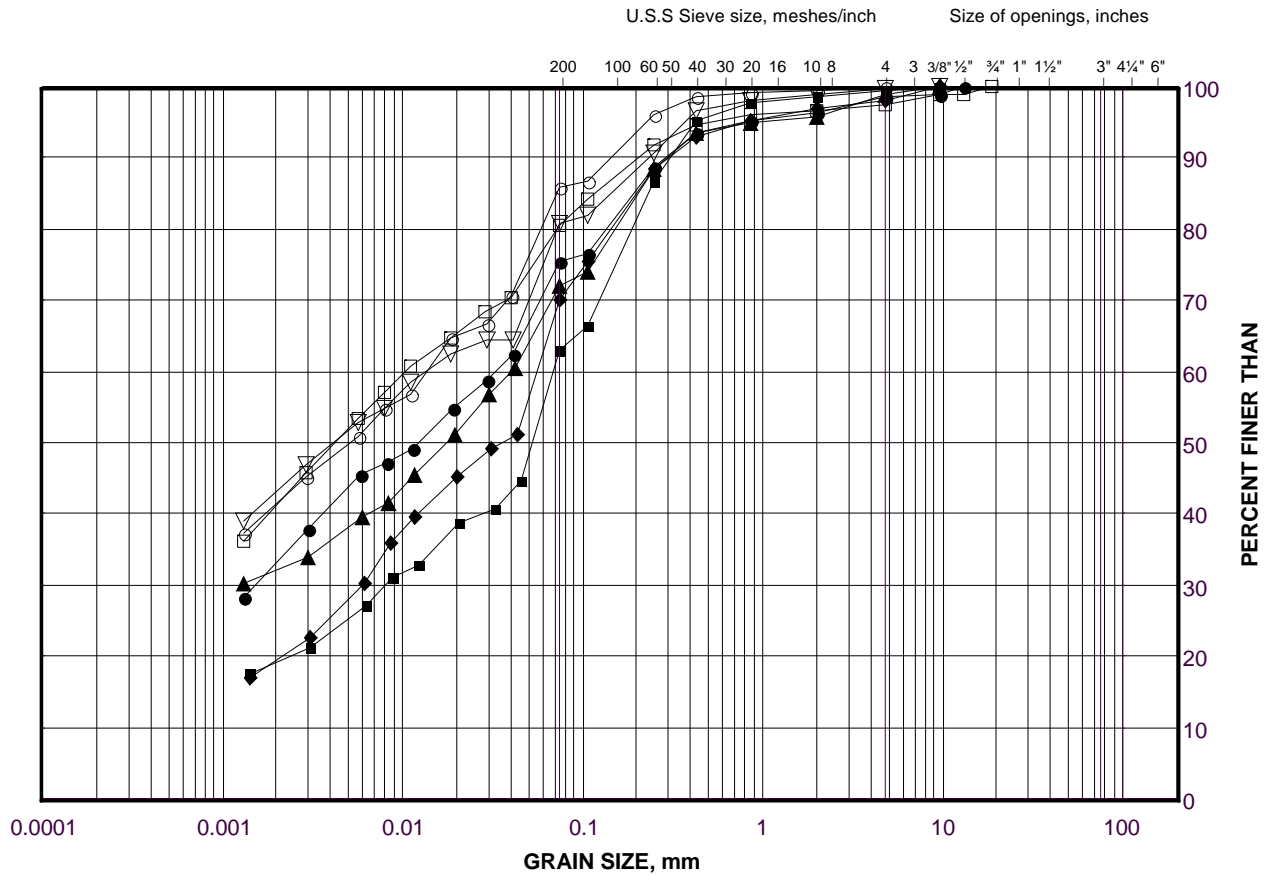
FIGURE

C-1

GRAIN SIZE DISTRIBUTION

CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)

FIGURE C-2A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-15	1B	221.7
■	MS-23	2	226.1
◆	MS-21	2	223.1
▲	MS-8	2	205.1
▽	MS-17	3	221.1
○	MS-11	3	206.5
□	MS-3	3	203.1

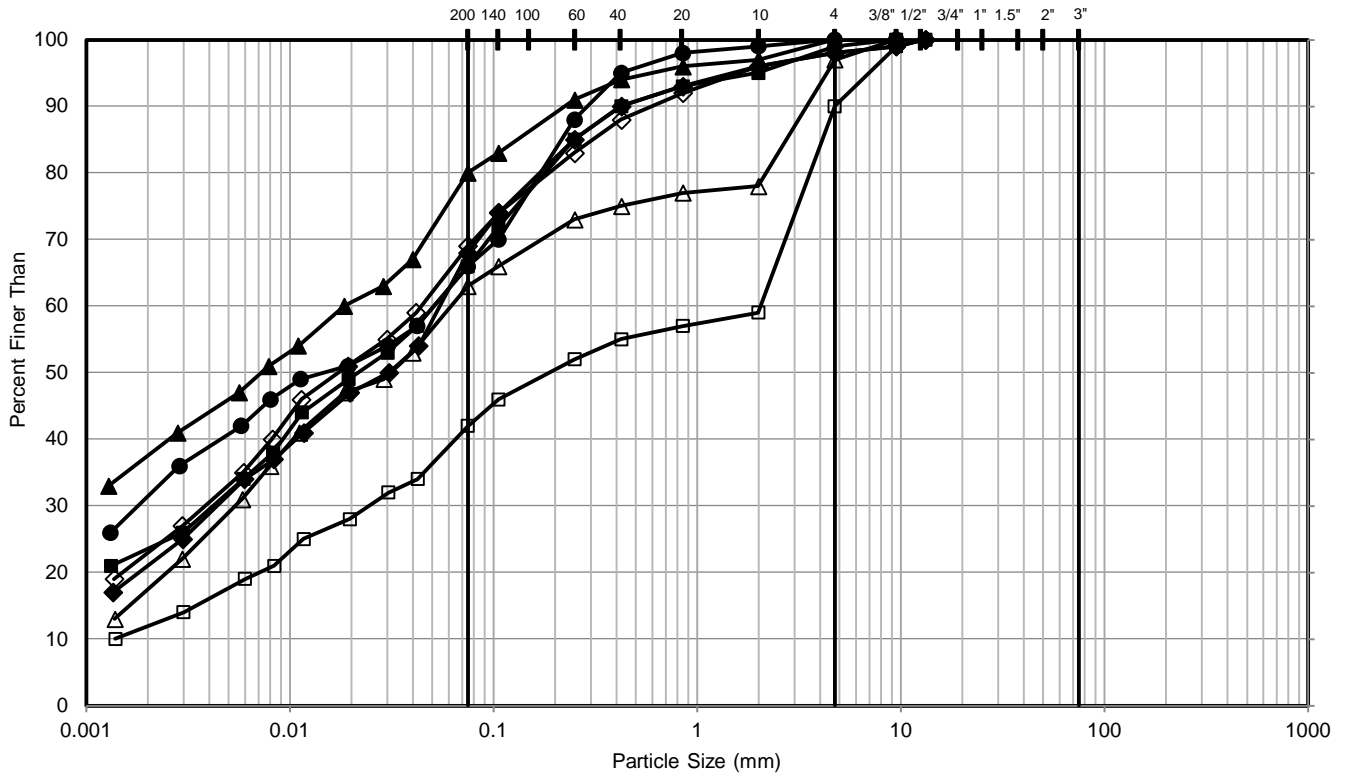
Project Number: 21490972

Checked By: _____

Golder Associates

Date: 09-Jan-23

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	MS-24	3	2.3 - 2.9	221.4 to 220.8
◆	MS-26	3	2.3 - 2.9	222.8 to 222.2
▲	MS-27	3	2.3 - 2.9	222.9 to 222.3
●	MS-28	3	2.3 - 2.9	205.4 to 204.8
□	MS-29	2	1.5 - 2.1	205.6 to 205.0
◇	MS-30	2B	1.8 - 2.1	205.0 to 204.7
△	MS-31	2	1.5 - 2.1	205.9 to 205.3

CLIENT

PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)

CONSULTANT

wsp **GOLDER**

YYYY-MM-DD 2023-02-08

DESIGNED NA

PREPARED T.T.

REVIEWED M.L.

APPROVED M.H.

PROJECT

Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00
Median Storm Sewers

TITLE

CLAYEY SILT - SILT (CL-ML) to SILT CLAY (CI) (FILL)

PROJECT NO.

21490972

CONTROL

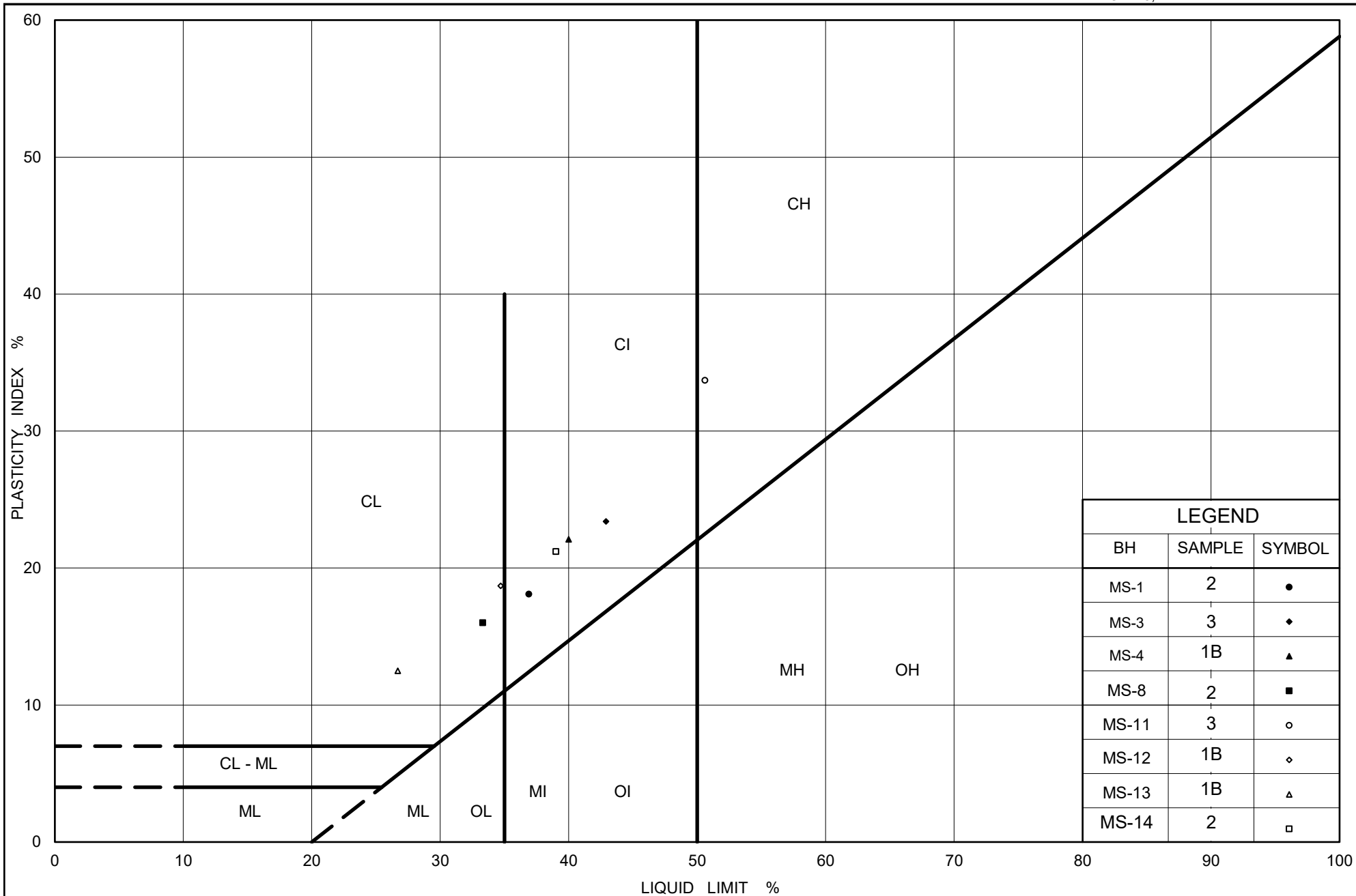
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REV.

0

FIGURE

C-2B



Ministry of Transportation

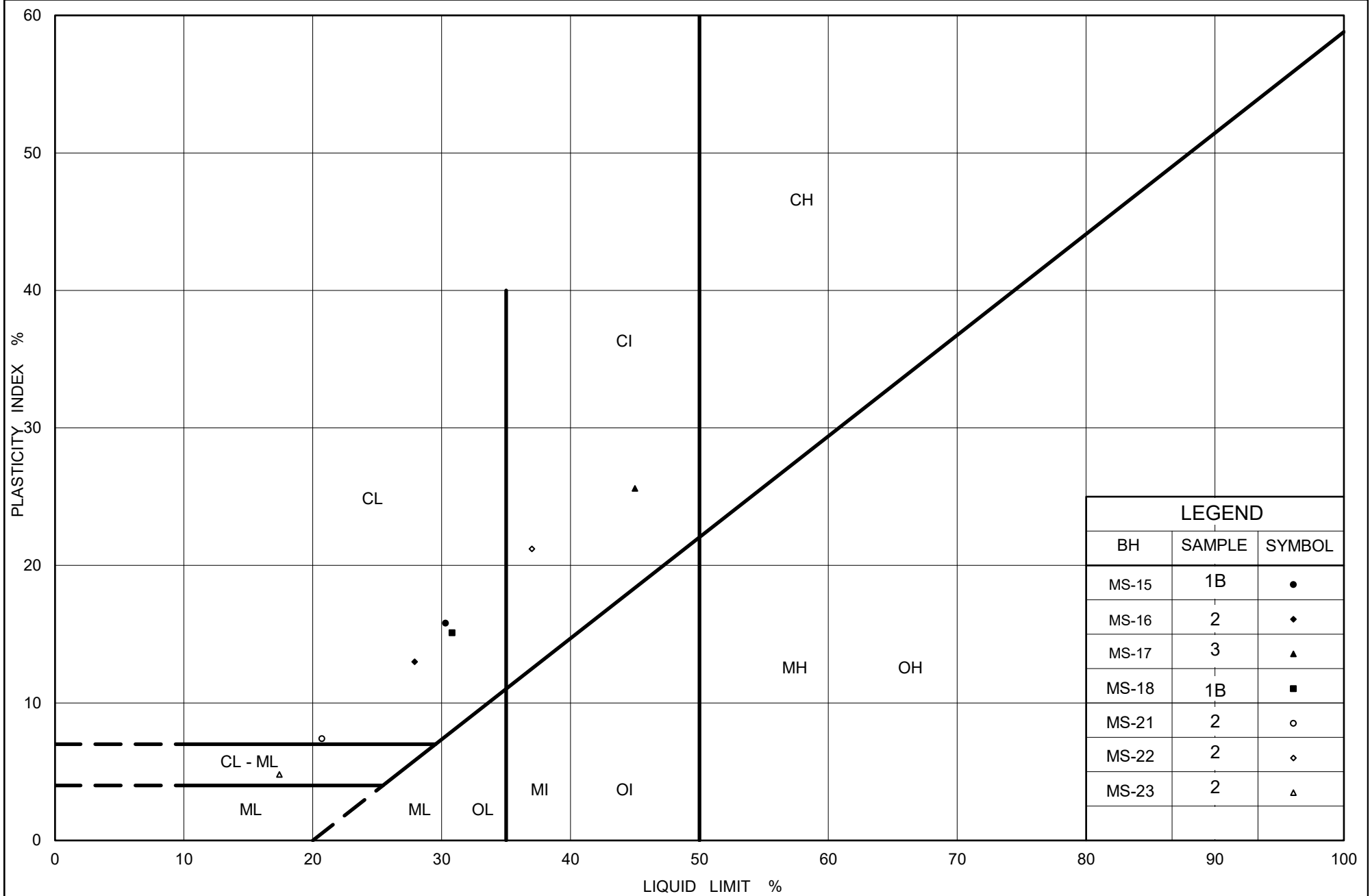
Ontario

PLASTICITY CHART CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)

Figure No. C-3A

Project No. 21490972

Checked By: MH



Ministry of Transportation

Ontario

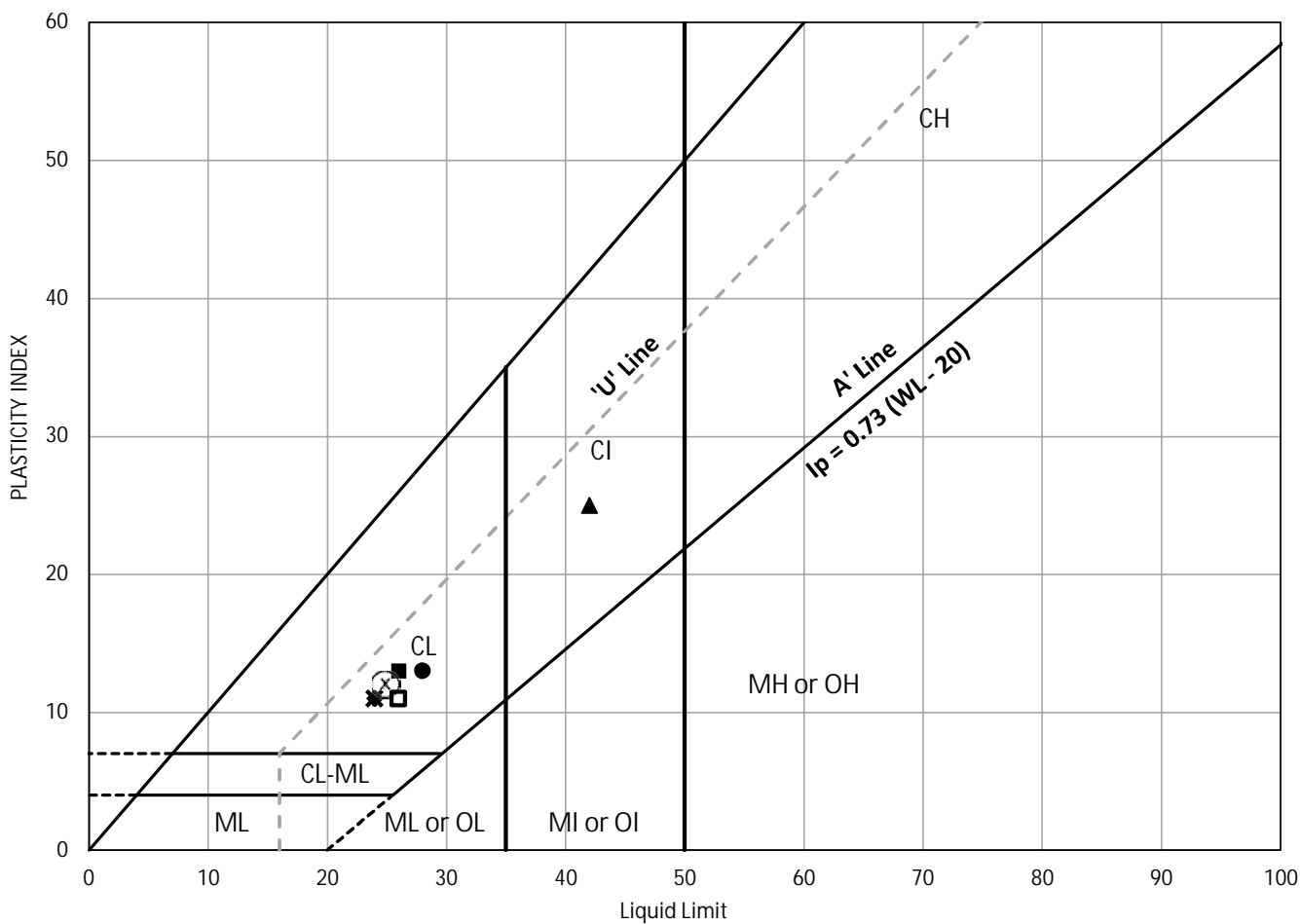
PLASTICITY CHART CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)

Figure No. C-3B

Project No. 21490972

Checked By: MH

PLASTICITY CHART



	Sample Location	Sample / Specimen Number	Depth (m)	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
■	MS-24	3	2.3 - 2.9		26	13	13	
◆	MS-26	3	2.3 - 2.9		24	13	11	
▲	MS-27	3	2.3 - 2.9		42	17	25	
●	MS-28	3	2.3 - 2.9	20	28	15	13	0.38
*	MS-29	2	1.5 - 2.1	11	24	13	11	-0.18
⊗	MS-30	2B	1.8 - 2.1		25	13	12	
□	MS-31	2	1.5 - 2.1	15.6	26	15	11	0.05

CLIENT
PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)

CONSULTANT
wsp GOLDER
YYYY-MM-DD
DESIGNED
PREPARED
REVIEWED
APPROVED
2023-02-08
NA
T.T.
M.L.
0

PROJECT
Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00
Median Storm Sewers

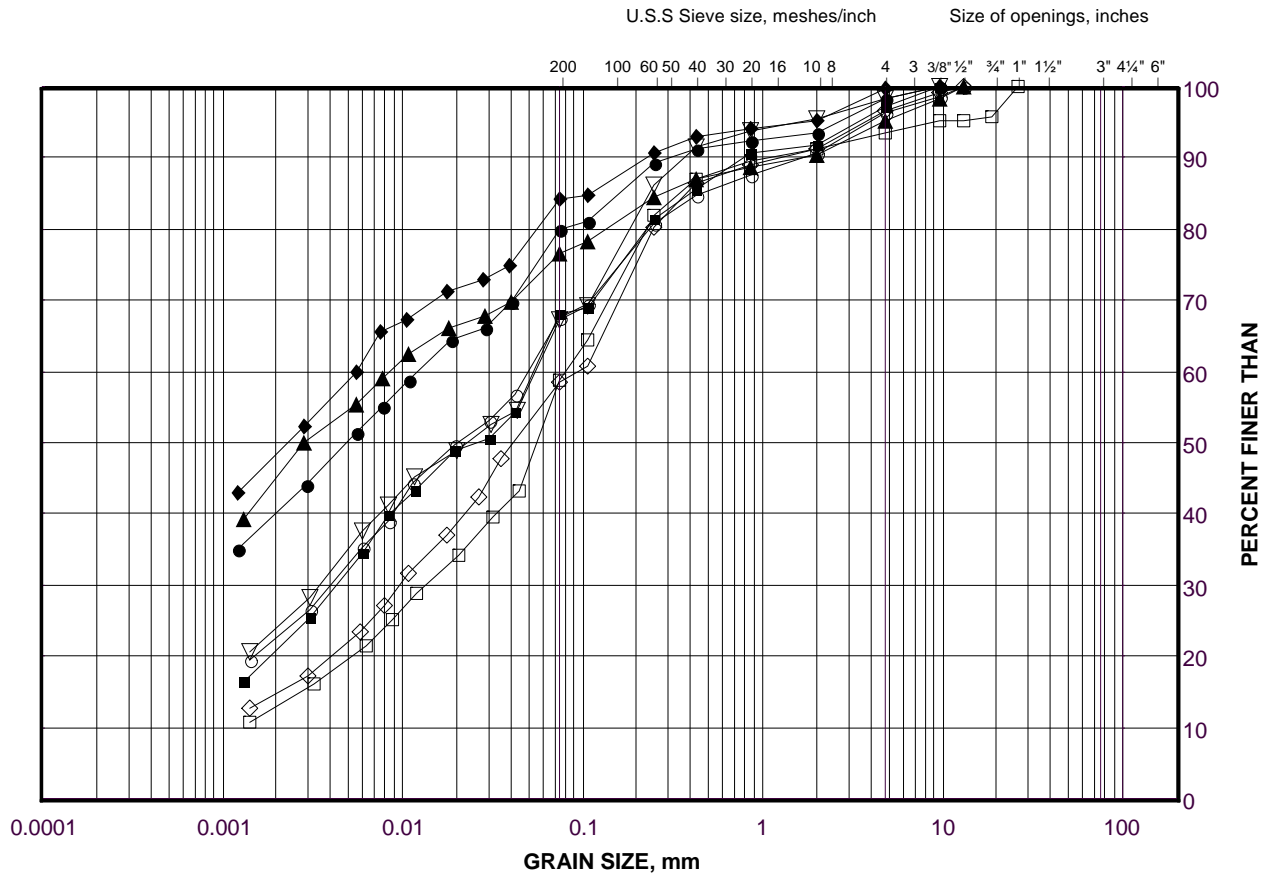
TITLE
CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (FILL)

PROJECT NO. 21490972
CONTROL 0
REV. 0
FIGURE C-3C

GRAIN SIZE DISTRIBUTION

Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Upper

FIGURE C-4A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-7	3	204.2
■	MS-5	3	204.6
◆	MS-1	3	201.6
▲	MS-13	4	208.4
▽	MS-6	4	204.1
○	MS-2	4	201.6
□	MS-7	5	202.7
△	MS-4	5	202.3

Project Number: 21490972

Checked By: _____

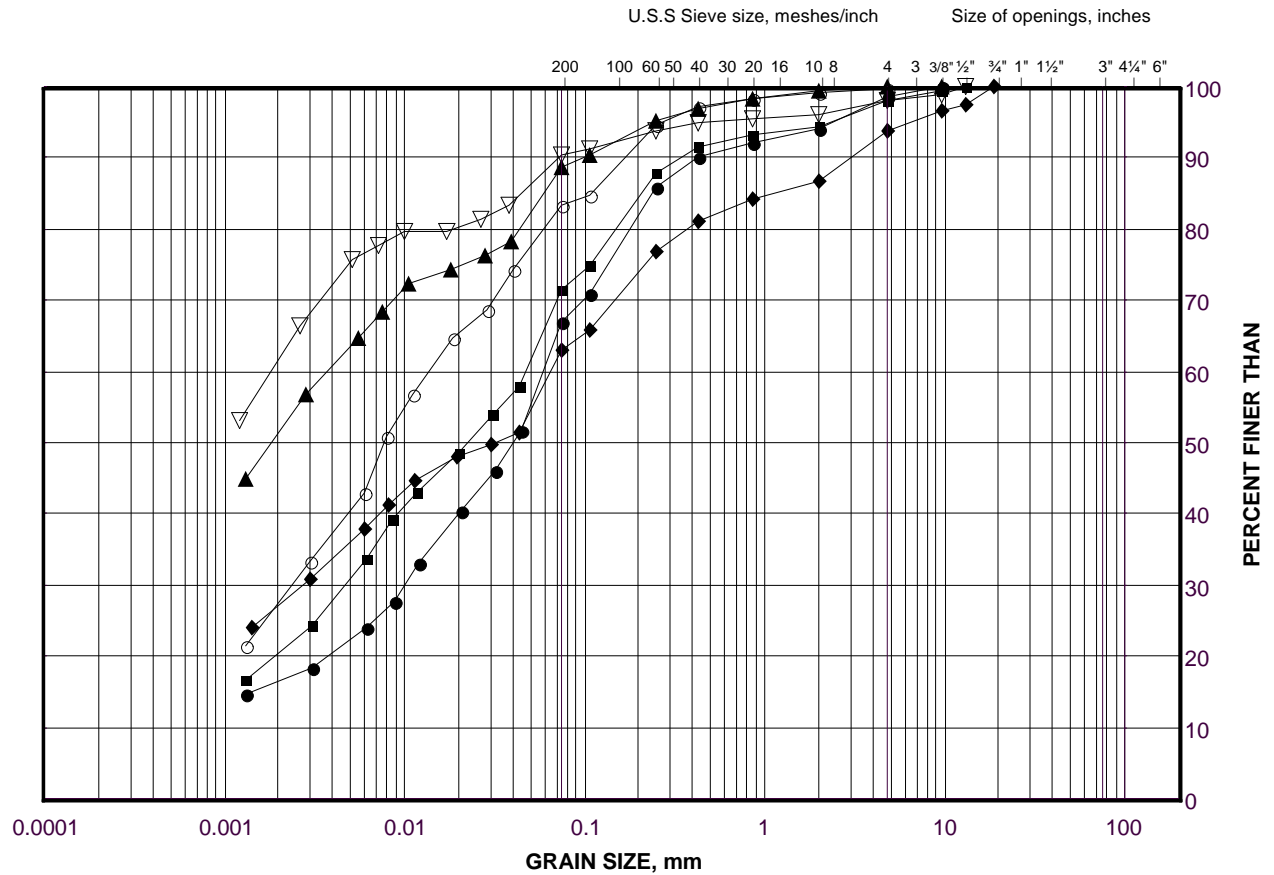
Golder Associates

Date: 09-Jan-23

GRAIN SIZE DISTRIBUTION

Sandy CLAYEY-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Upper

FIGURE C-4B



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-13	2B	209.8
■	MS-19	3	218.3
◆	MS-10	3	205.8
▲	MS-18	4A	219.3
▽	MS-9	4	204.3
○	MS-19	6	216

Project Number: 21490972

Checked By: _____

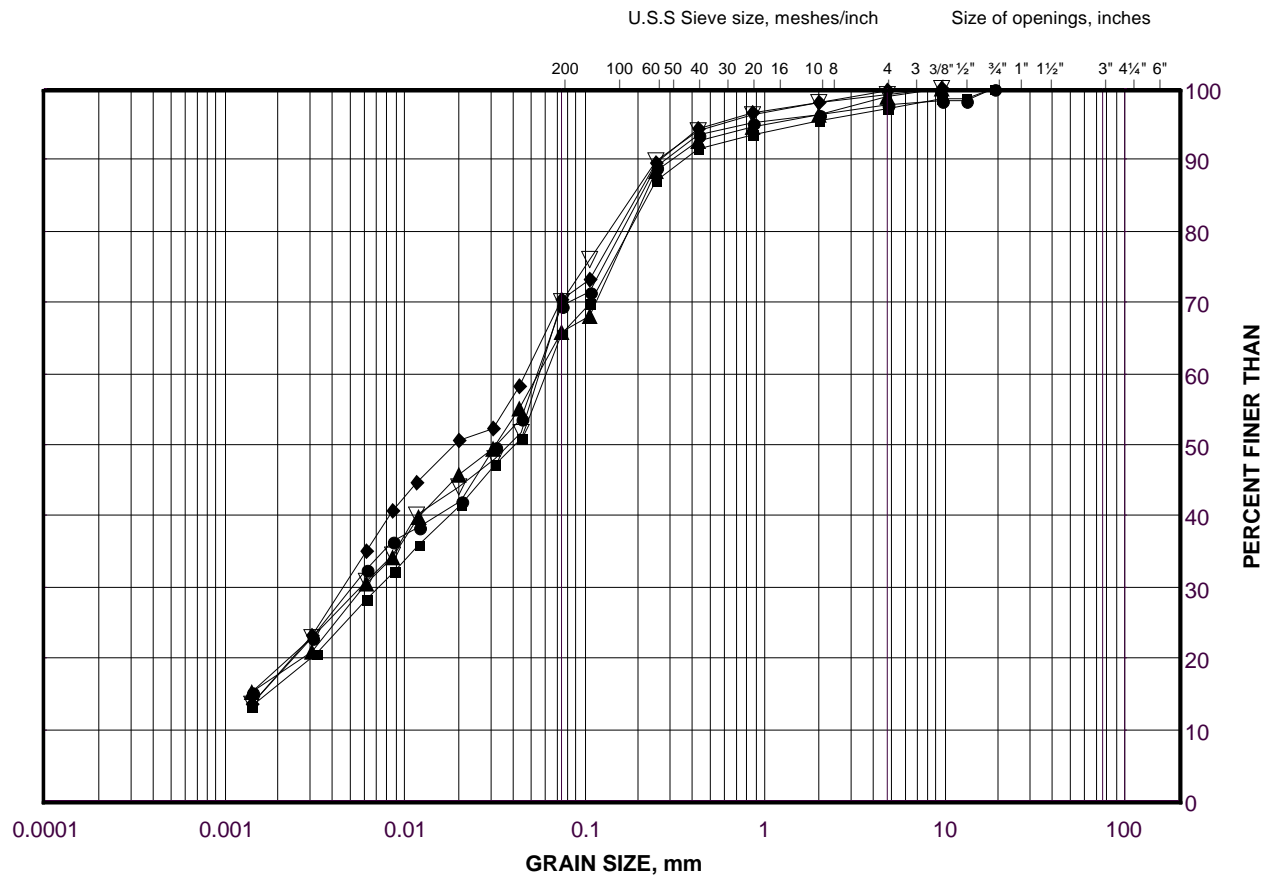
Golder Associates

Date: 25-May-23

GRAIN SIZE DISTRIBUTION

Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Upper

FIGURE C-4C



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-20	2	220.1
■	MS-22	3	224.5
◆	MS-21	4	221.5
▲	MS-12	4	206.8
▽	MS-20	5	217.8

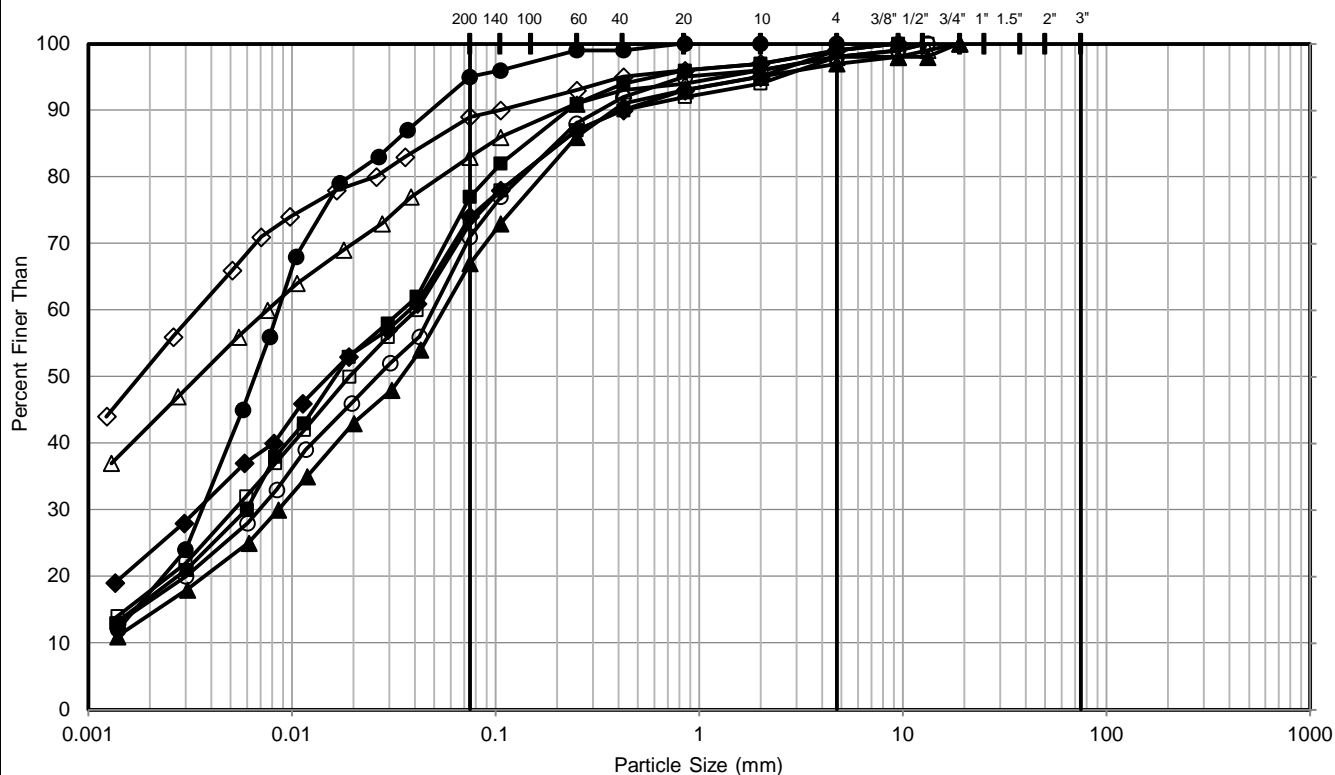
Project Number: 21490972

Checked By: _____

Golder Associates

Date: 09-Jan-23

GRAIN SIZE DISTRIBUTION



Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	MS-24	6	4.6 - 5.2	219.2 to 218.6
◆	MS-25	5	3.8 - 4.4	220.6 to 220.0
▲	MS-27	5	3.8 - 4.4	221.4 to 220.8
●	MS-27	7	6.1 - 6.7	219.1 to 218.5
□	MS-28	5	3.8 - 4.4	203.9 to 203.2
◇	MS-29	4	3.0 - 3.7	204.1 to 203.5
△	MS-30	5	3.8 - 4.4	203.1 to 202.5
○	MS-31	5	3.8 - 4.4	203.6 to 203.0

CLIENT

PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)

CONSULTANT

WSP **GOLDER**

YYYY-MM-DD 2023-02-08

DESIGNED NA

PREPARED T.T.

REVIEWED M.L.

APPROVED M.H.

PROJECT

Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00
Median Storm Sewers

TITLE

Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Upper

PROJECT NO.

21490972

CONTROL

0

REV.

0

FIGURE

C-4D



PLASTICITY CHART

Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL)
Upper

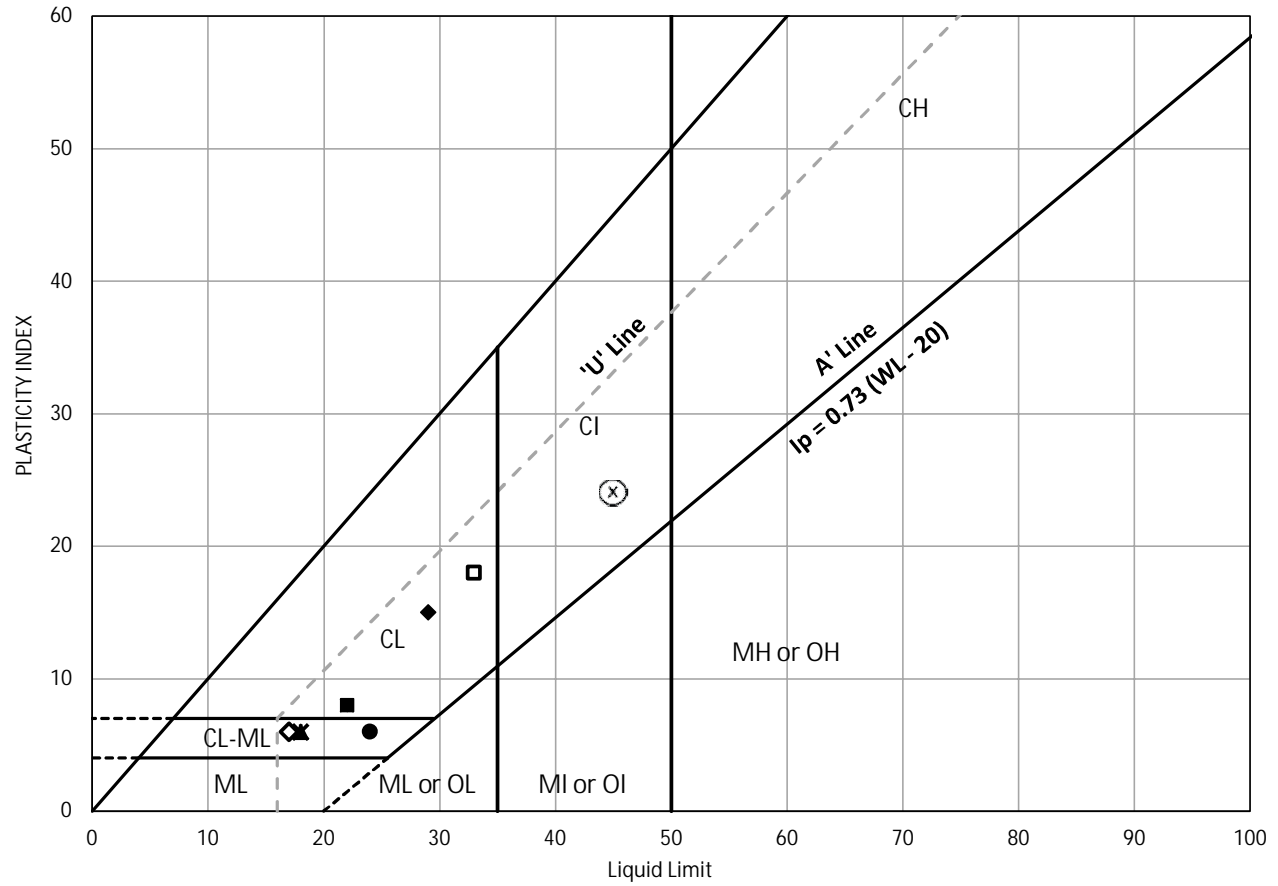
Checked By: MH



PLASTICITY CHART
Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL)
Upper

Checked By: MH

PLASTICITY CHART



	Sample Location	Sample / Specimen Number	Depth (m)	Natural Water Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index
■	MS-24	6	4.6 - 5.2	12.4	22	14	8	-0.20
◆	MS-25	5	3.8 - 4.4		29	14	15	
▲	MS-27	5	3.8 - 4.4	11.1	18	12	6	-0.15
●	MS-27	7	6.1 - 6.7	18.6	24	18	6	0.10
*	MS-28	5	3.8 - 4.4	13.9	18	12	6	0.32
⊗	MS-29	4	3.0 - 3.7		45	21	24	
□	MS-30	5	3.8 - 4.4	20.8	33	15	18	0.32
◇	MS-31	5	3.8 - 4.4	10.4	17	11	6	-0.10

CLIENT		
PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)		
CONSULTANT		
	YYYY-MM-DD	2023-02-08
	DESIGNED	NA
	PREPARED	T.T.
	REVIEWED	M.L.
	APPROVED	0

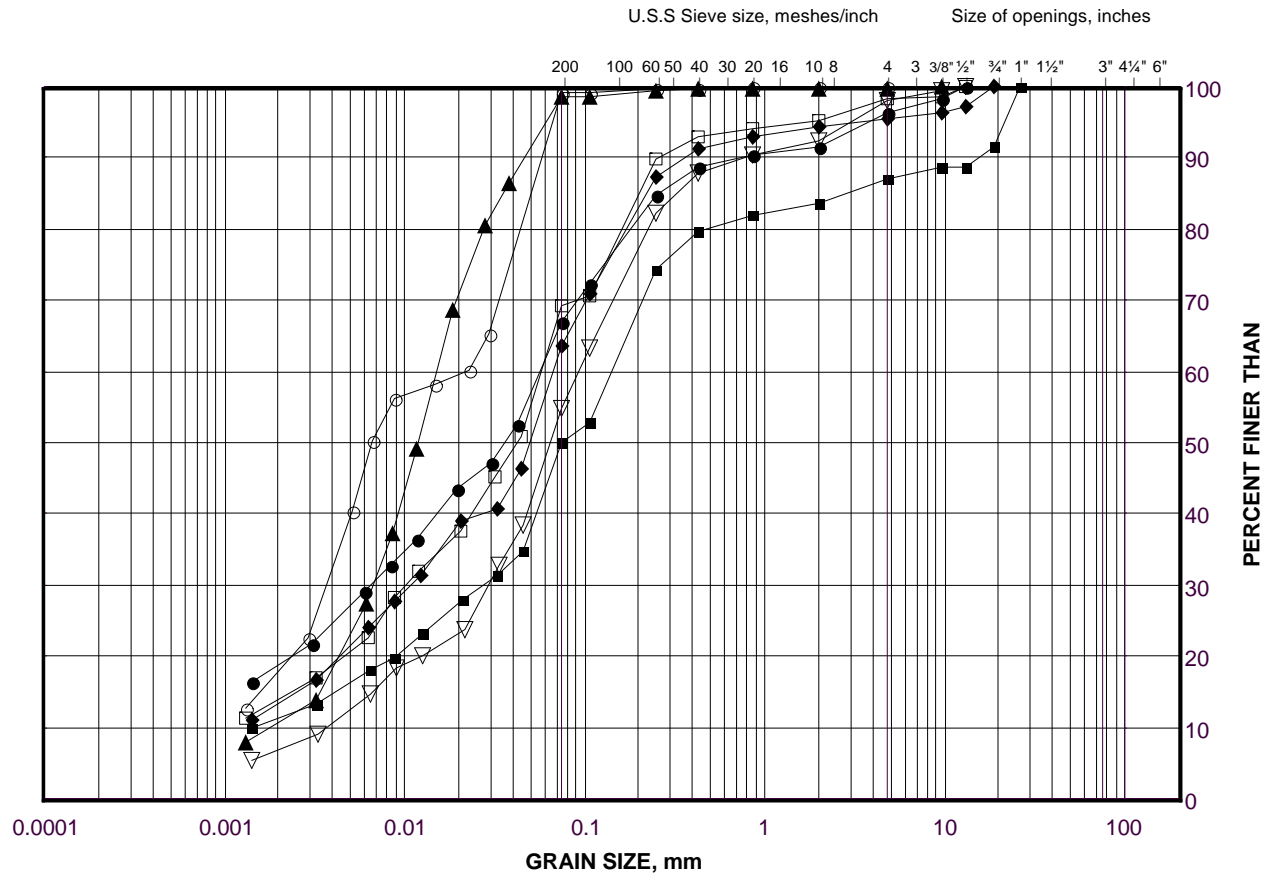


PROJECT			
Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00			
Median Storm Sewers			
TITLE			
Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Upper			
PROJECT NO.	CONTROL	REV.	FIGURE
21490972	0	0	C-5C

GRAIN SIZE DISTRIBUTION

Non-Cohesive Deposits - SILT (ML), SILT (ML) and
SAND, SILTY SAND (SM)

FIGURE C-6A



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-16	4	220.9
■	MS-11	5	205.2
◆	MS-1	5	200.1
▲	MS-16	6	219.4
▽	MS-9	6	202.8
○	MS-12	7	203.8
□	MS-4	7	200

Project Number: 21490972

Checked By: _____

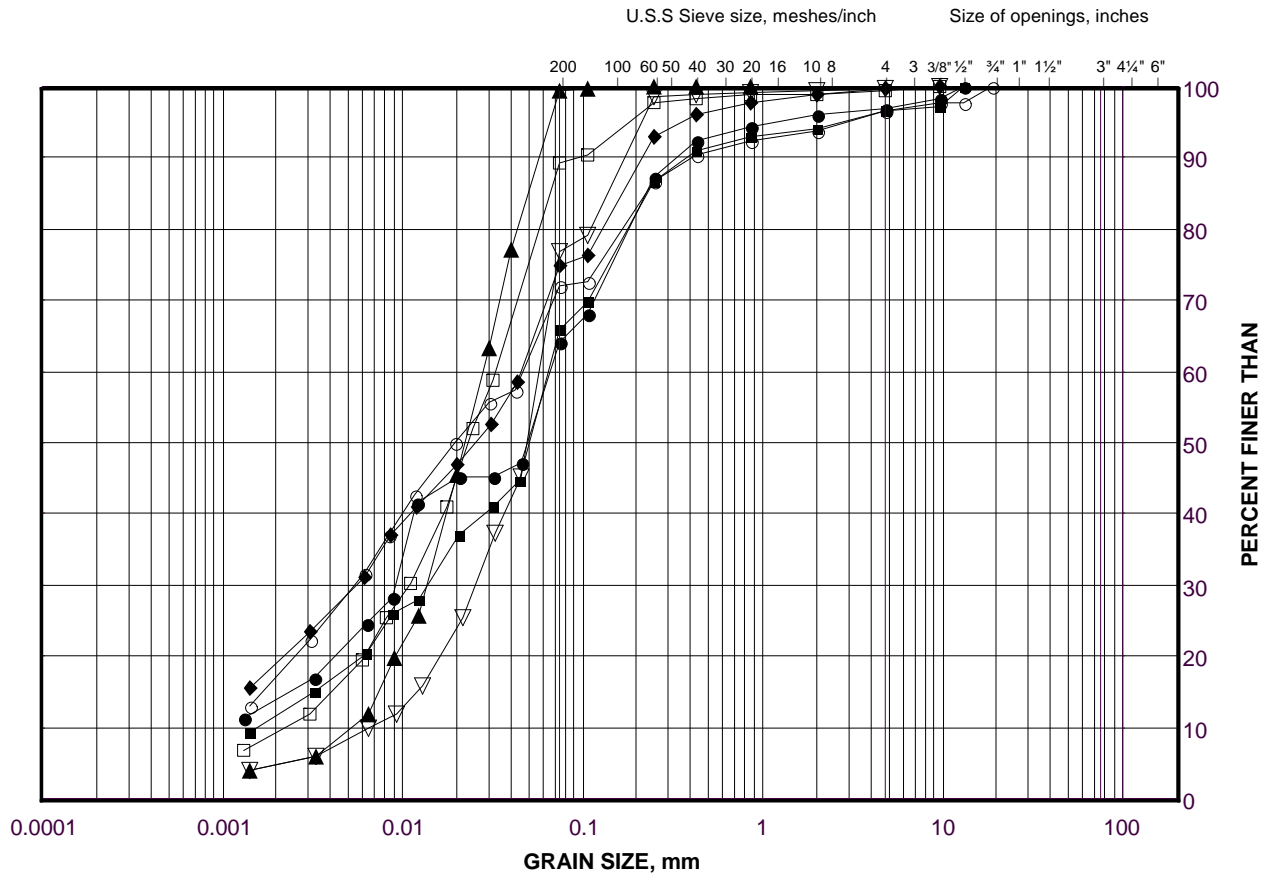
Golder Associates

Date: 25-May-23

GRAIN SIZE DISTRIBUTION

Non-Cohesive Deposits - SILT (ML), SILT (ML) and
SAND, SILTY SAND (SM)

FIGURE C-6B



SILT AND CLAY SIZES	FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED	SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-23	4	224.5
■	MS-14	4	215.2
◆	MS-18	5	218.3
▲	MS-17	5	219.6
▽	MS-15	5	219.5
○	MS-22	6	222.2
□	MS-14	6	213.7

Project Number: 21490972

Checked By: _____

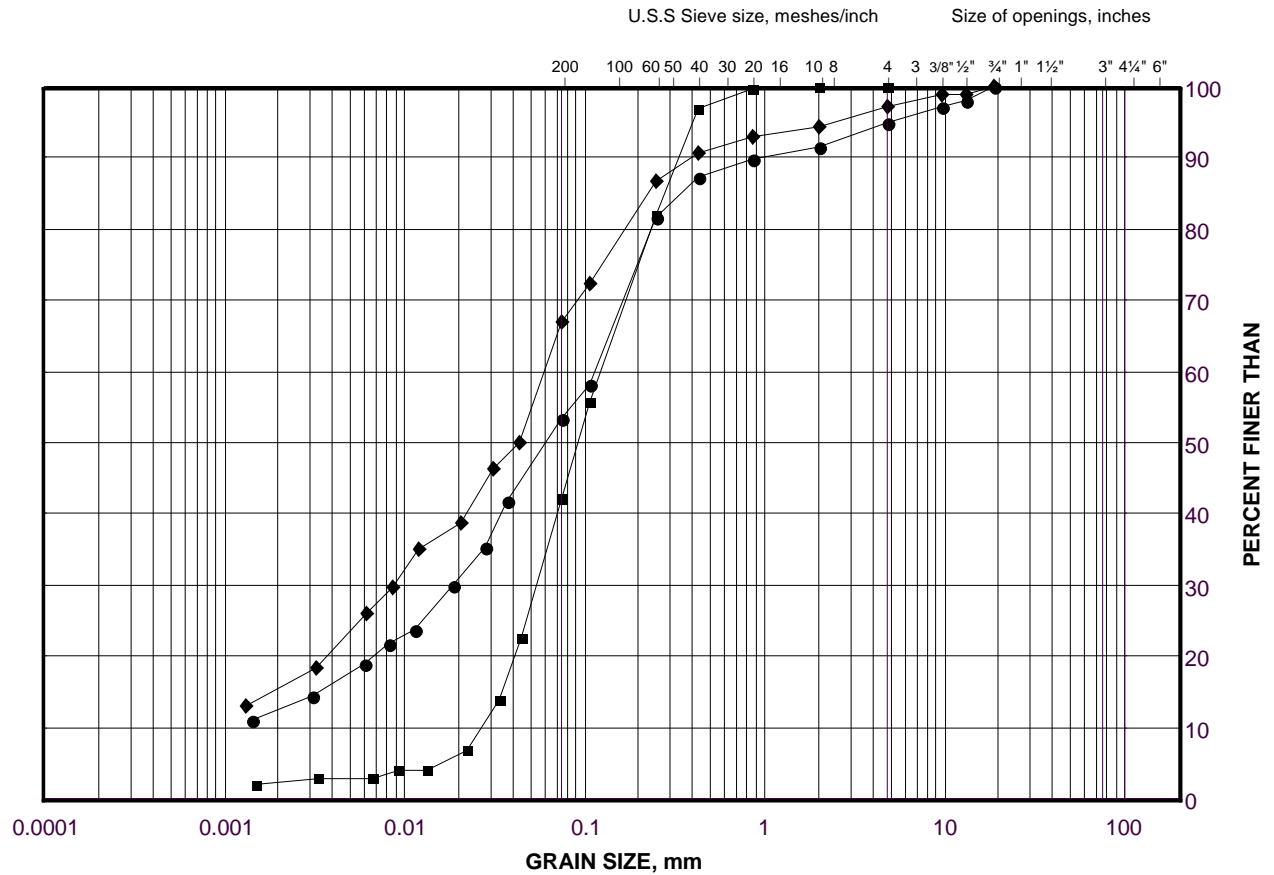
Golder Associates

Date: 09-Jan-23

GRAIN SIZE DISTRIBUTION

Non-Cohesive Deposits - SILT (ML), SILT (ML) and
SAND, SILTY SAND (SM)

FIGURE C-6C



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-10	5	204.3
■	MS-6	6	202.6
◆	MS-1	6	199.3

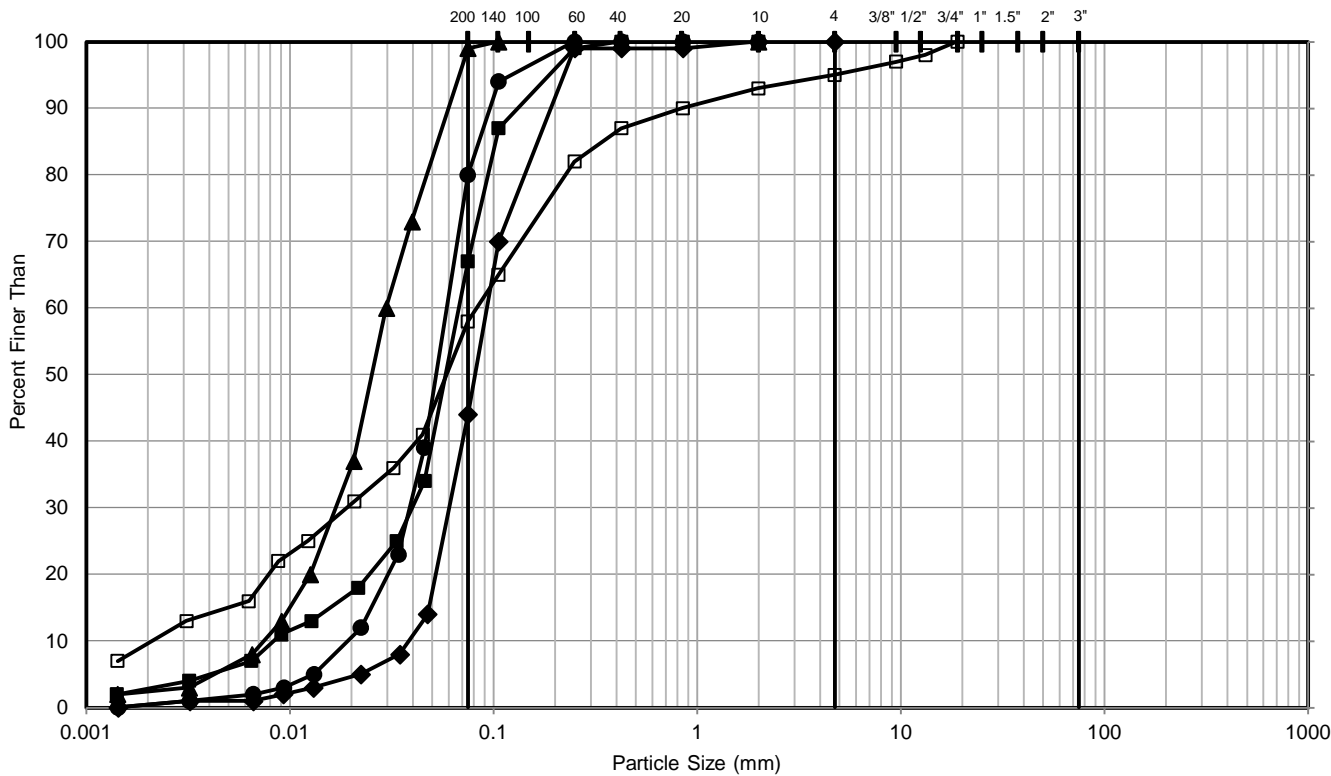
Project Number: 21490972

Checked By: _____

Golder Associates

Date: 09-Jan-23

GRAIN SIZE DISTRIBUTION



FINES (Silt, Clay)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Symbol	Sample Location	Sample Number	Depth (m)	Elevation (m)
■	MS-24	7	6.1 - 6.7	217.6 to 217.0
◆	MS-25	7	6.1 - 6.7	218.3 to 217.7
▲	MS-26	5	3.8 - 4.4	221.2 to 220.6
●	MS-26	7	6.1 - 6.7	219.0 to 218.3
□	MS-29	6	4.6 - 5.2	202.6 to 202.0

CLIENT

PARSONS / MINISTRY OF TRANSPORTATION ONTARIO (MTO)

CONSULTANT



YYYY-MM-DD 2023-02-08

DESIGNED NA

PREPARED T.T.

REVIEWED M.L.

APPROVED M.H.

PROJECT

Highway 400 Widening from Langstaff Road to Major Mackenzie Drive, Vaughan, Ontario, MTO GWP 2836-02-00
Median Storm Sewers

TITLE

Non-Cohesive Deposits - SILT (ML), SILT (ML) and SAND, SILTY SAND (SM)

PROJECT NO.

21490972

CONTROL

0

REV.

0

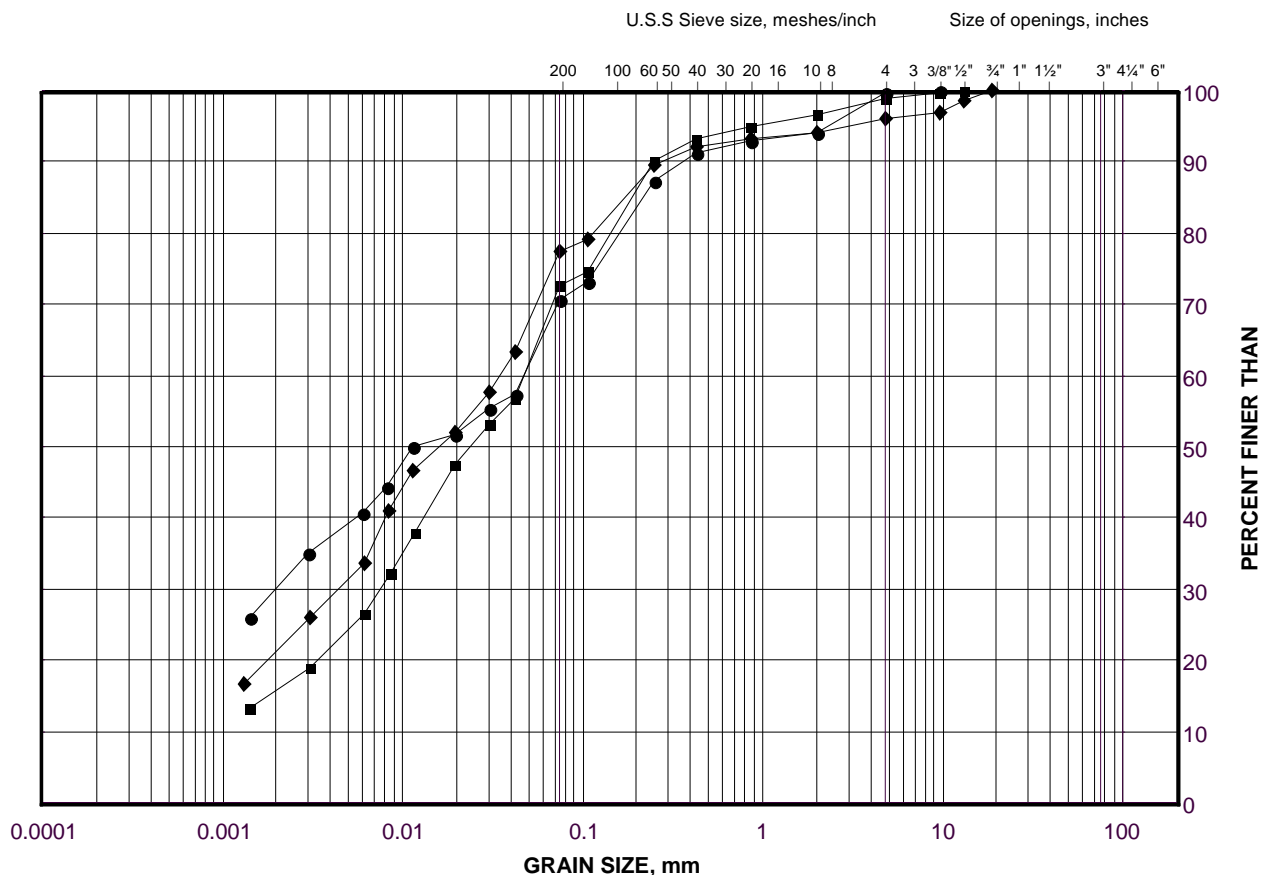
FIGURE

C-6D

GRAIN SIZE DISTRIBUTION

Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Lower

FIGURE C-7



SILT AND CLAY SIZES		FINE	MEDIUM	COARSE	FINE	COARSE	COBBLE
FINE GRAINED		SAND SIZE			GRAVEL SIZE		SIZE

LEGEND

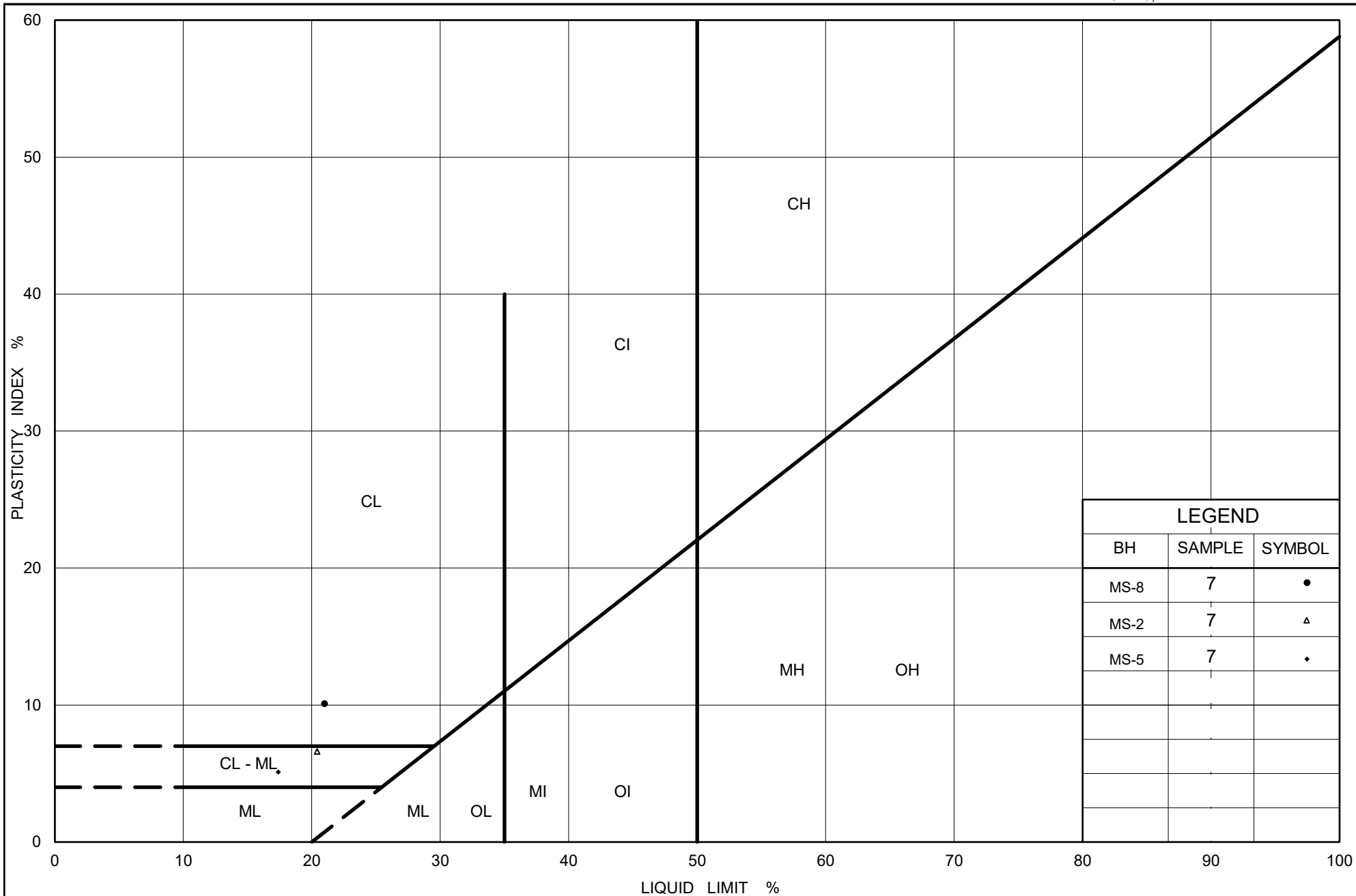
SYMBOL	BOREHOLE	SAMPLE	ELEVATION(m)
●	MS-8	7	200.5
■	MS-5	7	200.8
◆	MS-2	7	198.5

Project Number: 21490972

Checked By: _____

Golder Associates

Date: 13-Jan-23



Ministry of Transportation

Ontario

PLASTICITY CHART Sandy CLAYEY SILT-SILT (CL-ML) to SILTY CLAY (CI) (TILL) - Lower

Figure No. C-8

Project No. 21490972

Checked By: MH

APPENDIX D

Analytical Laboratory Test Results



Your Project #: 21490972
Site#: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Attention: Anastasia Poliacik

Golder Associates Ltd
100 Scotia Crt
Whitby, ON
CANADA L1N 8Y6

Your C.O.C. #: 847598-83-01, 844039-01-01, 844140-18-01

Report Date: 2022/07/07

Report #: R7200498

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2H6445

Received: 2022/06/24, 14:58

Sample Matrix: Soil
Samples Received: 23

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride (20:1 extract)	11	2022/06/27	2022/06/28	CAM SOP-00463	SM 23 4500-Cl E m
Chloride (20:1 extract)	12	2022/06/28	2022/06/29	CAM SOP-00463	SM 23 4500-Cl E m
Conductivity	20	2022/06/28	2022/06/28	CAM SOP-00414	OMOE E3530 v1 m
Conductivity	3	2022/06/29	2022/06/29	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 3)	23	N/A	2022/07/05	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	10	N/A	2022/07/04	AB SOP-00080	EPA9030B/SM4500S2-DF
Sulphide in Soil (1)	13	N/A	2022/07/05	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	20	2022/06/27	2022/06/27	CAM SOP-00413	EPA 9045 D m
pH CaCl2 EXTRACT	3	2022/06/29	2022/06/29	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	20	2022/06/25	2022/06/28	CAM SOP-00414	SM 23 2510 m
Resistivity of Soil	3	2022/06/25	2022/06/29	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	11	2022/06/27	2022/06/29	CAM SOP-00464	EPA 375.4 m
Sulphate (20:1 Extract)	12	2022/06/28	2022/06/29	CAM SOP-00464	EPA 375.4 m
Redox Potential (2, 4)	23	N/A	N/A		

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.



Your Project #: 21490972
Site#: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Attention: Anastasia Poliacik

Golder Associates Ltd
100 Scotia Crt
Whitby, ON
CANADA L1N 8Y6

Your C.O.C. #: 847598-83-01, 844039-01-01, 844140-18-01

Report Date: 2022/07/07

Report #: R7200498

Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C2H6445

Received: 2022/06/24, 14:58

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) This test was performed by Eurofins Environment Testing Canada, 146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1

(3) Offsite analysis requires that subcontracted moisture be reported.

(4) Oxidation-Reduction Potential (ORP) values are determined using a Ag/AgCl reference electrode.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

=====

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Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports.

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



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS791			SZS791		
Sampling Date		2022/06/16			2022/06/16		
COC Number		847598-83-01			847598-83-01		
	UNITS	MS-16 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-16 SA3 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	820		8075295			
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	690	20	8078410			
Conductivity	umho/cm	1230	2	8078415			
Available (CaCl2) pH	pH	7.52		8076339	7.65		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8078412			
Sulphide	mg/kg	1.0 (1)	0.5	8092084	1.3	0.5	8092084
Physical Testing							
Moisture-Subcontracted	%	13	0.30	8092083			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Matrix spike exceeds acceptance limits due to matrix interference. Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS792			SZS792		
Sampling Date		2022/06/15			2022/06/15		
COC Number		847598-83-01			847598-83-01		
	UNITS	MS-17 SA2 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-17 SA2 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	380		8075295			
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	1500	60	8078410	1400	60	8078410
Conductivity	umho/cm	2660	2	8078415			
Available (CaCl2) pH	pH	7.77		8076339			
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8078412			
Sulphide	mg/kg	1.7 (1)	0.5	8092084			
Physical Testing							
Moisture-Subcontracted	%	18	0.30	8092083			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS793	SZS794			SZS795		
Sampling Date		2022/06/16	2022/06/13			2022/06/13		
COC Number		847598-83-01	847598-83-01			847598-83-01		
	UNITS	MS-15 SA4 HWY 400 LANG STAFF TO MAJOR MAC	MS-14 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-13 SA2A HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters								
Resistivity	ohm-cm	1100	780		8075295	410		8075295
Inorganics								
Soluble (20:1) Chloride (Cl ⁻)	ug/g	570	710	20	8076589	1400	60	8078410
Conductivity	umho/cm	944	1280	2	8078415	2420	2	8078415
Available (CaCl ₂) pH	pH	7.79	7.74		8076339	7.78		8076339
Soluble (20:1) Sulphate (SO ₄)	ug/g	<20	<20	20	8076600	<20	20	8078412
Sulphide	mg/kg	0.8 (1)	2.3 (1)	0.5	8092084	1.5 (1)	0.5	8092084
Physical Testing								
Moisture-Subcontracted	%	9.8	10	0.30	8092083	17	0.30	8092083
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time								



**BUREAU
VERITAS**

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS796		SZS797		SZS798		
Sampling Date		2022/06/13		2022/06/12		2022/06/12		
COC Number		847598-83-01		847598-83-01		847598-83-01		
	UNITS	MS-12 SA3 HWY 400 LANG STAFF TO MAJOR MAC	QC Batch	MS-11 SA4 HWY 400 LANG STAFF TO MAJOR MAC	QC Batch	MS-10 SA2 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters								
Resistivity	ohm-cm	430	8075295	380	8075295	390		8075295
Inorganics								
Soluble (20:1) Chloride (Cl-)	ug/g	1300	8078410	1500	8078410	1800	60	8078410
Conductivity	umho/cm	2350	8078415	2650	8078415	2560	2	8081025
Available (CaCl2) pH	pH	7.80	8076339	7.72	8081077	7.60		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	76	8078412	<20	8078412	<20	20	8078412
Sulphide	mg/kg	2.8 (1)	8092084	<0.5 (1)	8092084	0.7 (1)	0.5	8092084
Physical Testing								
Moisture-Subcontracted	%	21	8092083	22	8092083	20	0.30	8092083
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time								



BUREAU
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Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS798			SZS799		
Sampling Date		2022/06/12			2022/06/12		
COC Number		847598-83-01			847598-83-01		
	UNITS	MS-10 SA2 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch	MS-9 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm				620		8075295
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g				920	20	8076589
Conductivity	umho/cm				1610	2	8078415
Available (CaCl2) pH	pH				7.51		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8078412	<20	20	8076600
Sulphide	mg/kg				<0.5 (1)	0.5	8092084
Physical Testing							
Moisture-Subcontracted	%				21	0.30	8092083
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							

**SOIL CORROSIVITY PACKAGE (SOIL)**

Bureau Veritas ID		SZS800			SZS801		
Sampling Date		2022/06/12			2022/06/07		
COC Number		847598-83-01			844039-01-01		
	UNITS	MS-8 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-7 SA2 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	210		8075295	430		8075295
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	2900	100	8078410	1400	60	8078410
Conductivity	umho/cm	4810	2	8078415	2350	2	8078415
Available (CaCl2) pH	pH	7.44		8081077	7.64		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	<200 (1)	200	8078412	<20	20	8078412
Sulphide	mg/kg	<0.5 (2)	0.5	8092084	<0.5 (3)	0.5	8092086
Physical Testing							
Moisture-Subcontracted	%	29	0.30	8092083	20	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Due to colour interferences, sample required dilution. Detection limit was adjusted accordingly. (2) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time (3) Matrix spike exceeds acceptance limits due to matrix interference. Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS801			SZS802	SZS803		
Sampling Date		2022/06/07			2022/06/02	2022/06/03		
COC Number		844039-01-01			844039-01-01	844039-01-01		
	UNITS	MS-7 SA2 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch	MS-6 SA3 HWY 400 LANG STAFF TO MAJOR MAC	MS-5 SA4 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch

Calculated Parameters								
Resistivity	ohm-cm				380	370		8075295
Inorganics								
Soluble (20:1) Chloride (Cl ⁻)	ug/g				1500	1600	60	8076589
Conductivity	umho/cm				2630	2710	2	8078415
Available (CaCl ₂) pH	pH				7.89	7.93		8076339
Soluble (20:1) Sulphate (SO ₄)	ug/g				99	120	20	8076600
Sulphide	mg/kg	0.5	0.5	8092086	3.1 (1)	4.0 (1)	0.5	8092086
Physical Testing								
Moisture-Subcontracted	%				12	12	0.30	8092085

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

(1) Sample extracted past method-specified hold time.

Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS804			SZS804		
Sampling Date		2022/06/02			2022/06/02		
COC Number		844039-01-01			844039-01-01		
	UNITS	MS-4 SA4 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-4 SA4 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	400		8075295			
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	1400	60	8078410			
Conductivity	umho/cm	2490	2	8078415	2490	2	8078415
Available (CaCl2) pH	pH	7.96		8076339			
Soluble (20:1) Sulphate (SO4)	ug/g	100	20	8078412			
Sulphide	mg/kg	3.0 (1)	0.5	8092086			
Physical Testing							
Moisture-Subcontracted	%	15	0.30	8092085			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS805			SZS806		
Sampling Date		2022/06/01			2022/06/01		
COC Number		844039-01-01			844039-01-01		
	UNITS	MS-3 SA2 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-2 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	530		8075295	940		8075295
Inorganics							
Soluble (20:1) Chloride (Cl ⁻)	ug/g	1100	60	8078410	610	20	8076589
Conductivity	umho/cm	1880	2	8078415	1070	2	8078415
Available (CaCl ₂) pH	pH	7.61		8076339	7.71		8076339
Soluble (20:1) Sulphate (SO ₄)	ug/g	<20	20	8078412	30	20	8076600
Sulphide	mg/kg	0.6 (1)	0.5	8092086	3.1 (1)	0.5	8092086
Physical Testing							
Moisture-Subcontracted	%	17	0.30	8092085	12	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS807		SZS808	SZS809		
Sampling Date		2022/06/01		2022/06/14	2022/06/14		
COC Number		844039-01-01		844039-01-01	844039-01-01		
	UNITS	MS-1 SA4 HWY 400 LANG STAFF TO MAJOR MAC	QC Batch	MS-23 SA3 HWY 400 LANG STAFF TO MAJOR MAC	MS-22 SA4 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	570	8075295	530	900		8075295
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	980	8076589	950	590	20	8076589
Conductivity	umho/cm	1750	8078415	1880	1110	2	8078415
Available (CaCl2) pH	pH	7.94	8081077	7.95	8.03		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	100	8076600	<20	33	20	8076600
Sulphide	mg/kg	1.7 (1)	8092086	3.6 (1)	2.9 (1)	0.5	8092086
Physical Testing							
Moisture-Subcontracted	%	13	8092085	14	9.9	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS810			SZS811		
Sampling Date		2022/06/14			2022/06/15		
COC Number		844039-01-01			844140-18-01		
	UNITS	MS-21 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch	MS-19 SA2 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	460		8075295	520		8075295
Inorganics							
Soluble (20:1) Chloride (Cl ⁻)	ug/g	1300	60	8078410	920	20	8076589
Conductivity	umho/cm	2180	2	8078415	1920	2	8081025
Available (CaCl ₂) pH	pH	7.73		8076339	7.88		8076339
Soluble (20:1) Sulphate (SO ₄)	ug/g	<20	20	8078412	110	20	8076600
Sulphide	mg/kg	3.8 (1)	0.5	8092086	2.4 (1)	0.5	8092086
Physical Testing							
Moisture-Subcontracted	%	18	0.30	8092085	12	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS811			SZS812		
Sampling Date		2022/06/15			2022/06/15		
COC Number		844140-18-01			844140-18-01		
	UNITS	MS-19 SA2 HWY 400 LANG STAFF TO MAJOR MAC Lab-Dup	RDL	QC Batch	MS-20 SA4 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm				1300		8075295
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g				410	20	8078410
Conductivity	umho/cm	1780	2	8081025	793	2	8081025
Available (CaCl2) pH	pH				7.56		8076339
Soluble (20:1) Sulphate (SO4)	ug/g				<20	20	8078412
Sulphide	mg/kg				0.6 (1)	0.5	8092086
Physical Testing							
Moisture-Subcontracted	%				14	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time							



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		SZS813		
Sampling Date		2022/06/15		
COC Number		844140-18-01		
	UNITS	MS-18 SA3 HWY 400 LANG STAFF TO MAJOR MAC	RDL	QC Batch
Calculated Parameters				
Resistivity	ohm-cm	390		8075295
Inorganics				
Soluble (20:1) Chloride (Cl-)	ug/g	1500	60	8076589
Conductivity	umho/cm	2550	2	8078415
Available (CaCl2) pH	pH	7.70		8076339
Soluble (20:1) Sulphate (SO4)	ug/g	<20	20	8076600
Sulphide	mg/kg	4.0 (1)	0.5	8092086
Physical Testing				
Moisture-Subcontracted	%	15	0.30	8092085
RDL = Reportable Detection Limit QC Batch = Quality Control Batch (1) Sample extracted past method-specified hold time. Sample contained greater than 10% headspace at time of extraction. Analyzed past method specified hold time				



**BUREAU
VERITAS**

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS791
Sample ID: MS-16 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/16
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS791 Dup
Sample ID: MS-16 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/16
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar

Bureau Veritas ID: SZS792
Sample ID: MS-17 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS792 Dup
Sample ID: MS-17 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu

Bureau Veritas ID: SZS793
Sample ID: MS-15 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/16
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS793
Sample ID: MS-15 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/16
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS794
Sample ID: MS-14 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/13
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS795
Sample ID: MS-13 SA2A HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/13
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS796
Sample ID: MS-12 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/13
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS796
Sample ID: MS-12 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/13
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS797
Sample ID: MS-11 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/12
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8081077	2022/06/29	2022/06/29	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS798
Sample ID: MS-10 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/12
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8081025	2022/06/29	2022/06/29	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/29	2022/06/29	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS798 Dup
Sample ID: MS-10 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/12
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/28	Chandra Nandlal



**BUREAU
VERITAS**

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS799
Sample ID: MS-9 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/12
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS800
Sample ID: MS-8 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/12
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092083	N/A	2022/07/05	Maren Glaser
Sulphide in Soil	SPEC	8092084	N/A	2022/07/04	Bailey Morrison
pH CaCl2 EXTRACT	AT	8081077	2022/06/29	2022/06/29	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS801
Sample ID: MS-7 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/07
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS801 Dup
Sample ID: MS-7 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/07
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS802
Sample ID: MS-6 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/02
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS803
Sample ID: MS-5 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/03
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS804
Sample ID: MS-4 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/02
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS804 Dup
Sample ID: MS-4 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/02
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS805
Sample ID: MS-3 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/01
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS806
Sample ID: MS-2 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/01
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS807
Sample ID: MS-1 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/01
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8081077	2022/06/29	2022/06/29	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS808
Sample ID: MS-23 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/14
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil



Bureau Veritas Job #: C2H6445
Report Date: 2022/07/07

Golder Associates Ltd
Client Project #: 21490972
Site Location: HWY 400 LANGSTAFF OF MAJOR MAC
Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS808
Sample ID: MS-23 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/14
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS809
Sample ID: MS-22 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/14
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS810
Sample ID: MS-21 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/14
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl2 EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS811
Sample ID: MS-19 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8081025	2022/06/29	2022/06/29	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison



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Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

TEST SUMMARY

Bureau Veritas ID: SZS811
Sample ID: MS-19 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
pH CaCl ₂ EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/29	2022/06/29	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS811 Dup
Sample ID: MS-19 SA2 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8081025	2022/06/29	2022/06/29	Roya Fathitil

Bureau Veritas ID: SZS812
Sample ID: MS-20 SA4 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8078410	2022/06/28	2022/06/29	Alina Dobreanu
Conductivity	AT	8081025	2022/06/29	2022/06/29	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl ₂ EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/29	2022/06/29	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8078412	2022/06/28	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla

Bureau Veritas ID: SZS813
Sample ID: MS-18 SA3 HWY 400 LANG STAFF TO MAJOR MAC
Matrix: Soil

Collected: 2022/06/15
Shipped:
Received: 2022/06/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8076589	2022/06/27	2022/06/28	Alina Dobreanu
Conductivity	AT	8078415	2022/06/28	2022/06/28	Roya Fathitil
Moisture (Subcontracted)	BAL	8092085	N/A	2022/07/05	Ashley Henderson
Sulphide in Soil	SPEC	8092086	N/A	2022/07/05	Bailey Morrison
pH CaCl ₂ EXTRACT	AT	8076339	2022/06/27	2022/06/27	Taslina Aktar
Resistivity of Soil		8075295	2022/06/28	2022/06/28	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8076600	2022/06/27	2022/06/29	Chandra Nandlal
Redox Potential	COND	8096334	2022/07/07		Ankita Bhalla



GENERAL COMMENTS

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

Package 1	7.0°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8076339	TAK	Spiked Blank	Available (CaCl ₂) pH	2022/06/27		100	%	97 - 103
8076339	TAK	RPD [SZS791-01]	Available (CaCl ₂) pH	2022/06/27	1.7		%	N/A
8076589	ADB	Matrix Spike	Soluble (20:1) Chloride (Cl ⁻)	2022/06/28		NC	%	70 - 130
8076589	ADB	Spiked Blank	Soluble (20:1) Chloride (Cl ⁻)	2022/06/28		102	%	70 - 130
8076589	ADB	Method Blank	Soluble (20:1) Chloride (Cl ⁻)	2022/06/28	<20		ug/g	
8076589	ADB	RPD	Soluble (20:1) Chloride (Cl ⁻)	2022/06/28	1.3		%	35
8076600	C_N	Matrix Spike	Soluble (20:1) Sulphate (SO ₄)	2022/06/29		118	%	70 - 130
8076600	C_N	Spiked Blank	Soluble (20:1) Sulphate (SO ₄)	2022/06/29		108	%	70 - 130
8076600	C_N	Method Blank	Soluble (20:1) Sulphate (SO ₄)	2022/06/29	<20		ug/g	
8076600	C_N	RPD	Soluble (20:1) Sulphate (SO ₄)	2022/06/29	NC		%	35
8078410	ADB	Matrix Spike [SZS792-01]	Soluble (20:1) Chloride (Cl ⁻)	2022/06/29		NC	%	70 - 130
8078410	ADB	Spiked Blank	Soluble (20:1) Chloride (Cl ⁻)	2022/06/29		105	%	70 - 130
8078410	ADB	Method Blank	Soluble (20:1) Chloride (Cl ⁻)	2022/06/29	<20		ug/g	
8078410	ADB	RPD [SZS792-01]	Soluble (20:1) Chloride (Cl ⁻)	2022/06/29	6.5		%	35
8078412	C_N	Matrix Spike [SZS798-01]	Soluble (20:1) Sulphate (SO ₄)	2022/06/29		104	%	70 - 130
8078412	C_N	Spiked Blank	Soluble (20:1) Sulphate (SO ₄)	2022/06/29		109	%	70 - 130
8078412	C_N	Method Blank	Soluble (20:1) Sulphate (SO ₄)	2022/06/29	<20		ug/g	
8078412	C_N	RPD [SZS798-01]	Soluble (20:1) Sulphate (SO ₄)	2022/06/28	NC		%	35
8078415	RFT	Spiked Blank	Conductivity	2022/06/28		100	%	90 - 110
8078415	RFT	Method Blank	Conductivity	2022/06/28	<2		umho/cm	
8078415	RFT	RPD [SZS804-01]	Conductivity	2022/06/28	0		%	10
8081025	RFT	Spiked Blank	Conductivity	2022/06/29		99	%	90 - 110
8081025	RFT	Method Blank	Conductivity	2022/06/29	<2		umho/cm	
8081025	RFT	RPD [SZS811-01]	Conductivity	2022/06/29	8.0		%	10
8081077	TAK	Spiked Blank	Available (CaCl ₂) pH	2022/06/29		100	%	97 - 103
8081077	TAK	RPD	Available (CaCl ₂) pH	2022/06/29	0.25		%	N/A
8092083	MGL	Method Blank	Moisture-Subcontracted	2022/07/05	<0.30		%	
8092084	BYM	Matrix Spike [SZS791-01]	Sulphide	2022/07/04		71 (1)	%	75 - 125
8092084	BYM	Spiked Blank	Sulphide	2022/07/04		101	%	75 - 125
8092084	BYM	Method Blank	Sulphide	2022/07/04	<0.5		mg/kg	
8092084	BYM	RPD [SZS791-01]	Sulphide	2022/07/04	28		%	30
8092085	A1H	Method Blank	Moisture-Subcontracted	2022/07/05	<0.30		%	
8092086	BYM	Matrix Spike [SZS801-01]	Sulphide	2022/07/05		59 (1)	%	75 - 125
8092086	BYM	Spiked Blank	Sulphide	2022/07/05		96	%	75 - 125
8092086	BYM	Method Blank	Sulphide	2022/07/05	<0.5		mg/kg	
8092086	BYM	RPD [SZS801-01]	Sulphide	2022/07/05	7.2		%	30

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C2H6445

Report Date: 2022/07/07

Golder Associates Ltd

Client Project #: 21490972

Site Location: HWY 400 LANGSTAFF OF MAJOR MAC

Sampler Initials: JS

VALIDATION SIGNATURE PAGE

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

Ankita Bhalla, Project Manager

Cristina Carriere, Senior Scientific Specialist

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

Sze Yeung Fock, B.Sc., Scientific Specialist

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Your P.O. #: 21490972/1006
Your Project #: 21490972/1006
Your C.O.C. #: 933554-01-01

Attention: Maor Levy

WSP Canada Inc.
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/24
Report #: R7641570
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D5105

Received: 2023/05/11, 19:25

Sample Matrix: Soil
Samples Received: 8

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Chloride (20:1 extract)	8	2023/05/16	2023/05/17	CAM SOP-00463	MOE E3013 m
Conductivity	8	2023/05/16	2023/05/16	CAM SOP-00414	OMOE E3530 v1 m
Moisture (Subcontracted) (1, 2)	8	N/A	2023/05/18	AB SOP-00002	CCME PHC-CWS m
Sulphide in Soil (1)	8	N/A	2023/05/17	AB SOP-00080	EPA9030B/SM4500S2-DF
pH CaCl2 EXTRACT	8	2023/05/16	2023/05/16	CAM SOP-00413	EPA 9045 D m
Resistivity of Soil	8	2023/05/11	2023/05/16	CAM SOP-00414	SM 23 2510 m
Sulphate (20:1 Extract)	8	2023/05/16	2023/05/17	CAM SOP-00464	MOE E3013 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

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

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Bureau Veritas Calgary (19th), 4000 19th Street NE, Calgary, AB, T2E 6P8

(2) Offsite analysis requires that subcontracted moisture be reported.



Your P.O. #: 21490972/1006
Your Project #: 21490972/1006
Your C.O.C. #: 933554-01-01

Attention: Maor Levy

WSP Canada Inc.
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2023/05/24
Report #: R7641570
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3D5105

Received: 2023/05/11, 19:25

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:

Ankita Bhalla, Project Manager

Email: Ankita.Bhalla@bureauveritas.com

Phone# (905) 817-5700

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BUREAU
VERITAS

Bureau Veritas Job #: C3D5105
Report Date: 2023/05/24

WSP Canada Inc.
Client Project #: 21490972/1006
Your P.O. #: 21490972/1006
Sampler Initials: TT

SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		VUF217		VUF218			VUF218		
Sampling Date		2023/04/24		2023/04/23			2023/04/23		
COC Number		933554-01-01		933554-01-01			933554-01-01		
	UNITS	MS-24 SS2	RDL	MS-25 SS3	RDL	QC Batch	MS-25 SS3 Lab-Dup	RDL	QC Batch
Calculated Parameters									
Resistivity	ohm-cm	550		530		8660365			
Inorganics									
Soluble (20:1) Chloride (Cl-)	ug/g	1000	20	1100	400	8666917			
Conductivity	umho/cm	1820	2	1880	2	8666944	1960	2	8666944
Available (CaCl2) pH	pH	7.97		7.71		8667305	7.83		8667305
Soluble (20:1) Sulphate (SO4)	ug/g	200	20	47	20	8666931			
Sulphide	mg/kg	<0.5 (1)	0.5	2.9 (1)	0.5	8670999			
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									
Lab-Dup = Laboratory Initiated Duplicate									
(1) Extracted past method specified hold time									

Bureau Veritas ID		VUF219	VUF220			VUF220			VUF221		
Sampling Date		2023/04/23	2023/04/23			2023/04/23			2023/04/27		
COC Number		933554-01-01	933554-01-01			933554-01-01			933554-01-01		
	UNITS	MS-26 SS4	MS-27 SS4	RDL	QC Batch	MS-27 SS4 Lab-Dup	RDL	QC Batch	MS-28 SS2	RDL	QC Batch
Calculated Parameters											
Resistivity	ohm-cm	900	1100		8660365				390		8660365
Inorganics											
Soluble (20:1) Chloride (Cl-)	ug/g	590	490	20	8666917	520	20	8666917	1400	400	8666917
Conductivity	umho/cm	1110	933	2	8666944				2550	2	8666944
Available (CaCl2) pH	pH	7.76	7.74		8667305				7.79		8667305
Soluble (20:1) Sulphate (SO4)	ug/g	31	37	20	8666931	39	20	8666931	190	20	8666931
Sulphide	mg/kg	3.2 (1)	<0.5 (1)	0.5	8670999				1.1 (1)	0.5	8670999
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate (1) Extracted past method specified hold time											



SOIL CORROSIVITY PACKAGE (SOIL)

Bureau Veritas ID		VUF222	VUF223		VUF224		
Sampling Date		2023/04/27	2023/04/28		2023/04/28		
COC Number		933554-01-01	933554-01-01		933554-01-01		
	UNITS	MS-29 SS3	MS-30 SS4	RDL	MS-31 SS3	RDL	QC Batch
Calculated Parameters							
Resistivity	ohm-cm	790	1000		560		8660365
Inorganics							
Soluble (20:1) Chloride (Cl-)	ug/g	720	460	20	1200	400	8666917
Conductivity	umho/cm	1260	993	2	1780	2	8666944
Available (CaCl ₂) pH	pH	7.79	7.73		7.80		8667305
Soluble (20:1) Sulphate (SO ₄)	ug/g	34	99	20	100	20	8666931
Sulphide	mg/kg	4.2 (1)	4.6 (1)	0.5	2.3 (1)	0.5	8670999
RDL = Reportable Detection Limit							
QC Batch = Quality Control Batch							
(1) Extracted past method specified hold time							



**BUREAU
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Bureau Veritas Job #: C3D5105
Report Date: 2023/05/24

WSP Canada Inc.
Client Project #: 21490972/1006
Your P.O. #: 21490972/1006
Sampler Initials: TT

RESULTS OF ANALYSES OF SOIL

Bureau Veritas ID		VUF217	VUF218	VUF219	VUF220	VUF221	VUF222		
Sampling Date		2023/04/24	2023/04/23	2023/04/23	2023/04/23	2023/04/27	2023/04/27		
COC Number		933554-01-01	933554-01-01	933554-01-01	933554-01-01	933554-01-01	933554-01-01		
	UNITS	MS-24 SS2	MS-25 SS3	MS-26 SS4	MS-27 SS4	MS-28 SS2	MS-29 SS3	RDL	QC Batch

Physical Testing									
Moisture-Subcontracted	%	6.4	10	11	13	12	20	0.30	8681378
RDL = Reportable Detection Limit									
QC Batch = Quality Control Batch									

Bureau Veritas ID		VUF222	VUF223	VUF224		
Sampling Date		2023/04/27	2023/04/28	2023/04/28		
COC Number		933554-01-01	933554-01-01	933554-01-01		
	UNITS	MS-29 SS3 Lab-Dup	MS-30 SS4	MS-31 SS3	RDL	QC Batch

Physical Testing						
Moisture-Subcontracted	%	20	16	11	0.30	8681378
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						
Lab-Dup = Laboratory Initiated Duplicate						



**BUREAU
VERITAS**

Bureau Veritas Job #: C3D5105

Report Date: 2023/05/24

WSP Canada Inc.

Client Project #: 21490972/1006

Your P.O. #: 21490972/1006

Sampler Initials: TT

TEST SUMMARY

Bureau Veritas ID: VUF217
Sample ID: MS-24 SS2
Matrix: Soil

Collected: 2023/04/24
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF218
Sample ID: MS-25 SS3
Matrix: Soil

Collected: 2023/04/23
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF218 Dup
Sample ID: MS-25 SS3
Matrix: Soil

Collected: 2023/04/23
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai

Bureau Veritas ID: VUF219
Sample ID: MS-26 SS4
Matrix: Soil

Collected: 2023/04/23
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan



BUREAU
VERITAS

Bureau Veritas Job #: C3D5105
Report Date: 2023/05/24

WSP Canada Inc.
Client Project #: 21490972/1006
Your P.O. #: 21490972/1006
Sampler Initials: TT

TEST SUMMARY

Bureau Veritas ID: VUF220
Sample ID: MS-27 SS4
Matrix: Soil

Collected: 2023/04/23
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF220 Dup
Sample ID: MS-27 SS4
Matrix: Soil

Collected: 2023/04/23
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF221
Sample ID: MS-28 SS2
Matrix: Soil

Collected: 2023/04/27
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF222
Sample ID: MS-29 SS3
Matrix: Soil

Collected: 2023/04/27
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan



**BUREAU
VERITAS**

Bureau Veritas Job #: C3D5105
Report Date: 2023/05/24

WSP Canada Inc.
Client Project #: 21490972/1006
Your P.O. #: 21490972/1006
Sampler Initials: TT

TEST SUMMARY

Bureau Veritas ID: VUF222 Dup
Sample ID: MS-29 SS3
Matrix: Soil

Collected: 2023/04/27
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth

Bureau Veritas ID: VUF223
Sample ID: MS-30 SS4
Matrix: Soil

Collected: 2023/04/28
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan

Bureau Veritas ID: VUF224
Sample ID: MS-31 SS3
Matrix: Soil

Collected: 2023/04/28
Shipped:
Received: 2023/05/11

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Chloride (20:1 extract)	KONE/EC	8666917	2023/05/16	2023/05/17	Massarat Jan
Conductivity	AT	8666944	2023/05/16	2023/05/16	Leily Karimi
Moisture (Subcontracted)	BAL	8681378	N/A	2023/05/18	Simranjeet Batth
Sulphide in Soil	SPEC	8670999	N/A	2023/05/17	Ly Vu
pH CaCl2 EXTRACT	AT	8667305	2023/05/16	2023/05/16	Surinder Rai
Resistivity of Soil		8660365	2023/05/16	2023/05/16	Automated Statchk
Sulphate (20:1 Extract)	KONE/EC	8666931	2023/05/16	2023/05/17	Massarat Jan



BUREAU
VERITAS

Bureau Veritas Job #: C3D5105

Report Date: 2023/05/24

WSP Canada Inc.

Client Project #: 21490972/1006

Your P.O. #: 21490972/1006

Sampler Initials: TT

GENERAL COMMENTS

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

Package 1	5.3°C
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Results relate only to the items tested.



BUREAU
VERITAS

Bureau Veritas Job #: C3D5105

Report Date: 2023/05/24

QUALITY ASSURANCE REPORT

WSP Canada Inc.
Client Project #: 21490972/1006
Your P.O. #: 21490972/1006
Sampler Initials: TT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8666917	Soluble (20:1) Chloride (Cl ⁻)	2023/05/17	NC	70 - 130	99	70 - 130	<20	ug/g	6.7	35
8666931	Soluble (20:1) Sulphate (SO ₄)	2023/05/17	NC	70 - 130	99	70 - 130	<20	ug/g	6.7	35
8666944	Conductivity	2023/05/16			99	90 - 110	<2	umho/cm	4.3	10
8667305	Available (CaCl ₂) pH	2023/05/16			100	97 - 103			1.6	N/A
8670999	Sulphide	2023/05/17	67 (1)	75 - 125	119	75 - 125	<0.5	mg/kg	NC	30
8681378	Moisture-Subcontracted	2023/05/18					<0.30	%	2.0	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.



BUREAU
VERITAS

Bureau Veritas Job #: C3D5105

Report Date: 2023/05/24

WSP Canada Inc.

Client Project #: 21490972/1006

Your P.O. #: 21490972/1006

Sampler Initials: TT

VALIDATION SIGNATURE PAGE


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

Anastassia Hamanov, Scientific Specialist

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

Sandy Yuan, M.Sc., QP, Scientific Specialist

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		Bureau Veritas 6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel: (905) 817-5700 Toll-free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com				11-May-23 19:25 Ankita Bhalla C3D5105		Page 1 of 1		
INVOICE TO: Company Name: #1326 WSP Canada Inc. Attention: Accounts Payable Address: 6925 Century Ave Suite 100 Mississauga ON L5N 7K2 Tel: (905) 567-4444 Fax: (905) 567-6561 Email: capayablesinquiry@wsp.com		REPORT TO: Company Name: <u>WSP Golden</u> Attention: <u>Maor Levy</u> Address: _____ Tel: _____ Fax: _____ Email: <u>maor.levy@wsp.com</u>		PROJECT INFORMATION: Quotation #: C31027 P.O. #: <u>21490972 / 1006</u> Project: <u>21490972 / 1006</u> Project Name: _____ Site #: _____ Sampled By: <u>T.T.</u>		ENV 021 Bottle Order #: 933554 Project Manager: Ankita Bhalla		COC #: _____ C#933554-01-01		
MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE BUREAU VERITAS DRINKING WATER CHAIN OF CUSTODY						ANALYSIS REQUESTED (PLEASE BE SPECIFIC)				
Regulation 153 (2011) <input type="checkbox"/> Table 1 <input type="checkbox"/> Res/Park <input type="checkbox"/> Medium/Fine <input type="checkbox"/> Table 2 <input type="checkbox"/> Ind/Comm <input type="checkbox"/> Coarse <input type="checkbox"/> Table 3 <input type="checkbox"/> Agri/Other <input type="checkbox"/> For RSC <input type="checkbox"/> Table _____			Other Regulations <input type="checkbox"/> CCME <input type="checkbox"/> Sanitary Sewer Bylaw <input type="checkbox"/> Reg 558 <input type="checkbox"/> Storm Sewer Bylaw <input type="checkbox"/> MISA <input type="checkbox"/> Municipality _____ <input type="checkbox"/> PWQO <input type="checkbox"/> Reg 406 Table _____ <input type="checkbox"/> Other _____			Special Instructions _____			Turnaround Time (TAT) Required: Please provide advance notice for rush projects	
Include Criteria on Certificate of Analysis (Y/N)? _____			Field Filtered (please circle): Metals / Hg / Cr VI			Regular (Standard) TAT: (will be applied if Rush TAT is not specified): Standard TAT = 5-7 Working days for most tests. Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.				
Job Specific Rush TAT (if applies to entire submission) Date Required: _____ Time Required: _____ Rush Confirmation Number: _____ (call lab for #)			Soil Corrosivity Package			# of Bottles				
Sample Barcode Label			Sample (Location) Identification			Date Sampled				
Time Sampled			Matrix			Comments				
1			MS-24 SS2			23/04/24 A.M. Soil				
2			MS-25 SS3			23/04/23 A.M. Soil				
3			MS-26 SS4			23/04/23 A.M. Soil				
4			MS-27 SS4			23/04/23 A.M. Soil				
5			MS-28 SS2			23/04/27 A.M. Soil				
6			MS-29 SS3			23/04/27 A.M. Soil				
7			MS-30 SS4			23/04/28 A.M. Soil				
8			MS-31 SS3			23/04/28 A.M. Soil				
9										
10										
* RELINQUISHED BY: (Signature/Print) <u>Maor Levy</u>		Date: (YY/MM/DD) <u>23/05/11</u>		Time <u>19:15</u>		RECEIVED BY: (Signature/Print) <u>Legat J. Adcock</u>		Date: (YY/MM/DD) <u>2023/05/11</u>		
Time <u>19:25</u>		# jars used and not submitted		Laboratory Use Only		Time Sensitive		Temperature (°C) on Receipt <u>14/15</u>		
Custody Seal Present <input checked="" type="checkbox"/> Intact		Yes		No		White: Bureau Veritas Yellow: Client		SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO BUREAU VERITAS		

APPENDIX E

Notice to Contractor

Notice to Contractor

The contractor is alerted that the fill materials encountered along the storm sewer locations may contain obstructions including concrete rubble, cobbles, boulders and wood, and that the native soils may contain cobbles and boulders. Consideration of the presence of these obstructions must be made in the selection of appropriate equipment and procedures for open-cut excavations and installation of temporary protection systems.



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