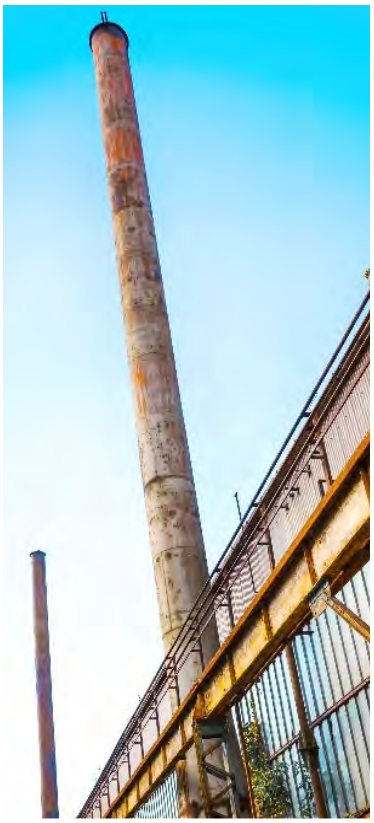
Geotechnical Investigation Report

Proposed Subdivision Development
787 and 825 Fallis Line
Millbrook, Ontario



Report for:
The Bromont Group

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1. Introduction

This report presents the results of a Geotechnical Investigation conducted in support of a proposed residential subdivision development to be constructed on the property located at 787 and 825 Fallis Line, in the Village of Millbrook, Ontario (the Site or Property). The site location is illustrated on the attached Site Location Map (Figure 1). GHD Limited (GHD) was retained by the Bromont Group (the Client), being represented by Valdor Engineering (Valdor), to complete this geotechnical investigation. The work conducted for this investigation was carried out under the authorization of Mr. Savario Montemarano, of Bromont Group, in accordance with our proposal PG-3951-1 dated July 13, 2017 and PG-5024-1 dated February 5, 2021.

A site plan was provided to GHD by Valdor, illustrating the proposed development layout. It is GHD's expectations that this project shall include design and construction of a new residential development containing typical 1- and 2-storey homes, with two (2) associated stormwater management ponds (SWPs), asphalt-paved roadways, and servicing. Proposed final grading for the development and service invert elevations were not available to GHD at the time of writing this report.

The factual data, interpretations and preliminary recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. This report should be read in conjunction with the Statement of Limitations appended to this report. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report.

2. Purpose and Scope

The purpose of the geotechnical investigation is to provide a definition and characterization of the subsurface soil and groundwater conditions at the test hole locations. Along with the findings from our exploratory program, our report provides geotechnical engineering recommendations relevant to earthwork construction, reuse of existing soils as backfill material, construction groundwater control / dewatering, utility installation (bedding and backfill), SWPs design, foundations, slabs, and pavement structure for road construction. Note that the scope contained herein does not address the chemical or environmental status of the project site.

The following scope of work was performed in order to accomplish the foregoing purposes:

1. Underground services were cleared prior to advancing the boreholes.
2. The boreholes were located as shown on the Borehole Location Plan (Figure 2).
3. The subsurface soils conditions were explored by advancing, sampling and logging a total of twenty-six (26) boreholes to depths ranging from 2.2 to 6.7 metres below ground surface (mbgs). Groundwater monitoring wells were installed in eleven (11) boreholes.

4. The ground at the borehole locations where monitoring wells were not installed was reinstated as close as possible to its original condition upon completion of the fieldwork. A mixture of bentonite and soil cuttings was used to backfill the boreholes, and excess cuttings were distributed evenly around the vicinity of each borehole location.

5. Physical laboratory analysis of the encountered material was carried out including grain size analysis of eleven (11) samples, and moisture content tests on all collected samples.

6. Geotechnical engineering analysis of acquired field and laboratory data was performed, with our findings, conclusions, and geotechnical engineering recommendations presented in this report.

3. Field and Laboratory Procedures

A field investigation was conducted under the supervision of GHD staff on August 22 and 23, 2017 and March 3 to March 5, 2021. The work consisted of subsurface exploration by means of advancing and sampling a total of twenty-six (26) exploratory boreholes to depths ranging from 2.2 to 6.7 mbgs. The location of each borehole is illustrated on the attached Borehole Location Plan (Figure 2).

A detailed log of each borehole was maintained and representative samples of the materials encountered in the boreholes were collected. These logs are presented graphically in Appendix A.

The boreholes were advanced using a track mounted drill rig equipped with continuous flight, solid stem augers. Representative, disturbed samples of the strata penetrated were obtained using a split-barrel, 50 mm outer-diameter (OD) sampler advanced by a 63.5 kg hammer dropping approximately 760 mm. The results of these standard penetration tests (SPT's) are reported as "N" values on borehole logs at the corresponding depths.

Groundwater monitoring wells were installed in eleven (11) of the boreholes, to depths ranging from 2.3 to 6.6 mbgs. All wells and piezometers utilized a sand pack around the screened interval, and a bentonite sealant above the screened interval. The monitoring wells were recorded and registered as wells with the Ministry of Environment, Conservation and Parks (MECP). Upon completion, the boreholes in which wells were not installed were backfilled with soil cuttings and bentonite pellets, and sealed at the top with auger cuttings.

Soil samples obtained from the boreholes were inspected in the field immediately upon retrieval for type, texture, and colour. All soil samples were sealed in clean plastic containers and transported to the GHD laboratory for further visual-tactile examination, and to select appropriate samples for laboratory analysis.

Physical laboratory testing was completed on the soil samples, consisting of moisture content tests on all samples recovered, gradation analyses on eleven (11) representative soil samples (including hydrometers), and Atterberg Limits testing on one (1) of the soil sample. The analytical results of the moisture content tests are plotted on the attached logs. The results of the gradation testing and Atterberg Limits testing are incorporated into the borehole logs, and are also presented graphically in Appendix B.

Groundwater measurements were obtained from the installed monitoring well and piezometers on September 7 and 22, 2017 and March 17, 2021. Groundwater data is presented on individual borehole logs.

Ground surface elevations at the borehole locations were interpolated from the topographic plan of the site provided by Valdor, with electronic title "16119_Fallis Line Subdivision Preliminary Concept.pdf" or from Ontario Digital Terrain Model (ODTM) Lidar Derived data. The elevations provided herein are for geotechnical analytical purposes only, and must be verified prior to finalizing any design or contract parameters upon which they are based.

4. Site Location and Surface Conditions

The investigated site is located on the southern side of Fallis Line, at municipal number 787 and 825, in the Village of Millbrook, Ontario. The Site is comprised predominantly of agricultural lands with forested areas and some lawn areas. Agricultural lands occur to the north and west; a recently constructed residential area is located to the east and the town of Millbrook is to the south. There are two existing residential homes on the Site.

Based upon topographic mapping, the Site exhibits rolling to hilly topography with relief on the order of 25 m. Small creeks were observed in the southern area of the Site that are tributaries of Baxter Creek. Surface water runoff flows according to the local topography toward Baxter Creek.

5. Subsurface Conditions

5.1 Regional Physiography and Geology

This area is underlain by Paleozoic sedimentary rocks (i.e. limestone) of Upper Middle Ordovician age. The Site is situated in the physiographic region known at the Peterborough Drumlin Field (Chapman and Putnam, 1984). Locally, the Site is identified to be within an area known as a "sand plains" with drumlinized till plains to the south and west. The physiographic region is shown on Figure 3.

To the west of the Site is the physiographic region known as the Oak Ridges Moraine (ORM) where the till is sandier with silt and fine sand. The ORM is a large distinctive feature that extends from Trenton to the east to the Niagara Escarpment to the west. The ground surface associated with this feature is typically hilly. The ORM is known to provide recharge to numerous streams and rivers.

The surficial geology is presented on Figure 4 which indicates the Site consists predominantly of stone-poor, sandy silt to silty sand-textured till. The northeast corner of the Site, and proposed future stormwater management pond, is comprised of fine-textured glaciolacustrine deposits. The southern portion of the Site is identified as Modern Alluvial deposits.

The Quaternary geology of this area indicates glaciofluvial ice-contact deposits that consists of gravel and sand, minor till and includes esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits throughout the Site. Surrounding areas consist of till, glaciolacustrine deposits and organic deposits. The Quaternary geology is depicted on Figure 5.

5.2 General

Details of the subsurface conditions encountered at the Site are graphically presented on the borehole logs (Appendix A). It should be noted that the boundaries between the strata have been inferred from the borehole observations and non-continuous samples. They generally represent a transition from one soil type to another, and should not be inferred to represent an exact plane of geological change. Further, conditions will vary between and beyond the boreholes.

The boreholes encountered a layer of topsoil, underlain by very loose to very dense till (the upper zones containing occasional organics). The till ranged in composition from silty sand / sandy silt to silty clay / clayey silt and was underlain in some boreholes by dense to very dense sand.

The following sections describe the soil and groundwater conditions encountered in more detail.

5.3 Topsoil

A surficial layer of topsoil was encountered in each of the boreholes and ranged from approximately 205 to 915 mm in thickness. This soil was observed to be in a damp, loose state, with a silty, highly organic content. As such, it is expected to be devoid of any structural engineering properties. A buried layer of topsoil (organic silt) was observed at approximately 1.5 mbgs in boreholes BH5-21 and BH6-21.

5.4 Fill

Layers of fill were encountered immediately beneath the topsoil in boreholes BH5-21 and BH6-21 and extended to depth of 1.5 mbgs. The fill consisted of sand containing some amount of silt and clay and was observed to be in a moist in-situ state. SPT N values obtained from within the fill layers varied from 4 blows/300mm to 34 blows/300mm, indicating a very loose to dense in-situ state of relative density. Moisture content tests conducted on samples of the fill yielded values ranging from approximately 7% to 11% moisture by weight.

5.5 Till

A layer of till was encountered beneath the topsoil or fill layer in all boreholes with the exception of borehole BH5-21. It is noted that each borehole encountered a layer of till and/or loam, that contained occasional organic matter including rootlets and pockets of disturbed layers of organics to depths ranging from about 0.3 mbgs to 1.1 mbgs.

The till layer extended to depths ranging from 1.5 to 6.2 mbeg in boreholes BH4-17, BH5-17, BH6-17, BH10-17, BH12-17, BH2-21 and BH4-21 and to the full depth of investigation in the remaining boreholes. This soil was generally medium to light brown in color, with a composition ranging from silty sand to silty clay, containing some amount of gravel and occasional cobbles, and existing in a generally moist in-situ condition. Based on past experience with till in this area, it can be expected to contain sand seams. SPT N values obtained from within the till layer varied from 1 blows/300mm to over 100 blows/300mm with increasing depth, indicating a very loose to very dense in-situ state of relative density or soft to hard consistency. As noted above, the upper zone of till to a maximum depth of 1.1 mbeg contained occasional organics and should be considered unsuitable for structural bearing purposes (ie, below foundations and/or slabs) as a result.

Moisture content tests conducted on samples of the till yielded values ranging from approximately 4 to 36 % moisture by weight. Grain size distribution analyses conducted on representative samples of the till suggests the following compositional ranges: 0 to 31 % gravel, 5 to 56 % sand, and 27 to 94 % silt and clay-sized particles. Hydrometer analyses conducted on these samples suggest it contains 18 to 54 % particles between 5 and 75 μm in size. An Atterberg Limits test indicated the Plasticity Index and Liquid Limit of the silty clay / clayey silt soil to be 16% and 30%, respectively.

5.6 Sand

A layer of sand was encountered beneath the organic silt layer in borehole BH5-21 and beneath the till layer in boreholes BH4-17, BH5-17, BH6-17, BH10-17, BH12-17 and BH2-21 and BH4-21. This layer was encountered at depths ranging from 1.5 to 6.2 mbgs and extended to the depth of the investigation in these boreholes. The soil was generally medium to light brown in colour, consisted of sand with some silt, and existed in a moist to wet in-situ condition. SPT N values obtained from within the sand layer varied from 2 blows/300mm to over 100 blows/300mm, indicating a very loose to very dense in-situ state of relative density.

Moisture content tests conducted on samples of the sand yielded values ranging from 3 to 25 % moisture by weight. Grain size distribution analyses conducted on representative samples of the sand suggests the following compositional range: 0 % gravel, 74 to 82 % sand, and 18 to 26 % silt and clay-sized particles. Hydrometer analysis conducted on these samples suggest it contains 10 to 20 % particles between 5 and 75 μm in size, and 6 % particles less than 5 μm in size.

5.7 Groundwater

Groundwater seepage was observed in boreholes BH3-17, BH10-17, BH11-17, BH12-17, BH1S-21, BH1D-21, BH3-21, BH11D-21 and BH11S-21 during the drilling operations at depths of 0.9 to 6.4 m. The remaining seventeen (17) boreholes remained dry throughout drilling operations. When encountered, seepage was generally noted from within the till (expected to be from thin sand seams) and of minimal volume. Only BH12-17 encountered groundwater seepage from within the sand layer. Groundwater monitoring wells were installed in eleven (11) of the boreholes including three (3) nested well locations. Five wells were installed in 2017 and six wells in 2021. The monitoring wells were installed to depths ranging from 2.3 to 6.6 m. All wells utilized a sand pack around the screened interval and a bentonite seal above the screened interval. A summary of the monitoring well details is provided in Table 5.1:

Table 5.1 Summary of Monitoring Wells

Location	Depth of Well (m)	Pipe Stick-Up (m)	Effective Well Screen Interval[1] (m)	Water Seepage Depth[2] (m)
BH3-17	6.6	1.0	3.1 – 6.6	~4.6
BH4-17	6.1	0.95	2.8 – 6.1	Not observed
BH8-17	6.1	1.0	2.8 – 6.1	Not observed
BH9-17	5.6	1.0	3.4 – 5.6	Not observed
BH11-17	6.1	0.9	4.3 – 6.1	~4.6
BH1S-21	2.3	0.65	0.6 – 2.3	~2.3
BH1D-21	6.1	0.9	2.8 – 6.1	~4.6
BH5S-21	2.2	0.8	0.4 – 2.2	Not observed
BH5D-21	5.8	1.1	2.5 – 5.8	Not observed
BH11S-21	2.3	0.75	0.5 – 2.3	~0.9
BH11D-21	6.0	0.85	2.6 – 6.0	~3.0

Notes:
"S" denotes the shallow nested well; "D" denotes the deep nested well; m = metres;
(1) Effective well screen includes 10-slot screen and sand pack; (2) Water seepage depth is the estimated depth where water was encountered during the drilling activities.

Groundwater measurements were obtained in September 2017 from the original monitoring wells and on March 17, 2021 from monitoring wells present on the Site. Depth to groundwater levels ranged from 0.2 to 2.5 m on March 17, 2021. Several wells were also dry including BH4-17, BH9-17, BH5S-21 and BH5D-21 to depths of 6.1, 5.6, 2.2 and 5.8 metres below ground surface (mbgs), respectively. The data is summarized in Table 5.2. Monitors BH4-17 and BH8-17 could not be located.

Table 5.2 Potentiometric Water Level Summary

Location	Ground Elevation (masl)*	Water Level (mbgs)			Potentiometric Elevation (masl)		
		Sept. 7, 2017	Sept. 22, 2017	Mar. 17, 2021	Sept. 7, 2017	Sept. 22, 2017	Mar. 17, 2021
BH3-17	248.3	0.9	0.9	--	247.4	247.4	--
BH4-17	251.6	Dry	Dry	Dry	Dry	Dry	Dry
BH8-17	255.4	Dry	Dry	--	Dry	Dry	--
BH9-17	251.6	Dry	Dry	Dry	Dry	Dry	Dry
BH11-17	246.5	4.7	4.8	2.0	241.8	241.7	244.5
BH1S-21		--	--	0.2	--	--	247.8
BH1D-21		--	--	0.2	--	--	247.8
BH5S-21		--	--	Dry	--	--	Dry
BH5D-21		--	--	Dry	--	--	Dry
BH11S-21		--	--	0.6	--	--	254.3
BH11D-21		--	--	2.5	--	--	252.4

Notes:
"S" denotes the shallow nested well; "D" denotes the deep nested well
mbgs = metres below ground surface; masl = metres above sea level
(*) Ground elevations for 2017 boreholes interpolated from the topographic plan of the site provided by Valdor, with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf". Ground elevations for 2021 boreholes interpolated from ODTM Lidar Derived data as shown on Figure 3.
The potentiometric elevations provided are for the purpose of evaluating groundwater elevation and flow direction. The ground elevations should not be relied upon as a legal survey or topographic elevation survey.

Based on the water level data collected and the surrounding topography, the shallow groundwater flow direction is inferred to be toward Baxter Creek. It should be noted that the water levels presented in this report represent potentiometric surface elevations and do not indicate that there is a permanent water table as shallow as the water levels indicated in Table 5.2 or at other areas of the Site where seepage was observed.

A water table can be visualized as a “surface” where the subsurface is permanently saturated with water (i.e. an aquifer) and is not confined below a lower permeable unit. Typically, unconfined water tables are comprised of sand and gravel and relatively shallow. Water observed in this assessment is minor in volume from within the till unit, not a sand and gravel aquifer.

It is GHD’s opinion that there is not a permanently saturated, shallow aquifer at the Site and the groundwater aquifer is found at depth. It is expected that minimal groundwater seepage will be encountered at depths ranging from about 0.9 to 6.4 m and is hydraulically discontinuous across the Site. It should be noted that groundwater levels are transient and tend to fluctuate with the seasons, periods of precipitation and temperature. It is our opinion that any high groundwater levels are seasonal in nature and will lower during drier summer or winter months. Long term groundwater monitoring is expected to illustrate this trend.

6. Discussion and Recommendations

Supporting data upon which our recommendations are based have been presented in the foregoing sections of this report. The following recommendations are governed by the physical properties of the subsurface materials that were encountered at the Property and assume that they are representative of the overall Site conditions. It should be noted that these conclusions and recommendations are intended for use by the designers only. Contractors bidding on or undertaking any work at the Site should examine the factual results of the assessment, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of this factual data as it affects their proposed construction techniques, equipment capabilities, costs, sequencing, and the like. Comments, techniques, or recommendations pertaining to construction should not be construed as instructions to the contractor.

The boreholes encountered a layer of topsoil, underlain by very loose to very dense till (the upper zones containing occasional organics). The till ranged in composition from silty sand / sandy silt to silty clay / clayey silt and was underlain in some boreholes by dense to very dense sand.

It is noted that loose to very loose zones of soil were encountered in boreholes BH3-17, BH10-17, BH1-21 and BH5-21 below depths ranging from about 2.3 to 4.6 mbgs. The final proposed grading was not available to GHD at the time of writing this report. It is strongly recommended that grade raises be avoided in the area of boreholes BH3-17, BH10-17, BH1-21 and BH5-21 due to the underlying layers of very soft to soft or loose to very loose soil. In any case, once proposed final grades are available it is strongly recommended that they be provided to GHD so that our recommendations can be reviewed and updated if and where needed.

Details regarding our conclusions and recommendations are outlined in the following sections.

6.1 Site Preparation, Excavation, Dewatering and Backfill

Any and all topsoil, vegetation, fill, disturbed earth, organic and organic-bearing material (including the organic-bearing till that was observed in the boreholes to a maximum depth of 1.5 mbgs) is to be stripped and removed from the proposed roadway and building areas (including floor slab areas) prior to commencing earthwork construction. The subexcavated surfaces must be proof rolled and/or approved by a member of GHD prior to placement of fill or foundations.

Excavations should be carried out to conform to the manner specified in Ontario Regulation 213/91 and the Occupational Health and Safety Act and Regulations for Construction Projects (OHSA). All excavations above the water table not exceeding 1.2 m in depth may be constructed with unsupported slopes. The soils encountered during this investigation above the groundwater table are generally classed by OHSA as Type 3. As such, unsupported / unshored excavation walls in these soils must maintain a gradient of 1 horizontal to 1 vertical (1H:1V) or flatter, to the base of the excavation. Note that where groundwater seepage exists, layers containing increased levels of sand (including sand seams within the till, and the underlying sand layers) may exhibit corresponding flowing characteristics leading to instability unless sloped at 3H:1V (or otherwise appropriately shored) within such zones.

Any groundwater or surficial water infiltration into open excavations above the groundwater table is expected to be controlled by pumping from sump(s) to an acceptable outlet. Should zones producing more significant groundwater infiltration be encountered, the use of filtered pumps, sheet piling, or other forms of groundwater control may be required. Based on local knowledge and previous experience in the area, it is expected that artesian (pressurized) groundwater conditions exist in the confined aquifer located at depths below this area. It is also know that the aquitard (i.e. confining) soil layer within which excavations for this construction may occur, can be “leaky”, in that it can allow upwards leakage of the pressurized groundwater into excavations via hydraulically-conductive seams/lenses of sand.

If short-term pumping of groundwater at volumes greater than 50,000 L/day and less than 400,000 L/day is required during the construction stage, the Environmental Activity Sector Registry (EASR) must be completed. The EASR streamlines the process and water pumping may begin once the EASR registration is completed, the fee paid and supporting document prepared. If water taking in excess of 400,000 litres/day is required, a Permit to Take Water (PTTW) must be obtained in advance. For dewatering purposes, hydraulic conductivities on the order of about 10^{-3} (eg: sand layers/seams) to 10^{-6} cm/sec (eg: silty clay till layer) may be expected for the subgrade soils encountered in our boreholes. It should be noted that hydraulic conductivities can vary over a vertical and horizontal extent, and may be outside the stated range if pockets or seams of soils with different grain size are encountered. Volume of water-taking will be dependent on the design as well as the contractor’s sequencing, equipment, techniques and overall methods.

It is expected that some of the excavation spoils may be suitable for reuse as trench and/or pavement subgrade backfill provided they are free of organics and at a moisture content that will permit adequate compaction (this may require prior processing such as aeration to lower the moisture content). Further, some native soils are naturally susceptible and sensitive to climatic conditions including frost and rain – this should be taken into account when considering the season in which the construction earthworks will occur. A final review and approval to reuse any soils should be made at the time of construction.

6.2 Service Installation

The materials encountered during this investigation at the anticipated service invert elevations (3 to 4 mbeg) typically consist of silty sand/silty clay till and sand. As such, normal compacted bedding material, placed in the Class “B” or Class “C” arrangement, is recommended for all underground services. The recommended bedding material is Granular “A” or 19 mm crusher run (angular) limestone, as per Ontario Provincial Standard Specifications (OPSS). The minimum recommended bedding thickness for the underground services is 150 mm. All bedding materials should be compacted to 98% of their Standard Proctor Maximum Dry Density (SPMDD). If trenching encounters overly wet or loose bedding subgrade, bedding material should consist of High Performance Bedding (HPB) or stone, wrapped in non-woven geotextile fabric equivalent to Terrafix 200R and placed in accordance with manufacture’s specifications. Based on local knowledge and previous experience in the area, it is expected that artesian (pressurized) groundwater conditions exist in the confined aquifer located at depths below this area. It is also know that the aquitard (i.e. confining) soil layer within which excavations for this construction will occur, can be “leaky”, in that it can allow upwards leakage of the pressurized groundwater into excavations via hydraulically-conductive seams/lenses of sand. If such conditions are encountered within the trenching subgrade, it is recommended that the bedding layer consist of HPB or HL-8 stone.

Prior to placement of bedding, the exposed subgrade should be inspected by an experienced geotechnical engineer and any identified soft or loose areas should be subexcavated and replaced with suitably compacted fill. If the subgrade warrants, a woven geotextile (Terrafix 200W or approximate equivalent) may be required on the subgrade prior to bedding material, to protect soft and/or sensitive areas. Thickening of the bedding material could also be considered where the subgrade is sufficiently loose to warrant (ie, such as in the soft or loose zones of soil present in BH3-17, BH10-17, BH1-21 and BH5-21).

It is recommended that cover backfilling of the underground services be accomplished using Granular “A”, sand, or other suitable material as allowed by the Municipality’s standards, to a minimum of 300 mm above the pipe. Compaction of this material should attain 100 % SPMDD. It is expected that the excavated, inorganic soils may be suitable for reuse as trench and road subgrade backfill, conditional upon suitable moisture content (within 2 % of optimum) and final review and approval by an experienced geotechnical engineer, at the beginning, and throughout the duration of construction. Compaction of any native soil in service trenches is recommended to be a minimum of 98% of its SPMDD. The soils observed may require processing (such as aeration) to lower their moisture content to appropriate levels prior to being considered as backfill material.

It is recommended that the service bedding subgrade be inspected and approved by GHD prior to placing the bedding fill, to ensure its suitability and consistency with conditions encountered during this investigation. Embedment and backfill materials, and compaction, should also be inspected and tested during placement.

It is recommended that trench plugs be installed at appropriate locations along the trench alignment, to minimize and control any flow of groundwater along the trench bedding and backfill materials. Note that concrete trench plugs for shallower watermain trench are susceptible to differential movement and heaving in relation to surrounding soils, particularly where plugs are located within the frost penetration depth (up to 1.5 to 1.6 m). Clay plugs should be used in such instances, utilizing frost tapers to minimize movement within the frost zones.

6.3 Roadway Construction

Based on the results of this investigation, we would recommend the following procedures be implemented to prepare the proposed new roadways for construction:

1. Remove any free organic topsoil, fill, disturbed earth, organics and organic-bearing materials, loam, frozen earth, and boulders larger than 150 mm in diameter encountered at subgrade elevation for the full width of construction.
2. Proof roll the subgrade for the purpose of detecting possible zones of overly wet or soft subgrade. Any deleterious areas thus delineated should be replaced with approved earth fill or granular material compacted to a minimum of 98 % of its SPMDD. Approved excavated soils can be reused as road subgrade backfill provided the soil is workable and at a moisture content that will permit adequate compaction. Saturated silts, organics and wet clay should not be reused. A final review and approval to reuse any soils must be made during construction.
3. Contour the subgrade surface to prevent ponding of water during the construction and to promote rapid drainage of the sub-base and base course materials.
4. To maximize drainage potential, and ensure satisfactory pavement performance, 150 mm diameter perforated pipe subdrains should be installed along any curb lines. The pipe should be encased in filter fabric and surrounded by clear stone aggregate. It is recommended that the subdrains outlet to the storm sewer system.
5. Construct transitions between varying depths of granular subbase materials at a rate of 1:25 minimum.

Depending on the final proposed grades, the subgrade soils at this site are expected to consist of native silty sand/silty clay till or sand. For overall pavement design purposes, the frost susceptibility of the native soils is assessed as being generally moderate to high. The Township's pavement structures standard (for both asphalt depths and granular depths) are considered sufficient. In this regard, the following minimum flexible pavement structure is recommended for the construction of the new roadways.

Table 6.1 Pavement Structure for Local Roadways

Profile	Material	Minimum Thickness (mm)		In Conformance with OPSS Form
		Local Residential	Collectors & Arterial	
Asphalt Surface	H.L.3	30	30	1150
Asphalt Base	H.L.4	50	70	
Granular Base	Granular "A"	150		1010
Granular Subbase	Granular "B"	450		

The following steps are recommended for optimum construction of paved areas:

1. The Granular "A" and "B" courses should be compacted to a minimum 100 percent of their respective SPMDD's.

2. All asphaltic concrete courses should be placed, spread and compacted conforming to OPSS Form 310 or equivalent. All asphaltic concrete should be compacted to a minimum 92.0 percent of their respective laboratory Maximum Relative Densities (MRD's).

3. Adequate drainage should be provided to ensure satisfactory pavement performance.

It is recommended that all fill material be placed in uniform lifts not exceeding 200 mm in thickness before compaction. It is suggested that all granular material used as fill should have an in-situ moisture content within 2 % of their optimum moisture content. All granular materials should be compacted to 100 % SPMDD. Granular materials should consist of Granular "A" and "B" conforming to the requirements of OPSS Form 1010 or equivalent.

It is noted that the above recommended pavement structure is for the end use of the project. During construction of the project, the recommended granular depths may not be sufficient to support loadings encountered.

6.4 Foundation Design

It is GHD's understanding that the proposed buildings will consist of 1 to 2 storey residences with or without basement areas. It is expected that structural loading for such buildings will be supported on reinforced, spread and continuous strip footings for column and load bearing walls, respectively. The footings should be placed on the compact to very dense native soil or on engineered fill placed directly on the competent native soil.

The following table summarizes the minimum depths at which such suitably competent soils were first encountered in each borehole.

Table 6.2 Depth to Competent Bearing Soil

Borehole	Minimum Depth (mbgs)	Borehole	Minimum Depth (mbgs)
BH1-17	0.6	BH1-21	0.8
BH2-17	1.1	BH2-21	0.7
BH3-17	1.2	BH3-21	1.5
BH4-17	1.2	BH4-21	2.3
BH5-17	0.9	BH5-21	3.0
BH6-17	0.9	BH6-21	1.8
BH7-17	1.1	BH7-21	1.5
BH8-17	1.1	BH8-21	0.8
BH9-17	0.8	BH9-21	0.8
BH10-17	1.2	BH10-21	0.8
BH11-17	0.8	BH11-21	1.5
BH12-17	0.9		

It is noted that soft or loose zones of soil were encountered in boreholes BH3-17 (between 4.6 and 6.0 mbgs), BH10-17 (between 2.3 and 3.0 mbgs), BH-1-21 (between 4.6 and 6.1 mbgs) and BH5-21 (between 2.3 and 3.0 mbgs). These boreholes exhibited an overlying "crust" of suitable bearing soils above these loose zones. Foundations in these (and other similar) areas must remain at least 1m above these loose soil zones, to ensure a suitable amount of the competent soil remains for foundation bearing purposes.

For design purposes, it is recommended that footings constructed on the compact to very dense native soils or on engineered fill placed directly on such soils be proportioned using the following bearing capacities:

Table 6.3 Bearing Pressures for Footing Design

Parameter	Bearing Pressure			
	Compact to Dense or Firm to Stiff Undisturbed Native Soils	Engineered Fill		
		Rock-based Fill (2)	Granular Fill (2)	Earth Borrow Fill (2)
Factored Bearing Capacity at ULS (1)	170 kPa	255 kPa	205 kPa	155 kPa
Bearing Capacity at SLS	95 kPa	150 kPa	120 kPa	90 kPa

Notes:
(1) Resistance factor Φ =0.5 applied to the ULS bearing pressure for design purposes.
(2) At least 1.0m of Rock-based fill, or at least 0.3m of Granular or Earth Borrow fill. Quality of material is to be approved prior to use as engineered fill.

Any engineered fill upon which footings are placed must be a minimum thickness corresponding to the notes that accompany the above table. Rock-based fill that does not have a relatively even distribution of particle sizes (eg: clear stone), must be completely encapsulated with suitable non-woven geotextile to minimize any migration of fine-grained particles from surrounding soils into the voids within the rock fill. Footings (and foundation walls) placed on engineered fill must be suitably reinforced; as a minimum, and where not already specified in the structural design drawings, this reinforcing should use continuous runs of two (2) 15M rebar throughout the footings, and continuous runs of two (2) 15M rebar throughout the foundation walls. Reinforcing for foundation walls should contain one run in the upper half, and one run in the lower half of the wall.

The following is recommended for the construction of any engineered fill for the footings:

1. Remove any and all existing vegetation, topsoil, fill, disturbed earth, organics, and organic-bearing soils to the competent, undisturbed native soil from within the area of the proposed engineered fill.
2. The area of the engineered fill should extend horizontally 1m beyond the outside edge of the proposed building foundations and then extend downward at a 1:1 slope to the competent native soil.

3. The base of the engineered fill area must be approved by a member of GHD prior to placement of any fill, to ensure that all unsuitable materials have been removed, that the materials encountered are similar to those observed, and that the subgrade is suitable for the engineered fill.

4. All engineered fill material is to be approved by GHD at the time of construction.

5. Place approved engineered fill, in maximum 300 mm lifts, compacted to 100% of its SPMDD. Any fill material placed under sufficiently wet conditions should consist of an approved, rock-based fill, with the inclusion of appropriate geotextile fabric around the rock-based fill should the rock fill contain enough voids to warrant.

6. Full time testing and inspection of the engineered fill will be required, to ensure compliance with material and compaction specifications.

Should any larger buildings (i.e., larger that the anticipated one to two-storey residential dwellings) be proposed, it is recommended that a specific geotechnical review be conducted to assess any need for further subsurface exploration to be conducted to assess the soil properties in that area.

All exterior footings or footings in unheated areas, should be founded at least 1.2 m below the final adjacent grade for frost protection, or be treated with an equivalent frost protection (such as suitable insulation). Footings and walls exposed to frost action should be backfilled with non-frost susceptible granular material.

Should basements, or other below-grade areas, be incorporated into any of the buildings' designs, it is recommended that for drainage purposes, drainage pipes (subdrains) be installed about the perimeter of the structure, at footing elevation. The subdrains would serve to drain seepage water that infiltrates the backfill, intersect the groundwater, and help relieve hydrostatic pressures due to high groundwater levels. The drains should consist of a perforated pipe, at least 150 mm in diameter, surrounded by clear, crushed stone and suitable filter protection. The drain should discharge to a positive sump or other permanent frost free outlet. It is also strongly recommended that the building's foundation walls be sealed and waterproofed.

Under no circumstances should the foundations be placed above organic materials, loose, frozen subgrade, construction debris, or within ponded water. Prior to forming, all foundation excavations must be inspected and approved by a member of GHD. This will ensure that the foundation bearing material has been adequately prepared at the foundation subgrade level and that the soils exposed are similar to those encountered during this investigation.

For design purposes this site is classed as Site Class D for Seismic Site Response, in accordance with the Ontario Building Code (OBC).

For foundations constructed in accordance with the foregoing manner, total and differential settlements are estimated to be less than 25 mm.

6.5 Slab on Grade

Floors may generally be constructed as normal slabs-on-grade, on granular material or 19 mm clear stone over native, inorganic soils. The floor slab should be formed over a base course consisting of at least 150 mm of either Granular “A” backfill as per OPSS, or where basement areas exist then use 19 mm clear stone, either material compacted to a minimum of 100 % of its SPMDD. All grade increases or infilling below the granular or clearstone should utilize well graded, free draining Granular "B", Type 1 backfill as per OPSS 1010, placed in lifts no thicker than 200 mm before compaction, and compacted to a minimum of 100 % of its SPMDD. If the groundwater table is intersected by any basement excavations, the floor slabs should incorporate under slab drains. A vapour barrier should be installed beneath the slabs to prevent migration of moisture vapour. All fill placed as engineered fill must be inspected, approved and compaction verified by personnel from GHD.

6.6 Basement and Retaining Walls

It is recommended that free draining backfill to walls be provided. Earth retaining walls located above the groundwater table may be designed for lateral earth pressures using the following equation:

$p = k (w\ h + q)$, where:

- p = the lateral earth pressure in kPa acting on the subsurface wall at depth h;
- k_a = the coefficient of active earth pressure;
  (= 0.3 for walls restrained from the bottom only);
  (= 0.5 for walls restrained at the top and bottom*);
- k_p = the coefficient of passive earth pressure, (= 3.0);
- w = the granular or native soil bulk density in kN/m^3;
  (= 21.0 kN/m^3 for well compacted, OPSS-approved Granular "B");
  (= 20.0 kN/m^3 for native soils);
- h = the depth (in metres) below the exterior grade at which the earth pressure is being calculated; and
- q = the equivalent value of any surcharge (in kN/m^3) acting on the ground surface adjacent to the walls.

(*) This value is recommended for rigid walls retaining compacted backfill.

The recommended value for the coefficient for sliding friction between the soil and the concrete is 0.4. In addition to the above, hydrostatic forces must be taken into account in the design where the walls extend below the groundwater table. Also, any additional surcharge loading that will influence the wall must be taken into account in its design.

6.7 Stormwater Management Pond

Recommendations provided in this report are for preliminary design purposes and does not include an analysis of the proposed SWP berm's stability. GHD can perform such stability analyses once overall grading plans for the Site are finalized. It is GHD's understanding that SWPs are proposed for this development in the areas of boreholes BH11-17 and BH12-17 and borehole BH1-21, as shown on Figure 2.

The native soils encountered at the expected base of the SWP located in the southeast end of the Site (boreholes BH11-17 and BH12-17) consist of silty sand till or sand in generally compact to very dense in-situ state of relative density. A gradation of a sample of silty sand till obtained from below the base of the proposed southeast SWP suggests the following composition: 21 % gravel, 48 % sand, and 30 % silt and clay-sized particles. The hydraulic conductivity of silty sand till soils in the proposed southeast SWP area is expected to be on the order of about 10^{-4} to 10^{-5} cm/sec.

The native soils encountered in the expected base of the SWP located in the northwest end of the Site (borehole BH1-21) consist of clayey silt till in a very stiff to soft in-situ consistency. A gradation of a sample of clayey silt / silty clay till obtained from below the base of the proposed northeast SWP suggests the following composition: 1 % gravel, 5 % sand, and 94 % silt and clay-sized particles. The hydraulic conductivity of clayey silt / silty clay till soils in the proposed northeast SWP area is expected to be on the order of about 10^{-5} to 10^{-7} cm/sec.

Based on the soils observed, and the anticipated base elevations, it appears that construction of the SWP in this area is feasible. In general, excavation of the soils for the SWPs are expected to be straightforward, provided that appropriate measures are taken during construction to minimize any overland or near-surficial flow of water into the area. Groundwater seepage was encountered in boreholes BH11-17, BH12-17 and BH1-21 at depth of 4.6 mbgs (241.8m), 5.2 mbgs (240.9m) and 4.6 mbgs (243.4m) respectively. Groundwater and surficial water inflow into the open SWP excavation is expected, however this is generally expected to be controlled by pumping from within the excavation, along with further measures if required including up-gradient cutoff trenching with appropriate drainage outletting.

It is recommended that the SWP subgrade surfaces be proof rolled, and a representative of GHD approve the subgrade prior to construction of the berms. Construction of the berms may utilize excess site till soils having a hydraulic conductivity of 10^{-5} cm/sec or lower. Such operations should place the till soils in lifts no thicker than 150mm prior to compaction, and compacted to at least 95% SPMDD.

Should sand seams or localized groundwater be encountered during excavation an appropriate liner can be used to seal the more permeable areas where encountered. Native, undisturbed till with finer-grained gradation (silts and clays) would have a sufficiently low permeability and could be used for a liner. An inspection of the excavated and exposed SWP surfaces should be performed at the time of construction, to assess where areas of increased hydraulic conductivity are present within the exposed soils, so that such areas may be lined with a more suitable (ie, less hydraulically conductive) material. It is recommended that construction of such approved material be at least 600mm thick, and must be placed under full time geotechnical inspections.

For the purpose of the proposed SWPs, the soils observed should be stable from slip circle failure if sloped at 3 horizontal to 1 vertical (3H:1V) or flatter in the long term both above and below the water table. Between the stable water level and the expected high water level, it is recommended that the slopes be lessened to 5H:1V (or flatter) to guard against erosion by wavelet action. The till material will require vegetative root mass (or otherwise suitable erosion protection) to minimize erosional forces on exposed slopes.

Slopes and berms of the SWPs should be constructed so as to reduce or eliminate the effects of surficial erosion. Features to do so may include slope vegetation, installation of erosion or gabion mats, rip rap, and/or other acceptable stabilizing features.

It is recommended that a regular maintenance program for the SWPs include monitoring of it for any potential slope erosion, degradation, or otherwise undesirable structural conditions. Should any such conditions become evident, immediate mitigative actions must be performed.

6.8 General Recommendations

6.8.1 Wells

Any decommissioning of wells on-site must be performed by an appropriately- licensed well contractor in compliance with O.Reg. 903.

6.8.2 Test Pits During Tendering

It is strongly recommended that test pits be excavated at representative locations of this Site during the tendering phase, with mandatory attendance of interested contractors. This will allow them to make their own assessments of the groundwater and soil conditions at the Site and how these will affect their proposed construction methods, techniques and schedules.

6.8.3 Subsoil Sensitivity

The native subsoils are susceptible to strength loss or deformation if saturated or disturbed by construction traffic. Therefore, where the subgrade consists of approved soil, care must be taken to protect the exposed subgrade from excess moisture and from construction traffic.

6.8.4 Winter Construction

The subsoils encountered across the site are frost-susceptible and freezing conditions could cause problems to the structures. As preventive measures, the following recommendations are presented:

1. During winter construction, exposed surfaces intended to support foundations must be protected against freezing by means of loose straw, insulated tarpaulins, heating, etc.

2. Care must be exercised so that any sidewalks and/or asphalt pavements do not interfere with the opening of doors during the winter when the soils are subject to frost heave. This problem may be minimized by any one of several means, such as keeping the doors well above outside grade, installing structural slabs at the doors, and by using well-graded backfill and positive drainage, etc.

3. Because of the frost heave potential of the soils during winter, it is recommended that the trenches for exterior underground services be excavated with shallow transition slopes in order to minimize the abrupt change in density between the granular backfill, which is relatively non-frost susceptible, and the more frost-susceptible native soils.

6.8.5 Design Review and Inspection

Due to the preliminary nature of the design details at the time of this report, it is strongly recommended that GHD's geotechnical group be allowed to review the foundation design and proposed final grading plans, prior to their finalization. In addition, we strongly recommend that our firm be retained to review the related earthworks specifications when they are available.

Geotechnical inspection and review of foundation excavations and compaction procedures must be carried out to ensure compliance with our recommendations.

7. Limitations of the Investigation

This report is intended solely for the Bromont Group and their designers and is prohibited for use by others without GHD's prior written consent. This report is considered GHD's professional work product and shall remain the sole property of GHD. Any unauthorized reuse, redistribution of or reliance on the report shall be at the Client and recipient's sole risk, without liability to GHD. No portion of this report may be used as a separate entity; it is to be read in its entirety and shall include all supporting drawings and appendices.

The recommendations made in this report are in accordance with our present understanding of the project, the current site use, ground surface elevation and conditions, and are based on the work scope approved by the Client and described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality. No other representations, and no warranties or representations of any kind, either expressed or implied, are made. 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.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in the study report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. We should be retained to review our recommendations when the drawings and specifications are complete. Without this review, GHD will not be liable for any misunderstanding of our recommendations or their application and adaptation into the final design.

By issuing this report, GHD is the geotechnical engineer of record. It is recommended that GHD be retained during construction of all foundations and during earthwork operations to confirm the conditions of the subsoil are actually similar to those observed during our study. The intent of this requirement is to verify that conditions encountered during construction are consistent with the findings in the report and that inherent knowledge developed as part of our study is correctly carried forward to the construction phases.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions confirmed at the test locations may vary at other locations. The subsurface conditions can also be significantly modified by the construction activities on site (e.g., excavation, dewatering and drainage, blasting, pile driving, etc.). These conditions can also be modified by exposure of soils or bedrock to humidity, dry periods or frost. Soil and groundwater conditions between and beyond the test locations may differ both horizontally and vertically from those encountered at the test locations and conditions may become apparent during construction which could not be detected or anticipated at the time of our investigation. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations. If changed conditions are identified during construction, no matter how minor, the recommendations in this report shall be considered invalid until sufficient review and written assessment of said conditions by GHD is completed.

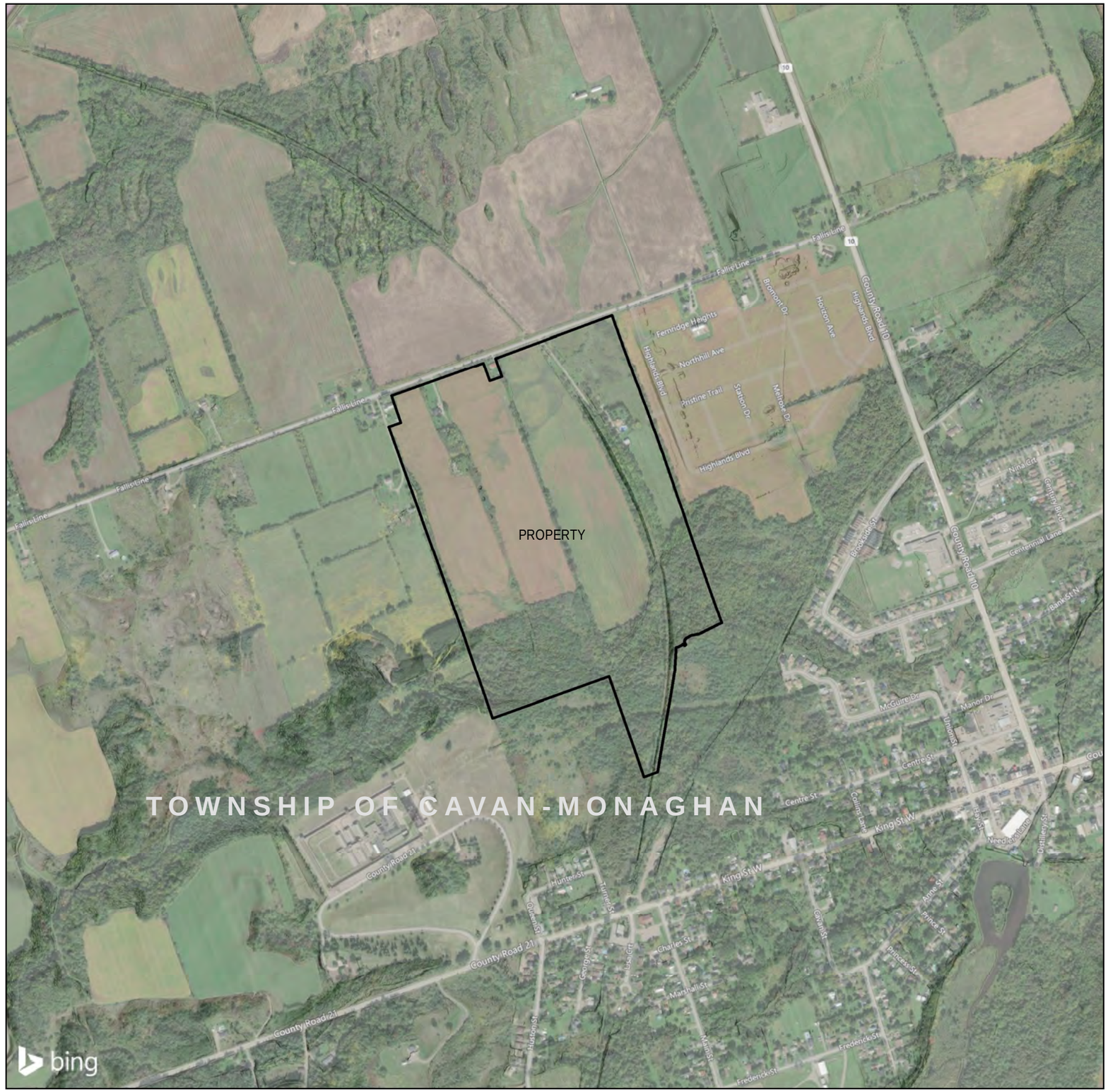
All of Which is Respectfully Submitted,

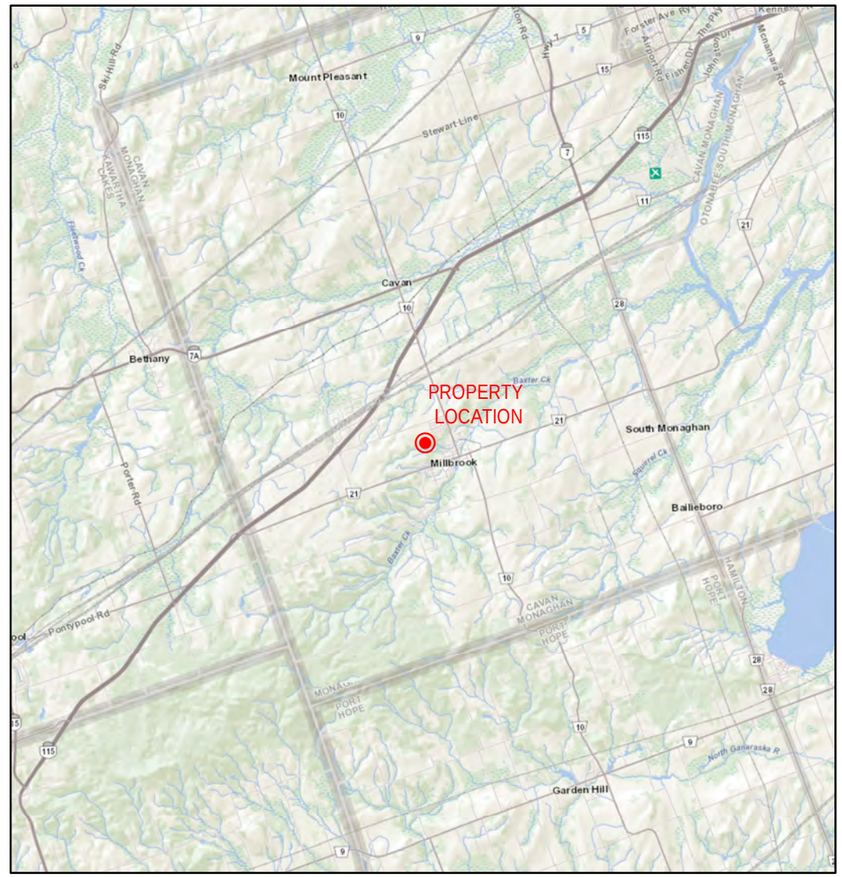
GHD

Leandro Ramos, P.Eng.

Nyle McIlveen, P. Eng.

Figures





Citation(s)

Ontario Digital Terrain Model [Derivative]. Central Lake Ontario Conservation Authority, 2018.

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Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

Paper Size ANSI B

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Meters

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TOWNSHIP OF CAVAN-MONAGHAN
COUNTY OF PETERBOROUGH

GEOTECHNICAL INVESTIGATION

SITE LOCATION **MAP**

Project No. 11224019
Revision No. -
Date Mar 2021

FIGURE 1

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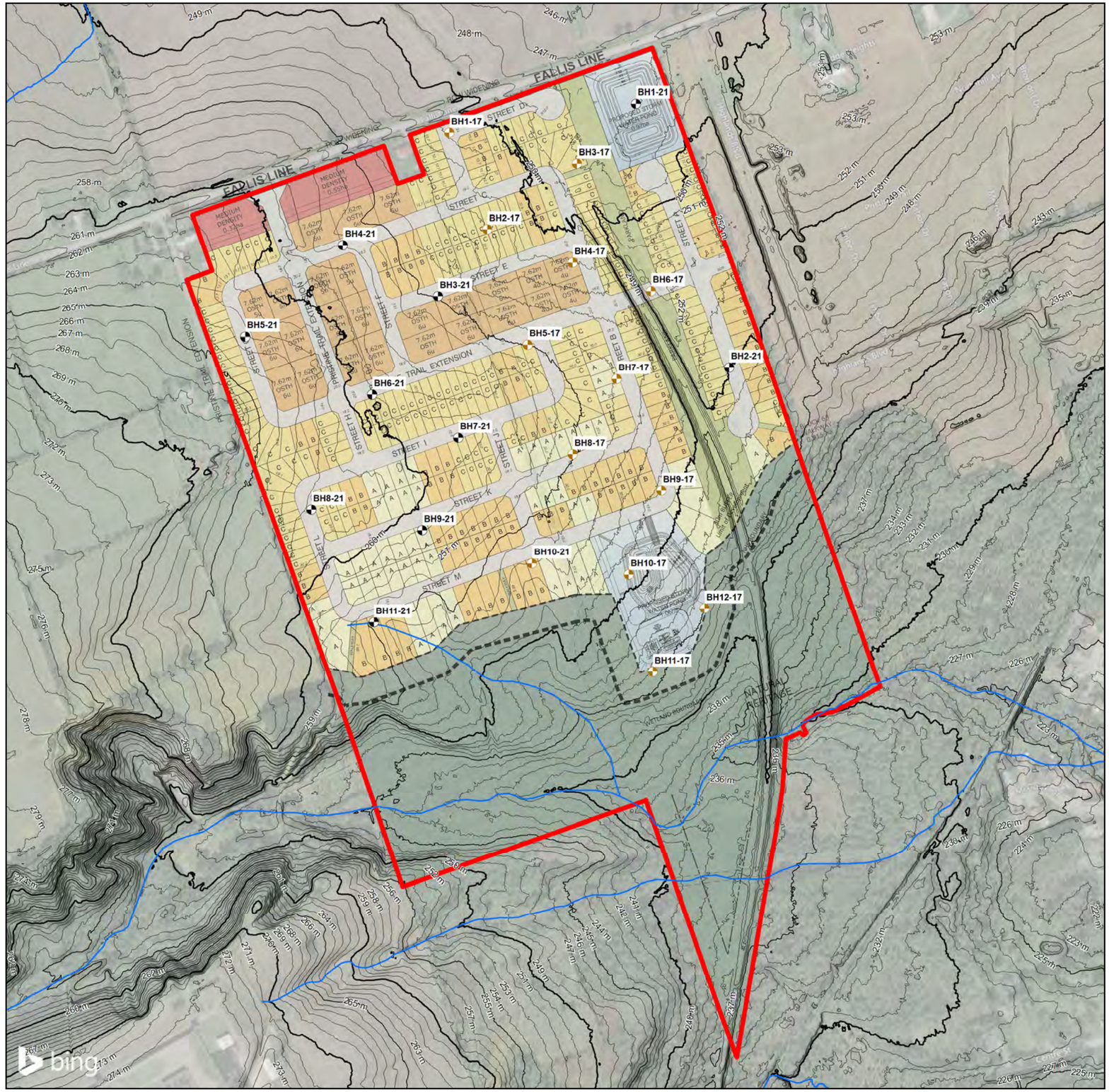

TEST HOLES

- Boreholes Drilled in 2021
- Boreholes Drilled in 2017

CONTOURS

- Contour Line, Major
  10 m Contour Index
  ODTM Lidar Derived
- Contour Line, Intermediate
  5 m Contour Index
  ODTM Lidar Derived
- Contour Line, Minor
  1 m Contour Interval
  ODTM Lidar Derived

ONTARIO HYDROGRAPHIC NETWORK (OHN)

- Stream

ADMINISTRATIVE BOUNDARIES

- Property Limit

CITATIONS

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Ontario Digital Terrain Model [Derivative]. OMAFRA. Peterborough, 2016-2017.

Conceptual Draft Plan, Fallis Line West [20697]. The Biglieri Group Ltd. 2021-03-29.

Map Projection: Transverse Mercator
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COUNTY OF PETERBOROUGH

GEOTECHNICAL INVESTIGATION

BOREHOLE LOCATION PLAN

Project No. 11224019
Revision No. -
Date Mar 2021

FIGURE 2

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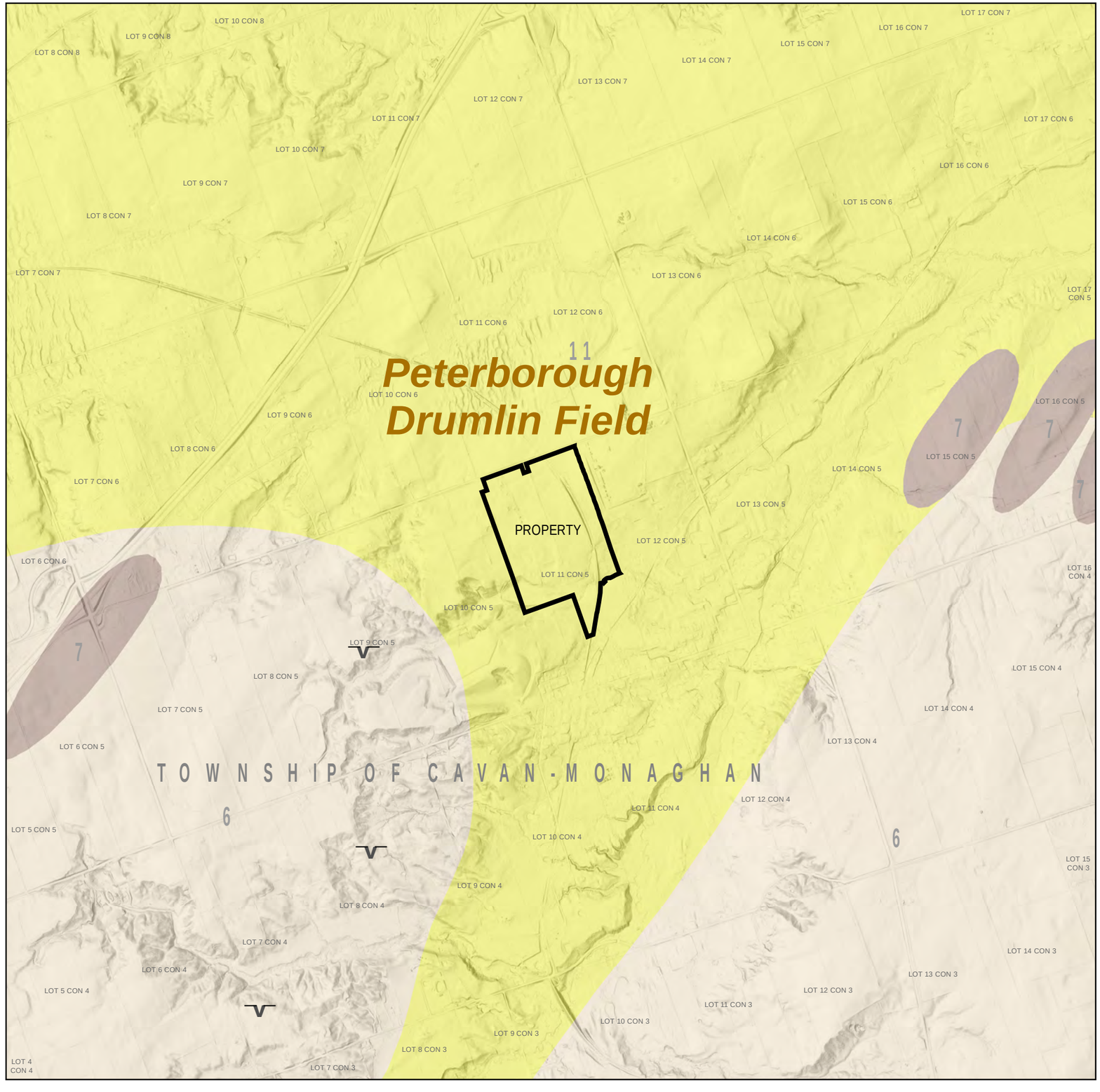

ADMINISTRATIVE BOUNDARIES

- Geographic Lot Fabric
- Property Limit
- Municipal, Lower Tier Boundary

PHYSIOGRAPHY

Physiography of Southern Ontario (MRD228)

DESCRIPTION

- Boulder Pavement
- Dissected Terrain
- Mud Flow Scars
- Sand Dunes
- Escarpment
- Shorecliff
- Shorecliff (weakly developed)
- Physiography Regions

PHYSIOGRAPHIC LANDFORMS

- 1: Escarpments
- 2: Till Moraines
- 3: Spillways
- 4: Kame Moraines
- 5: Till Plains (Undrumlinized)
- 6: Till Plains (Drumlinized)
- 7: Drumlins
- 8: Bevelled Till Plains
- 9: Limestone Plains
- 10: Shale Plains
- 11: Sand Plains
- 12: Clay Plains
- 13: Eskers
- 14: Beaches
- 15: Shallow Till And Rock
- 16: Bare Rock Ridges And Shallow
- 17: Peat And

Citation(s)

Chapman, L.J. and Putnam, D.F. 2007. Physiography of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 228 ISBN 978-1-4249-5158-1

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
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GEOTECHNICAL INVESTIGATION

PHYSIOGRAPHY

Project No.	11224019
Revision No.	-
Date	Mar 2021

FIGURE **3**

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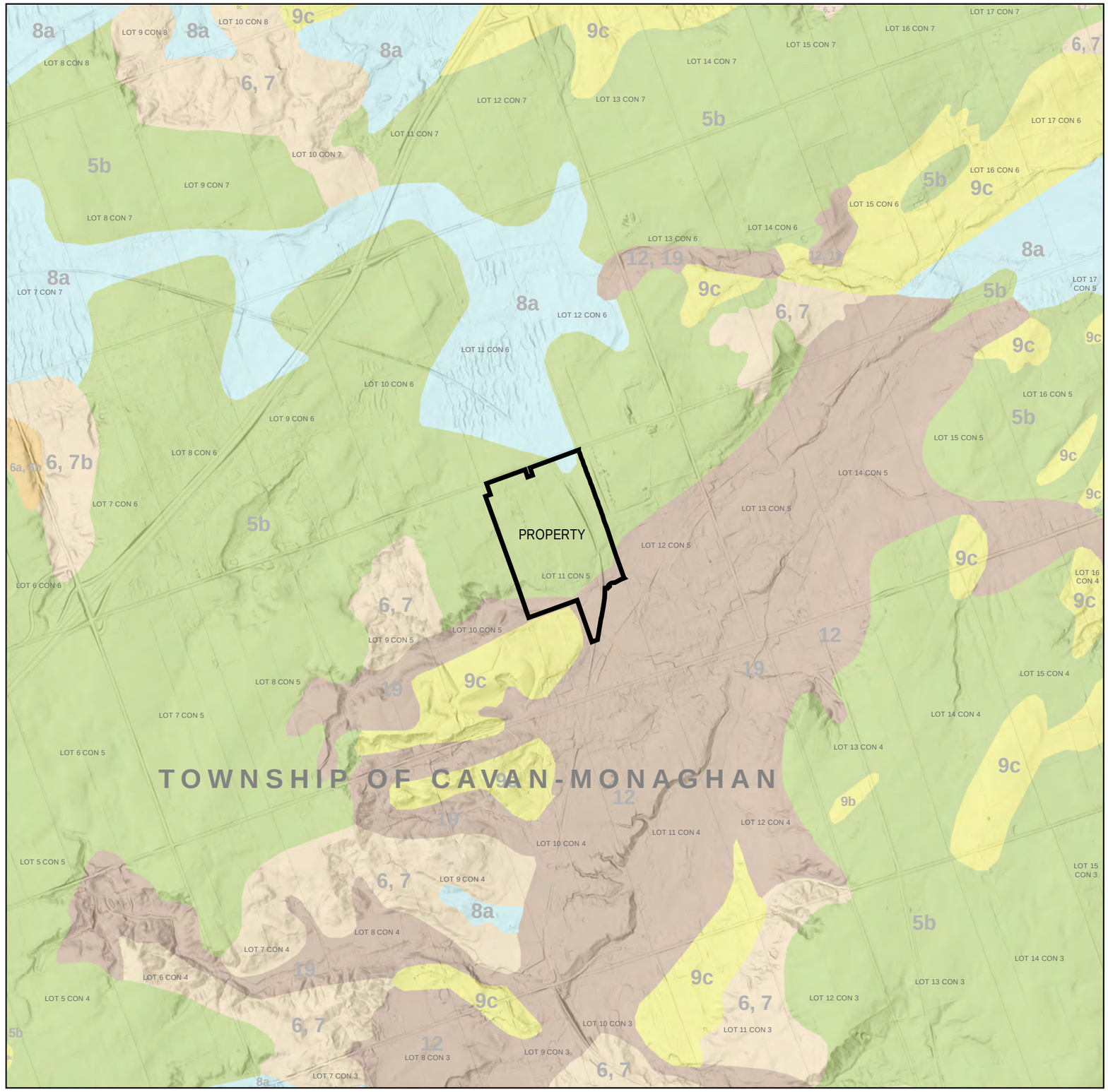

ADMINISTRATIVE BOUNDARIES

- Geographic Lot Fabric
- Property Limit
- Municipal, Lower Tier Boundary

SURFICIAL GEOLOGY

Surficial Geology of Southern Ontario (MRD128-REV)

RECENT

21: Man-made deposits:
Fill, sewage lagoon, landfill, urban development

20: Organic deposits:
Peat, muck, marl

19: Modern alluvial deposits:
Clay, silt, sand, gravel, may contain organic remains

18: Colluvial deposits:
Boulders, scree, talus, undifferentiated landslide materials

17: Eolian deposits:
Fine to very fine sand and silt

16: Coarse-textured marine deposits:
Sand, gravel, minor silt and clay
16a Deltaic deposits
16b Littoral deposits
16c Foreshore and basinal deposits

15: Fine-textured marine deposits:
Silt and clay, minor sand and gravel

14: Coarse-textured lacustrine deposits:
Sand, gravel, minor silt and clay
14a Deltaic deposit
14b Littoral deposits
14c Foreshore and basinal deposits

13: Fine-textured lacustrine deposits:
Silt and clay, minor sand and gravel

PLEISTOCENE

12: Older alluvial deposits:
Clay, silt, sand, gravel, may contain organic remains

11: Coarse-textured glaciomarine deposits:
Sand, gravel, minor silt and clay
11a Deltaic deposits
11b Littoral deposits
11c Foreshore and basinal deposits

10: Fine-textured glaciomarine deposits:
Silt and clay, minor sand and gravel
10a Massive to well laminated
10b Interbedded silt and clay and gritty, pebbly flow till and rainout deposits

9: Coarse-textured glaciolacustrine deposits:
Sand, gravel, minor silt and clay
9a Deltaic deposits
9b Littoral deposits
9c Foreshore and basinal deposits

8: Fine-textured glaciolacustrine deposits:
Silt andclay, minor sand and gravel
8a Massive to well laminated
8b Interbedded silt and clay and gritty, pebbly flow till and rainout deposits

7: Glaciofluvial deposits:
River deposits and delta topset facies
7a Sandy deposits
7b Gravelly deposits

6: Ice-contact stratified deposits:
Sand and gravel, minor silt, clay and till
6a In moraines, eskers, kames and crevasse fills
6b In subaquatic fans

5a: Till:
Silty sand to sand-textured till on Precambrian terrain
5a Silty sand to sand-textured till on Precambrian terrain

5b: Stone-poor, sandy silt to silty sand-textured till
Stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain

5c: Stony, sandy silt to silty sand-textured till
Stony, sandy silt to silty sand-textured till on Paleozoic terrain

5d: Clay to silt-textured till
Clay to silt-textured till (derived from glaciolacustrine deposits or shale)

5e: Undifferentiated older tills
Undifferentiated older tills, may include stratified deposits

PALEOZOIC

4: Bedrock-drift complex in Paleozoic terrain:
4a Primarily till cover
4b Primarily stratified drift cover

3: Paleozoic bedrock

PRECAMBRIAN

2: Bedrock-drift complex in Precambrian terrain:
2a Primarily till cover
2b Primarily stratified drift cover

1: Precambrian bedrock

Citation(s)

MRD128-REV. Ontario Geological Survey 2010. Surficial geology of southern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 128 – Revised.

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

Paper Size ANSI B

0 330 660 990 1,320
Meters

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GEOTECHNICAL INVESTIGATION

SURFICIAL GEOLOGY

Project No. 11224019
Revision No. -
Date Mar 2021

FIGURE **4**

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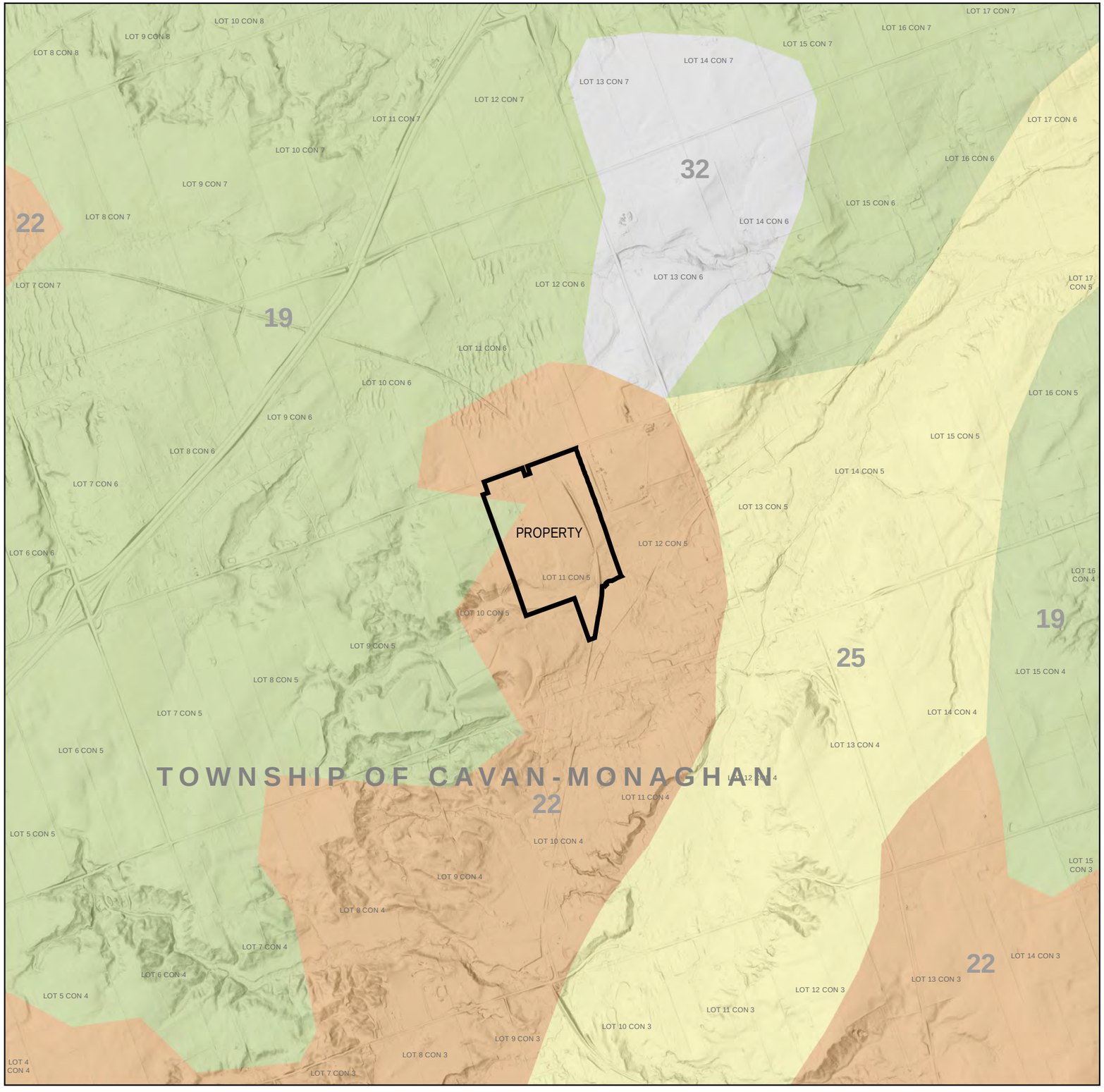

ADMINISTRATIVE BOUNDARIES

Geographic Lot Boundary

Property Limit

Municipal, Lower Tier Boundary

QUATERNARY GEOLOGY

Quaternary Geology of Southern Ontario (EDS014-REV)

33: Lakes

RECENT

29: Lacustrine deposits:
Silt and clay basin or quiet water deposits

32: Organic deposits:
Organic deposits: peat, muck and marl

31: Fluvial deposits:
Gravel, sand, silt and clay deposited on modern flood plains

30: Lacustrine deposits:
Sand, gravelly sand and gravel nearshore and beach deposits

PLEISTOCENE

28: Fluvial deposits:
Gravel, sand, silt and clay deposited on abandoned flood plains, terrace remnants

27: Glaciomarine and marine deposits:
Sand, gravelly sand and gravel nearshore and beach deposits

26: Glaciomarine and marine deposits:
Silt and clay basin and quiet water deposits

25: Glaciolacustrine deposits:
Sand, gravelly sand and gravel nearshore and beach deposits

24: Glaciolacustrine deposits:
Silt and clay, minor sand basin and quiet water deposits

23: Glaciofluvial Outwash deposits:
Gravel and sand includes proglacial river and deltaic deposits

22: Glaciofluvial ice-contact deposits:
Gravel and sand minor till includes esker, kame, end moraine, ice-marginal delta and subaqueous fan deposits

21: Till:
Undifferentiated, fine grained, predominantly silty clay to silt matrix, commonly clast poor, high matrix carbonated content

20: Till:
Undifferentiated, predominantly sand matrix, extremely stony, bouldery and high in total matrix carbonated, often associated with stratified sediments

19: Till:
Undifferentiated, predominantly sandy silt to silt matrix, commonly rich in clasts, often high in total matrix carbonate content

18: Till:
Undifferentiated, predominantly sand to silty to silt matrix, commonly rich in clasts, often low in matrix carbonate content

17: Halton Till (Ontario-Erie lobe):
Predominantly silt to silty clay matrix, high in matrix carbonate content and clast poor

16: Kettleby Till (simcoe lobe):
Predominantly silt to silty clay matrix, highly calcareous,

15: St. Joseph Till (Huron-Georgian Bay lobe):
Silt to silty clay matrix, clay content increases southward, clast poor

14: Wentworth Till (Ontario-Erie lobe):
Sandy silt to silt matrix becoming finer grained to silty clay near Lake Erie, highly calcareous, clast content moderate to low decreasing southward

13: Newmarket Till (Simcoe lobe):
Sandy silt to silt matrix, moderate to high in matrix carbonate content, clast content moderate to high

12: Dunkeld Till (Huron-Georgian Bay lobe):
Silt matrix, high matrix carbonate content, clast poor

11: Rannoch Till (Huron-Georgian Bay lobe):
Silt to clayey silt matrix becoming finer grained southward, highly calcareous, clast poor

10: Elma Till (Huron-Georgian Bay lobe):
Sandy silt to silty matrix, clayey silt along southern margin, moderatey stony, strongly calcareous

9: Port Stanley Till (Ontario-Erie lobe):
Silt to sandy silt matrix becoming silt to silty clay near Lake Erie, strongly calcareous, moderate to low clast content decreasing southward

8: Wartburg Till (Huron-Georgian Bay lobe):
Silty clay matrix, high carbonate content in matrix, clast poor

7: Stratford Till (Huron-Georgian Bay lobe):
Sandy silt matrix, strongly calcareous, moderately stony

6: Mornington Till (Huron-Georgian Bay lobe):
Silty clay matrix, moderate to high matrix carbonate content, clast poor.

5: Tavistock Till (Huron-Georgian Bay lobe)
Sandy silt to silt matrix, silty clay matrix in south and north, moderate to high carbonate content, clast content decreases from moderate to poor northward

4: Maryhill Till (Erie Lobe):
Silty clay to clay matrix, moderate to high matrix carbonate

3: Catfish Creek Till:
Sandy silt to silt matrix, strongly calcareous, moderately stony to stony

PALEOZOIC

2: Bedrock, post-Precambrian:
Undifferentiated carbonate and clastic sedimentary rock, exposed at surface or covered by a discontinuous, thin layer of drift

PRECAMBRIAN

1: Bedrock:
Undifferentiated igneous and metamorphic rock, exposed at surface or covered by a discontinuous, thin layer of drift

Citation(s)

EDS014-REV. Ontario Geological Survey, 1997. Quaternary geology, seamless coverage of the province of Ontario: Ontario Geological Survey, Data Set 14.

Map Projection: Transverse Mercator
Horizontal Datum: North American 1983
Grid: NAD 1983 UTM Zone 17N

Paper Size ANSI B

0 330 660 990 1,320

Meters

N

Data Disclaimer(s)

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GHD

THE BROMONT GROUP
787 & 825 FALLIS LINE, MILLBROOK, ON
TOWNSHIP OF CAVAN-MONAGHAN
COUNTY OF PETERBOROUGH

GEOTECHNICAL INVESTIGATION

QUATERNARY GEOLOGY

Project No. 11224019
Revision No. -
Date Mar 2021

FIGURE **5**

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Print date: 16 Feb 2021 - 19:35

Appendices

Appendix A
Borehole Stratigraphic Logs

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-1

BOREHOLE No.: BH1-17
ELEVATION: 251.3 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 22 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702910E 4892792N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE	COMMENTS
		0.0		GROUND SURFACE							
				TOPSOIL (380 mm)				1 3 5 5			
1		0.4		**TILL** - Brown Silty Clay, Some Sand, Trace Gravel, Moist, Compact - Occasional Organics to 0.6m	SS-1	79	25		8		Borehole open and dry upon completion of drilling
2								5			
3	1.0				SS-2	100	18	6 11 18	17		
4											
5								4			
6	2.0				SS-3	100	20	10 16 21	26		SS-3: 4% Gravel 10% Sand 86% Silt and Clay 31% between 5-75 µm
7		2.3		Occasional Cobbles, Dense				15			
8					SS-4	89	14	13 22	35		
9											
10	3.0	3.0		Damp to Moist, Very Dense	SS-5	100	7	24 38 50=4"	100+		
11											
12											
13	4.0										
14											
15								21			
16	5.0				SS-6	100	9	28 40	68		
17											
18											
19											
20	6.0	6.1		Dense				8			
21					SS-7	100	13	17 18	35		
22		6.6		END OF BOREHOLE							
23	7.0										
24											

Shear test (Cu) △ Field / Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-2

BOREHOLE No.: BH2-17
ELEVATION: 252.8 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 22 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702952E 4892690N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) △ Field □ Lab; Sensitivity (S); ○ Water content (%); Atterberg limits (%) W_p W_l; × "N" Value (blows / 0.3 m); ◆ RQD ◎ CONE (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE							
				TOPSOIL (300 mm)				2			
1		0.3		**TILL** - Brown Silty Clay, Some Sand, Trace Gravel, Damp, Compact	SS-1	83	13	5 6 8	11	× ○	Borehole open and dry upon completion of drilling
2				- Occasional Organics to 0.5m							
3	1.0				SS-2	100	17	3 3 8	11	× ○	
4											
5					SS-3	100	24	3 5 6	11	× ○	
6	2.0										
7											
		2.3		Brown Silty Sand, Some Clay, Trace Gravel, Damp, Compact				5			
8					SS-4	100	16	6 5	11	× ○	
9											
10	3.0				SS-5	100	10	6 6 9	15	○ ×	
11											
12											
13	4.0										
14											
15					SS-6	100	8	6 6 8	14	○ ×	
16	5.0										
17											
18											
19											
20	6.0				SS-7	100	15	7 7 9	16	⊗	
21											
		6.6		END OF BOREHOLE							
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-3

BOREHOLE No.: BH3-17
ELEVATION: 248.3 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 22 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703062E 4892759N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
				TOPSOIL (300 mm)				0 0 0 2	
1		0.3		**TILL** - Brown Silty Clay, Some Sand, Trace Gravel, Moist, Compact - Occasional Organics to 0.6m	SS-1	33	41		0
2								2 3 6	
3	1.0				SS-2	100	25		9
4								5 8 10	
5					SS-3	100	20		18
6	2.0							7 10 15	
7					SS-4	100	12		25
8								7 9 11	
9					SS-5	100	12		20
10	3.0								
11									
12									
13	4.0								
14									
15		4.6		Grey Sandy Silt, Some Clay, Trace Gravel, Wet, Very Loose	SS-6	100	34	0 1 3	4
16	5.0								
17									
18									
19									
20	6.0	6.1		Compact Sand Seam at 6.2m	SS-7	100	10	19 15 9	24
21		6.6		END OF BOREHOLE					
22									
23	7.0								
24									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

— 1.0 m

WL - 0.9 m 9/7/2017

Groundwater seepage encountered at 4.6 m during drilling

33 mm inside diameter piezometer installed to 6.6 m

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-4

BOREHOLE No.: BH4-17
ELEVATION: 251.6 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 22 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703055E 4892637N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
		0.3		**TOPSOIL** (300 mm)					
1				**TILL** - Brown Silty Clay, Trace Sand, Moist, Compact - Occasional Organics to 0.6m	SS-1	83	26	1 3 5 6	8
2									
3	1.0				SS-2	89	30	2 3 5	8
4									
5		1.5		Some Gravel, Damp	SS-3	100	12	4 7 11	18
6	2.0								
7									
8		2.6			SS-4	100	9	9 22 35	57
9				**SAND** - Brown Sand, Some Silt, Damp, Dense to Very Dense					
10	3.0				SS-5	94	3	40 25 26	51
11									
12									
13	4.0								
14									
15				Silt Seam at 4.6m	SS-6	100	25	16 22 21	43
16	5.0								
17									
18									
19	6.0								
20									
21					SS-7	100	5	21 35 40	75
		6.6		END OF BOREHOLE					
22									
23	7.0								
24									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

— m
— 0.91 m

Borehole open and dry upon completion of drilling

WL - Dry 9/7/2017

WL - Dry 10/17/2017

SS-6:
0% Gravel
74% Sand
26% Silt and Clay
20% between 5-75 µm

51 mm inside diameter monitoring well installed to 6.1 m

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-5

BOREHOLE No.: BH5-17
ELEVATION: 255.2 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 22 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703000E 4892563N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
		0.3		**TOPSOIL** (300 mm)					
1				**TILL** - Brown Sandy Silty Clay, Trace Gravel, Moist, Compact	SS-1	79	18	0 3 4 8	7
2				- Occasional Organics to 0.6m					
3	1.0				SS-2	89	14	4 14 21	35
4									
5		1.5		**SAND** - Brown Sand, Some Silt, Trace Gravel, Damp, Very Dense	SS-3	100	3	25 30 50=4"	100+
6	2.0								
7					SS-4	100	3	38 50=5"	100+
8									
9									
10	3.0				SS-5	100	3	46 50=4"	100+
11									
12									
13	4.0								
14									
15					SS-6	100	6	36 33 35	38
16	5.0								
17									
18									
19									
20	6.0				SS-7	100	5	28 50=5"	100+
21		6.4		END OF BOREHOLE					
22									
23	7.0								
24									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

Borehole open and dry upon completion of drilling

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-6

BOREHOLE No.: BH6-17
ELEVATION: 252.4 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703151E 4892614N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE	COMMENTS
		0.0		GROUND SURFACE							
				TOPSOIL (300 mm)				5			
1		0.3		**TILL** - Brown Sandy Silty Clay, Some Gravel, Moist, Compact	SS-1	79	13	5 8 9	13		Borehole open and dry upon completion of drilling
2				- Occasional Organics to 0.6m							
3	1.0				SS-2	100	23	5 5 5	10		
4											
5		1.5		Dense	SS-3	83	20	5 10 25	35		SS-2: 12% Gravel 20% Sand 68% Silt and Clay 33% between 5-75 µm
6	2.0										
7		2.3		Brown Silty Sand, Some Clay, Trace Gravel, Moist, Dense	SS-4	94	12	31 24 14	38		
8											
9											
10	3.0	3.0		Very Dense	SS-5	83	14	3 24 41	65		
11											
12											
13	4.0										
14											
15		4.6		**SAND** - Brown Sand, Some Silt, Trace Gravel, Damp, Very Dense	SS-6	100	4	16 50=5"	100+		
16											
17	5.0										
18											
19											
20	6.0	6.1		Dense	SS-7	100	5	15 15 29	44		
21		6.6		END OF BOREHOLE							
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-7

BOREHOLE No.: BH7-17
ELEVATION: 254.5 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703108E 4892501N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) Sensitivity (S) ○ Water content (%) Atterberg limits (%) × "N" Value (blows / 0.3 m) △ Field □ Lab ◆ RQD ◎ CONE	COMMENTS
		0.0		GROUND SURFACE						10 20 30 40 50 60 70 80 90	
				TOPSOIL (300 mm)				0			Borehole open and dry upon completion of drilling
1		0.3		**TILL** - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact	SS-1	83	18	3 3 5	6		
2				- Occasional Organics to 1.1m							
3	1.0				SS-2	83	15	4 3 20	23		
4											
5		1.5		Very Dense	SS-3	100	3	50=5"	100+		
6											
7	2.0				SS-4	100	6	50=5"	100+		
8											
9											
10	3.0				SS-5	100	6	50=4"	100+		
11											
12											
13	4.0										
14											
15					SS-6	100	6	46 50=4"	100+		
16	5.0										
17											
18											
19											
20	6.0										
21					SS-7	100	7	25 31 44	75		
		6.6		END OF BOREHOLE							
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-8

BOREHOLE No.: BH8-17
ELEVATION: 255.4 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703046E 4892430N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE	COMMENTS
		0.0		GROUND SURFACE							
		0.3		**TOPSOIL** (300 mm)							
1				**TILL** - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact - Occasional Organics to 1.1m	SS-1	88	21	0 2 3 5	5		Borehole open and dry upon completion of drilling
2											
3	1.0				SS-2	100	19	1 50=1"	100+		WL - Dry 9/7/2017
4											
5		1.5		Damp, Very Dense	SS-3	100	7	27 50=4"	100+		SS-3: 8% Gravel 56% Sand 36% Silt and Clay
6	2.0										
7											
8					SS-4	100	5	30 34 40	74		
9											
10	3.0				SS-5	100	6	34 40 42	82		
11											
12											
13	4.0										
14											
15					SS-6	100	4	46 50=4"	100+		
16	5.0										
17											
18											
19	6.0										
20		6.1		END OF BOREHOLE	SS-7	100	6	50=2"	100+		33 mm inside diameter piezometer installed to 6.1 m
21											
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-9

BOREHOLE No.: BH9-17
ELEVATION: 251.6 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703145E 4892381N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0		GROUND SURFACE						
		0.3		**TOPSOIL** (300 mm)						
1				**TILL** - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact - Occasional Organics to 0.6m	SS-1	83	25	0 2 3 3	5	Borehole open and dry upon completion of drilling
2										
3	1.0				SS-2	100	7	14 14 13	27	WL - Dry 9/7/2017
4										WL - Dry 10/17/2017
5		1.7		Brown Silt, Some Clay, Some Sand, Trace Gravel, Moist, Compact	SS-3	89	17	25 7 11	18	
6	2.0									
7										
8		2.4		Brown Gravelly Silty Sand, Some Clay, Moist, Very Dense	SS-4	100	10	17 22 32	54	
9										
10	3.0				SS-5	100	8	24 33 25	38	SS-5: 31% Gravel 42% Sand 27% Silt and Clay 18% between 5-75 µm
11										
12										
13	4.0									
14										
15					SS-6	100	7	35 50=5"	100+	
16	5.0									
17										
18										
19										51 mm inside diameter monitoring well installed to 5.6 m
20	6.0	6.1		END OF BOREHOLE	SS-7	100	5	50=2"	100+	
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE
10 20 30 40 50 60 70 80 90

— m
— 0.91 m

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-10

BOREHOLE No.: BH10-17
ELEVATION: 250.7 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703105E 4892285N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0		GROUND SURFACE						
		0.3		**TOPSOIL** (300 mm)						
				TILL - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact - Occasional Organics to 0.9m	SS-1	92	15	0 2 5 5	7	Borehole open upon completion of drilling
	1.0				SS-2	100	19	3 4 6	10	
					SS-3	100	19	6 6 8	14	
	2.0									
		2.3		Brown Silty Sand, Some Clay, Trace Gravel, Wet, Loose	SS-4	100	14	2 3 6	9	Slight groundwater seepage encountered at 2.3 m during drilling
	3.0	3.0		**SAND** - Brown Sand, Some Silt, Trace Gravel, Damp, Very Dense	SS-5	94	6	39 42 24	66	
	4.0									
		4.6		Moist	SS-6	100	7	24 32 38	70	
	5.0									
	6.0									
		6.2		END OF BOREHOLE	SS-7	100	6	50=5"	100+	
	7.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-11

BOREHOLE No.: BH11-17
ELEVATION: 246.5 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703134E 4892182N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0		GROUND SURFACE						
				TOPSOIL (300 mm)						
		0.3		**TILL** - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact - Occasional Organics to 0.8m	SS-1	83	22	0 2 3 7	5	Borehole open upon completion of drilling
	1.0				SS-2	78	9	11 6 7	13	
					SS-3	100	14	7 6 7	13	
	2.0				SS-4	100	12	9 10 9	19	
	3.0	3.0		Dense	SS-5	72	10	14 17 18	35	Slight groundwater seepage encountered at 4.6 m during drilling WL - 4.8 m 10/17/2017
		4.6		Wet, Compact	SS-6	100	10	6 8 7	15	WL - 4.7 m 9/7/2017
	5.0									SS-7: 21% Gravel 48% Sand 31% Silt and Clay 20% between 5-75 µm
	6.0	6.1		Dense, With Gravel	SS-7	100	6	9 20 27	47	51 mm inside diameter monitoring well installed to 6.1 m
		6.6		END OF BOREHOLE						
	7.0									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS — m — 0.91 m

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019-01 ENCLOSURE No.: A-12

BOREHOLE No.: BH12-17
ELEVATION: 246.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group c/o Valdor Engineering

PROJECT: Proposed Residential Development - Fallis Line, Millbrook, Ontario

LOGGED BY: S. Shepherd DATE: 23 August 2017

DRILLING COMPANY: Landshark Drilling METHOD: Solid Stem Augers and Split Spoons

NOTES: Ground surface elevation interpolated from concept plan provided by Valdor Engineering with electronic title "16119_Fallis Line Subdivision_Preliminary Concept.pdf" by email dated July 11, 2017.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703196E 4892253N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
1				**TOPSOIL** (460 mm)	SS-1	75	17	0 2 2	4
		0.5		**TILL** - Brown Silty Sand, Some Clay, Trace Gravel, Moist, Compact - Occasional Organics to 0.9m				1	
3	1.0				SS-2	94	11	4 7 10	17
5		1.5		Dense	SS-3	100	6	12 20 24	44
6		1.8		**SAND** - Brown Sand, Some Silt, Trace Gravel, Damp, Very Dense					
	2.0				SS-4	100	4	21 50=5"	100+
10					SS-5	100	7	30 40 50	90
	3.0								
	4.0								
15					SS-6	100	6	50=5"	100+
	5.0								
17		5.2		Wet					
	6.0								
20		6.1		Damp	SS-7	100	9	50=4"	100+
		6.2		END OF BOREHOLE					
23	7.0								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_p W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

Groundwater seepage encountered at 5.2 m during drilling

▼ WL - 5.2 m 8/23/2017

BOREHOLE LOG GEOTECH 11148475-01, 17-08-22, BOREHOLE LOG, LR.GPJ GEOLOGIC.GDT 24/10/17

REFERENCE No.: 11224019 ENCLOSURE No.: A-13

BOREHOLE No.: BH1D-21
ELEVATION: 248.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 3 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

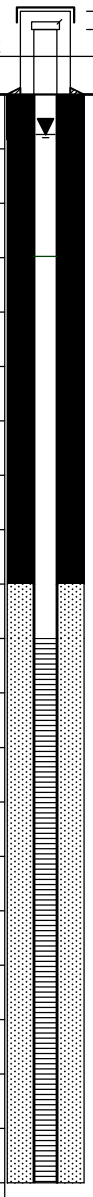
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

UTM: +/- 17T 703105.4E 4892846.0N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
				TOPSOIL (460mm)	SS-1	0		0 0 0 1	0
		0.5		**TILL** - Clayey Silt, Few Sand, Trace Gravel, Very Soft, Brown, Moist					
		0.8		Very Stiff				9 10 11 12	
	1.0				SS-2	100	17		21
					SS-3	100	15	9 9 15 12	24
	2.0				SS-4	100	22	7 8 8 8	16
	3.0	3.0		Stiff	SS-5	100	19	5 5 6 6	11
		4.6		Wet					
	4.0				SS-6	100	31	0 0 1 2	1
	5.0								
	6.0	6.1		Hard	SS-7	83	11	13 16 16 17	32
		6.7		END OF BOREHOLE					
	7.0								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
Atterberg limits (%) W_P W_L
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90



COMMENTS

- m
- 0.90 m

WL - 0.2 m 3/17/2021

- Borehole open upon completion with water level at approximately 3.7m

- SS5:
1% Gravel
5% Sand
54% Silt
40% Clay
(<0.002mm)
LL - 30%
PI - 16%

- Groundwater seepage first observed at approximately 4.6 m

- 50 mm diamter monitoring well installed to 6.1m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-14

BOREHOLE No.: BH1S-21
ELEVATION: 248.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 3 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

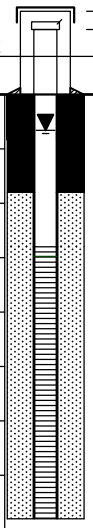
UTM: +/- 17T 703105.4E 4892846.0N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
				TOPSOIL (460mm)					
		0.5		**TILL** - Clayey Silt Few Sand Trace Gravel, Very Soft, Brown. Moist					
		0.8		Very Stiff					
	1.0								
	2.0								
		2.4		END OF BOREHOLE					
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS



WL - 0.2 m
3/17/2021

- Strata obtained from BH1D-21

- 50 mm diamter monitoring well installed to 2.3m

REFERENCE No.: 11224019 ENCLOSURE No.: A-15

BOREHOLE No.: BH2-21
ELEVATION: 249.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 3 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703243.9E 4892529.9N

Depth (ft / m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
0.0	0.0		GROUND SURFACE					
	0.2		**TOPSOIL** (200mm)	SS-1A	67	26	3 3	6
1			**TILL** - Sandy Silt, With Clay, Few Gravel, Loose, Dark Brown to Brown, Moist - Occasional Organics to 0.70m.	SS-1B		25	3 2	
2	0.7			SS-2A	50	21	3	32
3 1.0			Dense, Brown	SS-2B		9	10 22 19	
5	1.5		Very Dense	SS-3	79	7	12 22 50=5"	100+
6 2.0								
7	2.3		Dense	SS-4	67	11	13 15 18 12	33
9 10 3.0				SS-5	100	8	15 14 18 16	32
12 13 4.0								
14 15	4.6		Very Dense	SS-6	13	6	50=3"	100+
16 5.0								
17 18 19 6.0								
20	6.2		**SAND** - Sand, With Silt and Clay, Very Dense, Brown, Moist	SS-7A	46	9	32	100+
21				SS-7B		4	50=5"	
22	6.7		END OF BOREHOLE					
23 7.0								
24								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

- Borehole open and free of groundwater accumulation upon completion.

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-16

BOREHOLE No.: BH3-21
ELEVATION: 255.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND
SS - SPLIT SPOON
AS - AUGER SAMPLE
ST - SHELBY TUBE
CS - CORE SAMPLE
▼ - WATER LEVEL

UTM: +/- 17T 702896.8E 4892621.1N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE (10 20 30 40 50 60 70 80 90)	COMMENTS
		0.0		GROUND SURFACE							
				TOPSOIL (230mm)	SS-1A	54	34	2 3	5		
		0.2		**TILL** - Clayey Silt, Few Sand, Trace Gravel, Firm, Dark Brown to Brown, Moist - Occasional Organics to 0.85m.	SS-1B		35	2 2			
		0.8		Brown	SS-2A	33	36	2 2	5		
	1.0				SS-2B		33	3 2			
		1.5		Very Stiff				5 6			
				Sand Seam at 1.8m	SS-3	100	19	10 13	16		- SS3: 1% Gravel 11% Sand 45% Silt 43% Clay (<0.002mm)
	2.0	2.3		Hard				12 20			
					SS-4	100	10	16 18	36		
		3.0		Very Stiff Sand Seam at 3.2m				10 10			
	3.0				SS-5	100	10	15 12	25		
		3.7		Hard							
	4.0										
					SS-6	46	10	12 50=5"	100+		
	5.0										
	6.0										
					SS-7	100	21	18 16 21 24	37		
		6.7		END OF BOREHOLE							
	7.0										

- Borehole open upon completion with water level at approximately 6.4m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-17

BOREHOLE No.: BH4-21
ELEVATION: 257.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J.Scott DATE: 3 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

UTM: +/- 17T 702801.4E 4892676.0N

Depth (ft / m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
0.0	0.0		GROUND SURFACE					
	0.2		**TOPSOIL** (205mm)	SS-1A	83	33	2 2	5
1			**TILL** - Clayey Silt, Few Sand, Trace Gravel, Firm, Dark Brown to Brown, Moist - Occasional Organics to 0.60m.	SS-1B		25	3 4	
2	0.6		Stiff, Brown					
3 1.0				SS-2	50	18	5 4 5 5	9
4								
5				SS-3	88	19	3 4 5 5	9
6 2.0								
7	2.3		Very Stiff Sand Seam at 2.4m	SS-4	100	15	12 10 14 12	24
8								
9								
10 3.0	3.0		Hard, Occasional Cobbles	SS-5	46	9	17 23 50=4"	100+
11								
12								
13 4.0								
14								
15				SS-6	21	7	50=5"	100+
16 5.0								
17								
18								
19								
20 6.0	6.1		**SAND** - Sand, With Silt and Clay, Very Dense, Brown, Moist	SS-7	46	8	39 50=5"	100+
21	6.4		END OF BOREHOLE					
22								
23 7.0								
24								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

- Borehole open and free of groundwater accumulation upon completion.

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-18

BOREHOLE No.: BH5D-21
ELEVATION: 262.4 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J.Scott DATE: 5 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data. Well Tag Number A301561.

LEGEND
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

UTM: +/- 17T 702694.7E 4892571.5N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0		GROUND SURFACE						
				TOPSOIL (915mm)	SS-1	45	19	9 8 3 2	11	- Borehole open and free of groundwater accumulation upon completion.
		0.9		**FILL** - Sand, With Silt and Clay, Very Loose, Brown, Moist	SS-2A	71	29	3 2	4	
					SS-2B		7	2 1		WL - Dry 3/17/2021
		1.5		**ORGANIC SILT**	SS-3A	79	26	4 4	9	
		1.7		**SAND** - Sand, With Silt and Clay, Loose, Brown, Moist	SS-3B		5	5 2		
		2.3		Very Loose	SS-4	42	7	2 1 1 2	2	- SS4: 0% Gravel 82% Sand 11% Silt 7% Clay (<0.002mm)
		3.0		Dense	SS-5	67	7	14 14 17 18	31	
		4.6		Very Dense	SS-6	54	9	24 50=5"	100+	
		6.2		END OF BOREHOLE	SS-7	29	4	50=5"	100+	- 50 mm diamter monitoring well installed to 5.8m

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE
10 20 30 40 50 60 70 80 90

— m
— 1.08 m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-19

BOREHOLE No.: BH5S-21
ELEVATION: 262.4 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J.Scott DATE: 5 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702694.7E 4892571.5N

Depth (ft / m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
0.0	0.0		GROUND SURFACE					
			TOPSOIL (915mm)					
	0.9		**FILL** - Sand, With Silt and Clay, Very Loose, Brown, Moist					
	1.5		**ORGANIC SILT**					
	1.7		**SAND** - Sand, With Silt and Clay, Loose, Brown, Moist					
	2.2		END OF BOREHOLE					

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

— m
— 0.80 m

WL - Dry 3/17/2021

- Strata obtained from BH5D-21

- 50 mm diamter monitoring well installed to 2.2m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-20

BOREHOLE No.: BH6-21
ELEVATION: 259.1 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J.Scott DATE: 5 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

UTM: +/- 17T 702833.9E 4892513.0N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
				TOPSOIL (915mm)	SS-1	71	38	3 2 4 4	6
					SS-2A	67	19	2 5	34
	1.0	0.9		**FILL** - Sand, With Silt and Clay, Dense, Brown, Moist	SS-2B		10	29 20	
		1.6		**ORGANIC SILT**	SS-3A	63	11	16	29
		1.8		**TILL** - Sandy Silt, With Clay, Few Gravel, Compact, Brown, Moist	SS-3B		22	14	
	2.0				SS-3C		7	15	
								50=5"	
		2.3		Dense, Occasional Cobbles				14	
					SS-4	100	7	14 18 22	32
	3.0	3.0		Very Dense				22	
					SS-5	67	8	25 36 32	61
	4.0								
					SS-6	13	6	50=3"	100+
	5.0								
	6.0								
		6.2		END OF BOREHOLE	SS-7	21	6	50=5"	100+
	7.0								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

- Borehole open and free of groundwater accumulation upon completion.

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-21

BOREHOLE No.: BH7-21
ELEVATION: 259.3 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J.Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND
- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- WATER LEVEL

UTM: +/- 17T 702936.2E 4892456.8N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	COMMENTS
		0.0		GROUND SURFACE						
				TOPSOIL (300mm)	SS-1A	63	27	4 5	10	- Borehole open and free of groundwater accumulation upon completion.
1		0.3		**TILL** - Sandy Silt, With Clay, Few Gravel, Loose to Compact, Dark Brown to Brown, Moist	SS-1B		16	5 4		
2										
3	1.0	1.1		- Occasional Organics to 0.75m.	SS-2A	58	24	3 3	7	
				Compact, Brown	SS-2B		9	4 4		
5					SS-3	67	11	9 7 7 8	14	
6	2.0									
7										
8					SS-4	71	16	6 8 13 14	21	
9										
10	3.0									
11					SS-5	100	11	16 13 12 8	25	- SS5: 6% Gravel 34% Sand 46% Silt 14% Clay (<0.002mm)
12		3.7		Very Dense, Occasional Cobbles						
13	4.0									
15					SS-6	17	6	50=4"	100+	
16	5.0									
19										
20	6.0	6.2		END OF BOREHOLE	SS-7	21	5	50=5"	100+	
21										
22										
23	7.0									
24										

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m)
◆ RQD
◎ CONE

10 20 30 40 50 60 70 80 90

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-22

BOREHOLE No.: BH8-21
ELEVATION: 261.8 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 5 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702771.1E 4892372.6N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / Field / Lab / RQD / CONE	COMMENTS
		0.0		GROUND SURFACE							
		0.3		**TOPSOIL** (255mm)	SS-1		27	1 2 3 2	5		- Borehole open and free of groundwater accumulation upon completion.
		0.8		**TILL** - Sandy Silt, With Clay, Few Gravel, Loose, Brown, Moist							
	1.0			Very Dense	SS-2		13	5 11 50=1"	100+		
					SS-3		5	22 37 37 30	74		
	2.0	2.0		Occasional Cobbles							
					SS-4		5	27 44 50=5"	100+		
	3.0				SS-5		6	35 42 49 44	91		
	4.0										
					SS-6		7	48 50=5"	100+		
	5.0										
	6.0				SS-7		7	37 50=5"	100+		
		6.4		END OF BOREHOLE							
	7.0										

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-23

BOREHOLE No.: BH9-21
ELEVATION: 259.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702887.4E 4892348.3N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (%) / "N" Value (blows / 0.3 m) / RQD / CONE — 10 20 30 40 50 60 70 80 90	COMMENTS
		0.0		GROUND SURFACE							
		0.3		**TOPSOIL** (255mm)	SS-1A	12	28	5	12	× ○	- Borehole open and free of groundwater accumulation upon completion.
1				**TILL** - Sandy Silt, With Clay, Few Gravel, Compact, Dark Brown to Brown, Moist - Occasional Organics to 0.75m.	SS-1B		27	5 7		○	
2		0.8		Brown				4			
3	1.0				SS-2	24	19	4 6 8 7	14	× ○	
4											
5					SS-3	19	19	4 6 8 9	14	× ○	
6	2.0										
7								9			
8					SS-4	24	15	6 8 11	14	⊗	
9											
10	3.0							12			
11					SS-5	24	10	12 13 10	25	⊖ ×	
12											
13	4.0										
14											
15		4.6		Dense				19			
16	5.0				SS-6	24	17	17 24 24	41	⊖ ×	
17											
18											
19											
20	6.0	6.1		Very Dense, Occasional Cobbles	SS-7	22	10	10 18 50=4"	100+	⊖ ×	
21		6.5		END OF BOREHOLE							
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-24

BOREHOLE No.: BH10-21
ELEVATION: 253.0 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 703013.4E 4892304.0N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N	Shear test (Cu) / Sensitivity (S) / Water content (%) / Atterberg limits (W_P, W_l) / "N" Value (blows / 0.3 m) / Field △ / Lab □ / RQD ◆ / CONE ◎ — 10 20 30 40 50 60 70 80 90	COMMENTS
		0.0		GROUND SURFACE							
		0.2		**TOPSOIL** (230mm)	SS-1A	71	24	3 3	6	× ○	- Borehole open and free of groundwater accumulation upon completion.
1				**TILL** - Sandy Silt, With Clay Few Gravel, Loose, Dark Brown to Brown, Moist - Occasional Organics to 0.30m	SS-1B		23	3		○	
2		0.8			SS-1C		23	5		○	
3	1.0			Compact	SS-2	92	22	3 4 6 7	10	× ○	
5					SS-3	83	24	6 12 8 10	20	× ○	
6	2.0										
8		2.6		Dense, Occasional Cobbles	SS-4	88		32 6 22 19	28	×	
10	3.0				SS-5	100	15	16 20 26 26	46	○ ×	
13	4.0										
15		4.6		Very Dense, Occasional Cobbles	SS-6	42	16	25 50=3"	100+	○ ×	
16	5.0										
19	6.0										
20		6.2		END OF BOREHOLE	SS-7	16	6	50=4"	100+	○ ×	
21											
22											
23	7.0										
24											

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-25

BOREHOLE No.: BH11D-21
ELEVATION: 254.9 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND
SS - SPLIT SPOON
AS - AUGER SAMPLE
ST - SHELBY TUBE
CS - CORE SAMPLE
▼ - WATER LEVEL

UTM: +/- 17T 702829.8E 4892241.8N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
		0.3		**TOPSOIL** (275mm)	SS-1A	75	33	5 2	5
1				**TILL** - Clayey Silt, Few Sand, Trace Gravel, Firm, Dark Brown to Brown, Moist - Occasional Organics to 0.90m	SS-1B		29	3 3	
2									
3	1.0	0.9		Soft, Brown	SS-2A	67	21	3 2	4
					SS-2B		25	2 2	
4								2	
5		1.5		Stiff				3 6	
6	2.0				SS-3	100	10	7 10	13
7									
8		2.3		Very Stiff				5	
					SS-4	71	9	8 8	16
9								9	
10	3.0	3.0		Wet				6	
11					SS-5	100	16	8 12 10	20
12									
13	4.0								
14									
15								7	
16	5.0				SS-6	100	18	8 11 11	19
17									
18									
19									
20	6.0							10 12	
21					SS-7	100	17	13 14	25
22		6.7		END OF BOREHOLE					
23	7.0								
24									

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE
10 20 30 40 50 60 70 80 90

COMMENTS

— m
— 0.85 m

- Borehole open upon completion with water level at approximately 6.5m

- SS2B: 0% Gravel 6% Sand 54% Silt 40% Clay (<0.002mm)

WL - 2.5 m 3/17/2021

- Groundwater seepage first observed at approximately 3.0 m

- 50 mm diamter monitoring well installed to 6.0m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

REFERENCE No.: 11224019 ENCLOSURE No.: A-26

BOREHOLE No.: BH11S-21
ELEVATION: 254.9 m

BOREHOLE REPORT

Page: 1 of 1

CLIENT: Bromont Group
PROJECT: Geotechnical Investigation - 787 & 825 Fallis Line, Millbrook
LOGGED BY: J. Scott DATE: 4 March 2021
DRILLING COMPANY: Landshark Group METHOD: Solid Stem Augers and Split Spoons
NOTES: Ground surface elevation interpolated from ODTM Lidar Derived data.

LEGEND

- SS - SPLIT SPOON
- AS - AUGER SAMPLE
- ST - SHELBY TUBE
- CS - CORE SAMPLE
- ▼ - WATER LEVEL

UTM: +/- 17T 702829.8E 4892241.8N

Depth (ft)	Depth (m)	m Below Existing Grade	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	Type and Number	Recovery %	Moisture Content %	Blows per 6 in. / 15 cm	Penetration Index N
		0.0		GROUND SURFACE					
		0.3		**TOPSOIL** (275mm)					
				TILL - Clayey Silt, Few Sand, Trace Gravel, Firm, Dark Brown to Brown, Moist - Occasional Organics to 0.90m					
	1.0	0.9		Soft, Brown					
		1.5		Stiff					
	2.0	2.3		END OF BOREHOLE					
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								

Shear test (Cu) △ Field
Sensitivity (S) □ Lab
○ Water content (%)
W_P W_l Atterberg limits (%)
× "N" Value (blows / 0.3 m) ◆ RQD ◎ CONE

10 20 30 40 50 60 70 80 90

COMMENTS

— m
— 0.75 m

WL - 0.6 m
3/17/2021

- Strata obtained from BH11D-21

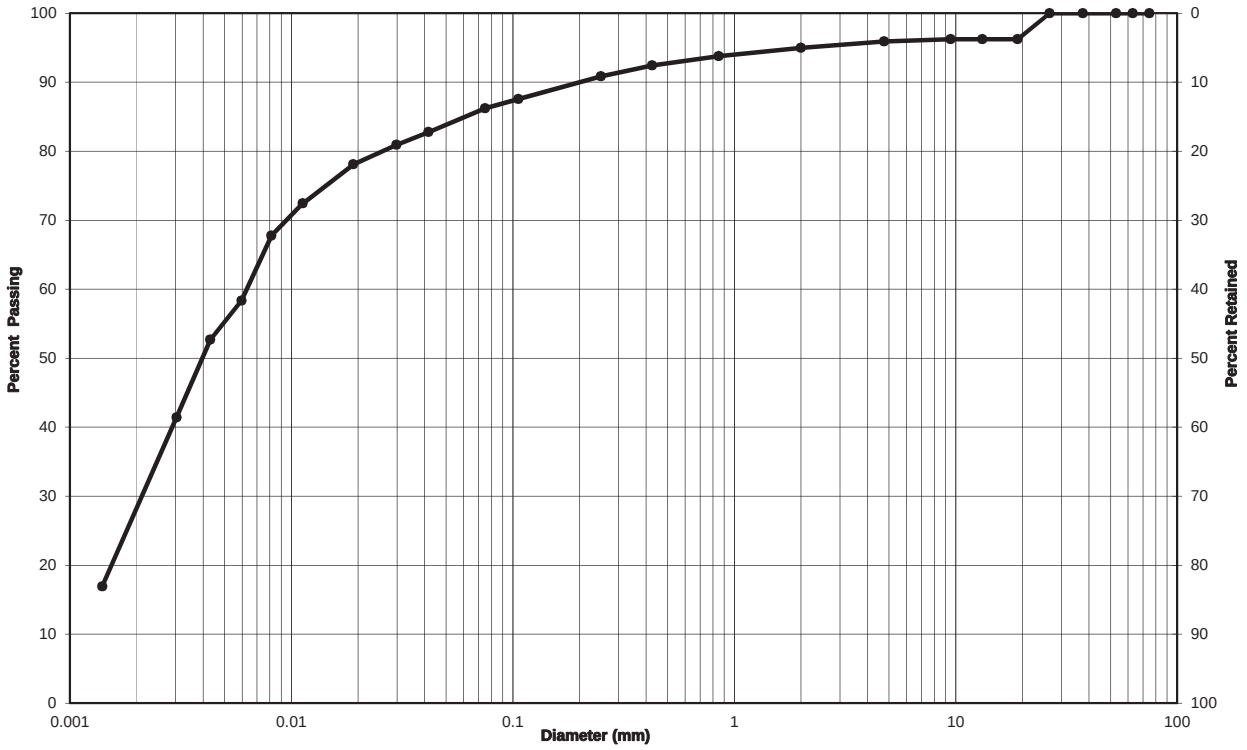
- 50 mm diamter monitoring well installed to 2.3m

BOREHOLE LOG GEOTECH 11224019-DSG-21-03-19, GINT BOREHOLE LOGS, JS.GPJ GEOLOGIC.GDT 22/3/21

Appendix B
Geotechnical Laboratory Testing Results

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01
Borehole no.:	BH1-17	Sample no.:	SS-3
Depth:	1.5 - 2.1 m	Enclosure:	B-1



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel	Sand	Clay & Silt
BH1-17 SS-3	4	10	86

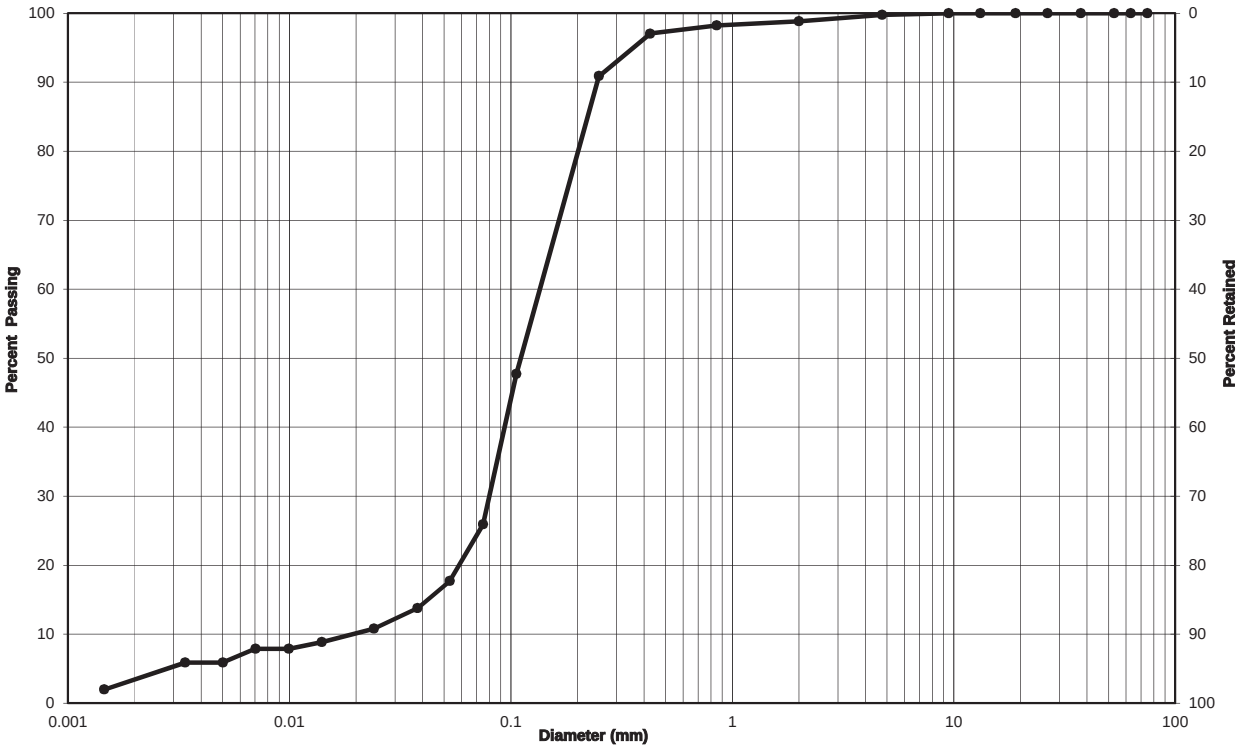
Remarks:

Performed by:	J. Sullivan	**Date:**	September 14, 2017
Verified by:		**Date:**	September 14, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01

Borehole no.:	BH4-17	Sample no.:	SS-6
Depth:	4.6 - 5.0 m	Enclosure:	B-2



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

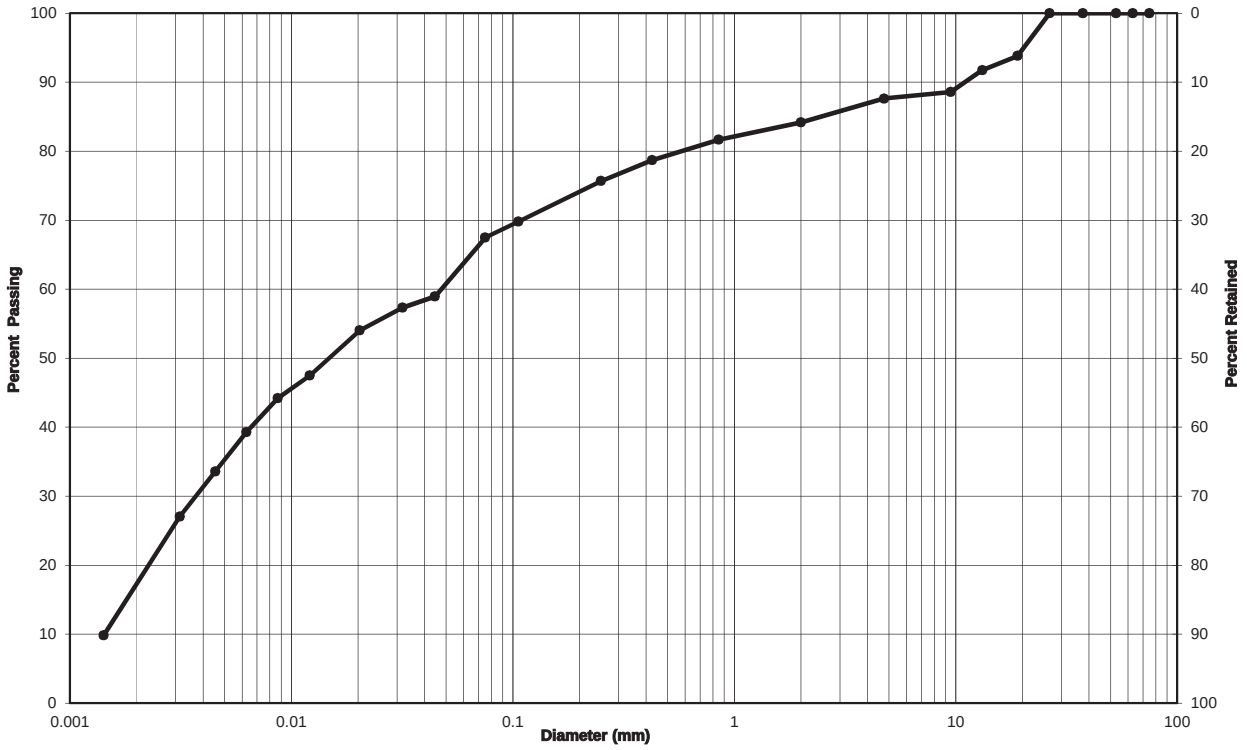
Soil Description	Gravel	Sand	Clay & Silt
BH4-17 SS-6	0	74	26

Remarks:

Performed by:	J. Sullivan	**Date:**	September 13, 2017
Verified by:		**Date:**	September 13, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01
Borehole no.:	BH6-17	Sample no.:	SS-2
Depth:	0.8 - 1.2 m	Enclosure:	B-3



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

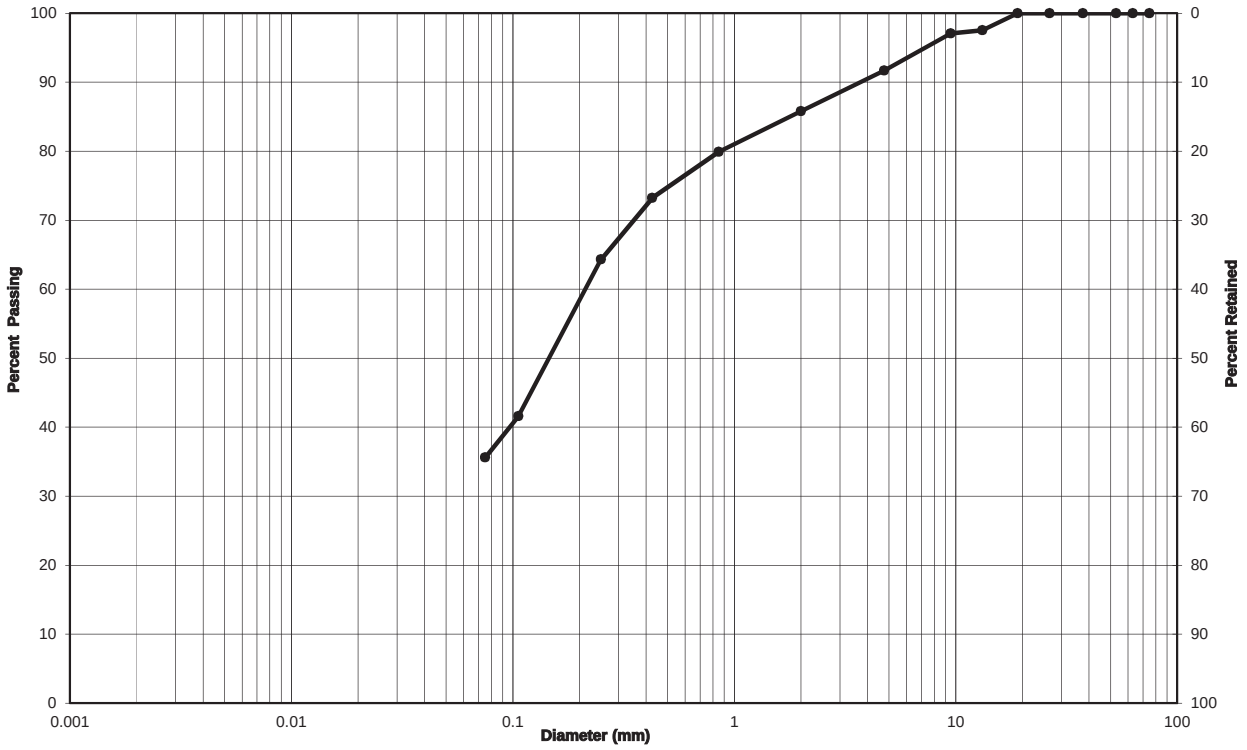
Soil Description	Gravel	Sand	Clay & Silt
BH6-17 SS2	12	20	68

Remarks:

Performed by:	J. Sullivan	**Date:**	September 14, 2017
Verified by:		**Date:**	September 14, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01
Borehole no.:	BH8-17	Sample no.:	SS-3
Depth:	1.5 - 1.8 m	Enclosure:	B-4



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

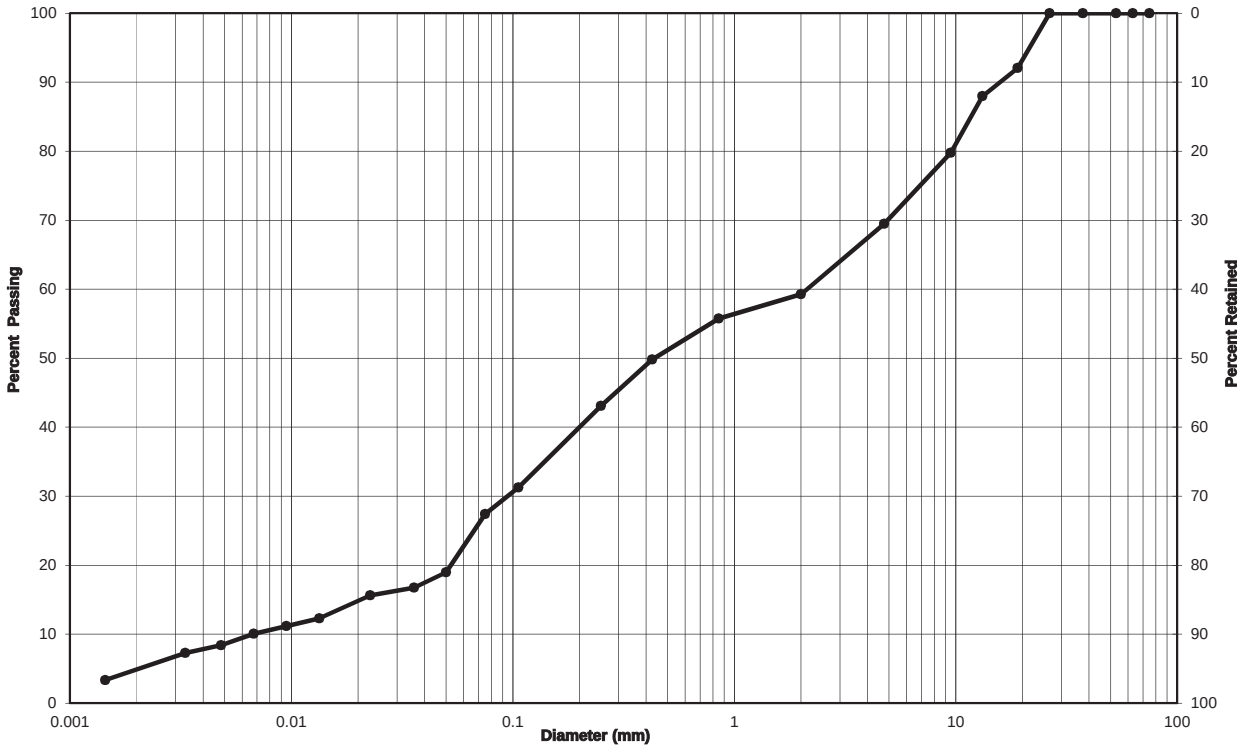
Soil Description	Gravel	Sand	Clay & Silt
BH8-17 SS-3	8	56	36

Remarks:

Performed by:	J. Sullivan	**Date:**	September 13, 2017
Verified by:		**Date:**	September 13, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01
Borehole no.:	BH9-17	Sample no.:	SS-5
Depth:	3.0 - 3.5 m	Enclosure:	B-5



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel	Sand	Clay & Silt
BH9-17 SS-5	31	42	27

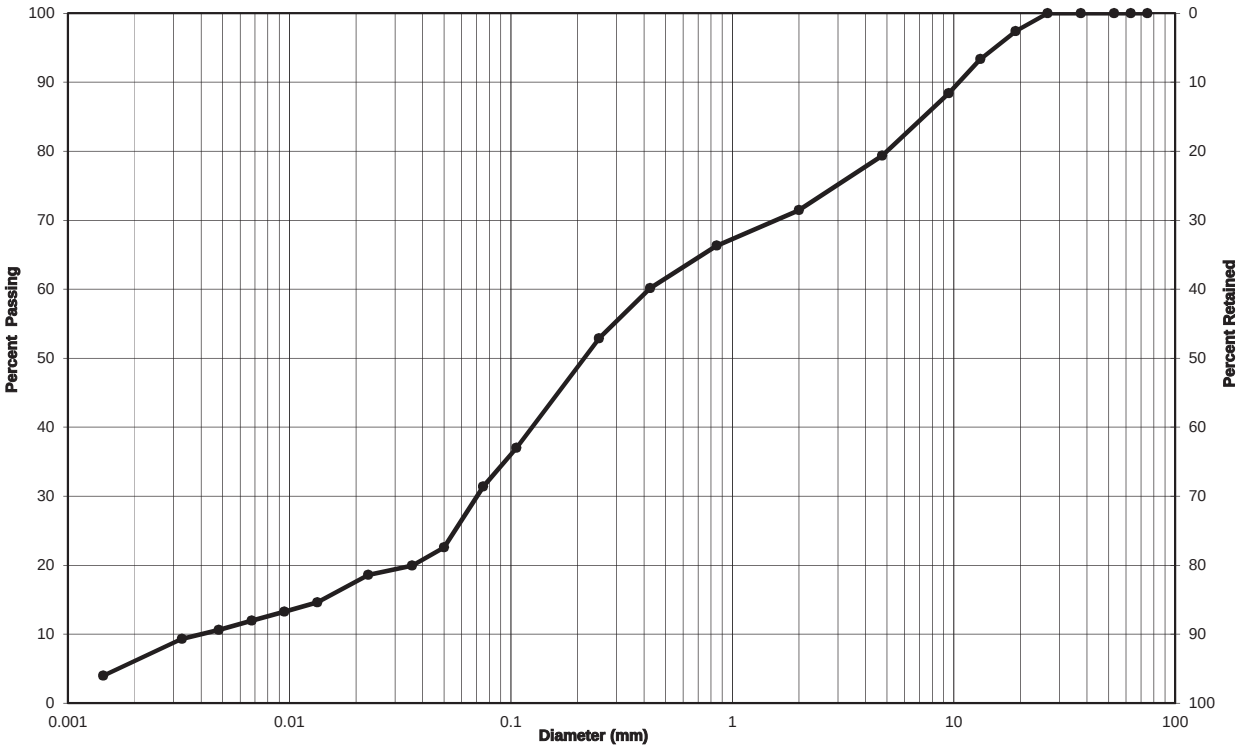
Remarks:

Performed by:	J. Sullivan	**Date:**	September 13, 2017
Verified by:		**Date:**	September 13, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont c/o Valdor Engineering	**Lab no.:**	SS-17-69
Project/Site:	Fallis Line Subdivision	**Project no.:**	11224019-01

Borehole no.:	BH11-17	Sample no.:	SS-7
Depth:	6.1 - 6.6 m	Enclosure:	B-6



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel	Sand	Clay & Silt
BH11-17 SS-7	21	48	31

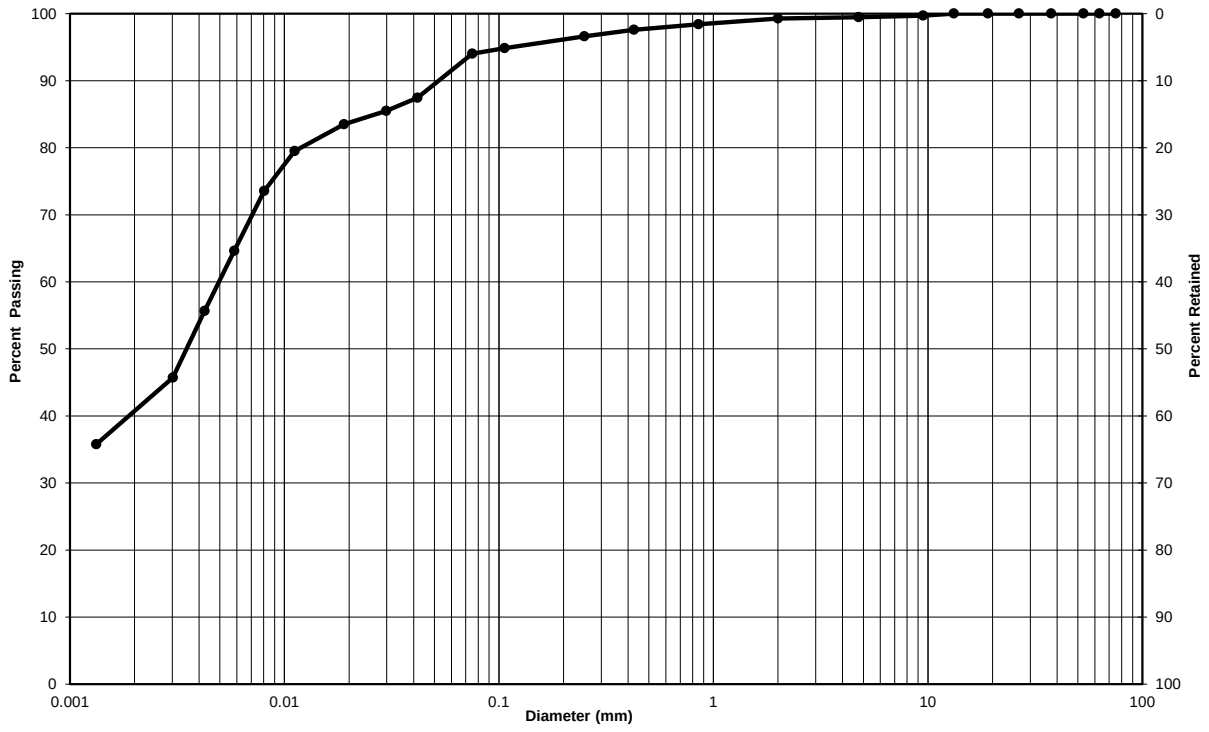
Remarks:

Performed by:	J. Sullivan	**Date:**	September 13, 2017
Verified by:		**Date:**	September 13, 2017

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH1-21	Sample no.:	SS5
Depth:	3.05 - 3.7 m	Enclosure:	B-7



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	1	5	94
Silt-size particles (%):	54		
Clay-size particles (%) (<0.002mm):	40		

Remarks:

Performed by:	Josh Sullivan	**Date:**	March 10, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

Liquid Limit, Plastic Limit and Plasticity Index of Soils (ASTM D4318)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH1-21	Sample no.:	SS5	Depth:	3.0 - 3.7 m
Soil description:	Lean Clay (CL)			Date sampled:	March 4, 2021

Apparatus:	1	Balance no.:	10	Porcelain bowl no.:	1
Liquid limit device no.:	1	Oven no.:	B23-02667	Spatula no.:	1
Sieve no.:	n/a	Glass plate no.:	1		

Liquid Limit (LL):

	Test No. 1	Test No. 2	Test No. 3
Number of blows	35	24	17
Water Content:			
Tare no.	5	21	24
Wet soil+tare, g	29.10	30.58	30.78
Dry soil+tare, g	27.38	28.46	28.53
Mass of water, g	1.72	2.12	2.25
Tare, g	21.41	21.50	21.43
Mass of soil, g	5.97	6.96	7.10
Water content %	28.8%	30.5%	31.7%

Plastic Limit (PL) - Water Content:

Tare no.	4	9
Wet soil+tare, g	27.85	28.01
Dry soil+tare, g	27.12	27.28
Mass of water, g	0.73	0.73
Tare, g	21.77	21.82
Mass of soil, g	5.35	5.46
Water content %	13.6%	13.4%
Average water content %	13.5%	

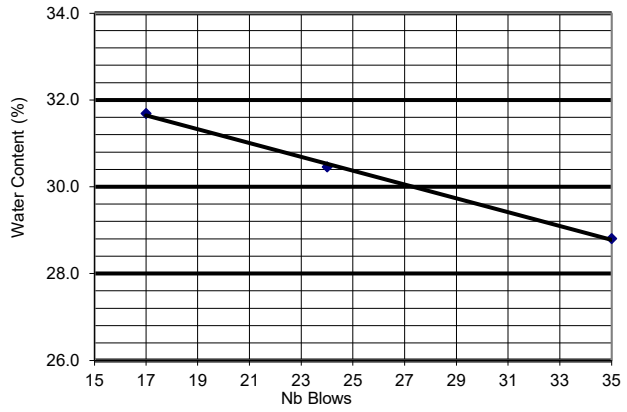
Natural Water Content (W^n):

Tare no.	BOWL	
Wet soil+tare, g	1029.22	
Dry soil+tare, g	897.03	
Mass of water, g	132.19	
Tare, g	209.79	
Mass of soil, g	687.24	
Water content %	19.2%	

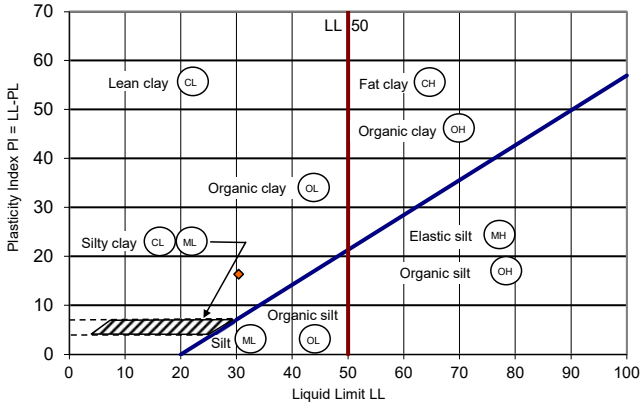
Soil Preparation:

- ☑ Cohesive <425 µm
- ☐ Cohesive >425 µm
- ☐ Non-cohesive
- ☑ Dry preparation
- ☐ Wet preparation

Results



Soil Plasticity Chart ASTM D2487



Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Natural Water Content W^n
30	14	16	19

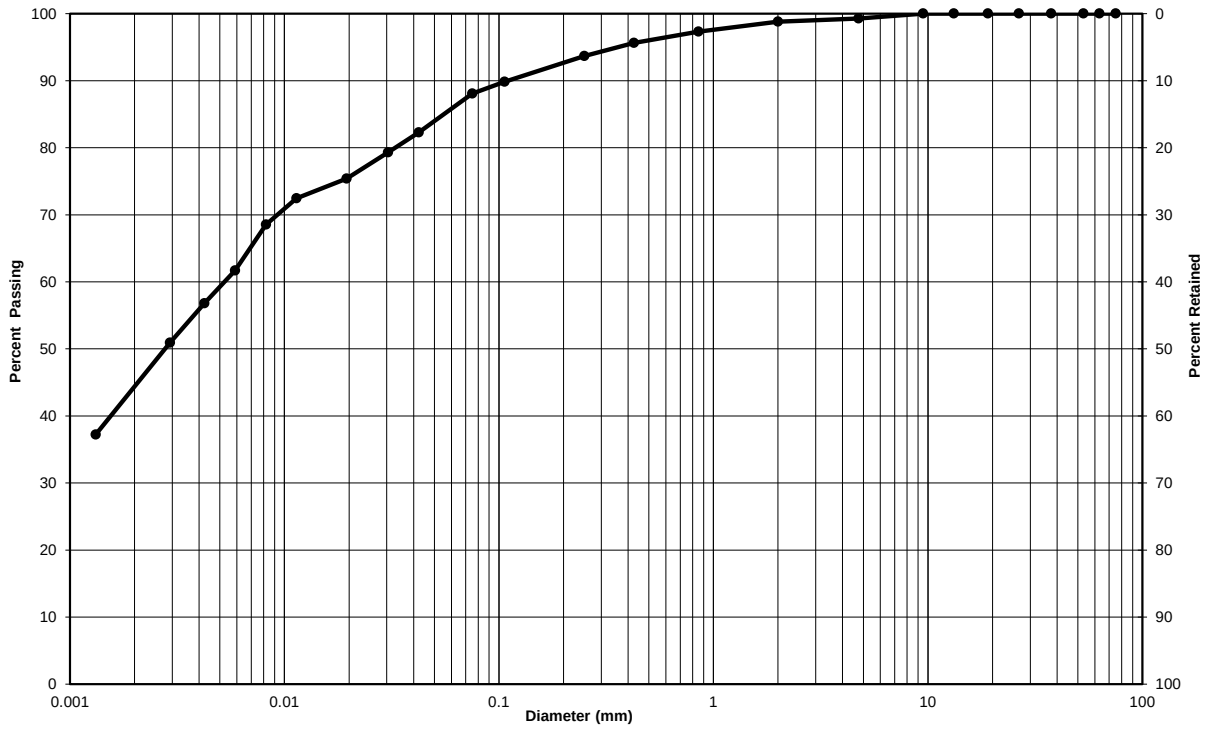
Remarks:

Performed by:	Josh Sullivan	**Date:**	March 11, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH3-21	Sample no.:	SS3
Depth:	1.5 - 2.1 m	Enclosure:	B-8



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	1	11	88
Silt-size particles (%):	45		
Clay-size particles (%) (<0.002mm):	43		

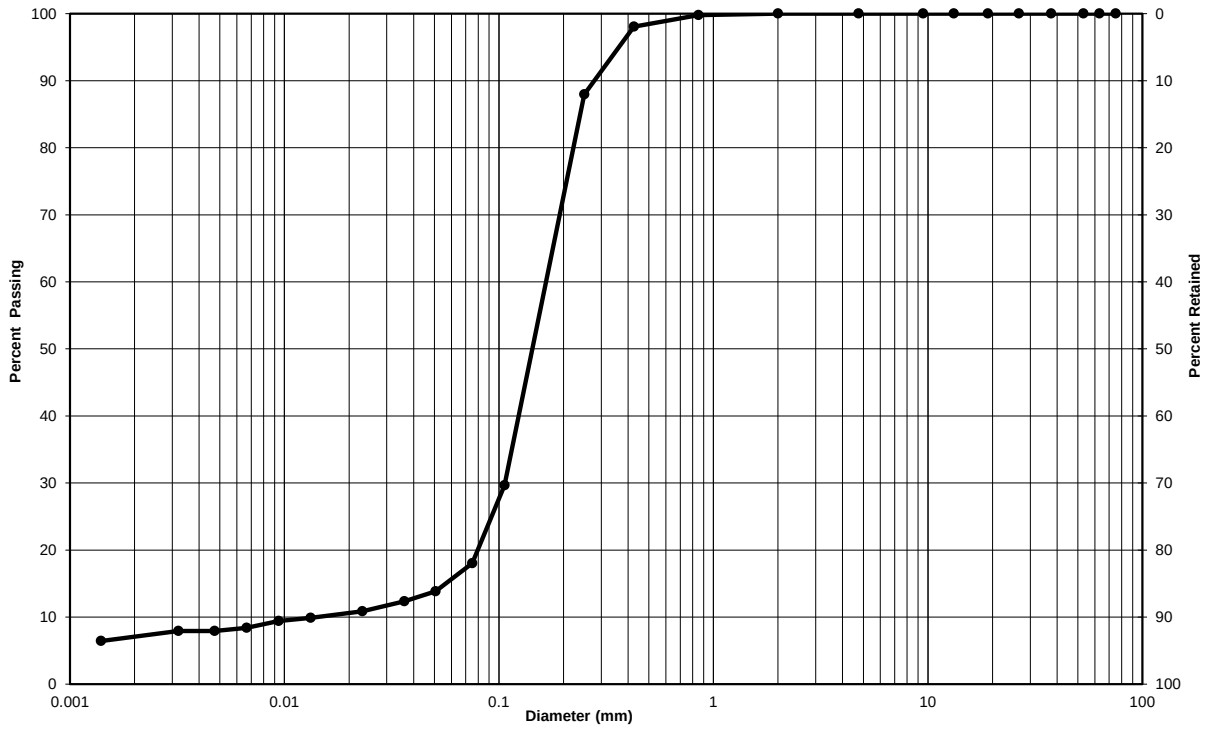
Remarks:

Performed by:	Josh Sullivan	**Date:**	March 10, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH5-21	Sample no.:	SS4
Depth:	2.3 - 2.9 m	Enclosure:	B-9



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	0	82	18
Silt-size particles (%):	11		
Clay-size particles (%) (<0.002mm):	7		

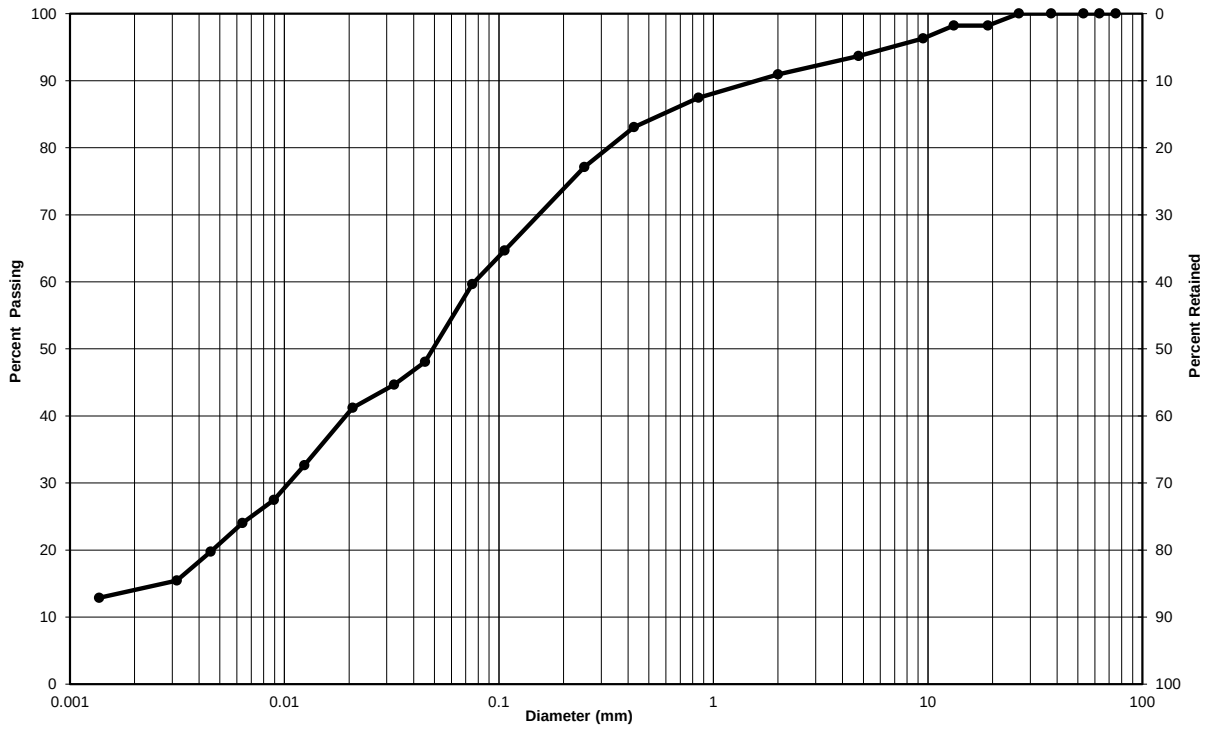
Remarks:

Performed by:	Josh Sullivan	**Date:**	March 10, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH7-21	Sample no.:	SS5
Depth:	3.1 - 3.7 m	Enclosure:	B-10



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	6	34	60
Silt-size particles (%):	46		
Clay-size particles (%) (<0.002mm):	14		

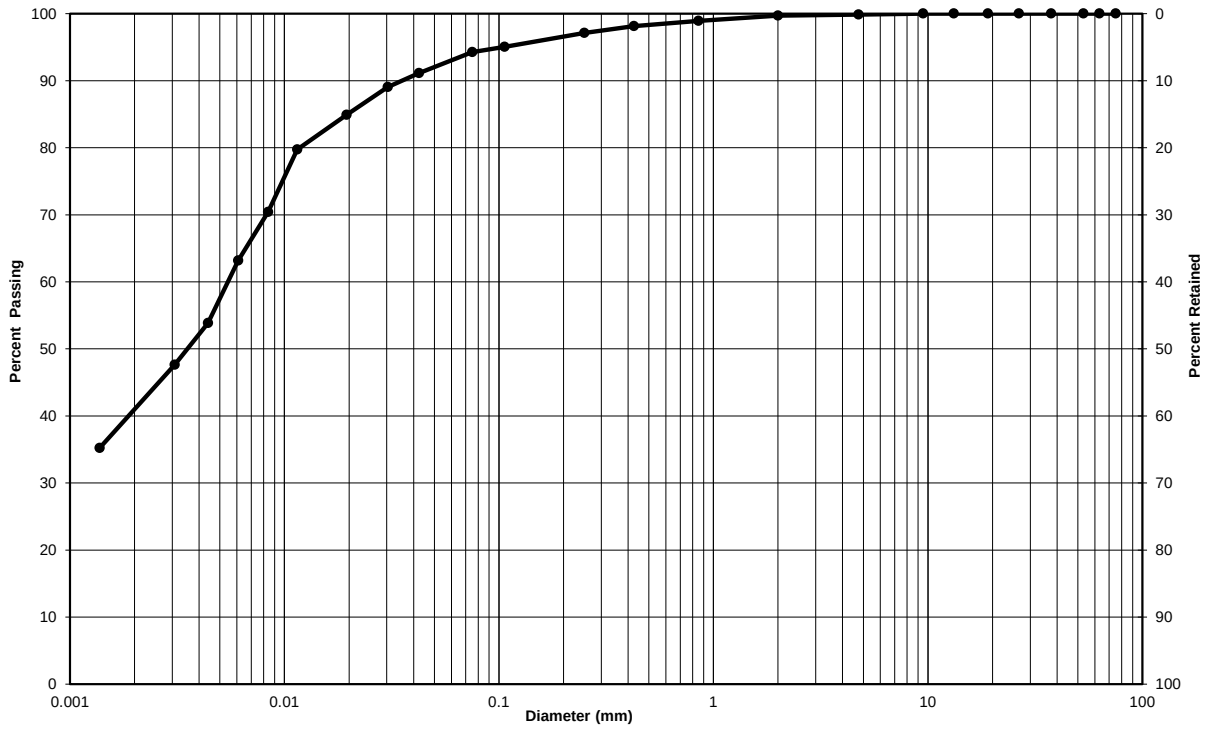
Remarks:

Performed by:	Josh Sullivan	**Date:**	March 10, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

Particle-Size Analysis of Soils (Geotechnical) (USCS) (ASTM D422)

Client:	Bromont Group	**Lab no.:**	SS-21-17
Project/Site:	Fallis Line	**Project no.:**	11224019

Borehole no.:	BH11-21	Sample no.:	SS2B
Depth:	0.9 - 1.35 m	Enclosure:	B-11



Clay & Silt	Sand			Gravel	
	Fine	Medium	Coarse	Fine	Coarse
Unified Soil Classification System					

Soil Description	Gravel (%)	Sand (%)	Clay & Silt (%)
	0	6	94
Silt-size particles (%):	54		
Clay-size particles (%) (<0.002mm):	40		

Remarks:

Performed by:	Josh Sullivan	**Date:**	March 10, 2021
Verified by:	Joe Sullivan	**Date:**	March 12, 2021

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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