Foundation Investigation and Design Report

Bradford Bypass – West Contract, County Road 4 Stormwater Management Ponds 3 & 4; G.W.P. 2026-23-00

Ministry of Transportation Ontario

60731727

March 2026

GEOCRES No: 31D04-031
Latitude: 44.130689°
Longitude: -79.569122°

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AECOM: 2024-12-21

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Bradford Bypass – West Contract – County Road 4 Stormwater Management Ponds 3 & 4

G.W.P. 2026-23-00

for
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1. Introduction

AECOM Canada ULC (AECOM) has been retained by the Ministry of Transportation Ontario (MTO) to undertake a foundation investigation for the proposed Bradford Bypass (BBP), West Contract, located in the County of Simcoe and Regional Municipality of York, Ontario. The entire new BBP freeway is a 16.3 km rural controlled access highway connecting Highway 400 to Highway 404. The West Contract is the western section of the project starting at Highway 400 and roughly ending 1.0 km east of County Road 4.

This Part A of the report provides a summary of the findings from the foundation investigation carried out for detailed design of proposed Stormwater Management Ponds (SWMPs) at County Road 4 (CR4); SWMP 3 is located at the southwest quadrant of CR 4 and the proposed BBP interchange, and SWMP 4 is located at the northeast quadrant of County Road 4 and the BBP interchange. The locations of the proposed SWMPs and the boreholes completed in this report are shown in **Appendix A**.

2. Site Description

The site is generally surrounded by a mix of agricultural and residential land uses, with the southwest quadrant adjoining an established residential subdivision. County Road 4, an undivided two-lane arterial roadway, runs north-south through the area.

The site at the location of the proposed SWMP 3 is vegetated and exhibits a gentle slope toward the southeast, draining in the direction towards County Road 4 with highest elevations being near Elev. 258.7 metres above sea level (mASL) and lowest at Elev. 253.5 mASL based on a review of Google Earth images and surveyed borehole data.

The proposed SWMP 4 area is situated primarily within agricultural land, with a transition to natural vegetated terrain along the western margin. The topography gently slopes toward the east and/or southeast. In comparison, the ground elevations at and/or near the proposed SWMP 4 location is approximately Elev. 252.4 mASL, slightly decreasing eastward and southeastward to near Elev. 247.9.0 mASL based on review of Google Earth images and surveyed borehole data. Site photographs at and/or near the location of the proposed SWMPs captured during the field investigation are included in **Appendix D** for reference.

As part of the pre-mobilization activities for the subsurface investigation, underground utility locates at each proposed borehole location were completed by AECOM. AECOM completed an Ontario 1 Call public utility locate request and retained a private utility locates subcontractor to clear all proposed borehole locations of buried utilities including Hydro One, Enbridge Gas, and other utilities.

Overhead hydro and telecommunication lines were observed running parallel to County Road 4 and close to nearby access routes. No other buried utilities including gas mains, telecommunication cables, or sanitary sewers, were identified within the proposed borehole areas, and it is assumed that adjacent rural properties are serviced by private wells and septic systems.

2.1 Regional Geological Conditions

The site for SWMP 3 and SWMP 4 is located within the Simcoe Lowlands physiographic region of southern Ontario, near the transition zone to the Peterborough Drumlin Field and the Schomberg Clay Plains (The Physiography of Southern Ontario, Chapman and Putnam, 3rd Edition, 1984). This region is characterized by streamlined, elongate hills composed of dense glacial till (drumlins), formed beneath a moving ice sheet. These drumlins are often overlain by stratified glaciolacustrine deposits, primarily associated with the post-glacial Lake Algonquin.

In low-lying areas between drumlins, fine-textured lacustrine silts, clays, and fine sands have been deposited, often reaching significant thicknesses. Although these soils typically contain a high proportion of clay-sized particles, the overall behaviour of the soil mass is more like a silt. When saturated, the soil becomes very slippery, while in a drier state it is powdery and friable. Organic deposits such as peat may also be present in depressions or former meltwater channels.

According to the Bedrock Geology of Ontario, Southern Sheet (Map 2544), published by the Ontario Ministry of Northern Development and Mines, the underlying bedrock near the proposed SWMPs comprises Ordovician-age units, including the Shadow Lake Formation (sandstone, conglomerate, and shale) and various limestones and dolostones of the Simcoe Group (e.g., Gull River, Bobcaygeon, and Verulam formations).

Further, the Bedrock Topography of the Alliston Area (Map P.3213) indicates that the bedrock surface depth in the region varies from approximately 130 m to 160 m below the existing ground surface, confirming the presence of a thick overburden layer.

3. Investigation Procedures

The investigation procedures for the proposed SWMP 3 and SWMP 4 consisted of a desktop study, review of available historical data, followed by a field exploration program based on the findings from the desktop study in accordance with the MTO Guideline for Foundation Engineering Services (April 2022). The desktop study gathered available geotechnical and geological data from several publicly available databases, such as the Ministry of the Environment, Conservation and Parks (MECP) well records, MTO's GEOCRES database, and other geological databases.

3.1 MTO´s GEOCRES Database

A search of the GEOCRES library identified one (1) foundation investigation report near the project site, *Foundation Investigation and Design Report – Simcoe County Road 4 (Yonge Street) Temporary Protection System, prepared by WSP Golder (May 10, 2022) GEOCRES No. 31D-797*.

In summary, this investigation outlined subsurface conditions, generally in line with the published information. The boreholes drilled for the proposed SWMP 3 encountered topsoil at the surface, followed by fill, underlain by a cohesive layer consisting of silty clay to clayey silt, overlaying a layer of silt to sandy silt till. The boreholes drilled for SWMP 4 encountered topsoil at the surface, followed by a layer of sandy silt to silt and sand, overlying a layer of sandy silt to silt and sand till. Bedrock was not encountered in any of the boreholes drilled at these locations. Groundwater conditions are typically shallow, with perched levels in fills, and expected seasonal fluctuations.

3.2 Subsurface Investigation Procedures

A subsurface investigation to support the detail design of the SWMP 3 and SWMP 4 was carried out at the site including a subsurface exploration program. AECOM's investigation methodology is described below followed by a summary of the factual results from the investigation.

For SWMP 3, the field work was carried out between July 14th and July 16th, 2025, and consisted of advancing a total of four (4) boreholes labelled SWMP3-01-MW through SWMP3-03-MW, and SWMP3-04.

For SWMP 4, the field work was carried out between December 2nd and December 4th, 2024, and consisted of advancing a total of four (4) boreholes labelled SWMP4-01-MW, SWMP4-02-MW, SWMP4-03, and SWMP4-04-MW.

The above noted eight (8) boreholes were drilled by utilizing a truck-mounted drill rig outfitted with hollow stem continuous flight augers. All eight (8) boreholes were advanced and terminated at a depth of 9.8 meters below the existing ground surface (mBGS).

Soil samples were obtained at regular intervals (i.e., every 0.75 m) using a 50 mm split spoon sampler driven with an automatic hammer in general accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). The split spoon samplers used in the investigation limit the maximum particle size that can be sampled and tested to about 35 mm. Therefore, particles that may exist within the soils that are larger than this dimension would not be sampled or represented in the grain size distributions.

In situ testing using Standard Penetration Test (SPT) was carried out at regular intervals of depth. MTO Field Vane testing could not be carried out because of the stiffness of the cohesive strata precluded the completion of these tests. Shelby tubes were not retrieved since the strata was too hard for the tubes to be pushed into.

The recovered samples from the borehole investigation were identified in the field, placed in labelled containers, and transported to AECOM's Etobicoke laboratory for further Visual Identification (VI) examination and testing. Selected soil samples were subjected to classification tests, including water content determinations, grain size distribution analyses and Atterberg limits determinations. The results of the testing are shown on the Record of Borehole Logs provided in **Appendix B,** and on the figures included in Laboratory Test Results, **Appendix C**.

In situ groundwater levels were measured in the open boreholes prior to backfilling, and in the monitoring wells following completion.

The field work was supervised on a full-time basis by AECOM staff who marked and staked the location of boreholes in the field, supervised the clearance of underground utilities, directed the sampling and testing of all samples in the field, and logged the boreholes. All laboratory tests were carried out in general accordance with MTO and/or ASTM Standards, as applicable.

Boreholes and/or monitoring wells were completed and backfilled in general accordance with Ontario Regulation 903 (as amended). The boreholes without monitoring wells were backfilled with a bentonite mixture upon completion of field work in general accordance with Ontario Regulation 903 (as amended) and the ground surface was restored to near original condition as practicable. No monitoring wells have been decommissioned at the time of writing this report, and at least one monitoring well will be retained at each SWMP for construction-phase monitoring. Any monitoring wells to be decommissioned, will need to be decommissioned during construction by the Contractor in general accordance with Ontario Regulation 903 (as amended).

The borehole locations were surveyed in the field by Callon-Dietz Surveyors, an Ontario Land Surveyor, positioned relative to MTM NAD 83 (Zone 10) northing and easting co-ordinates, and ground elevations to Geodetic datum (CGVD28 datum).

The borehole IDs including their depths, geodetic co-ordinates and elevations for SWMP 3 and SWMP 4 are summarized below in **Table 1** and **Table 2,** respectively. The location of the boreholes is also shown on the Borehole Location Plan and Soil Stratigraphy, provided in **Appendix A** for reference.

Table 1: Current Foundation Investigation Boreholes for SWMP 3

Borehole ID	MTM NAD 83 Zone 10 Co-ordinates		Latitude (°)	Longitude (°)	Ground Surface (mASL)	Depth (mBGS)
	Northing	Easting				
SWMP3-01-MW	4887844	299234	44.130570	-79.569555	258.7	9.8
SWMP3-02-MW	4887815	299186	44.130308	-79.570155	258.2	9.8
SWMP3-03-MW	4887774	299232	44.129940	-79.569580	253.5	9.8
SWMP3-04	4887805	299220	44.130219	-79.569730	255.9	9.8

Notes: mASL – metres above mean sea level
mBGS – meters below existing ground surface

Table 2: Current Foundation Investigation Boreholes for SWMP 4

Borehole ID	MTM NAD 83 Zone 10 Co-ordinates		Latitude (°)	Longitude (°)	Ground Surface (mASL)	Depth (mBGS)
	Northing	Easting				
SWMP4-01-MW	4888061	299411	44.132524	-79.567346	252.4	9.8
SWMP4-02-MW	4888016	299422	44.132119	-79.567208	251.2	9.8
SWMP4-03	4888038	299450	44.132317	-79.566858	250.1	9.8
SWMP4-04-MW	4888035	299490	44.132291	-79.566358	247.9	9.8

Notes: mASL – metres above mean sea level
mBGS – meters below existing ground surface

4. Summarized Subsurface Conditions

This section provides a general description of the major soil types encountered during AECOM's subsurface investigation carried out at the proposed SWMP 3 and SWMP 4 sites. It should be noted that the boundaries between the strata have been inferred from drilling observations and non-continuous samples. They generally represent a transition from one soil type to another and should not be inferred to represent exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

The subsurface soil and groundwater conditions encountered in the boreholes, and the results of the field and laboratory testing, are shown on the Record of Borehole Logs in **Appendix B**. A list of abbreviations and symbols are also provided in **Appendix B**. The geotechnical laboratory test results are included in **Appendix C**.

4.1 SWMP 3

4.1.1 Topsoil

Topsoil was encountered at the existing ground surface in all the boreholes. The thickness of the topsoil ranged approximately from 80 to 150 mm. It was generally brown to dark brown in colour and recovered in a moist to wet state.

The topsoil thickness might vary significantly beyond the areas where the boreholes were drilled. Some of the variations in topsoil thickness could be attributed to prior agricultural and earthwork activities conducted at the location of SWMP 3.

4.1.2 Fill

A layer of fill was encountered below the topsoil in all the boreholes. The composition of this fill layer generally varied and consisted of mostly sand to silty/gravelly sand, trace to some clay.

This fill layer was encountered at depths of 0.1 mBGS (Elev. 258.6 mASL) to 0.2 mBGS (Elev. 253.3 mASL) and extended to depths of 2.3 mBGS (Elev. 256.4 mASL) to 3.0 mBGS (Elev. 251.2 mASL).

The fill layer was brown in colour and recovered in a moist to wet state with moisture contents ranging from 7% to 25%.

The SPT N-values in the fill ranged from 4 blows to 63 blows per 305 mm of penetration, indicating a very loose to very dense in relative density.

Two (2) grain size distribution tests were performed on select samples and the tests indicated the following grain size distribution values as shown in **Table 3**.

Table 3: Grain Size Analysis for Fill

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Fines (%)
SWMP3-01-MW	SS-3	1.5 - 2.1	29	51	20
SWMP3-04	SS-3	1.5 - 2.1	9	58	33

4.1.3 Clayey Silt / Silty Clay

A cohesive soil deposit, generally described as clayey silt to silty clay, trace gravel, trace to some sand, trace organics was encountered below the fill in all the boreholes. This layer was encountered at depths of 2.3 mBGS (Elev. 256.4 mASL) to 3.0 mBGS (Elev. 251.2 mASL) and extended to depths of 4.6 mBGS (Elev. 252.9 mASL) to 6.9 mBGS (Elev. 248.9.0 mASL).

The layer of clayey silt/silty clay was brown to grey in colour and recovered in a moist to very moist state with moisture content values ranging from 13 to 36%.

The SPT N-values conducted within this layer ranged from 5 blows to 28 blows per 305 mm of penetration indicating a firm to very stiff consistency.

Five (5) grain size distribution tests were performed on select samples and the tests indicated the following grain size distribution values as shown in **Table 4**.

Table 4: Grain Size Analysis for Clayey Silt / Silty Clay

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
SWMP3-01-MW	SS-7	4.6 – 5.2	0	7	34	59
SWMP3-02-MW	SS-4	2.3 – 2.9	1	14	52	33
SWMP3-03-MW	SS-4	2.3 – 2.9	1	11	58	30
SWMP3-04	SS-6	3.8 – 4.4	1	20	37	42
SWMP3-04	SS-9	6.1 – 6.7	2	6	92	

The Atterberg limits testing results for the clayey silt to silty clay is shown in **Table 5**.

Table 5: Atterberg Limits Summary for Clayey Silt / Silty Clay

Borehole ID	Sample ID	Sample Depth (m)	Atterberg Limits			
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Behaviour
SWMP3-01-MW	SS-7	4.6 – 5.2	37	18	19	CL
SWMP3-04	SS-6	3.8 – 4.4	21	13	8	CL

4.1.4 Sand

A localized non-cohesive deposit consisting of sand, some silt, trace gravel, trace clay was encountered below the clayey silt in borehole SWMP3-02-MW. This layer extended to a depth of 7.6 mBGS (Elev. 250.6 mASL).

The layer of sand was grey in colour and was recovered in a wet state with moisture contents ranging from 18% to 22%.

The SPT N-values within the sand ranged from 16 blows to 25 blows per 305 mm of penetration indicating a compact in relative density.

One (1) grain size distribution test was performed on a select sample and the test indicated the following grain size distribution values as shown in **Table 6.**

Table 6: Grain Size Analysis for Sand

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)

SWMP3-02-MW	SS-8	5.3 – 5.9	1	76	20	3

4.1.5 Sandy Silt / Silt (Till)

A layer of sandy silt to silt (till), some clay, trace to some gravel, trace cobbles was encountered in all the boreholes. This layer was encountered at depths of 4.6 mBGS (Elev. 248.9 mASL) to 7.6 mBGS (Elev. 250.6 mASL) and extended to termination depths of 9.8 mBGS (Elev. 243.7 mASL).

The layer of sandy silt/silt (till) was grey in colour and recovered in a moist to very moist state with moisture content values ranging from 9 to 22%.

The SPT N-values conducted within this layer ranged from 17 blows to 97 blows per 305 mm of penetration indicating a compact to very dense in relative density.

Five (5) grain size distribution tests were performed on select samples and the tests indicated the following grain size distribution values as shown in **Table 7**.

Table 7: Grain Size Analysis for Sandy Silt / Silt (Till)

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
SWMP3-01-MW	SS-13	9.1 – 9.8	0	6	81	13
SWMP3-02-MW	SS-12	8.4 – 9.0	0	6	78	16
SWMP3-03-MW	SS-8	5.3 – 5.9	14	33	38	15
SWMP3-03-MW	SS-12	8.4 – 9.0	4	34	47	15
SWMP3-04	SS-13	9.1 – 9.8	0	1	86	13

The Atterberg limits testing information for the sandy silt (till) is shown in **Table 8**.

Table 8: Atterberg Limits Summary for Sandy Silt (Till)

Borehole ID	Sample ID	Sample Depth (m)	Atterberg Limits			
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Behaviour
SWMP3-03-MW	SS-12	8.4 – 9.0	14	11	3	ML

4.2 SWMP 4

4.2.1 Topsoil

Topsoil was encountered at the existing ground surface in all the boreholes. The thickness of the topsoil ranged from 80 to 150 mm. It was generally dark brown in colour and recovered in a moist state.

The topsoil thickness might vary significantly beyond the areas where the boreholes were drilled. Some of the variations in topsoil thickness could be attributed to prior agricultural and earthwork activities conducted at the SWMPs sites.

4.2.2 Sandy Silt / Silty Sand

A non-cohesive soil deposit, generally described as sandy silt to silty sand, trace gravel to gravelly, trace to some clay was encountered in boreholes SWMP4-01-MW, SWMP4-03, and SWMP4-04-MW. This layer was encountered below the topsoil and extended to depths of 3.0 mBGS (Elev. 247.1 mASL) to 5.3 mBGS (Elev. 244.8 mASL).

The layer of sandy silt/silty sand was brown to gray in colour and recovered in a moist to wet state with moisture content values ranging from 9 to 38%.

The SPT N-values conducted within this layer ranged from 6 blows to 31 blows per 305 mm of penetration indicating a loose to dense in relative density.

Four (4) grain size distribution tests were performed on select samples and the tests indicated the following grain size distribution values as shown in **Table 9**.

Table 9: Grain Size Analysis for Sandy Silt / Silty Sand

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
SWMP4-01-MW	SS-3	1.5 - 2.1	6	31	49	14
SWMP4-01-MW	SS-7	4.6 – 5.2	7	34	44	15
SWMP4-03	SS-3	1.5 - 2.1	24	29	47	
SWMP4-04-MW	SS-3	1.5 - 2.1	2	43	42	13

The Atterberg limits testing results for the sandy silt is shown in **Table 10**.

Table 10: Atterberg Limits Summary for Sandy Silt

Borehole ID	Sample ID	Sample Depth (m)	Atterberg Limits			
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Behaviour
SWMP4-01-MW	SS-3	1.5 - 2.1	16	11	5	CL- ML

4.2.3 Clayey Sandy Silt

A cohesive deposit consisting of clayey sandy silt, trace gravel was encountered in boreholes SWMP4-02-MW and SWMP4-03-MW. This deposit was encountered below the topsoil in borehole SWMP4-02-MW, below the silty sand in borehole SWMP4-03, and extended to a depth of 6.1 mBGS (Elev. 244.0 mASL).

The layer of clayey sandy silt was brown to grey in colour and recovered in a moist state with moisture contents ranging from 4% to 14%.

The SPT N-values within this deposit ranged from 8 blows to 28 blows per 305 mm of penetration indicating a stiff to very stiff consistency.

Three (3) grain size distribution tests were performed on the select samples and the test indicated the following grain size distribution values as shown in **Table 11**.

Table 11: Grain Size Analysis for Clayey Sandy Silt

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
SWMP4-02-MW	SS-3	1.5 - 2.1	5	33	39	23

SWMP4-03	SS-5	3.1 – 3.7	8	35	57	
SWMP4-03	SS-7	4.6 – 5.2	3	45	32	20

The Atterberg limits testing results for the clayey sandy silt is shown in **Table 12**.

Table 12: Atterberg Limits Summary for Clayey Sandy Silt

Borehole ID	Sample ID	Sample Depth (m)	Atterberg Limits			
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Behaviour
SWMP4-03	SS-7	4.6 – 5.2	13	9	4	CL- ML

4.2.4 Sandy Silt (Till)

A layer of sandy silt (till), some clay, trace to some gravel, some cobbles was encountered in all the boreholes. This layer was encountered at depths of 3.0 mBGS (Elev. 247.1 mASL) to 6.1 mBGS (Elev. 244.0 mASL) and extended to termination depths of 9.8 mBGS (Elev. 238.1 mASL).

The layer of sandy silt (till) was brown to grey in colour and recovered in a moist state with moisture content values ranging from 6 to 15%.

The SPT N-values conducted within this layer ranged from 12 blows to over 100 blows per 305 mm of penetration indicating a compact to very dense relative density.

Five (5) grain size distribution tests were performed on select samples and the tests indicated the following grain size distribution values as shown in **Table 13**.

Table 13: Grain Size Analysis for Sandy Silt (Till)

Borehole ID	Sample ID	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
SWMP4-01-MW	SS-11	7.6 – 8.2	1	33	47	19
SWMP4-02-MW	SS-9	6.1 – 6.7	3	38	45	14
SWMP4-03	SS-9	6.1 – 6.7	2	44	39	15
SWMP4-03	SS-11	7.6 – 8.2	2	36	42	20
SWMP4-04-MW	SS-9	6.1 – 6.7	3	34	45	18

The Atterberg limits testing information for sandy silt (till) is shown in **Table 14**.

Table 14: Atterberg Limits Summary for Sandy Silt (Till)

Borehole ID	Sample ID	Sample Depth (m)	Atterberg Limits			
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Behaviour
SWMP4-01-MW	SS-11	7.6 – 8.2	15	11	4	CL-ML
SWMP4-03	SS-9	6.1 – 6.7	12	9	3	ML
SWMP4-04-MW	SS-9	6.1 – 6.7	15	11	7	CL-ML

4.3 Groundwater Conditions

Groundwater observations in the open boreholes and the standpipe monitoring well piezometers installed at the site are presented in the tables below for reference. A total of five (5) readings were conducted from July 2025 to October 2025 for SWMP 3, and four (4) readings from January 2025 to June 2025 for SWMP 4.

Table 15 and **Table 16** below summarize the groundwater data obtained from the five (5) and four (4) monitoring rounds of readings undertaken for SWMP 3 and SWMP 4, respectively at the time of this report.

Table 15: Summary of Groundwater Measurement for SWMP 3

Borehole ID	2025-07-14 to 2025-07-16 (mBGS)	2025-07-29 (mBGS)	2025-08-07 (mBGS)	2025-08-08 (mBGS)	2025-09-15 (mBGS)	2025-10-03 (mBGS)
SWMP3-01-MW	-	2.2	2.2	-	2.3	2.3
SWMP3-02-MW	-	0.3	0.4	-	0.5	0.4
SWMP3-03-MW	-	6.6	4.2	3.2	1.8	4.8
SWMP3-04	Dry	-	-	-	-	-

Table 16: Summary of Groundwater Measurement for SWMP 4

Borehole ID	2024-12-02 to 2024-12-04 (mBGS)	2025-01-15 (mBGS)	2025-04-24 (mBGS)	2025-05-15 (mBGS)	2025-06-06 (mBGS)
SWMP4-01-MW	-	-	-0.6*	-0.4*	0.1
SWMP4-02-MW	-	1.7	0.8	-	1.0
SWMP4-03	Dry	-	-	-	-
SWMP4-04-MW	-	0.9	0.6	0.6	0.6

*Note: *- negative indicates height above ground surface*

Artesian conditions were recorded in the monitoring well installed at borehole SWMP4-01-MW. The hydraulic head above ground surface was 0.6 m on April 24, 2024, and 0.4 m on May 15, 2024, respectively, subsiding to 1.1 m below ground surface on the June 6, 2024 reading. Fluctuating groundwater levels were observed in borehole SWMP3-03-MW; groundwater levels ranging from 1.8 mBGS (September 15, 2025) to 6.6 mBGS (July 29, 2025) were measured.

The groundwater conditions described in this report refer only to those observed at the place and at the date of observation noted in the report. These levels and conditions may vary locally due to seasonal fluctuations; groundwater regimes encountered at the site during construction or as consequence of construction activities at the site or adjacent lands. A higher groundwater level condition would develop in the spring, during the thaw, and/or following rainfall events. Further discussion on groundwater conditions may be found in the hydrogeological report prepared for this project under a separate cover.

5. Miscellaneous and Closure

The field work drilling was carried out by Pontil Drilling Ltd. and Landshark Group under the full-time supervision of Mr. A. Ben Mahmoud, EIT and overall direction of B. Goddard, P.Eng.

This Foundation Investigation Report was prepared by Behnoosh Honarvar Sedighian. Technical and quality reviews were carried out by Senior Geotechnical Engineers, Amer Mohammad, P.Eng., Taesang Ahn, Ph.D., P.Eng. and AECOM's Geotechnical Lead Ontario, and Carlos Nascimento, P.Eng., the Designated MTO Foundations Contact for this project.

AECOM Canada ULC

Prepared by

Behnoosh Honarvar Sedighian, M.Sc.
Geotechnical Specialist

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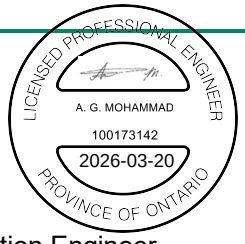
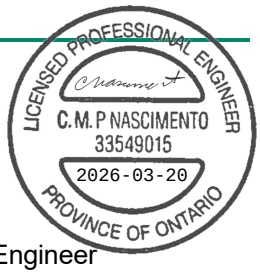


Amer Mohammad, P.Eng.
Senior Geotechnical/Foundation Engineer

Reviewed by



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PART B – FOUNDATION DESIGN REPORT

Bradford Bypass – West Contract – County Road 4 Stormwater Management Ponds 3 &4

G.W.P. 2026-23-00

For
Ministry of Transportation Ontario

GEOCRES No: 31D04-031
Latitude: 44.130689°
Longitude: -79.569122°

6. Discussion and Engineering Recommendations

6.1 General

This section of the report provides foundation recommendations in support of the detailed design and construction of the proposed SWMP 3 which is located in the southwest quadrant of County Road 4 and the proposed BBP interchange, and the proposed SWMP 4 which is located in the northeast quadrant of County Road 4 and the BBP interchange.

The discussion and recommendations presented in this report are intended for use of the Ontario Ministry of Transportation and their designers, AECOM, but should not be used or relied upon for any other purposes or by any other parties including the construction or design-build contractor. The contractor undertaking the work must make their own interpretation based on the information in the factual sections of the report (**Part A**). Where comments are made on construction, they are provided to highlight those aspects which could affect the design of the project. The contractor must make their own interpretation of the data provided as it may affect equipment selection, proposed construction methods, scheduling, and the like.

6.2 SWMP Details

Based on the latest design drawings (SWM Ponds Plan Details) provided by the design team, which are included in **Appendix E** and summarized in **Table 17**, the proposed SWMP 3 is to be designed and constructed at the southwest quadrant off of the County Road 4 N-E ramp, and the proposed SWMP 4 is to be designed and constructed at the northeast quadrant off of the County Road 4 S-W ramp. The SWMP 3 will provide stormwater quantity and quality control for an estimated drainage area of 30.9 hectare (ha) and SWMP 4 will provide 5.0 ha of drainage area.

Based on communication with the design team and review of the drawings, the SWMP 3 will have a bottom of permanent pool level near Elev. 247.3 mASL, which includes an approximate maximum cut depth of 10.6 m from a ground surface elevation near Elev. 257.9 mASL. The top of permanent pool elevation (designated stable water level) is near Elev. 248.3 mASL for a pool water level of 1.0 m. The side slopes for the SWMP 3 will have a slope of 4H:1V from the pond base extending to the top of permanent pool (Elev. 248.3 mASL), top of extended detention (Elev. 249.0 mASL), top of attenuation zone (Elev. 249.5 mASL), top of freeboard (Elev. 249.8 mASL), extending to match the existing ground.

The SWMP 4 will have a bottom of permanent pool level near Elev. 245.0 mASL, which includes an approximate maximum cut depth of 5.2 m from a ground surface elevation near Elev. 250.2 mASL. The top of permanent pool elevation (designated stable water level) is near Elev. 246.0 mASL for a pool water level of 1.0 m. The side slopes for the SWMP 3 will have a slope of 4H:1V from the pond base to the top of attenuation zone (Elev. 246.7 mASL); therefore, this slope will extend into the top of permanent pool (Elev. 246.0 mASL), top of extended detention (Elev. 246.4 mASL), and top of attenuation (Elev. 246.7 mASL) zones. A transition of 3H:1V will then occur from the top of attenuation (Elev. 246.7 mASL) zone to the top of freeboard (Elev. 247.0 mASL), extending to match the existing ground.

Table 17: SWMP General Arrangements

SWMP Pond	Bottom of Permanent Pool Elevation (mASL)	Top of Permanent Pool Elevation (mASL)	Top of Extended Detention Elevation (mASL)	Top of Attenuation Zone Elevation (mASL)	Top of Freeboard Elevation (mASL)	Side Slopes	Approximate Maximum Cut Depth (m)
SWMP 3	247.3	248.3	249.0	249.5	249.8	4H:1V	10.6
SWMP 4	245.0	246.0	246.4	246.7	247.0	4H:1V to 3H:1V	5.2

6.3 SWMP Design Criteria

Geotechnical models for each pond were developed based on the subsurface conditions described in **Part A** of this report. The selected soil parameters represent average values determined from the interpreted borehole data and laboratory test results. The models support the following criteria:

- Assessment of global slope stability for the SWMP 3 and SWMP 4 cut slopes, seismic and rapid drawdown conditions, and pond bases;
- Minimum traffic surcharge load of 16 kPa included in the design where traffic loading or other surface loads may occur near the pond edges or adjacent slopes;
- Estimation of hydraulic conductivities of native and fill soils at each SWMP site;
- Assessment of the requirement for provision of pond liner and respective installation recommendations; and,
- Basal stability of the pond base.

The interpreted soil stratigraphy and corresponding engineering parameters are presented on the relevant global stability analyses results in **Appendix F**.

6.3.1 Consequence and Site Understanding

It is inferred that the proposed SWMP 3 and SWMP 4 will have “typical consequence levels” associated with exceeding limit states design according with Clause 6.5 and Table 6.1 of the Canadian Bridge Design Code (CHBDC, 2019). Therefore, a consequence factor, Ψ, of 1.0 should be used in the foundations design.

In view of the level of site investigations completed, the site understanding is classified as “typical degree of site and prediction model understanding”. Therefore, the appropriate ultimate geotechnical resistance factors (Φ) for Table 6.2 of the CHBDC (2019) was used to assess the global stability design of the ponds.

Tables 6.1 and 6.2, minimum Factors of Safety (FoS) were applied for short term (FoS of 1.3), saturated/ unsaturated static conditions and for a rapid drawdown (FoS of 1.3, considered as temporary condition) and long term (FoS of 1.5), respectively.

For pseudo-static (seismic) loading, a minimum FoS of 1.1 was adopted. For the seismic assessment, a pseudo-static horizontal coefficient (k_h) of 0.078 was used. This value was derived conservatively from the NBC 2020 2% in 50-year PGA of 0.155 g for a Seismic Site Class D condition. This coefficient was applied to simulate inertial forces induced during a design earthquake.

Table 18 below summarizes the spectral acceleration values for use in stability analysis:

Table 18: Seismic Hazard Values for Site Class D (NBC 2020)

Return Period (Years)	PGA (g)	PGV (m/s)	Sa (0.2s) (g)	Sa (0.5s) (g)	Sa (1.0s) (g)	Sa (2.0s) (g)
475 (10% in 50 yrs)	0.0611	0.0608	0.1090	0.1090	0.0625	0.0280
975 (5% in 50 yrs)	0.0959	0.1000	0.1690	0.1700	0.0998	0.0465
2475 (2% in 50 yrs)	0.1550	0.1750	0.2730	0.2750	0.1670	0.0800

6.3.2 Global Stability

This section presents the results of the global slope stability assessments completed for the proposed SWMP 3 and SWMP 4 under static and pseudo-static (seismic) conditions. The purpose of these analyses is to evaluate the adequacy of the proposed 3H:1V to 4H:1V cut slopes, considering the strength and deformation characteristics of the underlying soils and the influence of groundwater conditions.

The analyses were conducted using the limit equilibrium method of slices, implemented through GeoStudio 2024 SLOPE/W, utilizing the Morgenstern-Price method. The assessment accounted for the interpreted subsurface conditions, site-specific groundwater levels, and geotechnical design parameters derived from both laboratory and correlation-based sources.

A minimum surcharge load of 16 kPa has been included in the design where traffic loading or other surface loads may occur near the pond edges or adjacent slopes.

6.3.2.1 Method of Analysis

The slope stability analyses were completed using GeoStudio 2024 SLOPE/W, employing the Morgenstern-Price method, which satisfies both force and moment equilibrium. The intent of the analysis was to determine the critical (minimum) FoS under permanent pool water levels, regional water level, rapid drawdown, and seismic loading conditions for the proposed side slopes at both ponds.

Detailed outputs of the analyses are provided in **Appendix F**, and summarized in the tables below:

Table 19A: Results of Stability Analyses SWMP 3 (NW of Pond)*

Analysis Condition	Minimum Factor of Safety	Appendix F Page No.
Permanent Water Level	2.8	1
Regional Storm Event	2.7	2
Rapid Drawdown	2.7	3
Permanent Water Level (Seismic)	2.1	4
Initial Water Level (seismic)	2.1	5

*Analysis completed for northwest side of the pond

Table 19B: Results of Stability Analyses SWMP 3 (SE of Pond)*

Analysis Condition	Minimum Factor of Safety	Appendix F Page No.
Permanent Water Level	3.2	6
Regional Storm Event	3.6	7
Rapid Drawdown	3.2	8
Permanent Water Level (Seismic)	2.4	9
Initial Water Level (seismic)	2.5	10

*Analysis completed for southeast side of the pond

Table 19C: Results of Stability Analyses SWMP 4 (N of Pond)*

Analysis Condition	Minimum Factor of Safety	Appendix F Page No.
Permanent Water Level	1.6	11
Regional Storm Event	1.6	12
Rapid Drawdown	1.6	13
Permanent Water Level (Seismic)	1.3	14
Initial Water Level (seismic)	1.3	15

*Analysis completed for north side of the pond

Table 19D: Results of Stability Analyses SWMP 4 (S of Pond)*

Analysis Condition	Minimum Factor of Safety	Appendix F Page No.
Permanent Water Level	2.6	16
Regional Storm Event	5.1	17
Rapid Drawdown	2.9	18
Permanent Water Level (Seismic)	1.9	19
Initial Water Level (seismic)	1.9	20

*Analysis completed for south side of the pond

The calculated Factors of Safety (FoS) exceed the minimum requirements outlined in CHBDC criteria, indicating that the proposed slope inclinations are geotechnically acceptable under static and pseudo static conditions.

6.3.3 Estimated Permeability of Overburden Soils

Based on the grain size distribution testing conducted on representative soil samples from the boreholes at the sites, the overburden soils consist predominantly of silty clay/clayey silt to silt/ sandy silt till at SWMP 3 and sandy silt/silty sand to sandy silt till at SWMP 4. The soils at the sites are generally characterized by a low plasticity index and a relatively high silt fraction, resulting in low to moderate low hydraulic conductivity.

Using empirical correlations between grain size characteristics and permeability for fine-grained till materials, for SWMP 3, the estimated saturated hydraulic conductivity (k) for the overburden soils is of the order of 1×10^{-6} m/s, with an expected range between 4×10^{-6} and 5×10^{-6} m/s. The estimated saturated hydraulic conductivity (k) for the overburden soils at SWMP 4 is of the order of 5×10^{-6} m/s, with an expected range between 1×10^{-5} and 1×10^{-6} m/s to account for natural variability.

6.3.4 SWMP Liner Design Considerations

The excavations for the proposed SWMP 3 will extend through native silty clay/clayey silt to silt/ sandy silt till. Excavations at SWMP 4 will extend through sandy silt/silty sand to sandy silt till. Although these soils exhibit relatively low permeability, it is recommended that a compacted clay liner be incorporated to minimize potential seepage losses through desiccations cracks.

The liner material could consist of locally available, low-permeability inorganic soils having a permeability of less than 1×10^{-8} m/s. The requirements of material index properties such as Liquid Limit (LL) and Plasticity Index (PI) shall be referred to OPSS. PROV 1205. Alternatively, geosynthetic clay liners such as Bentofix Geosynthetic Clay Liner (BGCL) or equivalent may be considered.

The liner should be placed over the pond base and side slopes, with a minimum thickness of 0.6 m, and compacted to at least 95% of its Standard Proctor Maximum Dry Density (SPMDD). To ensure a homogenous and desiccation

crack-free barrier, the material should be placed at 2% to 4% above optimum moisture content and compacted in lifts not exceeding 150 mm.

All liner placement and compaction should be carried out under the supervision of qualified geotechnical staff.

6.3.5 SWMP Base Stability During Operation and Maintenance

For the SWMP 3, the groundwater measurements ranged from 0.3 mBGS to 6.6 mBGS, and for the SWMP 4, the groundwater measurements ranged from 0.1 mBGS to 1.7 mBGS, with localized artesian conditions recorded in SWMP4-01-MW. Details of the groundwater measurements and observation are presented in Tables 15 and 16, in **Part A** of this report.

Based on the borehole elevations for SWMP 3 (approximately Elev. 253 mASL and Elev. 259 mASL) versus the proposed pond base elevations of Elev. 247.3 mASL and the borehole elevations for SWMP 4 (surficial elevations between Elev. 248 mASL and Elev. 252 mASL) versus the proposed pond base elevations of Elev. 245.0 mASL, it is likely that the excavation for the ponds will extend below the prevailing groundwater table. Consequently, groundwater inflow should be expected during construction, particularly in the deeper portions of the excavations.

Although the proposed pond base materials generally exhibit low to moderately low hydraulic conductivity, a compacted clay liner with a permeability of less than 1×10^{-8} m/s is recommended to further minimize seepage losses and to provide additional protection against softening during drawdown.

The subsurface soils, combined with the proposed low-permeability clay liner system, provide favourable resistance to hydraulic uplift or blowout during operation. Under normal pond operation, permanent pool levels will generally remain close to the surrounding groundwater elevations, resulting in minimal hydraulic gradients across the pond bases. However, under temporary maintenance conditions, particularly during partial or full drawdown, the potential for upward seepage, localized softening, or reduced base stability must be considered. To maintain adequate stability and limit seepage during both construction and operation, the following measures are recommended for both SWMP 3 and SWMP 4.

1. Avoid rapid or complete drawdown of the pond; maintain at least 0.5 to 1.0 m of water cover above the base where practical.
2. Where full drawdown is necessary, adopt staged pumping or provide temporary drainage relief (e.g., sump pits, toe drains, or pressure-relief trenches).
3. Enhance the resistance to uplift at the base of the proposed SWMPs, a minimum 0.3 m thick earth ballast or cover should be placed over the BGCL or equivalent to provide confinement and protection. The earth protection should be carefully placed using low ground pressure dozer, with a maximum tire or track pressure of 35 kPa.
4. Where artesian conditions occur, during construction, a 200–300 mm granular filter/drainage layer (OPSS.PROV 1004 Granular M or equivalent) over the pond base to intercept minor seepage and protect the subgrade or liner is recommended.
5. Monitor groundwater levels during excavation and operation; modify dewatering procedures if seepage or instability is observed.

Erosion protection should be provided for any remaining exposed surfaces of the side slopes. Provided the above measures are implemented and the compacted clay liner is correctly installed under qualified geotechnical supervision, the factor of safety against hydraulic heave or base instability is considered adequate for both short-term (construction) and long-term (operational) conditions at SWMP 3 and SWMP 4.

6.3.6 Surficial Stability and Erosion Protection

Surficial stability and erosion protection measures are required to maintain the integrity of the SWMP 3 and SWMP 4 slopes and inlet/outlet structures under long-term operating conditions and during storm events. The design of erosion protection at the inlet and outlet should be completed by the hydraulic design engineer; however, the following minimum geotechnical recommendations are provided based on site-specific subsurface conditions, as previously discussed in Section 4.

As a minimum, erosion protection for the inlet and outlet structures should be provided in accordance with:

- OPSD 810.010 – Rip-Rap Treatment for Sewer and Culvert Outlets (Type A), and
- OPSD 810.020 – Rip-Rap Treatment for Ditch Inlets.

Rip-rap should extend to at least the obvert of the pipes and should be placed on a properly prepared bedding layer with a non-woven geotextile separator meeting OPSS.PROV 1860 to prevent migration of the underlying silty soils. Rip-rap should extend across the full width of the channel and up the side slopes as required to mitigate erosion during elevated flow velocities or drawdown conditions.

Above the normal water level, the SWMPs side slopes should be vegetated as soon as practicable after earthworks are completed to reduce soil erosion from rainfall events, runoff, and wind. Vegetation should be established using seeding or sodding in accordance with OPSS.PROV 803 and 804.

During excavation of the cut slopes, thin water-bearing cohesionless seams may be encountered within the fill, sandy silt/silt and sand, or till deposits. As these seams may result in localized surficial sloughing or wet-face instability, the placement of 300 mm granular sheeting (in accordance with OPSS.PROV 511 – Rip-Rap, Rock Protection, and Granular Sheeting) may be required in affected areas. The need for granular sheeting should be assessed using an observational approach, with qualified geotechnical staff inspecting exposed cut slopes during excavation to identify seepage zones requiring stabilization.

6.3.7 Frost Protection

The design frost penetration depth for SWMP 3 and SWMP 4 sites is estimated to be 1.5 m, based on the Ontario Provincial Standard Drawing (OPSD) 3090.101 MTO Foundation Frost Penetration Depths for Southern Ontario.

The subsurface conditions within this depth are characterized predominantly by fill, silty clay/clayey silt to silt/sandy silt till at SWMP 3 and sandy silt/silty sand to sandy silt till at SWMP 4, as identified in the AECOM boreholes drilled at each site.

According to the MTO Frost Classification Criteria, soils containing a high proportion of silt-sized particles typically exhibit moderate to high frost susceptibility, depending on drainage and moisture conditions. As such, the soil near-surface for both sites is classified to be Moderate Frost Susceptibility while at the excavation bottom, soil is classified to be High Frost Susceptibility for SWMP 3, and Moderate Frost Susceptibility for SWMP 4.

Seasonal frost action may cause minor heaving and softening in exposed areas, particularly where drainage is impeded. Although these effects are not expected to significantly impact the overall stability of the SWMPs slopes or base, appropriate temporary and permanent frost protection (e.g., replacing frost susceptible soils or use of rigid polystyrene foam insulation) along with proper drainage should be considered for surface structures, pond liner interfaces, and shallow appurtenances to mitigate potential frost-related movements.

Should construction take place during the winter season, exposed subgrades and underlying soils, specifically for surface or exterior structures, must be protected by the Contractor against freezing for the entire duration of

construction, or until adequate frost protection is in place. Backfill should not be placed or compacted in a frozen condition or placed on frozen subgrades.

6.4 Construction Considerations

6.4.1 General

Construction of the SWMPs should be carried out under the supervision of qualified geotechnical staff acting as the client representative to confirm that the recommendations contained in this report are properly implemented. Additional considerations may arise depending on the contractor's means and methods. Contractors are advised to seek independent geotechnical advice regarding temporary works, excavation approaches, and dewatering strategies.

6.4.2 Site Preparation / Subgrade Protection

Prior to any earthworks or placement of structural fill, all topsoil, root-bearing or organic materials, and undocumented fill (where present) must be stripped and removed in accordance with OPSS.PROV 206 – Construction Specification for Grading.

Any soft, wet, or unstable materials exposed at the proposed founding levels of the inlet/outlet structures, pond liner interface, or other components should be removed until a competent native subgrade is reached.

Where sub-excavation is required, the excavated area may be backfilled with OPSS.PROV 1010 Granular 'A' or Granular 'B' Type II, compacted in accordance with OPSS.PROV 501 – Compaction. Subgrade inspection approval, and full-time compaction testing of engineered granular fill material by a client-representative qualified geotechnical staff is required prior to placing any foundation elements.

6.4.3 Open-Cut Excavations / Temporary Protection Systems

All excavations and shoring must comply with the Occupational Health and Safety Act (OHSA) and/or OPSS.PROV 539 – Temporary Protection Systems.

Based on the subsurface conditions summarized in **Part A**, the following OHSA soil classifications are applicable for open-cut excavations. These classifications reflect both the material type and observed groundwater conditions.

Table 20: Interpreted OHSA Requirements for Open-Cut Excavations

Material / Deposit	Groundwater Conditions**	Recommended OHSA Classification / Excavation Slope*
Surficial Fill	Minor to moderate seepage possible	Type 3; not steeper than 1H:1V
Sandy Silt / Silty Sand	Minor to moderate seepage possible	Type 3; not steeper than 1H:1V
Clayey Sandy Silt	Minor to moderate seepage possible	Type 3; not steeper than 1H:1V
Clayey Silt / Silty Clay	Minor to moderate seepage possible	Type 3; not steeper than 1H:1V
Sand	Minor to moderate seepage possible	Type 3; not steeper than 1H:1V
Sandy Silt / Silt (Till)	Minor to moderate seepage	Type 3 not steeper than 1H:1V

*Notes: *For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation.*
***If excavations proceed below the water table, become wet or muddy, or exhibit signs of seepage, they will become a "Type 4 Soil". A "Type 4 Soil" must be sloped from its bottom with a slope having a minimum gradient of 3H:1V.*

These recommendations apply to short-term, temporary excavation slopes only. Continuous monitoring for sloughing, seepage, or wet pockets is required, particularly in the sandy silt/silty sand, and clayey silt/silty clay layers that may soften upon disturbance.

Excavations within the till may generally be completed using standard heavy equipment such as hydraulic excavators. Where conditions require, temporary shoring must be designed by a qualified Professional Engineer and installed in accordance with OPSS.PROV 539.

6.4.4 Groundwater and Surface Water Control

The dewatering procedures may involve a combination of surface water drainage and diversion supplemented by excavation edge ditches and pumping from filtered sumps located within the excavation. If areas of excessive seepage are encountered such as water bearing sand/silt interlayers, more elaborate dewatering measures may need to be implemented. Dewatering operations should be carried out and managed in accordance with OPSS.PROV 517, as amended by Special Provision 517F01 (issued February 2024). The design of the dewatering system is the responsibility of the Contractor, and the Contract Documents must alert them to this responsibility. Surface water from runoff and precipitation events should be directed away from the proposed SWMPs to mitigate ponding water that could result in disturbance and softening of the subgrade and/or delay construction of the pond liner.

Groundwater levels at both ponds varied significantly with the seasons. The proposed pond bases for both ponds will be below the groundwater table, and groundwater inflow might be expected during excavation.

Given the low permeability of the native till ($k \approx 1 \times 10^{-6}$ m/s), groundwater inflow will generally be manageable but may still require localized control. Groundwater and surface water should be managed using:

- Filtered sump pumps in low points of the excavation
- Temporary drainage trenches feeding into sumps
- Surface water diversion berms during construction

No deep well dewatering is anticipated. However, if required, dewatering shall be in accordance with OPSS 517 and SP517F01. In addition, rapid drawdown of the pond during maintenance must be avoided, to limit upward seepage pressures.

During heavy rainfall events, runoff must be diverted away from active cuts to prevent erosion and saturation of slope faces.

7. Closure

The Foundation Investigation and Design Report was prepared by Behnoosh Honarvar Sedighian and the technical review of the report was completed by A. Mohammad, P.Eng.

An independent quality review of this report was carried out by C. Nascimento, P.Eng., the Designated MTO Foundations Contact and T. Ahn, Ph.D., P. Eng, Quality Control Auditor for this assignment.

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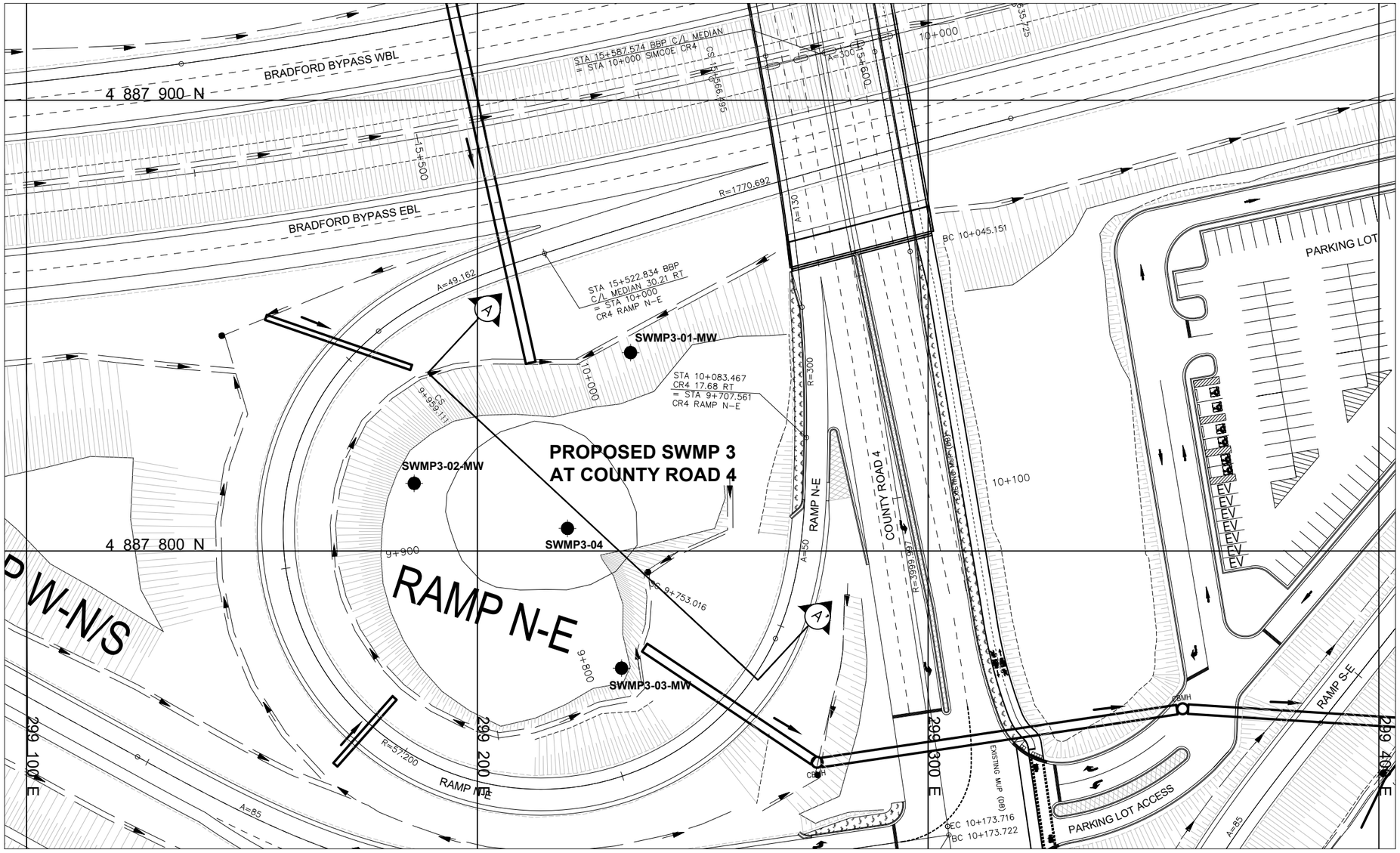
Appendix A

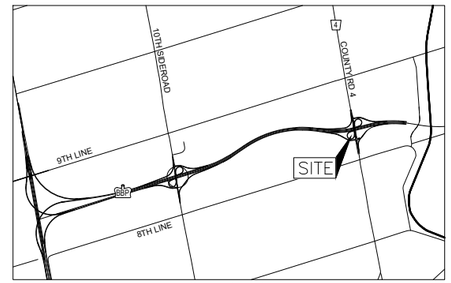
Borehole Location Plan and Soil Stratigraphy

MINISTRY OF TRANSPORTATION, ONTARIO



PLAN
SCALE 1:500

0 10 20 Meters



KEY PLAN
SCALE
1 0 1 2 km

CONT No. 2026–2005
GWP No. 2026–23–00

BRADFORD BYPASS PONDS
COUNTY ROAD 4 STORM WATER MANAGEMENT PONDS

BOREHOLE LOCATION PLAN
PROPOSED SWMP 3

AECOM

LEGEND

- BOREHOLE – CURRENT INVESTIGATION
- SEAL
- PIEZOMETER
- N — STANDARD PENETRATION TEST VALUE
- 16 — BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% — ROCK QUALITY DESIGNATION (RQD)
- WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- WL UPON COMPLETION OF DRILLING

BOREHOLE COORDINATES (MTM NAD 83 ZONE 10)

No.	ELEVATION	NORTHING	EASTING
SWMP3–01–MW	258.73	4887844	299234
SWMP3–02–MW	258.25	4887815	299186
SWMP3–03–MW	253.50	4887774	299232
SWMP3–04	255.90	4887805	299220

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. THE PROPOSED STRUCTURE DETAILS/WORKS ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY AND MAY NOT BE CONSISTENT WITH THE FINAL DESIGN CONFIGURATION AS SHOWN ELSEWHERE IN THE CONTRACTS DOCUMENTS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.
4. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.
5. REFERENCE: BASE PLANS PROVIDED IN DIGITAL FORMAT BY AECOM FILES "Bradford Bypass_plan.dwg". RECEIVED OR DATED: MARCH 03, 2025.
6. REFER TO DRAWING No. 02 FOR CROSS SECTION A–A' AND SOIL STRATA.

LICENSED PROFESSIONAL ENGINEER
C.M.P NASCIMENTO
33548015
2026-03-20
PROVINCE OF ONTARIO

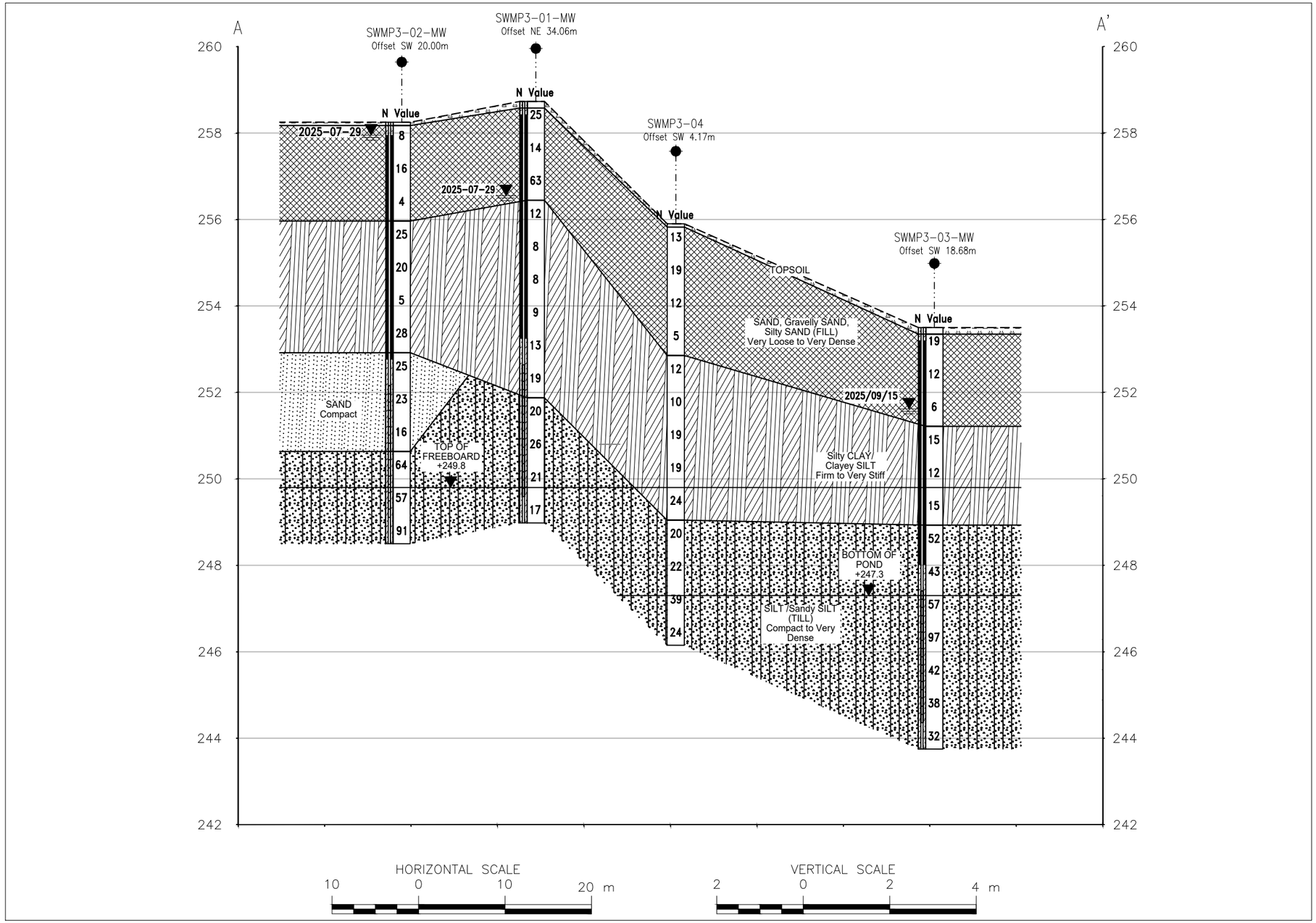
LICENSED PROFESSIONAL ENGINEER
A. G. MOHAMMAD
100173142
2026-03-20
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
2	MAR. 26	JC	FINAL
1	DEC. 25	AV	DRAFT

Geocres No. 31D–04–031

HWY. BRADFORD BYPASS WEST	PROJECT NO. 60731727		DIST. CENTRAL
SUBM'D. __	CHKD. __	DATE: 12/19/2025	SITE:
DRAWN: JC	CHKD. AM	APPD. CN	DWG. 1

PLOT DATE: 2026/03/20
FILENAME: C:\Users\Cheung31\OneDrive - AECOM\Documents\projects\MTO Highway 10 Hwy 413 Interchange\260320\Bradford Bypass_Borehole location plan_recover - Standard\Bradford Bypass_Borehole location plan_recover.dwg



SECTION A-A' - PROPOSED SWMP 3

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. THE PROPOSED STRUCTURE DETAILS/WORKS ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY AND MAY NOT BE CONSISTENT WITH THE FINAL DESIGN CONFIGURATION AS SHOWN ELSEWHERE IN THE CONTRACTS DOCUMENTS.
3. THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BOREHOLE LOCATIONS. BETWEEN BOREHOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE.
4. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.
5. REFERENCE: BASE PLANS PROVIDED IN DIGITAL FORMAT BY AECOM FILES "Bradford Bypass_plan.dwg". RECEIVED OR DATED: MARCH 03, 2025.
6. REFER TO BOREHOLE LOCATION PLAN, DRAWING NO. 01 FOR A LIST OF DRILLED BOREHOLES AND COORDINATES.

CONT No. 2026-2005
GWP No. 2026-23-00

BRADFORD BYPASS PONDS
COUNTY ROAD 4 STORM WATER MANAGEMENT PONDS
SOIL STRATA
PROPOSED SWMP 3
PROFILE SECTION A-A'

AECOM

LEGEND

- BOREHOLE – CURRENT INVESTIGATION
- SEAL
- PIEZOMETER
- N — STANDARD PENETRATION TEST VALUE
- 16 — BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% — ROCK QUALITY DESIGNATION (RQD)
- WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- WL UPON COMPLETION OF DRILLING

LEGEND – SOIL STRATA:

- TOPSOIL
- SAND, GRAVELLY SAND, SILTY SAND (FILL)
- SILTY CLAY / CLAYEY SILT
- SAND
- SILT / SANDY SILT (TILL)

LICENSED PROFESSIONAL ENGINEER
C.M.P NASCIMENTO
33549015
2026-03-20
PROVINCE OF ONTARIO

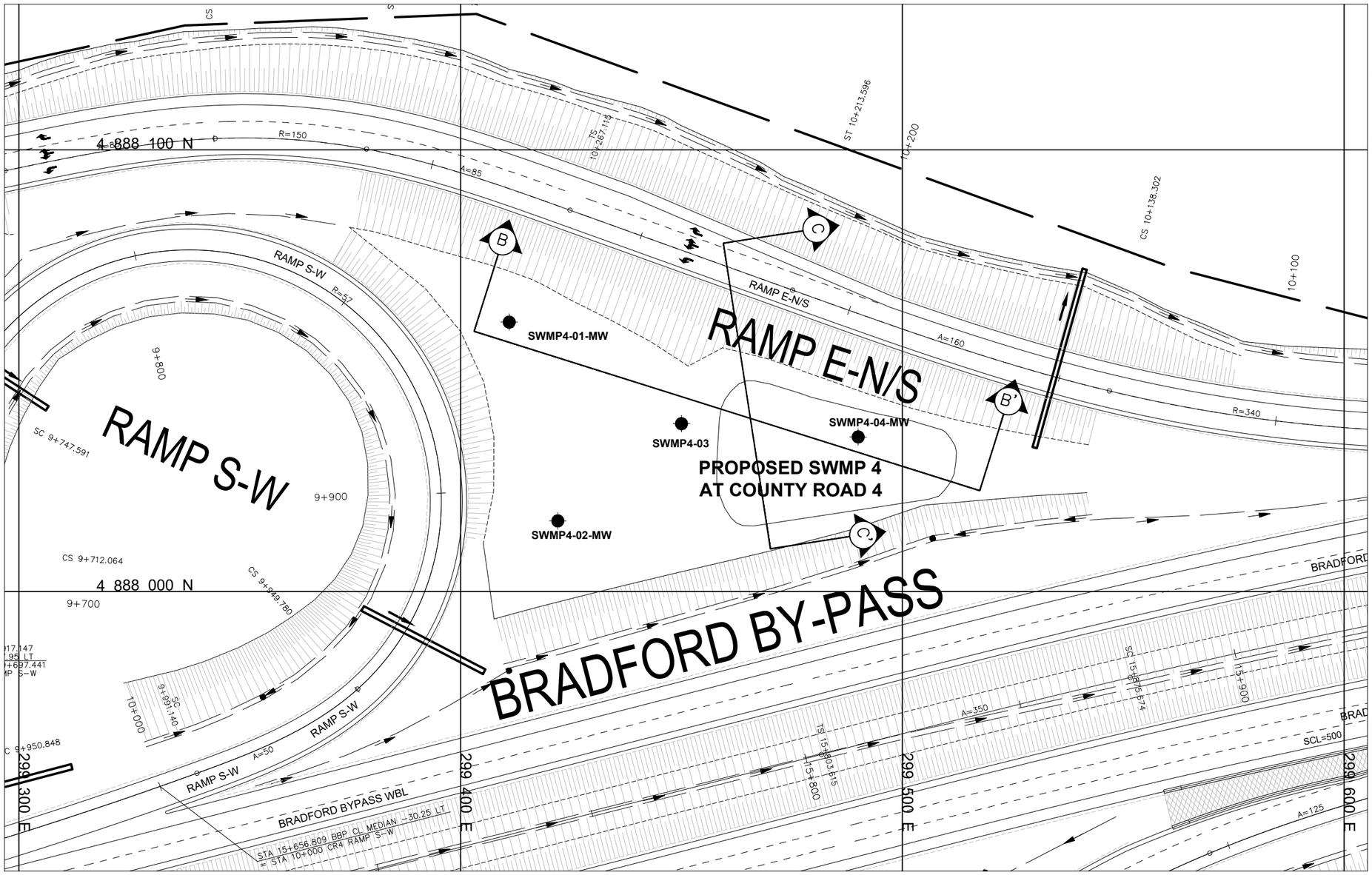
LICENSED PROFESSIONAL ENGINEER
A. G. MOHAMMAD
100173142
2026-03-20
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
2	MAR 26	JC	FINAL
1	DEC 25	AV	DRAFT

Geocres No. 31D04-031

HWY. **BRADFORD BYPASS WEST**	PROJECT NO. 60731727		DIST. CENTRAL
SUBM'D. __	CHKD. __	DATE: 12/19/2025	SITE:
DRAWN: JC	CHKD. AM	APPD. CN	DWG. 2

MINISTRY OF TRANSPORTATION, ONTARIO



PLAN
SCALE 1:500
0 10 20 Meters

NOTES:

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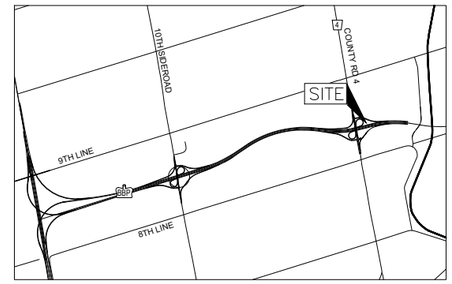
4. DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN. STATIONS ARE IN KILOMETRES AND METRES.
5. REFERENCE: BASE PLANS PROVIDED IN DIGITAL FORMAT BY AECOM FILES "Bradford Bypass_plan.dwg". RECEIVED OR DATED: MARCH 03, 2025.
6. REFER TO DRAWING No. 04 FOR CROSS SECTION B–B' AND SOIL STRATA.
7. REFER TO DRAWING No. 05 FOR CROSS SECTION C–C' AND SOIL STRATA.

CONT No. 2026–2005
GWP No. 2026–23–00

BRADFORD BYPASS PONDS
COUNTY ROAD 4 STORM WATER MANAGEMENT PONDS

BOREHOLE LOCATION PLAN
PROPOSED SWMP 4

AECOM



KEY PLAN
SCALE
1 0 1 2 km

LEGEND

- BOREHOLE – CURRENT INVESTIGATION
- SEAL
- PIEZOMETER
- N STANDARD PENETRATION TEST VALUE
- 16 BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% ROCK QUALITY DESIGNATION (RQD)
- WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- WL UPON COMPLETION OF DRILLING
- ARTESIAN WATER CONDITIONS

BOREHOLE COORDINATES (MTM NAD 83 ZONE 10)

No.	ELEVATION	NORTHING	EASTING
SWMP4–01–MW	252.43	4888061	299411
SWMP4–02–MW	251.21	4888016	299422
SWMP4–03	250.06	4888038	299450
SWMP4–04–MW	247.87	4888035	299490

LICENSED PROFESSIONAL ENGINEER
C.M.P NASCIMENTO
33549015
2026-03-26
PROVINCE OF ONTARIO

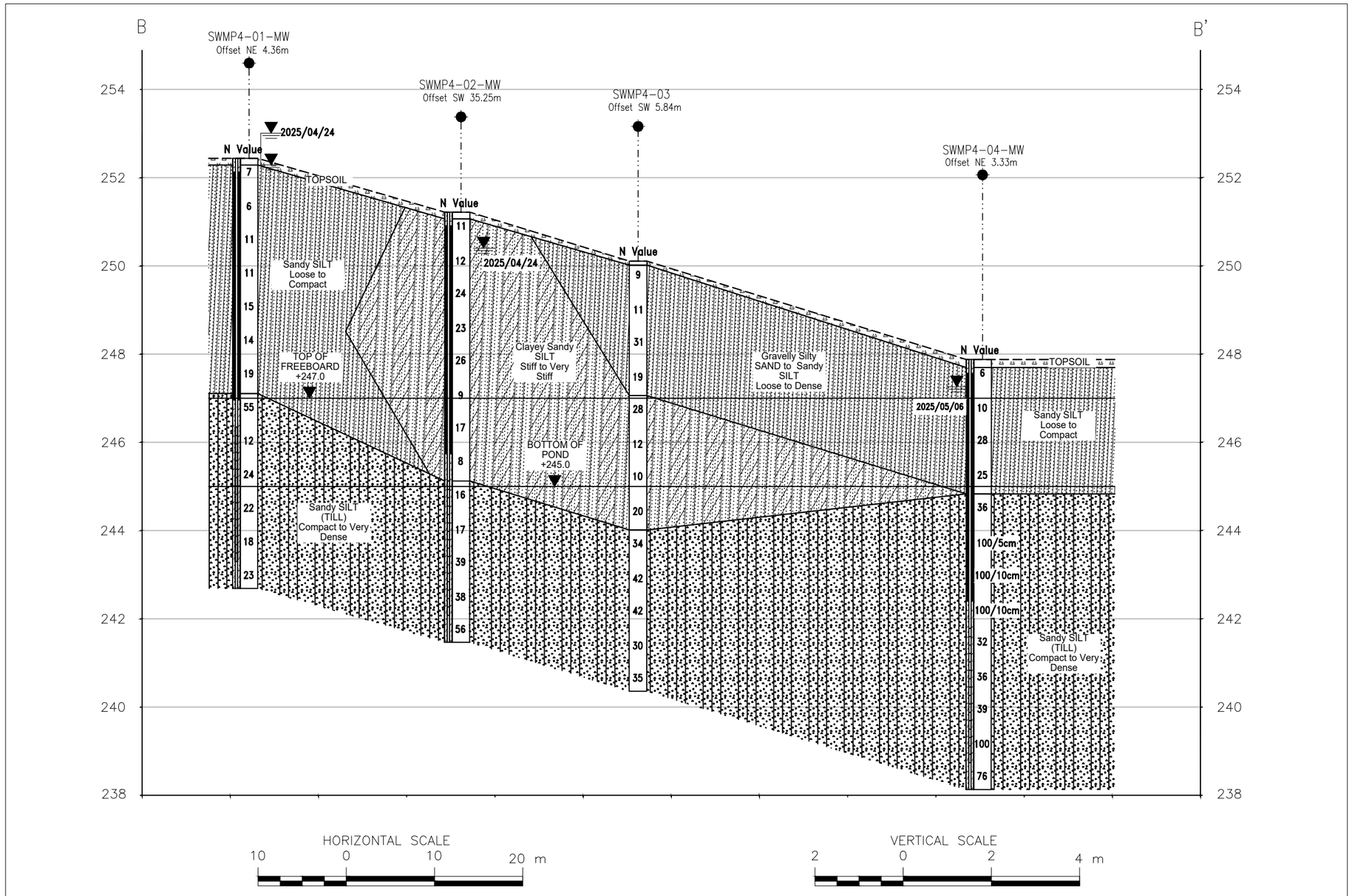
LICENSED PROFESSIONAL ENGINEER
A. G. MOHAMMAD
100173142
2026-03-20
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
2	MAR. 26	JC	FINAL
1	DEC. 25	AV	DRAFT

Geocres No. 31D–04–031

HWY. BRADFORD BYPASS WEST	PROJECT NO. 60731727		DIST. CENTRAL
SUBM'D. __	CHKD. __	DATE: 12/19/2025	SITE:
DRAWN: JC	CHKD. AM	APPD. CN	DWG. 3

PLOT DATE: 2026/03/20
FILENAME: C:\Users\CHeung3\OneDrive - AECOM\Documents\projects\MTO Highway 10 Hwy 413 Interchange\x60320\Bradford Bypass_Borehole location plan_recover - Standard\Bradford Bypass_Borehole location plan_recover.dwg



SECTION B-B' - PROPOSED SWMP 4

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
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6. REFER TO BOREHOLE LOCATION PLAN, DRAWING NO. 03 FOR A LIST OF DRILLED BOREHOLES AND COORDINATES.

CONT No. 2026-2005
GWP No. 2026-23-00

BRADFORD BYPASS PONDS
COUNTY ROAD 4 STORM WATER MANAGEMENT PONDS
SOIL STRATA
PROPOSED SWMP 4
PROFILE SECTION B-B'

AECOM

LEGEND

- BOREHOLE – CURRENT INVESTIGATION
- SEAL
- PIEZOMETER
- N — STANDARD PENETRATION TEST VALUE
- 16 — BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% — ROCK QUALITY DESIGNATION (RQD)
- WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- WL UPON COMPLETION OF DRILLING
- ARTESIAN WATER CONDITIONS

LEGEND – SOIL STRATA:

- TOPSOIL
- GRAVELLY SILTY SAND/ SANDY SILT
- CLAYEY SANDY SILT
- SANDY SILT (TILL)

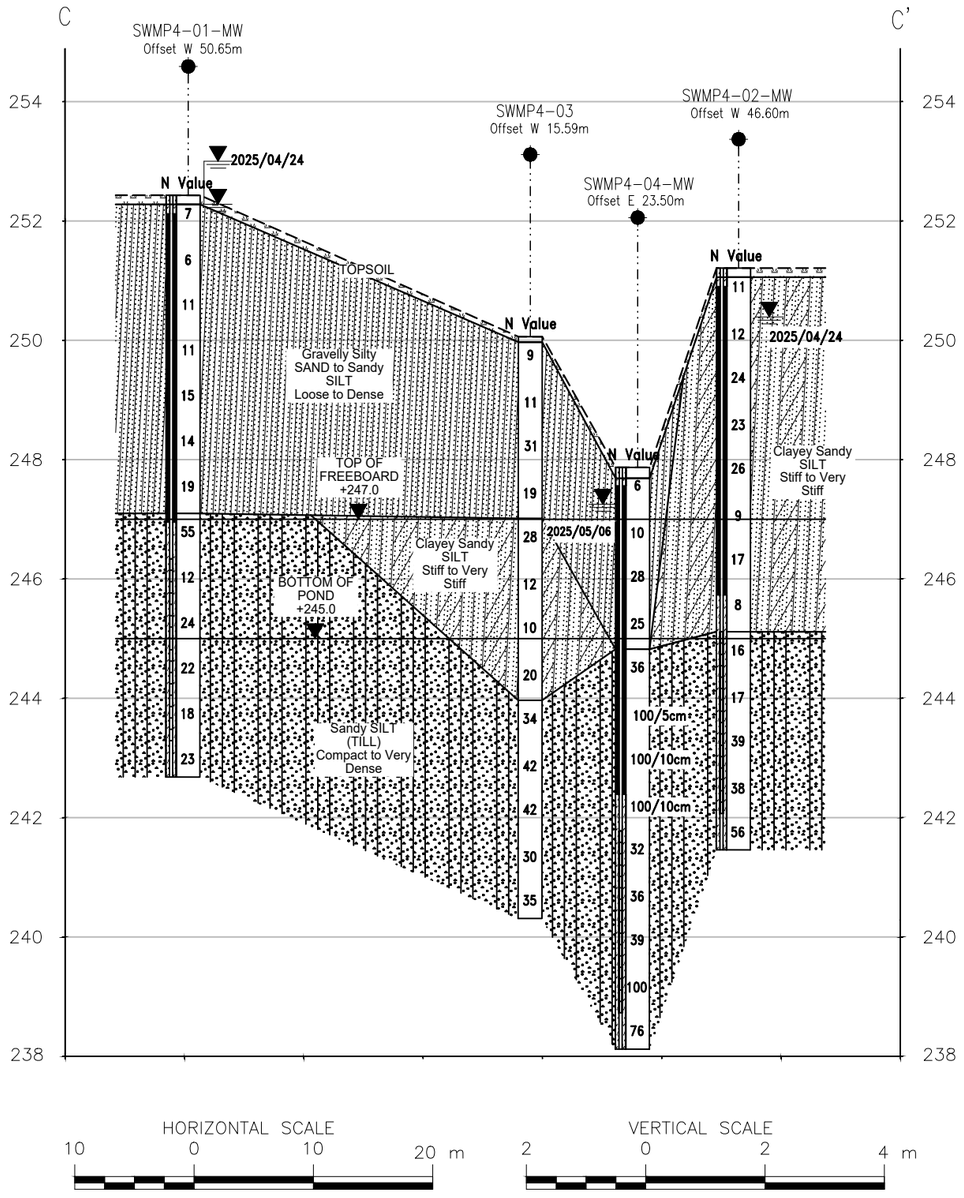
LICENSED PROFESSIONAL ENGINEER
C.M.P NASCIMENTO
33549015
2026-03-26
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
A. G. MOHAMMAD
100173142
2026-03-20
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
2	MAR 26	JC	FINAL
1	DEC 25	AV	DRAFT

Geocres No. 31D04-031

HWY. **BRADFORD BYPASS WEST**	PROJECT NO. 60731727		DIST. CENTRAL
SUBM'D. __	CHKD. __	DATE: 12/19/2025	SITE:
DRAWN: JC	CHKD. AM	APPD. CN	DWG. 4



SECTION C-C' - PROPOSED SWMP 4

NOTES:

1. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE TEXT OF REPORT AND RECORD OF BOREHOLE LOGS.
2. THIS DRAWING IS FOR SUBSURFACE INFORMATION ONLY. THE PROPOSED STRUCTURE DETAILS/WORKS ARE SHOWN FOR ILLUSTRATION PURPOSES ONLY AND MAY NOT BE CONSISTENT WITH THE FINAL DESIGN CONFIGURATION AS SHOWN ELSEWHERE IN THE CONTRACTS DOCUMENTS.
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6. REFER TO BOREHOLE LOCATION PLAN, DRAWING NO. 03 FOR A LIST OF DRILLED BOREHOLES AND COORDINATES.

CONT No. 2026-2005
GWP No. 2026-23-00

BRADFORD BYPASS PONDS
COUNTY ROAD 4 STORM WATER MANAGEMENT PONDS
SOIL STRATA
PROPOSED SWMP 4
PROFILE SECTION C-C'

AECOM

LEGEND

- BOREHOLE – CURRENT INVESTIGATION
- SEAL
- PIEZOMETER
- N — STANDARD PENETRATION TEST VALUE
- 16 — BLOWS/0.3M UNLESS OTHERWISE STATED (STD. PEN. TEST, 475 J/BLOW)
- 100% — ROCK QUALITY DESIGNATION (RQD)
- WL IN PIEZOMETER, MEASURED ON YYYY/MM/DD
- WL UPON COMPLETION OF DRILLING
- ARTESIAN WATER CONDITIONS

LEGEND – SOIL STRATA:

- TOPSOIL
- GRAVELLY SILTY SAND/ SILT AND SAND/ SANDY SILT
- CLAYEY SANDY SILT
- SANDY SILT (TILL)

LICENSED PROFESSIONAL ENGINEER
C.M.P NASCIMENTO
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2026-03-26
PROVINCE OF ONTARIO

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100173142
2026-03-20
PROVINCE OF ONTARIO

NO.	DATE	BY	REVISION
2	MAR 26	JC	FINAL
1	DEC 25	AV	DRAFT

Geocres No. 31D04-031

HWY. **BRADFORD BYPASS WEST**	PROJECT NO. 60731727		DIST. CENTRAL
SUBM'D. __	CHKD. __	DATE: 12/19/2025	SITE:
DRAWN: JC	CHKD. AM	APPD. CN	DWG. 5

Appendix B

Records of Boreholes Logs

AECOM

TERMINOLOGY USED IN BOREHOLE LOGS

Topsoil: Mixture of soil and humus capable of supporting good vegetative growth.

Peat: A mass of organic matter usually fibrous in texture in various stages of decomposition, generally dark brown to black in colour and of spongy consistency.

Fill: The term fill has been used to describe materials which have been placed by non-natural processes. Fills can often be heterogeneous in nature and those relying on this report should expect them to contain deleterious materials. Such materials can include wood, bricks, slag, porcelain, organics, and obstructions such as scrap metal, storage tanks, and abandoned concrete/steel structures.

Due to the uncertainty of the placement method of the material, the boring samples obtained for this report are not expected to represent other materials at any horizontal or vertical distance from where the sample was obtained.

Fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill site. Unless specifically stated, the fill on this site has not been tested for contaminants that can be considered toxic or hazardous. Testing to determine the toxicity of fill materials can be conducted, if requested.

Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Till must be considered heterogeneous in composition and containing pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) and boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the logs. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Due to the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone. Caution is essential when dealing with sensitive excavations or dewatering programs in till materials.

Terminology describing soil structure

Desiccated: having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.

Stratified: alternating layers of varying material or color with the layers greater than 6 mm thick.

Laminated: alternating layers of varying material or color with the layers less than 6 mm thick.

Fissured: material breaks along plane of fracture.

Varved: composed of regular alternating layers of silt and clay.

Slickensided: fracture planes appear polished or glossy, sometimes striated.

Blocky: cohesive soil that can be broken down into small angular lumps which resist further breakdown.

Lensed: inclusion of small pockets of different soil, such as small lenses of sand scattered through a mass of clay; not thickness.

Seam: a thin, confined layer of soil having different particle size, texture, or color from materials above and below.

Homogeneous: same color and appearance throughout.

Well Graded: having wide range in grain sized and substantial amounts of all predominantly on grain size.

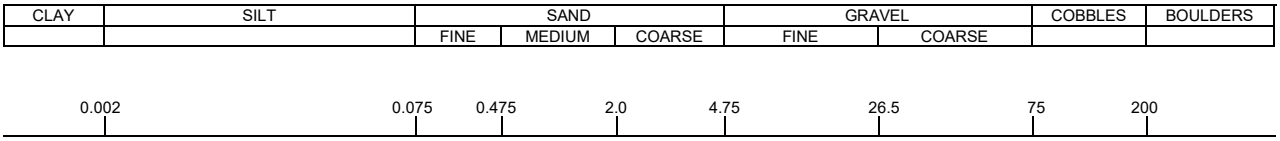
Uniformly Graded: predominantly on grain size.

Residual: completed weathered sedimentary rock mixed with native soils.

AECOM

All soil sample descriptions included in this report generally follow the Canadian Foundations Engineering Manual and the Unified Soil Classification System. These systems follow the standard proposed by the International Society for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by AECOM follow the same system. Note that, with exception of those samples where a grain size distribution analysis has been completed, all samples have been classified by visual inspection. Visual inspection classification is not sufficient to provide exact gain sizing.

ISSMFE / USCS SOIL CLASSIFICATION



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis. Standard Penetration Test 'N' values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils.

The standard terminology to describe cohesionless soils includes the compactness condition as determined by the Standard Penetration Test 'N' value.

Cohesionless Soils		Cohesive Soils			Composition	
Compactness Condition	**SPT N-Index (blows per 0.3 m)**	**Consistency**	**Undrained Shear Strength (kPa)**	**SPT N-Index (blows per 0.3 m)**	**Term**	**Criteria**
Very loose	0 – 5	Very soft	< 12	< 2	Trace	1% - 10%
Loose	5 – 10	Soft	12 - 25	2 – 5	Some	10% - 20%
Compact	10 – 30	Firm	25 – 50	5 – 8	Adjective	20% - 35%
Dense	30 – 50	Stiff	50 – 100	8 – 15	And	> 35%
Very Dense	> 50	Very Stiff	100 - 200	15 – 30	Noun	> 35% & largest fraction
		Hard	> 200	> 30		

Standard Penetration Test (SPT):

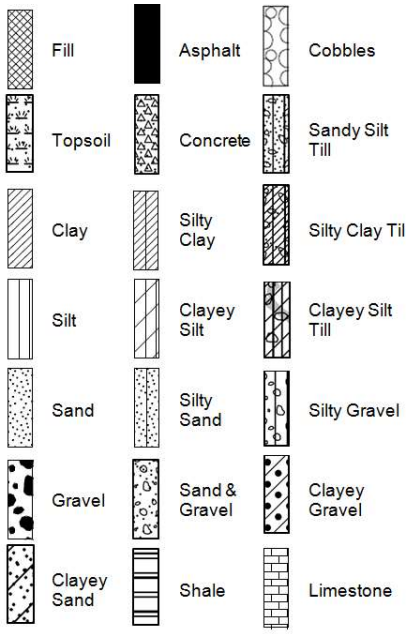
The number of blows required to drive a 50 mm (2 in.) open split spoon sampler from a depth of 150 mm (6 in.) to 450 mm (18 in.) in undisturbed soil. Each blow is driven by a 63.6 kg (140 lb.) hammer free falling a distance of 0.76 m (30 in.).

Sample & Soil Abbreviations	
CORE	Rock core sample
AS	Auger sample
FV	Field vane
PP	Pocket penetrometer
SG	Specific Gravity
GS	Grab sample
SS	Split spoon sample
DCPT	Dynamic cone penetration test
GR	Gravel
SA	Sand
SI	Silt
CL	Clay

Contaminant Abbreviations	
BNAE	base/neutral/acid extractables
BTEX	benzene, toluene, ethylbenzene, xylenes
OCP	organochlorine pesticides
MI	metals & inorganics
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PHC	CCME petroleum hydrocarbons (fractions 1 – 4)
VOC	volatile organic compounds (includes BTEX)

Plasticity Description	**Liquid Limit (w_l)**
Low	$w_l < 35$
Medium	$35 < w_l < 50$
High	$50 < w_l$

Strata/Graphic Plot



RECORD OF BOREHOLE No SWMP3-01-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4887844.0; E 299234.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY MF

DATUM Geodetic (CGVD28) DATE 2025.07.16 - 2025.07.16 LATITUDE 44.130570 LONGITUDE -79.569555 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w_L	WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.7	GROUND SURFACE														
258.6	**TOPSOIL**, brown, moist (150 mm)														
0.2	**FILL**, gravelly sand, trace to some silt, trace to some clay, brown, moist, compact to very dense		1	SS	25		258			○					
			2	SS	14										
			3	SS	63		257			○					29 51 (20)
256.4															
2.3	**SILTY CLAY**,trace sand, brown, moist to very moist, stiff to very stiff		4	SS	12		256								
			5	SS	8						○				
			6	SS	8		255								
			7	SS	9		254				⊖				0 7 34 59
			8	SS	13		253								
			9	SS	19					○					
251.9							252								
6.9	**SILT**, trace sand, some clay, grey, moist to very moist, compact (TILL)		10	SS	20										
			11	SS	26		251			○					
			12	SS	21		250								
			13	SS	17					○					0 6 81 13
249.0							249								
9.8	**END OF BOREHOLE**														

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 2025.07.29.
4. The borehole caved in at a depth of 9.1 m.
5. Groundwater levels were measured at 2.18 mBGS on 2025.07.29, 2.23 mBGS on 2025.08.07, 2.26 mBGS on 2025.09.15, and 2.27 mBGS on 2025.10.03.

Monitoring Well Legend: Filter Sand; Screen; Bentonite Seal; Bentonite at the bottom of hole; Open Borehole or Test Pit; Monitoring Well, Piezometer or Standpipe

○ 3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No SWMP3-02-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4887815.0; E 299186.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Track Mount CME 75 / HSA COMPILED BY MF

DATUM Geodetic (CGVD28) DATE 2025.07.14 - 2025.07.14 LATITUDE 44.130308 LONGITUDE -79.570155 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.2	GROUND SURFACE										
258.2 / 0.0	**TOPSOIL**, brown, wet (80 mm)										
258.1 / 0.1	**FILL**, gravelly sand, brown, moist to wet, very loose to compact		1	SS	8		258				
			2	SS	16		257				
			3	SS	4						
256.0							256				
2.3	**CLAYEY SILT**, some sand, trace gravel, trace organics, brown, moist to very moist, firm to very stiff		4	SS	25						1 14 52 33
			5	SS	20		255				
			6	SS	5		254				
			7	SS	28						
252.9							253				
5.3	**SAND**, trace gravel, some silt, trace clay, grey, wet, compact		8	SS	25						1 76 20 3
			9	SS	23		252				
			10	SS	16		251				
250.6											
7.6	**SILT**, some clay, trace sand, grey, moist, very dense (TILL)		11	SS	64		250				
			12	SS	57						Non-Plastic 0 6 78 16
			13	SS	91		249				
248.5											
9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 2025.07.29.
4. The borehole caved in at a depth of 7.5 m.
5. Groundwater levels were measured at 0.30 mBGS on 2025.07.29, 0.43 mBGS on 2025.08.07, 0.46 mBGS on 2025.09.15, and 0.43 mBGS on 2025.10.03.

Monitoring Well Legend: Filter Sand; Screen; Bentonite Seal; Bentonite at the bottom of hole; ▽ Open Borehole or Test Pit; ▼ Monitoring Well, Piezometer or Standpipe

○ 3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

RECORD OF BOREHOLE No SWMP3-03-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4887774.0; E 299232.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Track Mount CME 75 / HSA COMPILED BY MF

DATUM Geodetic (CGVD28) DATE 2025.07.14 - 2025.07.14 LATITUDE 44.129940 LONGITUDE -79.569580 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
253.5	GROUND SURFACE										
253.3	**TOPSOIL**, dark brown, moist (150 mm)										
0.2	**FILL**, sand, some silt, trace gravel, trace clay, brown, moist, loose to compact		1	SS	19		253		○		
			2	SS	12		252				
			3	SS	6	▼			○		
251.2											
2.3	**CLAYEY SILT**, some sand, trace gravel, grey, moist, stiff to very stiff		4	SS	15		251		○		1 11 58 30
			5	SS	12		250				
			6	SS	15				○		
248.9							249				
4.6	**SANDY SILT**, some clay, trace to some gravel, grey, moist, dense to very dense (TILL)		7	SS	52						
			8	SS	43		248		○		14 33 38 15
			9	SS	57		247				
			10	SS	97				○		
			11	SS	42		246				
			12	SS	38		245		○H		4 34 47 15
			13	SS	32		244		○		
243.7											
9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 2025.07.29.
4. The borehole caved in at a depth of 7.5 m.
5. Groundwater levels were measured at 6.63 mBGS on 2025.07.29, 4.19 mBGS on 2025.08.07, 3.17 mBGS on 2025.08.08, 1.84 mBGS on 2025.09.15, and 4.78 mBGS on 2025.10.03.

Monitoring Well Legend: Filter Sand; Screen; Bentonite Seal; Bentonite at the bottom of hole; Open Borehole or Test Pit; Monitoring Well, Piezometer or Standpipe

○ 3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

RECORD OF BOREHOLE No SWMP3-04 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4887805.0; E 299220.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY MF

DATUM Geodetic (CGVD28) DATE 2025.07.15 - 2025.07.15 LATITUDE 44.130219 LONGITUDE -79.569730 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
255.9	GROUND SURFACE										
255.8 / 0.1	**TOPSOIL**, brown, moist (80 mm)										
	FILL, silty sand, trace gravel, trace to some clay, brown, moist to wet, loose to compact		1	SS	13				○		
			2	SS	19		255				
			3	SS	12		254		○		9 58 (33)
			4	SS	5						
252.9							253				
3.0	**CLAYEY SILT**, trace to some sand, trace gravel, brown, moist to very moist, stiff to very stiff		5	SS	12				○		
			6	SS	10		252		⊢○		1 20 37 42
			7	SS	19		251		○		
			8	SS	19						
			9	SS	24		250		○		2 6 (92)
249.0											
6.9	**SILT**, some clay, trace sand, trace cobbles, grey, moist, compact to dense (TILL)		10	SS	20		249				
			11	SS	22		248		○		
			12	SS	39		247				
			13	SS	24				○		Non-Plastic 0 1 86 13
246.1											
9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. The borehole was backfilled with a bentonite hole plug.
4. The borehole caved in at a depth of 7.6 m.
5. The borehole was dry upon completion of drilling.

○ $^{3\%}$ STRAIN AT FAILURE

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

RECORD OF BOREHOLE No SWMP4-01-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4888061.0; E 299411.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY PAK

DATUM Geodetic (CGVD28) DATE 2024.12.02 - 2024.12.02 LATITUDE 44.132524 LONGITUDE -79.567346 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w_L	WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
252.4	GROUND SURFACE														
252.2 0.0	**TOPSOIL**, dark brown, moist (150 mm)														
0.2	**SANDY SILT**, some clay, trace gravel, brown to grey, moist to wet, loose to compact		1	SS	7		252				○				
			2	SS	6						○				
			3	SS	11		251			H					6 31 49 14
			4	SS	11		250								
			5	SS	15		249								
			6	SS	14		248								
247.1			7	SS	19						○				7 34 44 15
5.3	**SANDY SILT**, some clay, trace gravel, brown to grey, moist, compact to very dense (TILL)		8	SS	55		247								
			9	SS	12		246				○				
			10	SS	24										
			11	SS	22		245			H					1 33 47 19
			12	SS	18		244								
			13	SS	23		243				○				
242.7 9.8	**END OF BOREHOLE**														

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 2025-04-24.
4. The borehole caved in at a depth of 8.4 m.
5. Groundwater level was measured at 0.11 mBGS on 2025-06-06.
6. Flowing artesian was measured at 0.56 m on 2025-04-24, and 0.36 m on 2025-05-15.

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

Monitoring Well Legend

Filter Sand
Screen
Bentonite Seal
Bentonite at the bottom of hole
Open Borehole or Test Pit
Monitoring Well, Piezometer or Standpipe
○ 3% STRAIN AT FAILURE
+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No SWMP4-02-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4888016.0; E 299422.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY PAK

DATUM Geodetic (CGVD28) DATE 2024.12.04 - 2024.12.04 LATITUDE 44.132119 LONGITUDE -79.567208 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH kPa (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE) (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (20 40 60)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
251.2	GROUND SURFACE										
251.0 / 0.2	**TOPSOIL**, dark brown, moist (150 mm)										
	CLAYEY SANDY SILT, trace gravel, brown, moist, stiff to very stiff		1	SS	11		251		○		
			2	SS	12		250				
			3	SS	24				○		5 33 39 23
			4	SS	23		249				
			5	SS	26		248		○		
			6	SS	9		247				
			7	SS	17				○		
245.1			8	SS	8		246				
6.1	**SANDY SILT**, some clay, trace gravel, brown to grey, moist, compact to very dense (TILL)		9	SS	16		245		○		3 38 45 14
			10	SS	17		244				
			11	SS	39				○		
			12	SS	38		243				
			13	SS	56		242		○		
241.5 / 9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 11.30.2024.
4. The borehole caved in at a depth of 6.9 m.
5. Groundwater levels were measured at 0.96 mBGS on 2025.06.06, 1.72 mBGS on 2025.01.15, and 0.82 mBGS on 25.04.24.

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

Monitoring Well Legend: Filter Sand; Screen; Bentonite Seal; Bentonite at the bottom of hole; Open Borehole or Test Pit; Monitoring Well, Piezometer or Standpipe

○ 3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity

RECORD OF BOREHOLE No SWMP4-03 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4888038.0; E 299450.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY PAK

DATUM Geodetic (CGVD28) DATE 2024.12.03 - 2024.12.03 LATITUDE 44.132317 LONGITUDE -79.566858 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
250.1	GROUND SURFACE										
250.0 / 0.1	**TOPSOIL**, dark brown, moist (80 mm)										
	GRAVELLY SILTY SAND, trace to some clay, brown, moist, loose to dense		1	SS	9				○		
			2	SS	11		249				
			3	SS	31				○		24 29 (47)
247.0			4	SS	19		248		○		
3.0	**CLAYEY SANDY SILT**, trace gravel, grey, moist, stiff to very stiff		5	SS	28		247		○		8 35 (57)
			6	SS	12		246				
			7	SS	10				○ H		3 45 32 20
244.0			8	SS	20		245				
6.1	**SANDY SILT**, some gravel, some clay, some cobbles, brown, moist, dense (TILL)		9	SS	34		244		○ H		2 44 39 15
			10	SS	42		243				
			11	SS	42				○		2 36 42 20
			12	SS	30		242				
240.3			13	SS	35		241		○		
9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. The borehole was backfilled with a bentonite hole plug.
4. The borehole caved in at a depth of 9.2 m.
5. The borehole was dry upon completion of drilling.

○ 3% STRAIN AT FAILURE

+ 3, × 3: Numbers refer to Sensitivity

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

RECORD OF BOREHOLE No SWMP4-04-MW 1 OF 1 METRIC

G.W.P. 2026-23-00 LOCATION County Road 4 Storm Water Management Pond N 4888035.0; E 299490.0 / MTM Zone 10 ORIGINATED BY AK

DIST Central HWY BBP BOREHOLE TYPE Truck Mount CME 75 / HSA COMPILED BY PAK

DATUM Geodetic (CGVD28) DATE 2024.12.03 - 2024.12.04 LATITUDE 44.132291 LONGITUDE -79.566358 CHECKED BY BG

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
247.9	GROUND SURFACE										
247.7	**TOPSOIL**, dark brown, moist (150 mm)										
0.2	**SANDY SILT**, some clay, trace gravel, brown, moist, loose to compact		1	SS	6						
			2	SS	10		247				
			3	SS	28		246				2 43 42 13
			4	SS	25		245				
244.8											
3.0	**SANDY SILT**, some clay, trace gravel, brown, moist, dense to very dense (TILL)		5	SS	36						
			6	SS	100/ 5cm		244				
			7	SS	100/ 10cm		243				
			8	SS	100/ 10cm		242				
			9	SS	32						3 34 45 18
			10	SS	36		241				
			11	SS	39		240				
			12	SS	100		239				
			13	SS	76						
238.1											
9.8	**END OF BOREHOLE**										

Notes:
1. This log is to be read in conjunction with the subject report and project number as presented above.
2. Interpretation assistance by AECOM is required for projects excluding the above mentioned project.
3. Well capped on 11.30.2024.
4. The borehole caved in at a depth of 6.2 m.
5. Groundwater levels were measured at 0.63 mBGS on 2025.04.24, 0.62 mBGS on 2025.06.06, 0.62 mBGS on 2025.05.15, and 0.87 mBGS on 2025.01.15.

AECOM MTO FOUNDATION LOG BBP WEST LOGS 10 13 25.GPJ AECOM OTTAWA DATA TEMPLATE.GDT 25-12-18

Monitoring Well Legend: Filter Sand; Screen; Bentonite Seal; Bentonite at the bottom of hole

▽ Open Borehole or Test Pit; ▼ Monitoring Well, Piezometer or Standpipe

○ 3% STRAIN AT FAILURE

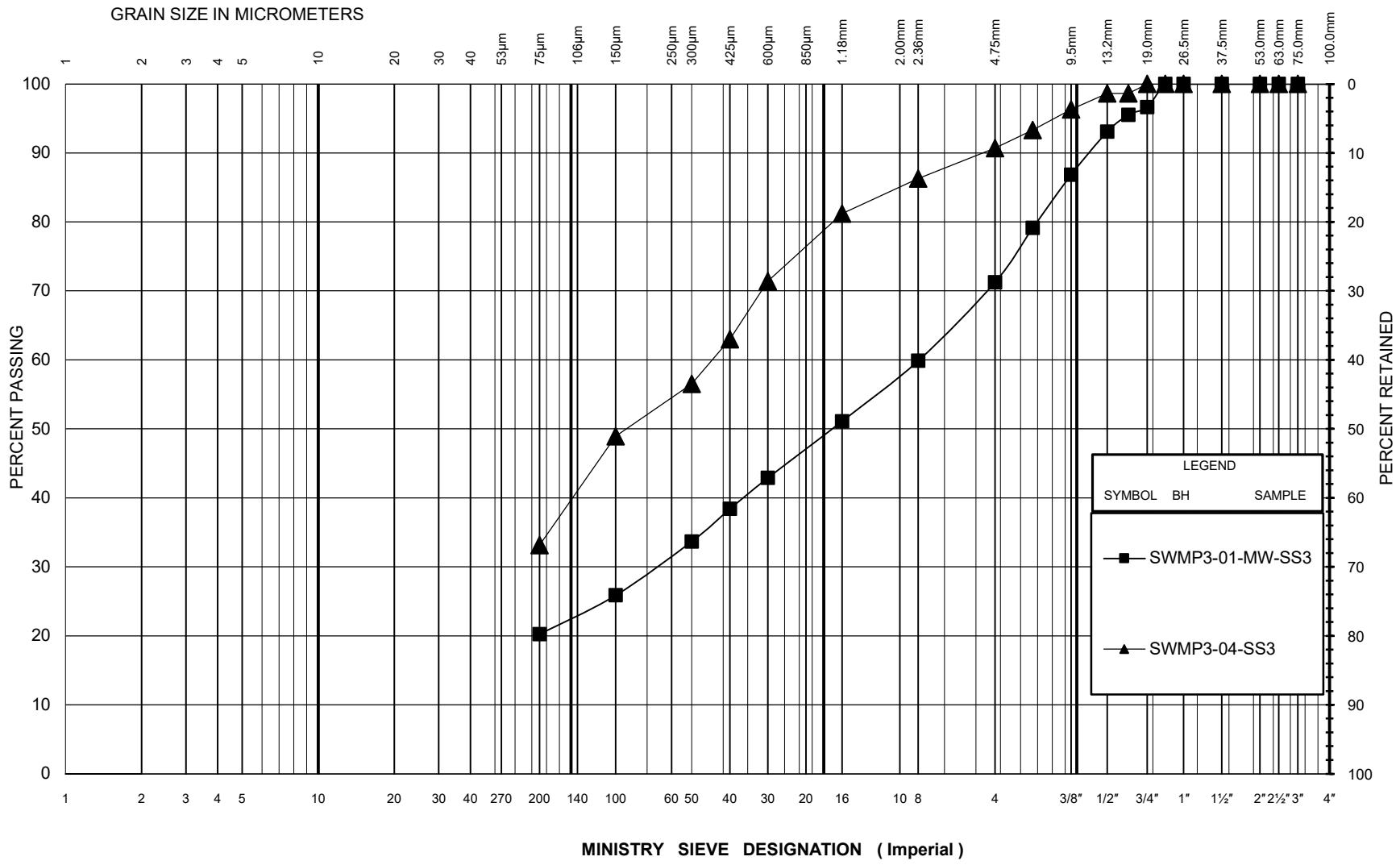
+ 3, × 3: Numbers refer to Sensitivity

Appendix C

Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	



Ministry of Transportation
Ontario

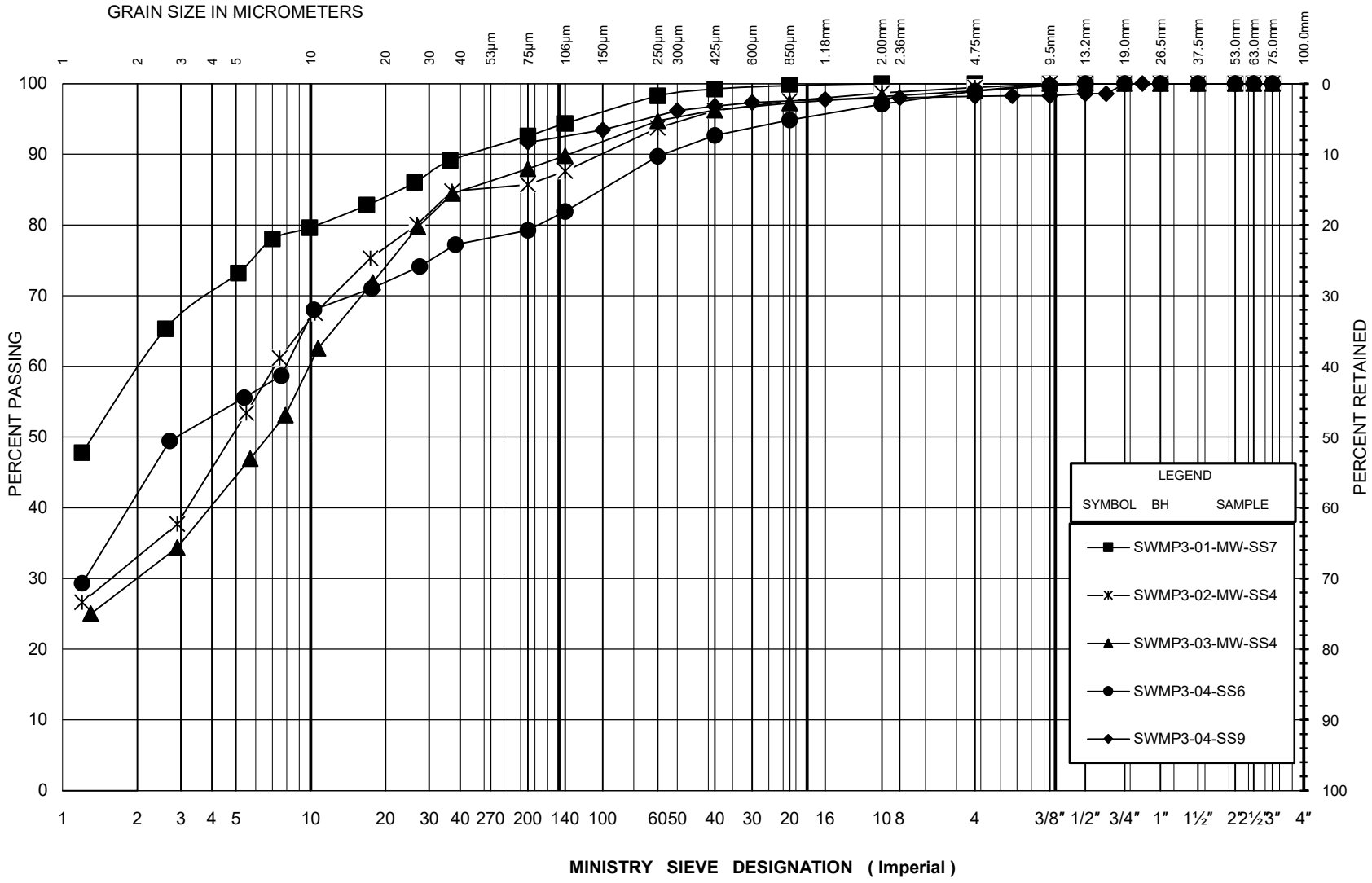
GRAIN SIZE DISTRIBUTION

Gravelly SAND / Silty SAND, trace to some clay (FILL)

Figure No.	1
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	



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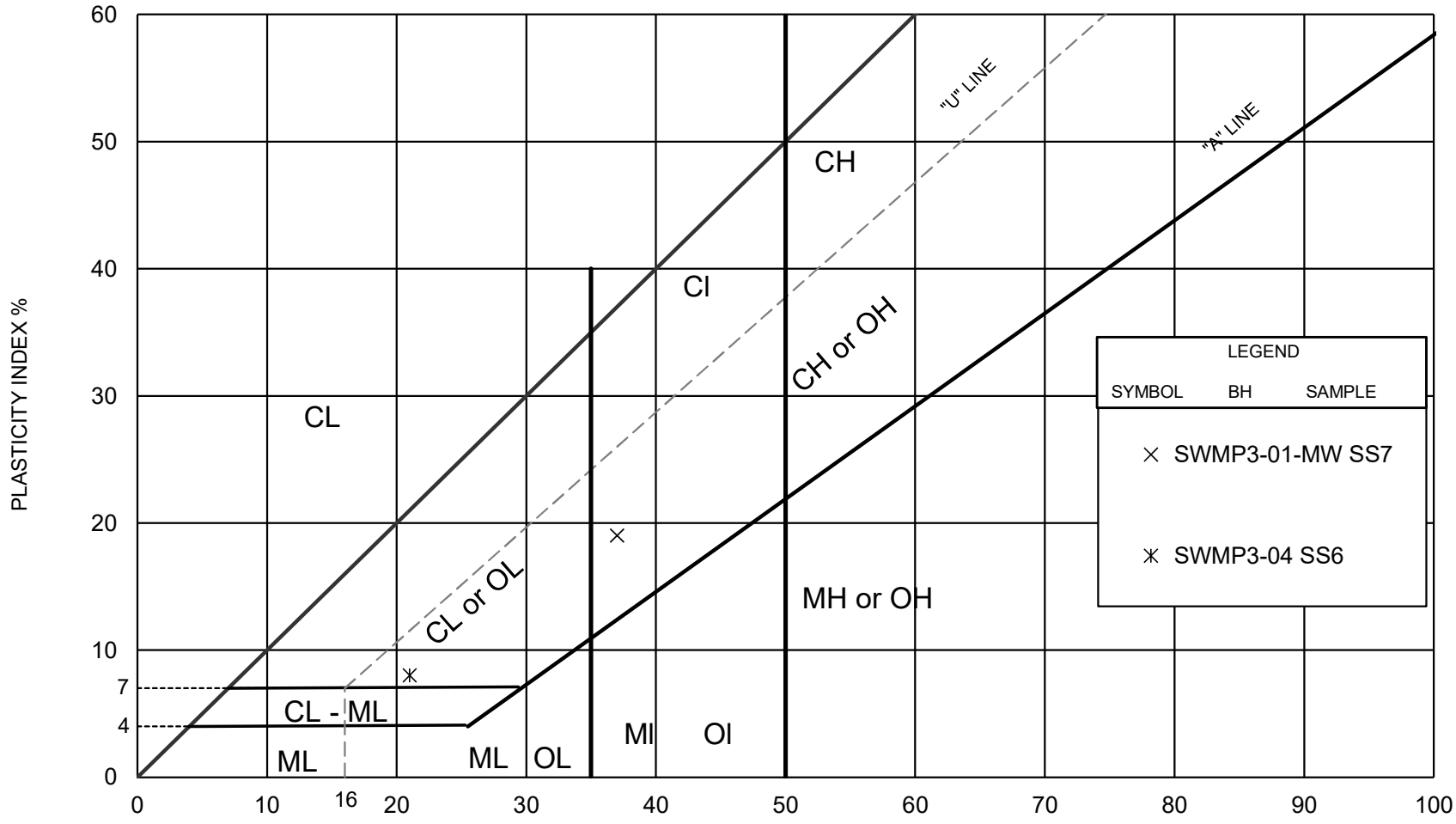
Ontario

GRAIN SIZE DISTRIBUTION

Clayey SILT / Silty CLAY, trace gravel, trace to some sand

Figure No.	2
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3



Ministry of Transportation
Ontario

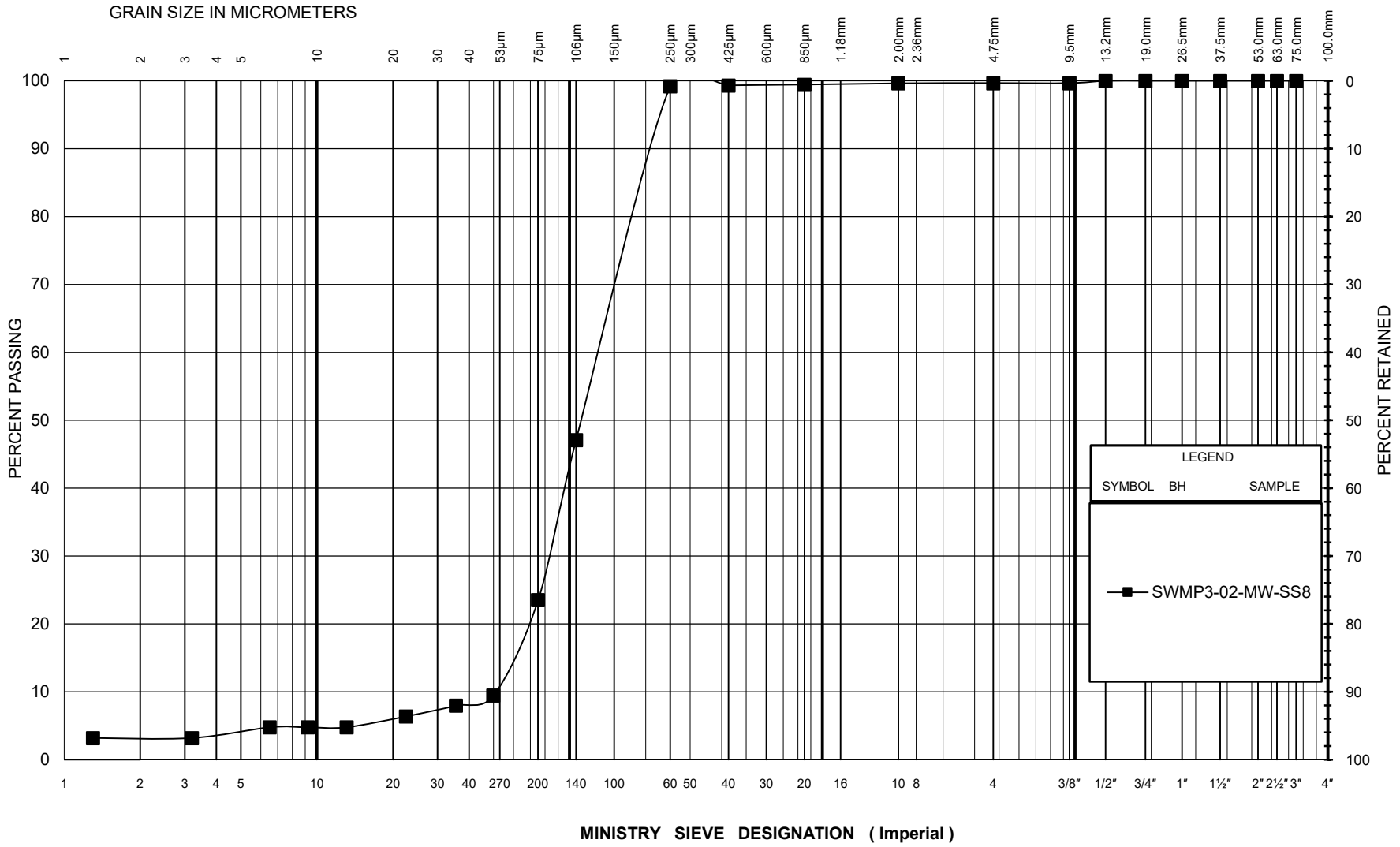
PLASTICITY CHART

Clayey SILT / Silty CLAY

Figure No.	3
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	



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Ontario

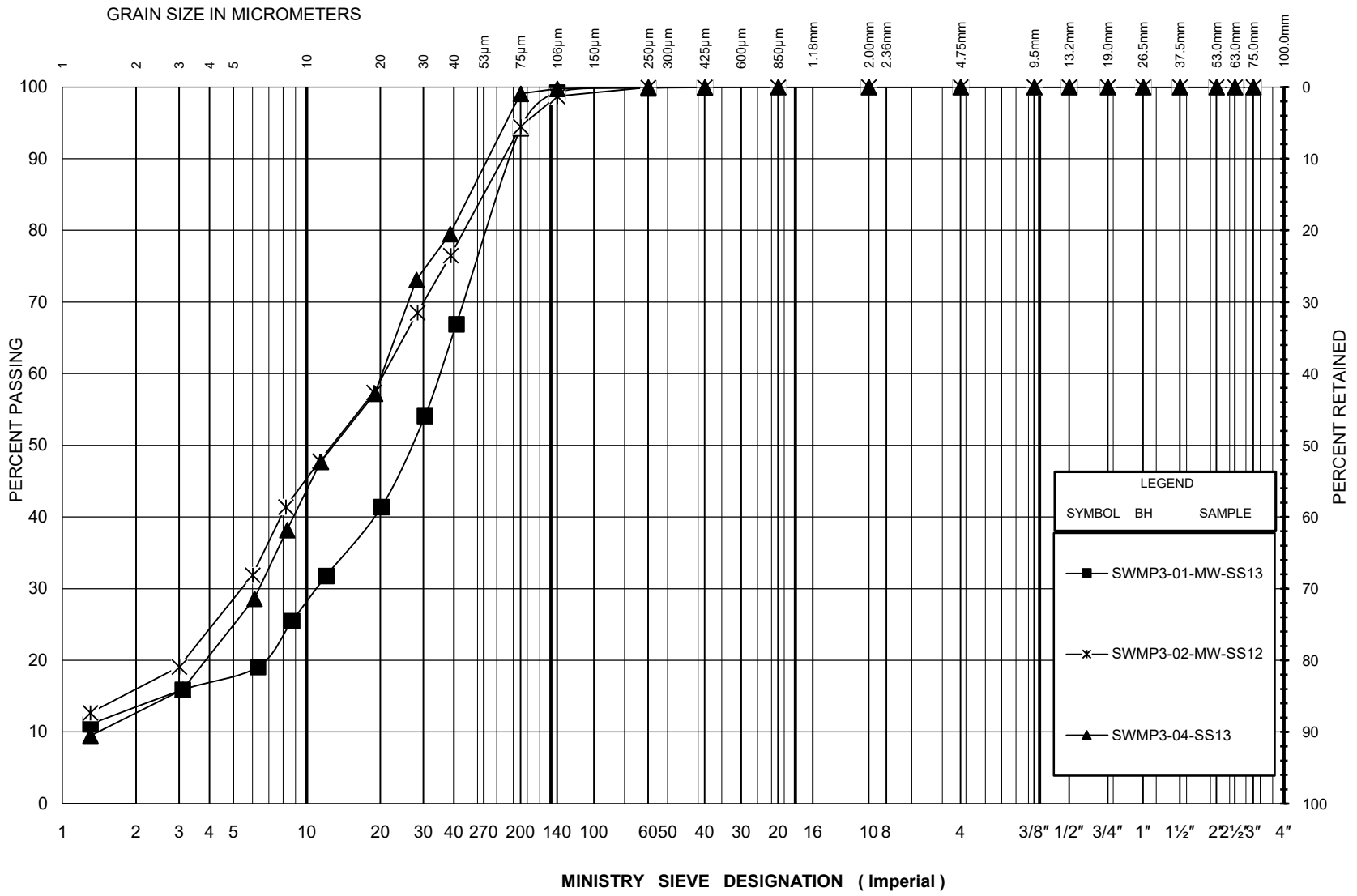
GRAIN SIZE DISTRIBUTION

SAND, trace gravel, some silt, trace clay

Figure No.	4
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	



Ministry of Transportation
Ontario

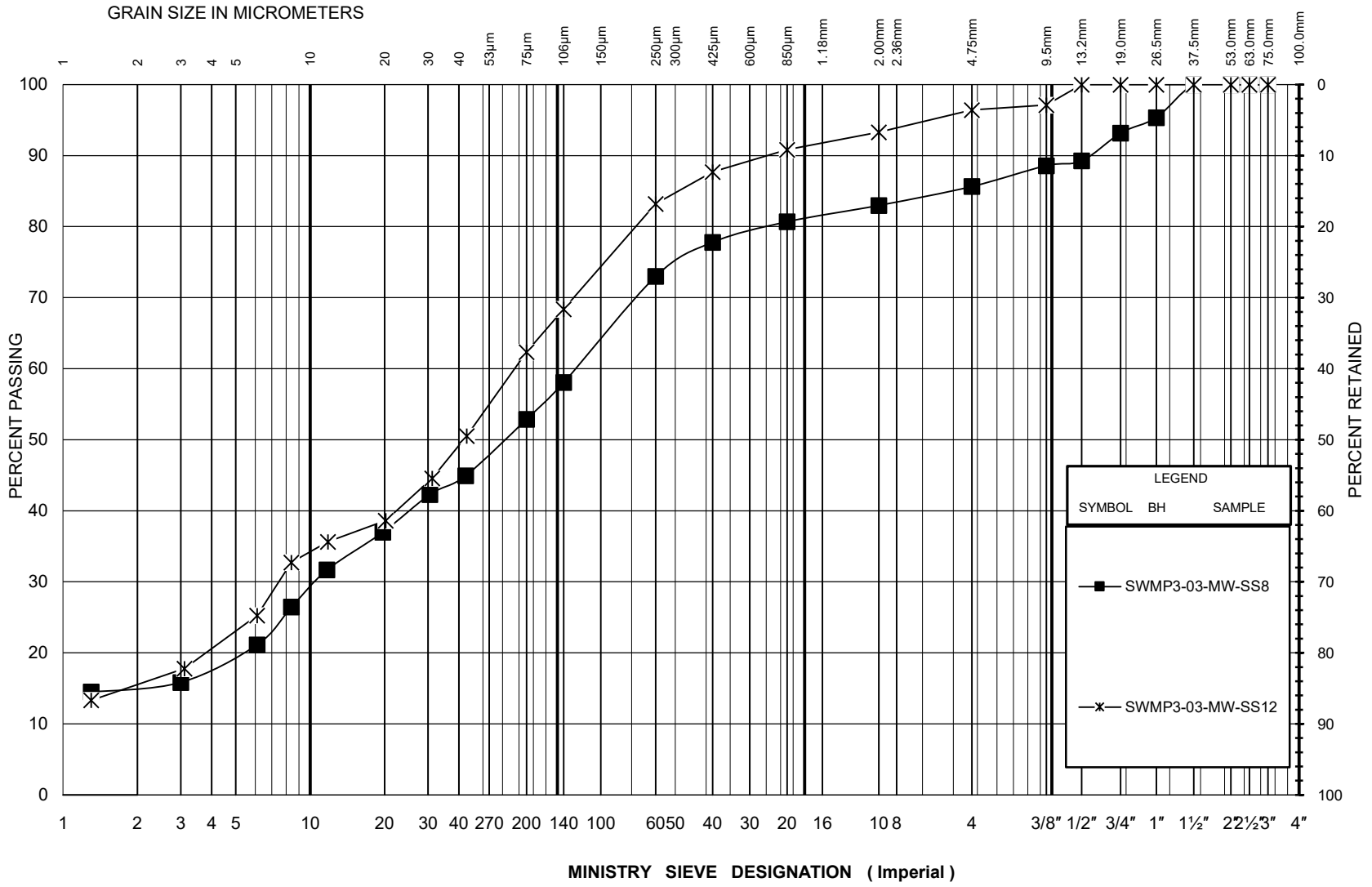
GRAIN SIZE DISTRIBUTION

SILT, trace sand, some clay (TILL)

Figure No.	5
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	

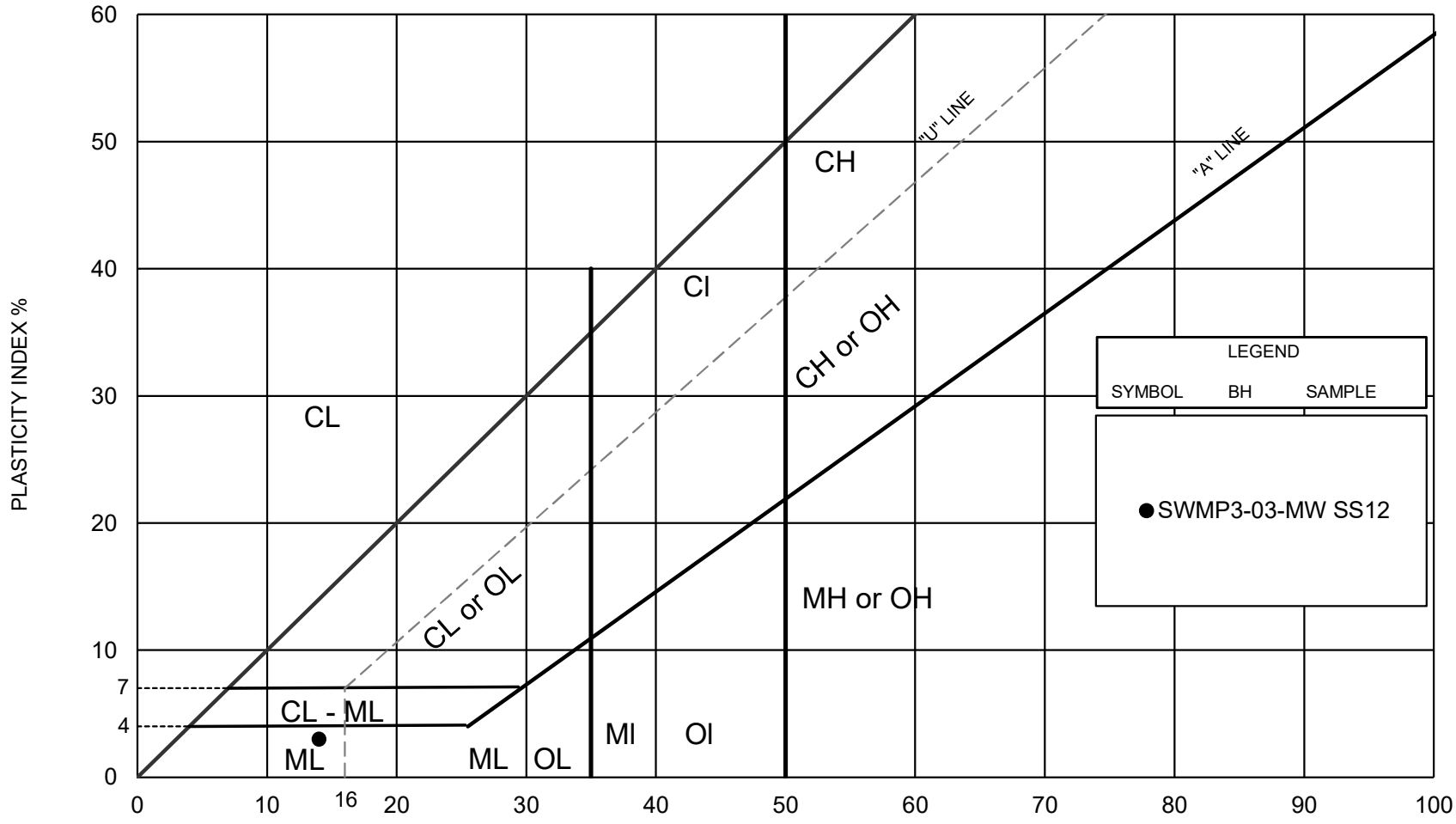


Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Sandy SILT, trace to some gravel, some clay (TILL)

Figure No.	6
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3



Ministry of Transportation
Ontario

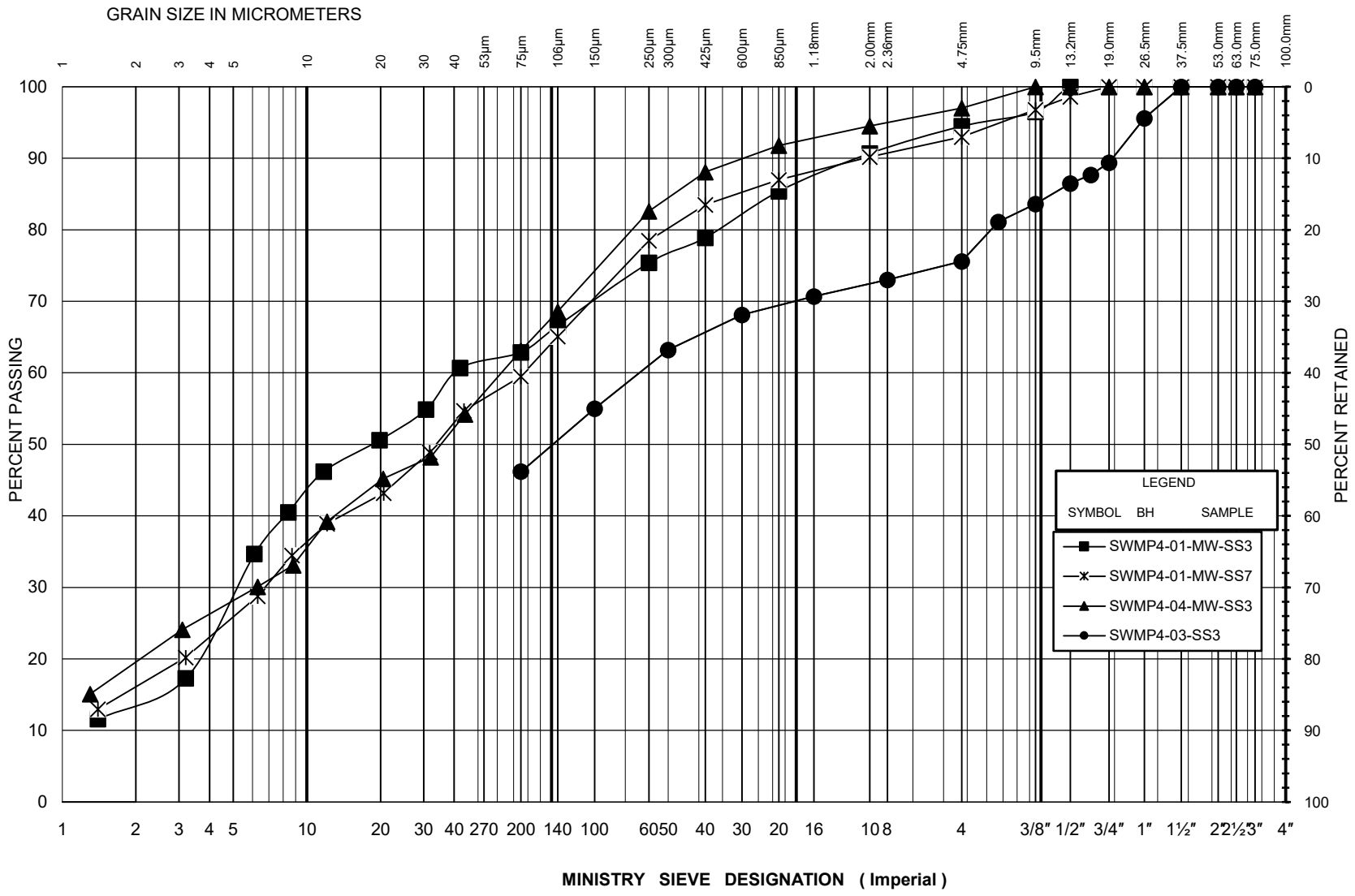
PLASTICITY CHART

Sandy SILT (TILL)

Figure No.	7
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 3

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	

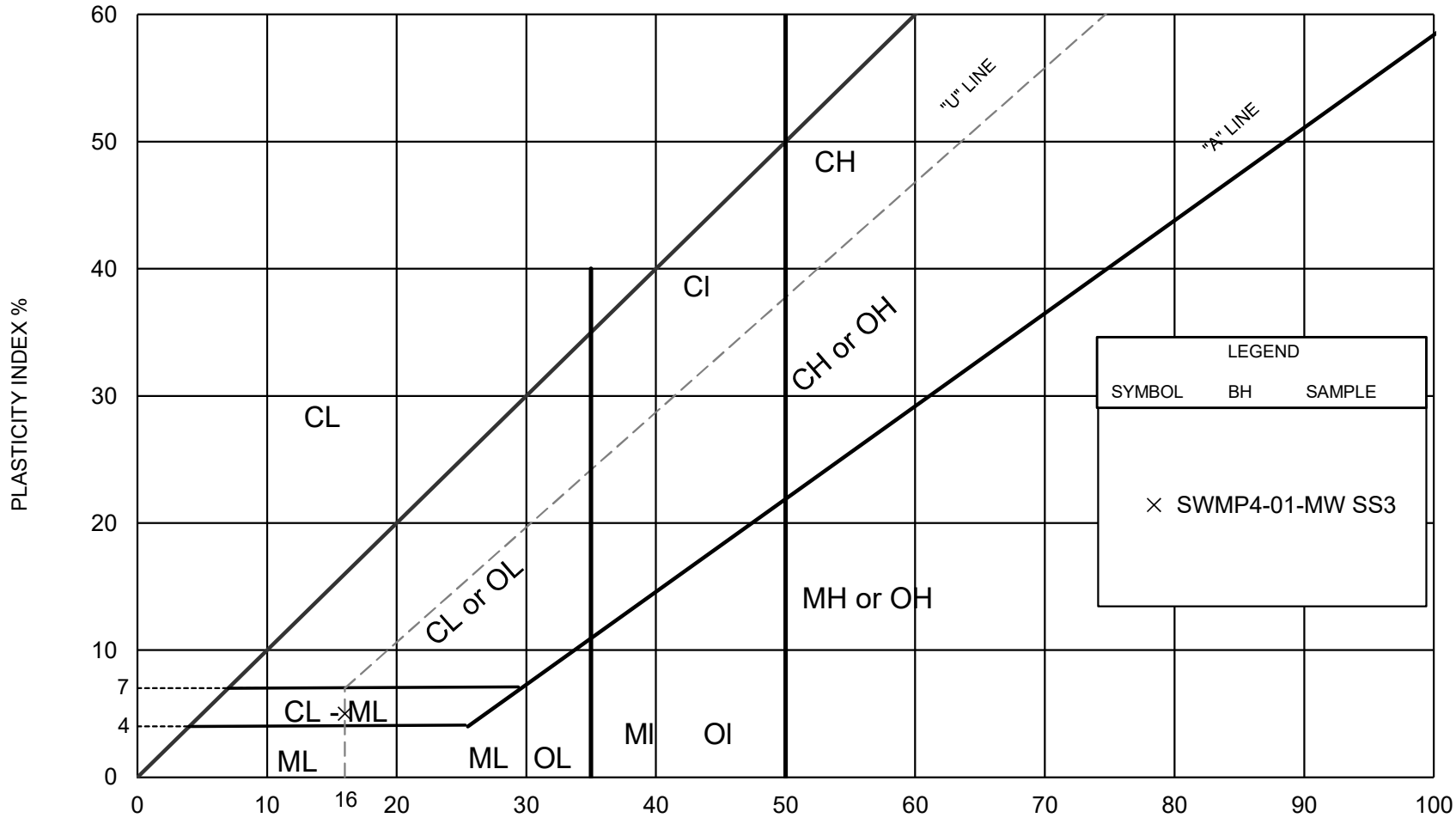


Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Sandy SILT / Silty SAND, trace gravel, some clay

Figure No.	8
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 4



Ministry of Transportation
Ontario

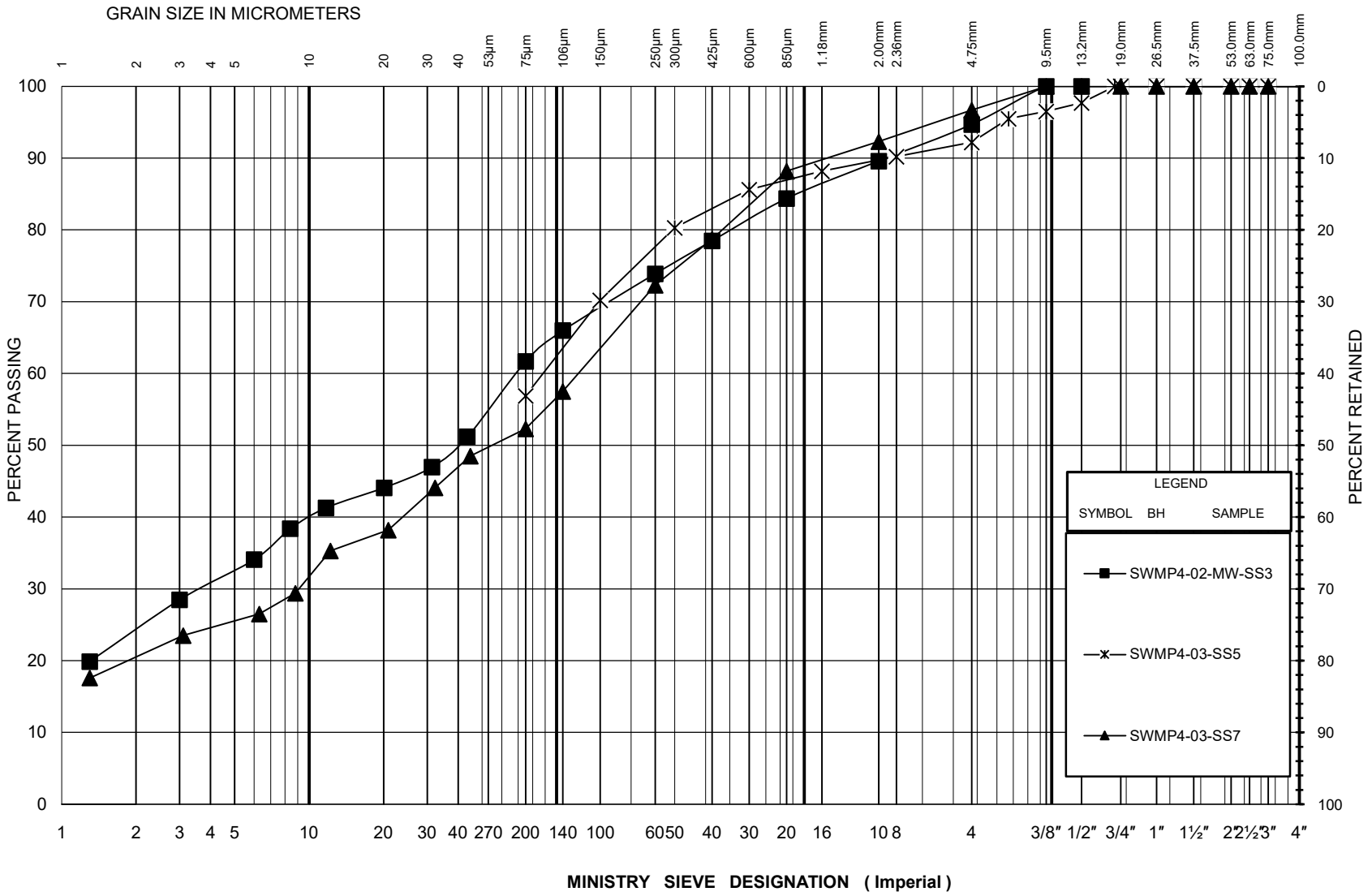
PLASTICITY CHART

Sandy SILT

Figure No.	9
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 4

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	

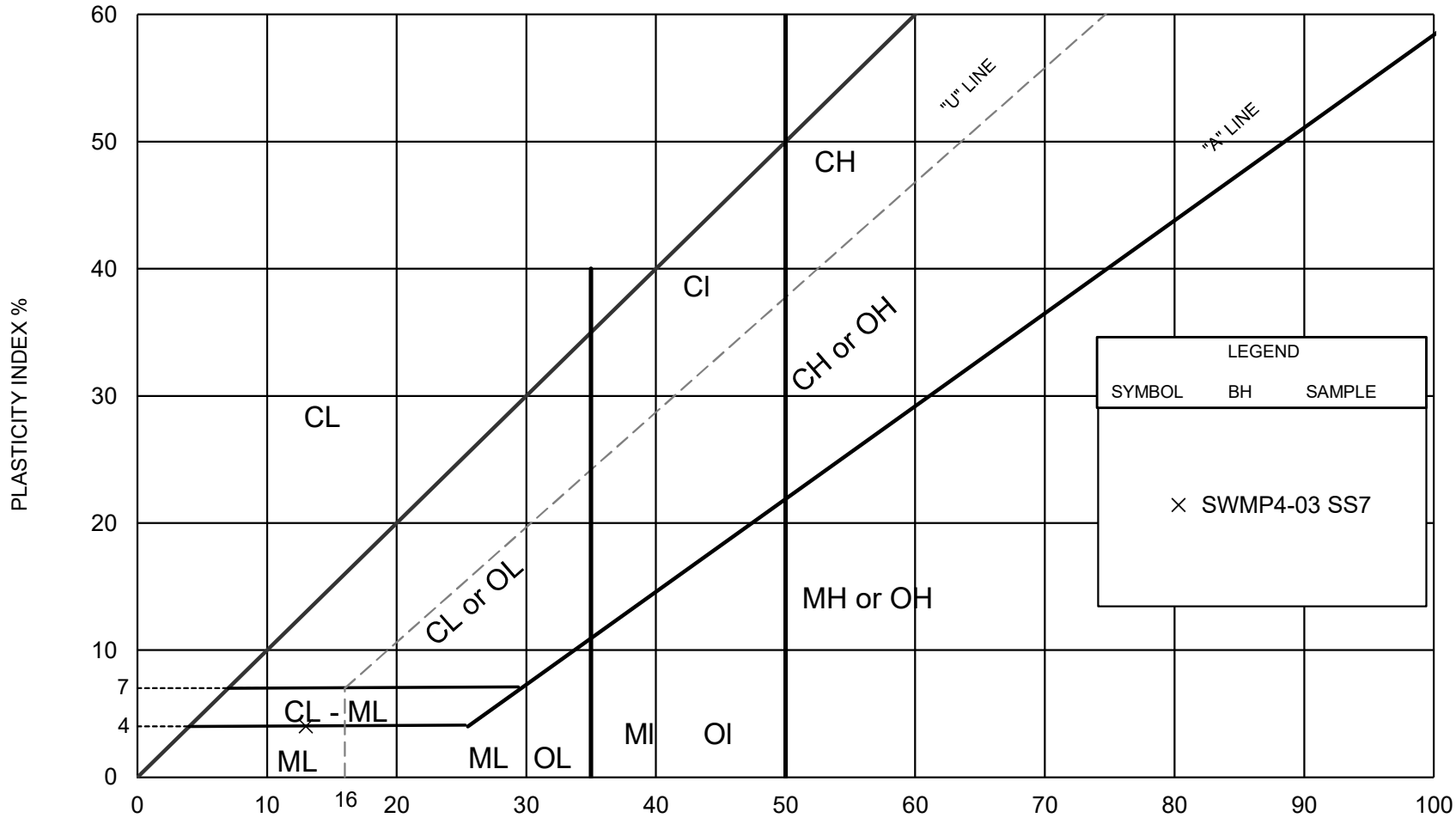


Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Clayey Sandy SILT, trace gravel

Figure No.	10
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 4



Ministry of Transportation
Ontario

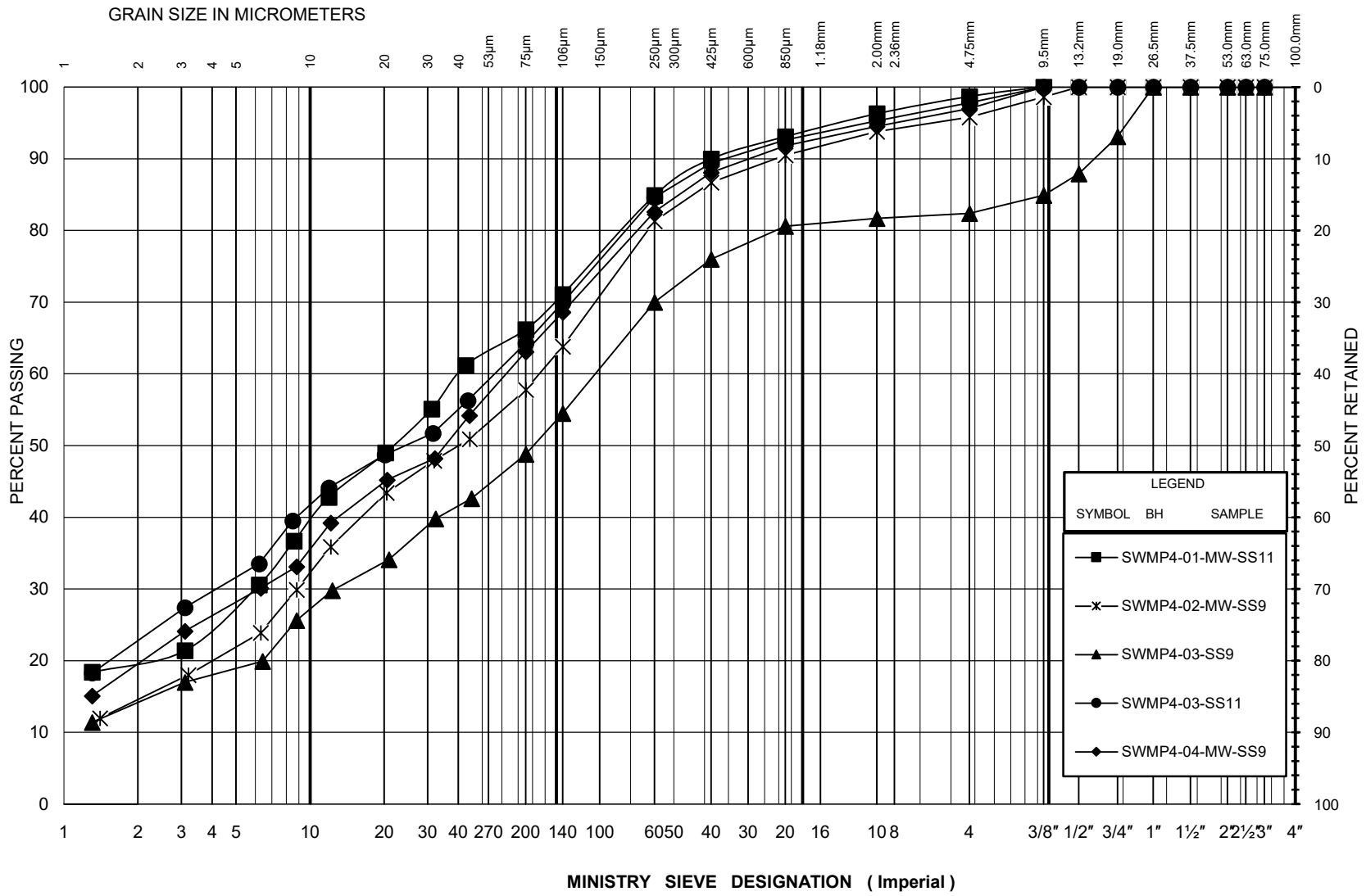
PLASTICITY CHART

Clayey Sandy SILT

Figure No.	11
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			Gravel		Cobbles
	Fine	Medium	Coarse	Fine	Coarse	

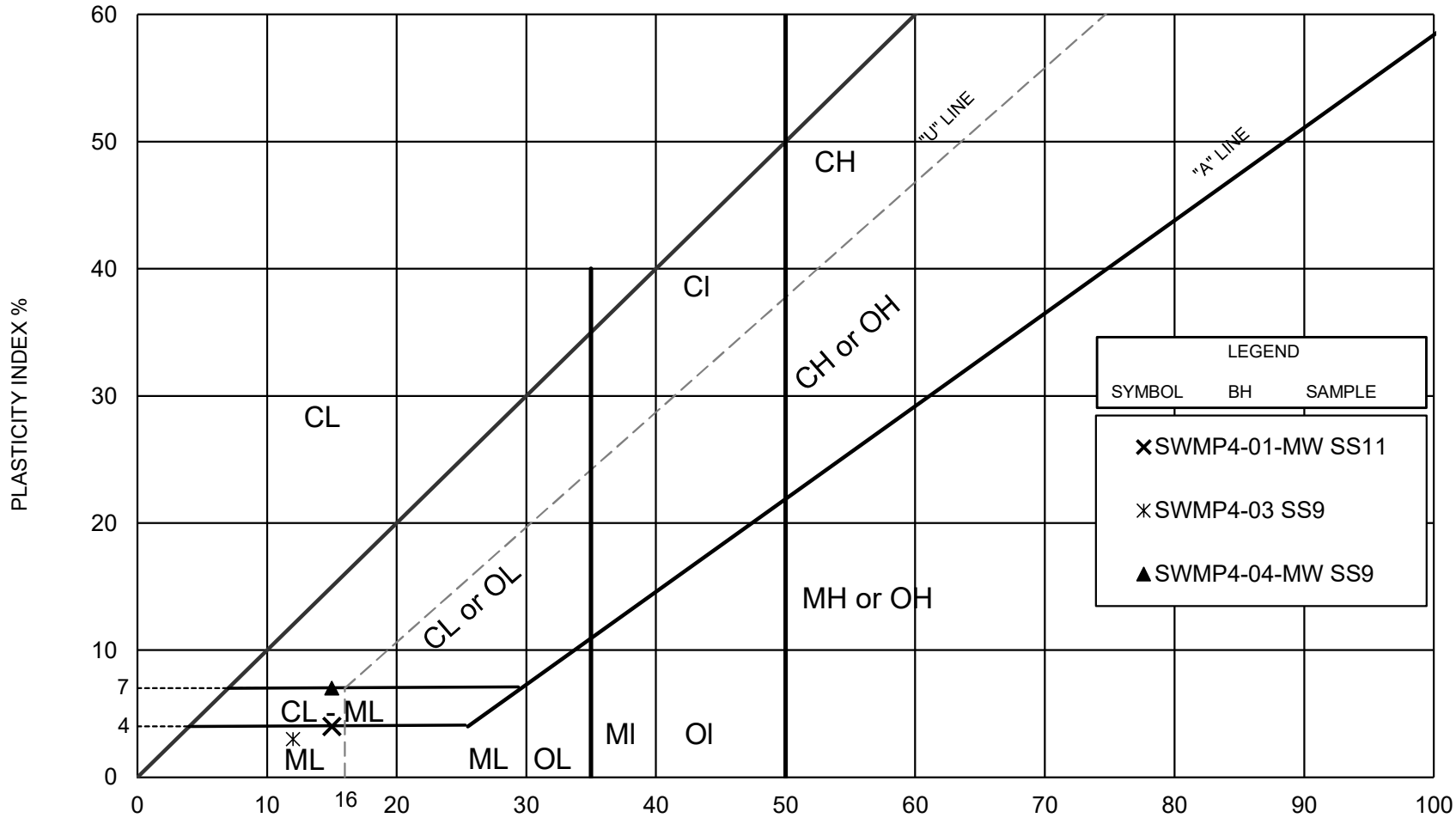


Ministry of Transportation
Ontario

GRAIN SIZE DISTRIBUTION

Sandy SILT, trace gravel, some clay (TILL)

Figure No.	12
Project No.	60731727
Project Name	Bradford Bypass - Country Road 4 SWMP 4



Ministry of Transportation
Ontario

PLASTICITY CHART

Sandy SILT (TILL)

Figure No.	13
Project No.	60731727
Project Name	Bradford Bypass -Country Road 4 SWMP 4

Appendix D

Site Photographs

AECOM

Photographic Log

Client Name:	Report Name	Street Name:	Project No.
MTO	Foundation Investigation and Design Report	County Road 4	60731727

Photo No.	Date
1	12/2/2024

Direction Photo Taken: Northwest

Description

- General Site conditions at SWMP 3

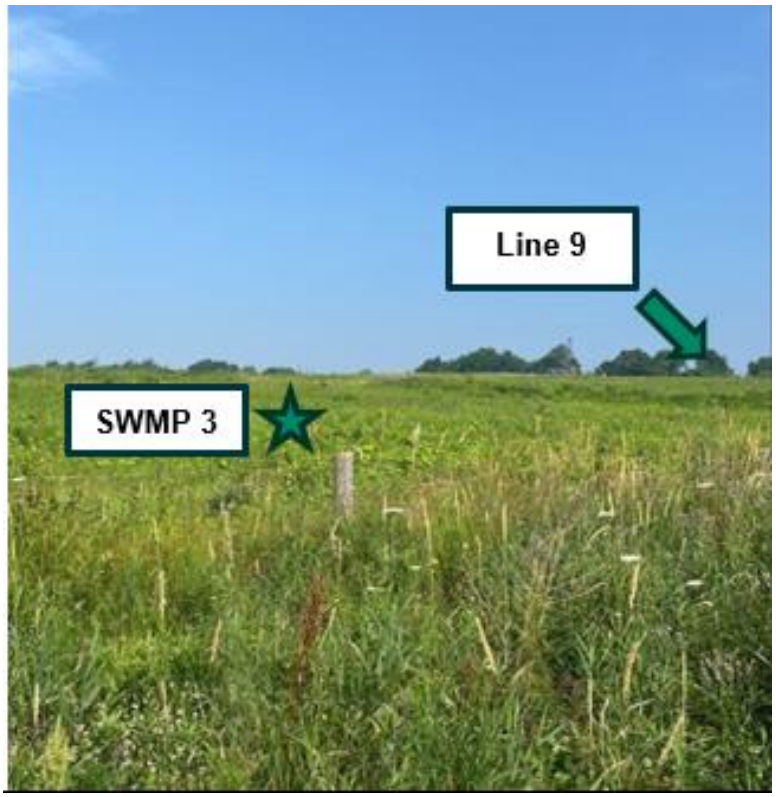
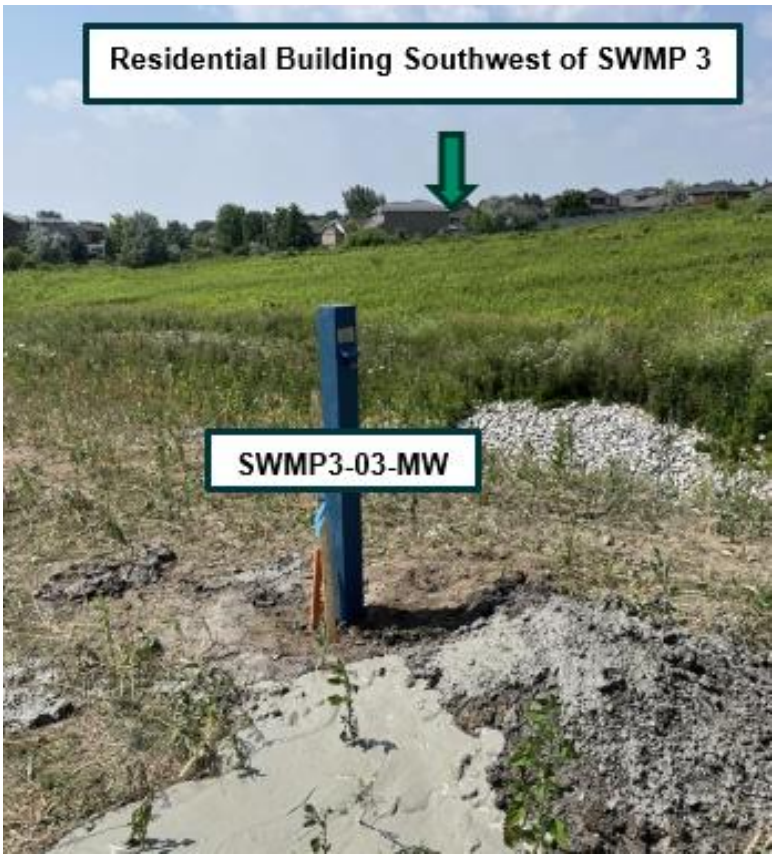


Photo No.	Date
2	12/2/2024

Direction Photo Taken: Southwest

Description

- Borehole SWMP3-03-MW
- Well installation completed



AECOM

Photographic Log

Client Name:	Report Name	Street Name:	Project No.
MTO	Foundation Investigation and Design Report	County Road 4	60731727

photo No.	Date
3	12/4/2024

Direction Photo Taken

Northwest

Description

- Ground Surface Condition
- Borehole SWMP3-01-MW

Photo No.	Date
4	7/16/2025

Direction Photo Taken

East

Description

- General Site conditions at SWMP 4

AECOM

Photographic Log

Client Name:	Report Name	Street Name:	Project No.
MTO	Foundation Investigation and Design Report	County Road 4	60731727

Photo No.	Date
5	7/16/2025

Direction Photo Taken

East

Description

- Well installation completed at SWMP 4

Borehole SWMP4-01-MW

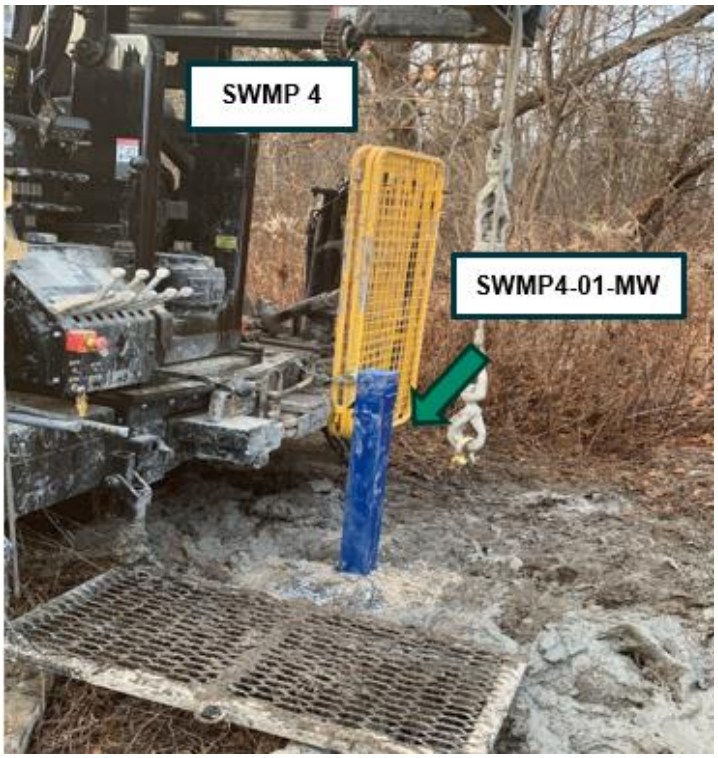


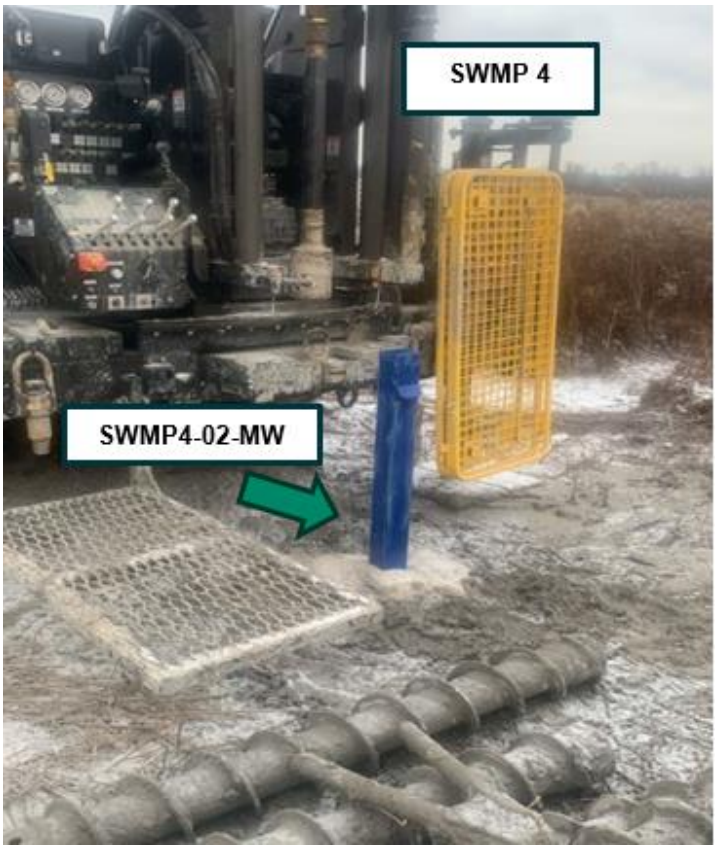
Photo No.	Date
6	7/14/2025

Direction Photo Taken

East

Description

- Well installation completed
- Borehole SWMP4-02-MW



Appendix E

SWM Ponds Plan Details

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

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

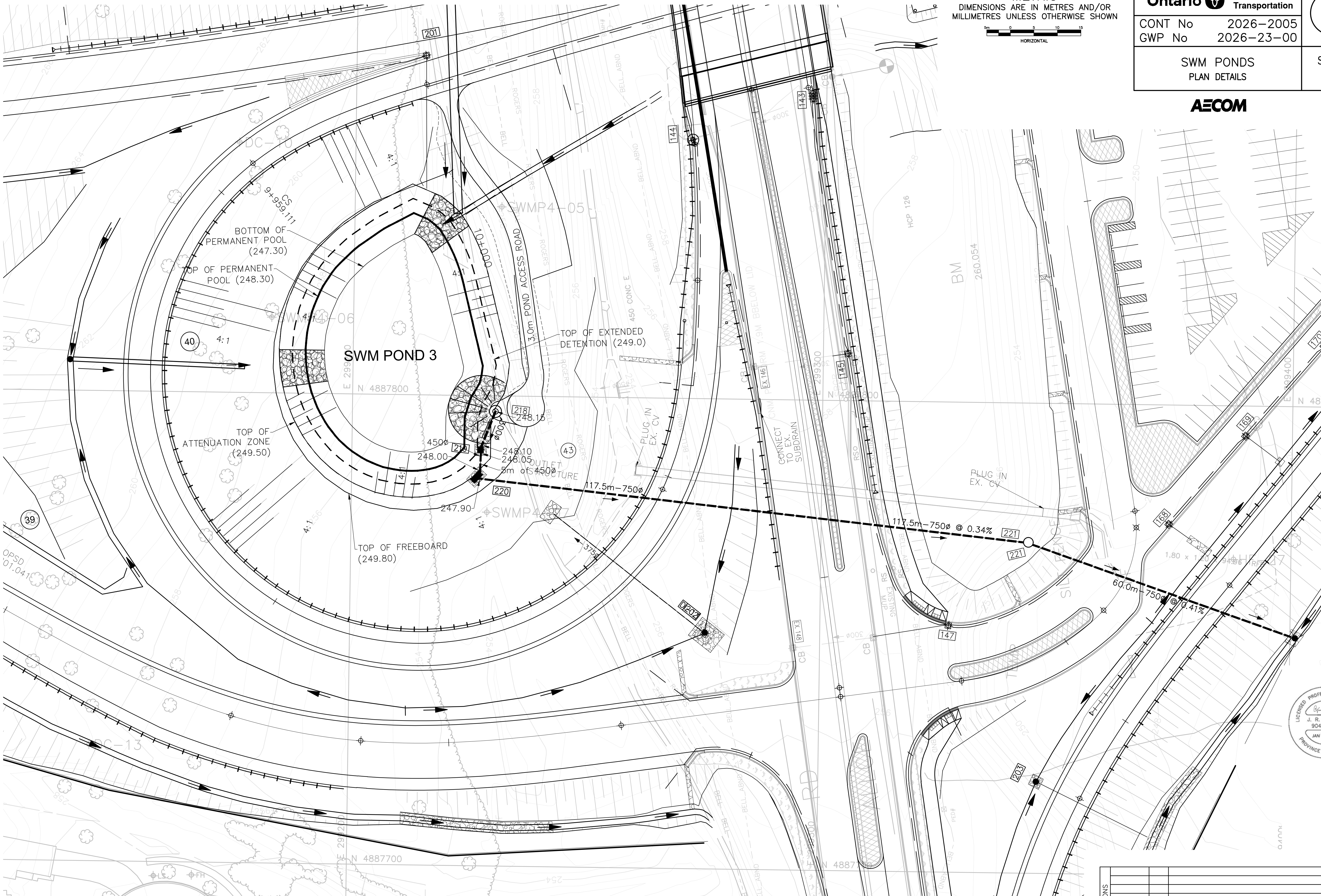
Ontario Ministry of Transportation

CONT No	2026-2005
GWP No	2026-23-00

SWM PONDS
PLAN DETAILS

SHEET 589

AECOM



LICENSED PROFESSIONAL ENGINEER
J. R. MALTEZ
90464868
JAN 30, 2026
PROVINCE OF ONTARIO

REVISIONS	DATE	BY	DESCRIPTION

DRAWING NAME: BBPW-DRN-SWM Pond Plan Details.dwg (DRN03)
PLOT DATE: 2026/01/31 10:29:59 AM

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN
5m 0 5 10 15
HORIZONTAL

Ontario Ministry of Transportation

CONT No 2026-2005
GWP No 2026-23-00

SWM PONDS
PLAN DETAILS

SHEET
590

AECOM

TOP OF FREEBOARD (0.30m ABOVE TOP OF ATTENUATION ZONE – 247.00)

MATCH EXISTING GROUND

TOP OF EXTENDED DETENTION (246.40)

TOP OF ATTENUATION ZONE (246.70)

OUTLET PIPE TO RAMP SIDE DITCH

75m – 450ø @ 0.33%

TOP OF PERMANENT POOL (246.00)

BOTTOM OF PERMANENT POOL (245.00)

3:1

4:1

SWM POND 4

300ø

223

224

222

225

47

SWMP4-04

4.0m POND ACCESS ROAD

OUTLET STRUCTURE

GRANULAR PAD

E 296400

E 296500

N 4888000

LICENSED PROFESSIONAL ENGINEER
J. R. MALTEZ
90464868
JAN 30, 2026
PROVINCE OF ONTARIO

REVISIONS

DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION, ONTARIO ANSI-D 2016-10

DRAWING NAME: BBPW-DRN-SWM Pond Plan Details.dwg (DRN04)
PLOT DATE: 2026/01/31 10:32:59 AM

Appendix F

Slope Stability Results

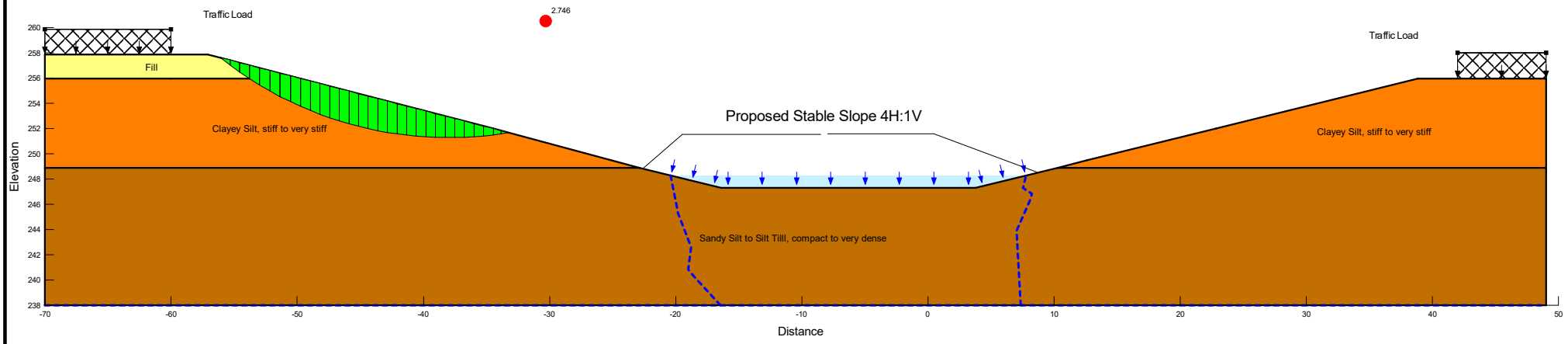
Summary of Slope Stability Assessment for SWMP 3

Location	Analysis Type	Target FoS	Calculated FoS	Comment
Northwestern Side of Pond	Saturated / Unsaturated – Static	1.5	2.74	Permanent Water Level
	Saturated / Unsaturated – Static	1.5	2.73	Regional Storm Event
	Saturated / Unsaturated – Static	1.3	2.71	Rapid Drawdown
	Saturated / Unsaturated – Seismic	1.1	2.08	Permanent Water Level
	Saturated / Unsaturated – Seismic	1.1	2.07	Initial water level
Southeastern Side of Pond	Saturated / Unsaturated – Static	1.5	3.24	Permanent Water Level
	Saturated / Unsaturated – Static	1.5	3.57	Regional Storm Event
	Saturated / Unsaturated – Static	1.3	3.22	Rapid Drawdown
	Saturated / Unsaturated – Seismic	1.1	2.40	Permanent Water Level
	Saturated / Unsaturated – Seismic	1.1	2.45	Initial water level

Summary of Slope Stability Assessment for SWMP 4

Location	Analysis Type	Target FoS	Calculated FoS	Comment
Northern Side of Pond	Saturated / Unsaturated – Static	1.5	1.59	Permanent Water Level
	Saturated / Unsaturated – Static	1.5	1.59	Regional Storm Event
	Saturated / Unsaturated – Static	1.3	1.59	Rapid Drawdown
	Saturated / Unsaturated – Seismic	1.1	1.31	Permanent Water Level
	Saturated / Unsaturated – Seismic	1.1	1.31	Initial water level
Southern Side of Pond	Saturated / Unsaturated – Static	1.5	2.60	Permanent Water Level
	Saturated / Unsaturated – Static	1.5	5.08	Regional Storm Event
	Saturated / Unsaturated – Static	1.3	2.89	Rapid Drawdown
	Saturated / Unsaturated – Seismic	1.1	1.86	Permanent Water Level
	Saturated / Unsaturated – Seismic	1.1	1.85	Initial water level

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34

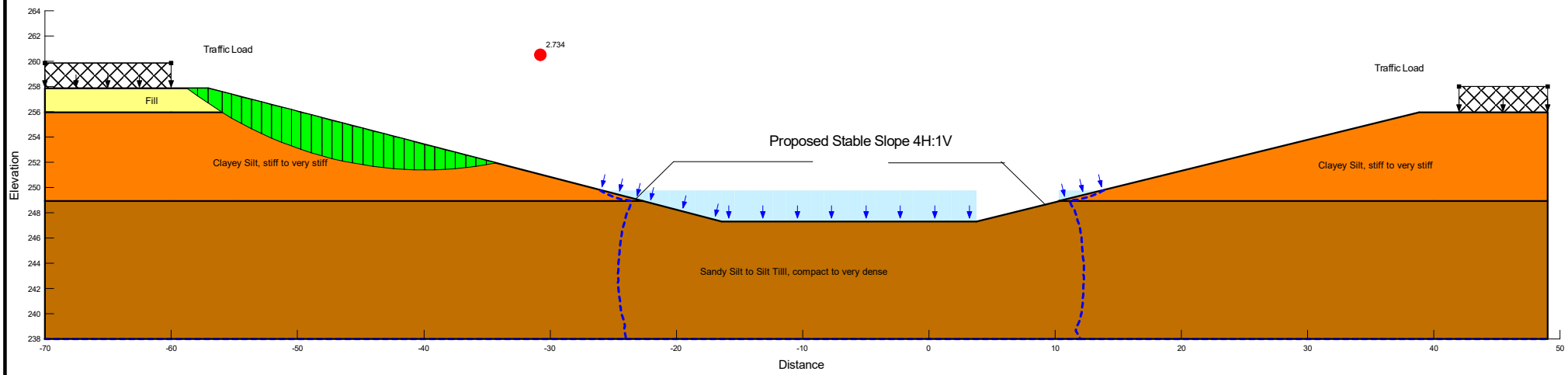


North West of Pond-Permanent Water Level

SWMP3-County Road 4.gsz

2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Till, compact to very dense	Mohr-Coulomb	20	0	34

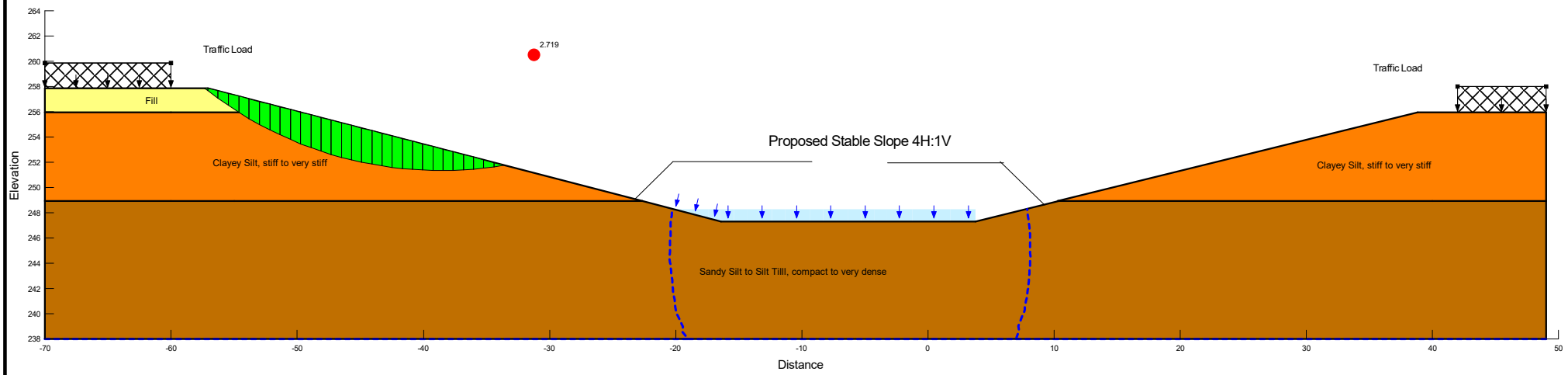


North West of Pond-Regional Storm Event

SWMP3-County Road 4.gsz

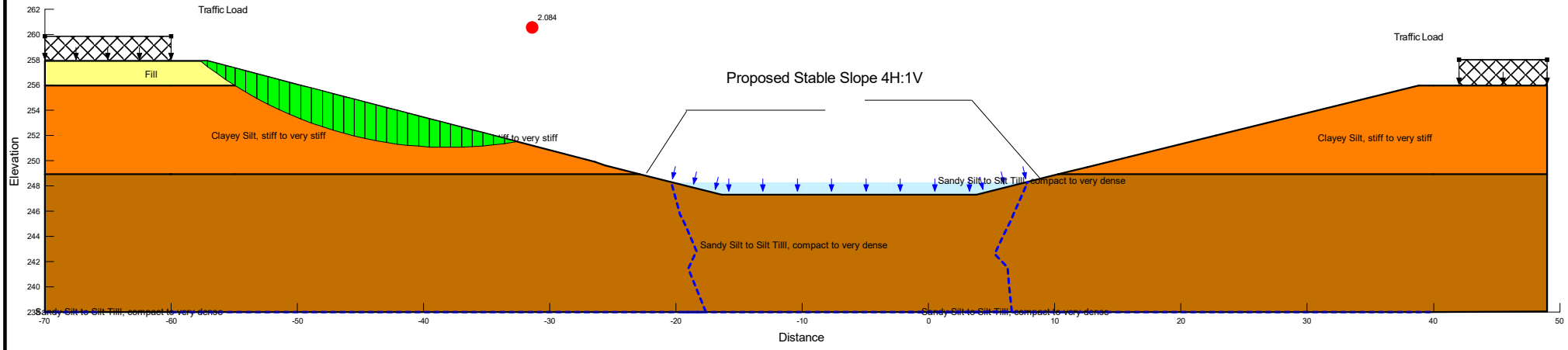
2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Till, compact to very dense	Mohr-Coulomb	20	0	34



North West of Pond-Rapid Drawdown	
SWMP3-County Road 4.gsz	
2026-02-28	1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30	0	0
	Fill	Mohr-Coulomb	19	0	28	0	0
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34	0	0

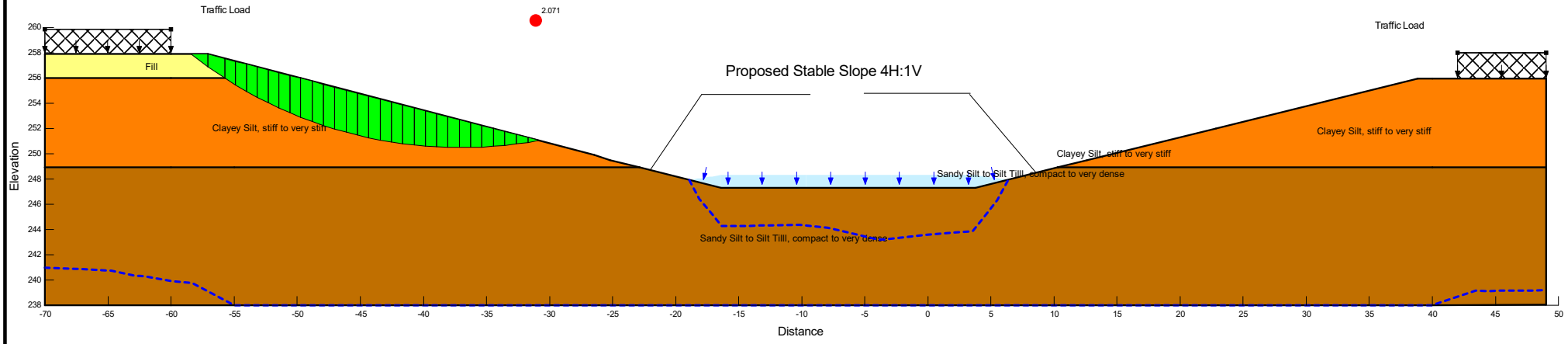


North West of Pond-Permanent Water Level (Seismic)

SWMP3-County Road 4.gsz

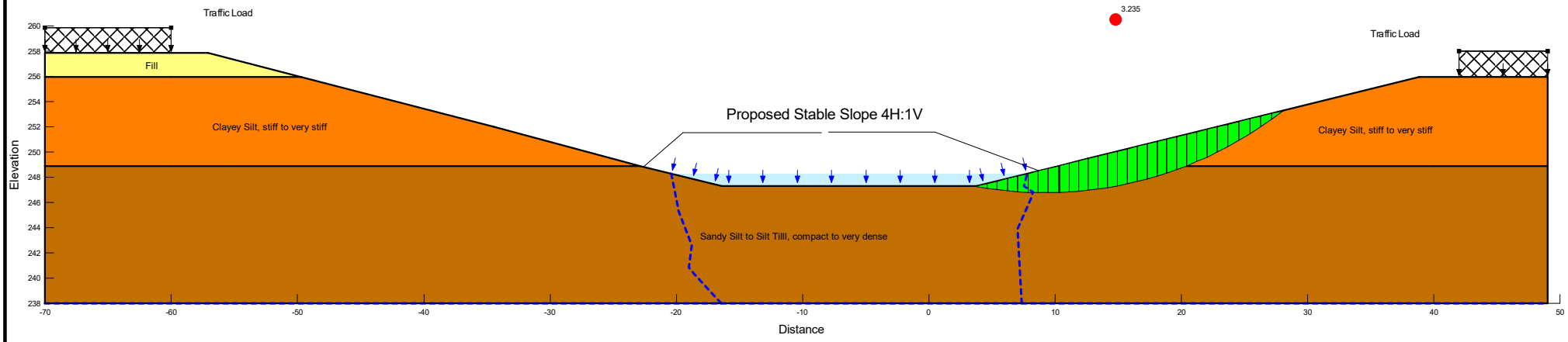
2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30	0	0
	Fill	Mohr-Coulomb	19	0	28	0	0
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34	0	0



North West of Pond-Initial Water Level (Seismic)
SWMP3-County Road 4.gsz
2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34

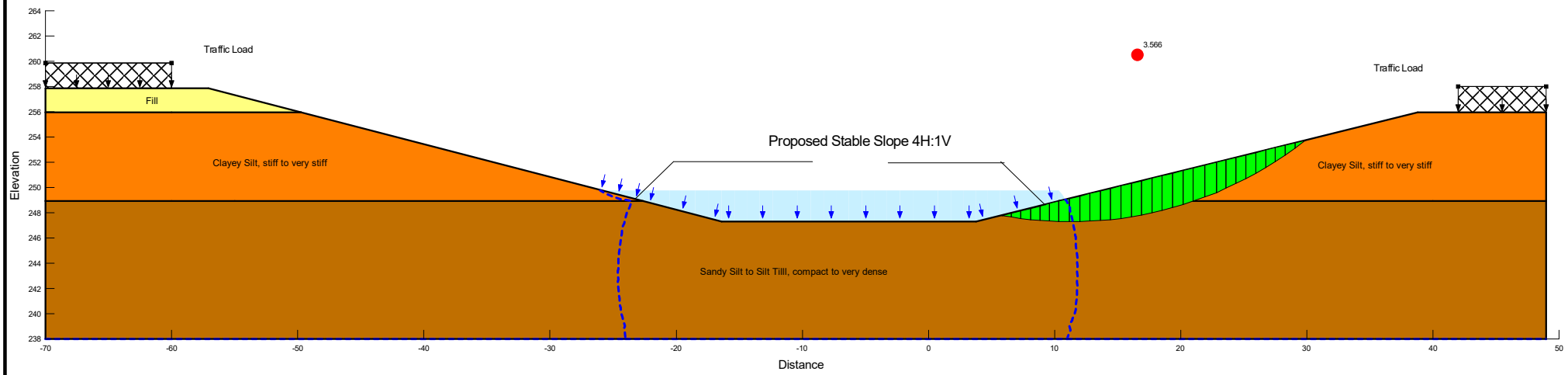


South East of Pond-Permanent Water Level

SWMP3-County Road 4.gsz

2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Till, compact to very dense	Mohr-Coulomb	20	0	34

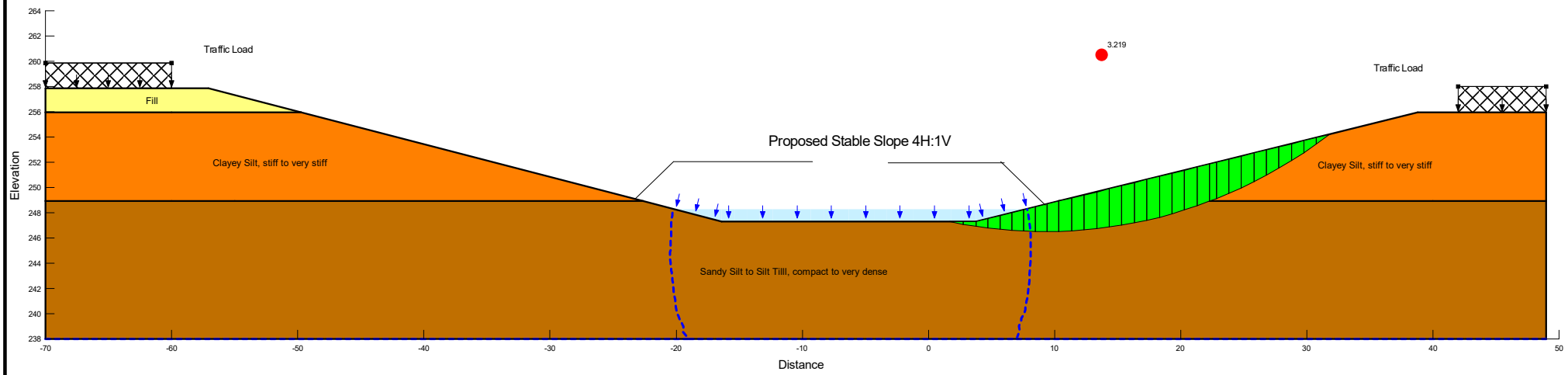


South East of Pond-Regional Storm Event

SWMP3-County Road 4.gsz

2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30
	Fill	Mohr-Coulomb	19	0	28
	Sandy Silt to Silt Till, compact to very dense	Mohr-Coulomb	20	0	34

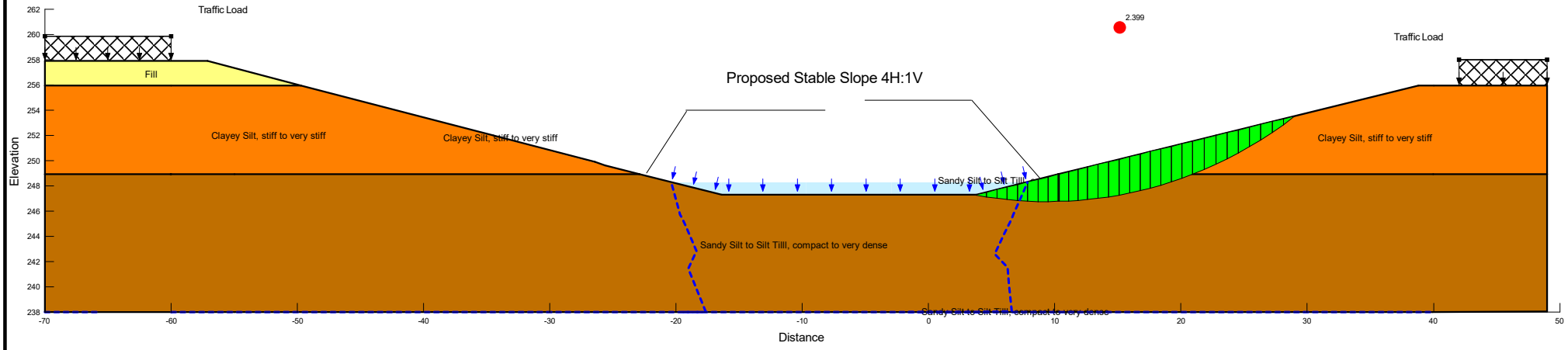


South East of Pond-Rapid Drawdown

SWMP3-County Road 4.gsz

2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30	0	0
	Fill	Mohr-Coulomb	19	0	28	0	0
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34	0	0

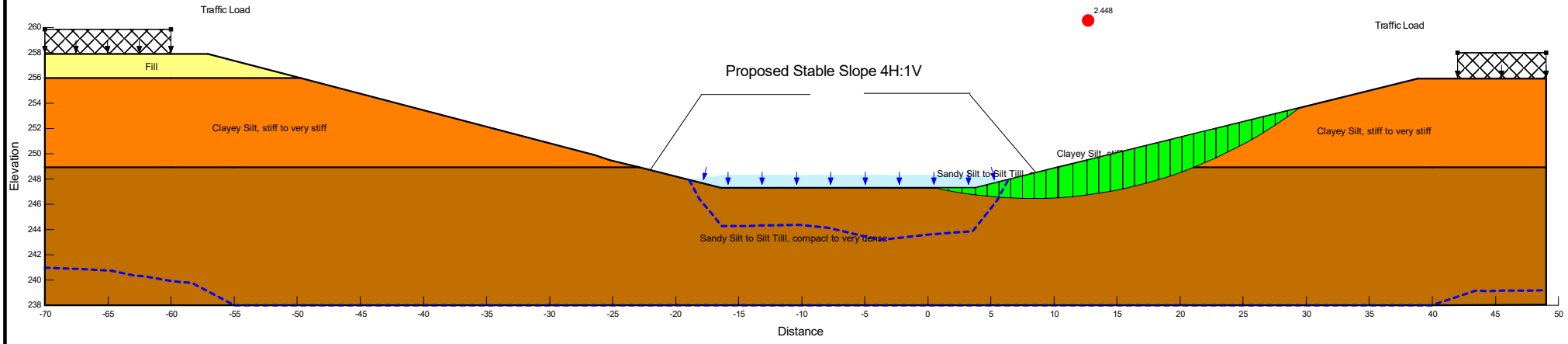


South East of Pond-Permanent Water Level (Seismic)

SWMP3-County Road 4.gsz

2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Clayey Silt, stiff to very stiff	Mohr-Coulomb	18	3	30	0	0
	Fill	Mohr-Coulomb	19	0	28	0	0
	Sandy Silt to Silt Tilll, compact to very dense	Mohr-Coulomb	20	0	34	0	0

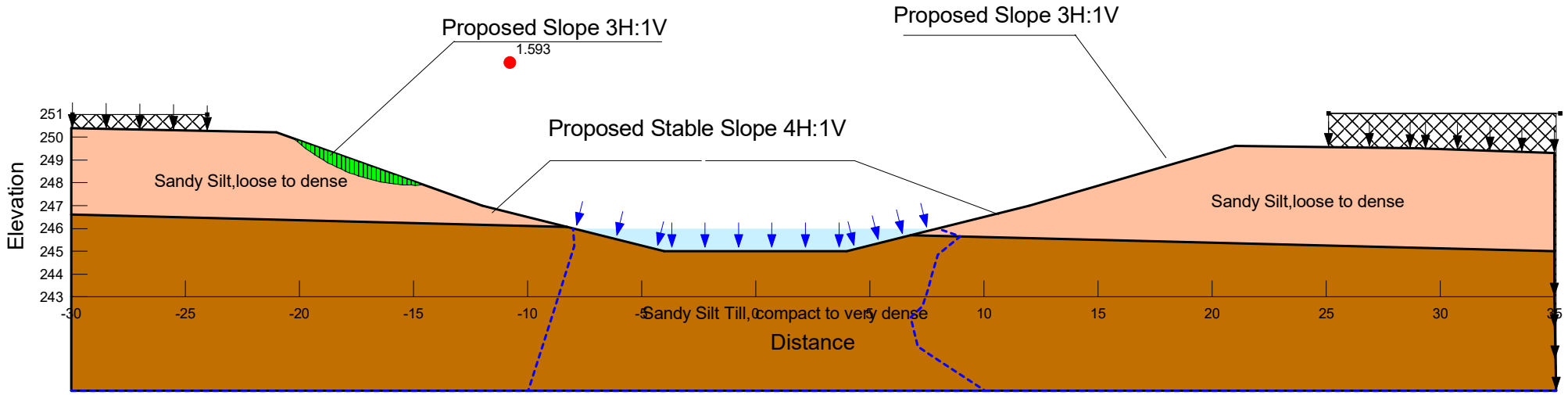


South East of Pond-Initial Water Level (Seismic)

SWMP3-County Road 4.gsz

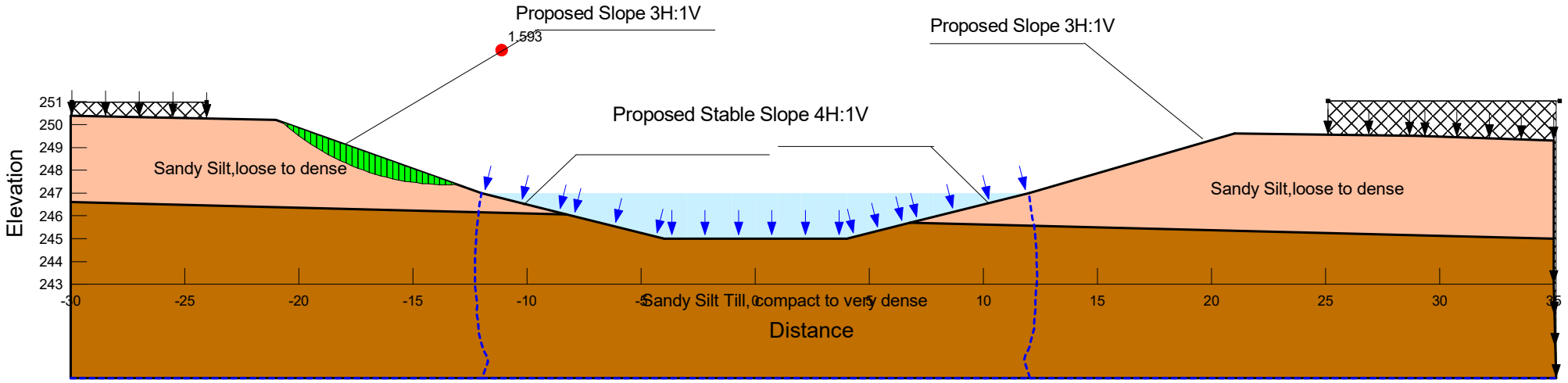
2026-02-28 1:465

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28



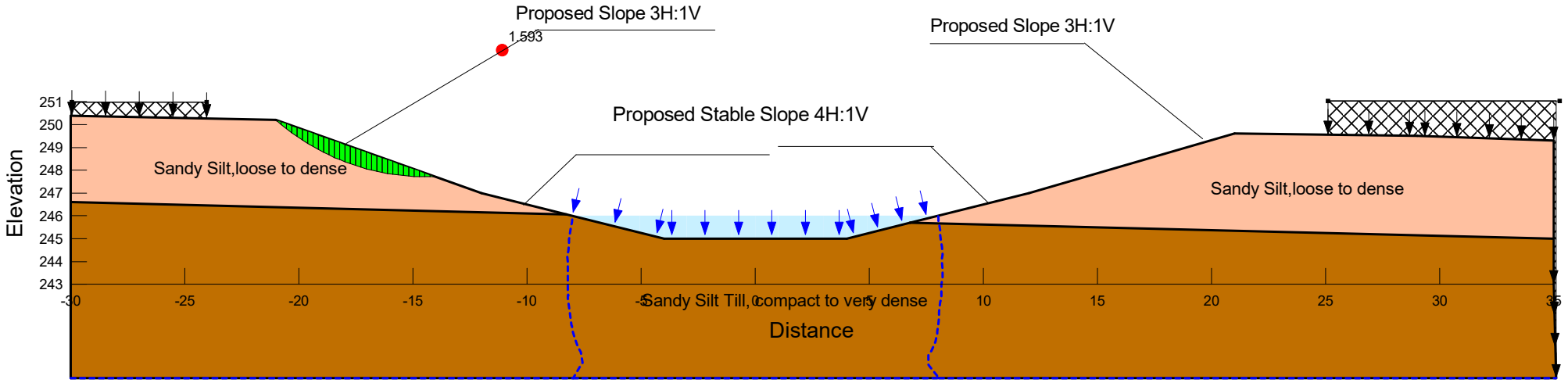
North of Pond-Permanent Water Level
SWMP4-County Road 4.gsz
2026-02-26 1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0



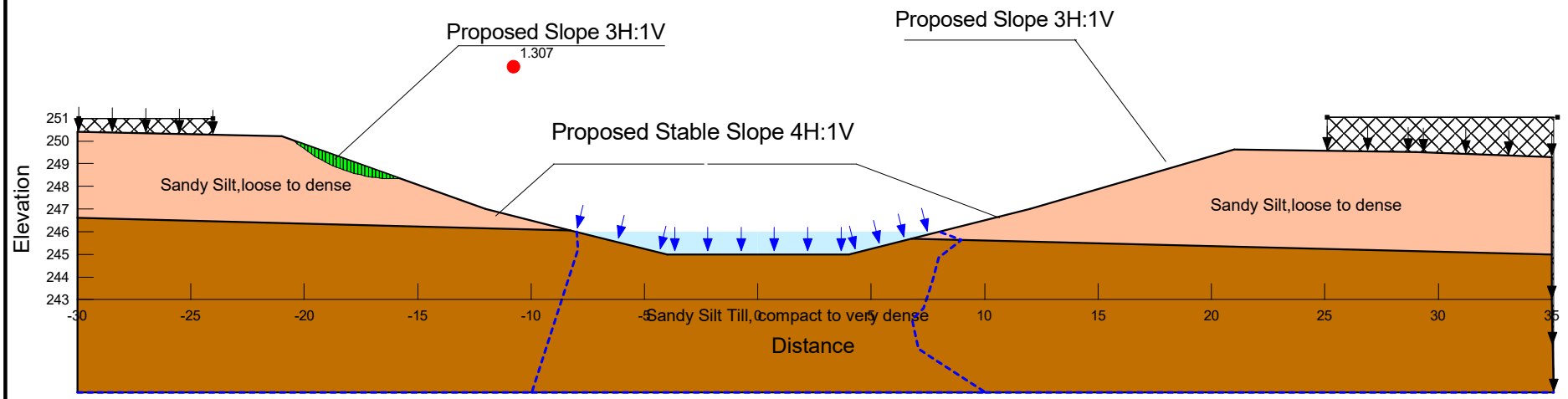
North of Pond-Regional Storm Event	
SWMP4-County Road 4.gsz	
2026-02-26	1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0



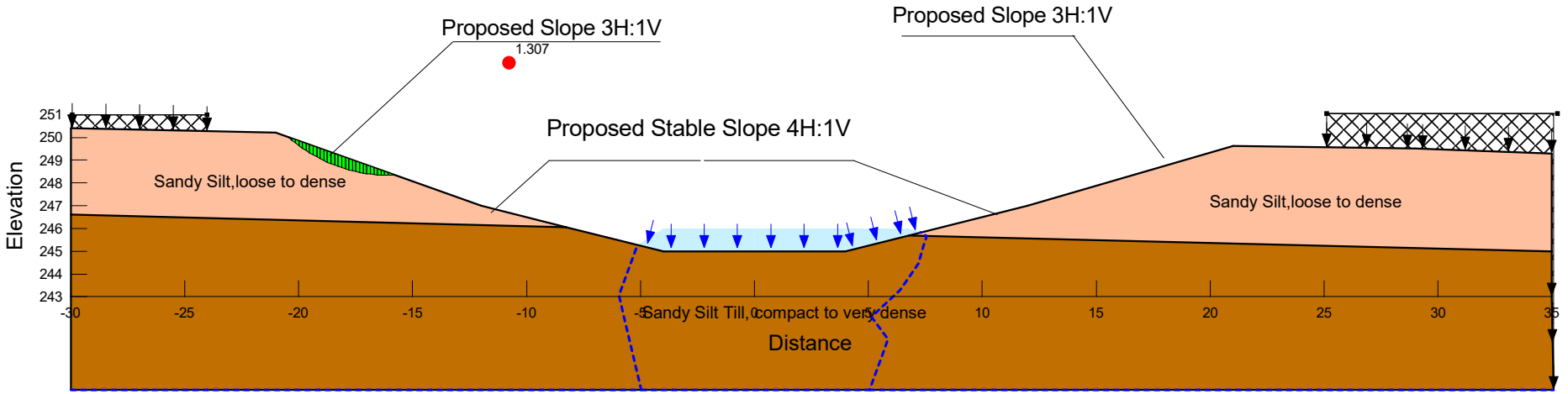
North of Pond-Rapid Drawdown	
SWMP4-County Road 4.gsz	
2026-02-26	1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34	0	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28	0	0



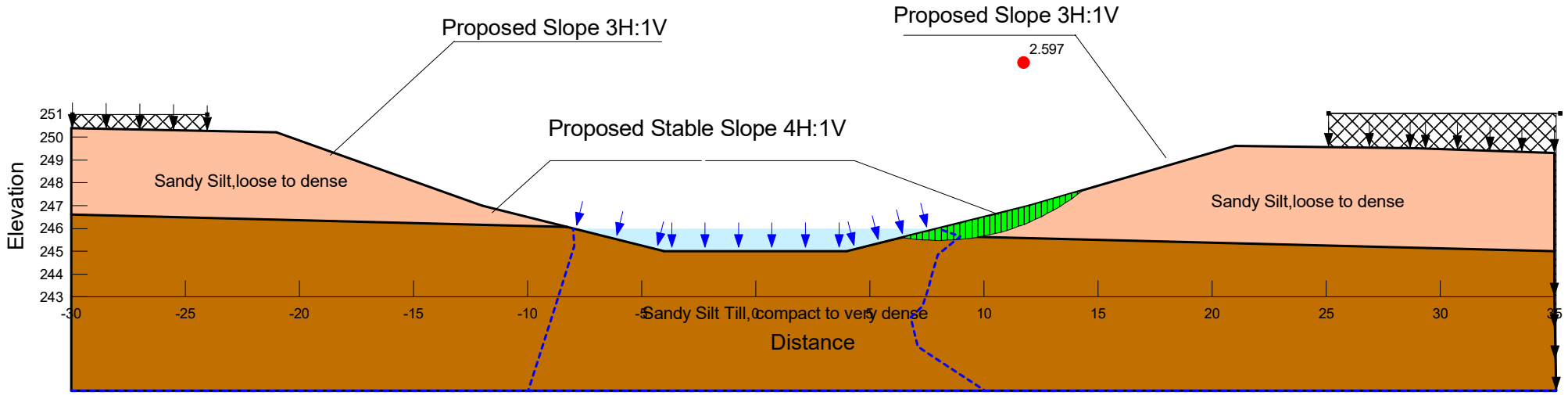
North of Pond-Permanent Water Level (Seismic)
SWMP4-County Road 4.gsz
2026-02-26 1:279

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34	0	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28	0	0



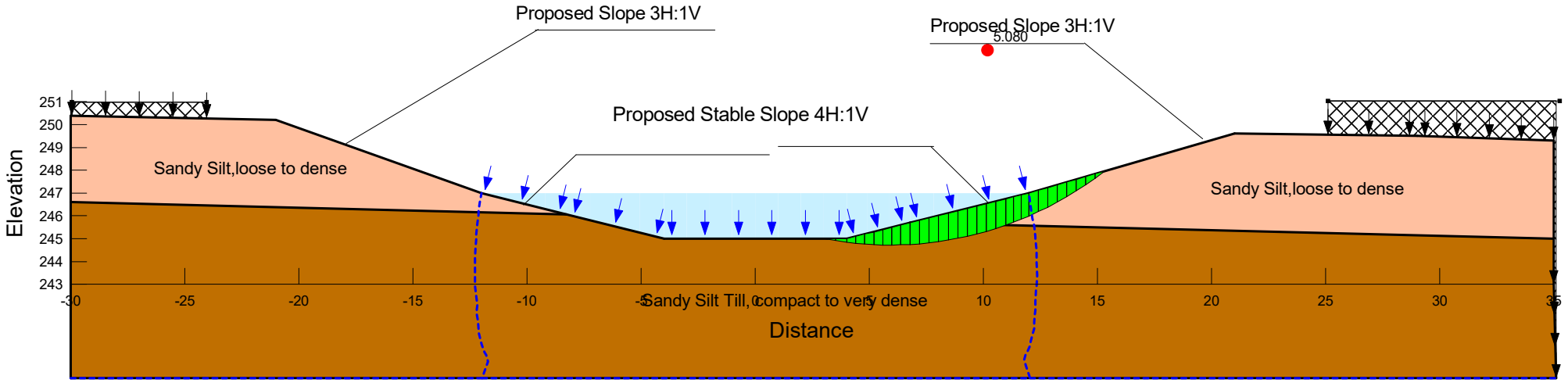
North of Pond-Initial water level (Seismic)
SWMP4-County Road 4.gsz
2026-02-26 1:279

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28



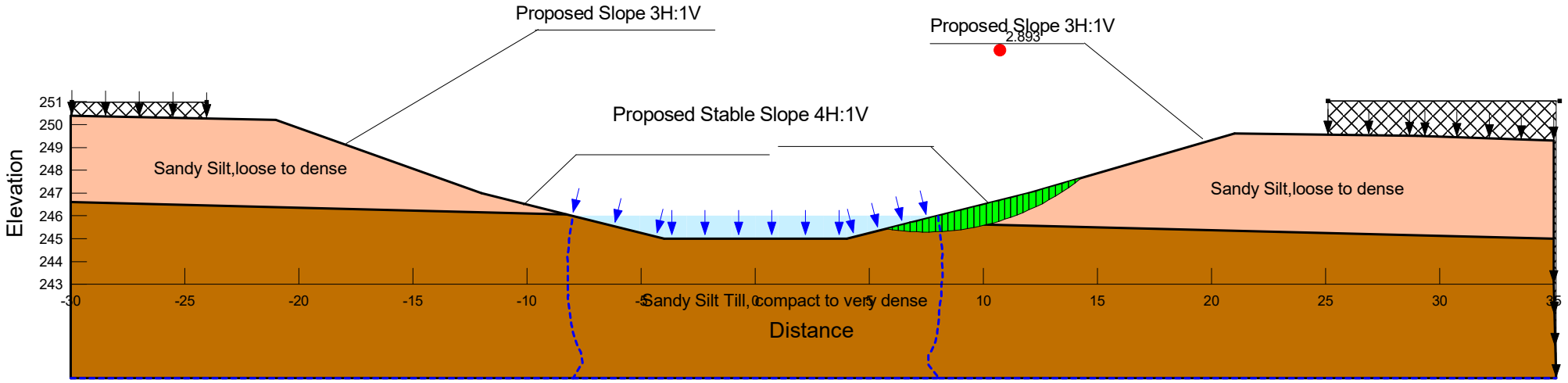
South of Pond-Permanent Water Level	
SWMP4-County Road 4.gsz	
2026-02-26	1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0



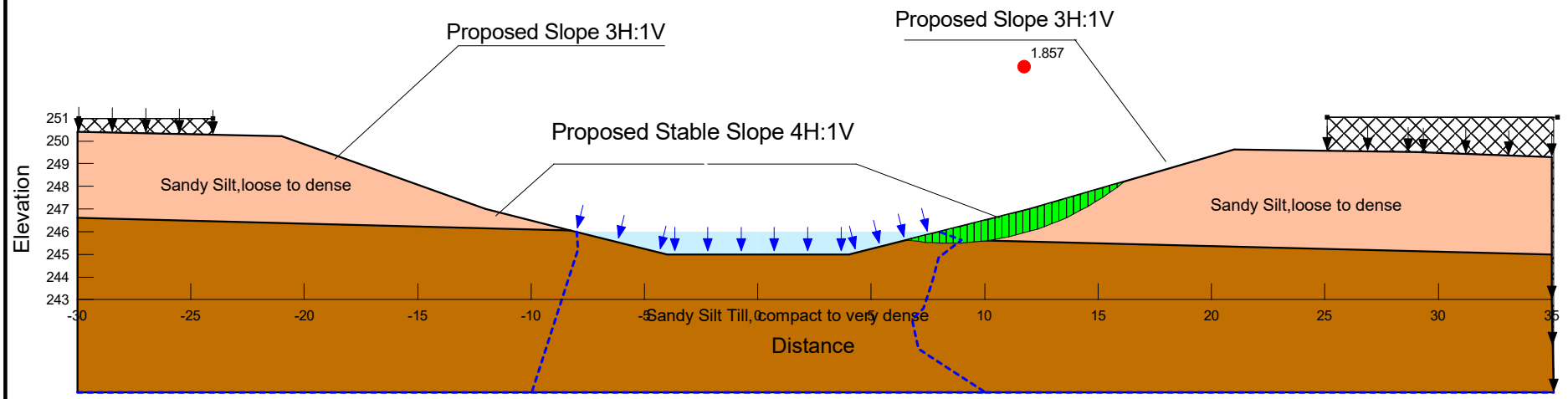
South of Pond-Regional Storm Event
SWMP4-County Road 4.gsz
2026-02-26 1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0



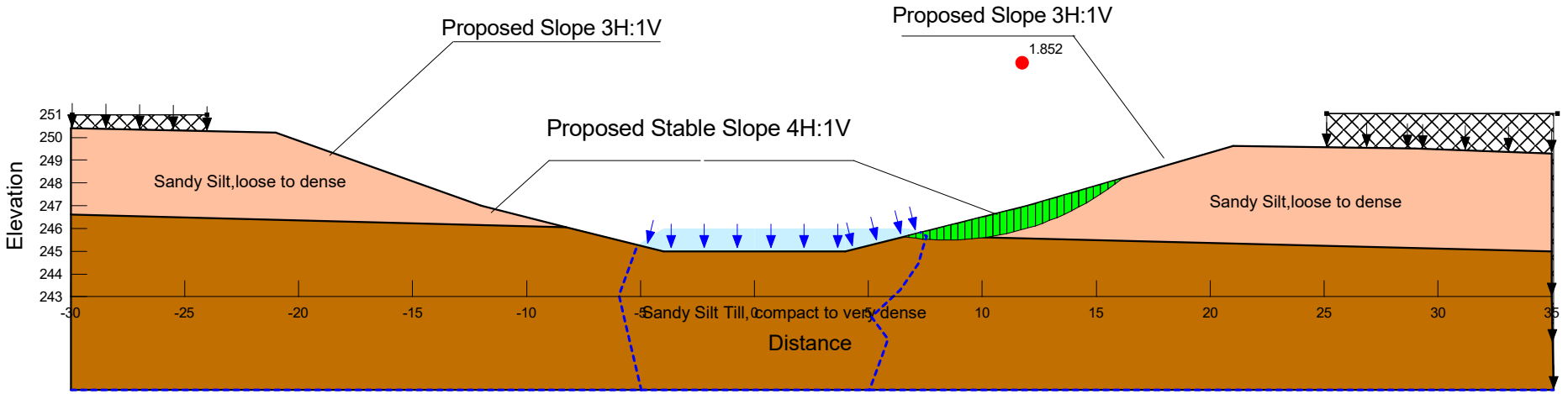
South of Pond-Rapid Drawdown	
SWMP4-County Road 4.gsz	
2026-02-26	1:259

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34	0	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28	0	0



South of Pond-Permanent Water Level (Seismic)
SWMP4-County Road 4.gsz
2026-02-26 1:279

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Cohesion R (kPa)	Phi R (°)
	Sandy Silt Till, compact to very dense	Mohr-Coulomb	20	0	34	0	0
	Sandy Silt,loose to dense	Mohr-Coulomb	18	0	28	0	0



South of Pond-Initial water level (Seismic)

SWMP4-County Road 4.gsz

2026-02-26 1:279

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Ottawa, ON K2H 8S9 Canada

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