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# Preliminary Geotechnical Investigation

Proposed Multi-Storey Building Complex
1500 Merivale Road
Ottawa, Ontario

Prepared For

Claridge Homes

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Report PG5561-1

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# 1.0 Introduction

Paterson Group (Paterson) was commissioned by Claridge Homes to conduct a preliminary geotechnical investigation for the proposed multi-storey building complex to be located at 1500 Merivale Road in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objectives of the investigation were to:

- ❏ Determine the subsoil and groundwater conditions at this site by means of boreholes.
- ❏ Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

# 2.0 Proposed Development

Although drawings were not available during the preparation of this report, it is anticipated that the proposed development will consist of several multi-storey buildings with one or more levels of underground parking. It is further anticipated that the proposed development will include asphalt-paved access lanes and parking areas surrounding the proposed buildings. It is also anticipated that the subject site will be municipally serviced.

# 3.0 Method of Investigation

## 3.1 Field Investigation

### Field Program

The field program for the current investigation was carried out between October 30 and November 4, 2020 and consisted of 10 boreholes advanced to a maximum depth of 15.1 m below the existing ground surface. The borehole locations were distributed in a manner to provide general coverage of the subject site. Previous investigations were also completed at the subject site by others in March 2013, April 2013, August 2013 and January 2014. During these previous investigations, a total of 51 boreholes were advanced to a maximum depth of 9.1 m. The approximate locations of the boreholes are shown on Drawing PG5561-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed with a truck-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of our personnel under the direction of a senior engineer. The drilling procedure consisted of augering and rock coring to the required depths at the selected locations, and sampling and testing the overburden.

### Sampling and In Situ Testing

Soil samples were collected from the boreholes using two different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. Rock cores (RC) were obtained using 47.6 mm inside diameter coring equipment. All samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags, and rock cores were placed in cardboard boxes. All samples were transported to our laboratory for further examination and classification. The depths at which the auger, split spoon and rock core samples were recovered from the boreholes are shown as AU, SS and RC, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

A Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Bedrock samples were recovered using a core barrel and diamond drilling techniques. The depths at which rock core samples were recovered from the boreholes are shown as RC on the Soil Profile and Test Data sheets in Appendix 1.

A recovery value and a Rock Quality Designation (RQD) value were calculated for each drilled section (core run) of bedrock and are shown on the borehole logs. The recovery value is the ratio, in percentage, of the length of the bedrock sample recovered over the length of the drilled section (core run). The RQD value is the ratio, in percentage, of the total length of intact rock pieces longer than 100 mm in one core run over the length of the core run. These values are indicative of the quality of the bedrock.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil and bedrock profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

**Groundwater**

Monitoring wells were installed in all boreholes to permit monitoring of the groundwater levels subsequent to the completion of the current sampling program. All groundwater observations are noted on the Soil Profile and Test Data sheets presented in Appendix 1.

## 3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the proposed development taking into consideration the existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a GPS unit with respect to a geodetic datum. The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5561-1 - Test Hole Location Plan in Appendix 2.

## 3.3 Laboratory Testing

Soil and bedrock samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Soil and bedrock samples will be stored for a period of one month after this report is completed, unless otherwise directed.

## 3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

# 4.0 Observations

## 4.1 Surface Conditions

The subject site is currently vacant, with the exception of the northern end of the site where a single-storey commercial building fronts onto Baseline Road. The southern end of the site generally has an asphalt or grass surface, while the northern end of the site is generally forested. A few fill piles were also observed in the central portion of the site. Concrete slabs from former structures are also present in the northern, southeastern, and southwestern portions of the site. This is discussed further in the following paragraph.

Based on available aerial photos, several buildings were historically located throughout the site. Structures can be seen in the northeast and northwest corners of the site as late as 1991, three structures can be seen on the east end of the site as late as 1965, 1976 and 2008, respectively, another structure can be seen on the south east side of the property as late as 2008, and a large commercial structure can be seen in the southwest corner of the site as late as 2011. Reference should be made to the aerial photographs in Figure 2 - Aerial Photograph - 1965, Figure 3 - Aerial Photograph - 2002 and Figure 4 - Aerial Photograph - 2019 in Appendix 2.

The existing ground surface across the site generally slopes downward from north to south, from approximate geodetic elevation 100 m near Baseline Road to approximate geodetic elevation 95 m near Merivale Road.

## 4.2 Subsurface Profile

### Overburden

Generally, the subsurface profile across the site consists of an approximate 0.8 to 2.6 m thickness of fill underlain by bedrock. The fill was generally observed to consist of a compact to very dense, brown silty sand with some gravel and cobbles.

However, on the southern end of the site, a glacial till deposit was encountered underlying the fill. The glacial till was generally observed to consist of a silty sand to silty clay with gravel, cobbles, and boulders. At BH 10-20, which was drilled in the southeast portion of the site, DCPT refusal was encountered at an approximate depth of 7.6 m below the existing ground surface.

### Bedrock

Bedrock was cored within BH 1-20 through BH 9-20 during the current investigation, which was observed to consist of limestone with interbedded shale. Based on the RQDs of the recovered rock core, the upper 1 to 3 m of the bedrock is generally very poor to fair in quality, becoming fair to excellent in quality with depth.

In reviewing available geological mapping, the bedrock at the subject site consists of interbedded limestone and dolomite of the Gull River formation with a drift thickness of 3 to 10 m.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil and bedrock profiles encountered at each test hole location.

## 4.3 Groundwater

Groundwater levels were measured in the monitoring wells installed in the boreholes from the current geotechnical investigation during the period of November 6 to 11, 2020. The observed groundwater levels are summarized in Table 1 and are also noted on the applicable Soil Profile and Test Data sheets presented in Appendix 1.

**Table 1 - Summary of Groundwater Levels**

| Borehole Number | Ground Surface Elev. (m) | Measured Groundwater Level | | Recording Date |
|---|---|---|---|---|
| | | Depth (m) | Elevation (m) | |
| BH 1-20 | 96.18 | 3.00 | 93.18 | November 6, 2020 |
| BH 2-20 | 95.71 | 1.98 | 93.73 | November 11, 2020 |
| BH 3-20 | 95.68 | 4.66 | 94.20 | November 6, 2020 |
| BH 4-20 | 95.89 | 3.13 | 92.76 | November 9, 2020 |
| BH 5-20 | 95.28 | 2.15 | 93.13 | November 9, 2020 |
| BH 6-20 | 95.44 | 2.14 | 93.30 | November 9, 2020 |
| BH 7-20 | 95.74 | 2.62 | 93.12 | November 9, 2020 |
| BH 8-20 | 95.73 | 2.52 | 93.21 | November 9, 2020 |
| BH 9-20 | 100.22 | 4.92 | 95.30 | November 10, 2020 |
| BH 10-20 | 94.73 | 1.87 | 92.86 | November 10, 2020 |

Note: Ground surface at test hole locations were surveyed by Paterson and are referenced to a geodetic datum

It should be noted that the groundwater level readings in the monitoring wells can be influenced by surface water becoming trapped in the backfill materials. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples.

Based on these observations, the long-term groundwater table can be expected at approximate depths of 2.5 to 3.5 m below the existing ground surface. However, it should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

# 5.0 Discussion

## 5.1 Geotechnical Assessment

The subject site is considered suitable for the proposed development, from a geotechnical perspective. The proposed multi-storey buildings at the subject site are recommended to be founded on conventional spread footings bearing on the undisturbed, compact glacial till or clean, surface sounded bedrock.

Bedrock removal will be required to complete the excavation of the underground parking levels.

The above and other considerations are further discussed in the following sections.

## 5.2 Site Grading and Preparation

### Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding, and other settlement sensitive structures.

Existing foundation walls and other construction debris should be entirely removed from within the perimeters of the proposed buildings. Under paved areas, existing construction remnants, such as foundation walls, should be excavated to a minimum of 1 m below final grade.

### Bedrock Removal

Bedrock removal can be accomplished by hoe ramming where the bedrock is weathered and/or where only a small quantity of the bedrock needs to be removed. Sound bedrock may be removed by line drilling and controlled blasting in conjunction with hoe ramming.

Prior to considering blasting operations, the blasting effects on the existing services, buildings and other structures should be addressed. A pre-blast or pre-construction survey of the existing structures located in proximity of the blasting operations should be completed prior to commencing site activities. The extent of the survey should be determined by the blasting consultant and should be sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocities (measured at the structures) should not exceed 25 mm/s during the blasting program to reduce the risks of damage to the existing structures.

The blasting operations should be planned and conducted under the supervision of a licensed professional engineer who is also an experienced blasting consultant.

**Vibration Considerations**

Construction operations are the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels should be incorporated in the construction operations to maintain, as much as possible, a cooperative environment with the residents.

The following construction equipment could be the source of vibrations: hoe ram, compactor, dozer, crane, truck traffic, etc. Vibrations, whether caused by blasting operations or by construction operations, could be the source of detrimental vibrations on the nearby buildings and structures. Therefore, all vibrations are recommended to be limited.

Two parameters are used to determine the permissible vibrations, namely, the maximum peak particle velocity and the frequency. For low frequency vibrations, the maximum allowable peak particle velocity is less than that for high frequency vibrations. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). The guidelines are for current construction standards. Considering that these guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended be completed to minimize the risks of claims during or following the construction of the proposed building.

**Fill Placement**

Fill used for grading beneath the proposed buildings should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the buildings and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

## 5.3 Foundation Design

### Bearing Resistance Values

Footings placed on a clean, surface sounded limestone bedrock surface can be designed using a factored bearing resistance value at ultimate limit states (ULS) of **2,500 kPa**, incorporating a geotechnical resistance factor of 0.5.

A clean, surface-sounded bedrock bearing surface should be free of loose materials, and have no near surface seams, voids, fissures or open joints which can be detected from surface sounding wit a rock hammer. The bedrock sounding should be carried out by the geotechnical consultant.

Footings bearing on an acceptable bedrock bearing surface and designed using the bearing resistance values provided herein will be subjected to negligible potential post-construction total and differential settlements.

Footings placed on an undisturbed, compact glacial till bearing surface can be designed using a factored bearing resistance value at serviceability limit states (SLS) of **150 kPa** and ultimate limit states (ULS) of **225 kPa**, incorporating a geotechnical resistance factor of 0.5.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Footings bearing on an acceptable glacial till bearing surface and designed using the bearing resistance values provided herein will be subjected to 25 mm and 20 mm potential post-construction total and differential settlements.

### Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passes through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete. A weathered bedrock or soil bearing medium will require a lateral support zone of 1.5H:1V (or shallower).

## 5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C**. If a higher seismic site class is required (Class A or B) and the proposed footings are within 3 m of the bedrock surface, a site specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed building, as presented in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the OBC 2012 for a full discussion of the earthquake design requirements.

## 5.5 Basement Slab

With the removal of all topsoil and fill, containing significant amounts of deleterious or organic materials, the native soil or bedrock subgrade will be considered an acceptable subgrade surface on which to commence backfilling for basement slab construction.

It is anticipated that the basement area for the proposed buildings will be mostly parking and the recommended pavement structures noted in Subsection 5.8 will be applicable. However, if storage or other uses of the lower level will involve the construction of a concrete floor slab, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

In consideration of the groundwater conditions encountered during the geotechnical investigation, a sub-slab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the clear crushed stone layer under the lower level floor slabs.

## 5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the proposed multi-storey buildings. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and a drained unit weight of 20 kN/m$^3$.

It is expected that a portion of the basement walls are to be poured against a composite drainage blanket, which will be placed against the exposed bedrock face. A nominal coefficient of at-rest earth pressure of 0.05 is recommended in conjunction with a bulk unit weight of 23.5 kN/m$^3$ (effective 15.5 kN/m$^3$) where this condition occurs. Further, a seismic earth pressure component will not be applicable for the foundation wall which is poured against the bedrock face. It is expected that the seismic earth pressure will be transferred to the underground floor slabs, which should be designed to accommodate these pressures. A hydrostatic groundwater pressure should be added for the portion below the groundwater level.

Undrained conditions are anticipated (i.e. below the groundwater level). Therefore, the applicable effective unit weight of the retained soil can be taken as 13 kN/m$^3$, where applicable. A hydrostatic pressure should be added to the total static earth pressure when using the effective unit weight.

**Lateral Earth Pressures**

The static horizontal earth pressure ($P_o$) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

$K_o$ = at-rest earth pressure coefficient of the applicable retained material
$\gamma$ = unit weight of fill of the applicable retained material (kN/m$^3$)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure will only be applicable for static analyses and should not be used in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

### Seismic Earth Pressures

The total seismic force ($P_{AE}$) includes both the earth force component ($P_o$) and the seismic component ($\Delta P_{AE}$).

The seismic earth force ($\Delta P_{AE}$) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

$a_c$ = $(1.45-a_{max}/g)a_{max}$
$\gamma$ = unit weight of fill of the applicable retained soil ($kN/m^3$)
H = height of the wall (m)
g = gravity, 9.81 $m/s^2$

The peak ground acceleration, ($a_{max}$), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The earth force component ($P_o$) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

The total earth force ($P_{AE}$) is considered to act at a height, h (m), from the base of the wall, where:

h = $\{P_o \cdot (H/3)+\Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth forces calculated are unfactored. For the ULS case, the earth loads should be factored as live loads, as per OBC 2012.

## 5.7 Rock Anchor Design

### Overview of Anchor Features

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or a 60 to 90 degree pullout of rock cone with the apex of the cone near the middle of the bonded length of the anchor. Interaction may develop between the failure cones of anchors that are relatively close to one another resulting in a total group capacity smaller than the sum of the load capacity of each individual anchor.

A third failure mode of shear failure along the grout/steel interface should be reviewed by the structural engineer to ensure all typical failure modes have been reviewed.

It should be further noted that centre to centre spacing between bond lengths be at least four (4) times the anchor hole diameter and greater than 1.2 m to lower the group influence effects. It is also recommended that anchors in close proximity to each other be grouted at the same time to ensure any fractures or voids are completely in-filled and that fluid grout does not flow from one hole to an adjacent empty one.

Anchors can be of the "passive" or the "post-tensioned" type, depending on whether the anchor tendon is provided with post-tensioned load or not prior to being put into service.

Regardless of whether an anchor is of the passive or the post tensioned type, it is recommended that the anchor be provided with a bonded length, or fixed anchor length, at the base of the anchor, which will provide the anchor capacity, as well an unbonded length, or free anchor length, between the rock surface and the start of the bonded length. As the depth at which the apex of the shear failure cone develops is midway along the bonded length, a fully bonded anchor would tend to have a much shallower cone, and therefore less geotechnical resistance, than one where the bonded length is limited to the bottom part of the overall anchor.

Permanent anchors should be provided with corrosion protection. As a minimum, the entire drill hole should be filled with cementious grout. The free anchor length is provided by installing a plastic sleeve to act as a bond break, with the sleeve filled with grout or a corrosion inhibiting mastic. Double corrosion protection can be provided with factory assembled systems, such as those available from Dywidag Systems or Williams Form Engineering Corp. Recognizing the importance of the anchors for the long term performance of the foundation of the proposed building, the rock anchors for this project are recommended to be provided with double corrosion protection.

**Grout to Rock Bond**

The Canadian Foundation Engineering Manual recommends a maximum allowable grout to rock bond stress (for sound rock) of 1/30 of the unconfined compressive strength (UCS) of either the grout or rock (but less than 1.3 MPa) for an anchor of minimum length (depth) of 3 m. Generally, the UCS of limestone ranges between about 50 and 80 MPa, which is stronger than most routine grouts. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.4, can be calculated. A minimum grout strength of 40 MPa is recommended.

### Rock Cone Uplift

As discussed previously, the geotechnical capacity of the rock anchors depends on the dimensions of the rock anchors and the configuration of the anchorage system. Based on existing bedrock information, a **Rock Mass Rating (RMR) of 62** was assigned to the bedrock, and Hoek and Brown parameters (**m and s**) were taken as **0.575 and 0.00293**, respectively.

### Recommended Rock Anchor Lengths

Parameters used to calculate rock anchor lengths are provided in Table 2 on the next page.

**Table 2 - Parameters used in Rock Anchor Review**

| | |
|---|---|
| Grout to Rock Bond Strength - Factored at ULS | 1.0 MPa |
| Compressive Strength - Grout | 40 MPa |
| Rock Mass Rating (RMR) - Good quality Limestone<br>Hoek and Brown parameters | 62<br>m=0.575 and s=0.00293 |
| Unconfined compressive strength - Limestone | 50 MPa |
| Unit weight - Submerged Bedrock | 15.2 kN/m$^3$ |
| Apex angle of failure cone | 60$^o$ |
| Apex of failure cone | mid-point of fixed anchor length |

The fixed anchor length will depend on the diameter of the drill holes. Recommended anchor lengths for a 75 mm and 125 mm diameter hole are provided in Table 3. The factored tensile resistance values given in Table 3 are based on a single anchor with no group influence effects. A detailed analysis of the anchorage system, including potential group influence effects, could be provided once the details of the loading for the proposed buildings are determined.

| Table 3 - Recommended Rock Anchor Lengths - Grouted Rock Anchor | | | | |
|---|---|---|---|---|
| Diameter of Drill Hole (mm) | Anchor Lengths (m) | | | Factored Tensile Resistance (kN) |
| | Bonded Length | Unbonded Length | Total Length | |
| 75 | 2.0 | 0.8 | 2.8 | 450 |
| | 2.6 | 1.0 | 3.6 | 600 |
| | 3.2 | 1.2 | 4.4 | 750 |
| | 4.5 | 2.0 | 6.5 | 1000 |
| 125 | 1.6 | 0.6 | 2.2 | 600 |
| | 2.0 | 1.0 | 3.0 | 750 |
| | 2.6 | 1.4 | 4.0 | 1000 |
| | 3.2 | 1.8 | 5.0 | 1250 |

**Other considerations**

The anchor drill holes should be within 1.5 to 2 times the rock anchor tendon diameter, inspected by geotechnical personnel and should be flushed clean prior to grouting. A tremie tube is recommended to place grout from the bottom of the anchor holes. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day that grout is prepared.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request.

## 5.8 Pavement Structure

For design purposes, it is recommended that the rigid pavement structure for the lowest level of the underground parking structure should consist of Category C2, 32 MPa concrete at 28 days with air entrainment of 5 to 8%. The recommended rigid pavement structure is further presented in Table 4 below. The flexible pavement structure presented in Table 5 should be used for at grade access lanes and heavy loading parking areas overlying the podium deck.

| Table 4 - Recommended Rigid Pavement Structure - Lower Parking Level | |
|---|---|
| **Thickness (mm)** | **Material Description** |
| 150 | **Exposure Class C2 - 32 MPa Concrete** (5 to 8% Air Entrainment) |
| 300 | **BASE** - OPSS Granular A Crushed Stone |
| **SUBGRADE** - Existing imported fill, or OPSS Granular B Type I or II material placed over bedrock. | |

To control cracking due to shrinking of the concrete floor slab, it is recommended that strategically located saw cuts be used to create control joints within the concrete floor slab of the lower underground parking level. The control joints are generally recommended to be located at the center of the column lines and spaced at approximately 24 to 36 times the slab thickness (for example; a 0.15 m thick slab should have control joints spaced between 3.6 and 5.4 m). The joints should be cut between 25 and 30% of the thickness of the concrete floor slab and completed as early as 4 hour after the concrete has been poured during warm temperatures and up to 12 hours during cooler temperatures.

| Table 5 - Recommended Asphalt Pavement Structure - Access Lanes and Heavy Loading Parking Areas | |
|---|---|
| **Thickness (mm)** | **Material Description** |
| 40 | **Wear Course** - Superpave 12.5 Asphaltic Concrete |
| 50 | **Binder Course** - Superpave 19.0 Asphaltic Concrete |
| 150 | **BASE** - OPSS Granular A Crushed Stone |
| 300 | **SUBBASE** - OPSS Granular B Type II |
| **SUBGRADE** - OPSS Granular B Type II overlying the Concrete Podium Deck. | |

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the material's SPMDD using suitable vibratory equipment.

# 6.0 Design and Construction Precautions

## 6.1 Foundation Drainage and Backfill

### Foundation Drainage

It is anticipated that the portion of the proposed building foundation walls located below the long-term groundwater table (approximate geodetic elevation 92 m) will be placed against a groundwater infiltration control system. Also, a perimeter foundation drainage system will be required as a secondary system to account for any groundwater which comes in contact with the proposed building's foundation walls.

For the groundwater infiltration control system for the foundation walls, the following is recommended:

- ❏ Line drill the excavation perimeter.
- ❏ Hoe ram any irregularities and prepare bedrock surface. Shotcrete areas to fill in cavities and smooth out angular features at the bedrock surface, as required based on site inspection by Paterson.
- ❏ Place a suitable membrane against the prepared bedrock surface, such as a bentomat liner system or equivalent. The membrane liner should extend from geodetic elevation 92 m below existing grade down to footing level. The membrane liner should also extend horizontally a minimum 600 mm below the footing at underside of footing level.
- ❏ Place a composite drainage layer, such as Delta Drain 6000 or equivalent, over the membrane (as a secondary system). The composite drainage layer should extend from finished grade to underside of footing level.
- ❏ Pour foundation wall against the composite drainage system.

It is recommended that 100 mm diameter sleeves at 3 m centres be cast in the footing or at the foundation wall/footing interface to allow the infiltration of any water that breaches the waterproofing system to flow to an interior perimeter drainage pipe. The perimeter drainage pipe should direct water to sump pit(s) within the lower basement area.

### Sub-slab Drainage

Sub-slab drainage will be required to control water infiltration for the underground parking levels. For preliminary design purposes, we recommend that 100 or 150 mm perforated pipes be placed at approximate 6 m centres. The spacing of the sub-slab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

### Foundation Backfill

Where sufficient space is available for backfilling, backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose. A waterproofing system should be provided for the elevator pits (pit bottom and walls).

## 6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum of 1.5 m of soil cover alone, or a minimum of 0.6 m of soil cover in conjunction with adequate foundation insulation, should be provided.

Exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the heated structure and require additional protection, such as soil cover of 2.1 m or an equivalent combination of soil cover and foundation insulation.

However, the footings are generally not expected to require protection against frost action due to the founding depth. Unheated structures such as the access ramp may require insulation for protection against the deleterious effects of frost action.

## 6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled.

### Unsupported Excavations

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soils are considered to be a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

As noted above, excavation side slopes in sound bedrock can be carried out using almost vertical side walls. A minimum 1 m horizontal ledge should be left between the bottom of the overburden excavation and the top of the bedrock surface to provide an area to allow for potential sloughing or to provide a stable base for the overburden shoring system.

Horizontal rock anchors may be required at specific locations to prevent pop-outs of the bedrock, especially in areas where bedrock fractures are conducive to the failure of the bedrock surface. The requirement for horizontal rock anchors should be evaluated during the excavation operations and should be discussed with the structural engineer during the design stage.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by “cut and cover” methods and excavations should not remain open for extended periods of time.

**Temporary Shoring**

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The design and approval of the shoring system will be the responsibility of the shoring contractor and the shoring designer who is a licensed professional engineer and is hired by the shoring contractor. It is the responsibility of the shoring contractor to ensure that the temporary shoring is in compliance with safety requirements, designed to avoid any damage to adjacent structures and include dewatering control measures. In the event that subsurface conditions differ from the approved design during the actual installation, it is the responsibility of the shoring contractor to commission the required experts to re-assess the design and implement the required changes.

The designer should also take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner’s representative prior to implementation.

The temporary shoring system may consist of a soldier pile and lagging system. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be added to the earth pressures described below. These systems can be cantilevered, anchored or braced. Generally, the shoring systems should be provided with tie-back rock anchors to ensure the stability.

The toe of the shoring is recommended to be adequately supported to resist toe failure, if required, by means of rock bolts or extending the piles into the bedrock through pre-augered holes if a soldier pile and lagging system is used.

The earth pressures acting on the shoring system may be calculated using the following parameters.

**Table 6 - Soil Parameters**

| Parameters | Values |
|---|---|
| Active Earth Pressure Coefficient ($K_a$) | 0.33 |
| Passive Earth Pressure Coefficient ($K_p$) | 3 |
| At-Rest Earth Pressure Coefficient ($K_o$) | 0.5 |
| Unit Weight ($\gamma$), kN/m$^3$ | 21 |
| Submerged Unit Weight ($\gamma$), kN/m$^3$ | 13 |

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible.

The dry unit weight should be used above the groundwater level while the effective unit weight should be used below the groundwater level.

The hydrostatic groundwater pressure should be added to the earth pressure distribution wherever the effective unit weights are used for earth pressure calculations. If the groundwater level is lowered, the dry unit weight for the soil should be used full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

## 6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on soil subgrade. If the bedding is placed on bedrock, the thickness of the bedding should be increased to 300 mm for sewer pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 225 mm thick lifts and compacted to 95% of the SPMDD.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to reduce the potential differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

## 6.5 Groundwater Control

It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

### Groundwater Control for Building Construction

A temporary Ministry of Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required if more than 400,000 L/day of ground and/or surface water are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

### Impacts on Neighbouring Properties

It is anticipated that one or more levels of underground parking are planned for the proposed development. Due to the presence of relatively shallow bedrock at, and in the vicinity of, the subject site, no adverse effects to neighbouring properties are expected as a result of any dewatering which may be required.

## 6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site mostly consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be carried out in a manner to avoid the introduction of frozen materials, snow or ice into the trenches.

## 6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a moderate to aggressive corrosive environment.

# 7.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ Undertake a final detailed geotechnical investigation program to address any data gaps within the preliminary geotechnical investigation program both horizontally and vertically.
- ❏ Review of the geotechnical aspects of the excavating contractor's shoring design, prior to construction.
- ❏ Review the bedrock stabilization and excavation requirements.
- ❏ Review proposed waterproofing and foundation drainage design and requirements.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming the work has been conducted in general accordance with the recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

# 8.0 Statement of Limitations

The preliminary recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A preliminary geotechnical investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The preliminary recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Claridge Homes or their agents is not authorized without review by Paterson for the applicability of our recommendations to the altered use of the report.

**Paterson Group Inc.**


Scott S. Dennis, P.Eng.

David J. Gilbert, P.Eng.

**Report Distribution**

- ❑ Claridge Homes (email copy)
- ❑ Paterson Group (1 copy)

# APPENDIX 1

**SOIL PROFILE AND TEST DATA SHEETS**

**SYMBOLS AND TERMS**

**SOIL PROFILE AND TEST DATA SHEETS BY OTHERS**

**ANALYTICAL TEST RESULTS**

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 1-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** October 30, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 96.18 |
| **TOPSOIL** 0.25 | | AU | 1 | | | | |
| | | AU | 2 | | | | |
| | | SS | 3 | 40 | 50+ | 1 | 95.18 |
| **FILL:** Brown silty sand with crushed stone | | SS | 4 | 57 | 50+ | 2 | 94.18 |
| 2.64 | | SS | 5 | 100 | 50+ | | |
| | | RC | 1 | 76 | 0 | 3 | 93.18 |
| | | RC | 2 | 100 | 66 | 4 | 92.18 |
| | | RC | 3 | 95 | 85 | 5 | 91.18 |
| | | RC | 4 | 100 | 100 | 6 | 90.18 |
| | | RC | 5 | 100 | 100 | 7 | 89.18 |
| **BEDROCK:** Very poor to excellent quality, grey limestone interbedded with shale | | RC | 6 | 100 | 100 | 8 | 88.18 |
| | | RC | 7 | 100 | 100 | 9 | 87.18 |
| | | RC | 8 | 100 | 97 | 10 | 86.18 |
| | | RC | 9 | 100 | 92 | 11 | 85.18 |
| | | | | | | 12 | 84.18 |
| | | | | | | 13 | 83.18 |
| | | | | | | 14 | 82.18 |
| 15.14 | | | | | | 15 | 81.18 |
| End of Borehole | | | | | | | |
| (GWL @ 3.00m - Nov. 6, 2020) | | | | | | | |

**Pen. Resist. Blows/0.3m**
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

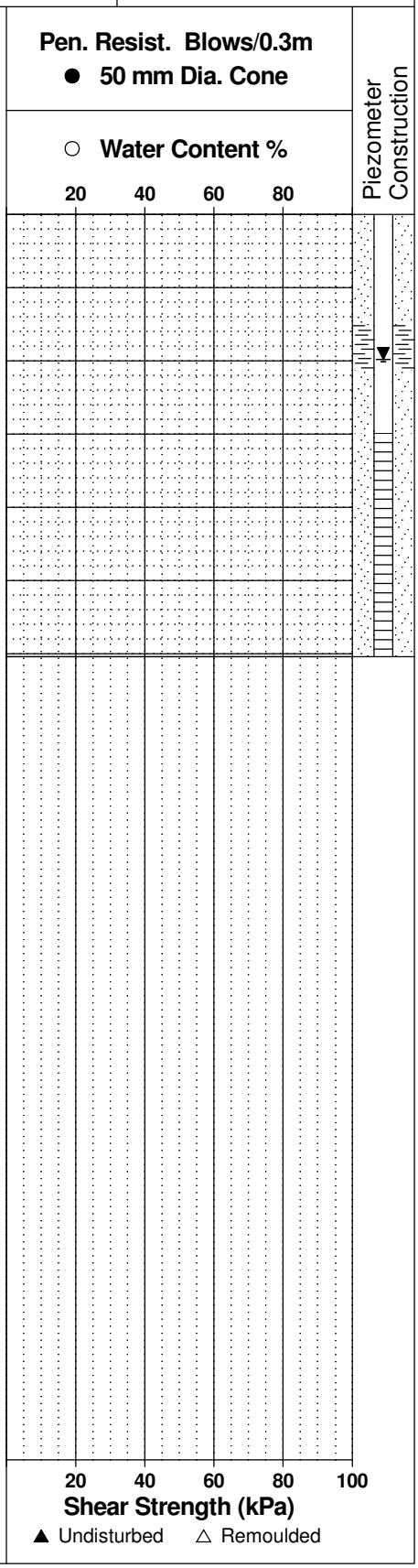
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 2-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** October 30, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 95.71 |
| Asphaltic concrete 0.08 | | AU | 1 | | | | |
| **FILL:** Brown silty sand with crushed stone 0.60 | | AU | 2 | | | | |
| 1.12 | | SS | 3 | 38 | 50+ | 1 | 94.71 |
| **FILL:** Brown silty sand with clay, some gravel | | RC | 1 | 82 | 0 | | |
| | | RC | 2 | 98 | 50 | 2 | 93.71 |
| **BEDROCK:** Very poor to excellent quality, grey limestone | | | | | | 3 | 92.71 |
| - vertical seam from 5.2 to 5.7m depth | | RC | 3 | 100 | 93 | 4 | 91.71 |
| | | RC | 4 | 100 | 100 | 5 | 90.71 |
| 6.04 | | | | | | 6 | 89.71 |
| End of Borehole | | | | | | | |
| (GWL @ 1.98m - Nov. 11, 2020) | | | | | | | |



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

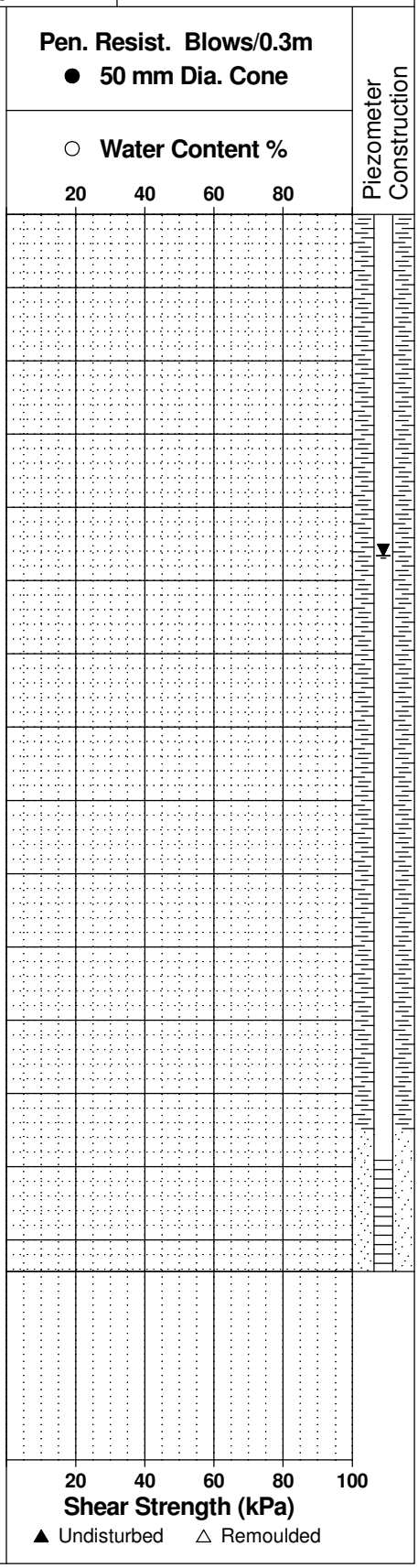
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 3-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 2, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 98.86 |
| **TOPSOIL** 0.08 | | AU | 1 | | | | |
| **FILL:** Brown silty sand, some gravel | | SS | 2 | 58 | 25 | 1 | 97.86 |
| 1.35 | | RC | 1 | 100 | 53 | 2 | 96.86 |
| | | RC | 2 | 100 | 87 | 3 | 95.86 |
| | | RC | 3 | 100 | 73 | 4 | 94.86 |
| | | RC | 4 | 100 | 100 | 5 | 93.86 |
| **BEDROCK:** Fair to excellent quality, grey limestone interbedded with shale | | RC | 5 | 100 | 100 | 6 | 92.86 |
| | | RC | 6 | 100 | 100 | 7 | 91.86 |
| | | RC | 7 | 97 | 95 | 8 | 90.86 |
| | | RC | 8 | 100 | 100 | 9 | 89.86 |
| | | RC | 9 | 100 | 92 | 10 | 88.86 |
| | | | | | | 11 | 87.86 |
| | | | | | | 12 | 86.86 |
| | | | | | | 13 | 85.86 |
| 14.43 | | | | | | 14 | 84.86 |
| End of Borehole | | | | | | | |
| (GWL @ 4.66m - Nov. 6, 2020) | | | | | | | |



# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 4-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 2, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 95.89 |
| **TOPSOIL** 0.20 | | AU | 1 | | | | |
| **FILL:** Brown silty sand, some gravel, trace organics | | SS | 2 | 33 | 23 | 1 | 94.89 |
| 1.52 | | | | | | | |
| Compact, brown **SILTY SAND,** some gravel 2.13 | | SS | 3 | 54 | 11 | 2 | 93.89 |
| | | SS | 4 | 100 | 11 | | |
| | | SS | 5 | 0 | 46 | 3 | 92.89 |
| **GLACIAL TILL:** Brown silty clay with gravel, some sand | | SS | 6 | 96 | 38 | 4 | 91.89 |
| - grey by 3.9m depth | | SS | 7 | 42 | 37 | | |
| | | SS | 8 | 64 | 50+ | 5 | 90.89 |
| | | | | | | 6 | 89.89 |
| 6.58 | | SS | 9 | 79 | 24 | | |
| | | RC | 1 | 100 | 100 | 7 | 88.89 |
| **BEDROCK:** Excellent quality, grey limestone interbedded with shale | | RC | 2 | 100 | 97 | 8 | 87.89 |
| 9.04 | | | | | | 9 | 86.89 |
| End of Borehole | | | | | | | |
| (GWL @ 3.13m - Nov. 9, 2020) | | | | | | | |

**Pen. Resist. Blows/0.3m**
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100
**Shear Strength (kPa)**
▲ Undisturbed △ Remoulded

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5561

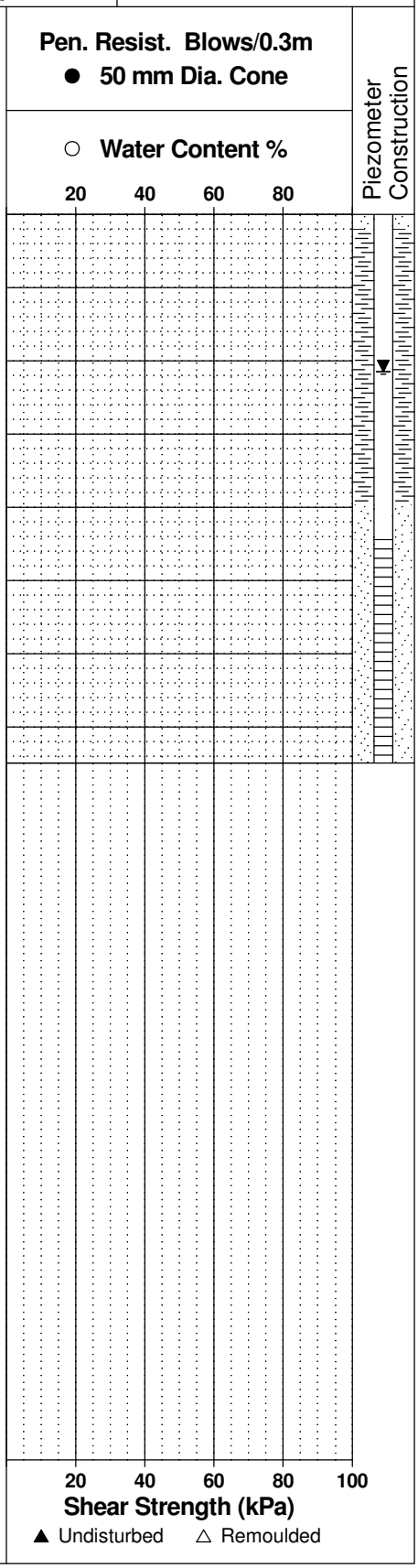
**REMARKS**

**HOLE NO.** BH 5-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 3, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 95.28 |
| Asphaltic concrete 0.08 | | AU | 1 | | | | |
| **FILL:** Brown silty sand with crushed stone 0.66 | | SS | 2 | 45 | 20 | 1 | 94.28 |
| **FILL:** Brown silty sand, trace clay 1.37 | | RC | 1 | 87 | 32 | 2 | 93.28 |
| | | | | | | 3 | 92.28 |
| **BEDROCK:** Poor to excellent quality, grey limestone | | RC | 2 | 100 | 93 | 4 | 91.28 |
| | | RC | 3 | 100 | 100 | 5 | 90.28 |
| | | | | | | 6 | 89.28 |
| | | RC | 4 | 100 | 93 | 7 | 88.28 |
| 7.49 End of Borehole | | | | | | | |

(GWL @ 2.15m - Nov. 9, 2020)



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

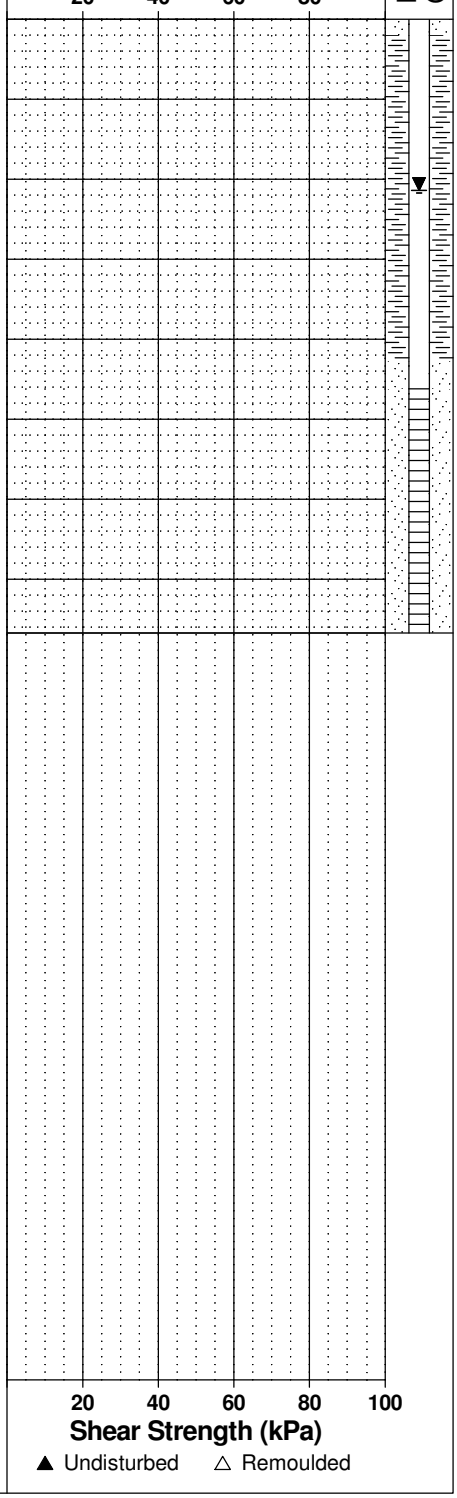
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 6-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 3, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | |
| Asphaltic concrete 0.08 | | AU | 1 | | | 0 | 95.44 |
| **FILL:** Brown silty sand with crushed stone 0.66 | | SS | 2 | 65 | | 1 | 94.44 |
| 1.22 | | | | | | | |
| **FILL:** Brown silty sand | | RC | 1 | 100 | 62 | | |
| | | RC | 2 | 90 | 75 | 2 | 93.44 |
| | | | | | | 3 | 92.44 |
| **BEDROCK:** Fair to excellent quality, grey limestone | | RC | 3 | 100 | 100 | 4 | 91.44 |
| | | RC | 4 | 100 | 97 | 5 | 90.44 |
| - vertical seam from 6.1 to 6.5m depth | | | | | | 6 | 89.44 |
| | | RC | 5 | 100 | 97 | 7 | 88.44 |
| 7.67 | | | | | | | |
| End of Borehole | | | | | | | |
| (GWL @ 2.14m - Nov. 9, 2020) | | | | | | | |



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

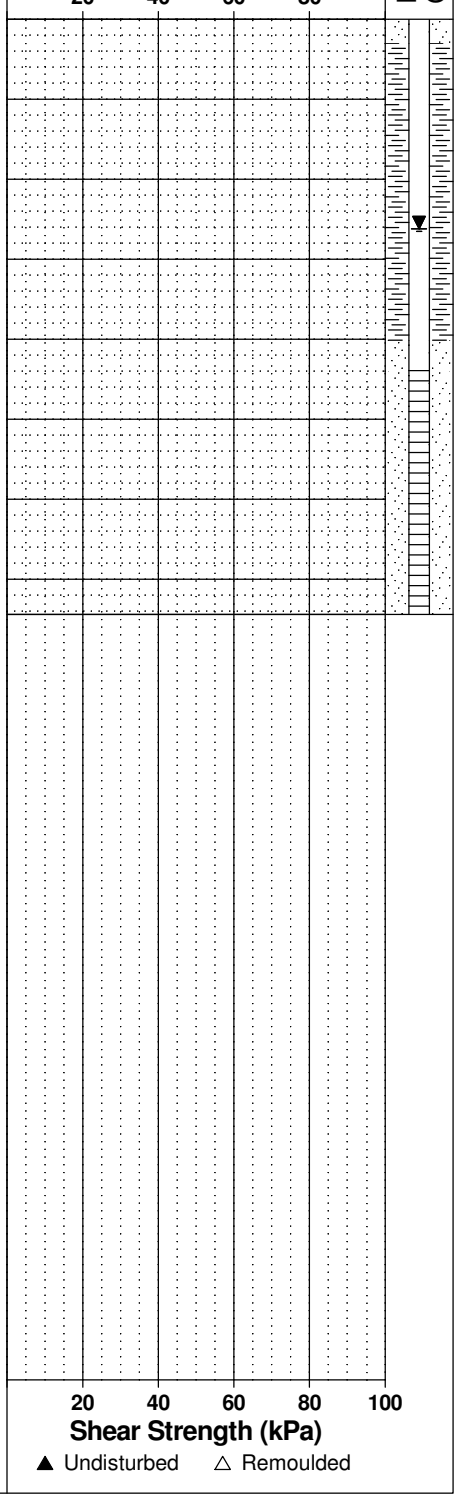
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 7-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 3, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | 0 | 95.74 |
| Asphaltic concrete 0.05 | | AU | 1 | | | | |
| **FILL:** Brown silty sand with crushed stone 0.59 | | SS | 2 | 100 | 50+ | 1 | 94.74 |
| 0.86 | | RC | 1 | 91 | 45 | | |
| **FILL:** Brown silty sand with cobbles | | RC | 2 | 93 | 68 | 2 | 93.74 |
| | | RC | 3 | 100 | 97 | 3 | 92.74 |
| **BEDROCK:** Poor to excellent quality, grey limestone | | RC | 4 | 100 | 100 | 4 | 91.74 |
| | | RC | 5 | 100 | 100 | 5 | 90.74 |
| | | | | | | 6 | 89.74 |
| | | | | | | 7 | 88.74 |
| 7.44 | | | | | | | |
| End of Borehole | | | | | | | |
| (GWL @ 2.62m - Nov. 9, 2020) | | | | | | | |



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 8-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 4, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) | Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % | Piezometer Construction |
|---|---|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | | | |
| Asphaltic concrete 0.08 | | AU | 1 | | | 0 | 95.73 | | |
| **FILL:** Brown silty sand with crushed stone 0.60 | | | | | | | | | |
| 1.24 | | SS | 2 | 60 | 12 | 1 | 94.73 | | |
| **FILL:** Brown silty sand, some gravel, trace clay | | | | | | | | | |
| | | RC | 1 | 93 | 28 | 2 | 93.73 | | |
| | | | | | | 3 | 92.73 | | |
| | | RC | 2 | 100 | 78 | 4 | 91.73 | | |
| **BEDROCK:** Poor to excellent quality, grey limestone interbedded with shale | | | | | | | | | |
| | | RC | 3 | 97 | 90 | 5 | 90.73 | | |
| | | | | | | 6 | 89.73 | | |
| | | RC | 4 | 100 | 90 | 7 | 88.73 | | |
| 8.03 | | RC | 5 | 100 | 68 | 8 | 87.73 | | |
| End of Borehole | | | | | | | | | |
| (GWL @ 2.52m - Nov. 9, 2020) | | | | | | | | | |

Pen. Resist. Blows/0.3m: ● 50 mm Dia. Cone; ○ Water Content %
20 40 60 80

Shear Strength (kPa)
20 40 60 80 100
▲ Undisturbed △ Remoulded

# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

## SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

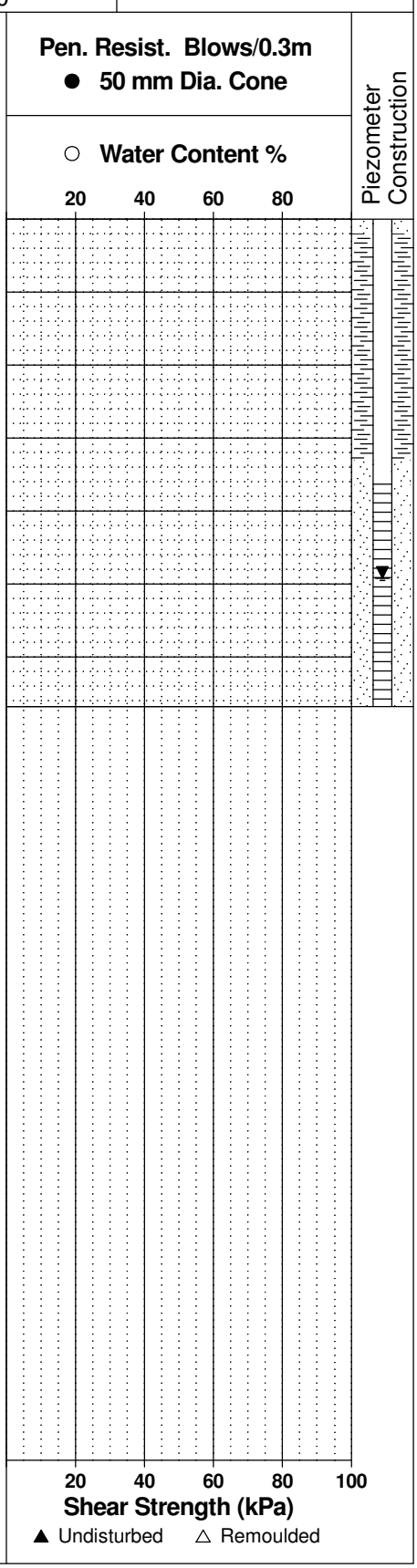
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH 9-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 4, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | |
| **TOPSOIL** 0.10 | | AU | 1 | | | 0 | 100.22 |
| **GLACIAL TILL:** Dense, brown silty sand with clay, gravel, cobbles and boulders 1.42 | | SS | 2 | 80 | 50+ | 1 | 99.22 |
| | | RC | 1 | 48 | 35 | 2 | 98.22 |
| | | RC | 2 | 94 | 47 | 3 | 97.22 |
| **BEDROCK:** Poor to excellent quality, grey limestone | | RC | 3 | 100 | 90 | 4 | 96.22 |
| | | RC | 4 | 78 | 57 | 5 | 95.22 |
| | | RC | 5 | 100 | 86 | 6 | 94.22 |
| 6.68 | | | | | | | |
| End of Borehole | | | | | | | |
| (GWL @ 4.92m - Nov. 10, 2020) | | | | | | | |



# patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

# SOIL PROFILE AND TEST DATA

**Geotechnical Investigation**
**Proposed Residential Complex - 1500 Merivale Road**
**Ottawa, Ontario**

**DATUM** Geodetic

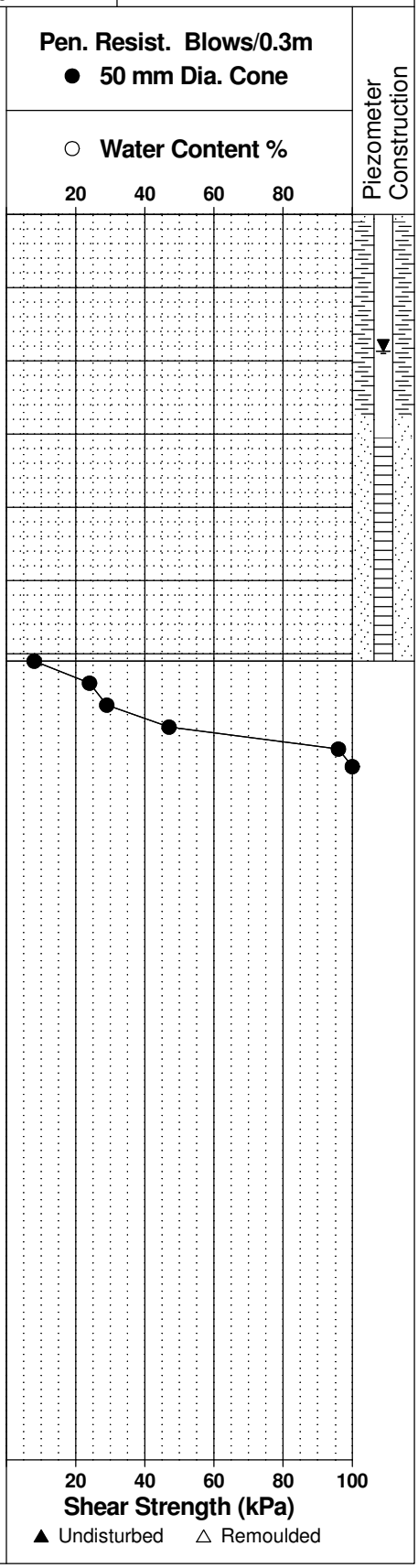
**FILE NO.** PG5561

**REMARKS**

**HOLE NO.** BH10-20

**BORINGS BY** CME-55 Low Clearance Drill **DATE** November 4, 2020

| SOIL DESCRIPTION | STRATA PLOT | SAMPLE TYPE | SAMPLE NUMBER | SAMPLE % RECOVERY | SAMPLE N VALUE or RQD | DEPTH (m) | ELEV. (m) |
|---|---|---|---|---|---|---|---|
| **GROUND SURFACE** | | | | | | | |
| Asphaltic concrete 0.05 | | AU | 1 | | | 0 | 94.73 |
| **FILL:** Brown silty sand with crushed stone 0.38 | | | | | | | |
| 0.71 | | SS | 2 | 21 | 6 | 1 | 93.73 |
| **FILL:** Brown silty sand, some gravel | | | | | | | |
| **GLACIAL TILL:** Brown silty sand with clay, trace gravel | | SS | 3 | 33 | 3 | 2 | 92.73 |
| | | SS | 4 | 58 | 20 | | |
| 2.90 | | | | | | 3 | 91.73 |
| | | SS | 5 | 62 | 8 | | |
| **GLACIAL TILL:** Grey silty clay, some sand and gravel | | SS | 6 | 79 | 9 | 4 | 90.73 |
| | | SS | 7 | 67 | 21 | 5 | 89.73 |
| | | SS | 8 | 71 | 22 | | |
| 6.10 | | | | | | 6 | 88.73 |
| Dymanic cone pentration test commenced at 6.10m | | | | | | | |
| 7.62 | | | | | | | |
| End of borehole | | | | | | | |
| Practical DCPT refusal at 7.54m depth. | | | | | | | |
| (GWL @ 1.87m - Nov. 10, 2020) | | | | | | | |



# SYMBOLS AND TERMS

## SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

| | | |
|---|---|---|
| Desiccated | - | having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc. |
| Fissured | - | having cracks, and hence a blocky structure. |
| Varved | - | composed of regular alternating layers of silt and clay. |
| Stratified | - | composed of alternating layers of different soil types, e.g. silt and sand or silt and clay. |
| Well-Graded | - | Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution). |
| Uniformly-Graded | - | Predominantly of one grain size (see Grain Size Distribution). |

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

| Relative Density | 'N' Value | Relative Density % |
|---|---|---|
| Very Loose | <4 | <15 |
| Loose | 4-10 | 15-35 |
| Compact | 10-30 | 35-65 |
| Dense | 30-50 | 65-85 |
| Very Dense | >50 | >85 |

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

| Consistency | Undrained Shear Strength (kPa) | 'N' Value |
|---|---|---|
| Very Soft | <12 | <2 |
| Soft | 12-25 | 2-4 |
| Firm | 25-50 | 4-8 |
| Stiff | 50-100 | 8-15 |
| Very Stiff | 100-200 | 15-30 |
| Hard | >200 | >30 |

# SYMBOLS AND TERMS (continued)

## SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

## ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

| RQD % | ROCK QUALITY |
|---|---|
| 90-100 | Excellent, intact, very sound |
| 75-90 | Good, massive, moderately jointed or sound |
| 50-75 | Fair, blocky and seamy, fractured |
| 25-50 | Poor, shattered and very seamy or blocky, severely fractured |
| 0-25 | Very poor, crushed, very severely fractured |

## SAMPLE TYPES

| | | |
|---|---|---|
| SS | - | Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT)) |
| TW | - | Thin wall tube or Shelby tube |
| PS | - | Piston sample |
| AU | - | Auger sample or bulk sample |
| WS | - | Wash sample |
| RC | - | Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits. |

## SYMBOLS AND TERMS (continued)

### GRAIN SIZE DISTRIBUTION

| | | |
|---|---|---|
| MC% | - | Natural moisture content or water content of sample, % |
| LL | - | Liquid Limit, % (water content above which soil behaves as a liquid) |
| PL | - | Plastic limit, % (water content above which soil behaves plastically) |
| PI | - | Plasticity index, % (difference between LL and PL) |
| Dxx | - | Grain size which xx% of the soil, by weight, is of finer grain sizes<br>These grain size descriptions are not used below 0.075 mm grain size |
| D10 | - | Grain size at which 10% of the soil is finer (effective grain size) |
| D60 | - | Grain size at which 60% of the soil is finer |
| Cc | - | Concavity coefficient = $(D30)^2 / (D10 \times D60)$ |
| Cu | - | Uniformity coefficient = D60 / D10 |

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

### CONSOLIDATION TEST

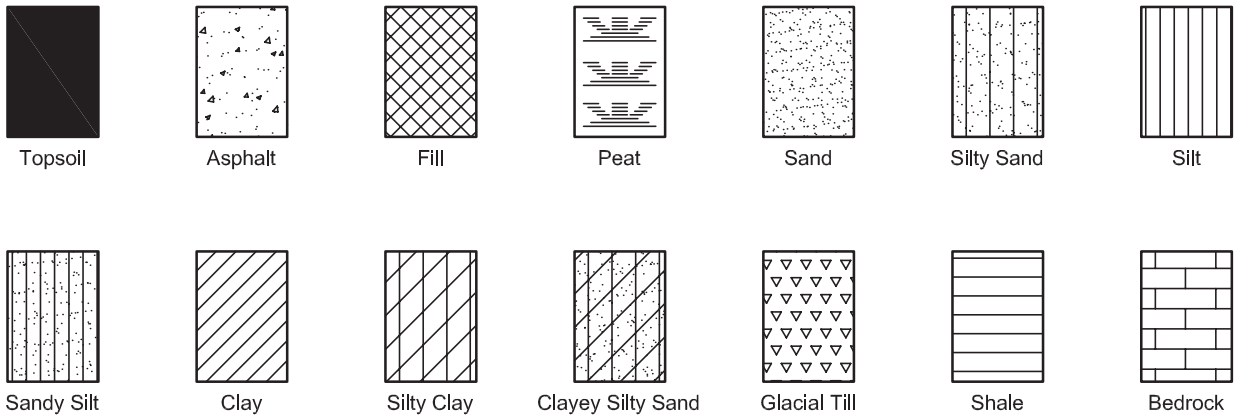
| | | |
|---|---|---|
| $p'_o$ | - | Present effective overburden pressure at sample depth |
| $p'_c$ | - | Preconsolidation pressure of (maximum past pressure on) sample |
| Ccr | - | Recompression index (in effect at pressures below $p'_c$) |
| Cc | - | Compression index (in effect at pressures above $p'_c$) |
| OC Ratio | | Overconsolidaton ratio = $p'_c / p'_o$ |
| Void Ratio | | Initial sample void ratio = volume of voids / volume of solids |
| Wo | - | Initial water content (at start of consolidation test) |

### PERMEABILITY TEST

| | | |
|---|---|---|
| k | - | Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test. |

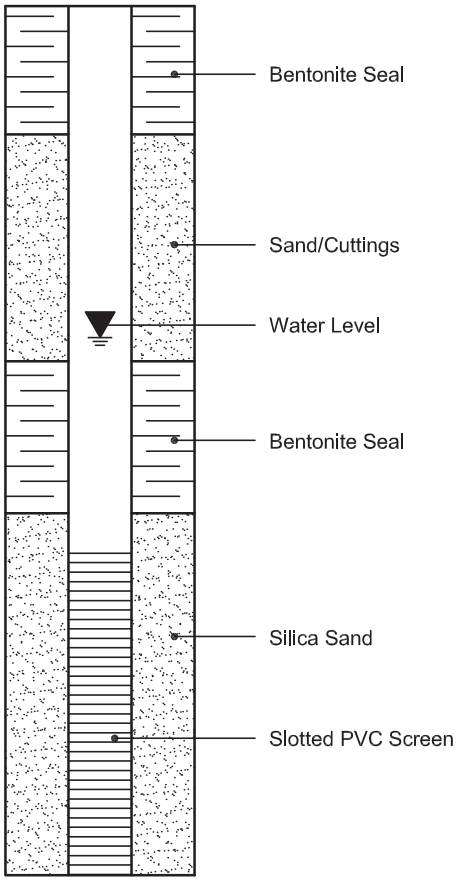
# SYMBOLS AND TERMS (continued)

## STRATA PLOT

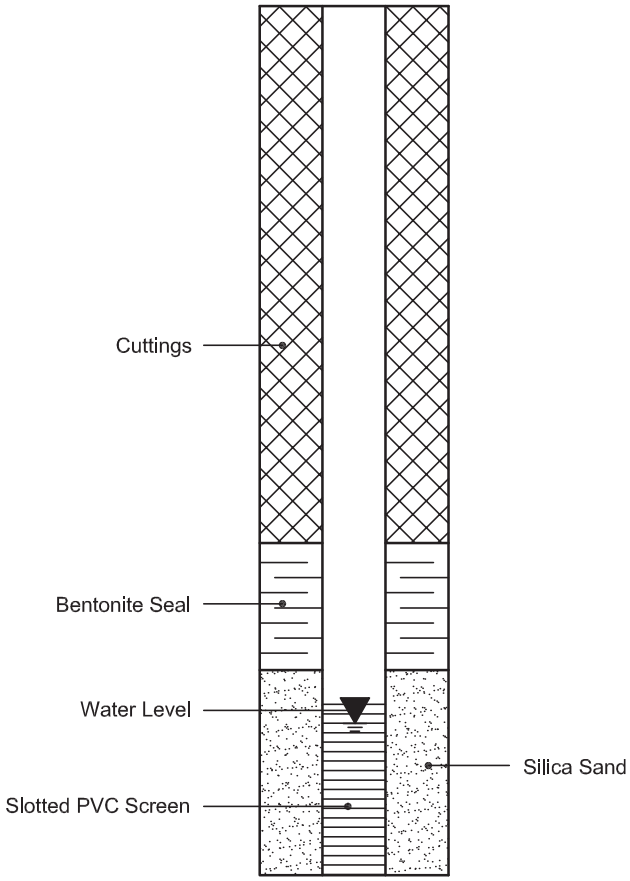



## MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION




PIEZOMETER CONSTRUCTION



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Suite 1001
Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-03

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 25, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>damp, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 15 | 0.0 | |
| | | | -1.5 | | | | | | | |
| | | ***Sand***<br>with gravel, moist, brown, no PHC odour or staining | | SS3 | Grab | SS | NA | 50 | 0.0 | |
| 2 | | | -2.3 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist to wet, brown, no PHC odour or staining | | SS4 | Grab | SS | NA | 10 | 0.0 | |
| 3 | | | -3.0 | | | | | | | |
| | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Suite 1001
Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-04

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 25, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 60 | 0.0 | |
| 1 | | Organics below 0.9 m depth | | SS2 | Grab | SS | NA | 40 | 0.0 | |
| | | Some shale and limestone fragments below 1.5 m depth | | SS3 | Grab | SS | NA | 10 | 0.0 | |
| 2 | | | -2.3 | | | | | | | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-05

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 101.7 | | | | | | | |
| | | ***Asphalt*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | 30 | 30 | 0.8 | |
| 1 | | | | SS2 | Grab | SS | 33 | 60 | 0.8 | |
| 2 | | | 99.6 | SS3 | Grab | SS | 29 | 80 | 2.4 | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** NA
***Ground Elevation:*** 101.73
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-06

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Asphalt*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | 106 | 70 | 0.5 | |
| 1 | | | | SS2 | Grab | SS | 29 | 0 | 1.2 | |
| | | | -1.5 | | | | | | | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-07

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Asphalt*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | 39 | 40 | 1.7 | |
| 1 | | | | SS2 | Grab | SS | 33 | 40 | 2.4 | |
| 2 | | | | SS3 | Grab | SS | 32 | 40 | 4.7 | |
| | | | -2.6 | SS4 | Grab | SS | 66 | 0 | 0.8 | |
| 3 | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: MW13-08

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

## SUBSURFACE PROFILE

## SAMPLE

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 101.9 | | | | | | | |
| | | ***Organics*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | 11 | 60 | 0.8 | |
| 1 | | | | SS2 | Grab | SS | 17 | 50 | 0.5 | |
| 2 | | | | SS3 | Grab | SS | 10 | 10 | 1.7 | |
| | | | 99.2 | SS4 | Grab | SS | NA | 50 | 2.4 | |
| 3 | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

Vapour Reading (ppm) ppm: 30 60 90 120

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** NA
***Ground Elevation:*** 101.92
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-09

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Asphalt*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, no PHC odour or staining | | SS1 | Grab | SS | 30 | 40 | 0.5 | |
| 1 | | | | SS2 | Grab | SS | 33 | 50 | 0.5 | |
| 2 | | | | SS3 | Grab | SS | 27 | 5 | 1.2 | |
| | | | | SS4 | Grab | SS | 49 | 60 | 1.8 | |
| 3 | | | -3.0 | | | | | | | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Suite 1001
Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-10

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Asphalt*** | | | | | | | | |
| | | ***Fill - Sand and Gravel*** some organics, damp, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 50 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 50 | 0.0 | |
| 2 | | Some gravel below 2.3 m depth | | SS3 | Grab | SS | NA | 40 | 0.0 | |
| | | | | SS4 | Grab | SS | NA | 5 | 0.0 | |
| 3 | | | -3.0 | | | | | | | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: MW13-11

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) (ppm: 30, 60, 90, 120) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 95.7 | | | | | | | |
| 0 | | ***Fill - Gravel*** some sand, damp, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 60 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 5 | 0.0 | |
| | | | 94.2 | | | | | | | |
| 2 | | ***Clay*** some silt, moist, grey, no PHC odour or staining<br>Slight PHC odour below 2.3 m depth | | SS3 | Grab | SS | NA | 90 | 0.0 | |
| 3 | | No PHC odour below 3.0 m depth | | SS4 | Grab | SS | NA | 90 | 36.1 | |
| | | | | SS5 | Grab | SS | NA | 90 | 0.0 | |
| 4 | | | | SS6 | Grab | SS | NA | NA | 0.0 | |
| | | | 91.2 | | | | | | | |
| 5 | | ***Silty Clay*** moist, grey, no PHC odour or staining | | SS7 | Grab | SS | NA | NA | 0.0 | |
| | | | 90.4 | | | | | | | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 95.73
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-12

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Gravel*** damp, grey, no PHC odour or staining | | SS1 | Grab | SS | NA | 50 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 10 | 0.0 | |
| 2 | | Slight PHC odour below 2.3 m depth | | SS3 | Grab | SS | NA | 10 | 0.0 | |
| | | | | SS4 | Grab | SS | NA | 10 | 0.3 | |
| 3 | | | -3.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some silt, moist, grey, slight PHC odour, no staining | -3.8 | SS5 | Grab | SS | NA | 10 | 0.9 | |
| 4 | | ***Silty Sand*** moist, grey, slight PHC odour, no staining | | SS6 | Grab | SS | NA | 15 | 0.2 | |
| 5 | | | -5.3 | SS7 | Grab | SS | NA | 10 | 0.2 | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 95.39
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-13

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 26, 2013

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 95.3 | | | | | | | |
| | | ***Fill - Gravel*** some sand, damp, grey, no PHC odour or staining | 94.5 | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | ***Silt and Sand*** Silt and sand, moist, grey, slight PHC odour, no staining | 93.7 | SS2 | Grab | SS | NA | 60 | 18.0 | |
| | | ***Silty Clay*** moist, grey, slight PHC odour, no staining | 93.0 | SS3 | Grab | SS | NA | 90 | 4.5 | |
| 2 | | ***Fill - Sand and Gravel*** some silt, moist, grey, slight PHC odour, no staining | | SS4 | Grab | SS | NA | 100 | 117.0 | |
| 3 | | | | SS5 | Grab | SS | NA | 50 | 3.5 | |
| 4 | | | | SS6 | Grab | SS | NA | 60 | | |
| 5 | | | 89.9 | SS7 | Grab | SS | NA | 70 | | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 95.27
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-14

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 27, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>damp, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | ***Fill - Sand***<br>moist, brown, no PHC odour or staining | -1.5 | SS2 | Grab | SS | NA | 30 | 0.0 | |
| 2 | | ***Silty Clay***<br>some sand, moist, grey, no PHC odour or staining | | SS3 | Grab | SS | NA | 40 | 0.0 | |
| | | | | SS4 | Grab | SS | NA | 60 | 0.5 | |
| 3 | | ***Clay***<br>with silt, moist, grey, no PHC odour or staining | -3.8 | SS5 | Grab | SS | NA | 100 | 0.0 | |
| 4 | | End of Borehole | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-15

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 27, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill -Gravel***<br>damp, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 5 | 0.0 | |
| 1 | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | -1.5 | SS2 | Grab | SS | NA | 50 | 0.0 | |
| 2 | | ***Silty Clay***<br>moist, grey, no PHC odour or staining<br><br>Some sand and slight PHC odour below 2.3 m depth | | SS3 | Grab | SS | NA | 70 | 0.0 | |
| 3 | | No PHC odour below 3.0 m depth | | SS4 | Grab | SS | NA | 90 | 24.4 | |
| | | | -3.8 | SS5 | Grab | SS | NA | NA | 0.0 | |
| 4 | | End of Borehole | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-16

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 25, 2013

## SUBSURFACE PROFILE

| Depth (m) | Symbol | Description | Elevation |
|---|---|---|---|
| 0 | | Ground Surface | 0.0 |
| 0 – 1.5 | | ***Fill - Sand and Gravel*** some asphalt, damp, brown, no PHC odour or staining | |
| 1.5 – 2.3 | | ***Silty Sand*** some gravel, moist, brown, no PHC odour or staining | -1.5 |
| 2.3 – 6.1 | | ***Fractured Limestone*** | -2.3 |
| 6 | | End of Borehole | -6.1 |

## SAMPLE

| Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm (30, 60, 90, 120) |
|---|---|---|---|---|---|
| SS1 | Grab | SS | NA | 10 | 0.0 |
| SS2 | Grab | SS | NA | 10 | 0.0 |
| SS3 | Grab | SS | NA | 60 | 0.0 |

Monitoring Well

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 96.82
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-17

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 27, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand*** some organics, damp, brown, PHC odour or staining | | SS1 | Grab | SS | NA | 10 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 10 | 0.3 | |
| 2 | | | -2.6 | SS3 | Grab | SS | NA | 5 | 0.0 | |
| | | ***Silt and Sand*** some gravel, moist, brown, no PHC odour or staining | -3.0 | SS4 | Grab | SS | NA | 35 | 0.0 | |
| 3 | | ***Silty Clay*** moist, grey, no PHC odour or staining | | SS5 | Grab | SS | NA | 60 | 0.0 | |
| 4 | | | | SS6 | Grab | SS | NA | 80 | 0.0 | |
| 5 | | Some shale and limestone fragments below 5.3 m depth | | SS7 | Grab | SS | NA | 35 | 0.0 | |
| 6 | | | -6.2 | SS8 | Grab | SS | NA | 35 | 0.0 | |
| | | End of Borehole | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-18

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 27, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>some asphalt, damp, brown, PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | NA | 0.0 | |
| 1 | | ***Silt and Sand***<br>moist, grey, no PHC odour or staining | | SS2 | Grab | SS | NA | 60 | 0.0 | |
| 2 | | Some embedded stone below 2.3 m depth | | SS3 | Grab | SS | NA | 80 | 0.1 | |
| 3 | | | | SS4 | Grab | SS | NA | 80 | 0.0 | |
| | | | | SS5 | Grab | SS | NA | 70 | 0.0 | |
| 4 | | | -4.6 | SS6 | Grab | SS | NA | 60 | 0.0 | |
| 5 | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-19

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 27, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some silt, moist, grey, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | ***Silty Sand*** some organics, moist, grey, no PHC odour or staining With embedded stone below 1.5 m depth | | SS2 | Grab | SS | NA | 60 | 0.0 | |
| 2 | | | | SS3 | Grab | SS | NA | 70 | 0.0 | |
| | | | | SS4 | Grab | SS | NA | 50 | 0.0 | |
| 3 | | Dark grey below 3.0 m depth | | | | | | | | |
| | | | | SS5 | Grab | SS | NA | 20 | 0.0 | |
| 4 | | | | SS6 | Grab | SS | NA | 30 | 0.0 | |
| | | | -4.6 | | | | | | | |
| | | End of Borehole | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 96.14
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-20

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 28, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, grey, no PHC odour or staining | | SS1 | Grab | SS | NA | 10 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 10 | 0.0 | |
| 2 | | | -2.3 | SS3 | Grab | SS | NA | 10 | 0.0 | |
| | | ***Fill - Gravel***<br>moist, grey, no PHC odour or staining | -3.0 | SS4 | Grab | SS | NA | 5 | 0.0 | |
| 3 | | ***Silt and Sand***<br>with gravel, moiost, grey, no PHC odour or staining | -3.8 | SS5 | Grab | SS | NA | 50 | 0.0 | |
| 4 | | End of Borehole | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-21

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 28, 2013

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand***<br>damp, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 40 | 0.0 | |
| | | | -1.5 | | | | | | | |
| | | ***Clay***<br>some gravel, moist, grey, no PHC odour or staining | | SS3 | Grab | SS | NA | 60 | 0.0 | |
| 2 | | | -2.3 | | | | | | | |
| | | ***Sand and Silt***<br>with gravel, damp, brown, slight PHC odour, no staining | | SS4 | Grab | SS | NA | 20 | 19.6 | |
| 3 | | | -3.0 | | | | | | | |
| | | ***Silty Sand***<br>moist, grey, slight PHC odour, no staining | | SS5 | Grab | SS | NA | 20 | 2.9 | |
| 4 | | | | SS6 | Grab | SS | NA | 60 | 14.7 | |
| 5 | | No PHC odour below 5.3 m depth | | SS7 | Grab | SS | NA | 60 | 9.6 | |
| | | | | SS8 | Grab | SS | NA | 20 | 0.5 | |
| 6 | | | -6.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

Vapour Reading (ppm) — ppm: 30, 60, 90, 120

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 95.89
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-22

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 28, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand*** some organics, moist, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 10 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 5 | 0.0 | |
| | | | -1.5 | | | | | | | |
| | | ***Sand and Silt*** some gravel, moist, grey, no PHC odour or staining | | SS3 | Grab | SS | NA | 10 | 0.1 | |
| 2 | | | | SS4 | Grab | SS | NA | 5 | 0.0 | |
| 3 | | | -3.0 | | | | | | | |
| | | ***Silty Sand*** with clay, some gravel, moist, grey, no PHC odour or staining | -3.8 | SS5 | Grab | SS | NA | 80 | 0.5 | |
| 4 | | ***Gravel*** some silt, moist,brown, no PHC odour or staining | -4.6 | SS6 | Grab | SS | NA | 5 | 0.0 | |
| | | End of Borehole | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-23

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** March 28, 2013

## SUBSURFACE PROFILE

| Depth (m) | Symbol | Description | Elevation |
|---|---|---|---|
| 0 | | Ground Surface | 95.9 |
| 0 | | ***Fill - Sand and Gravel*** moist, brown, no PHC odour or staining | |
| 1 | | | |
| | | | 94.4 |
| 2 | | ***Sand and gravel*** moist, dark grey, strong PHC odour, black staining | |
| 3 | | | 92.7 |
| 4 | | ***Silty Clay*** some sand, moist, grey, slight PHC odour, no staining<br>No sand below 4.6 m depth | |
| 5 | | | 90.5 |
| | | End of Borehole | |
| 6 | | | |
| 7 | | | |
| 8 | | | |

## SAMPLE

| Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) |
|---|---|---|---|---|---|
| SS1 | Grab | SS | NA | 10 | 0.0 |
| SS2 | Grab | SS | NA | 10 | 0.0 |
| SS3 | Grab | SS | NA | 5 | 324.0 |
| SS4 | Grab | SS | NA | 20 | 207.0 |
| SS5 | Grab | SS | NA | 60 | 126.0 |
| SS6 | Grab | SS | NA | 0 | |
| SS7 | Grab | SS | NA | 10 | 2.0 |

Vapour Reading (ppm): ppm 30 60 90 120

Monitoring Well

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 95.88
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: MW13-25

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 3, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 10 | 0.0 | |
| 1 | | ***Fractured Limestone*** | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | -4.7 | | | | | | | |
| 5 | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 96.52
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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Kanata, Ontario

# Stratigraphic and Instrumentation Log: BH13-26

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 1, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-27

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 1, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some silt, some clay, moist, grey, no PHC odour or staining | | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 5 | 0.0 | |
| | | | -1.5 | | | | | | | |
| 2 | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-28

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 1, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, grey, no PHC odour or staining | | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | | -1.4 | SS2 | Grab | SS | NA | 20 | 0.0 | |
| | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-29

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 1, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 10 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 5 | 0.0 | |
| | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-30

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 2, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand***<br>some gravel, moist, brown, no PHC odour or staining | | SS1 | Grab | SS | 9 | 10 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | 12 | 10 | 0.0 | |
| 2 | | | | SS3 | Grab | SS | 27 | 0 | 0.0 | |
| | | | -2.3 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | | SS4 | Grab | SS | 43 | 20 | 0.0 | |
| 3 | | | -3.2 | SS5 | Grab | SS | 50 | 5 | 0.0 | |
| | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-31

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 2, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>damp, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | 18 | 25 | 0.0 | |
| 1 | | ***Fill - Sand***<br>moist, brown, no PHC odour or staining | -1.5 | SS2 | Grab | SS | 19 | 25 | 0.0 | |
| 2 | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | -2.3 | SS3 | Grab | SS | 12 | 5 | 0.0 | |
| | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-32

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 2, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some organics, moist, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | 9 | 30 | 0.0 | |
| 1 | | ***Sand and Silt*** with gravel, moist, brownish grey, no PHC odour or staining | | SS2 | Grab | SS | 28 | 65 | 0.0 | |
| 2 | | | | SS3 | Grab | SS | 45 | 90 | 0.0 | |
| 3 | | | -3.0 | SS4 | Grab | SS | 50 | 5 | 0.0 | |
| | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-33

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 2, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** moist, brown, no PHC odour or staining | | SS1 | Grab | SS | 50 | 5 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | 24 | 15 | 0.0 | |
| 2 | | | | SS3 | Grab | SS | 50 | 0 | 0.0 | |
| | | | | SS4 | Grab | SS | 52 | 15 | 0.0 | |
| 3 | | | -3.0 | | | | | | | |
| | | ***Gravel*** moist, brown, no PHC odour or staining | -3.4 | SS5 | Grab | SS | 77 | 5 | 0.0 | |
| 4 | | End of Borehole Refusal on Bedrock | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: BH13-34

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 2, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>moist, brown, no PHC odour or staining | | SS1 | Grab | SS | 8 | 20 | 0.0 | |
| 1 | | | | SS2 | Grab | SS | 50 | 5 | 0.0 | |
| 2 | | | -2.3 | SS3 | Grab | SS | 32 | 80 | 0.0 | |
| | | ***Gravel***<br>some sand, moist, brown, no PHC odour or staining | -2.7 | SS4 | Grab | SS | 84 | 10 | 0.0 | |
| 3 | | End of Borehole<br>Refusal on Bedrock | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-35

***Project No.:*** 75040.001
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** April 3, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** moist, brown, no PHC odour or staining | -0.8 | SS1 | Grab | SS | NA | 60 | 0.0 | |
| 1 | | ***Silty Sand*** some gravel, moist, brown, no PHC odour or staining | -1.5 | SS2 | Grab | SS | NA | 50 | 0.0 | |
| 2 | | ***Fractured Limestone*** | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | -4.7 | | | | | | | |
| 5 | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Downing (CME 55)
***Drill Method:*** Spilt Spoon / Hollow Stem Auger
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 96.49
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-36

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| Depth (m) | Symbol | Description | Elevation | Sample Number | Sample Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 0.0 | | | | | | | |
| 0 | | ***Fill - Sand and Gravel*** dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.1 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 30 | 0.1 | |
| 1 | | ***Fractured Limestone*** | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 4 | | | -4.9 | | | | | | | |
| 5 | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

Vapour Reading (ppm): ppm — 30, 60, 90, 120

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-37

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some wood debris, dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.1 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | NA | 0.1 | |
| | | ***Fractured Limestone*** Start of Rock Core | | Run 1 | | | NA | NA | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | Run 2 | | | NA | NA | | |
| | | | | Run 3 | | | | | | |
| 5 | | | -5.1 | | | | NA | NA | | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-37D

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 15, 2014

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** Trace silt, trace clay, damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 30 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 30 | 0.0 | |
| | | ***Limestone*** Fractured throughout | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-38

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** some wood debris, dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 40 | 0.1 | |
| | | ***Fractured Limestone*** | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| | | | -4.9 | | | | | | | |
| 5 | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** Air Hammer
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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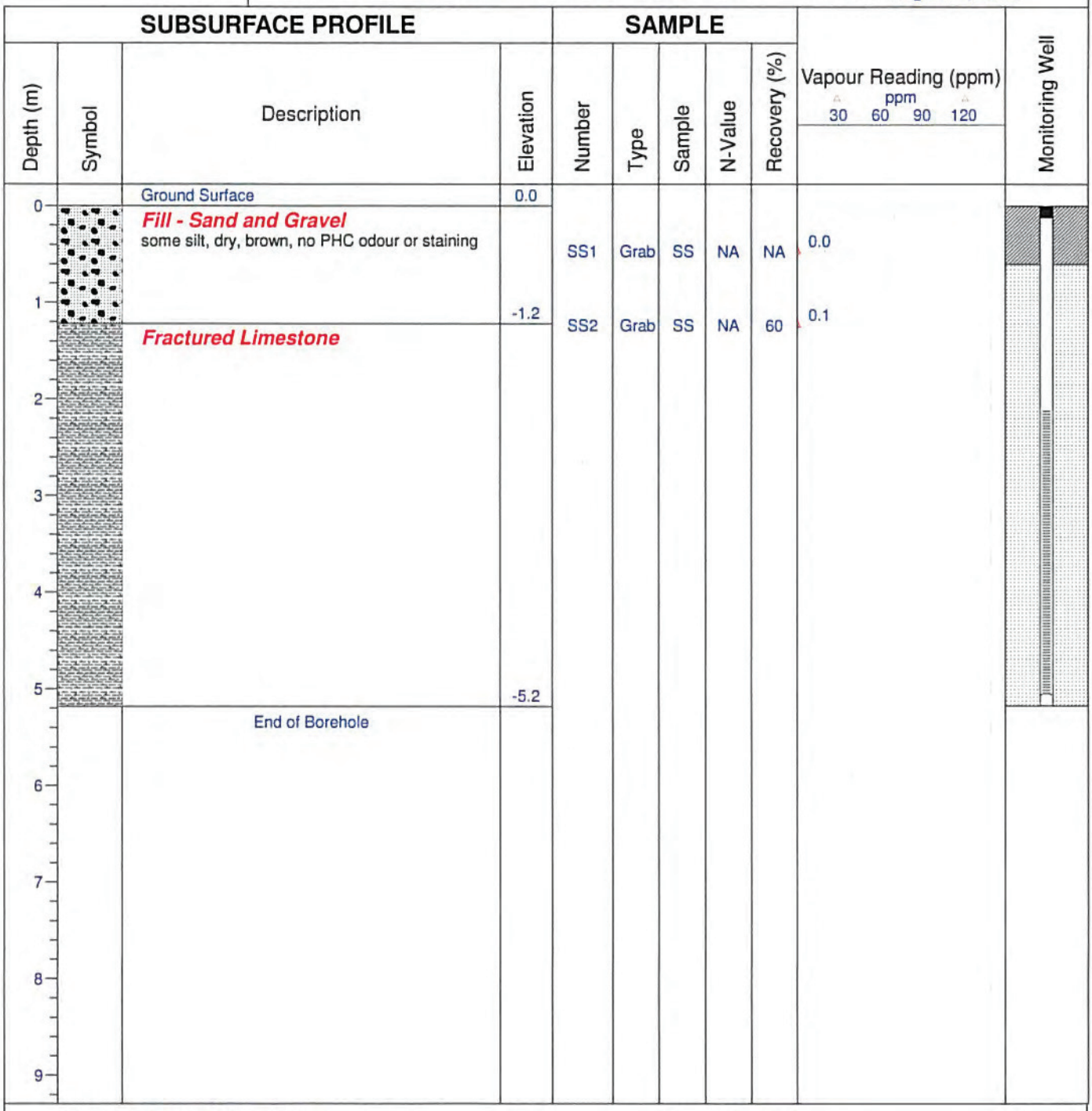
# Stratigraphic and Instrumentation Log: MW13-39

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013




***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-40

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 10 | 0.0 | |
| | | ***Fractured Limestone*** Start of Rock Core | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | Run 1 | | | NA | NA | | |
| 4 | | | | | | | | | | |
| 5 | | | -5.2 | | | | | | | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-41

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.0 | |
| 1 | | | | SS2 | Grab | SS | NA | 40 | 0.0 | |
| 2 | | | -2.1 | SS3 | Grab | SS | NA | 40 | 0.1 | |
| | | ***Fractured Limestone*** | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| | | | -5.9 | | | | | | | |
| 6 | | End of Borehole | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-42

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | NA | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 40 | 0.1 | |
| | | ***Fractured Limestone*** | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-43

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel***<br>dry, brown, no PHC odour or staining | | SS1 | Grab | SS | NA | 50 | 0.0 | |
| 1 | | | -1.2 | | | | | | | |
| | | ***Fractured Limestone*** | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | | | -12.2 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-44

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** W. Tabaczuk
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

## SUBSURFACE PROFILE

| Depth (m) | Symbol | Description | Elevation |
|---|---|---|---|
| 0 | | Ground Surface | 95.7 |
| | | ***Fill - Sand and Gravel*** dry, brown, medium grained, no PHC odour or staining | 95.0 |
| 1 | | ***Clayey Silt*** damp, grey, no PHC odour or staining | 94.2 |
| 2 | | ***Till - Silt*** trace to some gravel, damp, grey, no PHC odour or staining<br>Damp to moist below 2.4 m depth | |
| 3 | | Moist to wet below 3.0 m depth | |
| 4 | | | |
| 5 | | | 90.1 |
| 6 | | End of Borehole | |
| 7 | | | |
| 8 | | | |

## SAMPLE

| Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm (30, 60, 90, 120) |
|---|---|---|---|---|---|
| SS1 | Grab | SS | NA | 70 | 0.8 |
| SS2 | Grab | SS | NA | 100 | 0.2 |
| SS3 | Grab | SS | NA | 100 | 0.4 |
| SS4 | Grab | SS | NA | 100 | 0.9 |
| SS5 | Grab | SS | NA | 100 | 0.2 |
| SS6 | Grab | SS | NA | 100 | 0.0 |
| SS7 | Grab | SS | NA | 100 | 0.6 |
| SS8 | Grab | SS | NA | 100 | 0.0 |

Monitoring Well

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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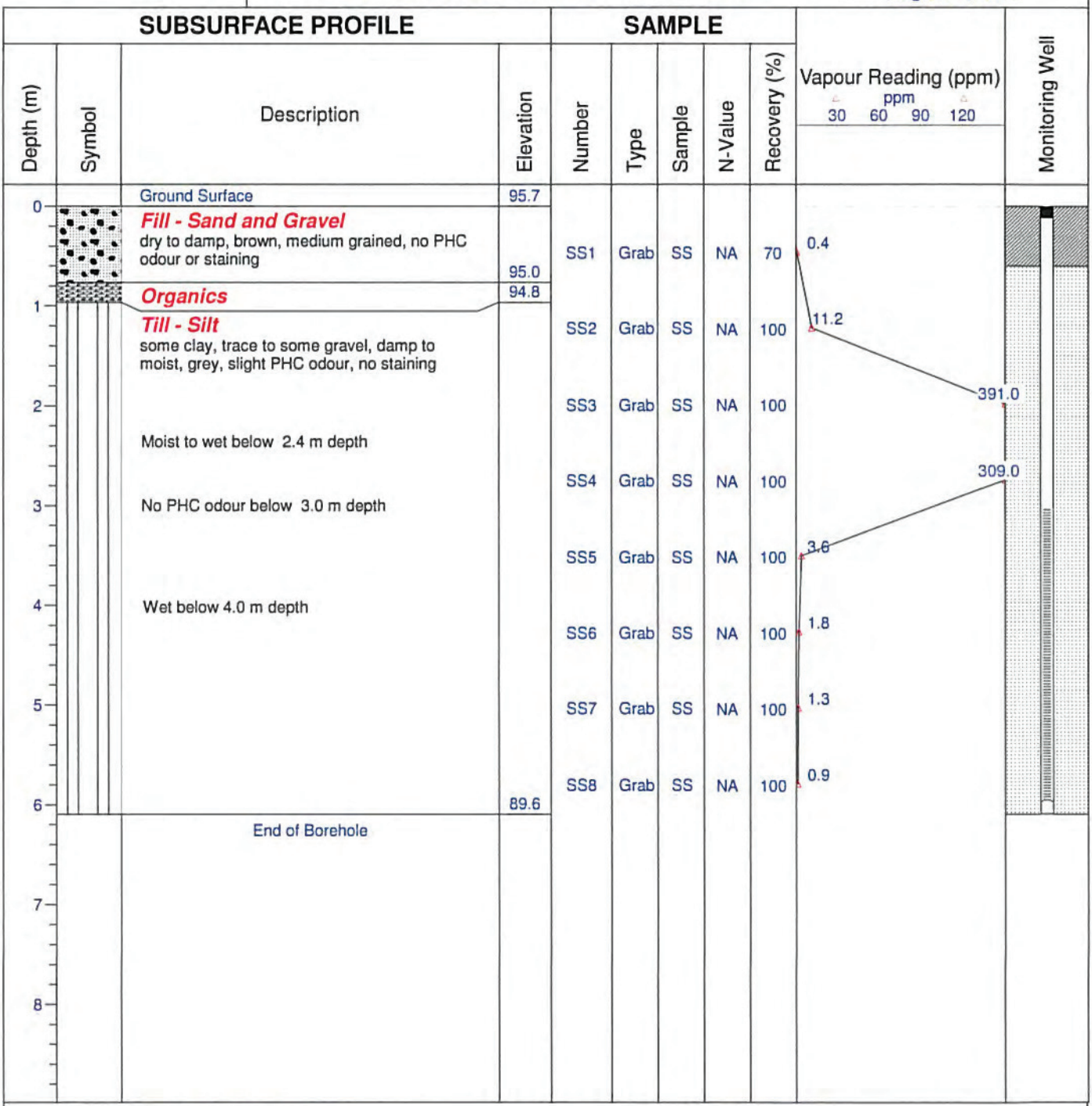
# Stratigraphic and Instrumentation Log: MW13-45

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** W. Tabaczuk
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013




***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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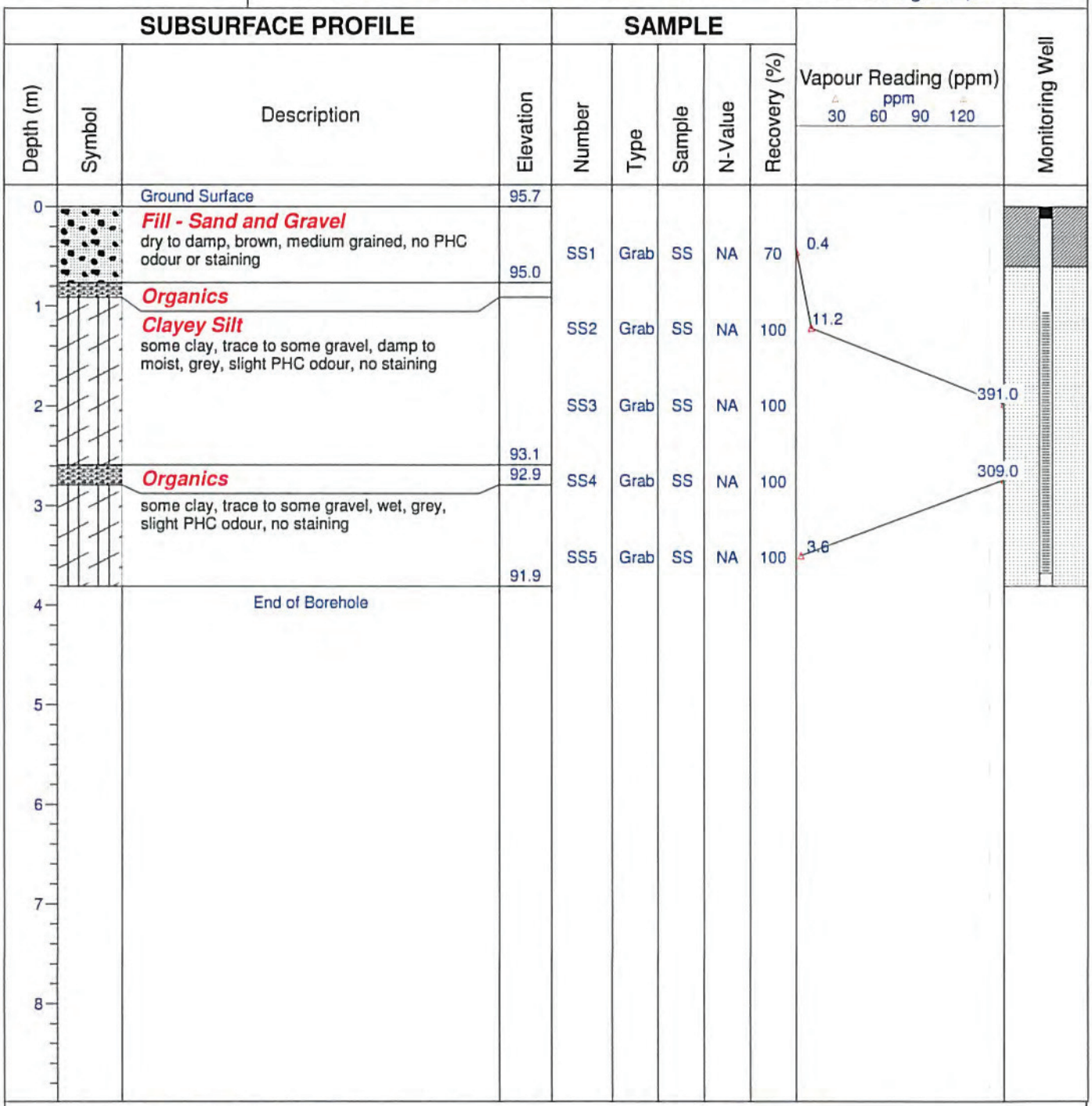
# Stratigraphic and Instrumentation Log: MW13-46

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** W. Tabaczuk
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013




***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-47

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** W. Tabaczuk
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

## SUBSURFACE PROFILE

| Depth (m) | Symbol | Description | Elevation |
|---|---|---|---|
| 0 | | Ground Surface | 95.7 |
| | | ***Fill - Sand and Gravel*** some silt, dry, brown, medium grained, no PHC odour or staining | 95.0 |
| 1 | | ***Clayey Silt*** trace organics, trace gravel, damp, grey, no PHC odour or staining | |
| | | No gravel slight PHC odour below 1.5 m depth | |
| 2 | | | |
| 3 | | Moist to wet below 3.0 m depth | |
| 4 | | | |
| | | | 90.9 |
| 5 | | End of Borehole | |
| 6 | | | |
| 7 | | | |
| 8 | | | |

## SAMPLE

| Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) |
|---|---|---|---|---|---|
| SS1 | Grab | SS | NA | 70 | 0.6 |
| SS2 | Grab | SS | NA | 100 | 10.3 |
| SS3 | Grab | SS | NA | 100 | 62.6 |
| SS4 | Grab | SS | NA | 70 | 10.5 |
| SS5 | Grab | SS | NA | 60 | 1.0 |
| SS6 | Grab | SS | NA | 30 | 0.6 |
| SS7 | Grab | SS | NA | 5 | 0.3 |

Vapour Reading (ppm) ppm 30 60 90 120

Monitoring Well

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-48

***Project No.:*** 75040.002
***Project:*** Supplemental Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** W. Tabaczuk
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** August 6, 2013

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) (ppm: 30, 60, 90, 120) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | | Ground Surface | 95.7 | | | | | | | |
| | | ***Fill - Sand and Gravel*** damp, brown, medium grained, no PHC odour or staining | 95.0 | SS1 | Grab | SS | NA | 60 | 0.0 | |
| 1 | | ***Fill - Sand*** trace to some silt, damp, brown | 94.2 | SS2 | Grab | SS | NA | NA | 0.2 | |
| 2 | | ***Silty Clay*** Silty clay, damp to moist, grey, slight PHC odour or staining | | SS3 | Grab | SS | NA | NA | 4.7 | |
| | | Wet below 2.7 m depth | | SS4 | Grab | SS | NA | NA | 0.5 | |
| 3 | | | | SS5 | Grab | SS | NA | NA | 0.3 | |
| 4 | | | 91.5 | SS6 | Grab | SS | NA | NA | 0.1 | |
| | | ***Till - Silt*** trace clay, trace gravel, wet, grey | | | | | | | | |
| 5 | | | 90.5 | SS7 | Grab | SS | NA | NA | 0.0 | |
| | | End of Borehole | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** Geodetic
***Casing Elevation:*** 0
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-55D

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 15, 2014

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** Trace silt, trace clay, damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 50 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 50 | 0.0 | |
| | | ***Limestone*** Fractured throughout | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-57D

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 14, 2014

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Ground Surface | 0.0 | | | | | | | |
| 0 | | ***Fill - Sand and Gravel***<br>Trace silt, trace clay, damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 40 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 40 | 0.0 | |
| | | ***Limestone***<br>Fractured throughout | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

Vapour Reading (ppm): ppm 30 60 90 120

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-60D

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 14, 2014

| Depth (m) | Symbol | Description | Elevation | Sample Number | Sample Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Ground Surface | 0.0 | | | | | | | |
| 0 | | ***Fill - Sand and Gravel*** Trace silt, trace clay, damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 50 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 50 | 0.0 | |
| | | ***Limestone*** Fractured throughout | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

Vapour Reading (ppm): ppm 30 60 90 120

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-62

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 15, 2014

| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) 30 60 90 120 | Monitoring Well |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Ground Surface | 0.0 | | | | | | | |
| 0 | | ***Fill - Sand and Gravel*** Damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 40 | 0.0 | |
| 1 | | | -1.2 | SS2 | Grab | SS | NA | 40 | 0.0 | |
| | | ***Limestone*** Fractured throughout | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

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# Stratigraphic and Instrumentation Log: MW13-63

***Project No.:*** 75040.003
***Project:*** Phase II ESA
***Client:*** Kempest Property Management Inc.
***Location:*** Merivale and Baseline Road, Ottawa, Ontario

***Logged By:*** M. Kosiw
***Entered By:*** L. DiAngelo
***Project Manager:*** M. Ryan
***Drill Date:*** January 15, 2014

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Depth (m) | Symbol | Description | Elevation | Number | Type | Sample | N-Value | Recovery (%) | Vapour Reading (ppm) ppm 30 60 90 120 | Monitoring Well |
| 0 | | Ground Surface | 0.0 | | | | | | | |
| | | ***Fill - Sand and Gravel*** Damp, brown, fine to coarse grained, no PHC odour or staining | | SS1 | Grab | SS | NA | 20 | 0.0 | |
| 1 | | | -1.2 | | | | | | | |
| | | ***Limestone*** Fractured throughout | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | -9.1 | | | | | | | |
| | | End of Borehole | | | | | | | | |

***Drilled By:*** Strata Soil Sampling
***Drill Method:*** GM 100
***Vapour Instrument:*** Photoionization Detector
***Well Casing Size:*** 38 mm

***Datum:*** NA
***Casing Elevation:*** NA
***Ground Elevation:*** NA
***Sheet:*** 1 of 1

Certificate of Analysis

Report Date: 09-Nov-2020

**Client:** **Paterson Group Consulting Engineers**

Order Date: 4-Nov-2020

**Client PO:** **31480**

**Project Description: PE5066**

| | | | | | |
|---|---|---|---|---|---|
| | **Client ID:** | BH4-20-SS4 | - | - | - |
| | **Sample Date:** | 02-Nov-20 14:00 | - | - | - |
| | **Sample ID:** | 2045388-01 | - | - | - |
| | **MDL/Units** | Soil | - | - | - |
| **Physical Characteristics** | | | | | |
| % Solids | 0.1 % by Wt. | 87.2 | - | - | - |
| **General Inorganics** | | | | | |
| pH | 0.05 pH Units | 7.13 | - | - | - |
| Resistivity | 0.10 Ohm.m | 32.1 | - | - | - |
| **Anions** | | | | | |
| Chloride | 5 ug/g dry | 75 | - | - | - |
| Sulphate | 5 ug/g dry | 98 | - | - | - |

# APPENDIX 2

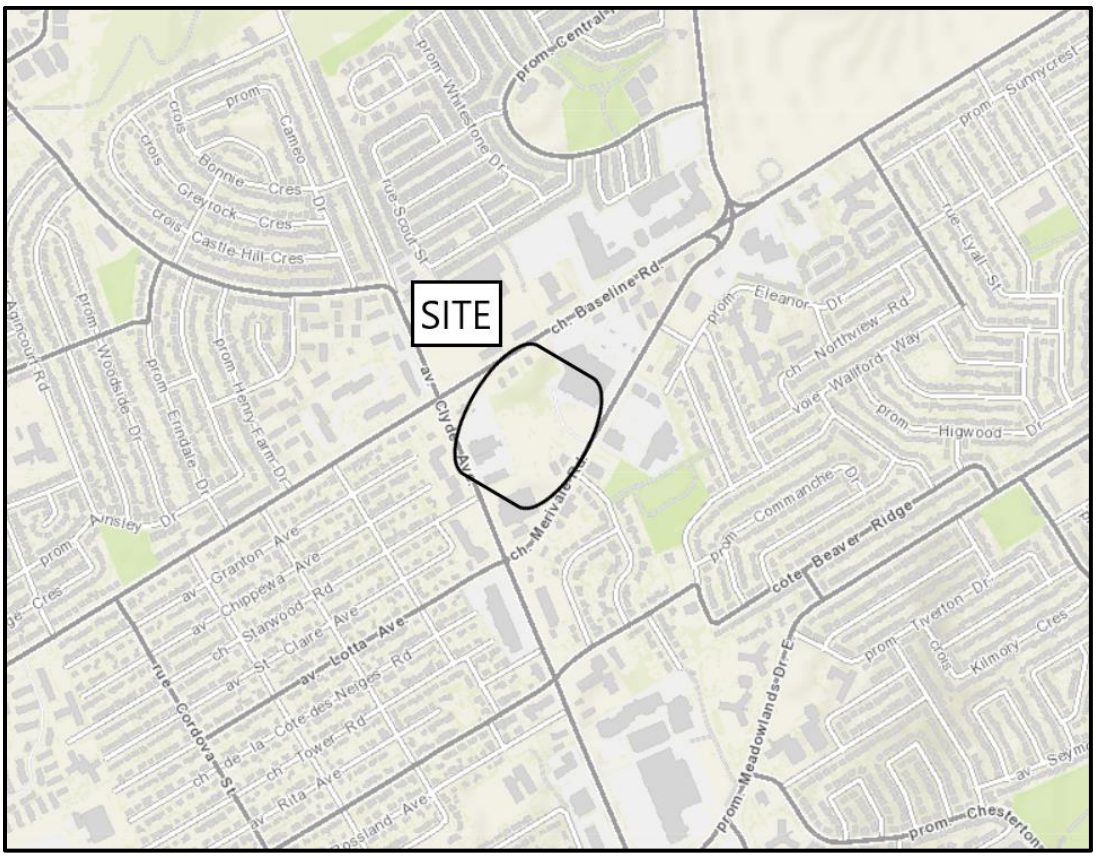
**FIGURE 1 - KEY PLAN**

**FIGURE 2 - AERIAL PHOTOGRAPH - 1965**

**FIGURE 3 - AERIAL PHOTOGRAPH - 2002**

**FIGURE 4 - AERIAL PHOTOGRAPH - 2019**

**DRAWING PG5561-1 - TEST HOLE LOCATION PLAN**




# FIGURE 1

## KEY PLAN


# FIGURE 2

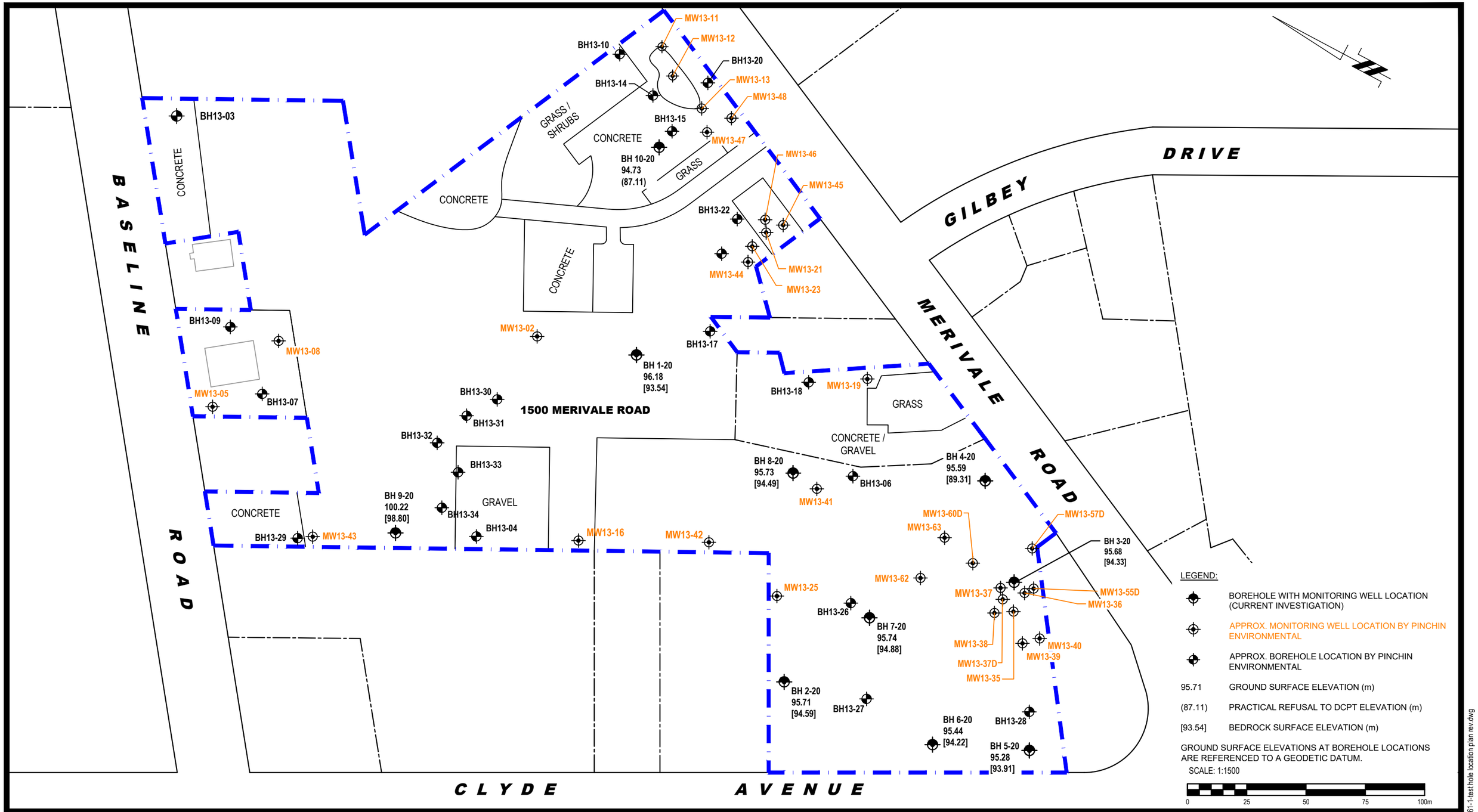
**Aerial Photograph - 1965**


# FIGURE 3

## Aerial Photograph - 2002


# FIGURE 4

## Aerial Photograph - 2019




LEGEND:

- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- APPROX. MONITORING WELL LOCATION BY PINCHIN ENVIRONMENTAL
- APPROX. BOREHOLE LOCATION BY PINCHIN ENVIRONMENTAL
- 95.71 GROUND SURFACE ELEVATION (m)
- (87.11) PRACTICAL REFUSAL TO DCPT ELEVATION (m)
- [93.54] BEDROCK SURFACE ELEVATION (m)

GROUND SURFACE ELEVATIONS AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

SCALE: 1:1500

0 25 50 75 100m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| NO. | REVISIONS | DATE | INITIAL |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| 1 | BOREHOLES BY OTHERS ADDED | 05/02/2021 | SD |

CLARIDGE HOMES
GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY BUILDINGS
1500 MERIVALE ROAD
OTTAWA, ONTARIO

Title:
# TEST HOLE LOCATION PLAN

| | |
|---|---|
| Scale: 1:1500 | Date: 11/2020 |
| Drawn by: NFRV | Report No.: PG5561-1 |
| Checked by: SD | Dwg. No.: PG5561-1 |
| Approved by: DJG | Revision No.: 1 |

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