PATERSON GROUP

Hydrogeological Study and Water Budget Assessment

Proposed Residential Development

East Parcel - 5971 Flewellyn Road and 1770 and 1820 Shea Road
Ottawa, Ontario

Prepared for Caivan (Stittsville) Inc.

Report PH4681-REP.02
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1.0 INTRODUCTION

1.1 Background

Paterson Group (Paterson) was retained by Caivan (Stittsville) Inc. to complete a hydrogeological study and water budget assessment for the proposed residential development to be located at 5971 and 1770 and 1820 Shea Road (East Parcel), in the City of Ottawa (hereinafter referred to as the "subject site"). It should be noted that this report was prepared solely to support the development applications for the East Parcel, with the understanding that the East Parcel forms part of a larger, integrated development. Accordingly, while the focus of this application is limited to the East Parcel, the Water Budget Assessment was undertaken for the entire area proposed for development. The location of the study area for the subject site is shown on Drawing PH4681-1 - Site Plan appended to this report. This report incorporates the findings of the most recent revision of the Paterson PG5570 Geotechnical Report and Paterson PH4625 Hydrogeological Existing Conditions Report.

1.2 Scope of Work

Paterson has completed this report in accordance with the scope prepared by Paterson. As per the agreed upon scope, the purpose of this study was to:

- ❑ Characterize the hydrogeological setting of the subject site. Consideration was given to bedrock and surficial geology, aquifer systems, groundwater levels, hydraulic properties and catchment characteristics.

Additionally, the study was to include the standard components of a Water Budget Assessment as per the City of Ottawa's Water Budget Assessment Terms of Reference, which included the following:

- ❑ Review related higher-level studies.
- ❑ Conduct pre and post-development water budget analyses, including water budget equations, to determine the hydrogeological function of the subject site in order to assess the need for supplemental stormwater management measures.
- ❑ Develop a conceptual model to characterize pre and post-development hydrologic and hydrogeologic site conditions.
- ❑ Discuss sensitive hydrologic and hydrogeologic features (if any) within the study area.
- ❑ Discuss mitigation strategies related to post-development hydrologic and hydrogeologic impacts.
- ❑ Discuss how climate change projections may impact the water budget.

2.0 PREVIOUS REPORTS

In addition to a review of the general literature summarized in the following sections and in the 'References' section of this report (MECP water well mapping, available geological and physiographic mapping), Paterson reviewed the following site-specific reports:

- Paterson PE5472 Phase 1 Environmental Site Assessment (prepared concurrently with this report).
- Paterson PG5570 Geotechnical Report (prepared concurrently with this report).
- Paterson PH4625 Existing Conditions Hydrogeological Report (prepared concurrently with this report).
- Kilgour & Associates Ltd. - Stittsville South W4 Future Neighborhood Area: Environmental Impact Study (December 20, 2024) - Project Number: CAIV 1300.4.
- Kilgour & Associates Ltd. Headwater Drainage Feature Assessment for Caivan Development Corporation, Flewellyn Road Properties (September 8, 2023) - Project Number: CAIV 1300.
- J.F. Sabourin and Associates Inc. - Stittsville Lands (5993, 6070 & 6115 Flewellyn Road) - Draft Pre-Development Hydraulic and Hydrologic Study" - (November 2022)
- Houle Chevrier Engineering - Technical Memorandum - Hydrogeological Study - (D007-16-13-0033) - Area 6, Stittsville South (April 2015) - As part of D07-16-13-0033.
- Houle Chevrier Engineering - Report on Private Well Monitoring Program Stittsville South Residential Development and Stormwater Management Pond (November 2015) - As part of D07-16-15-0008.
- Paterson Geotechnical Report PG2853-1- Proposed Residential Development - Stittsville Main Street (January 2013) - As part of D07-16-13-0033.
- Paterson Geotechnical Report PG2983-1 - Faulkner Lands - Fernbank Road at Main Street (July 2013) - As part of D07-16-13-0033.

3.0 METHOD OF INVESTIGATION

3.1 Records Review

A review of available physiographic, geological, and hydrogeological data was completed as a part of this assessment. However, the literature review and previous reports did not provide site-specific data regarding overburden and bedrock aquifers, recharge and discharge conditions or flow contributions to the nearby water features. Further detail is provided in the following sections.

3.2 Field Program

The geotechnical field programs were developed to assess geology, groundwater conditions, and hydraulic gradients in the overburden at the subject site. The test holes were advanced to various depths across the site to assess hydrogeological and geotechnical conditions at the approximate depth of the proposed construction activities. A supplemental hydrogeological field program was carried out within the subject site to determine the infiltration potential of the soils.

Geotechnical field investigations completed by Paterson have been carried out at the subject site between November 2020 and February 2026. During this time, a total of 50 boreholes, 1 hand auger hole and 18 test pits were advanced to a maximum depth of 10.2, 0.7 and 3.4 m below ground surface (bgs), respectively. The test holes were distributed in a manner to provide general coverage of the proposed development. Each of the boreholes were instrumented with either groundwater monitoring wells or flexible standpipe piezometers. The test hole locations are shown on Drawing PG5570-1 - Test Hole Location Plan located in Appendix 2.

The test pits were completed using a hydraulic shovel and backfilled with the excavated soil upon completion. The boreholes were advanced using a track-mounted drill rig. All fieldwork was conducted under the full-time supervision of Paterson personnel.

Soil samples were recovered from the sidewalls of the test pits. All soil samples were visually inspected and classified on site. The soil samples were placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the soil samples were recovered from the test pits are shown as G on the Soil Profile and Test Data sheets presented in Appendix 2.

Soil samples were obtained from the boreholes by means of split spoon sampling and the sampling of shallow soils directly from auger flights. Split-spoon samples were taken at approximate 0.76 m intervals. The depth at which split-spoon and auger flight samples were obtained from the test holes are shown as "**SS**" and "**AU**", respectively, on the Soil Profile and Test Data sheets, appended to this report.

All samples were classified on site, placed in sealed plastic bags and were transported to our laboratory for further review and testing. Transportation of the samples was completed in accordance with ASTM D4220-95 (2007) - Standard Practice for Preserving and Transporting Soils.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the ground after an initial penetration of 150 mm using a 63.5 kg hammer falling from a height of 760 mm. This test was done in accordance with ASTM D1586-11 - Standard Method for Penetration Test and Split-Barrel Sampling of Soils.

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

In-Situ Infiltration Testing

In conjunction with a supplemental geotechnical investigation, Paterson completed site specific infiltration testing in September 2022 using a Pask Permeameter in order to identify the infiltration potential of the underlying soils on site.

A total of 24 constant head Pask (Constant Head) Permeameter tests were conducted at 12 locations. The testing locations were distributed in a manner to provide general coverage of the site. Tests were completed at an approximate depth of 0.3 to 0.6 m bgs. Preparation and testing of this investigation are in accordance with the Canadian Standards Association (CSA) B65-12 - Annex E.

Field saturated hydraulic conductivity values were determined using Engineering Technologies Canada (ETC) Ltd. reference tables provided in the most recent ETC Pask Permeameter User Guide.

3.3 Laboratory Testing

All soil samples were retained for laboratory review following the field portion of the subsurface investigation. The soils were classified in general accordance with ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Based on the soil descriptions across the subject site during the geotechnical investigations, these samples are considered to be sufficiently representative of the site.

3.4 Groundwater Monitoring Well/Piezometer Installation

Groundwater monitoring wells or piezometers were installed in all boreholes to permit the monitoring of groundwater levels subsequent to the completion of the geotechnical field programs.

3.5 Groundwater Level Measurements

Following the geotechnical field programs mentioned above which included the installation of monitoring wells and piezometers across the subject site, groundwater levels were measured at the groundwater monitoring well and piezometer installations using an electronic water level meter. Water levels were measured relative to the ground surface elevation at each location and are noted on the Soil Profile and Test Data sheets, appended to this report. In addition to the manual groundwater measurements, select wells were outfitted with data loggers to record long-term fluctuations in groundwater elevations. Long-term groundwater monitoring data can be found in the most recent Paterson Report PH4625-REP.01 that was prepared concurrently with this report.

3.6 Surveying

The test hole locations and ground surface elevations at each test pit location completed by Paterson were surveyed using a GPS unit with respect to a geodetic datum. The locations and ground surface elevations for each test hole are presented on Drawing PG5570-1- Test Hole Location Plan, located in Appendix 2.

3.7 Water Budget

The site-specific water budget analyses conducted at the subject site employed the method derived by Thornthwaite and Mather (1957). This method utilizes soil water holding capacity along with the mean monthly air temperature and precipitation values to estimate the actual evapotranspiration (AET) at a specific location over the same time period (referred to as the water balance of the site).

By subtracting the average annual AET from the average annual precipitation, it was possible to determine the average annual water surplus available for either infiltration or runoff. The water holding capacities used in the water balance calculations at the subject site were obtained from the MOE Stormwater Management Planning and Design Manual (2003). The water balance information was then provided by Environment Canada's Engineering Climate Services (EC-ECS) division. The water balance information is presented in Section 5 and Appendix 3 of this report.

The average annual water surplus obtained from the water balance calculations were separated into infiltration and runoff using the approach taken from the MOE Stormwater Management Planning and Design Manual (2003). This method multiplies the sum of three factors (topography, soil type and land cover) by the annual water surplus to provide an estimated annual infiltration potential. The topography factor was derived from available mapping and the geodetic surveys completed by Paterson as part of the geotechnical investigations completed at the subject site. The soil factor was based on the average composition of the overburden materials found at the subject site during the Paterson geotechnical field investigations. The vegetation factor was based on site reconnaissance and aerial photography. Both the water balance and water budget calculations are discussed in greater detail within Section 5.0 of this report.

4.0 REVIEW AND EVALUATION

4.1 Physical Setting

The subject site is located west of Shea Road and north of Flewellyn Road. The subject site consists of multiple property parcels; 5971 Flewellyn Road and 1770 and 1820 Shea Road. As mentioned above, this assessment was completed for the entire study area as shown on Drawing PH4681-1 - Site Plan appended to this report.

The study area currently consists of a mixture of agricultural lands, meadows, and forested areas. The property is bordered to the north by existing and under construction residential developments, to the west by residential dwellings, to the south by Flewellyn Road and further by forested and agricultural lands and to the east by Shae road and further by agricultural lands. A stormwater management pond (SWMP) associated with the development to the north is centrally located at the subject site. A Hydro corridor transects the middle of the subject site in a north to south orientation.

The subject site is located within the Flowing Creek subwatershed. Tributaries to the Faulkner Drain were identified within the study area. Reference should be made to the Headwater Drainage Feature Assessment (September 8, 2023) and Environmental Impact Study (December 20, 2024) prepared by Kilgour & Associates Ltd. for a detailed assessment of these features.

Site topography consists of approximately 4 to 7 m of elevation variability across the subject site. The subject site generally slopes from northwest to southeast with greater topographic relief within the western portion of the site. The subject site is at grade with adjacent properties and roadways.

4.2 Geology

Surficial Geology

Overburden mapping provided by the Ontario Geological Survey (OGS) was reviewed as a part of this assessment. Available mapping indicates that overburden soils throughout the subject site consist primarily of fine grained glaciomarine deposits to the east and coarse grained glaciomarine deposits to the west. A till unit is mapped within the northern portion of the site. Overburden soils mapping is shown on Drawing PH4681-3 - Surficial Geology Plan.

Overburden soils identified during the geotechnical investigation by Paterson were generally consistent with the available mapping. Overburden thickness varied from approximately 0.3 to 6.1 m across the subject site, with greater depths of overburden materials typically present within the eastern portion of the subject site. Soils generally consisted of topsoil overlying silty sand to sandy silt layers underlain by a glacial till deposit comprised of a compact to dense, brown to grey silty sand to sandy silt with gravel, cobbles and boulders, dependent on the location across the subject site. A layer of loose to compact brown silty sand to sandy silt was observed underlying the topsoil across the subject site, extending to approximate depths ranging from 0.3 to 4.7 m bgs. A thin layer of stiff brown silty clay was observed underlying the topsoil and/or interlayered within the sandy silt deposit at select test hole locations and extended to a maximum depth of 3.2 m bgs. The above noted layers were underlain by a glacial till deposit consisting of compact to dense brown/grey silty sand to sandy silt with gravel, cobbles and boulders, extending to a maximum depth of 6.1 m bgs.

Specific details are provided on the Soil Profile and Test Data Sheets attached within Appendix 2 of this report.

Bedrock Geology

Bedrock was encountered between 0.8 and 6.0 m bgs and cored to maximum depth of 10.2 m bgs at select borehole locations. Bedrock depths are shown on Drawing PG5570-2 - Bedrock Contour Plan. The bedrock was observed to consist of limestone interbedded with dolostone, generally being excellent in quality.

Bedrock mapping provided by the OGS was reviewed as a part of this assessment. Available mapping indicates that bedrock at the subject site consists of limestone, dolostone, shale and sandstone of the Gull River Formation. Bedrock geology mapping is shown on Drawing PH4681-4 - Bedrock Geology Plan.

Karst Features

The term ‘karst’ refers to a geologic formation characterized by the dissolution of carbonate bedrock, such as limestone. Based on a review of available mapping, a small area within the western portion of the subject site is inferred to contain karst, while the remainder of the site falls within an area that can potentially contain karst. It should be noted that no evidence of karstification was observed at the time of the field investigations completed at the subject site. However, if future investigations identify karst within the subject site, best management practices should be implemented to reduce/mitigate the potential impacts related to developing on a karstic landscape.

4.3 Hydrogeological Setting (Conceptual Model)

Existing Aquifer Systems

Aquifer systems may be defined as geological media, either overburden soils or fractured bedrock, which permit the movement of groundwater under hydraulic gradients. In general, aquifer systems may be present in overburden soils or bedrock. Although groundwater has been observed within overburden soils at the subject site, the typical overburden materials found at the site do not allow for the development of significant water supply wells. Water supply wells in the vicinity are instead likely found in bedrock aquifers.

Bedrock aquifer mapping, provided by Natural Resources Canada Urban Geology of the National Capital Region mapping, was reviewed as a part of this assessment. Using this tool, the water supply aquifer system has been identified in the vicinity of the study area as the Gull River Formation aquifer system.

Groundwater Levels

Groundwater levels were observed to range from 0.6 to 2.8 m bgs in the piezometers and -0.18 to 3.7 m bgs in the groundwater monitoring wells installed at the borehole locations.

A long-term groundwater monitoring program was completed extending from October 2022 to May 2024. Specific information is available in the most recent Paterson Report PH4625-REP.02 that was prepared concurrently with this report.

Horizontal Hydraulic Gradients

Due to the nature of the water levels obtained from field work conducted at the subject site (groundwater monitoring wells and piezometers), the absolute direction of horizontal hydraulic gradients in the vicinity of the subject site was not determined. However, using the available data, it was possible to approximate the horizontal hydraulic gradients in the bedrock and overburden material given that the horizontal hydraulic gradient between any 2 points is the slope of the hydraulic head between those points:

$$i_h = h_2 - h_1 / L$$

Where: i = horizontal gradient
h = water level (m bgs)
L = horizontal distance between test hole locations

Using the above noted formula, the horizontal hydraulic gradients were observed to be in an approximate east orientation with a magnitude of 0.001 to 0.026 in the bedrock based on the groundwater readings collected on October 11, 2022. Overburden flow was interpreted to be in a similar orientation as the bedrock flow regime given the similarities in groundwater levels at the nested well locations. Local groundwater flow is expected to flow towards the Faulkner Drain and regional groundwater flow is expected to be towards the Jock River.

Vertical Hydraulic Gradients

Using the available water level data from the monitoring wells installed on the subject site, the approximate vertical hydraulic gradient of the aquifer was approximated by dividing the difference in hydraulic head by the vertical distance between the midpoints of the 2 well screens.

$$i_v=(h_2-h_1)/(z_2-z_1)$$

Where: i =vertical hydraulic gradient
h =water level (m bgs)
z =depth of midpoint of well screen (m bgs)

Due to the limited number of nested wells throughout the subject site, only a limited number of vertical hydraulic gradients were calculated. Using the above noted formula, vertical hydraulic gradients were calculated within two nested well installations across the study area. BH 1-22 and BH 1A-22 (west portion of the study area) had a vertical upward gradient of approximately 0.012 to 0.016 while BH 3-22 and BH 3A-22 (east portion of the study area) had a vertical downward gradient of 0.004 to 0.035 or a vertical upward gradient of 0.010, depending on the time of year.

Hydraulic Conductivity

Hydraulic conductivity testing (slug testing) was also completed by Paterson as part of the field investigation. The test data was analyzed as per the method set out by Hvorslev (1951). The results of the testing yielded hydraulic conductivity values ranging between 4.2×10^{-6} m/sec to 2.2×10^{-5} m/sec at the monitoring well locations screened in the sandy silt, silty sand and glacial till. Hydraulic conductivity results from slug tests conducted at wells screened in the limestone bedrock ranged from 4.3×10^{-7} to 1.6×10^{-4} m/sec. These values are consistent with tabulated values from Freeze and Cherry (1979) and field values encountered at similar sites. The testing results can be found in the most recent Paterson Report PH4625-REP.01 that was prepared concurrently with this report.

In-Situ Infiltration Testing

Based on Paterson's site-specific in-situ infiltration testing investigation, the field saturated hydraulic conductivity values measured are consistent with similar material Paterson has encountered on other sites as well as published values for the materials identified on-site. Field saturated hydraulic conductivity values for the native silty sand to sandy silt, silty clay, and glacial till deposit throughout the site ranged from ≤ 8.1 x 10^{-9} to 6.4 x 10^{-6} m/sec. Prior to implementation for design purposes in the stormwater management strategy, a minimum safety correction factor of 2.5 will need to be applied to the above rates. The rate to be applied will be dependent on soil properties at a given location across the site. The results from site-specific in-situ infiltration are summarized below in Table 1.

Table 1 – Summary of Field Saturated Conductivity Values

Test Completed Adjacent to Borehole ID	Infiltration Testing Elevation (m asl)	Material	K_{fs} (m/s)*
BH1-21	103.90	Brown Silty Sand	2.10 x 10^{-6}
	103.63	Brown Silty Sand	1.90 x 10^{-6}
BH2-21	106.95	Brown Silty Sand	6.40 x 10^{-6}
	106.65	Brown Silty Sand	5.30 x 10^{-7}
BH7-21	106.74	Brown Silty Sand	1.10 x 10^{-6}
	106.44	Brown Silty Sand	1.60 x 10^{-6}
BH11-21	104.68	Brown Silty Sand	2.70 x 10^{-6}
	104.38	Brown Silty Sand	1.60 x 10^{-6}
BH15-21	102.70	Brown Silty Sand to Sandy Silt	2.10 x 10^{-7}
	102.48	Brown Silty Clay w/ Sand	≤ 8.1 x 10^{-9}
BH17-21	106.74	Brown Silty Sand to Sandy Silt	5.90 x 10^{-6}
	106.44	Brown Silty Sand to Sandy Silt	4.10 x 10^{-6}
BH22-21	102.58	Brown Silty Sand	1.10 x 10^{-6}
	102.28	Brown Silty Sand	1.60 x 10^{-6}
BH23-21	102.33	Brown Silty Clay w/ Sand	5.30 x 10^{-7}
	101.70	Brown Silty Clay w/ Sand	≤ 8.1 x 10^{-9}
BH26-21	102.74	Brown Silty Clay w/ Sand	1.10 x 10^{-7}
	102.44	Brown Silty Clay w/ Sand	1.10 x 10^{7}
BH29-21	101.87	Brown Silty Sand to Sandy Silt	5.30 x 10^{-7}
BH29-21	101.57	Brown Silty Sand to Sandy Silt	2.70 x 10^{-7}
BH31-21	103.19	Brown Silty Sand to Sandy Silt	1.10 x 10^{-6}
	102.89	Brown Silty Sand to Sandy Silt	1.35 x 10^{-7}

Table 1 – Summary of Field Saturated Conductivity Values			
Test Completed Adjacent to Borehole ID	**Infiltration Testing Elevation (m asl)**	**Material**	**K_{fs} (m/s)***
BH37-21	103.21	Brown Silty Sand to Sandy Silt	5.30×10^{-6}
	102.91	Brown Silty Sand to Sandy Silt	5.90×10^{-6}

*Field saturated hydraulic conductivity

Groundwater Recharge and Discharge

In general, groundwater will follow the path of least resistance from areas of higher hydraulic head to areas of lower hydraulic head. While upward and downward hydraulic gradients may be indicative of areas of discharge and recharge respectively, other factors must be considered.

The majority of surface water will infiltrate the sandy silt, silty sand and glacial till layer before being intercepted by the underlying bedrock unit where it will either recharge the underlying bedrock aquifer or flow laterally down-gradient as perched water (interflow). Given the topographic relief of the subject site and high RQD of the bedrock, it is Paterson's interpretation that the majority of water will predominantly travel laterally at the bedrock interface.

Given that the subject site resides in one subwatershed and all flows are directed to the Faulkner Drain, the site is characterized by one catchment area.

Based on site conditions, large scale groundwater discharge is not anticipated to be occurring at the subject site. A stable isotope investigation was completed as part of Paterson's hydrogeological existing conditions study to determine the magnitude of groundwater discharge occurring in the vicinity of the surface water features within the western portion of the site. The results from the investigation showed that the surface water sampled was generally sourced by precipitation derived water with minimal contribution from deeper groundwater discharge. The Environmental Impact Study completed by Kilgour and Associates Ltd. (December 20, 2024) supports this interpretation.

A detailed overview of hydrogeological existing conditions is described in the most recent Paterson Report PH4625-REP.01 which was prepared concurrently with this report.

5.0 SITE SPECIFIC WATER BUDGET ASSESSMENT

The site-specific water budget assessment (SSWB) was conducted on a monthly and annual basis to determine the hydrologic/hydrogeological function of the subject site, to identify infiltration potential and to identify opportunities for Low Impact Development (LID) measures. The study area currently consists of a mixture of agricultural lands, meadows, and forested areas. The pre and post-development terrain compositions are illustrated on Drawings PH4681-6 - Pre-Development Terrain Composition Plan and Drawing PH4681-7 - Post-Development Terrain Composition Plan appended to this report.

5.1 Calculations

Thornthwaite and Mather Water Balance Calculations

When falling precipitation intercepts the ground, three possible outcomes arise. The water can either evaporate/transpire back into the atmosphere (evapotranspiration), infiltrate into the surface soils (infiltration) or leave the area as runoff.

As mentioned earlier in this report, the method employed by Thornthwaite and Mather (1957) was used along with modelling software modelling software by EC-ECS to determine the partitioning of water throughout various portions of the hydrologic cycle. Inputs into the modelling program included monthly temperature, precipitation, water holding capacities and site latitude. Using the long-term averages of these variables, it was possible to calculate annual potential and actual evapotranspiration, change in soil moisture storage and the water surplus. The formula employed by Thornthwaite and Mather is as follows:

$$S = R + I = P - ET$$

Where: S = surplus (mm/year)
R = annual runoff (mm/year)
I = annual infiltration (mm/year)
P = annual precipitation (mm/year)
ET = annual evapotranspiration (mm/year).

Soils within the study area generally consisted of topsoil overlying fill material and/or silty clay, dependent on the location across the site. Therefore, the above noted calculations were carried out for the soil moisture holding capacities of each material found on site.

Based on the location of the site within the Ottawa area, climatic data was obtained from the climate station located at the MacDonald-Cartier International Airport covering the period of January 1939 to December 2018. The information was provided by Environment Canada's Engineering Climate Services Unit and is presented in Appendix 3 of the report.

Table 2, below, displays the soil types present within the study area and their associated water holding capacities (WHC) as well as the actual evapotranspiration (AET) and surplus data. For the purposes of this study, AET values were used as they account for accumulated soil moisture deficit. This deficit represents the volume of water retained within the available pore spaces of the soil and is subtracted from the potential evapotranspiration (PET) value to more accurately calculate the water surplus. The monthly/annual water balance and water budget data is presented in Appendix 3 of the report.

For the purpose of this study, the roadways, 80% of the condo blocks and 68% of the detached homes/townhomes are considered to be impervious surfaces (100% of surplus will result in runoff).

Table 2: Site Specific Water Surplus Information

Soil Type	Water Holding Capacity (mm)	Actual Evapotranspiration (mm/year)	Surplus Water (mm/year)
Impervious Surfaces	N/A	145*	759
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	75	525	378
Pasture and Shrubs (Fine Sandy Loam)	150	574	329
Mature Forests (Fine Sandy Loam)	300	605	298

Table reproduced using WHC values from MOE (2003) - Stormwater Management Planning and Design Manual and modelling data from Environment Canada.
*Values based on evaporation information for urban areas (16% of precipitation) included in the Eastern Ontario Water Resources Management Study prepared by CH2M HILL Canada Limited (March 30, 2001). For the monthly water budget calculations in Appendix 3, 16% of the rain and melt total was used to estimate an evaporation value which was subtracted from the rain and melt total to estimate the monthly surplus.

Infiltration Factors

In order to break down the surplus water values for the various materials into infiltration and runoff, various factors must be considered. The MOE Stormwater

Management Planning and Design Manual (2003) lists three main factors that contribute to surface water infiltration rates.

The first factor is topography, which is broken down further into three sections: flat and average slope, rolling land and hilly land. Flat and average slope provides the greatest potential for infiltration and has the largest factor applied to it (0.3), while the other two have progressively lower factors (rolling land is 0.2 and hilly land is 0.1).

The second factor is soil, which is also broken down further into three sections: tight impervious clay, medium combinations of clay and loam and open sandy loam. Open sandy loam provides the greatest potential for infiltration (factor of 0.4) while the other two have progressively lower potential for infiltration to occur (factors for medium combinations of clay and loam is 0.2 and tight impervious clay is 0.1).

The final factor the MOE manual uses to partition infiltration from runoff is land cover. It is broken down into two sections: open fields/cultivated lands and woodlands. Woodlands have greater infiltration potential and a factor of 0.2. Open fields and cultivated lands have lower potential and with a factor of 0.1. A summary of the MOE manual's descriptors and their associated infiltration factors is shown below in Table 3.

Table 3: MOE (2003) Infiltration Factors

Description of Area/Development Site	Value of Infiltration Factor
Topography	
Flat and average slope (<0.6 m/km)	0.30
Rolling land (slope of 2.8-3.8 m/km)	0.20
Hilly land (slope of 28-47 m/km)	0.10
Soil	
Tight impervious clay	0.10
Medium combinations of clay and loam	0.20
Open sandy loam	0.40
Cover	
Open fields/cultivated lands	0.10
Woodlands	0.20

Table reproduced from MOE (2003) - Stormwater Management Planning and Design Manual.

The topography of the study area consists of a mixture of rolling land (generally 2 to 4 m/km throughout the subject site) and hilly land (generally 28 to 47 m/km throughout the subject site). Therefore, a pre-development topography infiltration factor of 0.15 was given for the materials analysed on this property. In order for

development to proceed, it is expected that alterations will be made to the topography of the site. In general, it is expected that the overall slope of the site will be reduced to accommodate buildings and roadways. However, given the anticipated grading for the landscaped areas, a post-development topography factor of 0.15 was assigned for the subject site.

As previously discussed, soils within the study area generally consisted of topsoil overlying silty sand to sandy silt layers underlain by a glacial till deposit. Therefore, a pre-development soil infiltration factor of 0.3 was given for the materials analysed on this property. Under post-development conditions, the majority of the site will consist of either landscaped areas with similar subsoils as pre-development conditions, native soils or impervious surfaces Therefore, a post-development soil infiltration factor of 0.3 was given for the native soils and landscaped areas.

The subject site generally consists of agricultural lands and meadows with select areas with mature forests to the western portion of the site. A pre-development vegetation infiltration factor of 0.1 was therefore used for the majority of the site with the exception of the tree covered areas which were given a vegetation infiltration factor of 0.2. Post-development, it is expected that the majority of trees on site will be removed to accommodate buildings and roadways. A post-development vegetation infiltration factor of 0.1 was therefore used for the majority of the site apart from the tree covered areas which were given a vegetation infiltration factor of 0.2.

All impervious surfaces were given infiltration factors of 0 given their inability to promote infiltration.

The pre and post-development infiltration factors for all materials considered are included in the water budget calculations provided in Table 7 and 8 included in Appendix 3 of this report. The pre and post development terrain compositions are displayed on Drawings PH4681-6 and PH4681-7, respectively, included in Appendix 1.

5.2 Pre and Post-Development Water Budget

The pre-development water budget analysis conducted for the study area determined that an estimated 148,798,834 L/year of surplus water currently infiltrates the surficial soils. The remaining estimated 106,920,571 L/year of surplus leaves the site as runoff, draining towards the Faulkner Drain.

The post-development water budget analysis conducted for the study area determined that an estimated 57,627,824 L/year of surplus water will infiltrate the

surficial soils and 381,702,557 L/year will leave the site as runoff. These values equate to an approximate decrease in infiltration of 61% and an increase in runoff of 257% when compared to pre-development conditions.

The main variable that changed from pre-development conditions to post-development conditions was the addition of approximately 441,725 m^2 of impervious surfaces. This results in reducing the area of pervious materials throughout the subject site, therefore, reducing the overall infiltration potential of the subject site. The remaining areas that are not being converted to impervious surfaces will become landscaped surfaces characterized by urban lawn (fine sandy loam) material that can promote infiltration. Also, it should be noted that the SWMP areas were excluded from the water budget analyses given that these areas are designed to manage stormwater runoff and do not contribute to the infiltration or runoff potential of the site.

It is important to note that the post-development water budget analysis for the subject site does not consider any potential infiltration of the anthropogenic sources (100% runoff was taken as a conservative approach). In reality, some portion of surface water that lands on impervious surfaces either evaporates, infiltrates (asphalt is not 100% impervious) or is diverted to grassed areas where additional infiltration may occur. As such, the post-development runoff volumes should be considered a conservative estimate and not expected to definitively represent future conditions.

As a mitigation measure to reduce infiltration deficits and increased runoff under post-development conditions, the stormwater management design team has indicated that rooftop drainage from detached homes and the rear portions of townhome roofs can be directed to the adjacent lawn areas via a direct connection from the drainage leads and as well as reducing lot grading to promote infiltration. This will increase the pervious surfaces in the post-development water budget calculations as well as increasing the post-development topography infiltration factor to 0.2 for the urban lawn areas. By implementing these measures, the post-development water budget calculations with mitigation (refer to Table 7 in the Post-Development Annual Water Budget Calculations With Mitigation in Table 7 in Appendix 3) determined that an estimated 88,577,195 L/year of surplus water will infiltrate the surficial soils and 303,382,935 L/year will leave the site as runoff. These values equate to an approximate reduction in the post-development infiltration deficit and runoff increase from 61% to 40% and 257% to 184%, respectively.

Details of the annual and monthly pre and post-development water budget analyses are presented in Table 7-19 in Appendix 3 of this report.

6.0 ASSESSMENT AND RECOMMENDTIONS

Existing Wells

A search of the Ontario Water Well Records database indicates there are several water wells within 500 m of the site as depicted on Drawing PH4681-2 - MECP Water Well Location Plan appended to this report. It should be noted that other construction activities such as blasting and hoe-ramming can have an impact on adjacent well users depending on the location and duration of such activities, in addition to dewatering activities. However, after reviewing the water well records of the surrounding water supply wells, it was noted that the majority of the wells are screened within the bedrock aquifer at depths below the proposed servicing depths at the subject site, providing sufficient vertical separation between the wells and potential development activities which may include dewatering and/or blasting.

Based on the results of assessments done under separate cover, it was determined that a radius of influence of approximately 15 to 56 m will develop as a steady state condition, extending from the edge of the housing and servicing excavations associated with the proposed development. As such, it was determined that all surrounding water supply wells are located outside the theoretical radius of influence associated with the proposed development. Additionally, the surrounding water supply wells are screened within the bedrock aquifer system, well below the anticipated maximum depth of housing and servicing excavations. It should be noted that existing developments have been constructed in the area and Paterson is unaware of negative impacts on private wells related to the previous dewatering / bedrock removal (blasting and hoe-ramming) for pre or post development conditions. Furthermore, excavations related to the proposed development are anticipated to be short-term in duration. Therefore, impacts to surrounding water supply wells are not expected as a result of construction activities associated with the proposed development.

A groundwater impact assessment (GIA) will be completed at the detailed design stage and will inform the scope of a potential baseline sampling program if required.

Sources of Contamination

A review of the most recent Paterson PE5472 Phase 1 Environmental Site Assessment (ESA) that was prepared concurrently with this report did not identify any sources of groundwater/soil contamination.

Prior to and during site development, it is recommended that construction best management practices with respect to fuels and chemical handling, spill prevention, and erosion and sediment control be followed. This will minimize the

potential for the introduction of contaminants to the soil, surface water, or groundwater at the subject site.

With respect to stormwater runoff quality, it is recommended that best management practices with respect to operational standards be maintained for any stormwater management facilities constructed for the proposed development. It is also recommended that adherence to the City of Ottawa Salt Management Plan - Appendix A (October, 2011) included in Appendix 4 is enforced to ensure that chloride levels in stormwater runoff are as low as possible.

Services

It is our understanding that the subject site will be developed with municipal sewer and water services. General recommendations regarding site servicing are provided under separate cover in our geotechnical investigation report. Specific hydrogeological and geotechnical recommendations will be provided during the detail design phase. Although specific details regarding site servicing are not currently available, it is our expectation that site servicing depths will be in the range of 2 to 5 m bgs.

Permit To Take Water

For any water taking of greater than 50,000 L/day, a water taking Environmental Activity and Sector Registration (EASR) will be required. The requirement for an EASR will be determined during the detail design phase. The information contained in this report may be used as supporting documentation for an EASR application for the subject site; however, an additional hydrogeological investigation may be required.

Infiltration Potential and Low Impact Development (LID) Considerations

As previously discussed, soils within the study area generally consisted of topsoil overlying silty sand to sandy silt layers underlain by a glacial till deposit. With regards to field saturated hydraulic conductivity values for the soils found on-site, site-specific testing varied from ≤ 8.1 x 10^{-9} to 6.4 x 10^{-6} m/sec mm/hr for the sandy silt to silty sand and the glacial till deposits. A minimum safety correction factor of 2.5 will need to be applied to the estimated field saturated hydraulic conductivity values noted above prior to consideration in the stormwater management design. It is also recommended that the proposed invert elevation of potential infiltration systems be constructed at least 1 m above the seasonally high groundwater level and sound bedrock surface to promote infiltration.

As noted above, the results of the water budget analyses completed at the subject site indicated that 148,798,834 L/year of infiltration and 106,920,571 L/year of surface runoff are occurring under pre-development conditions. Under post development conditions, it is expected that there will be an approximate 61% infiltration deficit and a 257% increase in runoff.

The stormwater management design team has indicated that reduced lot grading and directing roof drainage to landscaped areas are feasible mitigation measures to reduce the infiltration deficit and increase in runoff under post-development conditions. Therefore, by diverting precipitation that intercepts approximately 124,214 m^2 of roofed areas to adjacent lawns as well as reducing the lot grading, the post-development infiltration deficit and runoff increase is reduced by 34% and 29%, respectively, as shown in the Annual Post-Development Water Budget With Mitigation component of Table 7 in Appendix 3.

It should be noted that Paterson's water budget assessment is based on mean water budget values for the soil types at the subject site that were calculated by modeling conducted by EC-ECS. The EC-ECS model is calibrated to historical climate data and does not account for climate change predictions. Therefore, based on the National Capital Commission and City of Ottawa climate change predictions, the stormwater management design team could consider potential seasonal changes (longer spring and shorter winter) and increases in temperature and precipitation when developing their stormwater management strategy.

Based on the Consolidated Linear Infrastructure Environmental Compliance Approval (CLI ECA) documentation and the City of Ottawa Technical Bulletin IWSTB-2024-04, the opportunities for infiltration-based Low Impact Development (LID) measures at the subject site are constrained due to the presence of shallow bedrock, the shallow water table elevation and the clay/silt content of the subsoils. Therefore, Paterson recommends establishing the post-development mitigation target as retaining 34% of the post-development infiltration deficit of the annual water budget by the means of implementing the mitigation strategies described above. This target is based on the opportunities and constraints discussed in this report for the subject site. Additionally, the stormwater management strategy should target Best Management Practices (BMPs) best suited to mitigate the impacts of post-development site conditions, while maintaining consideration of site constraints. This strategy should align with the findings from the Headwater Drainage Feature Assessment (September 8, 2023) and Environmental Impact Study (December 20, 2024) prepared by Kilgour & Associates Ltd. and should include but not be limited to:

- ❒ Rear yard grassed swales (dry swales)
- ❒ Enhanced pond design
- ❒ Incorporating wetland features
- ❒ Extended planting
- ❒ Other Filtration LID opportunities
- ❒ Soil Amendment in Parks
- ❒ Vegetated filter strips around ponds / Faulkner Drain

It is our understanding that post-development flows will continue to be directed to the Faulkner Drain and therefore not deviate from the overall pre-development hydrologic function of the site.

7.0 CLOSURE

The client should be aware that any information pertaining to soils and all test hole logs are furnished as a matter of general information only, and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those of the test holes.

A hydrogeological review 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. 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 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 Caivan (Stittsville) Inc., 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.



Michael Laflamme, P.Geo.





Oliver Blume, P.Geo.

8.0 REFERENCES

Chapman, L.J., and Putnam, D. F. “The Physiography of Southern Ontario, Third Edition”. Ontario Ministry of Natural Resources, 1984.

Freeze, R.A., and Cherry, J.A. “Groundwater”. Prentice-Hall, Inc., 1979.

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City of Ottawa - Public Works and Services Department - Surface Operations Branch. "Material Applications Policy, Revision 3.2 - Salt Management Plan - Appendix A", October 31, 2011.

APPENDIX 1

DRAWING PH4681-1 - SITE PLAN

DRAWING PH4681-2 - MECP WATER WELL LOCATION PLAN

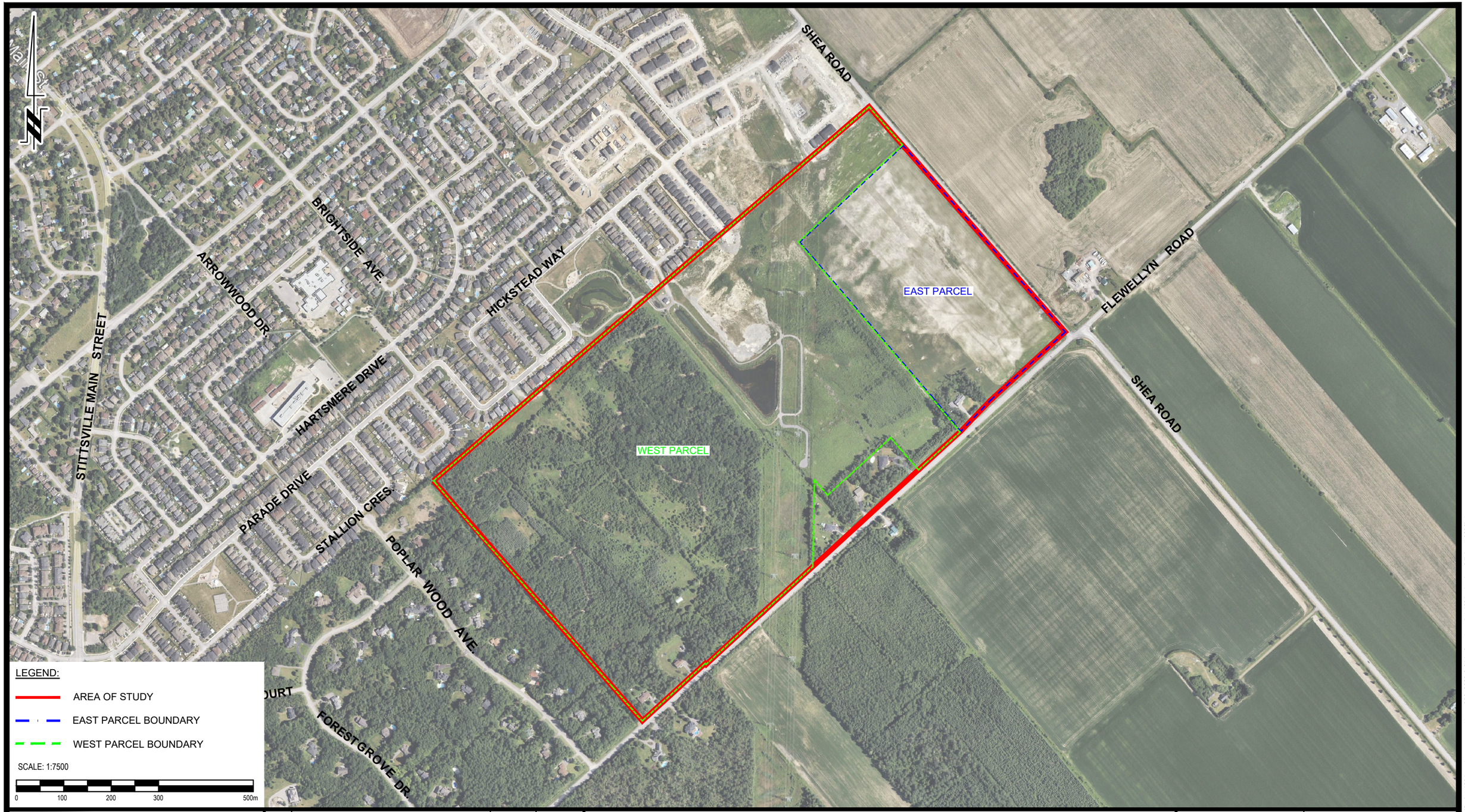
DRAWING PH4681-3 - SURFICIAL GEOLOGY PLAN

DRAWING PH4681-4 - BEDROCK GEOLOGY PLAN

DRAWING PH4681-5 - BEDROCK AQUIFER PLAN

DRAWING PH4681-6 - PRE-DEVELOPMENT TERRAIN COMPOSITION PLAN

DRAWING PH4681-7 - POST-DEVELOPMENT TERRAIN COMPOSITION PLAN



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NO.	REVISIONS	DATE	INITIAL
4	UPDATED CONCEPT PLAN AND SITE BOUNDARIES	10/04/2026	OB
3	UPDATE ADDRESS AND ADDITION OF EAST PARCEL	03/06/2025	OB
2	REVISED SITE BOUNDARY	23/05/2025	OB
1	REVISED SITE BOUNDARY	04/07/2024	OB

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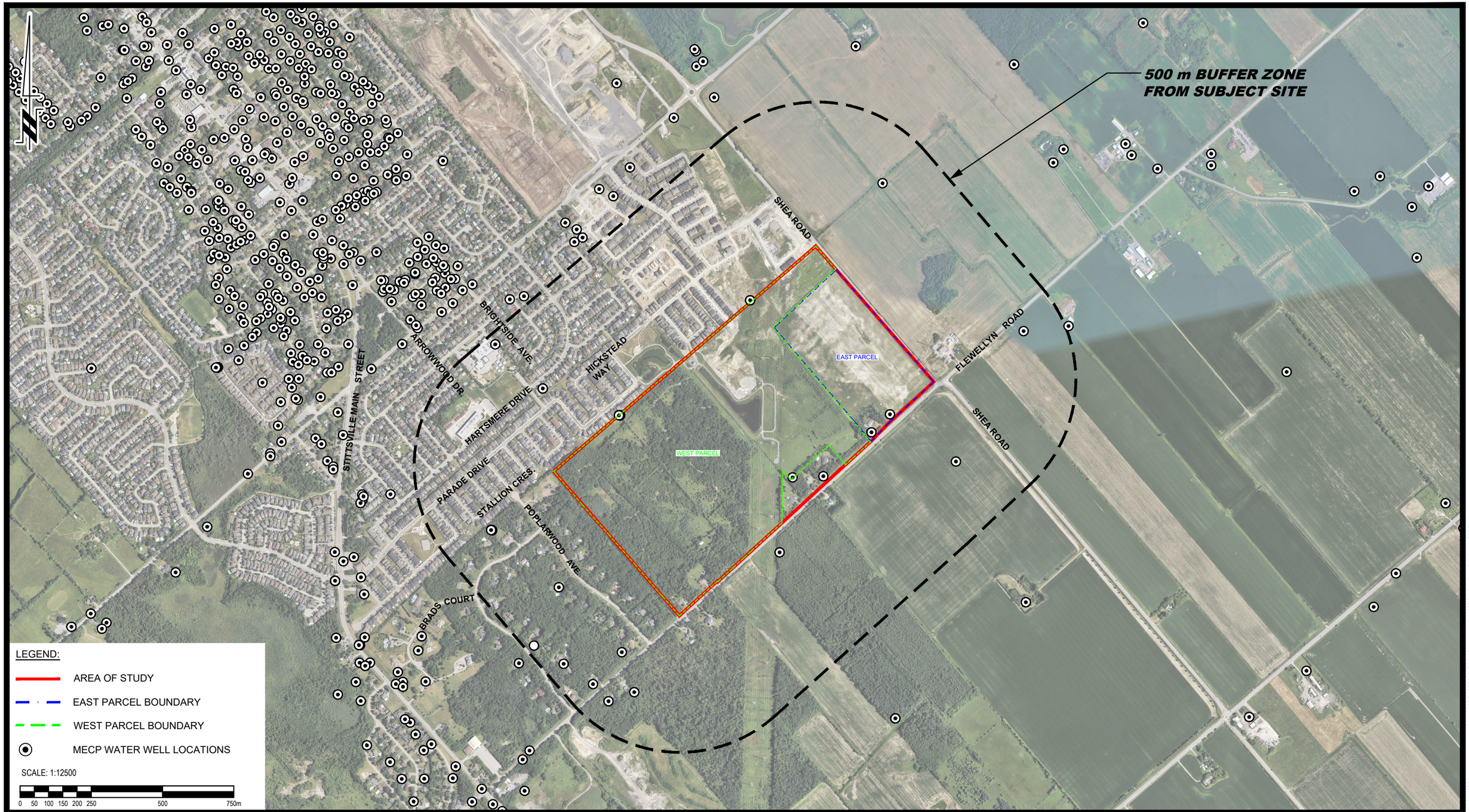
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Checked by: OB	Dwg. No.: PH4681-1
Approved by: ML	Revision No.: 4

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1	REVISED SITE BOUNDARY	04/07/2024	OB

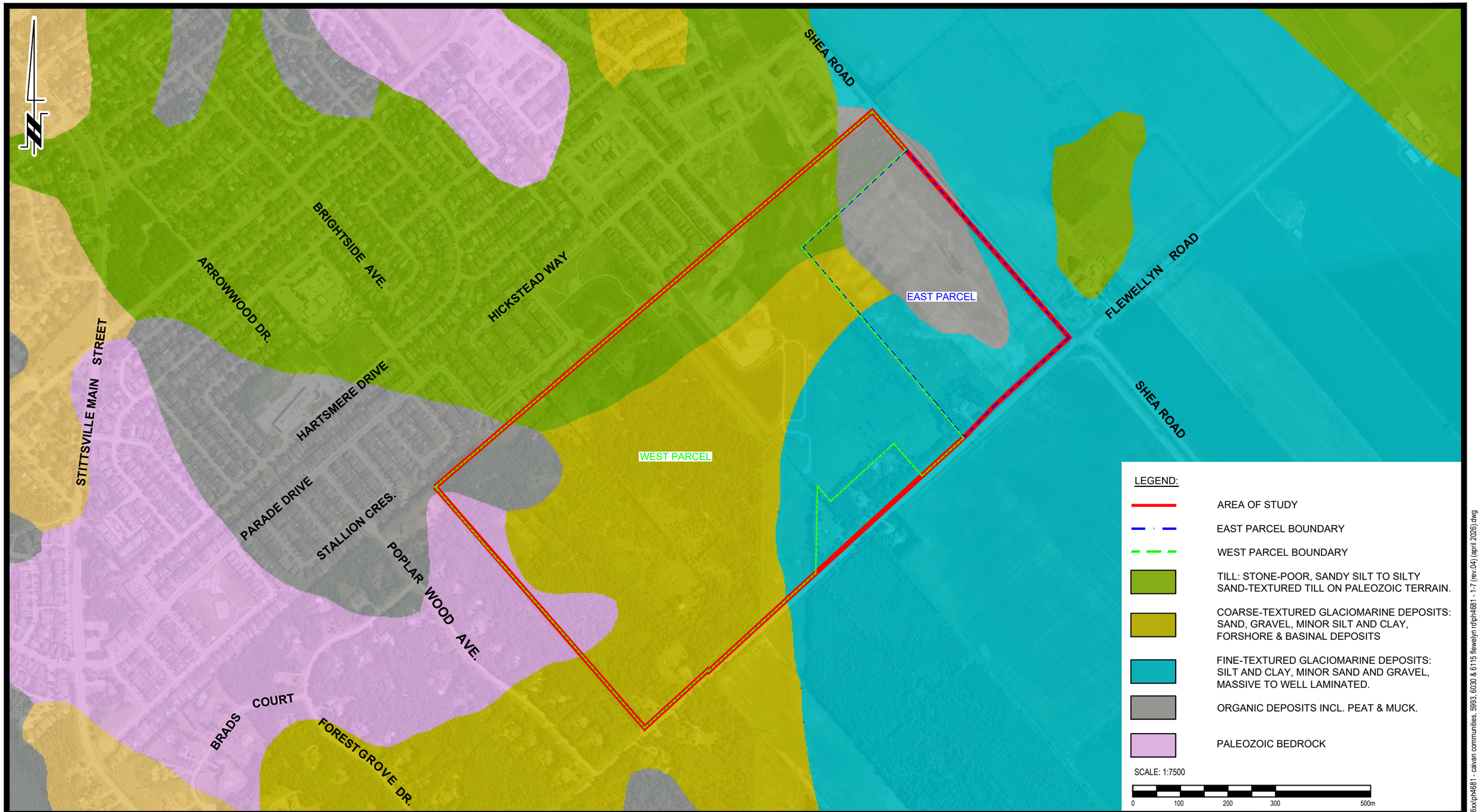
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Title:
MECP WATER WELL LOCATION PLAN

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Checked by: OB	Dwg. No.: PH4681-2
Approved by: ML	Revision No.: 4

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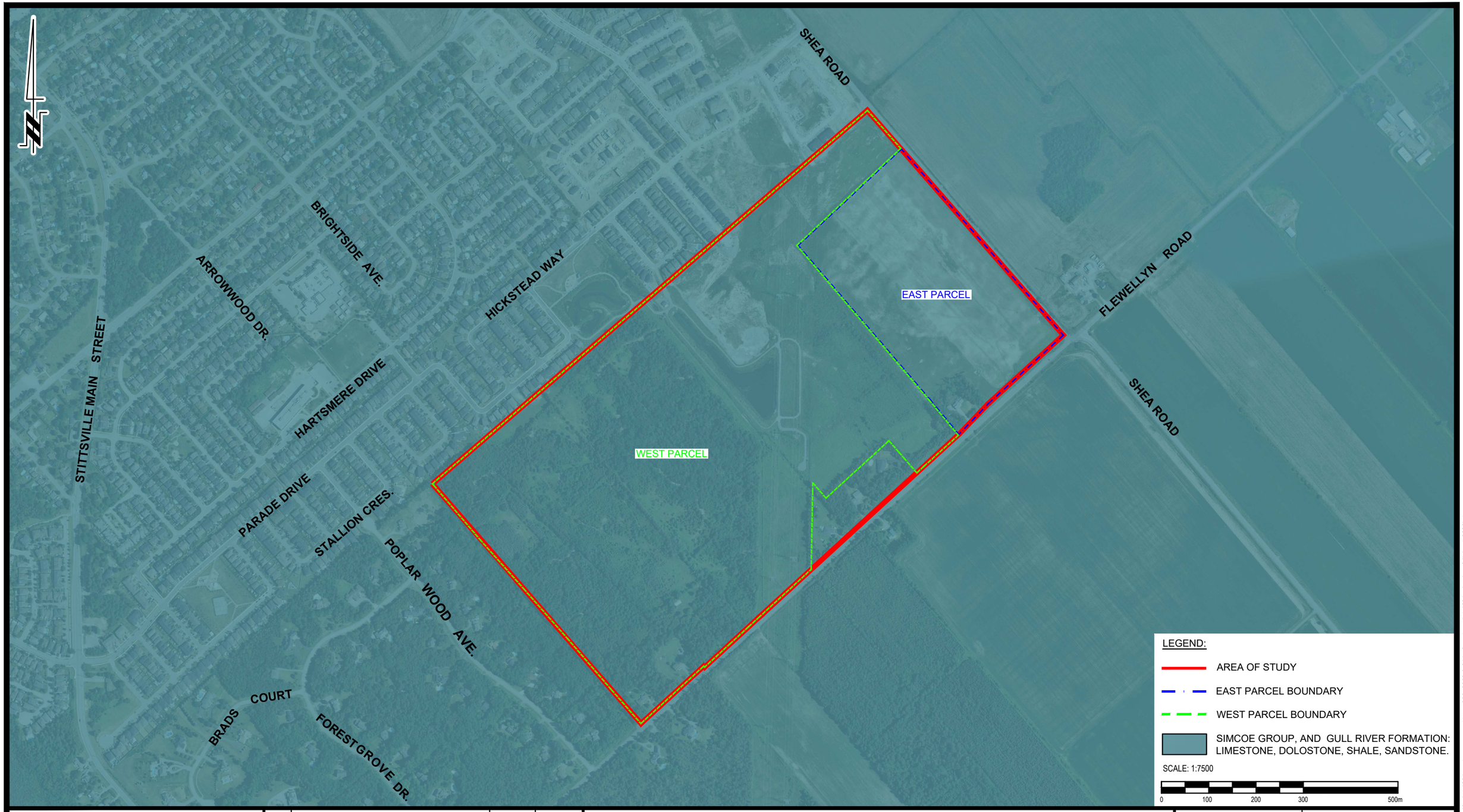
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Checked by:	OB
Approved by:	ML
Date:	12/2022
Report No.:	PH4681-REP.01 PH4681-REP.02
Dwg. No.:	PH4681-3
Revision No.:	4

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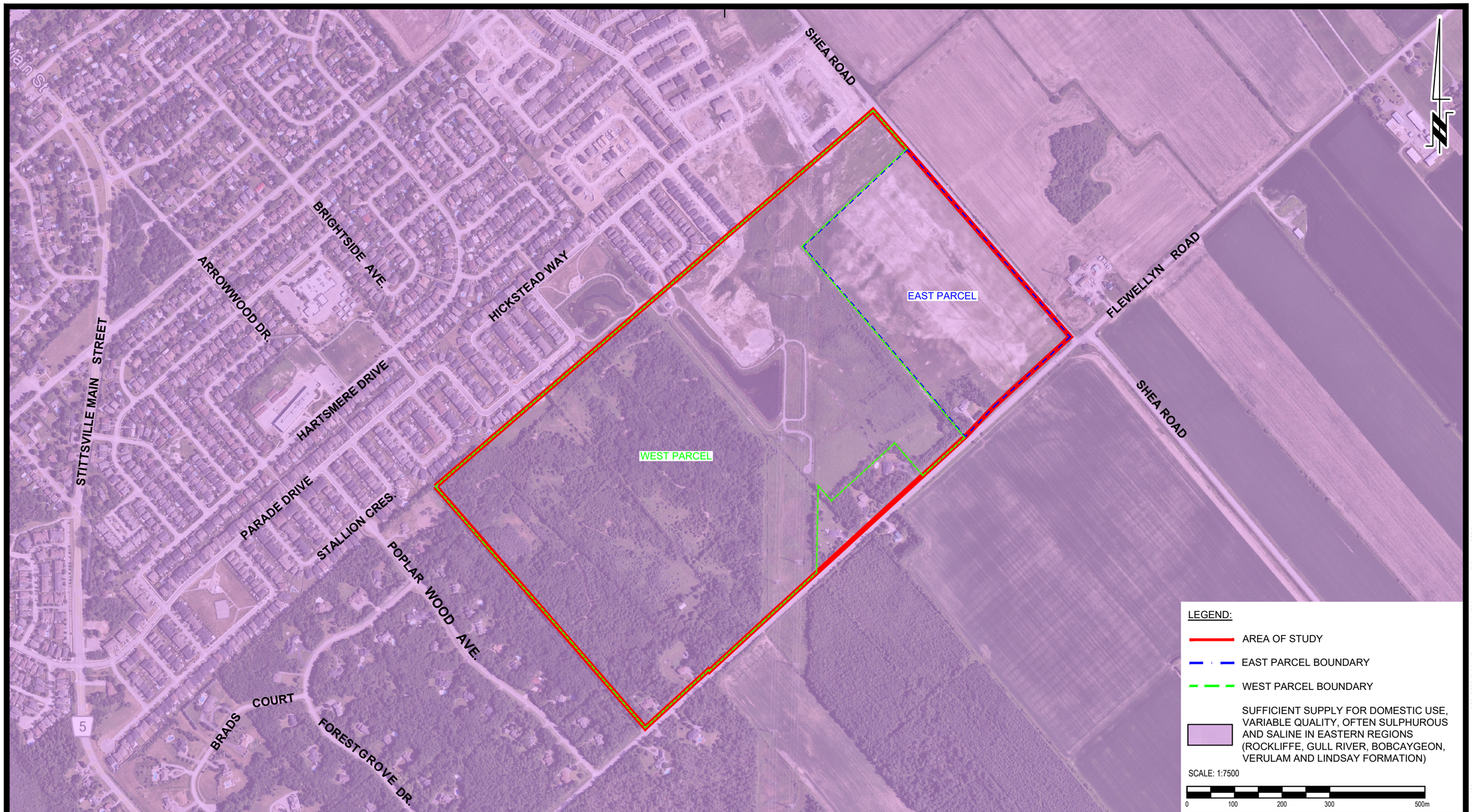
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Title:
BEDROCK GEOLOGY PLAN

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Drawn by: JM	Report No.: PH4681-REP.01 PH4681-REP.02
Checked by: OB	Dwg. No.: PH4681-4
Approved by: ML	Revision No.: 4

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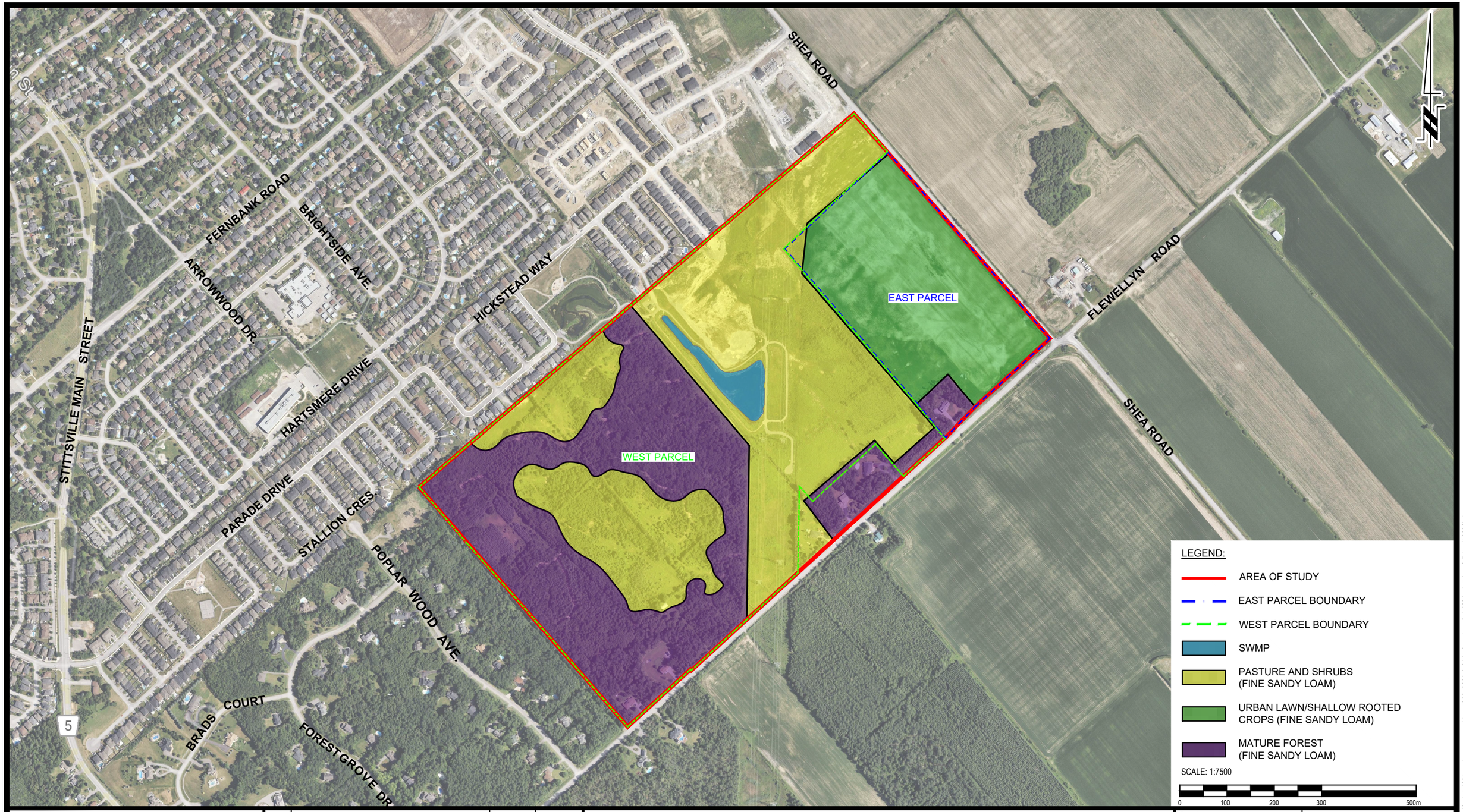
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Title:
BEDROCK AQUIFER PLAN

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Drawn by: JM	Report No.: PH4681-REP.01 PH4681-REP.02
Checked by: OB	Dwg. No.: PH4681-5
Approved by: ML	Revision No.: 4

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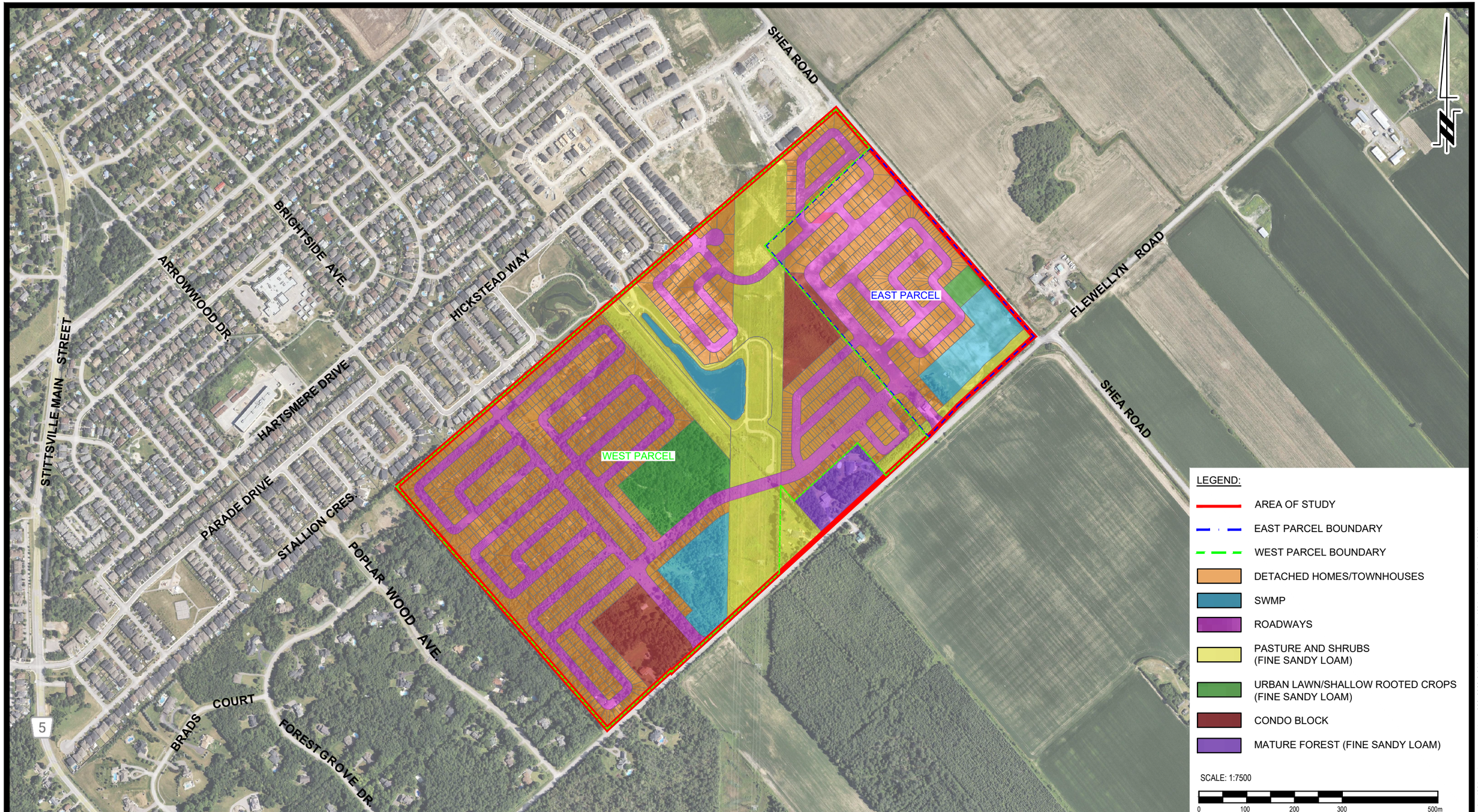
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Title:
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Checked by: OB	Dwg. No.: PH4681-6
Approved by: ML	Revision No.: 4

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Title:
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Approved by: ML	Revision No.: 2

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APPENDIX 2

SOIL PROFILE AND TEST DATA SHEETS

DRAWING PG5570-1 - TEST HOLE LOCATION PLAN

DRAWING PG5570-2 - BEDROCK CONTOUR PLAN

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

6115 Flewelyn Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 352905.38 **NORTHING:** 5012191.28 **ELEVATION:** 101.90

PROJECT: Proposed Residential Development

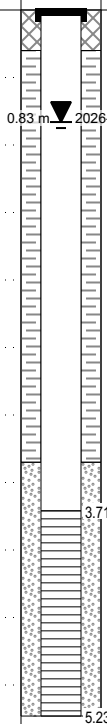
ADVANCED BY: Track Mounted Drill Rig

REMARKS: Datum: NAD1983 (Canada) Geoid: HT2-2010 **DATE:** January 15, 2026

FILE NO. : PG5570

HOLE NO. : BH 1-26

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL 0.20m [101.70m]									
Very loose to loose, brown **SILTY SAND** to **SANDY SILT**			AU 1			23			
		1	SS 2	67	3-2-3-5 5	28			
		2	SS 3	113	2-4-5-3 9	23			
- Grey by 2.6 m depth			SS 4	83	2-3-3-3 6	22 30			
3.51m [98.39m]		3	SS 5	75	1-2-1-2 3	33 13			
GLACIAL TILL: Compact, grey silty sand, with gravel		4	SS 6	4	7-7-11-10 18	12			
5.31m [96.59m]		5	SS 7		9-14-50-/ 64/0.28	13			
End of Borehole		6							
Practical refusal to augering at 5.31 m depth		7							
(GWL at 0.83 m depth - March 6, 2026)		8							
		9							
		10							



DISCLAIMER: THE DATA PRESENTED IN THIS SHEET IS THE PROPERTY OF PATERSON GROUP AND THE CLIENT FOR WHOM IT WAS PRODUCED. THIS SHEET SHOULD BE READ IN CONJUNCTION WITH ITS CORRESPONDING REPORT. PATERSON GROUP IS NOT RESPONSIBLE FOR THE UNAUTHORIZED USE OF THIS DATA.

P:/AutoCAD Drawings/Test Hole Data Files/PG55xx/PG5570/data.sqlite 2026-04-24, 00:29 Paterson_Template AE

SOIL PROFILE AND TEST DATA

Geotechnical Investigation

6115 Flewelyn Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 352849.53 **NORTHING:** 5012139.89 **ELEVATION:** 101.77

PROJECT: Proposed Residential Development

ADVANCED BY: Track Mounted Drill Rig

REMARKS: Datum: NAD1983 (Canada) Geoid: HT2-2010 **DATE:** January 15, 2026

FILE NO. : PG5570

HOLE NO. : BH 2-26

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL 0.18m [101.59m]			AU 1			25		0.54 m 2026-03-06	101
Compact, brown **SILTY SAND** to **SANDY SILT**		1	SS 2	83	4-5-5-7 10	24			
2.21m [99.56m]		2	SS 3	75	4-6-7-4 13	23			100
GLACIAL TILL: Compact to very dense, brown silty sand, with gravel and cobbles		3	SS 4	50	3-7-6-9 13	10			99
			SS 5	60	11-41-49-50 90	6		3.78m	8
		4	SS 6	73	16-49-47-50 96	7			
4.80m [96.97m]			SS 7	73	10-50-/-/ 50/0.05	6		5.00m	97
End of Borehole		5							
Practical refusal to augering at 4.80 m depth		6							96
(GWL at 0.54 m depth - March 6, 2026)		7							95
		8							94
									93
		9							
		10							92

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

6115 Flewelyn Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 352324.90 **NORTHING:** 5011723.17 **ELEVATION:** 102.91

PROJECT: Proposed Residential Development

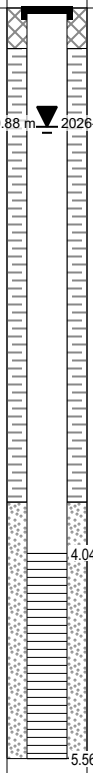
ADVANCED BY: Track Mounted Drill Rig

REMARKS: Datum: NAD1983 (Canada) Geoid: HT2-2010 **DATE:** February 26, 2026

FILE NO. : PG5570

HOLE NO. : BH 3-26

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL 0.10m [102.81m]			AU 1			24			
GLACIAL TILL: Compact to very dense, brown silty sand, with gravel, cobbles and boulders		1	SS 2	67	4-4-9-10 13	25			
1.75m [101.16m]			SS 3	60	5-50-/-/ 50/0.05	9			
BEDROCK: Excellent quality, grey limestone		2	RC 1	100	RQD 100				
		3	RC 2	100	RQD 98				
		4							
5.66m [97.25m]		5	RC 3	100	RQD 98				
End of Borehole		6							
(GWL at 0.88 m depth - March 6, 2026)		7							
		8							
		9							
		10							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

6115 Flewelyn Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 352111.41 **NORTHING:** 5011460.99 **ELEVATION:** 104.56

PROJECT: Proposed Residential Development

ADVANCED BY: Track Mounted Drill Rig

REMARKS: Datum: NAD1983 (Canada) Geoid: HT2-2010 **DATE:** February 26, 2026

FILE NO. : PG5570

HOLE NO. : BH 4-26

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	PIEZOMETER CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL 0.13m [104.43m]									
Compact, brown **SILTY SAND**			AU 1			19			
		1	SS 2	75	4-5-5-9 10	21		1.30 m 2026-03-06	
2.21m [102.35m]		2	SS 3	50	5-13-12-14 25	19			
GLACIAL TILL: Compact to very dense, brown silty sand, with gravel, cobbles and boulders			SS 4	42	8-20-18-24 38	16			
- Grey by 3.0 m depth		3	SS 5	50	8-26-24-26 50	20			
		4	SS 6	48	4-13-12-50 25	18			
4.70m [99.86m]			SS 7	78	50-/-/-/ 50/0.13	11			
						11			
End of Borehole		5							
Practical refusal to augering at 4.70 m depth		6							
(GWL at 1.30 m depth - March 6, 2026)		7							
		8							
		9							
		10							

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation

6115 Flewelyn Road, Ottawa, Ontario

COORD. SYS.: MTM ZONE 9 **EASTING:** 352311.94 **NORTHING:** 5011659.47 **ELEVATION:** 103.31

PROJECT: Proposed Residential Development

ADVANCED BY: Track Mounted Drill Rig

REMARKS: Datum: NAD1983 (Canada) Geoid: HT2-2010 **DATE:** February 26, 2026

FILE NO. : PG5570

HOLE NO. : BH 5-26

SAMPLE DESCRIPTION	STRATA PLOT	DEPTH (m)	SAMPLE TYPE AND NO.	SAMPLE RECOVERY (%)	SAMPLE N OR RQD	SAMPLE WATER CONTENT (%)	PEN. RESIST. (BLOWS/0.3m) DCPT (50mm DIA. CONE) 20 40 60 80 / REMOULDED SHEAR STRENGTH (kPa) / UNDRAINED SHEAR STRENGTH (kPa) 20 40 60 80 / PL (%) WATER CONTENT (%) LL (%) 20 40 60 80	MONITORING WELL CONSTRUCTION	ELEVATION (m)
GROUND SURFACE									
TOPSOIL 0.10m [103.21m]									103
Overburden		1						0.89 m 2026-03-06	102
		2							101
		3	RC 1	100	RQD 83				100
3.94m [99.37m]		4							99
BEDROCK: good to excellent quality, grey limestone		5	RC 2	100	RQD 86			4.50m	98
6.20m [97.11m]		6	RC 3	100	RQD 75			6.02m	97
End of Borehole		7							96
(GWL at 0.89 m depth - March 6, 2026)		8							95
		9							94
		10							

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 28, 2022

FILE NO. PG5570

HOLE NO. BH 1-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.31
TOPSOIL 0.30							
Loose to compact, brown **SILTY SAND,** trace gravel 0.60		AU	1				
		SS	2	45	17	1	106.31
GLACIAL TILL: Compact to dense, brown silty sand to sandy silt with gravel, cobbles and boulders		SS	3	14	65	2	105.31
2.34		RC	1	100	89	3	104.31
		RC	2	100	100	4	103.31
		RC	3	100	100	5	102.31
BEDROCK: Excellent quality, grey limestone interbedded with dolostone		RC	4	98	98	6	101.31
		RC	5	100	100	7	100.31
9.02						8	99.31
End of Borehole						9	98.31
(GWL @ 1.33m - Oct. 11, 2022)							

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

Monitoring Well Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
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DATUM Geodetic

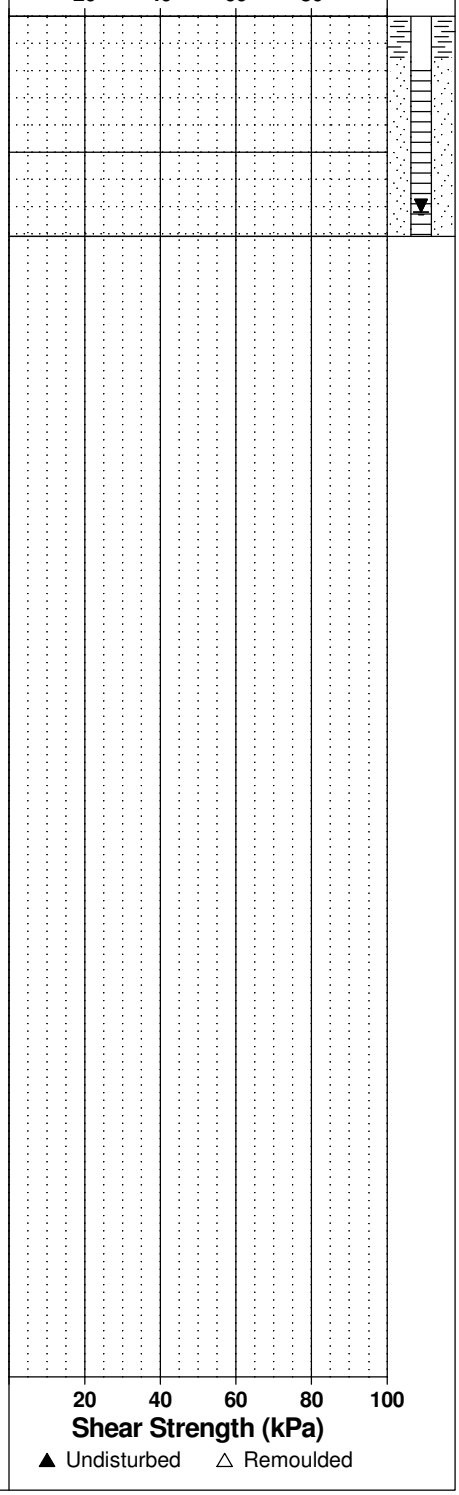
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 28, 2022

FILE NO. PG5570

HOLE NO. BH 1A-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	107.31		
OVERBURDEN						1	106.31		
1.62									
End of Borehole Practical refusal to augering at 1.62m depth (GWL @ 1.44m - Oct. 11, 2022)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 28, 2022

FILE NO. PG5570

HOLE NO. BH 2-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.58
TOPSOIL 0.30							
Compact, brown **SILTY SAND to SANDY SILT,** trace clay and gravel 0.76		AU	1				
		RC	1	100	77	1	102.58
		RC	2	100	97	2	101.58
		RC	3	100	100	3	100.58
BEDROCK: Good to excellent quality, grey limestone interbedded with dolostone		RC	4	100	100	4	99.58
		RC	5	100	97	5	98.58
		RC	6	100	100	6	97.58
						7	96.58
						8	95.58
9.02						9	94.58
End of Borehole							
(GWL @ 1.52m - Oct. 11, 2022)							

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

Monitoring Well Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
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DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 29, 2022

FILE NO. PG5570

HOLE NO. BH 3-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.25
TOPSOIL 0.28		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	58	19	1	101.25
		SS	3	58	17	2	100.25
2.21							
GLACIAL TILL: Grey silty sand to sandy silt with gravel, cobbles and boulders, trace clay		SS	4	67	3		
		SS	5	67	50+	3	99.25
3.43							
		RC	1	100	96	4	98.25
						5	97.25
		RC	2	100	98		
BEDROCK: Excellent quality, grey limestone interbedded with doloston						6	96.25
		RC	3	100	100	7	95.25
						8	94.25
		RC	4	100	100		
9.12						9	93.25
End of Borehole							
(GWL @ 0.84m - Oct. 11, 2022)							

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

Monitoring Well Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 29, 2022

FILE NO. PG5570

HOLE NO. BH 3A-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	102.25		
TOPSOIL 0.28									
Compact, brown **SILTY SAND to SANDY SILT**		AU	1			1	101.25		
2.20						2	100.25		
GLACIAL TILL: Grey silty sand to sandy silt with gravel, cobbles and boulders, trace clay 3.15						3	99.25		
End of Borehole									
Practical refusal to augering at 3.15m depth.									
(GWL @ 0.81m - Oct. 11, 2022)									

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

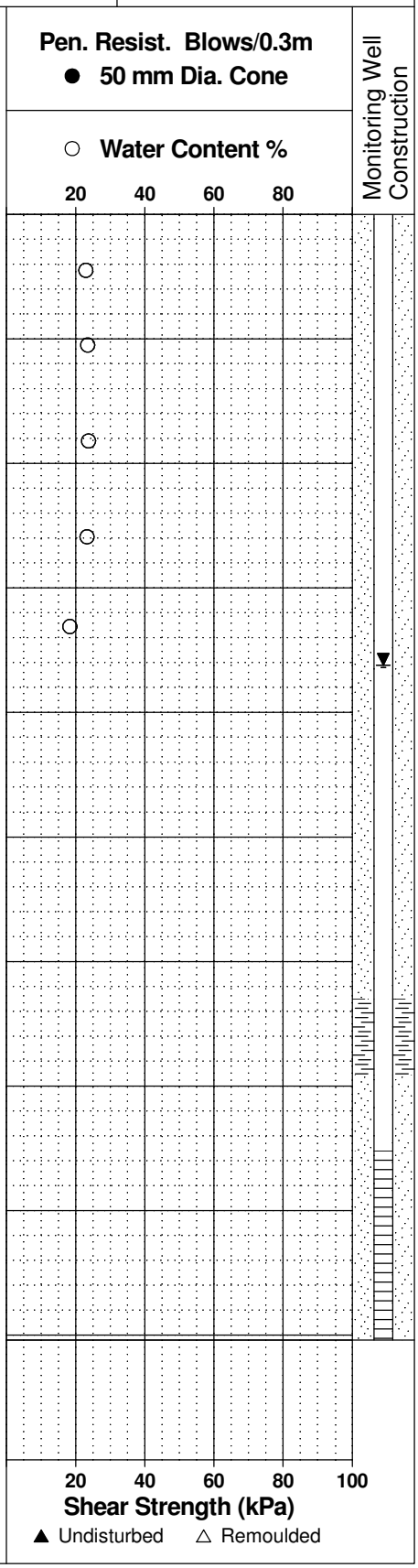
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 29, 2022

FILE NO. PG5570

HOLE NO. BH 4-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.71
TOPSOIL 0.28		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	75	22	1	104.71
		SS	3	75	21	2	103.71
2.21							
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders, trace clay		SS	4	67	17	3	102.71
- grey by 3.0m depth		SS	5	57	45		
3.61							
		RC	1	100	84	4	101.71
		RC	2	100	98	5	100.71
BEDROCK: Good to excellent quality, grey limestone interbedded with dolostone		RC	3	100	100	6	99.71
						7	98.71
		RC	4	100	100	8	97.71
9.04						9	96.71
End of Borehole							
(GWL @ 3.62m - Oct. 11, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
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DATUM Geodetic

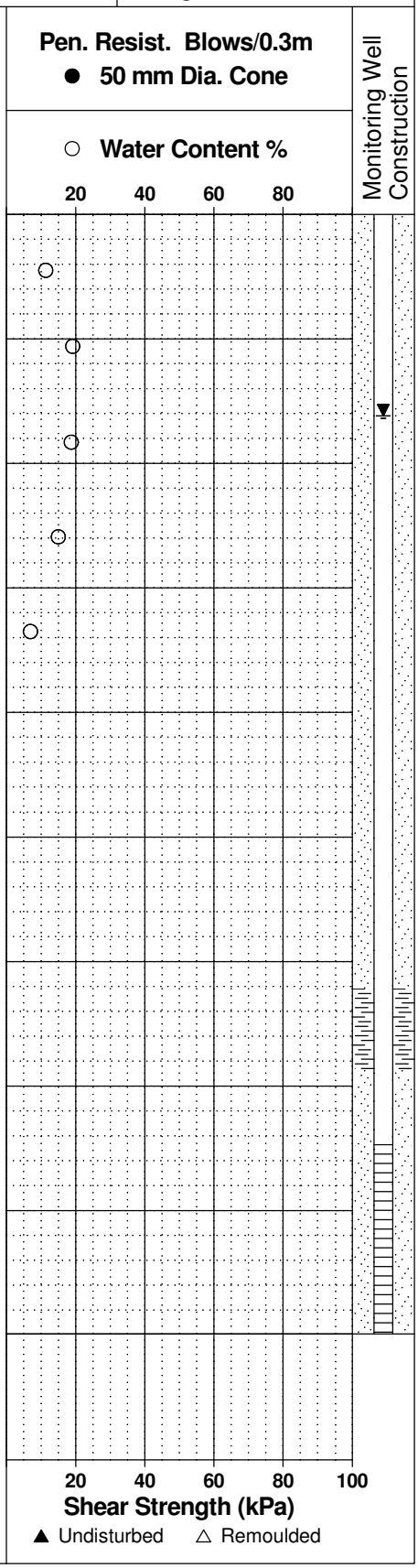
REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** September 30, 2022

FILE NO. PG5570

HOLE NO. BH 5-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.70
TOPSOIL 0.28		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	79	21	1	104.70
1.96		SS	3	71	29	2	103.70
GLACIAL TILL: Compact to dense, brown silty sand to sandy silt, trace gravel 2.29		SS	4	100	50+		
		RC	1	100	100	3	102.70
		RC	2	100	100	4	101.70
BEDROCK: Excellent quality, grey limestone interbedded with dolostone		RC	3	100	100	5	100.70
		RC	4	100	100	6	99.70
		RC	5	100	100	7	98.70
8.99						8	97.70
End of Borehole							
(GWL @ 1.62m - Oct. 11, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
5993, 6070 and 6115 Flewellyn Road
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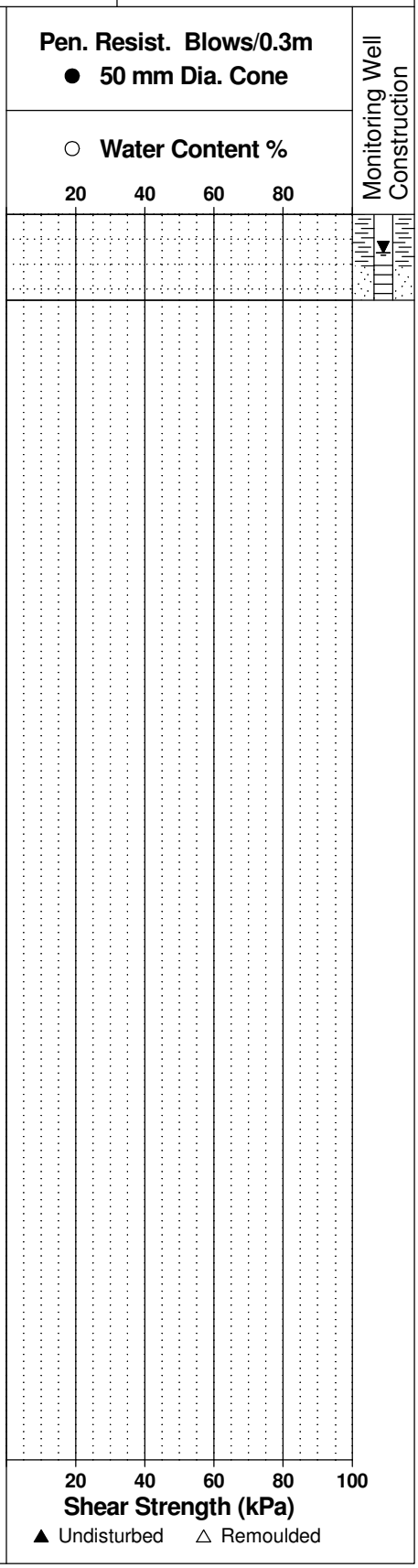
REMARKS

BORINGS BY Hand Auger **DATE** September 28, 2022

FILE NO. PG5570

HOLE NO. HA 1-22

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Monitoring Well Construction
GROUND SURFACE						0	106.78		
TOPSOIL 0.30									
Brown **SILTY SAND,** trace gravel 0.69									
End of Hand Auger Hole									
(GWL @ 0.31m - Oct. 11, 2022)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 14, 2021

FILE NO. PG5570

HOLE NO. BH 1-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.29
TOPSOIL 0.43							
Very loose, brown **SILTY SAND**		AU	1				
- some clay by 0.6m depth		SS	2	8	1	1	103.29
1.52							
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders, trace clay 2.19		SS	3	25	23	2	102.29
		SS	4	100	50+		
		RC	1	100	57		
BEDROCK: Fair to excellent quality, grey limestone interbedded with dolostone		RC	2	100	68	3	101.29
- 20mm thick mud seam at 3.4m depth						4	100.29
- 12mm thick mud at 3.7m depth		RC	3	100	98	5	99.29
5.77							
End of Borehole							
(GWL @ 1.22m - Jan. 11, 2022)							

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

Monitoring Well Construction

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

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 14, 2021

FILE NO. PG5570

HOLE NO. BH 2-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.19
Mulch 0.10							
TOPSOIL 0.51							
Compact, brown **SILTY SAND**		AU	1				
0.91		SS	2	75	12	1	106.19
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	3	75	50		
2.21		SS	4	0	50+	2	105.19
		RC	1	100	80		
BEDROCK: Good to excellent quality, grey limestone		RC	2	100	100	3	104.19
- 12mm thick mud seam at 4.1m depth						4	103.19
		RC	3	100	95	5	102.19
5.61							
End of Borehole							
(GWL @ 0.82m - Jan. 11, 2022)							

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

Monitoring Well Construction

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

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 3-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.41
Mulch 0.08							
TOPSOIL 0.43		AU	1				
Loose, brown **SILTY SAND** 0.63							
Loose to compact, brown **SILTY SAND to SANDY SILT**		SS	2	50	10	1	107.41
1.55		SS	3	0	50+		
		RC	1	100	100	2	106.41
BEDROCK: Good to excellent, grey limestone interbedded with dolostone		RC	2	100	72	3	105.41
						4	104.41
- 30mm thick mud seam at 4.3m depth		RC	3	100	100	5	103.41
5.72							
End of Borehole							
(GWL @ 0.89m - Jan. 11, 2022)							

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

○ Water Content %

20 40 60 80

Monitoring Well Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 4-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.95
Mulch 0.10							
TOPSOIL 0.30		AU	1				
Compact, brown **SILTY SAND,** trace shells 0.60		SS	2	50	12	1	107.95
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders		SS	3	42	21	2	106.95
2.23							
End of Borehole							
Practical refusal to augering at 2.23m depth							
(GWL @ 1.23m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 5-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.38
TOPSOIL 0.36		AU	1				
Loose, brown **SILTY SAND**		SS	2		4	1	107.38
1.22							
GLACIAL TILL: Dense, grey silty sand with gravel, cobbles and boulders 1.62		SS	3	0	50+		
End of Borehole							
Practical refusal to augering at 1.62m depth							
(BH dry - January 11, 2022)							

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

20 40 60 80

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

Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 6-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	106.32
TOPSOIL 0.41							
Loose, brown **SILTY SAND,** trace clay 0.60		AU	1				
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders 1.55		SS	2	83	17	1	105.32
End of Borehole							
Practical refusal to augering at 1.55m depth							
(BH dry - January 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 7-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	107.04
Mulch 0.10		AU	1				
TOPSOIL 0.41							
Loose, brown **SILTY SAND** 0.60		SS	2	100	19	1	106.04
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	3	67	44	2	105.04
		SS	4		52		
2.97							
End of Borehole							
Practical refusal to augering at 2.97m depth							
(GWL @ 1.09m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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SOIL PROFILE AND TEST DATA

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Prop. Residential Development - 6115 Flewellyn Road
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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 8-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.91
Mulch 0.05		AU	1				
TOPSOIL 0.38							
Loose, brown **SILTY SAND** 0.60							
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	2	67	20	1	104.91
1.60		SS	3	0	50+		
End of Borehole							
Practical refusal to augering at 1.60m depth							
(BH dry - January 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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Prop. Residential Development - 6115 Flewellyn Road
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DATUM Geodetic

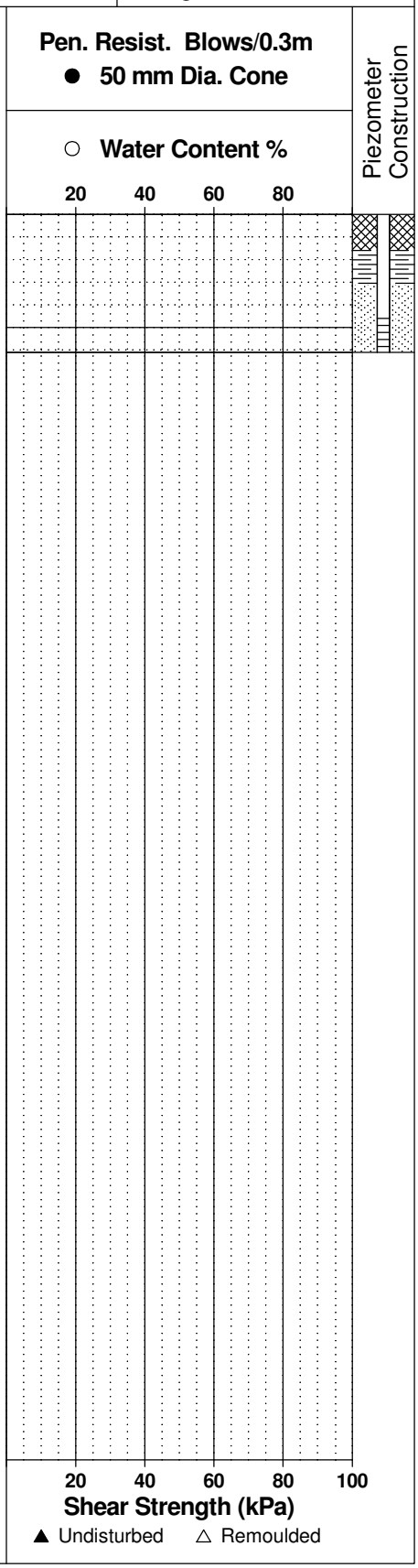
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH 9-21

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE								
TOPSOIL	0.36						0	104.62
Loose, brown **SILTY SAND,** trace clay	0.69		AU	1				
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders	1.22		SS	2		50+	1	103.62
End of Borehole								
Practical refusal to augering at 1.22m depth								
(Piezometer damaged - Jan. 11, 2022)								



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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

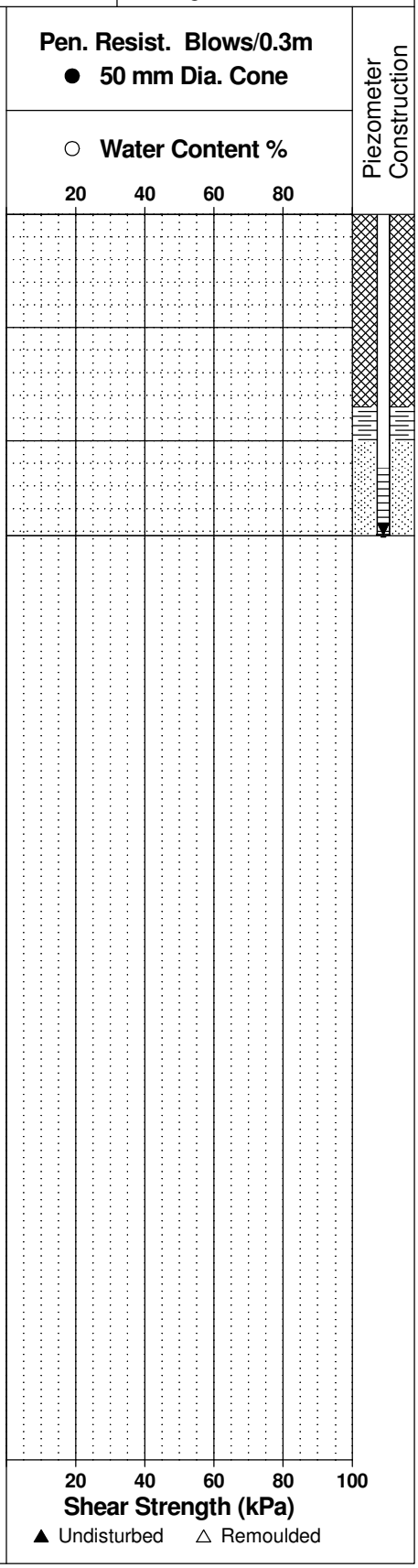
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 15, 2021

FILE NO. PG5570

HOLE NO. BH10-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.70
TOPSOIL 0.36		AU	1				
Compact, brown **SILTY SAND**		SS	2	67	23	1	104.70
		SS	3	67	16	2	103.70
		SS	4	64	25		
2.74							
GLACIAL TILL: Compact to dense, grey silty sand with gravel, cobbles and boulders 2.84							
End of Borehole							
Practical refusal to augering at 2.84m depth							
(GWL @ 2.83m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM Geodetic

REMARKS

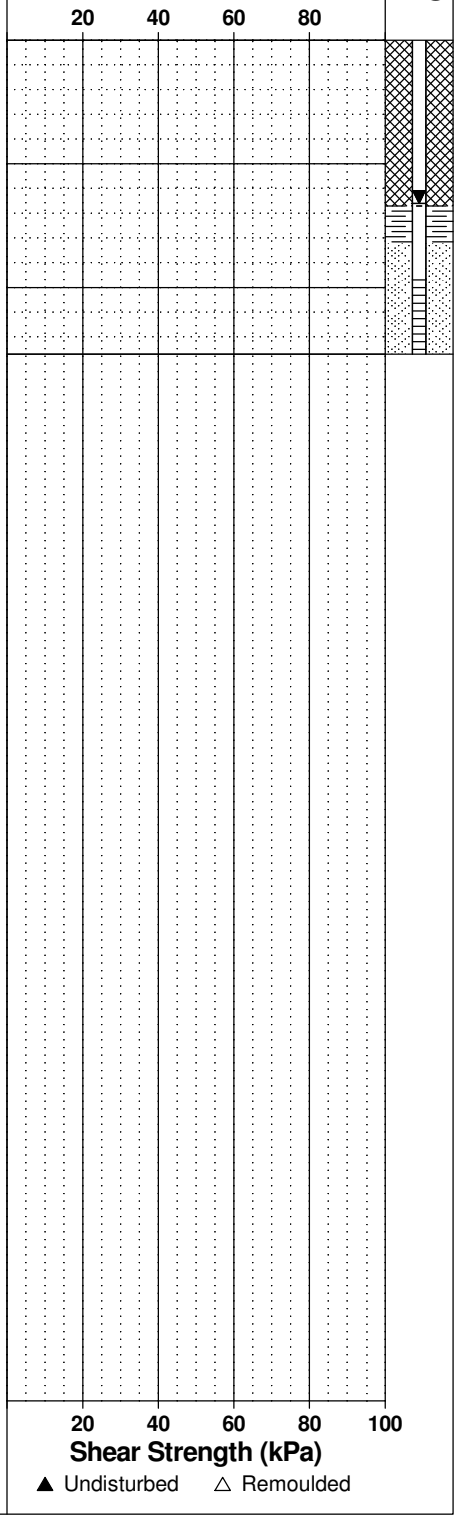
BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH11-21

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	104.98
TOPSOIL	0.33							
Compact, brown **SILTY SAND**	0.66		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**	1.12		SS	2	67	24	1	103.98
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders			SS	3	67	32		
	2.54		SS	4	80	50+	2	102.98
End of Borehole								
Practical refusal to augering at 2.54m depth								
(GWL @ 1.32m - Jan. 11, 2022)								

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



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Geodetic

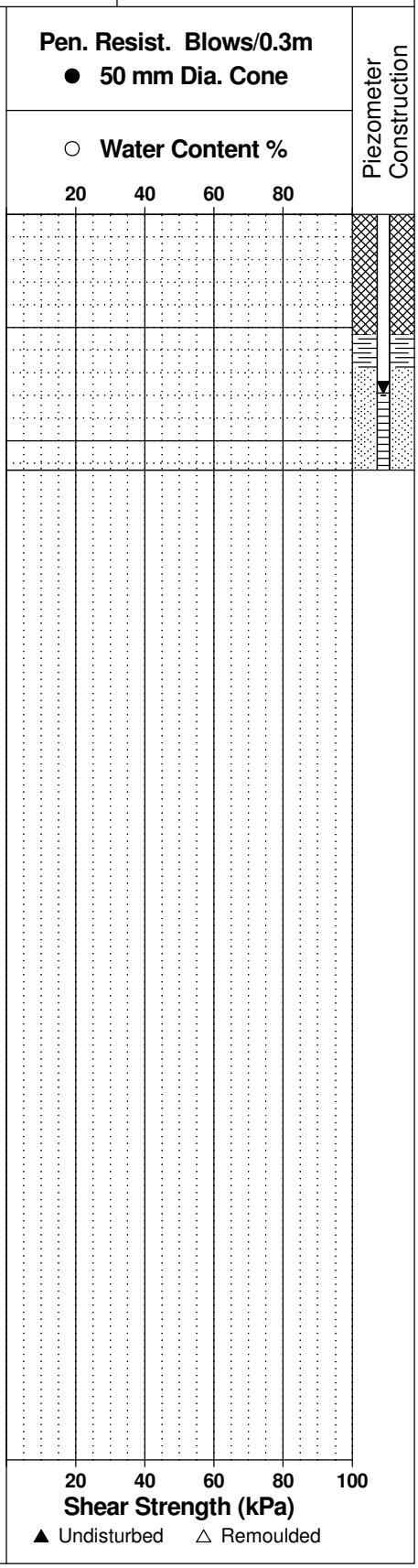
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH12-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.05
TOPSOIL 0.36							
Compact, brown **SILTY SAND** 0.69		AU	1				
Compact, brown **SILTY SAND to SANDY SILT** 1.45		SS	2	67	13	1	103.05
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders 2.26		SS	3	17	36	2	102.05
End of Borehole							
Practical refusal to augering at 2.26m depth							
(GWL @ 1.58m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

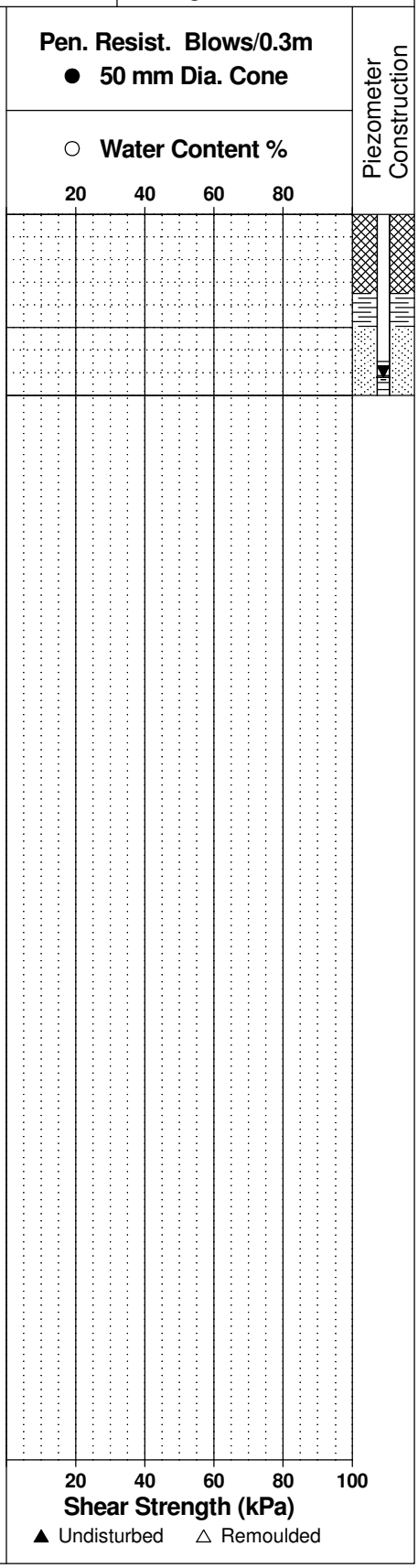
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH13-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.36						0	103.54		
Loose, brown **SILTY SAND to SANDY SILT**		AU	1						
		SS	2	25	6	1	102.54		
1.60		SS	3	0	50+				
End of Borehole									
Practical refusal to augering at 1.60m depth									
(GWL @ 1.44m - Jan. 11, 2022)									



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

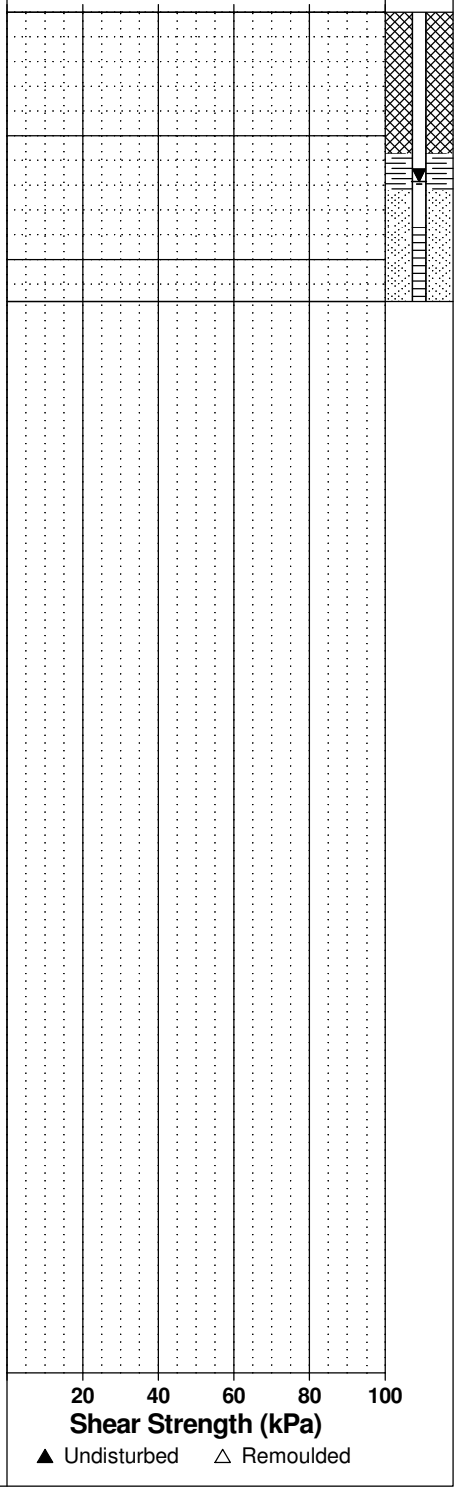
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH14-21

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							0	103.28
TOPSOIL	0.36							
Loose, brown **SILTY SAND**	0.69		AU	1				
Loose, brown **SILTY SAND to SANDY SILT**	1.45		SS	2	67	6	1	102.28
GLACIAL TILL: Loose to dense, brown silty sand with clay, gravel, cobbles and boulders	2.34		SS	3	25	7	2	101.28
			SS	4	0	50+		
End of Borehole								
Practical refusal to augering at 2.34m depth								
(GWL @ 1.37m - Jan. 11, 2022)								



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM Geodetic

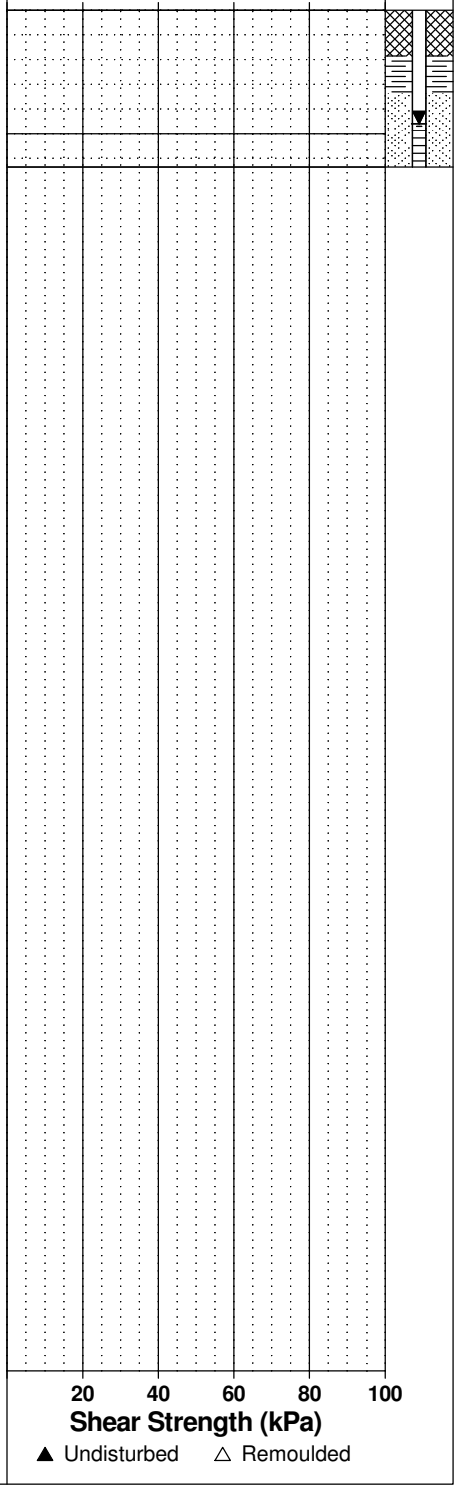
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH15-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.30						0	103.08		
Compact, brown **SILTY SAND to SANDY SILT** 0.91		AU	1						
GLACIAL TILE: Compact, brown silty sand with gravel, cobbles and boulders 1.27		SS	2	63	19	1	102.08		
End of Borehole									
Practical refusal to augering at 1.27m depth									
(GWL @ 0.92m - Jan. 11, 2022)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
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DATUM Geodetic

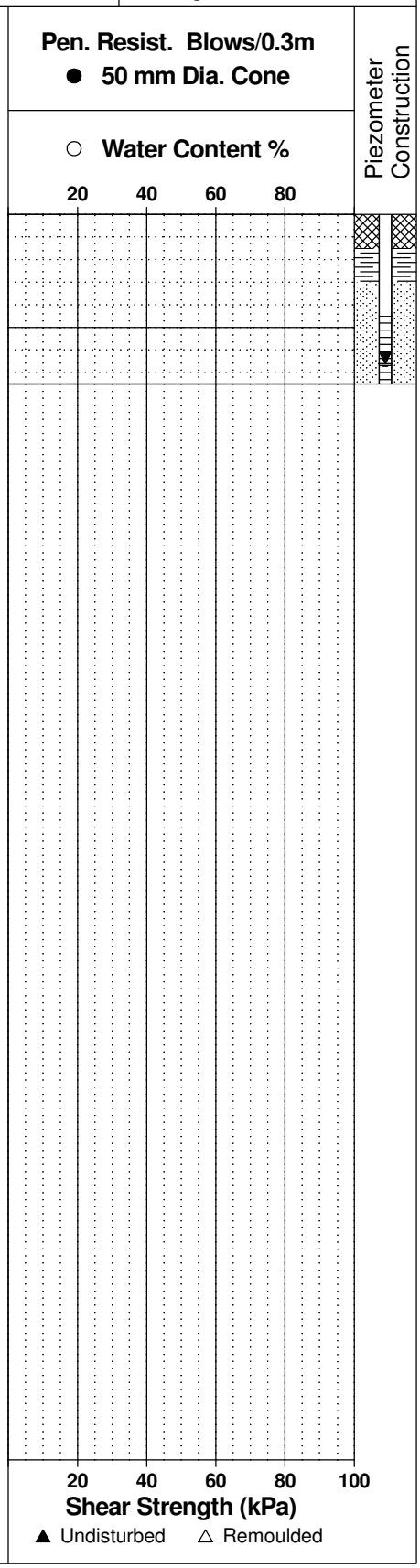
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH16-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.19
TOPSOIL 0.25							
Compact, brown **SILTY SAND,** trace gravel 0.69		AU	1				
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders 1.50		SS	2		22	1	103.19
End of Borehole							
Practical refusal to augering at 1.50m depth							
(GWL @ 1.32m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

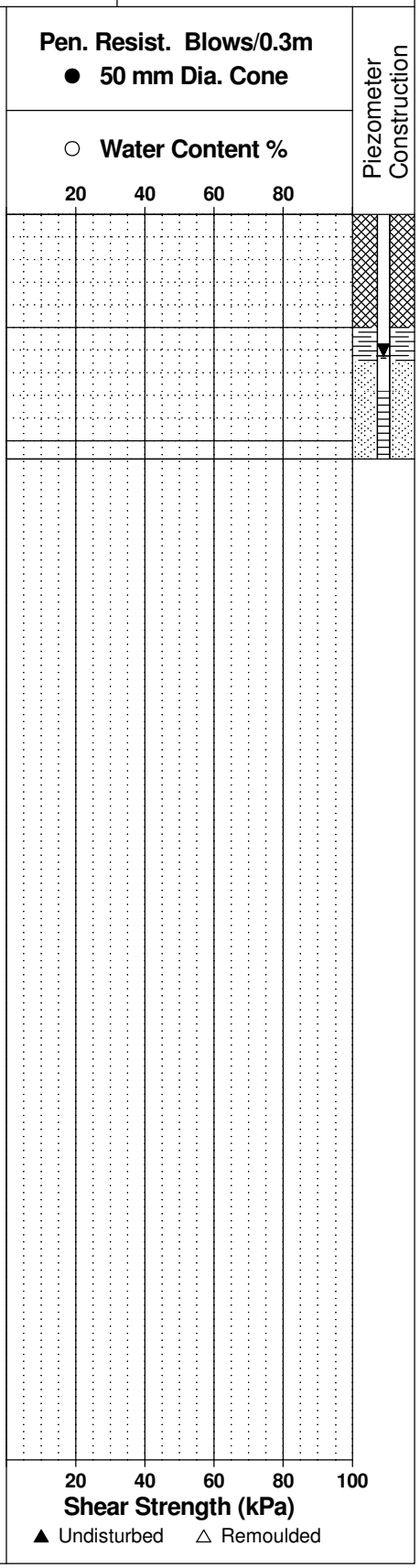
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH17-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.42
TOPSOIL 0.28		AU	1				
Loose, brown **SILTY SAND to SANDY SILT**		SS	2	75	5	1	103.42
1.98		SS	3	91	11		
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders 2.16						2	102.42
End of Borehole							
Practical refusal to augering at 2.16m depth							
(GWL @ 1.25m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

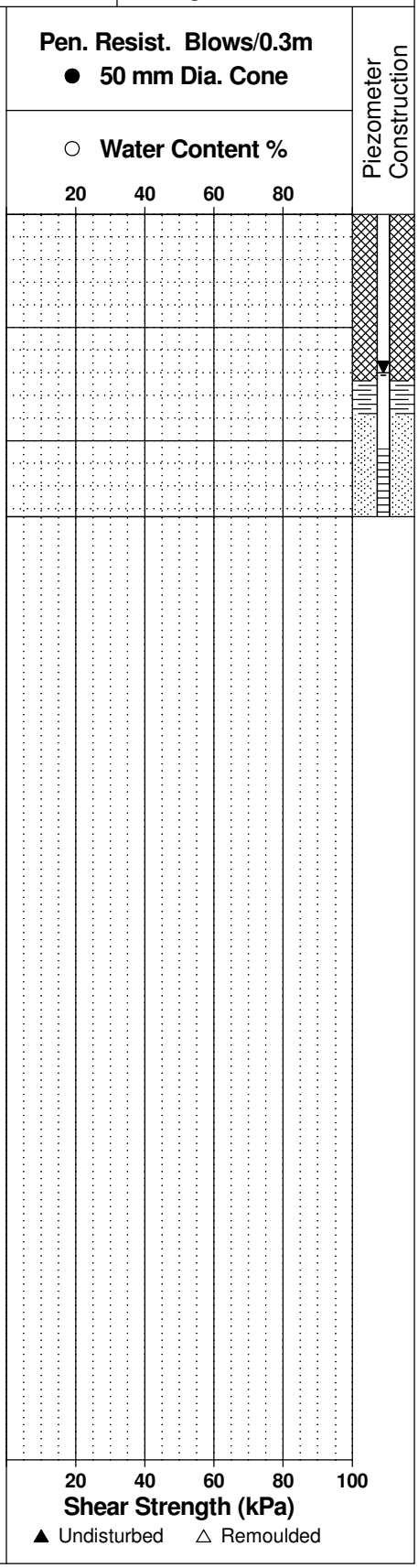
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH18-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.06
TOPSOIL 0.30		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	75	10	1	104.06
		SS	3	100	19	2	103.06
- grey by 2.0m depth		SS	4		50+		
2.67							
End of Borehole							
Practical refusal to augering at 2.67m depth							
(GWL @ 1.40m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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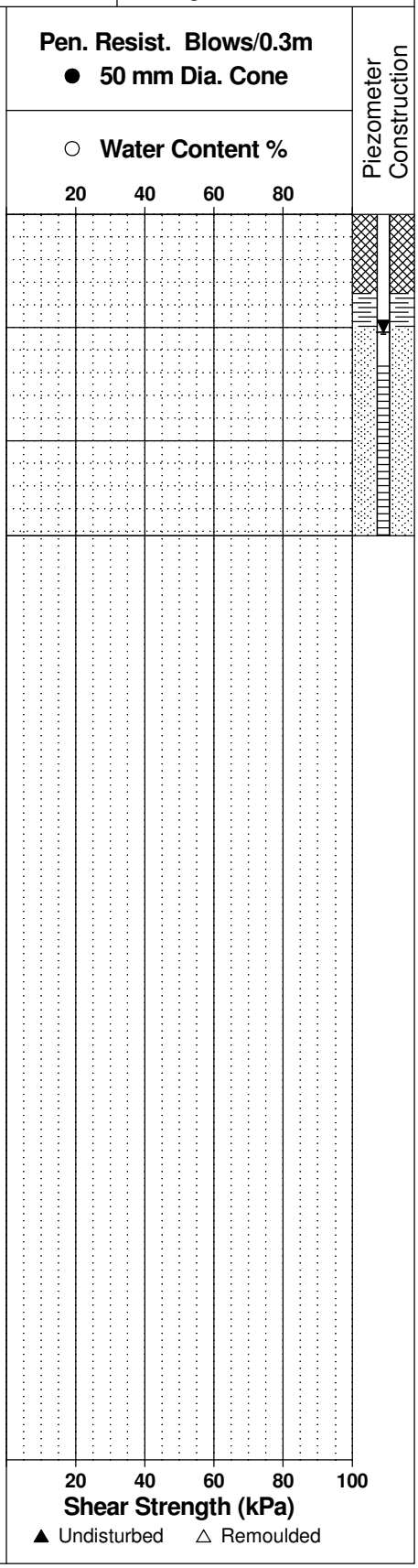
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 16, 2021

FILE NO. PG5570

HOLE NO. BH19-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.85
TOPSOIL 0.20		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	50	12	1	100.85
1.73		SS	3	75	8		
Loose, brown **SILTY SAND,** some clay						2	99.85
2.59		SS	4	100	12		
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders 2.84							
End of Borehole							
Practical refusal to augering at 2.84m depth							
(GWL @ 1.04m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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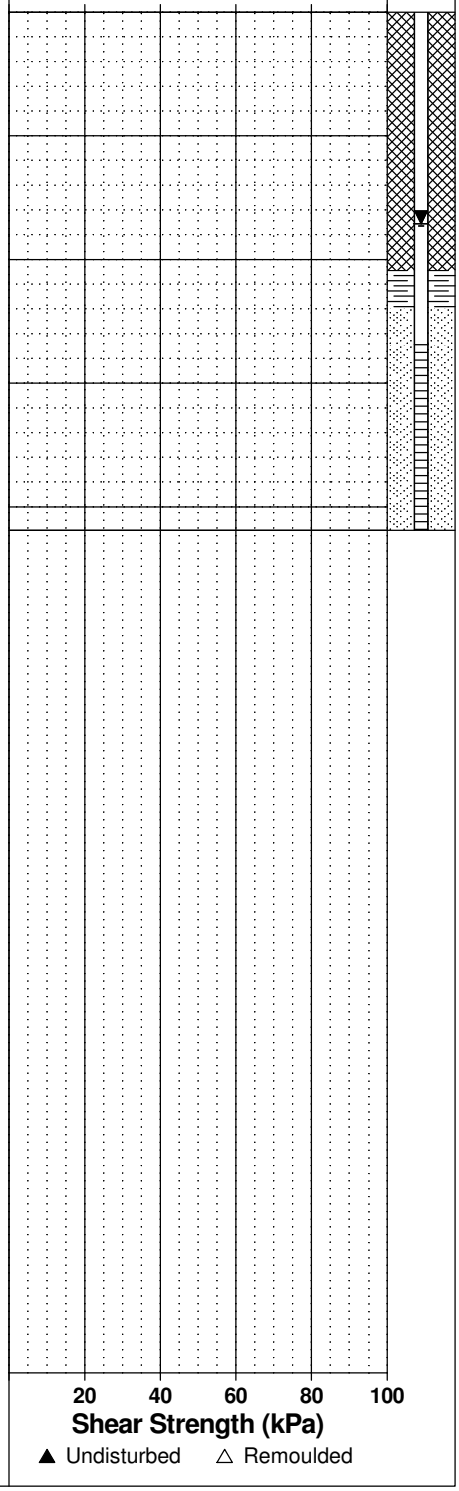
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 17, 2021

FILE NO. PG5570

HOLE NO. BH20-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.25
TOPSOIL 0.23		AU	1				
Compact to loose, brown **SILTY SAND to SANDY SILT**		SS	2	58	11	1	101.25
		SS	3	42	7	2	100.25
2.44							
Interlayered grey **SANDY SILT** and grey **SILTY CLAY**		SS	4	75	3	3	99.25
3.20							
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders		SS	5	67	23		
4.19		SS	6		50+	4	98.25
End of Borehole							
Practical refusal to augering at 4.19m depth							
(GWL @ 1.71m - Jan. 11, 2022)							



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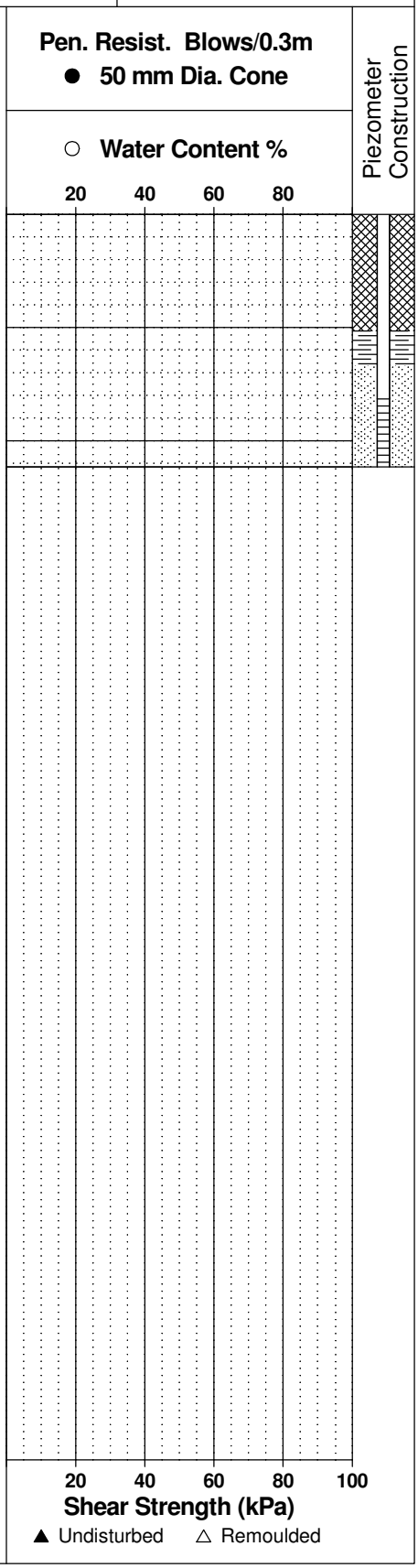
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 17, 2021

FILE NO. PG5570

HOLE NO. BH21-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.92
TOPSOIL 0.25							
Loose, brown **SILTY SAND to SANDY SILT**		AU	1				
1.07		SS	2	42	36	1	101.92
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders		SS	3	50	71		
2.23						2	100.92
End of Borehole							
Practical refusal to augering at 2.23m depth							
(Piezometer damaged - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 20, 2021

FILE NO. PG5570

HOLE NO. BH22-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.98
TOPSOIL 0.20							
Loose, brown **SILTY SAND,** trace gravel 0.69		AU	1				
		SS	2	100	22	1	101.98
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	3	92	29	2	100.98
		SS	4	83	46		
		SS	5	50	50+	3	99.98
3.48							
End of Borehole							
Practical refusal to augering at 3.48m depth.							

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

Piezometer Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** January 10, 2022

FILE NO. PG5570

HOLE NO. BH22A-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.98
TOPSOIL 0.20							
Loose, brown **SILTY SAND,** trace gravel 0.69		AU	1				
		SS	2	100	22	1	101.98
		SS	3	92	29	2	100.98
GLACIAL TILL: Compact to dense, brown silty sand with gravel, cobbles and boulders		SS	4	83	46		
		SS	5	50	50+	3	99.98
		RC	1	77		4	98.98
		RC	2	14		5	97.98
5.97						6	96.98
		RC	3	100	94	7	95.98
BEDROCK: Excellent quality, grey dolostone interbedded with grey limestone		RC	4	100	100	8	94.98
						9	93.98
		RC	5	100	100		
10.21						10	92.98
End of Borehole							
(GWL @ 2.49m - Jan. 11, 2022)							

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

20 40 60 80

Monitoring Well Construction

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

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Prop. Residential Development - 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

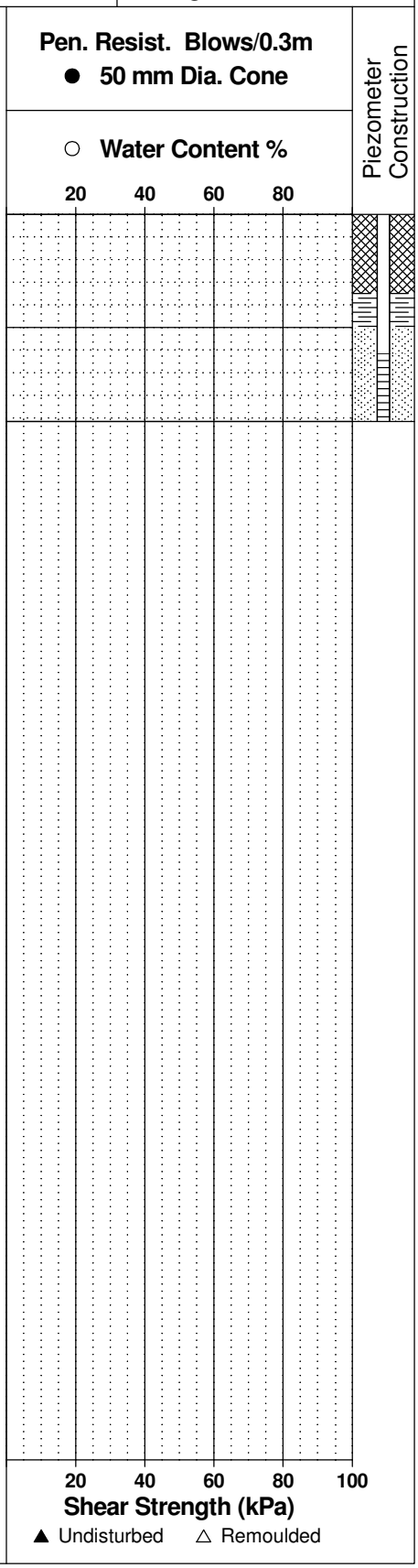
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 20, 2021

FILE NO. PG5570

HOLE NO. BH23-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.38
TOPSOIL 0.28							
Stiff, brown **SILTY CLAY,** some sand		AU	1				
1.12		SS	2	25	32	1	101.38
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, trace clay 1.83		SS	3	55			
End of Borehole							
Practical refusal to augering at 1.83m depth							
(Piezometer damaged - Jan. 11, 2022)							



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DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 20, 2021

FILE NO. PG5570

HOLE NO. BH24-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.07
TOPSOIL 0.30		AU	1				
Loose to dense, brown **SILTY SAND to SANDY SILT**		SS	2	58	8	1	102.07
1.83		SS	3	75	32	2	101.07
		SS	4	50	50+		
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders		RC	1	100		3	100.07
- boulders cored from 2.46 to 4.42m depth		RC	2	19		4	99.07
4.42		RC	3	100	81	5	98.07
BEDROCK: Good to excellent quality, grey limestone interbedded with dolostone						6	97.07
- 15mm thick mud seam at 5.25m depth		RC	4	100	100	7	96.07
7.92		RC	5	100	100		
End of Borehole							
(GWL @ 0.67m - Jan. 11, 2022)							

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

20 40 60 80

Monitoring Well Construction

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

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DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH25-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.73
TOPSOIL 0.25							
Loose, brown **SILTY SAND,** trace clay and gravel		AU	1				
1.17		SS	2	71	50+	1	101.73
End of Borehole							
Practical refusal to augering at 1.17m depth							
(GWL @ 0.71m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH26-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.04
TOPSOIL 0.25							
Stiff, brown **SILTY CLAY,** some sand 0.69		AU	1				
		SS	2	40	50+	1	102.04
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles and boulders, trace clay		SS	3	61	33		
2.16						2	101.04
End of Borehole							
Practical refusal to augering at 2.16m depth							
(GWL @ 0.78m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

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

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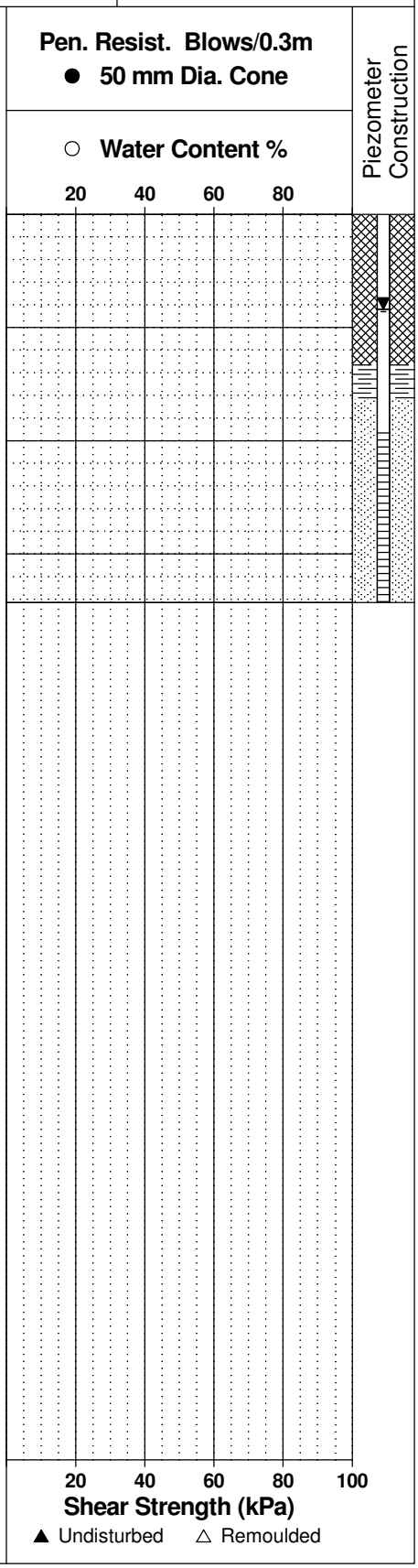
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH27-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.71
TOPSOIL 0.28		AU	1				
Compact to loose, brown **SILTY SAND to SANDY SILT,** trace clay		SS	2	67	19	1	101.71
		SS	3	83	21	2	100.71
- grey by 2.4m depth		SS	4	50	9		
3.12						3	99.71
GLACIAL TILL: Very loose, grey silty sand with gravel, cobbles and boulders 3.43		SS	5	86	3		
End of Borehole							
Practical refusal to augering at 3.43m depth							
(GWL @ 0.84m - Jan. 11, 2022)							



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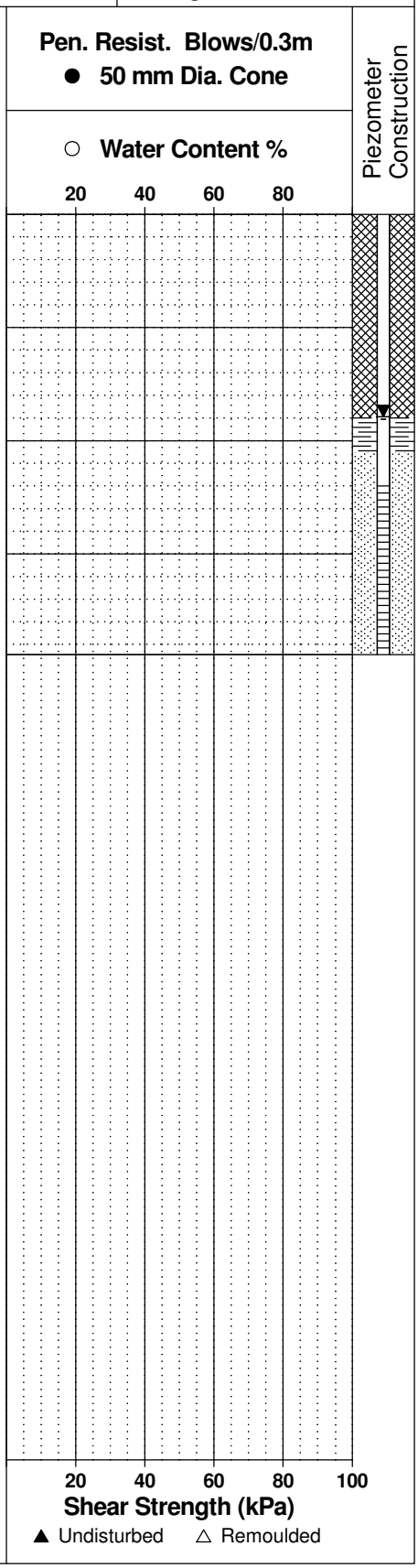
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH28-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.85
TOPSOIL 0.30		AU	1				
Loose, brown **SILTY SAND to SANDY SILT,** trace clay		SS	2	42	7	1	100.85
		SS	3	58	8	2	99.85
2.21							
Interbedded layers of grey **SILTY SAND** and grey **SILTY CLAY**		SS	4	100	2	3	98.85
2.97							
GLACIAL TILL: Very loose, grey silty sand with clay, gravel and cobbles		SS	5	100	3		
3.89		SS	6		50+		
End of Borehole							
Practical refusal to augering at 3.89m depth							
(GWL @ 1.79m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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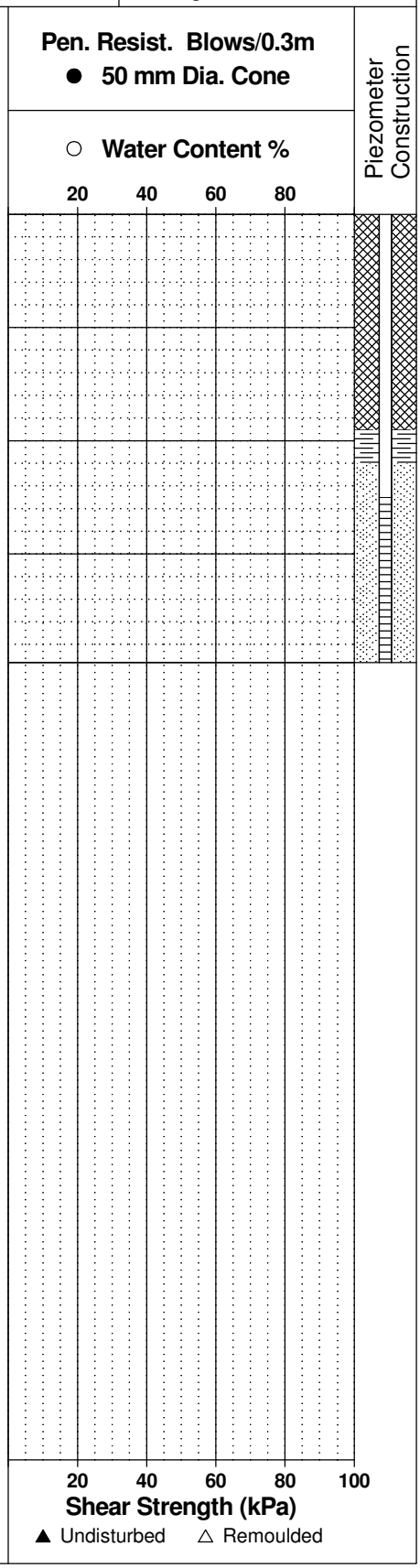
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH29-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.31
TOPSOIL 0.28		AU	1				
Loose to very loose, brown **SILTY SAND to SANDY SILT,** trace clay		SS	2	50	9	1	101.31
		SS	3	67	8	2	100.31
- grey by 1.9m depth		SS	4	67	4		
- intermittent layers of grey silty clay by 3.0m depth		SS	5	58	2	3	99.31
3.96		SS	6	67			
End of Borehole							
Practical refusal to augering at 3.96m depth							
(Piezometer damaged - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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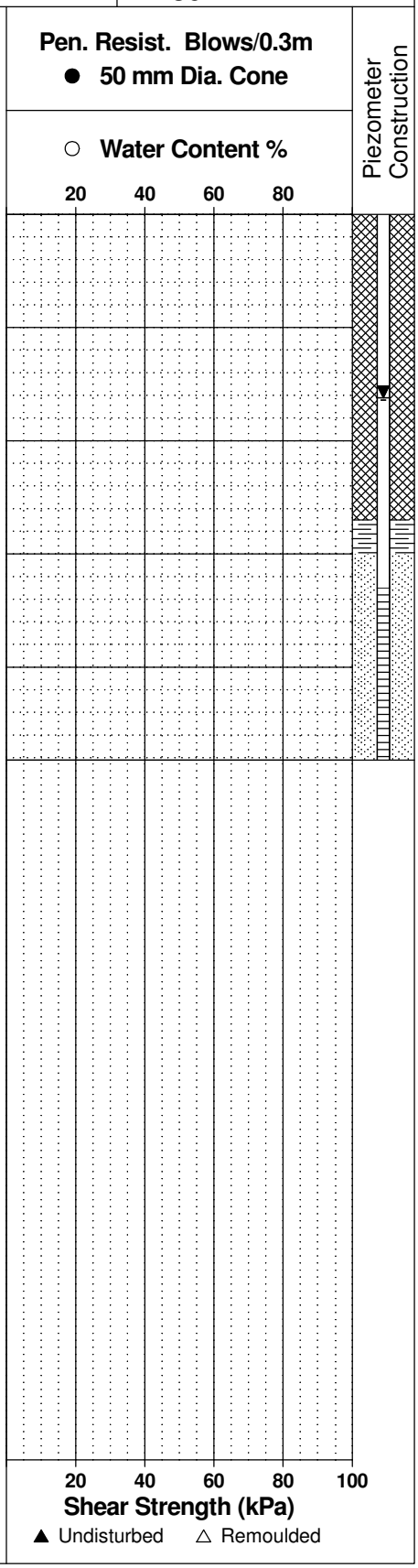
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH30-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.44
TOPSOIL 0.25		AU	1				
		SS	2	50	12	1	101.44
Compact to very loose, brown **SILTY SAND to SANDY SILT,** trace clay		SS	3	33	10	2	100.44
- grey by 2.0m depth		SS	4	92	1	3	99.44
3.45		SS	5	83	2		
GLACIAL TILL: Very loose to compact, grey silty sand with gravel, cobbles and boulders, trace clay		SS	6	33	24	4	98.44
4.82		SS	7	50	50+		
End of Borehole							
Practical refusal to augering at 4.82m depth							
(GWL @ 1.62m - Jan. 11, 2022)							



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SOIL PROFILE AND TEST DATA

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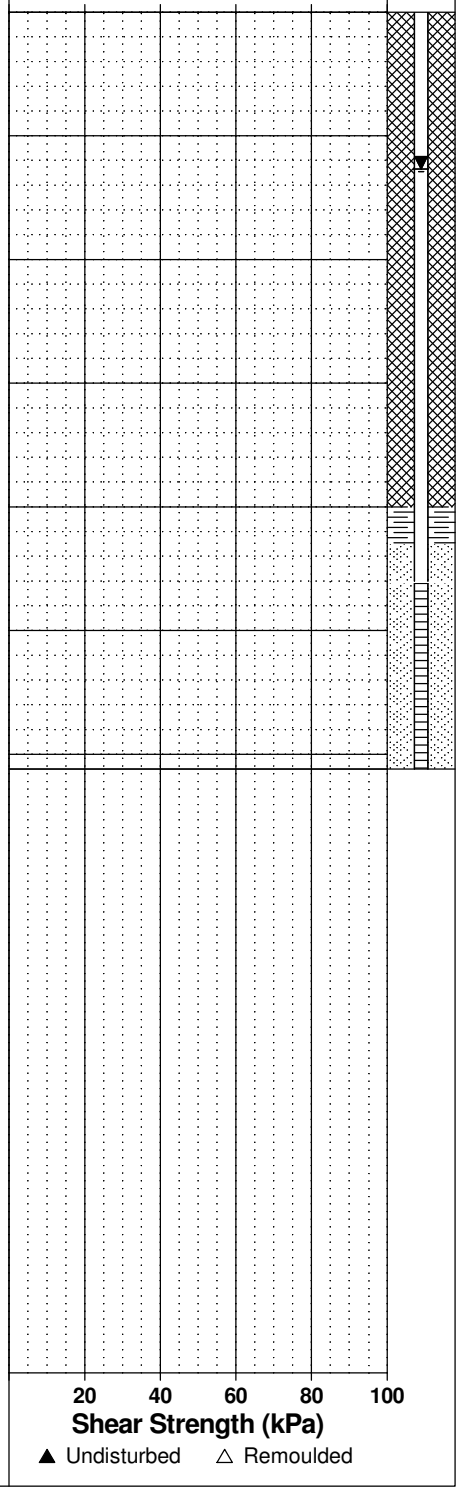
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH31-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.43		
TOPSOIL 0.36		AU	1						
		SS	2	50	14	1	102.43		
Compact to loose, brown **SILTY SAND to SANDY SILT,** trace clay		SS	3	50	22	2	101.43		
		SS	4	42	9				
- grey by 3.2m depth		SS	5	58	5	3	100.43		
		SS	6	42	12	4	99.43		
4.72		SS	7	58	37				
GLACIAL TILL: Dense, grey silty sand with gravel, cobbles and boulders		SS	8		58	5	98.43		
6.12		SS	9	0	50+	6	97.43		
End of Borehole									
Practical refusal to augering at 6.12m depth									
(GWL @ 1.27m - Jan. 11, 2022)									



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
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DATUM Geodetic

REMARKS

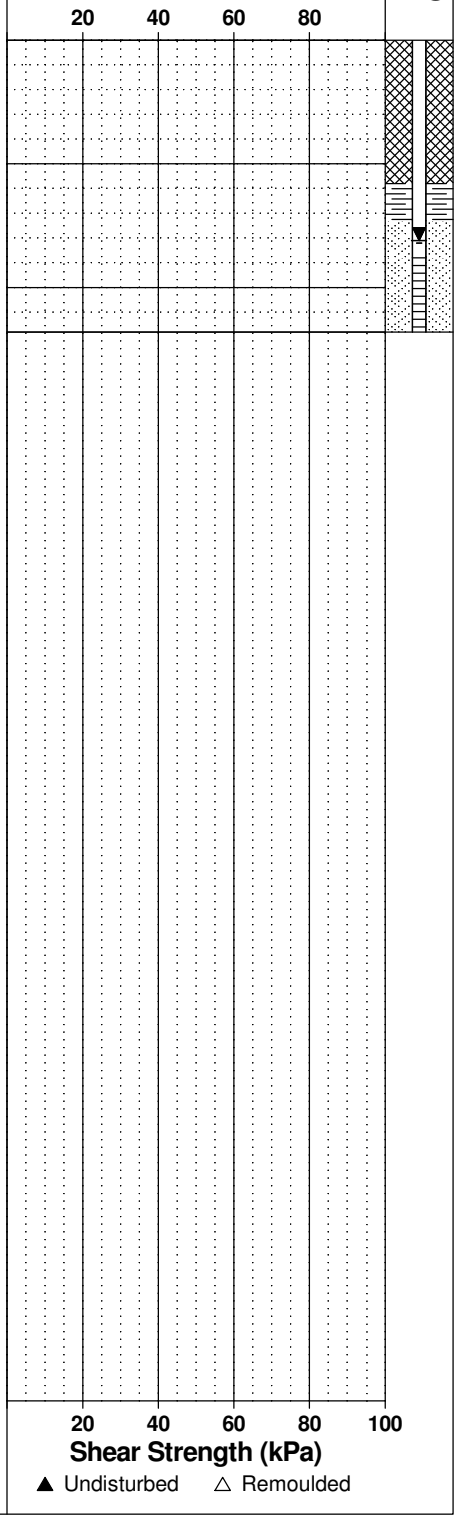
BORINGS BY Track-Mount Power Auger **DATE** December 21, 2021

FILE NO. PG5570

HOLE NO. BH32-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.74
TOPSOIL 0.15		AU	1				
Compact to dense, brown **SILTY SAND to SANDY SILT**		SS	2	67	39	1	102.74
- grey 1.4m depth		SS	3	67	26		
2.21						2	101.74
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders 2.36		SS	4	50	50+		
End of Borehole							
Practical refusal to augering at 2.36m depth							
(GWL @ 1.62m - Jan. 11, 2022)							

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



Piezometer Construction

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SOIL PROFILE AND TEST DATA

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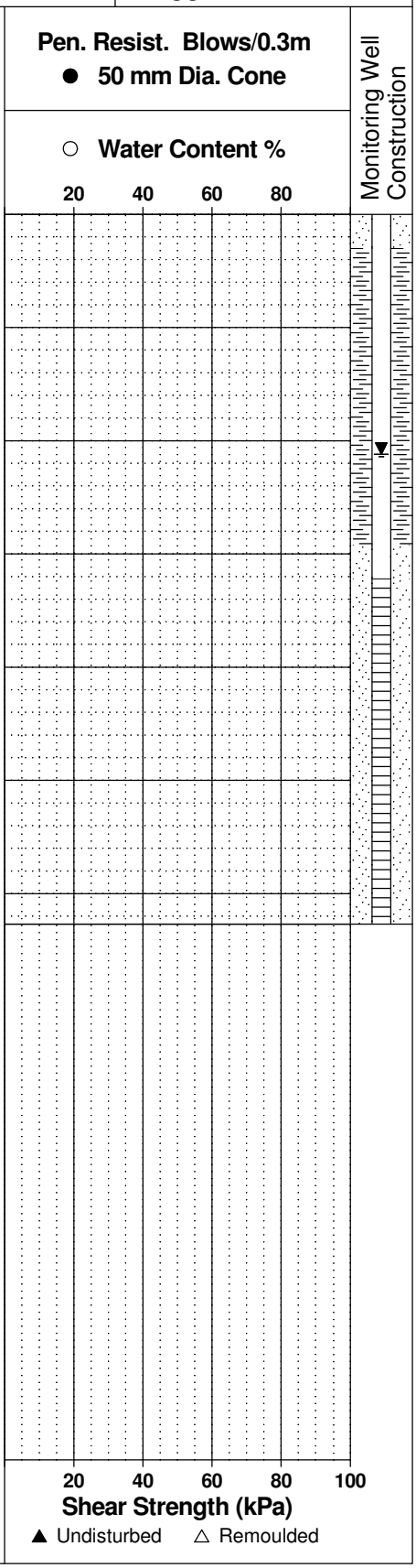
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 22, 2021

FILE NO. PG5570

HOLE NO. BH33-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.70
Compact, brown **SILTY SAND,** trace clay and organics		AU	1				
		SS	2	50	13	1	103.70
1.45							
GLACIAL TILL: Compact, brown silty sand with gravel, cobbles and boulders		SS	3	8	11	2	102.70
		RC	1	30			
2.74							
		RC	2	100	73	3	101.70
BEDROCK: Good to excellent quality, grey limestone						4	100.70
- 25mm thick mud seam at 3.7m depth		RC	3	95	85	5	99.70
- 30mm thick mud seam at 3.8m depth		RC	4	100	100	6	98.70
6.27							
End of Borehole							
(GWL @ 1.84m - Jan. 11, 2022)							



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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** December 22, 2021

FILE NO. PG5570

HOLE NO. BH34-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.65
TOPSOIL 0.25		SS	5	17	8		
		AU	1				
Compact to loose, brown **SILTY SAND to SANDY SILT**		SS	2	42	10	1	101.65
		SS	3	25	9	2	100.65
2.21							
		SS	4	17	2	3	99.65
GLACIAL TILL: Very loose to loose, grey silty sand with gravel, cobbles and boulders, trace clay		RC	1	31		4	98.65
		RC	2	100	100	5	97.65
5.21							
BEDROCK: Excellent quality, grey limestone interbedded with dolostone		RC	3	100	100	6	96.65
6.61							
End of Borehole							

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

20 40 60 80

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

Piezometer Construction

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SOIL PROFILE AND TEST DATA

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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** January 7, 2022

FILE NO. PG5570

HOLE NO. BH35-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.03
TOPSOIL 0.28		AU	1				
Loose to compact, brown **SILTY SAND to SANDY SILT**		SS	2	50	7	1	104.03
1.68		SS	3	50	25	2	103.03
GLACIAL TILL: Compact to very dense, grey silty sand with gravel, cobbles and boulders		SS	4	25	56		
		SS	5	67	50+	3	102.03
3.51							
End of Borehole							
Practical refusal to augering at 3.51m depth.							
(GWL @ 1.22m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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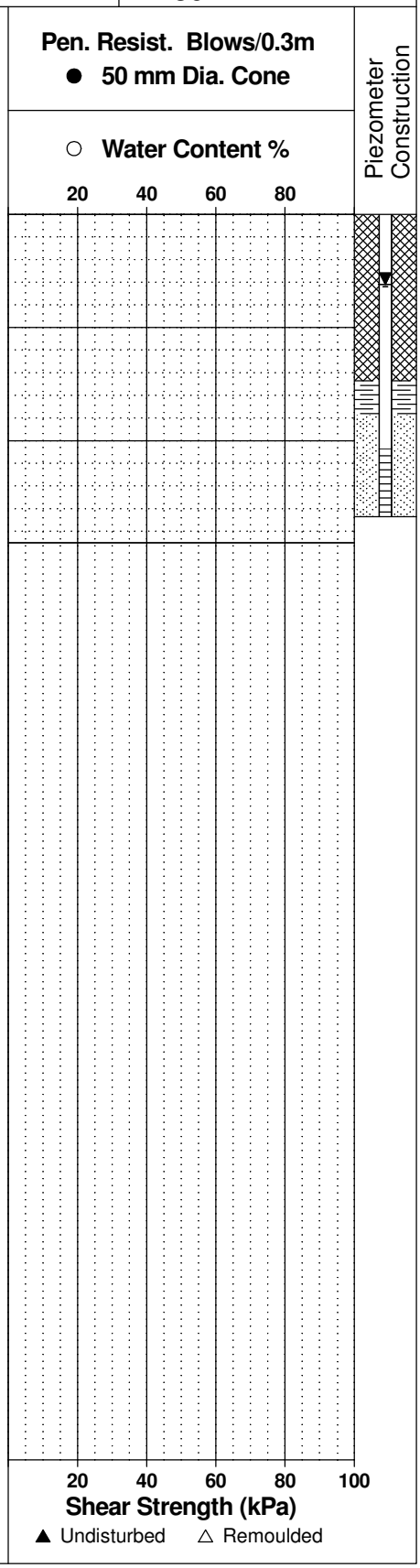
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** January 7, 2022

FILE NO. PG5570

HOLE NO. BH36-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.79
TOPSOIL 0.30		AU	1				
Compact, brown **SILTY SAND to SANDY SILT**		SS	2	42	15	1	101.79
1.45		SS	3	60	50+		
GLACIAL TILL: Very dense to compact, brown silty sand with gravel, cobbles and boulders		SS	4	8	15	2	100.79
2.90							
End of Borehole							
Practical refusal to augering at 2.90m depth.							
(GWL @ 0.62m - Jan. 11, 2022)							



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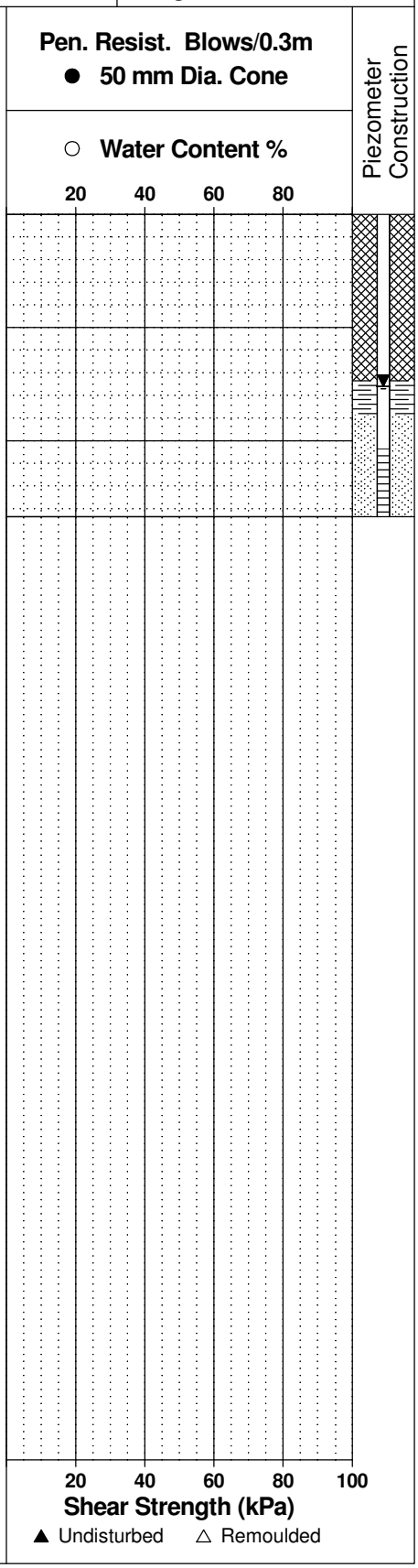
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** January 7, 2022

FILE NO. PG5570

HOLE NO. BH37-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.54
TOPSOIL 0.36		AU	1				
Compact to dense, brown **SILTY SAND to SANDY SILT**		SS	2	42	22	1	102.54
		SS	3	58	34		
2.21						2	101.54
GLACIAL TILL: Very dense, grey silty sand with gravel, cobbles and boulders 2.67		SS	4	50	50+		
End of Borehole							
Practical refusal to augering at 2.67m depth.							
(GWL @ 1.52m - Jan. 11, 2022)							



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REMARKS

BORINGS BY Track-Mount Power Auger **DATE** January 7, 2022

FILE NO. PG5570

HOLE NO. BH38-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.62
FILL: Crushed stone and gravel 0.15		AU	1				
Dense to compact, brown **SILTY SAND to SANDY SILT**		SS	2		32	1	102.62
		SS	3		24		
- grey by 2.0m depth		SS	4	100	50+	2	101.62
2.64							
End of Borehole							
Practical refusal to augering at 2.64m depth.							
(GWL @ 1.94m - Jan. 11, 2022)							

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

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
6070 and 6115 Flewellyn Road
Ottawa, Ontario

DATUM Geodetic

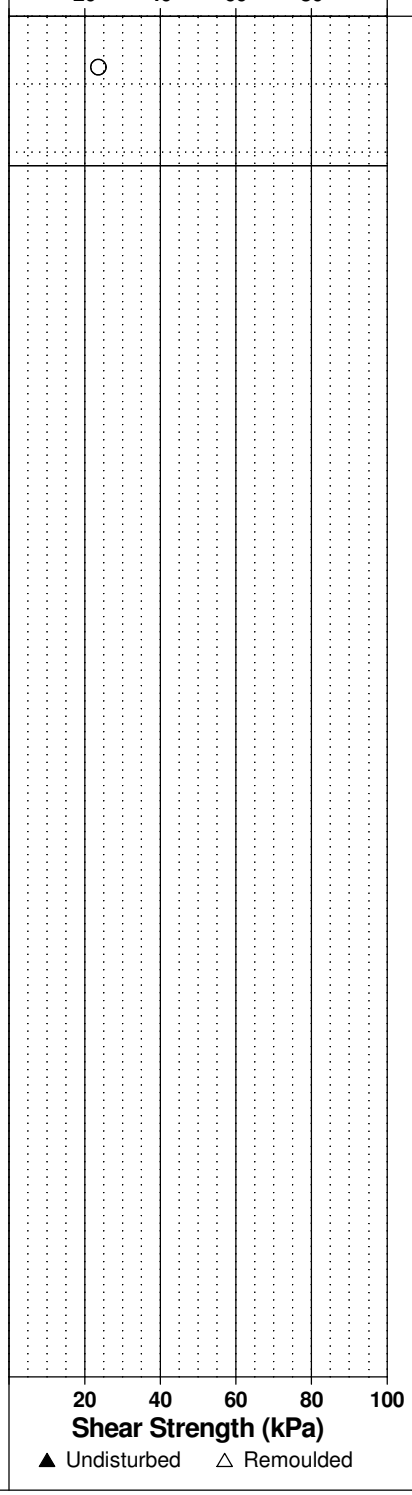
FILE NO. PG5570

REMARKS

HOLE NO. TP 1

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL		G	1			0	105.94		
0.15									
GLACIAL TILL: Brown silty sand with gravel and some clay		G	2						
0.25									
BEDROCK Weathered interbedded limestone		G	3						
0.44									
End of Test Pit									
Practical refusal to excavation at 0.44m depth									
(TP dry upon completion)									



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FILE NO. PG5570

REMARKS

HOLE NO. TP 2

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	105.06
TOPSOIL 0.21		G	1				
Brown **SILTY SAND,** trace gravel 0.92		G	2			1	104.06
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 1.64		G	3				
End of Test Pit TP terminated on inferred bedrock surface at 1.64m depth (TP dry upon completion)							

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

20 40 60 80

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

Piezometer Construction

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DATUM Geodetic

FILE NO. PG5570

REMARKS

HOLE NO. TP 3

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.10
TOPSOIL		G	1				
0.25							
Brown **SILTY SAND,** trace sea shells		G	2				
0.59						1	101.10
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		G	3				
1.61							
End of Test Pit							
TP terminated on inferred bedrock surface at 1.61m depth							
(TP dry upon completion)							

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

20 40 60 80

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

Piezometer Construction

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DATUM Geodetic

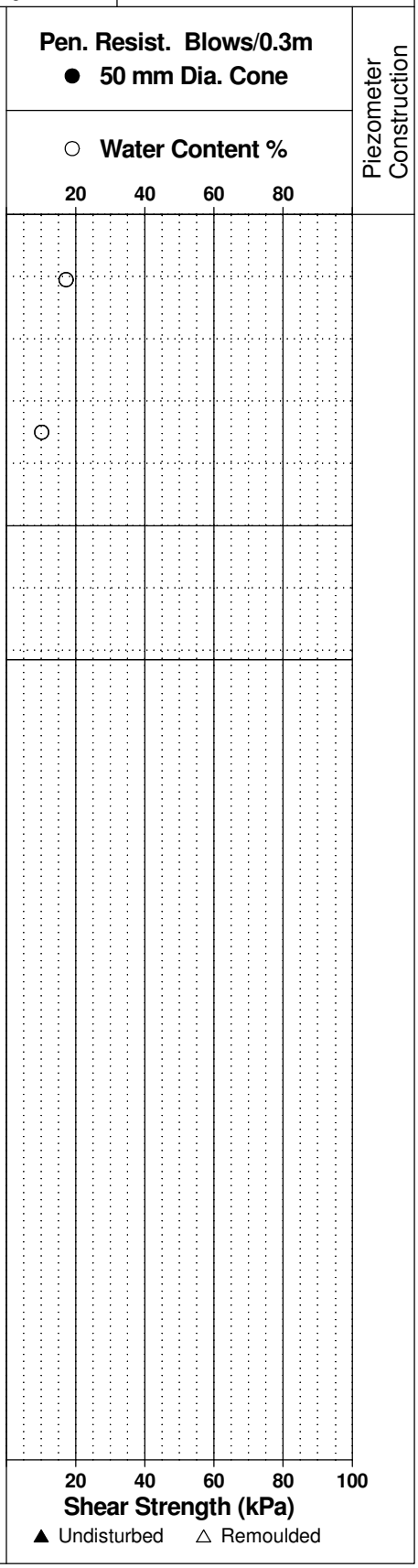
FILE NO. PG5570

REMARKS

HOLE NO. TP 4

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	108.49
TOPSOIL 0.21		G	1				
Brown **SILTY SAND,** trace gravel, cobble and organics 0.70		G	2				
GLACIAL TILL: Brown silty sand, some gravel, cobble, boulder, trace clay 1.43		G	3			1	107.49
End of Test Pit							
Test Pit terminated on bedrock surface at 1.43m depth							
(TP dry upon completion)							



Piezometer Construction

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DATUM Geodetic

FILE NO. PG5570

REMARKS

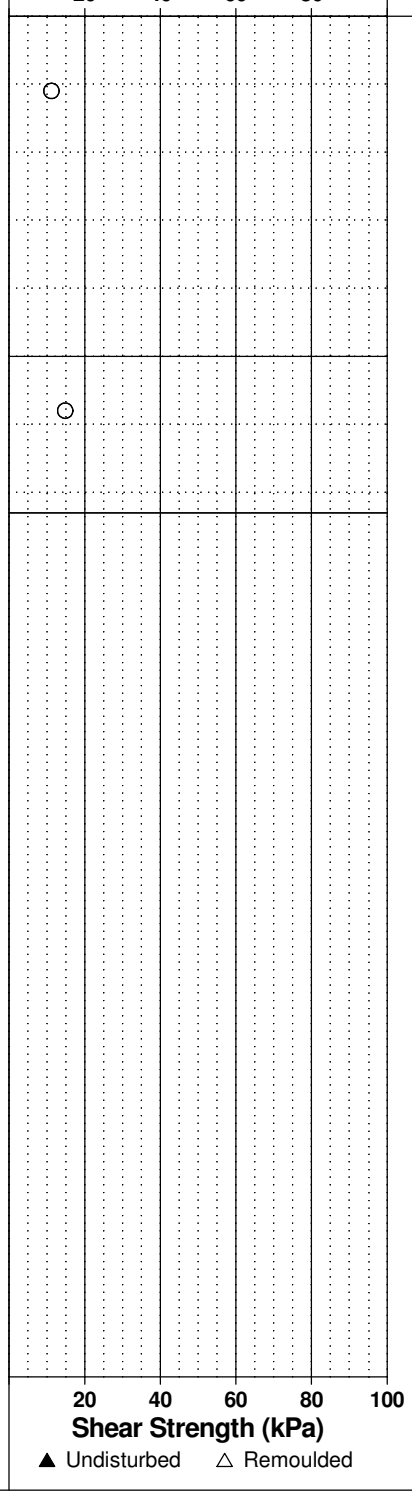
HOLE NO. TP 5

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	108.36		
TOPSOIL 0.22		G	1						
Brown **SILTY SAND**		G	2			1	107.36		
1.16									
GLACIAL TILL: Brown silty sand, some gravel, cobble, and boulder 1.46		G	3						▽
End of Test Pit									

TP terminated on inferred bedrock surface at 1.46m depth

(Groundwater infiltration at 1.28m - Nov 20, 2020)



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FILE NO. PG5570

REMARKS

HOLE NO. TP 6

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.27		G	1			0	107.91		
Brown **SILTY SAND,** trace cobble, boulders and seashells 1.70		G	2			1	106.91		
		G	3						▽
BEDROCK: Weathered interbedded limestone 2.89		G	4			2	105.91		
End of Test Pit TP terminated on inferred bedrock surface at 2.89m depth (Groundwater infiltration at 1.70m - Nov 20, 2020)									

Water Content % scale: 20 40 60 80

Shear Strength (kPa) scale: 20 40 60 80 100

▲ Undisturbed △ Remoulded

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FILE NO. PG5570

REMARKS

HOLE NO. TP 7

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.31		
TOPSOIL 0.22		G	1						
Brown **SILTY SAND,** trace clay 0.81		G	2			1	105.31		
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders		G	3			2	104.31		▽
		G	4			3	103.31		
3.37 End of Test Pit									
TP terminated on inferred bedrock surface at 3.37m depth									
(Groundwater infiltration at 2.24m - Nov 20, 2020)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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DATUM Geodetic

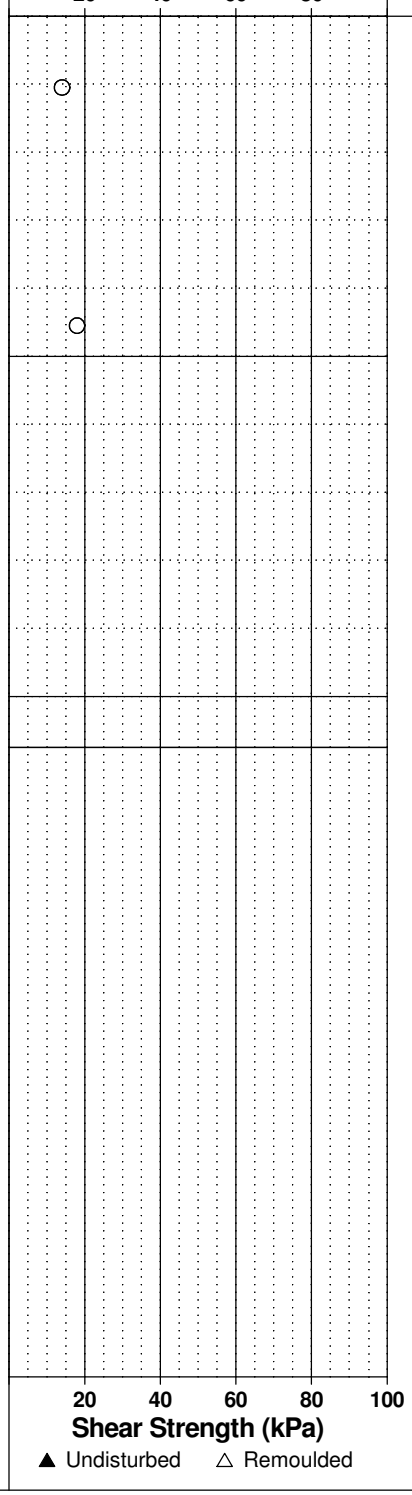
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REMARKS

HOLE NO. TP 8

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.21		G	1			0	105.48		
		G	2			1	104.48		
Brown **SILTY SAND,** trace clay and organics - increasing in silt content with depth		G	3			2	103.48		
2.15 End of Test Pit TP terminated on inferred bedrock surface at 2.15m depth (TP dry upon completion)									



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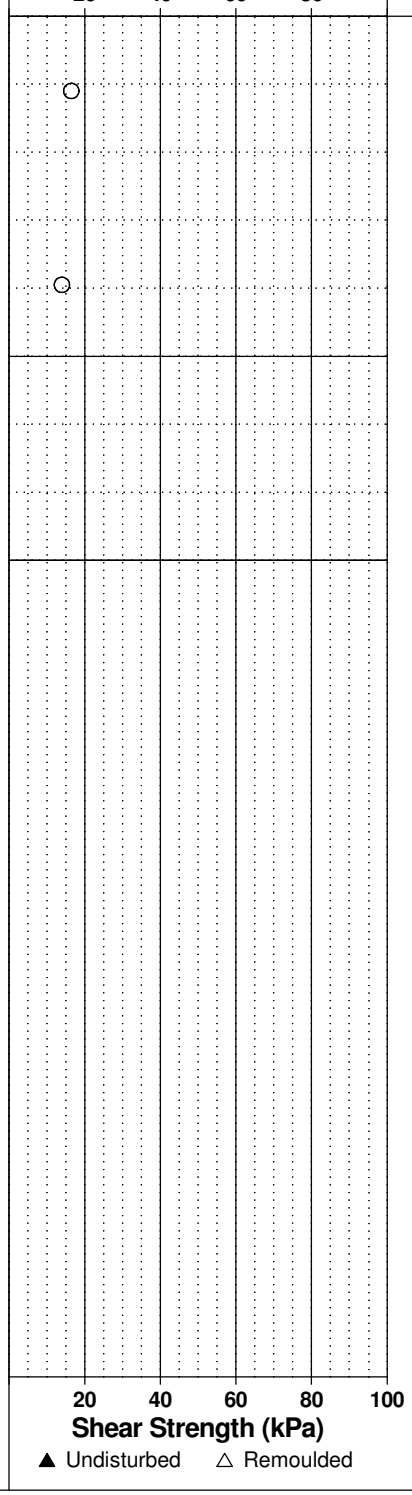
FILE NO. PG5570

REMARKS

HOLE NO. TP 9

BORINGS BY CME-55 Low Clearance Drill **DATE** November 20, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.47		
TOPSOIL 0.22		G	1						
Brown **SILTY SAND,** trace organics 0.79		G	2						
GLACIAL TILL: Brown silty sand trace gravel, cobbles, and boulders 1.60		G	3			1	103.47		
End of Test Pit									
TP terminated on inferred bedrock surface at 1.60m depth									
(TP dry upon completion)									



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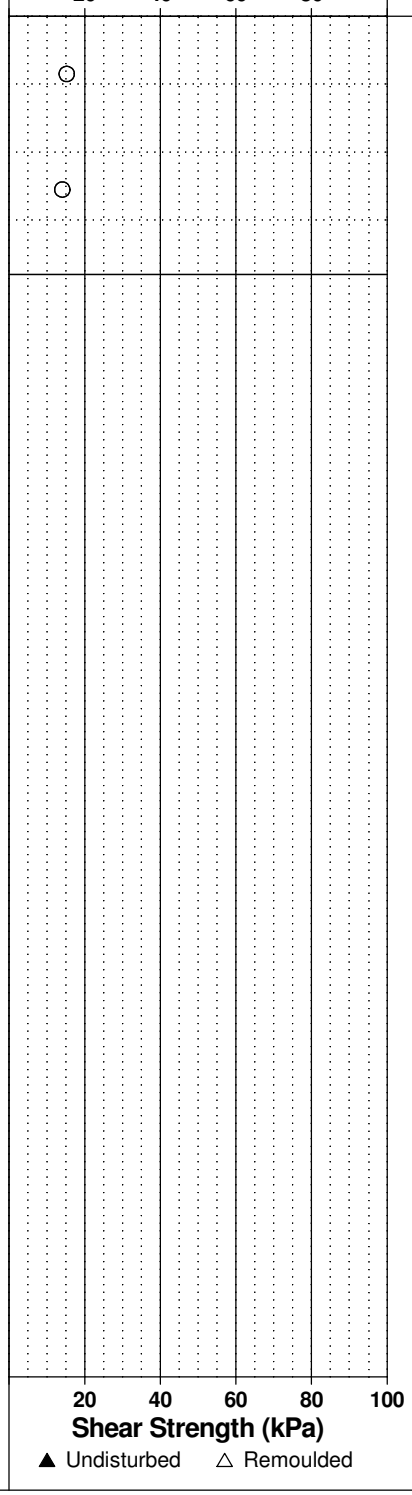
FILE NO. PG5570

REMARKS

HOLE NO. TP 10

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.62		
TOPSOIL 0.17		G	1						
Brown **SILTY SAND,** trace gravel and cobbles 0.51		G	2						
GLACIAL TILL: Brown silty sand, with gravel, trace cobble and boulders 0.76		G	3						
End of Test Pit TP terminated on inferred bedrock surface at 0.76m depth (Groundwater infiltration at 0.51m - Dec 10, 2020)									



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DATUM Geodetic

FILE NO. PG5570

REMARKS

HOLE NO. TP 11

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE									
TOPSOIL 0.15		G	1			0	103.01		
Brown **SILTY SAND,** trace gravel		G	2						
0.89		G	3			1	102.01		
GLACIAL TILL: Brown silty sand, with gravel, cobbles, and boulders		G	1						
1.49									
End of Test Pit									
TP terminated on inferred bedrock surface at 1.49m depth									
(Groundwater infiltration at 0.89m - Dec 10, 2020)									

Pen. Resist. Blows/0.3m: 20 40 60 80

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

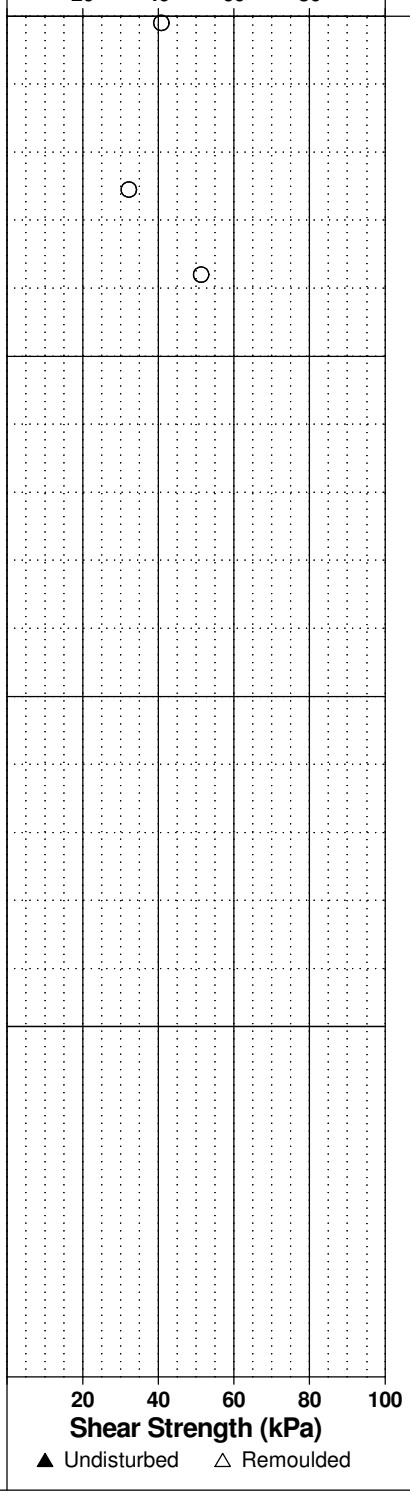
FILE NO. PG5570

REMARKS

HOLE NO. TP 12

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	103.21		
TOPSOIL 0.02		G	1						
		G	2						
Brown **SILTY SAND,** trace gravel 0.51									
Organic silt with **PEAT** fibers 0.76		G	3						
		G	4			1	102.21		
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders						2	101.21		▽
2.97									
End of Test Pit									
TP terminated on inferred bedrock surface at 2.97m depth									
(Groundwater infiltration at 1.82m - Dec 10, 2020)									



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DATUM Geodetic

FILE NO. PG5570

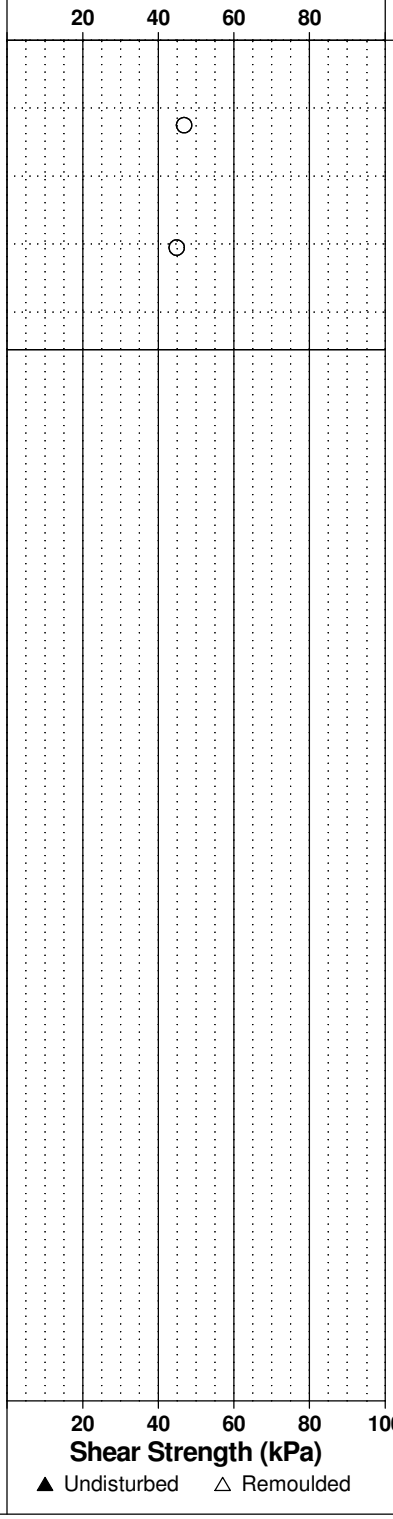
REMARKS

HOLE NO. TP 13

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	104.30
TOPSOIL 0.25		G	1				
Brown **SILTY SAND,** trace organics 0.61		G	2				
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 0.91		G	3				
End of Test Pit							
TP terminated on inferred bedrock surface at 0.91m depth							
(Groundwater infiltration at 0.61m - Dec 10, 2020)							

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



Piezometer Construction

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FILE NO. PG5570

REMARKS

HOLE NO. TP 14

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	105.60		
TOPSOIL			1						
0.30									
Brown **SILTY SAND**			2						
0.56									
GLACIAL TILL: Brown silty sand with gravel, cobbles, and boulders.			3						
0.97									
End of Test Pit									
Practical refusal to excavation at 0.94m depth									
(TP dry upon completion)									

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG5570

REMARKS

HOLE NO. TP 15

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	106.80		
TOPSOIL 0.18		G	1						
		G	2			1	105.80		
		G	3						
Brown **SILTY SAND**		G	4						
		G	5			2	104.80		
2.64									
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders 2.74		G	6						
End of Test Pit									
TP terminated on inferred bedrock surface at 2.74m depth									
(Groundwater infiltration at 2.28m - Dec 10, 2020)									

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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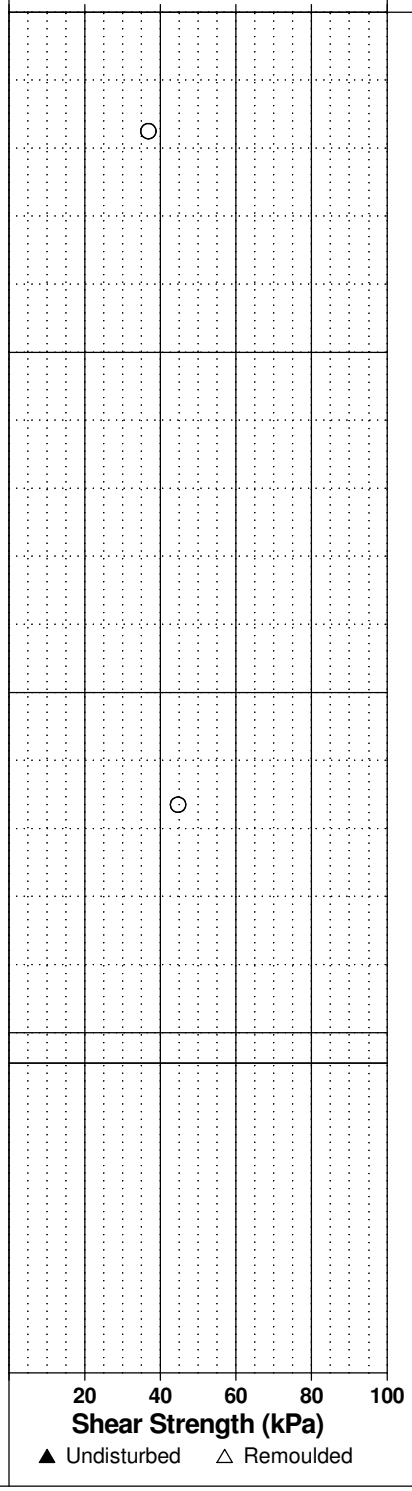
FILE NO. PG5570

REMARKS

HOLE NO. TP 16

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	104.62		
TOPSOIL		G	1						
0.35									
		G	2			1	103.62		
Brown **SILTY SAND,** trace gravel									
2.34						2	102.62		
GLACIAL TILL: Grey silty sand with gravel, cobbles and boulders.		G	3						
3.09						3	101.62		
End of Test Pit									
TP terminated on inferred bedrock surface at 3.09m depth									
(Groundwater infiltration at 2.33m - Dec 10, 2020)									



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FILE NO. PG5570

REMARKS

HOLE NO. TP 17

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.90
TOPSOIL		G	1				
0.33							
Brown **SILTY SAND,** trace gravel		G	2			1	102.90
1.37							
GLACIAL TILL: Brown silty sand, with gravel cobbles and boulders		G	3				
1.78							
End of Test Pit							
TP terminated on inferred bedrock surface at 1.78m depth							
(Groundwater infiltration at 1.37m - Dec 10, 2020)							

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

20 40 60 80

Piezometer Construction

▽

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

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FILE NO. PG5570

REMARKS

HOLE NO. TP 18

BORINGS BY CME-55 Low Clearance Drill **DATE** December 10, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.42
TOPSOIL		G	1				
0.30							
Brown **SILTY SAND,** some gravel		G	2				
		G	3			1	102.42
1.32							
End of Test Pit							
TP terminated on inferred bedrock surface at 1.32m depth							
(TP dry upon completion)							

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

20 40 60 80

20 40 60 80 100

Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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 = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

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

CONSOLIDATION TEST

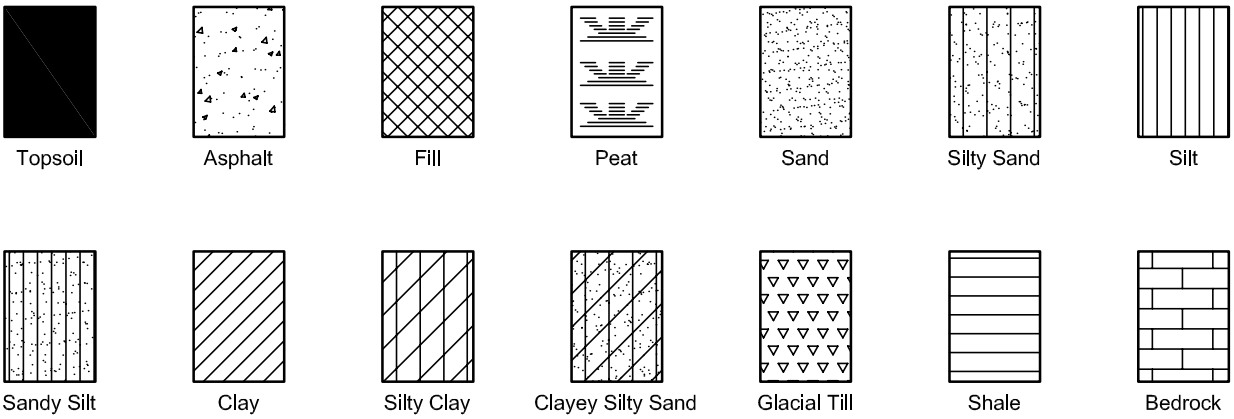
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

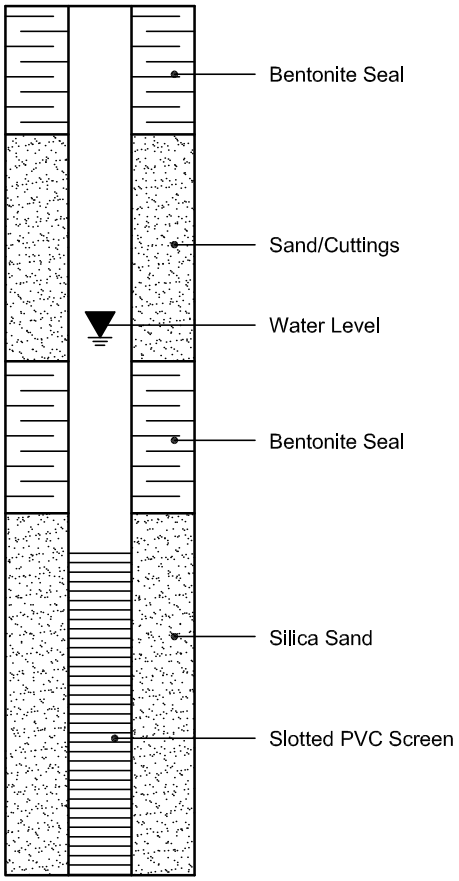
SYMBOLS AND TERMS (continued)

STRATA PLOT

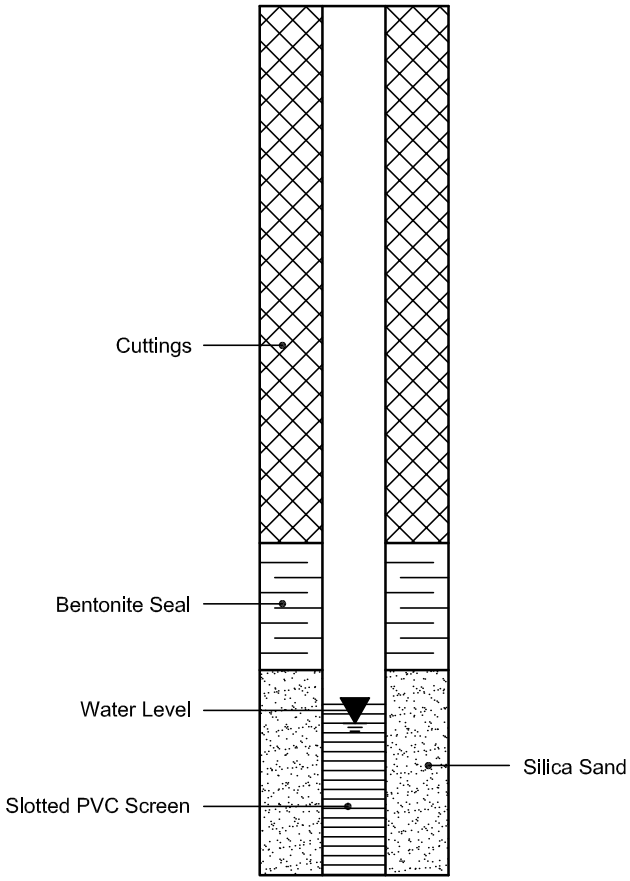


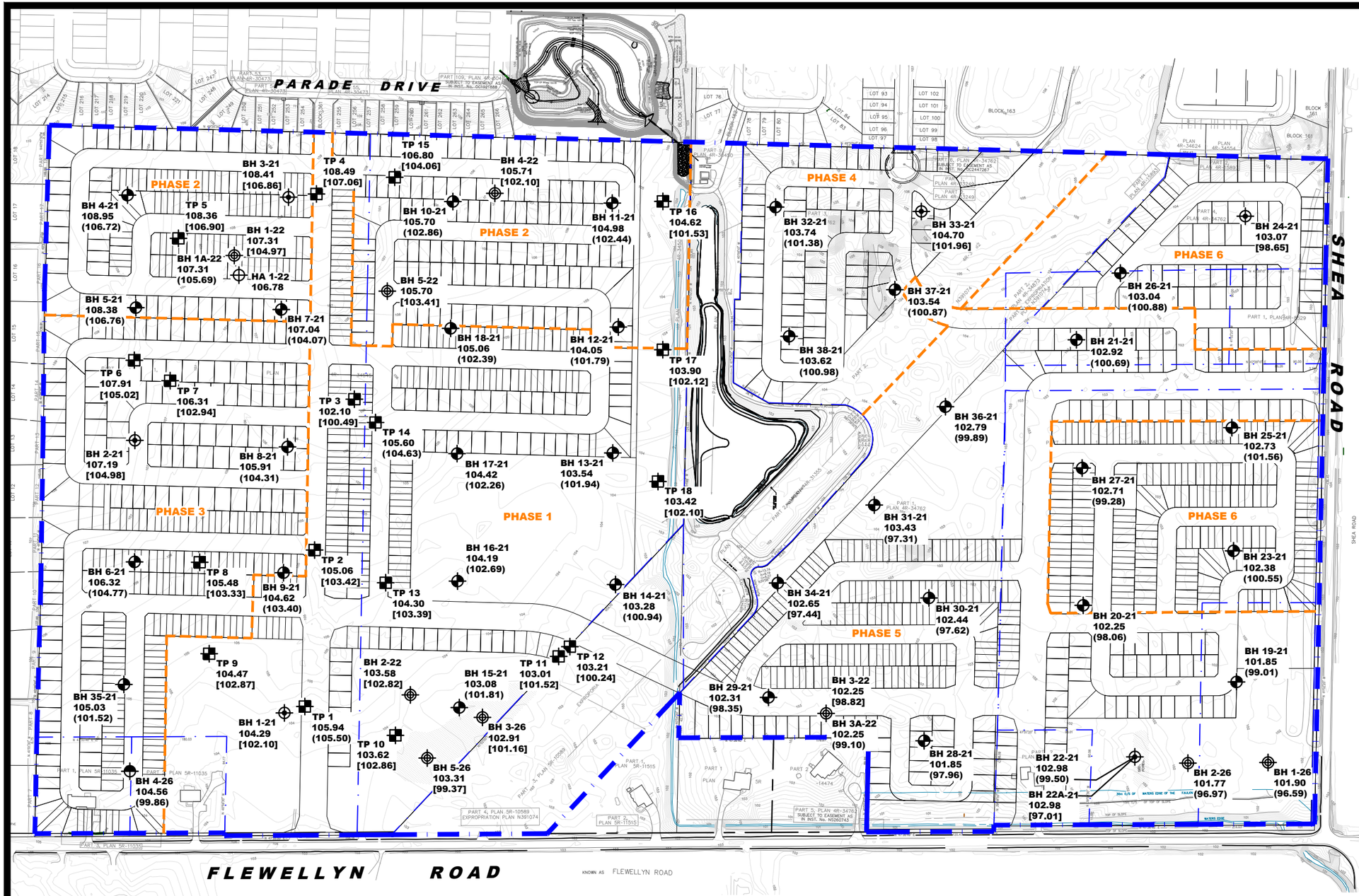
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





LEGEND:

- HAND AUGER LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH PIEZOMETER LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH PIEZOMETER LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- TEST PIT LOCATION (PATERSON GROUP REPORT; PG5570-1, JAN 3, 2021)

104.29 GROUND SURFACE ELEVATION (m)

[102.10] BEDROCK SURFACE ELEVATION (m)

(102.39) PRACTICAL REFUSAL TO AUGERING / EXCAVATION ELEVATION (m)

BASE PLAN PREPARED BY J.D. BARNES LIMITED.

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

SCALE: 1:4000

0 50 100 150 200 250m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DD/MM/YYYY	INITIAL
9	ADDED 2026 BOREHOLE LOCATIONS	24/04/2026	KP
8	UPDATED TO NEW CONCEPTUAL PLAN	10/04/2026	KP
7	UPDATED SITE BOUNDARY	15/05/2025	OB
6	UPDATED TO NEW CONCEPTUAL PLAN	03/07/2024	KP
5	UPDATED TO NEW CONCEPTUAL PLAN	28/08/2023	KP

CAIVAN (STITTSVILLE) INC.

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
5971, 5993, 6115, 6141 & 6159 FLEWELLYN ROAD, 6070 FERNBANK ROAD & 1770 & 1820 SHEA ROAD
OTTAWA, ONTARIO

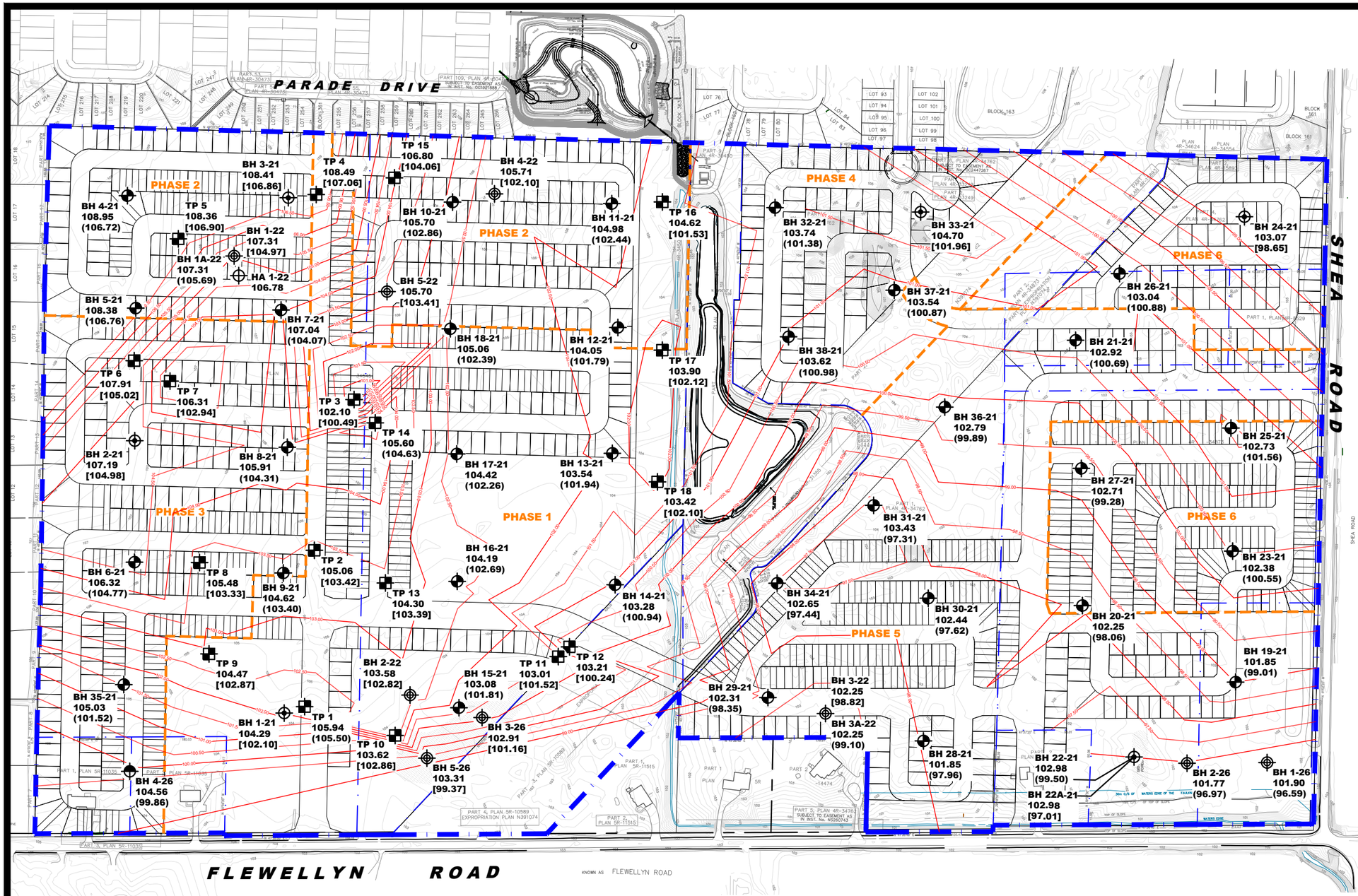
Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 01/2022
Drawn by: YA	Report No.: PG5570-3
Checked by: KP	Dwg. No.: PG5570-1
Approved by: DJG	Revision No.: 9

11x17

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LEGEND:

- HAND AUGER LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH MONITORING WELL LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH PIEZOMETER LOCATION (CURRENT INVESTIGATION)
- BOREHOLE WITH PIEZOMETER LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- BOREHOLE WITH MONITORING WELL LOCATION (PATERSON GROUP REPORT; PG5570-2, JAN 20, 2022)
- TEST PIT LOCATION (PATERSON GROUP REPORT; PG5570-1, JAN 3, 2021)
- 97.50 BEDROCK CONTOURS (m)
- 104.29 GROUND SURFACE ELEVATION (m)
- [102.10] BEDROCK SURFACE ELEVATION (m)
- (102.39) PRACTICAL REFUSAL TO AUGERING / EXCAVATION ELEVATION (m)

BASE PLAN PREPARED BY J.D. BARNES LIMITED.

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

SCALE: 1:4000

0 50 100 150 200 250m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DD/MM/YYYY	INITIAL
9	ADDED 2026 BOREHOLE LOCATIONS	24/04/2026	KP
8	UPDATED TO NEW CONCEPTUAL PLAN	10/04/2026	KP
7	UPDATED SITE BOUNDARY	15/05/2025	OB
6	UPDATED TO NEW CONCEPTUAL PLAN	03/07/2024	KP
5	UPDATED TO NEW CONCEPTUAL PLAN	28/08/2023	KP

CAIVAN (STITTSVILLE) INC.
GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
5971, 5993, 6115, 6141 & 6159 FLEWELLYN ROAD, 6070 FERNBANK ROAD & 1770 & 1820 SHEA ROAD
OTTAWA, ONTARIO

Title:
BEDROCK CONTOUR PLAN

Scale: 1:4000	Date: 01/2022
Drawn by: YA	Report No.: PG5570-3
Checked by: KP	Dwg. No.: PG5570-2
Approved by: DJG	Revision No.: 9

11x17

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APPENDIX 3

TABLE 4 - MONTHLY WATER BALANCE FOR SOIL WITH 75 mm WATER HOLDING CAPACITY AT THE OTTAWA INTERNATIONAL AIRPORT

TABLE 5 - MONTHLY WATER BALANCE FOR SOIL WITH 150 mm WATER HOLDING CAPACITY AT THE OTTAWA INTERNATIONAL AIRPORT

TABLE 6 - MONTHLY WATER BALANCE FOR SOIL WITH 300 mm WATER HOLDING CAPACITY AT THE OTTAWA INTERNATIONAL AIRPORT

TABLE 7 - ANNUAL WATER BUDGET CALCULATIONS

TABLES 8-19 - MONTHLY WATER BUDGET CALCULATIONS

Table 4 - Monthly Water Balance for Soil With 75 mm Water Holding Capacity at the Ottawa International Airport

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2022 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY... 75 MM HEAT INDEX... 36.77
LONG... 75.67 LOWER ZONE..... 45 MM A..... 1.081

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	25	82	74	294
28- 2	-9.0	56	11	16	1	1	0	26	111	74	350
31- 3	-2.8	65	31	77	6	6	0	103	67	75	416
30- 4	5.7	73	68	72	31	31	0	110	0	75	489
31- 5	13.1	75	75	0	80	80	0	14	0	56	565
30- 6	18.3	85	85	0	116	107	-9	4	0	30	650
31- 7	20.9	88	88	0	136	104	-32	3	0	11	738
31- 8	19.7	85	85	0	118	84	-34	1	0	11	823
30- 9	14.8	82	82	0	75	65	-10	3	0	25	906
31-10	8.3	77	77	0	37	36	-1	14	0	52	78
30-11	1.3	76	59	8	10	10	0	38	9	71	154
31-12	-6.8	79	27	15	1	1	0	37	46	74	233
AVE	6.0 TTL	904	700	202	611	525	-86	378			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2022 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	28	44	3	59
28- 2	2.6	26	14	25	1	1	0	34	59	3	63
31- 3	2.6	28	22	48	5	5	0	55	87	0	70
30- 4	1.8	32	32	88	9	9	0	88	2	1	79
31- 5	1.8	34	34	2	12	12	0	24	0	22	94
30- 6	1.2	37	37	0	8	17	18	16	0	29	104
31- 7	1.2	44	44	0	8	31	33	16	0	22	116
31- 8	1.3	39	39	0	9	29	31	4	0	22	127
30- 9	1.4	39	39	0	8	16	16	15	0	29	131
31-10	1.5	37	37	1	7	7	2	21	0	27	37
30-11	1.8	27	27	8	4	4	0	31	13	12	45
31-12	3.0	30	22	14	1	1	0	30	34	4	54

Table 5 - Monthly Water Balance for Soil With 150 mm Water Holding Capacity at the Ottawa International Airport

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2022 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...150 MM HEAT INDEX... 36.77
LONG... 75.67 LOWER ZONE..... 90 MM A..... 1.081

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	21	82	143	294
28- 2	-9.0	56	11	16	1	1	0	24	111	145	350
31- 3	-2.8	65	31	77	6	6	0	99	67	149	416
30- 4	5.7	73	68	72	31	31	0	109	0	150	489
31- 5	13.1	75	75	0	80	80	0	14	0	131	565
30- 6	18.3	85	85	0	116	116	0	4	0	96	650
31- 7	20.9	88	88	0	136	127	-9	3	0	54	738
31- 8	19.7	85	85	0	118	98	-20	1	0	40	823
30- 9	14.8	82	82	0	75	68	-8	2	0	53	906
31-10	8.3	77	77	0	37	36	-1	7	0	87	78
30-11	1.3	76	59	8	10	10	0	20	9	124	154
31-12	-6.8	79	27	15	1	1	0	25	46	140	233
AVE	6.0 TTL	904	700	202	611	574	-38	329			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2022 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	29	44	18	59
28- 2	2.6	26	14	25	1	1	0	34	59	17	63
31- 3	2.6	28	22	48	5	5	0	53	87	5	70
30- 4	1.8	32	32	88	9	9	0	88	2	1	79
31- 5	1.8	34	34	2	12	12	0	24	0	22	94
30- 6	1.2	37	37	0	8	8	1	16	0	41	104
31- 7	1.2	44	44	0	8	19	20	16	0	43	116
31- 8	1.3	39	39	0	9	22	24	4	0	44	127
30- 9	1.4	39	39	0	8	14	13	12	0	48	131
31-10	1.5	37	37	1	7	7	2	17	0	46	37
30-11	1.8	27	27	8	4	4	0	28	13	33	45
31-12	3.0	30	22	14	1	1	0	29	34	21	54

Table 6 - Monthly Water Balance for Soil With 300 mm Water Holding Capacity at the Ottawa International Airport

Ottawa Intl A WATER BUDGET MEANS FOR THE PERIOD 1939-2022 DC20492

LAT.... 45.32 WATER HOLDING CAPACITY...300 MM HEAT INDEX... 36.77
LONG... 75.67 LOWER ZONE.....180 MM A..... 1.081

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.6	62	12	14	0	0	0	17	82	277	294
28- 2	-9.0	56	11	16	1	1	0	21	111	283	350
31- 3	-2.8	65	31	77	6	6	0	91	67	296	416
30- 4	5.7	73	68	72	31	31	0	105	0	300	489
31- 5	13.1	75	75	0	80	80	0	14	0	281	565
30- 6	18.3	85	85	0	116	116	0	4	0	245	650
31- 7	20.9	88	88	0	136	136	0	3	0	195	738
31- 8	19.7	85	85	0	118	114	-4	1	0	165	823
30- 9	14.8	82	82	0	75	73	-2	2	0	172	906
31-10	8.3	77	77	0	37	37	0	6	0	207	78
30-11	1.3	76	59	8	10	10	0	16	9	248	154
31-12	-6.8	79	27	15	1	1	0	18	46	271	233
AVE	6.0 TTL	904	700	202	611	605	-6	298			

Ottawa Intl A STANDARD DEVIATIONS FOR THE PERIOD 1939-2022 DC20492

DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	26	15	17	1	1	0	27	44	40	59
28- 2	2.6	26	14	25	1	1	0	33	59	38	63
31- 3	2.6	28	22	48	5	5	0	55	87	16	70
30- 4	1.8	32	32	88	9	9	0	85	2	1	79
31- 5	1.8	34	34	2	12	12	0	24	0	22	94
30- 6	1.2	37	37	0	8	8	0	16	0	42	104
31- 7	1.2	44	44	0	8	8	2	16	0	55	116
31- 8	1.3	39	39	0	9	11	10	4	0	66	127
30- 9	1.4	39	39	0	8	9	6	12	0	71	131
31-10	1.5	37	37	1	7	7	1	17	0	67	37
30-11	1.8	27	27	8	4	4	0	27	13	56	45
31-12	3.0	30	22	14	1	1	0	28	34	43	54

Table 7- Annual Water Budget Calculations

Pre-Development Annual Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	329	0.15	0.3	0.1	0.55	0.45	180.95	64,787,519	148.05	53,007,970
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	378	0.15	0.3	0.1	0.55	0.45	207.9	31,015,769	170.1	25,376,539
Mature Forest (Fine Sandy Loam)	273,596	298	0.15	0.3	0.2	0.65	0.35	193.7	52,995,545	104.3	28,536,063
Total	**792,450**								**148,798,834**		**106,920,571**

Post-Development Annual Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	759	0	0	0	0	1	0	0	759.36	168,760,926
Impervious Surfaces - Condos	33,820	759	0	0	0	0	1	0	0	759.36	25,681,895
Impervious Surfaces - Roadways	185,664	759	0	0	0	0	1	0	0	759.36	140,985,815
Pasture and Shrubs (Fine Sandy Loam)	132,311	329	0.15	0.3	0.1	0.55	0.45	180.95	23,941,712	148.05	19,588,673
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	378	0.15	0.3	0.1	0.55	0.45	207.9	7,053,163	170.1	5,770,770
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	378	0.15	0.3	0.1	0.55	0.45	207.9	21,743,014	170.1	17,789,738
Urban Lawn - Condo (Fine Sandy Loam)	8,455	378	0.15	0.3	0.1	0.55	0.45	207.9	1,757,818	170.1	1,438,215
Mature Forest (Fine Sandy Loam)	16,170	298	0.15	0.3	0.2	0.65	0.35	193.7	3,132,117	104.3	1,686,525
Total	**792,450**								**57,627,824**		**381,702,557**
Difference (L/year)									**-91,171,010**		**274,781,986**
Percentage Variation									**-61%**		**257%**

Post-Development Annual Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/year)	Total Infiltration (L/year)	Total Runoff (mm/year)	Total Runoff (L/year)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	759	0	0	0	0	1	0	0	759.36	74,437,783
Impervious Surfaces - Condos	33,820	759	0	0	0	0	1	0	0	759.36	25,681,895
Impervious Surfaces - Roadways	185,664	759	0	0	0	0	1	0	0	759.36	140,985,815
Pasture and Shrubs (Fine Sandy Loam)	132,311	329	0.15	0.3	0.1	0.55	0.45	180.95	23,941,712	148.05	19,588,673
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	378	0.2	0.3	0.1	0.6	0.4	226.8	7,694,360	151.2	5,129,573
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	378	0.2	0.3	0.1	0.6	0.4	226.8	51,891,386	151.2	34,594,258
Urban Lawn - Condo (Fine Sandy Loam)	8,455	378	0.2	0.3	0.1	0.6	0.4	226.8	1,917,619	151.2	1,278,413
Mature Forest (Fine Sandy Loam)	16,170	298	0.15	0.3	0.2	0.65	0.35	193.7	3,132,117	104.3	1,686,525
Total	**792,450**								**88,577,195**		**303,382,935**
Difference (L/year)									**-60,221,639**		**196,462,364**
Percentage Variation									**-40%**		**184%**
% of Infiltration and Runoff Decrease due to Mitigation									**34%**		**29%**

Table 8 - January Water Budget Calculations

Pre-Development January Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	21	0.15	0.3	0.1	0.55	0.45	11.55	4,135,374	9.45	3,383,487
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	25	0.15	0.3	0.1	0.55	0.45	13.75	2,051,308	11.25	1,678,343
Mature Forest (Fine Sandy Loam)	273,596	17	0.15	0.3	0.2	0.65	0.35	11.05	3,023,236	5.95	1,627,896
Total	**792,450**								**9,209,917**		**6,689,726**

Post-Development January Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	22	0	0	0	0	1	0	0	21.84	4,853,743
Impervious Surfaces - Condos	33,820	22	0	0	0	0	1	0	0	21.84	738,639
Impervious Surfaces - Roadways	185,664	22	0	0	0	0	1	0	0	21.84	4,054,902
Pasture and Shrubs (Fine Sandy Loam)	132,311	21	0.15	0.3	0.1	0.55	0.45	11.55	1,528,194	9.45	1,250,341
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	25	0.15	0.3	0.1	0.55	0.45	13.75	466,479	11.25	381,665
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	25	0.15	0.3	0.1	0.55	0.45	13.75	1,438,030	11.25	1,176,570
Urban Lawn - Condo (Fine Sandy Loam)	8,455	25	0.15	0.3	0.1	0.55	0.45	13.75	116,258	11.25	95,120
Mature Forest (Fine Sandy Loam)	16,170	17	0.15	0.3	0.2	0.65	0.35	11.05	178,678	5.95	96,211
Total	**792,450**								**3,727,639**		**12,647,190**
Difference (L/month)									**-5,482,278**		**5,957,464**

Post-Development January Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	22	0	0	0	0	1	0	0	21.84	2,140,910
Impervious Surfaces - Condos	33,820	22	0	0	0	0	1	0	0	21.84	738,639
Impervious Surfaces - Roadways	185,664	22	0	0	0	0	1	0	0	21.84	4,054,902
Pasture and Shrubs (Fine Sandy Loam)	132,311	21	0.15	0.3	0.1	0.55	0.45	11.55	1,528,194	9.45	1,250,341
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	25	0.2	0.3	0.1	0.6	0.4	15	508,886	10	339,258
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	25	0.2	0.3	0.1	0.6	0.4	15	3,431,970	10	2,287,980
Urban Lawn - Condo (Fine Sandy Loam)	8,455	25	0.2	0.3	0.1	0.6	0.4	15	126,827	10	84,551
Mature Forest (Fine Sandy Loam)	16,170	17	0.15	0.3	0.2	0.65	0.35	11.05	178,678	5.95	96,211
Total	**792,450**								**5,774,555**		**10,992,791**
Difference (L/month)									**-3,435,362**		**4,303,064**

Table 9 - February Water Budget Calculations

Pre-Development February Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	24	0.15	0.3	0.1	0.55	0.45	13.2	4,726,141	10.8	3,866,843
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	26	0.15	0.3	0.1	0.55	0.45	14.3	2,133,360	11.7	1,745,476
Mature Forest (Fine Sandy Loam)	273,596	21	0.15	0.3	0.2	0.65	0.35	13.65	3,734,585	7.35	2,010,931
Total	**792,450**								**10,594,086**		**7,623,250**

Post-Development February Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	23	0	0	0	0	1	0	0	22.68	5,040,426
Impervious Surfaces - Condos	33,820	23	0	0	0	0	1	0	0	22.68	767,048
Impervious Surfaces - Roadways	185,664	23	0	0	0	0	1	0	0	22.68	4,210,860
Pasture and Shrubs (Fine Sandy Loam)	132,311	24	0.15	0.3	0.1	0.55	0.45	13.2	1,746,508	10.8	1,428,961
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	26	0.15	0.3	0.1	0.55	0.45	14.3	485,138	11.7	396,931
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	26	0.15	0.3	0.1	0.55	0.45	14.3	1,495,551	11.7	1,223,633
Urban Lawn - Condo (Fine Sandy Loam)	8,455	26	0.15	0.3	0.1	0.55	0.45	14.3	120,908	11.7	98,925
Mature Forest (Fine Sandy Loam)	16,170	21	0.15	0.3	0.2	0.65	0.35	13.65	220,720	7.35	118,849
Totals	**792,450**								**4,068,825**		**13,285,632**
Difference (L/month)									**-6,525,261**		**5,662,382**

Post-Development February Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	23	0	0	0	0	1	0	0	22.68	2,223,252
Impervious Surfaces - Condos	33,820	23	0	0	0	0	1	0	0	22.68	767,048
Impervious Surfaces - Roadways	185,664	23	0	0	0	0	1	0	0	22.68	4,210,860
Pasture and Shrubs (Fine Sandy Loam)	132,311	24	0.15	0.3	0.1	0.55	0.45	13.2	1,746,508	10.8	1,428,961
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	26	0.2	0.3	0.1	0.6	0.4	15.6	529,242	10.4	352,828
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	26	0.2	0.3	0.1	0.6	0.4	15.6	3,569,249	10.4	2,379,499
Urban Lawn - Condo (Fine Sandy Loam)	8,455	26	0.2	0.3	0.1	0.6	0.4	15.6	131,900	10.4	87,933
Mature Forest (Fine Sandy Loam)	16,170	21	0.15	0.3	0.2	0.65	0.35	13.65	220,720	7.35	118,849
Totals	**792,450**								**6,197,618**		**11,569,230**
Difference (L/month)									**-4,396,469**		**3,945,980**

Table 10 - March Water Budget Calculations

Pre-Development March Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	99	0.15	0.3	0.1	0.55	0.45	54.45	19,495,332	44.55	15,950,727
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	103	0.15	0.3	0.1	0.55	0.45	56.65	8,451,387	46.35	6,914,771
Mature Forest (Fine Sandy Loam)	273,596	91	0.15	0.3	0.2	0.65	0.35	59.15	16,183,203	31.85	8,714,033
Total	**792,450**								**44,129,923**		**31,579,530**

Post-Development March Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	91	0	0	0	0	1	0	0	90.72	20,161,704
Impervious Surfaces - Condos	33,820	91	0	0	0	0	1	0	0	90.72	3,068,191
Impervious Surfaces - Roadways	185,664	91	0	0	0	0	1	0	0	90.72	16,843,438
Pasture and Shrubs (Fine Sandy Loam)	132,311	99	0.15	0.3	0.1	0.55	0.45	54.45	7,204,345	44.55	5,894,464
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	103	0.15	0.3	0.1	0.55	0.45	56.65	1,921,894	46.35	1,572,459
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	103	0.15	0.3	0.1	0.55	0.45	56.65	5,924,684	46.35	4,847,468
Urban Lawn - Condo (Fine Sandy Loam)	8,455	103	0.15	0.3	0.1	0.55	0.45	56.65	478,982	46.35	391,894
Mature Forest (Fine Sandy Loam)	16,170	91	0.15	0.3	0.2	0.65	0.35	59.15	956,452	31.85	515,013
Totals	**792,450**								**16,486,356**		**53,294,631**
Difference (L/month)									**-27,643,567**		**21,715,100**

Post-Development March Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	91	0	0	0	0	1	0	0	90.72	8,893,009
Impervious Surfaces - Condos	33,820	91	0	0	0	0	1	0	0	90.72	3,068,191
Impervious Surfaces - Roadways	185,664	91	0	0	0	0	1	0	0	90.72	16,843,438
Pasture and Shrubs (Fine Sandy Loam)	132,311	99	0.15	0.3	0.1	0.55	0.45	54.45	7,204,345	44.55	5,894,464
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	103	0.2	0.3	0.1	0.6	0.4	61.8	2,096,611	41.2	1,397,741
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	103	0.2	0.3	0.1	0.6	0.4	61.8	14,139,716	41.2	9,426,478
Urban Lawn - Condo (Fine Sandy Loam)	8,455	103	0.2	0.3	0.1	0.6	0.4	61.8	522,526	41.2	348,351
Mature Forest (Fine Sandy Loam)	16,170	91	0.15	0.3	0.2	0.65	0.35	59.15	956,452	31.85	515,013
Totals	**792,450**								**24,919,650**		**46,386,684**
Difference (L/month)									**-19,210,272**		**14,807,154**

Table 11 - April Water Budget Calculations

Pre-Development April Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	109	0.15	0.3	0.1	0.55	0.45	59.95	21,464,558	49.05	17,561,911
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	110	0.15	0.3	0.1	0.55	0.45	60.5	9,025,753	49.5	7,384,707
Mature Forest (Fine Sandy Loam)	273,596	105	0.15	0.3	0.2	0.65	0.35	68.25	18,672,927	36.75	10,054,653
Total	**792,450**								**49,163,238**		**35,001,271**

Post-Development April Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	118	0	0	0	0	1	0	0	117.6	26,135,542
Impervious Surfaces - Condos	33,820	118	0	0	0	0	1	0	0	117.6	3,977,285
Impervious Surfaces - Roadways	185,664	118	0	0	0	0	1	0	0	117.6	21,834,086
Pasture and Shrubs (Fine Sandy Loam)	132,311	109	0.15	0.3	0.1	0.55	0.45	59.95	7,932,056	49.05	6,489,864
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	110	0.15	0.3	0.1	0.55	0.45	60.5	2,052,508	49.5	1,679,325
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	110	0.15	0.3	0.1	0.55	0.45	60.5	6,327,332	49.5	5,176,908
Urban Lawn - Condo (Fine Sandy Loam)	8,455	110	0.15	0.3	0.1	0.55	0.45	60.5	511,534	49.5	418,528
Mature Forest (Fine Sandy Loam)	16,170	105	0.15	0.3	0.2	0.65	0.35	68.25	1,103,598	36.75	594,245
Totals	**792,450**								**17,927,029**		**66,305,783**
Difference (L/month)									**-31,236,209**		**31,304,512**

Post-Development April Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	118	0	0	0	0	1	0	0	117.6	11,527,975
Impervious Surfaces - Condos	33,820	118	0	0	0	0	1	0	0	117.6	3,977,285
Impervious Surfaces - Roadways	185,664	118	0	0	0	0	1	0	0	117.6	21,834,086
Pasture and Shrubs (Fine Sandy Loam)	132,311	109	0.15	0.3	0.1	0.55	0.45	59.95	7,932,056	49.05	6,489,864
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	110	0.2	0.3	0.1	0.6	0.4	66	2,239,100	44	1,492,733
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	110	0.2	0.3	0.1	0.6	0.4	66	15,100,668	44	10,067,112
Urban Lawn - Condo (Fine Sandy Loam)	8,455	110	0.2	0.3	0.1	0.6	0.4	66	558,037	44	372,025
Mature Forest (Fine Sandy Loam)	16,170	105	0.15	0.3	0.2	0.65	0.35	68.25	1,103,598	36.75	594,245
Totals	**792,450**								**26,933,460**		**56,355,326**
Difference (L/month)									**-22,229,778**		**21,354,055**

Table 12 - May Water Budget Calculations

Pre-Development May Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	14	0.15	0.3	0.1	0.55	0.45	7.7	2,756,916	6.3	2,255,658
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	14	0.15	0.3	0.1	0.55	0.45	7.7	1,148,732	6.3	939,872
Mature Forest (Fine Sandy Loam)	273,596	14	0.15	0.3	0.2	0.65	0.35	9.1	2,489,724	4.9	1,340,620
Total	**792,450**								**6,395,372**		**4,536,151**

Post-Development May Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	63	0	0	0	0	1	0	0	63	14,001,183
Impervious Surfaces - Condos	33,820	63	0	0	0	0	1	0	0	63	2,130,688
Impervious Surfaces - Roadways	185,664	63	0	0	0	0	1	0	0	63	11,696,832
Pasture and Shrubs (Fine Sandy Loam)	132,311	14	0.15	0.3	0.1	0.55	0.45	7.7	1,018,796	6.3	833,561
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	14	0.15	0.3	0.1	0.55	0.45	7.7	261,228	6.3	213,732
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	14	0.15	0.3	0.1	0.55	0.45	7.7	805,297	6.3	658,879
Urban Lawn - Condo (Fine Sandy Loam)	8,455	14	0.15	0.3	0.1	0.55	0.45	7.7	65,104	6.3	53,267
Mature Forest (Fine Sandy Loam)	16,170	14	0.15	0.3	0.2	0.65	0.35	9.1	147,146	4.9	79,233
Totals	**792,450**								**2,297,572**		**29,667,375**
Difference (L/month)									**-4,097,799**		**25,131,225**

Post-Development May Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	63	0	0	0	0	1	0	0	63	6,175,701
Impervious Surfaces - Condos	33,820	63	0	0	0	0	1	0	0	63	2,130,688
Impervious Surfaces - Roadways	185,664	63	0	0	0	0	1	0	0	63	11,696,832
Pasture and Shrubs (Fine Sandy Loam)	132,311	14	0.15	0.3	0.1	0.55	0.45	7.7	1,018,796	6.3	833,561
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	14	0.2	0.3	0.1	0.6	0.4	8.4	284,976	5.6	189,984
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	14	0.2	0.3	0.1	0.6	0.4	8.4	1,921,903	5.6	1,281,269
Urban Lawn - Condo (Fine Sandy Loam)	8,455	14	0.2	0.3	0.1	0.6	0.4	8.4	71,023	5.6	47,349
Mature Forest (Fine Sandy Loam)	16,170	14	0.15	0.3	0.2	0.65	0.35	9.1	147,146	4.9	79,233
Totals	**792,450**								**3,443,845**		**22,434,616**
Difference (L/month)									**-2,951,526**		**17,898,466**

Table 13 - June Water Budget Calculations

Pre-Development June Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	4	0.15	0.3	0.1	0.55	0.45	2.2	787,690	1.8	644,474
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	4	0.15	0.3	0.1	0.55	0.45	2.2	328,209	1.8	268,535
Mature Forest (Fine Sandy Loam)	273,596	4	0.15	0.3	0.2	0.65	0.35	2.6	711,350	1.4	383,034
Total	**792,450**								**1,827,249**		**1,296,043**

Post-Development June Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	71	0	0	0	0	1	0	0	71.4	15,868,007
Impervious Surfaces - Condos	33,820	71	0	0	0	0	1	0	0	71.4	2,414,780
Impervious Surfaces - Roadways	185,664	71	0	0	0	0	1	0	0	71.4	13,256,410
Pasture and Shrubs (Fine Sandy Loam)	132,311	4	0.15	0.3	0.1	0.55	0.45	2.2	291,085	1.8	238,160
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	4	0.15	0.3	0.1	0.55	0.45	2.2	74,637	1.8	61,066
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	4	0.15	0.3	0.1	0.55	0.45	2.2	230,085	1.8	188,251
Urban Lawn - Condo (Fine Sandy Loam)	8,455	4	0.15	0.3	0.1	0.55	0.45	2.2	18,601	1.8	15,219
Mature Forest (Fine Sandy Loam)	16,170	4	0.15	0.3	0.2	0.65	0.35	2.6	42,042	1.4	22,638
Totals	**792,450**								**656,449**		**32,064,532**
Difference (L/month)									**-1,170,800**		**30,768,489**

Post-Development June Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	71	0	0	0	0	1	0	0	71.4	6,999,128
Impervious Surfaces - Condos	33,820	71	0	0	0	0	1	0	0	71.4	2,414,780
Impervious Surfaces - Roadways	185,664	71	0	0	0	0	1	0	0	71.4	13,256,410
Pasture and Shrubs (Fine Sandy Loam)	132,311	4	0.15	0.3	0.1	0.55	0.45	2.2	291,085	1.8	238,160
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	4	0.2	0.3	0.1	0.6	0.4	2.4	81,422	1.6	54,281
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	4	0.2	0.3	0.1	0.6	0.4	2.4	549,115	1.6	366,077
Urban Lawn - Condo (Fine Sandy Loam)	8,455	4	0.2	0.3	0.1	0.6	0.4	2.4	20,292	1.6	13,528
Mature Forest (Fine Sandy Loam)	16,170	4	0.15	0.3	0.2	0.65	0.35	2.6	42,042	1.4	22,638
Totals	**792,450**								**983,956**		**23,365,002**
Difference (L/month)									**-843,293**		**22,068,959**

Table 14 - July Water Budget Calculations

Pre-Development July Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	3	0.15	0.3	0.1	0.55	0.45	1.65	590,768	1.35	483,355
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	3	0.15	0.3	0.1	0.55	0.45	1.65	246,157	1.35	201,401
Mature Forest (Fine Sandy Loam)	273,596	3	0.15	0.3	0.2	0.65	0.35	1.95	533,512	1.05	287,276
Total	**792,450**								**1,370,437**		**972,032**

Post-Development July Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	74	0	0	0	0	1	0	0	73.92	16,428,055
Impervious Surfaces - Condos	33,820	74	0	0	0	0	1	0	0	73.92	2,500,008
Impervious Surfaces - Roadways	185,664	74	0	0	0	0	1	0	0	73.92	13,724,283
Pasture and Shrubs (Fine Sandy Loam)	132,311	3	0.15	0.3	0.1	0.55	0.45	1.65	218,313	1.35	178,620
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	3	0.15	0.3	0.1	0.55	0.45	1.65	55,977	1.35	45,800
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	3	0.15	0.3	0.1	0.55	0.45	1.65	172,564	1.35	141,188
Urban Lawn - Condo (Fine Sandy Loam)	8,455	3	0.15	0.3	0.1	0.55	0.45	1.65	13,951	1.35	11,414
Mature Forest (Fine Sandy Loam)	16,170	3	0.15	0.3	0.2	0.65	0.35	1.95	31,531	1.05	16,978
Totals	**792,450**								**492,337**		**33,046,346**
Difference (L/month)									**-878,100**		**32,074,314**

Post-Development July Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	74	0	0	0	0	1	0	0	73.92	7,246,156
Impervious Surfaces - Condos	33,820	74	0	0	0	0	1	0	0	73.92	2,500,008
Impervious Surfaces - Roadways	185,664	74	0	0	0	0	1	0	0	73.92	13,724,283
Pasture and Shrubs (Fine Sandy Loam)	132,311	3	0.15	0.3	0.1	0.55	0.45	1.65	218,313	1.35	178,620
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	3	0.2	0.3	0.1	0.6	0.4	1.8	61,066	1.2	40,711
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	3	0.2	0.3	0.1	0.6	0.4	1.8	411,836	1.2	274,558
Urban Lawn - Condo (Fine Sandy Loam)	8,455	3	0.2	0.3	0.1	0.6	0.4	1.8	15,219	1.2	10,146
Mature Forest (Fine Sandy Loam)	16,170	3	0.15	0.3	0.2	0.65	0.35	1.95	31,531	1.05	16,978
Totals	**792,450**								**737,967**		**23,991,459**
Difference (L/month)									**-632,470**		**23,019,427**

Table 15 - August Water Budget Calculations

Pre-Development August Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	1	0.15	0.3	0.1	0.55	0.45	0.55	196,923	0.45	161,118
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	1	0.15	0.3	0.1	0.55	0.45	0.55	82,052	0.45	67,134
Mature Forest (Fine Sandy Loam)	273,596	1	0.15	0.3	0.2	0.65	0.35	0.65	177,837	0.35	95,759
Total	**792,450**								**456,812**		**324,011**

Post-Development August Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	71	0	0	0	0	1	0	0	71.4	15,868,007
Impervious Surfaces - Condos	33,820	71	0	0	0	0	1	0	0	71.4	2,414,780
Impervious Surfaces - Roadways	185,664	71	0	0	0	0	1	0	0	71.4	13,256,410
Pasture and Shrubs (Fine Sandy Loam)	132,311	1	0.15	0.3	0.1	0.55	0.45	0.55	72,771	0.45	59,540
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	1	0.15	0.3	0.1	0.55	0.45	0.55	18,659	0.45	15,267
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	1	0.15	0.3	0.1	0.55	0.45	0.55	57,521	0.45	47,063
Urban Lawn - Condo (Fine Sandy Loam)	8,455	1	0.15	0.3	0.1	0.55	0.45	0.55	4,650	0.45	3,805
Mature Forest (Fine Sandy Loam)	16,170	1	0.15	0.3	0.2	0.65	0.35	0.65	10,510	0.35	5,659
Totals	**792,450**								**164,112**		**31,670,531**
Difference (L/month)									**-292,700**		**31,346,520**

Post-Development August Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	71	0	0	0	0	1	0	0	71.4	6,999,128
Impervious Surfaces - Condos	33,820	71	0	0	0	0	1	0	0	71.4	2,414,780
Impervious Surfaces - Roadways	185,664	71	0	0	0	0	1	0	0	71.4	13,256,410
Pasture and Shrubs (Fine Sandy Loam)	132,311	1	0.15	0.3	0.1	0.55	0.45	0.55	72,771	0.45	59,540
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	1	0.2	0.3	0.1	0.6	0.4	0.6	20,355	0.4	13,570
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	1	0.2	0.3	0.1	0.6	0.4	0.6	137,279	0.4	91,519
Urban Lawn - Condo (Fine Sandy Loam)	8,455	1	0.2	0.3	0.1	0.6	0.4	0.6	5,073	0.4	3,382
Mature Forest (Fine Sandy Loam)	16,170	1	0.15	0.3	0.2	0.65	0.35	0.65	10,510	0.35	5,659
Totals	**792,450**								**245,989**		**22,843,988**
Difference (L/month)									**-210,823**		**22,519,978**

Table 16 - September Water Budget Calculations

Pre-Development September Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	2	0.15	0.3	0.1	0.55	0.45	1.1	393,845	0.9	322,237
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	3	0.15	0.3	0.1	0.55	0.45	1.65	246,157	1.35	201,401
Mature Forest (Fine Sandy Loam)	273,596	2	0.15	0.3	0.2	0.65	0.35	1.3	355,675	0.7	191,517
Total	**792,450**								**995,677**		**715,155**

Post-Development September Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	69	0	0	0	0	1	0	0	68.88	15,307,960
Impervious Surfaces - Condos	33,820	69	0	0	0	0	1	0	0	68.88	2,329,552
Impervious Surfaces - Roadways	185,664	69	0	0	0	0	1	0	0	68.88	12,788,536
Pasture and Shrubs (Fine Sandy Loam)	132,311	2	0.15	0.3	0.1	0.55	0.45	1.1	145,542	0.9	119,080
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	3	0.15	0.3	0.1	0.55	0.45	1.65	55,977	1.35	45,800
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	3	0.15	0.3	0.1	0.55	0.45	1.65	172,564	1.35	141,188
Urban Lawn - Condo (Fine Sandy Loam)	8,455	3	0.15	0.3	0.1	0.55	0.45	1.65	13,951	1.35	11,414
Mature Forest (Fine Sandy Loam)	16,170	2	0.15	0.3	0.2	0.65	0.35	1.3	21,021	0.7	11,319
Totals	**792,450**								**409,055**		**30,754,850**
Difference (L/month)									**-586,622**		**30,039,695**

Post-Development September Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	69	0	0	0	0	1	0	0	68.88	6,752,100
Impervious Surfaces - Condos	33,820	69	0	0	0	0	1	0	0	68.88	2,329,552
Impervious Surfaces - Roadways	185,664	69	0	0	0	0	1	0	0	68.88	12,788,536
Pasture and Shrubs (Fine Sandy Loam)	132,311	2	0.15	0.3	0.1	0.55	0.45	1.1	145,542	0.9	119,080
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	3	0.2	0.3	0.1	0.6	0.4	1.8	61,066	1.2	40,711
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	3	0.2	0.3	0.1	0.6	0.4	1.8	411,836	1.2	274,558
Urban Lawn - Condo (Fine Sandy Loam)	8,455	3	0.2	0.3	0.1	0.6	0.4	1.8	15,219	1.2	10,146
Mature Forest (Fine Sandy Loam)	16,170	2	0.15	0.3	0.2	0.65	0.35	1.3	21,021	0.7	11,319
Totals	**792,450**								**654,685**		**22,326,002**
Difference (L/month)									**-340,992**		**21,610,847**

Table 17 - October Water Budget Calculations

Pre-Development October Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	7	0.15	0.3	0.1	0.55	0.45	3.85	1,378,458	3.15	1,127,829
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	14	0.15	0.3	0.1	0.55	0.45	7.7	1,148,732	6.3	939,872
Mature Forest (Fine Sandy Loam)	273,596	6	0.15	0.3	0.2	0.65	0.35	3.9	1,067,024	2.1	574,552
Total	**792,450**								**3,594,214**		**2,642,253**

Post-Development October Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	65	0	0	0	0	1	0	0	64.68	14,374,548
Impervious Surfaces - Condos	33,820	65	0	0	0	0	1	0	0	64.68	2,187,507
Impervious Surfaces - Roadways	185,664	65	0	0	0	0	1	0	0	64.68	12,008,748
Pasture and Shrubs (Fine Sandy Loam)	132,311	7	0.15	0.3	0.1	0.55	0.45	3.85	509,398	3.15	416,780
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	14	0.15	0.3	0.1	0.55	0.45	7.7	261,228	6.3	213,732
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	14	0.15	0.3	0.1	0.55	0.45	7.7	805,297	6.3	658,879
Urban Lawn - Condo (Fine Sandy Loam)	8,455	14	0.15	0.3	0.1	0.55	0.45	7.7	65,104	6.3	53,267
Mature Forest (Fine Sandy Loam)	16,170	6	0.15	0.3	0.2	0.65	0.35	3.9	63,063	2.1	33,957
Totals	**792,450**								**1,704,090**		**29,947,418**
Difference (L/month)									**-1,890,124**		**27,305,165**

Post-Development October Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	65	0	0	0	0	1	0	0	64.68	6,340,386
Impervious Surfaces - Condos	33,820	65	0	0	0	0	1	0	0	64.68	2,187,507
Impervious Surfaces - Roadways	185,664	65	0	0	0	0	1	0	0	64.68	12,008,748
Pasture and Shrubs (Fine Sandy Loam)	132,311	7	0.15	0.3	0.1	0.55	0.45	3.85	509,398	3.15	416,780
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	14	0.2	0.3	0.1	0.6	0.4	8.4	284,976	5.6	189,984
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	14	0.2	0.3	0.1	0.6	0.4	8.4	1,921,903	5.6	1,281,269
Urban Lawn - Condo (Fine Sandy Loam)	8,455	14	0.2	0.3	0.1	0.6	0.4	8.4	71,023	5.6	47,349
Mature Forest (Fine Sandy Loam)	16,170	6	0.15	0.3	0.2	0.65	0.35	3.9	63,063	2.1	33,957
Totals	**792,450**								**2,850,363**		**22,505,979**
Difference (L/month)									**-743,851**		**19,863,727**

Table 18 - November Water Budget Calculations

Pre-Development November Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	20	0.15	0.3	0.1	0.55	0.45	11	3,938,451	9	3,222,369
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	38	0.15	0.3	0.1	0.55	0.45	20.9	3,117,987	17.1	2,551,081
Mature Forest (Fine Sandy Loam)	273,596	16	0.15	0.3	0.2	0.65	0.35	10.4	2,845,398	5.6	1,532,138
Total	**792,450**								**9,901,837**		**7,305,587**

Post-Development November Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	56	0	0	0	0	1	0	0	56.28	12,507,723
Impervious Surfaces - Condos	33,820	56	0	0	0	0	1	0	0	56.28	1,903,415
Impervious Surfaces - Roadways	185,664	56	0	0	0	0	1	0	0	56.28	10,449,170
Pasture and Shrubs (Fine Sandy Loam)	132,311	20	0.15	0.3	0.1	0.55	0.45	11	1,455,423	9	1,190,801
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	38	0.15	0.3	0.1	0.55	0.45	20.9	709,048	17.1	580,130
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	38	0.15	0.3	0.1	0.55	0.45	20.9	2,185,806	17.1	1,788,386
Urban Lawn - Condo (Fine Sandy Loam)	8,455	38	0.15	0.3	0.1	0.55	0.45	20.9	176,712	17.1	144,582
Mature Forest (Fine Sandy Loam)	16,170	16	0.15	0.3	0.2	0.65	0.35	10.4	168,167	5.6	90,552
Totals	**792,450**								**4,695,156**		**28,654,760**
Difference (L/month)									**-5,206,681**		**21,349,173**

Post-Development November Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	56	0	0	0	0	1	0	0	56.28	5,516,960
Impervious Surfaces - Condos	33,820	56	0	0	0	0	1	0	0	56.28	1,903,415
Impervious Surfaces - Roadways	185,664	56	0	0	0	0	1	0	0	56.28	10,449,170
Pasture and Shrubs (Fine Sandy Loam)	132,311	20	0.15	0.3	0.1	0.55	0.45	11	1,455,423	9	1,190,801
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	38	0.2	0.3	0.1	0.6	0.4	22.8	773,507	15.2	515,671
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	38	0.2	0.3	0.1	0.6	0.4	22.8	5,216,594	15.2	3,477,730
Urban Lawn - Condo (Fine Sandy Loam)	8,455	38	0.2	0.3	0.1	0.6	0.4	22.8	192,777	15.2	128,518
Mature Forest (Fine Sandy Loam)	16,170	16	0.15	0.3	0.2	0.65	0.35	10.4	168,167	5.6	90,552
Totals	**792,450**								**7,806,469**		**23,272,815**
Difference (L/month)									**-2,095,368**		**15,967,228**

Table 19 - December Water Budget Calculations

Pre-Development December Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	11,627	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Pasture and Shrubs (Fine Sandy Loam)	358,041	25	0.15	0.3	0.1	0.55	0.45	13.75	4,923,064	11.25	4,027,961
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	149,186	37	0.15	0.3	0.1	0.55	0.45	20.35	3,035,935	16.65	2,483,947
Mature Forest (Fine Sandy Loam)	273,596	18	0.15	0.3	0.2	0.65	0.35	11.7	3,201,073	6.3	1,723,655
Total	**792,450**								**11,160,072**		**8,235,563**

Post-Development December Water Budget Calculations

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	222,241	35	0	0	0	0	1	0	0	35.28	7,840,662
Impervious Surfaces - Condos	33,820	35	0	0	0	0	1	0	0	35.28	1,193,185
Impervious Surfaces - Roadways	185,664	35	0	0	0	0	1	0	0	35.28	6,550,226
Pasture and Shrubs (Fine Sandy Loam)	132,311	25	0.15	0.3	0.1	0.55	0.45	13.75	1,819,279	11.25	1,488,501
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	37	0.15	0.3	0.1	0.55	0.45	20.35	690,389	16.65	564,864
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	104,584	37	0.15	0.3	0.1	0.55	0.45	20.35	2,128,284	16.65	1,741,324
Urban Lawn - Condo (Fine Sandy Loam)	8,455	37	0.15	0.3	0.1	0.55	0.45	20.35	172,062	16.65	140,778
Mature Forest (Fine Sandy Loam)	16,170	18	0.15	0.3	0.2	0.65	0.35	11.7	189,188	6.3	101,871
Totals	**792,450**								**4,999,202**		**19,621,410**
Difference (L/month)									**-6,160,870**		**11,385,847**

Post-Development December Water Budget Calculations With Mitigation

Land Use Unit	Area (m^2)	Water Surplus (mm)	Topography Factor	Soil Factor	Vegetation Factor	Infiltration Factor	Runoff Factor	Total Infiltration (mm/month)	Total Infiltration (L/month)	Total Runoff (mm/month)	Total Runoff (L/month)
SWMP	55,278	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Impervious Surfaces - Detached Homes/Townhouses	98,027	35	0	0	0	0	1	0	0	35.28	3,458,393
Impervious Surfaces - Condos	33,820	35	0	0	0	0	1	0	0	35.28	1,193,185
Impervious Surfaces - Roadways	185,664	35	0	0	0	0	1	0	0	35.28	6,550,226
Pasture and Shrubs (Fine Sandy Loam)	132,311	25	0.15	0.3	0.1	0.55	0.45	13.75	1,819,279	11.25	1,488,501
Urban Lawn/Shallow Rooted Crops (Fine Sandy Loam)	33,926	37	0.2	0.3	0.1	0.6	0.4	22.2	753,152	14.8	502,101
Urban Lawn - Detached Homes/Townhouses (Fine Sandy Loam)	228,798	37	0.2	0.3	0.1	0.6	0.4	22.2	5,079,316	14.8	3,386,210
Urban Lawn - Condo (Fine Sandy Loam)	8,455	37	0.2	0.3	0.1	0.6	0.4	22.2	187,703	14.8	125,136
Mature Forest (Fine Sandy Loam)	16,170	18	0.15	0.3	0.2	0.65	0.35	11.7	189,188	6.3	101,871
Totals	**792,450**								**8,028,638**		**16,805,623**
Difference (L/month)									**-3,131,434**		**8,570,060**

APPENDIX 4

CITY OF OTTAWA - SALT MANAGEMENT PLAN - APPENDIX A - OCTOBER 31, 2011

City of Ottawa
Public Works and Services Department
Surface Operations Branch

Salt Management Plan
Appendix A

MATERIAL APPLICATION POLICY

CONTENT

Maintenance Quality Standards – Snow and Ice Control on Roads
General Information
Use of Liquid Chemicals
Material Application Guideline and Policy – Bare Pavement Roads
Material Application Guideline and Policy – Centre-Bare Roads
Material Application Guideline and Policy – Snow Packed Roads
Blast Policy

The Surface Operations Branch District Managers, Area Managers and Zone Supervisors have been consulted through the development of this document.

REVISION INFO

Rev	Date	By	Description
3.1	Jan 10 2007		
3.2	Oct 31 2011	D Vander Wal	• Removed 50/50 mix per Dan O'Keefe. • Removed specific references to Sodium and Calcium Chloride as new product for 2011 is a Multi-Chloride Brine. Changed liquid application rate from 46 (6%) to 39L/tonne (5%). • Removed Dry and Wet salt rates for pavement temperatures below -18C. • Updated Epoke rates to match Appendix B and added wet rates to obtain 20% reduction when pre-wetting. • Removed separate rate table for Hwy 174 Epoke spreaders since the resulting lane-km rates are the same as other bare pavement.

COUNCIL APPROVED MAINTENANCE QUALITY STANDARDS

For snow clearing, resources are to be deployed and snow clearing completed as defined in the Table below. If the depth of snow accumulation is less than the minimum for deployment, then resources may be deployed subject to road conditions resulting from previous snow accumulations or from forecasted weather conditions.

For treating icy roads, resources are to be deployed as soon as practicable after becoming aware of the icy conditions. Icy roads are to be treated within the times defined in the Table below after becoming aware of the icy conditions.

MAINTENANCE QUALITY STANDARD SNOW AND ICE CONTROL ON ROADS							
Road Maintenance Class		**Road Type**	**Minimum Depth of Snow Accumulation for Deployment of Resources** *(Depth as per MMSMH)*	**Time to Clear Snow Accumulation From the End of Snow Accumulation or Time to Treat Icy Conditions** *(Time as per MMSMH)*	**Treatment Standard**		
					Bare Pavement	**Centre Bare**	**Snow Packed**
1	A	High Priority Roads	As accumulation begins *(2.5-8 cm depending on class)*	2 h *(3-4 h)*	√		
	B				√		
2	A	Most Arterials		3 h *(3-6 h)*	√		
	B				√		
3	A	Most Major Collectors		4 h *(8-12 h)*	√		
	B				√		
4	A	Most Minor Collectors	5 cm *(8 cm)*	6 h *(12-16 h)*	√		
	B					√	
	C						√
5	A, C	Residential Roads and Lanes	7 cm *(10 cm)*	10 h *(16-24 h)*			√
	B		10 cm *(not defined)*	16 h *(not defined)*			√

Note - MMSMH refers to Ontario Regulation 239/02, Minimum Maintenance Standards for Municipal Highways shown for comparison purposes.

- **Bare Pavement:** requires that snow and ice be controlled, cleared and/or prevented for the full traveled road pavement width, including flush medians of 2 m width or less, paved shoulders and/or adjacent cycling lanes. It does not include parking lanes.
- **Centre-Bare:** requires that snow and ice be controlled, cleared and/or prevented in a strip down the middle of the road pavement width for a minimum width of 2.5 m on each side of centre-line.
- **Snow-Packed:** requires that snow and ice be cleared and that ruts and/or potholes that may cause poor vehicle control be leveled off. Abrasive or deicing materials are applied at intersections, hills and sharp curves.

LIQUID CHEMICALS

Application Rates and Reductions

USE OF LIQUID CHEMICALS					
Chemical	**Use**	**Application Ratio**	**Chemical Concentration**	**Application Rate**	**Dry Salt Reduction**
CaCl, MgCl, or Multi-Chloride	Pre-Wetting	5% by weight	Varies (28%-35%)	39L / t	20%[1]
CaCl, MgCl, or Multi-Chloride	Straight Liquid Application	N/A	Varies	60 to 100L/ lane-km	-

[1] The Epoke controller does not support setting a separate reduction percentage – the rate will only be reduced by the set liquid application ratio (5%).

Pre-Wetted Salt

- Pre-wetting salt is a recommended practice to enhance the performance of the road salt.
- When salt is pre-wet, the brine solution is formed quicker than dry salt and more material is retained on the road surface. It is the brine solution that prevents or breaks the bond between the road surface and snow/ice.
- The enhanced performance of the salt as well as the retention of salt on the road surface facilitates achieving a bare road more quickly and maintains bare pavement longer. As a result, a reduction in salt application rates can achieve the same effectiveness as dry salt application at traditional rates.

Practical temperature ranges for Pre-Wetted Salt (WET SALT)

- Sodium Chloride Brine (NaCl):
  - From 0 to –9ºC (0 to -12ºC as per pre-wetting practices in urban areas)
- Calcium Chloride ($CaCl_2$), Magnesium Chloride (MgCl), and Multi-Chloride Brines with a minimum eutectic temperature of -30°C:
  - From 0 to –15ºC (0 to -18ºC as per pre-wetting practices in urban areas)

Direct Liquid Applications (DLA)

- Anti-icing by Direct Liquid Application is a recommended practice to treat frost and black ice conditions in the shoulder seasons at pavement temperatures between 0 and –10ºC.
- Liquid should be applied to treat forecasted conditions at the following rates:

Winter Event	Litres / LaneKm	mL / m^2 (at 3m width)
Frost	60	20
Light Snow	60 to 80	25
Moderate to Heavy Snow, Freezing Rain	80 to 100	30

- DLA should be applied:
  - As close to the beginning of the winter event as possible
  - When the air and pavement temperatures are both below +5°C currently and forecasted to remain below +5°C within the next 12 hours.
  - When the air and pavement temperatures are a minimum of 10°C above the eutectic temperature of the DLA liquid and forecasted to do so for the next 24 hours.
- DLA should NOT be applied:

- When the relative humidity is below 60% and the air and pavement temperatures are between 0°C and +5°C.
- More than once in a three-day period unless a Winter Event (frost, snow, freezing rain or rain) has removed the product from the pavement. Note that DLA liquid can remain on the pavement up to several days after the initial application.

GENERAL INFORMATION

When the Pavement Temperature is below –18ºC

- Below –18ºC, the salt melting action is close to none.
- Below –18ºC, the use of salt shall be discontinued and replaced by an abrasive.
- Multiple factors can affect the performance of de-icing chemicals and abrasives below pavement temperature of –18ºC. Under such conditions, supervisors shall select the most appropriate material based on the current and expected traffic volume, current and forecasted weather and road conditions.

Abrasives

- Accepted abrasives are Sand and Grit
- Straight abrasive does contain salt to prevent the stockpile from freezing. The goal is to minimize the amount of salt mixed with the abrasives. The objective is to use an engineered abrasive of 5% salt / 95% sand or grit by volume. The following interim abrasive ratios are accepted (where the engineered ratio cannot be achieved due to equipment and material storage constraints)
  - 10% salt / 90% sand or grit by volume

Rush Hours and Forecasted Conditions

- Supervisors are responsible for making timely material application calls based on forecasted conditions and expected traffic peak hours.

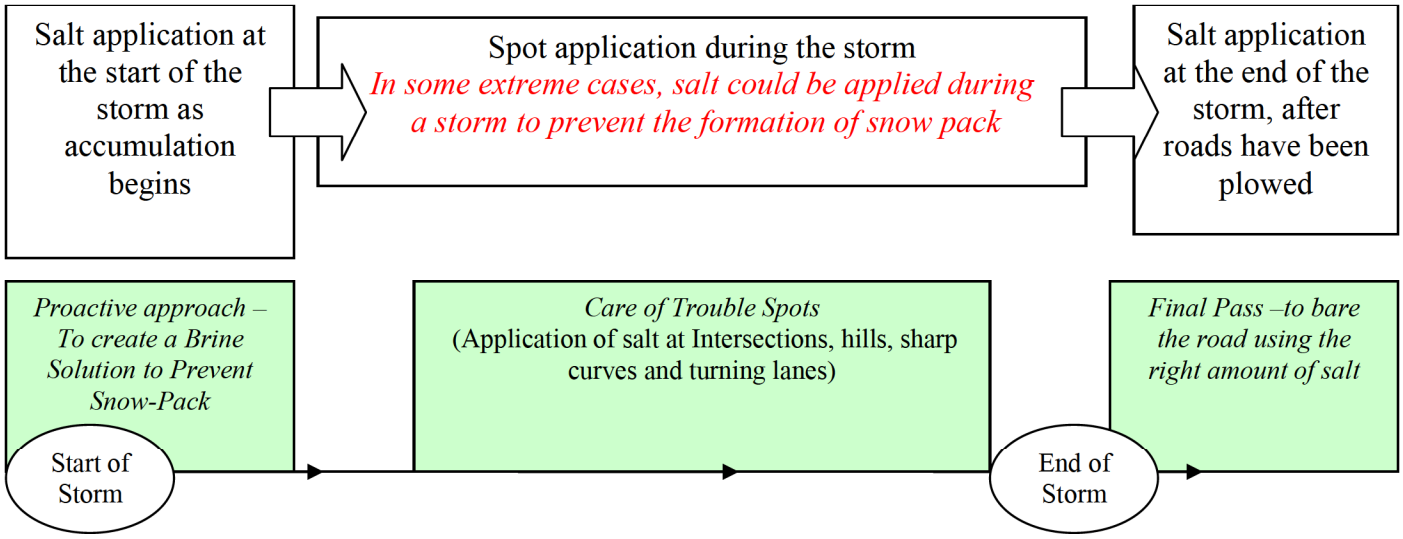
Freezing Rain

- When Freezing Rain occurs, abrasive materials (sand or grit) will be applied on snow packed roads on a continuous basis (to the full Road Width).
- Snow Packed Roads – where available, graders with ice blades shall drag the roads to aid traction.

MATERIAL APPLICATION POLICY BARE PAVEMENT					
Pavement Temperature °C	**Material**	**Frost and Black Ice *Kg/2-lane km***	**Light Snow <1cm/hr *Kg/2-lane km***	**Heavy Snow >1cm/hr *Kg/2-lane km***	**Freezing Rain *Kg/2-lane km***
0 to –5°C	DRY SALT	70	100	140	230
	WET SALT	55	80	110	185
-5 to –10°C	DRY SALT	85	140	180	230
	WET SALT	70	110	145	185
-10 to –18°C	DRY SALT	85	180	230	230
	WET SALT	70	145	185	185
< -18°C*	ABRASIVE	350	350	350	-

* Refer to the General Information Section for additional information when the Pavement Temperature is below –18°C. When forecasted warming conditions are expected, dry/wet rates of 180/145, and 230/185 may provide some baring-off benefit.
* Note: Use wet rates where pre-wetting capable spreaders and liquid supply is available.

Timing of Application – BARE PAVEMENT ROADS



Start of the Storm
Salt shall be spread just at the beginning of the icy precipitation.

End of Storm
Salt shall not be spread once bare pavement is achieved and when no further precipitation is forecasted.

MATERIAL APPLICATION POLICY

BARE PAVEMENT (EPOKE SPREADERS)

Pavement Temperature °C	Material	Frost and Black Ice		Light Snow <1cm/hr		Heavy Snow >1cm/hr		Freezing Rain	
		g/m2	*Width*	*g/m2*	*Width*	*g/m2*	*Width*	*g/m2*	*Width*
0 to –5°C	DRY Salt (WET Salt)*	70kg/2ln-km		100kg/2ln-km		140kg/2ln-km		230kg/2ln-km	
		35 (30)	2m	50 (43)	2m	70 (60)	2m	115 (98)	2m
		23 (20)	3m	35 (30)	3m	45 (38)	3m	77 (65)	3m
		17 (14)	4m	23 (20)	4m	35 (30)	4m	58 (49)	4m
		17 (14)	5m	20 (17)	5m	28 (24)	5m	45 (38)	5m
-5 to –10°C	DRY Salt (WET Salt)*	85kg/2ln-km		140kg/2ln-km		180kg/2ln-km		230kg/2ln-km	
		45 (38)	2m	70 (60)	2m	90 (77)	2m	115 (98)	2m
		28 (24)	3m	45 (38)	3m	58 (49)	3m	77 (65)	3m
		20 (17)	4m	35 (30)	4m	45 (38)	4m	58 (49)	4m
		17 (14)	5m	28 (24)	5m	35 (30)	5m	45 (38)	5m
-10 to –18°C	DRY Salt (WET Salt)*	85kg/2ln-km		180kg/2ln-km		230kg/2ln-km		230kg/2ln-km	
		45 (38)	2m	90 (77)	2m	115 (98)	2m	115 (98)	2m
		28 (24)	3m	58 (49)	3m	77 (65)	3m	77 (65)	3m
		20 (17)	4m	45 (38)	4m	58 (49)	4m	58 (49)	4m
		17 (14)	5m	35 (30)	5m	45 (38)	5m	45 (38)	5m
< -18°C†	ABRASIVE	350kg/2ln-km		350kg/2ln-km		350kg/2ln-km		-	
		175	2m	175	2m	175	2m		
		115	3m	115	3m	115	3m	-	-
		88	4m	88	4m	88	4m		
		70	5m	70	5m	70	5m		

* When the pre-wetting system is engaged, the dry material output is reduced. The Epoke controller does not support setting a separate reduction percentage – the rate is only reduced by the set liquid application ratio (5%). Material 2 was therefore configured with rates reduced by 15%.

* Use wet rates where pre-wetting capable spreaders and liquid supply is available.

† Refer to the General Information Section for additional information when the Pavement Temperature is below –18°C. When forecasted warming conditions are expected, dry/wet rates of 180/145, and 230/185 may provide some baring-off benefit.

Notes

There are 2 variables affecting the material output on an Epoke salt spreader:

-Material Application Rate in **g/m^2** AND Application Width in **m**.

Examples:

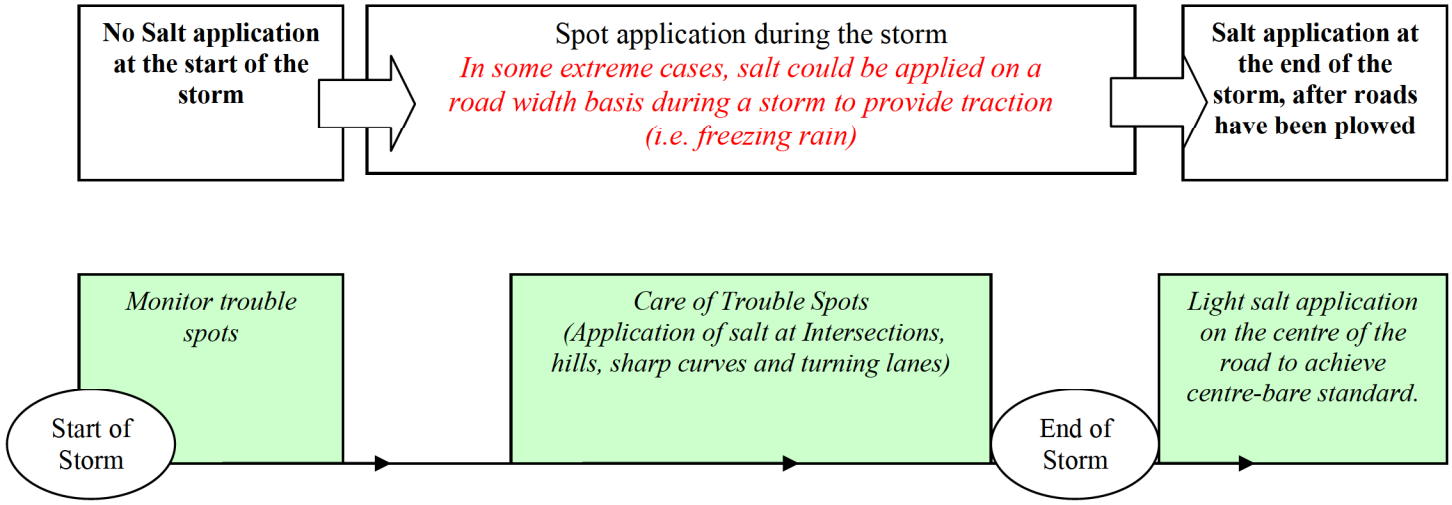
1- For a rate of 100kg/2ln-km, the Epoke Setup would be 25g/m^2 at a Width of 4m. **OR** a rate of 50g/m^2 at a Width of 2m.

2- For a rate of 170kg/2ln-km, the Epoke Setup would be 42g/m^2 at a Width of 4m. **OR** a rate of 57g/m^2 at a Width of 3m.

MATERIAL APPLICATION POLICY CENTRE-BARE PAVEMENT				
Pavement Temperature °C	**Material**	**Frost and Black Ice** ***Kg/2-lane km***	**Snow** ***Kg/2-lane km***	**Freezing Rain** ***Kg/2-lane km***
0 to –5°C	DRY SALT	70	100	230
	WET SALT	55	80	185
-5 to –18°C	DRY SALT	85	140	230
	WET SALT	70	110	185
< -18°C	ABRASIVE	350	350	-

Note: Use wet rates where pre-wetting capable spreaders and liquid supply is available.

Timing of Application – CENTRE-BARE PAVEMENT ROADS

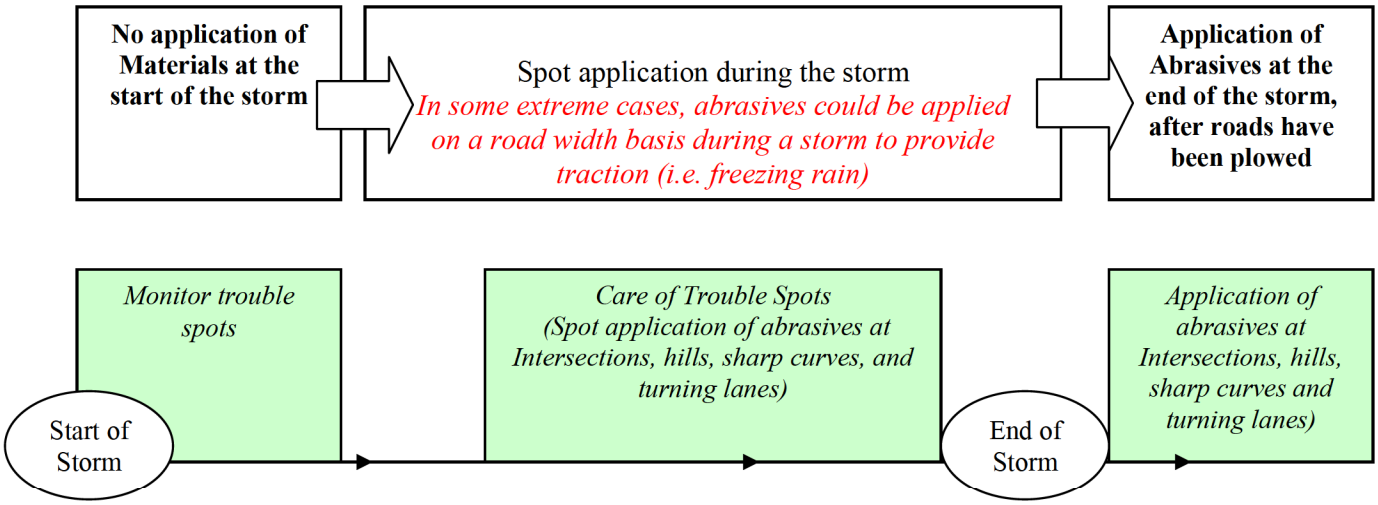


Start of the Storm
No Salt application at the start of the storm. Monitor trouble spots.

End of Storm
Salt shall not be spread once centre-bare pavement is achieved and when no further precipitation is forecasted.

MATERIAL APPLICATION POLICY (Intersections, Hills and Sharp Curves) SNOW PACKED				
Pavement Temperature °C	**Material**	**Frost and Black Ice** *Kg/2-lane km*	**Snow** *Kg/2-lane km*	**Freezing Rain** *Kg/2-lane km*
0 to –30°C and below	ABRASIVE	350	350	500

Timing of Application – SNOW PACKED ROADS



Start of the Storm
No application of abrasives at the start of the storm. Monitor trouble spots.

End of Storm
Abrasives shall not be spread once traction is provided.

BLASTING POLICY

The On-Board Electronic Controller's Blast function is an important tool for roadway de-icing operations. It allows operational staff to timely increase the amount of spread material at trouble locations such as steep hills and sharp curves. Although the blast function is indispensable, it should be used with care as it its liberal use can lead to significant increases in salt consumption and environmental impacts.

- Supervisory staff shall work toward minimizing the amount of salt being spread using the Blast function to achieve the required maintenance quality standard.
- Many variables come into play during a winter weather event. As such, the call to allow the use of the Blast Function during a winter event is left to the judgment of the supervisory staff, as the first priority is the safety of the traveling public.

The Blast function shall only be used at the following locations:

- Steep Hills
- Elevated Curves
- Intersections (within 30m of the stop line on the approach side only)
- Shade areas
- Right and Left Turning Lanes
- Bus Bays
- Railways (within 30m of the railway crossing on the approach side only)
- Bridge Decks

  Caution: when blasting salt on a bridge deck. Rock salt needs heat to dissolve. Spreading salt on a bridge deck could lower its surface temperature to a point where the brine solution will refreeze.

Application:

- The Blast function shall only be used under severe winter conditions
- The Blast function shall not be used during light winter weather events such as light snow, frost, etc.
- The blast function shall not be used while clearing the roads (stripping) at the end of a storm.

On-Board Electronic Controller's Blast function

- The Epoke controllers will blast at the highest material calibration setting.
- The CS-230 controller will blast to its maximum hydraulic power (which can be adjusted if too high)
- The CS-440 controller can be calibrated at a defined Blast rate for each material.
  - The Blast Rate for Salt is to be set at 300kg/2 lane-km
  - The Blast Rate for Abrasive is to be set at 500kg/2 lane-km. Note: Suburban/Rural District has a requirement to Blast Abrasives on gravel roads at a rate of 700kg/2 lane-km. To achieve this rate, the spreaders need to be calibrated using two gate settings. The District will provide, every fall, a list of spreaders requiring this specific calibration.