



**Foundation Investigation Report –
Lindsay Drain Culvert –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,
Elgin County, ON
West Region

GWP 3042-22-00

Latitude 42.816367
Longitude -81.248505

Geocres No. 40I14-222

Prepared for:

Ministry of Transportation, Ontario
(MTO), West Region

Prepared by:

Stantec Consulting Ltd.
300W – 675 Cochrane Drive
Markham, ON L3R 0B8

Project No. 165001308

April 02, 2025



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

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Introduction
April 2025

FOUNDATION INVESTIGATION REPORT

For
G.W.P. 3042-22-00
Lindsay Drain Culvert

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, Elgin County, 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 Drain 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 (between Stations 13+100 and 11+100, south side of the existing Highway 3, and between Stations 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.



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Site Description
April 2025

This Foundation Investigation Report has been prepared specifically and solely for the proposed Lindsay Drain Culvert. Other foundations engineering components for this project 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

Lindsay Drain Culvert is planned to cross the Highway 3 Bypass at Station 10+803.222, approximately 850 m east of Highway 4 in Township of Southwold, Elgin County, Ontario. The site location is shown on the Key Plan inset to Drawing No. 1 included in Appendix A.

2.2 GENERAL SITE DESCRIPTION

At the proposed location of the Lindsay Drain culvert, the Highway 3 Bypass is planned to be a twinned freeway, with two lanes (with paved shoulder) in each direction, divided by a grass median. The orientation of the Highway 3 Bypass is approximately east-west and the orientation of the proposed culvert is approximately northwest-southeast. For the purposes of this report, the orientation of the Highway 3 Talbotville Bypass and the Lindsay Drain culvert are taken as east-west and north-south, respectively.

At the culvert site, the eastbound and westbound lanes of the Highway 3 Talbotville Bypass are planned to be constructed on an embankment. The centreline of the eastbound and westbound lanes are planned to be at approximately elevations 240.26 m and 240.37 m, respectively, approximately 4.5 m higher than the deepest portion of the existing watercourse. The embankments are planned to have 2 horizontal : 1 vertical side slope. The top portion of embankment will have a flatter slope - 4 horizontal : 1 vertical (shoulder rounding). The invert of the culvert will be at approximately elevation 235.3 m on the north side and at approximately elevation 235.15 m on the south side. Beyond the culvert and associated drainage features, the overall topography surrounding the culvert site is relatively flat to gently sloping.



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Site Description
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Photo 1 Lindsay Drain Culvert Site (formerly Dodd's Creek) looking south

Flow in the Lindsay Drain Culvert is from north to south. The surrounding lands generally consist of farm fields.

2.3 PROPOSED STRUCTURE

Based on the General arrangement (GA) drawing provided by the structural team, the Lindsay Drain Culvert is planned to consist of two (2) side-by-side precast concrete culverts, with a 60 mm gap, each with a width of 6 m (inner span of 5.4 m), rise of 3.5 m (inner rise of 2.7 m) and an overall length of approximately 109.4 m. The culverts will be at a skew of 51° to the proposed Highway 3 Talbotville Bypass centreline. A concrete header wall is being considered on the north end of the west culvert and precast concrete block retaining walls are planned at the northwest and southeast corners of the culverts.

Both culverts are planned to be filled with up to 800 mm thick layer of waterbody aggregates (substrate), WB-200 with Granular B to fill the voids.

The GA Drawing is included in Appendix A for reference.



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Review of Previous Investigations
April 2025

2.4 GEOLOGICAL INFORMATION

The project alignment is situated 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 is estimated to be at a depth of approximately 85 m below grade at the location of Lindsay Drain Culvert.

2.5 EXISTING UTILITIES

No existing above-ground or underground utilities have been identified at the proposed Lindsay Drain Culvert site location.

3.0 REVIEW OF PREVIOUS INVESTIGATIONS

A review of MTO GEOCREs database did not identify any reports for the Lindsay Drain Culvert site. However, the following reports included subsurface information for structures in proximity to the planned culvert:

GEOCREs 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 proposed Lindsay Drain Culvert. 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

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.



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Review of Previous Investigations

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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.

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 that is located approximately 1 km east of the proposed Lindsay Drain Culvert.

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 for 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, from greater than 240 kPa at approximate elevation 237.8 m to about 190 kPa at approximate elevation 213.4 m. The deposit appeared to be highly over-consolidated due to desiccation.

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, stratigraphy along the culvert, borehole records and laboratory test results are included in Appendix B.



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Investigation Procedures
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4.0 INVESTIGATION PROCEDURES

4.1 FIELD INVESTIGATION

The foundation investigation for the detail design of the proposed Lindsay Drain Culvert consisted of a total of three (3) boreholes, designated as Boreholes DCC1, DCC2 and DCC33. All three (3) boreholes were advanced on the east bank of the Lindsay Creek (formerly identified as Dodd's Creek) across the proposed bypass alignment due to the drill rig accessibility issue on the west side of the creek (steep slope and heavy vegetation in the wider floodplain). The locations of these boreholes are shown on the Borehole Locations and Soil Strata Plan, Drawing No.1, in Appendix A.

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

The boreholes were advanced using D50 track-mounted drill rigs equipped for soil sampling between the dates of January 10 and February 27, 2024. The boreholes were advanced using continuous flight hollow stem augers.

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 1.5 m interval to a depth of 20 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.

Following completion of drilling, a 50-millimeter (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 were taken in borehole DCC2 on March 20, March 27 and May 9, 2024.

Groundwater was also observed in open boreholes during and upon completion of drilling.

After completion of drilling, boreholes 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 R12i GPS with an elevation and spatial accuracy of ± 0.02 m vertically and ± 0.01 m horizontally 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.



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Subsurface Conditions
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Table 4.1 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				
DCC1	4742624.0	407117.6	237.3	15.9	221.4	15
DCC2	4742609.0	407154.4	237.4	15.9	221.5	15
DCC3	4742591.0	407191.9	237.3	15.9	221.4	14

4.3 LABORATORY TESTING

All samples were taken to Stantec's Markham laboratories 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 4.2. One soil sample was forwarded to AGAT Laboratories. The sample was tested for pH, soluble sulphate content, chloride content, electrical conductivity, resistivity, and redox potential.

Table 4.2: Laboratory Testing Program

Laboratory Test Type	Number of Tests
Moisture Content	47
Gradation Analysis	10
Atterberg Limits	10
Chemical Analysis	1

Samples remaining after testing will be placed in storage for a period of one year after issuance 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 D4 contained in Appendix D.

A borehole location plan and a stratigraphic section of the soils encountered in the boreholes along the culvert alignment are provided on Drawing No.1 in Appendix A.



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Subsurface Conditions

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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.

In general, the subsurface stratigraphy encountered in the boreholes consisted of:

- Ground surface cover (grass and topsoil); underlain by,
- Fill comprising clayey silt to the depths of approximately 0.9 m and 1.0 m below grade in boreholes DCC1 and DCC2 respectively; underlain by,
- Firm silty clay and clay to a depth of approximately 1.4 m below grade in boreholes DCC1 and DCC3, respectively; underlain by,
- Very stiff to hard clayey silt till.

More detailed descriptions of the subsurface conditions encountered in the boreholes are provided in the following sections.

5.2 OVERBURDEN

5.2.1 Ground Surface Cover

Grass underlain by topsoil was encountered at all three (3) borehole locations. The topsoil was approximately 180 mm, 200 mm and 150 mm thick in Borehole DCC1, DCC2 and DCC3, respectively.

5.2.2 Fill (Clayey Silt)

Fill materials comprising brown to black clayey silt were encountered below the topsoil in Boreholes DCC1 and DCC2. Samples obtained from the fill materials typically contained trace to some sand. Trace rootlets and a silty sand layer were noted in the samples obtained from the fill in Borehole DCC2. These materials were described as fill based on the soil texture as examined in the field (previously disturbed, possibly tilled soil due to farming) and presence of rootlets and topsoil inclusions.

The fill materials were 0.7 m and 0.8 m thick and extended to the depths of approximately 0.9 m and 1.0 m, corresponding to approximately elevations 236.5 m and 236.4 m in Boreholes DCC1 and DCC2, respectively.

N-values of 7, 8 and 9 blows per 0.3 m penetration were obtained from the SPTs advanced in the fill materials, indicating firm to stiff consistency.

Samples obtained from the fill materials were described as moist based on manual examination of the samples in the field. Laboratory tests conducted on samples of the fill yielded natural moisture contents ranging from approximately 16% to 26%, averaging 23%.



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5.2.3 Silty Clay and Clay

Layers of brown silty clay and clay were encountered below the fill materials in Boreholes DCC1 and DCC3, respectively. Samples obtained from the silty clay and clay layers typically contained trace sand and gravel.

The silty clay and clay layers were approximately 0.5 m to 1.3 m thick and extended to a depth of approximately 1.4 m below grade, corresponding to approximate elevation 235.9 m.

N-values of 4 to 7 blows per 0.3 m penetration were obtained from the SPTs advanced in the silty clay and clay soils. Undrained shear strengths of approximately 63 kPa and 125 kPa were estimated for the silty clay and clay, respectively based on the results of pocket penetrometer tests. Based on the results of SPT and pocket penetrometer tests, the silty clay and clay soils are described as firm to stiff.

Laboratory tests conducted on samples of the silty clay and clay soils yielded natural moisture contents of approximately 22%, 22% and 28%.

Gradation analyses were carried out on a single sample of the clay soils obtained from Borehole DCC3. The test results are illustrated on the borehole record in Appendix C and on the gradation curve on Figure No. D1 in Appendix D. The tests yielded the following results:

- Gravel: 0%
- Sand: 15%
- Silt: 43%
- Clay: 42%

Atterberg Limits tests were conducted on the sample referenced above. The tests yielded a Liquid Limit of 54% and a Plastic Limit of 32%, corresponding to a Plasticity Index of 22%. The test results are illustrated on the borehole records in Appendix C and on the gradation curve on Figure No. D2 in Appendix D.

Based on the results of the laboratory tests, the sample tested can be classified as clay with a group symbol of CH based on the Unified Soil Classification System (USCS).

5.2.4 Clayey Silt Till

A deposit of clayey silt till was encountered below the soils described in the preceding sections in all three (3) boreholes. Samples obtained from the clayey silt till deposit typically contained some sand and trace gravel. Presence of cobbles and/or boulder was inferred in this deposit based on rock fragments in the samples. A sand seam was noted in a sample of the clayey silt deposit obtained from Borehole DCC3.

All three (3) boreholes were terminated in the clayey silt till deposit after penetrating approximately 14.5 m, 14.9 m and 14.5 m into the deposit.

N-values ranging from 13 to 84 blows per 0.3 m penetration were obtained from the SPTs advanced in the clayey silt layer. If the single N-value of 84 is disregarded, the remaining N-values ranged from 13 to



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Subsurface Conditions
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45. Undrained shear strengths ranging from approximately 163 kPa to more than 220 kPa were estimated for the clayey silt till based on the results of pocket penetrometer tests. In this respect, the clayey silt till layer can be described as very stiff to hard.

Laboratory tests conducted on samples of the clayey silt layer yielded natural moisture contents ranging from approximately 6% to 18%, averaging 13%.

Gradation analyses were carried out on nine (9) representative samples of the clayey silt till soils. The test results are illustrated on the borehole records in Appendix C and on the gradation curve on Figure No. D3 in Appendix D. The tests yielded the following results:

- Gravel: 0% to 8%
- Sand: 8% to 15%
- Silt: 44% to 71%
- Clay: 19% to 44%

Atterberg Limits tests were also conducted on the samples referenced above. The tests yielded Liquid Limits ranging from approximately 20% to 34%, Plastic Limits ranging from approximately 13% to 19%, and corresponding Plasticity Indices ranging from approximately 7% to 19%. The test results are illustrated on the borehole records in Appendix C and on the gradation curve on Figure No. D4 in Appendix D.

Based on the results of the laboratory tests, the samples tested can be classified as clayey silt with a group symbol of CL-ML and CL based on the Unified Soil Classification System (USCS).

5.3 BEDROCK

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

5.4 GROUNDWATER CONDITIONS

A monitoring well was installed in Borehole DCC2 to observe the long-term groundwater levels. In other boreholes, groundwater level observations were made during drilling operations, and in the open boreholes upon completion of drilling. Cave-in depths were also recorded. The groundwater level recorded in DCC2 and inferred in the other boreholes are summarized in Table 5.1 below.

Table 5.1: Measured and Inferred Groundwater Levels

Borehole No	Date	Groundwater Level (m)		Remark
		Depth	Elevation	
DCC1	Upon completion	Dry	Dry	Borehole Open
DCC2	March 20, 2024	5.5	231.9	-
	March 27, 2024	5.0	232.4	-
	May 9, 2024	2.1	235.3	-
DCC3	Upon completion	Dry	Dry	Cave-in at 14.9 m



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Groundwater levels at the site will be subject to fluctuations due to seasonal changes, snowmelt, precipitation events and water level in Lindsay Drain. 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

A single soil sample was forwarded to AGAT Laboratories to be tested for pH, soluble sulphate content, chloride content, electrical conductivity, resistivity, and redox potential. The results of the tests are summarized in the table below and included in Appendix D for reference.

Table 5.2: Results of Chemical Analysis

Borehole No	Sample No.	Depth (m)	pH	Chloride (µg/g)	Sulphate (µg/g)	Resistivity (Ohm-cm)
DCC2	SS3	1.5 – 2.1	8.40	17	24	5430



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Miscellaneous
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6.0 MISCELLANEOUS

The field work was carried out under the supervision of Mr. Kirby Lales, EIT and Mr. 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 London Soil Ltd. based in 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 Roshan Rashed, M.Sc., P.Eng., and reviewed by Gwangha Roh, P. Eng., Ph.D., and Raymond Haché, M.Sc., P.Eng., Designated Principal MTO Foundation Contact.



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Closure
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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.



Roshan Rashed, M.Sc., 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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3022e0014\project\geotechnical_investigation_reports\lindsay_creek\final\165001308_talbotville_fir_lindsay_creek_culvert_20250402.docx



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

April 2025

APPENDIX A

A.1 DRAWING NO. 1 – BOREHOLE LOCATION PLAN AND SOIL STRATA PLOT

A.2 GENERAL ARRANGEMENT DRAWING



MINISTRY OF TRANSPORTATION, ONTARIO
PR-D-707
BB-05
DRAWING NAME: 165001308_Lindsay Drain_PP_250401.dwg
CREATED BY: GBB
MODIFIED: C:\Users\gbriones\AppData\Local\temp\AcPublish_24204\165001308_Lindsay Drain_PP_250401.dwg (1)
Printed: Apr 01, 2025

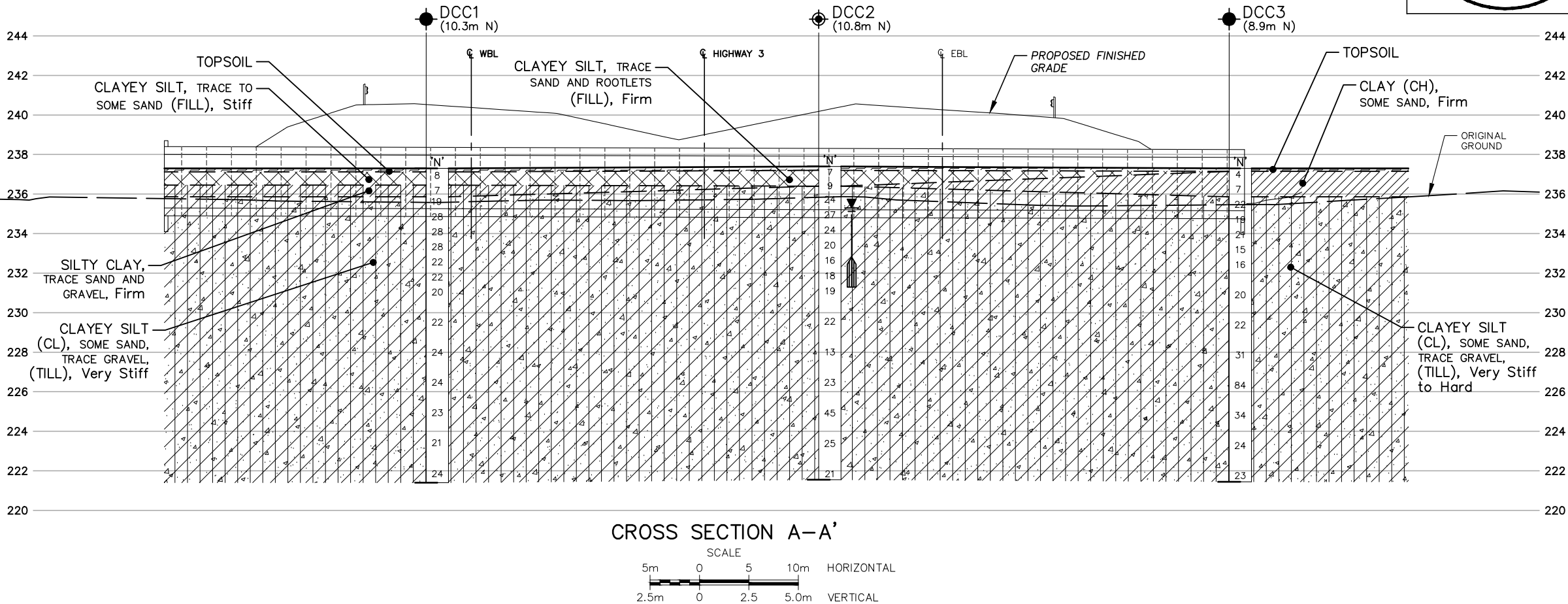
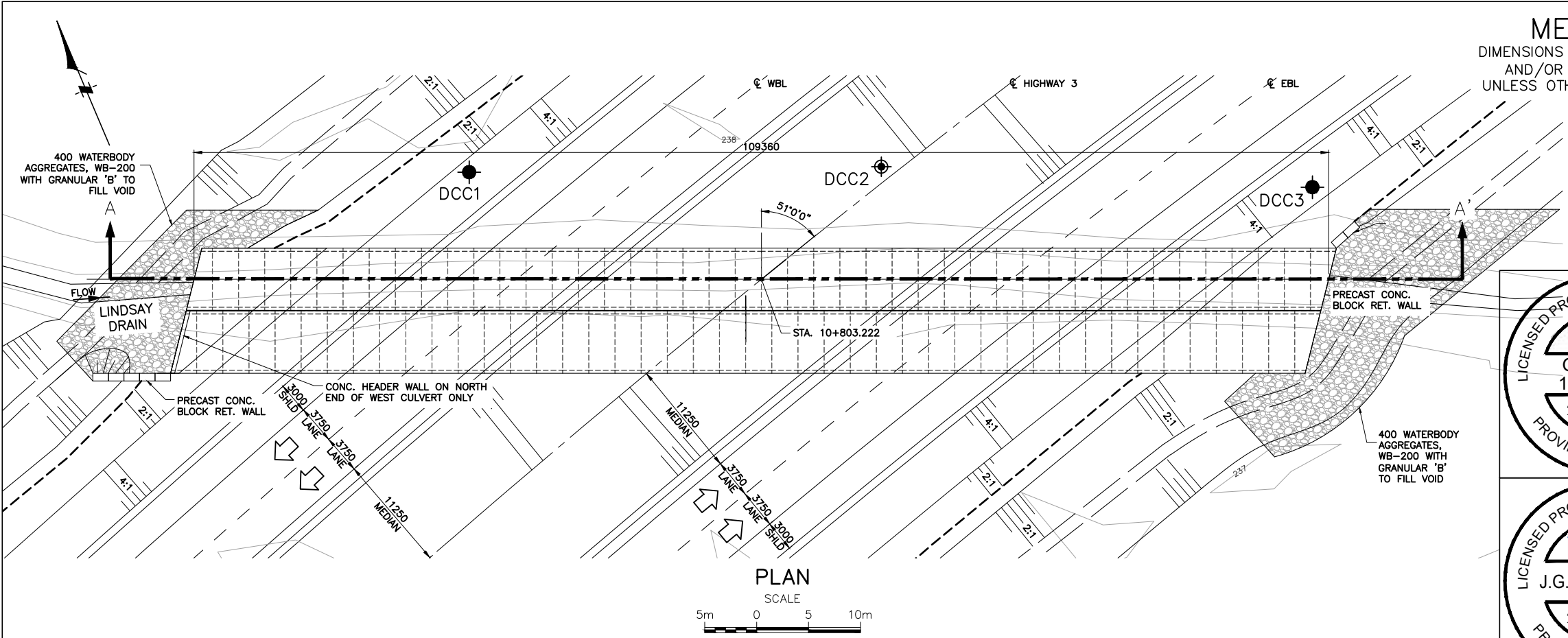


PLATE No
CONT
WP 3041-22-00

SHEET
—

Stantec

KEY PLAN
800m 0 800 1600m

LEGEND

- Borehole (Stantec, 2024)
- Monitoring Well (Stantec, 2024)
- (x.x m) Offset from Hwy 3 Centreline
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- WL Measured on May 2024
- Piezometer

NOTES

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

This drawing is for subsurface information only. Surface details and features are for conceptual illustration.

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.

No	ELEV	MTM ZONE 11 NORTH	COORDINATES EAST
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

DATE	BY	DESCRIPTION

GEORES No 40114-222

HWY No 3	SUBM'D RR	CHECKED	DATE 2025-04-01	SITE 05X-0374/CO

DWG 1



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

HWY 3
CONT
GWP 3042-22-00



LINDSAY DRAIN CULVERTS

SHEET

PRELIMINARY
GENERAL ARRANGEMENT



GENERAL NOTES

1. SPECIFIED 28-DAY CONCRETE COMPRESSIVE STRENGTH:

PRE-CAST CONCRETE 45 MPa
MASS CONCRETE 20 MPa
REMAINDER 30 MPa

2. CLEAR COVER TO REINFORCING STEEL:

ALL 50±10

3. REINFORCING STEEL:

REINFORCING STEEL SHALL BE GRADE 500W UNLESS OTHERWISE SPECIFIED.

TENSION LAP LENGTHS NOT INDICATED ON THE CONTRACT DRAWINGS SHALL BE CLASS B.

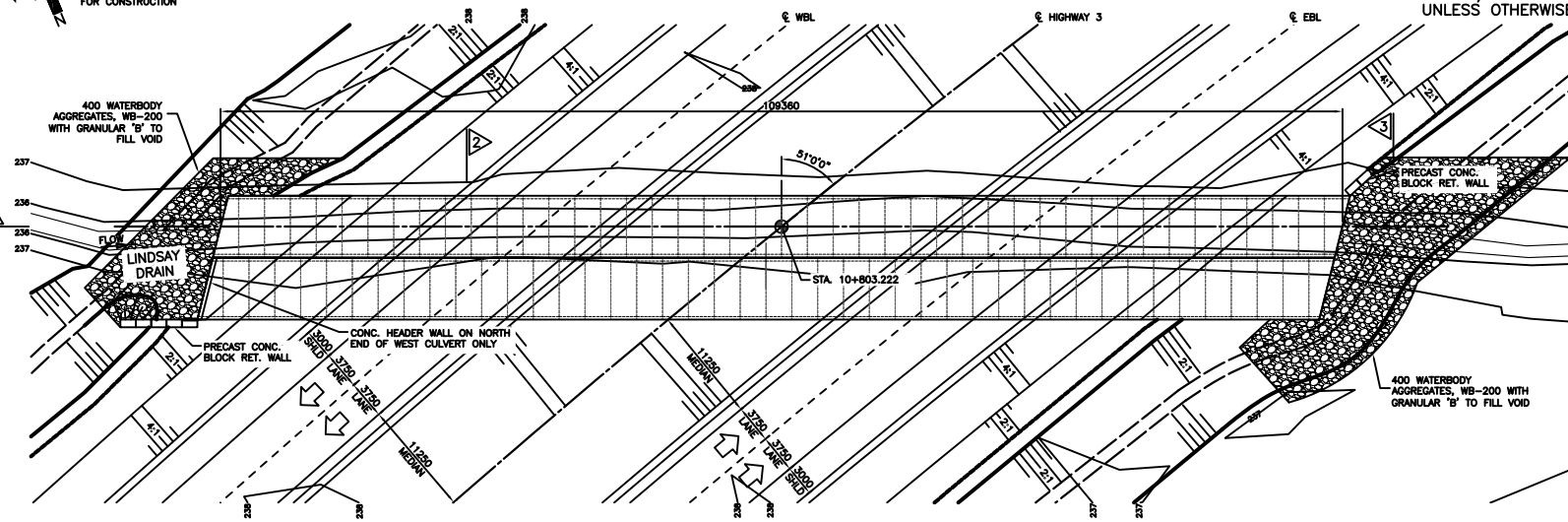
BAR HOOKS SHALL HAVE STANDARD HOOK DIMENSIONS USING MINIMUM BEND DIAMETERS. WHILE STIRRUPS AND TIES SHALL HAVE MINIMUM HOOK DIMENSIONS. ALL HOOKS SHALL BE IN ACCORDANCE WITH THE STRUCTURAL STANDARD DRAWING SS112-1, UNLESS INDICATED OTHERWISE.

CONSTRUCTION NOTES

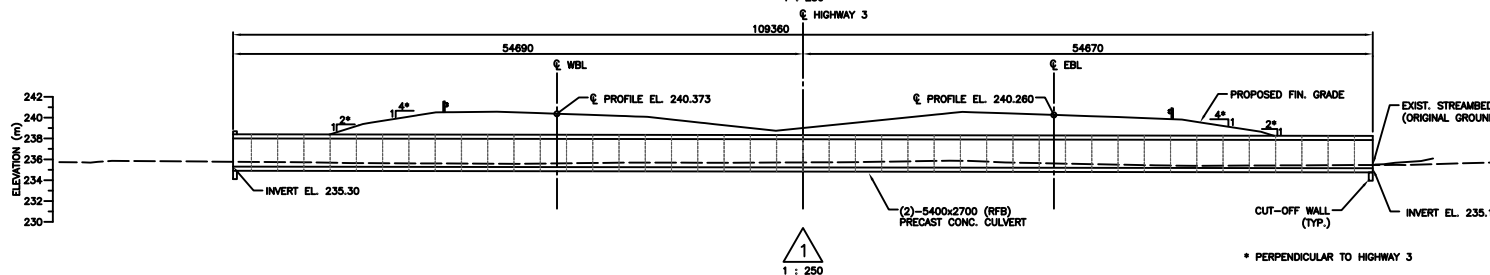
- BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH CONCRETE WALLS KEEPING THE HEIGHT OF THE BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 500mm.
- THE CONTRACTOR SHALL ISOLATE WORK AREAS FROM THE WATERCOURSE FLOW FOR CULVERT INSTALLATION AS REQUIRED TO COMPLETE ALL WORK IN THE DRY.

LIST OF DRAWINGS:

- GENERAL ARRANGEMENT
- BOREHOLE LOCATION AND SOIL STRATA
- CULVERT DETAILS I
- CULVERT DETAILS II
- EXCAVATION AND BACKFILL
- MISCELLANEOUS DETAILS

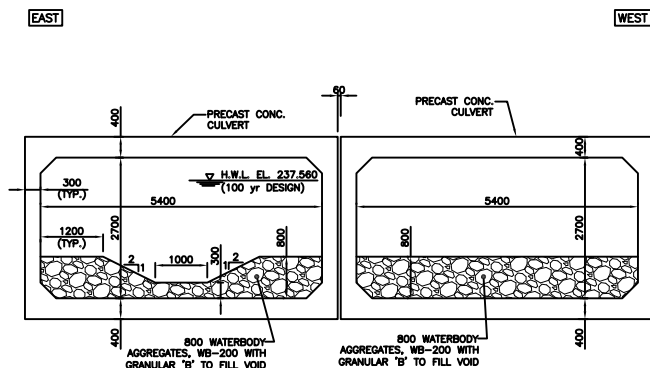


PLAN
1 : 250

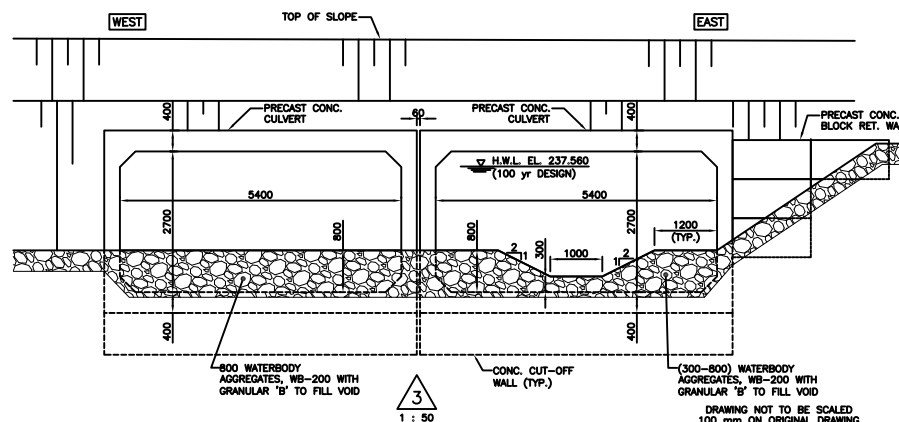


1 : 250

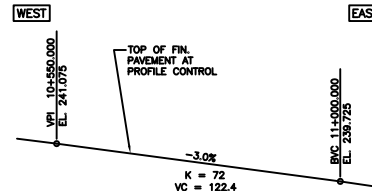
* PERPENDICULAR TO HIGHWAY 3



2
1 : 50



3
1 : 50



PROFILE OF HIGHWAY 3 (BYPASS)
N.T.S.

REVISIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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**FOUNDATION INVESTIGATION REPORT – LINDSAY DRAIN CULVERT –HIGHWAY 4 WIDENING
FROM CLINTON LINE TO NEW TALBOTVILLE BYPASS AND NEW TALBOTVILLE BYPASS FROM
HIGHWAY 4 TO HIGHWAY 3 AT RON MCNEIL LINE**

April 2025

APPENDIX B

B.1 AVAILABLE GEOCRETS INFORMATION



61-20 SEP 1976

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

FOUNDATIONS OFFICE

JOB 73-11019

LOCATION Co-ords. 15,558,786 N; 1,336,588 E.

ORIGINAL ED 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.

20
15 ϕ 5 % STRAIN AT FAILURE
10

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 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P — W — W_L	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT					
777.0	Ground Level									
0.0			1	SS	21	770				1 15 58 2
	Brown Grey		2	SS	26					
	Clayey silt, some sand, trace of gravel. Very stiff		3	SS	26	760				
			4	SS	26					
			5	SS	29	750				4 11 49 36
745.5			6	SS	26					
31.5	End of Borehole					740				
	NOTE: Groundwater level not established									

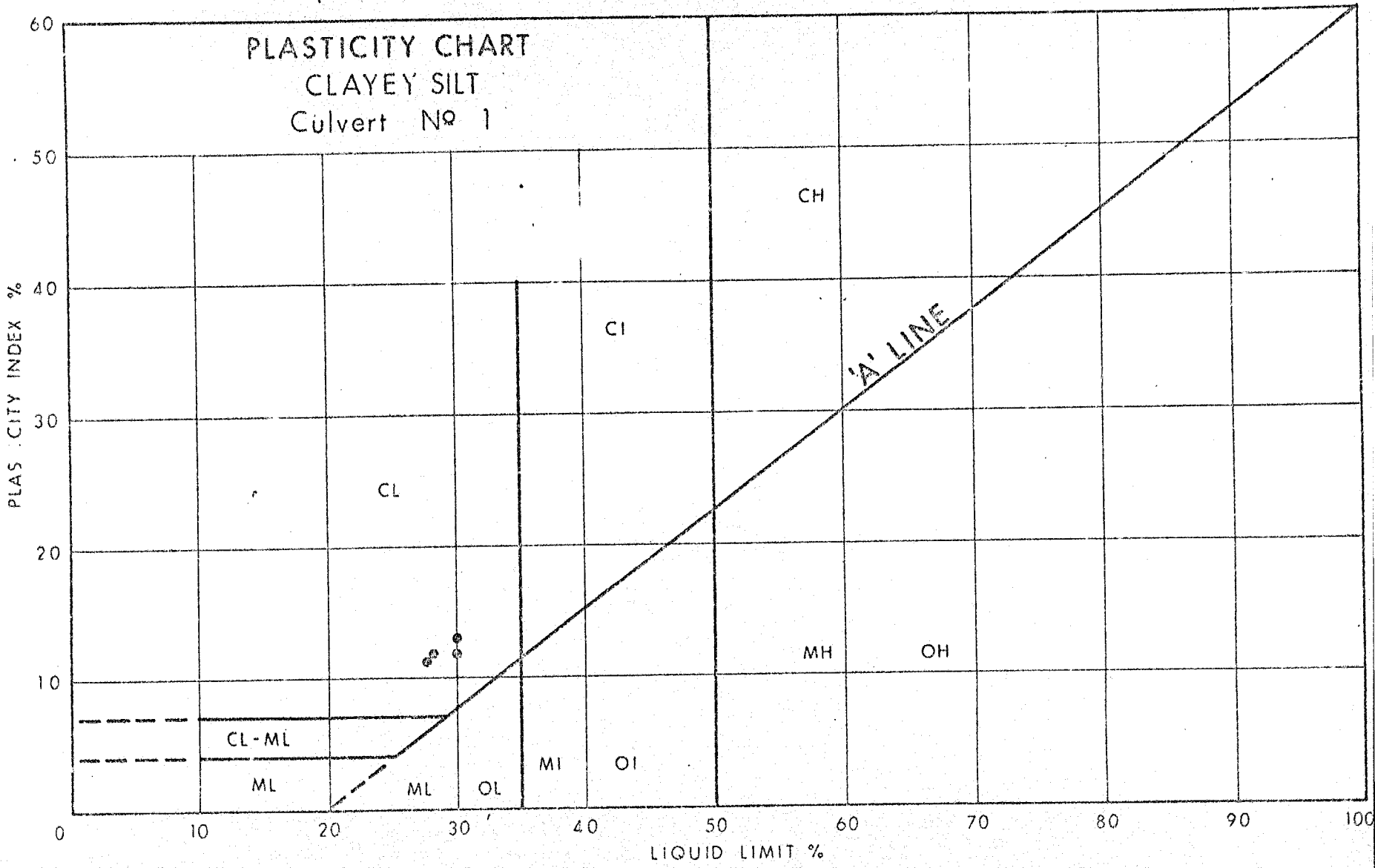
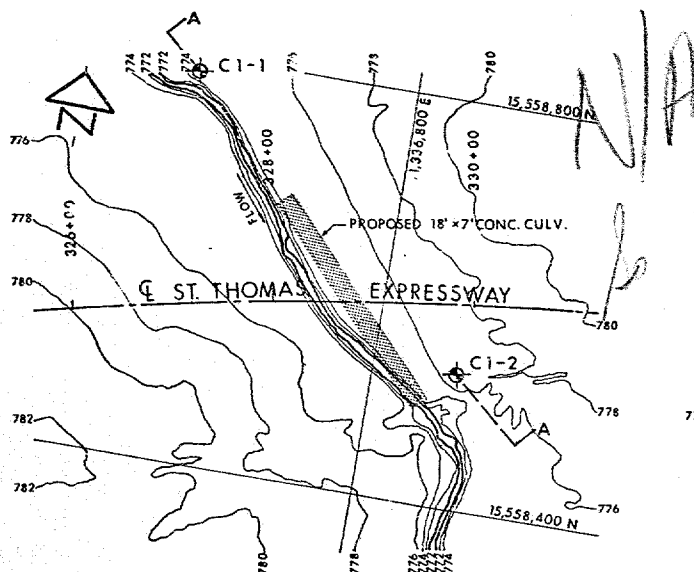
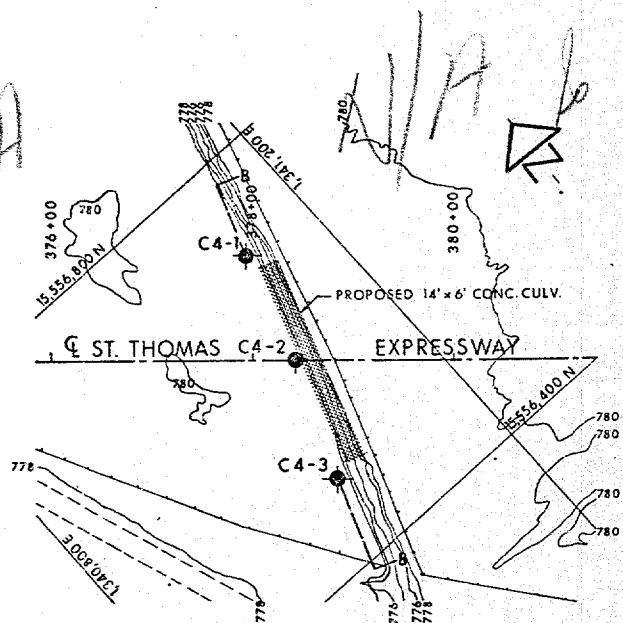


FIG. 1

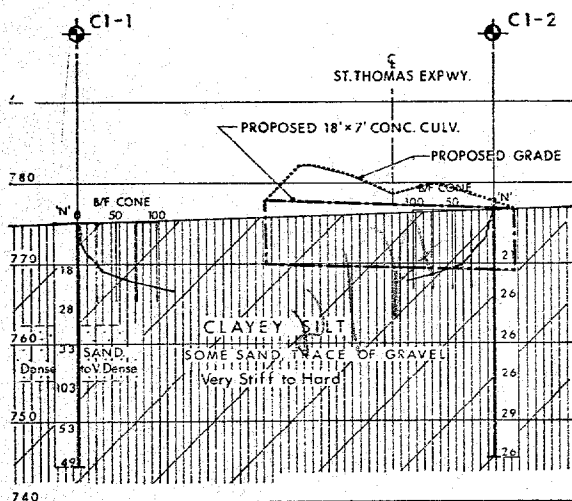


CULVERT NO.1

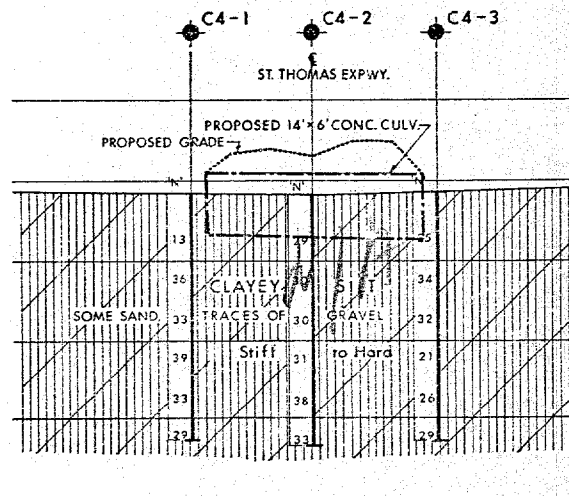


CULVERT NO.4

PLANS

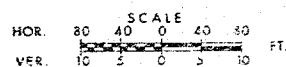


CULVERT NO.1
A-A



CULVERT NO.4
B-B

SECTIONS



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_L PLASTIC LIMIT ——— w_P WATER CONTENT ——— w			BULK DENSITY γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					WATER CONTENT %				
							20	40	60	80	100	w_o	w	w_L		
SHEAR STRENGTH PS F																
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
788.1	Ground level.						2000	4000				10	20	30	P.C.F.	GR.SA.SI.CL.
0.0	Clayey silt, some sand, trace of gravel. Very stiff to hard.		1	SS	29											
			2	TW	PH	780									134	1 13 49 3
			3	SS	27											
			4	SS	70/6"	770										
			5	SS	34											
			6	TW	PH	760									140	
			7	SS	34											
			8	TW	PH	750									142	
			9	SS	40											
			10	TW	PH	740									136.5	
			11	SS	22											
						730										
			12	TW	PH										133	3 9 43 45
						720										
			13	SS	29											
					710											
		14	TW	PH										131		
					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 γ P.C.F. GR. SA. SI. CL.	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.		1	SS	25										
			2	TW	PH	780								134.5	
	Very stiff to hard.		3	SS	20										
			4	TW	PH	770								138	3 7 53 37
			5	SS	41										
			6	SS	65/6	760									
			7	TW	PH									140	755.5
748.0			8	SS	53	750									
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			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	PLASTIC LIMIT	WATER CONTENT	WATER CONTENT %		
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	93/6"										
			6	SS	67										
			7	TW	PH										
			8	SS	65										
740.5	End of borehole.		9	SS	67										
46.5															

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

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w			BULK DENSITY γ	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	20	40	60	80	100	WATER CONTENT % 10 20 30				
787.9	Ground level.						SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								P.C.F.	GR. SA. SI. CL.
	Clayey silt, some sand, trace of gravel.		1	SS	17											
			2	SS	27											
			3	SS	35	780										
			4	SS	27											
			5	SS	25											
	Very stiff to hard.		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

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT --- w _L PLASTIC LIMIT --- w _p WATER CONTENT --- w			BULK DENSITY γ	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w _p	w	w _L		
788.3	Ground level.														
0.0															
	Clayey silt, some	1	SS	16											
	sand, trace of	2	TW	PH	780									136	
	gravel.	3	SS	17											
		4	TW	PH											
	Very stiff to	5	SS	55	770									135	
	hard.	6	TW	PH											
		7	SS	55	760									139	
		8	TW	PH											
		9	SS	40	750									140	2 13 51 34
		10	TW	PH											
		11	SS	69	740										
		12	TW	PH	730									133	
		13	SS	34	720										▼ 723.3
		14	SS	50	710										
706.8					700										
81.5	End of borehole.														0 9 41 50

FOUNDATION SECTION

ORIGINATED BY P.P.

COMPILED BY H.S.

CHECKED BY

20
10-5 % STRAIN AT FAILURE
10

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 BLOWS / FOOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	20	40	60	80	100	10	20		
787.8	Ground level.														
0.0			1	SS	12										
	Clayey silt, some sand, trace of gravel.		2	SS	34										
			3	SS	31	780									
			4	SS	31										
			5	SS	31										
			6	SS	29										
	Stiff to hard.		7	SS	35	770									
			8	SS	28										
			9	SS	34	760									
			10	SS	25										
748.8			11	SS	27	750									
39.0	End of borehole.														
						740									

End of cone test.

2 14 51 33

752.8

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.8

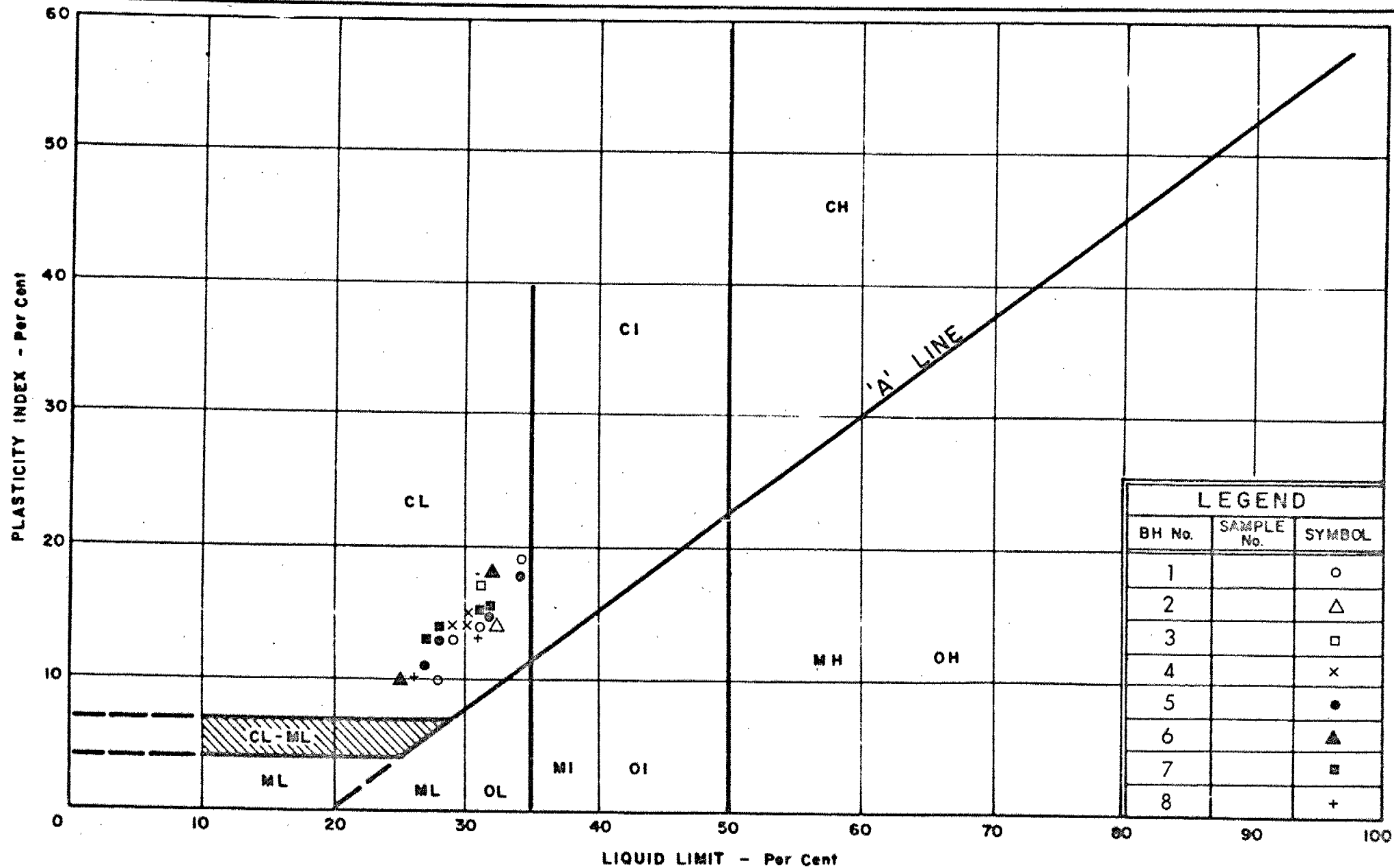
FOUNDATION SECTION

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

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					w _p w _L w				
							20	40	60	80	100	WATER CONTENT %				
							SHEAR STRENGTH P.S.F.									
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE									
							2000 4000					10 20 30				
788.0	Ground level.															
0.0			1	SS	13											
	Clayey silt, some sand, trace of gravel.		2	TS	PH	780										
			3	SS	26											
	Stiff to hard.		4	TS	PH	770										
			5	SS	36											
			6	TS	PH	760								139	3 14 53 30	
			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

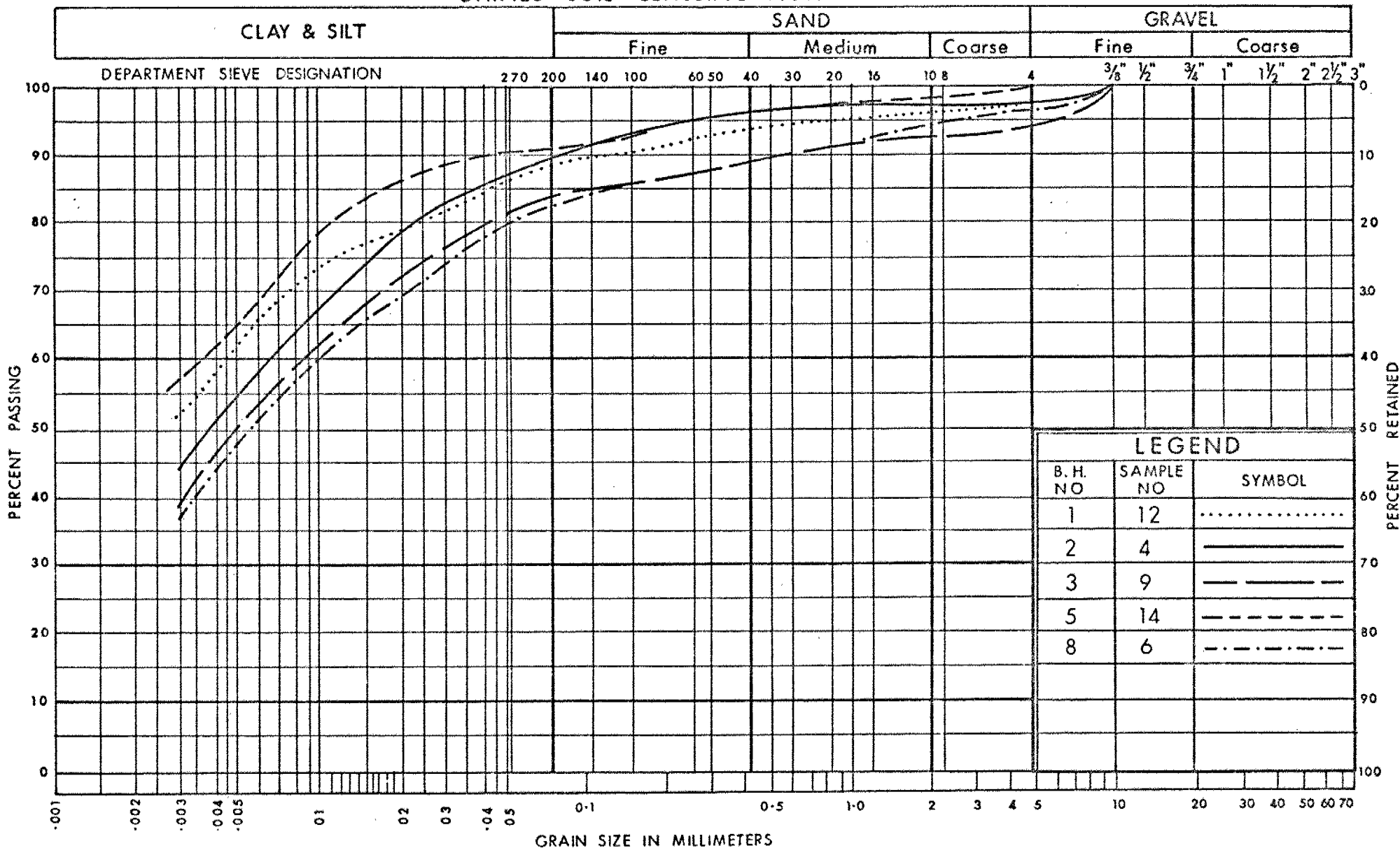
PLASTICITY CHART CLAYEY SILT, SOME SAND, TRACE OF GRAVEL

WP No. 89-69-05 & 06

JOB No. 71-11068

FIG No 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS



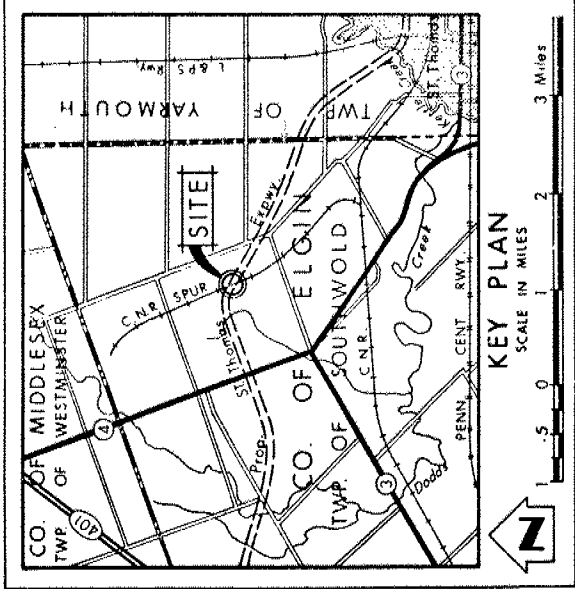
DESIGN SERVICES
BRANCH





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		DESCRIPTION
DATE	BY	

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

C. N. R. SPUR LINE

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

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

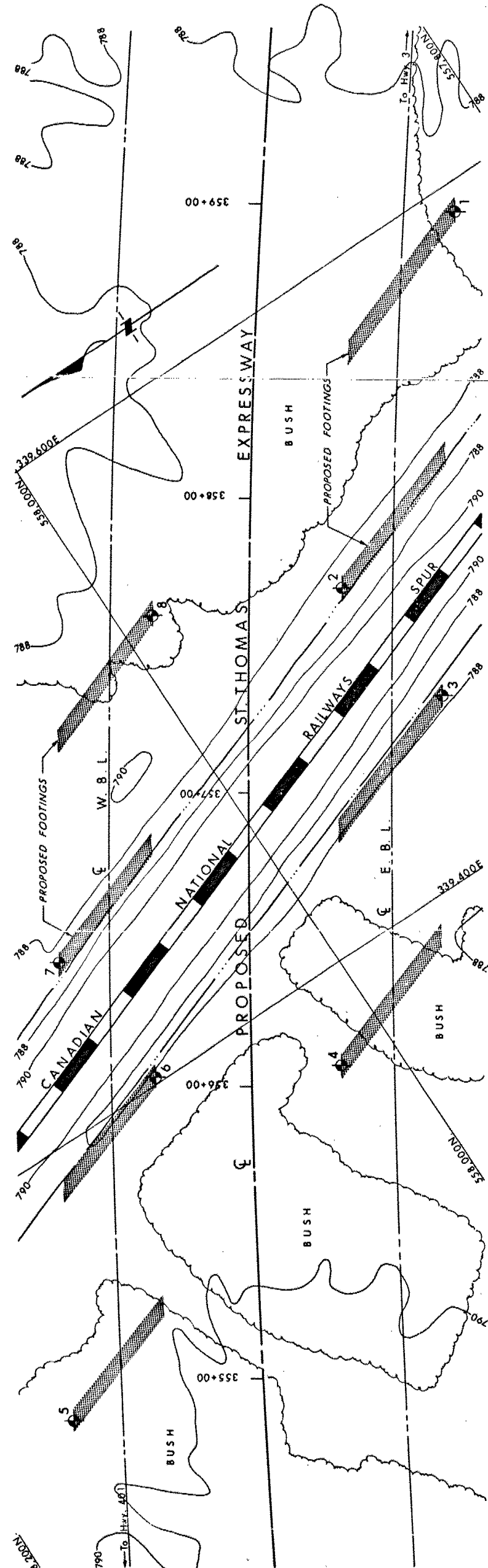
BORE HOLE LOCATIONS & SOIL STRATA

SUBNO. P.P. CHECKED W.P. NO. 89-69-05.06 DRAWING NO.

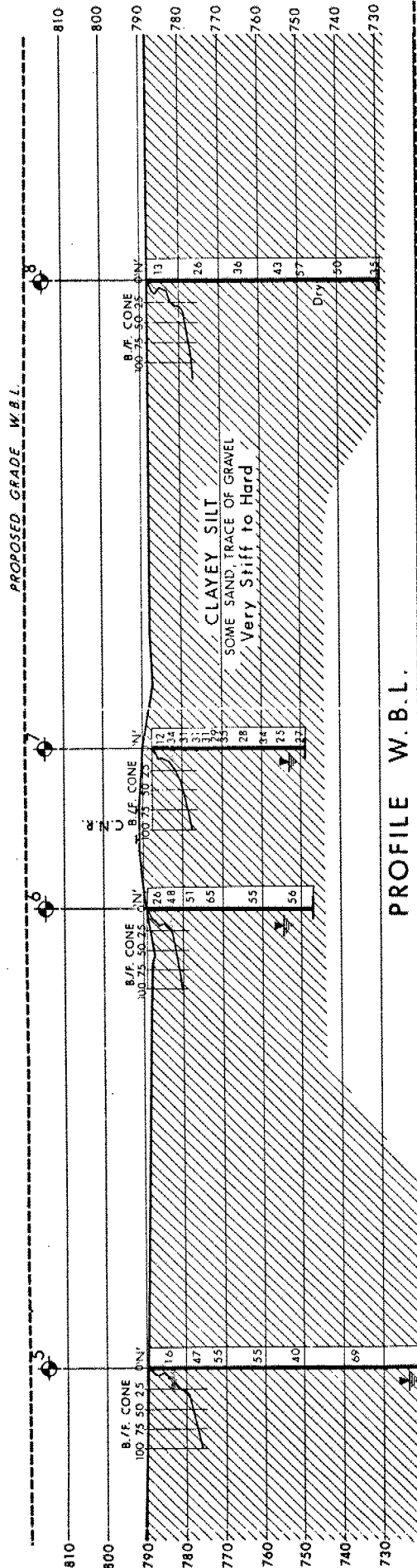
DRAWN BY CHECKED JOB NO. 71-110.68 71-11068A

DATE AUG. 31, 1971 SITE NO. BRIDGE DRAWING NO.

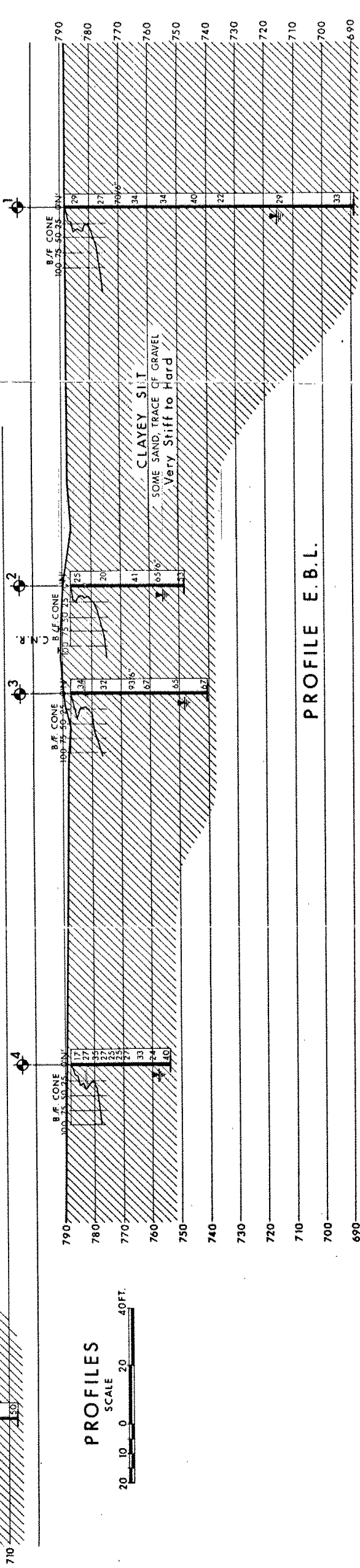
APPROVED BY CONT. NO.



PLAN
SCALE 0 20 40 FT.



PROFILE W.B.L.



PROFILE E.B.L.

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 11

JOB 71-11068

LOCATION Co-ords. 558,021 N; 339,473 E.

ORIGINATED BY LJH

W.P. 89-69-05/06

BORING DATE Nov. 7, 1973

COMPILED BY LJH

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT — w_p	WATER CONTENT — w		
						SHEAR STRENGTH P.S.F.		w_p — w — w_L				
						○ UNCONFINED + FIELD VANE						
						● QUICK TRIAXIAL × LAB VANE						
						WATER CONTENT %						
787.5	Ground Level											
0.0	Clayey silt, some sand, trace of gravel		1	SS	20							
	Very Stiff		2	SS	19							
	Hard		3	SS	26							
771.0			4	SS	35							
16.5	End of Borehole											

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 12

JOB 71-11068

LOCATION Co-ords. 558,098 N; 339,398 E.

ORIGINATED BY L.J.H.

W.P. 89-69-05/06

BORING DATE Nov. 8, 1973

COMPILED BY L.J.H.

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		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT %			
788.2	Ground Level											
0.0	Clayey silt, some sand traces of gravel. Very Stiff to Hard		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

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 13

JOB 71-11068

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

ORIGINATED BY LJH

W.P. 89-69-05/06

BORING DATE Nov. 7, 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		BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT %			
789.0	Ground Level											
0.0	Clayey silt, some sand, traces of gravel.		1	SS	11							
			2	SS	10							
	Stiff to Hard		3	SS	30	780						
772.5			4	SS	38							
16.5	End of Borehole					770						

OFFICE REPORT SOIL EXPLORATION

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			BULK DENSITY γ P.C.F. GR. SA. SI. CL.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL X LAB VANE				WATER CONTENT % W_P — W — W_L					
789.4	Ground Level															
0.0	Clayey silt, some sand, traces of gravel.		1	SS	9	780										
			2	SS	23											
	Very Stiff to Hard		3	SS	30											
772.9			4	SS	52											
16.5	End of Borehole					770										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 15

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 LJH

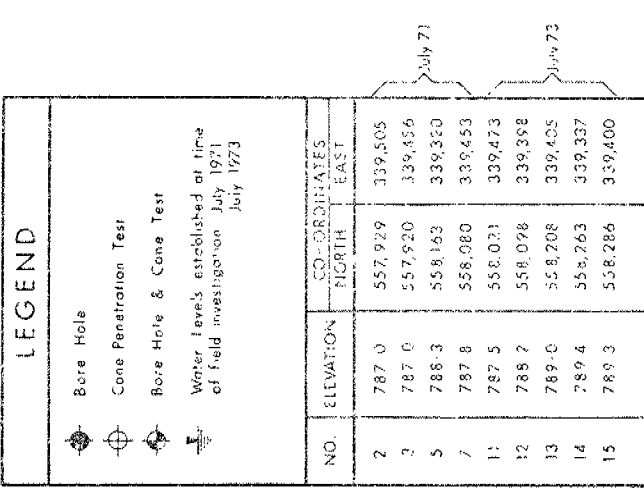
DATUM Geodetic

BOREHOLE TYPE Cont. 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	20	40	60	80	100	PLASTIC LIMIT W_P	WATER CONTENT W		
789.3	Ground Level															
0.0	Clayey silt, some sand, traces of gravel.		1	SS	16											
			2	SS	45											
			3	SS	24											
	Very Stiff to Hard		4	SS	27											
772.8			5	SS	54											
16.5	End of Borehole															

OFFICE REPORT SOIL EXPLORATION



NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
2	787.0	557,929	339,505
3	787.0	557,920	339,456
5	786.3	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	554,208	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.

[illegible]

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

C.N.R. SPUR LINE OVERPASS

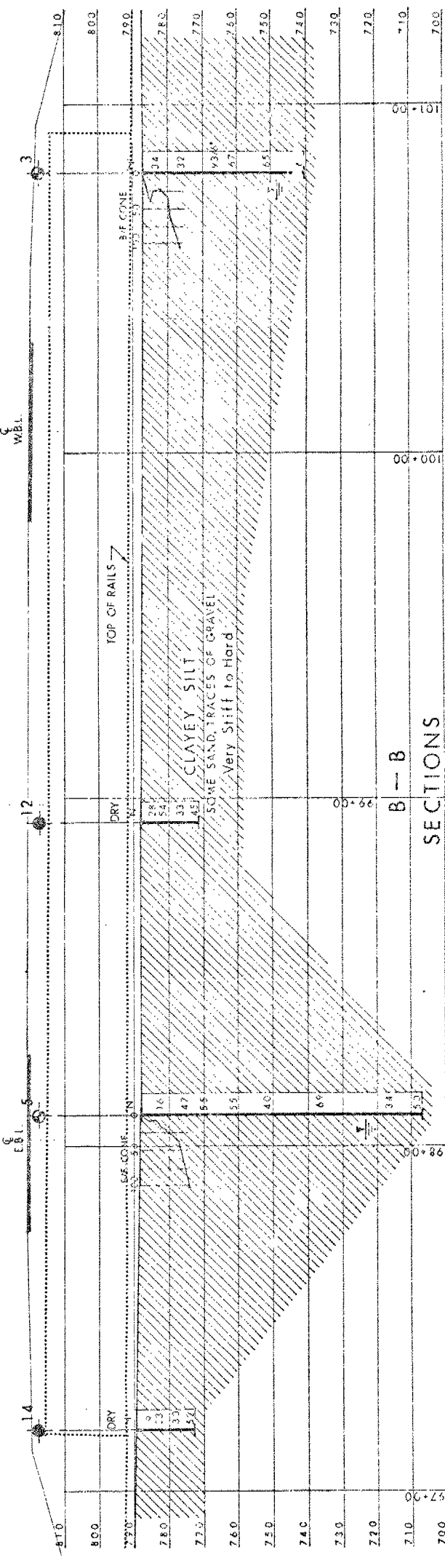
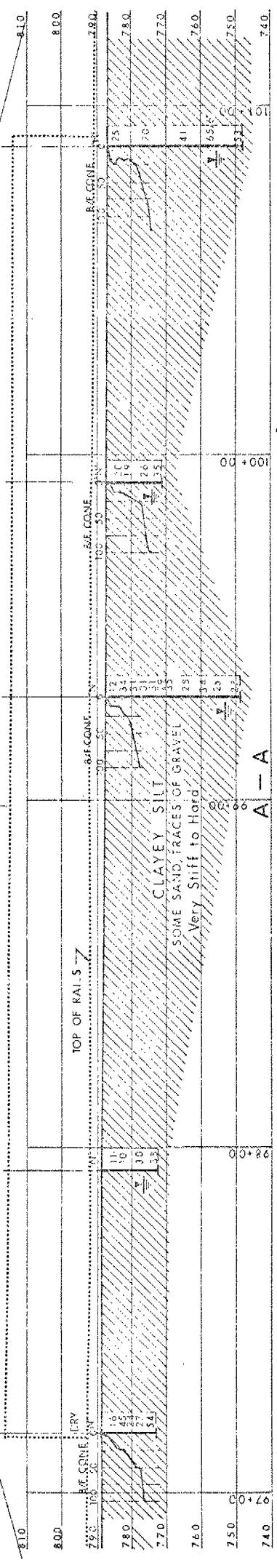
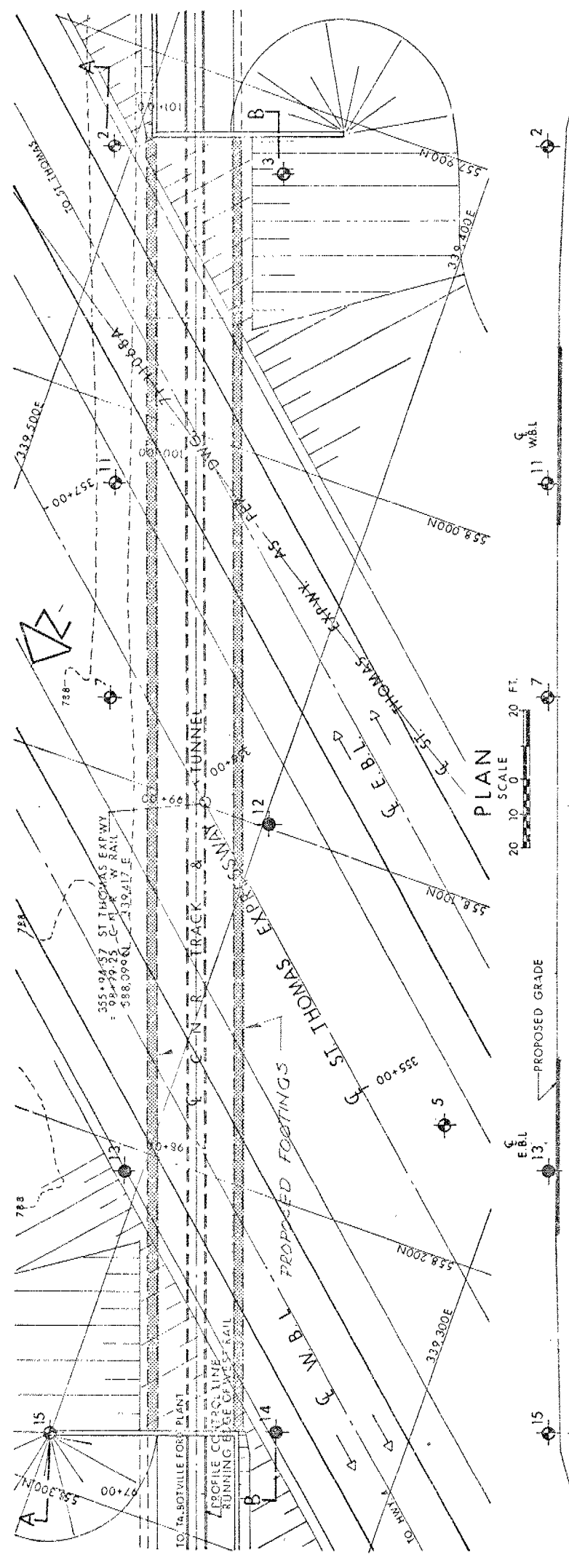
CO. EICIN
HIGHWAY NO. PROP ST. THOMAS EXPWY. DIST. NO. 2

COLUMBIA
W. & J. COLUMBIA CO., INC.
TWP SOUTHWOOD LOT 42 & 43 CON E.S.R.

BORE HOLE LOCATIONS & SOIL STRATA

[illegible]

6261 NOV 26 319
C. J. 3. 1
BIRCHMOUNT, N.Y.



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

REF. NO. FFI-3892-97-109

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

April 2025

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, 4th 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:

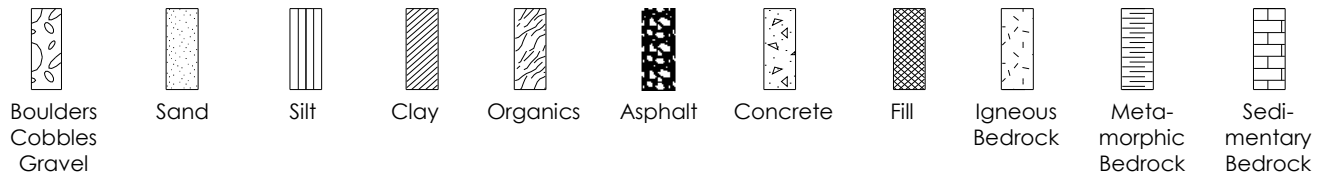
Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

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

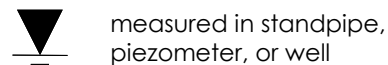
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



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
y	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 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 NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa					WATER CONTENT (%)				
								○ UNCONFINED		+ FIELD VANE		● QUICK TRIAXIAL				× LAB VANE	
237.3	Grass						20	40	60	80	100						
237.0	180 mm TOPSOIL		1	SS	8												
0.2	CLAYEY SILT (farmed layer), trace to some sand (FILL)																
236.5	Stiff																
0.9	Dark brown/black		2	SS	7												
235.9	Moist																
1.4	SILTY CLAY, trace sand and gravel																
	Firm		3	SS	19												
	Dark brown																
	Moist																
	CLAYEY SILT (CL), some sand, trace gravel (TILL)		4	SS	28												
	Very stiff																
	Brown																
	Moist																
	Grey below 3 m		5	SS	28												
			6	SS	28												
			7	SS	22												
			8	SS	22												
	Inferred cobbles/boulder based on rock fragments in SS9		9	SS	20												
			10	SS	22												
			11	SS	24												
			12	SS	24												
			13	SS	23												
			14	SS	21												
			15	SS	24												
221.4	END OF BOREHOLE																
15.9	Borehole open and dry upon completion.																

ONTARIO MTO 165001308_MTO_HWY3-TWINNING_20241127.GPJ ONTARIO MTO.GDT 12/3/24

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 NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa				W _p	W	W _L		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				WATER CONTENT (%)				
237.4	Grass						20	40	60	80	100	20	40	60		
230.0	200 mm TOPSOIL		1	SS	7							○				
0.2	CLAYEY SILT (farmed layer), trace sand, trace rootlets (FILL) Firm Brown		2	SS	9							○				PP = 125 kPa
236.4	Moist 300 mm thick silty sand layer at the top of SS2		3	SS	24							○	—			2 13 44 41 PP > 450 kPa
1.0	CLAYEY SILT (CL), some sand, trace gravel (TILL) Very stiff to hard Brown Moist		4	SS	27							○				PP > 450 kPa
	Grey below 3 m		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							○				
			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.															

Continued Next Page

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

ONTARIO MTO 165001308_MTO_HWY3-TWINNING_20241127.GPJ ONTARIO MTO.GDT 12/3/24

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 _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE							
	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

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 _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
237.3	Grass						20	40	60	80	100					
237.0	150 mm TOPSOIL		1	SS	4											
0.2	CLAY (CH), some sand Firm Brown Moist		2	SS	7											
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											
1.4			4	SS	19											
			5	SS	21											
			6	SS	15											
	SS7 contains sand seams		7	SS	16											
			8	SS	20											
			9	SS	22											
			10	SS	31											
	clayey silt (CL-ML) layer from 10.7 m to 11.2 m		11	SS	84											
			12	SS	34											
			13	SS	24											
			14	SS	23											
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

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

April 2025

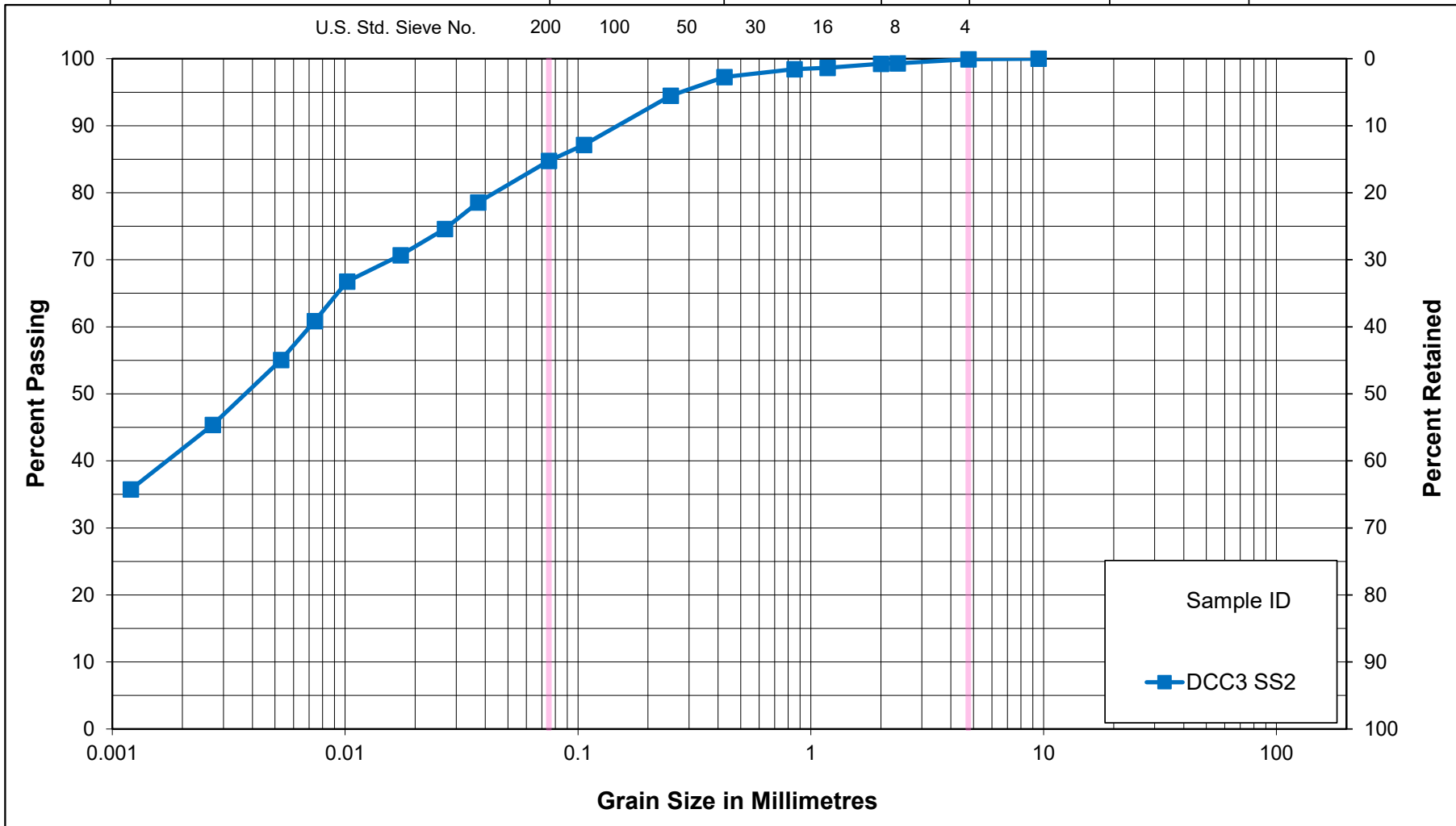
APPENDIX D

D.1 LABORATORY TEST RESULTS



Unified Soil Classification System

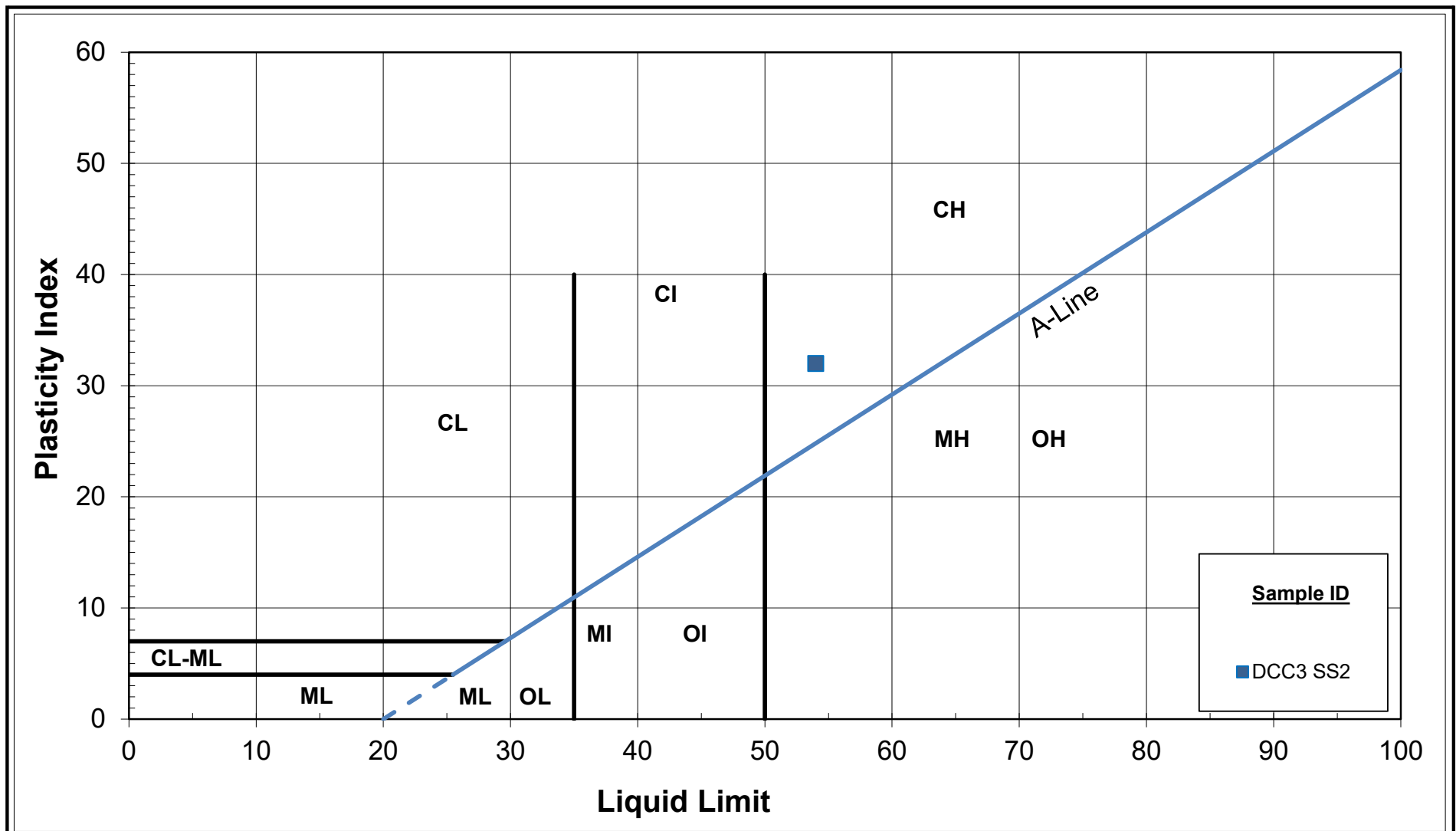
CLAY & SILT	SAND			Gravel	
	Fine	Medium	Coarse	Fine	Coarse



CLAY (CH)
Ministry of Transportation (MTO)
HWY 3 Twinning - Lindsay Drain Culvert

Figure No. D1

Project No. 165001308

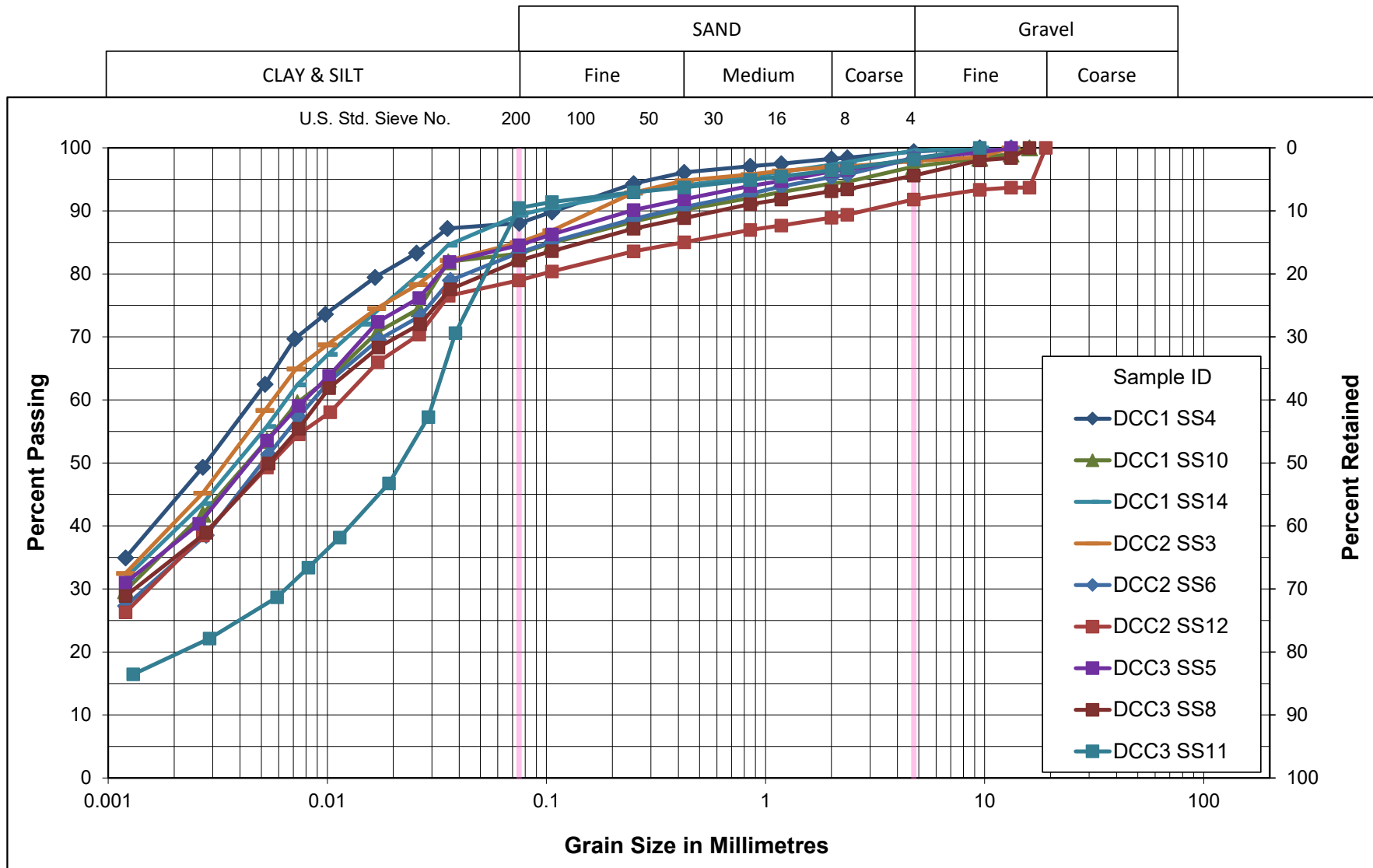


CLAY (CH)
Ministry of Transportation (MTO)
 HWY 3 Twinning - Lindsay Drain Culvert

Figure No. D2

Project No. 165001308

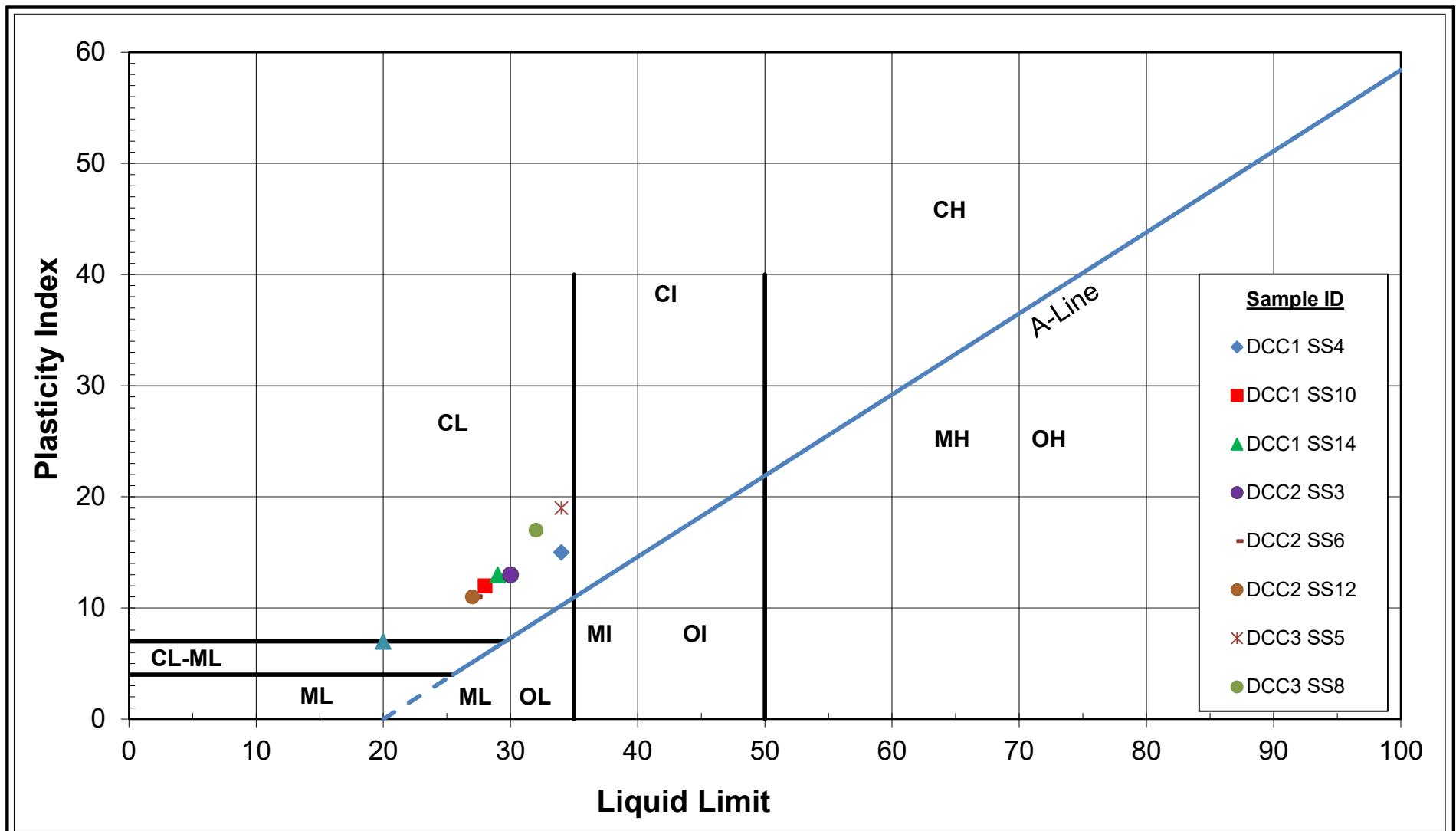
Unified Soil Classification System



TILL: CLAYEY SILT (CL-ML to CL)
Ministry of Transportation (MTO)
HWY 3 Twinning - Lindsay Drain Culvert

Figure No. D3

Project No. 165001308



TILL: CLAYEY SILT (CL-ML to CL)
Ministry of Transportation (MTO)
HWY 3 Twinning - Linday Drain Culvert

Figure No. D4

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

SAMPLING SITE:

ATTENTION TO: Bahram Siavash

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	0.01	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

SAMPLING SITE:

ATTENTION TO: Bahram Siavash

SAMPLED BY:

Corrosivity Package

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
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:



skaur

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

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:


Subhinder Kaur Randhawa

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



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

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 #:		

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

Same: Yes ☒ No ☐

Company: _____
Contact: _____
Address: _____

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

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

☐ Regulation 153/09
(reg. 511 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 (PWOO)☐ None

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[illegible]

Samples Relinquished by (print name & sign):

Date/Time

Samples Received by (Print name & sign):

Date/Time

PipkCopy - Client

Samples Relinquished by (print name & sign): _____

Date/Time

Samples Received by (Print name & sign):

Date/Time

Yellow + Golden Copy - AGAT
White Copy - AGAT

Page ____ of ____

NO: