



**Foundation Investigation Report –  
Overhead Signs - Highway 4  
Widening from Clinton Line to  
New Talbotville Bypass and New  
Talbotville Bypass from Highway 4  
to Highway 3 at Ron McNeil Line**

Highway 3 Township of Southwold,  
County of Elgin, ON  
West Region

GWP 3042-22-00

Latitude 42.815854

Longitude -81.239097

Geocres No. 40114-226

Prepared for:

Ministry of Transportation, Ontario  
(MTO), West Region

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Introduction  
April 2025

## FOUNDATION INVESTIGATION REPORT For G.W.P. 3042-22-00 Overhead Signs

Highway 4 widening from Clinton Line to New Talbotville Bypass and New Talbotville Bypass from Highway 4 to Highway 3 at Ron McNeil Line  
West Region, Township of Southwold, County of Elgin, Ontario

## 1.0 INTRODUCTION

Stantec has been retained by the Ministry of Transportation Ontario (MTO) to provide preliminary and detailed design services for the Highway 4 widening from Clinton Line to the new Talbotville Bypass and for the new Talbotville Bypass from Highway 4 to Highway 3 at Ron McNeil Line (GWP 3042-22-00), and for the Highway 3 widening from Ron McNeil Line to Centennial Avenue (GWP 3041-22-00).

As part of the GWP 3042-22-00 new Talbotville Bypass from Highway 4 to Highway 3 at Ron McNeil Line, the following new structures are proposed:

- CNR Talbotville Overhead - Two (2) Single Span Bridges with about 300 m long approach embankment on both sides of bridges,
- Ron McNeil Line Interchange Overpass - Two Span Bridge with approach embankments, and
- Lindsay Creek Culvert (formerly Dodd's Creek Culvert).

As part of the GWP 3041-22-00 Highway 3 Twinning from Ron McNeil Line to Centennial Avenue, the following new structures, including two existing culverts replacement, are proposed:

- Wellington Road Interchange Underpass – New Two Span Bridge with approach embankments
- Kettle Creek WBL Bridge – New Three Span Bridge
- 05X-0266/C0 Underhill Drain Culvert – New Culvert Construction Under the proposed Highway Twinning
- 05X-0268/C0 – Existing CSP Culvert replacement & New Culvert Construction Under the proposed Highway Twinning
- Noise Walls (Station between 13+100 and 11+100, south side of the existing Highway 3 & between Station 12+400 and 13+600 on both sides of Highway 3)
- Deep Cuts (between Stations 13+650 and 15+050, north of the existing Highway 3)

Eighteen (18) Overhead Signs and three (3) Storm Water Management Ponds (SWMPs) were also planned at the early stage of the project. As per the preliminary design, three (3) Storm Water Management Ponds were eliminated, and four (4) structural culverts were added at the Ron McNeil Line interchange area. During the design stage, several sign locations were shifted and two (2) new signs were also added.



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Site Description  
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This Foundation Investigation Report has been prepared specifically and solely for the proposed overhead signs. Other project foundations engineering components are reported under separate cover.

The terms of reference for the foundation investigation work scope were provided in the MTO’s RFP (Request for Proposal) and addenda. The MTO Guideline for Foundation Engineering Services V.3.0 is also considered for the borehole termination depth based on the clarifications provided during the bid phase.

## 2.0 SITE DESCRIPTION

### 2.1 SITE LOCATION

The project consists of widening of Highway 4 from Clinton Line to Talbotville Bypass and new Talbotville bypass from Highway 4 to Highway 3 at Ron McNeil Line in the Town of Southwold, Ontario. As part of the project, seven (7) overhead signs were planned in the preliminary design stage and the overhead sign foundation investigation was carried out for the sign locations determined during preliminary design. Subsequent changes were made through the design process and after completion of the overhead sign foundation investigation. Following consultation with MTO regarding the available information at the locations of new overhead signs, a supplementary investigation was carried out for one of the new signs. The details of the proposed signs and the changes are provided below in Table 2.1.

**Table 2.1: Proposed Overhead Sign Locations**

Proposed Station	Location	Anticipated New Structure Type	Comments
16 + 030	Highway 4 Southbound	RAB – Overhead Sign	New sign
15 + 570		RAB – Overhead Sign	Same as the preliminary design
11 + 197	Talbotville Bypass Eastbound	G105 - Cantilever	Same as the preliminary design
12 +222		G103 – Overhead Sign	Moved approximately 15 m east of the preliminary design location after completion of foundation investigation
13 + 760	Talbotville Bypass Westbound	G105 - Cantilever	Moved approximately 60 m east of the preliminary design location after completion of foundation investigation
13 + 255		G101 & G113 – Overhead Sign	Moved approximately 10 m east of the preliminary design location after completion of foundation investigation
10 +725		RAB – Overhead Sign	New sign
10 + 250		RAB – Overhead Sign	Moved approximately 50 m east of the preliminary design location after completion of foundation investigation

The locations of the signs are shown on Drawing Nos. 1 to 7 in Appendix A.



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Site Description  
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## 2.2 GENERAL SITE DESCRIPTION

At the project site, Highway 4 is an undivided freeway with one lane (and paved shoulders) in each direction. Highway 4 is planned to be widened from Clinton Line to the new Talbotville Bypass. The widened highway will have two lanes in each direction. The orientation of Highway 4 is north-south.

At the project site, Talbotville Bypass is planned to provide access to Highway 3 from Highway 4. Talbotville Bypass will be a divided freeway, with two lanes (with paved shoulders) in each direction, divided by a grass median. The orientation of Talbotville Bypass will be approximately northwest-southeast. The Orientation of Highway 3 is approximately east-west.

Within the project limit, Highway 4 has been constructed almost at grade. The elevation of the travelled surface of the existing highway varies from approximately 241 m at the north limit (Clinton Line) to approximately 238.5 m at the location of Talbotville Bypass to approximately 236.5 m at the south end (approximately 350 m south of Talbotville Bypass).

Within the project limit, Talbotville Bypass will be mostly constructed on an embankment. The elevation of the travelled surface of the bypass will vary from approximately 240 m at the west limit (Highway 4) to approximately 250.5 m at the location of CNR overhead to approximately 238.5 m at Ron McNeil Line. The embankment will be up to approximately 10 m higher than the surrounding ground.

The overall topography surrounding the site is relatively flat to gently rolling/sloping.

The surrounding lands generally consist of open fields and industrial/commercial properties.

## 2.3 GEOLOGICAL INFORMATION

The site is located within the physiographic region of Mount Elgin Ridges, as delineated in the Physiography of Southern Ontario (Chapman and Putnam, 1983). According to the Ontario Department of Mines Preliminary Geological Maps 238 (Pleistocene Geology of The St. Thomas Area, West Half) and P.606 (Pleistocene Geology of The St. Thomas Area, East Half), the site subsurface conditions are generally characterized by lacustrine deposits of silt, silty sand and clay, Port Stanley silty clay to clayey silt till and modern alluvium deposits of gravel, sand, and silt along watercourses. As per the Ontario Geological Survey Map 2441 (Geological Highway Map Southern Ontario), the bedrock within the project area is described as grey limestone of the Dundee Formation. Based on the Ontario Department of Mines Preliminary Geological Map P. 482 (St. Thomas Sheet), the bedrock depths at the proposed CNR overhead site is estimated to be about 85 m below the original ground surface (o.g.).



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Review of Previous Investigations  
April 2025

## 3.0 REVIEW OF PREVIOUS INVESTIGATIONS

A review of MTO GEOCRES database identified the following reports within the project limits:

### GEOCRES Reference No. 40114-070

A foundation investigation report dated September 17, 1971, was available for the proposed crossing at CNR spur overhead and St. Thomas Expressway.

The report was referenced as follows:

Foundation Investigation Report  
For Proposed Crossing at  
CNR Spur Overheads and St. Thomas Expressway  
Twps. Of Southwold; County of Elgin  
W.O. 71-11068 - W.P. 89-69-05 & 06

The investigation included a total of eight (8) sampled boreholes (BH No. 1 to 8), advanced to depths ranging from approximately 10.4 m to 30.2 m below grade (corresponding to approximately elevations 229.8 m to 210.1 m) and eight (8) dynamic cone penetration tests carried out adjacent to each borehole advanced in July 1971.

The boreholes encountered a deep stratum of stiff to hard clayey silt with some sand and trace gravel immediately below the topsoil. Except the top 2 m, the stratum had a moisture content that was at or below the Plastic Limit. The undrained shear strength of the stratum generally decreased with depth, being in excess of 240 kPa at approximate elevation 237.8 m and about 190 kPa at approximate elevation 213.4 m. The deposit appeared to be highly over-consolidated.

Groundwater levels were observed at elevations ranging from approximately 231 m to 218.1 m.

Following shifts in the alignment of the St. Thomas Expressway at the CNR overhead, five (5) additional borings (BH No.11 to 15) were advanced to a depth of approximately 5 m below grade at this site, which reported similar subsoil conditions as those indicated above.

For reference, copies of the Borehole Location Plan, stratigraphical profile, borehole records and laboratory test results are included in Appendix B.

### GEOCRES Reference No. 40114-35

A foundation investigation report dated August 13, 1973, was available for the proposed crossing at St. Thomas Expressway and County Road #52.



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Review of Previous Investigations  
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The report was referenced as follows:

Foundation Investigation Report  
For Proposed Crossing at  
St. Thomas Expressway and County Road #52  
Twps. Of Southwold; Co. of Elgin  
District #2 (London)  
W.O. 73-11021 - W.P. 89-69-07

The investigation included a total of three (3) sampled boreholes (BH No. 1 to 3), advanced to depths of approximately 18.8 m, 15.7 and 24.8 m below grade (corresponding to approximately elevations 218.4 m, 221.4 m and 212.7 m) and six (6) dynamic cone penetration tests advanced in May 1973.

The boreholes encountered a deep stratum of very stiff to hard clayey silt to silty clay with small amounts of sand and trace gravel. Occasional pockets and/or thin seams of silt were also noted, and sand partings were inferred to be present within this deposit. Except within the top 2 m, the stratum had a moisture content that was at or below the Plastic Limit. Based on the N-values obtained, the undrained shear strength of the stratum was inferred to be higher than approximately 100 kPa everywhere and as high as 240 kPa.

The boreholes were dry upon completion. However, it was noted in the report that due to the relatively impermeable nature of the soils encountered and short duration of the fieldwork, groundwater levels at the site could not be established conclusively but were inferred to be well below the elevation of the proposed structure footing at the time (i.e., approximately Elevation 234 m). It was noted that the randomly distributed silt seams and/or sand partings could be water bearing.

For reference, copies of the Borehole Location Plan, stratigraphic profile, borehole records and laboratory test results are included in Appendix B.

GEOCREC Reference No. 40114-033

A foundation investigation report dated September 12, 1973, was available for Culverts No. 1, 4, 5, 6 and 7 for the proposed St. Thomas Expressway. The proposed Culvert No. 1 was planned approximately 1 km west of Wonderland Road and approximately 200 m north of the new Talbotville Bypass. The report was referenced as follows:

Foundation Investigation Report  
For Proposed St. Thomas Expressway  
Culverts No. 1, 4, 5, 6 and 7  
Twp. Of Southwold and Yarmouth  
County of Elgin  
District No. 2 (London)  
W.O. 73-11019- W.P. 89-69-01



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Investigation Procedures  
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The investigation included two (2) boreholes (C1-1 and C1-2) advanced to a depth of approximately 9.6 m below grade (corresponding to approximate elevation 227 m and 227.3 m) in June 1973.

The boreholes encountered a deposit of very stiff to hard clayey silt with some sand and trace gravel. In Borehole C1-1, a 1.8 m thick layer of dense to very dense sand underlain by silt was embedded in the clayey silt deposit.

Groundwater levels were not established in any of the boreholes.

For reference, copies of the Borehole Location Plan, stratigraphy along the culvert, borehole records and laboratory test results are included in Appendix B.

## 4.0 INVESTIGATION PROCEDURES

### 4.1 FIELD INVESTIGATION

The foundation investigation for the overhead signs along Highway 4 and Talbotville Bypass initially consisted of a total of seven (7) boreholes (based on the preliminary design), designated as Boreholes BH No. Sign 1-6 and 8. As referenced in a preceding section, changes were made to the preliminary overhead sign locations during the design stage and following completion of the field work. These changes have been summarized in Table 2.1. In this respect, some of the boreholes have been advanced at a distance from the latest sign locations. In addition, Boreholes DCC-1, DCC-2, DCC-3 (advanced for Lindsay Creek Culvert as part of the same project), Borehole CNR-EMB9 (advanced for the CNR overhead as part of the same project) and Borehole SWMP1-BH1 and BH3 (advanced for stormwater management pond 1 as part of the same project) have been considered to provide subsurface information at the overhead sign locations. Following consultation with MTO, a supplementary foundation investigation, consisting of BH No. Sign 11, was subsequently carried out at the location of one of the new signs where no previous information was available. The locations of these boreholes are shown on Drawing Nos. 1 to 6 in Appendix A.

Prior to carrying out the investigation, Stantec contacted public utility authorities, private locaters and MTO to mark and clear the borehole locations of public, private and MTO-owned utilities.

The boreholes were advanced using CME 55 track-mounted drill rigs equipped for soil sampling between the dates of January 10, 2024 and March 10, 2025. The boreholes were advanced using continuous flight hollow and solid stem augers. Borehole Sign 1 was advanced to a depth of approximately 7.5 m below grade, boreholes Sign 2 to Sign 6, Sign 8 and Sign 11 were advanced to a depth of approximately 8.2 m below grade. Boreholes DCC1 to DCC3 and CNR-EMB9 were advanced to a depth of approximately 15.9 m below grade and boreholes SWMP1-BH1 and SWMP1-BH3 were advanced to a depth of approximately 11.3 m below grade.

The subsurface stratigraphy encountered in each borehole was recorded in the field by an experienced Stantec field technician. Standard Penetration Tests (SPT) were carried out in the drilled holes and split spoon samples were collected at regular intervals (0.75 m interval for the shallow depth / critical zone and



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1.5 m interval to a depth of 15.8 m below ground surface to meet the typical MTO subsurface investigation sampling requirements) in accordance with ASTM D1586. All recovered SPT samples were returned to our Markham laboratory for detailed classification and testing. A pocket penetrometer was also used to estimate the strength/consistency of clayey soil samples at the site.

Groundwater was observed in open boreholes during and upon completion of drilling. Following completion of drilling, a 50 mm diameter groundwater monitoring well, screened over a depth of 4.6 m to 6.1 m below ground surface, was installed in Borehole DCC2. The borehole annulus surrounding the slotted pipe section was backfilled with sand. The remaining annulus was backfilled with bentonite up to the ground surface. Groundwater level measurements in the monitoring well were taken out on March 20 and 27 and May 9, 2024.

After completion of drilling, the boreholes without monitoring wells were backfilled with a mix of bentonite and drill cuttings.

## 4.2 LOCATION AND ELEVATION SURVEY

The borehole locations and respective ground surface elevations were surveyed by Stantec Geomatics personnel using Trimble R10-2 (horizontal accuracy of 8 mm+0.5 ppm and vertical accuracy of 15 mm+0.5 ppm as per the Trimble GNSS datasheet) to meet the survey accuracy requirements (vertical accuracy of 0.1 m and horizontal accuracy of 0.5 m) of the Guideline for MTO Foundation Engineering Services V2.

Table 3.1 below summarizes the borehole survey information and includes the drilling depth, end of borehole elevation and number of samples recovered for each borehole.

**Table 4.1: Borehole Information Summary**

Investigation Borehole	MTM Zone 11 Coordinates		Ground surface elevation (m)	Total depth drilled or advanced (m)	End of borehole elevation (m)	Number of soil samples
	Northing	Easting				
BH No. Sign 1	4742446.0	406350.9	239.5	7.5	232.0	10
BH No. Sign 2	4742410.1	406558.2	238.2	8.2	230.0	11
BH No. Sign 3	4742428.9	406548.3	238.0	8.2	229.8	11
BH No. Sign 4	4742624.9	407525.2	237.8	8.2	229.6	10
BH No. Sign 5	4742179.4	408406.1	240.1	8.2	231.9	11
BH No. Sign 6	4741584.7	409224.5	237.8	8.2	229.3	11
BH No. Sign 8	4741469.5	409663.1	200.9	8.2	192.7	11
BH No. Sign 11	4742887.1	406193.4	241.3	8.2	233.1	11
BH DCC 1	4742624.0	407117.6	237.3	15.9	229.6	15
BH DCC 2	4742608.8	407154.4	237.4	15.9	221.5	15
BH DCC 3	4742591.2	407191.9	237.3	15.9	221.5	14
CNR-EMB 09	4742180.1	408425.8	239.7	15.9	223.9	14
SWMP1-BH1	4742459.3	406444.4	238.7	11.3	227.4	12
SWMP1-BH3	4742511.5	406645.5	238.7	11.3	227.4	12



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Subsurface Conditions

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## 4.3 LABORATORY TESTING

All samples were taken to Stantec’s Markham laboratory where they were subjected to a detailed visual and tactile examination. The geotechnical laboratory testing program completed on the borehole samples is summarized in Table 3.2. Some soil samples from boreholes were tested for pH, soluble sulphate content, chloride content, and resistivity.

**Table 4.2: Laboratory Testing Program**

Laboratory Test Type	Number of Tests
Moisture Content	177
Gradation Analysis	36
Atterberg Limits	36
Chemical Analysis	8

Samples remaining after testing will be placed in storage for a period of one year after issue of the final report. After the storage period, the samples will be discarded unless we are directed otherwise by MTO.

## 5.0 SUBSURFACE CONDITIONS

### 5.1 FRAMEWORK & OVERVIEW

The detailed soil and groundwater conditions encountered in the boreholes and the results of the in-situ and laboratory testing are shown on the Borehole Records included in Appendix C. An explanation of the symbols and terms used to describe the Borehole Records is also provided in Appendix C. The results of the geotechnical laboratory testing are presented on Figures D1 to D3 contained in Appendix D.

A borehole location plan is provided on Drawing Nos.1 to 7 in Appendix A.

The stratigraphic boundaries on the borehole records and the strata plot are inferred from non-continuous sampling and therefore represent transitions between soil types rather than exact boundaries between geological units. The subsurface conditions will vary between and beyond the borehole locations.

### 5.2 OVERBURDEN

#### 5.2.1 Overhead Sign at Station 16+030 (Highway 4 Southbound)

Borehole Sign 11 was advanced for the overhead sign at station 16+030 along Highway 4 southbound.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.1.



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Subsurface Conditions  
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**Table 5.1: Summary of Subsurface Soil Conditions at Borehole No. Sign 11**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 11	FILL: SILTY SAND with Gravel	0	0.4	241.3	240.9	23 (Compact)	N/A	w=17%
	FILL: CLAYEY SILT	0.4	1.5	240.9	239.9	7 (Firm)	-	w=18%
	CLAYEY SILT TILL	1.5	8.2	239.9	233.1	8-28 (Stiff to Very Stiff)	-	w= 11% to 21% W <sub>t</sub> =26% W <sub>p</sub> =12% & 11% PI= 14% & 15%  Laboratory results on Figure Nos. D1 & D2

The laboratory test results are also illustrated on the borehole records in Appendix D.

### 5.2.2 Overhead Signs at Stations 15+570 (Highway 4 Southbound)

Borehole Sign 1 was advanced for the overhead sign at station 15+570 along Highway 4 southbound. Borehole SWMP1-BH1 was advanced approximately 70 m east of this sign.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.2.



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Subsurface Conditions

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**Table 5.2: Summary of Subsurface Soil Conditions at Borehole No. Sign 1 and SWMP1-BH1.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 1	FILL: SILTY SAND with Gravel	0	0.3	239.5	239.2	12 (Compact)	N/A	w=17%
	FILL: CLAYEY SILT	0.3	1.4	239.2	238.1	5 (Firm)	Su <sub>pp</sub> = 150	w=20%
	CLAYEY SILT TILL	1.4	7.5	238.1	232.0	14-22 (Stiff to Very Stiff)	210<Su <sub>pp</sub> <270	w= 14% to 15% W <sub>l</sub> =15% W <sub>p</sub> =28% PI= 13%  Laboratory results on Figure Nos. D1 & D2
SWMP1-BH1	Topsoil	0	0.3	238.7	238.4	N/A	N/A	w=27%
	SILTY CLAY	0.3	1.5	238.4	237.3	6 and 13 (Firm to Stiff)	190<Su <sub>pp</sub> <210	w= 17% & 18% W <sub>l</sub> =36% W <sub>p</sub> =16% PI= 20%  Laboratory results on Figure Nos. D1 & D2
	CLAYEY SILT TILL	1.5	11.3	237.3	227.4	15 – 28 (Stiff to Very Stiff)	190<Su <sub>pp</sub> <240	w= 13% to 16% W <sub>l</sub> =31% W <sub>p</sub> =14% PI= 17%  Laboratory results on Figure Nos. D1 & D2

Notes:

Su<sub>pp</sub> = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

### 5.2.3 Overhead Sign at Station 10+250 (Talbotville Bypass Westbound)

Borehole Nos. Sign 2 & 3 were advanced for the overhead sign at station 10+250 along Talbotville Bypass westbound. Borehole SWMP1-BH3 was advanced approximately 160 m northeast of this sign.

A summary of subsurface conditions encountered in the boreholes and the laboratory test results are provided below in Table 5.3.



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

**Table 5.3: Summary of Subsurface Soil Conditions at BH No. Sign 2&3 and SWMP1-BH3.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of $S_u$ from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 2	Topsoil	0	0.2	238.2	238.0	N/A	N/A	N/A
	CLAYEY SILT TILL	0.2	8.2	238.0	230.0	7-38 (Firm to Hard)	$80 < S_{u_{pp}} < 240$	w=13 % to 17% $W_L = 34\%$ to 41% $W_p = 14\%$ to 17% $PI = 19\%$ to 24%  Laboratory results on Figure Nos. D1 & D2
BH No. Sign 3	Topsoil	0	0.1	238.0	237.9	N/A	N/A	w=37%
	CLAYEY SILT TILL	0.1	8.2	237.9	229.8	7-22 (Firm to Very Stiff)	$110 < S_{u_{pp}} < 240$	w=14% to 16% $W_L = 32\%$ to 36% $W_p = 15\%$ to 16% $PI = 17\%$ to 20%  Laboratory results on Figure Nos. D1 & D2
SWMP-BH3	Topsoil	0	0.1	238.7	238.6	N/A	N/A	w=33%
	SILTY CLAY	0.1	2.2	238.6	237.5	12 to 21 (Stiff to Very Stiff)	$210 < S_{u_{pp}} < 240$	w= 15% $W_L = 37\%$ $W_p = 15\%$ $PI = 22\%$  Laboratory results on Figure Nos. D1 & D2
	CLAYEY SILT TILL	2.2	11.3	237.5	227.4	16 – 30 (Very Stiff to hard)	$190 < S_{u_{pp}} < 240$	w= 13% to 16% $W_L = 33\%$ $W_p = 15\%$ $PI = 18\%$  Laboratory results on Figure Nos. D1 & D2

Notes:

$S_{u_{pp}}$  = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

**5.2.4 Overhead Sign at Station 10+750 (Talbotville Bypass Westbound)**

The overhead sign at station 10+750 along Talbotville Bypass westbound was added to the to the scope during design stage. Boreholes DCC1, DCC2 & DCC3 (advanced for the Lindsay Drain culvert as part of the same project) were advanced approximately 50 m east of this overhead sign location. Given the consistency of subsurface conditions within the project site, these boreholes have been considered for the design of this overhead sign.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.4.

**Table 5.4: Summary of Subsurface Soil Conditions in BH DCC1, DCC2 & DCC3.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
DCC1	Topsoil	0	0.2	237.3	237.1	N/A	N/A	N/A
	FILL: CLAYEY SILT	0.2	0.9	237.1	236.5	8 (Stiff)	N/A	w=25%
	SILTY CLAY	0.9	1.4	236.5	235.9	7 (Firm)	Su <sub>pp</sub> =65	w=22% & 26%
	CLAYEY SILT TILL	1.4	15.9	235.9	221.4	19 to 28 (Very stiff)	210<Su <sub>pp</sub> <240	w=13% to 16% w <sub>L</sub> =28-34% w <sub>p</sub> = 16-19% PI=12-16%  Laboratory results on Figure Nos. D1 & D2
DCC2	Topsoil	0	0.2	237.4	237.2	N/A	N/A	w= 25%
	FILL: CLAYEY SILT	0.2	1.0	237.2	236.4	7 to 9 (Firm)	N/A	w= 16%
	CLAYEY SILT TILL	1.0	15.9	236.4	221.5	13-45 (Very Stiff to Hard)	160<Su <sub>pp</sub> <240	w=6% to 16% w <sub>L</sub> =27-30% w <sub>p</sub> = 16-17% PI=11-13%



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of $S_u$ from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
								Laboratory results on Figure Nos. D1 & D2
DCC 3	Topsoil	0	0.2	237.2	237.0	N/A	N/A	N/A
	CLAY	0.2	1.4	237.0	235.9	4-7 (Firm)	$S_{u_{pp}}=120$	$w=22\% \text{ \& } 28\%$ $W_L= 54\%$ $W_P= 22\%$ $PI= 32\%$  Laboratory results on Figure Nos. D1 & D2
	CLAYEY SILT TILL	1.4	15.9	235.9	221.5	16-84 (Very Stiff to Hard)	$175 < S_{u_{pp}} < 240$	$w=9\% \text{ to } 18\%$ $W_L= 20-34\%$ $W_P= 13-15\%$ $PI = 7-19\%$  Laboratory results on Figure Nos. D1 & D2

Notes:

$S_{u_{pp}}$  = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

### 5.2.5 Overhead Sign at Station 11+197 (Talbotville Bypass Eastbound)

Borehole Sign 4 was advanced for the overhead sign at Station 11+197 along Talbotville Bypass Eastbound.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.5.



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

**Table 5.5: Summary of Subsurface Soil Conditions at BH No. Sign 4.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 4	Topsoil	0	0.1	237.8	238.7	N/A	N/A	N/A
	CLAYEY SILT TILL	0.1	8.2	238.7	229.6	7-20 (Firm to Very Stiff)	110<Su <sub>pp</sub> <190	w=14%-21% W <sub>l</sub> = 32%-36% W <sub>p</sub> = 15%-16% PI = 17%-20%  Laboratory results on Figure Nos. D1 & D2

Notes:

Su<sub>pp</sub> = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

**5.2.6 Overhead Sign at Station 12+222 (Talbotville Bypass Eastbound)**

Borehole No. Sign 5 was advanced for the overhead sign at Station 12+222 along Talbotville Bypass eastbound. Borehole CNR-EMB9 was also advanced approximately 20 m east of this overhead sign.

A summary of subsurface conditions encountered in the boreholes and the laboratory test results are provided below in Table 5.6.

**Table 5.6: Summary of Subsurface Soil Conditions at BH No. Sign 5 & CNR-EMB 09.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 5	Topsoil	0	0.2	240.1	239.9	N/A	N/A	N/A
	CLAYEY SILT TILL	0.2	2.6	239.9	237.5	3-10 (Firm to Stiff)	110<Su <sub>pp</sub> <241	w=16% to 23% W <sub>l</sub> = 32% W <sub>p</sub> = 17% PI = 15%  Laboratory results on Figure Nos. D1 & D2
	Silty Sand	2.6	3.7	237.5	236.4	25 & 35 (Compact to dense)	N/A	w=15%



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
CNR-EMB 09	CLAYEY SILT TILL	3.7	8.2	236.4	231.8	13-20 (Stiff to Very Stiff)	110<Su <sub>pp</sub> <241	Laboratory results on Figure No. D3  w=13% to 17%  Laboratory results on Figure Nos. D1 & D2
	Topsoil	0	0.2	237.9	237.7	N/A	N/A	W-41.9%
	CLAYEY SILT TILL	0.2	14.8	237.7	224.9	14-34 (Stiff to Hard)	190<Su <sub>pp</sub> <241	w=12 to 16% W <sub>l</sub> = 31-32% W <sub>p</sub> = 16% PI = 15-16%  Laboratory results on Figure Nos. D1 & D2
	CLAYEY SILT	14.8	15.9	224.9	223.9	17 (Very Stiff)	N/A	w= 17% W <sub>l</sub> = 28% W <sub>p</sub> = 14% PI = 14%  Laboratory results on Figure Nos. D1 & D2

Notes:

Su<sub>pp</sub> = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

### 5.2.7 Overhead Sign at Station 13+255 (Talbotville Bypass Westbound)

Borehole No. Sign 6 was advanced for the overhead sign at Station 13+255 along Talbotville Bypass westbound. This overhead sign was moved approximately 10 m to the east following completion of the field work.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.7.



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

**Table 5.7: Summary of Subsurface Soil Conditions at BH No. Sign 6.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 6	FILL: SILTY SAND with Gravel	0	0.3	237.5	237.2	N/A	N/A	N/A
	CLAYEY SILT TILL	0.3	8.2	237.2	229.3	11-23 (Stiff to Very Stiff)	160<Su <sub>pp</sub> <241	w=13% to 16% W <sub>i</sub> = 24% & 29% W <sub>p</sub> = 13% & 15% PI= 11% & 14%  Laboratory results on Figure Nos. D1 & D2

Notes:

Su<sub>pp</sub> = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

**5.2.8 Overhead Sign at Station 13+760 (Talbotville Bypass Westbound)**

Borehole No. Sign 8 was advanced for the overhead sign at Station 13+760 along Talbotville Bypass westbound. This overhead sign was moved approximately 60 m to the east following completion of the field work.

A summary of subsurface conditions encountered in the borehole and the laboratory test results are provided below in Table 5.8.

**Table 5.8: Summary of Subsurface Soil Conditions at BH No. Sign 8.**

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
BH No. Sign 8	FILL: SANDY SILT to SILTY SAND	0	0.8	200.9	200.1	5 (Loose)	N/A	w=28%
	CLAYEY SILT TILL	0.8	5.5	200.1	195.4	10 – 22 (Stiff to very stiff)	160<Su <sub>pp</sub> <241	w=15%-18% W <sub>i</sub> =31% W <sub>p</sub> =15% PI = 16%  Laboratory results on Figure Nos. D1 & D2
	SAND with SILT	5.5	6.8	195.4	194.1	11 & 22 (Compact)	N/A	w=18% to 22%



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Subsurface Conditions

April 2025

Borehole	Soil Type	Depth (m)		Elevation (m)		Range of SPT N-values (Compactness/ Consistency)	Range of Su from Field Tests (kPa)	Laboratory Test Results
		From	To	From	To			
								Laboratory results on Figure No. D3
	CLAYEY SILT TILL	6.8	7.5	194.1	193.4	24 (Very stiff)	Su <sub>pp</sub> =190	w=15%
	SILTY SAND	7.5	8.2	193.4	192.7	32 (Dense)	N/A	w=16%

Notes:

Su<sub>pp</sub> = Undrained Shear Strength interpreted from pocket penetrometer tests, supplementary information only

The laboratory test results are also illustrated on the borehole records in Appendix D.

### 5.3 BEDROCK

Bedrock was not encountered to the termination depth of the boreholes.

### 5.4 GROUNDWATER CONDITIONS

The summary of groundwater conditions measured in the boreholes during/upon completion of drilling is provided below in Table 5.9.

**Table 5.9: Summary of Groundwater Conditions in Boreholes Advanced for the Overhead Signs**

Proposed Station	Location	Borehole	Measured Groundwater during/upon Completion of Drilling		Comments
			Depth (m)	Elevation (m)	
16 + 030	Highway 4 Southbound	Sign 11	Dry	Dry	Color change at a depth of 3.8 m
15 + 570		Sign 1	Dry	Dry	Color change at a depth of 4.6 m
		SWMP1-BH1	Dry	Dry	Color change at a depth of 1.5 m
11 + 197	Talbotville Bypass Eastbound	Sign 4	Dry	Dry	Color change at a depth of 2.3 m
12 + 222		Sign 5	7.0	233.1	-
		CNR-EMB9	Dry	Dry	Color change at a depth of 3.0 m
13 + 760	Talbotville Bypass Westbound	Sign 8	5.5	195.4	Color change at a depth of 3.0 m
13 + 255		Sign 6	Dry	Dry	Color change at a depth of 2.3 m
10 + 750		DCC1	Dry	Dry	Color change at a depth of 3.0 m
		DCC2	2.1	235.3	Color change at a depth of 3.0 m
		DCC3	Dry	Dry	Color change at a depth of 2.3 m
10 + 250		Sign 2	Dry	Dry	Color change at a depth of 2.3 m
		Sign 3	Dry	Dry	Color change at a depth of 2.3 m
		SWMP1-BH3	Dry	Dry	Color change at a depth of 2.2 m



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Miscellaneous  
April 2025

Groundwater levels at the site will be subject to fluctuations due to seasonal changes, snowmelt, and precipitation events. The water levels should be expected to be higher during the spring season and during and following periods of heavy precipitation or snow melt.

## 5.5 CHEMICAL ANALYSIS

Eight (8) soil samples were forwarded to AGAT Laboratories to be tested for pH, soluble sulphate content, chloride content, electrical conductivity, resistivity, and redox potential. The test results are provided in Table 5.10 below.

**Table 5.10: Results of Chemical Analysis**

Proposed Station	Location	Borehole	Sample No.	Depth (m)	pH	Chloride (µg/g)	Sulphate (µg/g)	Resistivity (Ohm-cm)
16 + 030	Highway 4 Southbound	Sign 11	SS5	3.3	7.35	1490	40	418
15 + 570		Sign 1	SS2	0.76	8.56	602	49	187
11 + 197	Talbotville Bypass Eastbound	Sign 4	SS2	0.76	8.52	957	68	4830
12 + 222		Sign 5	SS2	0.76	8.09	6	65	4780
13 + 760	Talbotville Bypass Westbound	Sign 8	SS3	1.52	8.29	61	9	4460
13 + 255		Sign 6	SS2	0.76	8.15	380	13	1560
10 + 750		DCC2	SS3	1.52	8.40	17	24	5430
10 + 250		Sign 2	SS3	1.52	8.62	8	14	5810
		Sign 3	SS2	0.76	8.75	21	26	5920

## 6.0 MISCELLANEOUS

The field work was carried out under the supervision of Harpreet Singh, EIT, Alireza Ghadamgahi, EIT, Muhammed Cuned, Geotechnical Technician, Taylor Koson, Field Supervisor, Kirby Lales, EIT and Akshat Shukla, EIT under the direction of Gwangha Roh, P. Eng., Ph.D.

Utility locates were arranged by Stantec staff prior to initiation of drilling.

The drilling equipment was supplied and operated by DBW Drilling based in North York, Ontario, and London Soil, London, Ontario.

The borehole locations and elevations were surveyed by Stantec’s Geomatics division based in London.

Geotechnical laboratory testing was carried out at Stantec’s laboratory in Markham, Ontario.

This report was prepared by Harpreet Singh, EIT and Roshan Rashed, P.Eng., and reviewed by Gwangha Roh, P. Eng., Ph.D., and Raymond Haché, M.Sc., P.Eng., Designated Principal MTO Foundation Contact.



**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS – HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Closure  
April 2025

## 7.0 CLOSURE

A subsurface investigation is a limited sampling of a site. The subsurface conditions described herein are based on information obtained at the specific borehole locations. Should any conditions at the site be encountered which differ from those at the borehole locations, we request that we be notified immediately to assess the additional information.

Respectfully Submitted,

**STANTEC CONSULTING LTD.**

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Geotechnical Engineer-in-Training

Roshan Rashed, P.Eng.  
Geotechnical Engineer



Gwangha Roh, P. Eng., Ph.D.  
Senior Geotechnical Engineer



Raymond Haché, M.Sc., P. Eng.  
MTO Designated Principal Foundation Contact



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**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS - HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

Appendix A

## **APPENDIX A**

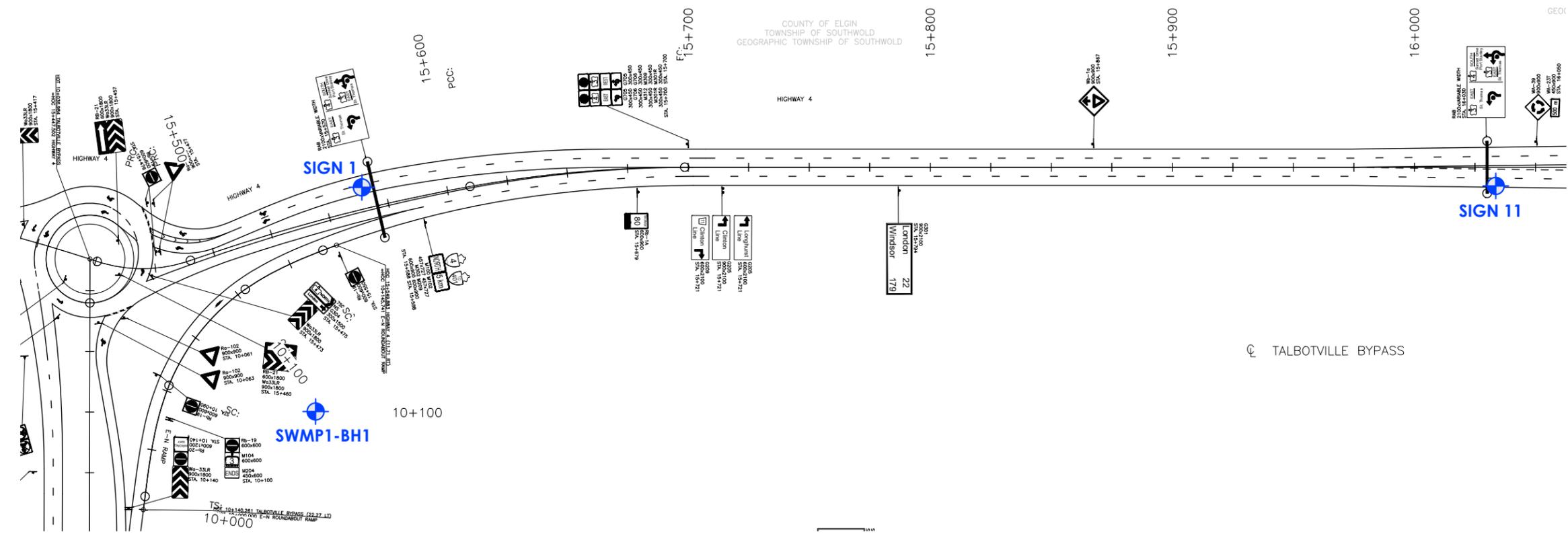
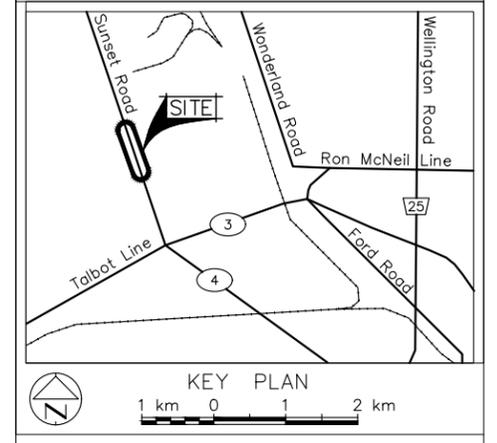
### **A.1 DRAWING NOS. 1 TO 7 – BOREHOLE LOCATION PLAN**





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

PLATE No	CONT 2025-3007 WP 3042-22-00	
SIGNS	STA 10+000 TO STA 10+150	SHEET -
BOREHOLE LOCATIONS PLAN		



LEGEND

Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

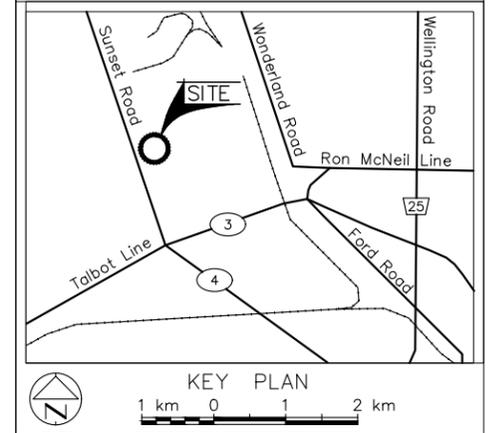
REVISIONS			
DATE	BY		DESCRIPTION
GEOGRES No 40114-226			
HWY No			DIST
SUBM'D RR	CHECKED	DATE 2025-04-01	SITE
DRAWN GBB	CHECKED	APPROVED	DWG 1



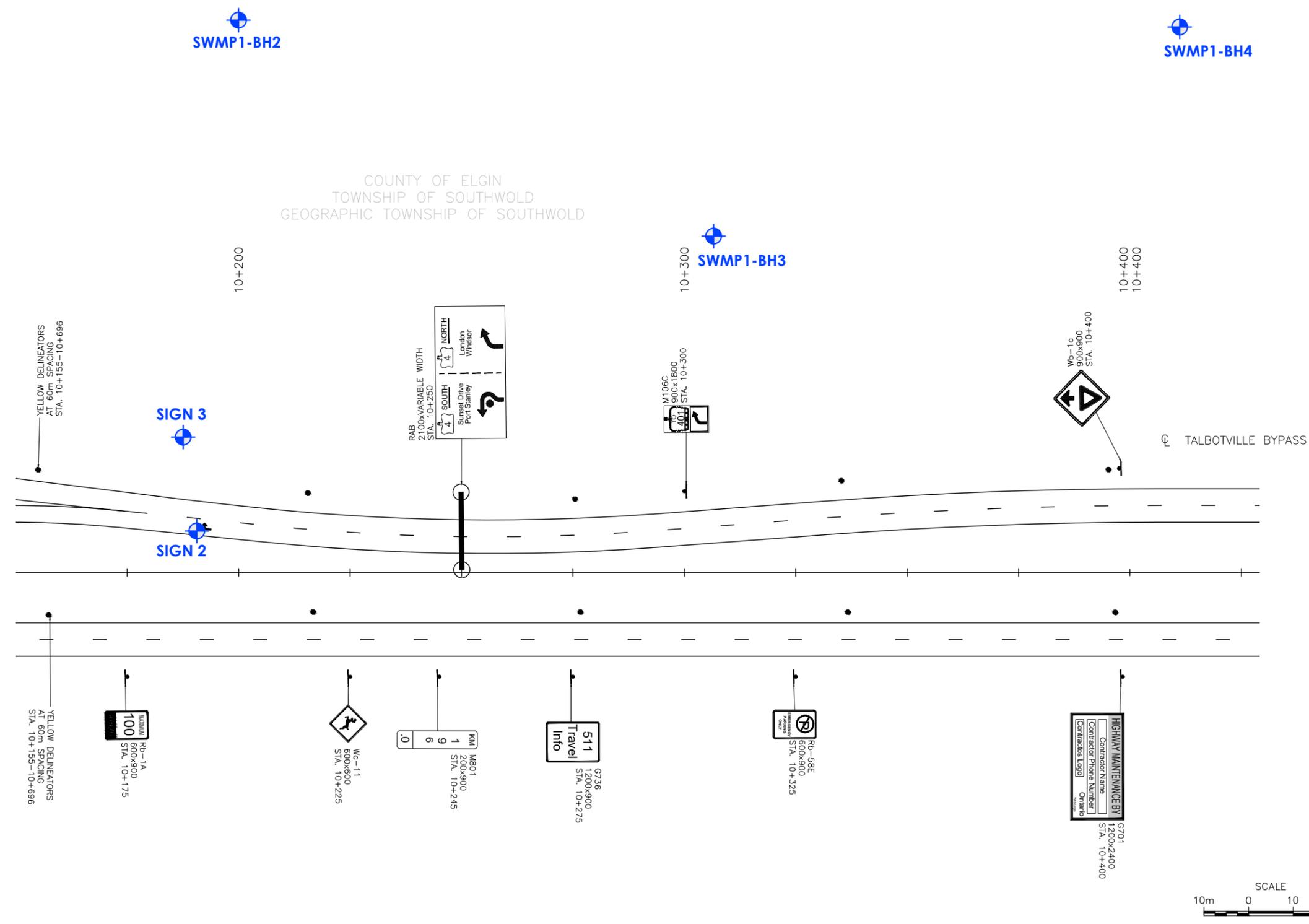


METRIC  
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 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

PLATE No	CONT 2025-3007 WP 3042-22-00	
SIGNS	STA 10+150 TO STA 10+400	SHEET -
BOREHOLE LOCATIONS PLAN		



COUNTY OF ELGIN  
 TOWNSHIP OF SOUTHWOLD  
 GEOGRAPHIC TOWNSHIP OF SOUTHWOLD



LEGEND

Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS			
DATE	BY	DESCRIPTION	
GEOGRES No 40114-226			
HWY No			DIST
SUBM'D RR	CHECKED	DATE 2025-04-01	SITE
DRAWN GBB	CHECKED	APPROVED	DWG 2



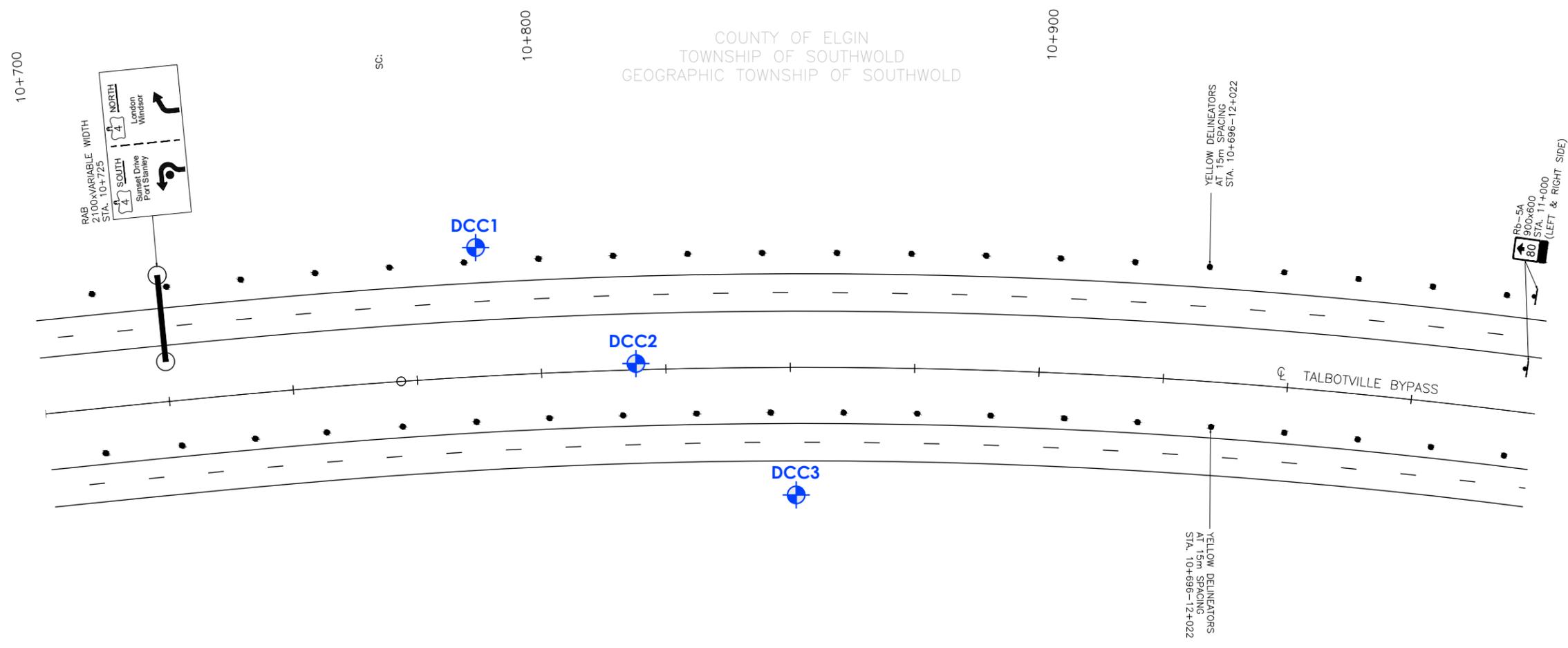
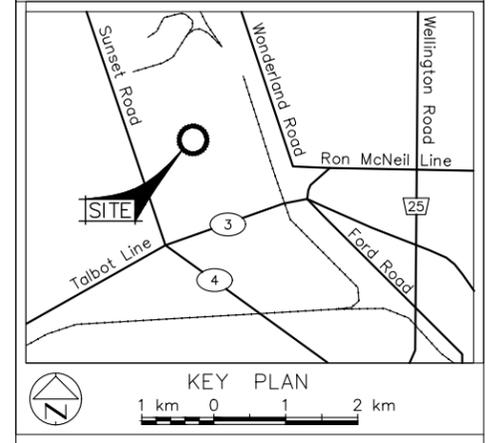


METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

PLATE No  
CONT 2025-3007  
WP 3042-22-00

SIGNS  
STA 10+700 TO 11+000  
BOREHOLE LOCATIONS PLAN

SHEET  
-



LEGEND

- Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

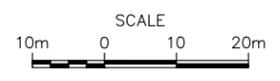
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS	DATE	BY	DESCRIPTION

GEOGRES No 40114-226

HWY No	CHECKED	DATE	SITE
		2025-04-01	

DRAWN	APPROVED	DWG
GBB		3





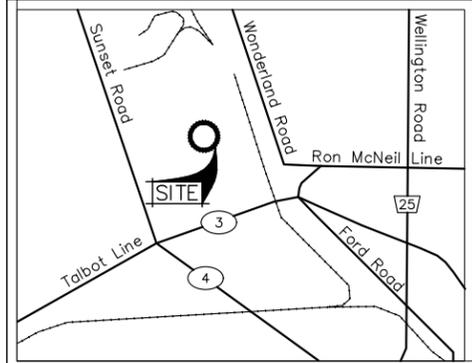
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DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

PLATE No  
CONT 2025-3007  
WP 3042-22-00



SIGNS  
STA 11+000 TO 11+300  
BOREHOLE LOCATIONS PLAN

SHEET  
-



LEGEND

Borehole (Stantec, 2025)

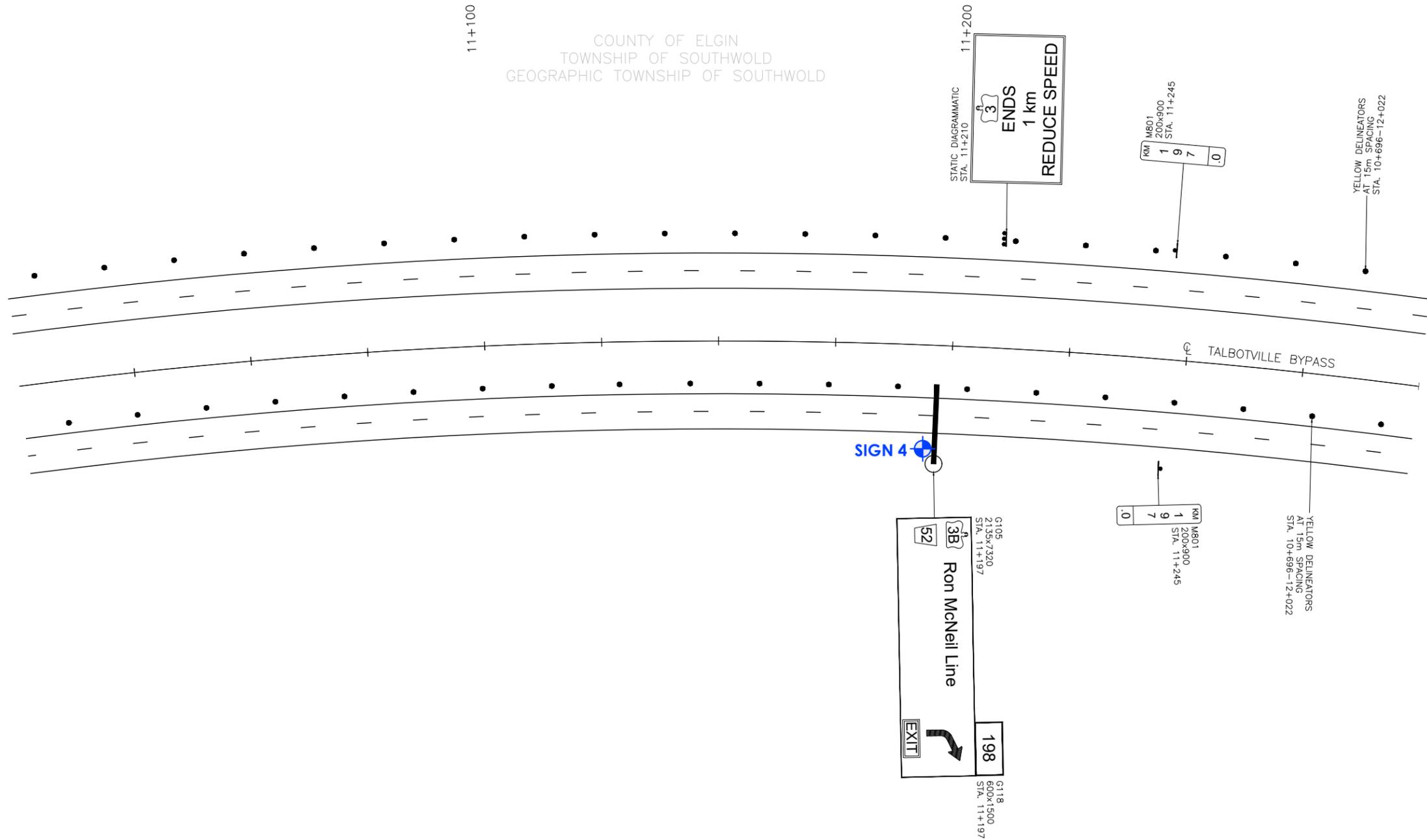
No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

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REVISIONS	DATE	BY	DESCRIPTION

GEOGRES No 40114-226	
HWY No	DIST
SUBM'D RR	CHECKED DATE 2025-04-01 SITE
DRAWN GBB	CHECKED APPROVED DWG 4

COUNTY OF ELGIN  
TOWNSHIP OF SOUTHWOLD  
GEOGRAPHIC TOWNSHIP OF SOUTHWOLD



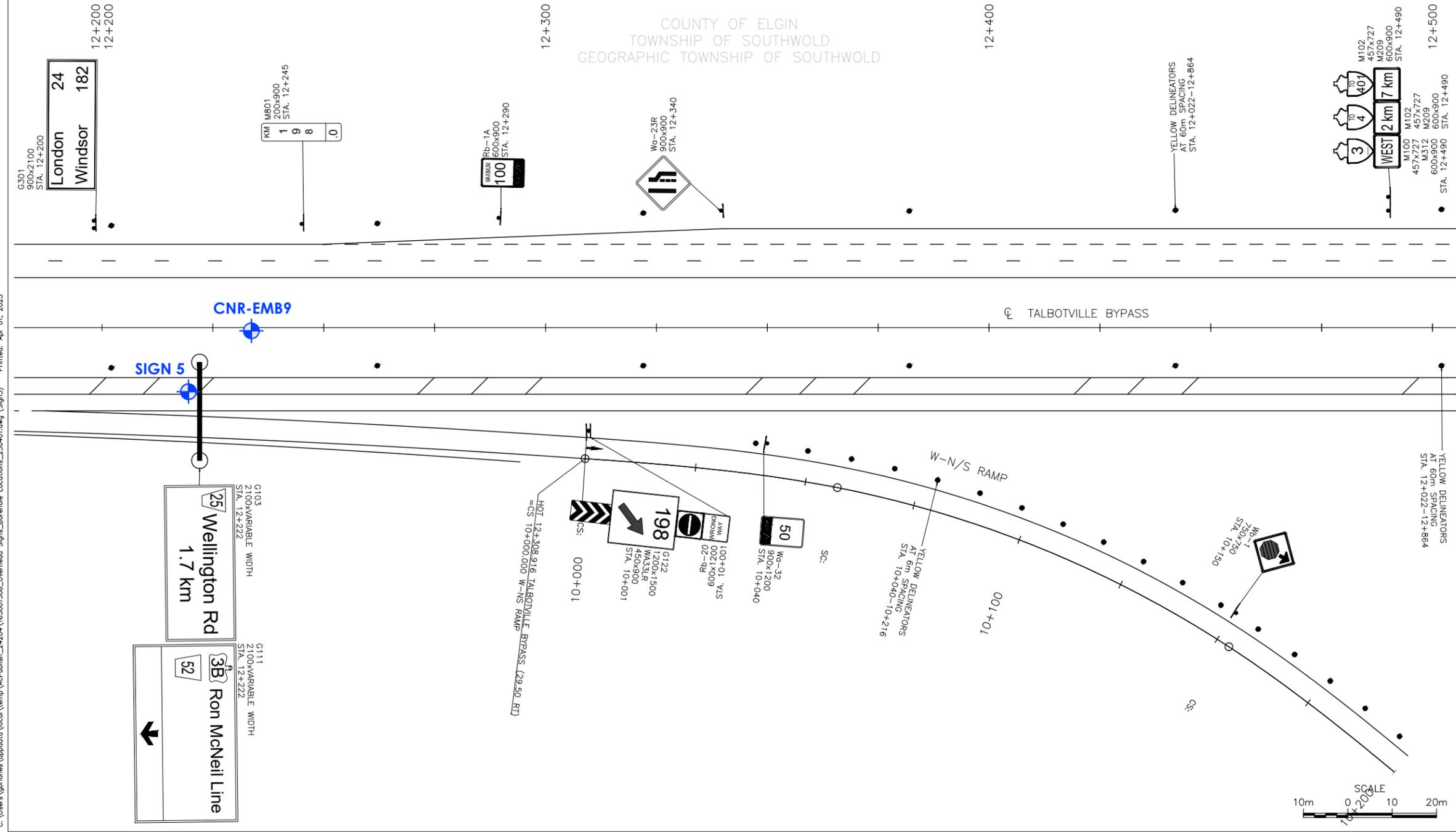
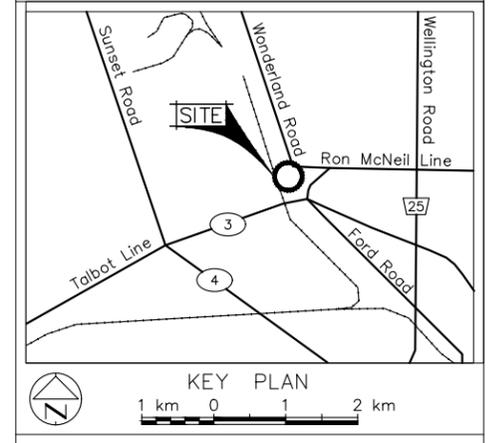


METRIC  
 DIMENSIONS ARE IN METRES  
 AND/OR MILLIMETRES  
 UNLESS OTHERWISE SHOWN

PLATE No  
 CONT 2025-3007  
 WP 3042-22-00

SIGNS  
 STA 12+200 TO 12+500  
 BOREHOLE LOCATIONS PLAN

SHEET  
 -



LEGEND

Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

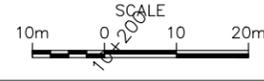
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REVISIONS

DATE	BY	DESCRIPTION

GEOGRES No 40114-226

HWY No	CHECKED	DATE	DIST
SUBM'D RR	CHECKED	2025-04-01	SITE
DRAWN GBB	CHECKED	APPROVED	DWG 5



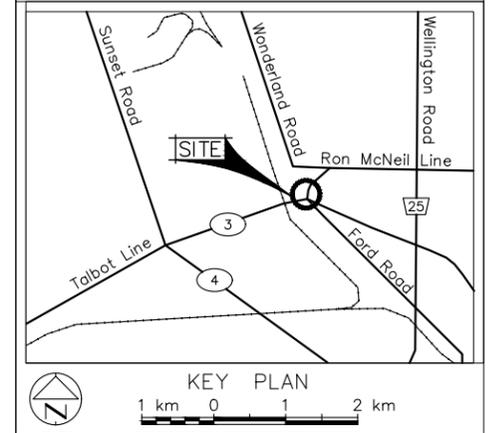


**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

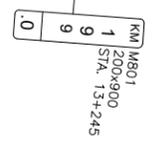
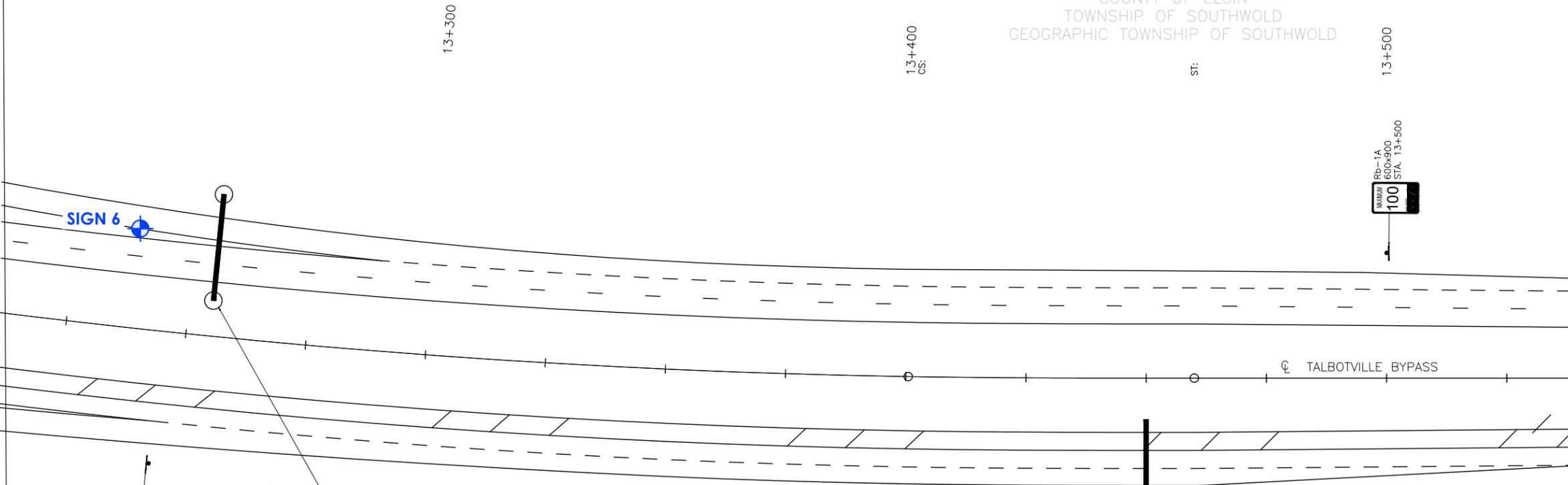
PLATE No  
**CONT 2025-3007**  
**WP 3042-22-00**

SIGNS  
STA 12+225 TO 12+525  
BOREHOLE LOCATIONS PLAN

SHEET  
-



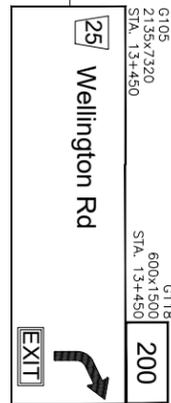
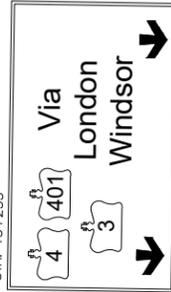
COUNTY OF ELGIN  
TOWNSHIP OF SOUTHWOLD  
GEOGRAPHIC TOWNSHIP OF SOUTHWOLD



G105  
2700xVARIABLE WIDTH  
STA. 13+235



G113  
2700xVARIABLE WIDTH  
STA. 13+255



G105  
2135x7320  
STA. 13+450



W-23R  
300x900  
STA. 13+512



LEGEND

Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

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REVISIONS	DATE	BY	DESCRIPTION

GEORES No 40114-226

HWY No	CHECKED	DATE	DIST
SUBM'D RR	CHECKED	2025-04-01	SITE
DRAWN GBB	CHECKED	APPROVED	DWG 6

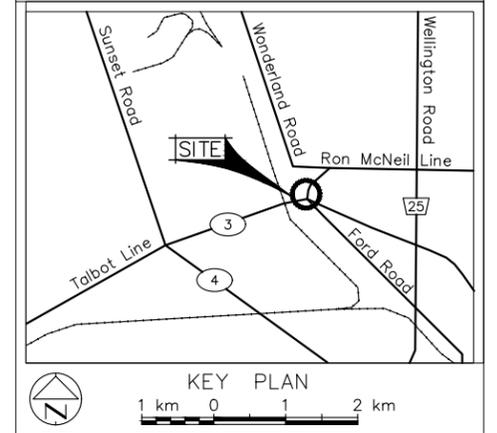


METRIC  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

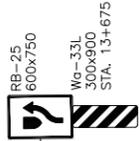
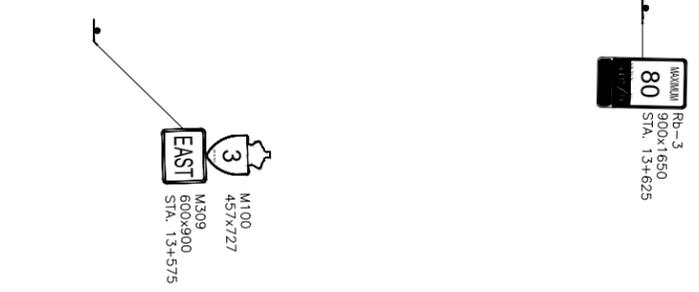
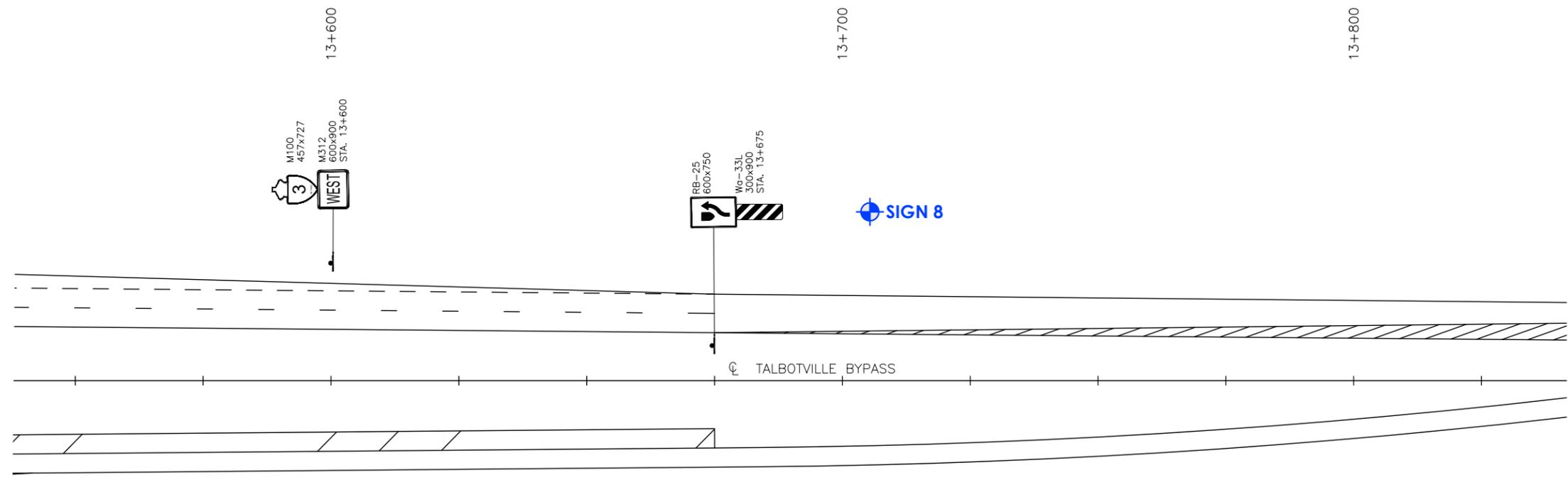
PLATE No  
CONT 2025-3007  
WP 3042-22-00

SIGNS  
STA 12+225 TO 12+525  
BOREHOLE LOCATIONS PLAN

SHEET  
-



COUNTY OF ELGIN  
TOWNSHIP OF SOUTHWOLD  
GEOGRAPHIC TOWNSHIP OF SOUTHWOLD



LEGEND

Borehole (Stantec, 2025)

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
SIGN 1	239.5	4 742 446.0	406 350.9
SIGN 2	238.2	4 742 410.1	406 558.2
SIGN 3	238.0	4 742 428.9	406 548.3
SIGN 4	237.8	4 742 624.9	407 525.2
SIGN 5	240.1	4 742 179.4	408 406.1
SIGN 6	237.5	4 741 584.7	409 224.5
SIGN 8	200.9	4 741 469.5	409 663.1
SIGN 11	241.3	4 742 887.7	406 193.4
DCC1	237.3	4 742 624.0	407 117.6
DCC2	237.4	4 742 609.0	407 154.4
DCC3	237.3	4 742 591.0	407 191.9
CNR-EMB9	239.7	4 742 180.1	408 425.8
SWMP1-BH1	238.7	4 742 459.0	404 444.4
SWMP1-BH2	239.0	4 742 521.0	406 528.9
SWMP1-BH3	238.7	4 742 511.0	406 645.5
SWMP1-BH4	239.9	4 742 590.0	406 728.5

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REVISIONS	DATE	BY	DESCRIPTION

GEOGRES No 40114-226

HWY No	DIST
SUBM'D RR	CHECKED DATE 2025-04-01 SITE
DRAWN GBB	CHECKED APPROVED DWG 7



FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS - HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE

Appendix B

## APPENDIX B

### B.1 AVAILABLE GEOCRETS INFORMATION



DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 40I14-70

DIST. 2 REGION \_\_\_\_\_

W.P. No. 89-69-05

CONT. No. \_\_\_\_\_

W. O. No. \_\_\_\_\_

STR. SITE No. 5-212

HWY. No. 3N

LOCATION PROPOSED CROSSING

AT CNR

NO OF PAGES -



OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

DEPARTMENT OF HIGHWAYS- ONTARIO.  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 557,826 N. 339,591 E. ORIGINATED BY P.P.  
W.P. 89-69-05 & 06 BORING DATE July 22, 1971 COMPILED BY P.P.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger CHECKED BY

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT --- W <sub>L</sub>			BULK DENSITY	REMARKS													
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT --- W <sub>P</sub>	WATER CONTENT --- W			W <sub>0</sub>	W	W <sub>L</sub>	γ	P.C.F.	GR	SA	SI	CL				
788.1	Ground level.																											
0.0	Clayey silt, some sand, trace of gravel.  Very stiff to hard.	1	SS	29																								
		2	TW	PH		780																		134	1	13	49	37
		3	SS	27																								
		4	SS	70/6		770																						
		5	SS	34																								
		6	TW	PH		760																						
		7	SS	34																								
		8	TW	PH		750																						
		9	SS	40																								
		10	TW	PH		740																						
		11	SS	22																								
						730																						
		12	TW	PH																								
						720																						
		13	SS	29																								
					710																							
	14	TW	PH																									
					700																							
	14A	SS	33																									
689.1		15	TW	PH		690																						
99.0	End of borehole.																											

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 557,929 N. 339,505 E. ORIGINATED BY P.P.  
W.P. 89-69-05 & 06 BORING DATE July 23, 1971 COMPILED BY H.S.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight 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 $\gamma$	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	WATER CONTENT % $w_p$ ——— $w$ ——— $w_L$					
787.0	Ground level.															
	Clayey silt, some sand, trace of gravel.  Very stiff to hard.		1	SS	25											
			780	2	TW	PH									134.5	
			770	3	SS	20										
			770	4	TW	PH										138 3 7 53 37
			760	5	SS	41										
			760	6	SS	65/6										
			750	7	TW	PH										140
748.0					8	SS	53									
39.0	End of borehole.															
					740											

DEPARTMENT OF HIGHWAYS - ONTARIO  
 MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 557,920 N. 339,456 E. ORIGINATED BY P.P.  
 W.P. 89-69-05 & 06 BORING DATE July 26, 1971 COMPILED BY H.S.  
 DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger. CHECKED BY

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT --- W <sub>L</sub>			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT --- W <sub>p</sub>	WATER CONTENT --- W			
					SHEAR STRENGTH P.S.F.					WATER CONTENT %			P.C.F. GR SA SI CL			
					○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W <sub>p</sub> --- W --- W <sub>L</sub> 10 20 30						
787.0	Ground level.															
	Clayey silt, some sand, trace of gravel.  Hard.	1	SS	34												
		2	TW	PH												
		3	SS	32												
		4	TW	PH												
		5	SS	9 3/8"												
		6	SS	67												
		7	TW	PH												
		8	SS	65												
		9	SS	67												
740.5	End of borehole.															

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 558,019 N. 339,370 E. ORIGINATED BY P.P.  
W.P. 89-69-05 & 06 BORING DATE July 27, 1971 COMPILED BY H.S.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger. CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT - $w_L$			BULK DENSITY $\gamma$	REMARKS	
			NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	BLOWS / FOOT	PLASTIC LIMIT - $w_p$	WATER CONTENT - $w$			WATER CONTENT %
787.9	Ground level.						20	40	60	80	100						
	Clayey silt, some sand, trace of gravel.  Very stiff to hard.		1	SS	17												
			2	SS	27												
			3	SS	35	780											
			4	SS	27												
			5	SS	25												
			6	SS	25												
			7	SS	27	770											
			8	SS	33												
			9	SS	24	760											
753.9			10	SS	40												
34.0	End of borehole.					750											

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 558,163 N. 339,320 E. ORIGINATED BY P.P.  
W.P. 89-69-05 & 06 BORING DATE July 27, 1971 COMPILED BY H.S.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger CHECKED BY

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT --- w <sub>L</sub> PLASTIC LIMIT --- w <sub>p</sub> WATER CONTENT --- w			BULK DENSITY γ	REMARKS		
			NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w <sub>p</sub>	w	w <sub>L</sub>			P.C.F.	GR.
788.3	Ground level.						2000	4000					10	20	30			
0.0	Clayey silt, some sand, trace of gravel.  Very stiff to hard.		1	SS	16													
			2	TW	PH													
			3	SS	47	780												
			4	TW	PH													
			5	SS	55													
			6	TW	PH	770												
			7	SS	55													
			8	TW	PH	760												
			9	SS	40													
			10	TW	PH	750												
			11	SS	69	740												
			12	TW	PH	730												
			13	SS	34	720												
706.8		End of borehole.		14	SS	50	710											0 9 41 50
81.5						700												

20  
10 5 % STRAIN AT FAILURE  
10

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.6

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 558,074 N. 339,402 E.  
W.P. 89-69-05 & 06 BORING DATE July 26, 1971  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger.

ORIGINATED BY P.P.  
COMPILED BY H.S.  
CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT - $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT					PLASTIC LIMIT - $w_p$					
						20	40	60	80	100	WATER CONTENT - $w$					
						SHEAR STRENGTH P.S.F.					WATER CONTENT %					
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE										
788.4	Ground level.					2000	4000				10	20	30			
0.0	Clayey silt, some sand, trace of gravel.  Very stiff to hard.		1	SS	26											
				2	SS	48										
				3	SS	51	780									
				4	TW	PH										
				5	SS	65									136	1 12 49 38
				6	TW	PH	770									141
				7	SS	55	760									140
				8	TW	PH										
				9	SS	56	750									754.4'
746.9	End of borehole.					740										

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 558,080 N, 339,453 E. ORIGINATED BY P.P.  
W.P. 89-69-05 & 06 BORING DATE July 26, 1971 COMPILED BY H.S.  
DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger. CHECKED BY

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— $w_L$			BULK DENSITY	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE		BLOWS/FOOT	BLOWS / FOOT					PLASTIC LIMIT ——— $w_p$				
						20	40	60	80	100	WATER CONTENT ——— $w$					
						SHEAR STRENGTH P.S.F.					WATER CONTENT %					
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					$w_p$ ——— $w$ ——— $w_L$ 10 20 30					
						2000	4000									
787.8	Ground level.															
0.0			1	SS	12											
	Clayey silt, some sand, trace of gravel.  Stiff to hard.		2	SS	24											
			3	SS	31	780										
			4	SS	31											
			5	SS	31											
			6	SS	29											
			7	SS	35	770										2 14 51 33
			8	SS	28											
			9	SS	34	760										
			10	SS	25											
748.8			11	SS	27	750										752.8
39.0		End of borehole.														
						740										

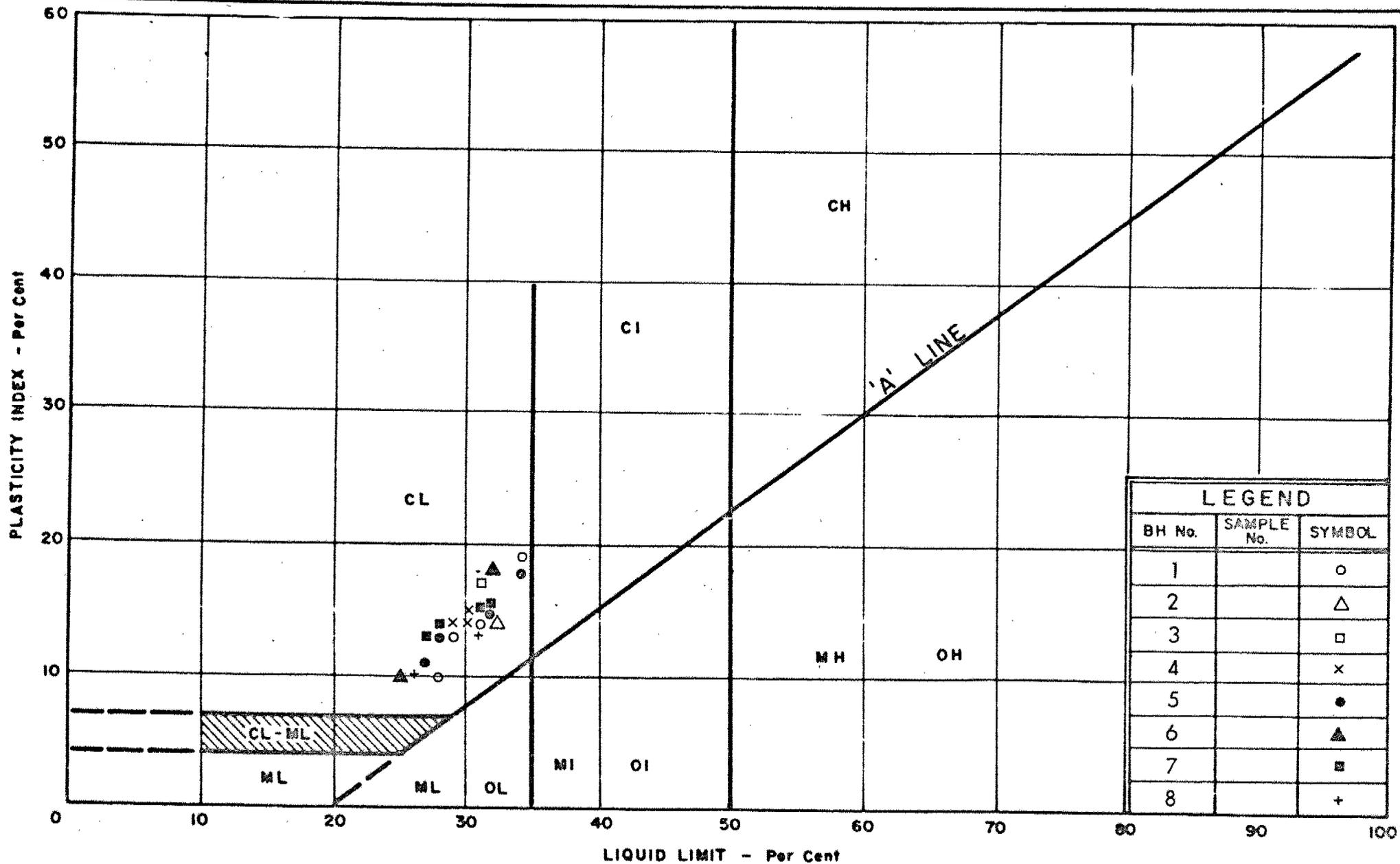
DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 8

FOUNDATION SECTION

JOB 71-11068 LOCATION Co-Ord's 557, 988 N. 339, 33. E. ORIGINATED BY P.P.  
 W.P. 89-69-05 & 06 BORING DATE July 26, 1971 COMPILED BY P.P.  
 DATUM Geodetic BOREHOLE TYPE Continuous Flight Auger. CHECKED BY

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY	REMARKS			
			NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>L</sub>	W <sub>P</sub>	W			P.C.F.	GR.	SA.
788.0	Ground level.																		
0.0	Clayey silt, some sand, trace of gravel.  Stiff to hard.		1	SS	13														
			2	TW	PH	780													
			3	SS	26														
			4	TW	PH	770													
			5	SS	36														
			6	TW	PH	760													
			7	SS	43														
			8	SS	57	750													
			9	SS	50	740													
729.0			10	SS	35	730													
59.0	End of borehole.																		
						720													



DEPARTMENT OF HIGHWAYS  
 MATERIALS and  
 TESTING  
 DIVISION

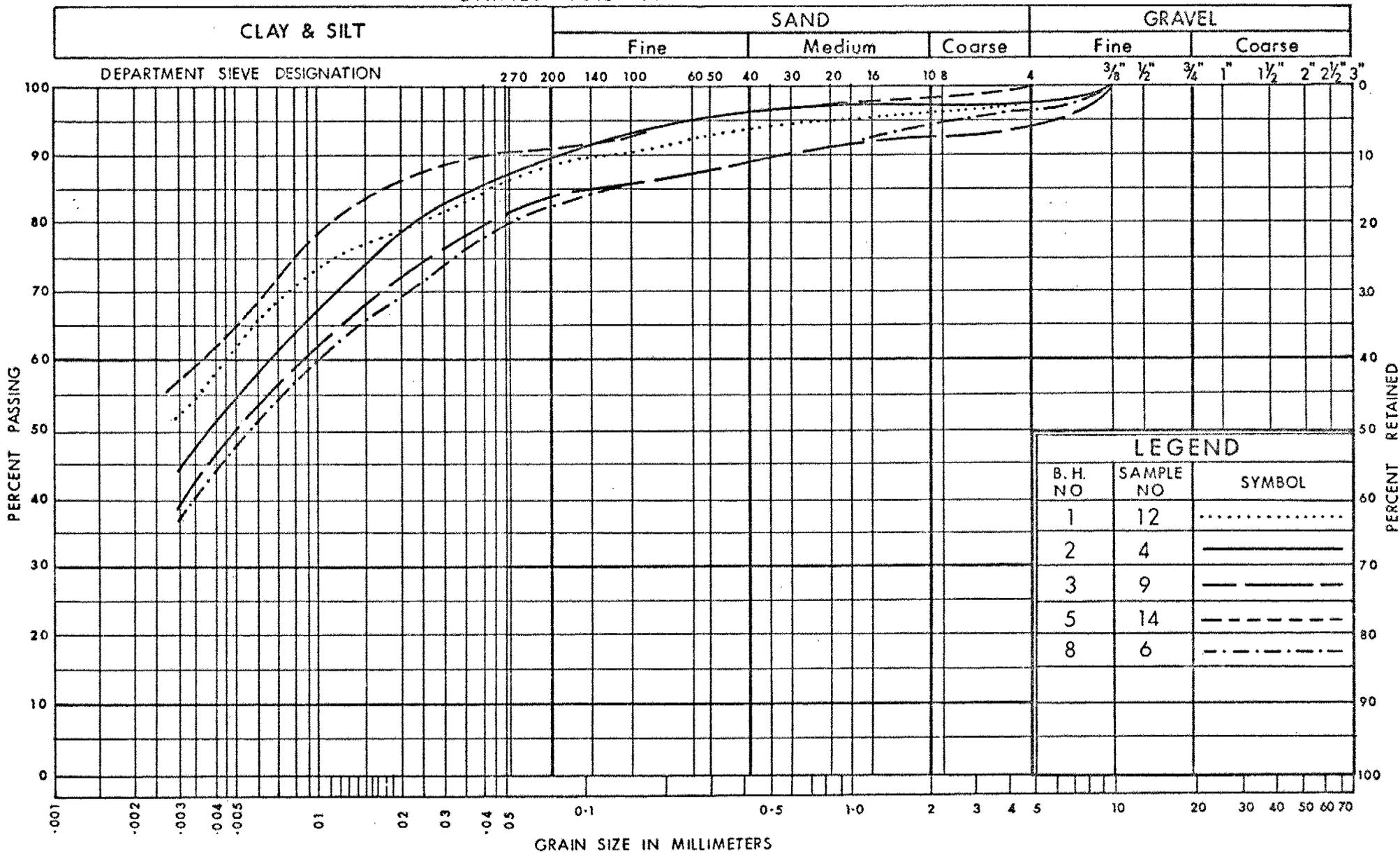
**PLASTICITY CHART**  
 CLAYEY SILT, SOME SAND, TRACE OF GRAVEL

WP No. 89-69-05 & 06

JOB No. 71-11068

FIG No 1

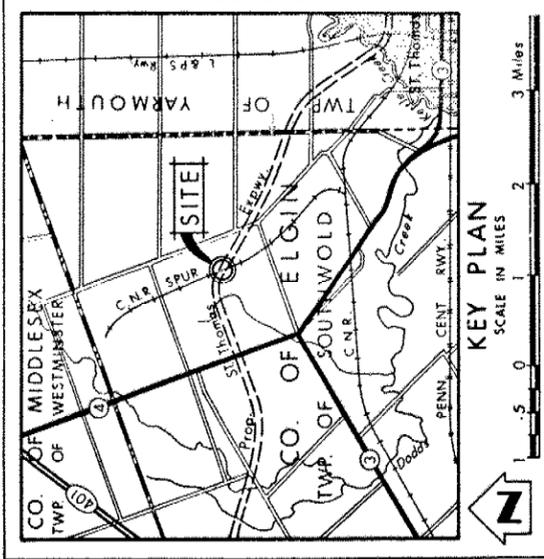
UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS  
DESIGN SERVICES BRANCH

GRAIN SIZE DISTRIBUTION  
CLAYEY SILT, SOME SAND, TRACE OF GRAVEL

W.P. No. 89-69-05 & 06  
JOB No. 71-11068  
FIG. No 2



**LEGEND**

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation, July 1971

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	788.1	557,826	339,591
2	787.0	557,929	339,505
3	787.0	557,920	339,456
4	787.9	558,019	339,370
5	788.3	558,163	339,320
6	788.4	558,074	339,402
7	787.8	558,080	339,453
8	788.0	557,988	339,533

**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.

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

**C. N. R. SPUR LINE**

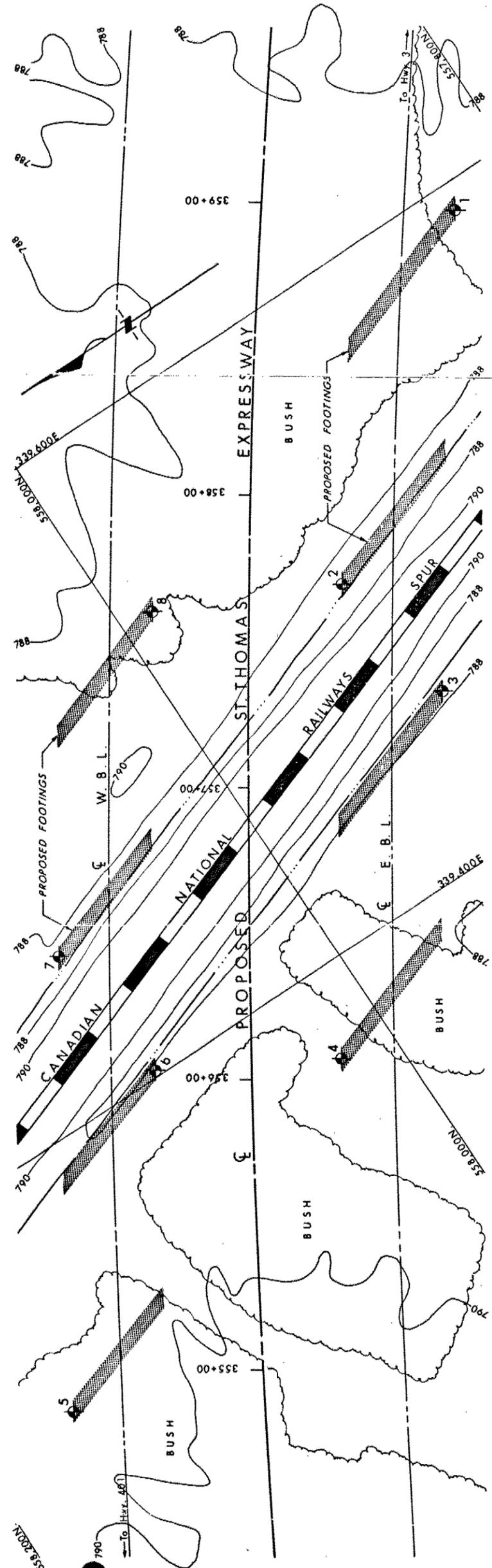
HIGHWAY NO. PROP. ST. THOMAS EXPWY., DIST. NO. 2  
CO. ELGIN

TWP. SOUTHWOLD LOT 42 & 43 CON. E.S.T.R.

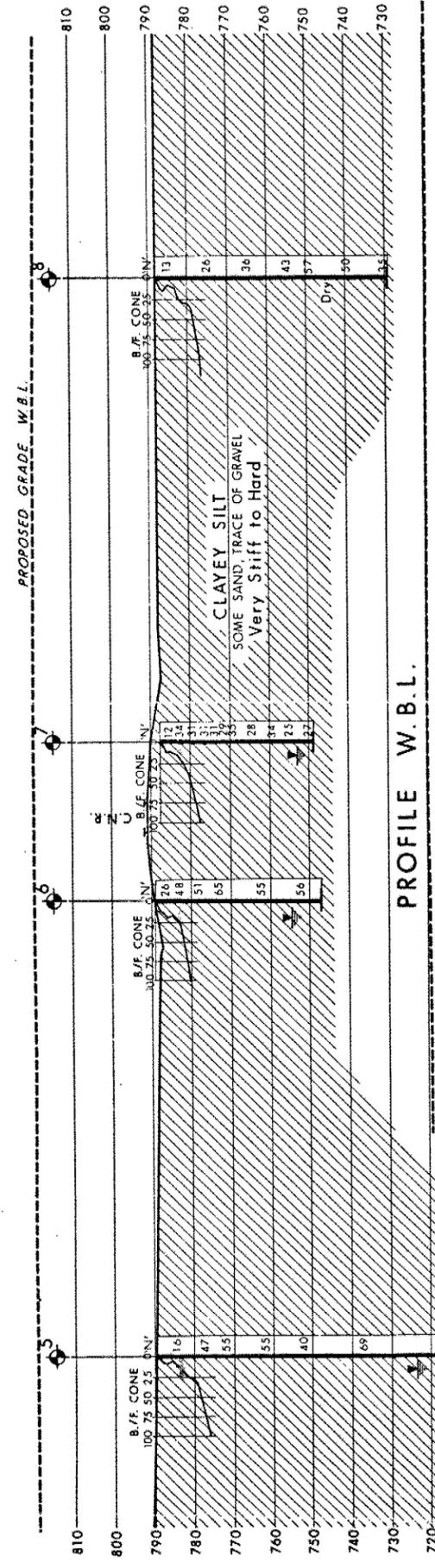
**BORE HOLE LOCATIONS & SOIL STRATA**

SUBNO. P.P. CHECKED ✓ W.P. NO. 89-69-05&06 DRAWING NO. 71-11068A  
DRAWN ✓ CHECKED ✓ JOB NO. 71-11068  
DATE Aug. 31, 1971 SITE NO. BRIDGE DRAWING NO.

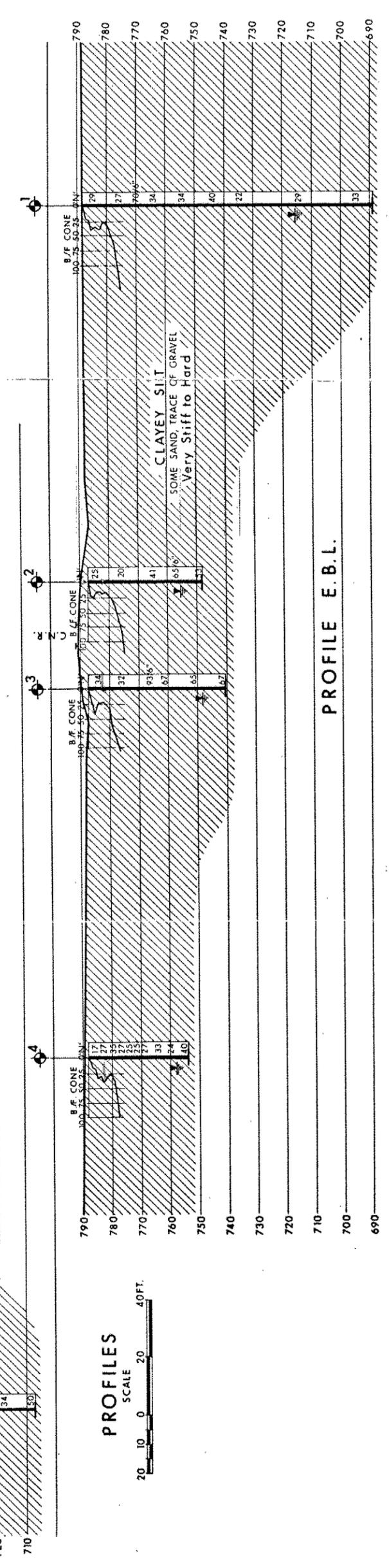
APPROVED: *[Signature]* CONT. NO.  
PRINCIPAL FOUNDATION ENGINEER



**PLAN**  
SCALE 1" = 40 FT.



**PROFILE W.B.L.**



**PROFILES E.B.L.**

**PROFILES**  
SCALE 1" = 40 FT.



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 12

JOB 71-11068  
 W.P. 89-69-05/06  
 DATUM Geodetic

LOCATION Co-ords. 558,098 N; 339,398 E.  
 BORING DATE Nov. 8, 1973  
 BOREHOLE TYPE Cont. Flight Auger

ORIGINATED BY LJH  
 COMPILED BY LJH  
 CHECKED BY [Signature]

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F.		WATER CONTENT %		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		$W_P$ — $W$ — $W_L$			
788.2	Ground Level										
0.0	Clayey silt, some sand traces of gravel.  Very Stiff to Hard	[Hatched]	1	SS	28	780					Hole Dry
			2	SS	54						
			3	SS	33						
771.7			4	SS	45						
16.5	End of Borehole				770						

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 13

FOUNDATIONS OFFICE

JOB 71-11068

LOCATION Co-ords. 558,208 N; 339,405 E.

ORIGINATED BY L.J.H.

W.P. 89-69-05/06

BORING DATE Nov. 7, 1973

COMPILED BY L.J.H.

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY *[Signature]*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	SHEAR STRENGTH P.S.F.		WATER CONTENT %				
						○ UNCONFINED	+ FIELD VANE	$w_p$	$w$	$w_L$			
						● QUICK TRIAXIAL	x LAB VANE						
789.0	Ground Level												
0.0	Clayey silt, some sand, traces of gravel.  Stiff to Hard		1	SS	11	780							
			2	SS	10								
			3	SS	30								
772.5	End of borehole		4	SS	38	770							
16.5													

OFFICE REPORT SOIL EXPLORATION

776.5

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 14

JOB 71-11068

LOCATION Co-ords. 558,263 N; 339,337 E.

ORIGINATED BY LJH

W.P. 89-69-05/06

BORING DATE Nov. 8, 1973

COMPILED BY LJH

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$ $W_P$ — $W$ — $W_L$ WATER CONTENT %	BULK DENSITY $\gamma$ P.C.F. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
789.4	Ground Level								
0.0	Clayey silt, some sand, traces of gravel.  Very Stiff to Hard	[Hatched]	1	SS	9	780			
			2	SS	23				
			3	SS	30				
772.9			4	SS	52				
16.5	End of Borehole					770			Hole Dry

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 15

FOUNDATIONS OFFICE

JOB 71-11068

LOCATION Co-ords. 558,286 N; 339,400 E.

ORIGINATED BY WJH

W.P. 89-69-05/06

BORING DATE November 7, 1973

COMPILED BY L.J.H.

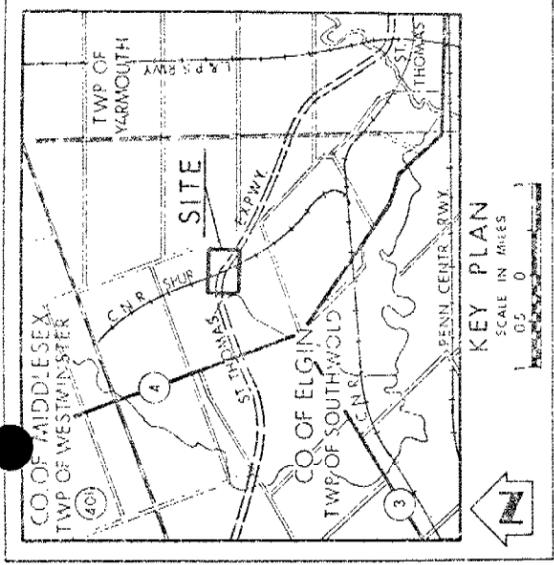
DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — W <sub>L</sub>			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT — W <sub>p</sub>				
						20	40	60	80	100	WATER CONTENT — W					
						SHEAR STRENGTH P.S.F.					W <sub>p</sub> — W — W <sub>L</sub>					
						○ UNCONFINED + FIELD VANE					WATER CONTENT %			γ		
						● QUICK TRIAXIAL × LAB VANE								P.C.F.	GR.SA.SI.CL.	
789.3	Ground Level															
0.0	Clayey silt, some sand, traces of gravel.  Very Stiff to Hard	[Hatched]	1	SS	16											
			2	SS	45											
			3	SS	24											
			4	SS	27											
772.8			5	SS	54										Hole Dry	
16.5	End of Borehole															

OFFICE REPORT SOIL EXPLORATION



**LEGEND**

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation July 1973

NO.	ELEVATION	CO. COORDINATES	
		NORTH	EAST
2	787.0	557,929	339,505
2	787.0	557,920	339,456
5	788.3	558,163	339,320
7	787.8	558,080	339,453
11	787.5	558,021	339,473
12	788.2	558,078	339,398
13	789.0	558,208	339,405
14	789.4	558,263	339,337
15	789.3	558,286	339,400

**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

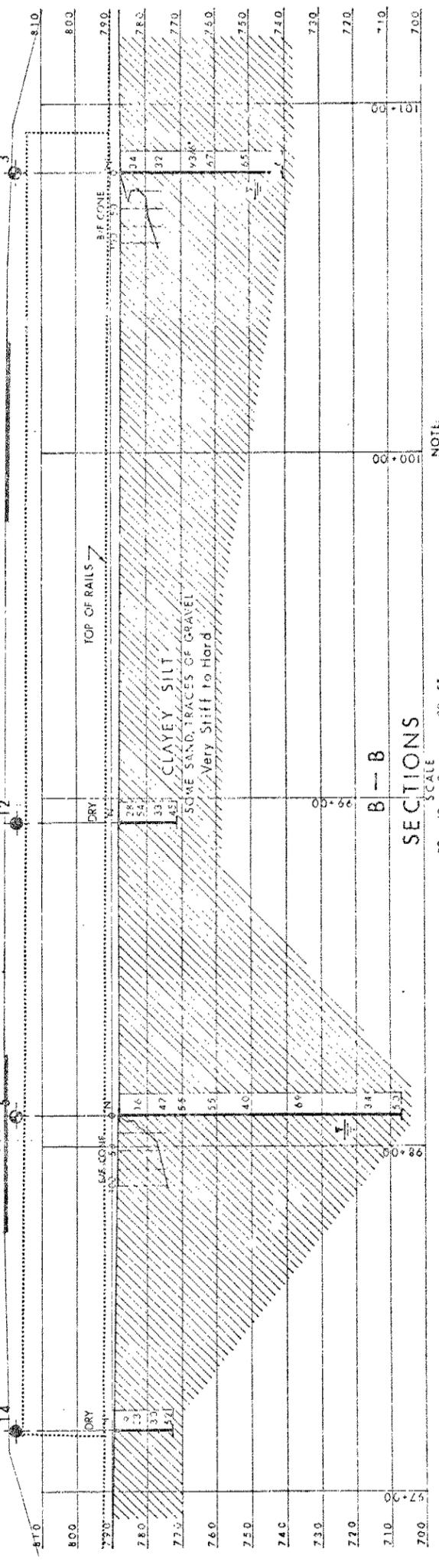
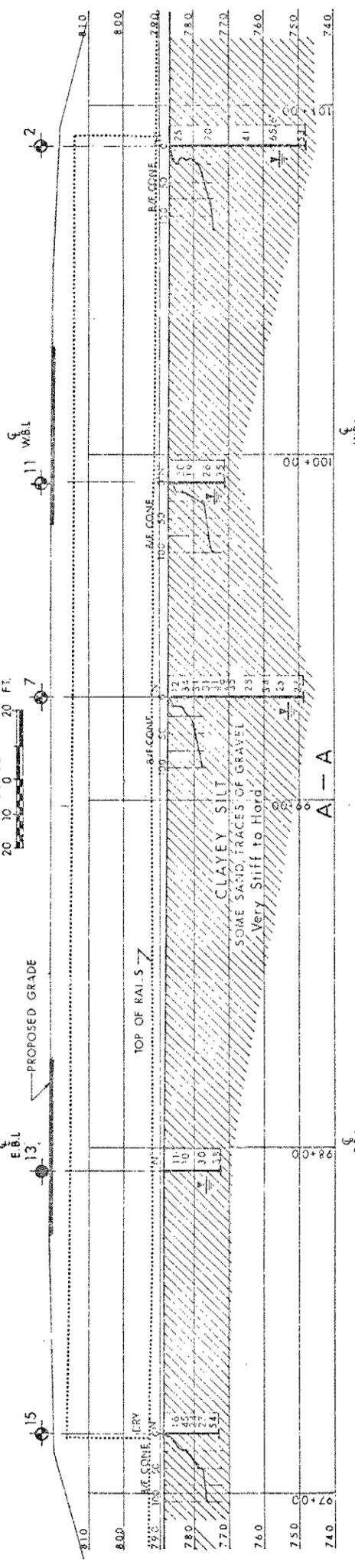
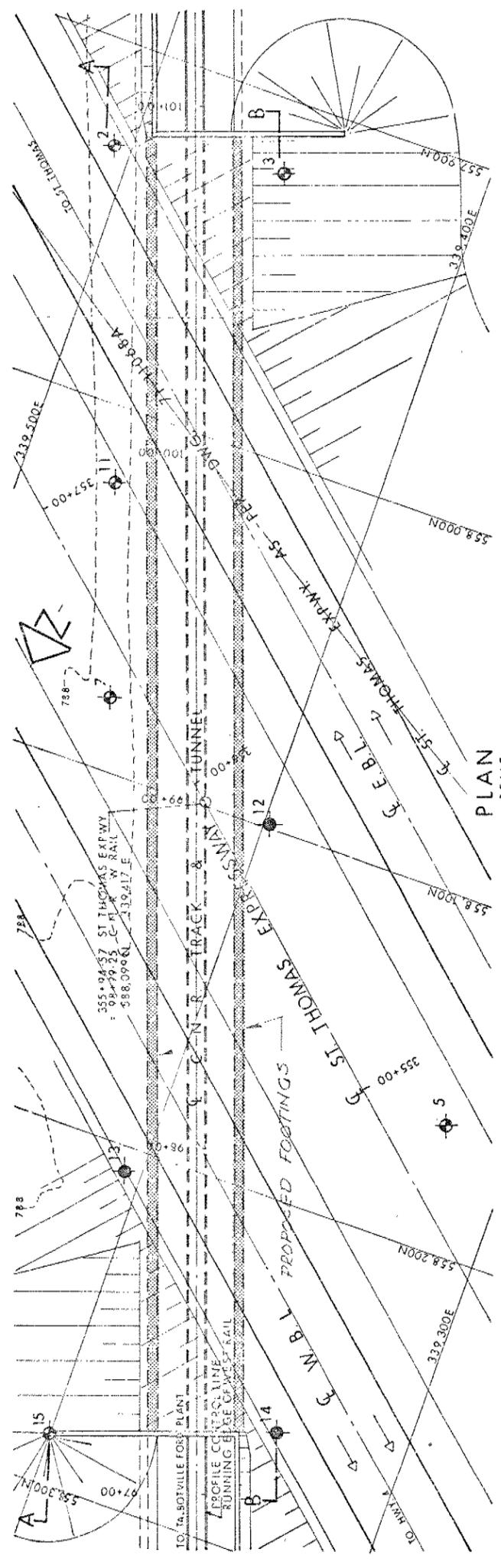
**REVISIONS**

NO.	DATE	DESCRIPTION
1		
2		

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

**C.N.R. SPUR LINE OVERPASS**  
HIGHWAY NO. PROP. ST. THOMAS EXPWY DIST. NO. 2  
CO. ELGIN  
TWP. SOUTHWOLD LOT 42 & 43 CON. E.S. 1 R.  
**BORE HOLE LOCATIONS & SOIL STRATA**

SUBV. PLAN: 89-100-0515  
DRAWING: C.N.R. NO. 71-11068  
DATE: 7/20/73  
SCALE: AS SHOWN



**NOTE:**  
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the District Office.

REF. NO. FENCO 3802-97-109

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

40I-183

TO: Mr. A. P. Watt, (2)  
Regional Structural Planning Eng.,  
Southwestern Region,  
London, Ontario.

FROM: Foundations Office,  
Design Services Branch,  
West Bldg., Downsview.

ATTENTION: DATE: August 13, 1973.

OUR FILE REF. IN REPLY TO **AUG 28 1973**

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Crossing at St. Thomas  
Expressway and County Road #52  
Twp. of Southwold, Co. of Elgin  
District #2 (London)  
W.O. 73-11021 -- W.P. 89-69-07

40I14-35  
GEOCREs No.

Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

*A. G. Stermac*

A. G. Stermac,  
PRINCIPAL FOUNDATIONS ENGINEER.

- AGS/ao  
Attch.  
c.c. E. J. Orr  
B. R. Davis  
A. Rutka  
A. Wittenberg  
L. E. Walker  
B. J. Giroux  
J. R. Roy  
G. A. Wrong  
B. A. Singh

Foundations Files ✓  
Documents



DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 73-11021

LOCATION Co-ords. 15,556,715 N; 1,340,955 E.

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 18, 1973

COMPILED BY L.J.H.

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone

CHECKED BY M.S.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ $w$ $w_L$	BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
777.8	Ground Level									
			1	SS	31					
			2	SS	26					3 10 54 33
			3	SS	27					
			4	SS	25					
			5	SS	26					
			6	SS	25					
			7	SS	36					
			8	SS	37					0 9 55 36
			9	SS	36					
726.3			10	SS	45					Hole Dry
51.5	End of Borehole									

Brown  
Grey

Clayey silt to silty clay, some sand, traces of gravel.  
Occasional thin seams or pockets of silt.

Very Stiff to Hard

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 73-11021  
 W.P. 89-69-07  
 DATUM GEODETIC

LOCATION Co-ords. 15,556,767 N; 1,341,045 E  
 BORING DATE May 22, 1973  
 BOREHOLE TYPE HOLLOW STEM AUGER AND CONE

ORIGINATED BY L.J.H.  
 COMPILED BY L.J.H.  
 CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$W_P$			$W$
779.3	GROUND LEVEL														
0.0	Brown Grey  Clayey silt to silty clay, some sand, traces of gravel  occasional thin seams or pockets of silt.  Very Stiff to Hard		1	SS	45									2 31 53 32	
				2	SS	48									
				3	SS	31									1 18 47 34
				4	SS	25									
				5	SS	15									
				6	SS	26									
				7	SS	43									
				8	SS	26									
				9	SS	26									3 9 56 32
				10	SS	19									
				11	SS	18									
				12	SS	27									
697.8				13	SS	26									
697.8			14	SS	30									HOLE DRY. 3 32 40 25	
81.5	END OF BOREHOLE														

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 73-11021

LOCATION Co-ords. 15,556,642N; 1,340,891E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 22, 1973

COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

CHECKED BY *AMS*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					PLASTIC LIMIT — $w_p$				
							20	40	60	80	100	WATER CONTENT — $w$				
							SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					$w_p$ — $w$ — $w_L$			$\gamma$	
												P.C.F.			GR. SA. SI. CL.	
777.3	GROUND LEVEL															
0.0																
764.0																
13.0	END OF CONE TEST															

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 73-11021

LOCATION Co-ords. 15556694.38N; 1340978.19E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 22, 1973

COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

CHECKED BY 17

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT $W_L$ PLASTIC LIMIT $W_P$ WATER CONTENT $W$		BULK DENSITY $\gamma$	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	$W_P$		
778.2	GROUND LEVEL													
0.0														
763.3														
14.9	END OF CONE TEST													

20  
15  $\phi$  5 % STRAIN AT FAILURE  
10

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 6

JOB 73-11021

LOCATION Co-ords. 15556788.65N; 1341022.06E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 18, 1973

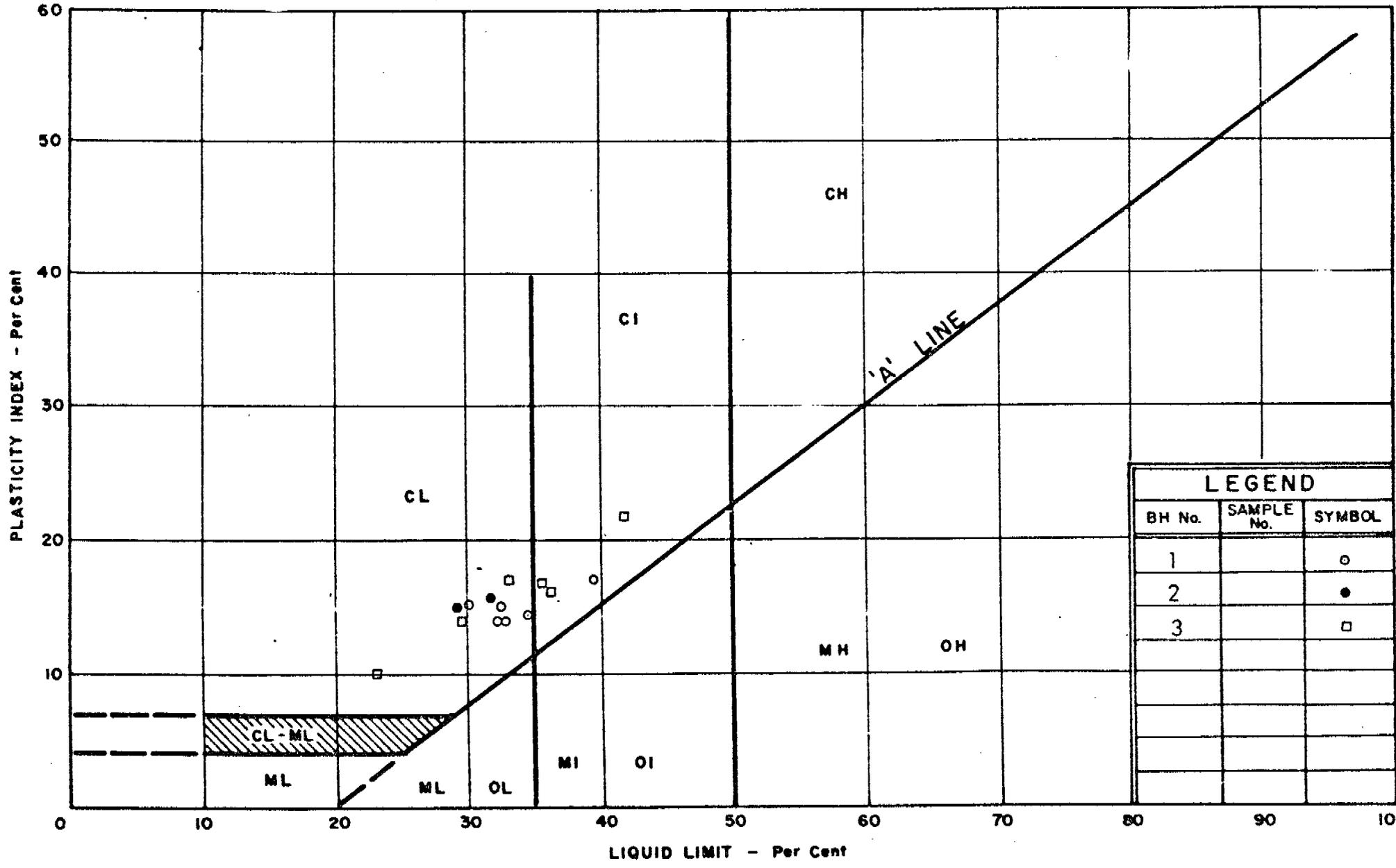
COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

CHECKED BY *[Signature]*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — $w_L$			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	BLOWS / FOOT					WATER CONTENT — $w$			
						20	40	60	80	100	SHEAR STRENGTH P.S.F.				
											$w_p$ — $w$ — $w_L$ WATER CONTENT %				
											○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			$\gamma$	
											P.C.F.			GR. SA. SI. CL.	
779.4	GROUND LEVEL														
768.5															
10.9	END OF CONE TEST														



LEGEND		
BH No.	SAMPLE No.	SYMBOL
1		○
2		●
3		□



DEPARTMENT OF HIGHWAYS  
**MATERIALS and TESTING**  
 DIVISION

**PLASTICITY CHART**  
 CLAYEY SILT TO SILTY CLAY

WP. No. 89-69-07  
 JOB No. 73-11021  
 FIG. 1





61-20 SEP 1972

GEOCRES No. 40J14-33

DIST. 2 REGION Southwestern

W.P. No. 89-69-01

CONT. No. 78-96

W. O. No. \_\_\_\_\_

STR. SITE No. \_\_\_\_\_

HWY. No. \_\_\_\_\_

LOCATION Proposed St. Thomas  
Expressway

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 2

REMARKS: documents to be unfolded  
before microfilming

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO C1-1

JOB 73-11019

LOCATION Co-ords. 15,558,786 N; 1,536,588 E.

ORIGINAL BY LJH

W.P. 89-69-01

BORING DATE June 4, 1973

COMPILED BY LJH

DATUM Geodetic

BOREHOLE TYPE Auger & Cone Test

CHECKED BY C.

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	BULK DENSITY $\gamma$ P.C.F. GR. SA. SI. CL.	REMARKS
FLEV. DEPTH	DESCRIPTION	SIRA PLOT	NUMBER	TYPE	BLOWS/FOOT					
776.2	Ground Level									
0.0	Clayey silt, some sand, trace of gravel. Brown Grey		1	SS	18	770				
	Very Stiff		2	SS	28					
762.2										
14.0	Sand, some clayey silt, trace of gravel, Dense to Very Dense. Brown		3	SS	32	760				
755.2	Silt Grey		4	SS	10					6 73 (21)
21.0	Clayey silt, some sand, trace of gravel. Hard, Grey		5	SS	53	750				1 14 49 36
744.7			6	SS	49					
51.5	End of Borehole					740				

NOTE: Groundwater level not established.

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO C1-2

JOB 73-11019

LOCATION Co-ord's N. 15,558,532; E. 1,336,884

ORIGINATED BY L.J.E.

W.P. 89-69-01

BORING DATE June 4, 1973

COMPILED BY L.J.E.

DATUM Geodetic

BOREHOLE TYPE Auger & Core Test

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 50 80 100	LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>p</sub> WATER CONTENT — W	BULK DENSITY γ	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE						BLOWS/FOOT
777.0	Ground Level									
0.0	Brown Grey  Clayey silt, some sand, trace of gravel. Very stiff		1	SS	21				1 15 58 2	
			2	SS	26					
			3	SS	26					
			4	SS	26					
			5	SS	29					
745.5			6	SS	26					
31.5	End of Borehole									
	NOTE: Groundwater level not established									

OFFICE REPORT SOIL EXPLORATION

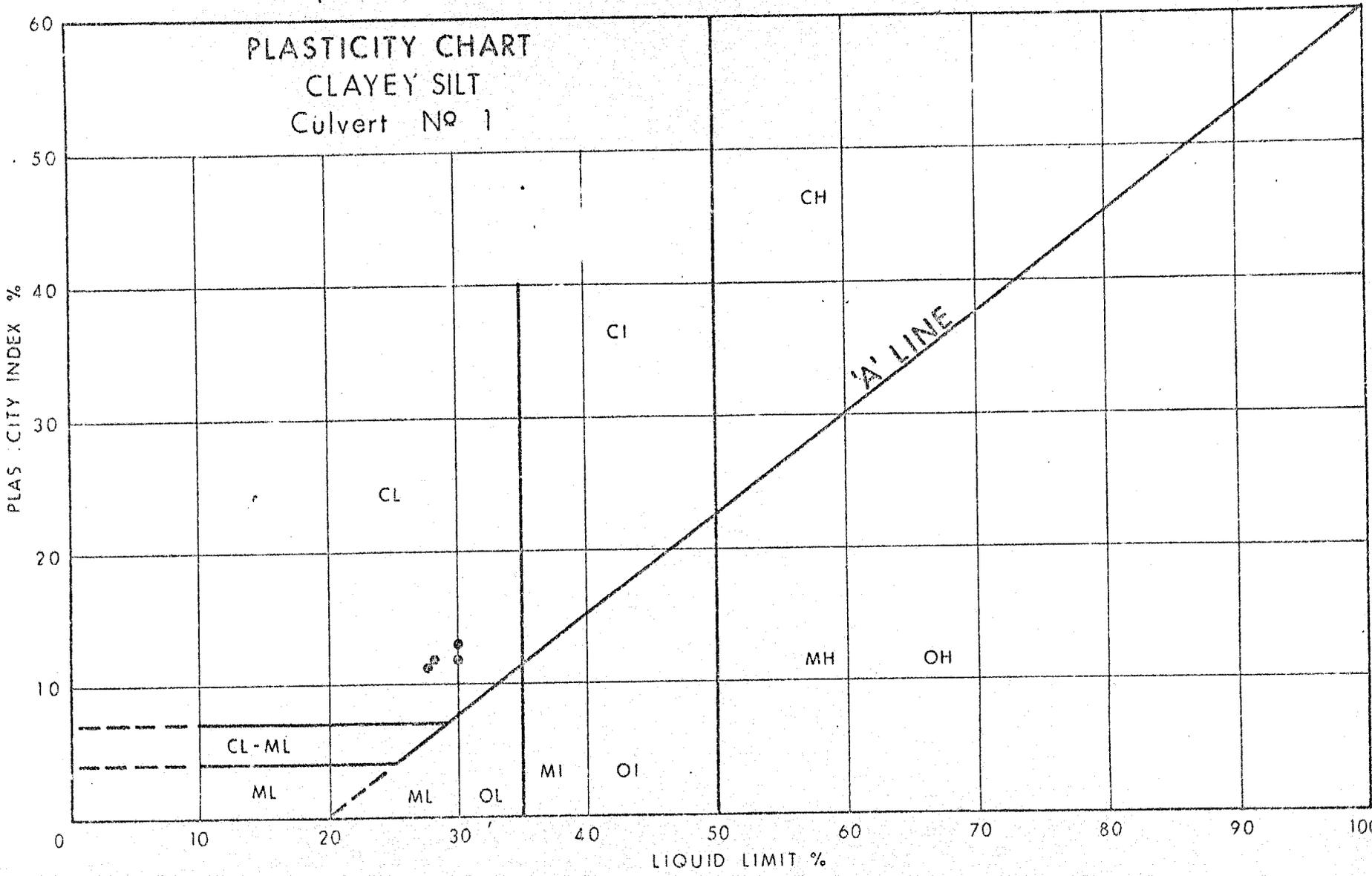
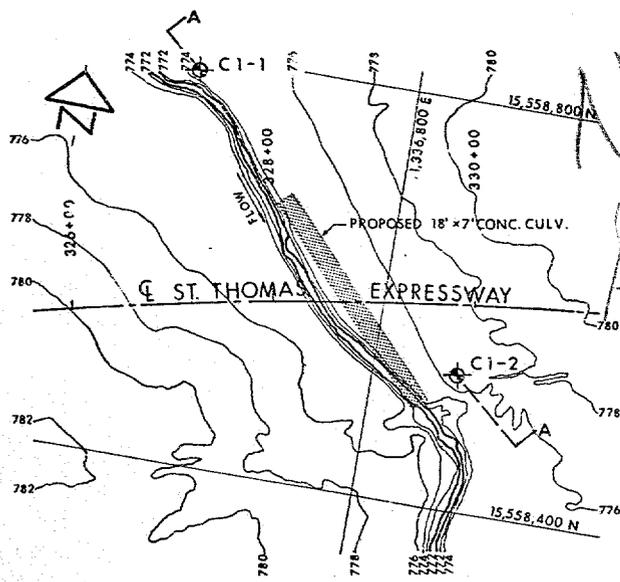
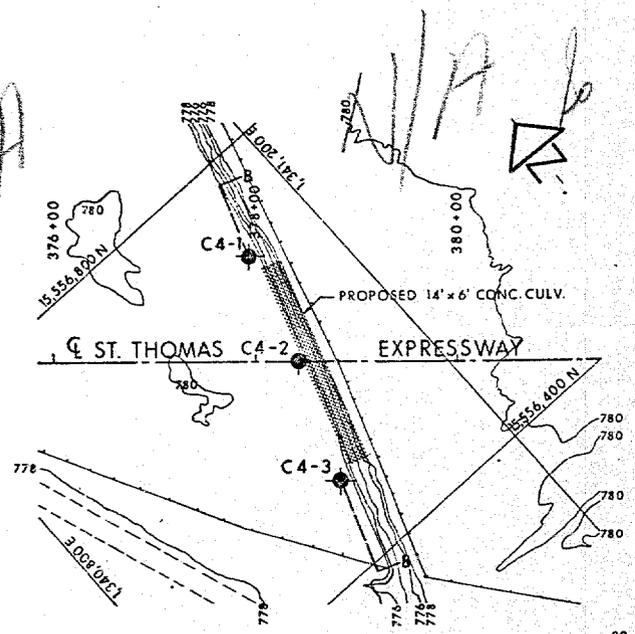


FIG. 1

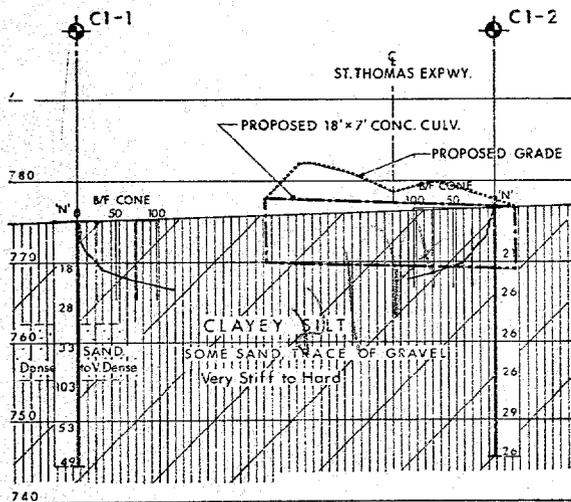


CULVERT NO.1

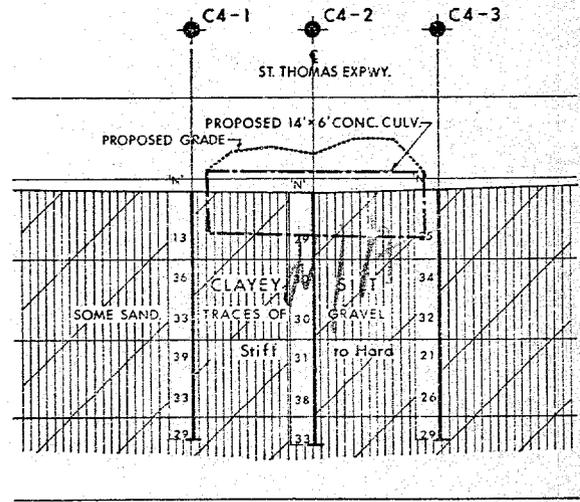


CULVERT NO.4

PLANS



CULVERT NO.1  
A-A



CULVERT NO.4  
B-B

SECTIONS



730

720

710

80 40

## APPENDIX C

### C.1 SYMBOLS AND TERMS USED ON BOREHOLE RECORDS

### C.2 BOREHOLE RECORDS



## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

### SOIL DESCRIPTION

#### Terminology describing common soil genesis:

<i>Rootmat</i>	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
<i>Topsoil</i>	- mixture of soil and humus capable of supporting vegetative growth
<i>Peat</i>	- mixture of visible and invisible fragments of decayed organic matter
<i>Till</i>	- unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	- material below the surface identified as placed by humans (excluding buried services)

#### Terminology describing soil structure:

<i>Desiccated</i>	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	- having cracks, and hence a blocky structure
<i>Varved</i>	- composed of regular alternating layers of silt and clay
<i>Stratified</i>	- composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	- > 75 mm in thickness
<i>Seam</i>	- 2 mm to 75 mm in thickness
<i>Parting</i>	- < 2 mm in thickness

#### Terminology describing soil types:

The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4<sup>th</sup> Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

#### Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):

Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	> 20%

#### Terminology describing compactness of cohesionless soils:

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
<i>Very Loose</i>	<4
<i>Loose</i>	4-10
<i>Compact</i>	10-30
<i>Dense</i>	30-50
<i>Very Dense</i>	>50

#### Terminology describing consistency of cohesive soils:

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
<i>Very Soft</i>	<0.25	<12.5	<2
<i>Soft</i>	0.25 - 0.5	12.5 - 25	2-4
<i>Firm</i>	0.5 - 1.0	25 - 50	4-8
<i>Stiff</i>	1.0 - 2.0	50 - 100	8-15
<i>Very Stiff</i>	2.0 - 4.0	100 - 200	15-30
<i>Hard</i>	>4.0	>200	>30

## ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

### Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	Very Poor Quality
25-50	Poor Quality
50-75	Fair Quality
75-90	Good Quality
90-100	Excellent Quality

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	Crushed
Severely Fractured	Shattered or Very Blocky
Fractured	Blocky
Moderately Jointed	Sound
Intact	Very Sound

**RQD (Rock Quality Designation)** denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

**SCR (Solid Core Recovery)** denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

**Fracture Index (FI)** is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

### Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
<20	Extremely Close	Laminated
<6	-	Thinly Laminated

### Terminology describing rock strength:

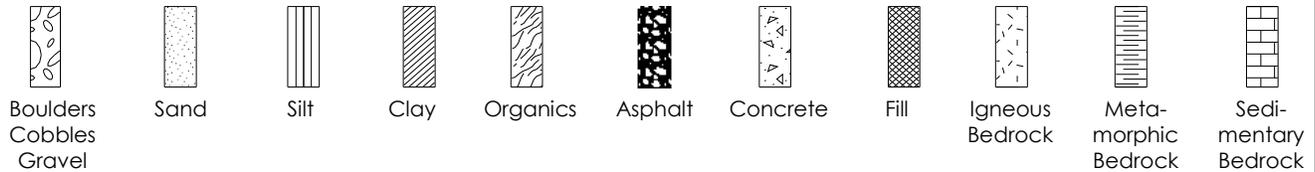
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

### Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

## STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



## SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

## WATER LEVEL MEASUREMENT



measured in standpipe, piezometer, or well



inferred

## RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

## N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

## DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

## OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
$\gamma$	Unit weight
$G_s$	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
$Q_u$	Unconfined compression
$I_p$	Point Load Index ( $I_p$ on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

# RECORD OF BOREHOLE No Sign1

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742446.0 E:406350.9 ORIGINATED BY KT  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.03.07 - 2024.03.07 LATITUDE 42.81504 LONGITUDE -81.2582 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			GR	SA
239.5	Road Shoulder																	
239.2	SILTY SAND with gravel (FILL) Compact Brown Moist	1	SS	12														
0.3																		
238.1	CLAYEY SILT, trace to some sand, trace gravel (FILL) Firm to stiff Brown Moist	2	SS	5														
1.4																		
	CLAYEY SILT (CL), some sand, trace gravel (TILL) Stiff to very stiff Brown Moist	3	SS	15											1	16	47	37
		4	SS	22														
		5	SS	18														
		6	SS	16														
	Grey below 4.6 m																	
		7	SS	14														
		8	SS	17														
		9	SS	18														
		10	SS	21														
232.0	END OF BOREHOLE Borehole open and dry upon completion of drilling.																	
7.5																		

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No Sign2**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742410.1 E:406558.2 ORIGINATED BY KL  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.01.10 - 2024.01.10 LATITUDE 42.81469 LONGITUDE -81.25568 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)			
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20	40	60
238.2	Cultivated Farmland																		
238.0	150 mm TOPSOIL																		
0.2	CLAYEY SILT TILL (CL), some sand, trace gravel (TILL) Firm to hard Brown Moist	1	SS	7												0	14	50	36
		2	SS	19															
		3	SS	38															
	Grey below 2.3 m	4	SS	25												5	12	46	37
		5	SS	21															
		6	SS	17															
		7	SS	20															
		8	SS	17															
		9	SS	18															
		10	SS	15															
		11	SS	17															
230.0	END OF BOREHOLE																		
8.2	Borehole open and dry upon completion of drilling.																		

ONTARIO.MTO\_165001308\_MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No Sign3**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742428.9 E:406548.3 ORIGINATED BY KT  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.01.11 - 2024.01.11 LATITUDE 42.81486 LONGITUDE -81.25579 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			GR
238.0	Cultivated Farmland																
238.0	100 mm TOPSOIL																
237.0	CLAYEY SILT (CL), some sand, trace gravel (TILL) Brown Moist Firm to very stiff	1	SS	7													
		2	SS	12													
		3	SS	22													2 13 45 39
	Grey below 2.3 m	4	SS	19													
		5	SS	18													
		6	SS	16													
		7	SS	19													
		8	SS	21													2 14 47 37
		9	SS	16													
		10	SS	19													
		11	SS	20													
229.8	END OF BOREHOLE																
8.2	Borehole open and dry upon completion of drilling.																

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No Sign4**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742624.9 E:407525.2 ORIGINATED BY AS  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.02.23 - 2024.02.23 LATITUDE 42.81649 LONGITUDE -81.24382 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT $\gamma$	REMARKS & GRAIN SIZE DISTRIBUTION (%)		
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>			GR	SA
237.8	Cultivated Farmland																	
237.0	100 mm TOPSOIL																	
	CLAYEY SILT (CL), some sand, trace gravel (TILL). Firm to very stiff Brown Moist	1	SS	7														
		2	SS	20														
		3	SS	20											3	12	48	37
	Grey Below 2.3 m	4	SS	17														
		5	SS	13														
		6	SS	12														
		7	SS	12														
		8	SS	19														
		9	SS	15														
		10	SS	18														
229.6	END OF BOREHOLE																	
8.2	Borehole open and dry upon completion of drilling.																	

ONTARIO.MTO\_165001308\_MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No Sign5**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742179.4 E:408406.1 ORIGINATED BY AG  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.10.16 - 2024.10.16 LATITUDE 42.81236281 LONGITUDE -81.23312711 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
240.1	Grass																
239.0	200 mm TOPSOIL																
0.2	CLAYEY SILT (CL), some sand, trace gravel (TILL) Firm to hard Brown Moist	1	SS	3													
		2	SS	4													
		3	SS	10													1 14 47 38
237.5		4	SS	35													
2.6	SILTY SAND (SM), trace clay Compact to dense Brown Moist to wet	5	SS	25													0 71 23 6
236.4		6	SS	13													
3.7	CLAYEY SILT (CL), some sand, trace gravel (TILL) Stiff to very stiff Grey Moist	7	SS	15													
		8	SS	16													
		9	SS	17													
		10	SS	18													
		11	SS	20													
231.9	END OF BOREHOLE																
8.2	Borehole open and water measured at 7.0 m upon completion of drilling.																

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No Sign6**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4741584.7 E:409224.5 ORIGINATED BY MC  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY HS  
 DATUM Geodetic DATE 2024.06.26 - 2024.06.26 LATITUDE 42.80689905 LONGITUDE -81.2232323 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
237.5	Road Shoulder															
237.2	SILTY SAND with gravel (FILL) Compact Brown to dark brown Moist	1	SS	16												
0.3	CLAYEY SILT (CL), some sand, trace gravel (TILL), Stiff to very stiff Brown Moist	2	SS	11												
		3	SS	18											6 14 45 35	
	Grey below 2.3 m.	4	SS	16												
		5	SS	14												
		6	SS	13												
		7	SS	20											0 6 58 36	
		8	SS	14												
		9	SS	16												
		10	SS	22												
		11	SS	23												
229.3	END OF BOREHOLE															
8.2	Borehole open and dry upon completion of drilling.															

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, X<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE



**RECORD OF BOREHOLE No Sign 11**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742887.1 E:406193.4 ORIGINATED BY AS  
 DIST West HWY Hwy4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY KL  
 DATUM Geodetic DATE 2025.03.10 - 2025.03.10 LATITUDE 42.81902826 LONGITUDE -81.26004996 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	SHEAR STRENGTH kPa								
						20	40	60	80	100	20	40	60			
241.3	Gravel Shoulder															
0.0	SILTY SAND with gravel (FILL)		1	SS	23											
240.9	Compact															
0.4	Brown															
	Moist															
	CLAYEY SILT, trace to some sand, trace to some gravel (FILL)		2	SS	7											
239.9	Firm															
1.5	Brown to grey															
	Moist															
	CLAYEY SILT (CL), trace to some sand, trace to some gravel (TILL)		3	SS	8											
	Stiff to very stiff															
	Brown															
	Moist															
			4	SS	12											1 13 53 33
			5	SS	21											
	Grey below 3.8 m															
			6	SS	18											
			7	SS	28											
			8	SS	20											1 13 52 34
			9	SS	22											
			10	SS	23											
			11	SS	23											
233.1	END OF BOREHOLE															
8.2	Borehole open and dry upon completion of drilling.															

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250310.GPJ ONTARIO.MTO.GDT 3/14/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No CNR-EMB9**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION CNR Overhead, Southwold, Ontario N: 4742180.1 E: 408425.8 ORIGINATED BY HS  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY KL  
 DATUM Geodetic DATE 2024.05.14 - 2024.05.15 LATITUDE 42.81236663 LONGITUDE -81.23288586 CHECKED BY RR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
239.7	150 mm TOPSOIL	1	SS	3												
230.6	CLAYEY SILT (CL), trace to some sand, trace gravel (TILL) Stiff to very stiff (SS1 soft) Brown to grey Moist	2	SS	16												1 13 46 40
		1	TW													
		3	SS	23												PP = 4.5 TSF
	Grey below 3.0 m	4	SS	19												0 12 43 44 PP = 4.5 TSF
		5	SS	18												PP = 4.0 TSF
		6	SS	17												PP = 4.5 TSF
		7	SS	14												PP = 4.5 TSF
		2	TW													Consolidation Test
		8	SS	34												PP = 4.5 TSF
		9	SS	19												2 17 47 34 PP = 3.5 TSF
		10	SS	22												
		11	SS	26												
		12	SS	18												
		13	SS	20												
224.9	CLAYEY SILT (CL), trace sand, trace gravel Very stiff Grey Moist to wet	14	SS	17												1 2 65 32 PP = 2.0 TSF
223.9	END OF BOREHOLE															
15.9	Borehole open and dry on completion of drilling.															

ONTARIO MTO 165001308\_MTO\_CNR-BYPASS\_20240926.GPJ ONTARIO MTO.GDT 9/26/24

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

# RECORD OF BOREHOLE No DCC1

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Lindsay Creek Drain, St. Thomas, Ontario N: 4742624 E:407117.6 ORIGINATED BY AS  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.02.22 - 2024.02.23 LATITUDE 42.81654 LONGITUDE -81.2488 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
237.3	Grass															
237.0	180 mm TOPSOIL	1	SS	8												
236.5	CLAYEY SILT, trace to some sand (FILL) Stiff	2	SS	7												PP = 125 kPa
235.9	Dark brown/black Moist SILTY CLAY, trace sand and gravel Firm	3	SS	19												PP > 450 kPa
	Dark brown Moist CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff	4	SS	28												1 11 44 44 PP > 450 kPa
	Brown Moist Grey below 3 m	5	SS	28												PP > 450 kPa
		6	SS	28												PP > 450 kPa
		7	SS	22												PP > 450 kPa
		8	SS	22												PP > 450 kPa
	Inferred cobbles/boulder based on rock fragments in SS9	9	SS	20												PP = 400 kPa
		10	SS	22												3 14 46 37 PP = 400 kPa
		11	SS	24												PP > 450 kPa
		12	SS	24												PP > 450 kPa
		13	SS	23												PP > 450 kPa
		14	SS	21												0 10 50 39 PP > 450 kPa
221.4	END OF BOREHOLE	15	SS	24												PP > 450 kPa
15.9	Borehole open and dry upon completion.															

ONTARIO MTO\_165001308\_MTO\_HWY3-TWINNING\_20241127.GPJ ONTARIO MTO.GDT 12/3/24

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

# RECORD OF BOREHOLE No DCC2

1 OF 2

**METRIC**

W.P. 3041-22-00 LOCATION Lindsay Creek Drain, St. Thomas, Ontario N: 4742609 E:407154.4 ORIGINATED BY AS  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.02.22 - 2024.02.27 LATITUDE 42.8164 LONGITUDE -81.2484 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40					
237.4	Grass												
237.0	200 mm TOPSOIL												
0.2	CLAYEY SILT, trace sand, trace rootlets (FILL) Firm Brown Moist	1	SS	7									
236.4	300 mm thick silty sand layer at the top of SS2												PP = 125 kPa
1.0	CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff to hard Brown Moist	2	SS	9									2 13 44 41 PP > 450 kPa
		3	SS	24									PP > 450 kPa
		4	SS	27									PP > 450 kPa
		5	SS	24									PP > 450 kPa
		6	SS	20									2 15 49 34 PP > 450 kPa
		7	SS	16									PP > 450 kPa
		8	SS	18									PP > 450 kPa
		9	SS	19									PP > 450 kPa
		10	SS	22									PP = 325 kPa
		11	SS	13									PP > 450 kPa
		12	SS	23									8 13 45 34 PP = 400 kPa
		13	SS	45									PP > 450 kPa
		14	SS	25									PP > 450 kPa
		15	SS	21									PP > 450 kPa
221.5	END OF BOREHOLE												
15.9	Monitoring well installed in borehole, screened from approximately 4.6 m to 6.1 m below grade.												

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20241127.GPJ ONTARIO.MTO.GDT 12/3/24

Continued Next Page

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No DCC2**

2 OF 2

**METRIC**

W.P. 3041-22-00 LOCATION Lindsay Creek Drain, St. Thomas, Ontario N: 4742609 E:407154.4 ORIGINATED BY AS  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.02.22 - 2024.02.27 LATITUDE 42.8164 LONGITUDE -81.2484 CHECKED BY GR

SOIL PROFILE		SAMPLES				GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT <b>γ</b> kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100					
	Groundwater level recorded in monitoring well at approximately 5.5 m, 5 m and 2.1 m below grade on March 20, March 27 and May 9, 2024, respectively.																

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20241127.GPJ ONTARIO.MTO.GDT 12/3/24

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

### RECORD OF BOREHOLE No DCC3

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Lindsay Creek Drain, St. Thomas, Ontario N: 4742591 E:407191.9 ORIGINATED BY KL  
 DIST West HWY Hwy 3 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.01.10 - 2024.01.10 LATITUDE 42.81623 LONGITUDE -81.2479 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40					
237.3	Grass												
237.0	150 mm TOPSOIL	1	SS	4									
237.0	CLAY (CH), some sand Firm Brown Moist	2	SS	7									0 15 43 42 PP = 250 kPa
235.9	CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff to hard Brown Moist SS3 contains trace rock fragments Grey below 2.3 m	3	SS	22									PP = 350 kPa
1.4		4	SS	19									PP > 450 kPa
		5	SS	21									2 14 47 37 PP > 450 kPa
		6	SS	15									PP > 450 kPa
	SS7 contains sand seams	7	SS	16									PP = 425 kPa
		8	SS	20									4 13 47 35 PP > 450 kPa
		9	SS	22									PP > 450 kPa
		10	SS	31									PP > 450 kPa
	clayey silt (CL-ML) layer from 10.7 m to 11.2 m	11	SS	84									2 8 71 19
		12	SS	34									PP > 450 kPa
		13	SS	24									PP = 450 kPa
		14	SS	23									PP = 350 kPa
221.5	END OF BOREHOLE												
15.9	Borehole caved in to 14.9 m below grade and was dry on completion.												

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20241127.GPJ ONTARIO.MTO.GDT 12/3/24

**RECORD OF BOREHOLE No SWMP1-BH1 1 OF 1 METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742459.3 E:406444.4 ORIGINATED BY TK  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.01.11 - 2024.01.11 LATITUDE 42.81514 LONGITUDE -81.25706 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
238.7	Grass																
238.9	250 mm TOPSOIL																
0.3	SILTY CLAY (CI), some sand, trace gravel Firm to stiff Brown Moist	1	SS	6													2 16 39 43
237.3	CLAYEY SILT (CL), some sand, trace gravel (TILL) Stiff to very stiff Grey Moist	2	SS	13													2 16 39 43
1.5		3	SS	24													
		4	SS	15													
		5	SS	15													
	SS6 contains rock fragments	6	SS	18													
		7	SS	18													2 16 39 43
		8	SS	19													
	SS9 contains rock fragments	9	SS	28													
		10	SS	23													
		11	SS	17													
		12	SS	28													
227.4	END OF BOREHOLE																
11.3	Borehole open and dry upon completion.																

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250203.GPJ ONTARIO.MTO.GDT 2/7/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

**RECORD OF BOREHOLE No SWMP1-BH3**

1 OF 1

**METRIC**

W.P. 3041-22-00 LOCATION Southwold, Ontario N:4742511.5 E:406645.5 ORIGINATED BY TK  
 DIST West HWY Hwy 4 BOREHOLE TYPE Hollow Stem Auger COMPILED BY RR  
 DATUM Geodetic DATE 2024.01.11 - 2024.01.11 LATITUDE 42.81559 LONGITUDE -81.25459 CHECKED BY GR

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60	80	100						20
238.7	Grass																
238.0	130 mm TOPSOIL	1	SS	12													
238.0	SILTY CLAY (Cl), some sand, trace gravel Stiff to very stiff Brown to grey Moist	2	SS	15													
		3	SS	21													
236.5																	2 13 36 49
2.2	CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff to hard Grey Moist SS4 contains rock fragments	4	SS	30													
		5	SS	19													
		6	SS	19													
		7	SS	18													
		8	SS	19													
		9	SS	16													8 16 35 42
		10	SS	19													
		11	SS	26													
		12	SS	30													
227.4	END OF BOREHOLE																
11.3	Borehole open and dry upon completion.																

ONTARIO.MTO\_165001308.MTO\_HWY3-TWINNING\_20250203.GPJ ONTARIO.MTO.GDT 2/7/25

+<sup>3</sup>, ×<sup>3</sup>: Numbers refer to Sensitivity      ○ 3% STRAIN AT FAILURE

**FOUNDATION INVESTIGATION REPORT – OVERHEAD SIGNS - HIGHWAY 4 WIDENING FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

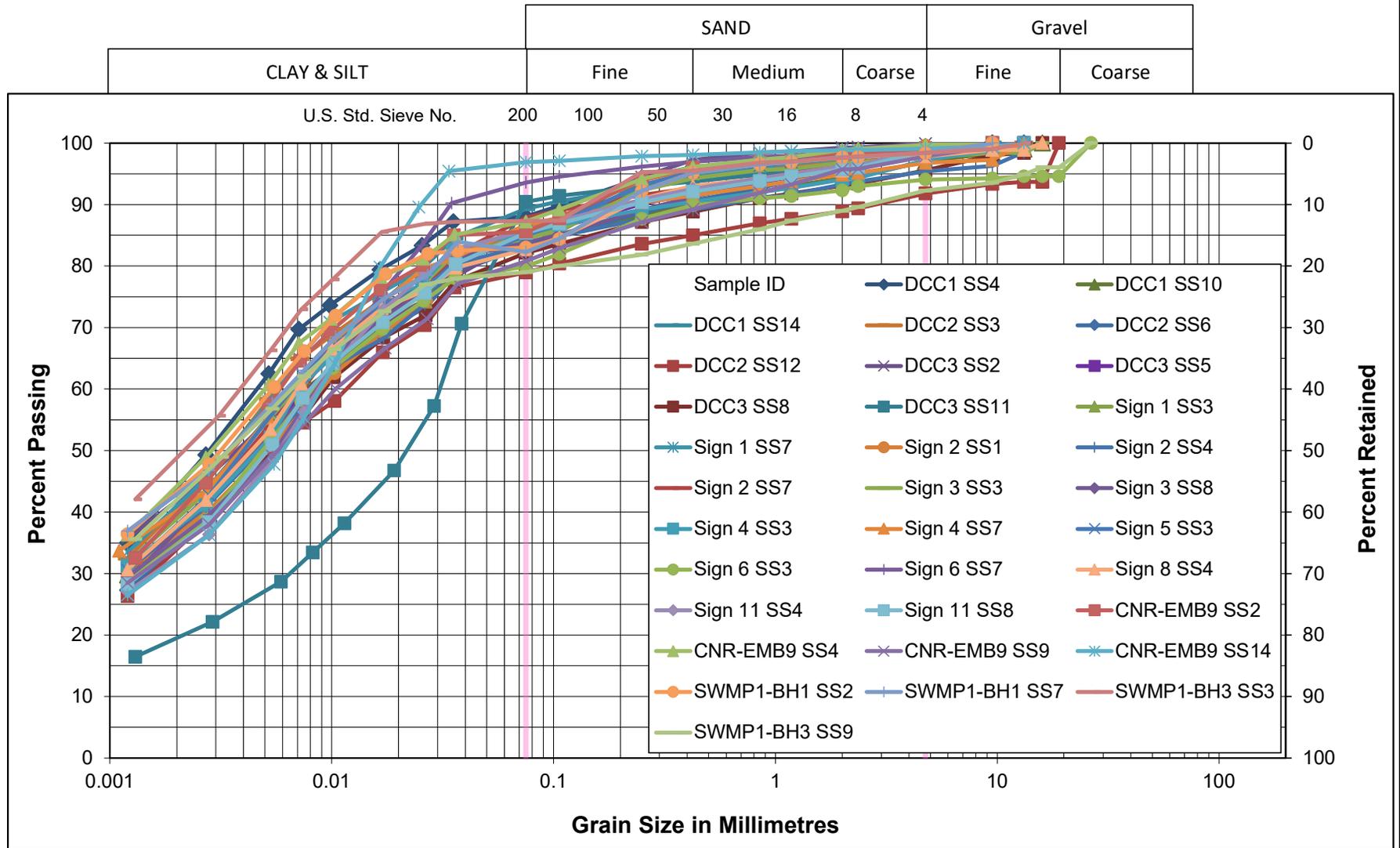
Appendix D

## **APPENDIX D**

### **D.1 LABORATORY TEST RESULTS**



# Unified Soil Classification System



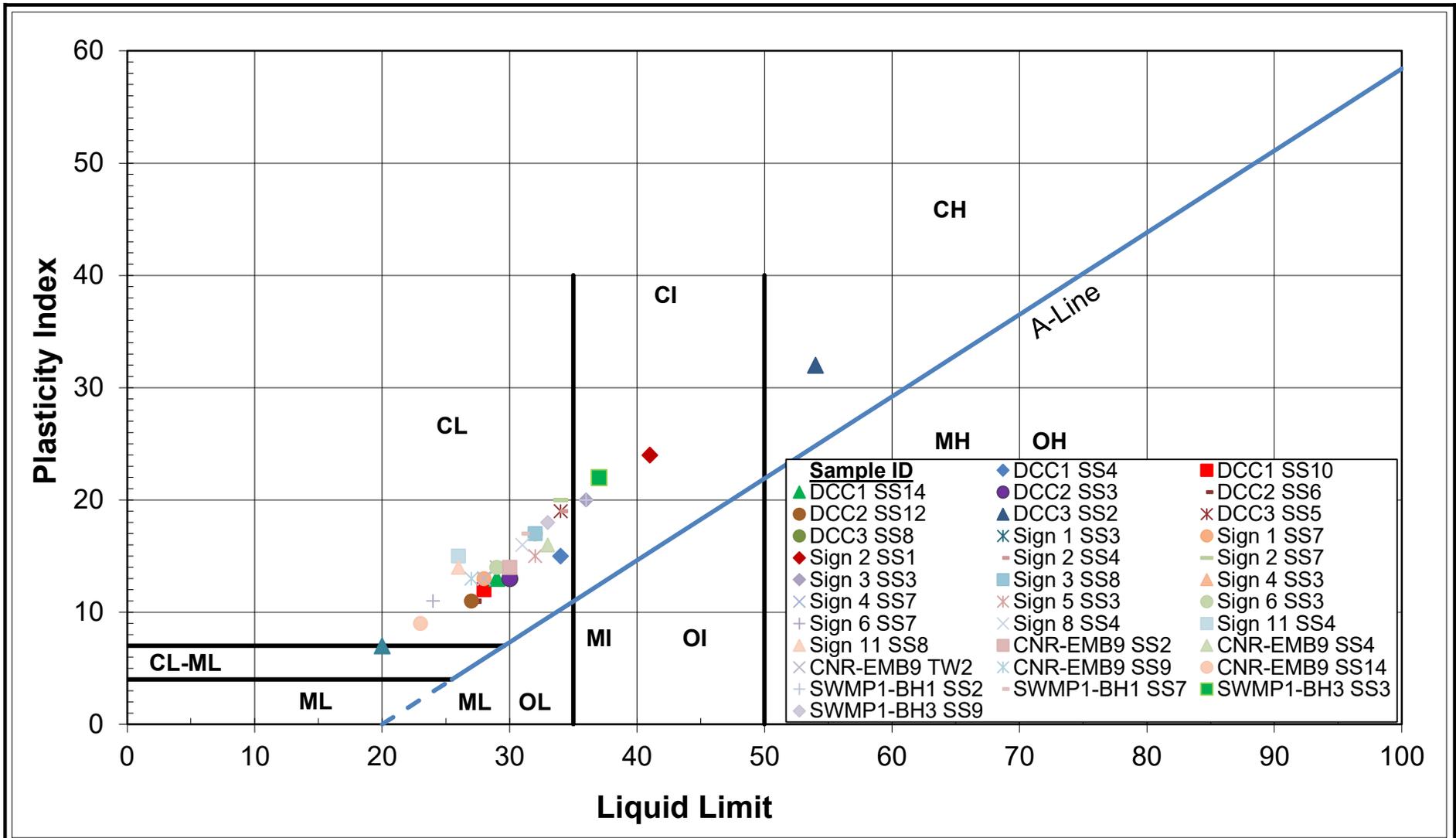
CLAYEY SILT to SILTY CLAY TO CLAY TILL (CL-ML, CL, CI, CH)

Ministry of Transportation (MTO)

Highway 4 Widening and New Talbotville Bypass -  
Overhead Signs

Figure No. D1

Project No. 165001308



CLAYEY SILT to SILTY CLAY TO CLAY TILL (CL-ML, CL, CI, CH)

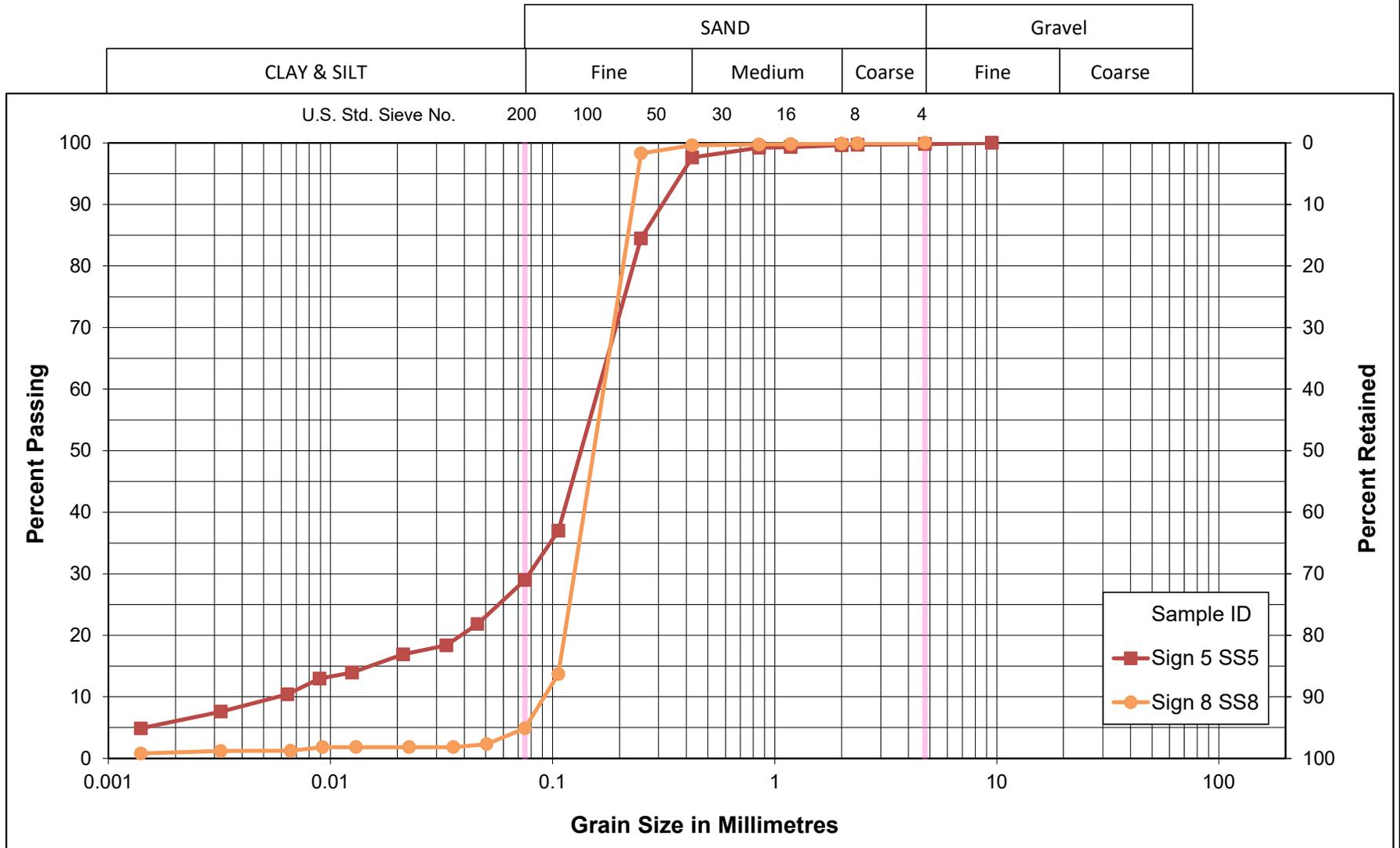


**Ministry of Transportation (MTO)**  
 Highway 4 Widening and New Talbotville  
 Bypass - Overhead Signs

Figure No. D2

Project No. 165001308

# Unified Soil Classification System



Silty SAND (SM)

Ministry of Transportation (MTO)

Highway 4 Widening and New Talbotville Bypass -  
Overhead Signs

Figure No. D3

Project No. 165001308





CLIENT NAME: STANTEC CONSULTING LTD  
300-675 Cochrane Drive  
MARKHAM, ON L3R0B8  
(905) 444-7777

ATTENTION TO: Bahram Siavash  
PROJECT: 165001308.551.102

AGAT WORK ORDER: 24T149317

ROCK ANALYSIS REVIEWED BY: Ali Reza Khosh Kish, Report Writer

SOIL ANALYSIS REVIEWED BY: Sukhwinder Randhawa, Inorganic Team Lead

DATE REPORTED: May 18, 2024

PAGES (INCLUDING COVER): 7

VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

\*Notes

**Disclaimer:**

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



## Certificate of Analysis

AGAT WORK ORDER: 24T149317

PROJECT: 165001308.551.102

2910 12TH STREET NE  
CALGARY, ALBERTA  
CANADA T2E 7P7  
TEL (403)735-2005  
FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### (284-137) Sulfide (CGY)

DATE RECEIVED: 2024-05-10

DATE REPORTED: 2024-05-18

		SAMPLE DESCRIPTION:		DCC2-SS3	KCBA1-SS12	KCBA2-SS11	KCBP1-SS12	KCBP2-SS5	
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	
		DATE SAMPLED:		2024-05-09	2024-05-09	2024-05-09	2024-05-09	2024-05-09	
Parameter	Unit	G / S	RDL	5850929	5850950	5850951	5850952	5850953	
Sulfide	%			0.01	0.01	0.06	<0.01	0.02	0.08

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by \*)

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 24T149317

PROJECT: 165001308.551.102

2910 12TH STREET NE  
 CALGARY, ALBERTA  
 CANADA T2E 7P7  
 TEL (403)735-2005  
 FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Corrosivity Package

DATE RECEIVED: 2024-05-10

DATE REPORTED: 2024-05-18

Parameter	Unit	SAMPLE DESCRIPTION:		DCC2-SS3	KCBA1-SS12	KCBA2-SS11	KCBP1-SS12	KCBP2-SS5
		G / S	RDL	5850929	5850950	5850951	5850952	5850953
Chloride (2:1)	µg/g	2	17	12	10	13	18	
Sulphate (2:1)	µg/g	2	24	290	281	93	90	
pH (2:1)	pH Units	NA	8.40	8.16	8.14	8.85	8.58	
Electrical Conductivity (2:1)	mS/cm	0.005	0.184	0.573	0.277	0.181	0.205	
Resistivity (2:1) (Calculated)	ohm.cm	1	5430	1750	3610	5520	4880	
Redox Potential 1	mV	NA	216	208	247	243	223	
Redox Potential 2	mV	NA	221	210	245	245	232	
Redox Potential 3	mV	NA	218	208	244	243	232	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

5850929-5850953 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.

Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T149317  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Rock Analysis															
RPT Date: May 18, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

(284-137) Sulfide (CGY)

Total Sulfur	5850929	5850929	0.01	0.01	19.5%	< 0.01	104%	80%	120%
Sulfate	5853092		<0.01	<0.01	0.0%	< 0.01	108%	80%	120%

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

(284-137) Sulfide (CGY)

Sulfate	5850929	5850929	<0.01	<0.01	0%	< 0.01		80%	120%
---------	---------	---------	-------	-------	----	--------	--	-----	------

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

(284-000) Re-Work (CGY)

Total Sulfur	5856796		0.11	0.12	6.3%	< 0.01	107%	90%	110%
--------------	---------	--	------	------	------	--------	------	-----	------

Certified By: \_\_\_\_\_



## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T149317  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Soil Analysis																
RPT Date: May 18, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

Corrosivity Package															
Chloride (2:1)	5856796		<2	<2	NA	< 2	95%	70%	130%	96%	80%	120%	96%	70%	130%
Sulphate (2:1)	5856796		1480	1480	0.0%	< 2	96%	70%	130%	97%	80%	120%	NA	70%	130%
pH (2:1)	5856856		6.20	6.53	5.2%	NA	98%	80%	120%						
Electrical Conductivity (2:1)	5856856		0.339	0.371	9.0%	< 0.005	96%	80%	120%						
Redox Potential 1	5850929					NA	100%	90%	110%						

Comments: NA signifies Not Applicable.  
 pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.  
 Matrix spike NA: Spike level < native concentration. Matrix spike acceptance limits do not apply and are not calculated.

Certified By: \_\_\_\_\_



*B. Siavash*



## Method Summary

CLIENT NAME: STANTEC CONSULTING LTD

AGAT WORK ORDER: 24T149317

PROJECT: 165001308.551.102

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Rock Analysis			
Total Sulfur	MIN-283-12001	ASTM E1915; ASTM E1019; ASTM D5373	LECO
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE



# AGAT Laboratories

5835 Coopers Avenue  
Mississauga, Ontario  
L4Z 1Y2

www.agatlabs.com • webeearth.agatlabs.com

### Laboratory Use Only

Arrival Temperature: 19.4, 18.3, 18.9  
AGAT WO #: 24T149317  
Lab Temperature: \_\_\_\_\_  
Notes: 1304

## Chain of Custody Record

Ph.: 905.712.5100 • Fax: 905.712.5122 • Toll Free: 800.856.6261

### Client Information:

Company: Stantec Consulting Ltd.  
Contact: Bahram Siavash  
Address: 300-675 Cochran Drive West Tower  
  
Phone: 905-479-9345 Fax: 905-474-9889  
Project: 165001308.551.102 PO: \_\_\_\_\_  
AGAT Quotation #: \_\_\_\_\_

### Regulatory Requirements:

- Regulation 153/09 (reg. 514 Amend.)  
Table \_\_\_\_\_ Indicate one  
 Ind/Com  
 Res/Park  
 Agriculture
- Sewer Use  
Region \_\_\_\_\_ Indicate one  
 Sanitary  
 Storm
- Regulation 558  
 CCME  
 Other (specify) \_\_\_\_\_
- Prov. Water Quality Objectives (PWQO)  
 None
- Soil Texture (check one)  
 Coarse  Fine

### Turnaround Time Required (TAT) Required\*

#### Regular TAT

5 to 7 Working Days

**Rush TAT** (please provide prior notification)

#### Rush Surcharges Apply

3 Working Days

2 Working Days

1 Working Day

#### OR

Date Required (Rush surcharges may apply): \_\_\_\_\_

\*TAT is exclusive of weekends and statutory holidays

Please note, if quotation number is not provided, client will be billed full price for analysis.

### Invoice To:

Same: Yes  No

Company: \_\_\_\_\_  
Contact: \_\_\_\_\_  
Address: \_\_\_\_\_

**Is this a drinking water sample?**  
(potable water intended for human consumption)  
 Yes  No  
If "Yes", please use the  
**Drinking Water Chain of Custody Form**

Is this submission for a **Record of Site Condition?**  
 Yes  No

### Legend Matrix

**GW** Ground Water **O** Oil  
**SW** Surface Water **P** Paint  
**SD** Sediment **S** Soil

### Report Information – reports to be sent to:

- Name: Bahram Siavash  
Email: Bahram.Siavash@stantec.com
- Name: Kirby Lales  
Email: kirby.lales@stantec.com

Sample Identification	Date Sampled	Time Sampled	Sample Matrix	# of Containers	Comments Site/Sample Information	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: <input type="checkbox"/> B-HWS <input type="checkbox"/> Cl- <input type="checkbox"/> CN- <input type="checkbox"/> EC <input type="checkbox"/> FOC <input type="checkbox"/> CH+G <input type="checkbox"/> SAR <input type="checkbox"/> NO <sub>3</sub> /NO <sub>2</sub> <input type="checkbox"/> N-Total <input type="checkbox"/> Hg <input type="checkbox"/> pH	Nutrients: <input type="checkbox"/> TP <input type="checkbox"/> NH <sub>3</sub> <input type="checkbox"/> TKN <input type="checkbox"/> NO <sub>3</sub> <input type="checkbox"/> NO <sub>2</sub> <input type="checkbox"/> NO <sub>3</sub> /NO <sub>2</sub>	VOC: <input type="checkbox"/> VOC <input type="checkbox"/> THM <input type="checkbox"/> BTEX	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	TCLP:	Sewer Use	Corrosivity Pckg (pH, Redox Potential	sulphates and sulphides contents	chlorides contents and resistivity)	
DCC2 -SS3	2024-05-09			1	6'																		X	X	X
KCBA1-SS12	2024-05-09			1	46'																		X	X	X
KCBA2-SS11	2024-05-09			1	41'																		X	X	X
KCBP1-SS12	2024-05-09			1	36'																		X	X	X
KCBP2-SS5	2024-05-09			1	11'																		X	X	X

Samples Relinquished by (print name & sign): _____	Date/Time _____	Samples Received by (Print name & sign): <u>Tiffan</u>	Date/Time <u>May 10 10:15h</u>	Pink Copy – Client	Page ____ of ____
Samples Relinquished by (print name & sign): _____	Date/Time _____	Samples Received by (Print name & sign): _____	Date/Time _____	Yellow + Golden Copy – AGAT	NO:
				White Copy – AGAT	



CLIENT NAME: STANTEC CONSULTING LTD  
300-675 Cochrane Drive  
MARKHAM, ON L3R0B8  
(905) 444-7777

ATTENTION TO: Bahram Siavash

PROJECT: 165001308.551.102

AGAT WORK ORDER: 24T152603

ROCK ANALYSIS REVIEWED BY: Ali Reza Khosh Kish, Report Writer

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

DATE REPORTED: May 29, 2024

PAGES (INCLUDING COVER): 7

VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

\*Notes

**Disclaimer:**

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
- This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
- The test results reported herewith relate only to the samples as received by the laboratory.
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- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



## Certificate of Analysis

AGAT WORK ORDER: 24T152603

PROJECT: 165001308.551.102

2910 12TH STREET NE  
CALGARY, ALBERTA  
CANADA T2E 7P7  
TEL (403)735-2005  
FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### (284-137) Sulfide (CGY)

DATE RECEIVED: 2024-05-21

DATE REPORTED: 2024-05-29

		SAMPLE DESCRIPTION:		Sign 3-SS2	Sign 2-SS3	Sign 1-SS2	Sign 4-SS2
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2024-05-17	2024-05-17	2024-05-17	2024-05-17
Parameter	Unit	G / S	RDL	5872329	5872353	5872354	5872355
Sulfide	%	0.01	<0.01	<0.01	<0.01	0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Analysis performed at AGAT Calgary (unless marked by \*)

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 24T152603

PROJECT: 165001308.551.102

2910 12TH STREET NE  
 CALGARY, ALBERTA  
 CANADA T2E 7P7  
 TEL (403)735-2005  
 FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Corrosivity Package

DATE RECEIVED: 2024-05-21

DATE REPORTED: 2024-05-29

Parameter	Unit	SAMPLE DESCRIPTION:		Sign 3-SS2	Sign 2-SS3	Sign 1-SS2	Sign 4-SS2
		G / S	RDL	Soil	Soil	Soil	Soil
DATE SAMPLED:		2024-05-17	2024-05-17	2024-05-17	2024-05-17	2024-05-17	2024-05-17
Chloride (2:1)	µg/g	2	21	8	602	957	
Sulphate (2:1)	µg/g	2	26	14	49	68	
pH (2:1)	pH Units	NA	8.75	8.62	8.56	8.52	
Electrical Conductivity (2:1)	mS/cm	0.005	0.169	0.172	5.35	0.207	
Resistivity (2:1) (Calculated)	ohm.cm	1	5920	5810	187	4830	
Redox Potential 1	mV	NA	244	195	222	242	
Redox Potential 2	mV	NA	248	196	219	246	
Redox Potential 3	mV	NA	242	192	224	242	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

5872329-5872355 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.

Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



*Nvine Basly*

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T152603  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Rock Analysis															
RPT Date: May 29, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

(284-137) Sulfide (CGY)

Total Sulfur	5872329	5872329	<0.01	<0.01	0.0%	< 0.01	106%	80%	120%					
Sulfate	5866626	5866626	<0.01	<0.01	0.0%	< 0.01	88%	80%	120%					

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

(284-137) Sulfide (CGY)

Sulfate	5872329	5872329	<0.01	<0.01	0.0%	< 0.01		80%	120%					
---------	---------	---------	-------	-------	------	--------	--	-----	------	--	--	--	--	--

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

Certified By: \_\_\_\_\_



## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T152603  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Soil Analysis																
RPT Date: May 29, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

**Corrosivity Package**

Chloride (2:1)	5872329	5872329	21	21	0.0%	< 2	94%	70%	130%	97%	80%	120%	95%	70%	130%
Sulphate (2:1)	5872329	5872329	26	25	3.9%	< 2	95%	70%	130%	100%	80%	120%	97%	70%	130%
pH (2:1)	5872329	5872329	8.75	8.63	1.4%	NA	101%	80%	120%						
Electrical Conductivity (2:1)	5872329	5872329	0.169	0.139	19.5%	< 0.005	94%	80%	120%						
Redox Potential 1	5872329						100%	90%	110%						

Comments: NA signifies Not Applicable.

pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

### Certified By:






## Method Summary

CLIENT NAME: STANTEC CONSULTING LTD

AGAT WORK ORDER: 24T152603

PROJECT: 165001308.551.102

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE



# AGAT Laboratories

5835 Coopers Avenue  
Mississauga, Ontario  
L4Z 1Y2

www.agatlabs.com · webeearth.agatlabs.com

**Laboratory Use Only**

Arrival Temperature: 25-3/26.0/23.1  
 AGAT WO #: 24T152603  
 Lab Temperature: \_\_\_\_\_  
 Notes: no ice - 1 box

## Chain of Custody Record

Ph.: 905.712.5100 · Fax: 905.712.5122 · Toll Free: 800.856.6261

**Client Information:**

Company: Stantec Consulting Ltd.  
 Contact: Bahram Siavash  
 Address: 300W-675 Cochrane Drive West Tower  
Markham, ON L3R 0B8  
 Phone: 905-479-9345 Fax: 905-474-9889  
 Project: 165001308.551.102 PO: \_\_\_\_\_  
 AGAT Quotation #: \_\_\_\_\_

**Please note, if quotation number is not provided, client will be billed full price for analysis.**

**Regulatory Requirements:**

Regulation 153/09 (reg. 51.1 Amend.)  
 Table \_\_\_\_\_ Indicate one  
 Ind/Com  
 Res/Park  
 Agriculture  
 Soil Texture (check one)  
 Coarse  Fine

Sewer Use  
 Region \_\_\_\_\_ Indicate one  
 Sanitary  
 Storm

Regulation 558  
 CCME  
 Other (specify) \_\_\_\_\_  
 Prov. Water Quality Objectives (PWQO)  
 None

**Turnaround Time Required (TAT) Required\***

**Regular TAT**  
 5 to 7 Working Days

**Rush TAT (please provide prior notification)**  
**Rush Surcharges Apply**  
 3 Working Days  
 2 Working Days  
 1 Working Day

**OR**  
 Date Required (Rush surcharges may apply): \_\_\_\_\_

\*TAT is exclusive of weekends and statutory holidays

**Invoice To:** \_\_\_\_\_ Same: Yes  No

Company: \_\_\_\_\_  
 Contact: \_\_\_\_\_  
 Address: \_\_\_\_\_

**Is this a drinking water sample?**  
 (potable water intended for human consumption)  
 Yes  No

If "Yes", please use the **Drinking Water Chain of Custody Form**

**Is this submission for a Record of Site Condition?**  
 Yes  No

**Legend Matrix**

<b>GW</b> Ground Water	<b>O</b> Oil
<b>SW</b> Surface Water	<b>P</b> Paint
<b>SD</b> Sediment	<b>S</b> Soil

**Report Information** – reports to be sent to:

1. Name: Bahram Siavash  
 Email: Bahram.Siavash@stantec.com

2. Name: Kirby Lales  
 Email: kirby.lales@stantec.com

Sample Identification	Date Sampled	Time Sampled	Sample Matrix	# of Containers	Comments Site/Sample Information	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: <input type="checkbox"/> B-HWS <input type="checkbox"/> Cl- <input type="checkbox"/> CN- <input type="checkbox"/> EC <input type="checkbox"/> FOC <input type="checkbox"/> Cr+6- <input type="checkbox"/> SAR <input type="checkbox"/> NO <sub>3</sub> /NO <sub>2</sub> <input type="checkbox"/> N-Total <input type="checkbox"/> Hg <input type="checkbox"/> pH	Nutrients: <input type="checkbox"/> TP <input type="checkbox"/> NH <sub>3</sub> <input type="checkbox"/> TKN <input type="checkbox"/> NO <sub>3</sub> <input type="checkbox"/> NO <sub>2</sub> <input type="checkbox"/> NO <sub>x</sub> /NO <sub>3</sub>	VOC: <input type="checkbox"/> VOC <input type="checkbox"/> THM <input type="checkbox"/> BTEX	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	TCLP:	Sewer Use	Corrosivity Pckg (pH, Redox Potential sulphates and sulphides contents chlorides contents and resistivity)	
Sign 3-SS2	2024-05-17			1	2.5'-5'																		X X X
Sign2 <del>Sign 4</del> -SS3	2024-05-17			1	5'-7'																		X X X
Sign1-SS2	2024-05-17			1	2.5'-5'																		X X X
Sign4 <del>Sign 5</del> -SS2	2024-05-17			1	2.5'-5'																		X X X

Samples Relinquished by (print name & sign): \_\_\_\_\_ Date/Time: \_\_\_\_\_

Samples Received by (print name & sign): Andy J... Date/Time: May 21 124 10:30 am

Samples Relinquished by (print name & sign): \_\_\_\_\_ Date/Time: \_\_\_\_\_

Samples Received by (print name & sign): \_\_\_\_\_ Date/Time: \_\_\_\_\_

Pink Copy – Client  
 Yellow + Golden Copy – AGAT  
 White Copy – AGAT

Page \_\_\_\_\_ of \_\_\_\_\_  
 NO: \_\_\_\_\_



CLIENT NAME: STANTEC CONSULTING LTD  
300-675 Cochrane Drive  
MARKHAM, ON L3R0B8  
(905) 444-7777

ATTENTION TO: Bahram Siavash  
PROJECT: 165001308.551.102

AGAT WORK ORDER: 24T162759

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

DATE REPORTED: Jun 21, 2024

PAGES (INCLUDING COVER): 5

VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

\*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
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- All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.
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## Certificate of Analysis

AGAT WORK ORDER: 24T162759

PROJECT: 165001308.551.102

5835 COOPERS AVENUE  
MISSISSAUGA, ONTARIO  
CANADA L4Z 1Y2  
TEL (905)712-5100  
FAX (905)712-5122  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Inorganic Chemistry (Soil)

DATE RECEIVED: 2024-06-14

DATE REPORTED: 2024-06-21

Parameter	Unit	SAMPLE DESCRIPTION:		Sign 7 - SS3		Sign 9 - SS4	
		G / S	RDL	5936289	5936306	Soil	Soil
Sulphate (2:1)	µg/g		2	44		18	
pH (2:1)	pH Units		NA	8.55		8.57	
Electrical Conductivity (2:1)	mS/cm		0.005	0.161		0.169	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard  
5936289-5936306 EC, pH and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).  
Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



*Nvine Basly*

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T162759  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Soil Analysis																
RPT Date: Jun 21, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

**Inorganic Chemistry (Soil)**

Sulphate (2:1)	5936670		86	87	1.2%	< 2	100%	70%	130%	100%	80%	120%	98%	70%	130%
pH (2:1)	5941190		7.76	7.70	0.8%	NA	96%	80%	120%						
Electrical Conductivity (2:1)	5941190		0.203	0.188	7.7%	< 0.005	109%	80%	120%						

Comments: NA signifies Not Applicable.

pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Certified By:






## Method Summary

CLIENT NAME: STANTEC CONSULTING LTD

AGAT WORK ORDER: 24T162759

PROJECT: 165001308.551.102

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE





CLIENT NAME: STANTEC CONSULTING LTD  
300-675 Cochrane Drive  
MARKHAM, ON L3R0B8  
(905) 444-7777

ATTENTION TO: Bahram Siavash  
PROJECT: 165001308.551.102

AGAT WORK ORDER: 24T219442

ROCK ANALYSIS REVIEWED BY: Jewel Shibu, Lab Supervisor

SOIL ANALYSIS REVIEWED BY: Nivine Basily, Inorganic Team Lead

DATE REPORTED: Nov 18, 2024

PAGES (INCLUDING COVER): 7

VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

\*Notes

**Disclaimer:**

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- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
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- The test results reported herewith relate only to the samples as received by the laboratory.
- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.
- This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



## Certificate of Analysis

AGAT WORK ORDER: 24T219442

PROJECT: 165001308.551.102

2910 12TH STREET NE  
CALGARY, ALBERTA  
CANADA T2E 7P7  
TEL (403)735-2005  
FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

(284-137) Sulfide (CGY)

DATE RECEIVED: 2024-11-11

DATE REPORTED: 2024-11-18

SAMPLE DESCRIPTION: SIGN 5 (SS2)

SAMPLE TYPE: Soil

DATE SAMPLED: 2024-11-08  
11:00

Parameter	Unit	G / S	RDL	6308709
Sulfide	%		0.01	<0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6308709 Sulfide is a calculated parameter and is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by \*)

Certified By:

Jewel Shibu



## Certificate of Analysis

AGAT WORK ORDER: 24T219442

PROJECT: 165001308.551.102

2910 12TH STREET NE  
 CALGARY, ALBERTA  
 CANADA T2E 7P7  
 TEL (403)735-2005  
 FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Corrosivity Package

DATE RECEIVED: 2024-11-11

DATE REPORTED: 2024-11-18

SAMPLE DESCRIPTION: SIGN 5 (SS2)

SAMPLE TYPE: Soil

DATE SAMPLED: 2024-11-08  
 11:00

Parameter	Unit	G / S	RDL	6308709
Chloride (2:1)	µg/g		2	6
Sulphate (2:1)	µg/g		2	65
pH (2:1)	pH Units		NA	8.09
Electrical Conductivity (2:1)	mS/cm		0.005	0.209
Resistivity (2:1) (Calculated)	ohm.cm		1	4780
Redox Potential 1	mV		NA	427
Redox Potential 2	mV		NA	425
Redox Potential 3	mV		NA	427

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6308709 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.

Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



*Bahram Siavash*

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T219442  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

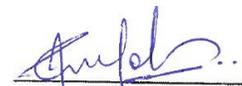
Rock Analysis															
RPT Date: Nov 18, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

(284-137) Sulfide (CGY)

Total Sulfur	6313174	6313174	<0.01	<0.01	NA	< 0.01	101%	80%	120%					
Sulfate	6308709	6308709	0.01	0.01	NA	< 0.01	115%	80%	120%					

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

Certified By:

  
**Jewel Shibu**

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 24T219442  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Soil Analysis																
RPT Date: Nov 18, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	

Corrosivity Package															
Chloride (2:1)	6313174		4	4	NA	< 2	94%	70%	130%	101%	80%	120%	94%	70%	130%
Sulphate (2:1)	6313174		3	3	NA	< 2	96%	70%	130%	106%	80%	120%	99%	70%	130%
pH (2:1)	6308709	6308709	8.09	8.04	0.7%	NA	102%	80%	120%						
Electrical Conductivity (2:1)	6308709	6308709	0.209	0.245	15.9%	< 0.005	101%	80%	120%						
Redox Potential 1	6308709						100%	90%	110%						

Comments: NA signifies Not Applicable.  
 pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Duplicate NA: results are under 5X the RDL and will not be calculated.

### Certified By:






## Method Summary

CLIENT NAME: STANTEC CONSULTING LTD

AGAT WORK ORDER: 24T219442

PROJECT: 165001308.551.102

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE





CLIENT NAME: STANTEC CONSULTING LTD  
300-675 Cochrane Drive  
MARKHAM, ON L3R0B8  
(905) 444-7777

ATTENTION TO: Bahram Siavash

PROJECT: 165001308.551.102

AGAT WORK ORDER: 25T257123

ROCK ANALYSIS REVIEWED BY: Jewel Shibu, Lab Supervisor

SOIL ANALYSIS REVIEWED BY: Chuandi Zhang, Inorganic Supervisor

DATE REPORTED: Mar 13, 2025

PAGES (INCLUDING COVER): 7

VERSION\*: 1

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

\*Notes

Disclaimer:

- All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.
- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
- AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.
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- Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the guidelines contained in this document.
- All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.
- This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



## Certificate of Analysis

AGAT WORK ORDER: 25T257123

PROJECT: 165001308.551.102

2910 12TH STREET NE  
CALGARY, ALBERTA  
CANADA T2E 7P7  
TEL (403)735-2005  
FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

(284-137) Sulfide (CGY)

DATE RECEIVED: 2025-03-11

DATE REPORTED: 2025-03-13

SAMPLE DESCRIPTION: Sign11-SS5

SAMPLE TYPE: Soil

DATE SAMPLED: 2025-03-10  
16:00

Parameter	Unit	G / S	RDL	6574351
Sulfide	%		0.01	0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6574351 Sulfide is a calculated parameter and is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by \*)

Certified By:

Jewel Shibu



## Certificate of Analysis

AGAT WORK ORDER: 25T257123

PROJECT: 165001308.551.102

2910 12TH STREET NE  
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 FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Corrosivity Package

DATE RECEIVED: 2025-03-11

DATE REPORTED: 2025-03-13

SAMPLE DESCRIPTION: Sign11-SS5

SAMPLE TYPE: Soil

DATE SAMPLED: 2025-03-10  
 16:00

Parameter	Unit	G / S	RDL	6574351
Chloride (2:1)	µg/g		2	1490
Sulphate (2:1)	µg/g		2	40
pH (2:1)	pH Units		NA	7.35
Electrical Conductivity (2:1)	mS/cm		0.005	2.39
Resistivity (2:1) (Calculated)	ohm.cm		1	418
Redox Potential 1	mV		NA	363
Redox Potential 2	mV		NA	366
Redox Potential 3	mV		NA	378

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6574351 EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter.

Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results.

Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Dilution required, RDL has been increased accordingly.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 25T257123  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

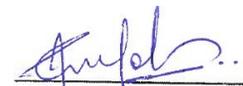
Rock Analysis															
RPT Date: Mar 13, 2025			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

(284-137) Sulfide (CGY)

Total Sulfur	6574351	6574351	0.01	0.01	5.7%	< 0.01	100%	80%	120%					
Sulfate	6519695	6519695	0.05	0.05	0.0%	< 0.01	113%	80%	120%					

 Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

Certified By:

  
**Jewel Shibu**

## Quality Assurance

 CLIENT NAME: STANTEC CONSULTING LTD  
 PROJECT: 165001308.551.102  
 SAMPLING SITE:

 AGAT WORK ORDER: 25T257123  
 ATTENTION TO: Bahram Siavash  
 SAMPLED BY:

Soil Analysis															
RPT Date: Mar 13, 2025			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE	
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Corrosivity Package															
Chloride (2:1)	6574351	6574351	1490	1480	0.7%	< 2	98%	70%	130%	98%	80%	120%	NA	70%	130%
Sulphate (2:1)	6574351	6574351	40	39	2.5%	< 2	100%	70%	130%	94%	80%	120%	90%	70%	130%
pH (2:1)	6574351	6574351	7.35	6.46	12.9%		111%	80%	120%						
Electrical Conductivity (2:1)	6574351	6574351	2.39	2.49	4.1%	< 0.005	99%	80%	120%						
Redox Potential 1	6574351		NA	NA	NA		100%	90%	110%						

Comments: NA signifies Not Applicable.  
 pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.  
 Duplicate NA: results are under 5X the RDL and will not be calculated.  
 Matrix spike: Spike level < native concentration. Matrix spike acceptance limits do not apply.

Certified By:





## Method Summary

CLIENT NAME: STANTEC CONSULTING LTD

AGAT WORK ORDER: 25T257123

PROJECT: 165001308.551.102

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE





**CLIENT NAME: STANTEC CONSULTING LTD**  
**300-675 Cochrane Drive**  
**MARKHAM, ON L3R0B8**  
**(905) 444-7777**

**ATTENTION TO: Bahram Siavash**  
**PROJECT: 165001308.451.102**

**AGAT WORK ORDER: 24T175676**

**ROCK ANALYSIS REVIEWED BY: Jewel Shibu, Lab Supervisor**

**SOIL ANALYSIS REVIEWED BY: Sukhwinder Randhawa, Inorganic Team Lead**

**DATE REPORTED: Jul 26, 2024**

**PAGES (INCLUDING COVER): 7**

**VERSION\*: 1**

Should you require any information regarding this analysis please contact your client services representative at (403) 735-2005

\*Notes

**Disclaimer:**

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- All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.
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- All reportable information is available on request from AGAT Laboratories, in accordance with ISO/IEC 17025:2017, ISO/IEC 17025:2005 (Quebec), DR-12-PALA and/or NELAP Standards.
- This document is signed by an authorized signatory who meets the requirements of the MELCCFP, CALA, CCN and NELAP.
- For environmental samples in the Province of Quebec: The analysis is performed on and results apply to samples as received. A temperature above 6°C upon receipt, as indicated in the Sample Reception Notification (SRN), could indicate the integrity of the samples has been compromised if the delay between sampling and submission to the laboratory could not be minimized.



## Certificate of Analysis

AGAT WORK ORDER: 24T175676

PROJECT: 165001308.451.102

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CANADA T2E 7P7  
TEL (403)735-2005  
FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### (284-137) Sulfide (CGY)

DATE RECEIVED: 2024-07-19

DATE REPORTED: 2024-07-26

		SAMPLE DESCRIPTION:		Sign 6 - ss2	Sign 8 - ss3	Sign 10 - ss4
		SAMPLE TYPE:		Soil	Soil	Soil
		DATE SAMPLED:		2024-07-18 08:00	2024-07-18 08:00	2024-07-18 08:00
Parameter	Unit	G / S	RDL	6014595	6014598	6014599
Sulfide	%		0.01	<0.01	<0.01	0.01

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

6014595-6014599 Sulfide is a calculated parameter and is non-accredited. The parameters that are components of the calculation are accredited.

Analysis performed at AGAT Calgary (unless marked by \*)

Certified By:

Jewel Shibu



## Certificate of Analysis

AGAT WORK ORDER: 24T175676

PROJECT: 165001308.451.102

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 TEL (403)735-2005  
 FAX (403)735-2771  
<http://www.agatlabs.com>

CLIENT NAME: STANTEC CONSULTING LTD

ATTENTION TO: Bahram Siavash

SAMPLING SITE:

SAMPLED BY:

### Corrosivity Package

DATE RECEIVED: 2024-07-19

DATE REPORTED: 2024-07-26

Parameter	Unit	SAMPLE DESCRIPTION:				
		G / S	RDL	Sign 6 - ss2	Sign 8 - ss3	Sign 10 - ss4
				Soil	Soil	Soil
				2024-07-18	2024-07-18	2024-07-18
				08:00	08:00	08:00
				6014595	6014598	6014599
Chloride (2:1)	µg/g	2	380	61	11	
Sulphate (2:1)	µg/g	2	13	9	9	
pH (2:1)	pH Units	NA	8.15	8.29	8.37	
Electrical Conductivity (2:1)	mS/cm	0.005	0.641	0.224	0.145	
Resistivity (2:1) (Calculated)	ohm.cm	1	1560	4460	6900	
Redox Potential 1	mV	NA	321	339	344	
Redox Potential 2	mV	NA	328	356	352	
Redox Potential 3	mV	NA	330	352	351	

**Comments:** RDL - Reported Detection Limit; G / S - Guideline / Standard

**6014595-6014599** EC, pH, Chloride and Sulphate were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil). Resistivity is a calculated parameter. Redox potential measured on as received sample. Due to the potential for rapid change in sample equilibrium chemistry with exposure to oxidative/reduction conditions laboratory results may differ from field measured results. Redox potential measurement in soil is quite variable and non reproducible due in part, to the general heterogeneity of a given soil. It is also related to the introduction of increased oxygen into the sample after extraction. The interpretation of soil redox potential should be considered in terms of its general range rather than as an absolute measurement.

Analysis performed at AGAT Toronto (unless marked by \*)

Certified By:



## Quality Assurance

**CLIENT NAME:** STANTEC CONSULTING LTD  
**PROJECT:** 165001308.451.102  
**SAMPLING SITE:**

**AGAT WORK ORDER:** 24T175676  
**ATTENTION TO:** Bahram Siavash  
**SAMPLED BY:**

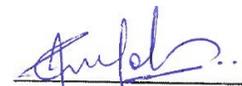
Rock Analysis															
RPT Date: Jul 26, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

**(284-137) Sulfide (CGY)**

Total Sulfur	6013796	6013796	<0.01	0.01	NA	< 0.01	96%	80%	120%					
Sulfate	6013805	6013805	<0.01	<0.01	NA	< 0.01	99%	80%	120%					

Comments: RPDs are calculated using raw analytical data and not the rounded duplicate values reported.  
 Duplicate/ Replicate NA: Results are less than 10X the RDL and RPD will not be calculated

Certified By:

  
**Jewel Shibu**

## Quality Assurance

**CLIENT NAME:** STANTEC CONSULTING LTD  
**PROJECT:** 165001308.451.102  
**SAMPLING SITE:**

**AGAT WORK ORDER:** 24T175676  
**ATTENTION TO:** Bahram Siavash  
**SAMPLED BY:**

### Soil Analysis

RPT Date: Jul 26, 2024			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits			Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper	Lower		Upper	Lower		Upper	

**Corrosivity Package**

Chloride (2:1)	6019767	128	131	2.3%	< 2	93%	70%	130%	99%	80%	120%	91%	70%	130%
Sulphate (2:1)	6019767	69	71	2.9%	< 2	96%	70%	130%	100%	80%	120%	100%	70%	130%
pH (2:1)	6016095	7.01	7.41	5.5%	NA	100%	80%	120%						
Electrical Conductivity (2:1)	6016095	0.115	0.098	16.0%	< 0.005	98%	80%	120%						
Redox Potential 1	6014595				NA	100%	90%	110%						

Comments: NA signifies Not Applicable.  
 pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.

Certified By: \_\_\_\_\_



*B. Siavash*

## Method Summary

**CLIENT NAME: STANTEC CONSULTING LTD**
**AGAT WORK ORDER: 24T175676**
**PROJECT: 165001308.451.102**
**ATTENTION TO: Bahram Siavash**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Soil Analysis</b>			
Chloride (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	modified from SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	modified from EPA 9045D and MCKEAGUE 3.11	PH METER
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Resistivity (2:1) (Calculated)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION
Redox Potential 1	INOR-93-6066	G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 2	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE
Redox Potential 3	INOR-93-6066	ASTM G200-20, SM 2580 B	REDOX POTENTIAL ELECTRODE

