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Geotechnical Investigation
Proposed Tower Complex

4933 Victoria Avenue North
Vineland Station, Ontario
L0R 2E0

Prepared for:

4933 Vic Court Globizen LP
2720 Dundas Street West, Suite 608
Toronto, Ontario
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■ GEOTECHNICAL INVESTIGATIONS ■ ENVIRONMENTAL SITE ASSESSMENTS & CLEANUP ■ GROUNDWATER STUDIES ■ SLOPE STABILITY STUDIES
■ ASPHALT TECHNOLOGY ■ ASPHALT MIX DESIGNS ■ PAVEMENT PERFORMANCE ANALYSIS ■ CONSTRUCTION MATERIALS TESTING & INSPECTION
■ ANALYSIS OF SOIL CORROSION POTENTIAL ■ PAVEMENT REHABILITATION & TENDER SPECIFICATIONS ■ CONCRETE QUALITY ASSURANCE TESTING
■ ROOF/STEEL INSPECTIONS ■ HYDROGEOLOGICAL ASSESSMENTS ■ FAILURE ANALYSES & EXPERT WITNESS SERVICES ■ AGGREGATE EVALUATION

EXECUTIVE SUMMARY

SCOPE OF SERVICES

Proposed Development	The proposed development is to comprise of the following: a stepped, five-storey to 17-storey residential tower, with three partial, above-ground parking levels and a three- and four- storey podium; a stepped, four-storey to 14-storey residential tower, with a four-storey podium courtyard; a 13- to 15-storey hotel with a rooftop pool; a central courtyard comprising public open space, trees, a pond and trellis-covered areas; and, a new deck, dock and access ramp.
Report Deliverables	The Preliminary Geotechnical Investigation Report is required to provide an understanding of the subsurface conditions underlying the site and to provide preliminary design and construction recommendations for the proposed new tower complex.

SITE DETAILS AND SETTING

Coordinates	630435, 4783500	**Geodetic Elevation**	73.0 m to 80.0 m

Site Description	The site is irregular in shape and is situated at the intersections of Verity Lane, Viceroy Avenue and Victoria Avenue North. The site is bound to the north by Lake Ontario, the west by Victoria Avenue North, the east by a forested area, and to the south by residential properties. The topography of the site is generally flat-lying and all existing buildings have been removed.
Geology	Existing pavement areas and/or fill material was encountered in all boreholes at the ground surface or underlying the existing pavement structure, and extends to depths between approximately 0.6 m and 4.5 m below existing ground level. Clayey silt, silty clay, silt till, clayey silt to silty clay till and completely to highly weathered red shale bedrock underlies the fill material to depths of between approximately 2.6 m and 12.1 m below existing ground level.
Groundwater	Groundwater, water seepages or saturated soils were not encountered during drilling but was reported at 2.2 m to 3.7 m depth during subsequent groundwater monitoring visits. Further information pertaining to groundwater conditions is provided in the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

ENGINEERING CONSIDERATIONS

Foundations	It is considered by Landtek that the anticipated moderately- to highly-loaded tower structures and associated infrastructure can be supported by the shale bedrock underlying the site using conventional, concrete strip or pads foundations. It is anticipated that the foundations will be seated at depths of approximately 4.0 m to 5.0 m below surrounding ground level.
Settlements	The general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate. The SLS condition will not govern foundation design in bedrock as the stress required to induce the typical 25 mm settlement criteria at the SLS is anticipated to exceed the ULS. As such. settlements for foundations seated within bedrock are to be deemed negligible (i.e., less than 15 mm).
Earthquake Considerations	Based on the soil conditions encountered, and in accordance with Table 4.1.8.4.A. of the current Ontario Building Code (*OBC*), the site is considered to be a ‘C’ Site Class.
At-grade Floor Slabs	It should be possible to construct the lowest (i.e., basement) concrete floor slab using slab-on-grade methods. The subgrade support condition is anticipated to be native clay, silt and till soils or bedrock, which should provide competent conditions for placing the vapour barrier material.

CONSTRUCTION CONSIDERATIONS

Excavations	The subsurface soils to be encountered during excavation at the site are expected to behave as “Type 2” and “Type 3” materials according to the OHSA classification in Part III. Type 2 soils are characteristic of the generally hard “clayey silt/silty clay till”, while Type 3 soils are characteristic of the generally firm/compact “clayey silt/silty clay and silt till”. The residual soils of completed weathered shale bedrock is considered to have strength characteristics that exceed Type 1 soils.
Subsurface Concrete	The native soils generally have a low to mild sulphate environment and are not aggressive to concrete (CSA criteria of less than 0.2 % water soluble sulphate in the soils). Therefore, normal General use (GU) hydraulic cement can be used for subsurface structures.
Construction Dewatering	It is expected that foundation elements for the proposed structure will be seated above the level at which groundwater was encountered. As such, temporary dewatering is not expected to be required during the construction process. Further construction dewatering considerations are provided in Landtek’s Hydrogeological Assessment for the site, as reported under separate cover.

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1.0 INTRODUCTION

Landtek Limited (herein "*Landtek*") is pleased to submit this Preliminary Geotechnical Investigation report for the proposed new "*Vineland*" tower complex at civic address 4933 Victoria Avenue North in Vineland, Ontario. Authorization to proceed with the work was received from 4933 Vic Court Globizen LP, in January 2023.

Based on the Concept Plan drawing "*Site Plan – Ground Floor*", reference A103, it is understood that the proposed development is to comprise of the following:

- A stepped, five-storey to 17-storey residential tower in the east of the property, with three partial, above-ground parking levels and a three- and four- storey podium;
- A stepped, four-storey to 14-storey residential tower in the south of the property, with a four-storey podium courtyard;
- A 13- to 15-storey hotel in the northwest of the property, with a rooftop pool;
- A central courtyard comprising public open space, trees, a pond and trellis-covered areas; and,
- A new deck, dock and access ramp in the north of the property.

It is understood that one level of basement parking is also proposed and will cover the development footprint in full. Limited at-grade, deck parking is also proposed, with access leading from Victoria Avenue North.

No significant grade changes are anticipated, with foundations anticipated at depths of between approximately 4.0 m and 5.0 m below existing ground level. Elevator pits for the residential towers and hotel are expected to extend below foundation subgrades a further 1.5 m depth as a minimum.

The primary objectives of this investigation are:

- To confirm the subsurface soil and groundwater conditions for foundation design and construction;
- Provide design and construction recommendations with regards to building foundations, at-grade floor slabs, pavement structures, and subsurface drainage and utilities; and,
- Assess the characteristics of the soils to be excavated and their impact on excavatability, reuse and shoring systems.

This report has been prepared for the Client, the nominated engineers, designers, and project managers pertaining to the proposed residential tower complex at the site at civic address 4933 Victoria Avenue North in Hamilton, Ontario. Further dissemination of this report is not permitted without Landtek's prior written approval. Further details of the limitations of this report are presented in Appendix A.

2.0 SITE SETTING

2.1 Site Location and Description

The site is located in Vineland Station, Ontario, and is centered at approximate grid reference 630435, 4783500 (UTM 17T coordinates). The Geodetic elevation of the ground surface at the site is approximately 73.0 m to 80.0 m.

The site location is shown in Figure 2.1.1 below.

Figure 2.1.1: *Site Location and Surrounding Area*

The site is irregular in shape and is situated at the intersections of Verity Lane, Viceroy Avenue and Victoria Avenue North. The site is bound to the north by Lake Ontario, the west by Victoria Avenue North, the east by a forested area, and to the south by residential properties.

The topography of the site is generally flat-lying and has been cleared of all existing buildings that were once located on the site.

2.2 Published Geology

Based on previous geotechnical experience for the area and a review of the existing geological publications for the site area, Ontario Geological Survey (herein "*OGS*") Map P.0764 "*Quaternary*

Geology of the Niagara Area", the site is underlain by interbedded deposits of Lake Iroquois stratified sands and silt and clay till of the Halton Till Formation.

The Ontario Department of Mines (herein "*ODM*") Map 2344 "*Paleozoic Geology of the Niagara Area*" indicates that the superficial geology is underlain by red shale of the Queenston Formation.

Information provided by historical borehole records from within the vicinity of the site, and held by the OGS, generally confirms the anticipated geological conditions beneath the site. Based on the data from records for Borehole ID 852602, located approximately 500 m south of the site, the soil profile comprises of topsoil at the ground surface, followed by clay and silt till to approximately 6.6 m depth.

3.0 FIELDWORK AND INVESTIGATION METHODOLOGY

Fieldwork undertaken at the site by Landtek included clearance of underground services, borehole layout, borehole drilling and soil sampling, and field supervision. A total of 11 boreholes (boreholes BH1 to BH11A) were drilled between April 14th and 27th, 2022. An additional total of nine boreholes (boreholes BH1-23 to BH9) were drilled between July 4th and 7th, 2023. All boreholes were logged using those standard symbols and terms defined in Appendix B. The Borehole Location Plan, Drawing 23016-01, and associated borehole logs are provided in Appendix C.

Full time supervision of drilling and soil sampling operations was carried out by a representative of Landtek. The boreholes were drilled using a Diedrich D-50 track mounted drill rig equipped with continuous flight, solid and hollow stem augers and were extended to depths of between approximately 2.6 m and 12.1 m below existing ground level. Standard Penetration Tests (SPT's) and split spoon samples were taken during drilling at selected depths. Boreholes encountering ultimate auger refusal were extended from bedrock refusal using NQ-gauge, rotary coring methodologies.

Boreholes BH2, BH3, BH8, BH9A, BH11A, BH1-23, BH2-23, BH3-23, BH4-23, BH5-23, BH6-23, BH8-23 and BH9-23 were completed as monitoring wells and renamed BH/MW2, BH/MW3, BH/MW8, BH/MW9A, BH/MW11A, BH/MW1S/D-23, BH/MW2S/D-23, BH/MW3S/D-23, BH/MW4/4S-23, BH/MW5S-23, BH/MW6-23, BH/MW8S-23, and BH/MW9S/D-23, respectively. The monitoring well consisted of new/sealed 50 mm polyvinyl chloride (PVC) screen with No.10 slots threaded onto a matching riser. The screens and risers were pre-threaded including o-ring seals such that no glues or solvents were used to connect the pipe sections. The annular space between the PVC well and the borehole was backfilled to approximately 0.3 m above the top of the screen section with sand pack, and then with bentonite to existing ground level. A J-Plug lockable air-tight cap was installed on the riser. The monitoring well installation details are presented on the respective borehole logs in Appendix C.

All soil samples were transported to the Landtek's in-house, Canadian Council of Independent Laboratories (CCIL) certified laboratory and visually examined to determine their textural classification. Moisture content testing was carried out on all samples. Four selected, composite samples were submitted to Paracel Laboratories Ltd. (herein *"Paracel*") to be analyzed for soil corrosivity to assist with any protective requirements for buried concrete and metal infrastructure.

Borehole locations were established by Landtek using measurements and offsets relative to existing site structures. Ground surface elevations at the borehole locations were established by Landtek in reference to the Topographical Survey for the site, reference number 22-16-360-00 and dated February 8, 2023, as issued by J. D. Barnes Limited.

4.0 SUBSURFACE CONDITIONS

4.1 Overview

The borehole information is generally consistent with the geological data identified in Section 2.2, with the predominant soils comprising sands, silts, clay and silt tills overlying red shale bedrock.

The detailed borehole logs are presented in Appendix C, with the ground conditions encountered by the boreholes discussed in the following sections.

4.2 Existing Pavement Structure

Boreholes BH1, BH/MW2, BH/MW3 and BH/MW8 were drilled within existing pavement areas, with a concrete thickness of approximately 150 mm to 475 mm. No pavement granular materials were encountered.

4.3 Fill Materials

Fill material was encountered in all boreholes from ground surface or underlying the existing pavement structure and extends to depths between approximately 0.6 m and 4.5 m below existing ground level. The fill comprises of sands, silts, clays and gravels, with varying proportions of orange brick fragments, gravel, concrete fragments, asphalt fragments, organics and limestone fragments, and is primarily brown, grey and red in colour.

SPT ‘‘N’’ values ranging from 2 to 50 blows for 50 mm of split spoon penetration were reported within the fill materials, indicating their compactness condition to be variable and as expected for fill soils placed historically and in an uncontrolled manner.

4.4 Clayey Silt to Silty Clay

Clayey silt to silty clay deposits were encountered underlying the fill material in boreholes BH1, BH/MW4S-23, BH/MW7-23 and BH/MW8S-23 and extends to depths between approximately 1.4 m and 2.5 m below existing ground level. The clayey silt to silty clay was observed to be generally brown and red in colour and contains traces of gravel, sand, iron staining and peat.

SPT ‘‘N’’ values ranging from 6 to 18 were recorded, indicating the native clayey silt to silty clay deposits to be of a firm to very stiff, but generally firm consistency. Moisture content testing results were recorded between 11 % and 22 %, which are generally representative of a moist soil with silt and clay as the primary constituents.

The moisture content testing results are presented on the borehole logs in Appendix C.

4.5 Silt Till

Silt till was encountered in boreholes BH/MW1S/D-23, BH/MW3S/D-23 and BH/MW5S-23 underlying the fill materials and extends to depths between approximately 1.5 m to 2.3 m below existing ground surface. The silt till contains traces of gravel, iron staining and red shale fragments, and is generally brown in colour.

SPT ‘‘N’’ values ranging from 13 to 50 blows for 150 mm of split spoon penetration were reported, indicating the silt till deposits to be in a compact to very dense, but generally compact condition. Moisture contents are in the order of 10 % to 14 %, which is as to be expected for dry to moist soil with silt as the primary constituent.

4.6 Clayey Silt to Silty Clay Till

Clayey silt to silty clay till was encountered **only** in boreholes BH1, BH/MW2, BH/MW3, BH/MW4, BH5, BH6, BH7, BH/MW8, BH/MW9A, and BH/MW11A underlying the fill and sand material and extends to depths of approximately 1.5 m and 3.0 m below existing pavement surface. The till is generally red and brown and contains traces of gravel, sand, iron staining and red shale fragments.

SPT ‘‘N’’ values ranging from 3 to 38 were reported, indicating the silty clay till deposits to be of a soft to hard, but generally hard consistency.

4.7 Bedrock

Red shale of the Queenston Formation was encountered in all boreholes at depths of between approximately 1.5 m to 4.5 m below existing ground level, equating to Geodetic elevations between approximately 79.6 m and 73.4 m. The shale is red and grey in colour, is very weak to weak, completely to highly weathered and was primarily recovered as “*residual soil*”.

The Rock Quality Designation (RQD) values of the competent shale bedrock were in the order of 0 % to 77 % indicating the bedrock to be of a “*very poor to good*” quality, though improving with depth. The results of the rock strength parameter testing will be presented in Appendix D, once received.

4.8 Groundwater

Groundwater, water seepages or saturated soils were not encountered during augur drilling, with all boreholes remaining open and dry either on termination or on transition to rotary coring. Six subsequent groundwater monitoring well visits have been completed at the site to date, the most recent results of which are presented in Table 4.8.1.

Table 4.8.1: Summary of Water Level Measurements

MW ID	Well Details			Groundwater Monitoring Results	
	Depth	Screen	Water Strike	September 20, 2023	October 17, 2023
BH/MW1S-23	6.0 m	3.0 m – 6.0 m	-	-	3.42 m
BH/MW1D-23	10.6 m	7.6 m – 10.6 m	-	-	3.48 m
BH/MW2S-23	3.0 m	1.5 m – 3.0 m	-	-	3.33 m
BH/MW2D-23	4.5 m	1.5 m – 4.5 m	-	-	3.16 m
BH/MW3S-23	6.0 m	3.0 m – 6.0 m	-	-	3.48 m
BH/MW3D-23	10.6 m	7.6 m – 10.6 m	-	-	3.63 m
BH/MW4S-23	6.0 m	3.0 m – 6.0 m	-	-	3.22 m
BH/MW4-23	3.0 m	1.5 m – 3.0 m	-	-	2.35 m
BH/MW5S-23	6.0 m	3.0 m – 6.0 m	-	-	3.61 m
BH/MW6-23	3.0 m	1.5 m – 3.0 m	-	-	3.01 m
BH/MW8S-23	4.5 m	1.5 m – 4.5 m	-	-	2.74 m
BH/MW9S-23	4.5 m	1.5 m – 4.5 m	-	-	2.44 m
BH/MW9D-23	12.1 m	9.1 m – 12.1 m	-	-	3.43 m
BH/MW2	4.5 m	1.5 m – 4.5 m	-	2.02 m	-
BH/MW3	4.5 m	1.5 m – 4.5 m	-	2.22 m	-
BH/MW8	4.5 m	1.5 m – 4.5 m	-	2.25 m	-
BH/MW9A	4.5 m	1.5 m – 4.5 m	-	3.04 m	-
BH/MW10	4.5 m	1.5 m – 4.5 m	-	3.18 m	-
BH/MW11A	4.5 m	1.5 m – 4.5 m	-	2.21 m	-

It is noted that the boreholes were generally dry at the depths where water has been recorded during monitoring. This is indicative of a fracture-controlled groundwater regime with the bedrock responding to exposure by rising in the monitoring well through pressurization until it reaches a static equilibrium; what is referred to as the "*piezometric level*".

It should be noted that groundwater conditions and surface water flow conditions are expected to vary according to the time of the year and seasonal precipitation levels. Water seepage may be also anticipated from soil fissures and any fill material present at the site.

Further information pertaining to groundwater conditions is provided in the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

5.0 FOUNDATION DESIGN CONSIDERATIONS

5.1 Shallow Foundation Considerations

It is understood that the proposed structure is assumed to include for maximum of one level of basement parking. On this basis, it is anticipated that the foundations will be seated at depths of approximately 4.0 m to 5.0 m below surrounding ground level.

Based on the ground conditions observed at the borehole locations, it is considered by Landtek that the anticipated moderately- to highly-loaded tower structures and associated infrastructure can be supported by the shale bedrock underlying the site using conventional, concrete strip or pads foundations.

Table 5.1.1 summarizes the preliminary, recommended geotechnical reactions at the Serviceability Limit State (herein "*SLS*") and factored geotechnical resistances at the Ultimate Limit State (herein "*ULS*") for the native soils. It should be noted that the design parameters have been determined by Landtek for the design stage only.

In accordance with the Ontario Building Code (herein "*OBC*"), 9.12.2.2 (5), and based on local experience, the shallowing of exterior and interior footings to 0.9 m and 0.6 m depth below the basement finished floor level respectively, may be adopted for the proposed development. Such shallowing of foundations is to be limited to only those areas where a minimum of one basement level is to be included.

Table 5.1.1: Limit State Foundation Design Values

Approximated Founding Depth Ranges		Founding Stratum	Foundation Design Value	
Depth	Geodetic Elevation		SLS [1 2]	ULS [3 4]
±4.0 m to ±6.0 m	±74.1 m – ±71.7 m	Completely to Highly Shale	750 kPa	1.5 MPa
> ±6.0 m	±71.7 m	Competent Shale	-	2 MPa

Notes:
1. The National Building Code general safety criterion for the serviceability limit states is: SLS resistance ≥ effect of service loads.
2. Recommended SLS bearing values conform to Estimated Values based on soil types given in Tables K-8 and K-9 of the National Building Codes User's Guide.
3. The ULS resistance factor for shallow foundations is 0.5, as given in Table K-1 of the National Building Code User's Guide.
4. The National Building Code general safety criterion for the ultimate limit states is: factored ULS resistance ≥ effect of factored loads.
5. Geodetic elevations reference to the Topographical Survey for the site, reference number 22-16-360-00 and dated February 8, 2023, as issued by J. D. Barnes Limited.

Where the bearing levels of the footings are at different design elevations, the footing base levels should be stepped along a line of 7V:10H, drawn upwards from the lowest footing, to avoid overlapping stresses.

Subsurface conditions can vary over relatively short distances and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. Therefore, a Geotechnical Engineer should be engaged during construction to examine the exposed sub-soil quality and condition, and confirm the subsurface conditions are consistent with design assumptions. This is in compliance with field review requirements in the National Building Code, Volume 1, Clause 4.2.2.3.

Design factors related to structural loads will determine the most cost-effective foundation system for the proposed development. The impact on foundation size and soil bearing pressure is illustrated in Figure 5.1.1 and emphasizes that foundation design sizes, bearing pressures, and bearing levels must be taken into account to avoid excessive consolidation settlements.

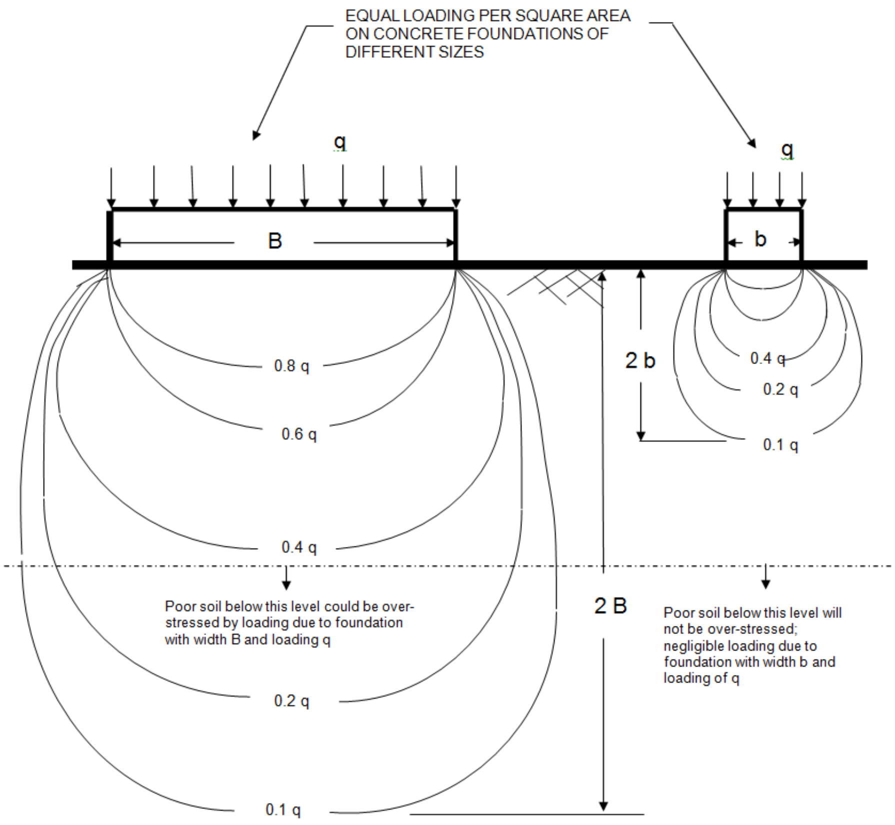


Figure 5.1.1: *Illustration of Load Distribution below Variable Size Foundations with the Same Applied Loading*

Footing foundations may be considered an appropriate option, though the acceptability of footings will depend upon design issues such as the elevation of the lowest floor level and the structural loading. If the footing design criteria provided in this report cannot be satisfied then an alternative solution may be considered, such as a piled solution, particularly if the proposed structures are of a generally high loading than anticipated.

5.2 Frost Susceptibility

The fill material and shallow soils encountered across the site are considered sensitive to water and frost, and their physical and mechanical properties are dependent on in-situ moisture content. As such, the founding soils at the site are considered to have a moderate to high frost susceptibility, being classified as Frost Group "*F4*" (Table 13.1 of the "*Canadian Foundation Engineering Manual*", 4th Edition). However, the identified depths for foundations and the associated foundation depth reductions for the areas of proposed basement, as given in Section 5.1 and Table 5.1.1 of this report, are considered to be below the maximum extents of influence from frost penetration in the Jordan Station area.

This given, in the event that any re-grading be required as part of the proposed development and adjacent to the new structures, it will be important to ensure that the associated exterior footings will have a minimum of 1.2 m of soil cover, or equivalent suitable insulation, for frost protection.

Concerns regarding frost protection to footings are more directed towards those seated within soils. Foundations in the shale bedrock are generally deemed exempt from any frost protection requirements. This given however, consideration should be given to the use of non-frost susceptible materials as backfill for foundation wall excavations and the installation of foundation drainage in order to minimize the risk of adfreezing.

5.3 Settlement Considerations

Based on the outline information provided for the nature of the proposed redevelopment of the site, it is anticipated that the loads to be applied to the ground by any such structure will be generally moderate to potentially high intensity. As such, associated settlements are expected to be potentially significant, though the general limiting of the total settlement to 25 mm and the differential settlement to 19 mm by the recommended geotechnical reaction at the SLS is considered appropriate.

The SLS condition will not govern foundation design in bedrock, particularly the more competent bedrock as the stress required to induce the typical 25 mm settlement criteria at the SLS is anticipated to exceed the ULS. As such. settlements for foundations seated within competent bedrock are to be deemed negligible (i.e., less than 15 mm).

5.4 Existing Building Demolition

It is understood that all structures, including pavements and services, will have been removed prior to the proposed development. For the purposes of this report, it has been assumed that any existing structures and all associated substructures will be removed in full prior to construction.

Should there be a need to fill excavations created by the demolition of the existing structure with engineered fill or unshrinkable backfill prior to commencing the proposed development, Landtek should be contacted to determine the most appropriate placement requirements of the fill material.

5.5 Seismic Design Considerations

Based on the soil conditions encountered, and in accordance with Table 4.1.8.4.A. of the current Ontario Building Code (herein "*OBC*"), the site is considered to be a 'C' Site Class. The acceleration and velocity-based site coefficients, F_a and F_v, should be determined from Tables 4.1.8.4.B. and 4.1.8.4.C. respectively of the OBC for the above recommended Site Class.

An improved seismic site classification (i.e., Class 'B' or 'A') may be achieved through the completion of a shear wave velocity test at the site using Multi-channel Analysis of Surface Waves (herein "*MASW*") methodologies, particularly as the foundations are likely to be seated within the bedrock strata.

The seismic design data given in Table 1.2 of Supplementary Standard SB-1 in Volume 2 of the OBC, for selected Municipal locations, should be used to complete the seismic analysis.

5.6 Damp Proofing and Waterproofing Considerations

The subsurface areas should be damp proofed and comply with the OBC requirements. As a minimum it is recommended that the damp proofing system include a Delta Drainage Board or MiraDrain 2000 series product, or an approved alternative, along with an asphalt-based spray-on wall coating.

It is recommended that all subsurface structures and areas (i.e., basement walls, floor slabs etc.) are appropriately waterproofed where below the seasonally highest groundwater level established by the Hydrogeological Assessment undertaken by Landtek, as reported under separate cover, plus the required buffer zone (nominally 1.0 m to 1.5 m above the stabilized or highest recorded groundwater level).

6.0 FLOOR SLAB AND PERIMETER DRAINAGE CONSIDERATIONS

Based on the borehole soil conditions and preliminary design information provided to Landtek, it should be possible to construct the lowest (i.e., basement) floor slab level using slab-on-grade methods. The subgrade support condition is anticipated to be native clay, silt, till and sand soils or bedrock, which should provide competent conditions for placing the vapour barrier material.

After the subgrade has been prepared to the underfloor design elevation it is recommended that the area be proof-rolled with a loaded tandem axle dump truck to delineate if there are soft or unstable ground conditions that require repair. This operation should be completed before the underfloor vapour barrier granular material is placed.

It is recommended that a minimum 200 mm layer of clear, 19 mm crushed quarried stone be used as the vapour barrier under the floor slab. The vapour barrier stone should meet the requirements of Ontario Provincial Standard Specifications (herein "*OPSS*") 1004 for 19 mm Type II clear stone. If a graded crushed stone is substituted for clear stone, the material should be limited to a maximum of 5 % fines (passing the 0.075 mm sieve). The floor slab thickness should meet the specifications of the project based on anticipated floor loadings.

The finished exterior ground surface should be sloped away from the buildings at a grade in the order of 2 %.

The concrete properties should meet the requirements of OPSS 1350. Contraction and isolation jointing practices should be in accordance with current Portland Cement Association recommendations, as given in the engineering bulletin "*Concrete Floors on Ground*", second edition, by R. E. Spears, and W. C. Panarese.

The design of concrete slabs may be made on the basis of a value of modulus of subgrade reaction of 30 MPa/m for clay and silt soils and 120 MPa/m for the bedrock.

Unless the proposed structure is to be waterproofed as prescribed in Section 5.6, perimeter drainage should be provided around all subsurface floor areas where water may accumulate. This, however, is subject to the Municipal approval allowing for the discharge of groundwater into the Municipal storm system where the perimeter drainage is going to be installed at a depth below the established groundwater level.

Underfloor drains may be also required depending on the provision of waterproofing, or excavation and groundwater seepage conditions, particularly if below the groundwater level. Based on the anticipated foundation elevations for the two basement levels and deeper elevator pit, and when considering the groundwater monitoring data, groundwater is to be expected within the excavation profile for the proposed structure.

The drainage system should comply with the OBC and associated amendments. Further details pertaining to perimeter and underfloor drainage systems are provided in Drawings 23016-02 and 23016-03 respectively, in Appendix F.

7.0 EARTH PRESSURE CONSIDERATIONS FOR SUBSURFACE WALLS

The earth pressure, p, acting on subsurface walls at any depth, h, in metres below the ground surface assumes an equivalent triangular fluid pressure distribution and may be calculated using the expression below. It is assumed that granular material is used as backfill. Allowances for pressure due to compaction operations should be included in the earth pressure determinations and a value of 12 kPa is applicable for a vibratory compactor and granular material.

If the structure retaining soil can move slightly, the active earth pressure case can be used in determining the lateral earth pressure. For restrained structures and no yielding an "at rest" earth pressure condition should be used. The determination of the earth pressures should be based on the following expression:

$$P_1 = K\ (\delta\ h + q)$$

where:

P_1 = the pressure in kPa acting against any subsurface wall at depth, h, in metres (feet) below the ground surface;

K = the at rest earth pressure coefficient considered appropriate for subsurface walls; OPSS 1010 Granular B Type 1 (pit-run sand and gravel) material has an effective angle of friction estimated to be 32° with a corresponding at rest earth pressure coefficient, K_o, of 0.45; and,

δ = the moist bulk unit weight of the retained backfill; 21.5 kN/m^3.

and,

q = the value for any adjacent surcharge in kPa, which may be acting close to the wall; and,

h = the depth, in m, at which the pressure is calculated

For any subsurface walls below the established, "*seasonally highest groundwater level*", the pressure distribution on the wall should include the hydrostatic pressure. The determination of hydrostatic pressure should be based on the following expression:

$$P_2 = \delta_w\ h_w$$

where:

P_2 = hydrostatic pressure;

δ_w = unit weight of water; 9.8 kN/m^3; and,

h_w = depth of wall, below reported water level.

Backfill materials required for behind the retaining structure is assumed to meet an OPSS 1010 Granular B Type 1 pit-run sand and gravel material or OPSS 1010 Granular A. The granular fill should be compacted to a minimum of 98 % of the material's SPMDD, or to the levels and backfilling procedures specified.

Table 7.1 below provides those lateral earth pressure parameters for the predominant soils anticipated at the site.

Table 7.1: Recommended Lateral Earth Pressure Parameters

Parameter	Site Soils (Generalized)	OPSS 1010 Granular A	OPSS 1010 Granular B Type I
Angle of Internal Friction, ϕ	34°	35°	32°
Unit Weight (KN/m^3)	17	23	22
Passive Earth Pressure Coefficient, K_p	4.20	3.70	3.25
At-Rest Earth Pressure Coefficient, K_o	0.38	0.43	0.47
Active Earth Pressure Coefficient, K_a	0.24	0.27	0.31

Given the presence of shale bedrock beneath the site, the following parameters should be applied for the bedrock when considering lateral pressures on subsurface walls:

- Internal angle of friction (ϕ) should be taken as 28°; and,
- Bulk unit weight (ϒ) should be taken as 24.5 kN/m^3.

In designing a subsurface wall within bedrock, a uniform pressure distribution is assumed and is consistent with the maximum earth pressure calculated for the wall where in soil.

8.0 SOIL CORROSIVITY AND SUBSURFACE CONCRETE

8.1 Soil Corrosivity

Four composite soil samples were obtained from the boreholes associated with the proposed industrial development and submitted to Paracel Laboratories for analysis of pH, soil conductivity, resistivity and concentrations of sulphates, and chlorides (Soil Corrosivity).

The American Water Works Association (AWWA) document, "*Polyethylene Encasement for Ductile-Iron Pipe Systems*" *ANSI/AWWA C105/A21.5-18,* dated December 1, 2018, uses a 10-point scoring method to determine the soil corrosivity potential. For each given soil sample, points were assigned to the different parameters to evaluate their contribution towards the corrosivity of soil.

The test results are provided in Appendix D and are summarized in Table 7.1.1.

Table 8.1.1: Results of Soil Corrosivity Testing

Borehole and Sample ID	Chloride (µg/g)	Sulphate (µg/g)	pH (pH units)	Resistivity (ohm.cm)	Redox. Potential (mV)	Moisture (%)	Total ANSI/AWWA Points
BH2 SS6	9	97	7.75	542	328	7.4	10
BH3 SS4	11	69	7.72	546	326	5.3	10
BH5 SS5	8	84	7.73	501	329	2.8	10
BH8 SS6	12	173	7.74	344	337	3.9	10

Corrosion protection for buried ductile-iron pipes is recommended, when a score of 10 points or greater is reported. Based on the total ANSI/AWWA values above of 10, ductile-iron pipes used at the site will require corrosion protective measures such as cathodic protection. It should be noted that the analytical results only provide an indication of the potential for corrosion.

The contribution of chloride ions to soil corrosivity towards buried metallic improvements or steel structures is very significant. According to the Corrosion Guidelines (Caltrans, January 2015, version 2.1), a site is considered corrosive if, "*chloride concentration is 500 ppm or greater, sulphate concentration is 2,000 ppm or greater, or the pH is 5.5 or less.* "

In addition, the Canadian Standards Association (CSA) A23.1-14 "*Concrete materials and methods of concrete construction*", Table 3, "*Additional requirements for concrete subjected to sulphate attack*", states that design requirements for sulphate resistant concrete are only necessary when the water-soluble sulphate content of the soil in which the concrete is to be embedded is greater than 0.1 % (1,000 µg/g).

The representative soil samples at the site are reported to contain chloride ion concentrations of 8 µg/g (0.0008 %) and 12 µg/g (0.0012 %), and sulphate concentrations between 69 µg/g (0.0069 %) and 173 µg/g (0.0173 %). These equate to an average of 10 µg/g and 106 µg/g, respectively, and indicate a very limited, local potential (i.e., "*low risk*") of sulphate attack on buried reinforced concrete structures.

8.2 Concrete Class Considerations

The requirements for subsurface concrete subject to a sulphate and chloride environment are presented in Canadian Standards Association specification, CSA A23.1-14 *"Concrete Materials and Methods of Concrete Construction, Tables 1-4"*. It is recommended that subsurface concrete at the site have the following characteristics for general use (GU), normal Portland cement.

For the parking garage decks and ramps it is recommended that the concrete exposure class be C-1 and the concrete have the following minimum properties:

- minimum 56-day compressive strength: 35 MPa;
- maximum water to cement ratio: 0.40;
- chloride ion penetrability requirement: < 1500 coulombs (within 91 days)
- cementing materials: GU (general use hydraulic cement) or GUb (blended general use)
- air content: as per CSA A23.1-14 Table 4, air content category 1 (freeze-thaw environment)

The concrete should be placed without segregation and should be consolidated to achieve a uniform dense mass.

8.3 Methods for Specifying Concrete

Alternative methods of specifying concrete for a project are outlined in CSA A23.1-14 and allow for "*Performance*" or "*Prescription*" based methods. Each method attaches different levels of responsibility to the owner, the contractor, and the concrete supplier. The pros and cons of each method should be examined prior to completion of the specifications for the project.

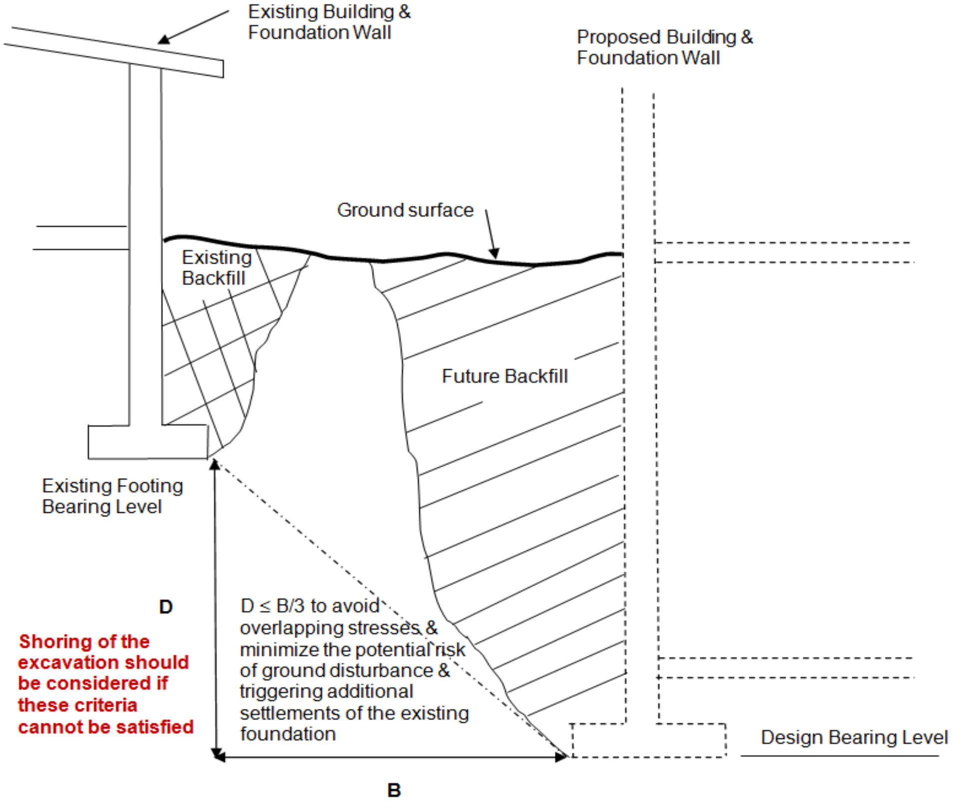
9.0 EXCAVATION AND BACKFILL CONSIDERATIONS

9.1 Excavation Considerations for Soils

All temporary excavations and unbraced side slopes in the soils should conform to standards set out in the Occupational Health and Safety Act, Ontario Regulation 213/91 "*Construction Projects*" (herein "*OHSA*"). The subsurface soils to be encountered during excavation at the site are expected to behave as "*Type 2"* and "*Type 3"* materials according to the OHSA classification in Part III. Type 2 soils are characteristic of the generally hard "*clayey silt to silty clay till deposits"*, while Type 3 soils are characteristic of the generally firm "*clayey silt to silty clay deposits*", and the generally compact "*silt till deposits*".

The residual soils of completed weathered shale bedrock is considered to have strength characteristics that exceed Type 1 soils.

Excavations for new foundations should satisfy the criteria given in the example shown in Figure 9.1.1 to avoid overlapping stresses and minimize the risk of undermining existing adjacent structures, including utilities, and/or triggering additional settlements of the existing structures due to soil disturbance.



Example: If the separation between existing and new proposed footings is 2 m the difference in bearing elevation should not exceed 0.67 m.

Figure 9.1.1: *Criteria for Assessing Excavation Shoring Requirements (Not to Scale)*

It should be possible to excavate the overburden soils with a hydraulic backhoe. Moist Type 2 and 3 soils are expected to be stable for short construction periods at slopes of approximately 45° to the horizontal (i.e., 1V:1H).

Consideration should be given to any existing trench excavations and associated backfill that may be present directly behind cut slopes within the native soils that may appear to be stable on first excavation. In these circumstances, slopes can suddenly slough or collapse due to the effects of the adjacent backfill.

Consequently, for excavation conditions that cannot satisfy the OHSA requirements for unbraced 1H:1V side slopes, a trench box system should be used, or temporary shoring should be installed to maintain safe working conditions. This may be more applicable to basement excavations, though may also apply to service trench excavations etc., particularly when in close proximity to new road pavements or associated infrastructure. Temporary shoring considerations are provided in more detail in Section 10.0 of this report.

9.2 Excavation Considerations for Bedrock

In accordance with the standards set out in the OHSA, the more competent "*shale bedrock*" encountered underlying the site has strength properties that exceed a Type 1 soil.

For any required bedrock excavation, a backhoe equipped with a hydraulic breaker and/or a bucket with rock-ripping 'tiger teeth' may be required in the shale bedrock, particularly where encountering harder siltstone or limestone bands. The blasting of bedrock will not be permitted by the Corporation of the Town of Lincoln (herein "*Town of Lincoln*"). Significant ground vibrations resulting from excavation works are not anticipated, though may be elevated above those associated with normal construction activities. As such, a period of ground vibration monitoring may be required to determine the peak vibration levels and any remedial measures or limitations required.

A backhoe equipped with a hydraulic breaker and/or a bucket with rock-ripping 'tiger teeth' may be required in the shale strata. Significant ground vibrations resulting from excavation works are not anticipated other than those associated with normal construction activities.

The shale is expected to remain relatively stable at near vertical slopes for short periods of time. It is recommended that any excavation slopes be scaled of loose rock pieces and overhang and cut back to about 10V:1H.

9.3 Short-Term (Construction) Dewatering Considerations

Based on the anticipated depths of excavation required for the one proposed basement parking level and associated elevator pits, it is expected that foundation elements for the proposed structure will be seated above the level at which groundwater was encountered. As such, temporary dewatering is not expected to be required during the construction process other than standard pumping of storm water or localized seepages from sumps at the base of excavations.

More detailed considerations regarding groundwater control and dewatering requirements during construction have been provided by the Hydrogeological Assessment for the site, as completed by Landtek and reported under separate cover.

9.4 General Backfill Considerations

Backfill next to foundation walls and in service trenches should be selected to be compactable in narrow trench conditions. The on-site clayey silt, sand and silty sand and completely to highly weathered shale are expected to be reusable as trench backfill and backfill around the proposed structures on the site. Any variation in the moisture contents of the soils encountered may require selective separation of material to avoid the use of wet soil.

Experience with shale indicates that any excavated bedrock material will not be suitable for reuse at the site without mechanical processing and grading to an Ontario Provincial Standard Specification (herein "*OPSS*") 1010-compliant product prior to its application.

Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. It is recommended that the target compaction specification for trench backfill be 97 % SPMDD with no individual test below 95 % SPMDD.

During inclement weather the native soils may become too wet to achieve satisfactory compaction. If construction is proposed for late in the year, a reduced level of trench compaction with a higher risk of future settlements is to be anticipated, and it is recommended that provisional contract quantities be established for the supply and placement of imported granular fill under such circumstances. The imported granular should meet the requirements of OPSS 1010 for Granular B Type I material as a minimum requirement.

10.0 TEMPORARY SHORING CONSIDERATIONS

The installation of temporary shoring is also recommended to maintain safe working conditions and eliminate the possibility of loss of ground and damage to nearby structures and buried utilities on the adjacent road allowances during excavation for the basement construction.

The requirement and application of shoring to support excavation side slopes will be dependent on the required excavation depth and the proximity of existing or newly constructed infrastructure adjacent to the excavation.

The preferred method of shoring will consist of a concrete caisson wall. This type of system is expected to provide the additional benefit of sealing the excavation from water penetration and loss of soil fines into the open excavation. Soldier piles and timber lagging may be considered as an option for a shoring system, though this type of system may require measures to prevent groundwater inflow into the excavation and any subsequent loss of soil between the spaces of lagging boards. Consideration may be also given to the application of shotcrete where groundwater is encountered and/or where shale bedrock is exposed in the excavation faces.

The shoring methods may provide lateral restraining force through the use of rakers or tieback anchors. Tieback anchors provide additional advantage since they do not protrude into the excavations as rakers would. However, the use of tieback anchors is also dependent upon whether permission is needed or whether it is physically possible to extend the anchors to the required distance into neighbouring properties.

It should be noted that the design of any temporary shoring system is the responsibility of the Contractor. Therefore, a specialist shoring contractor should be consulted to provide the most appropriate shoring type method and associated installation procedures. In any event, the shoring design should be based on the procedures outlined in the latest edition of the Canadian Foundation Engineering Manual. It is also recommended that lateral and vertical movement of the shoring system be monitored during construction to ensure that movements are within the acceptable range.

11.0 SITE SERVICING CONSIDERATIONS

There is no indication that special pipe bedding materials or procedures are required for the installation of services. All bedding cover and backfill materials should be selected in accordance with OPSS 1010 Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

The pipes should be placed with a minimum bedding thickness in conformance of Ontario Provincial Standard Drawing (herein "*OPSD*") 802.010, 802.013 and 802.014 for flexible pipe and OPSD 802.030, 031, 032, 033 and 034 for rigid pipes. The type of bedding shall be selected to suit the applicable pipe strength and site conditions.

Bedding material shall be placed in layers not exceeding 300 mm in thickness, loose measurement, and compacted to 95 % of the SPMDD before a subsequent layer is placed. Site servicing trench backfill should be uniformly compacted to a density that minimizes the risk of long-term settlements. Bedding on each side of the pipe shall be completed simultaneously. At no time shall the levels on each side differ by more than the 300 mm uncompacted layer. The remainder of the trench should be backfilled as per the requirements defined in Sections 9.0 of this report.

It is assumed all services will have a minimum of 1.2 m of soil cover for frost protection. For services installed at shallower depths, suitable insulation for frost protection is recommended.

12.0 SOIL MANAGEMENT CONSIDERATIONS

From a geotechnical perspective, and in order to optimize the use of the on-site soils, a Soil Management Plan should be established in accordance with the requirements of Ontario Regulation (herein "*O. Reg.*") 406/19 for excess soils and O. Reg. 153/04 for soil stockpiles.

The plan objective should be to achieve a self-sustainable development with respect to excavated materials and control the placement of organic soils so that there is negligible impact on the settlement performance of the compacted fill material. The soil management criteria should be per the following sections, as a minimum:

12.1 Organic and Deleterious Materials

Surface vegetation, topsoil and organic soils should not be placed within the proposed roadways, below finished subgrade level for pavement construction or building limits. These materials should be placed in landscaped areas where settlements are not critical.

12.2 Materials Reuse Management

12.2.1 Fill Compaction Requirements

Excavated soils for structural fill in pavement areas and building floor slab areas, which do not have topsoil or organic matter and are compactable with moisture contents within 2 % to 3 % of the optimum value, should be placed and compacted to a target density of 97 % of the SPMDD with no individual test result below 95 % SPMDD.

If engineered fill is required to support building foundations:

- the engineered fill should be placed and compacted in lifts to a target density of 100 % SPMDD with no individual tests below 98 % SPMDD; and,
- the soil should be placed in a loose lift thickness not exceeding 250 mm and should be compacted using a large (10 ton or larger) pad-foot type roller with vibratory capability.

If engineered fill to support building foundations is being considered it is recommended that a pre-construction meeting be scheduled to review the proposed fill materials, fill placement and compaction procedures, and the testing and inspection requirements.

Soils to be placed in landscaped areas where settlements are not critical should receive nominal compaction effort in order to achieve at least 90 % of the SPMDD.

12.2.2 Structural Fill Subgrades

Prior to the placement of any structural fill materials, the exposed subgrade soil should be inspected and proof-rolled using a loaded tandem axle truck and traversing the exposed subgrade for full coverage. The proof-rolling should be monitored by a geotechnical representative of this office to delineate any soft areas which may require repair.

13.0 PAVEMENT CONSIDERATIONS

13.1 Deck Pavement Design Considerations

It is understood that the footprint of the proposed basement will cover the site area in full. As such, any pavement structures are anticipated to be deck structures rather than standalone, at-grade pavement structures.

Such deck pavements should comprise a minimum 50 mm cover of OPSS HL 3 asphalt or minimum 80 mm cover of interlocking concrete pavers. The bedding or grading material to be placed between the concrete deck and the asphalt pavement surface or interlocking concrete pavers should comprise either blinding sand or OPSS Granular A material, depending on the thickness of the layer required.

Any tie-ins of the deck pavements to the road pavement structure of Victoria Avenue North should match existing as a minimum, in accordance with OPSS 310.

13.2 Pavement Materials

13.2.1 Granular Base Course

The granular base course material should meet OPSS Granular “A” specifications. Quarried 20 mm limestone crushed to Granular "A" gradation specifications is recommended.

13.2.2 Hot Mix Asphalt

The surface course asphalt should meet current specifications for HL 3, as prescribed by the Town of Lincoln or, alternatively, OPSS 1150.

13.2.3 Compaction

Granular base course and subbase course fill material should be compacted to 100 % SPMDD. Hot mix asphalt should be compacted to the criteria set out by the Town of Lincoln.

13.3 Sidewalk Considerations

The construction of the concrete sidewalks at the site should be completed to the satisfaction of the Town of Lincoln’s Engineering Standards, and as detailed in Table 13.3.1. The concrete and aggregates should be produced and placed to meet those standards also stipulated by the Town of Lincoln’s Engineering Standards.

Table 13.3.1: Recommended Minimum Concrete Sidewalk Specifications

Materials	Compaction Requirements	Layer Thickness
Normal Portland GU (32 MPa) (CAN3-CSA A23.1) - Class C-2	N/A	125 mm
Granular “A” Base	95 % SPMDD*	150 mm

* Standard Proctor Maximum Dry Density

Where finished sidewalks are on level ground, and to ensure that they remain free of ponding water, a final slope/gradient of the concrete sidewalk surface of at least 2 % should be maintained. In addition, construction joints in the sidewalk concrete should be properly sealed (e.g., bitumen filler) to minimize the water migration.

14.0 CLOSURE

The Limitations of Report, as stated in Appendix A, are an integral part of this report.

Soil samples will be retained and stored by Landtek for a period of three months after the report is issued. The samples will be disposed of at the end of the three-month period unless a written request from the client to extend the storage period is received.

We trust this report will be of assistance with the design and construction of the proposed development. Should you have any questions, please do not hesitate to contact our office.

Yours sincerely,

LANDTEK LIMITED

LICENSED PROFESSIONAL ENGINEER
R. DI CIENZO
Nov. 3/23
PROVINCE OF ONTARIO

James Dann, B.Eng. (Hons) ACSM
Manager, Geotechnical Projects

Ralph Di Cienzo, P. Eng.
Consulting Engineer

APPENDIX A
LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the borehole locations. Subsurface and ground water conditions between and beyond the Boreholes may be different from those encountered at the borehole locations, and conditions may become apparent during construction that could not be detected or anticipated at the time of the Preliminary Geotechnical Investigation. It is recommended practice that Landtek be retained during construction to confirm that the subsurface conditions throughout the site are consistent with the conditions encountered in the Boreholes.

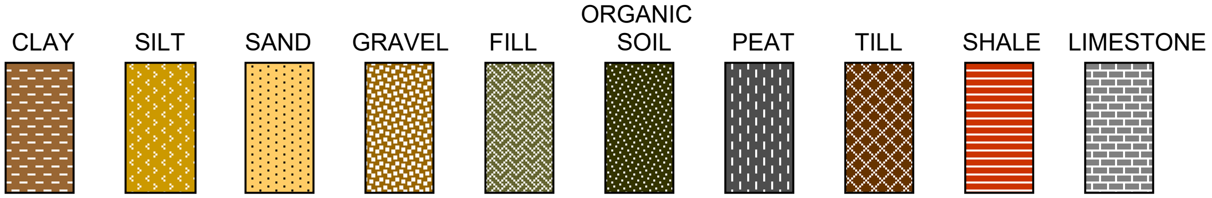
The comments made in this report on potential construction problems and possible remedial methods are intended only for the guidance of the designer. The number of Boreholes may not be sufficient to determine all the factors that may influence construction methods and costs. For example, the thickness and quality of surficial topsoil or fill layers may vary markedly and unpredictably. Additionally, bedrock contact depths throughout the site may vary significantly from what was encountered at the exact borehole locations. Contractors bidding on the project, or undertaking construction on the site should make their own interpretation of the factual borehole information, and establish their own conclusions as to how the subsurface conditions may affect their work.

The survey elevations in the report were obtained by Landtek Limited or others, and are strictly for use by Landtek in the preparation of the geotechnical report. The elevations should not be used by any other parties for any other purpose.

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. Landtek Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

This report does not reflect environmental issues or concerns related to the property unless otherwise stated in the report. The design recommendations given in the 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, it is recommended that Landtek Limited be retained during the final design stage to verify that the design is consistent with the report recommendations, and that the assumptions made in the report are still valid.

APPENDIX B
SYMBOLS AND TERMS USED IN THE REPORT



RELATIVE PROPORTIONS

Term	Range
Trace	0 - 5%
A Little	5 – 15%
Some	15 – 30%
With	30 – 50%

CLASSIFICATION BY PARTICLE SIZE

Boulder -------------------- > 200 mm
Cobble --------------------- 80 mm – 200 mm
Gravel -
Coarse ---------- 19 mm – 80 mm
Fine -------------- 4.75 mm – 19 mm
Sand -
Coarse ---------- 4.75 mm – 2 mm
Medium -------- 2 mm – 0.425 mm
Fine -------------- 0.425 mm – 0.75 mm
Silt -------------------------- 0.075 mm – 0.002 mm
Clay ------------------------- < 0.002 mm

DENSITY OF NON-COHESIVE SOILS

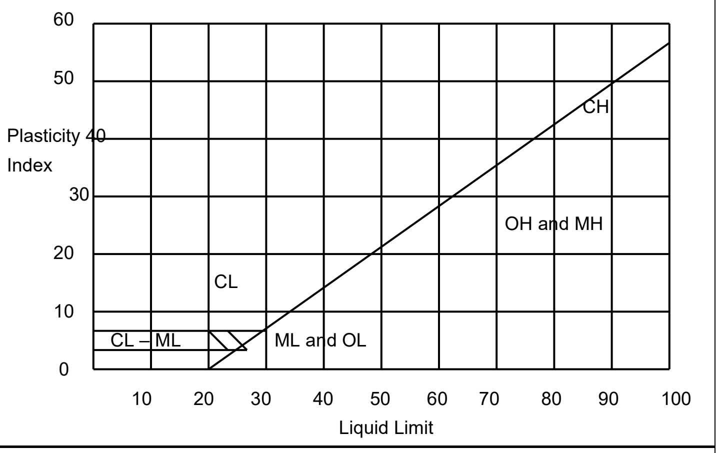
Descriptive Term	Relative Density	Standard Penetration Test
Very Loose	0 – 15%	0 – 4 Blows Per 300 mm Penetration
Loose	15 – 35%	4 – 10 Blows Per 300 mm Penetration
Compact	35 – 65%	10 – 30 Blows Per 300 mm Penetration
Dense	65 – 85%	30 – 50 Blows Per 300 mm Penetration
Very Dense	85 – 100%	Over 50 Blows Per 300 mm Penetration

CONSISTENCY OF COHESIVE SOILS

Descriptive Term	Undrained Shear Strength kPa (psf)	N Value Standard Penetration Test	Remarks
Very Soft	< 12 (< 250)	< 2	Can penetrate with fist
Soft	12 – 25 (250 – 500)	2 – 4	Can indent with fist
Firm	25 – 50 (500 –1000)	4 – 8	Can penetrate with thumb
Stiff	50 – 100 (1000 – 2000)	8 – 15	Can indent with thumb
Very Stiff	100 – 200 (2000 – 4000)	15 – 30	Can indent with thumb-nail
Hard	> 200 (> 4000)	> 30	Can indent with thumb-nail

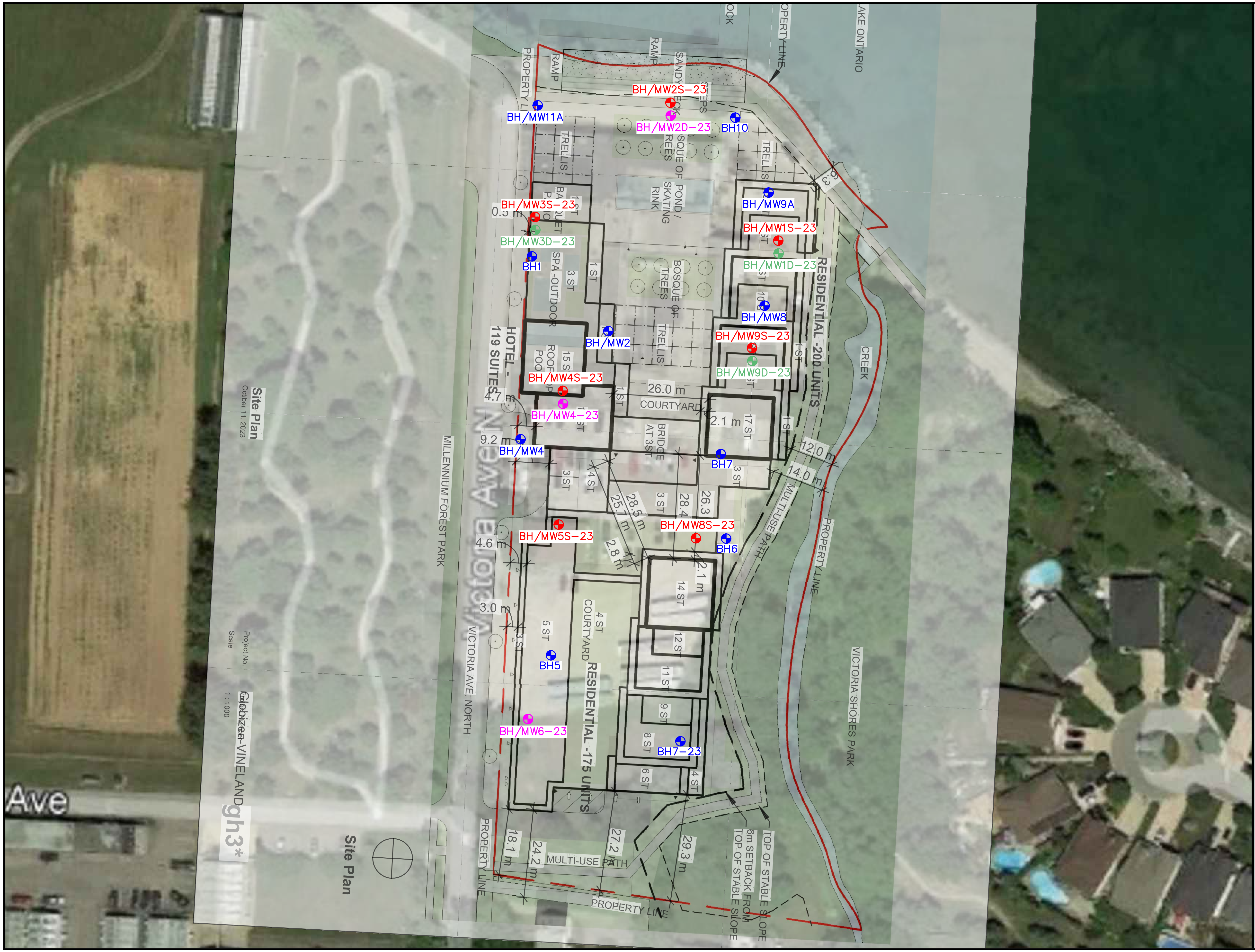
Notes: 1. Relative density determined by standard laboratory tests.
2. N value – blows/300 mm penetration of a 623 N (140 Lb.) hammer falling 760 mm (30 in.) on a 50 mm O.D. split spoon soil sampler. The split spoon sampler is driven 450 mm (18 in.) or 610 mm (24 in.). The "N" value is the Standard Penetration Test (SPT) value and is normally taken as the number of blows to advance the sampler the last 300 mm.

APPENDIX B CONTINUED
CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487 - 69 AND D 2488 – 69
(Unified Soil Classification System)

Major Divisions			Group Symbols	Typical Names	Classification Criteria		
Coarse-grained soils More than 50% retained on No. 200 sieve *	Gravels 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	**GW**	Well-graded gravels and gravel-sand mixtures, little or no fines	Classification on basis of percentage of fines Less than 5% pass No. 200 sieve . . . . . . GW, GP, SW, SP More than 12% pass No. 200 sieve . . . . . GM, GC, SM, SC 5 to 12% pass No.200 sieve . . . . Borderline classifications requiring use of dual symbols	C_u=D60/D10 greater than 4; C_z = $(D30)^2$/(D10xD60) between 1 and 3	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW	
		Gravels with fines	**GM**	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below “A” line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above “A” line with P.I. greater than 7	
	Sands More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	**SW**	Well-graded sands and gravelly sands, little or no fines		C_u=D60/D10 greater than 6; C_z = $(D30)^2$/ (D10xD60) between 1 and 3	
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW	
		Sands with fines	**SM**	Silty sands, sand-silt mixtures		Atterberg limits below “A” line or P.I. less than 4	Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above “A” line with P.I. greater than 7	
Fine-grained soils 50% or more passes No. 200 sieve *	Silts and clays Liquid limit 50% or less		**ML**	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	Plasticity Chart For classification of fine-grained soils and fine fraction of coarse-grained soils. Atterberg limits plotting in hatched area are borderline classifications requiring use of dual symbols. Equation of A-line: PI=0.73 (LL-20)  		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silts			
			OL	Organic silts and organic silts of low plasticity			
	Silts and clays Liquid limit greater than 50%		**MH**	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
	Highly organic soils		**Pt**	Peat, much and other highly organic soils	* Based on the material passing the 3 in. (76mm) sieve.		

APPENDIX C

DRAWING 23016-01 – BOREHOLE AND MONITORING WELL LOCATION PLAN
BOREHOLE LOGS



LANDTEK LIMITED

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w: www.landtek.ca

project location

Key plan an extract from town of Lincoln gis map©

Key:

- 🔵 Approximate location of borehole drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- 🟣 Approximate location of Hydrogeological borehole and monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- 🔴 Approximate location of shallow borehole and monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.
- 🟢 Approximate location of deep borehole and monitoring well drilled by Landtek Limited between July 4th, 5th, and 6th, 2023.

Notes:

Base plan and extract from the preliminary drawing "Concept Plan", reference 281-18 sheet 1 dated January 21, 2019, as issued by Urban Solutions Planning & Land Development

revisions/ submissions

#	date	description

client
Court Holdings Limited

municipality
Town of Lincoln

project
Geotechnical, Environmental, and Hydrogeological Investigation 4933 Victoria Avenue North

sheet
Borehole and Monitoring Well Location Plan

date: October, 2023
drawn: mdc
checked: jdc
project #: 23016
scale: 1:1000

23016-01

LOG OF BOREHOLE BH1

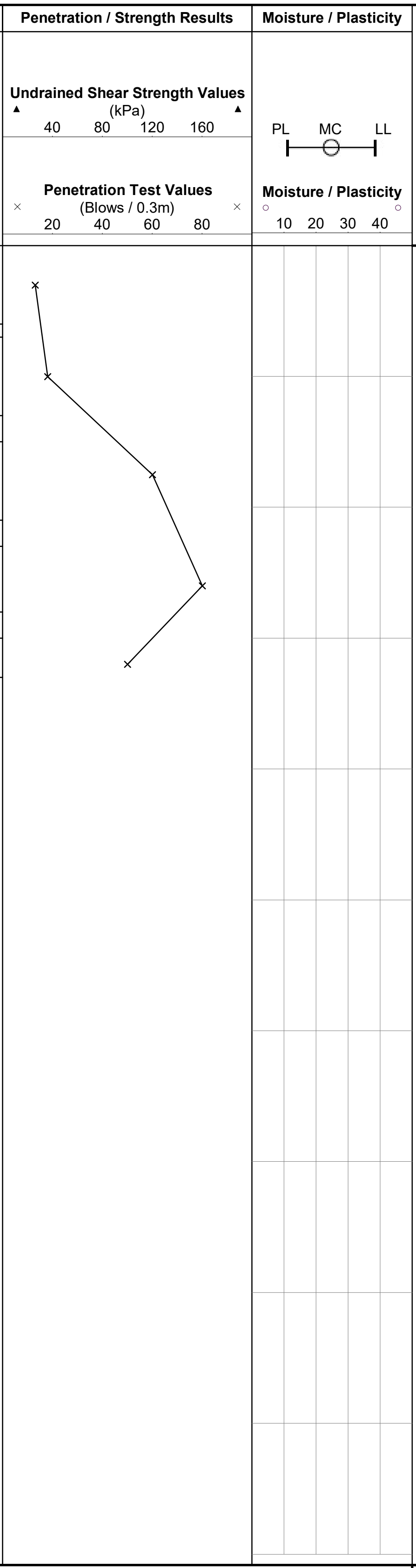
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193842
Easting: -79.395091
Ground Surface Elevation: 78.9

Subsurface Conditions		Samples			
Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
	Concrete ~150 mm. **Fill** Sand and gravel, some silt, trace concrete fragments. Compact, grey and brown, dry.	1	SS	25 10 3 3	13
78.0	**Silty Clay** trace iron staining. Very stiff, brown and red, moist.	2	SS	4 7 11 16	18
77.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	11 13 47 50	60
		4	SS	15 24 56	80
76.0		5	SS	58 50-5"	50
	End of Log				
75.0					
74.0					
73.0					
72.0					
71.0					
70.0					
69.0					



Depth Scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Well Details | Groundwater Conditions | Headspace Vapor HEX/IBL (ppm) [LEL(%)] | Comments

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW2

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

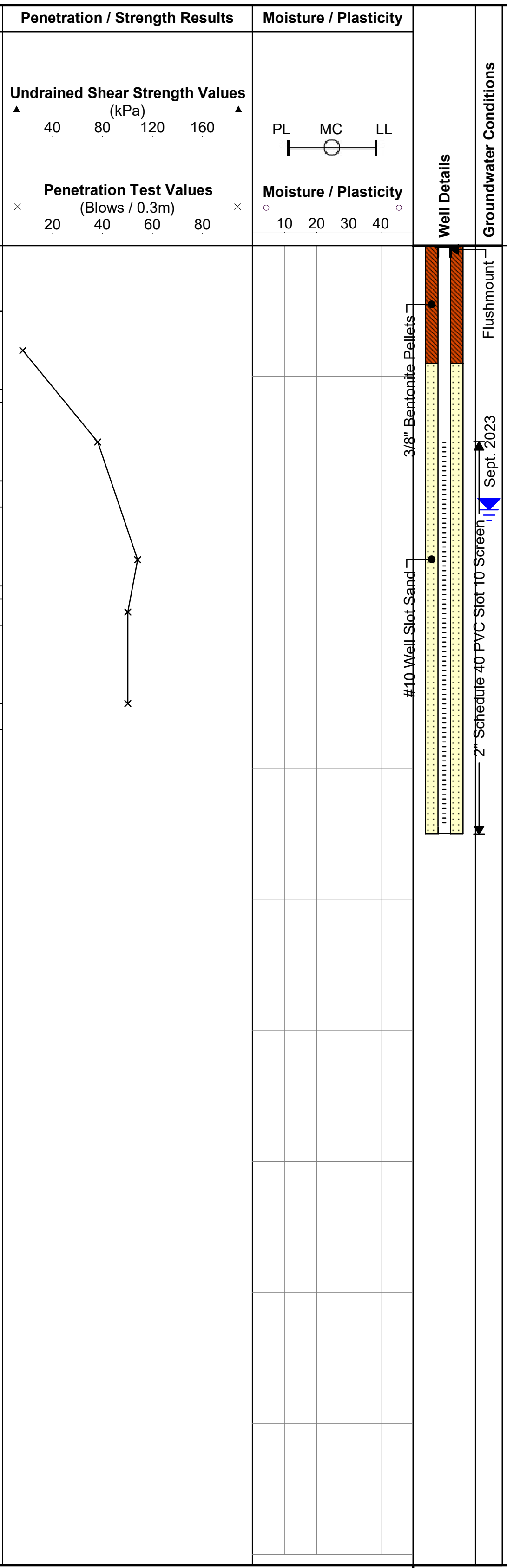
Northing: 43.193615
Easting: -79.394797
Ground Surface Elevation: 78.9

Subsurface Conditions		Samples			
Depth/Elevation (m)	**Description**	**Number**	**Type**	**Blow Counts/150 mm**	**N Value**
	Concrete ~475 mm.				
78.0	**Fill** Silty clay, some gravel, trace concrete fragments. Firm to stiff, brown, moist.	1	SS	2 3 5 7	8
77.0	**Silty Clay Till** trace gravel. Hard, brown and red, moist.	2	SS	2 13 25 13	38
	Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	13 21 33 50	24
76.0		4	SS	50-6"	50
75.0		5	SS	50-0"	50
	End of Log				

Depth Scale (m): 1 2 3 4 5 6 7 8 9 10

Depth/Elevation (m): 78.0 77.0 76.0 75.0 74.0 73.0 72.0 71.0 70.0 69.0

Stratigraphic Symbol



Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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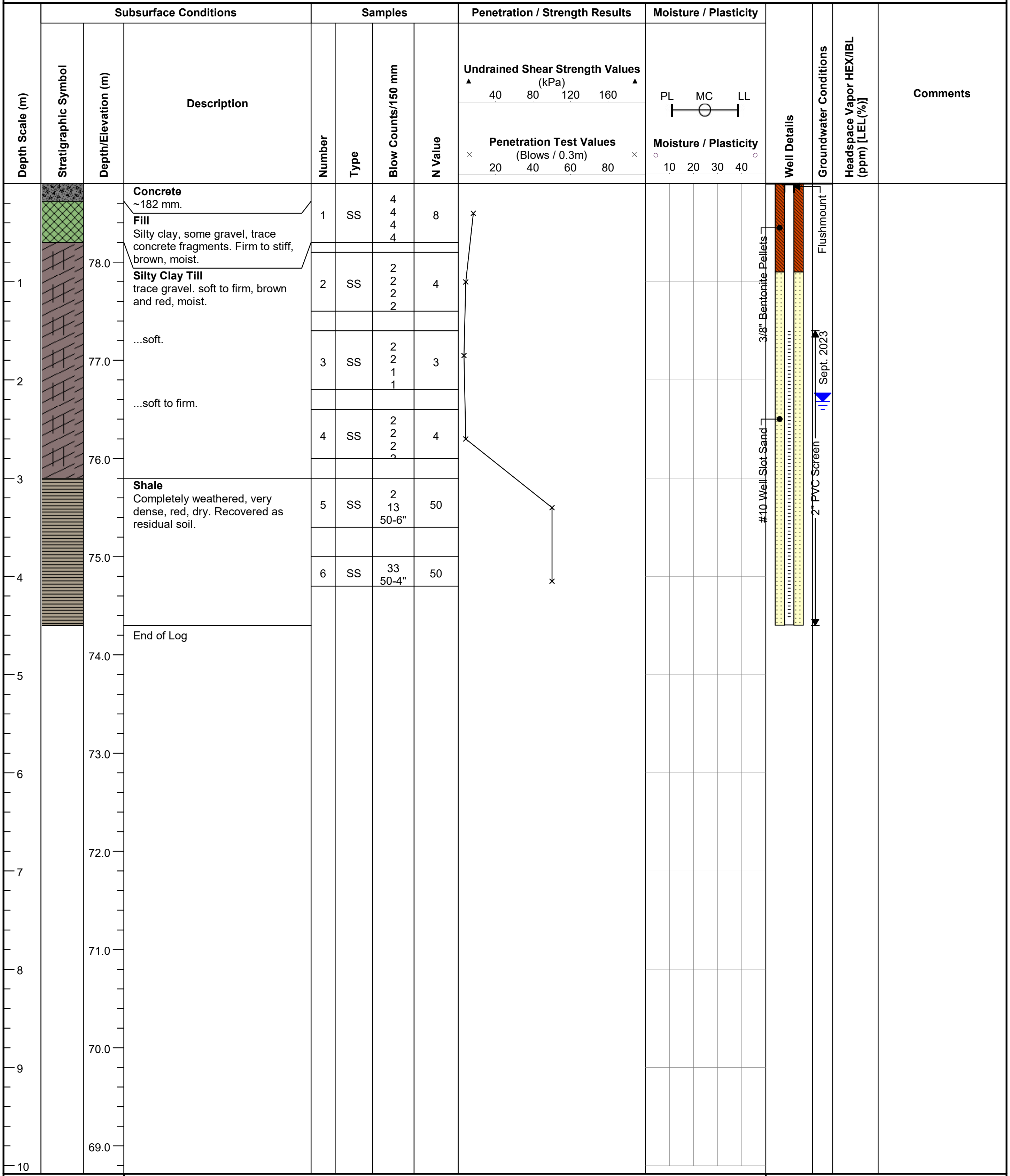
LOG OF BOREHOLE BHMW3

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-14
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.194026
Easting: -79.395079
Ground Surface Elevation: 78.8



Description
Concrete ~182 mm.
Fill Silty clay, some gravel, trace concrete fragments. Firm to stiff, brown, moist.
Silty Clay Till trace gravel. soft to firm, brown and red, moist.
...soft.
...soft to firm.
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.
End of Log

Number	Type	Blow Counts/150 mm	N Value
1	SS	4 4 4 4	8
2	SS	2 2 2 2	4
3	SS	2 2 1 1	3
4	SS	2 2 2 2	4
5	SS	2 13 50-6"	50
6	SS	33 50-4"	50

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW4

SHEET 1 of 1

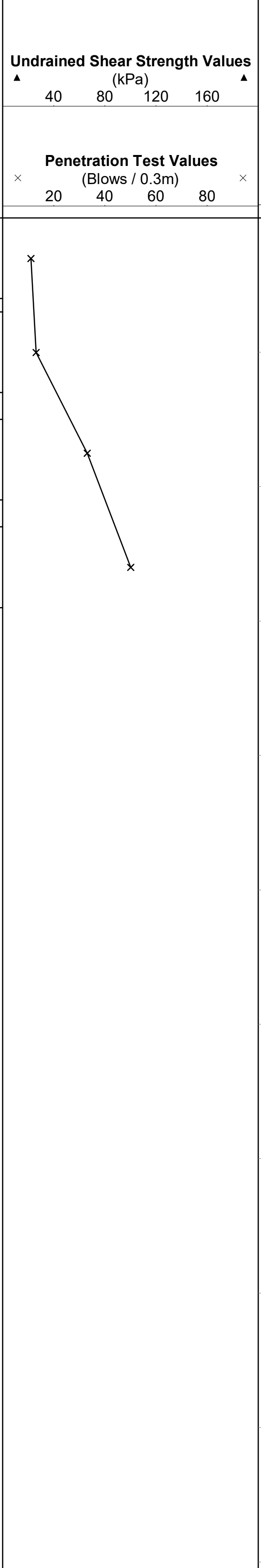
Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193379
Easting: -79.395076
Ground Surface Elevation: 79

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
		Fill Silty clay, some gravel, trace sand. Stiff, brown, moist.	1	SS	4 5 6 5	11
1	78.0	...clayey silt.	2	SS	4 5 8 11	13
		Silty Clay Till trace gravel, trace iron staining. Hard, brown and red, moist.	3	SS	7 11 22 30	33
2	77.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	10 29 14 50-6"	50
3	76.0					
4	75.0					
		End of Log				
5	74.0					
6	73.0					
7	72.0					
8	71.0					
9	70.0					
10	69.0					

Penetration / Strength Results



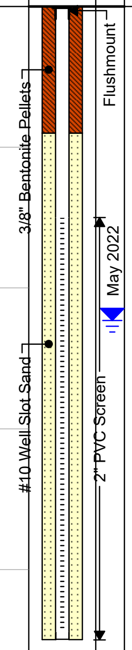
Moisture / Plasticity

PL MC LL

Moisture / Plasticity

10 20 30 40

Well Details | **Groundwater Conditions** | **Headspace Vapor HEX/IBL (ppm) [LEL(%)]** | **Comments**



Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH5

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.19287
Easting: -79.394925
Ground Surface Elevation: 79.2

Subsurface Conditions		Samples				Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
Stratigraphic Symbol	Description	Number	Type	Blow Counts/150 mm	N Value				
🟩	**Fill** Sandy silt, some gravel. Compact, brown, moist.	1	SS	6 5 8 9	13				
▨	**Silty Clay Till** some gravel. Hard, brown and red, moist.	2	SS	9 13 21 23	34				
▤	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	15 29 50-6"	50				
		4	SS	37 50-3"	50				
	End of Log								

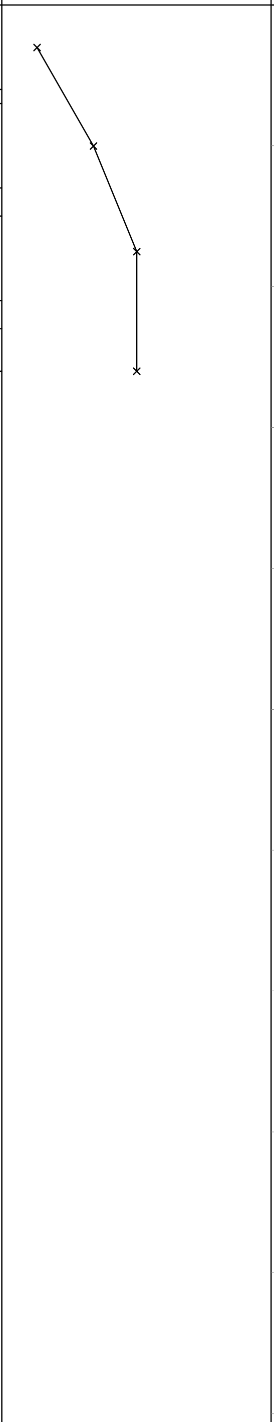
Depth Scale (m): 1 2 3 4 5 6 7 8 9 10

Depth/Elevation (m): 79.0 78.0 77.0 76.0 75.0 74.0 73.0 72.0 71.0 70.0

Penetration / Strength Results

Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲

Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×



Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ 10 20 30 40 ○

Additional Notes:
1. Borehole open to approximately 2.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH6

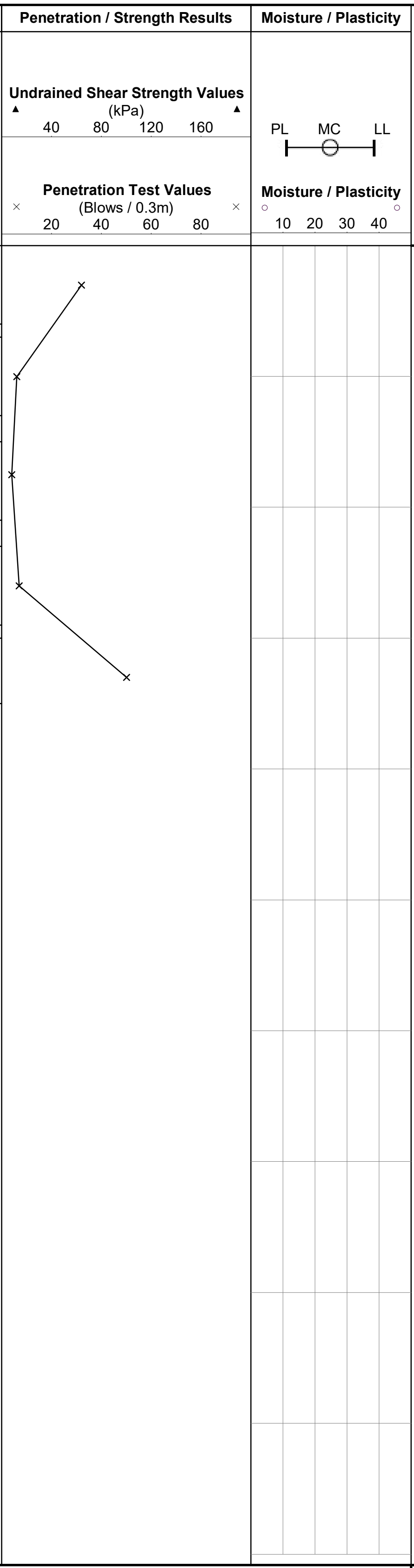
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.19319
Easting: -79.394378
Ground Surface Elevation: 78

Depth Scale (m)	Subsurface Conditions			Samples				Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value				
	▩		**Fill** Sand and gravel, some silt. Dense, brown, moist.	1	SS	20 15 17 12	32				
1	▨	77.0	**Clayey Silt Till** trace gravel. Firm, brown and red, moist.	2	SS	5 4 2 2	6				
	▨		...soft to firm.	3	SS	4 2 2 3	4				
2	▨	76.0	...trace red shale fragments. Firm.	4	SS	1 2 5 12	7				
3	☰	75.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	13 35 50-5"	50				
			End of Log								
4		74.0									
5		73.0									
6		72.0									
7		71.0									
8		70.0									
9		69.0									
10		68.0									



Additional Notes:
1. Borehole open to approximately 3.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH7

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

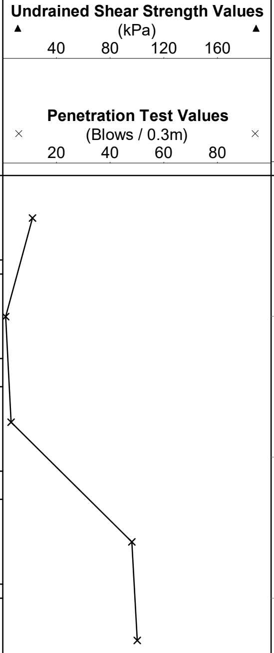
Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193375
Easting: -79.394433
Ground Surface Elevation: 78

Subsurface Conditions		Samples				Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
Stratigraphic Symbol	Description	Number	Type	Blow Counts/150 mm	N Value				
▨	**Fill** Sand and gravel, some silt. Compact, red and brown, moist.	1	SS	4 6 5 3	11				
▨	...sandy silt, some gravel, trace sand seam. Very loose.	2	SS	2 1 1	2				
▨		3	SS	1 2 1	3				
▨	**Clayey Silt Till** trace gravel. Very dense, red, very moist to wet.	4	SS	25 29 19 27	48				
▤	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	16 41 50-4"	50				
	End of Log								

Depth Scale (m)	Depth/Elevation (m)
1	77.0
2	76.0
3	75.0
4	74.0
5	73.0
6	72.0
7	71.0
8	70.0
9	69.0
10	68.0

Penetration / Strength Results



Moisture / Plasticity

PL MC LL

Moisture / Plasticity

10 20 30 40

Additional Notes:
1. Borehole open to approximately 3.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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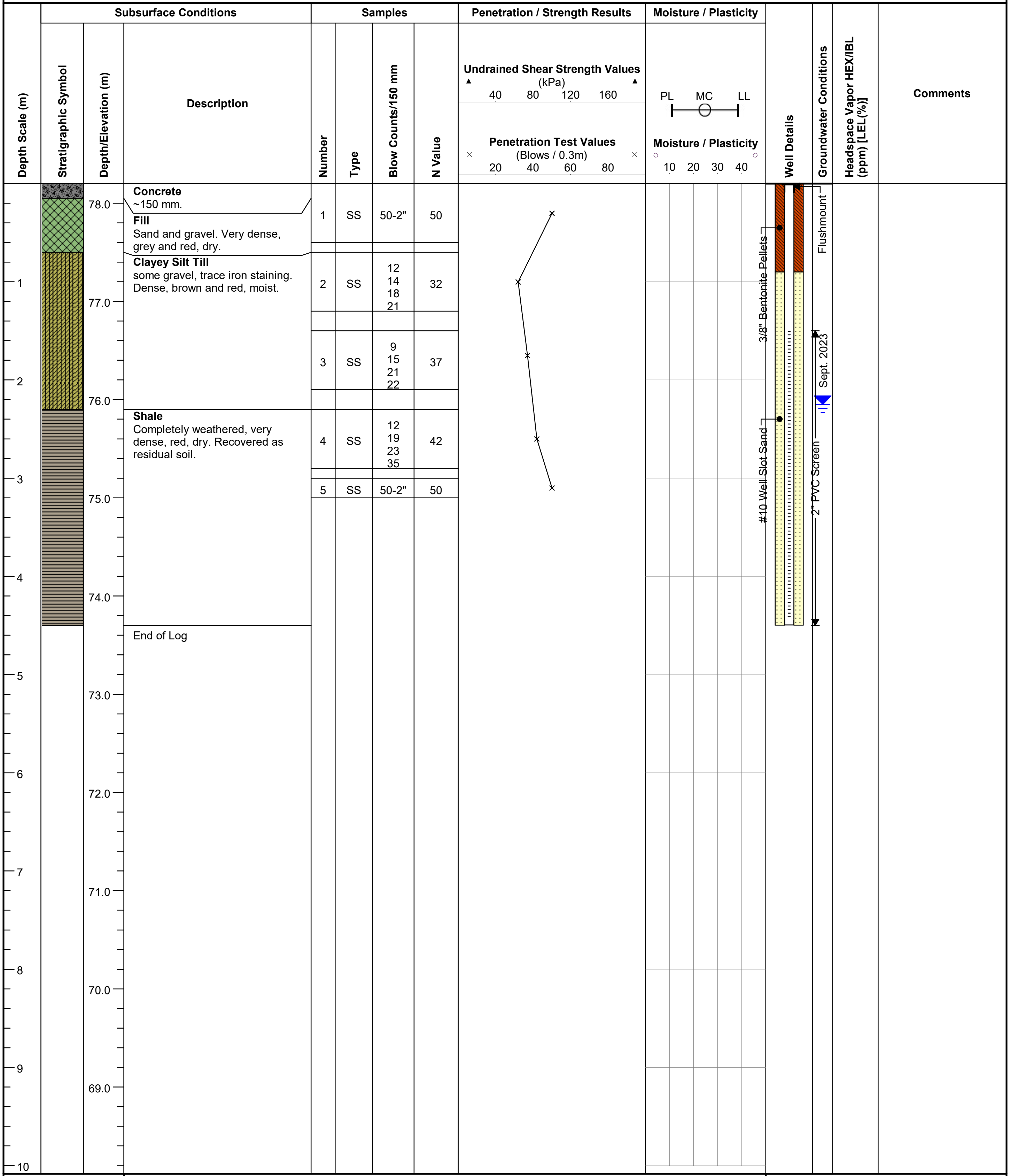
LOG OF BOREHOLE BHMW8

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193727
Easting: -79.394329
Ground Surface Elevation: 78.2



Description	Number	Type	Blow Counts/150 mm	N Value
Concrete ~150 mm.				
Fill Sand and gravel. Very dense, grey and red, dry.	1	SS	50-2"	50
Clayey Silt Till some gravel, trace iron staining. Dense, brown and red, moist.	2	SS	12 14 18 21	32
	3	SS	9 15 21 22	37
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	12 19 23 35	42
	5	SS	50-2"	50
End of Log				

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW9A

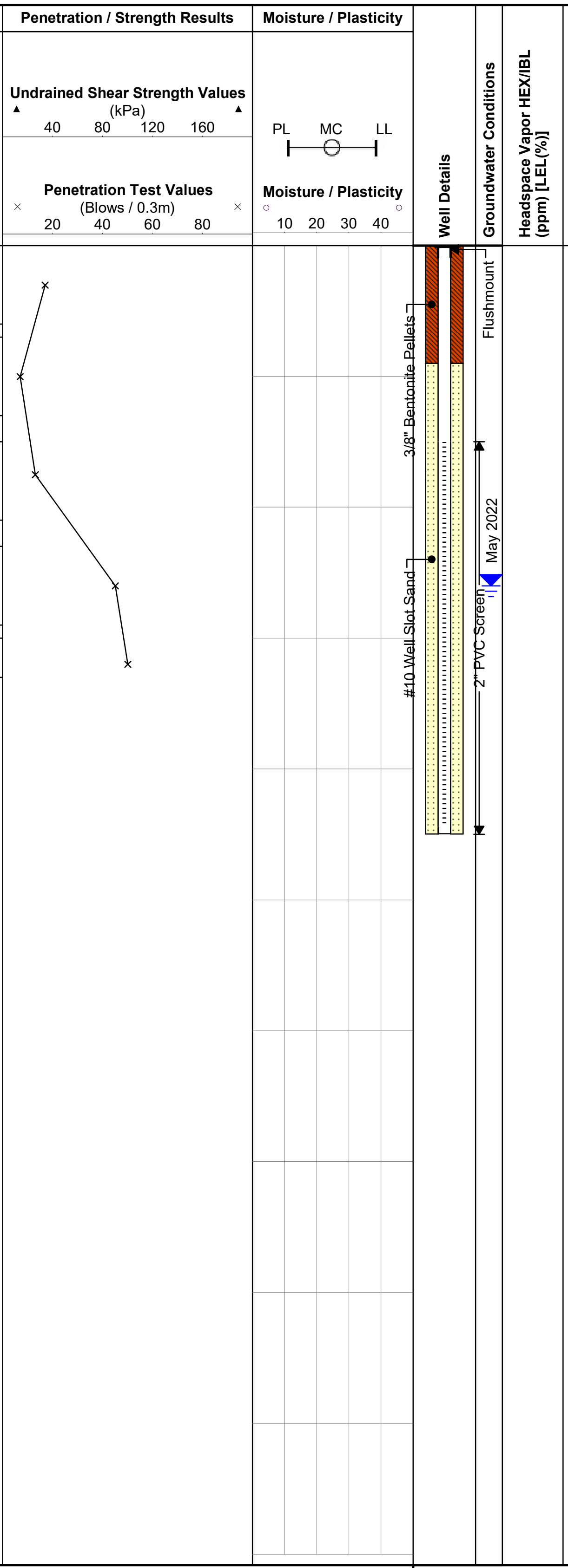
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-26
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.193988
Easting: -79.39434
Ground Surface Elevation: 77.9

Subsurface Conditions: Description	Samples: Number	Type	Blow Counts/150 mm	N Value
Fill Silt, with gravel, trace black staining. Compact, brown, dry.	1	SS	6 11 6 6	17
...clayey silt, some gravel. Firm.	2	SS	5 3 4 4	7
Clayey Silt Till trace gravel, trace sand. Stiff, brown and red, moist.	3	SS	2 4 9 12	13
...some black staining. Dense.	4	SS	9 15 30 50	45
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	18 50-4"	50
End of Log				



Depth Scale (m): 1 2 3 4 5 6 7 8 9 10

Depth/Elevation (m): 77.0 76.0 75.0 74.0 73.0 72.0 71.0 70.0 69.0 68.0

Comments

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH10

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2022-04-27
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.194162
Easting: -79.394529
Ground Surface Elevation: 77.9

Stratigraphic Symbol	Description	Number	Type	Blow Counts/150 mm	N Value
🟩	**Fill** Sand and gravel. Compact, grey, moist.	1	SS	9 14 14 13	28
🟩	...brown and black.	2	SS	18 16 8 7	24
🟩	...loose.	3	SS	3 4 2 2	6
▤	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	14 42 50-4"	50
	End of Log				

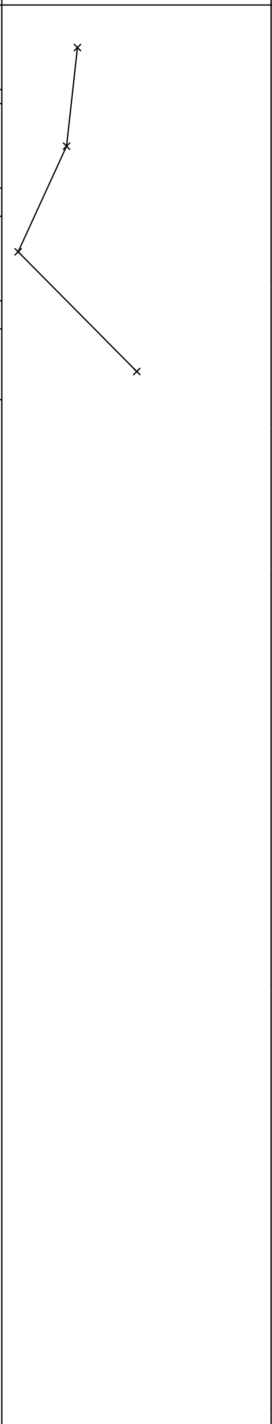
Depth Scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Depth/Elevation (m): 77.0, 76.0, 75.0, 74.0, 73.0, 72.0, 71.0, 70.0, 69.0, 68.0

Penetration / Strength Results

Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲

Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×



Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ 10 20 30 40 ○

Well Details

Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW11A

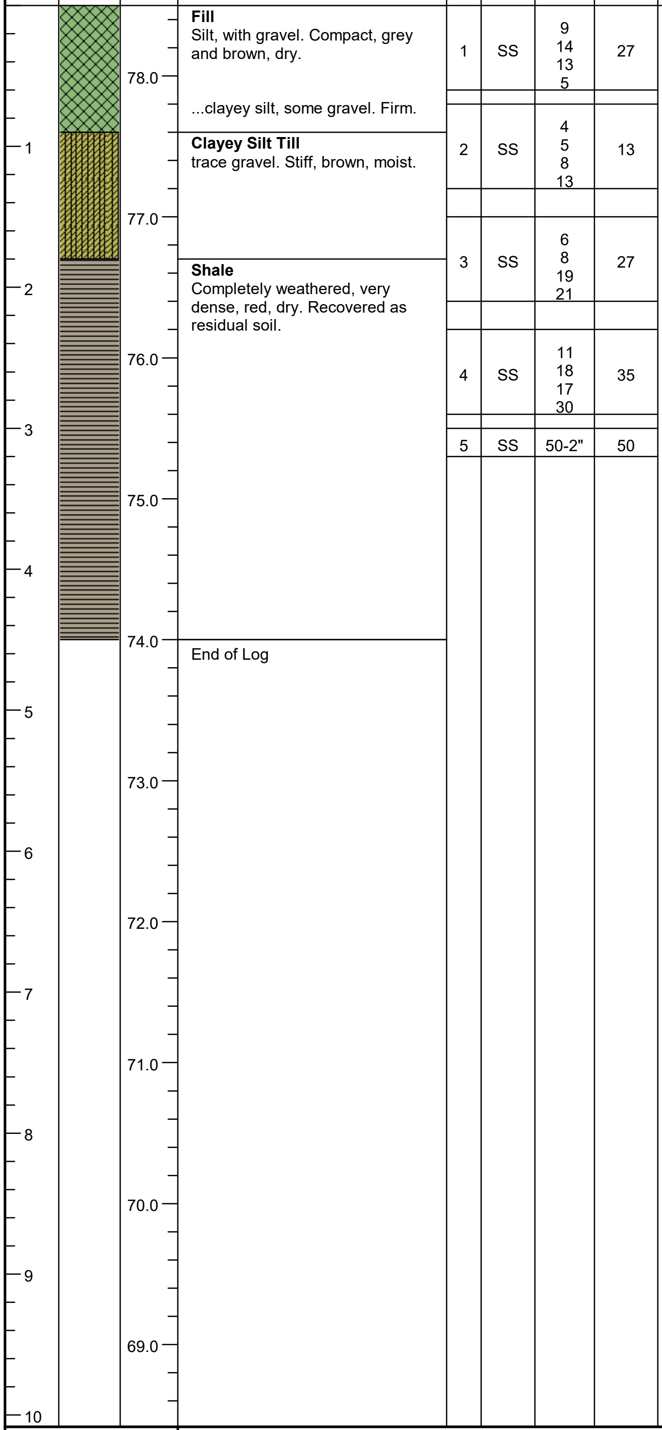
SHEET 1 of 1

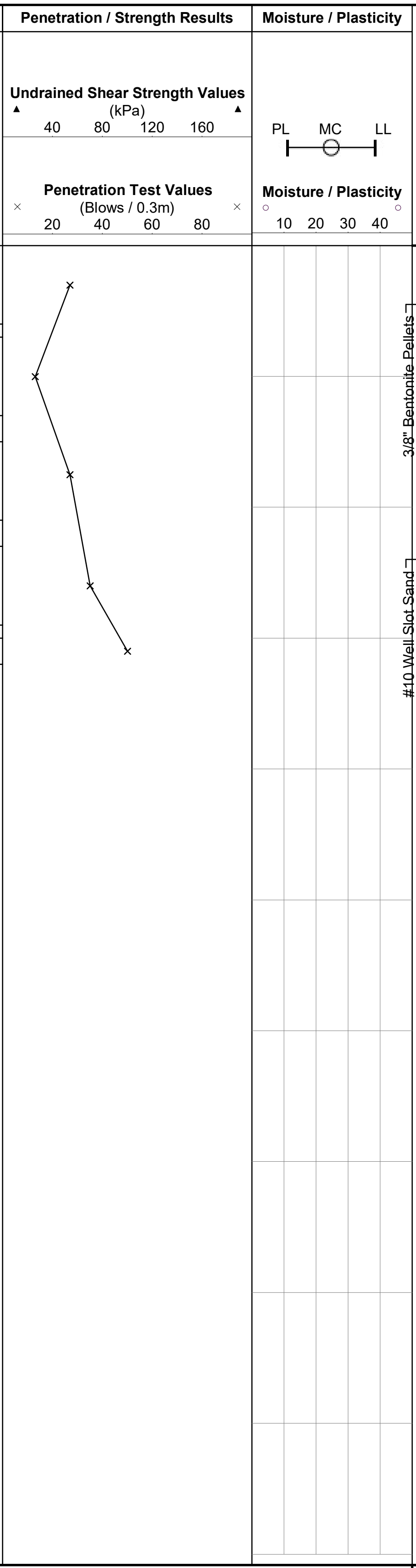
Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

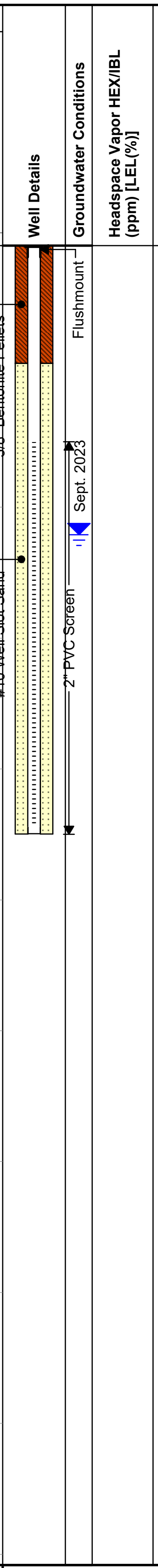
Drill Date: 2022-04-27
Drilling Method: Solid Stem
Datum: Ground Surface

Northing: 43.194158
Easting: -79.395129
Ground Surface Elevation: 78.5

Description	Number	Type	Blow Counts/150 mm	N Value
Fill Silt, with gravel. Compact, grey and brown, dry.	1	SS	9 14 13 5	27
...clayey silt, some gravel. Firm.				
Clayey Silt Till trace gravel. Stiff, brown, moist.	2	SS	4 5 8 13	13
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	6 8 19 21	27
	4	SS	11 18 17 30	35
	5	SS	50-2"	50
End of Log				







Comments

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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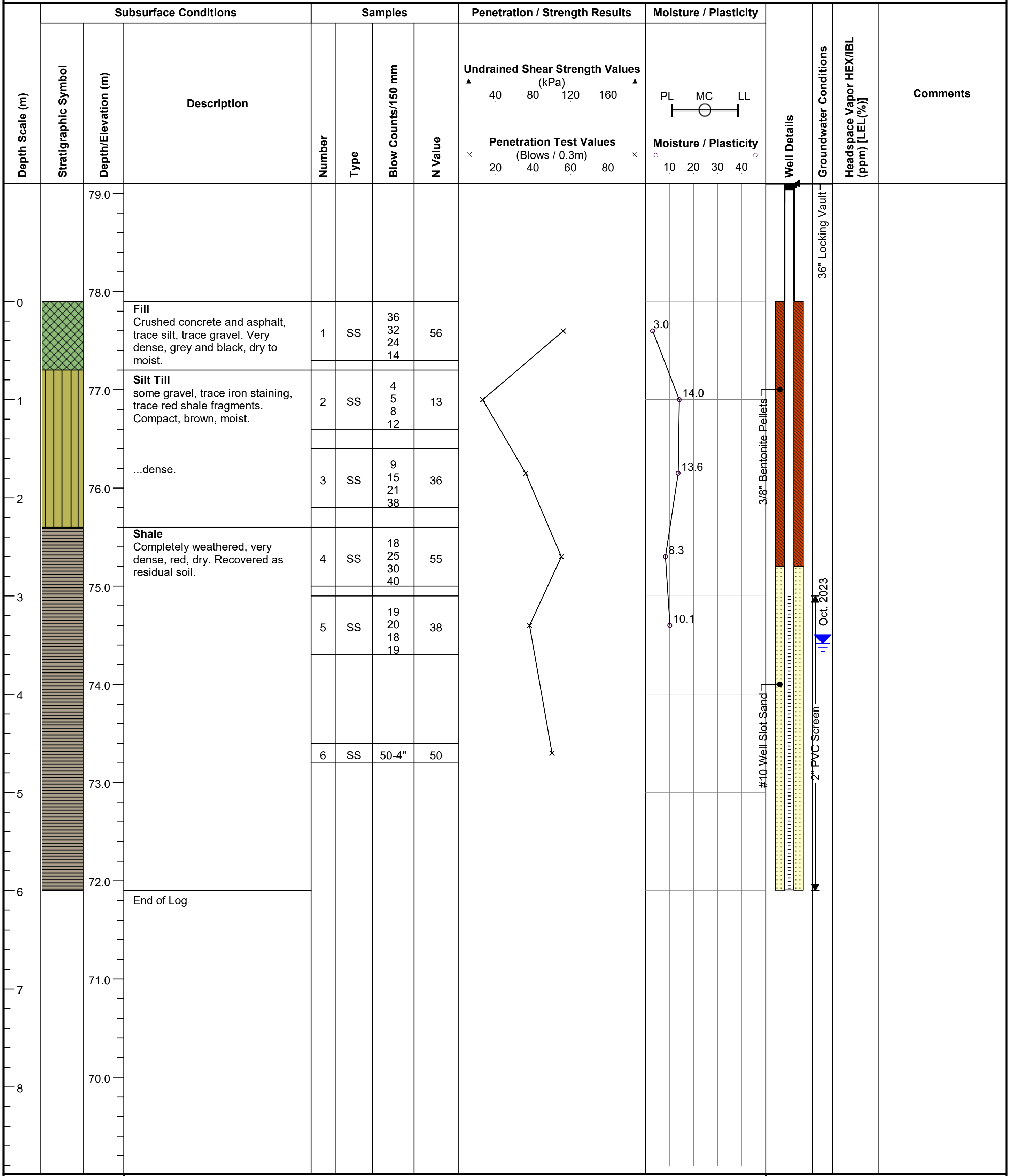
LOG OF BOREHOLE BHMW1S-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193899
Easting: -79.394279
Ground Surface Elevation: 77.9



Stratum	Description
Fill	Crushed concrete and asphalt, trace silt, trace gravel. Very dense, grey and black, dry to moist.
Silt Till	some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist. ...dense.
Shale	Completely weathered, very dense, red, dry. Recovered as residual soil.
	End of Log

Number	Type	Blow Counts/150 mm	N Value
1	SS	36 32 24 14	56
2	SS	4 5 8 12	13
3	SS	9 15 21 38	36
4	SS	18 25 30 40	55
5	SS	19 20 18 19	38
6	SS	50-4"	50

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW1D-23

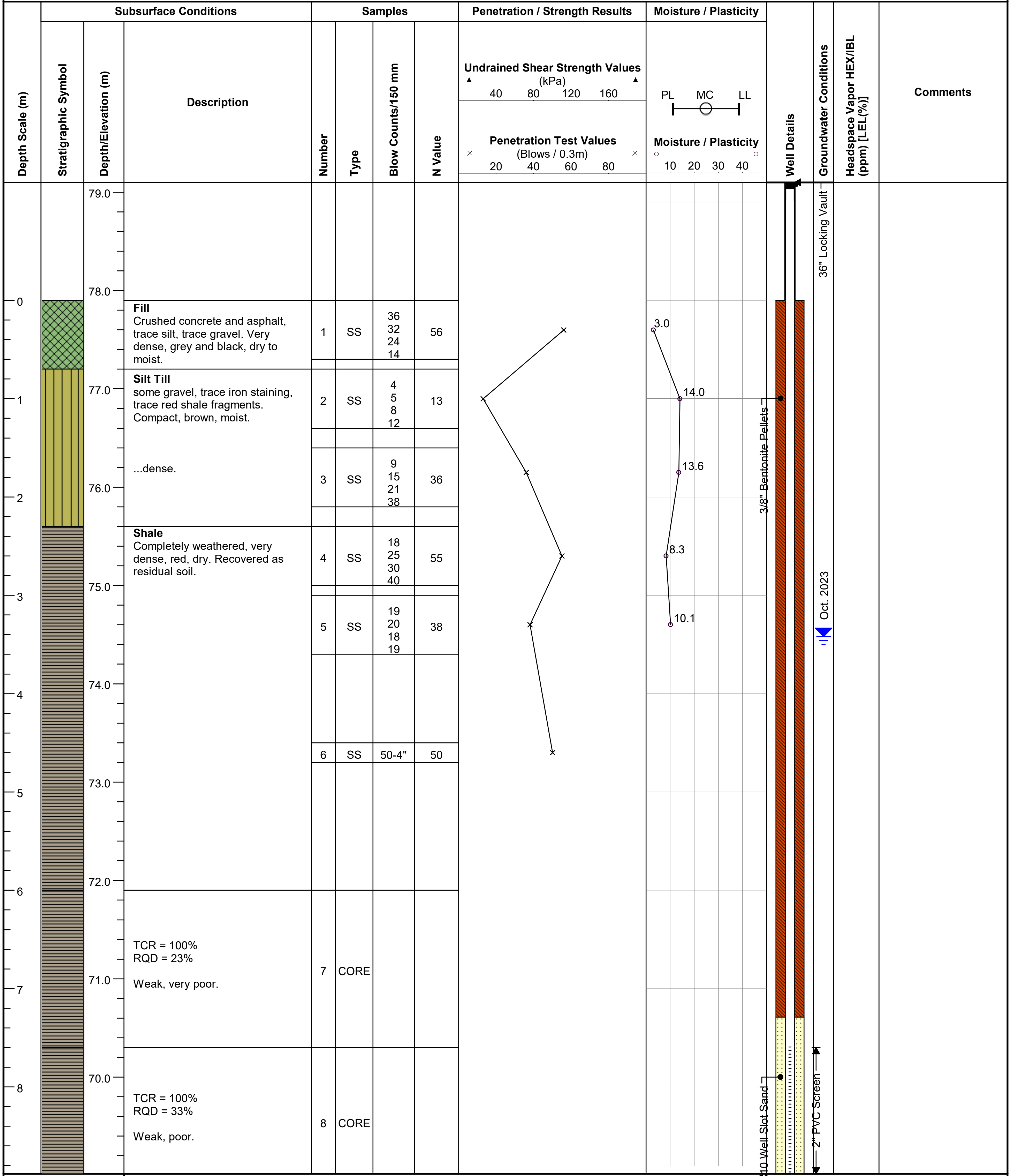
SHEET 1 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19392
Easting: -79.394279
Ground Surface Elevation: 77.9

Subsurface Conditions: Description	Samples: Number	Type	Blow Counts/150 mm	N Value
Fill Crushed concrete and asphalt, trace silt, trace gravel. Very dense, grey and black, dry to moist.	1	SS	36 32 24 14	56
Silt Till some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	4 5 8 12	13
...dense.	3	SS	9 15 21 38	36
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	18 25 30 40	55
	5	SS	19 20 18 19	38
	6	SS	50-4"	50
TCR = 100% RQD = 23% Weak, very poor.	7	CORE		
TCR = 100% RQD = 33% Weak, poor.	8	CORE		



Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW1D-23

SHEET 2 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19392
Easting: -79.394279
Ground Surface Elevation: 77.9

Subsurface Conditions				Samples			
Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
9	▤	69.0					
	▤		TCR = 99% RQD = 29% p = 2.64 g/cm^3 UCS = 43.0 MPa Weak, poor.	9	CORE		
			End of Log				

Depth Scale (m)	Depth/Elevation (m)
9	69.0
10	68.0
11	67.0
12	66.0
13	65.0
14	64.0
15	63.0
16	62.0
17	61.0
18	60.0

Penetration / Strength Results

Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲

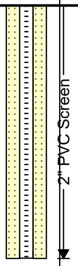
Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×

Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ 10 20 30 40 ○

Well Details



Groundwater Conditions

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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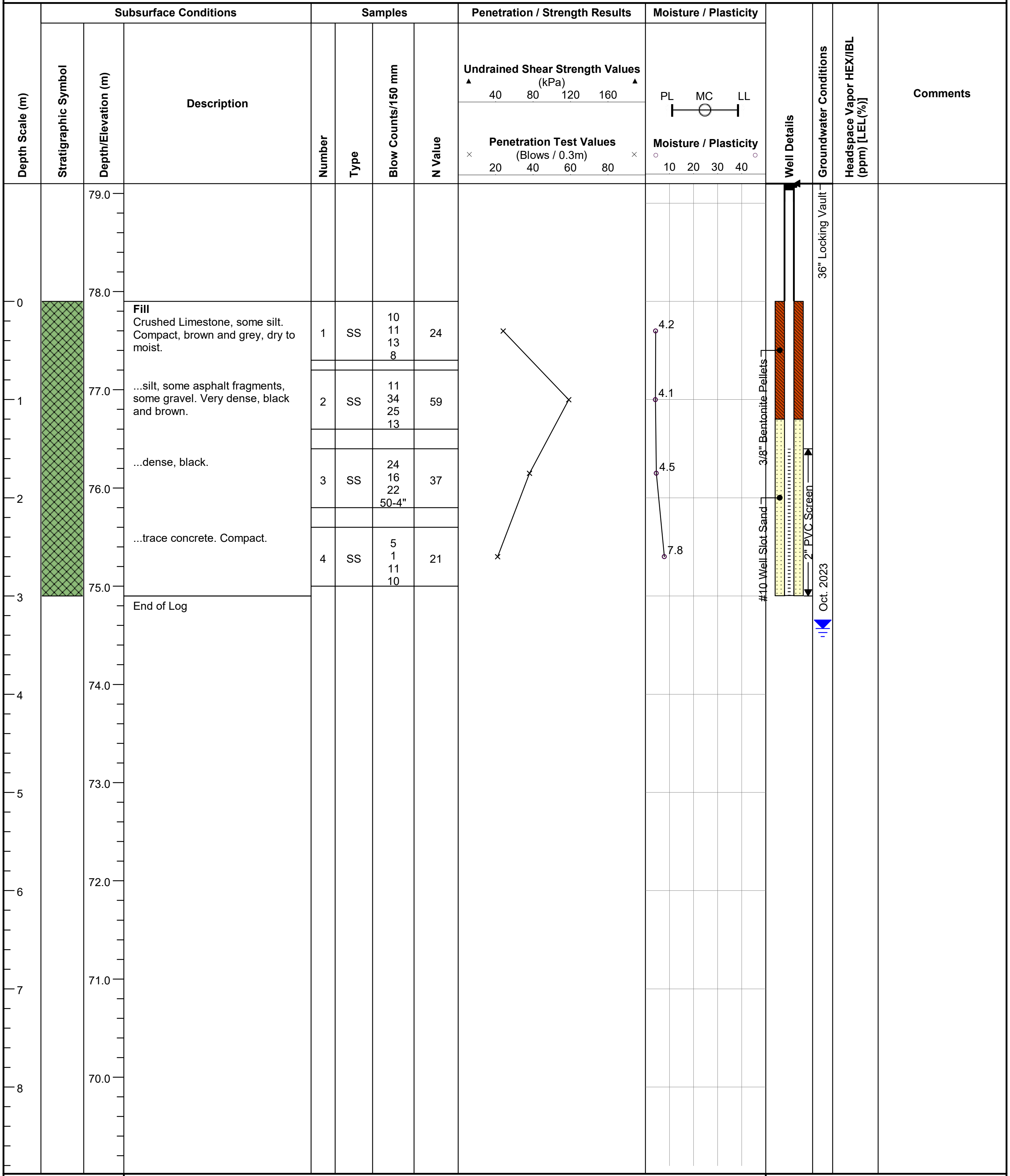
LOG OF BOREHOLE BHMW2S-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.194185
Easting: -79.394701
Ground Surface Elevation: 77.9



Description	Number	Type	Blow Counts/150 mm	N Value
Fill Crushed Limestone, some silt. Compact, brown and grey, dry to moist.	1	SS	10 11 13 8	24
...silt, some asphalt fragments, some gravel. Very dense, black and brown.	2	SS	11 34 25 13	59
...dense, black.	3	SS	24 16 22 50-4"	37
...trace concrete. Compact.	4	SS	5 1 11 10	21
End of Log				

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW2D-23

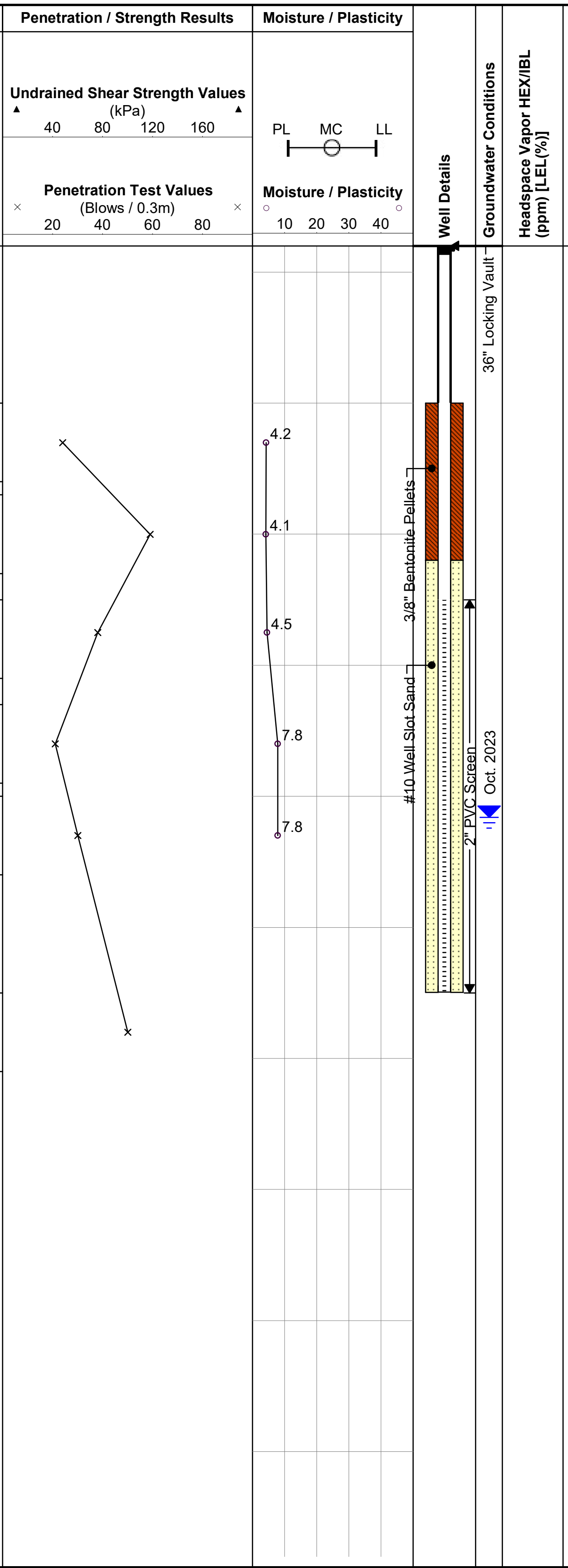
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.194145
Easting: -79.394701
Ground Surface Elevation: 77.9

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
	79.0					
	78.0					
0		**Fill** Crushed Limestone, some silt. Compact, brown and grey, dry to moist.	1	SS	10 11 13 8	24
1	77.0	...silt, some asphalt fragments, some gravel. Very dense, black and brown.	2	SS	11 34 25 13	59
2	76.0	...dense, black.	3	SS	24 16 22 50-4"	37
		...trace concrete. Compact.	4	SS	5 1 11 10	21
3	75.0	...trace orange brick fragments, trace wood debris. Compact to dense.	5	SS	9 14 16 21	30
4	74.0					
5	73.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	6	SS	10 19 30 50-4"	50
		End of Log				
6	72.0					
7	71.0					
8	70.0					



Comments

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW3S-23

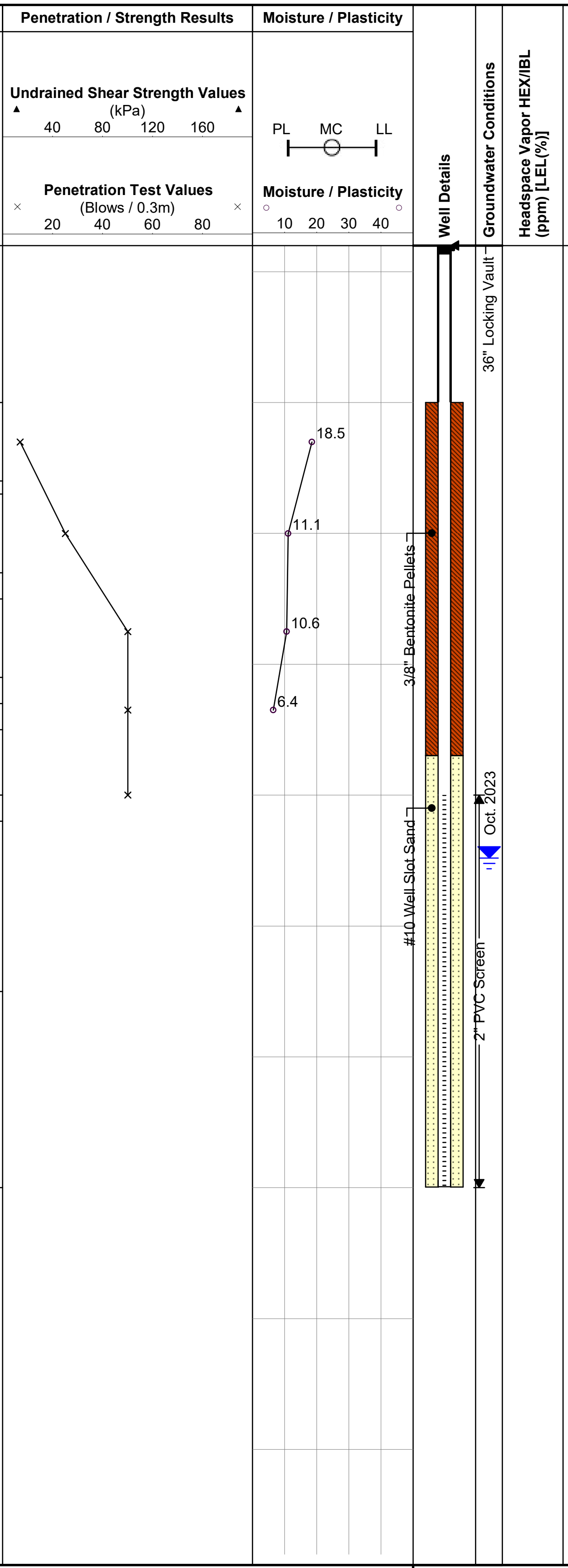
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193916
Easting: -79.3951
Ground Surface Elevation: 78.8

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
		79.0					
0	▨		**Fill** Silt, trace gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	6 5 2 4	7
1		78.0	**Silt Till** some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	6 10 15 18	25
2		77.0	...no iron staining. Dense.	3	SS	8 11 15 50-6"	50
			Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	50-4"	50
3		76.0		5	SS	50-4"	50
4–5		75.0 74.0 73.0		6	CORE		
6			End of Log				
7		72.0					
8		71.0 70.0					



Comments

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Ph: (905) 383-3733

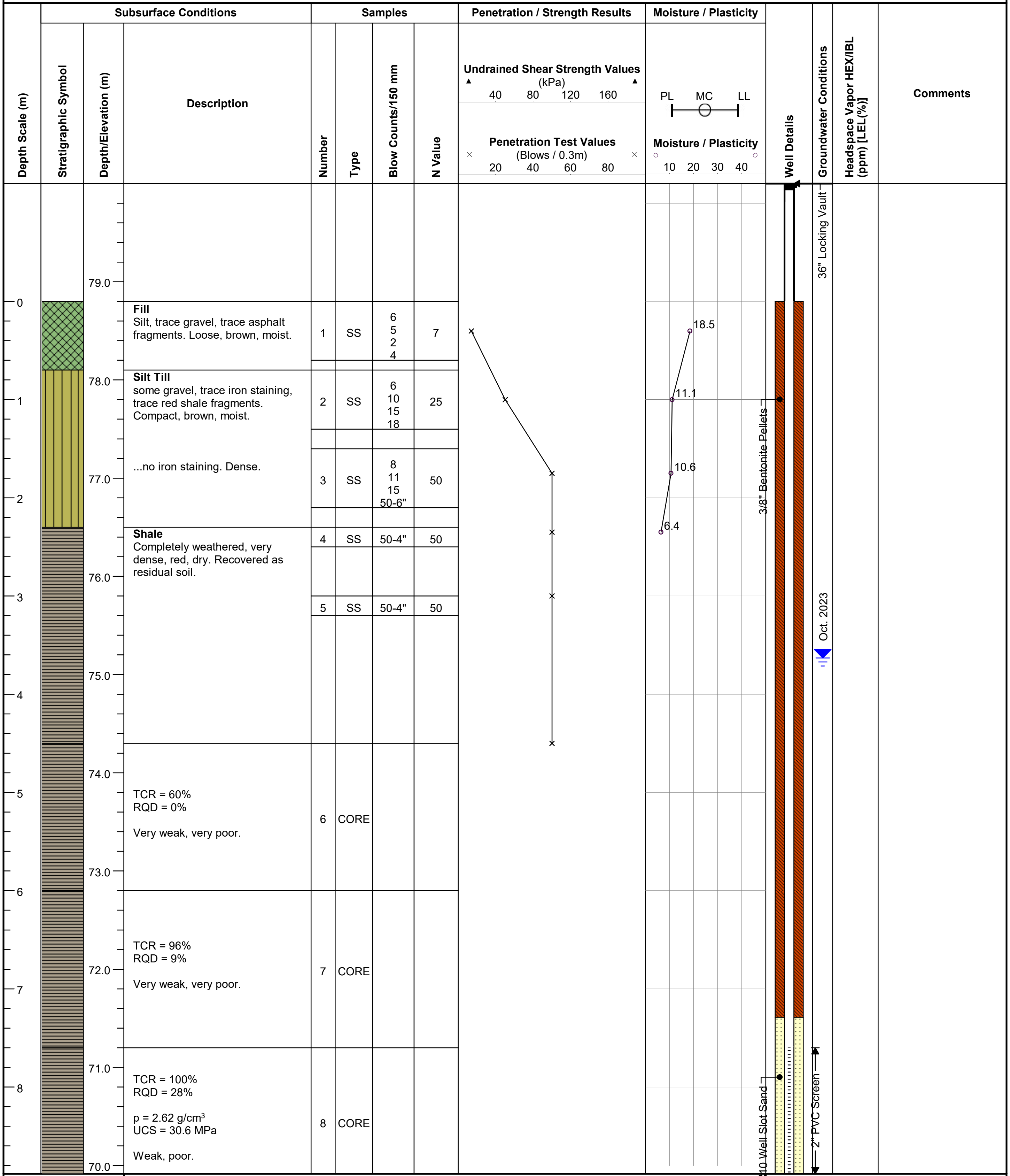
LOG OF BOREHOLE BHMW3D-23

SHEET 1 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19388
Easting: -79.3951
Ground Surface Elevation: 78.8



Description	Number	Type	Blow Counts/150 mm	N Value
Fill Silt, trace gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	6 5 2 4	7
Silt Till some gravel, trace iron staining, trace red shale fragments. Compact, brown, moist.	2	SS	6 10 15 18	25
...no iron staining. Dense.	3	SS	8 11 15 50-6"	50
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	50-4"	50
	5	SS	50-4"	50
TCR = 60% RQD = 0% Very weak, very poor.	6	CORE		
TCR = 96% RQD = 9% Very weak, very poor.	7	CORE		
TCR = 100% RQD = 28% p = 2.62 g/cm^3 UCS = 30.6 MPa Weak, poor.	8	CORE		

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Ph: (905) 383-3733

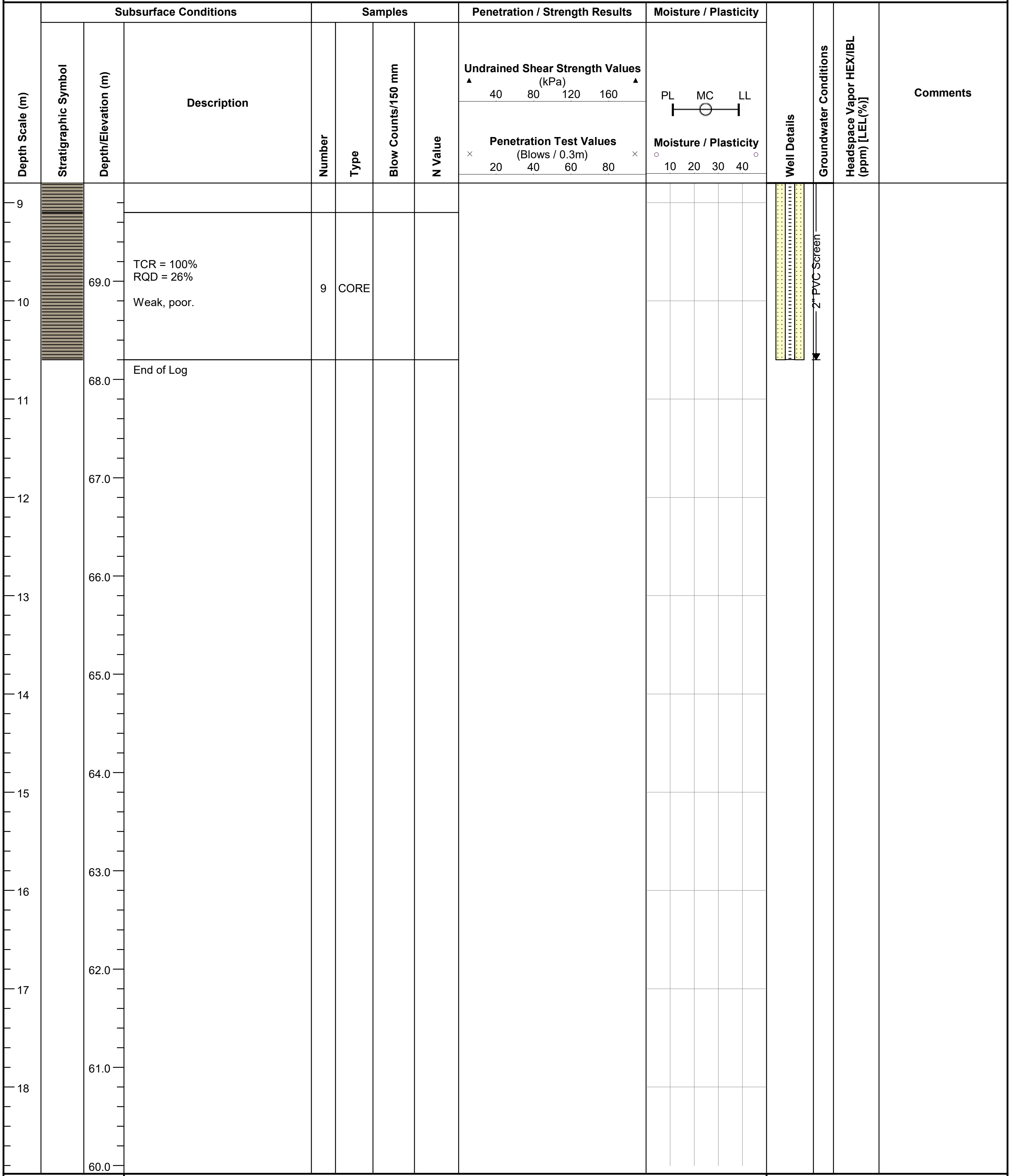
LOG OF BOREHOLE BHMW3D-23

SHEET 2 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19388
Easting: -79.3951
Ground Surface Elevation: 78.8



Description	Number	Type	Blow Counts/150 mm	N Value
TCR = 100% RQD = 26% Weak, poor.	9	CORE		
End of Log				

Additional Notes:
1. Borehole open to approximately 10.6 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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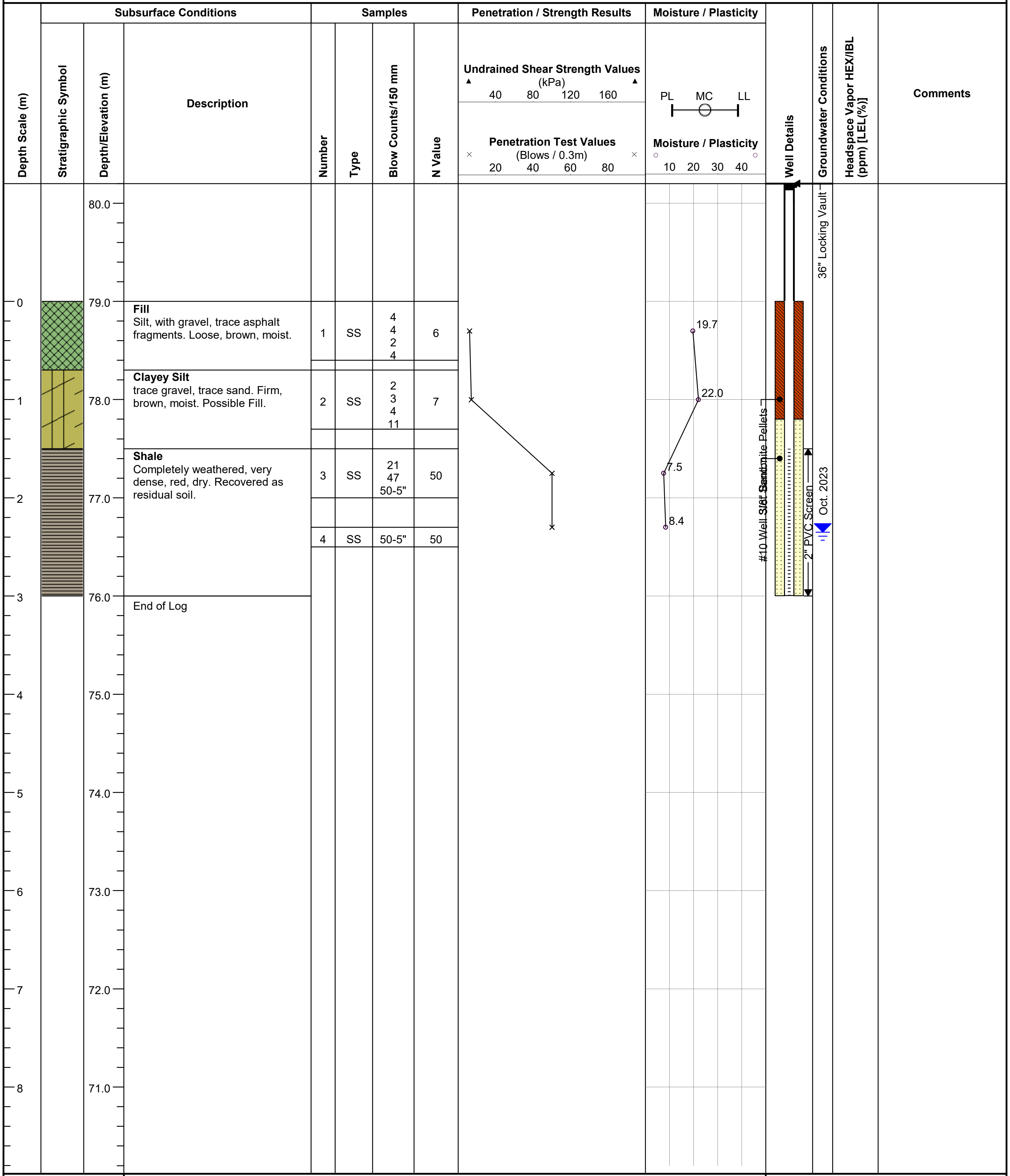
LOG OF BOREHOLE BHMW4-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193466
Easting: -79.395015
Ground Surface Elevation: 79



Description	Number	Type	Blow Counts/150 mm	N Value
Fill Silt, with gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	4 4 2 4	6
Clayey Silt trace gravel, trace sand. Firm, brown, moist. Possible Fill.	2	SS	2 3 4 11	7
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	21 47 50-5"	50
	4	SS	50-5"	50
End of Log				

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

LOG OF BOREHOLE BHMW4S-23

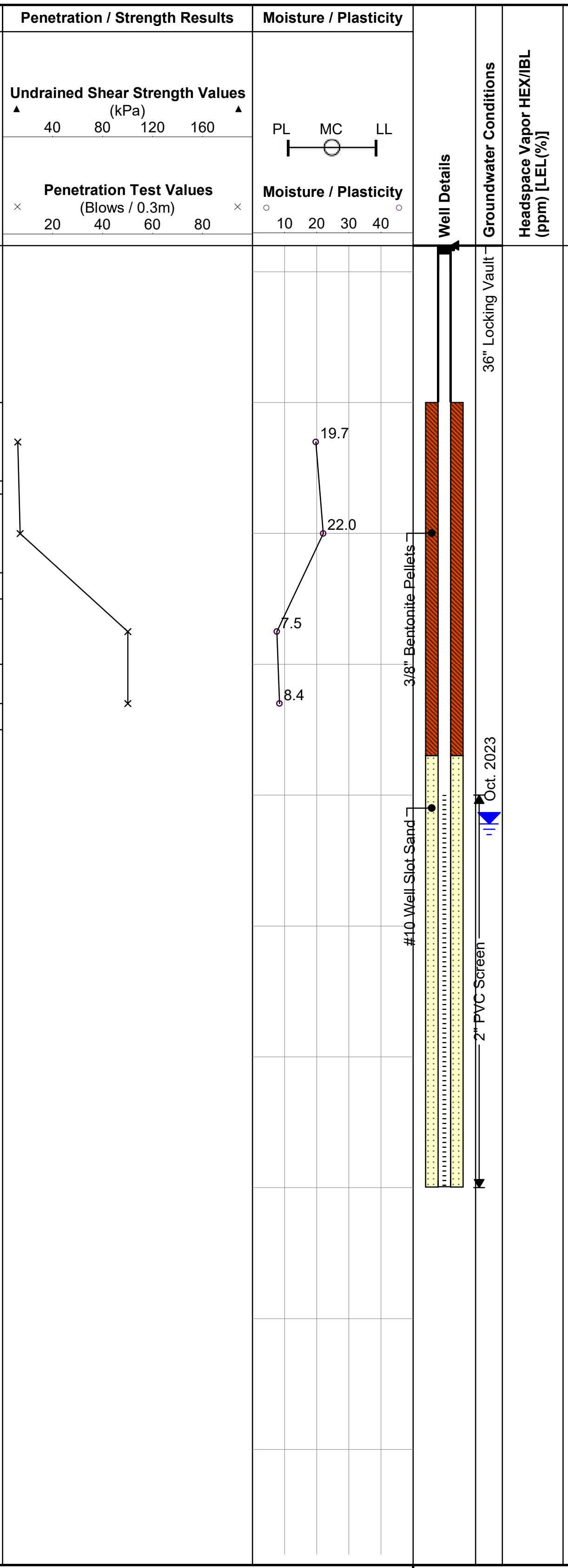
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193498
Easting: -79.395015
Ground Surface Elevation: 79

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
	80.0						
0	79.0	**Fill** Silt, with gravel, trace asphalt fragments. Loose, brown, moist.	1	SS	4 4 2 4	6	
1	78.0	**Clayey Silt** trace gravel, trace sand. Firm, brown, moist. Possible Fill.	2	SS	2 3 4 11	7	
2	77.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	21 47 50-5"	50	
			4	SS	50-5"	50	
3	76.0						
4	75.0						
5	74.0						
6	73.0	End of Log					
7	72.0						
8	71.0						



Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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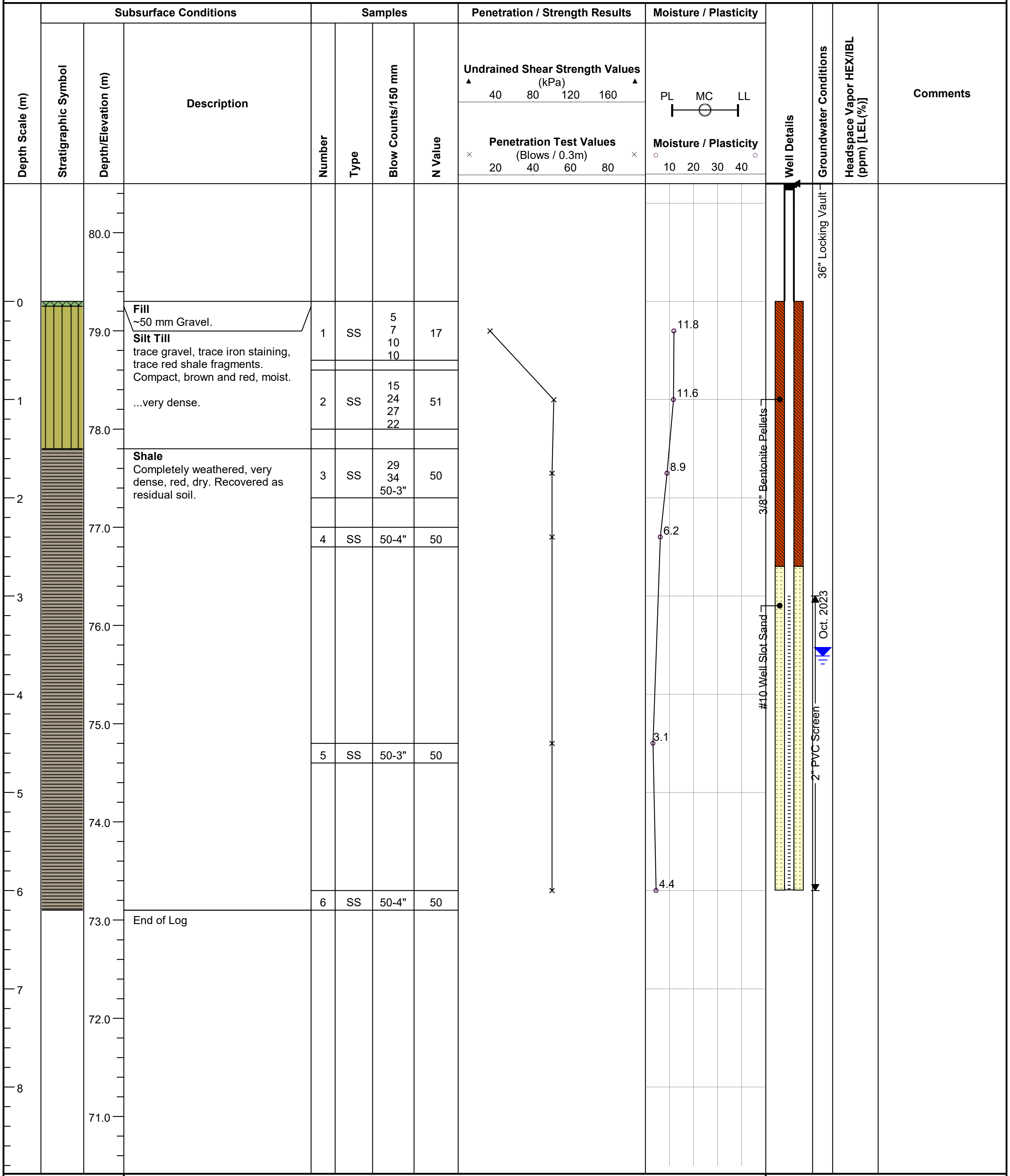
LOG OF BOREHOLE BHMW5S-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-05
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.193038
Easting: -79.394998
Ground Surface Elevation: 79.3



Description	Number	Type	Blow Counts/150 mm	N Value
Fill ~50 mm Gravel. **Silt Till** trace gravel, trace iron staining, trace red shale fragments. Compact, brown and red, moist.	1	SS	5 7 10 10	17
...very dense.	2	SS	15 24 27 22	51
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	29 34 50-3"	50
	4	SS	50-4"	50
	5	SS	50-3"	50
	6	SS	50-4"	50
End of Log				

Additional Notes:
1. Borehole open to approximately 6.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW6-23

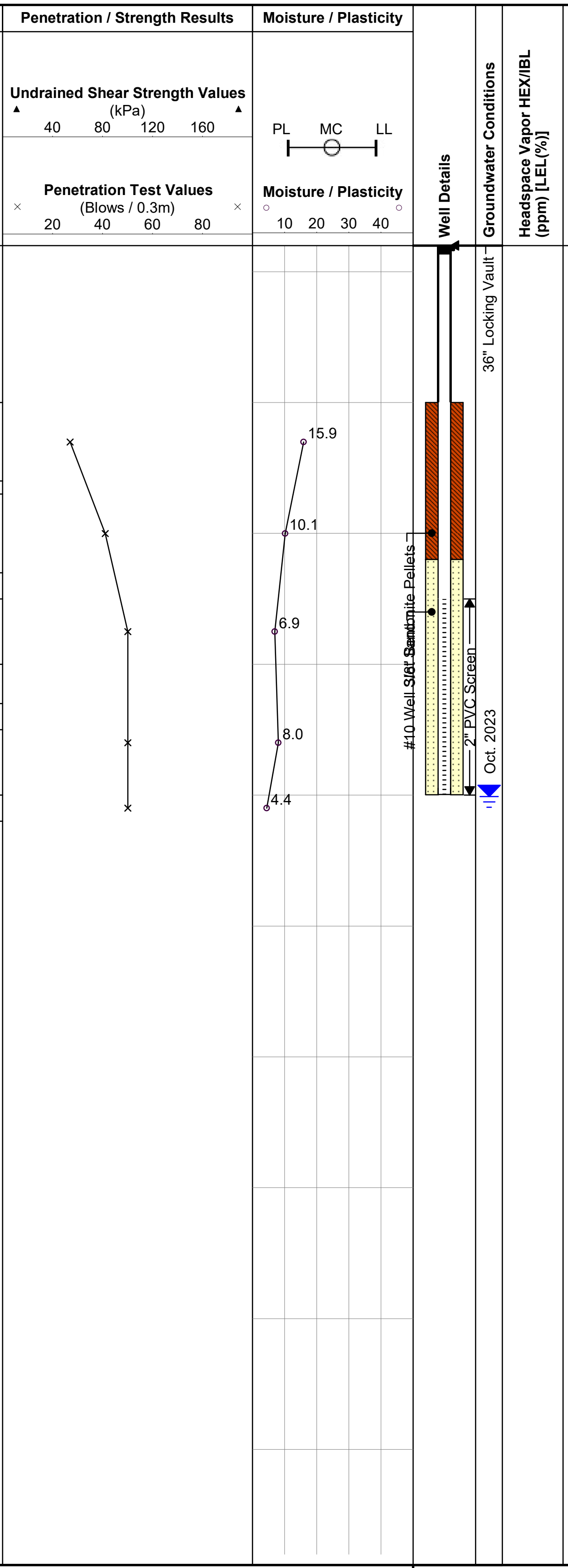
SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.192738
Easting: -79.395024
Ground Surface Elevation: 79.9

Depth Scale (m)	Stratigraphic Symbol	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value
0	▨		**Fill** Silt, with gravel. Compact, brown, moist.	1	SS	13 15 12 9	27
	▤	79.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	2	SS	12 16 25 26	41
2		78.0		3	SS	47 47 50-5"	50
				4	SS	26 50-4"	50
3		77.0		5	SS	50-2"	50
			End of Log				



Comments

Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BH7-23

SHEET 1 of 1

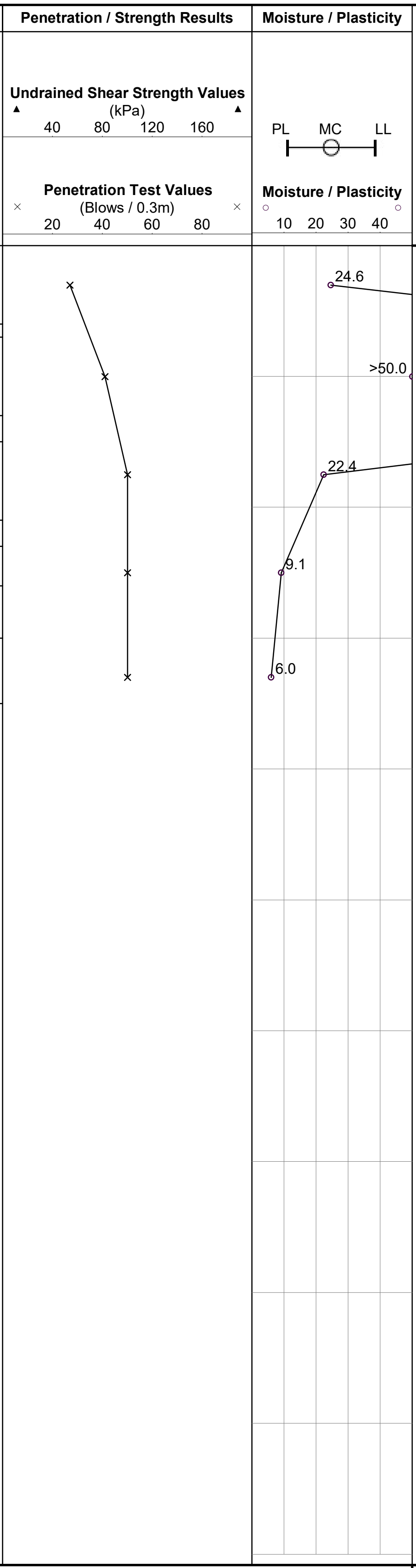
Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-06
Drilling Method: Hollow Stem
Datum: Ground Surface

Northing: 43.19273
Easting: -79.394474
Ground Surface Elevation: 78.8

Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Well Details	Groundwater Conditions	Headspace Vapor HEX/IBL (ppm) [LEL(%)]	Comments
	Fill Sandy silt, trace clay, trace gravel, trace red shale fragments. Loose, brown, moist.	1	SS	3 3 3 3	6				
78.0	...Peat, organic material, trace gravel. Very moist brown and black.	2	SS	3 2 4 3	6				
77.0	**Clayey Silt** trace peat, trace iron staining. Firm, brown and black, very moist.	3	SS	4 3 4 3	7				
	...wet.	4	SS	17 50-5"	50				
76.0	**Shale** Completely weathered, very dense, red, dry. Recovered as residual soil.	5	SS	18 22 50-5"	50				
75.0	End of Log								

Depth Scale (m): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Elevation (m): 78.0, 77.0, 76.0, 75.0, 74.0, 73.0, 72.0, 71.0, 70.0, 69.0



Additional Notes:
1. Borehole open to approximately 3.0 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW8S-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Solid Stem
Datum: Ground Surface

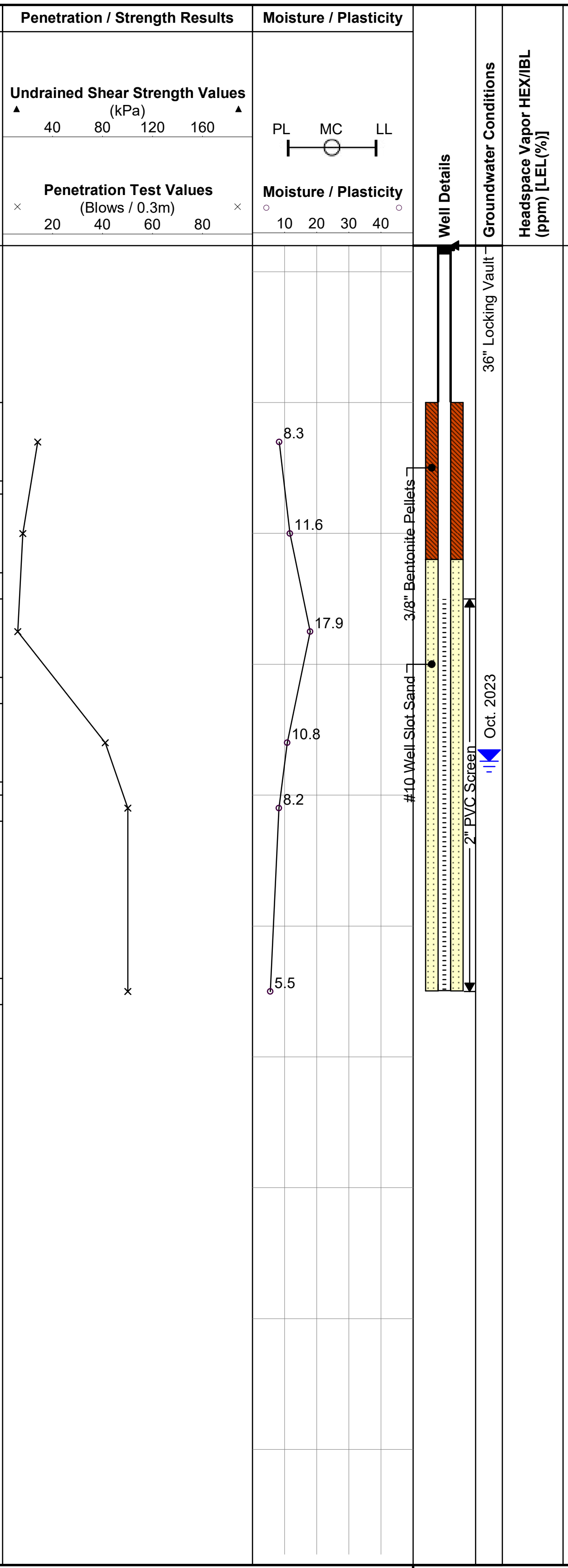
Northing: 43.193186
Easting: -79.394465
Ground Surface Elevation: 78

Description	Number	Type	Blow Counts/150 mm	N Value
Fill Sand and gravel. Compact, brown and red, dry.	1	SS	10 7 7 5	14
Clayey Silt Stiff, red and brown, dry to moist.				
...some gravel. Firm to stiff.	2	SS	7 5 3 2	8
...trace sand. Firm.	3	SS	3 2 4 5	6
Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	4	SS	7 17 24 30	41
	5	SS	50-6"	50
	6	SS	50-4"	50
End of Log				

Depth Scale (m): 0, 1, 2, 3, 4, 5, 6, 7, 8
Depth/Elevation (m): 79.0, 78.0, 77.0, 76.0, 75.0, 74.0, 73.0, 72.0, 71.0, 70.0

Headspace Vapor HEX/IBL (ppm) [LEL(%)]

Comments



Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Ph: (905) 383-3733

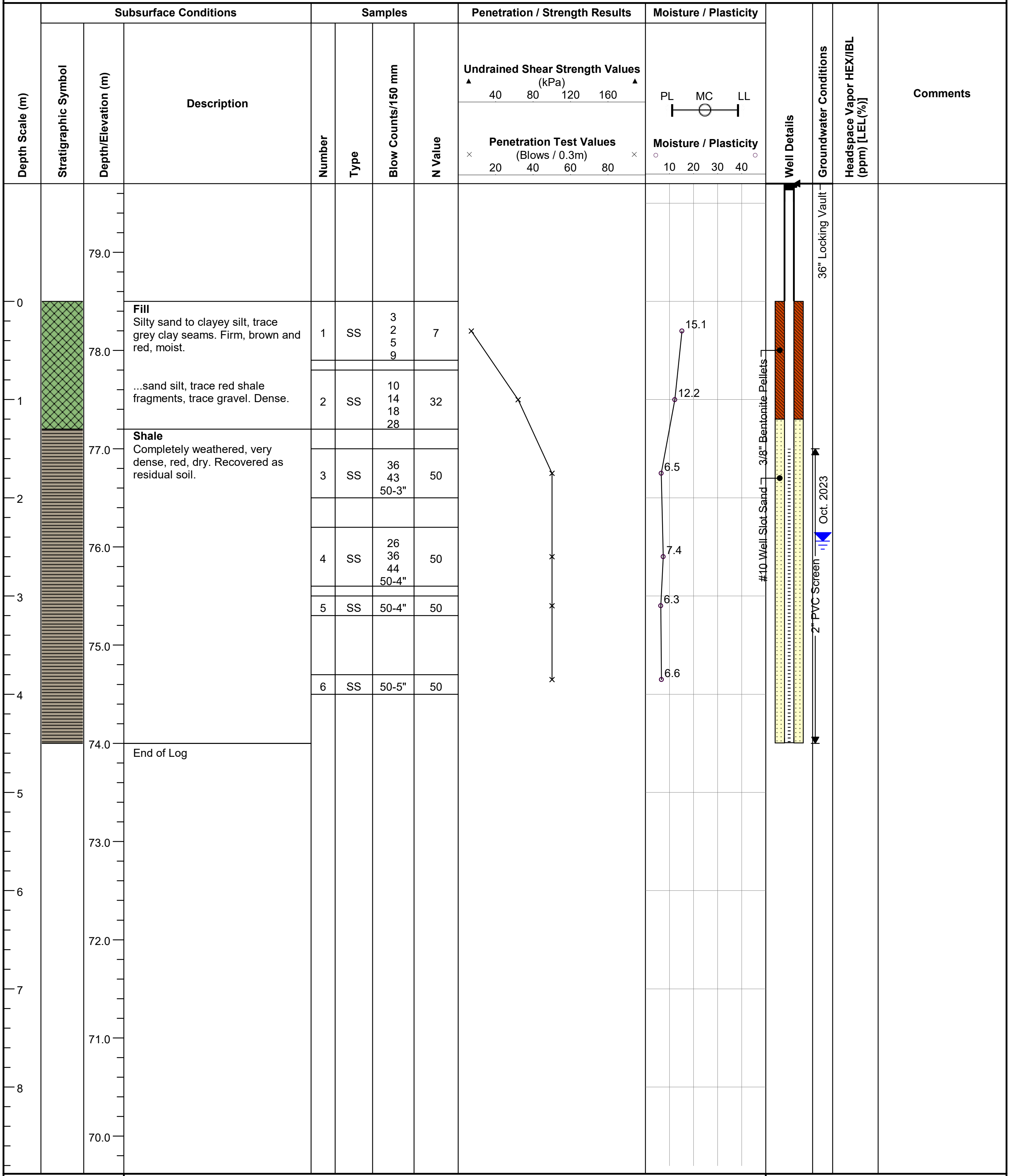
LOG OF BOREHOLE BHMW9S-23

SHEET 1 of 1

Project No.: 23016
Project Name: 4933 Victoria Ave. North, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.193644
Easting: -79.394366
Ground Surface Elevation: 78.5



Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Moisture (%)
0 / 78.5	**Fill** Silty sand to clayey silt, trace grey clay seams. Firm, brown and red, moist.	1	SS	3 2 5 9	7	15.1
	...sand silt, trace red shale fragments, trace gravel. Dense.	2	SS	10 14 18 28	32	12.2
	Shale Completely weathered, very dense, red, dry. Recovered as residual soil.	3	SS	36 43 50-3"	50	6.5
		4	SS	26 36 44 50-4"	50	7.4
		5	SS	50-4"	50	6.3
		6	SS	50-5"	50	6.6
74.0	End of Log					

Additional Notes:
1. Borehole open to approximately 4.5 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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Ph: (905) 383-3733

LOG OF BOREHOLE BHMW9D

SHEET 1 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

Northing: 43.19361
Easting: -79.394363
Ground Surface Elevation: 78.5

Subsurface Conditions

Depth Scale (m)	Depth/Elevation (m)	Description
0	78.5	**Fill** Silty sand to clayey silt, trace grey clay seams. Firm, brown and red, moist.
		...sand silt, trace red shale fragments, trace gravel. Dense.
		Shale Completely weathered, very dense, red, dry. Recovered as residual soil.
		TCR = 95% RQD = 65% Weak, fair.

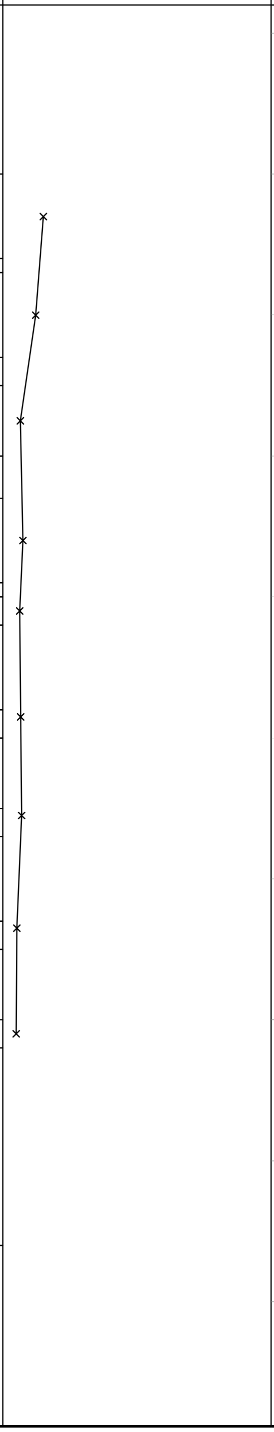
Samples

Number	Type	Blow Counts/150 mm	N Value
1	SS	3 2 5 9	7
2	SS	10 14 18 28	32
3	SS	36 43 50-3"	50
4	SS	26 36 44 50-4"	50
5	SS	50-4"	50
6	SS	50-5"	50
7	SS	50-6"	50
8	SS	50-6"	50
9	SS	50-3"	50
10	CORE		

Penetration / Strength Results

Undrained Shear Strength Values ▲ (kPa) ▲ 40 80 120 160

Penetration Test Values × (Blows / 0.3m) × 20 40 60 80

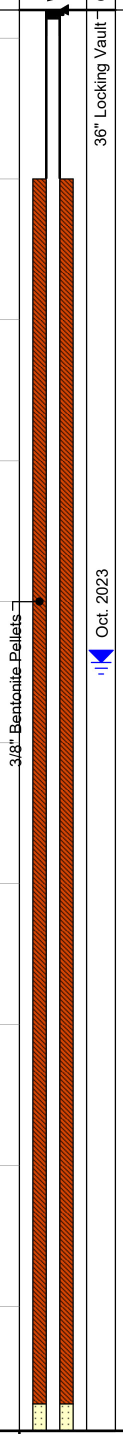


Moisture / Plasticity

PL MC LL

Moisture / Plasticity ○ 10 20 30 40 ○

Well Details | **Groundwater Conditions** | **Headspace Vapor HEX/IBL (ppm) [LEL(%)]** | **Comments**



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

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LOG OF BOREHOLE BHMW9D

SHEET 2 of 2

Project No.: 22122
Project Name: 22122 - Phase 2 ESA_4937 Victoria Ave, Vineland
Location: 4933 & 4937 Victoria Avenue, Vineland

Drill Date: 2023-07-04
Drilling Method: Hollow Stem/Coring
Datum: Ground Surface

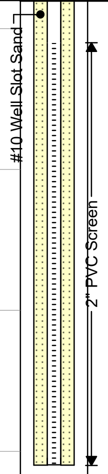
Northing: 43.19361
Easting: -79.394363
Ground Surface Elevation: 78.5

Depth Scale (m)	Depth/Elevation (m)	Description	Number	Type	Blow Counts/150 mm	N Value	Comments
9							
10	69.0	TCR = 98% RQD = 13% Very weak, very poor.	11	CORE			
11	68.0 67.0	TCR = 100% RQD = 77% p = 2.62 g/cm³ UCS = 65.9 MPa Weak, good.	12	CORE			
12–18	66.0 65.0 64.0 63.0 62.0 61.0 60.0	End of Log					

Penetration / Strength Results: Undrained Shear Strength Values (kPa) ▲ 40 80 120 160 ▲; Penetration Test Values (Blows / 0.3m) × 20 40 60 80 ×

Moisture / Plasticity: PL MC LL; Moisture / Plasticity ○ 10 20 30 40 ○

Well Details | Groundwater Conditions | Headspace Vapor HEX/IBL (ppm) [LEL(%)]



Additional Notes:
1. Borehole open to approximately 12.1 m depth on completion.
2. Groundwater or water seepage not encountered during drilling.
3.
4.

LANDTEK LIMITED
205 Nebo Road, Unit 4B
Hamilton, Ontario, L8W 2E1
Ph: (905) 383-3733

APPENDIX D

GEOTECHNICAL LABORATORY TESTING RESULTS

GEOMECHANICA

Geomechanica Inc.
Unit 14 – 1240 Speers Rd.
Oakville Ontario
Canada L6L 2X4

October 23, 2023

Mr. Joey DiCenzo
Landtek Limited
205 Nebo Road
Hamilton, Ontario
Canada, L8W 2E1

Re: UCS and PLT Testing
(Landtek Project No. 23014)

Dear Mr. DiCenzo:

On September 26th, 2023, a total of seven (6) HQ-sized core samples were received by Geomechanica Inc. via drop-off by Landtek personnel. These samples were identified as being from Landtek project 23014. From these samples, three (3) Uniaxial Compressive Strength (UCS) test specimens and three (3) Point Load Tests (PLT) were completed.

Details regarding the steps of specimen preparation and testing along with the test results are presented in the accompanying laboratory report and summary spreadsheets.

Sincerely,

Bryan Tatone Ph.D., P. Eng.

Geomechanica Inc.
Tel: (647) 478-9767
Email: bryan.tatone@geomechanica.com

Rock Laboratory Testing Results

A report submitted to:
Joey Di Cienzo
Landtek Limited
205 Nebo Road
Hamilton, Ontario
Canada, L8W 2E1

Prepared by:
Bryan Tatone, PhD, PEng

Omid Mahabadi, PhD, PEng
Geomechanica Inc.
#14-1240 Speers Rd.
Oakville ON
L6L 2X4 Canada
Tel: +1-647-478-9767
lab@geomechanica.com

October 23, 2023
Project number: 23014

Abstract

This document summarizes the results of rock laboratory testing, including 3 Uniaxial Compressive Strength (UCS) tests and 4 Point Load Tests (PLT). The results for each test type are presented in seperate sub-sections herein.

In this document:

1 Uniaxial Compressive Strength Tests

1.1 Overview

This section summarizes the results of uniaxial compressive strength testing. The testing was performed in Geomechanica's rock testing laboratory using a 150 ton (1.3 MN) Forney loading frame equipped with pressure-compensated control valve to maintain an axial displacement rate of approximately 0.15 mm/min (Figure 1). The preparation and testing procedure for each specimen included the following:

1. Unwrapping the core sample, inspecting it for damage, and re-wrapping it in electrical tape to minimize exposure to moisture and potential damage during subsequent specimen preparation.
2. Diamond cutting the core sample to obtain a cylindrical specimen with an appropriate length (length:diameter = 2:1) and nearly parallel end faces.
3. Diamond grinding the specimen to obtain flat (within ±0.025 mm) and parallel end faces (within 0.25°).
4. Placing the specimen into the loading frame, applying a 1 kN axial load, and removing the electrical tape.
5. Axially loading the specimen to rupture while continuously recording axial force and axial deformation to determine the peak strength (UCS).

Figure 1: Forney loading frame setup for UCS testing.

Using a precision V-block mounted on the magnetic chuck of the surface grinder, test specimens met the end flatness, end parallelism, and perpendicularity criteria set out in ASTM D4543-19. The side straightness criteria, as checked with a feeler gauge, and the minimum length:diameter criteria were met for all specimens unless noted otherwise in Table 1. Testing of the specimens followed ASTM D7012-14 Method C.

1.2 Results

The results of UCS testing are summarized in Table 1. Additional specimen and testing details are provided in the summary spreadsheet that accompanies this report.

Table 1: Summary of Uniaxial Compression test results.

Sample	Depth (ft' in")	Bulk density ρ (g/cm^3)	UCS (MPa)	Lithology	Failure description
BHMW9, R3	37'4.5" - 38'0"	2.625	65.9	Red Shale and limestone	1
BHMW1D-23, R3	33'11" - 34'7"	2.638	43.0	Red Shale	2
BHMW3D-23, R3	27'9" - 28'2"	2.623	30.6	Red Shale	2, 3

[1] Hourglass failure

[2] Axial splitting failure

[3] Length:Diameter ratio less than 2

1.3 Specimen photographs

Photographs of the specimens before and after testing are presented in the Appendix of this report.

2 Point Load Testing

2.1 Overview

This section summarizes the results of Point Load Testing (PLT). Tests were performed using a Carver 12-ton hydraulic press with point load test platens and equipped with a 0-5000 psi digital pressure gauge with a peak pressure holding capability (Figure 2). Testing was completed on rock core samples. Both axial and diametric tests were performed according to ASTM D5731-16.

Figure 2: Point load tester equipped with digital pressure gauge.

2.2 Results

The results of the PLT tests are summarized in Table 2. Note that the load, *P*, in kN was calculated from the measured peak pressure, as:

$$P = p \times A_{ram} \quad (1)$$

where, p is the peak pressure in kPa and A_{ram} is the effective cross-sectional area of the hydraulic ram in square metres. The effective diameter of the ram of the employed tester was 52 mm.

The uncorrected point load strength (I_s) is calculated as:

$$I_s = \frac{P}{{D_e}^2} \tag{2}$$

where, D_e is the equivalent core diameter in mm calculated as:

$$
\begin{aligned}
{D_e}^2 &= D^2 \quad \text{for diameteral tests} && (3)\\
&= \frac{4A}{\pi} \quad \text{for axial tests} && (4)
\end{aligned}
$$

where D is the distance between platens in mm and A is the minimum cross sectional area of a plane through the platen contact points. The value of A is given by:

$$A = W \times D \tag{5}$$

where W is the width of the specimen.

The size correction factor (F) is obtained from the expression:

$$F = \left(\frac{D_e}{50}\right)^{0.45} \tag{6}$$

and the size-corrected point load strength ($I_{s(50)}$) for a core with D = 50 mm was calculated as:

$$I_{s50} = F \times I_s. \tag{7}$$

Table 2: Summary of PLT results.

Sample	Depth (ft' in")	Test type A-axial D-diametric	Distance Between Platens, D (mm)	Failure Load P (kN)	Effective Diameter De (mm)	Uncorrected Point Strength, Strength, I_s (MPa)	Size Correction Factor, F	Size-Corrected Point Load Strength, $I_{s(50)}$ (MPa)
BHMW1D-23, R2b	28'2" - 28'8"	A ^{1,2}	59.00	0.17	69.25	0.04	1.16	0.04
		A ^{1,2}	59.00	1.41	69.25	0.29	1.16	0.34
		A ^{1,2}	59.00	1.20	69.25	0.25	1.16	0.29
		D ^{1,2}	39.00	0.18	39.00	0.12	0.89	0.10
		D ^{1,2}	36.00	0.30	36.00	0.23	0.86	0.20
		D ^{1,2}	32.00	1.32	32.00	1.29	0.82	1.05
		D ^{1,2}	33.00	0.15	33.00	0.14	0.83	0.11
				Axial Mean		0.19		0.22
				Diametric Mean		0.44		0.37
BHMW3D-23, R2	24'4.5" - 24'10"	A ^{1,2}	58.00	0.20	68.23	0.04	1.15	0.05
		A ^{1,2}	58.00	0.18	68.23	0.04	1.15	0.04

Continued on next page

Table 2 – Summary of PLT results. (continued from previous page)

Sample	Depth (ft' in")	Test type A-axial D-diametric	Distance Between Platens, D (mm)	Failure Load P (kN)	Effective Diameter De (mm)	Uncorrected Point Strength, Strength, I_s (MPa)	Size Correction Factor, F	Size-Corrected Point Load Strength, $I_{s(50)}$ (MPa)
		A [1, 2]	58.00	0.19	68.23	0.04	1.15	0.05
		D [1, 2]	44.00	0.33	44.00	0.17	0.94	0.16
		D [1, 2]	31.00	0.29	31.00	0.30	0.81	0.24
		D [1, 2]	19.00	0.28	19.00	0.78	0.65	0.51
		D [1, 2]	25.00	0.46	25.00	0.73	0.73	0.54
					Axial Mean	0.04		0.05
					Diametric Mean	0.50		0.36
BHMW9, R3	35'4" - 35'11"	A [1, 2]	58.00	2.80	68.49	0.60	1.15	0.69
		A [1, 2]	58.00	1.23	68.49	0.26	1.15	0.30
		A [1, 2]	58.00	1.01	68.49	0.22	1.15	0.25
		A [1, 2]	58.00	1.07	68.49	0.23	1.15	0.26
		D [1, 2]	33.00	0.20	33.00	0.18	0.83	0.15
		D [1, 2]	26.00	0.26	26.00	0.39	0.75	0.29
		D [1, 2]	34.00	0.34	34.00	0.29	0.84	0.24
		D [1, 2]	26.00	0.15	26.00	0.22	0.75	0.16
					Axial Mean	0.33		0.37
					Diametric Mean	0.27		0.21

[1] Short sample length. Limited testing possible

[2] Queenston Formation - red shale

Appendices

Specimen sheets

- BHMW9, R3
- BHMW1D-23, R3
- BHMW3D-23, R3

Uniaxial Compression Test

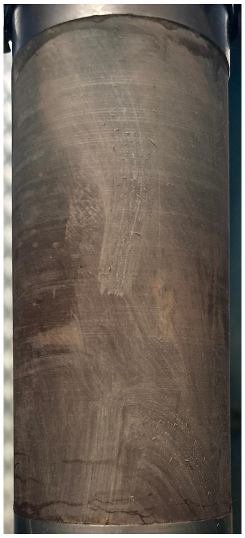
Client	Landtek Limited	**Project**	23014
Sample	BHMW9, R3	**Depth**	37’4.5” - 38’0”

Specimen parameters

Diameter (mm) [a]	63.26
Length (mm) [a]	126.43
Bulk density ρ (g/cm^3)	2.625
UCS (MPa)	65.9
Lithology	Red Shale and limestone
Failure description [b]	1

[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Failure description: [1] Hourglass failure;

Prior to testing



After testing

Remarks: Loading rate: 0.15 mm/min.

Performed by	AB	**Date**	2023-10-16

Uniaxial Compression Test

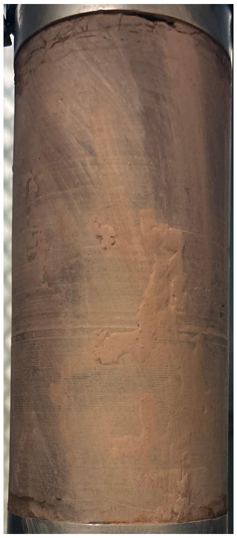
Client	Landtek Limited	**Project**	23014
Sample	BHMW1D-23, R3	**Depth**	33’11” - 34’7”

Specimen parameters

Diameter (mm) [a]	63.17
Length (mm) [a]	126.83
Bulk density ρ (g/cm^3)	2.638
UCS (MPa)	43.0
Lithology	Red Shale
Failure description [b]	2

[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.
[b] Failure description: [2] Axial splitting failure;

Prior to testing



After testing

Remarks: Loading rate: 0.15 mm/min.

Performed by	AB	**Date**	2023-10-16

Uniaxial Compression Test

Client	Landtek Limited	**Project**	23014
Sample	BHMW3D-23, R3	**Depth**	27’9” - 28’2”

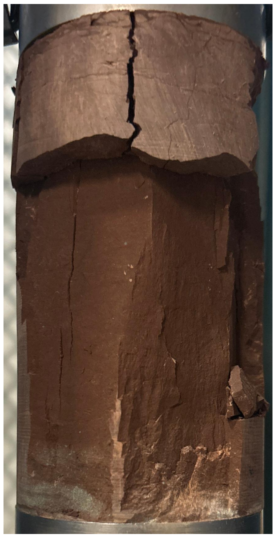
Specimen parameters	
Diameter (mm) [a]	63.17
Length (mm) [a]	112.25
Bulk density ρ (g/cm^3)	2.623
UCS (MPa)	30.6
Lithology	Red Shale
Failure description [b]	2, 3

[a] Additional specimen measurement/details provided in accompanying summary spreadsheet.

[b] Failure description: [2] Axial splitting failure; [3] Length:Diameter ratio less than 2;

Prior to testing

After testing



Remarks: Loading rate: 0.15 mm/min.

Performed by	AB	**Date**	2023-10-16

APPENDIX E

CHEMICAL LABORATORY TESTING RESULTS

PARACEL LABORATORIES LTD.
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351 Nash Road North, unit 9B
Hamilton, ON L8H 7P4
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Landtek Limited
205 Nebo Road, Unit 3
Hamilton, ON L8W 2E1
Attn: Joey Dicienzo

Client PO:
Project: 23016
Custody:

Report Date: 30-Oct-2023
Order Date: 24-Oct-2023

Order #: 2343099

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
2343099-01	BH2 SS6
2343099-02	BH3 SS4
2343099-03	BH5 SS5
2343099-04	BH8 SS6

Approved By:

Milan Ralitsch, PhD

Senior Technical Manager

Order #: 2343099

Certificate of Analysis

Report Date: 30-Oct-2023

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23016

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Anions	EPA 300.1 - IC, water extraction	25-Oct-23	26-Oct-23
Conductivity	MOE E3138 - probe @25 °C, water ext	26-Oct-23	26-Oct-23
Moisture, %	CWS Tier 1 - Gravimetric	26-Oct-23	27-Oct-23
pH, soil	EPA 150.1 - pH probe @ 25 °C, CaCl buffered ext.	24-Oct-23	25-Oct-23
Resistivity	EPA 120.1 - probe, water extraction	26-Oct-23	26-Oct-23
Solids, %	CWS Tier 1 - Gravimetric	26-Oct-23	27-Oct-23

Certificate of Analysis

Report Date: 30-Oct-2023

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23016

Client ID:		BH2 SS6	BH3 SS4	BH5 SS5	BH8 SS6	-	-
Sample Date:		24-Oct-23 11:00	24-Oct-23 11:00	24-Oct-23 11:00	24-Oct-23 11:00		
Sample ID:		2343099-01	2343099-02	2343099-03	2343099-04		
Matrix:		Soil	Soil	Soil	Soil		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	92.6	94.7	97.2	96.1	-	-
% Moisture	0.1 % by Wt.	7.4	5.3	2.8	3.9	-	-
General Inorganics							
Conductivity	5 uS/cm	184	183	200	290	-	-
pH	0.05 pH Units	7.75	7.72	7.73	7.74	-	-
Resistivity	0.10 Ohm.m	54.2	54.6	50.1	34.4	-	-
Anions							
Chloride	5 ug/g	9	11	8	12	-	-
Sulphate	5 ug/g	97	69	84	173	-	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions								
Chloride	ND	5	ug/g					
Sulphate	ND	5	ug/g					
General Inorganics								
Conductivity	ND	5	uS/cm					
Resistivity	ND	0.10	Ohm.m					

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23016

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	25.2	5	ug/g	23.7			6.2	20	
Sulphate	271	5	ug/g	275			1.7	20	
General Inorganics									
Conductivity	90.7	5	uS/cm	92.6			2.1	5	
pH	7.88	0.05	pH Units	7.93			0.6	10	
Resistivity	110	0.10	Ohm.m	108			2.1	20	
Physical Characteristics									
% Moisture	8.1	0.1	% by Wt.	7.8			3.9	25	
% Solids	91.9	0.1	% by Wt.	92.2			0.3	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Anions									
Chloride	114	5	ug/g	23.7	90.6	82-118			
Sulphate	356	5	ug/g	275	80.7	80-120			

Order #: 2343099

Certificate of Analysis

Report Date: 30-Oct-2023

Client: **Landtek Limited**

Order Date: 24-Oct-2023

Client PO:

Project Description: 23016

Qualifier Notes:

Sample Data Revisions:

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable

ND: Not Detected

MDL: Method Detection Limit

Source Result: Data used as source for matrix and duplicate samples

%REC: Percent recovery.

RPD: Relative percent difference.

NC: Not Calculated

Soil results are reported on a dry weight basis unlesss otherwise noted.

Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

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Paracel ID: 2343099

Chain Of Custody
(Lab Use Only)

Client Name: Landtek Limited

Contact Name: Joey DiCrenzo

Address: 205 Nebo Rd, Unit 3
Hamilton, ON

Telephone: 905-383-3733

Project Ref: 23016

Quote #: 23-046

PO #:

E-mail: joey@landtek.ca

Page 1 of 1

Turnaround Time

☐ 1 day ☐ 3 day

☐ 2 day ☒ Regular

Date Required:

☐ REG 153/04 ☐ REG 406/19

☐ Table 1 ☐ Res/Park ☐ Med/Fine

☐ Table 2 ☐ Ind/Comm ☐ Coarse

☐ Table 3 ☐ Agri/Other

☐ Table

For RSC: ☐ Yes ☐ No

Other Regulation

☐ REG 558 ☐ PWQO

☐ CCME ☐ MISA

☐ SU - Sani ☐ SU - Storm

Mun:

☐ Other:

Matrix Type: S (Soil/Sed.) **GW** (Ground Water) **SW** (Surface Water) **SS** (Storm/Sanitary Sewer) **P** (Paint) **A** (Air) **O** (Other)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	**Sample Taken** Date	**Sample Taken** Time	406 pkg w/out PAH	406 pkg with PAH	Soil corrosivity									
1	BH2 SS6	S	\	1	Oct.24/23	11:00am	☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	BH3 SS4	↓	\	1	↓		☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	BH5 SS5		\	1			☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	BH8 SS6		\	1			☐	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments: ~~Package = PHC, BTEX, M&I~~

Method of Delivery: Walk In

Relinquished By (Sign):	Received By Driver/Depot:	Received at Lab:	Verified By: C-Ply
Relinquished By (Print): Joey DiCrenzo	Date/Time:	Date/Time: 10/24/23 1139	Date/Time: 10/24/23 12:12
Date/Time: Oct 24/23	Temperature: °C	Temperature: 22.5	pH Verified: ☐ By:

Chain of Custody (Blank).xlsx

Revision 4.0

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Subcontracted Analysis

Landtek Limited
205 Nebo Road, Unit 3
Hamilton, ON L8W 2E1
Attn: Joey Dicienzo

Paracel Report No. **2343099**
Client Project(s): **23016**
Client PO:
Reference: **#23-046 - Standing Offer**
CoC Number:

Order Date: 24-Oct-23
Report Date: 27-Oct-23

Sample(s) from this project were subcontracted for the listed parameters. A copy of the subcontractor's report is attached

Paracel ID	Client ID	Analysis
2343099-01	BH2 SS6	Redox potential, soil Sulphide, solid
2343099-02	BH3 SS4	Redox potential, soil Sulphide, solid
2343099-03	BH5 SS5	Redox potential, soil Sulphide, solid
2343099-04	BH8 SS6	Redox potential, soil Sulphide, solid

CERTIFICATE OF ANALYSIS

Client:	Alex Enfield	Work Order Number:	516889
Company:	Paracel Laboratories Ltd. - Hamilton	PO #:	2343099
Address:	351 Nash Rd. N Unit 9b Hamilton, ON, L8H7P4	Regulation:	None
		Project #:	
Phone:	(905) 631-2077	DWS #:	
Email:	aenfield@paracellabs.com	Sampled By:	

Date Order Received:	10/25/2023	Analysis Started:	10/27/2023
Arrival Temperature:	21.6 C	Analysis Completed:	10/27/2023

WORK ORDER SUMMARY

ANALYSES WERE PERFORMED ON THE FOLLOWING SAMPLES. THE RESULTS RELATE ONLY TO THE ITEMS TESTED.

Sample Description	Lab ID	Matrix	Type	Comments	Date Collected	Time Collected
BH2 SS6	1944770	Soil	None		10/24/2023	
BH3 SS4	1944771	Soil	None		10/24/2023	
BH5 SS5	1944772	Soil	None		10/24/2023	
BH8 SS6	1944773	Soil	None		10/24/2023	

METHODS AND INSTRUMENTATION

THE FOLLOWING METHODS WERE USED FOR YOUR SAMPLE(S):

Method	Lab	Description	Reference
RedOx - Soil (T06)	Mississauga	Determination of RedOx Potential of Soil	Modified from APHA-2580B

REPORT COMMENTS

Non-Testmark containers received 10/25/23 JP
Samples for Redox Potential received past hold time, proceed with analysis as per client notes 10/25/23 JP

CERTIFICATE OF ANALYSIS

Paracel Laboratories Ltd. - Hamilton

Work Order Number: 516889

This report has been approved by:

Marc Creighton
Laboratory Director

WORK ORDER RESULTS

Sample Description	BH2 SS6		BH3 SS4		BH5 SS5		BH8 SS6		
Sample Date	10/24/2023 12:00 AM		10/24/2023 12:00 AM		10/24/2023 12:00 AM		10/24/2023 12:00 AM		
Lab ID	1944770		1944771		1944772		1944773		
General Chemistry	Result	MDL	Result	MDL	Result	MDL	Result	MDL	Units
RedOx (vs. S.H.E.)	328	N/A	326	N/A	329	N/A	337	N/A	mV

LEGEND

Dates: Dates are formatted as mm/dd/year throughout this report.

MDL: Method detection limit or minimum reporting limit.

Organic Soil Analysis: Data reported for organic analysis in soils samples are corrected for moisture content.

Quality Control: All associated Quality Control data is available on request.

Field Data: Reports containing Field Parameters represent data that has been collected and provided by the client. Testmark is not responsible for the validity of this data which may be used in subsequent calculations.

Sample Condition Deviations: A noted sample condition deviation may affect the validity of the result. Results apply to the sample(s) as received.

Reproduction of Report: Report shall not be reproduced, except in full, without the approval of Testmark Laboratories Ltd.

ICPMS Dustfall Insoluble: The ICPMS Dustfall Insoluble Portion method analyzes only the particulate matter from the Dustfall Sampler which is retained on the analysis filter during the Dustfall method.

Regulation Comparisons: Disclaimer: Please note that regulation criteria are provided for comparative purposes, however the onus on ensuring the validity of this comparison rests with the client.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

27-October-2023

Paracel Laboratories
Attn : Dale Robertson

300-2319 St.Laurent Blvd.
Ottawa, ON
K1G 4K6, Canada

Phone: 613-731-9577
Fax:613-731-9064

Date Rec. : 25 October 2023
LR Report: **CA15745-OCT23**
Reference: Project#: 2343099

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	Sulphide (Na2CO3) %
1: Analysis Start Date		27-Oct-23
2: Analysis Start Time		14:51
3: Analysis Completed Date		27-Oct-23
4: Analysis Completed Time		15:09
5: RL		0.02
6: BH2 SS6	24-Oct-23	< 0.01
7: BH3 SS4	24-Oct-23	< 0.01
8: BH5 SS5	24-Oct-23	< 0.01
9: BH8 SS6	24-Oct-23	0.03

`RL - SGS Reporting Limit`

Kimberley Didsbury
Project Specialist,
Environment, Health & Safety

OnLine LIMS

0003515709

Quality Control Report

Inorganic Analysis													
Parameter	Reporting Limit	Unit	Method Blank	Duplicate				LCS / Spike Blank			Matrix Spike / Reference Material		
				Result 1	Result 2	RPD	Acceptance Criteria	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
							%		Low	High		Low	High
Carbon/Sulphur - QCBatchID: ECS0107-OCT23													
Sulphide (Na2CO3)	0.01	%	< 0.01										

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Paracel ID: 2343099

Chain Of Custody
(Lab Use Only)

Client Name: Landtek Limited
Contact Name: Joey DiCrenzo
Address: 205 Nebo Rd, Unit 3
Hamilton, ON
Telephone: 905-383-3733

Project Ref: 23016
Quote #: 23-046
PO #:
E-mail: joey@landtek.ca

Page 1 of 1

Turnaround Time
☐ 1 day ☐ 3 day
☐ 2 day ☒ Regular
Date Required:

☐ REG 153/04 ☐ REG 406/19
☐ Table 1 ☐ Res/Park ☐ Med/Fine
☐ Table 2 ☐ Ind/Comm ☐ Coarse
☐ Table 3 ☐ Agri/Other
☐ Table
For RSC: ☐ Yes ☐ No

Other Regulation
☐ REG 558 ☐ PWQO
☐ CCME ☐ MISA
☐ SU - Sani ☐ SU - Storm
Mun:
☐ Other:

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Required Analysis

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	406 pkg w/out PAH	406 pkg with PAH	Soil corrosivity									
1	BH2 SS6	S	\	1	Oct. 24/23	11:00am	☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐
2	BH3 SS4	↓	\	1	↓		☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐
3	BH5 SS5		\	1			☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	BH8 SS6		\	1			☐	☐	X	☐	☐	☐	☐	☐	☐	☐	☐	☐
5							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
7							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10							☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Comments: Package ~~= PHC, BTEX, M&I~~

Method of Delivery: Walk In

Relinquished By (Sign):
Relinquished By (Print): Joey DiCrenzo
Date/Time: Oct 24/23

Received By Driver/Depot:
Date/Time:
Temperature: °C

Received at Lab:
Date/Time: 10/24/23 1139
Temperature: 22.5

Verified By:
Date/Time: 10/24/23 12:12
pH Verified: ☐ By:

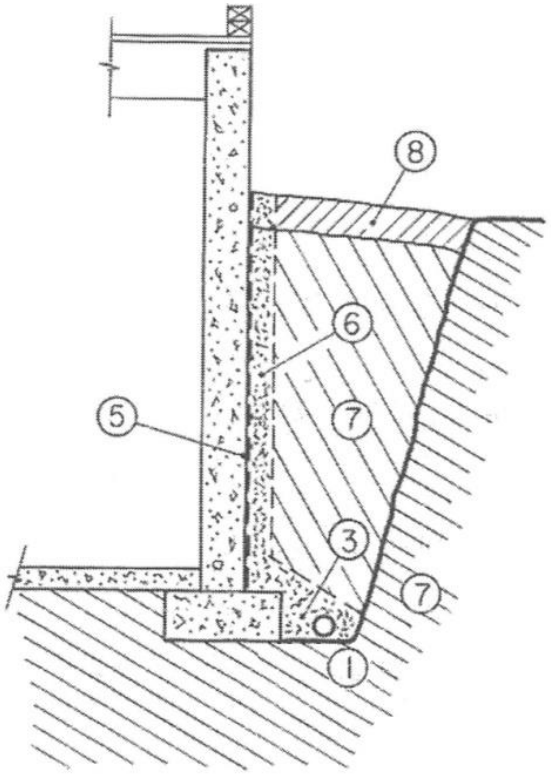
Chain of Custody (Blank).xlsx

Revision 4.0

APPENDIX F

DRAWING 23016-02 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR DRAINAGE TO BASEMENT STRUCTURES

DRAWING 23016-03 - ENGINEERING COMMENTARIES – GENERAL REQUIREMENTS FOR UNDERFLOOR DRAINAGE SYSTEMS



① 100 mm, perforated or slotted pipe placed below the upper level of the floor slab.;

③ Filter material that is compatible with the grain size characteristics of the fine grained foundation and backfill soils, as well as with the perforations of the pipe;

④ Filter material continuously or intermittently placed next to the foundation wall to intercept water draining from window wells, down exterior walls and from low areas near the building;

⑤ Damp-proofing on wall – optional depending on the quality of the concrete wall;

⑥ Optional use of sheet drain, or synthetic fire blanket, next to the foundation wall to replace the soil filter according to ④;

⑦ Foundation and backfill soils, which may contain fine grained and erosion-susceptible materials;

⑧ "*Topping off*" material is to be graded such that it slopes outwards to lead surface water away from the building. It is usually desirable to use low permeability topsoil to reduce the risk of overloading the drainage pipe.

Based on Figure 12.1, Canadian Foundation Engineers Manual, Fourth Edition, 2006.

Additional Notes:

1. The perforated or slotted drainage pipe is to lead to a positive drainage sump or outlet. The invert of the pipe is to be a minimum of 150 mm below the underside of the proposed floor slab.
2. Backfill materials to the interior of the foundation walls may be clean, organic-free soils that can be compacted to the specified density within in a confined space.
3. Heavy, vibratory compaction equipment should not be used within 450 mm of the foundation wall. Fill is not to be placed or compacted within 1.8 m of the wall unless fill is being placed simultaneously on both sides of the wall.
4. The moisture barrier beneath the floor slab is to comprise at least 200 mm of compacted19mm clear stone or an equivalent free-draining material.
5. Should the 19 mm clear stone require surface blinding then 6mm stone chips are to be used.
6. The slab on grade should not be structurally connected to the foundation wall or footing.

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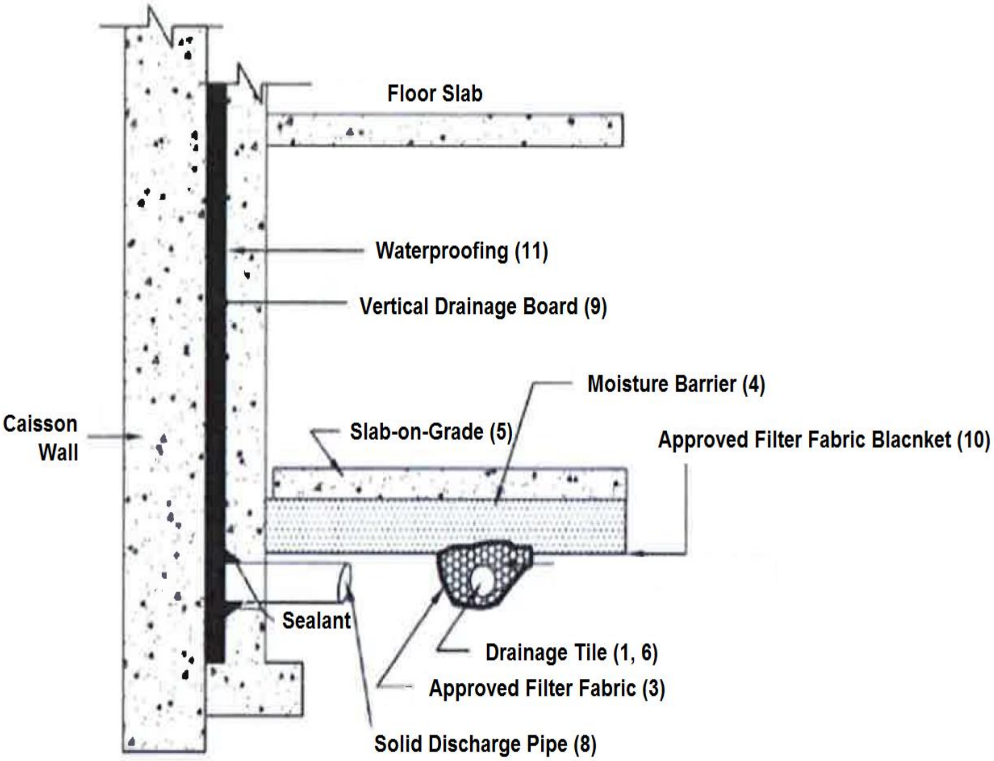
General Requirements for Drainage to Basement Structures

client 4933 Vic Court Globizen LP

project 4933 Victoria Avenue North, Vineland Station, Ontario

project # 23016

drawing # 23016-02



Notes:

1. Drainage tile, if required for permanent dewatering, to consist of 100 mm diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns;
2. 19 mm clear stone – 150 mm top and side of drain. If the drain is not on the footing then place 100 mm of 19 mm clear stone below the drain;
3. Wrap the clear stone with an approved filter fabric (e.g., Terrafix 270R or equivalent);
4. Moisture barrier to be at least 200 mm of compacted, 19 mm clear stone or equivalent (and approved), free-draining material. A vapour barrier may be required for specialty floor coverings;
5. Typically, the slab-on-grade is not structurally connected to the wall or footing. However, if it is connected to the walls it should be designed accordingly;
6. Underfloor drain invert, where to be installed, to be at least 300 mm below underside of floor slab. Drainage tile should be placed in parallel rows 6 m to 8 m centres one way. Place drains on 100 mm of 19 mm clear stone and 150 mm of 19 mm clear stone on top and sides. Enclose clear stone with filter fabric as prescribed in Note (3);
7. Do not connect any underfloor drainage to perimeter drainage. The two systems are to remain separate.
8. Locate solid discharge at the middle of each bay between soldier piles;
9. Vertical drainage board (e.g., MiraDrain 6000 or equivalent) with filter cloth should be continuous from bottom to 1.2 m below exterior finished grade;
10. The entire subgrade is to be sealed with an approved filter fabric as in Note (3) where non-cohesive (silty/sandy/granular) soils are encountered below the groundwater table;
11. Where no permanent dewatering is proposed, the basement walls must be waterproofed below the seasonally highest groundwater level (plus 1.0 m to 1.5 m buffer) using bentonite or an equivalent waterproofing system;
12. The Geotechnical Report should be reviewed for site-specific details. Final detail must be approved before system is considered acceptable.

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General Requirements for Underfloor Drainage Systems

client 4933 Vic Court Globizen LP

project 4933 Victoria Avenue North, Vineland Station, Ontario

project # 23016

drawing # 23016-03