CHUNG & VANDER DOELEN
ENGINEERING LTD.

GEOTECHNICAL INVESTIGATION
PROPOSED TOWNHOUSE DEVELOPMENT
20 Scott Street
Grand Valley, Ontario

SUBMITTED TO:
Daniel Hrycyna
1081 Bloor Street, Unit 200
Toronto, Ontario
M6H 1M5

FILE NO / G17440 **/** January 3, 2018

CHUNG & VANDER DOELEN
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January 3, 2018
File No.: G17440

Daniel Hrycyna
1081 Bloor Street, Unit 200
Toronto, Ontario
M6H 1M5

RE: **Geotechnical Investigation**
Proposed Townhouse Development
20 Scott Street, Grand Valley, Ontario

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation Report carried out at the above-referenced Site. Soil samples will be retained for a period of three (3) months and will thereafter be disposed of unless we are otherwise instructed.

If you have any questions or clarifications are required, please contact the undersigned at your convenience.

We thank you for giving us this opportunity to be of service to you.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

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1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by Mr. Daniel Hrycyna to carry out a geotechnical investigation for the proposed townhouse development at 20 Scott Street in Grand Valley, Ontario.

It is understood that the proposed development will consist of several blocks of townhomes and/or single-family homes. These structures will typically be 2 to 3 storeys high. Due to the sloping site grades, a retaining wall will likely be constructed along the north property limit and up to 5 m cuts will take place along the north property and west property limits. A stormwater management area will be created on site.

The purpose of this investigation was to determine the subsurface conditions at the site and, based on the findings, to make general geotechnical recommendations for the design and construction of site grading, foundations and retaining walls, as the development concept plan has not been finalized at the time of reporting. Infiltration rates of the various soil deposits encountered during the investigation will also be provided for potential design of at-source infiltration features.

2.0 FIELD WORK

To investigate the subsurface conditions at the site, thirteen (13) boreholes were advanced to depths ranging between 4.70 and 7.90 m below ground surface. The investigation was performed on May 30 to June 1, 2017. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions. The boreholes were advanced to the sampling depths using a track-mounted power auger drilling rig, equipped with continuous flight augers and standard soil sampling equipment. Standard Penetration tests (SPTs) in accordance with ASTM Specification D1586 were carried out at frequent intervals of depth during the advancement of the boreholes. These test results are shown on the Borehole Log Sheets as Penetration Resistance or “N”-values. The compactness condition or consistency of the soil strata has been inferred from these test results.

Groundwater conditions were monitored during and at completion of each borehole. Monitoring wells were installed in Boreholes 2, 4 and 13 to allow measurement of the stabilized groundwater table.

The location and ground surface elevation of the boreholes were surveyed by CVD for the purpose of this report. The ground surface elevations were referenced to a temporary benchmark (TBM) which is shown on Drawing No. 1 and described below:

TBM:	Top of existing manhole in Scott Street in front of lot number 20 , as shown on Drawing No. 1
Elevation:	100.00 m (Assumed)

3.0 LABORATORY TESTING

Soil samples obtained from the in-situ tests were examined in the field and subsequently brought to our laboratory for visual and tactile examination to confirm field classification. Moisture content determination of all retrieved samples occurred.

In addition, three (3) grain size distribution analyses and two (2) standard proctor tests were performed on the major soil deposits to confirm field identification and to provide information on the soil hydraulic conductivity for the design of infiltration galleries.

4.0 EXISTING SITE CONDITIONS

The site is located on the north side of the western extent of Scott Street, Lot No. 20. The site is consisted of two (2) two-storey residential dwellings surrounded by a maintained grass covered yard. The maintained portion of the property is surrounded by a tall grass and bush covered area with many trees.

The grades of the site consist of significant declining elevations from the northwest corner (near Crozier Street) to the southeast corner. The ground surface elevations at the borehole locations ranged between 99.38 and 110.00 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered in the thirteen (13) boreholes advanced as part of this investigation are shown on the Borehole Log Sheets, Enclosures 1 to 13, inclusive. The following sections provide descriptions of the major soil deposits encountered in the boreholes.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

5.1 Topsoil

The topsoil was encountered at ground surface at all borehole locations with thicknesses ranging between 200 and 460 mm

5.2 Sand and Silt

A deposit of sand and silt was encountered at Boreholes 1 to 9 and 11 below the topsoil and extended to depths ranging between 1.37 and 2.90 m below ground surface. The dark brown to brown sand and silt deposit contained trace to some clay and trace to some gravel. The results of one (1) grain size distribution analysis from Borehole 7 are shown graphically on Enclosure 14.

The SPT "N"-values measured within the sand and silt deposit ranged from 3 to 21 blows per 300 mm of penetration, indicating a very loose to compact compactness condition. The measured water content of the samples collected from this deposit ranged between 6 and 21%, thus indicating a moist moisture condition.

5.3 Sand

A deposit of brown sand was encountered underlying the topsoil at Boreholes 10, 12 and 13 and the sand and silt deposit at Boreholes 6, 8 and 11. The sand deposit extended to depths ranging between 3.51 and 5.49 m below ground surface at Boreholes 8 and 12 and at least depths ranging between 4.70 and 5.03 m, the maximum depths of exploration at Boreholes 6, 10, 11 and 13. The sand deposit contained gravel in the amounts of trace to gravelly and trace to some silt. Occasional silt seams/pockets were observed in the deposit at Boreholes 8, 12 and 13. The results of two (2) grain size distribution analyses from Boreholes 12 and 13 are shown graphically on Enclosures 15 and 16, respectively.

The SPT "N"-values measured within the sand deposit ranged from 5 blows per 300 mm to 50 blows per 125 mm of penetration, indicating a variable very loose to very dense compactness condition. The measured water content of the samples collected from this deposit ranged between 2 and 10%, thus indicating a damp to saturated moisture condition.

5.4 Silt Till

A deposit of brown silt till was encountered at Boreholes 1 to 5, 6 and 9 underlying the sand and silt deposit and at Boreholes 8 and 12 underlying the sand deposit. The silt till deposit extended to at least depths ranging between 4.70 and 7.90 m below ground surface, the maximum depths of exploration. The silt till contained cobbles, some sand, trace to some clay and traces of gravel.

The SPT "N"-values measured within the silt till deposit ranged from 7 blows per 300 mm to 50 blows per 75 mm of penetration, indicating a variable loose to very dense compactness condition. The measured water content of the samples collected from this deposit ranged between 4 and 18%, thus indicating a damp to saturated moisture condition.

5.5 Groundwater

Groundwater conditions were monitored during and following the completion of borehole sampling. Groundwater levels were measured on June 14, 2017 at 3.35 m, 4.48 m and 4.85 m in monitoring wells installed at Boreholes 2, 4 and 12, respectively, and this information is summarized below.

Borehole No.	Existing Ground Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)
2	110.00	3.35	106.65
4	106.92	4.48	102.44
12	99.59	4.85	94.74

Saturated soil conditions were observed in Boreholes 2, 4, 12 and 13 at depths of 3.3± m to 4.9± m below existing grades, corresponding to elevations between 94.7± m and 106.7± m. From the above measured groundwater elevations, it is observed that the groundwater table follows the surficial topography across the site.

It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is understood that the proposed development will consist of several blocks of townhomes and/or single-family homes. These structures will typically be 2 to 3 storeys high. Due to the sloping site grades, a retaining wall will likely be constructed along the north property limit and up to 5 m cuts will take place along the north property and west property limits. A stormwater management area will be created on site.

In general, the surficial topsoil was underlain by typically very loose to compact sand and silt or loose to very dense sand, followed by a loose to very dense silt till deposit. Saturated soil conditions were observed in Boreholes 2, 4, 12 and 13 at depths of 3.3± m to 4.9± m below existing grades, corresponding to elevations between 94.7± m and 106.7± m. From the above measured groundwater elevations, it is observed that the groundwater table follows the surficial topography across the site. It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

6.2 Footing Foundations

Conventional strip and spread footing foundations can be used to support the proposed townhomes and/or single-family homes. Footings should be cast on competent native compact sand and silt, compact to very dense sand or compact to very dense silt till and can be designed using a Geotechnical Reaction at SLS of 150 kPa (3000 psf) with a Factored Geotechnical Resistance at ULS of to 250 kPa (5000 psf). These soil bearing pressures can be achieved provided the exposed bearing surface is undisturbed during construction.

The following table summarizes the highest founding level and elevation for the footing at each borehole location:

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	106.29	2.19	104.10
2	110.00	2.50	107.50
3	109.08	2.98	106.10
4	106.92	2.22	104.70
5	103.31	2.21	101.10
6	102.17	2.17	100.00
7	106.15	0.65	105.50

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
8	100.96	1.46	99.50
9	102.81	2.21	100.60
10	99.67	0.67	99.00
11	99.71	2.11	97.60
12	99.59	1.59	98.00
13	99.38	0.78	98.60

The maximum total and differential settlements of footings designed to the above recommended soil bearing pressure are expected to be less than 25 and 12 mm, respectively, and these are considered tolerable for the structure being contemplated. The majority of the settlements will take place during construction and the first loading cycle of the building.

In addition, the footings should be founded below any existing fill materials and existing basements and foundations, on competent native undisturbed soils. Spacing between adjacent footing steps should not be steeper than 10H to 7V.

Exterior footings and footings in unheated portions of the building should be provided with a soil cover of not less than 1.2 m or equivalent synthetic thermal insulation for adequate frost protection. The founding subgrade soils must be protected from frost penetration during winter construction.

CVD recommends that the footing excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper excavation and subgrade preparation.

6.3 Engineered Fill Construction

The existing topsoil layer, loose sand and very loose to loose sand and silt are not considered suitable for supporting building foundations and floor slabs in their present condition. Removing these poor soils and constructing engineered fill could prove to be an effective and economical method to repair poor bearing soil areas to provide suitable bearing at more desirable elevations.

On site excavated sand or imported sand and gravel could be used to construct the engineered fill under controlled and supervised conditions. The moisture content of the soil requires to being within 3% dry of its optimum moisture condition to achieve the specified degree of compaction. Engineered fill is to be constructed in accordance with the following procedures in order to support the future foundations and floor slabs, if adopted:

1. All existing topsoil, loose sand, very loose to loose sand and silt, existing foundations/footings and otherwise deleterious materials are to be excavated/removed to expose the underlying competent native subgrade;

2. The exposed subgrade surface is to be thoroughly recompacted by large heavy compaction equipment (10 tonne recommended) and inspected by qualified geotechnical personnel. Any loose or soft areas identified should be excavated to the level of competent soil;

3. The required grades can then be achieved by placing imported sand and gravel or approved on site excavated sand in maximum 300 mm thick lifts and compacted to no less that 98% Standard Proctor maximum dry density (SPMDD) under the footing areas. Above the footing founding elevations, the compaction can be reduced to 95% SPMDD for the floor slab-on-grade support. The moisture content of the soil requires to be within 3% dry of its optimum moisture condition to achieve the specified degrees of compaction;

4. Engineered fill must be placed such that the fill pad extends horizontally outwards from all footings/foundation at least the same distance as how thick the engineered fill pad will exist between the underside of future footings and the approved native subgrade;

5. All fill placement and compaction operations must be supervised on a full-time basis by qualified geotechnical personnel to approve fill material and ensure the specified degree of compaction has been achieved.

Foundations supported on approved engineered fill constructed in accordance with the procedures given above can be designed to 150 kPa at SLS and 250 kPa at ULS.

6.4 Earthquake Considerations

In accordance with The Ontario Building Code 2012 (OBC), the proposed structure should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8.

Based on the anticipated condition of the engineered fill materials and the underlying soil condition encountered at the boreholes, the site can be classified as a Site Class C as per OBC Table 4.1.8.4.A (Page B4-24).

6.5 Construction and Groundwater Control

Excavations are generally expected to be in the order of 1 to 4 m deep for installing site grading, servicing, basement and foundation construction. The excavations will generally penetrate topsoil very loose to compact sand and silt and dense sand or sand and gravel. These materials are considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act.

The anticipated excavations will be carried out above the observed groundwater table and in Type 3 Soil. Type 3 Soils are expected to remain stable during the construction period provided that side slopes are cut to 1H : 1V from the bottom of the excavation. The side slopes may require to be cut back to flatter inclinations where saturated soils are encountered. The side slopes should be suitably protected from erosion processes.

Uncontrollable groundwater flows are not expected to be encountered within the anticipated construction excavations. Subsurface seepage and surface water runoff into the excavations may be handled by conventional sump pumping techniques, as and where required. The sump pits should be filtered.

If excavations are carried out deeper than 600 mm into the groundwater table which is the practical limit of sump pumping, well points (or other dewatering methods) and pre-draining will be necessary to facilitate excavations and prevent disturbance to the granular subgrade soils. In wet/saturated subgrade condition, pouring a 50 to 75 mm thick lean concrete mud mat is recommended to protect the foundation soils and to facilitate placement of re-bars and formworks.

6.6 Floor Slab Construction

The floor slabs for the proposed structures can be constructed as conventional slab-on-grade on the well-compacted engineered fill or the native sand, sand and silt or silt till deposits. At the time of floor slab construction, the exposed subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer. Any soft and/or unstable areas detected should be replaced with imported granular fill which should be compacted to at least 95% SPMDD.

Following the proof-rolling of the subgrade, it is recommended that a minimum 150 mm thick layer of OPSS Granular "A" be placed and compacted to at least 100% SPMDD beneath the concrete floor slabs to provide uniform support.

The floor slabs should be separated structurally from the columns and foundation walls. Sawcut control joints should be provided at regular spacing (less than 30 times the concrete slab thickness) and to depths between one-third and one-quarter of the slab thickness.

If the floor slab is situated at least 150 mm above the exterior grade and the ground surface slopes down and away from the building, perimeter drainage is not required. Similarly, under-floor drains will not be required.

It is recommended that the basement floor levels of the proposed structures be established at an elevation of at least 0.5 m above the groundwater table. Under-floor drains will be required due to the fluctuating groundwater table.

6.7 Lateral Earth Pressure

The unbalanced foundation walls and any other soil retaining structures should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$P = K (\gamma H + q)$

where:

$P =$ lateral earth pressure kPa

$K =$ earth pressure coefficient, 0.5 for non-yielding foundation wall
earth pressure coefficient, 0.3 for yielding retaining wall

$\gamma =$ unit weight of granular backfill, compacted to 95% SPMDD $21\ kN/m^3$

$H =$ unbalanced height of wall m

$q =$ surcharge load at ground surface kPa

A perimeter drainage system is required to ensure hydrostatic pressure does not build up in the backfill against the foundation wall. The perimeter weeping tile system is to be installed at the base of the footing to direct the collected waters to sump pump installations or the storm sewer. Similarly, it is recommended that a system of under-floor drains be installed below the basement level and be connected to positively drained sump(s)or permanently to the municipal sewer to locally control subsurface seepage in order to keep the basement floor in a dry condition.

The backfill for the foundation walls and retaining walls should be free-draining granular materials which should have less than 8% silt particles (OPSS Granular "B" Type I). The backfill should be placed in thin layers and compacted to 95% SPMDD. Over-compaction should be avoided. Weeping tiles leading to a frost-free outlet or weep holes should be installed to effect drainage behind the retaining wall.

The sliding resistance of the retaining wall footings should be checked. The unfactored horizontal resistance against sliding between cast-in-place concrete and the various soils can be calculated using a friction coefficient as follows:

- Compact to very dense sand: 0.40
- Compact to very dense sand and silt: 0.45
- Compact to very dense silt till: 0.45

The unit weight of sand, sand and silt and silt till soils is $21\ kN/m^3$, and the unit weight of sand and gravel and the granular backfill compacted to 95% SPMDD is $21\ kN/m^3$.

6.8 Access Driveway and Paved Parking Areas

Based on the results of the field work, the predominant subgrade materials at the site will consist of sand, sand and silt and silt till. The following flexible pavement structures are recommended based on the results of grain size distribution, assumed CBR values, groundwater table, frost susceptibility of subgrade soils and traffic volume.

Component	Light Duty Pavement (mm)	Heavy Duty Pavement (mm)
Asphaltic Concrete		
HL3	40	40
HL8	40	50
Granular "A" Base	150	150
Granular "B" Type II Sub-base Course	300	450

The pavement design considers that pavement construction will be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base may be required.

The base and sub-base materials should be produced in accordance with the current OPSS specifications, and placed and uniformly compacted to at least 100% SPMDD. The asphaltic concrete should be placed and compacted in accordance with OPSS Form 310 and to at least 92% of the Marshall Density (MRD). Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

It should be noted that even well-compacted trench backfill could settle for a period of time after construction. In this regard, the surface course of the asphaltic concrete should be placed at least one (1) year after trench backfill is completed so as to allow any minor settlements to occur within the trench backfill. The incomplete pavement structure may not be capable of supporting construction traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to paving with the base course and/or the surface course asphaltic concrete.

The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff away from buildings, sidewalks and other similar pertinent structures. Positive drainage outlets should be provided at all low points of the prepared earth subgrade, such as stub drains extended from the catch-basins.

Longitudinal sub-drains with positive drainage outlets are recommended to be installed at the subgrade level along the edges of the roadway construction to enhance the performance of the pavement. Systematic drainage of the granular base materials will promote the longevity of the pavement structure.

6.9 On Site Infiltration

It is understood that the potential for at-source storm water infiltration features are to be considered at the site. It is noted that infiltration features should have the base located at least 1.0 m above the groundwater table and that a minimum infiltration rate of 15 mm/hr is required.

Based on the results of grain size analyses and our past experience, the hydraulic conductivity and infiltration rate of the native inorganic soil types encountered at the boreholes are estimated and provided in the following table and may be used for storm water management purposes:

MATERIAL	PERMEABILITY (K) (cm/sec)	INFILTRATION RATE (mm/hr)
Sand, trace gravel to gravelly, trace to some silt (Enclosures 15 and 16)	1×10^{-3}	50
Sand and Silt, trace to some clay, trace gravel (Enclosure 14)	1×10^{-5}	3
Silt Till, some sand, trace to some clay, trace gravel	1×10^{-6}	1

Considering the subsurface conditions encountered at the boreholes, at-source infiltration features may be considered within the native sand deposits.

7.0 CLOSURE

The Limitations of Report, as quoted in Appendix A, is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
E.Y. CHUNG
8345506
Jan 4, 2018
PROVINCE OF ONTARIO

Joe van der Zalm, B. Eng., E.I.T.
Geotechnical Engineer in Training

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

APPENDIX A

LIMITATIONS OF REPORT

APPENDIX "A"

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

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. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report. The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

ENCLOSURES

Enclosure No.: 1
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 1

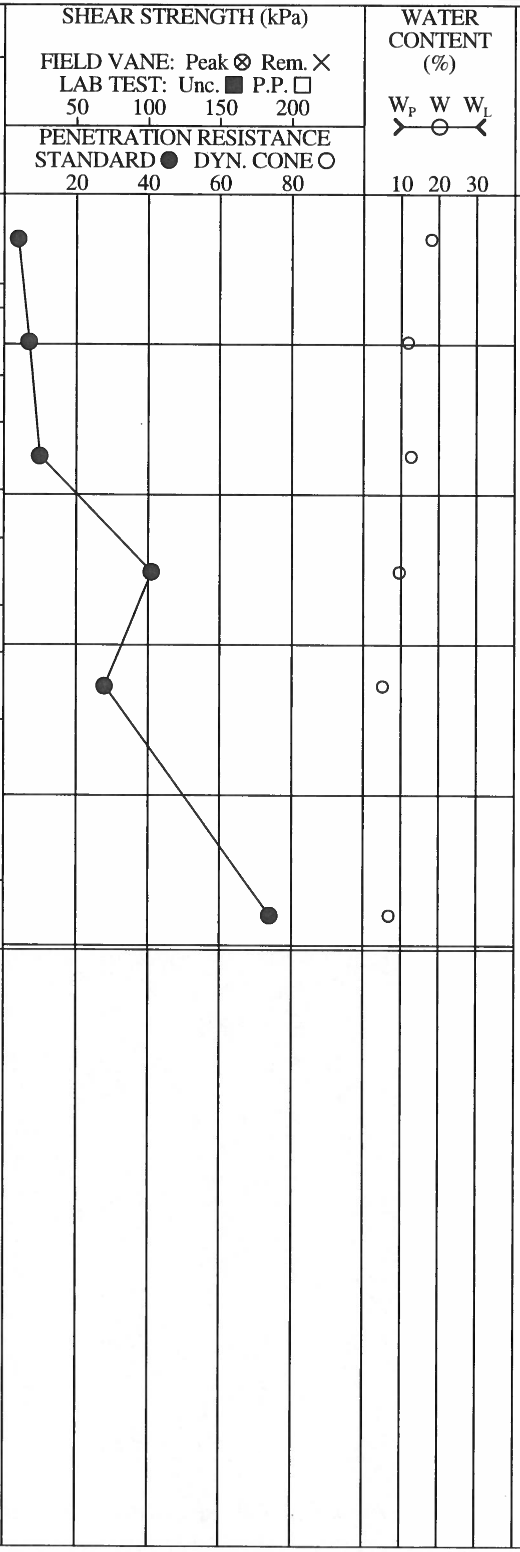
Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 / 17** TO **May 31 / 17**

SOIL LITHOLOGY / SAMPLE

ELEV./ DEPTH (m)	DESCRIPTION	SAMPLE ID	TYPE	N-VALUE	REMARKS
	Ground Elevation: **106.29 m**				
	250 mm TOPSOIL				
106.04 0.25	very loose to compact brown SAND and SILT trace to some clay, trace gravel moist	1 2 3	SS SS SS	4 7 10	
104.16 2.13	compact to very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist	4 5 6	SS SS SS	41 28 74	
101.26 5.03	End of Borehole				borehole open and dry to 5.03 m bgs upon completion of drilling



PROJECT MANAGER: **EYC**

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CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

Enclosure No.: 2
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 2

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 / 17** TO **May 31 / 17**

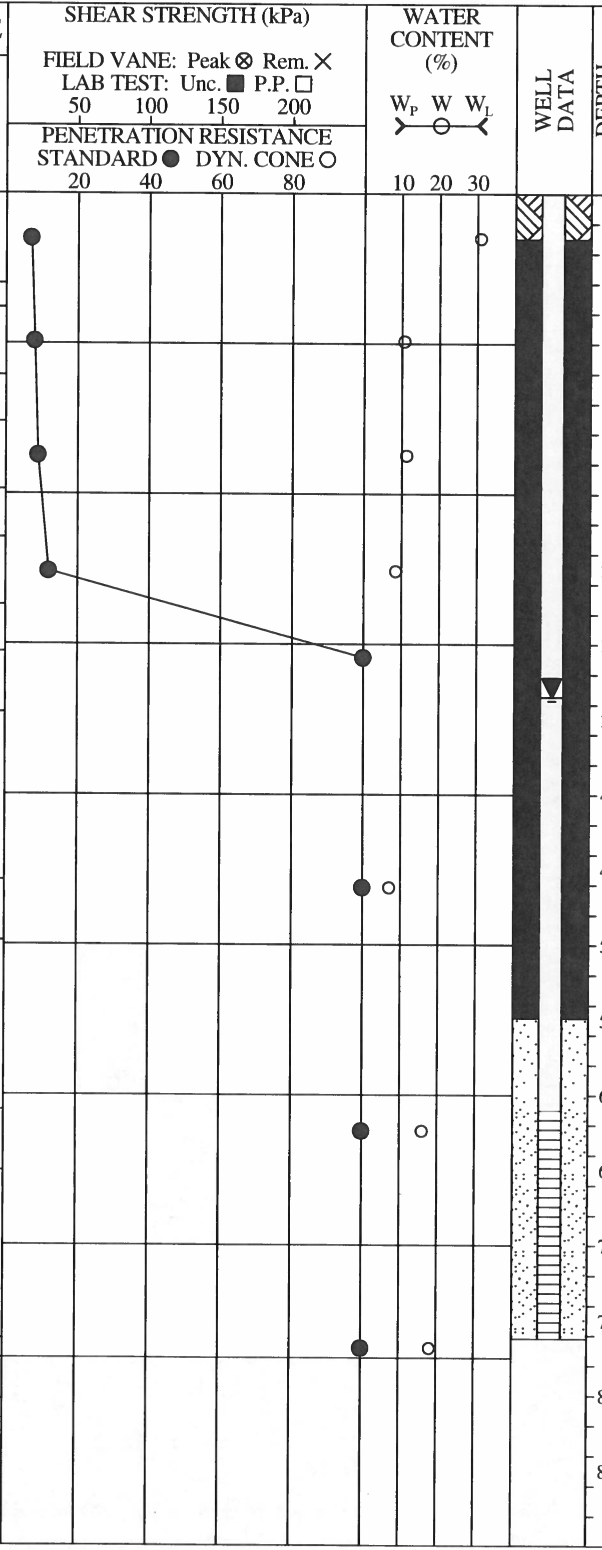
SOIL LITHOLOGY

Ground Elevation: **110.00 m**

ELEV./ DEPTH (m)	DESCRIPTION
109.75 0.25	250 mm TOPSOIL
107.10 2.90	loose to compact dark brown to brown SAND and SILT trace to some clay, trace gravel moist
102.25 7.75	very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers damp to saturated
	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	7
2	SS	8
3	SS	9
4	SS	12
5	SS	50/ 75 mm
6	SS	50/ 100 mm
7	SS	50/ 125 mm
8	SS	50/ 125 mm



REMARKS

DEPTH (m)	REMARKS
	steel monument casing set in concrete
2.0	bentonite seal/50 mm I.D. PVC rizer
5.5	1.5 m long, 50 mm I.D. PVC screen with sandpack
8.0	water level in monitoring measured to 3.35 bgs on June 14, 2017

PROJECT MANAGER: **EYC**

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Enclosure No.: 3
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 3

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 / 17** TO **May 31 / 17**

SOIL LITHOLOGY

Ground Elevation: **109.08 m**

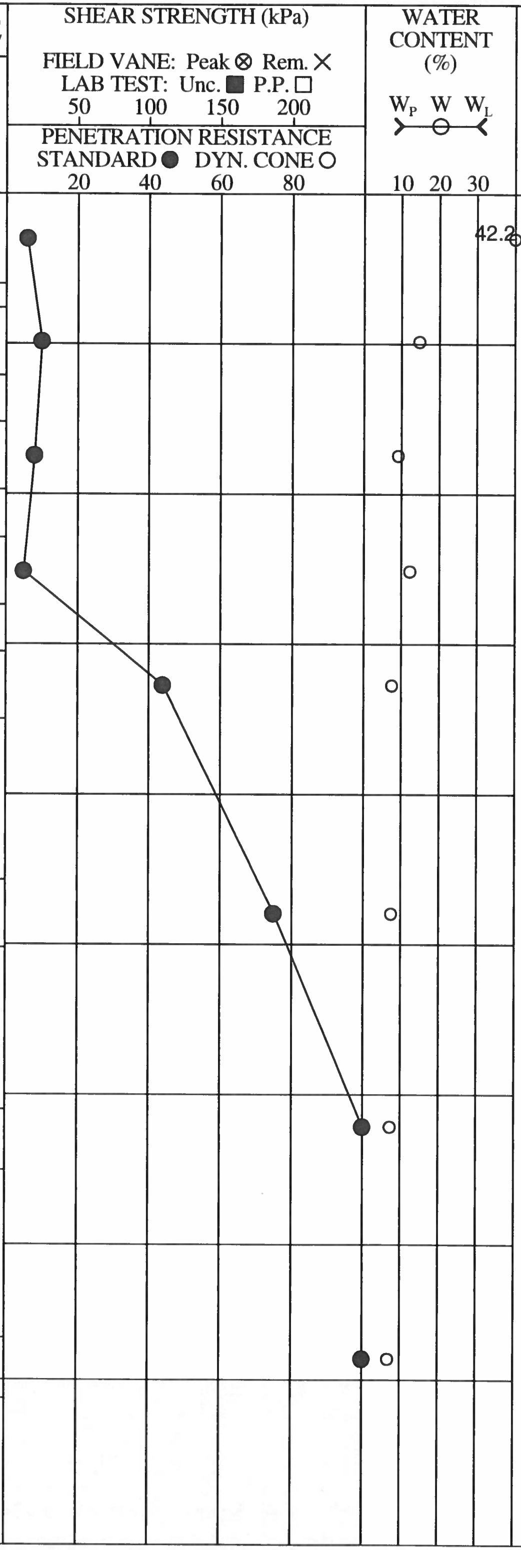
ELEV./ DEPTH (m)	DESCRIPTION
	325 mm TOPSOIL
108.75 0.33	loose to compact dark brown to brown SAND and SILT trace to some clay, trace gravel moist
106.18 2.90	dense to very dense brown SILT TILL some sand to sandy, some gravel, trace clay contains cobbles occ. clayey seams/layers damp to moist
101.18 7.90	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	6
2	SS	10
3	SS	8
4	SS	5
5	SS	44
6	SS	75
7	SS	50/ 75 mm
8	SS	50/ 125 mm

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○

WATER CONTENT (%)
W_P W W_L



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS

borehole open and dry to 7.90 m bgs upon completion of drilling

PROJECT MANAGER: **EYC**

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Enclosure No.: 4
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 4

Client: **Daniel Hrycyna**

Project: **Proposed Townhouse Development**

Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 / 17** TO **May 31 / 17**

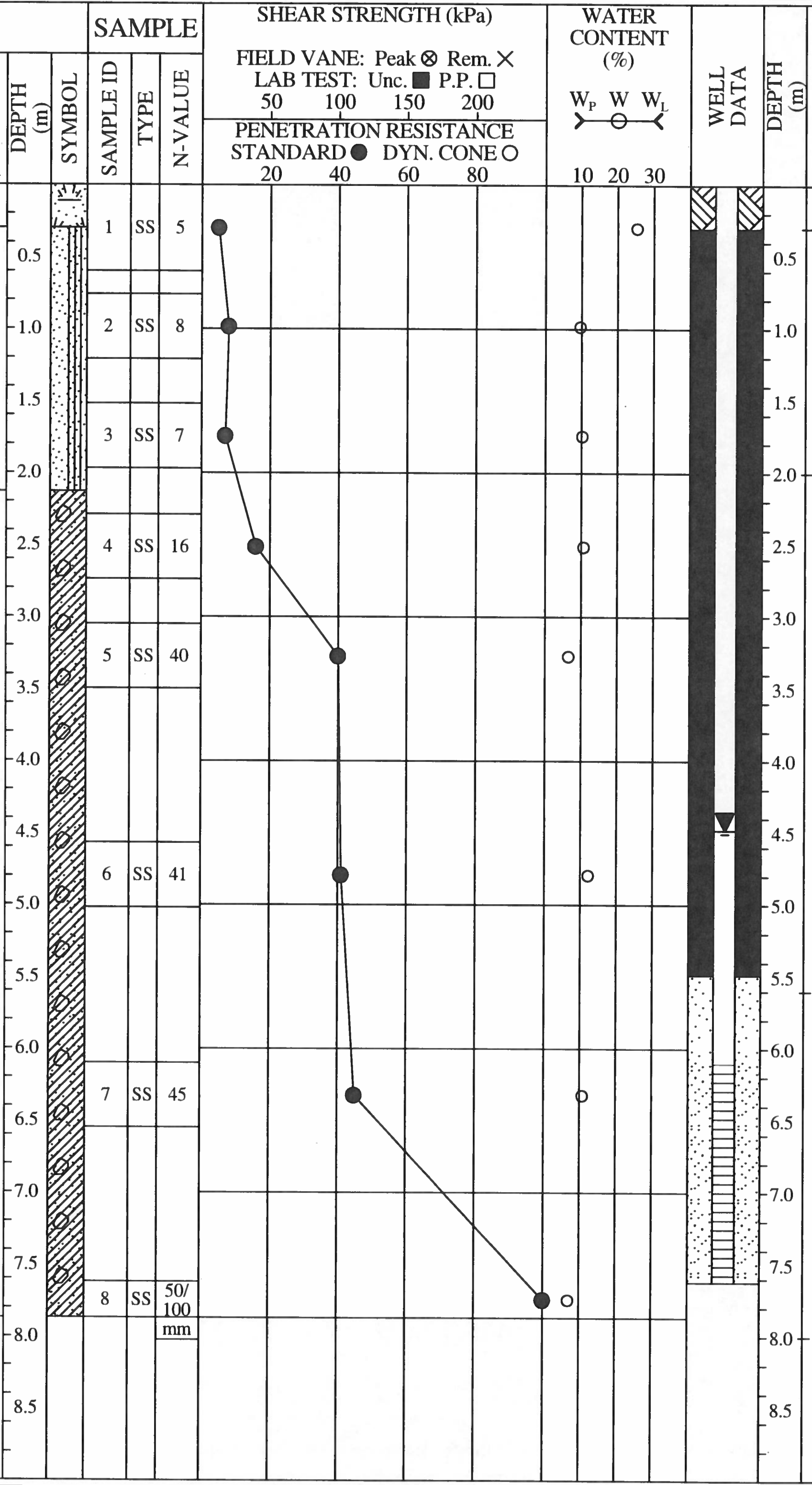
SOIL LITHOLOGY

Ground Elevation: **106.92 m**

ELEV./ DEPTH (m)	DESCRIPTION
106.62 0.30	300 mm TOPSOIL
104.79 2.13	loose brown SAND and SILT trace to some clay, trace gravel moist
99.05 7.87	compact to very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist to saturated
	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	5
2	SS	8
3	SS	7
4	SS	16
5	SS	40
6	SS	41
7	SS	45
8	SS	50/ 100 mm



REMARKS

steel monument casing set in concrete

bentonite seal/50 mm I.D. PVC rizer

1.5 m long, 50 mm I.D. PVC screen with sandpack

water level in monitoring measured to 4.48 bgs on June 14, 2017

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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FILE No: G17440

BOREHOLE No. 5

Enclosure No.: 5
Sheet 1 of 1

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Jun 01 / 17** TO **Jun 01 / 17**

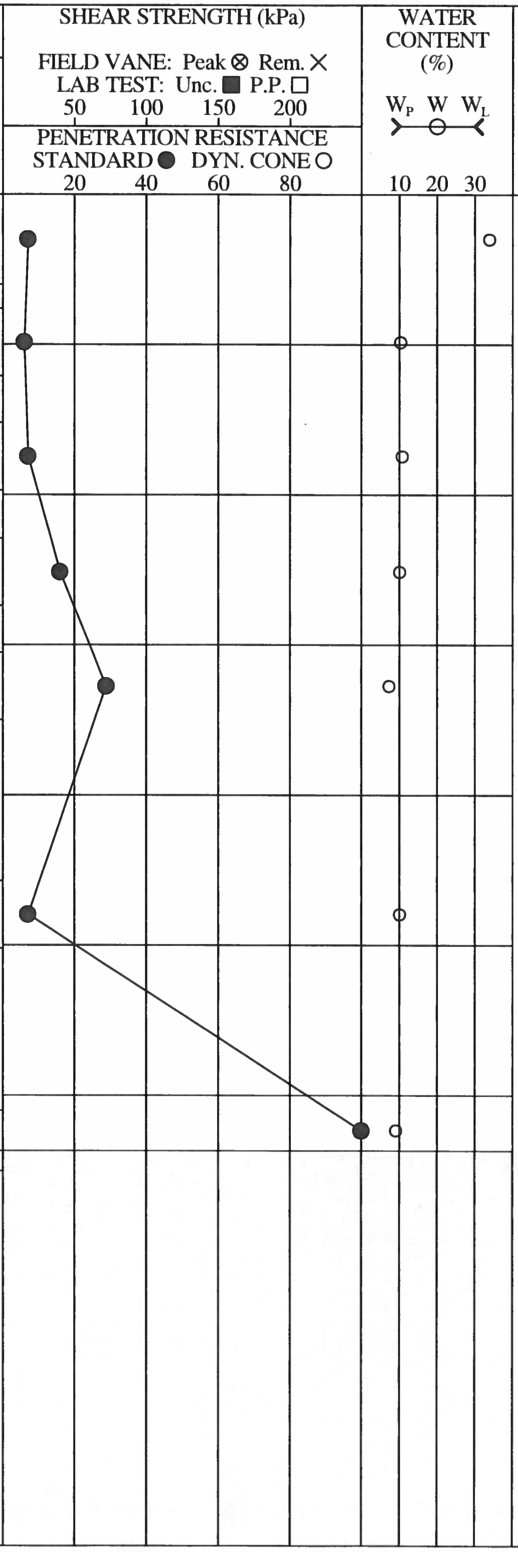
SOIL LITHOLOGY

Ground Elevation: **103.31 m**

ELEV./ DEPTH (m)	DESCRIPTION
	250 mm TOPSOIL
103.06 0.25	loose brown SAND and SILT trace to some clay, trace gravel moist
101.18 2.13	loose to very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers occ. saturated seams moist to wet
96.94 6.37	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	7
2	SS	6
3	SS	7
4	SS	16
5	SS	29
6	SS	7
7	SS	50/ 125 mm



WELL DATA

REMARKS

borehole cave-in and dry to 5.79 m bgs upon completion of drilling

PROJECT MANAGER: **EYC**

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Enclosure No.: 6
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 6

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

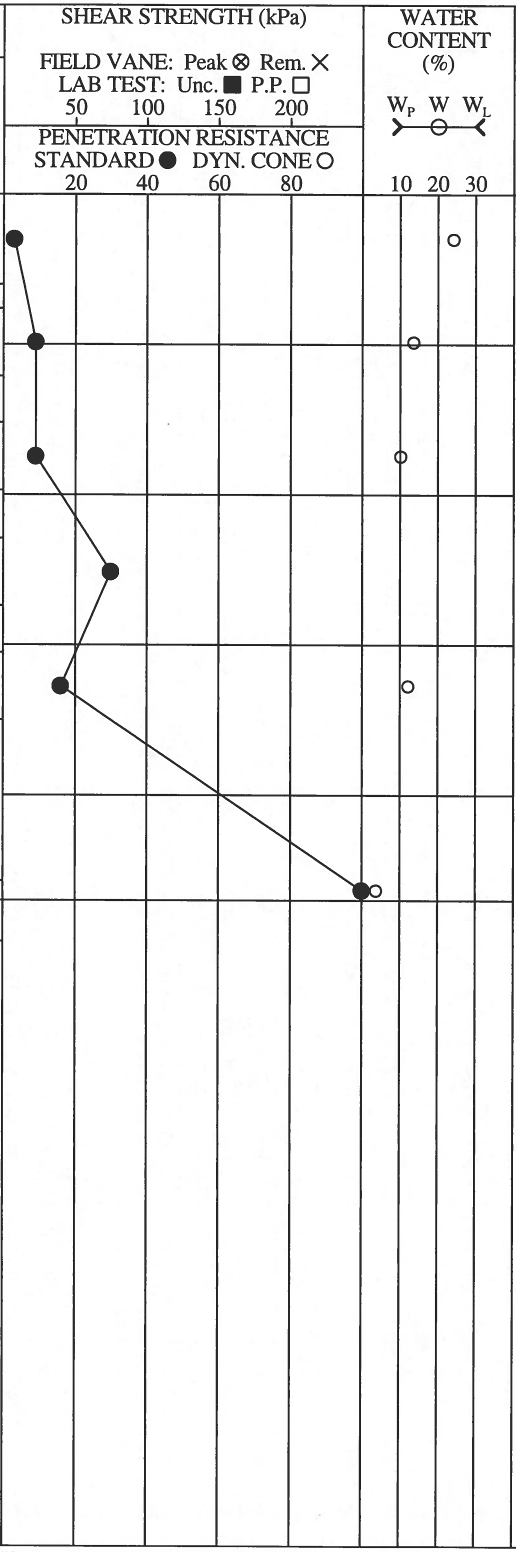
SOIL LITHOLOGY

Ground Elevation: **102.17 m**

ELEV./ DEPTH (m)	DESCRIPTION
	350 mm TOPSOIL
101.82 0.35	very loose to loose brown SAND and SILT trace to some clay, trace gravel moist
100.04 2.13	compact to very dense brown SAND trace to some silt, trace gravel damp to moist
97.47 4.70	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	3
2	SS	9
3	SS	9
4	SS	30
5	SS	16
6	SS	50/ 125 mm



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS

4.70 m: borehole open and dry to 4.70 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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Enclosure No.: 7
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 7

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

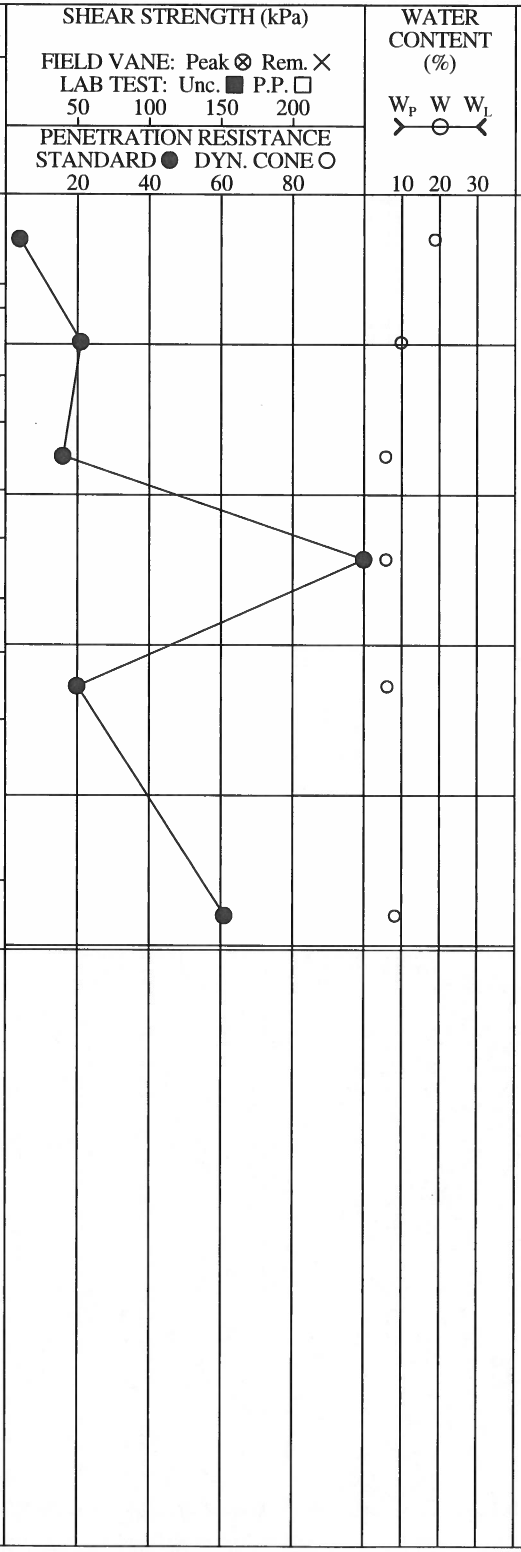
SOIL LITHOLOGY

Ground Elevation: **106.15 m**

ELEV./ DEPTH (m)	DESCRIPTION
	375 mm TOPSOIL
105.77 0.38	very loose to compact dark brown to brown SAND and SILT trace to some clay, trace gravel moist
104.02 2.13	compact to very dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist
101.12 5.03	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	4
2	SS	21
3	SS	16
4	SS	50/ 125 mm
5	SS	20
6	SS	61



WELL DATA

REMARKS

5.0 – borehole open and dry to 5.03 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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FILE No: G17440

BOREHOLE No. 8

Enclosure No.: 8
Sheet 1 of 1

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

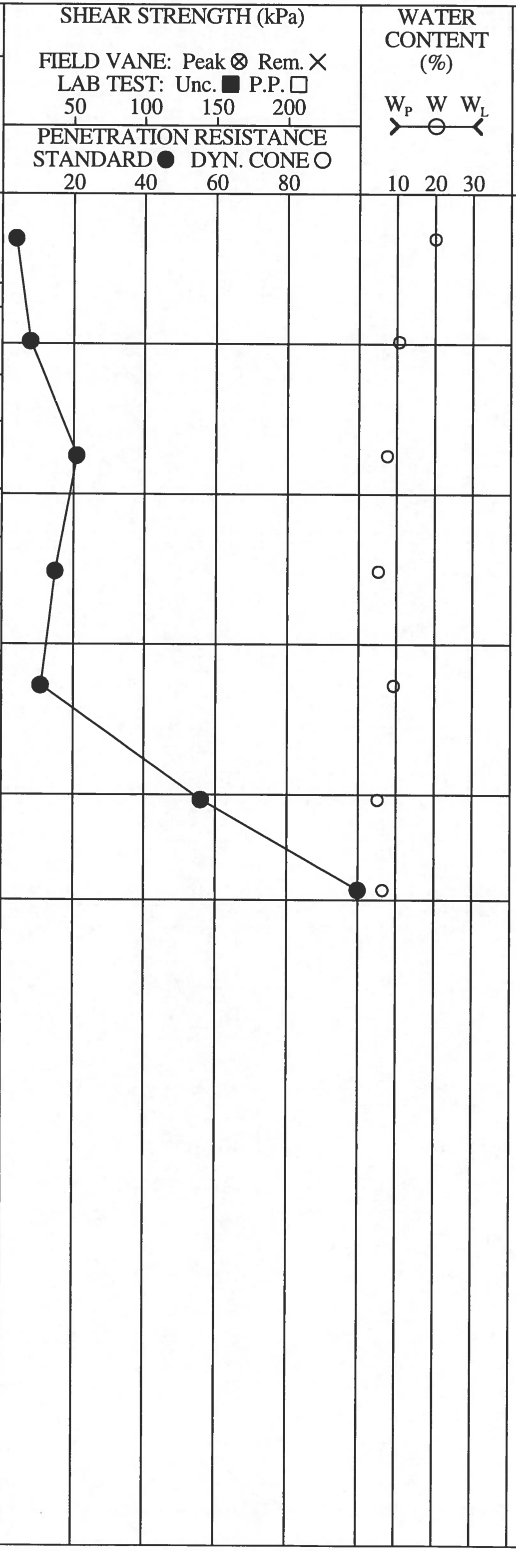
SOIL LITHOLOGY

Ground Elevation: **100.96 m**

ELEV./ DEPTH (m)	DESCRIPTION
	200 mm TOPSOIL
100.76 0.20	very loose to loose brown SAND and SILT trace to some clay, trace gravel moist
99.59 1.37	compact brown SAND trace to some silt occ. silt pockets moist
97.45 3.51	very dense, brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers moist
96.26 4.70	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	4
2	SS	8
3	SS	21
4	SS	15
5	SS	11
6	SS	56
7	SS	50/ 125 mm



REMARKS
- borehole open and dry to 4.7 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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Enclosure No.: 9
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 9

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **May 31 / 17** TO **May 31 / 17**

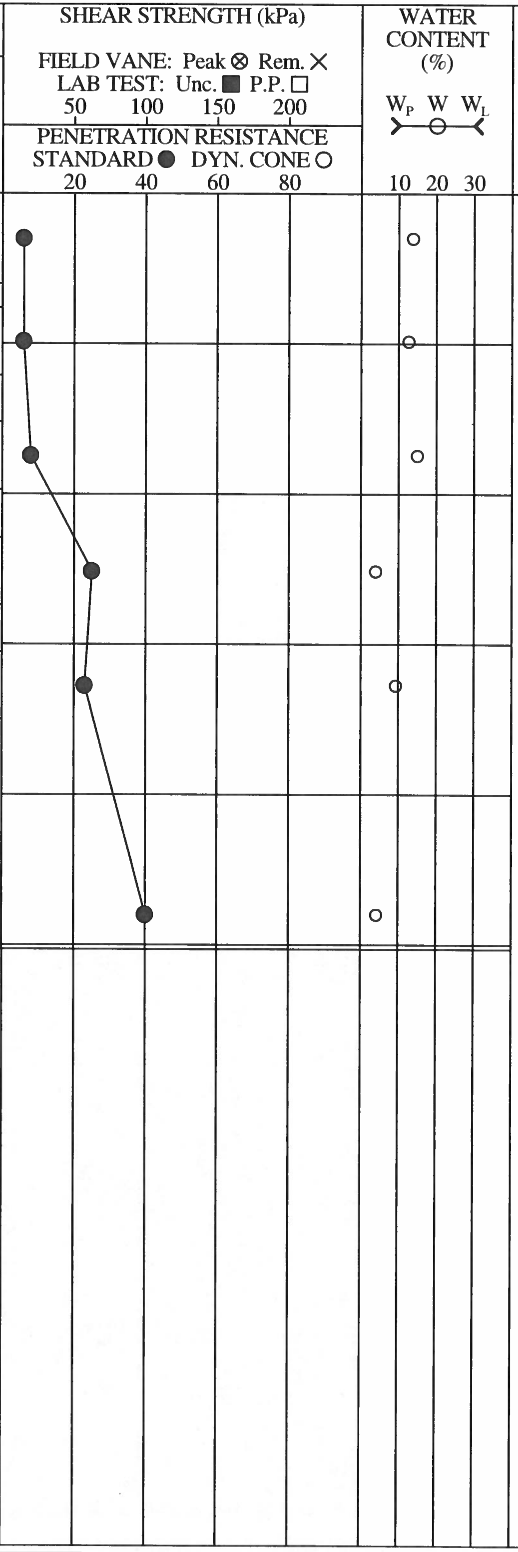
SOIL LITHOLOGY

Ground Elevation: **102.81 m**

ELEV./ DEPTH (m)	DESCRIPTION	SYMBOL
	250 mm TOPSOIL	⁂
102.56 0.25	loose brown SAND and SILT trace to some clay, trace gravel moist	▒
100.68 2.13	compact to dense brown SILT TILL some sand, trace to some clay, trace gravel contains cobbles occ. clayey seams/layers damp to moist	▨
97.78 5.03	End of Borehole	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	6
2	SS	6
3	SS	8
4	SS	25
5	SS	23
6	SS	40



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS
5.0 – borehole open and dry to 5.03 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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Enclosure No.: 10
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 10

Client: **Daniel Hrycyna**

Project: **Proposed Townhouse Development**

Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

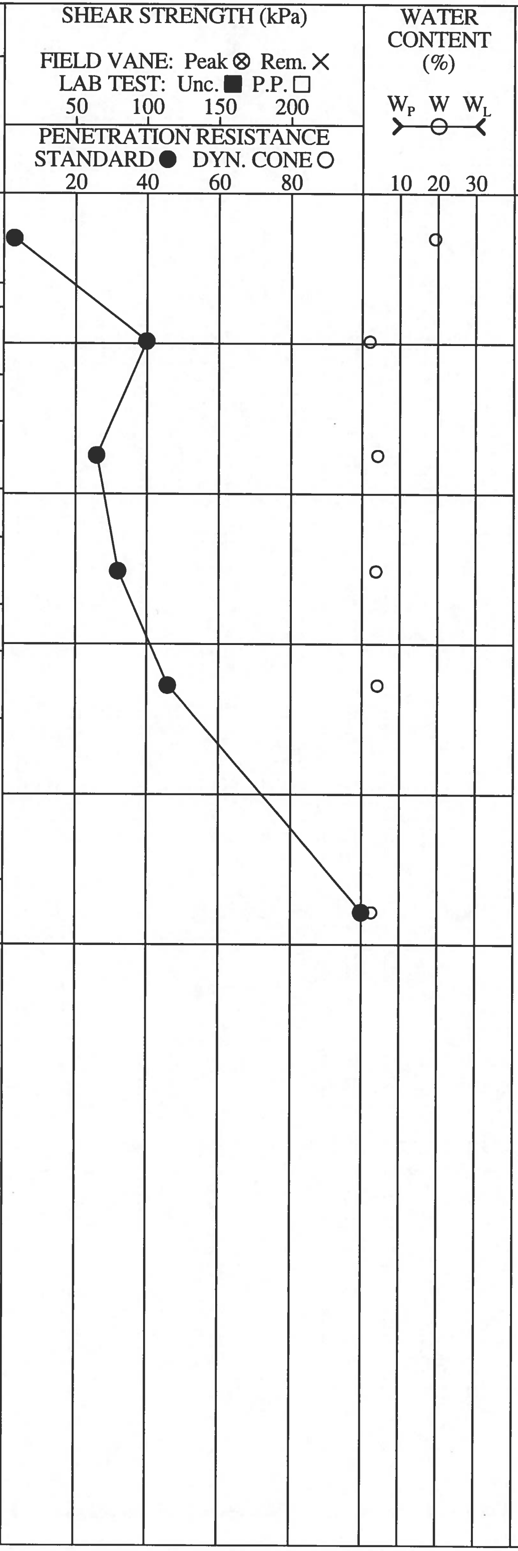
SOIL LITHOLOGY

Ground Elevation: **99.67 m**

ELEV./ DEPTH (m)	DESCRIPTION
	300 mm TOPSOIL
99.37 0.30	very loose to very dense brown SAND trace to some gavel, trace silt damp to moist
94.67 5.00	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	3
2	SS	40
3	SS	26
4	SS	32
5	SS	46
6	SS	50/ 125 mm



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS

borehole cave-in and dry to 3.66 m bgs upon completion of drilling

CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

PROJECT MANAGER: **EYC**

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Enclosure No.: 11
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 11

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

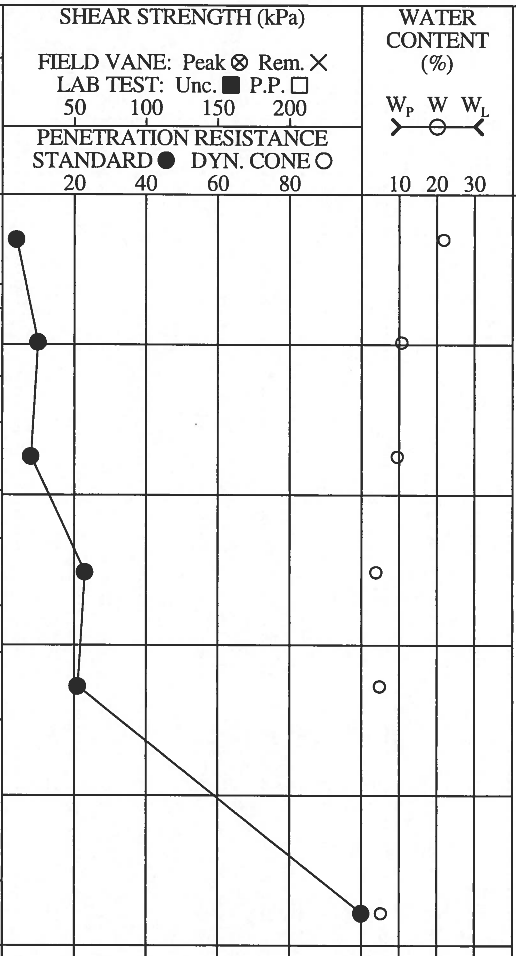
SOIL LITHOLOGY

Ground Elevation: **99.71 m**

ELEV./ DEPTH (m)	DESCRIPTION	SYMBOL
99.51 0.20	200 mm TOPSOIL	
98.34 1.37	very loose to compact brown SAND and SILT trace to some clay, trace gravel moist	
94.71 5.00	loose to very dense brown SAND trace gravel to gravelly, trace silt damp to moist	
	End of Borehole	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	4
2	SS	10
3	SS	8
4	SS	23
5	SS	21
6	SS	50/ 125 mm



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS

3.66 m: borehole cave-in and dry to 3.66 m bgs upon completion of drilling

PROJECT MANAGER: **EYC**

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CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

Enclosure No.: 12
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 12

Client: **Daniel Hrycyna**
Project: **Proposed Townhouse Development**
Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Jun 01 / 17** TO **Jun 01 / 17**

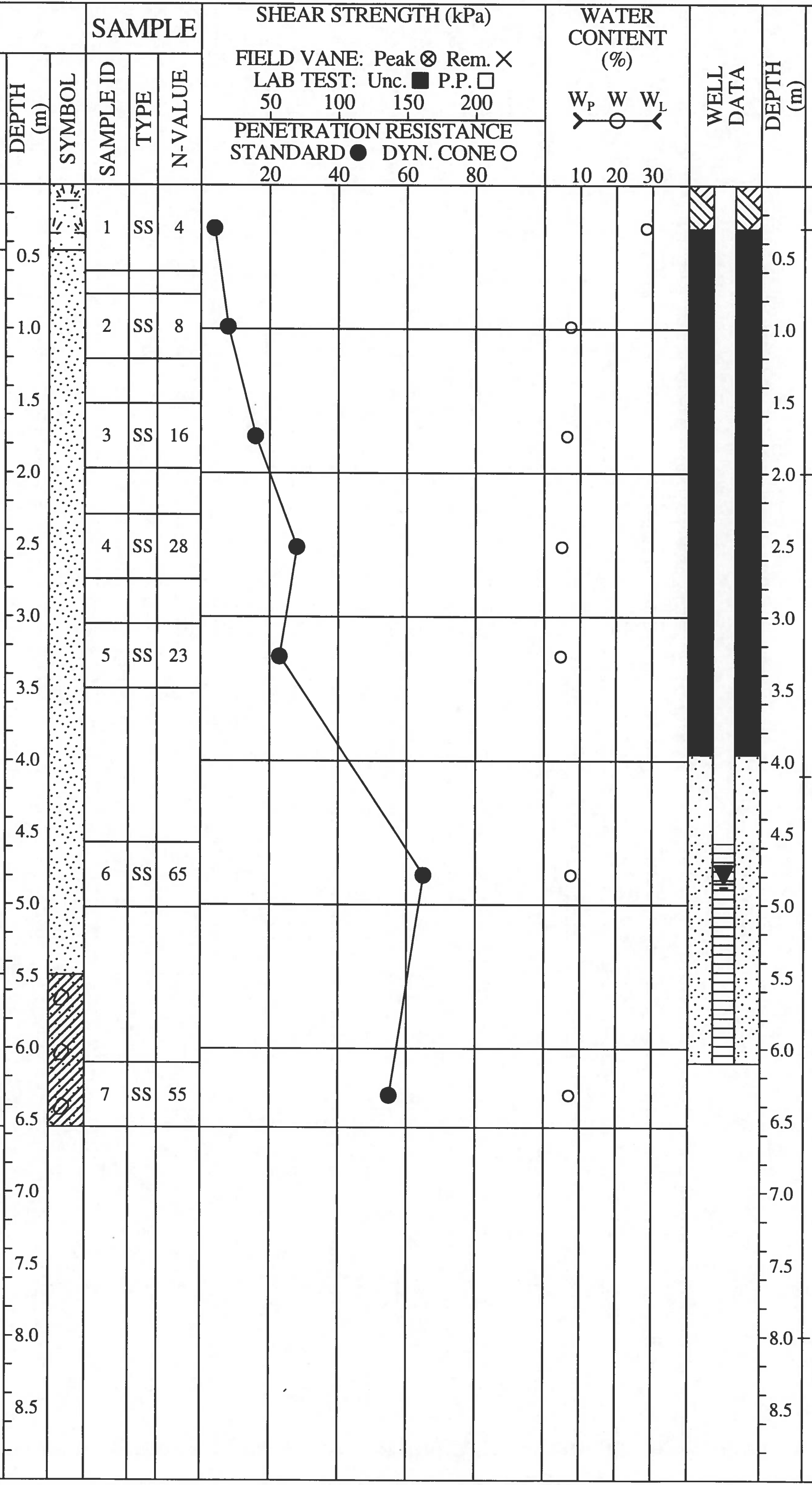
SOIL LITHOLOGY

Ground Elevation: **99.59 m**

ELEV./ DEPTH (m)	DESCRIPTION
	460 mm TOPSOIL
99.13 0.46	very loose to very dense brown SAND trace to some gravel and silt occ. silt pockets/seams damp to saturated
94.10 5.49	very dense, brown SILT TILL some sand, trace to some clay, trace gravel saturated
93.04 6.55	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	4
2	SS	8
3	SS	16
4	SS	28
5	SS	23
6	SS	65
7	SS	55



REMARKS

DEPTH (m)	REMARKS
0.3	steel monument casing set in concrete
2.0	bentonite seal/50 mm I.D. PVC rizer
4.0	1.5 m long, 50 mm I.D. PVC screen with sandpack
8.0	water level in monitoring measured to 4.85 bgs on June 14, 2017

PROJECT MANAGER: **EYC**

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CVD BOREHOLE (2017) G17440 20 SCOTTS ST GRAND VALLEY.GPJ CVD_ENG.GDT 14/12/17

Enclosure No.: 13
Sheet 1 of 1

FILE No: G17440

BOREHOLE No. 13

Client: **Daniel Hrycyna**

Project: **Proposed Townhouse Development**

Location: **20 Scott Street, Grand Valley, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D-50T**
Method: **Hollow Stem Auger**
Size: **82 mm I.D.**
Date: **May 30 / 17** TO **May 30 / 17**

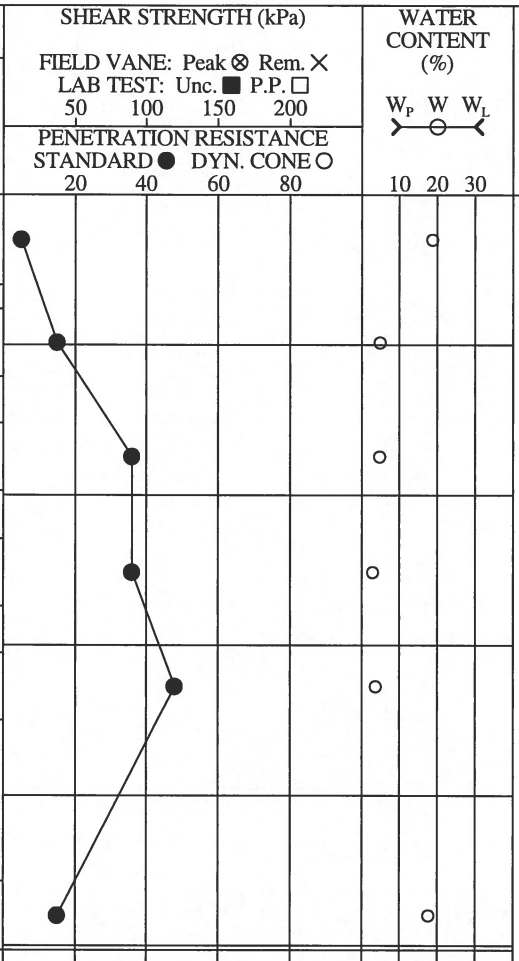
SOIL LITHOLOGY

Ground Elevation: **99.38 m**

ELEV./ DEPTH (m)	DESCRIPTION
	300 mm TOPSOIL
99.08 0.30	loose to dense brown SAND trace to some silt, trace gravel to gravelly occ. silt pockets/seams damp to saturated
94.35 5.03	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	5
2	SS	15
3	SS	36
4	SS	36
5	SS	48
6	SS	15



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5

REMARKS

- borehole cave-in and dry to 2.44 m bgs upon completion of drilling
- hydrostatic pressure

PROJECT MANAGER: **EYC**

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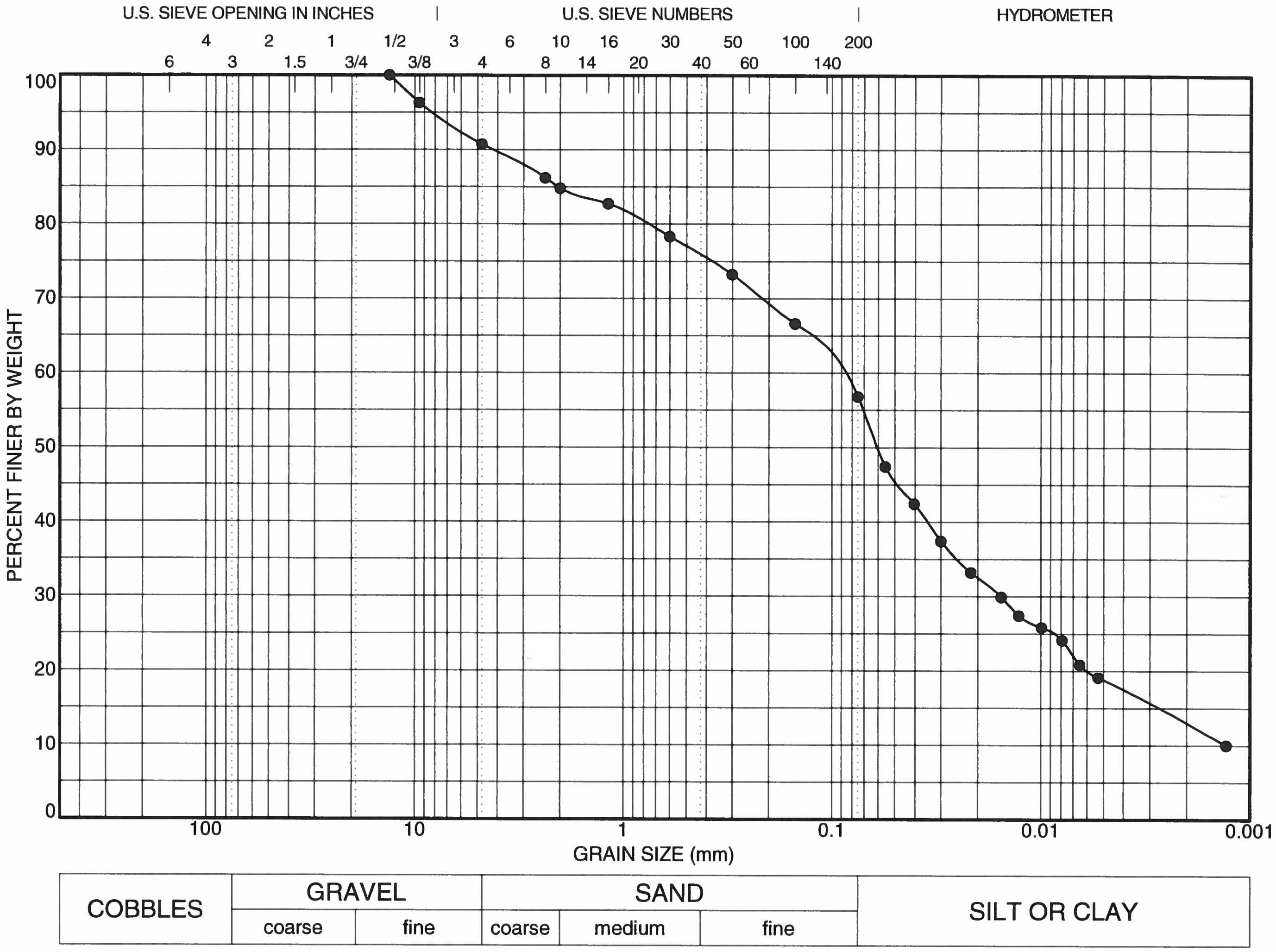

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.98	72.35	13.2	0.094	0.016	0.001	9.3	33.9	56.8	

Date:	Jun. 08 / 2017
Client:	Daniel Hrycyna
Contractor:	
Source:	
Sampled From:	BH 7, SA 3, 1.52 to 1.98 m depth
Sample No.:	7-3
Date Sampled:	Jun. 06 / 2017
Sampled By:	AB
Lab No.:	1736
Date Tested:	Jun. 07 / 2017
Type of Material:	Sand and Silt, some clay, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

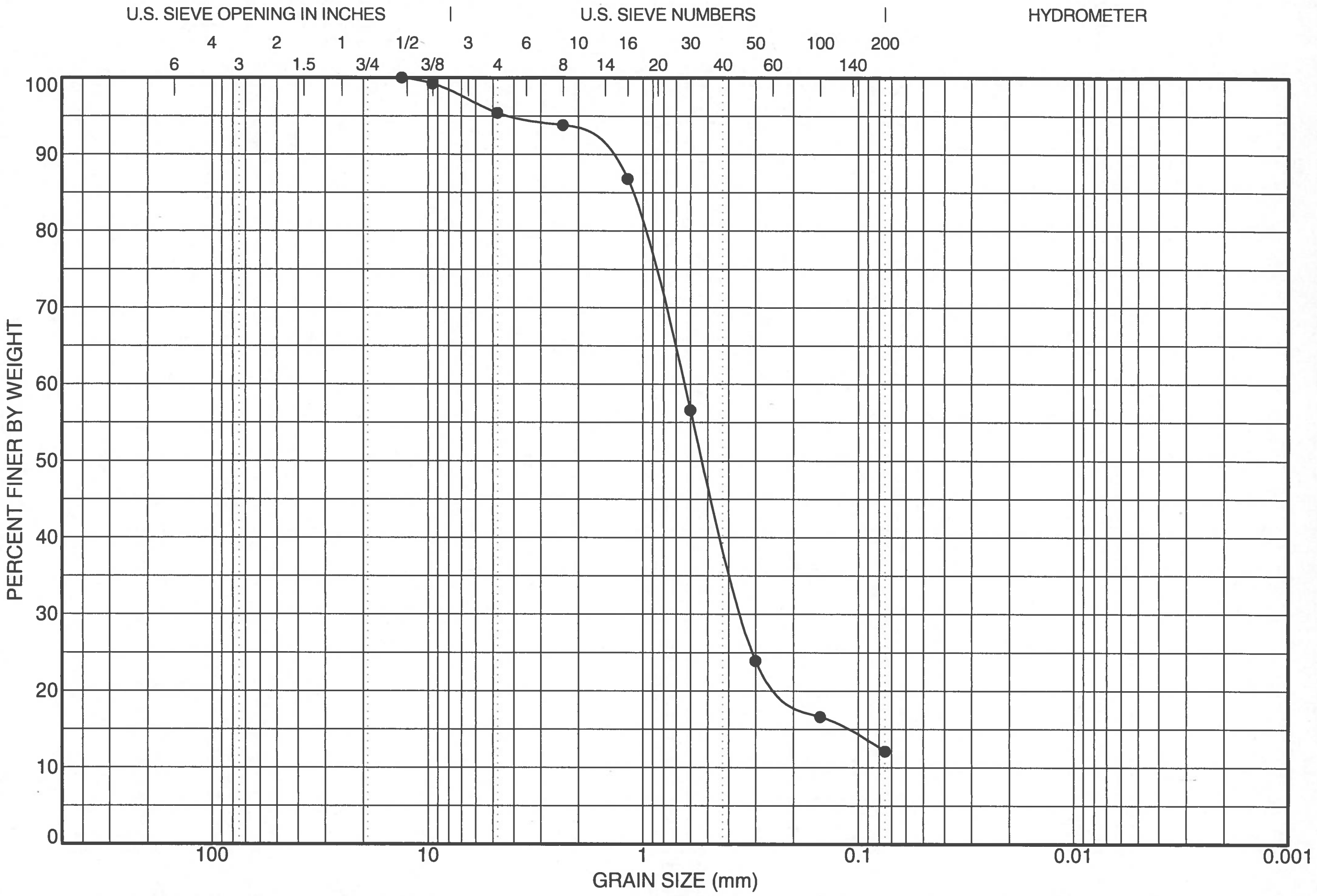
GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development

Location: 20 Scott Street, Grand Valley, Ontario

File No.: G17440

Enclosure No.: 14



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			3.32	11.93	13.2	0.647	0.341		4.6	83.3	12.1	

Date: Jun. 08 / 2017
Client: Daniel Hrycyna
Contractor:
Source:
Sampled From: BH 12, SA 5, 3.05 to 3.51 m depth
Sample No.: 12-5
Date Sampled: Jun. 06 / 2017
Sampled By: AB
Lab No.: 1734
Date Tested: Jun. 06 / 2017
Type of Material: Sand, some silt, trace gravel

Sieve Size (mm)	Percent Passing	No Specifications

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e-mail: info@cvdengineering.com

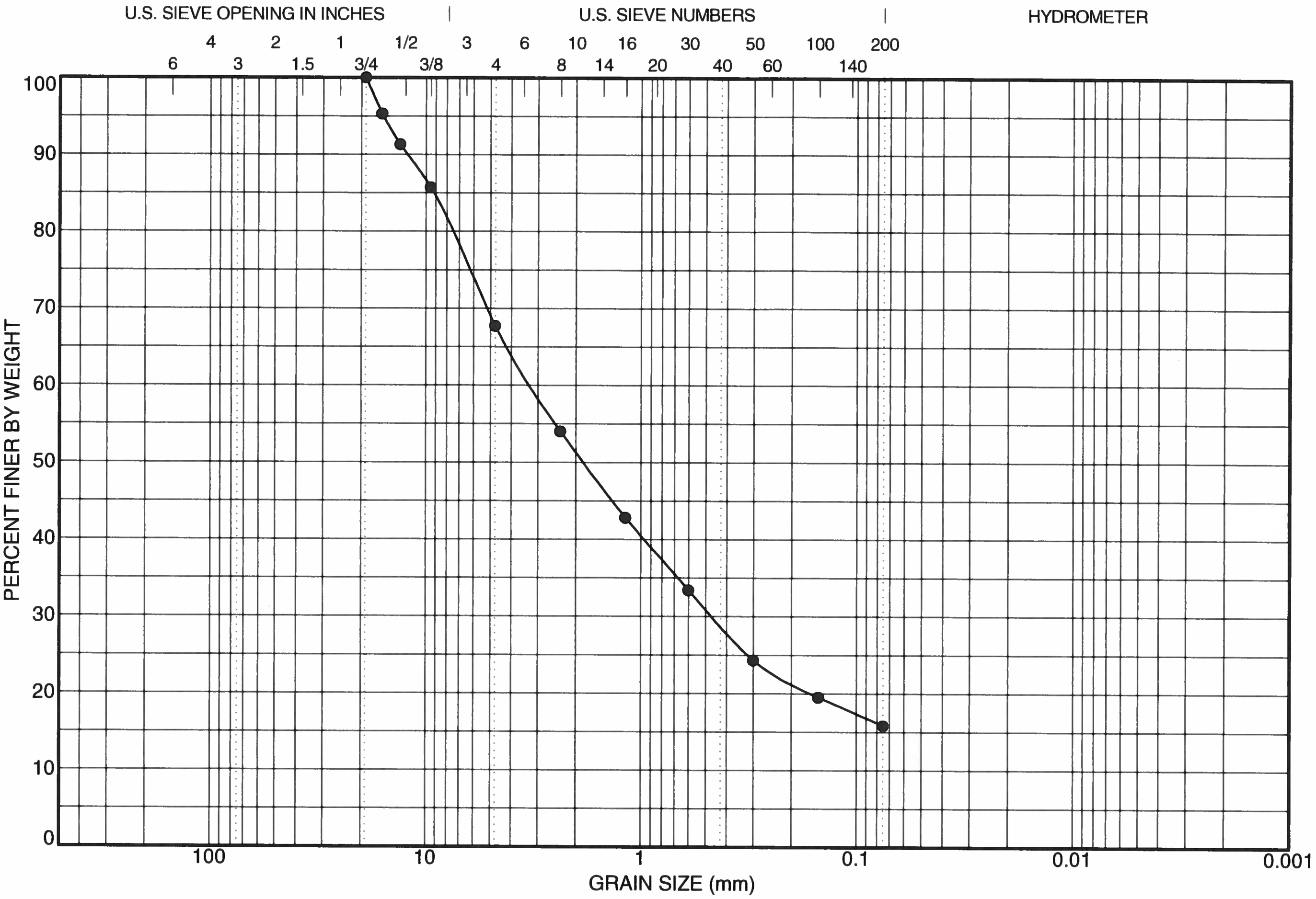
GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development

Location: 20 Scott Street, Grand Valley, Ontario

File No.: G17440

Enclosure No.: 15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
					19	3.206	0.463		32.3	51.9	15.8	

Date:	Jun. 08 / 2017
Client:	Daniel Hrycyna
Contractor:	
Source:	
Sampled From:	BH 13, SA 5, 3.05 to 3.51 m depth
Sample No.:	13-5
Date Sampled:	Jun. 06 / 2017
Sampled By:	AB
Lab No.:	1735
Date Tested:	Jun. 06 / 2017
Type of Material:	Gravelly Sand, some silt

Sieve Size (mm)	Percent Passing	No Specifications

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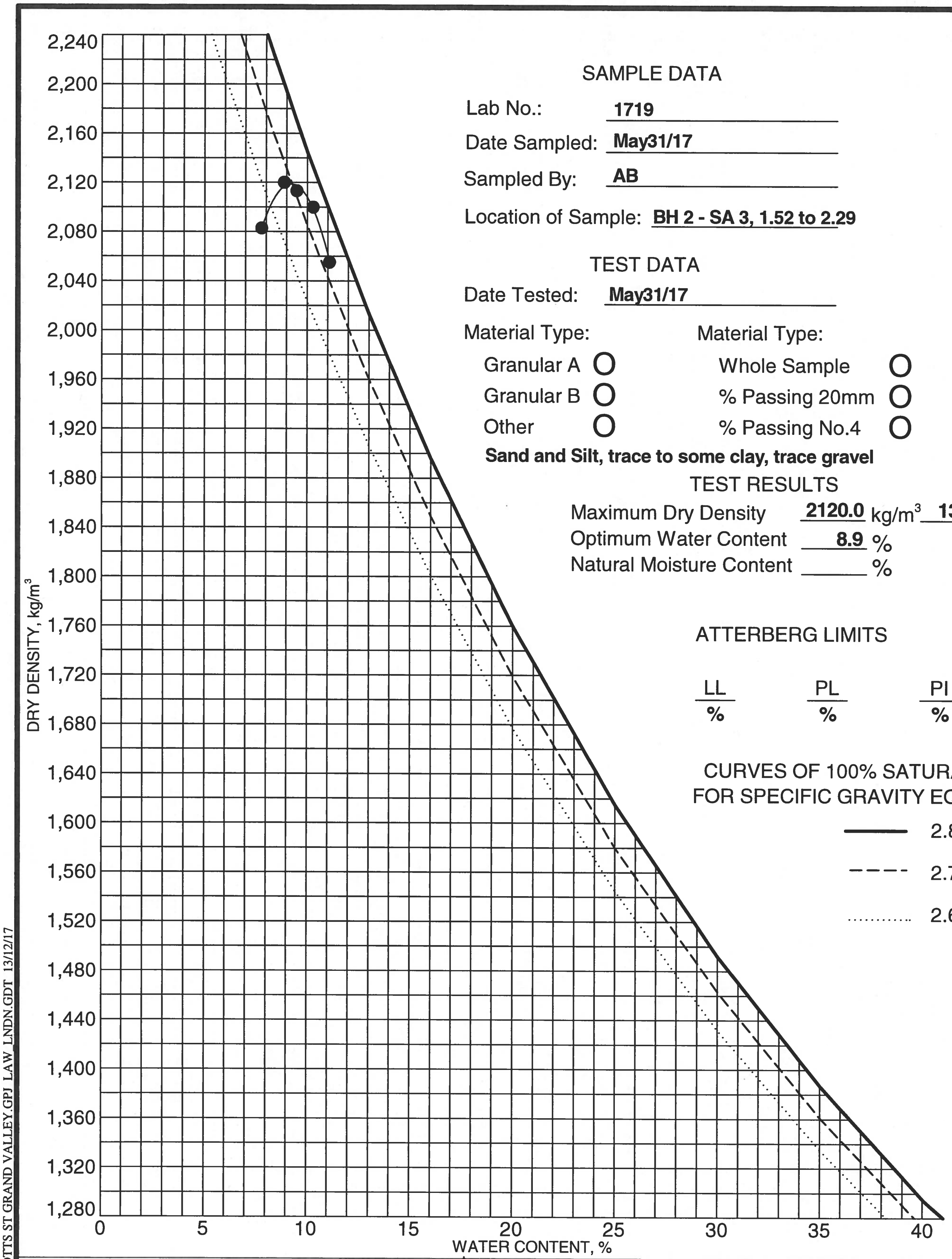
GRAIN SIZE DISTRIBUTION

Project: Proposed Townhouse Development

Location: 20 Scott Street, Grand Valley, Ontario

File No.: G17440

Enclosure No.: 16



SAMPLE DATA

Lab No.: 1719

Date Sampled: May31/17

Sampled By: AB

Location of Sample: BH 2 - SA 3, 1.52 to 2.29

TEST DATA

Date Tested: May31/17

Material Type:		Material Type:	
Granular A	○	Whole Sample	○
Granular B	○	% Passing 20mm	○
Other	○	% Passing No.4	○

Sand and Silt, trace to some clay, trace gravel

TEST RESULTS

Maximum Dry Density **2120.0** kg/m³ **132.3** PCF

Optimum Water Content **8.9** %

Natural Moisture Content ______ %

ATTERBERG LIMITS

LL	PL	PI
%	%	%

CURVES OF 100% SATURATION FOR SPECIFIC GRAVITY EQUAL TO:

———	2.80
– – – –	2.70
…………	2.60

CAN COMPACTION G17440 20 SCOTTS ST GRAND VALLEY.GPJ LAW LNDN.GDT 13/12/17

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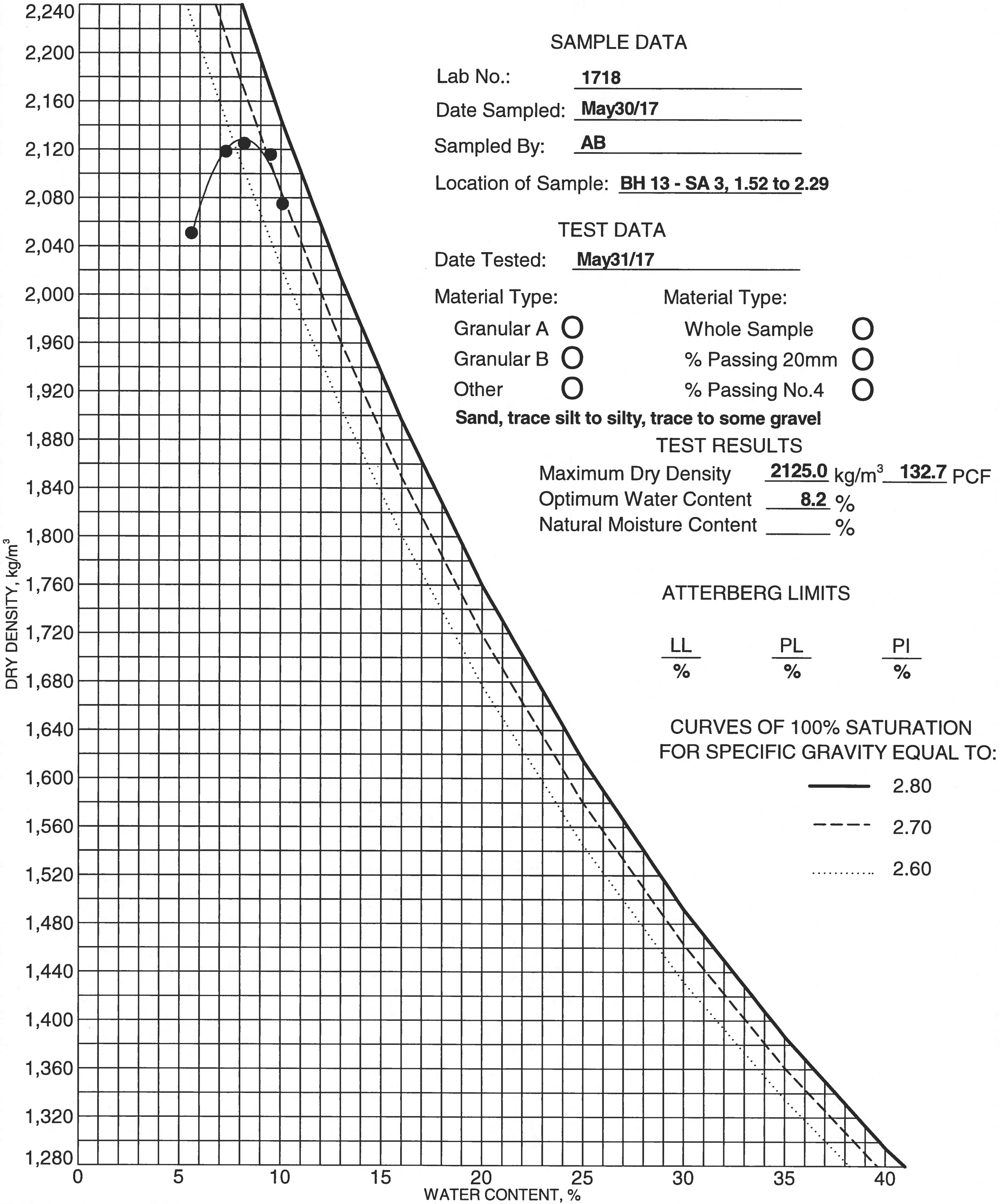
STANDARD PROCTOR TEST RESULTS

Project: **Proposed Townhouse Development**

Location: **20 Scott Street, Grand Valley, Ontario**

File No.: **G17440**

Enclosure No.: 17



SAMPLE DATA

Lab No.: **1718**

Date Sampled: **May30/17**

Sampled By: **AB**

Location of Sample: **BH 13 - SA 3, 1.52 to 2.29**

TEST DATA

Date Tested: **May31/17**

Material Type:		Material Type:	
Granular A	○	Whole Sample	○
Granular B	○	% Passing 20mm	○
Other	○	% Passing No.4	○

Sand, trace silt to silty, trace to some gravel

TEST RESULTS

Maximum Dry Density **2125.0** kg/m³ **132.7** PCF

Optimum Water Content **8.2** %

Natural Moisture Content ______ %

ATTERBERG LIMITS

LL	PL	PI
%	%	%

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CAN COMPACTION G17440 20 SCOTTS ST GRAND VALLEY.GPJ LAW LNDN.GDT 13/12/17

KEY PLAN **SOURCE:** Google Earth

LEGEND

▲ **TBM: Top of existing manhole in Scott Street in front of lot number 20 Elevation: 100.00 m (Assumed)**

⌖ **Borehole Location**

BOREHOLE LOCATION PLAN

Proposed Townhouse
Development

20 Scott Street
Grand Valley, Ontario

CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979

Drawn By: AB	Date: December, 2017	File No.: G17440
Checked By: EYC	Scale: 1:600	Drawing No.: 1