APPENDIX A: Geotechnical Report, Stantec, File no 3702, Aug 21, 2015

Geotechnical Investigation – Proposed Barn #80 Addition and Proposed Greenhouse Expansion, Harrington Farms, Queens County, PEI

Job No. 121618196 – File No. 3702

Stantec

Prepared for:

Public Works and Government
Services Canada
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August 21, 2015

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August 21, 2015
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Attention: Ms. Brenda Victor, P.Eng.
Public Works and Government Services Canada
3 Queen Street (Cambridge Building)
PO Box 1268
Charlottetown PE C1A 8R4

Dear Ms. Victor,

Reference: Geotechnical Investigation – Proposed Barn #80 Addition and Proposed Greenhouse Expansion, Harrington Farms, Queens County, PEI

This report presents the results of the geotechnical investigation carried out for the above-noted project, in accordance with your request. The purpose of the investigation was to establish the subsurface conditions within the area of the proposed buildings to be constructed and, based on the conditions encountered, to provide geotechnical engineering recommendations pertaining to site preparation and foundation design.

It is understood that the proposed development is to consist of an addition to the existing Barn #80 and an expansion to the existing greenhouse building. The addition to Barn #80 will consist of a single storey, slab-on-grade structure, and have plan dimensions of approximately 12 m by 14 m. The greenhouse expansion is to consist of a single storey, slab-on-grade structure with the exception of a central corridor through the greenhouse which will have a full basement below. The expansion is to have plan dimensions of approximately 18 m by 19 m. It is assumed that the main floor level of both buildings will be set at existing grade within the building area.

PROCEDURE

The field work for the present investigation was carried out on June 17, 2015, and consisted of drilling a total of four (4) boreholes with a track mounted auger drill rig. The boreholes were designated BH-01 and BH-02 for the proposed Barn #80 addition location, and BH-03 and BH-04 for the proposed greenhouse expansion location. The boreholes were all advanced to a depth of 4.57m below present grade at the locations shown on the appended Drawing No. 1.

Samples of the overburden soils encountered were taken at regular intervals by means of a conventional split spoon sampler during the performance of Standard Penetration Tests.

All soil samples recovered were placed in moisture-proof containers and were delivered to our Charlottetown laboratory for classification and testing. All soil samples remaining after testing will

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be stored for a period of three months from the date of issue of this report, after which they will be discarded unless directions to the contrary are received.

Detailed logs of the strata encountered at the site, and of the sampling and testing carried out are shown on the appended Borehole Records.

The locations and elevations of the boreholes were established in the field by our personnel. The borehole locations were established relative to the existing buildings. Ground surface elevations at the borehole locations are referenced to an Assumed Datum. A benchmark, assigned an elevation of 100.0 m, was established for each addition/expansion and are both shown on Drawing No. 1.

SUBSURFACE CONDITIONS

The subsurface conditions encountered at the boreholes are shown in detail on the appended Borehole Records, are summarized on Table 1 (also appended) and are described below.

Proposed Barn #80 Addition

Fill

Fill materials were encountered at the surface of both borehole locations. The ground surface was asphalted (100 to 150 mm in thickness), overlying 150 to 200 mm of grey gravel, which was overlying a reddish brown silty sand fill. The thickness of the fill was found to be 0.61 m at each borehole.

Standard Penetration Test N-values within the fill were found to be 22 and 23, indicating a compact compactness.

Two (2) grain size analyses (curves appended) performed on split spoon samples of the fill material shows it to contain 29 percent gravel, 44 to 46 percent sand, and 25 to 27 percent fines (i.e., silt and clay sizes). The moisture content of selected samples of the fill was found to be 5 and 6 percent.

Glacial Till

A reddish brown glacial till stratum, ranging in thickness from 2.03 to 2.16 m, was encountered directly below the fill layer. The till was found to consist of a silty sand (SM) with gravel.

The N-values obtained within the till (20 to 58) show the till to have a compact to very dense compactness. One N-value of 58 obtained within this layer at BH-02 is likely attributed to the presence of cobbles.

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Grain size analyses (curves appended) performed on representative split spoon samples of the till show it to contain 30 to 32 percent gravel, 33 to 38 percent sand, and 30 to 37 percent fines. The natural moisture content of selected samples of the till was found to range from 10 to 11 percent.

Bedrock

Sandstone bedrock was inferred at both borehole locations based on split spoon refusal and resistance to auger advancement. The depth below grade to the bedrock surface was found to be 2.64 to 2.77 m. The elevation of the inferred bedrock surface was found to range from el. 96.37 m at BH-02 to el. 97.06 m at BH-02.

Groundwater

Groundwater was not encountered within the depth investigated. Fluctuations of the groundwater table can occur as a result of seasonal variations and/or in response to significant weather events.

Proposed Greenhouse Expansion

Topsoil

A naturally occurring layer of rootmat and topsoil, 200 mm in thickness, was encountered at the surface of each borehole/test pit. The topsoil was found to consist of a loose brown silty sand containing trace to some gravel and roots.

Glacial Till

A reddish brown glacial till stratum, ranging in thickness from 2.49 to 2.77 m, was encountered directly below the topsoil layer. The till was found to consist of a silty sand (SM) with gravel. The silt content increased in BH-04.

The N-values obtained within the till (16 to 25) show the till to have a compact compactness.

Grain size analyses (curves appended) performed on representative split spoon samples of the till show it to contain 10 to 30 percent gravel, 21 to 45 percent sand, and 33 to 69 percent fines. The natural moisture content of selected samples of the till was found to range from 11 to 17 percent.

Bedrock

Sandstone bedrock was inferred at both borehole locations based on split spoon refusal and resistance to auger advancement. The depth below grade to the bedrock surface was found to be 2.69 to 2.97 m. The elevation of the inferred bedrock surface was found to range from el. 96.10 m at BH-03 to el. 96.45 m at BH-04.

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Groundwater

Groundwater was encountered at a depth of 2.13 m at both borehole locations. Fluctuations of the groundwater table can occur as a result of seasonal variations and/or in response to significant weather events.

DISCUSSION AND RECOMMENDATIONS

Overview

Site Preparation

Site preparation to permit the use of conventional spread footing foundations and slab-on-grade construction for both sites will require the removal of all fill, surficial vegetation and the rootmat/topsoil layer from within the proposed building areas.

All surface runoff should be directed away from excavated areas to prevent disturbance of the native till which is susceptible to water-softening. The groundwater table was encountered at 2.13 m below present grade at the proposed greenhouse expansion location and may be encountered during excavation for the basement area; therefore, dewatering of excavations should be expected.

Upon removal of all unsuitable soils from within the building area, any low areas should be brought up to the required subgrade level using structural fill. Structural fill should consist of an approved soil (preferably granular) which is free of organics and deleterious material such as a pit run sandstone or other approved inorganic soil. Fill material meeting the current Prince Edward Island Transportation and Public Works (PEITPW) Select Borrow specification (ie. maximum of 30 percent fines based on the minus 4.75 mm sieve fraction) would be acceptable for use.

Excavated site till that has a moisture content within two percent of optimum would also be acceptable for reuse as structural fill. The results of the moisture content tests indicate that the present moisture levels of the till are either within, or above, the required range to achieve proper compaction. Site till that has a moisture content above the optimum range, either naturally or as a result of precipitation, would have to be permitted to dry or be used for non-structural applications such as landscaping.

All structural fill placed within the building area should be placed and compacted in lifts to 100 percent of Standard Proctor maximum dry density. Lift thicknesses must be compatible with the compaction equipment used, and the fill material selected, in order to achieve the required density throughout.

Site preparation activities should be undertaken during dry weather. It is recommended that operation of equipment and construction traffic (particularly tandem trucks) over the native till be carefully planned to prevent disturbance of this soil.

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If construction is carried out during the winter, it should be noted that all earthworks performed during freezing conditions are suspect, and special measures are required. Structural fill should not be placed over frozen material; any soil that becomes frozen after placement must be removed, or allowed to thaw prior to the placement of subsequent lifts.

It is recommended that site preparation be monitored by experienced geotechnical personnel to ensure that all unsuitable materials are removed, that only suitable replacement fills are used, and that the required degree of compaction is attained.

Foundations

An allowable bearing pressure of up to 175 kPa may be used for design of footings placed on the undisturbed native till or on structural fill (prepared as outlined above). Associated total and differential settlements would be within tolerable limits for a conventional structure. All footings subjected to freezing conditions should have a minimum soil cover of 1.5 m (or equivalent insulation) for frost protection.

Structural fill used as a bearing stratum must extend outward beyond the exterior footing base perimeter a distance at least equal to the depth of fill placed below the footing to include the full stress zone of influence.

Groundwater, if encountered, should be kept to a minimum in the footing excavations to prevent disturbance of the till which is susceptible to water softening. Control of groundwater inflow may require pumping from a temporary sump(s) installed below founding level.

It is recommended that final excavation for footings be carried out with a ditching type bucket (i.e. no teeth) so as to minimize disturbance of the bearing surface. Any soil that becomes disturbed as result of construction activity and/or water should be removed from the bearing surface prior to footing placement. If softening persists, consideration could be given to the over-excavation of the bearing surface (e.g. by 300 mm) to allow the placement/compaction of a clean gravel layer. The gravel would stabilize the bearing surface and facilitate dewatering of the footing excavation. Alternatively, the use of a lean concrete layer (i.e. mud slab) could be considered to stabilize the bearing surface.

If winter construction is anticipated, all bearing surfaces, footings, foundation walls and floor slabs must be protected against freezing.

Slab-on-Grade/Foundation Drainage

A slab-on-grade may be cast over the native till or structural fill. A layer of compacted, free-draining granular material should be used under the floor slab area. Depending on the founding level selected, the basement floor may extend below the groundwater table. Furthermore, seasonal variations of the groundwater table could result in higher levels than those recorded

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during the present investigation. The following design elements should therefore be provided as a minimum:

- perimeter footing drains with a positive discharge for all areas where the floor level is located below final exterior grade;
- a heavy duty under-slab vapour barrier; and,
- damp-proofing of basement walls to final exterior grade.

In addition to the above, consideration could also be given to the use of an under-slab drainage system and/or a water-proofing system (e.g., impervious membrane) depending on the basement floor elevation selected and on the intended use of the basement area.

Basement Walls

Basement walls should be backfilled with a well-graded, free-draining, granular material such as a clean, coarse gravel with a maximum size of 50 mm. It would be necessary to fill the zone above a line drawn upward at 55 degrees to the horizontal from the back of the footing with this material to allow wall design to be based on the granular backfill. If a lesser wedge of granular backfill is utilized, the properties of the existing fill/native till must be used. In any case, all backfill placed within 450 mm of the wall, and to within 450 mm of finished grade, should consist of free draining granular material for drainage purposes. The use of a non-woven geotextile is recommended to encapsulate the granular backfill and to prevent the migration of fines into this material. The following geotechnical design parameters are recommended for foundation wall design:

Backfill Type	Total Unit Weight, kN/m³	Submerged Unit Weight, kN/m³	Effective Internal Friction Angle, degrees	Earth Pressure Coefficients		
				Ka	Ko	Kp
Granular Fill (clean crushed gravel)	20.5	10.7	34	0.28	0.44	3.54
Existing Fill/Native Till	21.0	11.2	30	0.33	0.50	3.00

Note: Ka would apply to walls that are free to rotate, whereas Ko would be applicable for a wall that is fixed at the top. The earth pressure coefficients given above are based on a vertical wall and a horizontal backfill surface; effects of wall friction are not considered.

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The wall backfill should be compacted to 95 percent of Standard Proctor density. Near the wall, compaction should be carried out with light equipment to prevent over stressing of the wall.

CLOSING COMMENTS

Use of this report is subject to the Statement of General Conditions provided in the Appendix. It is the responsibility of Public Works and Government Services Canada, which is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

We trust that this report it contains all of the information required at this time. This report was written by Mark Macdonald, P.Eng., and reviewed by Mark Bochmann, P.Eng. Should you have any questions or if we can be of further service, please contact us at your convenience.

Regards,

STANTEC CONSULTING LTD.

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APPENDIX

STATEMENT OF GENERAL CONDITIONS

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INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

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SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

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

Terminology describing soil structure:

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

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

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

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

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

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

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

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

ROCK DESCRIPTION

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

Terminology describing rock quality:

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

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

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

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

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

Terminology describing rock with respect to discontinuity and bedding spacing:

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

Terminology describing rock strength:

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

Terminology describing rock weathering:

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

STRATA PLOT

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

Boulders Cobbles Gravel	Sand	Silt	Clay	Organics	Asphalt	Concrete	Fill	Igneous Bedrock	Meta-morphic Bedrock	Sedi-mentary Bedrock

SAMPLE TYPE

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

WATER LEVEL MEASUREMENT

▼ measured in standpipe, piezometer, or well

▽ inferred

RECOVERY

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

N-VALUE

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

DYNAMIC CONE PENETRATION TEST (DCPT)

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

OTHER TESTS

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

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

Table 1 - Borehole Summary - Harrington Farms, Harrington, Queens County, PE

	Borehole Number			
	Proposed Barn #80 Addition		Proposed Greenhouse Expansion	
	BH-01	BH-02	BH-03	BH-04
Ground Surface el., m	99.83	99.01	99.07	99.14
Asphalt Thickness, m	0.15	0.10	---	---
Gravel Thickness, m	0.15	0.20	---	---
Silty Sand Fill Thickness, m	0.31	0.31	---	---
Rootmat and Topsoil Thickness, m	---	---	0.20	0.20
Till Surface el., m	99.22	98.40	98.87	98.94
Till Thickness, m	2.16	2.03	2.77	2.49
Depth to Groundwater, m	>4.57	>4.57	2.13	2.13
Groundwater Surface el., m	<95.26	<94.44	96.94	97.01
Depth to Bedrock, m	2.77	2.64	2.97	2.69
Bedrock Surface el., m	97.06	96.37	96.10	96.45
Total Depth Drilled, m	4.57	4.57	4.57	4.57

NOTES:

- the boreholes were drilled at the site during on June 17, 2015 with an auger drill rig
- ground surface elevations are referenced to an assumed datum based on the benchmarks provided
- sandstone bedrock was inferred by auger drilling at each borehole

Stantec

BOREHOLE RECORD

BH-01

CLIENT Public Works and Government Services Canada
LOCATION Harrington Farms, Queens County, PEI
DATES: BORING 2015/06/17
WATER LEVEL Not Encountered
PROJECT No. 121618196
BOREHOLE No. BH-01
DATUM ASSUMED

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
0	99.83	Proposed Barn #80						
	99.7	ASPHALT (150 mm)						
	99.5	FILL: compact grey gravel with sand			SS	1	450	23
	99.2	FILL: compact reddish brown silty sand (SM) with gravel						
1		Compact reddish brown silty sand (SM) with gravel: GLACIAL TILL			SS	2	500	24
					SS	3	450	21
2					SS	4	475	27
	97.1				SS	5	350	81/175
3		Inferred sandstone: BEDROCK						
4	95.3							
5		End of borehole at 4.57 meters.						
6								

Undrained Shear Strength - kPa
50 100 150 200

Water Content & Atterberg Limits W_P W W_L
Dynamic Penetration Test, blows/0.3m ★
Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test
☐ Field Vane Test ■ Remoulded
✖ Fall Cone

Stantec BOREHOLE RECORD BH-02

CLIENT: Public Works and Government Services Canada
LOCATION: Harrington Farms, Queens County, PEI
DATES: BORING 2015/06/17
WATER LEVEL: Not Encountered
PROJECT No. 121618196
BOREHOLE No. BH-02
DATUM: ASSUMED

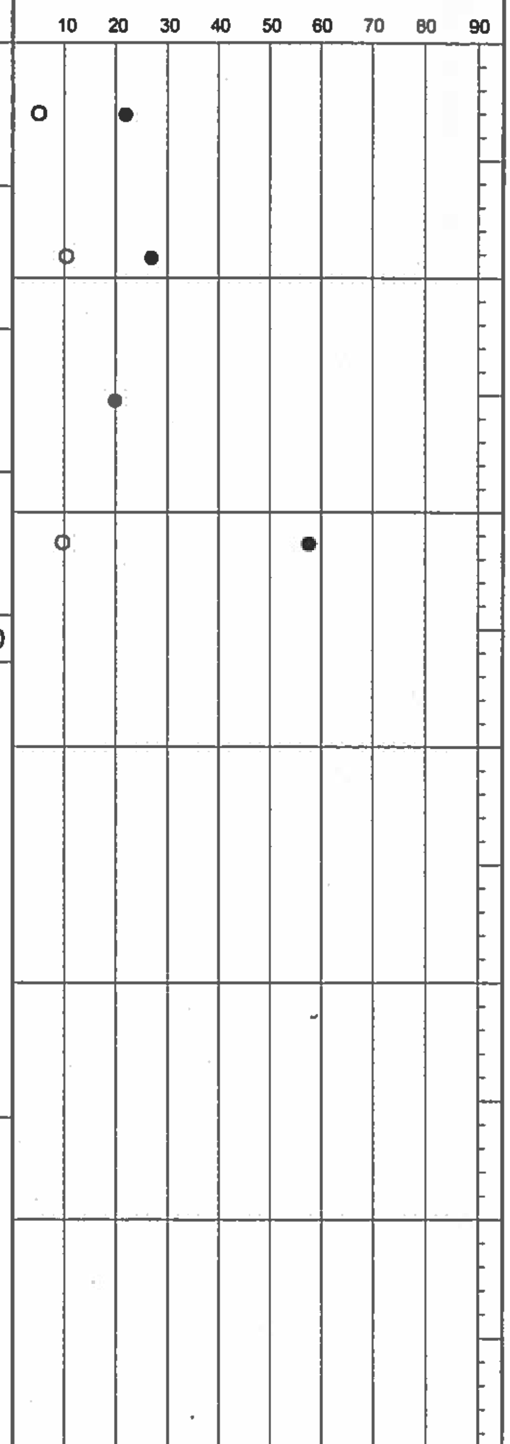
DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
	99.01	Proposed Barn #80						
0	98.9	ASPHALT (100 mm)						
	98.7	FILL: compact grey gravel with sand			SS	1	425	22
	98.4	FILL: compact reddish brown silty sand (SM) with gravel						
1		Compact reddish brown silty sand (SM) with gravel: GLACIAL TILL			SS	2	500	27
					SS	3	400	20
2					SS	4	500	58
	96.4				SS	5	200	50/50
3		Inferred sandstone: BEDROCK						
4	94.4							
5		End of borehole at 4.57 meters.						
6								

Undrained Shear Strength - kPa: 50, 100, 150, 200

Water Content & Atterberg Limits: W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●



△ Unconfined Compression Test
☐ Field Vane Test ■ Remoulded
✖ Fall Cone

Stantec

BOREHOLE RECORD

BH-03

CLIENT Public Works and Government Services Canada

LOCATION Harrington Farms, Queens County, PEI

DATES: BORING 2015/06/17

WATER LEVEL June 17, 2015 (2.13 m)

PROJECT No. 121618196

BOREHOLE No. BH-03

DATUM ASSUMED

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD	SPT blows/0.3m	Water content
0	99.07	Proposed Greenhouse Expansion								
	98.9	Rootmat (50 mm) and brown silty sand topsoil								
		Compact reddish brown silty sand (SM) with gravel: GLACIAL TILL			SS	1	400	8	●	○
1					SS	2	475	21	●	
					SS	3	425	23	●	○
2				▽	SS	4	400	16	●	○
					SS	5	400	25	●	
3	96.1	Inferred sandstone: BEDROCK								
					SS	6	0	50/50		
4										
	94.5	End of borehole at 4.57 meters.								
5										
6										

Undrained Shear Strength - kPa: 50, 100, 150, 200

Water Content & Atterberg Limits W_P W W_L

Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test

□ Field Vane Test ■ Remoulded

✖ Fall Cone

Stantec

BOREHOLE RECORD

BH-04

CLIENT: Public Works and Government Services Canada
PROJECT No. 121618196

LOCATION: Harrington Farms, Queens County, PEI
BOREHOLE No. BH-04

DATES: BORING 2015/06/17
WATER LEVEL June 17, 2015 (2.13 m)
DATUM ASSUMED

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD
	99.14	Proposed Greenhouse Expansion				
0	98.9	Rootmat (50 mm) and brown silty sand topsoil				
		Compact reddish brown silty sand (SM) with gravel: GLACIAL TILL -higher silt content near bedrock contact	SS	1	325	8
1			SS	2	450	20
			SS	3	450	25
2			SS	4	475	24
	96.5		SS	5	200	50/100
3		Inferred sandstone: BEDROCK				
4	94.6					
		End of borehole at 4.57 meters.				
5						
6						

Undrained Shear Strength - kPa: 50, 100, 150, 200

Water Content & Atterberg Limits W_P W W_L

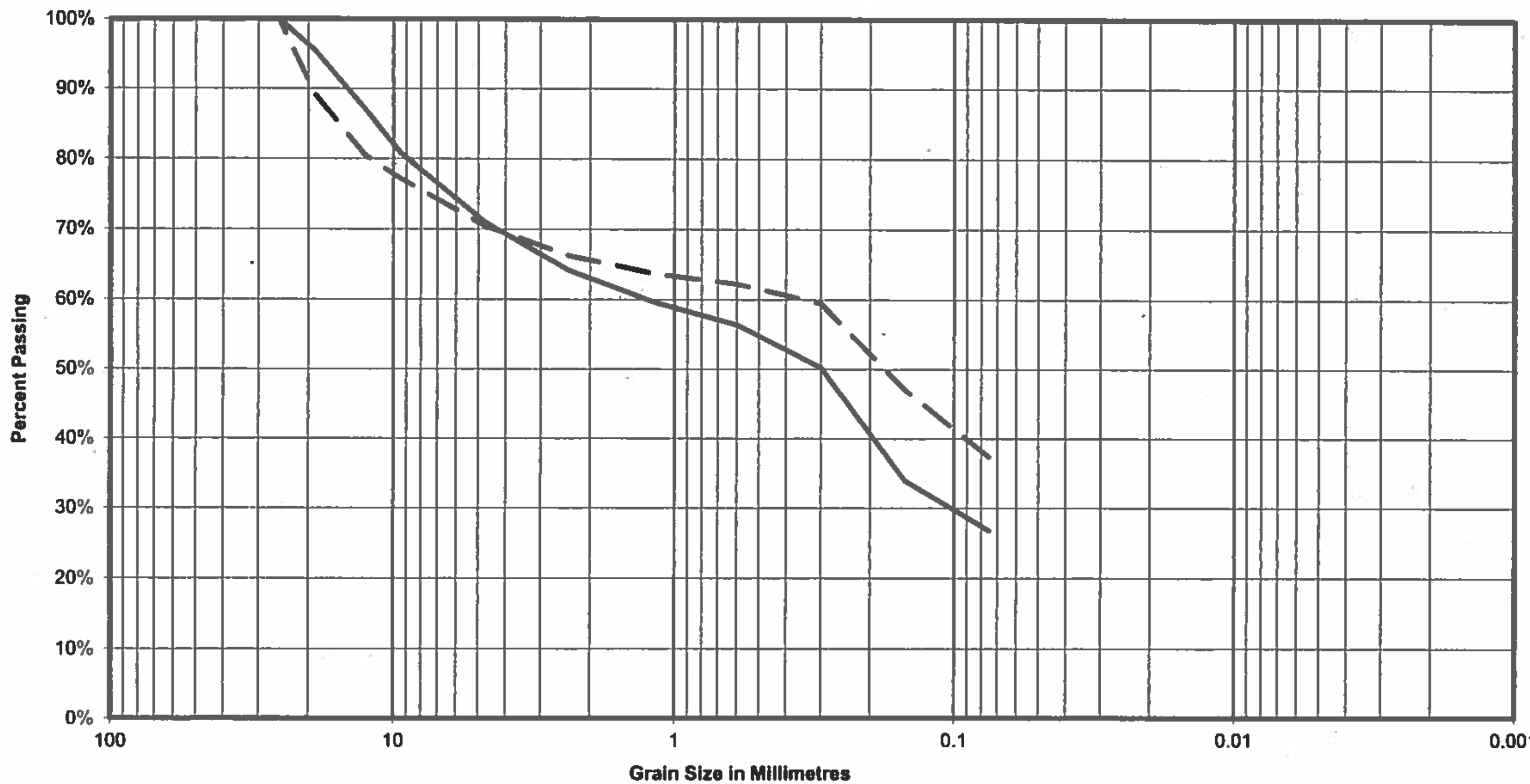
Dynamic Penetration Test, blows/0.3m ★

Standard Penetration Test, blows/0.3m ●

10 20 30 40 50 60 70 80 90

△ Unconfined Compression Test
□ Field Vane Test ■ Remoulded
✖ Fall Cone

Approved: MM



	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

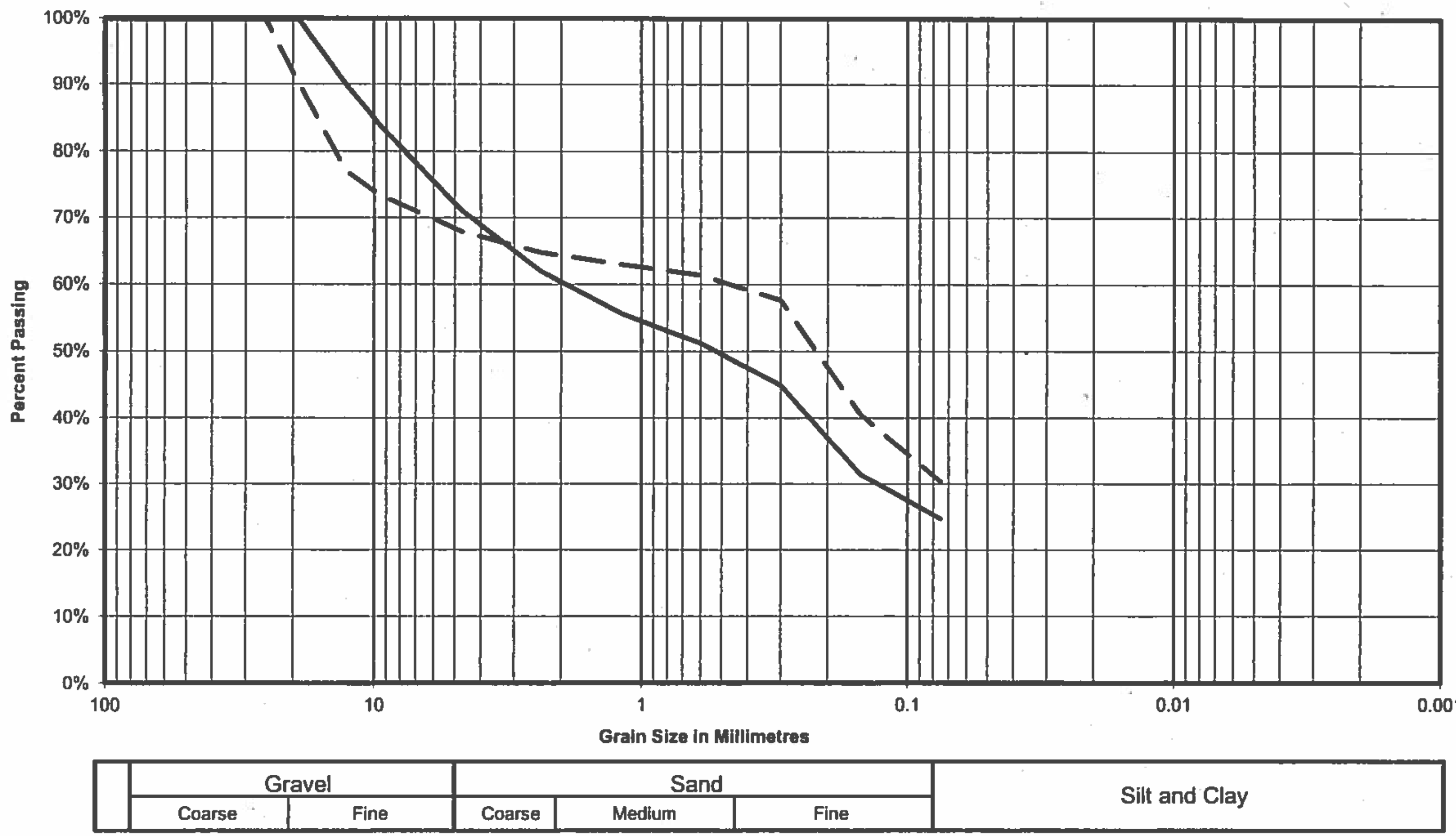
Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
———	BH-01	SS-01	0 to 0.61	29%	44%	27%	FILL: Silty Sand (SM) with Gravel
— — ·	BH-01	SS-04	1.83 to 2.44	30%	33%	37%	Silty Sand (SM) with Gravel: TILL

Stantec

PROJECT: Harrington Farms, Queens County, PE

Job No.: 3702

Approved: MM



Unified Soil Classification System ASTM D 2487/2488

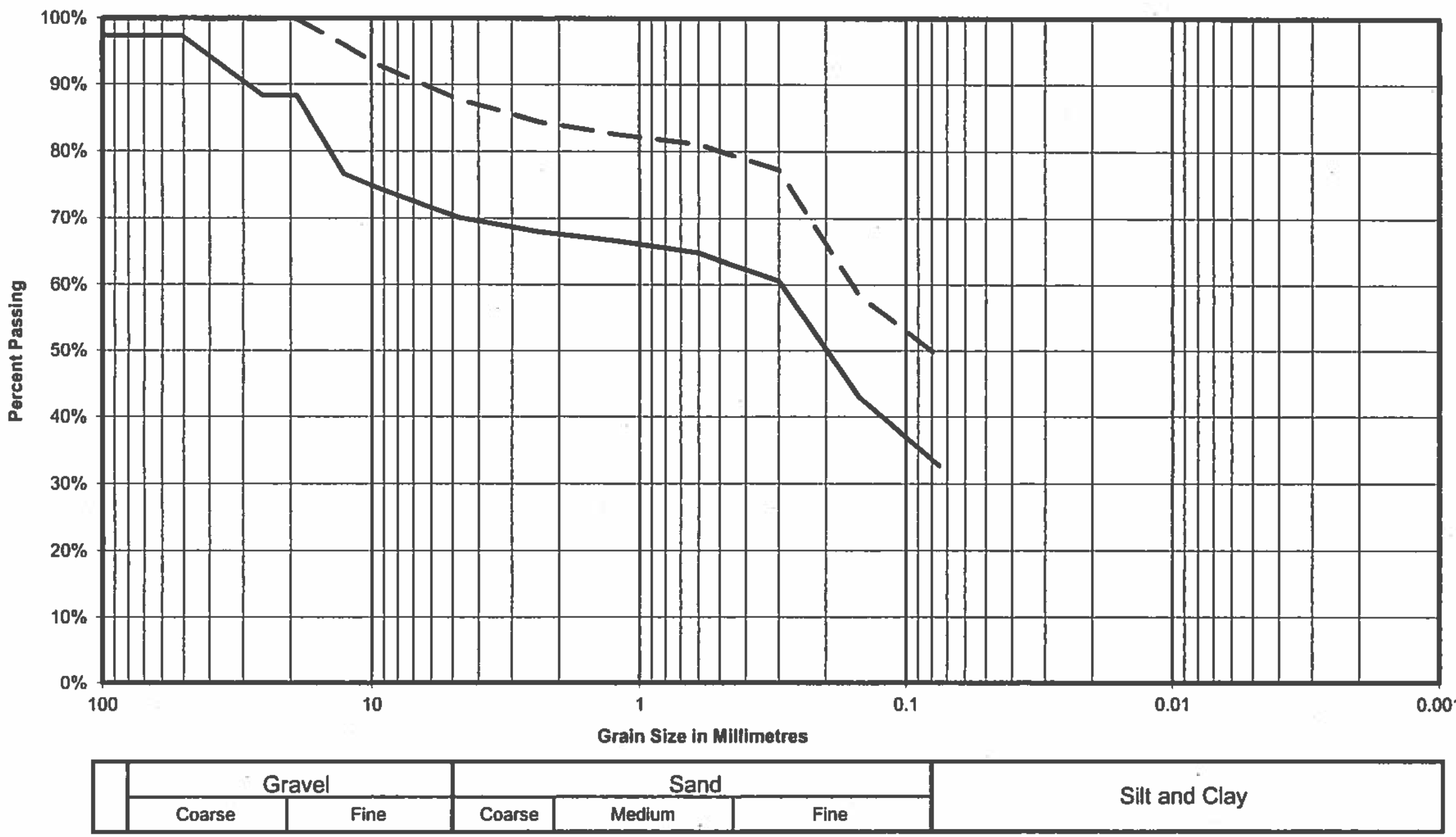
Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
———	BH-02	SS-01	0 to 0.61	29%	46%	25%	FILL: Silty Sand (SM) with Gravel
— — ·	BH-02	SS-04	1.83 to 2.44	32%	38%	30%	Silty Sand (SM) with Gravel: TILL

Stantec

PROJECT: Harrington Farms, Queens County, PE

Job No.: 3702

Approved: MM



Unified Soil Classification System ASTM D 2487/2488

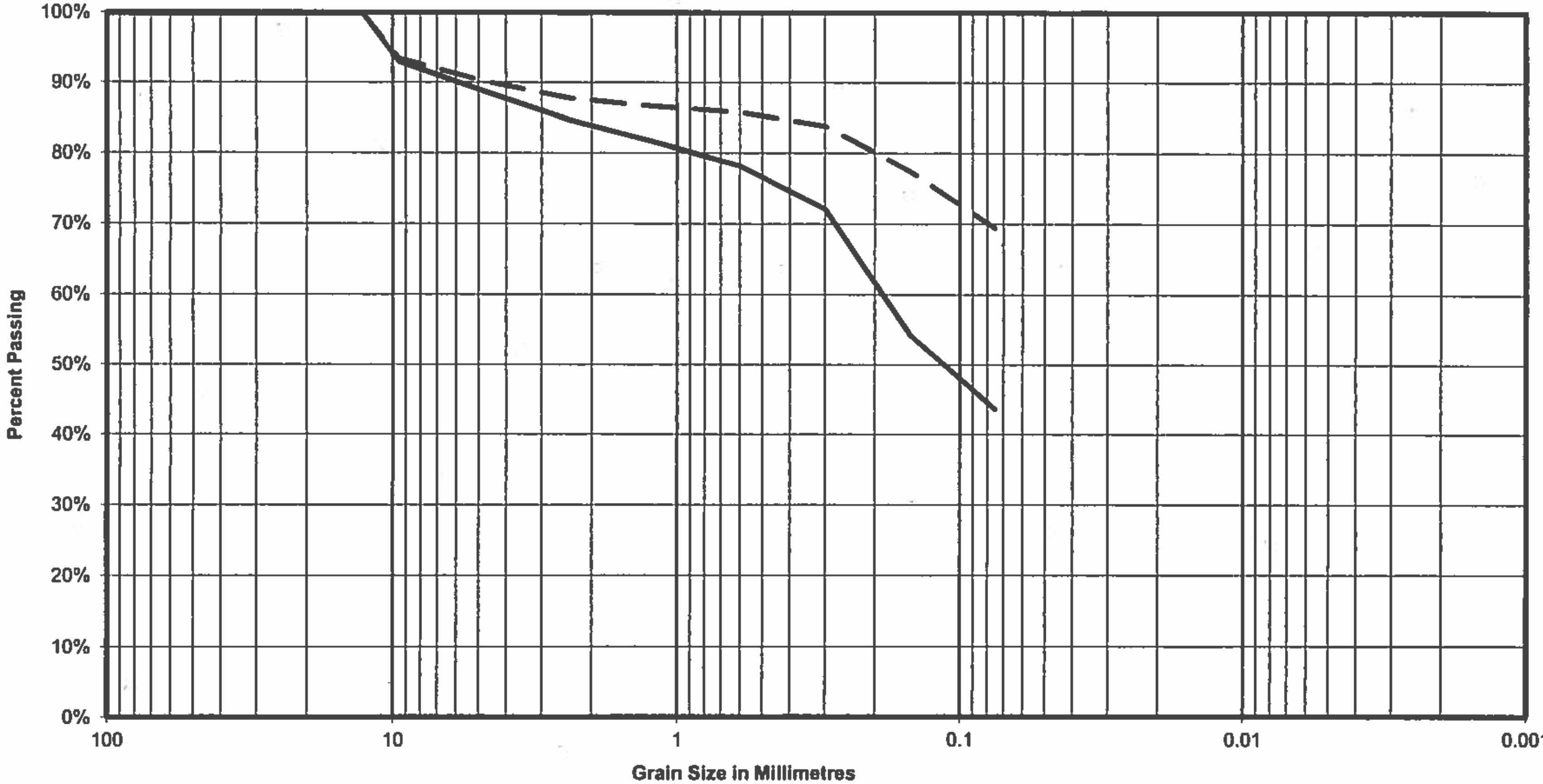
Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
———	BH-03	SS-03	1.22 to 1.83	30%	37%	33%	Silty Sand (SM) with Gravel: TILL
— — ·	BH-03	SS-04	1.83 to 2.44	12%	39%	49%	Silty Sand (SM), trace Gravel: TILL

Stantec

PROJECT: Harrington Farms, Queens County, PE

Job No.: 3702

Approved: MM



	Gravel		Sand			Silt and Clay
	Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	BOREHOLE/TESTPIT	SAMPLE	DEPTH (m)	Soil Fractions			Soil Description
				Gravel	Sand	Silt/Clay	
——	BH-04	SS-02	0.61 to 1.22	11%	45%	44%	Silty Sand (SM) with Gravel: TILL
— — ·	BH-04	SS-05	2.44 to 2.69	10%	21%	69%	Sandy Silt (SM), trace Gravel: TILL

Stantec

PROJECT: Harrington Farms, Queens County, PE

Job No.: 3702

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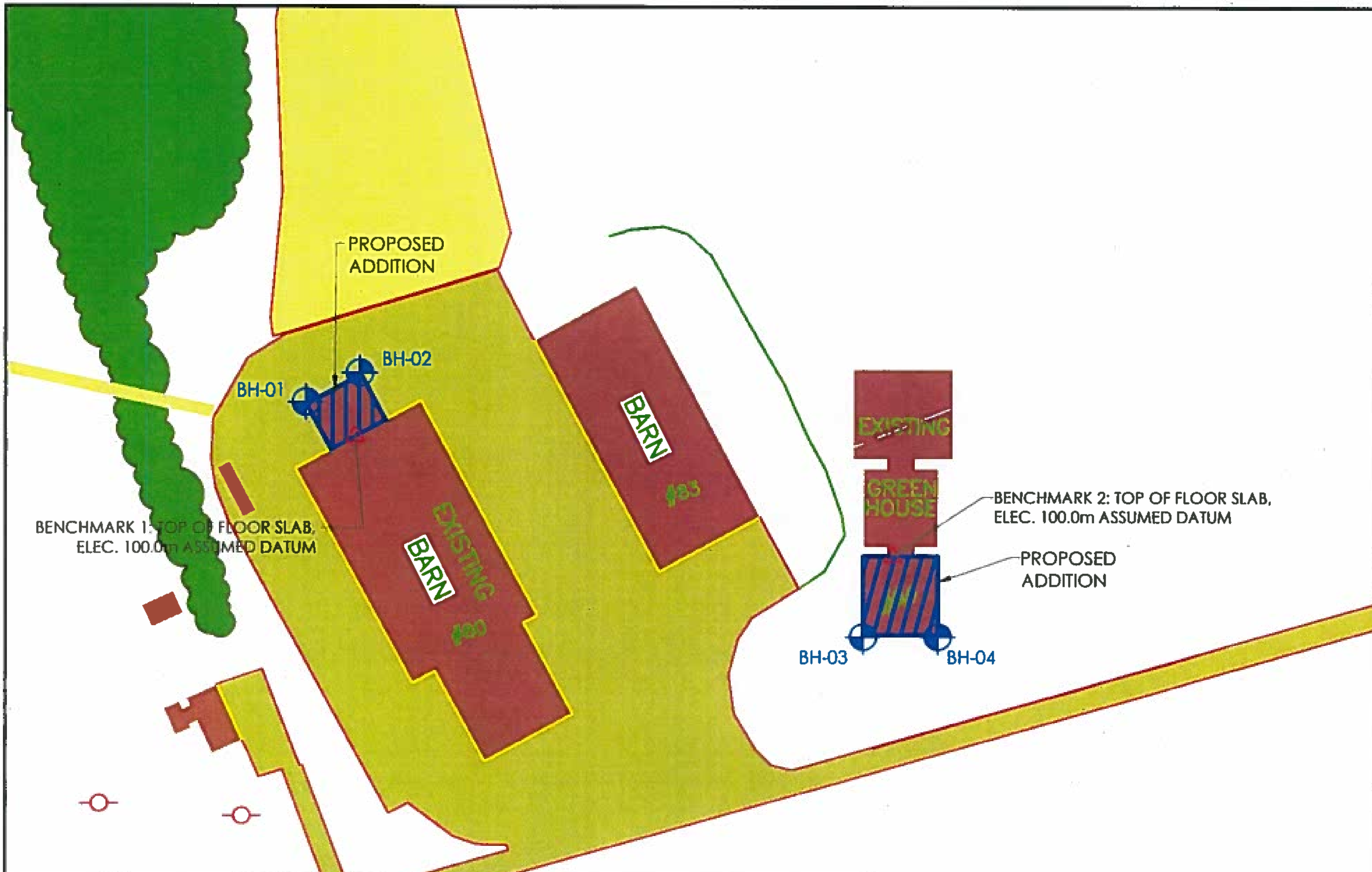

THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC CONSULTING LTD. REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

BOREHOLE LOCATION PLAN HARRINGTON FARM, HARRINGTON QUEENS COUNTY, PEI	Job No.:	121618196	Dwg. No.: 1
	Scale:	1:1250	
	Date:	15.07.23	Stantec
	Dwn. By:	MO	
Client: PWGSC	App'd By:	MM	