



Stantec Consulting Ltd.
100-300 Hagey Boulevard
Kitchener ON N2L 0A4

June 27, 2024

Project/File: 161413217

Joe Lefave, P.Eng., MPL, Candidate MCIP, RPP

Project Manager

Stantec Consulting Ltd.

100 - 300 Hagey Boulevard

Waterloo, ON N2L 0A4

Dear Recipient's Name Ron Stroh,

Reference: Submission of Revised Draft Plan/ZBA - Basement Construction

1 Introduction

The proposed Strohvest residential Subdivision (Site) is located at the southwest end of the Village of Wellesley, in the Township of Wellesley (Township) in the Region of Waterloo (Region). The Site is located north of Gerber Road and west of existing residential properties along Lawrence Street, and is presently used for agricultural purposes.. The proposed residential subdivision planned for the Site will be a low to a medium density development comprised of single-family and semi-detached residential homes, townhouse blocks and one possible apartment block.

Stantec conducted a geotechnical investigation in 2021 and provided its findings and recommendations based thereon through the report titled 'Final Geotechnical Investigation, Report for Proposed Subdivision Development – Stroh Lands, Gerber Road, Wellesley, Ontario' dated August 6, 2021, to Strohvest Ontario Inc. The reader is referred to the aforementioned report for the details. Stantec assumed at the time of writing of the report that the proposed residential units will be constructed without below grade levels (basements). However, the developer wants to develop the residential units with basements. This letter provides a geotechnical opinion on the technical feasibility of basement construction due to the relatively shallow groundwater encountered at the time of the 2021 geotechnical investigation.

2 Subsurface Conditions

A review of the geology maps shows that the southern and northern halves of the Site are covered by clayey and sandy glacial tills. The sandy glacial tills are underlain by clayey glacial tills, which are exposed on the ground surface in the southern half of the Site. A review of the bedrock geology map¹ shows that the limestone bedrock of the Bois Blanc Formation is at a depth of approximately 50 to 55 m below the existing

¹ Thomas, J., Holden, K.M. and Karrow, P.F. 1993. Bedrock topography, Stratford area, southern Ontario; Ontario Geological Survey, Preliminary Map P.3211, scale 1:50 000

Reference: Submission of Revised Draft Plan/ZBA - Basement Construction

grades. The Site is comprised of gently rolling hills with a relief of approximately 6.7 m across the Site with a general slope direction from north to south towards the Nith River valley .

The 2021 Stantec Geotechnical Investigation report shows that the soils at the Site are predominantly clayey comprised of low to medium plasticity clays, denoted by Unified Soil Classification System symbols CL-ML and CL, respectively. Based on three years of monitoring data (i.e., June 2021 to June 2024), groundwater levels at Site have ranged from just below ground surface to 4.8 m below ground surface (BGS), corresponding to elevations of 353.1 to 361.6 m AMSL.

Stantec completed a test pit investigation on May 2, 2024, at the Site to confirm the subsurface soil and groundwater conditions encountered during the previous geotechnical and hydrogeological investigations. The locations of the test pits are shown on the attached **Figure 1**. The soil samples obtained from the test pits were analyzed for grain size distribution, Atterberg Limits, and moisture contents. The laboratory test results, along with the laboratory test results from the 2021 geotechnical investigation for ease of reference are produced in the following table.

Table 1 Summary of Laboratory Test Results

Test Pit/ BH #	Depth (m BGS)	Grain Size (%)			W _n (%)	Atterberg Limits (%)			Soil Classification
		Gravel	Sand	Fines		LL	PL	PI	
2024 Test Pit Hydrogeological Investigation									
TP01-24	0.7	0	4	96	15	-	-	-	Silty Clay (CL-ML)
	1.1	1	7	92	16	25	15	10	Lean Clay (CL)
TP04-24	0.6	9	32	59	23	30	17	13	Sandy Lean Clay (CL)
	1.1	1	5	94	20	-	-	-	Lean Clay (CL)
2021 Geotechnical Borehole Investigation									
MW01-21	2.6	2	8	90	18	29	15	14	Lean Clay (CL)
MW03-21	2.6	0	3	97	-	-	-	-	Lean Clay (CL)
MW05-21	1.1	5	20	75	-	22	14	8	Sandy Lean Clay (CL)

The test pits were excavated with vertical walls and were kept open for 24 hours. Groundwater seepage was encountered in all test pits with some wall instability. Further details on the test pit investigation findings are presented in Stantec's (2024²) Hydrogeological Assessment report. The test pit logs are attached with this letter.

A review of the attached laboratory test results shows that the samples generally contain more fines (fraction passing the No. 200 (0.074 mm) sieve) ranging from 56% to 97%. Based on the Atterberg limits analyses, the samples can be classified as Lean Clay (CL). Using the Ministry of Municipal Affairs and Housing (MMAH) Supplementary Standard SB-6 titled 'Percolation Time and Soil Descriptions' included in

² Stantec Consulting Limited, 2024. Hydrogeological Assessment, Strohvest Subdivision, Township of Wellesley, Ontario. June 2024.

Reference: Submission of Revised Draft Plan/ZBA - Basement Construction

Volume II of the 2012 Ontario Building Code (per latest amendments) the drainage related soil parameters estimated based on the laboratory test results are provided in the table below:

Table 2 Estimated Hydraulic Conductivity and Infiltration Rates

Test Pit/ BH #	Depth (m BGS)	Soil Classification	Percolation 'T' Time (min/cm)	Infiltration Rate (mm/hour)	Vertical Hydraulic Conductivity (m/sec)
2024 Test Pit Hydrogeological Investigation					
TP01-24	0.7	Silty Clay (CL-ML)	>50	12	1E-09
	1.1	Lean Clay (CL)	>50	12	1E-09
TP04-24	0.6	Sandy Lean Clay (CL)	>50	12	1E-09
	1.1	Lean Clay (CL)	>50	12	1E-09
2021 Geotechnical Borehole Investigation					
BH01-21	2.6	Lean Clay (CL)	>50	12	1E-09
BH03-21	2.6	Lean Clay (CL)	>50	12	1E-09
BH05-21	1.1	Sandy Lean Clay (CL)	>50	12	1E-09

The estimated values indicate that the on-Site soils are generally poorly draining. Stantec notes that these estimated infiltration rates agree with the average infiltration rate presented in the Hydrogeological Assessment report of 13 mm/hour, equating to a geometric mean vertical hydraulic conductivity in the range of 10^{-9} m/s.

3 Discussion

The estimated soil drainage parameters values provided in Table 2 indicate that the on-Site soils are characterized by low permeability and, consequently, are poorly draining. Basement structures in such soils can be constructed. Construction dewatering will be required. Minor to moderate groundwater ingress can be handled by standard filtered sump pumping techniques. Basement structure will need to be provided with passive dewatering systems; that is, perimeter foundation and sub-floor drainage pipes. The below grade basement foundation walls will also need to be provided with dual damp proofing measures as recommended below:

The exterior face of the basement walls must be damp proofed by applying a continuous sprayed bituminous coating. The bituminous coating should then be covered by core drains comprised of continuous prefabricated drainage composite (Terradrain® 600 or equal). The perimeter drainage tile system as per the 2012 Ontario Building Code (Section 9.13 to 9.15) should be laid on undisturbed or well compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe should be surrounded with not less than 150 mm of 19 mm Ø crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump. The sump must be equipped with an automatic pump that will discharge the water into a storm sewer.

Reference: Submission of Revised Draft Plan/ZBA - Basement Construction

The basement walls can be designed for lateral earth pressures using the following unfactored soil design parameters:

Table 3: Unfactored Soil Design Parameters for Below Grade Walls

Parameter	Native Clay	Compact Sand Fill
Bulk Unit Weight, γ (kN/m ³)	21	20
Effective Friction Angle, ϕ'	30	32
At Rest Earth Pressure (K_0)	0.50	0.47
Active Earth Pressure (K_A) (Static)	0.33	0.31
Passive Earth Pressure, (K_P) (Static)	3.00	3.25
The coefficients of lateral earth pressures are for level ground conditions surrounding the excavation.		

Provided the damp proofing and perimeter foundation drainage system is installed as recommended above, in Section 3 of this letter, hydrostatic pressures do not need to be considered in the basement wall design.

We trust the above meets your current needs. Should you have any questions or need further assistance, please do not hesitate to contact the undersigned.

Best regards,

STANTEC CONSULTING LTD.



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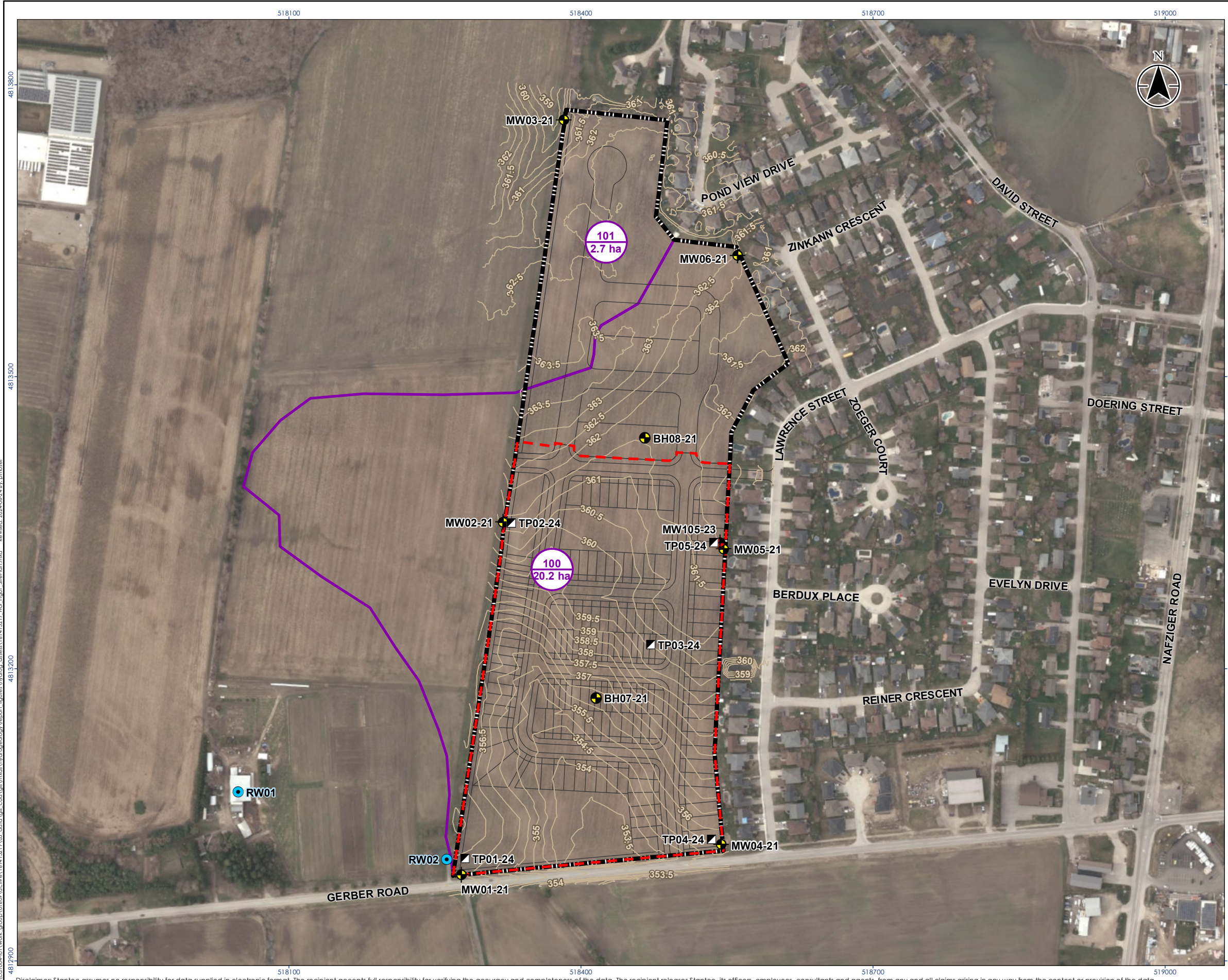


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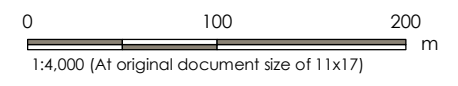


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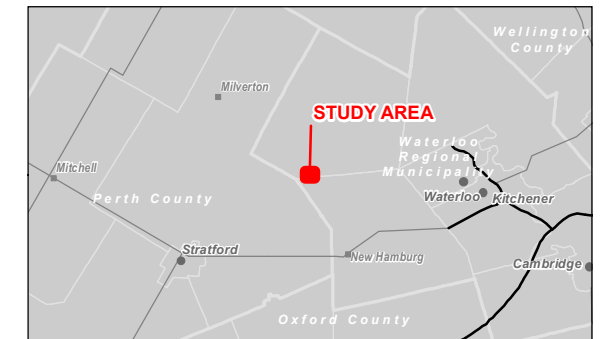
Attachment: Location Plan
Testpit Logs



- Legend**
- Subject Lands
 - Boundary of Lands Owned by the Applicant (Strohvest Ontario Inc.)
 - Monitoring Well (Stantec, 2023)
 - Monitoring Well (Stantec, 2021)
 - Borehole (Stantec, 2021)
 - ▲ Test Pit (Stantec, 2024)
 - Private Well Sampling Location
 - Topographic Contour (m AMSL)
 - Proposed Development Plan
 - Stormwater Catchment (Existing Conditions)



- Notes**
1. Coordinate System: NAD 1983 UTM Zone 17N
 2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
 3. Orthoimagery © First Base Solutions, 2024. Imagery Date, 2022.



Project Location: 161413217 REVA
 Township of Wellesley
 Prepared by CMC on 2024-06-24
 Technical Review by GW on 2024-06-24

Client/Project: STROHVEST ONTARIO INC.
 STROH LANDS, WELLESLEY, ONTARIO
 HYDROGEOLOGICAL ASSESSMENT

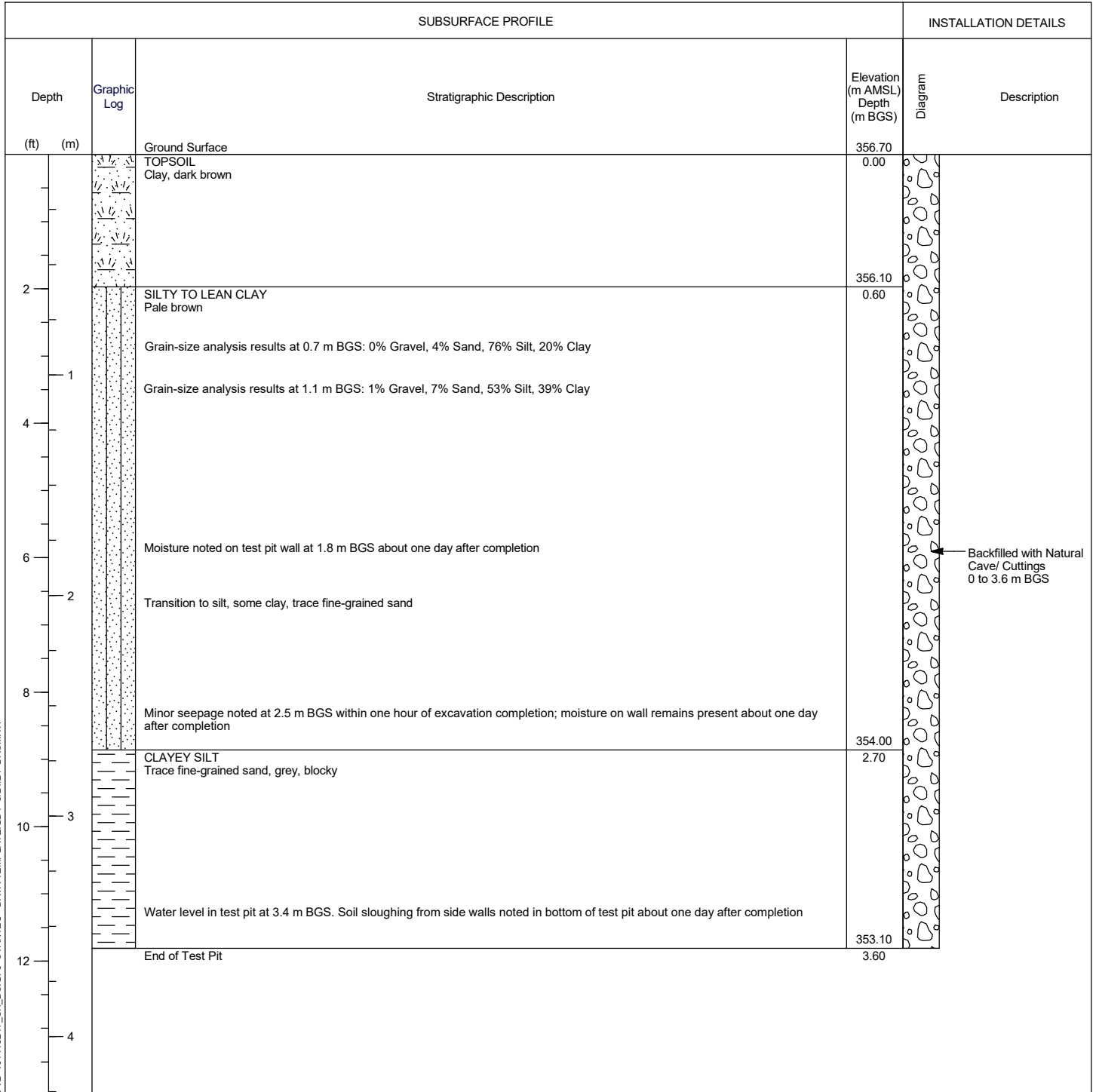
Figure No.: **1**
 Title: **Location Plan**

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 Revised: 2024-06-24 By: amoser
 4813200
 4813500
 4813800
 4812900
 4813200
 4812900

Test Pit: TP01-24

Project: Strohvest Subdivision, Hydrogeological Assessment
Client: Strohvest Ontario Inc.
Location: Wellesley ON
Number: 161413217
Field investigator: Drew Smith
Contractor: Strohvest Ontario Inc.

Method: Rubber Tire Backhoe
Date started/completed: 01-May-2024 / 02-May-2024
Ground surface elevation: 356.70 m AMSL
Top of casing elevation: n/a
Easting: 518328
Northing: 4813349



STANTEC BOREHOLE AND WELL V2 161413217_SH_DS.GPJ STANTEC - DATA TEMPLATE.GDT 6/21/24 DRSMITH

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

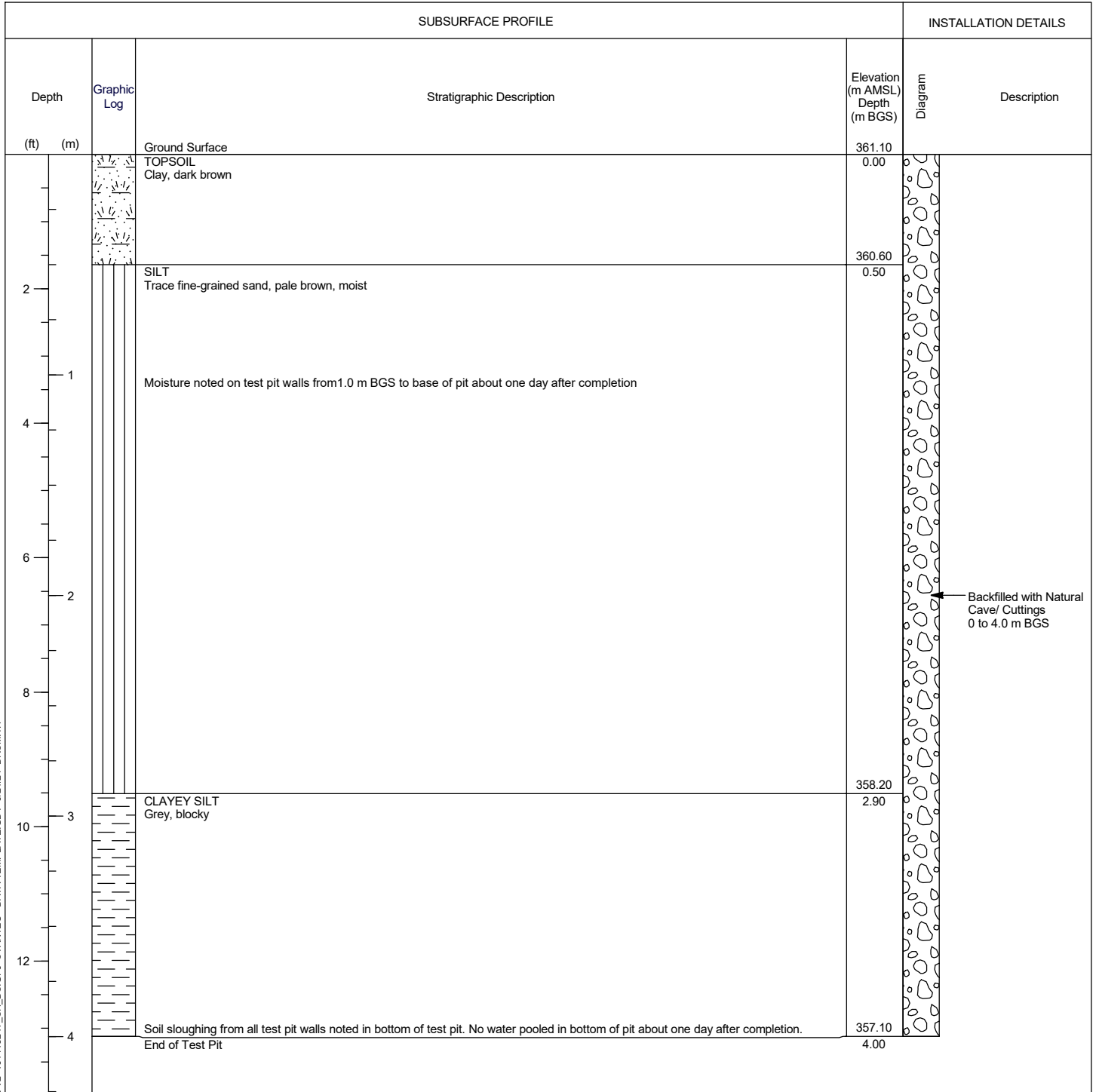
Depths and elevations are approximate.



Test Pit: TP02-24

Project: Strohvest Subdivision, Hydrogeological Assessment
Client: Strohvest Ontario Inc.
Location: Wellesley ON
Number: 161413217
Field investigator: Drew Smith
Contractor: Strohvest Ontario Inc.

Method: Rubber Tire Backhoe
Date started/completed: 01-May-2024 / 02-May-2024
Ground surface elevation: 361.10 m AMSL
Top of casing elevation: n/a
Easting: 518532
Northing: 4813329



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Depths and elevations are approximate.

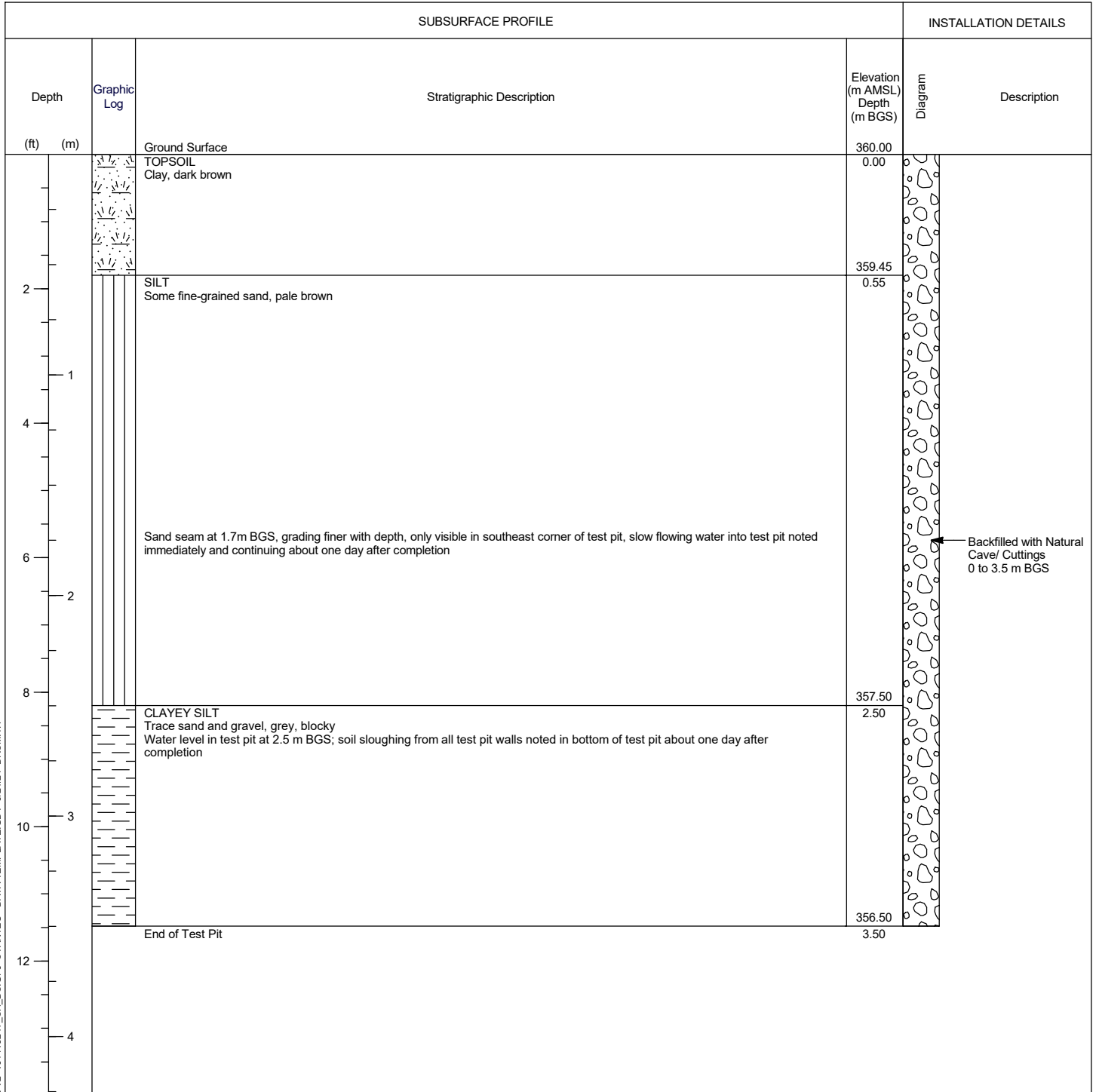
STANTEC BOREHOLE AND WELL V2 161413217_SH_DS.GPJ STANTEC - DATA TEMPLATE.GDT 6/21/24 DRSMITH



Test Pit: TP03-24

Project: Strohvest Subdivision, Hydrogeological Assessment
Client: Strohvest Ontario Inc.
Location: Wellesley ON
Number: 161413217
Field investigator: Drew Smith
Contractor: Strohvest Ontario Inc.

Method: Rubber Tire Backhoe
Date started/completed: 01-May-2024 / 02-May-2024
Ground surface elevation: 360.00 m AMSL
Top of casing elevation: n/a
Easting: 518471
Northing: 4813225



STANTEC BOREHOLE AND WELL V2 161413217_SH_DS.GPJ STANTEC - DATA TEMPLATE.GDT 6/21/24 DRSMITH

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

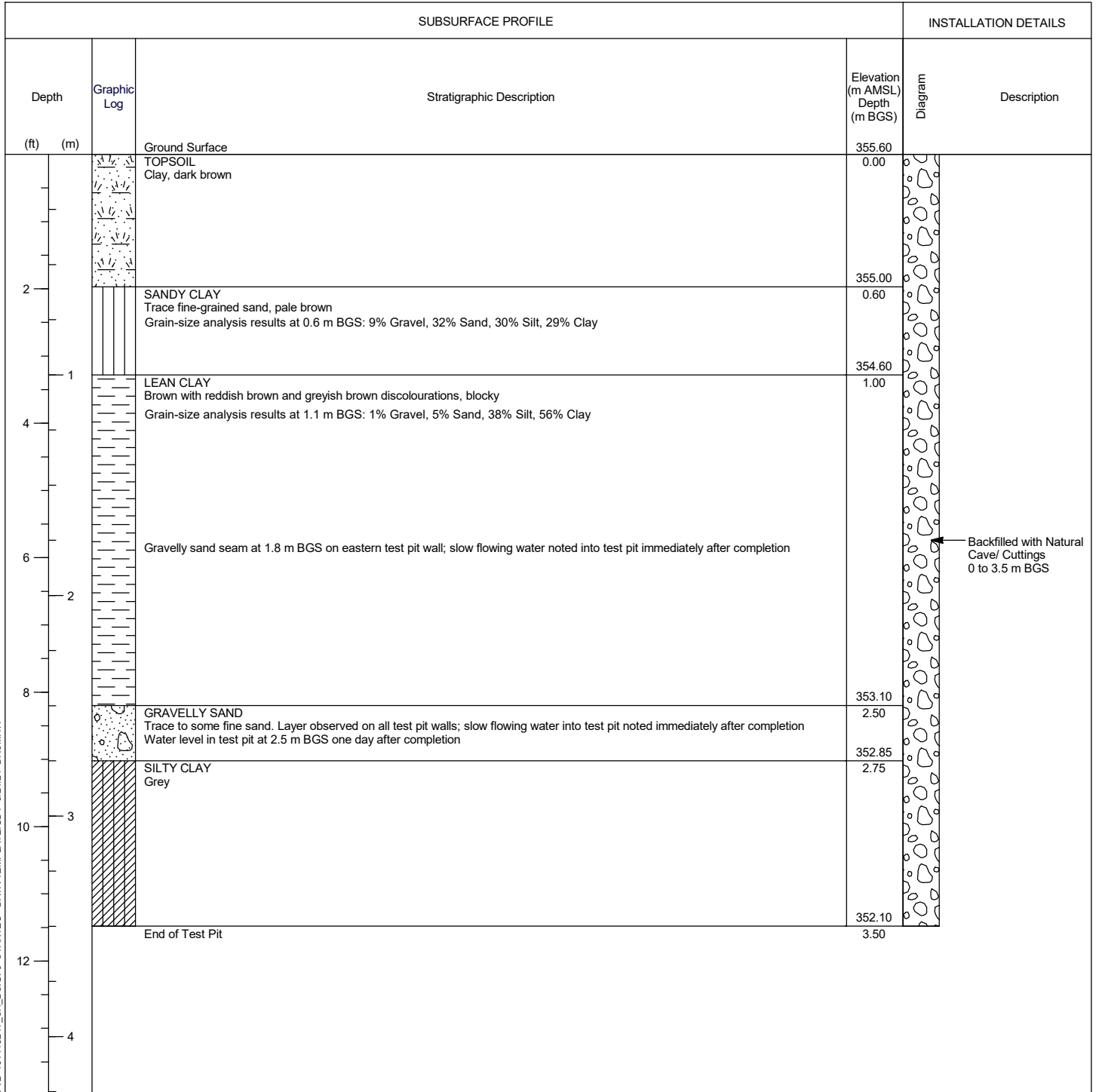
Depths and elevations are approximate.



Test Pit: TP04-24

Project: Strohvest Subdivision, Hydrogeological Assessment
Client: Strohvest Ontario Inc.
Location: Wellesley ON
Number: 161413217
Field investigator: Drew Smith
Contractor: Strohvest Ontario Inc.

Method: Rubber Tire Backhoe
Date started/completed: 01-May-2024 / 02-May-2024
Ground surface elevation: 355.60 m AMSL
Top of casing elevation: n/a
Easting: 518280
Northing: 4813005



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
n/a - not available

Depths and elevations are approximate.

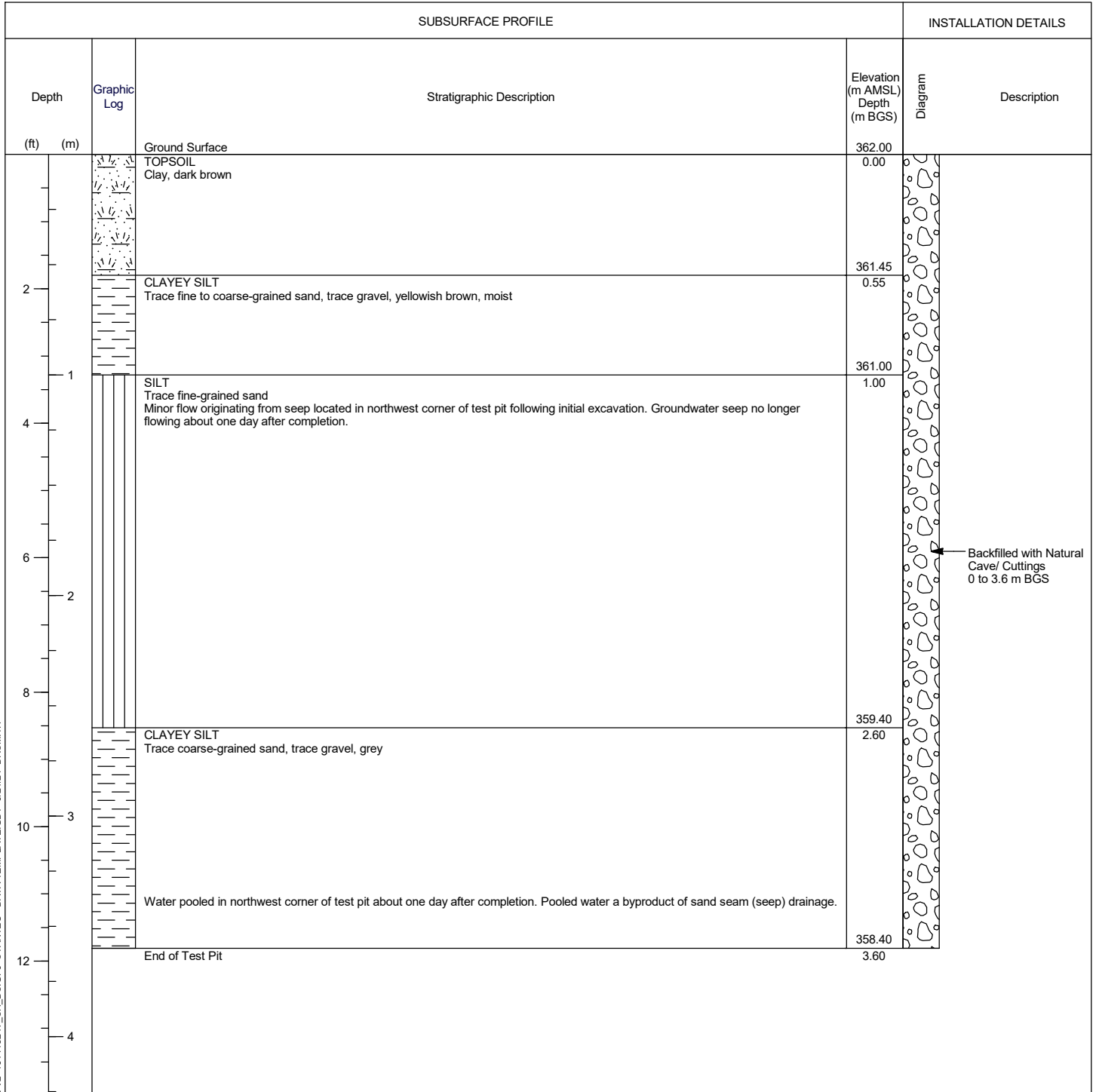
STANTEC BOREHOLE AND WELL V2 161413217_SH_DS.GPJ STANTEC - DATA TEMPLATE.GDT 6/21/24 DRSMITH



Test Pit: TP05-24

Project: Strohvest Subdivision, Hydrogeological Assessment
Client: Strohvest Ontario Inc.
Location: Wellesley ON
Number: 161413217
Field investigator: Drew Smith
Contractor: Strohvest Ontario Inc.

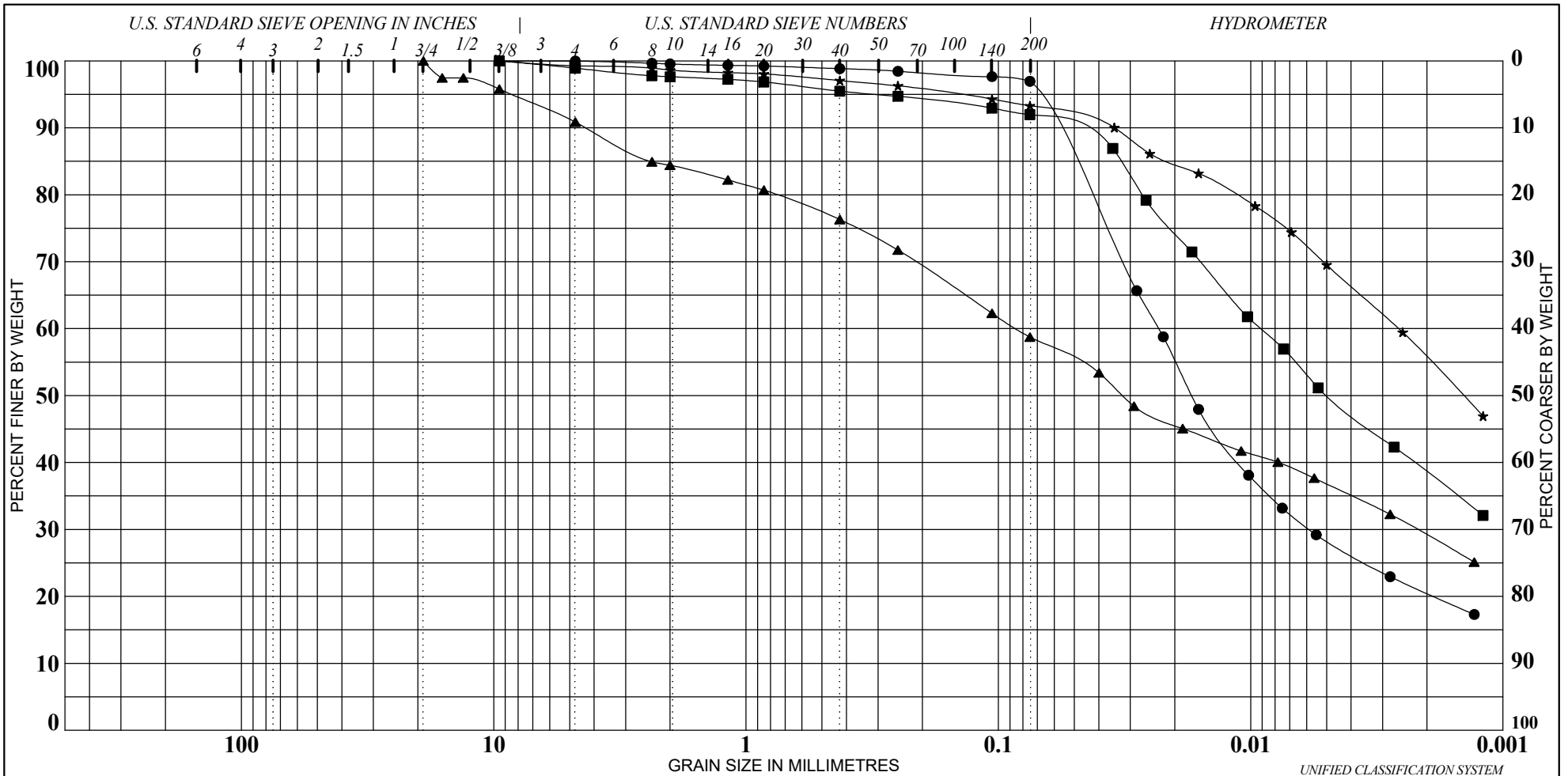
Method: Rubber Tire Backhoe
Date started/completed: 01-May-2024 / 02-May-2024
Ground surface elevation: 362.00 m AMSL
Top of casing elevation: n/a
Easting: 518532
Northing: 4813026



Notes:
 m AMSL - metres above mean sea level
 m BGS - metres below ground surface
 n/a - not available

Depths and elevations are approximate.



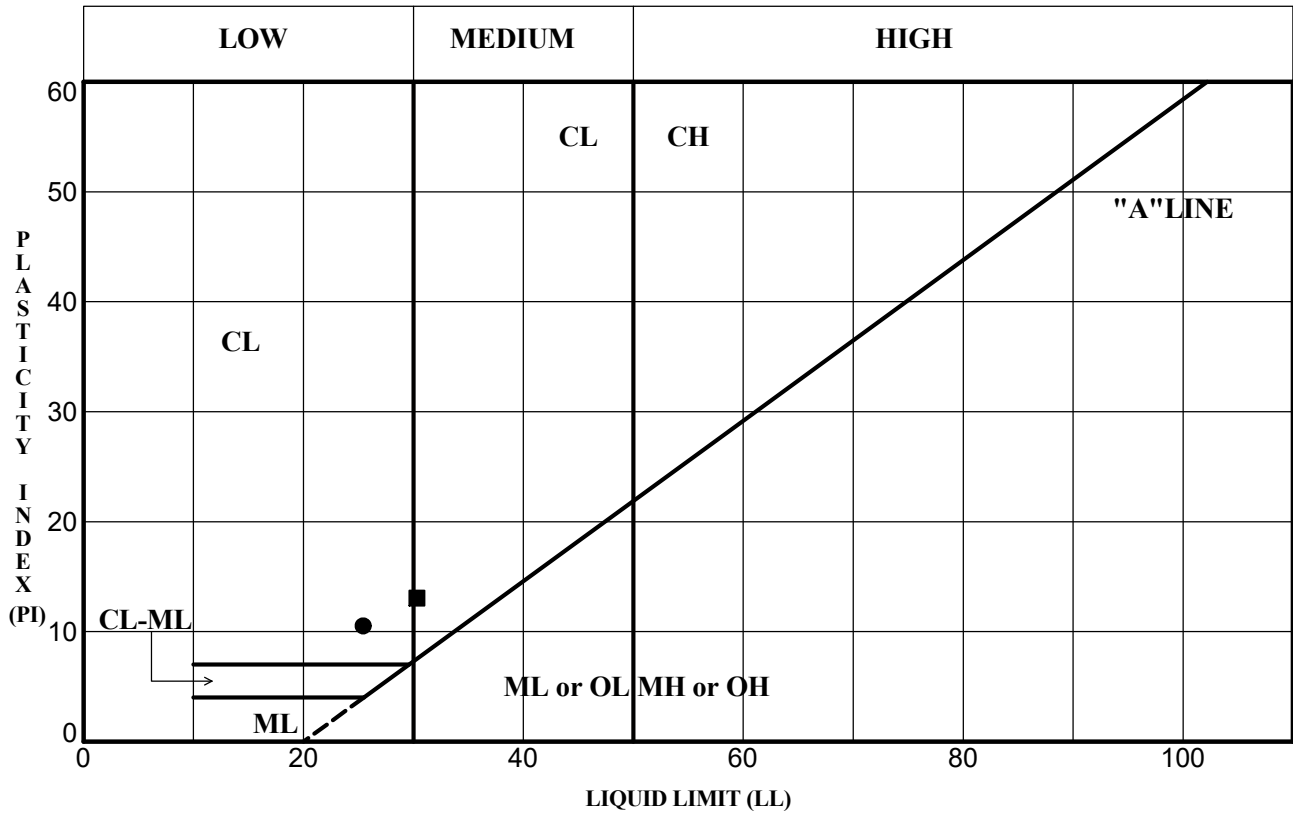


BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Sample	Depth (m)	Description	W%	W _L	W _p	I _p	%Gravel	%Sand	%Silt	%Clay
● TP01-24	0.7	SILTY CLAY(CL-ML)	15				0	4	76	20
■ TP01-24	1.1	LEAN CLAY(CL)	16	25	15	10	1	7	53	39
▲ TP04-24	0.6	SANDY LEAN CLAY(CL)	23	30	17	13	9	32	30	29
★ TP04-24	1.1	LEAN CLAY(CL)	20				1	5	38	56

	Project: Strohvest Subdivision Location: Project No.: 161413217	GRADATION CURVE (ASTM D422) Figure: 1 Remarks:
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PLASTICITY CHART



Specimen	Depth (m)	LL	PL	PI	Fines	W%	Classification
● TP01-24	1.1	25	15	10	92	16	LEAN CLAY(CL)
■ TP04-24	0.6	30	17	13	59	23	SANDY LEAN CLAY(CL)

STN13-ATTERBERG 160311082.GPJ STANTEC MARKHAM DATA TEMPLATE 2015-05-20.GDT 5/21/24



Project: Strohvest Subdivision
Location:
Project No.: 161413217

ATTERBERG LIMITS
 (ASTM D4318)

Figure: 2
Remarks:

PROJECT: Strohvest Subdivision**MOISTURE CONTENT**

BH	DEPTH (ft)	SAMPLE	Moisture Content %
TP01-24	2.2	1	14.7
TP01-24	3.5	2	16.3
TP04-24	2	1a	23.2
TP04-24	3.5	2	20.4