Geotechnical Engineering

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Geotechnical Investigation

Proposed Multi-Storey Buildings
1509 Merivale Road
Ottawa, Ontario

Prepared For
Katasa

May 7, 2021

Report: PG5812-1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Katasa to prepare a geotechnical investigation report for the proposed multi-storey buildings to be located at 1509 Merivale Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation report were to:

- ❏ Evaluate the subsoil and groundwater conditions at this site by means of previous boreholes conducted by Paterson and others;.
- ❏ 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.

Investigating for the presence or potential presence of contamination on the subject property is not part of the scope of this geotechnical investigation report.

2.0 Proposed Development

Based on the available drawings, it is understood that the proposed development will consist of two multi-storey buildings, each with 1 level of underground parking, which will occupy the majority of the site footprint. Asphalt-paved access lanes and parking areas with landscaped margins are also anticipated surrounding the proposed buildings. It is further anticipated that the proposed development will be municipally serviced.

3.0 Method of Investigation

3.1 Field Program

A previous Phase II Environmental Site Assessment (ESA) was conducted by Paterson on November 23, 1998. During this time, 6 boreholes were advanced to a maximum depth of 2.7 m below the existing ground surface.

A previous Phase I and Phase II ESA were conducted by others between February 7, 2015 and September 7, 2017. During this period, 39 boreholes were advanced to a maximum depth of 10.8 m below the existing ground surface.

The Soil Profile and Test Data sheets from Paterson and others are provided in Appendix 1. The borehole locations are shown on Drawing PG5812-1 - Test Hole Location Plan in Appendix 2.

3.2 Field Survey

The test hole locations from the geotechnical investigations conducted by others were surveyed by others and are understood to be referenced to a geodetic datum.

The location of the test holes and ground surface elevation at each test hole location are presented on Drawing PG5812-1 Test Hole Location Plan in Appendix 2.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by a low-rise commercial building with associated asphalt-paved parking areas and access lanes, and with mature trees along the east boundary of the site. A low-clearance, overhead billboard is present on the western site boundary, along Merivale Road. The site is bordered to the north and south by commercial properties, to the west by Merivale Road and to the east by Kerry Crescent. The site is generally flat and at grade with Merivale Road at approximate geodetic elevation 95 to 96 m.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the test hole locations consists of a thin asphalt layer overlying either sand and gravel or fill, consisting of sand and gravel with some silt, extending to approximate depths of 0.4 to 2.4 m below the existing ground surface.

A glacial till layer was generally encountered underlying the sand and gravel or fill, extending to approximate depths of 1.8 to 2.7 m. The glacial till generally varied from gravelly sand with some silt to silty clay with some sand and gravel.

Practical refusal of the augers was generally encountered at approximate depths of 1.2 to 2.7 m below the existing ground surface.

Bedrock

Bedrock was cored in boreholes MW15-1 to MW15-11, BH/MW205, BH/MW207, BH/MW208, and MW301 to MW312, by others, to approximate depths between 4.6 and 10.8 m. According to the boreholes by others, the bedrock varies from shale to a shaley limestone.

The Rock Quality Designation (RQD) was only listed on the borehole logs for MW15-10 and MW15-11. Based on the RQDs of the bedrock core from these 2 boreholes, the bedrock is of very poor to poor quality, increasing to fair quality by 3.6 m below the existing ground surface.

Based on available geological mapping, the local bedrock consists of limestone and dolomite of the Gull River formation with a drift thickness of approximately 3 to 5 m.

4.3 Groundwater

Groundwater levels were measured in the monitoring wells by others. The observed groundwater levels are summarized in Table 1 below and on the next page:

Table 1 - Summary of Groundwater Level Readings by Paterson and Others

Test Hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Recording Date
BH 1	-	2.44	-	November 23, 1998
BH 2	-	2.44	-	November 23, 1998
BH 3	-	Dry	-	November 23, 1998
BH 4	-	Dry	-	November 23, 1998
BH 5	-	Dry	-	November 23, 1998
BH 6	-	Dry	-	November 23, 1998
MW15-1	95.47	1.6	93.87	April 21, 2016
MW15-2	94.99	1.1	93.89	April 21, 2016
MW15-3	95.36	2.5	92.86	April 21, 2016
MW15-4	95.37	1.4	93.97	April 21, 2016
MW15-5	95.36	1.9	93.46	April 21, 2016
MW15-6	95.11	1.3	93.81	April 21, 2016
MW15-7	94.80	0.8	94.0	April 21, 2016
MW15-8	94.58	1.0	93.58	April 21, 2016
MW15-9	94.90	1.5	93.4	April 21, 2016
MW15-10	95.70	1.8	93.9	April 21, 2016
MW15-11	95.70	2.1	93.6	April 21, 2016
BH/MW205	95.24	1.4	93.84	April 21, 2016
BH/MW207	95.47	2.6	92.87	April 21, 2016
BH/MW208	94.68	1.8	92.88	April 21, 2016

Table 1 (continued) - Summary of Groundwater Level Readings by Paterson and Others

Test Hole Number	Ground Surface Elevation (m)	Groundwater Depth (m)	Groundwater Elevation (m)	Recording Date
MW301	95.70	2.3	93.4	September 14, 2017
MW302	95.25	2.0	93.25	September 14, 2017
MW303	95.42	1.8	93.62	September 14, 2017
MW304	95.70	2.3	93.4	September 14, 2017
MW305	95.70	2.3	93.4	September 14, 2017
MW306	95.70	2.5	93.2	September 14, 2017
MW307	95.38	2.3	93.08	September 14, 2017
MW308	95.35	2.2	93.15	September 14, 2017
MW309	95.43	2.3	93.13	September 14, 2017
MW310	95.50	2.3	93.2	September 14, 2017
MW311	95.70	2.3	93.4	September 14, 2017
MW312	94.97	2.9	92.07	September 14, 2017

Note: The ground surface elevations at the borehole locations are understood to be referenced to a geodetic datum.

It should be noted that the groundwater levels could be influenced by surface water infiltrating the backfilled boreholes. Long-term groundwater levels can also be estimated based on the observed colour and consistency of the recovered soil samples. Based on these observations, it is estimated that the long-term groundwater table can be expected at approximately 2 to 3 m below ground surface.

However, 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

From a geotechnical perspective, the subject site is suitable for the proposed development. It is recommended that foundation support for the proposed buildings consist of conventional spread footings placed on clean, surface sounded bedrock.

Bedrock removal will be required for the proposed building excavations. Bedrock removal may also be required for installation of site services, depending on the depths of the proposed utilities.

Expansive shale bedrock may present at this site. Precautions should be provided during construction to reduce the risks associated with the potentially heaving shale bedrock. This is discussed further in Section 6.7.

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 building perimeter. Under paved areas, existing construction remnants, such as foundation walls, should be excavated to a minimum of 1 m below final grade.

Bedrock Removal

Where the bedrock is weathered and/or where only small quantities of bedrock need to be removed, hoe ramming is an option for bedrock removal. Where large quantities of bedrock need to be removed, line drilling in conjunction with controlled blasting may be required.

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 conducted prior to commencing construction. The extent of the survey should be determined by the blasting consultant and sufficient to respond to any inquiries/claims related to the blasting operations.

As a general guideline, peak particle velocity (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 could be the cause of vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain 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 cause or the source of detrimental vibrations at the nearby buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the permissible vibrations, 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). These guidelines are current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people, a pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed buildings.

Fill Placement

Fill used for grading beneath the proposed building footprints, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. It 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 building area should be compacted to at least 98% of its 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. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of their respective SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on clean, surface sounded bedrock can be designed using a bearing resistance value at ultimate limit states (ULS) of **1,000 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance at ULS.

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 with a rock hammer.

Footings bearing on an acceptable bedrock bearing surface and designed for the bearing resistance values provided herein will be subjected to negligible 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 of the bedrock, such as concrete.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C**. A higher seismic site class, such as Class A or B, may be achievable for this site. However, a site specific shear wave velocity test is required 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.

The soils underlying the proposed foundations are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab Construction

For the proposed development, all overburden soil will be removed from the building footprint, leaving the bedrock as the founding medium for the basement floor slab. It is anticipated that the basement area for the proposed building 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.

Any soft areas in the basement slab subgrade should be removed and backfilled with appropriate backfill material prior to placing fill. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

In consideration of the groundwater conditions at the site, an underslab drainage system, consisting of lines of perforated drainage pipe subdrains connected to a positive outlet, should be provided in the subfloor fill under the lower basement floor. This is discussed further in Subsection 6.1.

5.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, in our opinion, 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 dry unit weight of 20 kN/m^3.

The applicable effective unit weight of the retained soil can be estimated as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when calculating the effective unit weight.

The total earth pressure (P_{AE}) includes both the static earth pressure component (P_o) and the seismic component (ΔP_{AE}).

Static Earth Pressures

The static horizontal earth pressure (P_o) can be calculated by 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 soil, 0.5
γ = unit weight of fill of the applicable retained soil (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 seismic earth pressure (ΔP_{AE}) can be calculated using the earth pressure distribution equal to $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = 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. The vertical seismic coefficient is assumed to be zero.

The earth force component (P_o) under seismic conditions could be calculated using $P_o = 0.5\ K_o \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions presented 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 Pavement Design

For design purposes, it is recommended that the rigid pavement structure for the underground parking level 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 2 below. The flexible pavement structure presented in Table 3 should be used for at grade access lanes and heavy loading parking areas.

Table 2 - 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 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 3 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas	
Thickness (mm)	**Material Description**
40	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
450	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

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.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% 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 recommended that a perimeter foundation drainage system be provided for the proposed buildings. The system should consist of a 150 mm diameter perforated and corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, which is placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Where insufficient room is available for exterior backfill, it is suggested that the composite drainage system (such as Delta Drain 6000 or equivalent) be secured against the temporary shoring system, extending to a series of drainage sleeves inlets through the building foundation wall at the footing/foundation wall interface. The drainage sleeves should be at least 150 mm diameter and be spaced 3 m along the perimeter foundation walls. An interior perimeter drainage pipe should be placed along the building perimeter along with the underslab drainage system. The perimeter drainage pipe and sub-slab drainage system should direct water to sump pit(s) within the underground level.

Underslab Drainage

Underslab drainage will be required to control water infiltration under the lowest level slab. For preliminary design purposes, we recommend that 100 or 150 mm perforated pipes be placed at approximate 6 m centres underlying the basement floor slab. 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 space is available, 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 composite drainage system, such as Delta Drain 6000 or an approved equivalent. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

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 1.5 m thick soil cover, or an equivalent combination of soil cover and foundation insulation, should be provided in this regard.

Exterior unheated footings, such as those for isolated piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection. The recommended minimum thickness of soil cover is 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 and very poor to poor quality bedrock 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 in the overburden and very poor to poor quality bedrock, above the groundwater level and 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.

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

Dependent on the final depth of the excavation, and the proximity of the excavation to the site boundaries, it is anticipated that a temporary shoring system may be required to support the overburden soils and very poor to poor quality bedrock during the building excavation. The design and approval of the temporary 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 their stability.

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

Table 4 - 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 (γ), kN/m^3	21
Submerged Unit Weight (γ), 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 and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm and should extend from the spring line of the pipe to at least 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the site excavated materials above the cover material if the operations are carried out in dry weather conditions.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.5 m below finished grade) and above the cover material should match the soils exposed at the trench walls to minimize 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 material's standard Proctor maximum dry density.

6.5 Groundwater Control

Groundwater Control for Building Construction

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.

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

Based on the subsurface conditions encountered at the subject site, it is anticipated that the adjacent structures are founded on bedrock or the glacial till deposit. Therefore, no adverse effects from short term and/or long term dewatering are expected for the surrounding structures.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project. The subsoil conditions at this site 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 and 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.

Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost into the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions.

6.7 Protection of Potential Expansive Bedrock

Upon being exposed to air and moisture, shale may decompose into thin flakes along the bedding planes. Previous studies have concluded shales containing pyrite are subject to volume changes upon exposure to air. As a result, the formation of jarosite crystals by aerobic bacteria occurs under certain ambient conditions.

It has been determined that the expansion process does not occur or can be retarded when air (i.e. oxygen) is prevented from contact with the shale and/or the ambient temperature is maintained below 20°C, and/or the shale is confined by pressures in excess of 70 kPa. The latter restriction on the heaving process is probably the major reason why damage to structures has, for the greater part, been confined to slabs-on-grade rather than footings.

Based on the borehole logs by others, expansive shale may be encountered at the subject site. To reduce the long term deterioration of the shale, exposure of the bedrock surface to oxygen should be kept as low as possible. The bedrock surface within the proposed building footprint should be protected from excessive dewatering and exposure to ambient air. A 50 mm thick concrete mud slab, consisting of minimum 15 MPa lean concrete, should be placed on the exposed bedrock surface within a 48 hour period of being exposed. The excavated sides of the exposed bedrock should be sprayed with a bituminous emulsion to seal bedrock from exposure to air and dewatering.

Another option for protecting the shale from deterioration is placing granular fill over the exposed surface within a 48 hour period after exposure. Preventing the dewatering of the shale bedrock will also prevent the rapid deterioration and expansion of the shale bedrock. This can be accomplished by spraying bituminous emulsion as noted above.

7.0 Recommendations

For the foundation design data provided herein to be applicable, a materials testing and observation services program is required to be completed. The following aspects should be performed by the geotechnical consultant:

- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.
- ❏ Review bedrock excavation activities and exposed vertical bedrock faces.

A report confirming the construction 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 recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The recommendations provided in this report are intended for the use of design professionals associated with this project. Contractors bidding on or undertaking the work should examine the factual information contained in this report and the site conditions, satisfy themselves as to the adequacy of the information provided for construction purposes, supplement the factual information if required, and develop their own interpretation of the factual information based on both their and their subcontractors construction methods, equipment capabilities and schedules.

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 Katasa or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Owen Canton, E.I.T.

Scott S. Dennis, P. Eng.

Report Distribution:

- ❏ Katasa (e-mail copy)
- ❏ Paterson Group

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS & TERMS

SOIL PROFILE AND TEST DATA SHEETS BY OTHERS

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. **E1677**

HOLE NO. **BH 1**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.10							
Grey crushed stone 0.43							
GLACIAL TILL: Compact to dense, brown sandy silt, some gravel		SS	1	54	42	1	
		SS	2	50	18	2	
2.34		SS	3	67	41		
Weathered **LIMESTONE** with occasional shale seams 2.59							
End of Borehole							
Auger refusal in inferred bedrock @ 2.59m depth							
(Open hole WL @ 2.44m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Lower Explosive Limit %

20 40 60 80

MONITORING WELL CONSTRUCTION

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. **E1677**

HOLE NO. **BH 2**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.08							
Grey crushed stone							
0.51							
GLACIAL TILL: Compact to very dense, brown sandy silt, some gravel		SS	4	79	14	1	
		SS	5	42	50+		
		SS	6	56	50+	2	
2.30							
Weathered **LIMESTONE** with occasional shale seams		SS	7	100	50+		
2.74							
End of Borehole							
Auger refusal in inferred bedrock @ 2.74m depth.							
(Open hole WL @ 2.44m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Lower Explosive Limit %

20 40 60 80

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

MONITORING WELL CONSTRUCTION

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

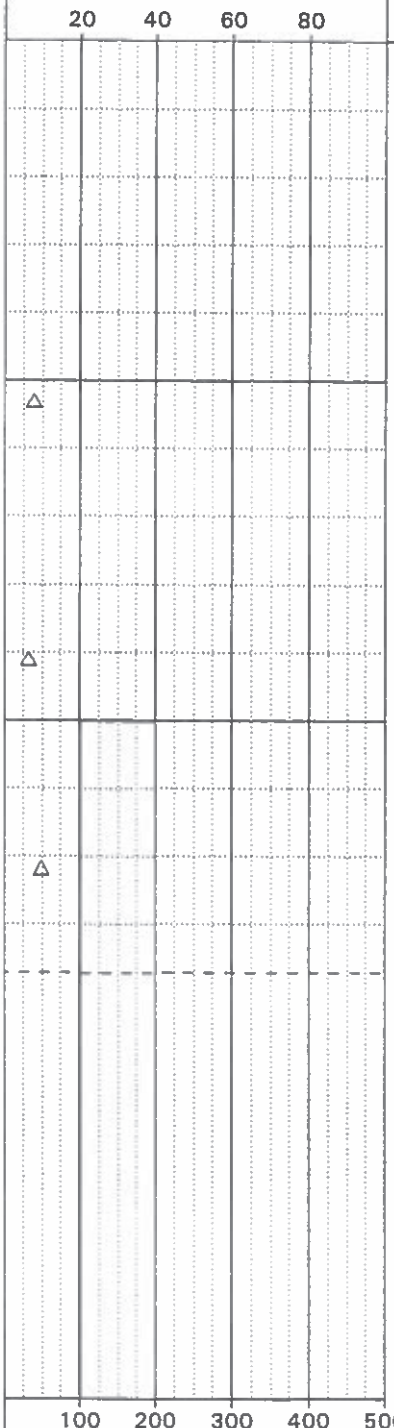
BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. E1677

HOLE NO. BH 3

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.05							
Grey crushed stone							
0.45							
GLACIAL TILL: Dense, dark brown to brownish grey sandy silt, some gravel		SS	8	88	39	1	
		SS	9	17	50+	2	
		SS	10	71	25		
2.74							
End of Borehole							
Auger refusal on inferred bedrock @ 2.74m depth.							
(BH dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Lower Explosive Limit %



MONITORING WELL CONSTRUCTION

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. **E1677**

HOLE NO. **BH 4**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.11							
Grey crushed stone 0.27							
FILL: Brown sand 0.47							
GLACIAL TILL: Dense, brown sandy silt, some gravel		AU	11			1	
		SS	12		61		
		AU	13			2	
2.29 End of Borehole							
Auger refusal on inferred bedrock @ 2.29m depth.							
(BH dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Lower Explosive Limit %

20 40 60 80

MONITORING WELL CONSTRUCTION

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. **E1677**

HOLE NO. **BH 5**

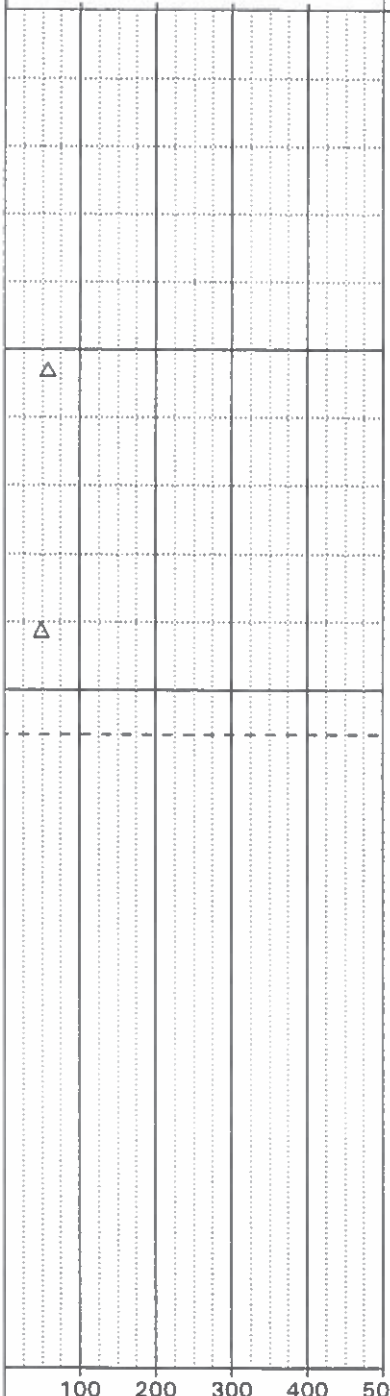
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.10							
Grey crushed stone 0.25							
FILL: Brown sand 0.51							
GLACIAL TILL: Dense to compact, brown sandy silt, some gravel		SS	14	54	40	1	
		SS	15	88	28	2	
End of Borehole 2.13							
Auger refusal on inferred bedrock @ 2.13m depth.							
(BH dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Lower Explosive Limit %

20 40 60 80

MONITORING WELL CONSTRUCTION



JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Geotechnical and Environmental Engineers
28 Concourse Gate, Unit 1, Nepean, Ont. K2E 7T7

SOIL PROFILE & TEST DATA

Phase II Environmental Site Assessment
Lancaster Plaza, 1509-1531 Merivale Road
Nepean, Ontario

DATUM

REMARKS

BORINGS BY Truck-mount Drill DATE 23 November 1998

FILE NO. **E1677**

HOLE NO. **BH 6**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	
Asphaltic concrete 0.06							
Grey crushed stone 0.16							
FILL: Dark brown, mixture of clay, silt and sand							
0.60		AU	16				
		SS	17	75	61	1	
GLACIAL TILL: Very dense to compact, brown sandy silt							
		SS	18	79	18	2	
2.29							
End of Borehole							
Auger refusal on inferred bedrock @ 2.29m depth.							
(BH dry upon completion)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Lower Explosive Limit %

20 40 60 80

MONITORING WELL CONSTRUCTION

100 200 300 400 500

Gastech 1314 Rdg. (ppm)

▲ Full Gas Resp. △ Methane Elim.

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 relative strength of cohesionless soils is the compactness condition, 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. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'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 shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

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, S_t, is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

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 NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, 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, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water 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 at which xx% of the soil, by weight, is of finer grain sizes 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 x 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

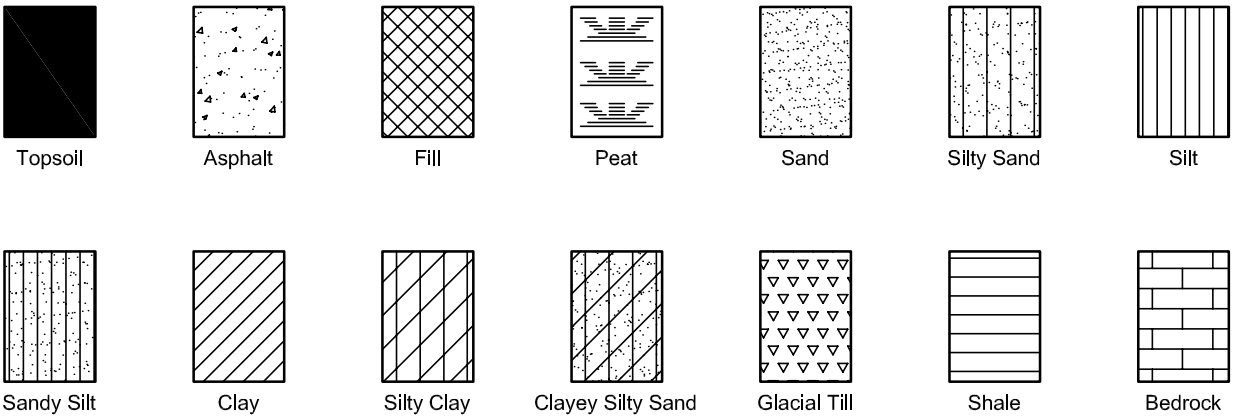
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

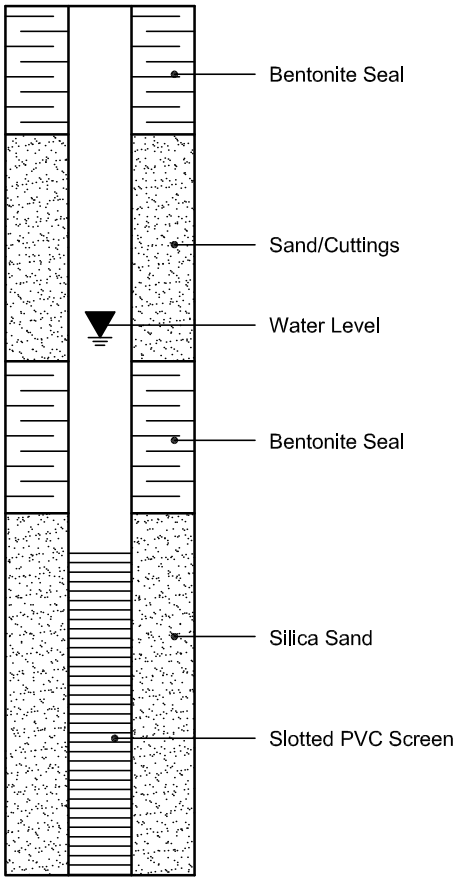
SYMBOLS AND TERMS (continued)

STRATA PLOT

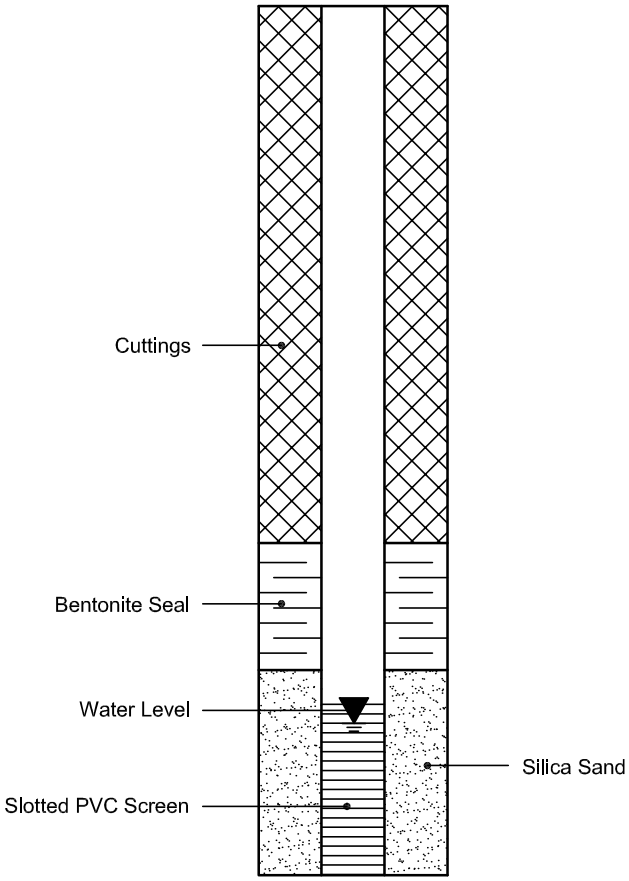


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Log of Borehole MW15-1

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 3

Page. 1 of 1

Date Drilled: 3/31/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ☒
Auger Sample ▯
SPT (N) Value ○
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 50 mm	95.47	0
		SAND AND GRAVEL	95.4	
		Disturbed native soil, grey and brown, moist, no odour	94.8	
		TILL		1
		Gravelly sand, some silt, brown, moist to wet, no odour		
		Refusal at 2.3 m Depth on Bedrock	93.49	2
		SHALE BEDROCK	93.2	
		Dark grey cuttings, brown water in air flushing medium, no odour		3
				4
		Borehole Terminated at 4.6 m Depth	90.9	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	
S3	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
10 days	1.3	-
April 21, 2016	1.6	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA GDT 10/7/16

Log of Borehole MW15-2

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 4

Page. 1 of 1

Date Drilled: 3/31/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ▯
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 50 mm	94.99	0
		SAND AND GRAVEL	94.9	
		Disturbed native soil, grey and brown, moist, no odour	94.7	
		TILL		
		Gravelly sand, some silt, brown, moist, no odour	93.56	1
		Refusal at 2.3 m Depth on Bedrock	92.7	2
		SHALE BEDROCK		
		Dark grey cuttings, brown water in air flushing medium, no odour		3
				4
		Borehole Terminated at 4.6 m Depth	90.4	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	
S3	

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA GDT 10/7/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
10 days	0.8	-
April 21, 2016	1.1	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW15-3

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 5

Page 1 of 1

Date Drilled: 3/31/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ◫
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 60 mm	95.36	0
		SAND AND GRAVEL	95.3	
		Disturbed native soil, with some gravel, grey and brown, moist, no odour		
			94.0	1
		TILL		
		Gravelly sand, some silt, some shale cobbles present, brown, moist, no odour		
		Refusal at 2.4 m Depth on Bedrock		2
			93.0	
		SHALE BEDROCK		
		Dark grey cuttings, brown water in air flushing medium, no odour	92.59	3
				4
				5
				6
				7
				8
			86.2	9
		Borehole Terminated at 9.2 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	
S3	
S4	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 19 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
10 days	2.1	-
April 21, 2016	2.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-4

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 6

Page. 1 of 1

Date Drilled: 3/31/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 60 mm	95.37	0
		SAND AND GRAVEL Imported sand and gravel from a commercial pit, with silt and clay, brown to dark brown then grey, moist, no odour	95.3	
			93.63	2
		Refusal at 2.4 m Depth on Bedrock		
		SHALE BEDROCK Dark grey cuttings, brown water in air flushing medium, no odour	93.0	
			90.8	4
		Borehole Terminated at 4.6 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	
S3	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
10 days	1.2	-
April 21, 2016	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-5

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 7

Page. 1 of 1

Date Drilled: 4/30/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ▮
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 60 mm	95.36	0
		SAND AND GRAVEL	95.3	
		Disturbed native soil, grey and brown, moist, no odour		
		(Inferred from MW15-1)	94.7	
		TILL		1
		Gravelly sand, some silt, brown, moist turning moist/wet, no odour		
		(Inferred from MW15-1)		
			93.24	2
		SHALE BEDROCK	93.0	
		Dark grey cuttings, brown water in air flushing medium, no odour		3
				4
			91.1	
		Borehole Terminated at 4.3 m Depth		
		Note: stratigraphy inferred from MW15-1		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
8 days	2.1	-
April 21, 2016	1.9	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-6

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 8

Page. 1 of 1

Date Drilled: 4/30/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength (20 40 60 80 / 50 100 150 200 kPa)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 60 mm	95.11	0				
		SAND AND GRAVEL	95.0					
		Disturbed native soil, grey and brown, moist, no odour *(Inferred from MW15-1)*	94.4					
		TILL Gravelly sand, some silt, brown, moist turning moist/wet, no odour *(Inferred from MW15-1)*	93.43	1				
				2				
		SHALE BEDROCK Dark grey cuttings, brown water in air flushing medium, no odour	92.7					
				3				
			90.9	4				
		Borehole Terminated at 4.2 m Depth						
		Note: stratigraphy inferred from MW15-1						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
8 days	1.7	-
April 21, 2016	1.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-7

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 9

Page. 1 of 1

Date Drilled: 6/26/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: DC Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test —
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 40 mm	94.8	0
		FILL Sand and gravel, grey and brown, moist, no odour	94.7 / 94.4	
		TILL Brown, silty clay, some sand and gravel, moist, no odour	93.47	1
		SHALE BEDROCK Dark grey cuttings, brown water in air flushing medium, no odour	93.0	2
				3
				4
			90.2	
		Borehole Terminated at 4.57 m Depth		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
11 days	1.3	
April 21, 2016	0.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-8

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 10

Page. 1 of 1

Date Drilled: 6/26/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: DC Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 40 mm	94.58	0				
		SAND AND GRAVEL Disturbed native soil, brown, moist, no odour	94.5 / 94.4					
		TILL Brown, silty clay, some sand and gravel, moist, no odour	93.4	1				
		SHALE BEDROCK Dark grey cuttings, brown water in air flushing medium, no odour	93.28	2				
				3				
				4				
			90.0					
		Borehole Terminated at 4.57 m Depth						

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
11 days	1.3	
April 21, 2016	1.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW15-9

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 11

Page. 1 of 1

Date Drilled: 6/26/15

Drill Type: Geoprobe

Datum: Geodetic

Logged by: DC Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 50 100 150 200)	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 40 mm	94.9	0				
		SAND AND GRAVEL	94.8					
		Disturbed native soil, brown, moist, no odour	94.8					
		TILL						
		Brown, silty clay, some sand and gravel, moist, no odour	93.9	1				
		SHALE BEDROCK						
		Dark grey cuttings, brown water in air flushing medium, no odour	93.21	2				
				3				
				4				
			90.3					
		Borehole Terminated at 4.57 m Depth						

NOTES:
1. Borehole data requires interpretation by exp before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
11 days	1.7	
April 21, 2016	1.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA GDT 10/7/16

Log of Borehole MW15-10

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 12

Page. 1 of 1

Date Drilled: 7/2/15

Drill Type: Manual Crew

Datum: Geodetic

Logged by: DC Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
			95.7	0
		CONCRETE SLAB ~ 100 mm	95.6	
		SAND AND GRAVEL Disturbed native soil, brown, moist, no odour	95.1	
		TILL Brown, silty clay, some sand and gravel, moist, no odour		1
			94.1	
▼		**WEATHERED ROCK WITH TILL SEAMS** Dark grey cuttings, no odour		2
			93.49	
			92.9	
		SHALE BEDROCK Dark grey cuttings, no odour		3
			91.9	
		Borehole Terminated at 3.8 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

0/1482

25/4913

25/1490

SAMPLES	Natural Unit Wt. kN/m³
SS1	
SS2	
SS3	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 32 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
5 days	2.2	
April 21, 2016	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.83 - 2.14	55	0
2	2.14 - 2.44	100	0
3	2.44 - 2.75	33	0
4	2.75 - 3.51	93	33
5	3.51 - 3.81	100	71

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole MW15-11

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 13

Page. 1 of 1

Date Drilled: 7/2/15

Drill Type: Manual Crew

Datum: Geodetic

Logged by: DC Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		CONCRETE SLAB ~ 100 mm	95.7	0				
		SAND AND GRAVEL Disturbed native soil, brown, moist, no odour	95.6			20/1000	SS1	
		TILL Brown, silty clay, some sand and gravel, moist, no odour	94.6	1		25/1823	SS2	
		WEATHERED ROCK WITH TILL SEAMS Dark grey cuttings, no odour	93.9	2				
		SHALE BEDROCK Dark grey cuttings, no odour	93.31 93.0	3				
		Borehole Terminated at 3.7 m Depth	92.0					

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 32 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
completion	2.1	-
April 21, 2016		

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %
1	1.45 - 1.71	90	44
2	1.71 - 1.83	60	0
3	1.83 - 2.72	43	0
4	2.72 - 3.66	44	0

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH201

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 14

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
			95.53	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		ASPHALT ~ 50 mm	95.4					
		SAND AND GRAVEL Crushed limestone above fine sand, grey turning brown, moist, no odour	94.8			30	S1	
		SANDY SILT WITH ORGANICS Organic layer, roots present, dark brown, moist, no odour	94.2	1		20	S2	
		TILL Sand and gravel, shale gravel throughout, grey, wet turning moist, no odour	93.5			20	S3	
		Refusal at 2.0 m Depth, Borehole Terminated		2				

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole was backfilled with hole plug upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH202

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 15

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 75 mm	95.98	0				
		SAND AND GRAVEL Crushed limestone, grey, moist, no odour	95.9				S1	
		TILL Grey, sand and gravel, moist turning wet, no odour	95.1	1		35	S2	
				2		20	S3	
		Refusal at 2.4 m Depth, Borehole Terminated	93.6					

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole was backfilled with hole plug upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH203

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 16

Page 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 75 mm	95.44	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		SAND AND GRAVEL Crushed limestone above fine sand, grey turning brown, moist, no odour	95.3 94.7			35	S1	
		TILL Sand and gravel, grey and brown, moist, no odour		1		20	S2	
						15	S3	
			93.3	2				
		Refusal at 2.1 m Depth, Borehole Terminated						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole was backfilled with hole plug upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH204

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 17

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth m	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT ~ 50 mm	95.38	0				
		SAND AND GRAVEL Disturbed native soil, grey/brown, moist, no odour	95.3			30 □	S1	
				1		30 □	S2	
		TILL Brown, sandy silt, with gravel, moist turning wet, no odour	93.6			25 □	S3	
			93.0	2				
		Refusal at 2.4 m Depth, Borehole Terminated						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. Borehole was backfilled with hole plug upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH/MW205

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 18

Page 1 of 1

Date Drilled: April 13th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	▯	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT ~ 50 mm	95.24	0
		SAND AND GRAVEL	95.1	
		Disturbed native soil, grey and brown, moist, no odour		
		(Inferred from MW15-1)		1
			93.4	
		TILL		
		Gravelly sand, with silt, trace clay, brown with dark grey, moist	93.1	2
		Refusal at 2.1 m Depth on Bedrock		
		SHALE BEDROCK		
		Dark grey cuttings, grey water in air flushing medium, no odour		3
				4
			90.6	
		Borehole Terminated at 4.6 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES: S1 S2 S3

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 38 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
April 21, 2016	1.4	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH206

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 19

Page. 1 of 1

Date Drilled: April 13th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	▯	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	DEPTH	Standard Penetration Test N Value 20 40 60 80 / Shear Strength 50 100 150 200 kPa	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt kN/m³
		ASPHALT ~ 25 mm	95.47	0				
		SAND AND GRAVEL Crushed limestone, grey, moist, no odour	95.4					
		TILL Sand and gravel, trace silt, brown with some orange mottling, moist turning wet, no odour	95.1			0	S1	
				1		0	S2	
						0	S3	
			93.4	2				
		Refusal at 2.1 m Depth, Borehole Terminated						

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA GDT 10/7/16

NOTES:
1. Borehole data requires interpretation by exp before use by others
2. Borehole was backfilled with hole plug upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH/MW207

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 20

Page 1 of 2

Date Drilled: April 13th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ☒
Auger Sample ▮
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	95.47	0
		SAND AND GRAVEL	95.4	
		Disturbed native soil, grey and brown, moist, no odour		
		(Inferred from MW15-1)	94.8	
		TILL		1
		Gravelly sand with some silt, brown, moist turning moist/wet, no odour		2
		(Inferred from MW15-1)		
		SHALE BEDROCK	93.2	3
		Dark grey cuttings with light and dark grey water in air flushing medium, no odour		4
				5
				6
				7
				8
				9
				10

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp, before use by others
2. A flushmount monitoring well with a 38 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
April 21, 2016	2.6	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH/MW207

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Figure No. 20

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK Dark grey cuttings with light and dark grey water in air flushing medium, no odour *(continued)*	85.47	10				
			84.7					
		Borehole Terminated at 10.8 m Depth						

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 38 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
April 21, 2016	2.6	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole BH/MW208

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 21

Page. 1 of 2

Date Drilled: April 13th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	▮▯	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—⊖
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	94.68	0
		SAND AND GRAVEL	94.6	
		Disturbed native soil, grey and brown, moist, no odour	94.5	
		(Inferred from MW15-1)		
		TILL	93.6	1
		Brown, silty clay, some sand and gravel, moist, no odour		
		(Inferred from MW15-9)		
		SHALE BEDROCK		2
		Dark grey cuttings with light and dark grey water in air flushing medium, no odour		3
				4
				5
				6
				7
				8
				9
				10

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

Continued Next Page

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 38 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
April 21, 2016	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH/MW208

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Figure No. 21

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value 20 40 60 80 / Shear Strength kPa 50 100 150 200	Combustible Vapour Reading (ppm) 250 500 750 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 20 40 60	SAMPLES	Natural Unit Wt. kN/m³
		SHALE BEDROCK	84.68					
		Dark grey cuttings with light and dark grey water in air flushing medium, no odour *(continued)*						
			83.9					
		Borehole Terminated at 10.8 m Depth						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 38 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
April 21, 2016	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole BH16-1

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 27

Page. 1 of 1

Date Drilled: 10/11/16

Drill Type: Manual Crew

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT - 60 mm	95.37	0
		SAND AND GRAVEL Crushed limestone, grey, moist, no odour	95.3	
		SAND AND GRAVEL Imported sand and gravel from a commercial pit, with silt and clay, brown to dark brown then grey, moist, no odour	95.1	
		End of Borehole	94.9	

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES: 0

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/12/16

Log of Borehole SV1

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 22

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◧	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth m	Standard Penetration Test N Value / Shear Strength kPa (20 40 60 80 / 50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT	94.94	0				
		SAND AND GRAVEL	94.8					
		Disturbed native soil, brown, moist, no odour	94.7					
		GLACIAL TILL						
		Brown, silty clay, some sand and gravel, moist, no odour		1				
		(Inferred from MW15-9)	93.4 93.54					
		Borehole Terminated at 1.5 m Depth						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A stainless steel soil vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole SV2

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 23

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	94.62	
		SAND AND GRAVEL	94.5	
		Disturbed native soil, brown, moist, no odour	94.4	
		GLACIAL TILL		
		Brown, silty clay, some sand and gravel, moist, no odour	93.4	1
		(Inferred from MW15-8)	93.52	
		Borehole Terminated at 1.2 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength kPa: 50 100 150 200

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A stainless steel soil vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole SV3

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 24

Page 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	◫	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	94.79	0
		SAND AND GRAVEL	94.7	
		Disturbed native soil, brown, moist, no odour	94.4	
		GLACIAL TILL		1
		Brown, silty clay, some sand and gravel, moist, no odour		
		(Inferred from MW15-7 and MW15-8)	93.3	
		Borehole Terminated at 1.5 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A stainless steel soil vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 10/7/16

Log of Borehole SV4

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 25

Page 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample	⊠	Combustible Vapour Reading	□
Auger Sample	▯	Natural Moisture Content	×
SPT (N) Value	○	Atterberg Limits	⊢—○
Dynamic Cone Test	——	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	+ S		

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	94.98	0
		SAND AND GRAVEL	94.9	
		Disturbed native soil, brown, moist, no odour	94.5	
		GLACIAL TILL		1
		Brown, silty clay, some sand and gravel, moist turning wet, no odour		
		(Inferred from MW15-7)	93.5	
		Borehole Terminated at 1.5 m Depth		

Standard Penetration Test N Value: 20 40 60 80

Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750

Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES

Natural Unit Wt. kN/m³

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA.GDT 10/7/16

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A stainless steel soil vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole SV5

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 26

Page. 1 of 1

Date Drilled: April 14th, 2016

Drill Type: Geoprobe (GM100GT)

Datum: Geodetic

Logged by: MAD Checked by: MGM

Split Spoon Sample ⊠
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test + S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits |—○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT	95.02	0
		SAND AND GRAVEL	94.9	
		Disturbed native soil, brown, moist, no odour	94.7	
▼		GRAVELLY SAND WITH SOME SILT		
		Brown, moist turning wet, no odour	93.98	1
		(Inferred from MW15-2)		
		Borehole Terminated at 1.5 m Depth	93.5	

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60
SAMPLES
Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A stainless steel soil vapour probe with 6 mm diameter tubing was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES GPJ TROW OTTAWA GDT 10/7/16

Log of Borehole MW301

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 27

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silt to fine sand, light brown, some gravel with rock fragments, moist, no odour	95.7	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60	S1	
				1			S2	
							S3	
			93.7	2			S4	
W		**BEDROCK** Grey, shaley limestone, no odour	93.4				S4	
				3				
				4				
			91.1					
		Borehole Terminated at 4.58 m						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW302

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 28

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT 50 mm	95.25	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60		
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour	95.2			0	S1	
				1		0	S2	
						35	S3	
			93.24	2				
		BEDROCK Grey, shaley limestone, no odour	93.0					
				3				
			91.6					
		Borehole Terminated at 3.66 m						

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.0	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW303

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 29

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT 50 mm	95.42 / 95.4	0
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour		1
			93.62	
			93.3	2
		BEDROCK Grey, shaley limestone, no odour		3
			91.8	
		Borehole Terminated at 3.66 m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES: S1, S2, S3

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	1.8	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW304

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 30

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silt with fine sand and clay, some gravel with rock fragments, moist, no odour	95.7	0	20 40 60 80 / 50 100 150 200	250 500 750 / 20 40 60	S1	
						0	S2	
			94.5	1				
		SILT Dark brown, sandy silt with some gravel, dry, no odour	94.2			0	S3	
		BEDROCK Grey, shaley limestone, no odour	93.45	2				
				3				
				4				
			91.1					
		Borehole Terminated at 4.58 m						

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW305

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 31

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		FILL Silt with fine sand and clay, some gravel, rusty mottling, moist, no odour	95.7	0
			94.5	1
		Boulders and Cobbles Rock fragments with brown, silty fine sanddry, no odour	93.3	2
		BEDROCK Grey, shaley limestone, no odour	93.41	3
			91.1	4
		Borehole Terminated at 4.58 m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	
S3	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW306

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 32

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value (20 40 60 80) / Shear Strength kPa (50 100 150 200)	Combustible Vapour Reading (ppm) (250 500 750) / Natural Moisture Content % Atterberg Limits (% Dry Weight) (20 40 60)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Grey crushed stone, with silt and fine sand, moist, no odour	95.7 / 95.4	0		0	S1	
		SILT Brown, silt with fine sand, occasional gravel, dry to moist, no odour		1		0	S2	
			94.2			0	S3	
		BEDROCK Grey, shaley limestone, no odour		2				
M			93.18	3				
				4				
			91.1					
		Borehole Terminated at 4.58 m						

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.5	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW307

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 33

Page. 1 of 1

Date Drilled: 9/7/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT 50 mm	95.38 / 95.3	0	20 40 60 80 / 50 100 150 200 kPa	250 500 750 / 20 40 60		
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour		1		0	S1	
			93.9			20	S2	
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	93.3	2		15	S3	
		BEDROCK Grey, shaley limestone, no odour	93.11	3				
				4				
			90.8					
		Borehole Terminated at 4.57m						

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS		
Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD			
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW308

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 34

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT 50 mm	95.35 / 95.3	0
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour	94.5	1
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	93.12	2
		BEDROCK Grey, shaley limestone, no odour	92.7	3
			90.8	4
		Borehole Terminated at 4.57m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³	Combustible Vapour Reading (ppm)	Natural Moisture Content %
S1		0	
S2		0	
S3		60	
S3		5	

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.2	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

Log of Borehole MW309

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 35

Page. 1 of 1

Date Drilled: 9/6/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits —⊖
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT 50 mm	95.43 / 95.4	0
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour		
			94.2	1
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	93.9	
		BEDROCK Grey, shaley limestone, no odour		2
			93.17	
				3
				4
			90.9	
		Borehole Terminated at 4.57m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

SAMPLES	Natural Unit Wt. kN/m³
S1	
S2	

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW310

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 36

Page. 1 of 1

Date Drilled: 9/7/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		ASPHALT 50 mm	95.5	0				
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour				0	S1	
				1		0	S2	
			93.9					
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	93.4			15	S3	
		BEDROCK Grey, shaley limestone, no odour	93.25	2				
				3				
				4				
			90.9					
		Borehole Terminated at 4.57m						

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW311

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 37

Page. 1 of 1

Date Drilled: 9/7/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT 50 mm	95.7	0
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour	95.7	
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	94.5	1
			93.3 93.41	2
		BEDROCK Grey, shaley limestone, no odour		3
			92.0	
		Borehole Terminated at 3.66m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

0
10
30

SAMPLES: S1 S2 S3

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.3	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

Log of Borehole MW312

Project No: OTT-00224605-C0

Project: Environmental Drilling and Groundwater Monitoring

Location: 1509 - 1531 Merivale Road, Ottawa

Figure No. 38

Page. 1 of 1

Date Drilled: 9/7/17

Drill Type: Geoprobe

Datum: Geodetic

Logged by: JO Checked by: MGM

Split Spoon Sample ☒
Auger Sample ◧
SPT (N) Value ○
Dynamic Cone Test ——
Shelby Tube ■
Shear Strength by Vane Test +S

Combustible Vapour Reading □
Natural Moisture Content ×
Atterberg Limits ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Shear Strength by Penetrometer Test ▲

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic m	Depth
		ASPHALT 50 mm	94.97 / 94.9	0
		FILL Grey and brown, sand and gravel to sand with some gravel, moist, no odour	94.2	
		SAND AND GRAVEL Grey and brown, some silt, moist, no odour	93.8	1
		BEDROCK Grey, shaley limestone, no odour		2
▼			92.11	3
			90.4	4
		Borehole Terminated at 4.57m		

Standard Penetration Test N Value: 20 40 60 80
Shear Strength: 50 100 150 200 kPa

Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % Atterberg Limits (% Dry Weight): 20 40 60

10 (S1)
10 (S2)

SAMPLES

Natural Unit Wt. kN/m³

NOTES:
1. Borehole data requires interpretation by exp. before use by others
2. A flushmount monitoring well with a 51 mm slotted standpipe was installed in the borehole upon completion.
3. Field work supervised by an exp representative.
4. See Notes on Sample Descriptions
5. This Figure is to read with exp. Services Inc. report OTT-00224605-C0

WATER LEVEL RECORDS

Elapsed Time	Water Level (m)	Hole Open To (m)
September 14, 2017	2.9	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE LOGS OF BOREHOLES.GPJ TROW OTTAWA.GDT 1/12/18

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5812-1 - TEST HOLE LOCATION PLAN

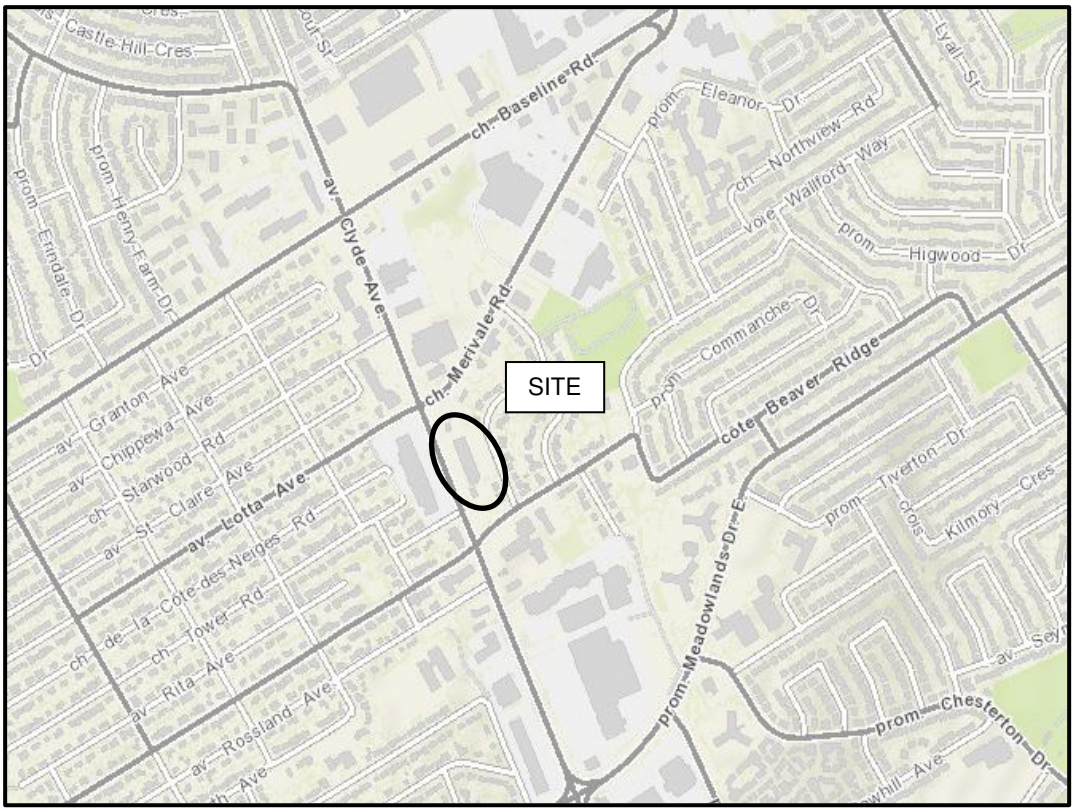


FIGURE 1

KEY PLAN

KERRY CRESCENT

BH/MW15-8
94.58
[93.40]

BH/MW15-7
94.80
[93.00]

SV2
94.62

SV3
94.79

SV4
94.98

SV5
95.02

BH/MW15-2
94.99
[92.69]

BH/MW208
94.68
[93.60]

BH/MW205
95.24
[93.14]

BH/MW15-9
94.90
[93.10]

BH/MW15-3
95.36
[92.96]

MW302
95.25
[93.00]

SV1
94.94

MW312
94.97
[93.80]

BH/MW15-6
95.11
[92.70]

BH/MW207
95.47
[93.20]

BH/MW15-4
95.37
[92.97]

BH16-1
95.37

BH/MW206
95.47
(93.37)

BH/MW15-5
95.36
[93.00]

BH/MW15-1
95.47
[93.17]

MW303
95.42
[93.30]

MW304
95.70
[94.20]

PROPOSED BUILDING

PROPOSED BUILDING

BH204
95.38
(92.98)

BH/MW15-11
95.70
[93.00]

MW306
95.70
[94.20]

BH/MW15-10
95.70
[92.90]

MW301
95.70
[93.70]

BH201
95.53
(93.53)

MW307
95.38
[93.33]

MW305
95.70
[93.30]

EXISTING BUILDING
(TO BE DEMOLISHED)

BH 6

BH 3

BH 5

BH 2

BH 4

MW308
95.35
[92.70]

MW309
95.43
[93.90]

MW310
95.50
[93.40]

MW311
95.70
[93.30]

BH 1

BH203
95.44
(93.34)

BH202
95.98
(93.58)

SIDEWALK

MERIVALE ROAD

LEGEND:

- BOREHOLE LOCATION (PATERSON GROUP REPORT E1677-98, NOVEMBER, 1998)
- BOREHOLE / MONITORING WELL LOCATION BY OTHERS
- 95.50 GROUND SURFACE ELEVATION (m)
- [93.40] BEDROCK SURFACE ELEVATION (m)
- (93.58) PRACTICAL REFUSAL ELEVATION (m)

CONCEPTUAL PLAN PROVIDED BY R.L.A. ARCHITECTURE

GROUND SURFACE ELEVATION AT BOREHOLE LOCATIONS ARE PROVIDED BY EXP SERVICES INC, PROJECT NO: OTT-00224605-D0, APRIL 2020

SCALE: 1:500

0 5 10 15 20 25 30m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

KATASA DEVELOPMENTS

DESKTOP REVIEW
MULTI-RESIDENTIAL BUILDING - 1509 MERIVALE ROAD

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:500	Date: 05/2021
Drawn by: YA	Report No.: PG5812-1
Checked by: OC	Dwg. No.: PG5812-1
Approved by: SD	Revision No.:

p:\autocad drawings\geotechnical\pg5xxx\pg5812\pg5812-1-test hole location plan.dwg