



Revised Foundation Investigation Report

TEMPORARY PROTECTION SYSTEM, HIGHWAY 402 (EASTBOUND AND WESTBOUND)
AND HOWARD WATSON NATURE TRAIL (FORMER CN) OVERHEAD STRUCTURES,
CITY OF SARNIA, ONTARIO, MINISTRY OF TRANSPORTATION, ONTARIO
GWP 3105-18-00

SITE NO.: 14X-0337/B1 AND 14X-0337/B2

| Site NO. | Latitude | Longitude |
|-------------|------------|-------------|
| 14X-0337/B1 | 42.987606° | -82.358487° |
| 14X-0337/B2 | 42.987774° | -82.358483° |

27 January 2023

GEOCRES NO.: 40J16-94

Distribution:

- 1 PDF & 1 Copy – Ministry of Transportation, Ontario (Central Region)
- 1 PDF & 1 Copy - Ministry of Transportation, Ontario (Foundation Section)
- 1 PDF – GHD Limited

➔ **The Power of Commitment**



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1. Introduction

GHD Limited (GHD) was retained by the Ministry of Transportation, Ontario (MTO), to provide foundation investigation and engineering services for the temporary protection systems associated with the proposed rehabilitation and conversion to semi-integral abutments of two CNR overhead structures on Highway 402 (eastbound and westbound) at Howard Watson Nature Trail (former CNR), located in the City of Sarnia, Ontario (see the Key Plan on Drawing 1).

The purpose of this investigation is to establish the subsurface soil and groundwater conditions at the locations of proposed temporary protection system by means of borehole drilling and geotechnical laboratory testing on selected soil samples.

The Terms of Reference (TOR) and the scope of work for this project are identified within the agreement of services as amended between MTO and GHD for Consultant's Assignment Number 3020-E-0014. The work has been carried out in accordance with the requirements of *Guideline for Foundation Engineering Services, Version 3.0, April 2022*, prepared by the MTO.

2. Site Description

The CNR overhead structures are located along Highway 402, about 1.3 km west of Highway 402 and Highway 40 interchange, and 0.7 km east of Murphy Road, in the City of Sarnia, Ontario.

The existing three span CNR overhead structures were constructed in 1976. Howard Watson Nature Trail (former CNR) passes under the CNR overhead structures and is generally aligned in north-south direction. The eastbound and westbound CNR overhead structures of Highway 402 consist of two lanes each, separated by a grass median and noise barrier walls along the perimeter of the structures.

The CNR overhead structures are situated in an urban-setting environment with generally a flat landscape. The areas surrounding the CNR overhead structures are a mix of residential and commercial land uses with vacant farm fields mostly towards the northeast side of the CNR overhead structures. West of the existing east abutment there are two buried power utilities that are operated by Bluewater Power and there is also a buried cable operated by Eastlink.

The embankment slopes between the CNR overhead structures are covered by grass or other vegetation (a grass median) and observed to be stable, with no signs of erosion. General site conditions are shown in Photographs 1 to 4 presented in Appendix A.

3. Investigation Procedures

3.1 Previous Investigation

A geotechnical investigation was completed for the Highway 402 overhead structure at the former CNR tracks on July 17, 1970, during which time a total of fourteen boreholes were advanced near the overhead structure. The boreholes were advanced from the original ground surface and prior to construction of the overhead structure to depths of between 6.4 m and 35.3 m below ground surface and geotechnical laboratory testing was carried out on selected soil samples. The results of the investigation are contained in a report titled, "*Foundation Investigation Report for The Proposed C.N.R. Overhead of Highway 402, near Sarnia, District No. 1 (Chatham)*", WP 346-65-01 & 02, prepared by the Department of Highways Ontario, dated July 17, 1970

(GEOCRES No. 40J16-039). The location of the boreholes are shown on Drawing 1 and on the borehole location drawing included in Appendix B.

3.2 Current Investigation

The geotechnical fieldwork for this investigation was carried out between September 6 and 12, 2022, during which time four boreholes designated as BH1-22 to BH4-22 (two boreholes at each structure) were advanced to a depth of about 12.8 m below ground surface (existing Highway 402 road level). The borehole depths were advanced to a minimum depth of 10 m below the base of the excavation for the proposed rehabilitation and in accordance with the MTO “*Guidelines for Foundation Engineering Services*”, dated April 2022. The boreholes were advanced through the right lanes of eastbound and westbound as shown on Drawing 1.

Prior to the start of fieldwork, utility clearance procedures were carried out through Ontario One Call, and fieldwork notification was sent to MTO West Region. A project specific Health and Safety as well as Traffic Protection Plans were prepared before commencement of the fieldwork. In addition, the borehole locations were marked by GHD staff prior to drilling. All drilling activity, soil sampling and logging, and backfilling of boreholes were conducted under the full-time supervision of an experienced GHD geotechnical engineer.

The boreholes were advanced using a B57 track-mounted drill rig, equipped with continuous flight, hollow stem augers, supplied and operated by Landshark Drilling of Brantford, Ontario. The asphalt and underlying concrete were cored using concrete coring equipment and municipal water supplied by the drilling subcontractor. Soil samples were obtained at 0.75 m intervals of depth, using a 50 mm outer-diameter split-spoon sampler driven by an automatic hammer in accordance with the Standard Penetration Test (SPT) procedures described in ASTM D1586¹. Where firm to stiff cohesive deposits were encountered, in-situ field vane shear tests were carried out using an MTO 'N'-size vane to assess the strength characteristics of these soils in accordance with ASTM D2573². Soil samples obtained from the boreholes were inspected in the field immediately upon retrieval for type, texture, and color. All retrieved samples from the investigation were sealed in clean plastic bags and transported to the GHD laboratory in Waterloo for further visual examination, and geotechnical laboratory tests.

No monitoring wells were installed in any of the boreholes; however, groundwater conditions and water levels were observed/measured in the open boreholes during drilling by visual examination of soil samples and drill rods as well as immediately following the drilling operations. The boreholes were backfilled with bentonite and sealed at the top with compacted auger cuttings, in accordance with Ontario Regulation 903, (as amended).

Surveying of the as-drilled borehole locations was conducted by Callon Dietz Inc. (Callon Dietz) of London, Ontario, subcontracted to GHD. Callon Dietz provided northing and easting in MTM NAD 83 (Zone 11) coordinates. The ground surface elevations are referenced to Geodetic datum. The coordinates and ground surface elevation are presented below, on the borehole records and on Drawing 1.

| Structure Number | Borehole Number | Location | Location (MTM NAD 83, ZONE 11) | | Borehole Depth (m) | Ground Surface Elevation (m) | End of Borehole Elevation (m) |
|----------------------------------|-----------------|---------------------------------|--------------------------------|-------------------------------|--------------------|------------------------------|-------------------------------|
| | | | Northing (m) (Latitude, °) | Easting (m) (Longitude, °) | | | |
| 14X-0337/B1 (Eastbound Lanes) | BH2-22 | Right lane of EB of Highway 402 | 4,760,863.7 (42.987490) | 316,314.3 (-82.358806) | 12.8 | 189.9 | 177.1 |
| | BH4-22 | Right lane of EB of Highway 402 | 4,760,879.4 (42.987631) | 316,364.0 (-82.358196) | 12.8 | 190.1 | 177.3 |
| 14X-0337/B2 | BH1-22 | Right lane of WB of Highway 402 | 4,760,893.2 (42.987756) | 316,314.3 (-82.358805) | 12.8 | 190.0 | 177.2 |

¹ ASTM D1586-08a – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of the soil.

² ASTM D2573-15 Standard Test Method for Field Vane Shear Test in Saturated Fine-Grained Soils

| Structure Number | Borehole Number | Location | Location (MTM NAD 83, ZONE 11) | | Borehole Depth (m) | Ground Surface Elevation (m) | End of Borehole Elevation (m) |
|-------------------|-----------------|---------------------------------|--------------------------------|-------------------------------|--------------------|------------------------------|-------------------------------|
| | | | Northing (m) (Latitude, °) | Easting (m) (Longitude, °) | | | |
| (Westbound Lanes) | BH3-22 | Right lane of WB of Highway 402 | 4,760,911.6 (42.987921) | 316,369.7 (-82.358125) | 12.8 | 189.9 | 177.1 |

Classification testing (i.e., water content, Atterberg limits and grain size distribution) was carried out on selected soil samples. All laboratory tests were conducted in accordance with MTO and/or American Society for Testing Materials (ASTM) standards, as appropriate.

4. Site Geology and Subsurface Conditions

4.1 Regional Geology

The CNR overhead structures are located within physiographic region known as Huron Fringe, which is a subdivision of the St. Clair Clay Plain, as delineated in *The Physiography of Southern Ontario* (Chapman and Putnam, 1984)³. The surficial soils of the Huron Fringe region in proximity to the site generally consist of sand, gravel, silt and clay, and littoral deposits derived from coarse-textured lacustrine deposits. The majority of the region is characterized by Sand Plains and tributary valleys to Lake St. Clair. The depth to the bedrock in the area is in excess of 30 m below ground surface and consists of shale of the Kettle Point Formation.

4.2 Subsurface Conditions – Previous Investigation

As discussed in Section 3.1 previously a geotechnical investigation was carried out from the original ground surface prior to the construction of the overhead structure. The results of previous investigation from GEOCREs No. 40J16-039 are presented in Appendix B.

The subsurface conditions encountered in boreholes advanced from the original ground surface (approximately Elevation 180 m) consist of sandy silt to silty sand and organics that extended to a depth of between about 1.5 m and 3 m below the original ground surface. The SPT “N” values presented on the borehole records range from 2 blows to 7 blows per 0.3 m of penetration, suggesting a very loose to loose compactness condition.

The surficial deposit was underlain by a 32 m thick deposit of clayey silt to silty clay, with trace sand and gravel. Within the deposit the upper approximately 3 m can be characterized as an “upper weathered crust” encountered at depths of between 1.5 m and 3 m below the original ground surface (between Elevation 179.2 m and 177.0 m). The SPT “N” values within the upper weathered crust range from about 9 blows to 43 blows per 0.3 of penetration, suggesting a stiff to hard consistency. The upper weathered crust has slight plasticity with the plastic limit averaging about 16% and the liquid limits at about 30%.

Underlying the upper weathered crust the deposit consists of silty clay, with trace sand and gravel and extended to the bedrock surface at about a depth of 33.8 m below ground surface (approximate Elevation of 146.6 m). In-situ vane shear testing was carried out in the boreholes and the undrained shear strength of the silty clay deposit varied from about 38 kPa to greater than 105 kPa, indicating that the cohesive deposit has a firm to very stiff consistency. The silty clay deposit has medium plasticity with the plastic limit averaging about 19% and the liquid limits at about 38%.

Shale bedrock of the Kettle Point Formation was encountered at a depth of 33.5 m below the original ground surface (Elevation 246.6 m).

³ 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.)

The previous report indicates that the groundwater level measured in the completed boreholes was at depths of about 0.6 m below the original ground surface and that it was likely lower during drier seasons.

4.3 Subsurface Conditions

Details of the subsurface soil and groundwater conditions as encountered in the boreholes advanced during the geotechnical investigation and the results of the laboratory tests carried out on selected soil samples are presented on the borehole records provided in Appendix C. The *Notes on Borehole and Test Pit Reports* are also included in Appendix C to assist in the interpretation of the borehole records. The results of the geotechnical laboratory testing are contained in Appendix D. The results of in-situ field tests (i.e., SPT “N” values), as presented on the borehole records and in the sub-sections of Section 4 are uncorrected.

The stratigraphic boundaries shown on the borehole records are inferred from non-continuous sampling, observations of drilling progress, the results of the Standard Penetration Tests and in-situ vane shear tests. These boundaries, therefore, represent transitions between soil types rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the borehole locations; however, the factual data presented in the borehole records governs any interpretation of the site conditions.

In summary, the subsurface conditions at boreholes completed in the vicinity of the existing CNR overhead structures consists of a layer of asphalt underlain by a layer of concrete. The concrete is further underlain by granular fill consisting of gravelly sand to sand and gravel, which in turn is underlain by fill material consisting of sandy clayey silt. In places beneath the cohesive fill material is a thin layer of fill material consisting of sand to gravelly sand. The fill material is underlain by a deposit consisting of sandy clayey silt. Detailed descriptions of subsurface conditions are provided in the following sections of this report. The subsurface conditions are described in accordance with the Ontario Ministry of Transportation (MTO) Guideline for Foundation Engineering Services Version 3.0 (April 2022).

4.3.1 Asphalt

Boreholes BH1-22 to BH4-22 were advanced through the eastbound and westbound lanes of Highway 402 and encountered an asphalt layer ranging in thickness from 150 mm to 310 mm.

4.3.2 Approach Slab Concrete

Underlying the asphalt in all four boreholes (BH1-22 to BH4-22), a layer of reinforced concrete was encountered, ranging in thickness from about 300 mm to 490 mm.

4.3.3 Fill

Underlying the concrete in all four boreholes (BH1-22 to BH4-22), fill material consisting of gravelly sand to sand and gravel with some fines was encountered and extended to depths of between about 1.2 m to 2.3 m below ground surface (Elevations 188.7 m and 187.8 m).

The Standard Penetration Test (SPT) “N” values recorded within the fill material range from 17 blows to 38 blows per 0.3 m of penetration, indicating a compact to dense compactness condition.

Grain size distribution testing was conducted on three representative samples of the granular fill and the results are presented on Figure D-1 in Appendix D). The water content measured on samples of the granular fill range from approximately 5% to 11%.

The granular fill is underlain by embankment fill consisting of sandy clayey silt, trace gravel. The cohesive fill extends to depths of between about 10.7 m and 11.3 m (Elevations 179.2 m and 178.6). In Borehole BH2-22 a 0.1 m thick layer of gravelly sand fill was encountered at 10.2 m depth (Elevation 179.7 m). Underlying the cohesive fill in Borehole BH2-22 at a depth of 10.7 m (Elevation 179.2 m) a 0.7 m thick layer of fill material consisting of sand, some silt, trace gravel and clay was encountered.

The Standard Penetration Test (SPT) “N” values recorded within the cohesive fill material range from 4 blows to 23 blows per 0.3 m of penetration. In-situ vane tests carried out within the cohesive fill material measured undrained shear strength of greater than 100 kPa. The in-situ field vane tests together with the SPT “N” values indicate that the cohesive encountered in the boreholes has a soft to very stiff consistency. The SPT “N” values recorded in the granular fill were 25 blows and 30 blows per 0.3 m of penetration, suggesting a compact compactness condition.

Grain size distribution testing was conducted on eight representative samples of the cohesive fill and the results are shown on Figure D-2 in Appendix D. Atterberg limits testing was carried out on fifteen samples of the cohesive fill and the results had liquid limits ranging from about 23% to 33%, plastic limits ranging from about 12% to 16%, and resulting plasticity indices of between about 9% to 17%. These results, which are plotted on a plasticity chart on Figures D-3A&B in Appendix D, indicate that the cohesive fill consist of sandy clayey silt of low to medium plasticity. Further, grain size distribution testing was conducted on two representative samples of the gravelly sand to sand fill material and the results are shown on Figure D-4 in Appendix D).

The water content measured on samples of the granular fill range from approximately 5% to 11% and water content measured on samples of the cohesive fill range from approximately 12% to 21%. The water content measured on a sample of the lower granular fill in Borehole BH2-22 was 17%.

4.3.4 Sandy Clayey Silt

A cohesive deposit consisting of sandy clayey silt with trace of gravel was encountered beneath the cohesive fill in Boreholes BH3-22 and 4-22 and below the granular fill in Boreholes BH1-22 and 2-22, at depths of about 11.3 m and 11.4 m below ground surface (Elevations 178.8 m and 178.5 m). All boreholes terminated within the sandy clayey silt at a depth of 12.8 m below ground surface (between Elevations 177.3 m and 177.1 m).

The SPT “N” values recorded within the sandy clayey silt deposit range from 11 blows to 18 blows per 0.3 m of penetration, suggesting a stiff to very stiff consistency.

The water content measured on samples of the sandy clayey silt deposit were 14% and 16%.

4.3.5 Groundwater

The groundwater level in the open boreholes was measure upon completion of drilling each borehole. The water levels measured in the open boreholes are summarized below.

| Structure Number | Borehole Number | Water Level Depth (m) | Water Level Elevation (m) | Date of Observation (Measurement) | Remark |
|----------------------------------|-----------------|-----------------------|---------------------------|-----------------------------------|--|
| 14X-0337/B1 (Eastbound Lanes) | BH2-22 | 12.7 | 177.2 | September 08, 2022 | Open boreholes upon completion of drilling |
| | BH4-22 | Dry | -- | September 07, 2022 | |
| 14X-0337/B2 (Westbound Lanes) | BH1-22 | 11.3 | 178.7 | September 12, 2022 | |
| | BH3-22 | Dry | -- | September 12, 2022 | |

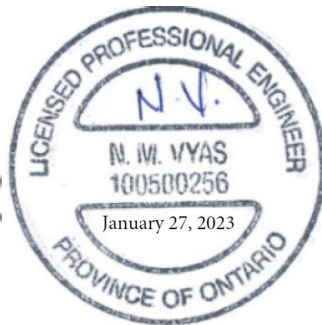
It should be noted that the groundwater level at the site will fluctuate with seasonal changes, periods of precipitation, and temperature and should be expected to be higher during wet periods of the year.

5. Closure

The fieldwork was supervised by Mr. Madlool Alsabak, E.I.T. under the direction of Mr. Nirjar Vyas, M.Eng., P.Eng., and Ms. Sandra McGaghran M.Eng., P.Eng. This report was prepared by Mr. Nirjar Vyas, M.Eng., P.Eng., a Geotechnical Engineer with GHD. Ms. Sandra McGaghran, M.Eng., P.Eng., a Senior Geotechnical Engineer with GHD and MTO Foundations Designated Contact conducted an independent review of the report.

Sincerely,

GHD Limited



Nirjar Vyas, M.Eng., P.Eng.
Geotechnical Engineer



Sandra McGaghran, M.Eng., P.Eng.
MTO Foundations Designated Contact, Senior Geotechnical Engineer

References

Canadian Geotechnical Society. 2006. Canadian Foundation Engineering Manual (CFEM), 4th Edition. The Canadian Geotechnical Society, BiTech Publisher Ltd., British Columbia.

Canadian Highway Bridge Design Code (CHBDC (2019)) and Commentary on CAN/CSA-S6-19. Canadian Standard Association. (CSA) Group.

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.

Kulhawy, F.H. and Mayne, P.W. 1990. Manual on Estimating Soil Properties for Foundation Design. EL6800, Research Project 14936. Prepared for Electric Power Research Institute, Palo Alto, California, U.S

ASTM International:

ASTM D1586 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils

ASTM D2573-15 Standard Test Method for Field Vane Shear Test in Saturated Fine-Grained Soils

Ontario Provincial Standard Specification:

OPSS.PROV 539 Construction Specification for Temporary Protection Systems

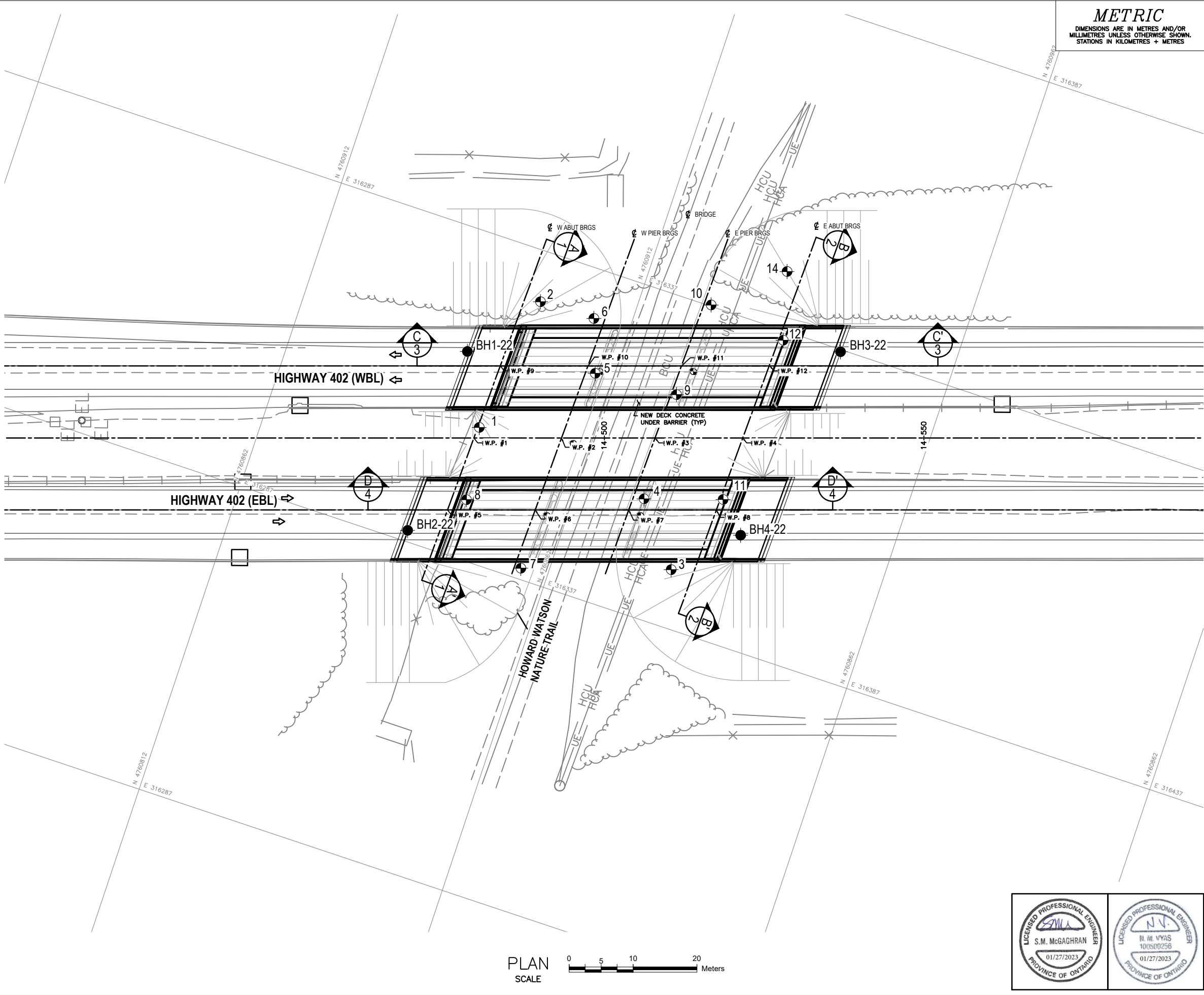
SP 105S09 Special Provision – Amendment to OPSS 539, November 2014

Ontario Water Resources Act:

Ontario Regulation 903 Wells (as amended)

Ontario Occupational Health and Safety Act:

Ontario Regulation 213/91 Construction Projects (as amended)

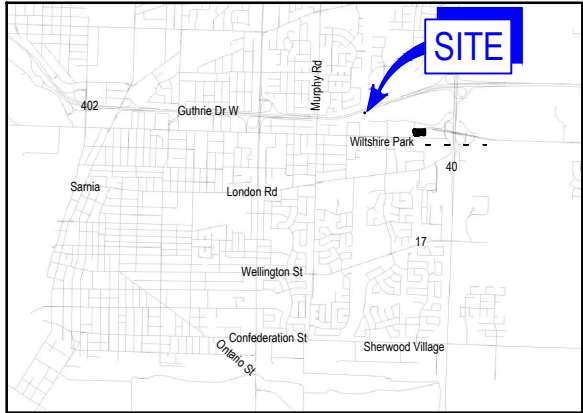


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES

CONT No.
GWP No. 3105-18-00



HWY 402/FORMER CN OVERHEAD
(RAPIDS PARKWAY) REHABILITATION
BOREHOLE LOCATIONS



KEY PLAN
SCALE

LEGEND

- Borehole Location
- Borehole Location
- Geocres no. 40J16-039

BOREHOLE CO-ORDINATES
(MTM ZONE 11)

| NO | Elevation | Northing | Easting |
|--------|-----------|-----------|----------|
| BH1-22 | 190.0 | 4760893.2 | 316314.3 |
| BH2-22 | 189.9 | 4760863.7 | 316314.3 |
| BH3-22 | 189.9 | 4760911.6 | 316369.7 |
| BH4-22 | 190.1 | 4760879.4 | 316364.0 |
| 1 | 180.6 | 4760882.5 | 316319.8 |
| 2 | 180.6 | 4760904.2 | 316322.7 |
| 3 | 180.4 | 4760870.9 | 316355.4 |
| 4 | - | 4760880.1 | 316347.8 |
| 5 | - | 4760896.3 | 316334.4 |
| 6 | - | 4760904.3 | 316331.5 |
| 7 | - | 4760863.7 | 316330.0 |
| 8 | 180.7 | 4760871.1 | 316321.5 |
| 9 | 180.4 | 4760897.1 | 316347.5 |
| 10 | - | 4760912.2 | 316348.2 |
| 11 | - | 4760883.9 | 316359.6 |
| 12 | 180.2 | 4760910.5 | 316360.6 |
| 14 | 180.3 | 4760920.9 | 316357.8 |

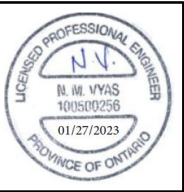
NOTES

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.

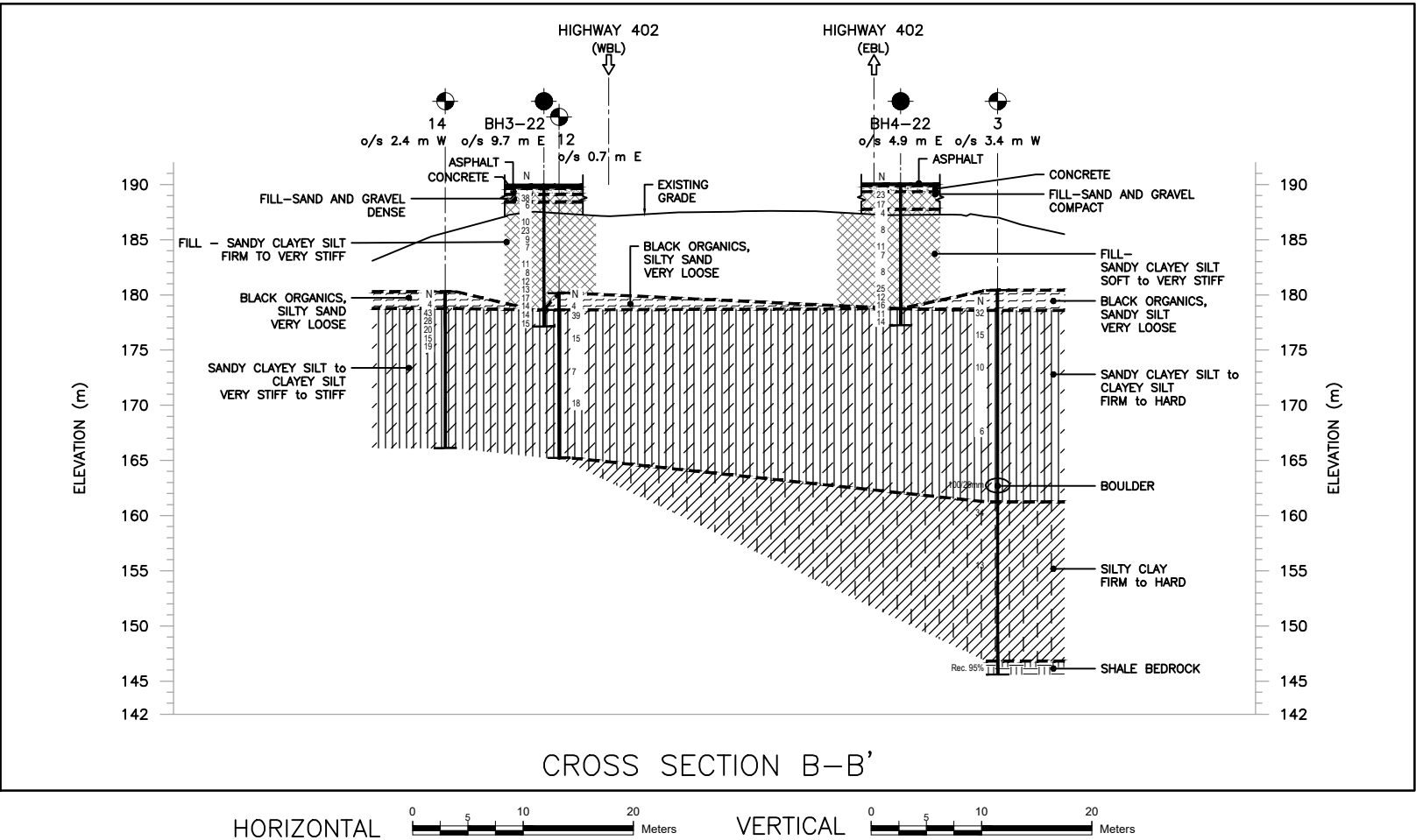
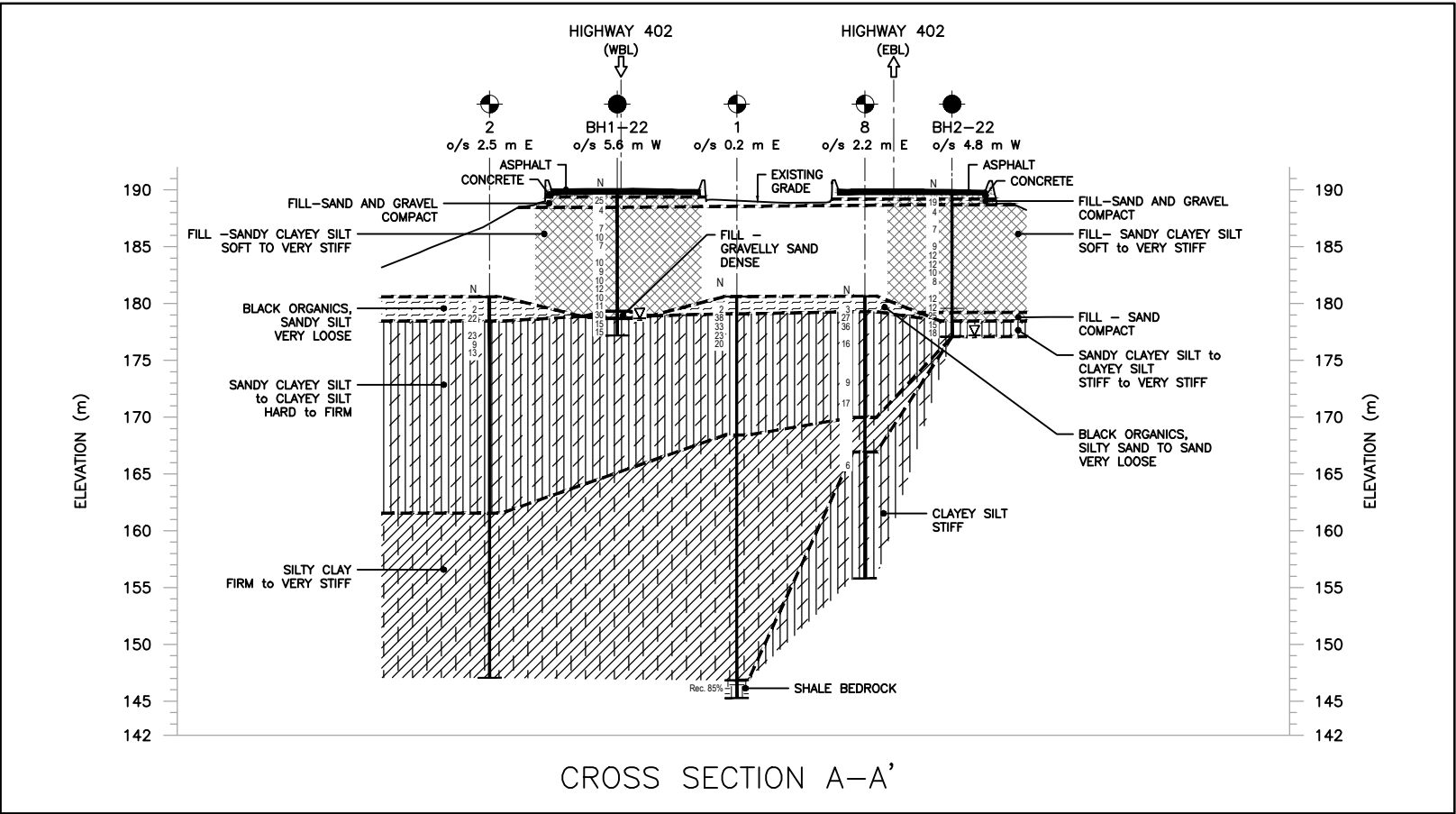
The boreholes shown in plan from GEOCREs 40J16-039 are approximate.

REFERENCE

Base plans provide in digital format by CALLON DIETZ, drawing file: 402SAR.dwg, received on October 31, 2022.



| NO. | DATE | BY | REVISION |
|-----------------------|----------------------|-----------------|-----------------------------------|
| | | | |
| | | | |
| Geocres No.: 40J16-94 | | | |
| HWY. 402 | PROJECT NO. 12566052 | | DIST. SOUTHWEST |
| SUBM'D. MA | CHKD. AC | DATE: 1.23.2023 | SITE: 14X-0337/B1 AND 14X-0337/B2 |
| DRAWN: AW | CHKD. NV | APPD. SMM | DWG. 1 |



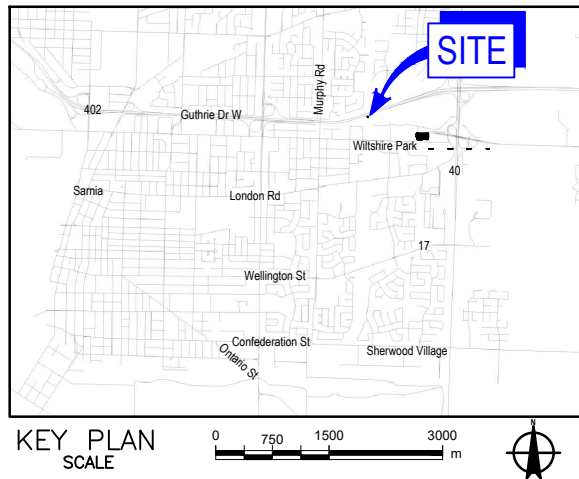
METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES

CONT No.
GWP No. 3105-18-00



HWY 402/FORMER CN OVERHEAD
(RAPIDS PARKWAY) REHABILITATION
SOIL STRATA

SHEET



LEGEND

- Borehole Location
- Borehole Location
Geocres no. 40J16-039
- Standard Penetration Test Value
- Blows/0.3 m unless otherwise stated
(Std. Pen. Test, 475 j/blow)
- WL upon completion of drilling
- Recovery

**BOREHOLE CO-ORDINATES
(MTM ZONE 11)**

| NO | Elevation | Northing | Easting |
|--------|-----------|-----------|----------|
| BH1-22 | 190.0 | 4760893.2 | 316314.3 |
| BH2-22 | 189.9 | 4760893.7 | 316314.3 |
| BH3-22 | 189.9 | 4760911.6 | 316369.7 |
| BH4-22 | 190.1 | 4760879.4 | 316364.0 |
| 1 | 180.6 | 4760882.5 | 316319.8 |
| 2 | 180.6 | 4760904.2 | 316322.7 |
| 3 | 180.4 | 4760870.9 | 316355.4 |
| 8 | 180.7 | 4760871.1 | 316321.5 |
| 12 | 180.2 | 4760910.5 | 316360.6 |
| 14 | 180.3 | 4760920.9 | 316357.8 |

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.

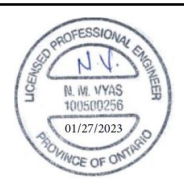
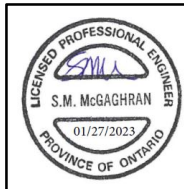
The boreholes shown in profile from GEOCRES 40J16-039 are approximate.

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

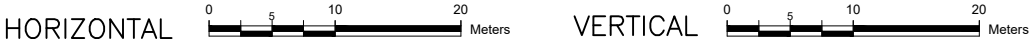
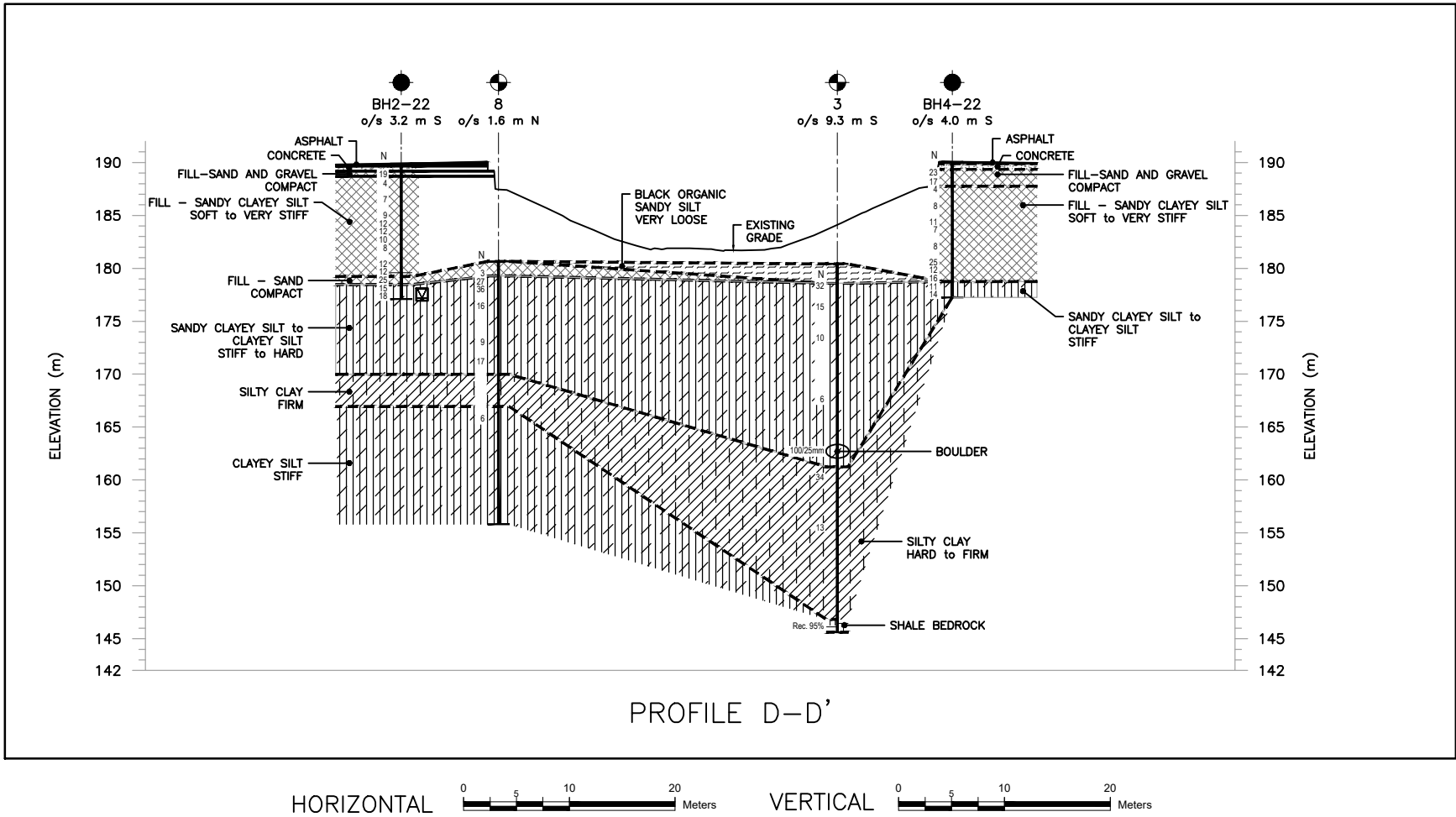
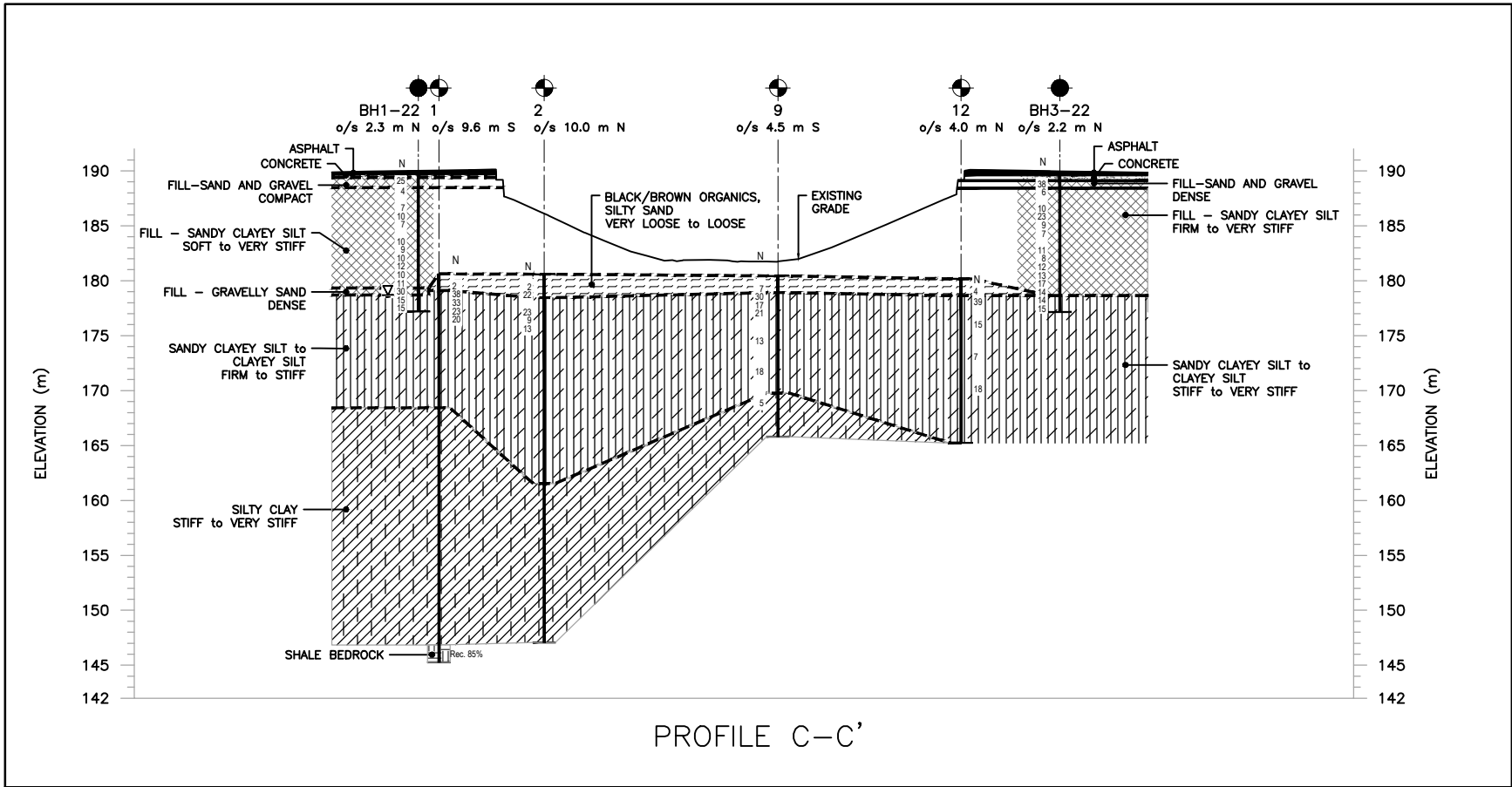
Boreholes from GEOCRES 40J16-039 were advanced prior to construction of the overpass.

REFERENCE

Base plans provide in digital format by CALLON DIETZ, drawing file: 402SAR.dwg, received on October 31, 2022.



| NO. | DATE | BY | REVISION |
|------------------------------|----------------------|-----------------|-----------------------------------|
| | | | |
| Geocres No.: 40J16-94 | | | |
| HWY. 402 | PROJECT NO. 12566052 | | DIST. SOUTHWEST |
| SUBM'D. MA | CHKD. AC | DATE: 1.24.2023 | SITE: 14X-0337/B1 AND 14X-0337/B2 |
| DRAWN: AW | CHKD. NV | APPD. SMM | DWG. 2 |

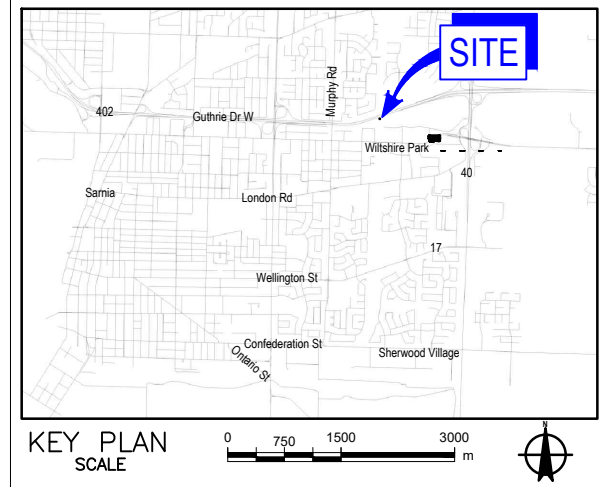


METRIC
DIMENSIONS ARE IN METRES AND/OR
MILLIMETRES UNLESS OTHERWISE SHOWN.
STATIONS IN KILOMETRES + METRES

CONT No.
GWP No. 3105-18-00



HWY 402/FORMER CN OVERHEAD
(RAPIDS PARKWAY) REHABILITATION
SOIL STRATA



LEGEND

| | |
|-------|---|
| | Borehole Location |
| | Geocres no. 40J16-039 |
| N | Standard Penetration Test Value |
| 16 | Blows/0.3 m unless otherwise stated (Std. Pen. Test, 475 j/blow) |
| | WL upon completion of drilling |
| REC/% | Recovery |

BOREHOLE CO-ORDINATES (MTM ZONE 11)

| NO | Elevation | Northing | Eastng |
|--------|-----------|-----------|----------|
| BH1-22 | 190.0 | 4760893.2 | 316314.3 |
| BH2-22 | 189.9 | 4760893.7 | 316314.3 |
| BH3-22 | 189.9 | 4760911.6 | 316369.7 |
| BH4-22 | 190.1 | 4760879.4 | 316364.0 |
| 1 | 180.6 | 4760882.5 | 316319.8 |
| 2 | 180.6 | 4760904.2 | 316322.7 |
| 3 | 180.4 | 4760870.9 | 316355.4 |
| 6 | 180.7 | 4760871.1 | 316321.5 |
| 9 | 180.4 | 4760897.1 | 316347.5 |
| 12 | 180.2 | 4760910.5 | 316360.6 |

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 boreholes shown in profile from GEOCREs 40J16-039 are approximate.

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

Boreholes from GEOCREs 40J16-039 were advanced prior to construction of the overpass.

REFERENCE

Base plans provide in digital format by CALLON DIETZ, drawing file: 402SAR.dwg, received on October 31, 2022.

| NO. | DATE | BY | REVISION |
|-----|------|----|----------|
| | | | |
| | | | |

Geocres No.: 40J16-94

| | | |
|------------|----------------------|-----------------|
| HWY. 402 | PROJECT NO. 12566052 | DIST. SOUTHWEST |
| SUBM'D. MA | CHKD. AC | DATE: 1.23.2023 |
| DRAWN: AW | CHKD. NV | APPD. SMM |



Appendices

Appendix A

Site Photographs



Photograph 1 – Drilling operations at Borehole, BH2-22 – Highway 402 Eastbound Lane



Photograph 2 – Highway 402 at CNR overhead structure - Eastbound Lanes



Photograph 3 – CNR Overhead structures at Highway 402, westbound and eastbound lanes – Looking southeast

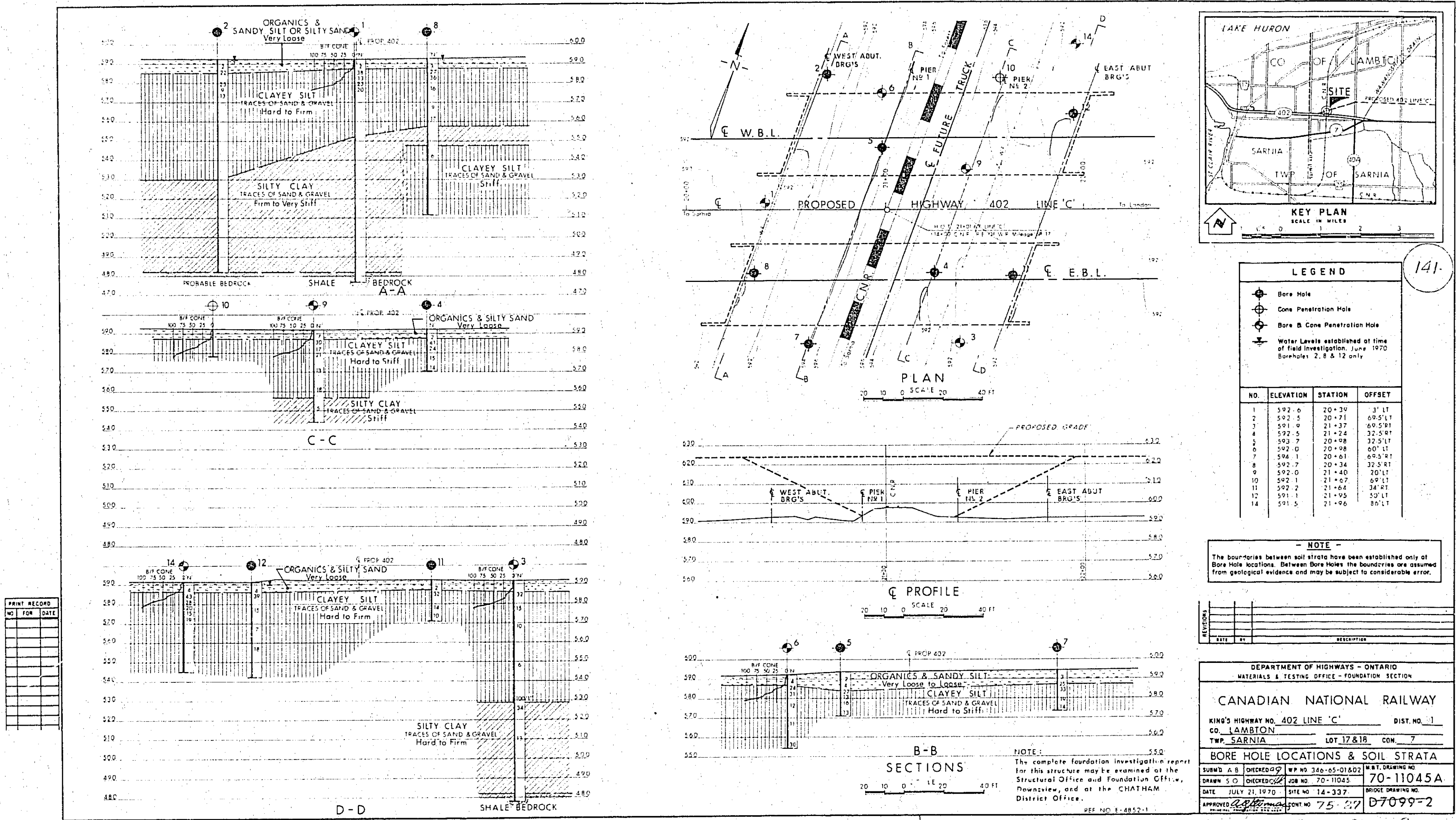


Photograph 4 – Drilling set up at Borehole, BH1-22 – Highway 402 Westbound Lane

Appendix B

Previous Investigation

Geocres No. 40J16-039



7-337 D-B

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS:-

| <u>CONSISTENCY</u> | <u>'N' BLOWS / FT.</u> | <u>c LB. / SQ. FT.</u> | <u>DENSENESS</u> | <u>'N' BLOWS / FT.</u> |
|--------------------|------------------------|------------------------|------------------|------------------------|
| VERY SOFT | 0 - 2 | 0 - 250 | VERY LOOSE | 0 - 4 |
| SOFT | 2 - 4 | 250 - 500 | LOOSE | 4 - 10 |
| FIRM | 4 - 8 | 500 - 1000 | COMPACT | 10 - 30 |
| STIFF | 8 - 15 | 1000 - 2000 | DENSE | 30 - 50 |
| VERY STIFF | 15 - 30 | 2000 - 4000 | VERY DENSE | > 50 |
| HARD | > 30 | > 4000 | | |

TYPE OF SAMPLE

| | | | |
|------|------------------------------------|------|-------------------|
| S.S. | SPLIT SPOON | T.W. | THINWALL OPEN |
| W.S. | WASHED SAMPLE | T.P. | THINWALL PISTON |
| S.B. | SCRAPER BUCKET SAMPLE | O.S. | OESTERBERG SAMPLE |
| A.S. | AUGER SAMPLE | F.S. | FOIL SAMPLE |
| C.S. | CHUNK SAMPLE | R.C. | ROCK CORE |
| S.T. | SLOTTED TUBE SAMPLE | | |
| | P.H. SAMPLE ADVANCED HYDRAULICALLY | | |
| | P.M. SAMPLE ADVANCED MANUALLY | | |

SOIL TESTS

| | | | |
|-----|---------------------------------|------|-----------------|
| Qu | UNCONFINED COMPRESSION | L.V. | LABORATORY VANE |
| Q | UNDRAINED TRIAXIAL | F.V. | FIELD VANE |
| Qcu | CONSOLIDATED UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| Qd | DRAINED TRIAXIAL | S | SENSITIVITY |

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

| | |
|------------|--|
| γ | UNIT WEIGHT OF SOIL (BULK DENSITY) |
| γ_s | UNIT WEIGHT OF SOLID PARTICLES |
| γ_w | UNIT WEIGHT OF WATER |
| γ_d | UNIT DRY WEIGHT OF SOIL (DRY DENSITY) |
| γ' | UNIT WEIGHT OF SUBMERGED SOIL |
| G | SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$ |
| e | VOID RATIO |
| n | POROSITY |
| w | WATER CONTENT |
| S_r | DEGREE OF SATURATION |
| w_L | LIQUID LIMIT |
| w_p | PLASTIC LIMIT |
| I_p | PLASTICITY INDEX |
| s | SHRINKAGE LIMIT |
| I_L | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$ |
| I_c | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$ |
| e_{max} | VOID RATIO IN LOOSEST STATE |
| e_{min} | VOID RATIO IN DENSEST STATE |
| I_D | DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$ |
| | RELATIVE DENSITY D_r IS ALSO USED |
| h | HYDRAULIC HEAD OR POTENTIAL |
| q | RATE OF DISCHARGE |
| v | VELOCITY OF FLOW |
| i | HYDRAULIC GRADIENT |
| k | COEFFICIENT OF PERMEABILITY |
| j | SEEPAGE FORCE PER UNIT VOLUME |
| m_v | COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$ |
| c_v | COEFFICIENT OF CONSOLIDATION |
| C_c | COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$ |
| T_v | TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH) |
| U | DEGREE OF CONSOLIDATION |
| τ_f | SHEAR STRENGTH |
| c' | EFFECTIVE COHESION INTERCEPT |
| ϕ' | EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION |
| c_u | APPARENT COHESION |
| ϕ_u | APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION |
| μ | COEFFICIENT OF FRICTION |
| S_t | SENSITIVITY |

GENERAL

| | |
|---------------------------|-----------------------------------|
| π | = 3.1416 |
| e | BASE OF NATURAL LOGARITHMS 2.7183 |
| $\log_e a$ OR $\ln a$ | NATURAL LOGARITHM OF a |
| $\log_{10} a$ OR $\log a$ | LOGARITHM OF a TO BASE 10 |
| t | TIME |
| g | ACCELERATION DUE TO GRAVITY |
| V | VOLUME |
| W | WEIGHT |
| M | MOMENT |
| F | FACTOR OF SAFETY |

STRESS AND STRAIN

| | |
|------------|--|
| u | PORE PRESSURE |
| σ | NORMAL STRESS |
| σ' | NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED) |
| τ | SHEAR STRESS |
| ϵ | LINEAR STRAIN |
| γ | SHEAR STRAIN |
| ν | POISSON'S RATIO (μ IS ALSO USED) |
| E | MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS) |
| G | MODULUS OF SHEAR DEFORMATION |
| K | MODULUS OF COMPRESSIBILITY |
| η | COEFFICIENT OF VISCOSITY |

EARTH PRESSURE

| | |
|----------|---|
| d | DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE |
| δ | ANGLE OF WALL FRICTION |
| K | DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS |
| K_0 | COEFFICIENT OF EARTH PRESSURE AT REST |

FOUNDATIONS

| | |
|-------|--|
| B | BREADTH OF FOUNDATION |
| L | LENGTH OF FOUNDATION |
| D | DEPTH OF FOUNDATION BENEATH GROUND |
| N | DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY |
| k_s | MODULUS OF SUBGRADE REACTION |

SLOPES

| | |
|---------|--|
| H | VERTICAL HEIGHT OF SLOPE |
| D | DEPTH BELOW TOE OF SLOPE TO HARD STRATUM |
| β | ANGLE OF SLOPE TO HORIZONTAL |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 70 - 11045

LOCATION Sta. 20 + 39 Offset 3 Lt.

ORIGINATED BY H.S.

W.P. 346-65-01802

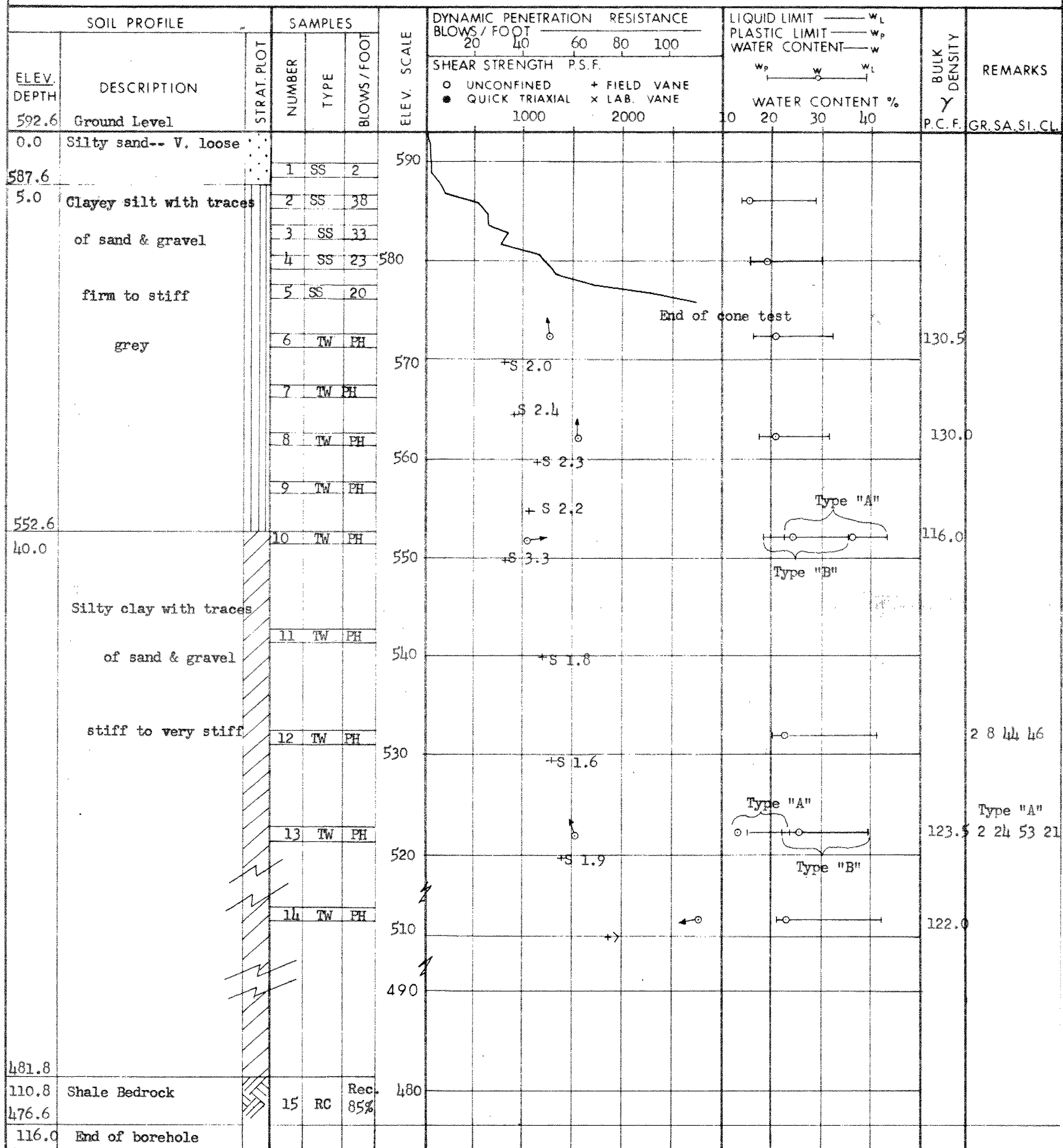
BORING DATE Nov. 26, 27, Dec. 1 & 2, 1969

COMPILED BY G.A.

DATUM Geodetic

BOREHOLE TYPE Washboring, NX, BX casing, BXL core

CHECKED BY



DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 70-11045

LOCATION STA. 20 + 71, 69.5 Ft. Lt. of ϕ

ORIGINATED BY T.P.

W.P. 346-65-01 & 02

BORING DATE June 24, 1970

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE C.M.E. Auger

CHECKED BY *ll*

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION BLOWS / FOOT | | RESISTANCE | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|----------------|--|-------------|---------|------|------------|-------------|-------------------------------------|-----------------------------|------------|--|-----|--------|---------------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | | SHEAR STRENGTH P.S.F. | | | WATER CONTENT % | | | | |
| | | | | | | | ○ UNCONFINED ● QUICK TRIAXIAL | + FIELD VANE x LAB. VANE | | w_p | w | w_L | | |
| 592.5 | Ground Level | | | | | | 1000 | 2000 | | 10 | 20 | 30 | | |
| 0.0 | Black organics & sandy silt--V. loose | | 1 | SS | 2 | 590 | | | | | | | | |
| 585.5 | | | 2 | SS | 22 | | | | | | ○ | | | |
| 7.0 | | | 3 | TW | PH | | | ○ 4000 | | | ○ | — | | 136 |
| | | | 4 | SS | 23 | 580 | | | | | ○ | | | |
| | | | 5 | SS | 9 | | | | | | ○ | | | |
| | Clayey silt with traces of sand & gravel | | 6 | SS | 13 | | + | | | | ○ | | | |
| | | | | | | 570 | + | | | | | | | |
| | | | 7 | TW | PH | | ○ | | | | — | ○ | — | 130 |
| | | | | | | | | + | | | | | | |
| | hard to firm | | | | | 560 | | | | | | | | |
| | | | 8 | TW | PH | | | ○ | | | — | ○ | — | 134 |
| | | | | | | | | ● | | | + | < 2200 | | 134.5 |
| | | | | | | 550 | | | | | | | | |
| | | | 9 | TW | PH | | ○ | | | | — | — | ○ | 120 |
| | | | | | | | + | | | | | | | |
| | | | | | | 540 | | | | | | | | |
| | | | 10 | TW | PH | | | | ○ | | — | — | ○ | 130 |
| 530.0 | | | | | | 530 | | | | | | | | |
| 62.5 | Silty clay with traces of sand & gravel | | 11 | TW | PH | | | ● | | | — | — | ○ | 120.5 |
| | | | | | | 520 | | | | | | | | |
| | firm to stiff | | 12 | TW | PH | | | | | | | | | |
| | | | | | | 490 | | | | | | | | |
| 481.5 | Probable Bedrock | | | | | | | | | | | | | |
| 110.0 | End of borehole | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.3

FOUNDATION SECTION

JOB 70-11045

LOCATION STA 21 + 37, 69.5 Ft. Rt. of \emptyset

ORIGINATED BY T.P.

W.P. 346-65-01 & 02

BORING DATE June 11-15, 1970

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE C.M.E. Auger & Washboring, BX casing

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|------------------------------|-------------|-------------|---------|------|------------|-------------|--------------------------------|----|----|----|-----|--|--|--|------------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | | BLOWS / FOOT | | | | | WATER CONTENT % | | | | |
| | | | | | | | 20 | 40 | 60 | 80 | 100 | w_p — w — w_L | | | | |
| SHEAR STRENGTH P.S.F. | | | | | | | | | | | | | | | | |
| ○ UNCONFINED + FIELD VANE | | | | | | | | | | | | | | | | |
| ● QUICK TRIAXIAL x LAB. VANE | | | | | | | | | | | | | | | | |
| | | | | | | | 1000 2000 | | | | | 10 20 30 | | | | |

| | | | | | | | | | | | | | | | | | |
|-------|--|----|----|----------|--------|-----|--|--|--|--|--|--|--|--|--|--|--|
| 591.9 | Ground Level | | | | | | | | | | | | | | | | |
| 0.0 | Black organics & sandy silt | | 1 | TW | PM | 590 | | | | | | | | | | | |
| 585.9 | V. Loose | | 2 | SS | 32 | | | | | | | | | | | | |
| 6.0 | Clayey silt with traces of sand & gravel | | 3 | TW | PH | 580 | | | | | | | | | | | |
| | | | 4 | SS | 15 | | | | | | | | | | | | |
| | | | 5 | TW | PH | 570 | | | | | | | | | | | |
| | | | 6 | SS | 10 | | | | | | | | | | | | |
| | Hard to Firm | | 7 | TW | PH | 560 | | | | | | | | | | | |
| | | | 8 | SS | 6 | 550 | | | | | | | | | | | |
| | | | 9 | TW | PH | 540 | | | | | | | | | | | |
| 529.0 | Boulder | | 10 | SS | 100/1" | 530 | | | | | | | | | | | |
| 62.9 | Silty clay with traces of sand & gravel | 11 | SS | 34 | | | | | | | | | | | | | |
| | | 12 | SS | 13 | 510 | | | | | | | | | | | | |
| | | 13 | TW | PM | 500 | | | | | | | | | | | | |
| 481.7 | Shale Bedrock | | | | | | | | | | | | | | | | |
| 110.2 | | 14 | RC | Rec. 95% | 480 | | | | | | | | | | | | |
| 477.7 | | | | | | | | | | | | | | | | | |
| 114.2 | End of borehole | | | | | | | | | | | | | | | | |

20
10-5 % STRAIN AT FAILURE
10

CHECKED BY

FOUNDATION SECTION

[illegible]

FOUNDATION SECTION

ORIGINATED BY T D

COMPILED BY A.K.B.

CHECKED BY *AK*

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 6

FOUNDATION SECTION

JOB 70-11045 LOCATION STA 20 + 98 Offset 60 Lt.

ORIGINATED BY G.A.

W.P. 346-65-01 & 02 BORING DATE Dec. 4/69

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|---|-------------|---------|------|--------------|-------------|--------------------------------|----|----|----|----|--|--|--|------------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | 20 | 40 | 60 | 80 | 100 | w_p ——— w ——— w_L WATER CONTENT % 10 20 30 | | | |
| 592.0 | ground level | | | | | | | | | | | | | | | |
| 0.0 | organics & silty sand | | 1 | SS | 4 | 590 | | | | | | | | | | |
| 587.0 | loose | | 2 | SS | 21 | | | | | | | | | | | |
| 5.0 | Clayey silt with traces of sand & gravel very stiff to stiff | | 3 | SS | 31 | | | | | | | | | | | |
| | | | 4 | TW | PH | 580 | | | | | | | | | | |
| | | | 5 | SS | 12 | | | | | | | | | | | |
| | | | 6 | TW | PH | 570 | | | | | | | | | | |
| | | | 7 | SS | 11 | | | | | | | | | | | |
| | | | 8 | | | 560 | | | | | | | | | | |
| | | | 9 | SS | 30 | | | | | | | | | | | |
| 554.0 | | | | | | | | | | | | | | | | |
| 38.0 | End of borehole | | | | | 550 | | | | | | | | | | |

SHEAR STRENGTH P.S.F.

○ UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x LAB. VANE

1000 2000

End of cone test

+S 1.9

+S 2.9

+S 2.4

+S 1.8

132.0

228.0

n.q.

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 70-11045 LOCATION STA 20 + 61, 69.5 Ft. Rt. of ~~E~~ ORIGINATED BY T.P.
 W.P. 346-65-01 & 02 BORING DATE June 25, 1970 COMPILED BY A.K.B.
 DATUM Geodetic BOREHOLE TYPE C.M.E. Auger CHECKED BY AK

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|--|-------------|---------|------|--------------|------------------|--|-------------|--------------|--|--|----|----|------------------------------------|-----------------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | | | | w_p — w — w_L WATER CONTENT % | | | | |
| | | | | | | | ○ UNCONFINED | | + FIELD VANE | | | | | | |
| | | | | | | ● QUICK TRIAXIAL | | x LAB. VANE | | | | | | | |
| 594.1 | ground level | | | | | | 1000 | 2000 | | | 10 | 20 | 30 | | GR. SA. SI. CL. |
| 0.0 | Black organics & sandy silt | ~ ~ ~ | 1 | SS | 3 | 590 | | | | | | | | | 1 27 64 8 |
| 587.6 | V. loose | | 2 | SS | 25 | | | | | | | | ○ | | |
| 6.5 | Clayey silt with traces of sand & gravel | | 3 | SS | 33 | | | | | | | | ○ | | |
| | hard to stiff | | 4 | SS | 19 | 580 | | | | | | ○ | | | |
| 573.1 | | | 5 | SS | 14 | | | | | | | | ○ | | |
| 21.0 | End of borehole | | | | | | | | + | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 70-11045

LOCATION STA 20 + 34 32.5 Ft. Rt of C

ORIGINATED BY T.P.

W.P. 346-65-01 & 02

BORING DATE June 22-23, 1970

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE C.M.E. Auger

CHECKED BY

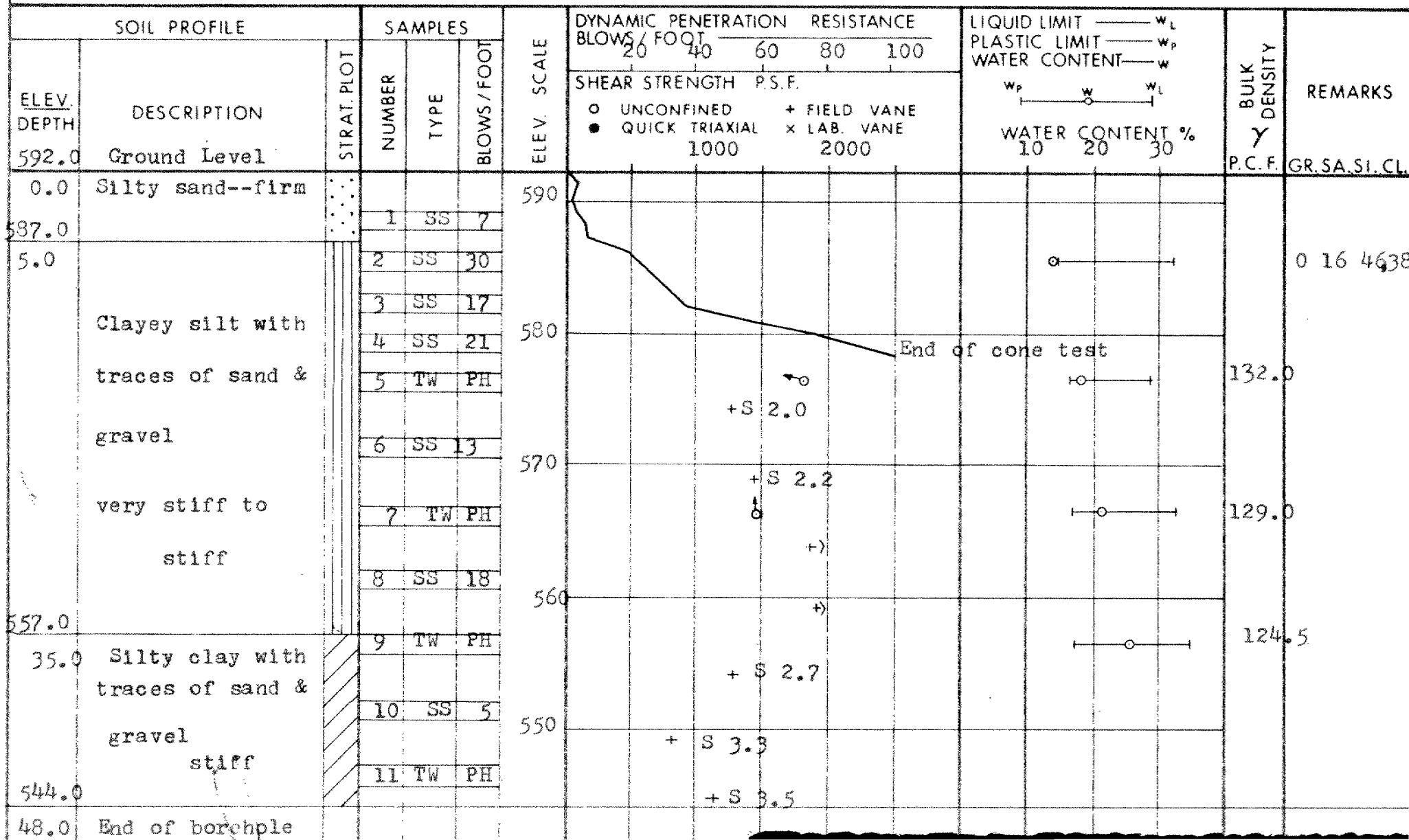
| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w | | | BULK DENSITY γ P.C.F. | REMARKS GR. SA. SI. CL. | | |
|--------------|---|-------------|---------|------|--------------|-------------|--|--------------------------------------|--|-----|---------|------------------------------------|----------------------------|-----|--|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | | | | |
| | | | | | | | \circ UNCONFINED \bullet QUICK TRIAXIAL | $+$ FIELD VANE \times LAB. VANE | w_p | w | w_L | | | | |
| 592.7 | Ground Level | | | | | 1000 | 2000 | 10 | 20 | 30 | | | | | |
| 0.0 | Black organics & very loose sand | ~ | 1 | SS | 3 | 590 | | | | | | 0 = 81 | | | |
| 4.5 | Clayey silt with traces of sand and gravel ; Hard to stiff | | 2 | SS | 27 | | | | | | \circ | | | | |
| | | | 3 | SS | 36 | | | | | | \circ | | | | |
| | | | 4 | TW | PH | 580 | | | \circ | | | \circ | 135 | | |
| | | | 5 | SS | 16 | | | | | | | \circ | | | |
| | | | 6 | TW | PH | 570 | | | \circ | | | \circ | 130 | | |
| | | | 7 | SS | 9 | | | | | | | \circ | | | |
| | | | 8 | SS | 17 | 560 | | | | | | \circ | | | |
| 557.7 | | | | | | | | | | | | | | | |
| 35.0 | Silty clay, traces of sand & gravel--firm | | 9 | TW | PM | 550 | | | | | | | 116.5 | | |
| 517.7 | Clayey silt with traces of sand & gravel stiff | | 10 | SS | 6 | 540 | | | | | | | | | |
| 45.0 | | | | 11 | TW | PM | 530 | | | | | | | 124 | |
| | | | | | | | | | | | | | | | |
| | | | | 12 | TW | PH | 520 | | | | | | | | |
| 511.2 | | | | | | | | | | | | | 121.5 | | |
| 81.5 | End of boreholes | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 9

FOUNDATION SECTION

JOB 70-11045 LOCATION STA 21 + 40 Offset 20' LT. ORIGINATED BY G.A.
W.P. 346-65-01 & 02 BORING DATE Dec. 2, 1969 COMPILED BY G.A.
DATUM Geodetic BOREHOLE TYPE Cont. Flt. Auger CHECKED BY AK



DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 10

FOUNDATION SECTION

JOB 70-11045 LOCATION STA 21+57 Offset 69' LT.
W.P. 346-65-01 & 02 BORING DATE Dec 1967
DATUM Geodetic BOREHOLE TYPE Dynamic Cone PenetrationORIGINATED BY G.A.
COMPILED BY G.A.
CHECKED BY [Signature]

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | LIQUID LIMIT — w_L | BULK DENSITY γ | REMARKS |
|--------------|-----------------------|-------------|---------|------|--------------|-------------|--|--|--------------------------|----------------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | PLASTIC LIMIT — w_p | | |
| 592.1 | Ground Level | | | | | | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | WATER CONTENT % w_p — w — w_L | P.C.F. | GR, SA, SI, CL |
| 0.0 | Cone Penetration Only | | | | | 590 | | | | |
| 578.1 | | | | | | 580 | | | | |
| 14.0 | End of cone test | | | | | 570 | | | | |

End of cone test

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB 70-11045 LOCATION STA 21 + 64, 34 Ft. Rt. of E ORIGINATED BY A.K.B.
 W.P. 346-65-01-02 BORING DATE June 26, 1970 COMPILED BY A.K.B.
 DATUM Geodetic BOREHOLE TYPE C.M.E. Auger CHECKED BY [Signature]

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|--|-------------|---------|------|--------------|-------------|--------------------------------|--|--|--|--|--|--|------------------------------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % 10 20 30 | | | | |
| 592.2 | Ground Level | | | | | | | | | | | | | | |
| 0.0 | Black organics & silty sand-V. loose | | 1 | SS | 2 | | | | | | | | | | |
| 587.2 | | | 2 | SS | 32 | | | | | | | | | | |
| 5.0 | Clayey silt with traces of sand & gravel | | 3 | SS | 14 | | | | | | | | | | |
| | hard to stiff | | 4 | SS | 10 | | | | | | | | | | |
| 571.2 | | | | | | | | | | | | | | | |
| 21.0 | End of borehole | | | | | | | | | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 12

FOUNDATION SECTION

JOB 70-11045

LOCATION STA 21 + 95, 50 Ft. Lt. of \varnothing

ORIGINATED BY A.K.B.

W.P. 346-65-01-02

BORING DATE June 26, 1970

COMPILED BY A.K.B.

DATUM Geodetic

BOREHOLE TYPE C.M.E. Auger

CHECKED BY *[Signature]*

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 14

FOUNDATION SECTION

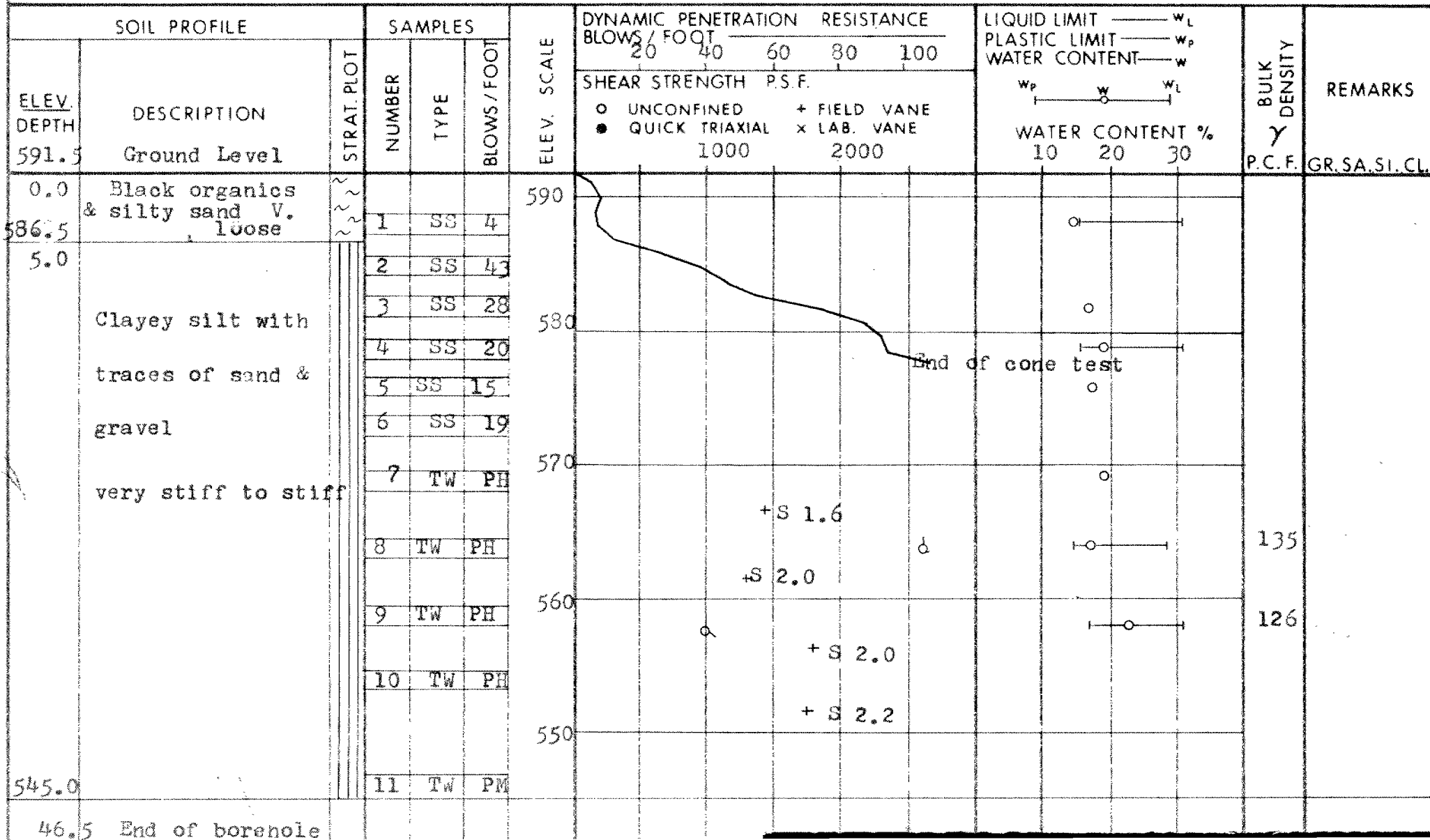
JOB 70-11045 LOCATION STA 21 + 96 Offset 86' LT.

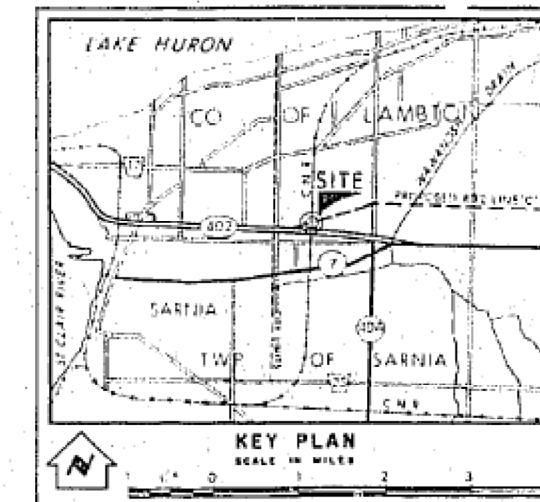
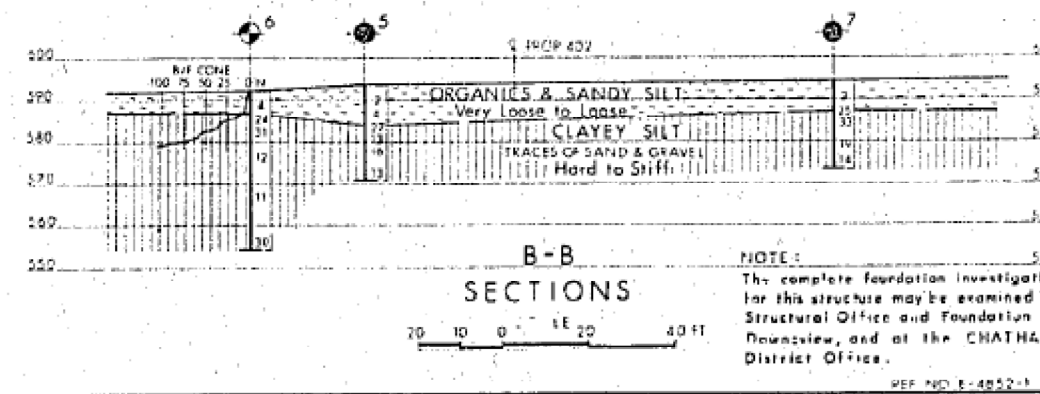
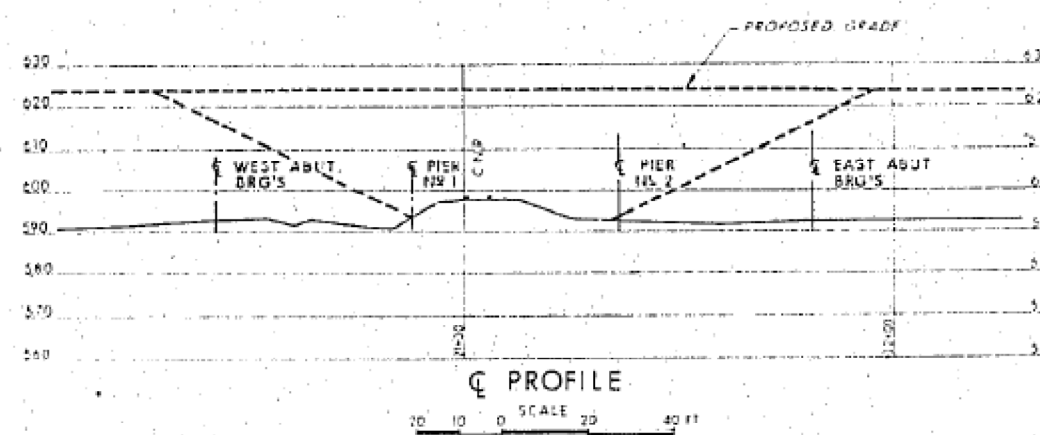
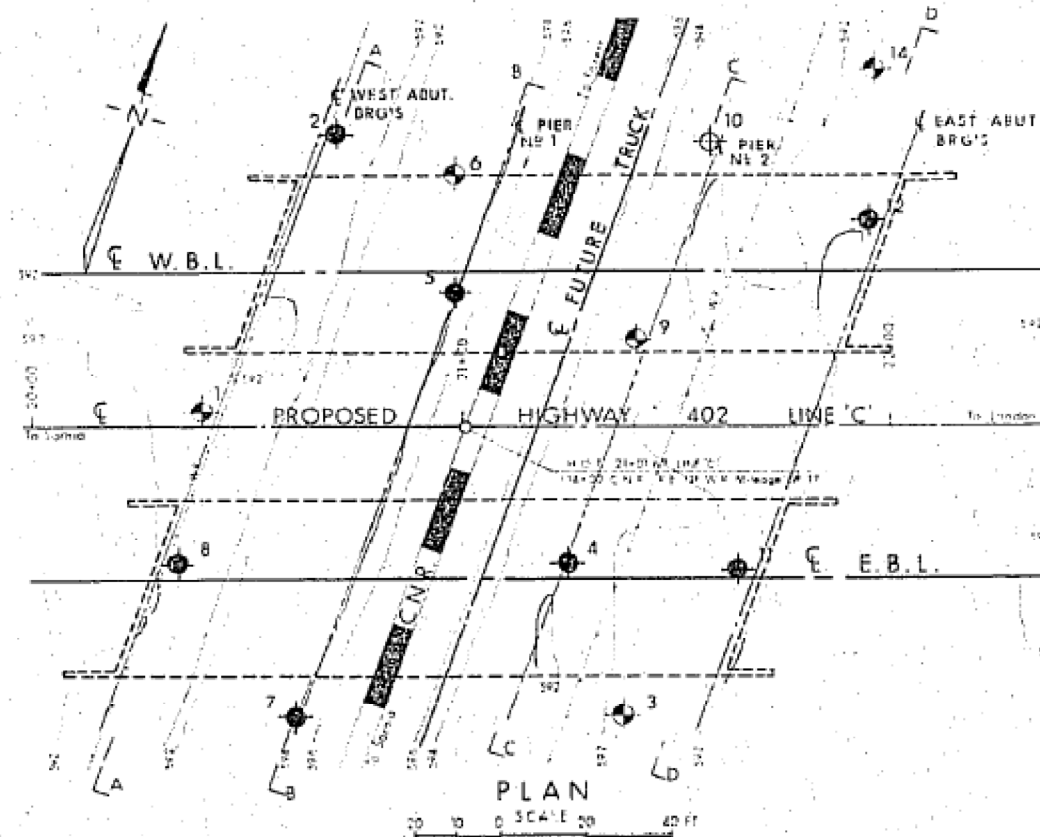
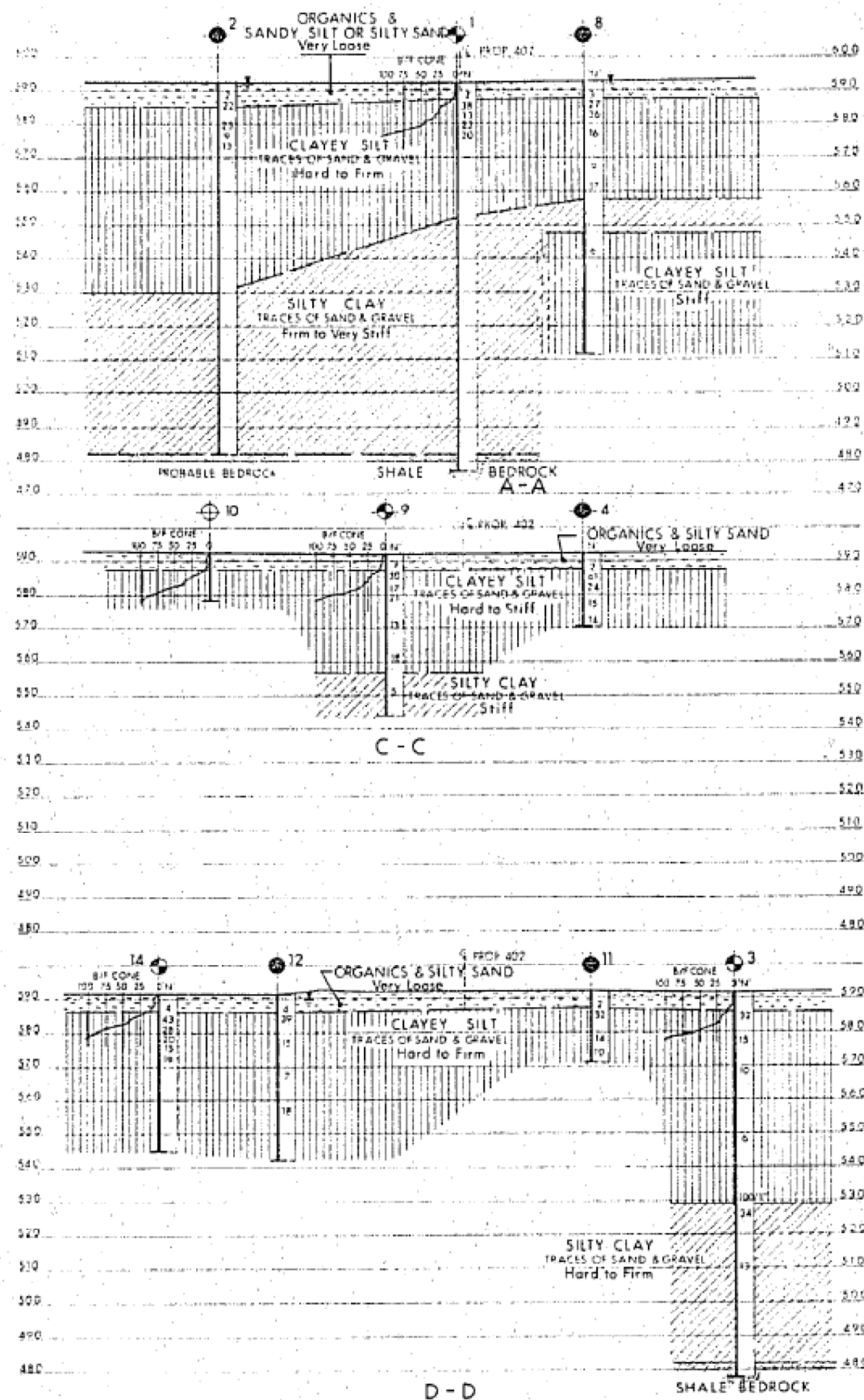
ORIGINATED BY P.P.

W.P. 346-65-01&02 BORING DATE Dec. 1 & 2, 1969

COMPILED BY G.A.

DATUM Geodetic BOREHOLE TYPE Cont. Flt. Auger

CHECKED BY *W.C.*



| LEGEND | | | |
|--------|--|---------|----------|
| | Bore Hole | | |
| | Cone Penetration Hole | | |
| | Bore & Cone Penetration Hole | | |
| | Water Levels established at time of field investigation, June 1970 | | |
| | Boreholes 2, 8 & 12 only | | |
| NO. | ELEVATION | STATION | OFFSET |
| 1 | 592.6 | 20+30 | 1' LT |
| 2 | 592.5 | 20+71 | 69.5' LT |
| 3 | 591.9 | 21+37 | 60.5' RT |
| 4 | 592.5 | 21+24 | 32.5' RT |
| 5 | 593.7 | 20+98 | 32.5' LT |
| 6 | 592.0 | 20+98 | 60' LT |
| 7 | 594.1 | 20+61 | 60.5' RT |
| 8 | 592.7 | 20+34 | 32.5' RT |
| 9 | 592.0 | 21+40 | 20' LT |
| 10 | 592.1 | 21+67 | 69' LT |
| 11 | 592.2 | 21+64 | 34' RT |
| 12 | 591.1 | 21+93 | 50' LT |
| 14 | 591.5 | 21+96 | 85' LT |

NOTE

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

| REVISION | DATE | BY | DESCRIPTION |
|----------|------|----|-------------|
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DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE - FOUNDATION SECTION

CANADIAN NATIONAL RAILWAY

KING'S HIGHWAY NO. 402 LINE 'C' DIST. NO. 1

CO. LAMBTON

TWP. SARNIA LOT 17 & 18 CON. 7

BORE HOLE LOCATIONS & SOIL STRATA

SUBMIT. A.B. CHECKED 9/9 WP NO. 146-65-01802 M.B.T. DRAWING NO.

DRAWN S.D. CHECKED 9/9 JOB NO. 70-11045 70-11045A

DATE JULY 21, 1970 SITE NO. 14-337 BRIDGE DRAWING NO.

APPROVED 9/9/70 FONT NO. 75-37 D7099-2

| PRINT RECORD | NO. | FOR | DATE |
|--------------|-----|-----|------|
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T-17-337-2-B

Appendix C

Borehole Records

RECORD OF BOREHOLE No BH1-22

1 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760893.2, Easting: 316314.3, MTM Zone 11) ORIGINATED BY M.A
 DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
 DATUM Geodetic DATE 2022.09.12 - 2022.09.12 LATITUDE 42.987756 LONGITUDE -82.358805 CHECKED BY SMM

| 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 | | | | | | | | | |
| 190.0 | 0.0 | ASPHALT (300 mm) | | | | | | | | | | | | | | | |
| 189.7 | 0.3 | CONCRETE (300 mm) | | | | | | | | | | | | | | | |
| 189.4 | 0.6 | FILL - SAND and GRAVEL, some fines Compact Brown Moist | | 1 | SS | 25 | | | | | | | | | | | |
| 188.5 | 1.5 | Fill - SANDY CLAYEY SILT, trace gravel Soft to stiff Brown to grey Moist | | 2 | SS | 4 | | | | | | | | | | | 5 26 49 20 |
| | | | | | VANE | | | | | | | | | | | | |
| | | | | 3 | SS | 7 | | | | | | | | | | | LL=25% PL=13% PI=12% |
| | | | | 4 | SS | 10 | | | | | | | | | | | 4 29 46 21 |
| | | | | 5 | SS | 7 | | | | | | | | | | | |
| | | | | | VANE | | | | | | | | | | | | |
| | | | | 6 | SS | 10 | | | | | | | | | | | LL=23% PL=14% PI=9% |
| | | | | 7 | SS | 9 | | | | | | | | | | | |
| | | | | 8 | SS | 10 | | | | | | | | | | | |
| | | | | 9 | SS | 12 | | | | | | | | | | | |
| | | | | 10 | SS | 10 | | | | | | | | | | | |
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contains trace rootlets below the depth of
9.1 m, up to the depth of 10.7 m

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 Library File: 12566052 MTO LIBRARY.GLB Report: 12566052 BOREHOLE LOG_V01 Date: 23/1/23

Continued Next Page

+ 3 Numbers refer to
Sensitivity

RECORD OF BOREHOLE No BH1-22

2 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760893.2, Easting: 316314.3, MTM Zone 11) ORIGINATED BY M.A
DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
DATUM Geodetic DATE 2022.09.12 - 2022.09.12 LATITUDE 42.987756 LONGITUDE -82.358805 CHECKED BY SMM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|------------|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | | WATER CONTENT (%) |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | | |
| | | | | | | | | ○ UNCONFINED | + | FIELD VANE | | | | | | | | |
| | | | | | | | | ● QUICK TRIAXIAL | × | REMOULDED | | | | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | | |
| 9.9 | FILL - SANDY CLAYEY SILT, trace gravel Stiff Brown to grey Moist | | 11 | SS | 11 | | 179 | | | | | | | | | | LL=30% PL=15% PI=15% | |
| 179.3 | | | | | | | | | | | | | | | | | | |
| 10.7 | FILL - GRAVELLY SAND, some silt, trace clay Dense Brown | 12 | SS | 30 | | | | | | | | | | | | | | 22 61 12 5 |
| 178.7 | Moist to wet | | | | | | | | | | | | | | | | | |
| 11.3 | SANDY CLAYEY SILT, trace gravel Stiff Grey Wet | | 13 | SS | 15 | 178 | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |
| | | | 14 | SS | 15 | | | | | | | | | | | | | |
| 177.2 | | | | | | | | | | | | | | | | | | |
| 12.8 | END OF BOREHOLE | | | | | | | | | | | | | | | | | |
| | NOTE: 1. Groundwater at a depth of 11.3 m (Elev. 178.7 m) upon completion of drilling. | | | | | | | | | | | | | | | | | |

+ 3 Numbers refer to
Sensitivity

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Library File: 12566052 MTO LIBRARY.GLB Report: 12566052 BOREHOLE LOG_V01 Date: 23/1/23

RECORD OF BOREHOLE No BH2-22

1 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760863.7, Easting: 316314.3, MTM Zone 11) ORIGINATED BY M.A
DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
DATUM Geodetic DATE 2022.09.08 - 2022.09.08 LATITUDE 42.987490 LONGITUDE -82.358806 CHECKED BY SMM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | | | |
|---------------|-------------|---|---------|------|------------|----------------------------|-----------------|---|----|---|----|----------------|---|---|-------------------|--|--|-------------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | W _P | W | W _L | | | WATER CONTENT (%) | | | | |
| 189.9 | 0.0 | ASPHALT (220 mm) | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | | | |
| 189.7 | 0.2 | CONCRETE (480 mm) | | | | | | | | | | | | | | | | | |
| 189.2 | 0.7 | FILL - SAND and GRAVEL, some fines Compact Brown | | 1A | SS | 19 | 189 | | | | | | | 6 | | | | | 34 49 (17) |
| 188.7 | 1.2 | Moist FILL - SANDY CLAYEY SILT, trace clay Soft to very stiff Brown to grey Moist | | 1B | | | | | | | | | | | 14 | | | | |
| | | | | 2 | SS | 4 | 188 | | | | | | | | | | | | |
| | | | | | VANE | | | | | | | | | | | | | | |
| | | | | 3 | SS | 7 | 187 | | | | | | | | 18 | | | | 1 20 40 39 LL=33% PL=16% PI=17% |
| | | | | | VANE | | | | | | | | | | | | | | |
| | | | | 4 | SS | 9 | 186 | | | | | | | | | | | | LL=27% PL=15% PI=12% |
| | | | | 5 | SS | 12 | 185 | | | | | | | | 13 | | | | |
| | | | | 6 | SS | 12 | 184 | | | | | | | | 12 | | | | LL=24% PL=13% PI=11% |
| | | | | 7 | SS | 10 | 183 | | | | | | | | | | | | |
| | | | 8 | SS | 8 | 182 | | | | | | | | 14 | | | | LL=25% PL=14% PI=11% | |
| | | | | VANE | | | | | | | | | | | | | | | |
| | | | 9 | SS | 12 | 181 | | | | | | | | | | | | | |
| | | | | | | 180 | | | | | | | | | | | | | |

Continued Next Page

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File: \\GHDNET\GHD\CA\WATERLOO\PROJECTS\66212566052\TECH\12 FOUNDATIONS\04\FIELDWORK\06-FIELD NOTES AND LOGS\GINT LOGS\12566052 LOGS.GPJ
Library File: 12566052 MTO LIBRARY.GLB Report: 12566052 BOREHOLE LOG_V01 Date: 23/1/23

RECORD OF BOREHOLE No BH2-22

2 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760863.7, Easting: 316314.3, MTM Zone 11) ORIGINATED BY M.A
DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
DATUM Geodetic DATE 2022.09.08 - 2022.09.08 LATITUDE 42.987490 LONGITUDE -82.358806 CHECKED BY SMM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | | |
|---------------|-------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|--|--|-------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | | | WATER CONTENT (%) | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED | | | | | | | | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | | | | | | | | |
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RECORD OF BOREHOLE No BH3-22

1 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760911.6, Easting: 316369.7, MTM Zone 11) ORIGINATED BY M.A
 DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
 DATUM Geodetic DATE 2022.09.12 - 2022.09.12 LATITUDE 42.987921 LONGITUDE -82.358125 CHECKED BY SMM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|-------------|--|---------|------|------------|----------------------------|-----------------|---|--------------|--|--|---------|----------------|---|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | w _p | w | w _L | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE | | | | | | | |
| | | | | | | | | ● QUICK TRIAXIAL × REMOULDED | | | | | | | |
| | | | | | | 20 40 60 80 100 | | | 20 40 60 | | | | | | |
| 189.9 | 0.0 | ASPHALT (310 mm) | | | | | | | | | | | | | |
| 189.6 | 0.3 | CONCRETE (490 mm) | | | | | | | | | | | | | |
| 189.1 | 0.8 | FILL - SAND and GRAVEL, some fines Dense Brown Moist | 1 | SS | 38 | | 189 | | | | | 5 ○ | | 36 49 | (16) |
| 188.4 | 1.5 | FILL - SANDY CLAYEY SILT, trace gravel, contains trace rootlets at the depth of 1.5 m below ground surface Firm to very stiff Brown to grey Moist | 2 | SS | 6 | | 188 | | | | | | | | |
| | | | | VANE | | | | | | | | | | | |
| | | | 3 | SS | 10 | | 187 | | | | | 13 ○ | | | LL=29% PL=14% PI=15% |
| | | | 4 | SS | 23 | | 186 | | | | | | | | |
| | | | 5 | SS | 9 | | 185 | | | | | 13 ○ | | 2 28 41 29 LL=28% PL=14% PI=14% | |
| | | | 6 | SS | 7 | | 184 | | | | | | | 2 28 44 26 LL=28% PL=13% PI=15% | |
| | | | | VANE | | | | | | | | | | | |
| | | | 7 | SS | 11 | | 183 | | | | | 13 ○ | | | |
| | | | 8 | SS | 8 | | 182 | | | | | | | | |
| | | | 9 | SS | 12 | | 181 | | | | | | | | |
| | | | 10 | SS | 13 | | | | | | | 12 ○ | | | LL=26% PL=13% PI=13% |

Continued Next Page

+ 3 Numbers refer to
Sensitivity

File: \\GHDNET\GHD\CA\WATERLOO\PROJECTS\66212566052\TECH\12 FOUNDATIONS\04-FIELDWORK\06-FIELD NOTES AND LOGS\GINT LOGS\12566052 LOGS.GPJ
 Library File: 12566052 MTO LIBRARY.GLB Report: 12566052 BOREHOLE LOG V01 Date: 23/1/23

METRIC

[illegible]

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| + 3 | Numbers refer to Sensitivity |
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RECORD OF BOREHOLE No BH4-22

1 OF 2

METRIC

G.W.P. NO. 3105-18-00 LOCATION Hwy 402 / Former CNR (Northing: 4760879.4, Easting: 316364.0, MTM Zone 11) ORIGINATED BY M.A
DIST West HWY 402/CNR BOREHOLE TYPE Hollow Stem Auger DRILLING RIG TYPE Track Mounted Drill Rig COMPILED BY N.V
DATUM Geodetic DATE 2022.09.06 - 2022.09.07 LATITUDE 42.987631 LONGITUDE -82.358196 CHECKED BY SMM

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|---|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | 20 | 40 | 60 | 80 | 100 | | |
| 190.1 | | | | | | | | | | | | | | |
| 190.0 | 0.0 ASPHALT (150 mm) | | | | | | 190 | | | | | | | |
| | 0.2 CONCRETE (350 mm) | | | | | | | | | | | | | |
| 189.4 | | | | | | | | | | | | | | |
| | 0.7 FILL - SAND and GRAVEL, some fines Compact Brown Moist | | 1 | SS | 23 | | 189 | | | | | | 11 | 35 50 (15) |
| | | | 2 | SS | 17 | | 188 | | | | | | | |
| 187.8 | | | | | | | | | | | | | | |
| | 2.3 FILL - SANDY CLAYEY SILT, trace gravel Soft to very stiff Brown to grey Moist to wet | | 3 | SS | 4 | | 187 | | | | | | 18 | 6 26 43 25 LL=23% PL=12% PI=11% |
| | | | | VANE | | | | | | | | | | |
| | | | 4 | SS | 8 | | 186 | | | | | | 17 | LL=28% PL=14% PI=14% |
| | | | | VANE | | | | | | | | | | |
| | | | 5 | SS | 11 | | 185 | | | | | | 20 | 3 26 44 28 LL=28% PL=15% PI=13% |
| | | | 6 | SS | 7 | | 184 | | | | | | 15 | |
| | | | | VANE | | | | | | | | | | |
| | | | 7 | SS | 8 | | 183 | | | | | | | |
| | | | | VANE | | | | | | | | | | |
| | | | | | | | 182 | | | | | | | |
| | | | | VANE | | | | | | | | | | |
| | | | 8 | SS | 25 | | 181 | | | | | | 15 | 2 27 (72) |
| 180.2 | | | | | | | | | | | | | | |

Continued Next Page

+ 3 Numbers refer to
Sensitivity

File: \\GHD\NET\GHD\CA\WATERLOO\PROJECTS\66212566052\TECH\12 FOUNDATIONS\04-FIELDWORK\06-FIELD NOTES AND LOGS\GINT LOGS\12566052 LOGS.GPJ
Library File: 12566052 MTO LIBRARY.GLB Report: 12566052 BOREHOLE LOG - V01 Date: 23/1/23

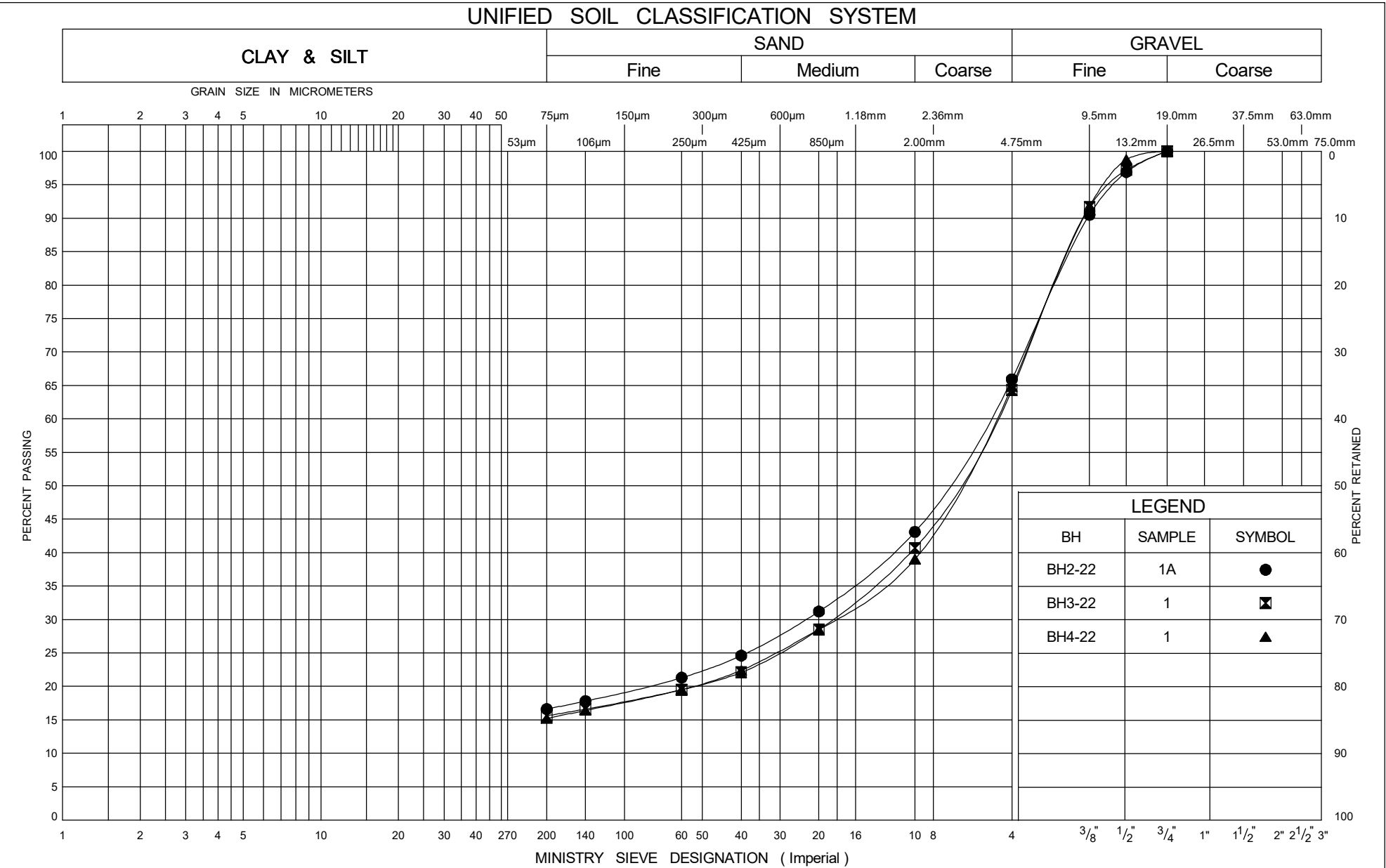
METRIC

| 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 kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | |
|---------------|---|------------|---------|------|------------|-------------------------|-----------------|---|--|---|---|--|-------------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × REMOULDED | | | | | WATER CONTENT (%) |
| 9.9 | FILL - SANDY CLAYEY SILT, trace gravel Stiff to very stiff Brown to grey Moist | | 9 | SS | 12 | | 180 | | | | | | LL=29% PL=13% PI=16% |
| | | | | | | | | | | | | | |
| 178.8 | | 10 | SS | 16 | 179 | | | | | | 21 | | |
| 11.3 | SANDY CLAYEY SILT, trace gravel Stiff Brown to grey Moist | | 11 | SS | 11 | | 178 | | | | | | |
| | | | | | | | | | | | | | |
| 177.3 | | | 12 | SS | 14 | | | | | | | | |
| 12.8 | END OF BOREHOLE NOTE: 1. Borehole open and dry upon completion of drilling. | | | | | | | | | | | | |

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| + 3 | Numbers refer to Sensitivity |
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Appendix D

Geotechnical Laboratory Test

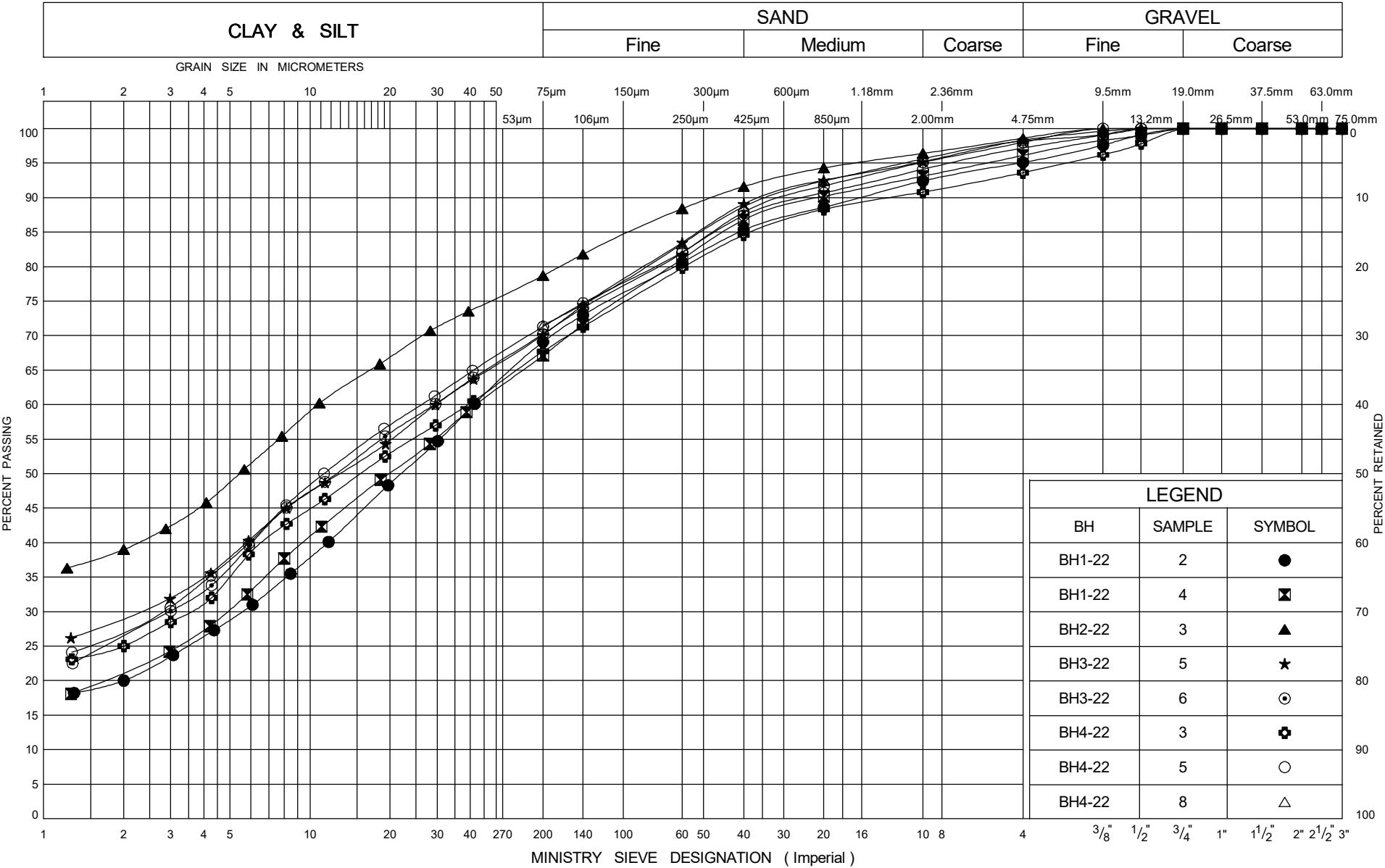


GRAIN SIZE DISTRIBUTION

Granular Fill - Sand and Gravel

| | |
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| Figure: | D-1 |
| Project Name: | Highway 402/CNR |
| G.W.P. No.: | 3105-18-00 |
| GHD Project No.: | 12566052 |

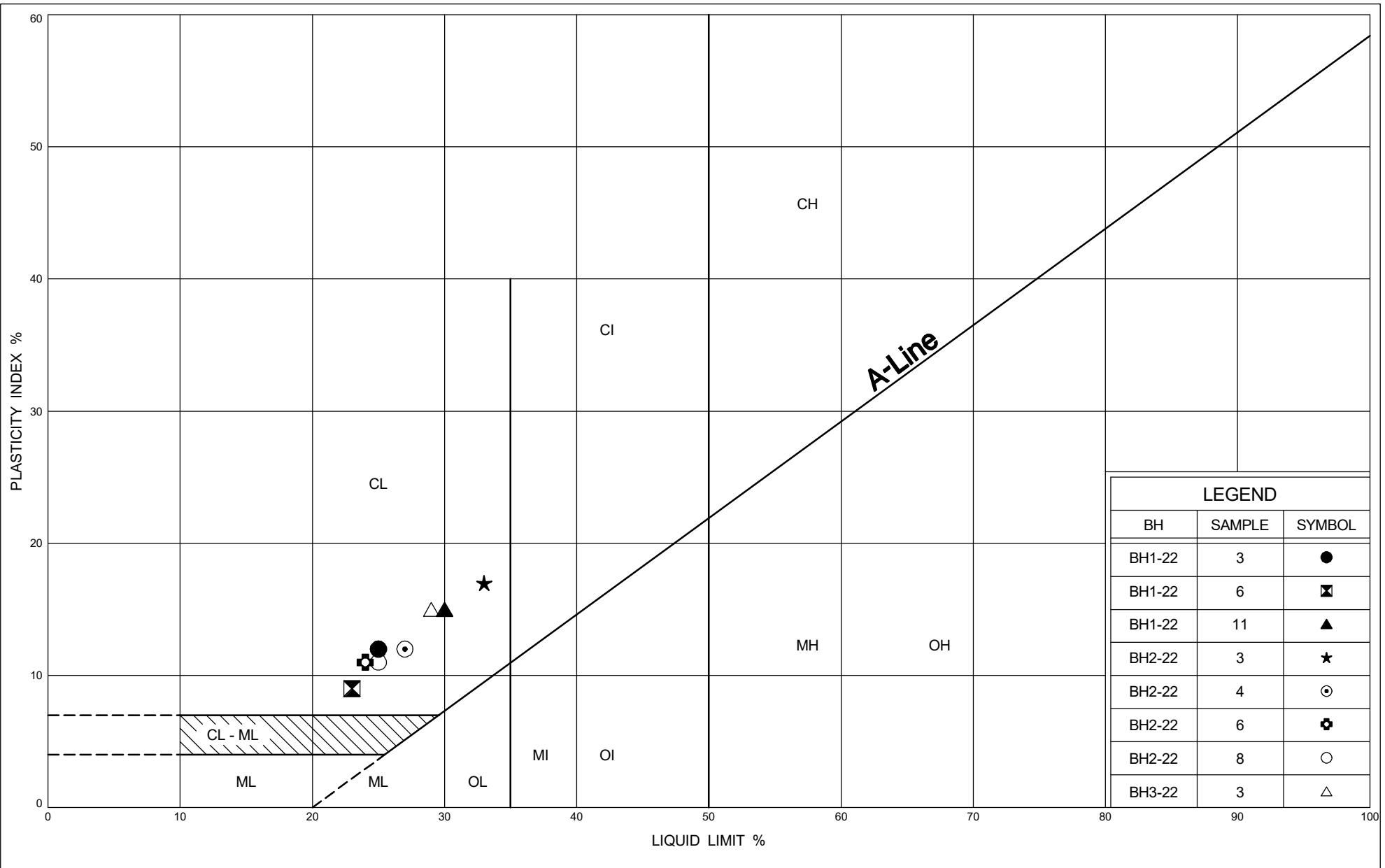
UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

FILL - Sandy Clayey Silt

| | |
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| Figure: | D-2 |
| Project Name: | Highway 402/CNR |
| G.W.P. No.: | 3105-18-00 |
| GHD Project No.: | 12566052 |



Ministry of
Transportation

PLASTICITY CHART

FILL - Sandy Clayey Silt

Figure:

D-3A

Project Name:

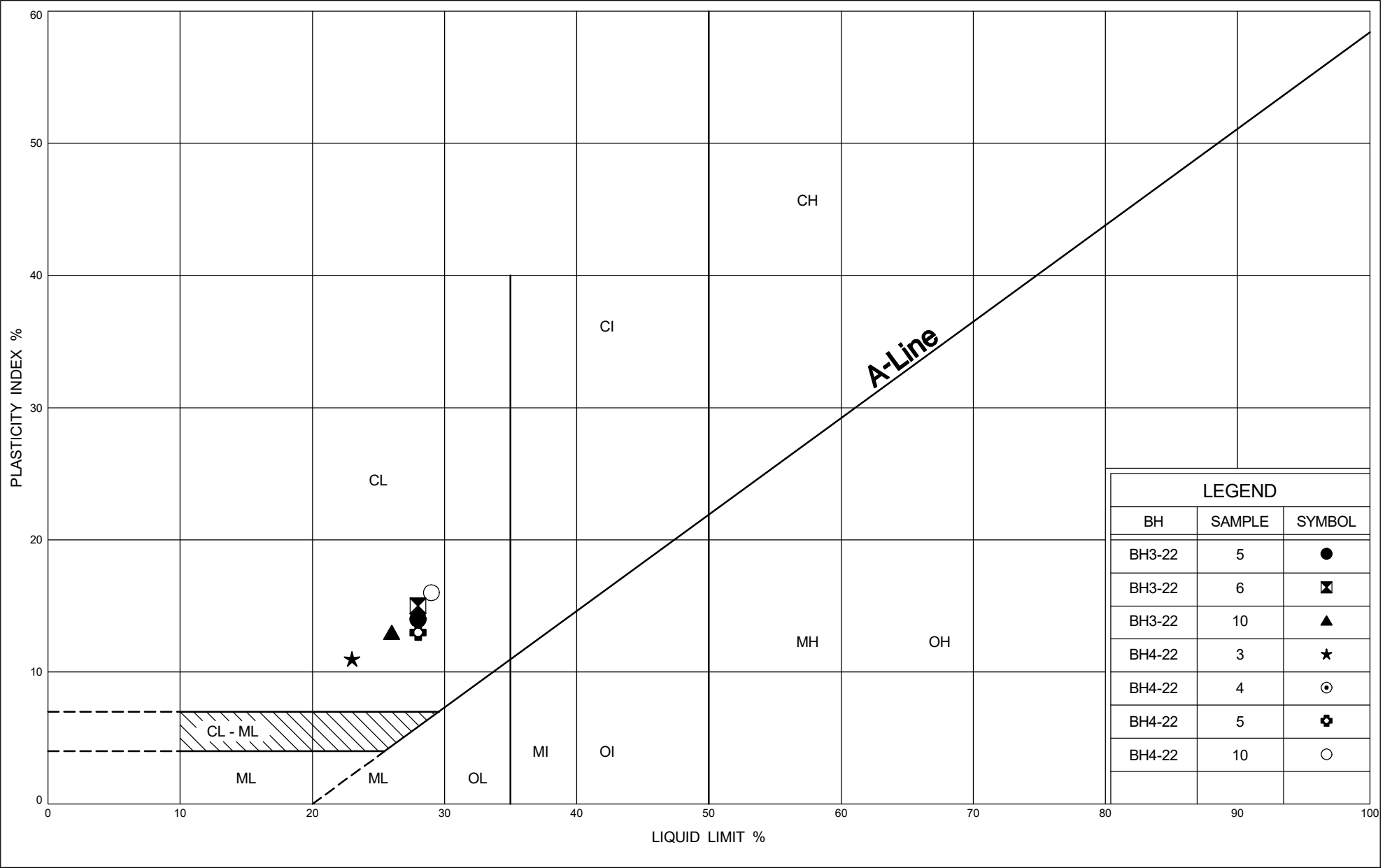
Highway 402/CNR

G.W.P. No.:

3105-18-00

GHD Project No.:

12566052



Ministry of
Transportation

PLASTICITY CHART

FILL - Sandy Clayey Silt

Figure:

D-3B

Project Name:

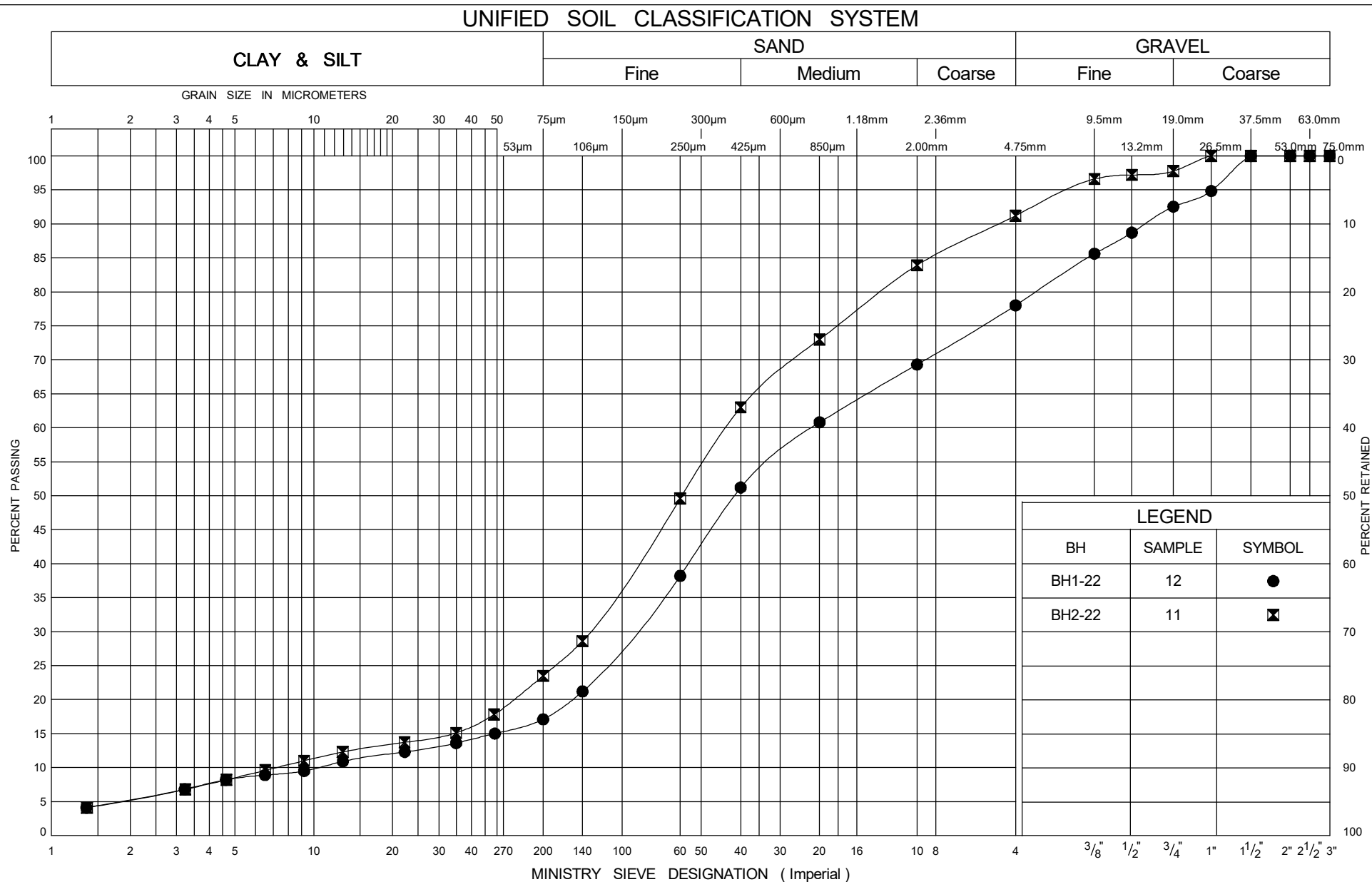
Highway 402/CNR

G.W.P. No.:

3105-18-00

GHD Project No.:

12566052



GRAIN SIZE DISTRIBUTION

FILL - Gravelly Sand to Sand

Figure:

D-4

Project Name:

Highway 402/CNR

G.W.P. No.:

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| 3105-18-00 |
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GHD Project No.:

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