REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
Areas 'F' to 'K' – MILLCROFT GOLF CLUB
2155 COUNTRY CLUB DRIVE
BURLINGTON, ONTARIO

PREPARED FOR:

MILLCROFT GREENS CORPORATION

Project No: 19-199-106 (R1)
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1. INTRODUCTION

DS Consultants Ltd (DS) was retained by Millcroft Greens Corporation to undertake a preliminary geotechnical investigation for the proposed development at Areas 'F' to 'K' of Millcroft Golf Club located at 2155 Country Club Drive in Burlington, Ontario.

It is understood that the project will entail a residential subdivision consisting of single-family houses, roads and sewers etc.

A total of seventeen (17) boreholes were advanced to depths of 4.7 to 7.9 m in Areas 'F' to 'J'. The locations and logs of boreholes for respective areas are presented in **Appendix A** to **Appendix E**. It is noted that no boreholes were drilled across Area K due to its active use as a golf course. Drilling in the Area K will be conducted in the future following completion of the golf season.

In 2018 and 2019, DS conducted geotechnical investigations for Areas 'A' to 'D'. The findings of Areas 'A' to 'D' are presented in the report entitled 'Revised Report on Geotechnical Investigation, Proposed Residential Subdivision, Areas 'A' to 'D' – Millcroft Golf Club, 2155 Country Club Drive, Burlington, Ontario', Project number 19-199-100 R3, dated October 27, 2021.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions by means of a limited number of boreholes and from the findings in the boreholes to make preliminary recommendations pertaining to the geotechnical design of underground utilities and subdivision roads and to comment on the foundation conditions for general house construction.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Millcroft Greens Corporation and its architects and designers. Third party use of this report without DS Consultants Ltd (DS) consent is prohibited.

2. FIELD AND LABORATORY WORK

Between May and July, 2025, a total of seventeen (17) boreholes were drilled to depths of 4.7 to 7.9 m in Areas 'F' to 'J' as listed on Table 1.

Table 1: Summary of Boreholes Drilled in Each Area

Area Name	Borehole No.	Depth of Borehole below Existing Ground (m)	Notes
Area 'F'	BH25F-1	7.9	Installed with 50 mm dia. Monitoring Well
	BH25F-2	7.7	Installed with 50 mm dia. Monitoring Well
	BH25F-3	6.2	Installed with 50 mm dia. Monitoring Well
Area 'G'	BH25G-1	6.2	
	BH25G-2	6.7	Installed with 50 mm dia. Monitoring Well
	BH25G-3	6.2	
	BH25G-4	6.2	Installed with 50 mm dia. Monitoring Well
	BH25G-8	4.7	Installed with 50 mm dia. Monitoring Well
Area 'H'	BH25H-1	6.2	Installed with 50 mm dia. Monitoring Well
	BH25H-2	4.7	
	BH25H-3	6.2	Installed with 50 mm dia. Monitoring Well
Area 'I'	BH25I-1	6.2	
	BH25I-2	4.7	
	BH25I-3	6.2	Installed with 50 mm dia. Monitoring Well
Area 'J'	BH25J-1	6.2	Installed with 50 mm dia. Monitoring Well
	BH25J-2	6.2	Installed with 50 mm dia. Monitoring Well
	BH25J-3	6.2	Installed with 50 mm dia. Monitoring Well

Boreholes were drilled with solid stem continuous flight auger equipment by a drilling sub-contractor under the direction and supervision of DS personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents. Eleven (11) soil samples were subjected to grain size analyses and eight (8) samples for Atterberg Limits testing.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Monitoring wells were installed in twelve (12) boreholes for groundwater level monitoring and hydrogeological study.

The elevation surveying of the borehole locations was undertaken by DS personnel, using the differential GPS unit. It should be noted that the elevations at the as-drilled borehole/well locations were not provided by a professional surveyor and should be considered to be approximate. Contractors performing any work referenced to the borehole elevations should confirm the borehole elevations for their work.

3. SUBSURFACE CONDITIONS

The locations of Area 'F' to Area 'K' are shown Drawing 1. The borehole location plan and borehole logs for Area 'F' to Area 'J' are attached in Appendix A to Appendix E of this report respectively. Notes on sample description are presented on Drawing 1A. The subsurface conditions in the boreholes are summarized in the following paragraphs.

3.1 Soil Conditions

AREA F (See Appendix A)

Three (3) boreholes (BH25F-1 to BH25F-3) were drilled to depths of 6.2 to 7.9 m below existing grade at Area F. The borehole location plan and borehole logs for Areas 'F' are attached in Appendix A of this report.

Topsoil/ Fill Material:

A surficial topsoil layer, ranging in thickness from 130 to 180 mm was found at all borehole locations. The thickness of the topsoil in each borehole was shown in the borehole log. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Underneath the topsoil, fill materials consisting sandy silt and clayey silt with trace organics/rootles were found in all boreholes extending to depths of 1.1 to 1.8 m below existing grade. Standard penetration tests carried out within the fill materials gave N values ranging from 3 to 20 blows per 0.3 m penetration, indicating a very loose to compact state or soft to very stiff consistency.

Sandy Silt to Silty Sand (Till)/Silt:

Native sandy silt to silty sand (till)/silt deposits were found in all boreholes, extending to depths of 6.1 to 7.2 m. The sandy silt to silty sand (till)/silt deposits were present in a very dense state, with measured SPT 'N' values of over 50 blows per 300 mm penetration. The till is known to contain cobbles and boulders.

Grain size analyses of three (3) samples (BH25F1/SS7, BH25F3/SS4 and BH25F3/SS6) were conducted and the results are presented on Drawing 2, with the following fractions:

Clay:	7% to 9%
Silt:	28% to 72%
Sand:	16% to 39%
Gravel:	5% to 26%

Clayey Silt to Silty Clay Till:

Native clayey silt to silty clay till was encountered in borehole BH25F-1, extending to borehole termination depth of 7.9 m. The clayey silt to silty clay till was present in a stiff to hard consistency, with

measured SPT 'N' values ranging from 8 to over 50 blows per 300 mm penetration. The till is known to contain layers and pockets of sand. Cobble/boulders are also known to be present in the till.

Grain size analysis of one (1) sample (BH25F1/SS5) was conducted and the results are presented on Drawing 2, with the following fractions:

Clay:	22%
Silt:	50%
Sand:	24%
Gravel:	4%

Atterberg limits tests of the same sample (BH25F1/SS5) were conducted. Based on the test results, the soil is classified as inorganic clays and silts of low plasticity (CL). The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L):	26%
Plastic limit (W_P):	15%
Plasticity index (PI):	11

Clayey Silt Till/Shale Complex:

Underlying the sandy silt to silty sand, a deposit termed clayey silt till /shale complex was encountered from 6.1 to 7.5 m in borehole BH25F-2. This deposit consisted of clayey silt till mixed with highly weathered shale. The till/shale complex was in a very hard state.

Shale Bedrock:

Shale bedrock of Queenston Formation was encountered at a depth of 7.5 m (Elev. 144.4 m). Refer to Section 3.2 Bedrock Conditions for more information regarding bedrock at the site.

AREA G (See Appendix B)

Area G is located in the area of existing parking lot and club house of golf course. Five (5) boreholes (BH25G-1 to BH25G-4 and BH25G-8) were drilled to depths of 4.7 to 6.7 m below existing grade. Additional three (3) test holes (BH25G-5, BH25G-6 and BH25G-7) were advanced to explore the asphalt thickness of existing parking lot. The borehole location plan and borehole logs (BH25G-1 to BH25G-4 and BH25G-8) for Areas 'G' are attached in Appendix B of this report.

Pavement and Granular Material:

Asphaltic pavement was encountered surficially in all boreholes/test holes except BH25G-1 and BH25G-2 in Area 'G'. The thicknesses of asphaltic pavement ranged from approximately 50 to 100 mm as shown on Table 2 below.

Table 2: Asphalt Pavement Thickness in Area 'G'

Area Name	Borehole/Test Hole No.	Asphalt Thickness (mm)
Area 'G'	BH25G-3	90
	BH25G-4	60
	BH25G-5	50
	BH25G-6	75
	BH25G-7	100
	BH25G-8	60

Granular materials consisting of sand and gravel were encountered below the asphalt or surficially in all boreholes/test holes except for BH25G-1. The thicknesses of granular material in BH25G-2 to BH25-G4 and BH25G-8 ranged from approximately 75 to 300 mm. The thickness of granular material in BH25G-5 to BH25G-7 was not explored. It should be noted that, at some borehole locations, it is difficult to distinguish the subgrade soil from the pavement granular base material as they consisted of similar granular soils.

Topsoil:

A surficial topsoil layer with a thickness of approximate 130 mm was found at borehole BH25G-1 location. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site.

Fill Material:

Underneath the topsoil, fill materials consisting clayey silt and sand and gravel with trace organics/rootles were found in boreholes BH25G-1 to BH25G-4 and BH25G-8, extending to depths of 1.3 to 2.3 m below existing grade. The fill depth in boreholes BH25G-5 to BH25-7 is not explored. Standard penetration tests carried out within the fill materials gave N values ranging from 3 to 20 blows per 0.3 m penetration, indicating a very loose to compact state or soft to very stiff consistency.

Silty Clay Till:

Native silty clay till was encountered in boreholes BH25G-1 to BH25G-4 and BH25G-8, extending to depths of 4.6 to 6.2 m. The silty clay till was present in a stiff to hard consistency, with measured SPT 'N' values ranging from 14 to over 50 blows per 300 mm penetration. The till is known to contain layers and pockets of sand. Cobble/boulders are also known to be present in the till.

Grain size analyses of three (3) sample (BH25G1/SS3, BH25G4/SS4 and BH25G8/SS4) was conducted and the results are presented on Drawing 2 and Drawing 3, with the following fractions:

Clay: 21% to 26%
Silt: 47% to 54%
Sand: 18% to 27%

Gravel: 2% to 5%

Atterberg limits tests of the same samples (BH25G1/SS3, BH25G4/SS4 and BH25G8/SS4) were conducted. Based on the test results, the soil is classified as inorganic clays and silts of low plasticity (CL). The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L):	26% to 28%
Plastic limit (W_P):	15%
Plasticity index (PI):	11 to 13

Clayey Silt Till/Shale Complex:

Underlying the silty clay till, a deposit termed clayey silt till /shale complex was encountered in boreholes BH25G-2 to BH25G-4, extending to depths of from 5.5 to 6.1 m. This deposit consisted of clayey silt till mixed with highly weathered shale. The till/shale complex was in a very hard state.

Shale Bedrock:

Shale bedrock of Queenston Formation was encountered at depths of 5.5 to 6.1 m (Elev. 138.9 to 140.3 m) in boreholes BH25G-2 to BH25G-4. Refer to Section 3.2 Bedrock Conditions for more information regarding bedrock at the site.

AREA H (See Appendix C)

Three (3) boreholes (BH25H-1 to BH25H-3) were drilled to depths of 4.7 to 6.2 m below existing grade at Area H. The borehole location plan and borehole logs for Areas 'H' are attached in Appendix C of this report.

Topsoil/ Fill Material:

A surficial topsoil layer, ranging in thickness from 100 to 200 mm was found at all borehole locations. The thickness of the topsoil in each borehole was shown in the borehole log. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Underneath the topsoil, fill materials consisting clayey silt with trace organics/rootles were found in all boreholes extending to depths of 1.0 to 1.2 m below existing grade. Standard penetration tests carried out within the fill materials gave N values ranging from 17 to 35 blows per 0.3 m penetration, indicating a very stiff to hard consistency.

Clayey Silt to Silty Clay Till:

Native clayey silt to silty clay till was encountered in all boreholes, extending to depths of 1.5 to 3.1 m below existing grade. The clayey silt to silty clay till was present in a very stiff to hard consistency, with measured SPT 'N' values ranging from 22 to over 50 blows per 300 mm penetration. The till is known to contain layers and pockets of sand. Cobble/boulders are also known to be present in the till.

Grain size analysis of one (1) sample (BH25H1/SS3) was conducted and the results are presented on Drawing 3, with the following fractions:

Clay: 25%
Silt: 49%
Sand: 22%
Gravel: 4%

Atterberg limits tests of the same sample (BH25H1/SS3) were conducted. Based on the test results, the soil is classified as inorganic clays and silts of low plasticity (CL). The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L): 28%
Plastic limit (W_P): 16%
Plasticity index (PI): 12

Clayey Silt Till/Shale Complex:

Underlying the clayey silt to silty clay till, a deposit termed clayey silt till /shale complex was encountered in all boreholes, extending to depths of from 2.3 to 4.6 m. This deposit consisted of clayey silt till mixed with highly weathered shale. The till/shale complex was in a very hard state.

Shale Bedrock:

Shale bedrock of Queenston Formation was encountered at depths of 2.3 to 4.6 m (Elev. 139.5 to 140.3 m) in all boreholes. Refer to Section 3.2 Bedrock Conditions for more information regarding bedrock at the site.

AREA I (See Appendix D)

Three (3) boreholes (BH25I-1 to BH25I-3) were drilled to depths of 4.7 to 6.2 m below existing grade at Area I. The borehole location plan and borehole logs for Areas 'I' are attached in Appendix D of this report.

Topsoil/ Fill Material:

A surficial topsoil layer, ranging in thickness from 130 to 180 mm was found at all borehole locations. The thickness of the topsoil in each borehole was shown in the borehole log. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Underneath the topsoil, fill materials consisting clayey silt with trace organics/rootles were found in all boreholes extending to depths of 0.6 to 3.0 m below existing grade. Standard penetration tests carried out within the fill materials gave N values ranging from 17 to 33 blows per 0.3 m penetration, indicating a very stiff to hard consistency.

Clayey Silt to Silty Clay Till:

Native clayey silt to silty clay till was encountered in all boreholes, extending to depths of 2.3 to 6.0 m below existing grade. The clayey silt to silty clay till was present in a very stiff to hard consistency, with measured SPT 'N' values ranging from 21 to over 50 blows per 300 mm penetration. The till is known to contain layers and pockets of sand. Cobble/boulders are also known to be present in the till.

Grain size analyses of two (2) samples (BH25I-2/SS4 and BH25I-3/SS5) were conducted and the results are presented on Drawing 3, with the following fractions:

Clay:	11% to 26%
Silt:	49% to 57%
Sand:	22% to 25%
Gravel:	3% to 7%

Atterberg limits tests of the same samples (BH25I-2/SS4 and BH25I-3/SS5) were conducted. Based on the test results, the soil is classified as inorganic clays and silts of low plasticity (CL). The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L):	19% to 31%
Plastic limit (W_P):	14%
Plasticity index (PI):	5 to 17

Sandy Silt Till:

Native sandy silt till was encountered at depths of 3.0 to 4.6 m in borehole BH25I-2. The sandy silt till was present in a very dense state, with a measured SPT 'N' value of over 50 blows per 300 mm penetration. The till is known to contain cobbles and boulders.

Clayey Silt Till/Shale Complex:

Underlying the clay silt till, a deposit termed clayey silt till /shale complex was encountered from 2.3 to 3.0 m in borehole BH25I-1. This deposit consisted of clayey silt till mixed with highly weathered shale. The till/shale complex was in a very hard state.

Shale Bedrock:

Shale bedrock of Queenston Formation was encountered at depths of 3.0 to 6.0 m (Elev. 136.9 to 138.8 m) in all boreholes. Refer to Section 3.2 Bedrock Conditions for more information regarding bedrock at the site.

AREA J (See Appendix E)

Three (3) boreholes (BH25J-1 to BH25J-3) were drilled to a depth of 6.2 m below existing grade at Area J. The borehole location plan and borehole logs for Areas 'J' are attached in Appendix E of this report.

Topsoil/ Fill Material:

A surficial topsoil layer with a thickness of approximately 130 mm was found at all borehole locations. The thickness of the topsoil in each borehole was shown in the borehole log. It should be noted that the thickness of the topsoil explored at the borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site. Underneath the topsoil, fill materials consisting clayey silt and silty sand with trace organics/rootles were found in all boreholes extending to depths of 1.5 to 2.3 m below existing grade. Standard penetration tests carried out within the fill materials gave N values ranging from 8 to 20 blows per 0.3 m penetration, indicating a loose to compact state or stiff to very stiff to hard consistency.

Clayey Silt to Silty Clay Till:

Native clayey silt to silty clay till was encountered in all boreholes, extending to depths of 3.0 to 4.6 m below existing grade. The clayey silt to silty clay till was present in a very stiff to hard consistency, with measured SPT 'N' values ranging from 20 to over 50 blows per 300 mm penetration. The till is known to contain layers and pockets of sand. Cobble/boulders are also known to be present in the till.

Grain size analysis of one (1) sample (BH25J-1/SS4) was conducted and the results are presented on Drawing 4, with the following fractions:

Clay:	26%
Silt:	50%
Sand:	21%
Gravel:	3%

Atterberg limits tests of the same sample (BH25J-1/SS4) were conducted. Based on the test results, the soil is classified as inorganic clays and silts of low plasticity (CL). The results are shown on the borehole logs and are summarized as follows:

Liquid limit (W_L):	28%
Plastic limit (W_P):	14%
Plasticity index (PI):	14

Clayey Silt Till/Shale Complex:

Underlying the clay silt till, a deposit termed clayey silt till /shale complex was encountered from 2.3 to 3.0 m in boreholes BH25J-1 and BH25J-2. This deposit consisted of clayey silt till mixed with highly weathered shale. The till/shale complex was in a very hard state.

Shale Bedrock:

Shale bedrock of Queenston Formation was encountered at depths of 4.0 to 5.8 m (Elev. 136.6 to 137.7 m) in all boreholes. Refer to Section 3.2 Bedrock Conditions for more information regarding bedrock at the site.

AREA K

No boreholes were drilled across Area K during this investigation due to its active use as a golf course. It is understood that the drilling will be conducted in the future following completion of the golf season. As such the geotechnical recommendations provided in this report will be updated and revised as necessary when boreholes across Area K are completed.

3.2 Bedrock Conditions

Shale bedrock of Queenston Formation was encountered at most borehole locations, except for BH25F-1, BH25F-3, BH25G-1 and BH25G-8. The highly weathered shale was encountered below depths ranging from 2.3 to 7.5 m, corresponding to Elevations 136.6 to 144.4 m. The shale bedrock was not proven by core drilling. The approximate depth and elevation of the shale bedrock surface in the boreholes are listed on Table 3 below.

Table 3: Approximate Depth and Elevation of Shale Bedrock Surface

Area Name	Borehole No.	Depth of Shale Bedrock Surface below Existing Ground (m)	Approximate Elevation of Shale Bedrock Surface (m)
Area 'F'	BH25F-2	7.5	144.4
Area 'G'	BH25G-2	6.1	139.7
	BH25G-3	6.0	138.9
	BH25G-4	5.5	140.3
Area 'H'	BH25H-1	4.6	139.5
	BH25H-2	3.0	140.3
	BH25H-3	2.3	139.6
Area 'I'	BH25I-1	3.0	138.8
	BH25I-2	4.6	136.9
	BH25I-3	6.0	137.6
Area 'J'	BH25J-1	5.8	136.6
	BH25J-2	4.0	137.7
	BH25J-3	4.0	137.1

Commonly the till overlying the shale contains slabs of limestone which would give a false indication of the bedrock level. Similarly, the depth of weathering cannot be determined accurately due to the presence of limestone layers.

The shale bedrock generally contains layers of sandstone, limestone and dolostone. Typically, the hard layers comprise about 15 to 20 percent of the unit. However, higher concentrations of hard layers can be present. The hard layers are usually less than 100 to 150 mm thick, but some layers are much thicker. The thicker layers have been observed to be as much as 750 to 900 mm at other sites. The layers are actually lenses and they can vary significantly in thickness over short distance.

Although not encountered during borehole drilling, methane gas can exist in the bedrock, normally below the top 1m and more concentrated with depth. Appropriate care, venting and monitoring is

essential in all confined bedrock excavations, particularly caissons and tunnels. **Appendix F** presents more details and general comments about the shale bedrock.

3.3 Groundwater Conditions

Groundwater levels in the monitoring wells were recorded on June 10 and July 24, 2025. The groundwater levels measured in the monitoring wells were 1.0 to 5.9 m below existing grade, corresponding to Elevations 135.2 to 152.9 m, as summarized on Table 4.

Table 4: Groundwater Levels Observed in Monitoring Wells

Area No	Borehole No.	Date of installation	Date of Observation	Depth of Groundwater (m)	Elevation of Groundwater (m)
Area 'F'	BH25F-1	May 23, 2025	Jun. 10, 2025	2.2	152.9
	BH25F-2	May 23, 2025	Jun. 10, 2025	1.0	150.9
	BH25F-3	May 23, 2025	Jun. 10, 2025	1.3	149.6
Area 'G'	BH25G-2	May 22, 2025	Jun. 10, 2025	2.8	143.0
	BH25G-4	May 22, 2025	Jun. 10, 2025	1.9	143.9
	BH25G-8	May 22, 2025	Jun. 10, 2025	2.6	144.3
Area 'H'	BH25H-1	Jul. 09, 2025	Jul. 24, 2025	2.3	141.8
	BH25H-3	Jul. 09, 2025	Jul. 24, 2025	2.5	139.4
Area 'I'	BH25I-3	Jul. 09, 2025	Jul. 24, 2025	2.6	141.0
Area 'J'	BH25J-1	Jul. 09, 2025	Jul. 24, 2025	3.8	138.6
	BH25J-2	Jul. 09, 2025	Jul. 24, 2025	5.2	136.5
	BH25J-3	Jul. 09, 2025	Jul. 24, 2025	5.9	135.2

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Further measurements of groundwater levels in the monitoring wells are recommended.

4. DISCUSSION AND RECOMMENDATIONS

It is proposed to develop the site as a residential subdivision. The lots will therefore be serviced by a network of roads, watermains and storm and sanitary sewers.

4.1 Site Grading and Engineered Fill

The site grading plan is not available to us when preparing this report.

In the areas where earth fill is required for the site grading purposes, an engineered fill can be constructed below foundations, roads/driveways, parking lots, etc. Prior to the construction of engineered fill, any existing fill materials, weathered/disturbed soils and loose native soils should be removed. ***It should be noted that, in the Area 'G', the existing pavement structure and fill materials below the pavement structure should be removed prior to the placement of engineered fill.*** The base

of the excavation should be compacted and proof rolled with heavy compactors (minimum 10,000 kg). The entire excavated area should be inspected and approved by geotechnical engineer. During proof rolling, spongy, wet or soft/loose spots should be sub-excavated to stable subgrade and replaced with approved backfill materials, compatible with subgrade conditions, as directed by the geotechnical engineer.

General guidelines for the placement and preparation of engineered fill are presented on **Appendix G**. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS can be used on engineered fill, provided that all requirements on **Appendix G** are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential. Despite full time supervision, it has been found that contractors frequently bulldoze loose fill into areas and compact only the surface. The inspector, either busy on other portions of the site or absent during "off hours" will be unaware of this condition. For this reason, we cannot guarantee the performance of the engineered fill, and this guarantee must be the responsibility of the contractor. The owner and his representatives must accept the risk involved in the use of engineered fill and offset this risk with the monetary savings of avoiding deep foundations. This potential problem must be recognized and discussed at a pre-construction meeting. Procedures can then be instigated to reduce the risk of settlement resulting from un-compacted fill.

The following is a recommended procedure for an engineered fill:

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained, and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS. Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.

6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS may be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings should be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

10. After completion of the pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain and frost.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

The inorganic clayey silt and sandy silt (till) are considered suitable for use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. As mentioned before in Section 4.3.3 of this report, the clayey tills are likely to be excavated in cohesive chunks or Areas and will be difficult to compact. They should be pulverized and placed in thin layers not exceeding 150 to 200

mm and compacted using heavy equipment suitable for these types of soils (e.g. heavy sheepsfoot compactors).

4.2 Roads

The investigation has shown that the predominant subgrade soil, after stripping the topsoil, loose fill and any other organic and otherwise unsuitable subsoil, will generally consist of clayey silt to silty clay till.

Based on the above and assuming that traffic usage will be residential minor local or local, the following minimum pavement thickness is recommended for roads to be constructed within the subdivision:

40 mm HL3 Asphaltic Concrete

50 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

350 mm Granular 'B'

For collector streets/bus routes, the following minimum pavement thickness is recommended:

40 mm HL3 Asphaltic Concrete

80 mm HL8 Asphaltic Concrete

150 mm Granular 'A'

400 mm Granular 'B'

These values may need to be adjusted according to the City of Burlington Standards. The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.2.1 Stripping, Sub-excavation and Grading

The site should be stripped of all topsoil, loose fill and any organic or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Owing to the clayey (i.e. impervious) nature of the subsoil at the site, proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains) is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade, or as per the City Standards. The compaction of the new fill should be checked by frequent field density tests.

4.2.2 Construction

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.2.3 Drainage

The City of Burlington requires the installation of full-length subdrains on all roads. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catchbasins. As discussed in Section 4.2.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

4.3 Sewers

As a part of the site development, a network of new storm and sanitary sewers is to be constructed. It is assumed that the trenches are generally within 4 to 5 m below the existing grade.

4.3.1 Trenching

Based on the boreholes, the trenches will be generally dug through the fill material, clayey silt to silty clay till, local sand silty to silty sand (till)/silt, and weathered shale. No major problems due to

groundwater seepage are anticipated during construction in trenches dug through the clayey soils and shale bedrock. It is expected that seepage through the clayey soil and bedrock will be slow and can be removed by pumping from sumps. In Area 'F' (see Appendix A for borehole logs), positive dewatering will be required for excavation in the cohesionless deposits of silt, sandy silt to silty sand (till). The groundwater table must be lowered to at least 1.0 m below the excavation base.

RJ Burnside is currently carrying out a hydrogeology study at the subject site. Detailed comments regarding the type and extent of groundwater control required at this site will be provided in the hydrogeology report by RJ Burnside.

Excavations can be carried out with heavy hydraulic backhoe. Excavation of the shale can be carried out using heaviest available single tooth ripper equipment. The limestone beds may overly the shale bedrock surface at some locations and it may be necessary at some locations to utilize jackhammer type equipment to "open" the limestone layers for the ripper.

The sides of excavations in the natural strata above groundwater can be expected to be temporarily stable at relatively steep side slopes for short periods of time but they should be cut back at slopes no steeper than 1:1 in order to comply with the safety regulations. If steep side slopes are required, the sides should be supported by braced skeleton or close sheeting.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and sandy silt to silty sand (till)/silt can be classified as Type 3 soil above the groundwater table and classified as Type 4 below the groundwater table soil. The very stiff to hard clayey silt to silty clay till and till/shale complex can be classified as Type 2 Soil above the groundwater table and Type 3 below the groundwater table.

4.3.2 Bedding

The undisturbed native soils and engineered fill will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions are encountered, especially when the soil at the trench base level consists of wet, dilatant silt. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed. Where the bedding falls below the anticipated water table, the bedding stone must be surrounded with a geotextile filter cloth.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The

geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

For deep trenches, i.e. more than 2.0 m below the shale surface, a minimum 50 mm thick polystyrene etc. layer will be required at both sides of the pipe to avoid rock squeezing. The polystyrene layer should extend vertically to at least 0.3 m above the pipe. The rock trench should be wide enough so that at each side, the horizontal distance between the pipe side and the cut rock surface is at least 0.3 m.

4.3.3 Backfilling of Trenches

Based on visual and tactile examination, the on-site excavated inorganic soil, free from topsoil and organics are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are at or near optimum.

Granular B material should be used as backfill for trenches located under slab on grade or paved areas. Compaction of the granular soils should be carried out with vibratory compactors and loose lifts not exceeding about 200 mm.

The clayey till especially when its consistency is hard is likely to be excavated in cohesive chunks or Areas and will be difficult to compact in confined areas. For use as backfill, the clayey material will have to pulverized and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly pulverized and compacted in sufficiently thin lifts post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at last 95% SPMDD. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

The on-site excavated soils and especially the clayey soils should not be used in confined areas (e.g. around catchbasins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch-basins.

4.4 Foundation Conditions

The boreholes show that provided the foundation soil is undisturbed during the construction, in general, soil bearing values 150 kPa at SLS and 225 kPa at ULS are feasible in the undisturbed inorganic natural (native) soils at or below the depths as given on Table 5. These values would be suitable for the use of conventional spread and strip footings to support normal single-family dwellings.

Table 5: Bearing Values and Founding Levels of Footings

Area No	BH No.	Founding Soil	Bearing* Capacity at SLS (kPa)	Factored* Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level At or Below Elevation (m)
Area 'A'	BH25F-1	Silty Clay Till	150	225	1.4	153.7
	BH25F-2	Sandy Silt to Silty Sand	150	225	1.8	150.1
	BH25F-3	Silt to Sandy Silt	150	225	1.9	149.0
Area 'G'	BH25G-1	Silty Clay Till	150	225	1.7	145.3
	BH25G-2	Silty Clay Till	150	225	1.6	144.2
	BH25G-3	Silty Clay Till	150	225	1.9	143.0
	BH25G-4	Silty Clay Till	150	225	1.9	143.9
	BH25G-8	Silty Clay Till	150	225	2.4	144.5
Area 'H'	BH25H-1	Clayey Silt to Silty Clay Till	150	225	1.3	142.8
	BH25H-2	Clayey Silt Till	150	225	1.3	142.0
	BH25H-3	Clayey Silt Till	150	225	1.1	140.8
Area 'I'	BH25I-1	Clayey Silt Till	150	225	0.9	140.9
	BH25I-2	Clayey Silt Till	150	225	0.9	140.6
	BH25I-3	Clayey Silt Till	150	225	3.1	140.5
Area 'J'	BH25J-1	Silty Clay Till	150	225	1.6	140.8
	BH25J-2	Clayey Silt Till	150	225	2.4	139.3
	BH25J-3	Clayey Silt Till	150	225	1.6	139.5

*Higher bearing pressure values are available if required

Where the grade needs to be raised, the proposed structures can be supported by spread and strip footings founded on engineered fill for bearing capacity values of 150 kPa at SLS and 225 kPa at ULS. The engineered fill supporting footings should be constructed in accordance with the guidelines presented in **Appendix G**. Other requirements of engineered fill are given in Section 4.1.

Variations in the soil conditions are expected in between the borehole locations, and during construction, the soil bearing pressures should be confirmed by the Geotechnical Engineer.

4.5 Floor Slab and Permanent Drainage

The floor slab can be supported on grade provided all topsoil, fill, and surficially softened/disturbed native soils are removed and the base thoroughly proof rolled. The fill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

If the floor slab is more than about 300 mm higher than the exterior grade, then perimeter drainage is not considered to be necessary. If the floor is lower, then the perimeter drainage system shown on **Drawing 7** is recommended.

For houses with basement, the perimeter drainage system shown on **Drawing 8** is recommended for the basement walls where open cut procedures are used.

5. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The sub-surface conditions are interpreted as relevant to the design and construction of the proposed sanitary sewer. Comments relating to construction are intended for the guidance of the design engineer to establish constructability and must not be considered as being specifications or recommendations to the prospective contractors, or as being the only suitable methods. Prospective contractors should evaluate all of the factual information, obtain additional subsurface information as they might deem necessary and should select their construction methods, sequencing and equipment based on their own experience in similar ground conditions. The readers of this report are also reminded that the conditions are known only at the borehole locations and in view of the generally wide spacing of the boreholes, conditions may vary significantly between boreholes.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

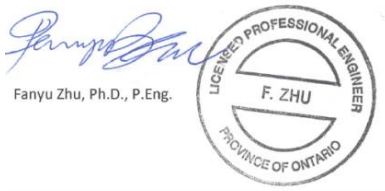
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD



Derek Wang, P.Eng.
Senior Geotechnical Engineer



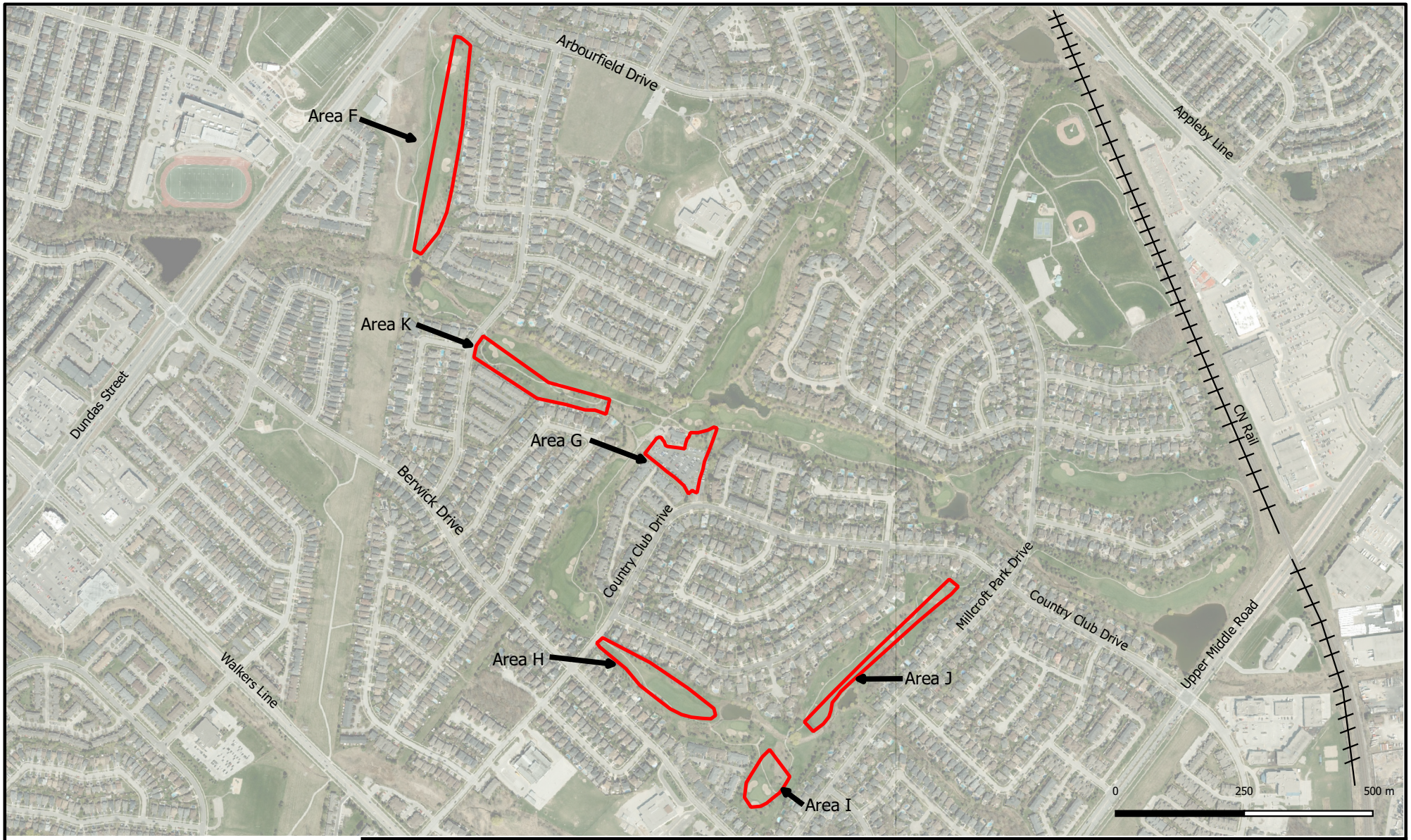
Fanyu Zhu, Ph.D., P.Eng.
Principal Engineer



Alka Sangar, M.Eng., P.Eng.
Principal Engineer

Drawings

Y:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Oct-06 15:26



Legend

Approx Site Boundary

DS CONSULTANTS LTD.
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Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: GEOTECHNICAL INVESTIGATION
Millcroft Phase - 2, Burlington, ON

Title: **SITE LOCATION PLAN**

N

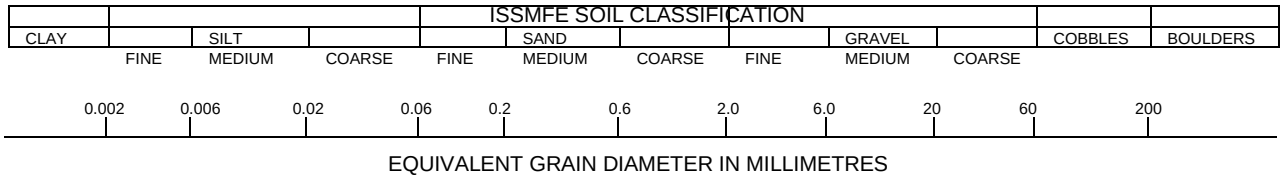
Client: ARGO LAND

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.W	K.T	October 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: 1

Image/Map Source: *Google Satellite Image*

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DSCL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

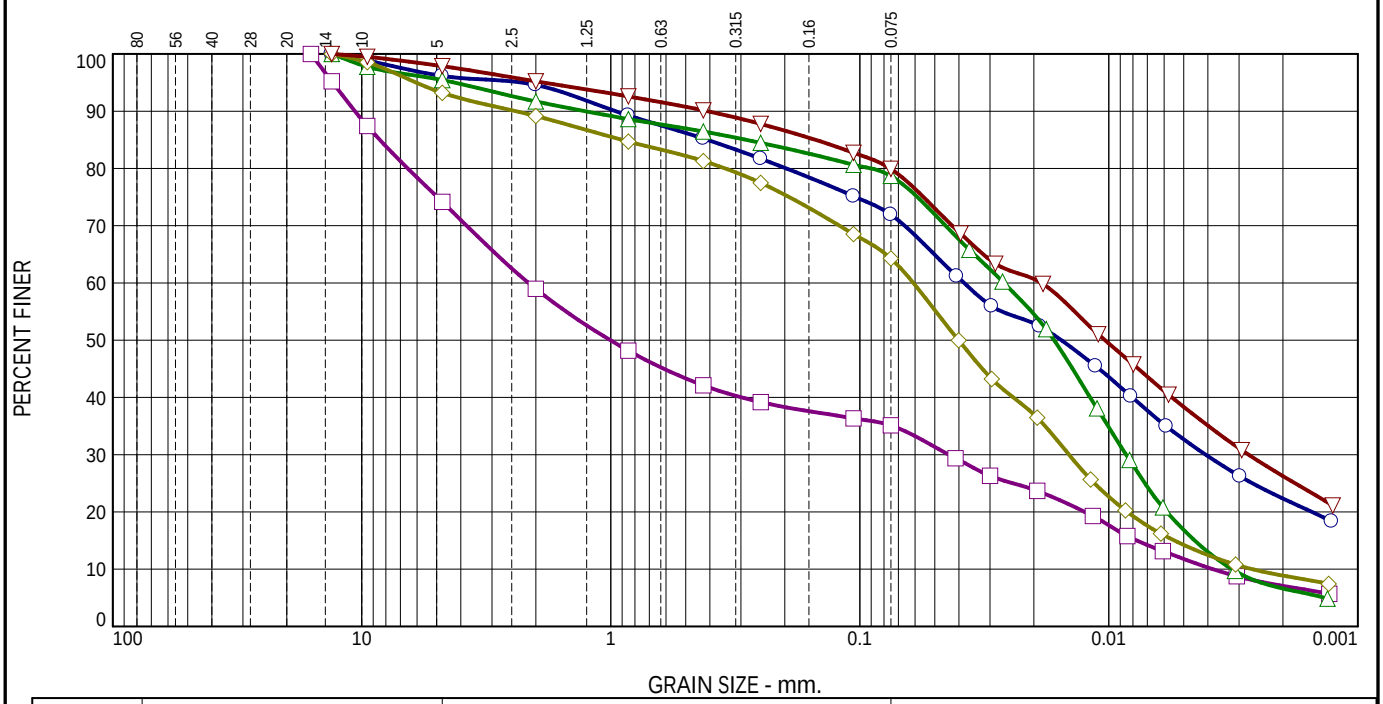
UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

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

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.9	1.5	9.4	13.3	49.6	22.3
□	0.0	0.0	25.8	15.2	16.9	7.0	28.0	7.1
△	0.0	0.0	4.6	3.7	5.3	7.7	72.1	6.6
◇	0.0	0.0	6.8	4.0	7.9	17.0	55.4	8.9
▽	0.0	0.0	2.1	2.7	5.1	10.2	53.6	26.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26	15	0.4100	0.0381	0.0155	0.0041				
□			8.4637	2.1383	1.0037	0.0439	0.0077	0.0038	0.24	560.37
△			0.2853	0.0264	0.0166	0.0085	0.0045	0.0032	0.86	8.24
◇			0.9022	0.0609	0.0401	0.0144	0.0054	0.0027	1.29	22.93
▽	28	15	0.1506	0.0186	0.0104	0.0027				

Material Description	USCS	AASHTO
○ Silty clay till, sandy, trace gravel	CL	A-6(5)
□ Silty sand till, trace clay, gravelly		
△ Silt, trace clay, some sand, trace gravel		
◇ Sandy silt till, trace clay, trace gravel		
▽ Silty clay till, some sand, trace gravel	CL	A-6(8)

Project No. 19-199-106 Client: Argo Land

Project: Geotechnical Investigation - Milcroft Golf Course, Burlington, ON

○ Location: BHF-1 SS5 Sample Number: VM-6668

□ Location: BHF-1 SS7 Sample Number: VM-6668

△ Location: BHF-3 SS4 Sample Number: VM-6668

◇ Location: BHF-3 SS6B Sample Number: VM-6668

▽ Location: BHG-1 SS3 Sample Number: VM-6668

Remarks:

○ F.M.=0.70

□ F.M.=3.03

△ F.M.=0.70

◇ F.M.=0.97

▽ F.M.=0.48

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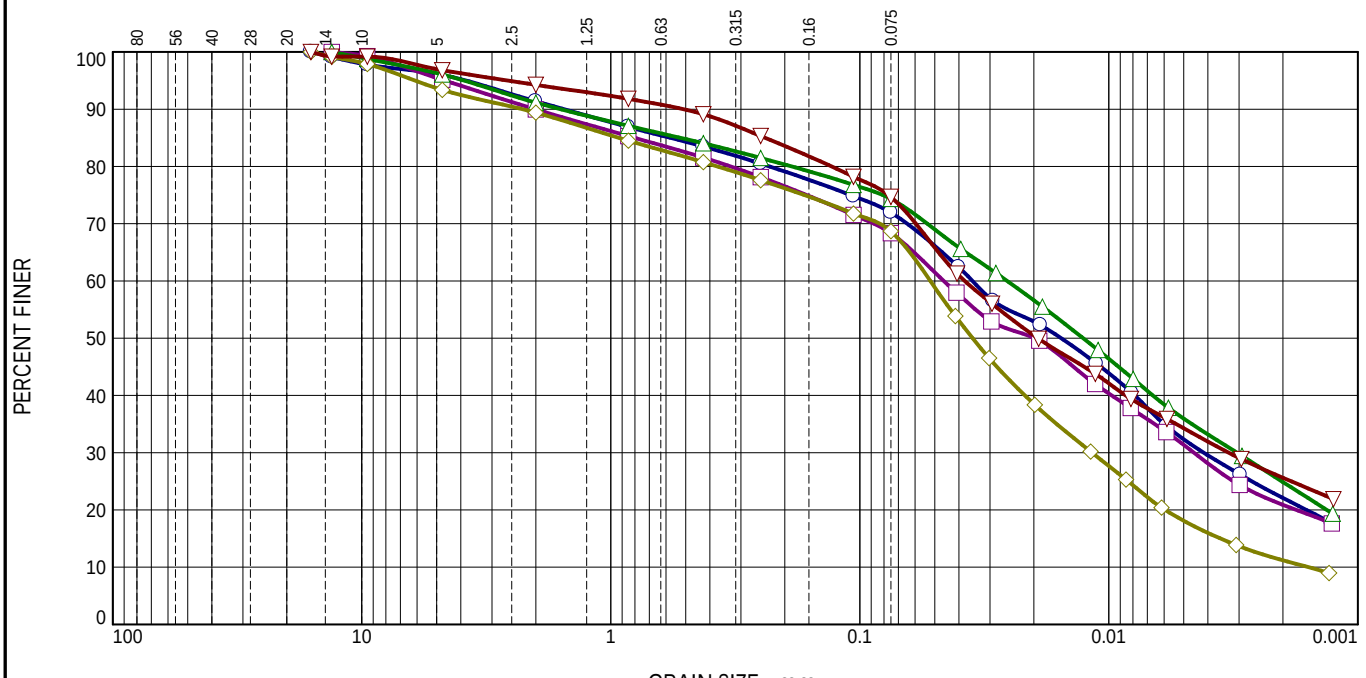
CCIL

Figure 2

Tested By: ○ Helen/Disha / Helen/Nisha □ Helen/Disha △ Helen/Disha ◇ Helen/Nisha ▽ Helen/Disha / Helen/Nisha Checked By: Kir

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	4.0	4.6	7.9	11.6	49.8	22.1
□	0.0	0.0	4.9	5.1	8.5	13.2	47.4	20.9
△	0.0	0.0	3.9	5.0	7.0	9.8	49.4	24.9
◇	0.0	0.0	6.6	4.0	8.7	12.0	57.5	11.2
▽	0.0	0.0	3.2	2.5	5.2	14.4	49.1	25.6

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26	15	0.5760	0.0353	0.0155	0.0042				
□	26	15	0.8035	0.0460	0.0199	0.0046				
△	28	16	0.5256	0.0256	0.0127	0.0031				
◇	19	14	0.9294	0.0521	0.0352	0.0117	0.0036	0.0016	1.66	33.00
▽	31	14	0.2402	0.0379	0.0193	0.0033				

Material Description	USCS	AASHTO
○ Silty clay till, sandy, trace gravel	CL	A-6(5)
□ Silty clay till, sandy, trace gravel	CL	A-6(5)
△ Silty clay till, sandy, trace gravel	CL	A-6(7)
◇ Clayey silt till, sandy, trace gravel	CL-ML	A-4(1)
▽ Silty clay till, sandy, trace gravel	CL	A-6(10)

Project No. 19-199-106 Client: Argo Land

Project: Geotechnical Investigation - Milcroft Golf Course, Burlington, ON

○ Location: BHG-4 SS4 Sample Number: VM-6668

□ Location: BHG-8 SS4 Sample Number: VM-6668

△ Location: BH25H-1 SS3 Sample Number: VM-6821

◇ Location: BH25I-2 SS4 Sample Number: VM-6821

▽ Location: BH25I-3 SS5 Sample Number: VM-6821

Remarks:

○ F.M.=0.81

□ F.M.=0.90

△ F.M.=0.78

◇ F.M.=0.96

▽ F.M.=0.58

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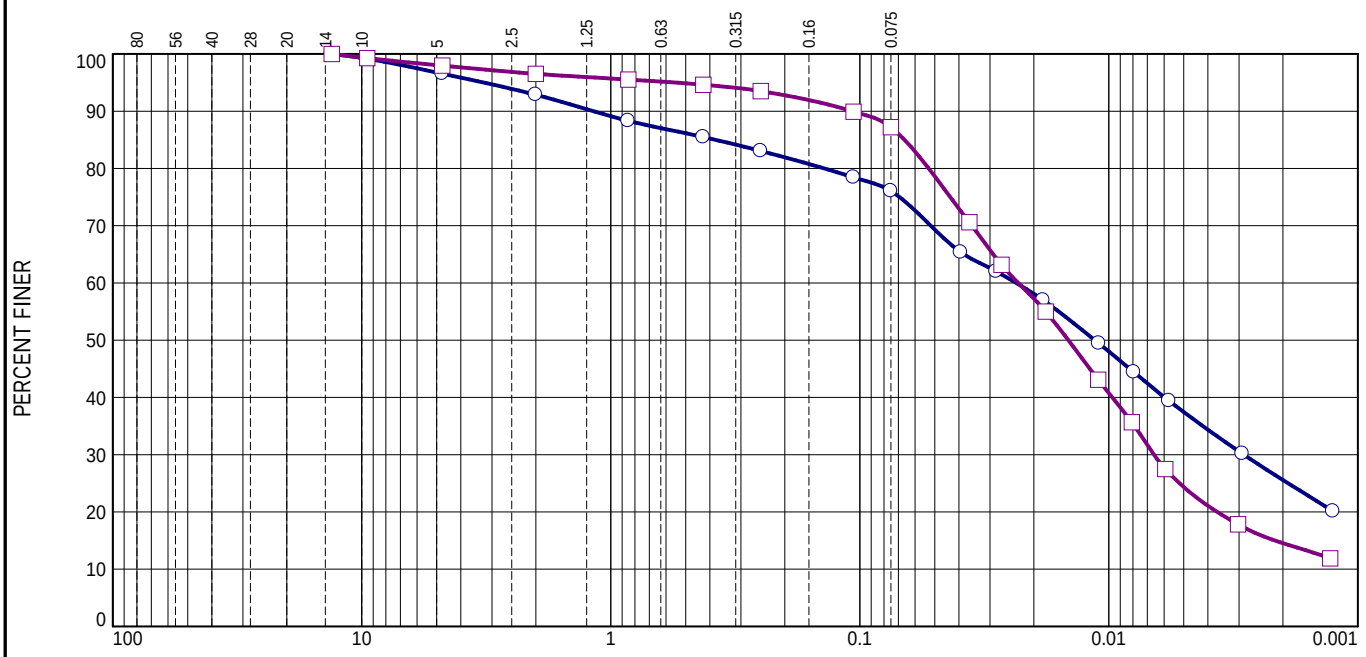
CCIL

Figure 3

Tested By: ○ Helen/Disha □ Helen/Nisha / Helen/Disha △ Helen/Nisha ◇ Helen/Nisha ▽ Helen/Nisha Checked By: Kirupa

Particle Size Distribution Report

ASTM D422



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.4	3.7	7.4	9.4	50.5	25.6
□	0.0	0.0	2.0	1.5	1.9	7.4	72.7	14.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	28	14	0.3803	0.0236	0.0114	0.0029				
□			0.0662	0.0231	0.0145	0.0066	0.0022			

Material Description	USCS	AASHTO
○ Silty clay till, sandy, trace gravel	CL	A-6(8)
□ Silt, some clay, some sand, trace gravel		

Project No. 19-199-106 Client: Argo Land

Project: Geotechnical Investigation - Milcroft Golf Course, Burlington, ON

○Location: BH25J-1 SS4 Sample Number: VM-6821

□Location: BHK-2 SS5 Sample Number: VM-6668

Remarks:

○F.M.=0.69

□F.M.=0.29

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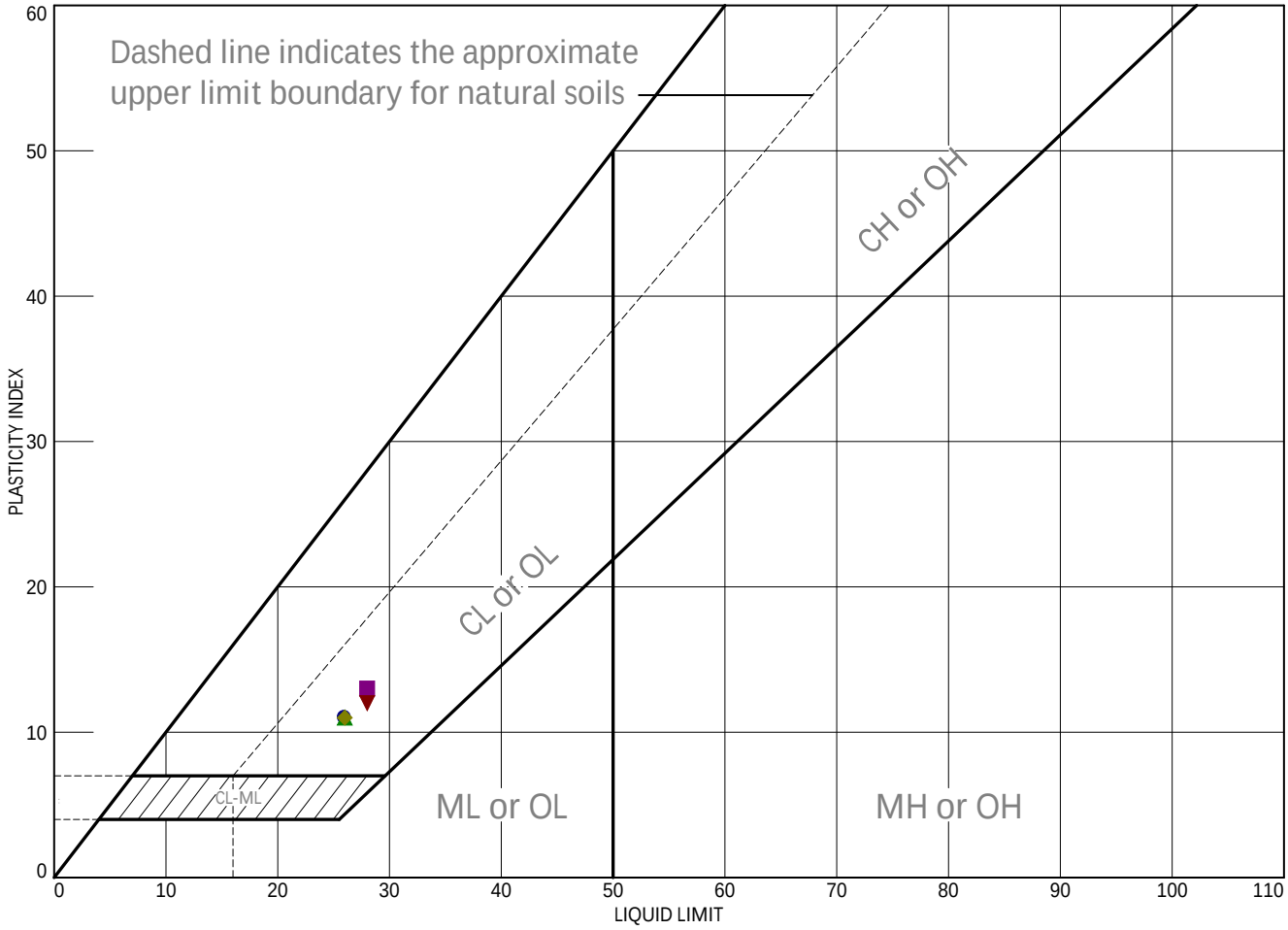
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CCIL

Figure 4

Tested By: ○ Helen/Nisha □Helen/Disha Checked By: Kirupa

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty clay till, sandy, trace gravel	26	15	11	85.2	71.9	CL
■	Silty clay till, some sand, trace gravel	28	15	13	90.1	79.9	CL
▲	Silty clay till, sandy, trace gravel	26	15	11	83.5	71.9	CL
◆	Silty clay till, sandy, trace gravel	26	15	11	81.5	68.3	CL
▼	Silty clay till, sandy, trace gravel	28	16	12	84.1	74.3	CL

Project No. 19-199-106 Client: Argo Land

Project: Geotechnical Investigation - Milcroft Golf Course, Burlington, ON

●Location: BHF-1 SS5 Sample Number: VM-6668
■Location: BHG-1 SS3 Sample Number: VM-6668
▲Location: BHG-4 SS4 Sample Number: VM-6668
◆Location: BHG-8 SS4 Sample Number: VM-6668
▼Location: BH25H-1 SS3 Sample Number: VM-6821

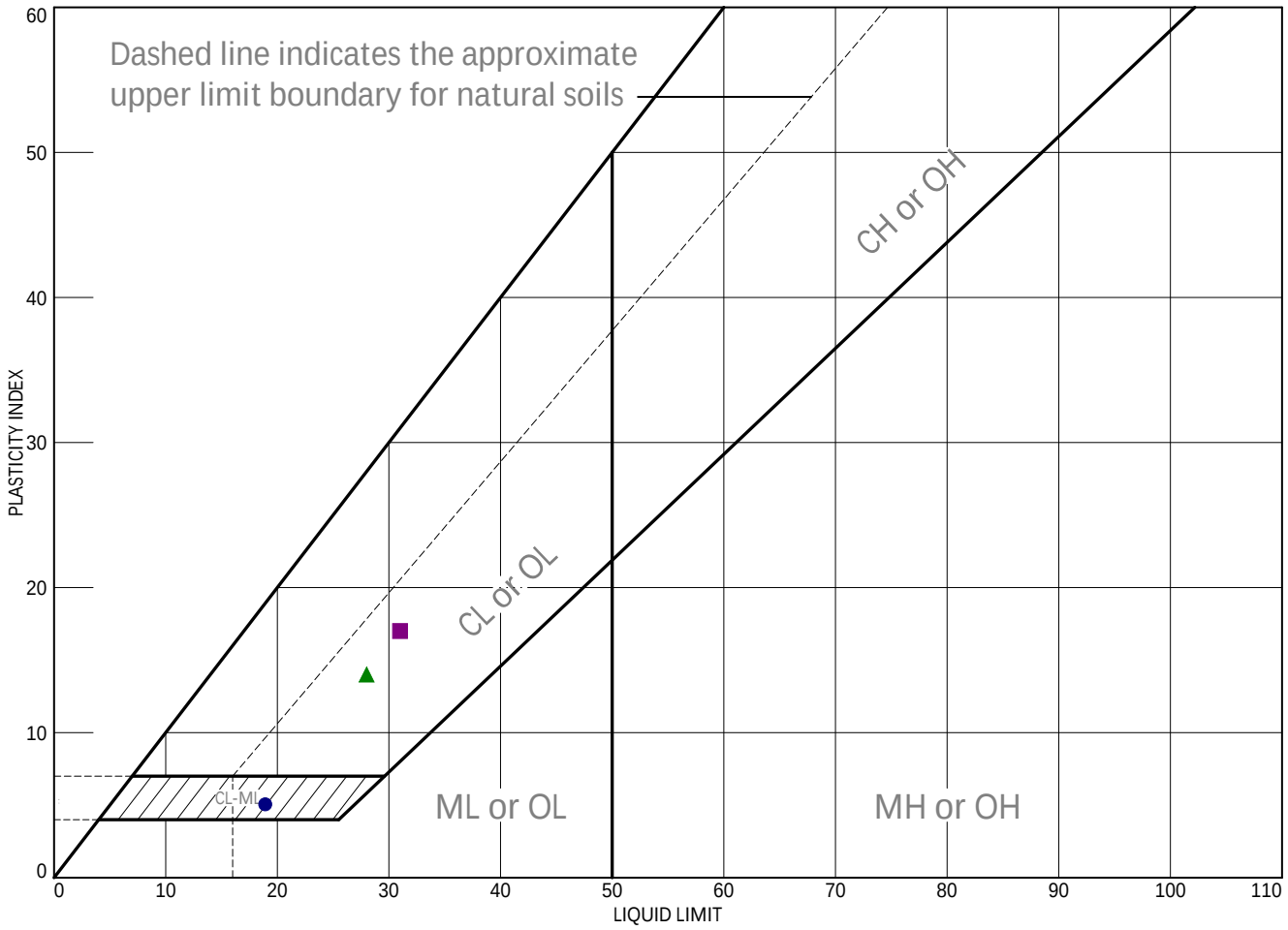
Remarks:
●Sampled on May 23, 2025
■Sampled on May 22, 2025
▲Sampled on May 22, 2025
◆Sampled on May 22, 2025
▼Sampled on July 09, 2025

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Figure 5

Tested By: ○Disha □Disha △Disha ◇Disha ▽Nisha Checked By: Kirupa

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Clayey silt till, sandy, trace gravel	19	14	5	80.7	68.7	CL-ML
■	Silty clay till, sandy, trace gravel	31	14	17	89.1	74.7	CL
▲	Silty clay till, sandy, trace gravel	28	14	14	85.5	76.1	CL

Project No. 19-199-106 Client: Argo Land

Project: Geotechnical Investigation - Milcroft Golf Course, Burlington, ON

●Location: BH25I-2 SS4 Sample Number: VM-6821

■Location: BH25I-3 SS5 Sample Number: VM-6821

▲Location: BH25J-1 SS4 Sample Number: VM-6821

Remarks:

●Sampled on July 09, 2025

■Sampled on July 09, 2025

▲Sampled on July 09, 2025

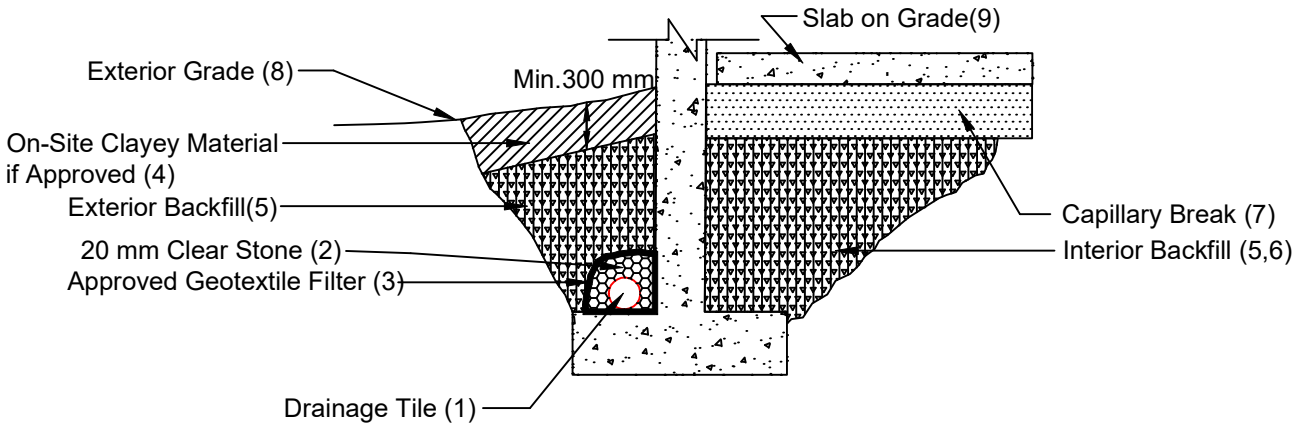
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Geotechnical ❖ Environmental ❖ Materials ❖ Hydrogeology

CCIL

Figure 6

Tested By: Nisha Checked By: Kirupa



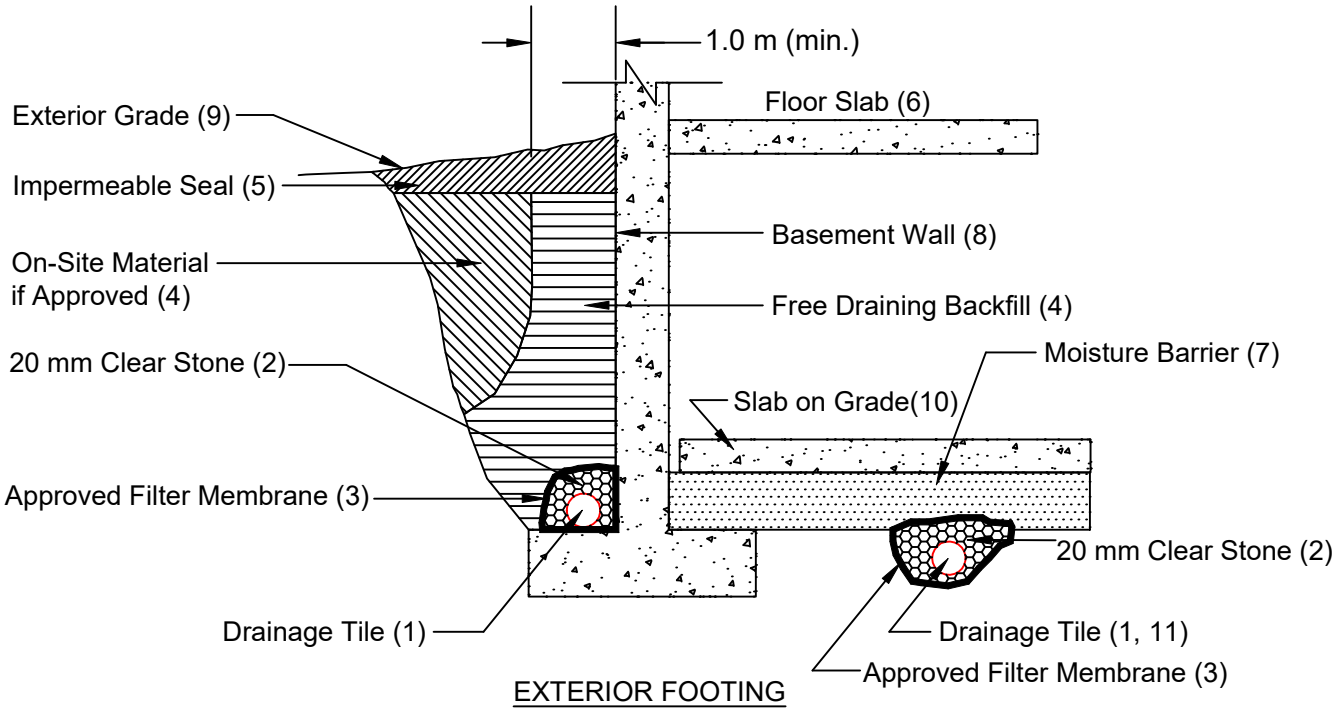
EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved geotextile filter (Terrafix 270R or equivalent).
4. The on-site clayey material, if approved, can be used as backfill in the upper 300 mm.
5. The interior and exterior fill adjacent to foundation walls should be OPSS Granular 'B' Type I. Compact to at least 98% SPMDD.
6. Do not use heavy compaction equipment within 450 mm (18") of the wall. Do not fill or compact within 1.8 m (6') of the wall. Place fill on both sides simultaneously.
7. Capillary break to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors (consult with architect).
8. Exterior grade to slope away from building at min. 2%.
9. Slab on grade should not be structurally connected to the wall or footing.
10. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Slab on Grade Construction Without Underfloor Drainage

(not to scale)



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

Appendix A

Borehole Logs & Location Plan for Area 'F'

Drawing A1: Borehole Location Plan
Drawings A2 to A4: Borehole Logs
Drawing A5: Generalized Sub-surface Profile

J:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Jun-13 14:44



Legend

Borehole With Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: GEOTECHNICAL INVESTIGATION (MILLCROFT - PHASE 2)
Dundas Street and Milcroft Park Drive, Burlington, ON

Title: **BOREHOLE LOCATION PLAN**

N

Client: ARGO LAND

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	A.S	K.T	June 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: A1

Image/Map Source: *Google Satellite Image*

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LOG OF BOREHOLE BH25F-1

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805879.2 E 596065.7

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-23-2025

REF. NO.: 19-199-106
ENCL NO.: A2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
155.1 / 0.0	**TOPSOIL:** 180mm						155
154.9 / 0.2	**FILL:** sandy silt, trace organics, trace clay, trace rootlets, dark brown to brown, moist, compact		1	SS	11		
154.3 / 0.8	**FILL:** clayey silt, trace rootlets, trace organics, brown, moist, stiff		2	SS	8		154
154.0 / 1.1	**SILTY CLAY TILL:** sandy, trace gravel, reddish brown, moist, stiff to very stiff		3	SS	25		
			4	SS	26	W. L. 152.9 m Jun 10, 2025	153
			5	SS	27		152
150.5 / 4.6	**SILTY SAND:** trace clay, trace gravel, brown, moist, very dense		6	SS	50/ 130mm		151
149.0 / 6.1	**SILTY SAND TILL:** trace clay, gravelly, cobbles/boulders, brown, moist, very dense		7	SS	50/ 130mm		150
147.9 / 7.2	**CLAYEY SILT TILL:** some sand, trace gravel, frequent shale fragments, reddish brown, moist, hard		8	SS	50/ 30mm		149
147.2 / 7.9	**END OF BOREHOLE:**						148

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
June 10, 2025	2.2

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	4	24	50	22
wet spoon				
	26	39	28	7

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25F-2

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805711.1 E 596042.3

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-23-2025

REF. NO.: 19-199-106
ENCL NO.: A3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
151.9					
151.8 / 0.0	**TOPSOIL:** 130mm				
0.1	**FILL:** clayey silt, trace organics, trace clay, trace rootlets, dark brown to brown, moist, soft to very stiff	1	SS	3	
		2	SS	20	151
	W. L. 150.9 m Jun 10, 2025				
150.2		3	SS	50/ 75mm	
1.7	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, brown, cobble/boulders, moist to very moist, very dense	4	SS	50/ 75mm	150
		5	SS	50/ 130mm	149
	weathered shale fragments at 4.6m	6	SS	50/ 75mm	148
	wet silty sand layer at 4.9m				147
145.8					146
6.1	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard	7	SS	50/ 50mm	
144.4					145
144.2	**SHALE BEDROCK:** Queenston	8	SS	50/ 25mm	
7.7	Formation, reddish brown, weathered				
	END OF BOREHOLE:				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
June 10, 2025	1.0

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25F-3

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805545.7 E 596010

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-23-2025

REF. NO.: 19-199-106
ENCL NO.: A4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
150.9												
150.8 / 0.2	**TOPSOIL:** 150mm											
	FILL: clayey silt, trace rootlets, trace organics, brown, moist, soft to very stiff		1	SS	3							
			2	SS	17	▽	150					
								W. L. 149.6 m Jun 10, 2025				
149.1	trace brick pieces at 1.5m		3	SS	52		149					
1.8	**SILT TO SANDY SILT:** trace clay, trace gravel, cobble/boulder, brown, moist, very dense		4	SS	58							5 16 72 7
			5	SS	50/ 100mm		148					
							147					
146.1	wet sand layer at 4.6m		6	SS	50/ 130mm							
4.8	**SANDY SILT TILL:** trace clay, trace gravel, cobble/boulder, brown, moist, very dense						146					7 29 55 9
144.7							145					
6.2	**END OF BOREHOLE:**		7	SS	50/ 0mm							

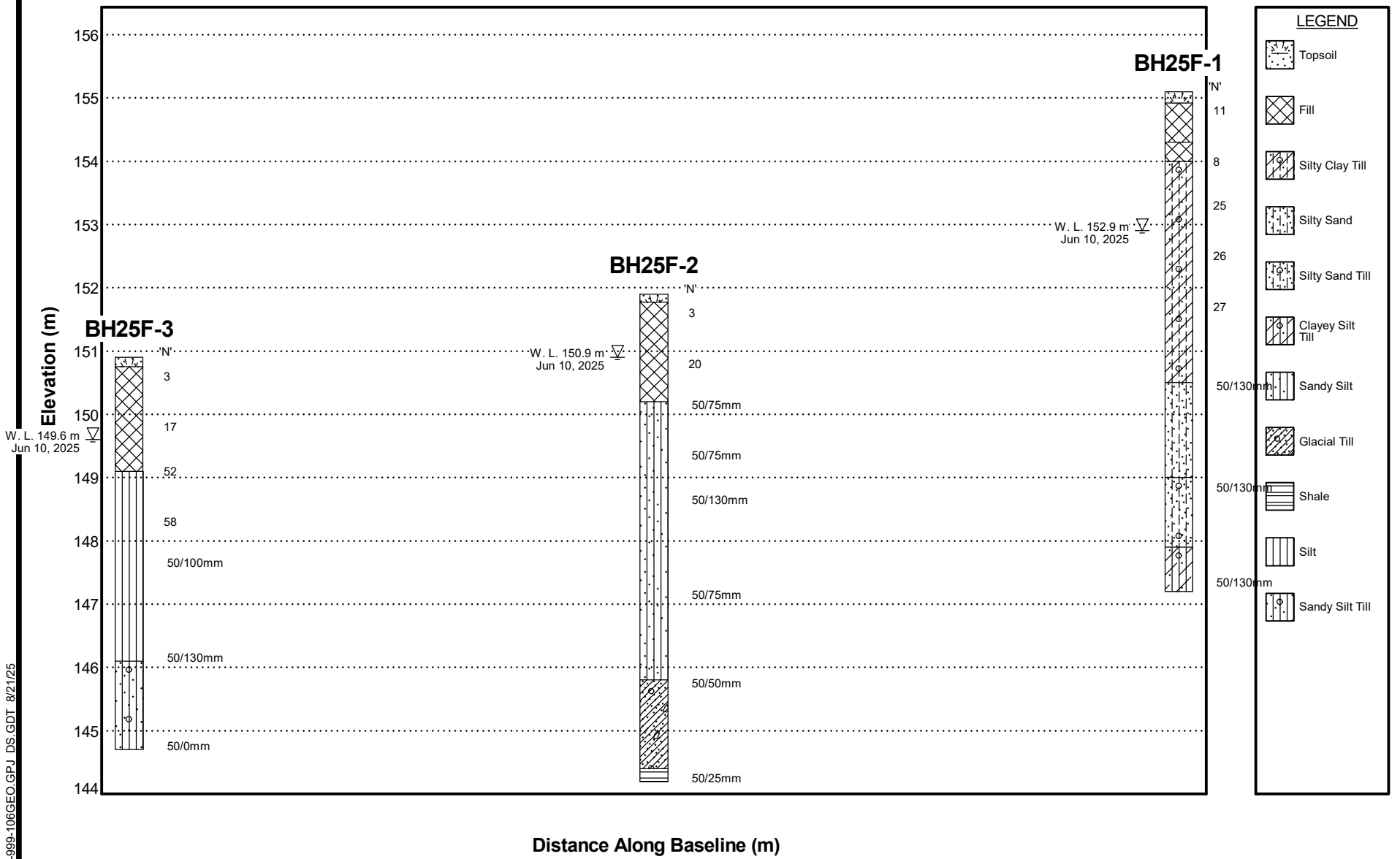
Notes:
1) Auger refusal on possible cobble/boulder at 6.2m.
2) 50mm dia. monitoring well installed upon completion.
3) Water Level Readings:

Date:	Water Level(mbgl):
June 10, 2025	1.3

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21



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Generalized Sub-surface Profile (NTS)

DRAWING NO.	A5
JOB NO.	19-199-106
DATE	August, 2025

DS FENCE (M) 19-999-106GEO.GPJ DS.GDT 8/21/25

Appendix B

Borehole Logs & Location Plan for Area 'G'

Drawing B1: Borehole Location Plan
Drawings B2 to B6: Borehole Logs
Drawing B7: Generalized Sub-surface Profile

Z:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Aug-15 14:06



Legend

- Borehole
- Borehole With Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Client: ARGO LAND

Project: GEOTECHNICAL INVESTIGATION (MILLCROFT - PHASE 2)
Country Club Manor, Burlington, ON

Title: **BOREHOLE LOCATION PLAN**

N

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	A.S	K.T	August 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: B1

Image/Map Source: *Google Satellite Image*

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LOG OF BOREHOLE BH25G-1

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805132.3 E 596517.7

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-22-2025

REF. NO.: 19-199-106
ENCL NO.: B2

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
147.0							
146.9 0.1	**TOPSOIL:** 130mm						
	FILL: clayey silt, trace organics, trace sand, dark brown to brown, moist to wet, firm to very stiff		1	SS	5		
			2	SS	20		146
145.7 1.3	**SILTY CLAY TILL:** trace to some sand, trace gravel, brown to reddish brown, moist, very stiff to hard		3	SS	27		145
			4	SS	31		144
			5	SS	20		
			6	SS	50/ 130mm		143
140.8 6.2	shale fragments at 6.1m		7	SS	50/ 25mm		142
	END OF BOREHOLE:						141

Notes:
1) Borehole wet at the bottom upon completion of drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)				
GR	SA	SI	CL	
2	18	54	26	

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH25G-2

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805144 E 596563

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-22-2025

REF. NO.: 19-199-106
ENCL NO.: B3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
145.8 / 0.0	**GRANULAR MATERIAL:** rock pieces and limestone screenings mixed with silty clay	1	SS	16	145
145.5 / 0.3	**FILL:** clayey silt to silty clay, trace organics, trace sand, dark brown, moist, stiff to very stiff	2	SS	11	
144.3 / 1.5	some organics at 0.8m				
	SILTY CLAY TILL: some sand to sandy, trace gravel, brown to reddish brown, moist, very stiff to hard	3	SS	22	144
		4	SS	25	143
		5	SS	50/ 100mm	142
141.2 / 4.6	**CLAYEY SILT TILL/SHALE COMPLEX:** some sand, trace gravel, reddish brown, moist, hard	6	SS	50/ 130mm	141
139.7 / 6.1	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered	7	SS	50/ 50mm	140
139.1 / 6.7	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
June 10, 2025	2.8

W. L. 143.0 m
Jun 10, 2025

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH25G-3

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805028.5 E 596509.6

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-22-2025

REF. NO.: 19-199-106
ENCL NO.: B4

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
144.9								20 40 60 80 100	10 20 30			
144.7 0.2	**ASPHALT:** 90mm **GRANULAR BASE:** sand and gravel, 90mm		1	SS	11							
1	**FILL:** clayey silt, some organics, trace sand, dark brown to brown, moist, stiff to very stiff		2	SS	18		144					
143.1			3	SS	14		143					
2 1.8	**SILTY CLAY TILL:** some sand to sandy, trace gravel, brown to reddish brown, moist, stiff to hard		4	SS	37		142					
3			5	SS	49							
	silt seams at 3.6m						141					
4												
140.0	trace shale fragments at 4.6m		6	SS	50/ 50mm							
5 4.9	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard						140					
6 138.9							139					
138.7	**SHALE BEDROCK:** Queenston		7	SS	50/ 50mm							
6.2	Formation, reddish brown, weathered											
	END OF BOREHOLE:											
	Notes: 1) Water encountered at 4.0m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH25G-4

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805077.7 E 596453.1

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-22-2025

REF. NO.: 19-199-106
ENCL NO.: B5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
145.8					
145.7 / 0.1	**ASPHALT:** 60mm	1	SS	12	145
	GRANULAR BASE: sand and gravel, 75mm				
	FILL: clayey silt, trace organics, some gravel, greyish brown to brown, moist, soft to very stiff	2	SS	3	
144.0 / 1.8	**SILTY CLAY TILL:** sandy, trace gravel, brown to reddish brown, moist, very stiff to hard	3	SS	18	144
		4	SS	41	143
		5	SS	50/ 130mm	
141.2 / 4.6	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard	6	SS	50/ 25mm	142
140.3 / 5.5	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered				141
139.6 / 6.2	**END OF BOREHOLE:**	7	SS	50/ 25mm	140

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
June 10, 2025	1.9

W. L. 143.9 m
Jun 10, 2025

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
4	24	50	22

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH25G-8

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4805115.2 E 596454.6

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: May-22-2025

REF. NO.: 19-199-106
ENCL NO.: B6

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
146.9												
146.8 / 0.1	**ASPHALT:** 60mm		1	SS	20		146					
146.8 / 0.1	**GRANULAR BASE:** sand and gravel, 80mm											
146.1 / 0.8	**FILL:** sand and gravel, brown, moist, compact		2	SS	11							
	FILL: clayey silt, trace organics, dark brown to brown, moist, firm to stiff		3	SS	7		145					
144.6 / 2.3	**SILTY CLAY TILL:** sandy, trace gravel, reddish brown, moist, hard		4	SS	33	W. L. 144.3 m Jun 09, 2025						5 27 47 21
			5	SS	50/ 130mm		143					
142.2 / 4.7	~~trace shale fragments at 4.6m~~		6	SS	50/ 75mm							
	END OF BOREHOLE:											

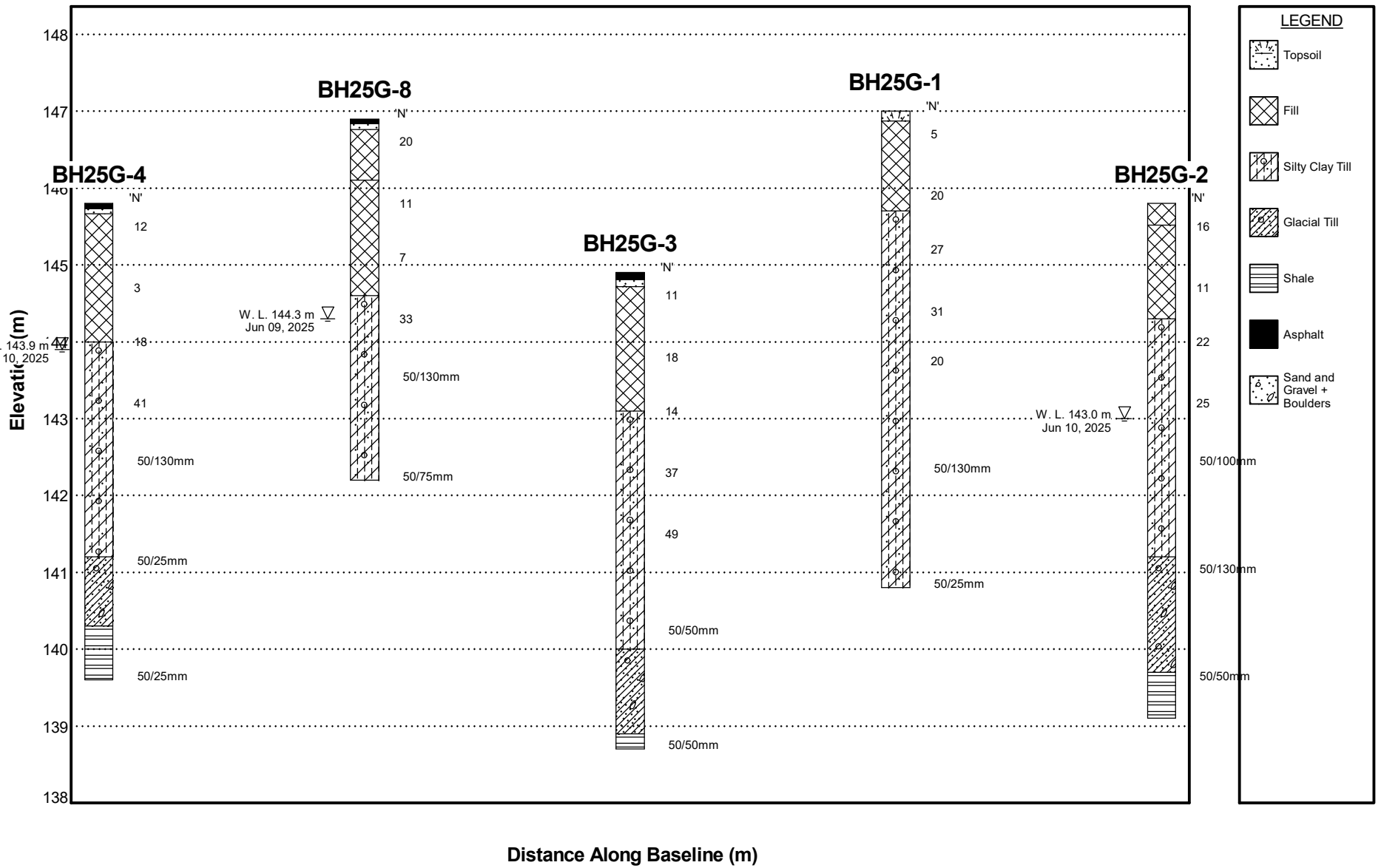
Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
June 9, 2025	2.6

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21



DS CONSULTANTS LTD.
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Generalized Sub-surface Profile (NTS)

DRAWING NO.	B7
JOB NO.	19-199-106
DATE	AUGUST, 2025

DS FENCE (M) 19-999-106GEO.GPJ DS.GDT 8/21/25

Appendix C

Borehole Logs & Location Plan for Area 'H'

Drawing C1: Borehole Location Plan
Drawings C2 to C4: Borehole Logs
Drawing C5: Generalized Sub-surface Profile

Z:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Jul-25 11:41



Legend

- Borehole
- Borehole With Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Client: ARGO LAND

Project: GEOTECHNICAL INVESTIGATION (MILLCROFT - PHASE 2)
Country Club Drive and Berwick Drive, Burlington, ON

Title: **BOREHOLE LOCATION PLAN**

N

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	A.S	K.T	July 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: C1

Image/Map Source: *Google Satellite Image*

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LOG OF BOREHOLE BH25H-1

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804705.7 E 596377.7

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: C2

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
144.1												
144.0	**TOPSOIL/ORGANIC MATERIAL:** 200mm											
0.2	**FILL:** clayey silt, trace cobble, trace gravel, trace organics, trace rootlets, brown, moist, hard		1	SS	30		144					
142.9			2	SS	35		143					
1.2	**CLAYEY SILT TO SILTY CLAY TILL:** sandy, trace gravel, occasional cobble, brown to reddish brown, moist, hard		3	SS	49							4 22 49 25
			4	SS	50/130mm	▽ W. L. 141.8 m Jul 24, 2025	142					
141.0												
3.1	**CLAYEY SILT TILL/SHALE COMPLEX:** sandy, trace gravel, occasional cobble, reddish brown, moist, hard trace shale fragments below 3.7m		5	SS	50/50mm		141					
139.5							140					
4.6	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered		6	SS	50/100mm		139					
137.9												
6.2	**END OF BOREHOLE:**		7	SS	50/50mm		138					

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	2.3

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25H-2

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804647.7 E 596440.8

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: C3

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
143.3											
143.2	**TOPSOIL:** 130mm										
0.1	**FILL:** clayey silt, trace organics, trace rootlets, cobbles, brown, moist, very stiff		1	SS	17		143				
142.1			2	SS	22						
1.2	**CLAYEY SILT TILL:** trace to some sand, trace gravel, occasional cobble, brown, moist, very stiff to hard		3	SS	39		142				
141.0											
2.3	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard		4	SS	65		141				auger slow below 2.1m
140.3											
3.0	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered		5	SS	50/ 100mm		140				
138.6							139				
4.7	**END OF BOREHOLE:** Notes: 1) Borehole dry upon completion of drilling.		6	SS	50/ 150mm						

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH25H-3

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804598.5 E 596512.3

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: C4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
141.9							
141.8 / 0.1	**TOPSOIL/ORGANIC MATERIAL:** 100mm		1	SS	19		
140.9 / 1.0	**CLAYEY SILT:** trace sand to some sand, trace rootlets, cobbles, brown, moist, very stiff (weathered/disturbed)		2	SS	50/ 75mm		141
140.4 / 1.5	**CLAYEY SILT TILL:** sandy, trace gravel, brown to reddish brown, moist, hard		3	SS	74		140
139.6 / 2.3	**CLAYEY SILT TILL/SHALE COMPLEX:** sandy, trace gravel, brown to reddish brown, moist, hard		4	SS	50/ 150mm	▽	W. L. 139.4 m Jul 24, 2025
	SHALE BEDROCK: Queenston Formation, reddish brown, weathered		5	SS	50/ 75mm		138
			6	SS	50/ 75mm		137
135.7 / 6.2	**END OF BOREHOLE:**		7	SS	50/ 50mm		136

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	2.5

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

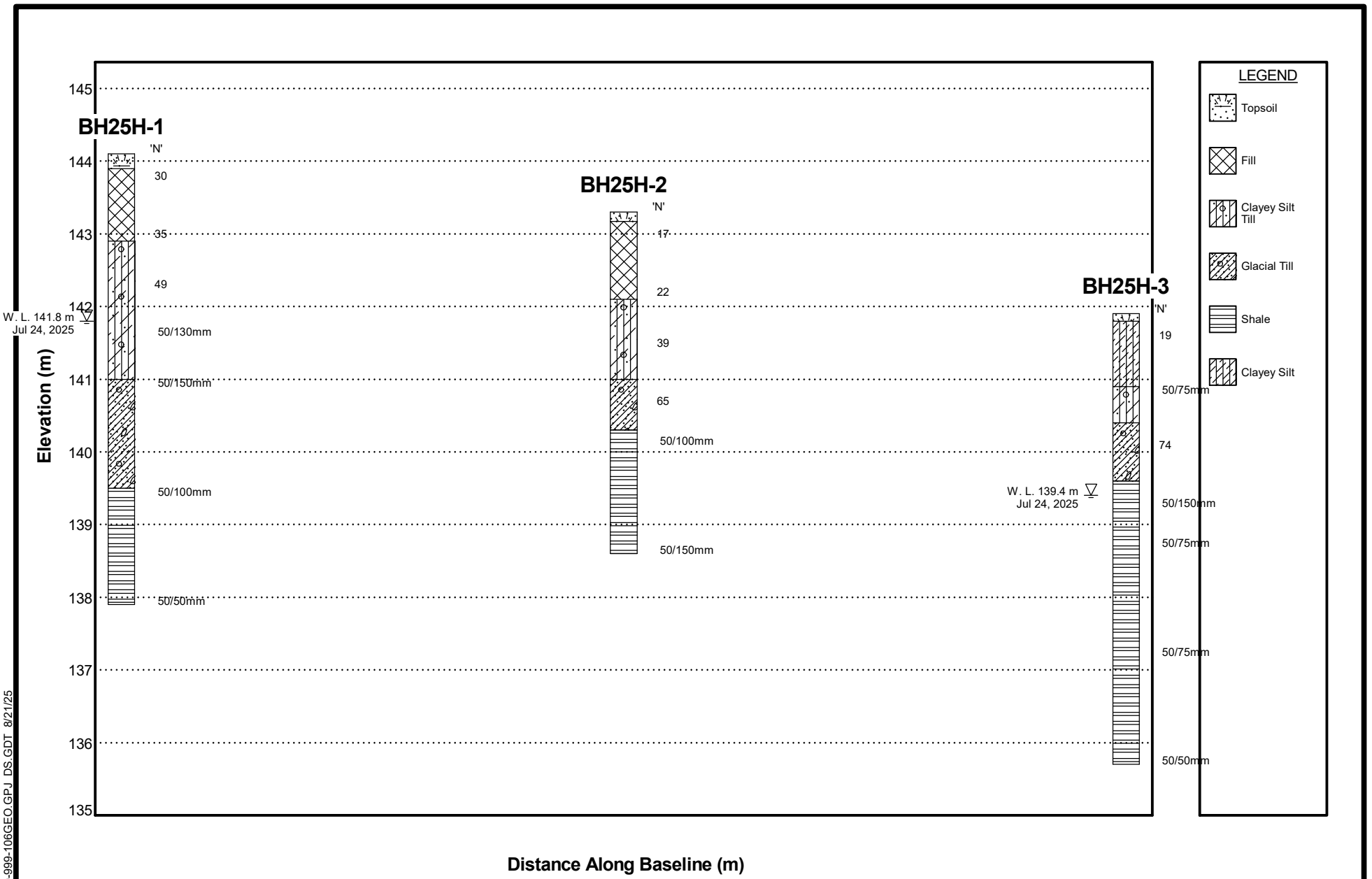
POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure



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Generalized Sub-surface Profile (NTS)

DRAWING NO.	C5
JOB NO.	19-199-106
DATE	AUGUST, 2025

DS FENCE (M) 19-999-106GEO.GPJ DS.GDT 8/21/25

Appendix D

Borehole Logs & Location Plan for Area 'I'

Drawing D1: Borehole Location Plan
Drawings D2 to D4: Borehole Logs
Drawing D5: Generalized Sub-surface Profile

Z:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Jul-25 11:48



Legend

- Borehole
- Borehole With Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Client: ARGO LAND

Project: GEOTECHNICAL INVESTIGATION (MILLCROFT - PHASE 2)
Berwick Drive and Millcroft Park Drive, Burlington, ON

Title: **BOREHOLE LOCATION PLAN**

N

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	A.S	K.T	July 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: D1

Image/Map Source: *Google Satellite Image*

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH25I-1

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804499.1 E 596660.5

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: D2

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
141.8												
141.7 0.1	**TOPSOIL:** 130mm											
	CLAYEY SILT: trace rootlets, some sand, brown, moist, hard (weathered/disturbed)		1	SS	33							
141.0 0.8	**CLAYEY SILT TILL:** trace to some sand, trace gravel, brown, moist, hard		2	SS	38		141					
			3	SS	38		140					
139.5 2.3	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard		4	SS	50/ 130mm		139					
138.8 3.0	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered		5	SS	50/ 100mm		138					
			6	SS	50/ 50mm		137					
135.6 6.2	**END OF BOREHOLE:** Notes: 1) Borehole dry upon completion of drilling.		7	SS	50/ 25mm		136					

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25I-2

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804464.7 E 596698.5

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: D3

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
141.5												
~~141.4~~ 0.1	**TOPSOIL:** 130mm											
140.9 0.6	**CLAYEY SILT:** trace rootlets, some sand, brown, moist, very stiff (weathered/disturbed)		1	SS	18		141					
1	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble, brown, moist, hard		2	SS	44							
	greyish brown at 0.8m		3	SS	38		140					
2												
			4	SS	50/ 100mm		139					7 25 57 11
138.5 3												
3.0	**SANDY SILT TILL:** trace to some clay, trace gravel, occasional cobble, reddish brown, moist, very dense		5	SS	50/ 130mm		138					
4												
136.9							137					
~~136.8~~ 4.7	~~**SHALE BEDROCK:** Queenston~~ Formation, reddish brown, weathered		6	SS	50/ 75mm							
	END OF BOREHOLE:											
	Notes: 1) Borehole dry upon completion of drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25I-3

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804420.1 E 596626.3

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: D4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
143.6					
143.4 0.0	**TOPSOIL:** 180mm				
0.2	**FILL:** clayey silt, trace rootlets, dark brown to brown, moist to very moist, very stiff	1	SS	18	143
1	trace organics below 0.8m	2	SS	17	
		3	SS	17	142
2	mixed with organics below 2.5m	4	SS	17	141
140.6 3					
3.0	**SILTY CLAY TILL:** sandy, trace gravel, brown to reddish brown, moist, very stiff to hard	5	SS	21	140
4					
	shale fragments below 4.7m	6	SS	50/ 130mm	139
5					
137.6 6					138
137.4 6.2	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered	7	SS	50/ 25mm	
	END OF BOREHOLE:				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	2.6

GROUND WATER CONDITIONS: W. L. 141.0 m Jul 24, 2025

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

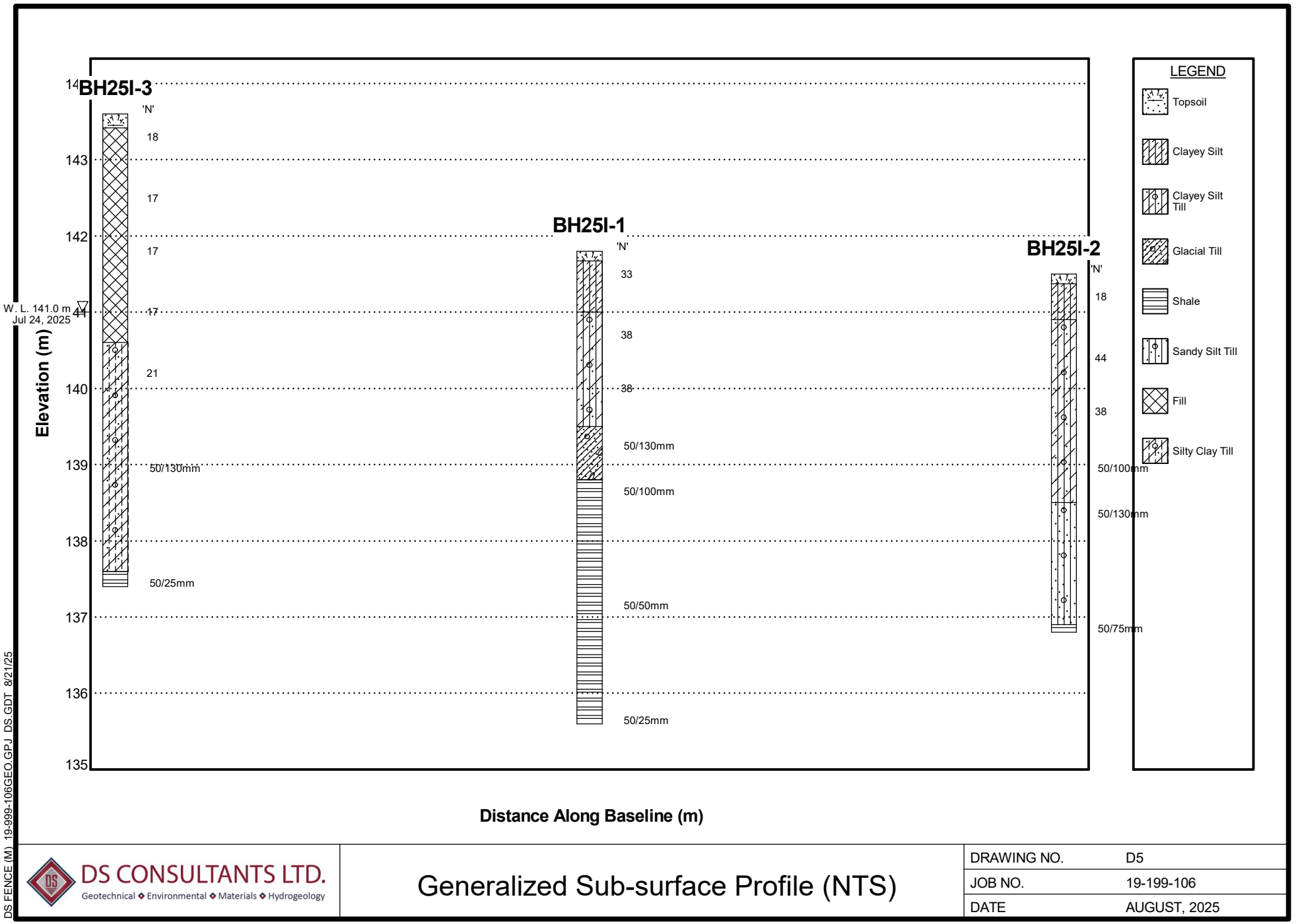
	GR	SA	SI	CL
5	3	22	49	26

wet sample

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21



DS FENCE (M) 19-999-106GEO.GPJ DS.GDT 8/21/25

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Generalized Sub-surface Profile (NTS)

DRAWING NO.	D5
JOB NO.	19-199-106
DATE	AUGUST, 2025

Appendix E

Borehole Logs & Location Plan for Area 'J'

Drawing E1: Borehole Location Plan
Drawings E2 to E4: Borehole Logs
Drawing E5: Generalized Sub-surface Profile

Z:\2019 Projects\19-199-106 Geo - Phase 2, Millcroft Golf Course (Area F to K), Burlington, Ontario\Geotechnical\QGIS\1-QGIS\Drawing 1 Borehole Location Plan - Area F.qgs Jul-25 11:56



Legend

Borehole With Monitoring Well

DS CONSULTANTS LTD.
6221 Highway 7, UNIT 16
Vaughan, Ontario L4H 0K8
Telephone: (905) 264-9393
www.dsconsultants.ca

Project: GEOTECHNICAL INVESTIGATION (MILLCROFT - PHASE 2)
Millcroft Park Drive, Burlington, ON

Title: **BOREHOLE LOCATION PLAN**

N

Client: ARGO LAND

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	A.S	K.T	July 2025
Rev: 0	Scale: As Shown	Project No.: 19-199-106	Drawing No.: E1

Image/Map Source: *Google Satellite Image*

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH25J-1

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804830.4 E 597021.4

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: E2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
142.4							
142.0 0.1	**TOPSOIL:** 130mm						
	FILL: silty sand, trace rootlets, trace organics, trace gravel, brown, moist, compact	1	SS	20		142	
1		2	SS	10			
140.9						141	
1.5	**SILTY CLAY TILL:** sandy, trace gravel, occasional cobble, brown, moist, very stiff to hard	3	SS	22			
2		4	SS	39		140	3 21 50 26
3	trace shale fragment at 3.1m	5	SS	57		139	
4					▽		W. L. 138.6 m Jul 24, 2025
137.8						138	
4.6	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard	6	SS	50/ 130mm			
5							
136.6						137	
5.8 6	**SHALE BEDROCK:** Queenston Formation, reddish brown,						
136.2		7	SS	50/ 25mm			
6.2	weathered						
	END OF BOREHOLE:						

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	3.8

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH25J-2

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804728.9 E 596903.6

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: E3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION
141.7							
141.6 / 0.1	**TOPSOIL:** 130mm						
	FILL: clayey silt, trace rootlets, sandy, trace organics, brown, moist, stiff to very stiff		1	SS	18		141
1	some organics at 0.8m		2	SS	8		
			3	SS	9		140
2 / 139.4							
2.3	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble, brown to reddish brown, moist, very stiff to hard		4	SS	20		139
3 / 138.7							
3.0	**CLAYEY SILT TILL/SHALE COMPLEX:** trace sand, trace gravel, reddish brown, moist, hard		5	SS	50/ 130mm		138
4 / 137.7							
4.0	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered		6	SS	50/ 75mm	W. L. 136.5 m Jul 24, 2025	137
5							
							136
6 / 135.5							
6.2	**END OF BOREHOLE:**		7	SS	50/ 50mm		

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	5.2

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21

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LOG OF BOREHOLE BH25J-3

PROJECT: Geotechnical Investigation
CLIENT: Argo Land
PROJECT LOCATION: Milcroft Golf Course, Burlington, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4804570.3 E 596747.5

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul-09-2025

REF. NO.: 19-199-106
ENCL NO.: E4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
141.1					
140.9 / 0.1	**TOPSOIL:** 130mm				
	FILL: silty sand, trace rootlets, trace gravel, brown, moist, compact	1	SS	13	141
140.3 / 0.8	**FILL:** clayey silt, trace sand to some sand, trace organics, trace rootlets, brown, moist, stiff	2	SS	10	140
139.6 / 1.5	**CLAYEY SILT TILL:** sandy, trace gravel, occasional cobble, brown to reddish brown, moist, hard	3	SS	41	139
	shale fragments below 2.4m	4	SS	50/ 130mm	
137.1 / 4.0	**SHALE BEDROCK:** Queenston Formation, reddish brown, weathered	5	SS	50/ 75mm	138
		6	SS	50/ 75mm	137
134.9 / 6.2	**END OF BOREHOLE:**	7	SS	50/ 25mm	136

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
July 24, 2025	5.9

W. L. 135.2 m
Jul 24, 2025

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

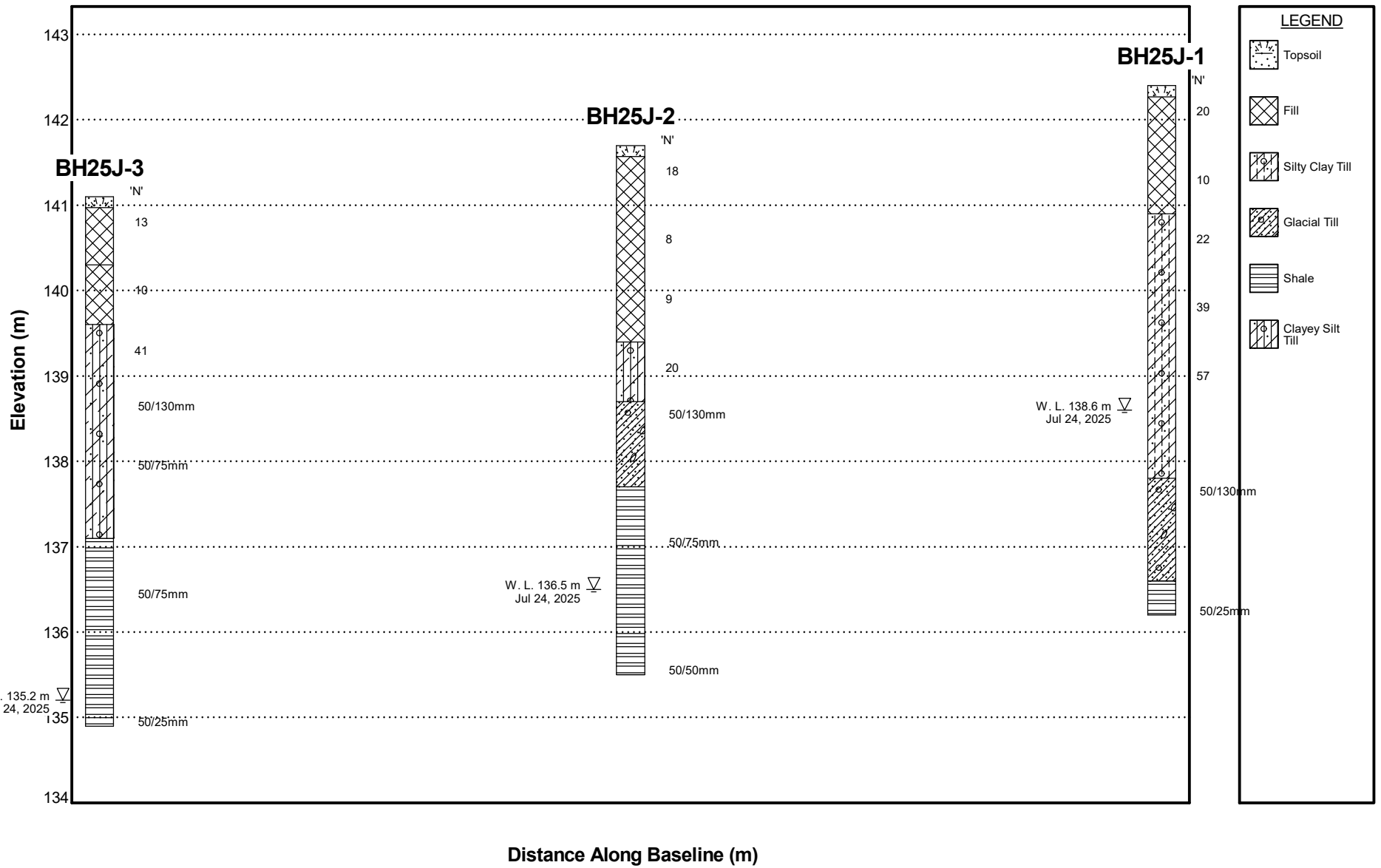
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 19-999-106GEO.GPJ DS.GDT 25-8-21



DS FENCE (M) 19-999-106GEO.GPJ DS.GDT 8/5/25

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Generalized Sub-surface Profile (NTS)

DRAWING NO.	E5
JOB NO.	19-199-106
DATE	AUGUST, 2025

Appendix F

General Comments on Shale Bedrock in GTA

General Comments – Bedrock in Greater Toronto Area

The bedrock that makes spread footings or caissons a popular choice for high-rise foundation support is a shale or shale limestone composition. The highest member, the Queenston Formation, is generally found west of Toronto, while the Georgian Bay Formation underlies most of Metro Toronto, with the Collingwood and Whitby Formations east of Toronto. The Queenston is, relatively speaking, the weaker of the four formations that are likely to support caissons or footings.

The Georgian Bay as well as the Queenston and Collingwood/Whitby Formation are of Middle Ordovician Age. It is defined as the rock unit that overlies the bluish grey shales of the Collingwood Formation and is in turn overlain by the red shale of the Queenston Formation. The Georgian Bay Formation consists of bluish and grey shale with interbeds of sandstone, limestone and dolostone. Towards the west where the Georgian Bay formation underlies the Queenston Formation, the limestone content increases significantly and limestone and/or sandstone may comprise as much as 70 to 90 percent of the bedrock. The hard layers are usually less than about 100 to 150 mm thick but some layers are much thicker. The thicker layers have been observed to be as much as 750 to 900 mm at some sites. The layers are actually lenses and they can vary significantly in thickness over short distances.

The upper portion of the bedrock is commonly weathered for a depth of 600 to 1000 mm and within this weathered zone hard limestone layers or lenses are common. These hard limestone layers can result in contractual problems for augers, and can provide misleading bedrock elevations. Where the weathering is more extensive a shale till layer may be found above the bedrock. In the sound bedrock, the limestone, sandstone, dolostone is hard to very hard.

Stress relief features such as folds and faults are common in the bedrock. In these features, the rock is heavily fractured and sheared, and contains layers of shale rubble and clay. Weathering is much deeper than the surrounding rock in these features and often there is a lateral migration of the stress relief features resulting in sound unweathered bedrock overlying fractured and weather bedrock. The stress relief features are usually in the order of 4 to 6 m wide, but the depth can vary from 4 to 5 m to in excess of 10 m. These features occur randomly.

The bedrock contains significant high locked in horizontal stresses. These stresses can impose significant loads on tunnel walls but the slower rate of construction for basements allows for a relaxation of these stresses and they are not normally a problem for basement construction.

Groundwater seepage below the top 1000 mm is generally small, however, at several locations in Toronto and Mississauga large quantities have been encountered.

Bedding joints in the bedrock are very close-to-close, smooth planar in the shale and rough planar in the limestone. Significant vertical jointing is common.

Where the bedrock was cored, a detailed description of the rock core is appended to the borehole log.

Design features related to the bedrock are discussed in other sections of this report, and these general comments must be considered with these comments.

Methane gas exists in the bedrock, normally below the top 1000 mm and more concentrated with depth. Appropriate care and monitoring is essential in all confined bedrock excavations, particularly caissons and tunnels.

Appendix G

General Requirements for Engineered Fill

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DS). Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

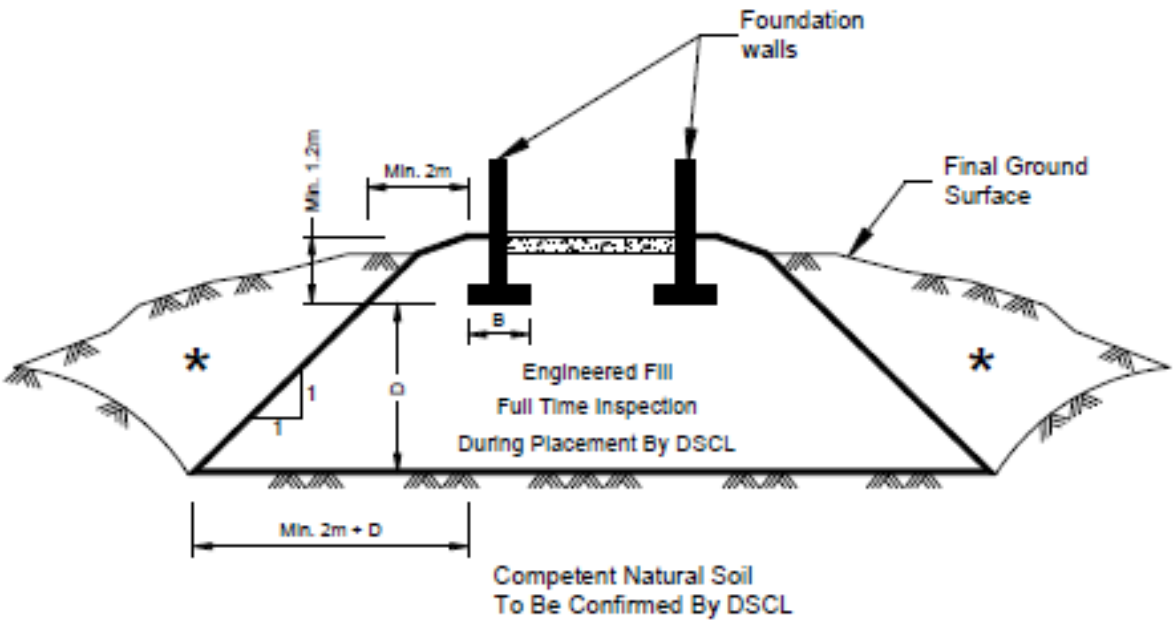
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DS prior to footing concrete placements. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

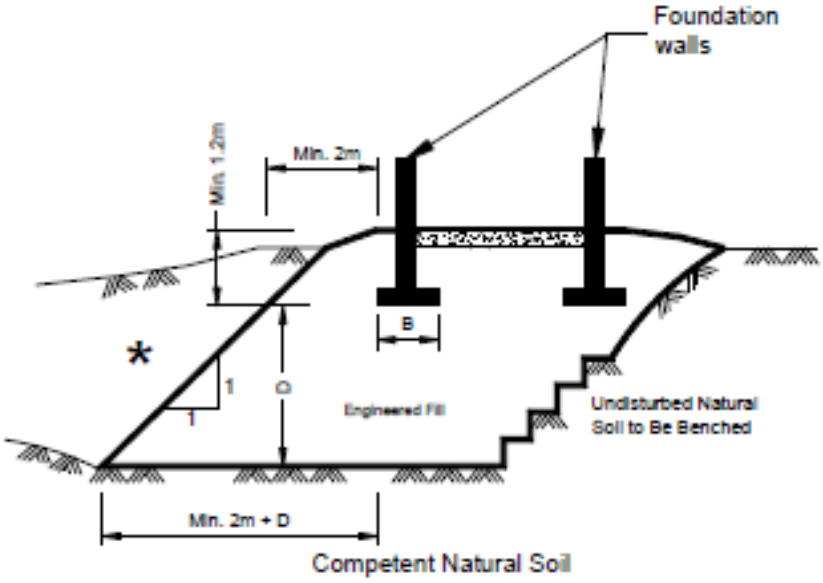
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





* Backfill in this area to be as per the DSCL report.