Preliminary Hydrogeological Investigation

Airport Road and Cranston Drive, Caledon East, ON

Client:
Triple Crown Line Residential Development c/o DG Group Inc.
Concord, ON L4K 4R1

Attn: Mr. Jordan Archer

Project Number:
BRM-00235186-E0

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1 Introduction

1.1 Project Description

Exp Services Inc. (**exp**) was retained by Triple Crown Development Inc. c/o DG Group Inc. to prepare a Preliminary Hydrogeological Investigation Report associated with the proposed development located at Airport Road and Cranston Drive, Caledon East, Ontario (hereinafter referred to as the 'Site').

The Site is located on the east side of Airport Road and straddles the intersection with Cranston Drive in Caledon East, Ontario. It is our understanding that the development plan consists of a residential development, including single family dwelling, one (1) storm water management pond, a neighborhood park, and several parkettes. The development will be provided with municipal roads and services, including sewers and watermains. The Site occupies an area of approximately 40 hectares (~100 acres). The Site location plan is shown on Figure 1.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation are to:

- Establish the local hydrogeological settings within the Site;
- Provide preliminary assessment of construction dewatering flow rates;
- Access groundwater quality; and
- Prepare a Preliminary Hydrogeological Investigation Report.

1.3 Scope of Work

To achieve the investigation objectives, **exp** completed the following scope of work:

- Review available geological and hydrogeological information for the Site;
- Instrument eight (8) geotechnical boreholes with 50 mm diameter monitoring wells to an approximate depth of six (6) meters in addition to the monitoring wells installed as part of the geotechnical investigation;
- Drill five (5) deep boreholes to an approximate depth of twelve (12) meters adjacent to the shallow wells. The five (5) noted wells will be instrumented with 50 mm diameter monitoring wells to form nested wells.
- Develop new and existing monitoring wells installed by **exp** during the Geotechnical Investigations, and conduct Single Well Response Tests (SWRT) on the noted wells to assess the hydraulic conductivity of the saturated water-bearing zones at the Site;
- Complete two (2) rounds of groundwater level measurements in all installed monitoring wells;
- Collect one (1) groundwater sample for the laboratory testing of the Region of Peel Sewer Use By-Law parameters, as well as one (1) groundwater sample of the general chemistry;

- Evaluate the information collected during the field investigation program, including borehole geological information, SWRT results, groundwater level measurements and groundwater water quality data;
- Prepare site plans, geological maps and cross-sections, as well as groundwater contour maps for the Site;
- Provide preliminary estimates for construction dewatering flow rates (Short-Term); and
- Prepare a Preliminary Hydrogeological Investigation Report.

1.4 Review of Previous Reports

The following reports were reviewed as part of this Hydrogeological Investigation:

- *Geotechnical Investigation, Proposed Residential Development,* Airport Road and Cranston Drive, Caledon East, Ontario*,* prepared for Triple Crown Line Development Inc., **EXP**, May 29, 2016.
- *Engineering Drawings, Residential Subdivision,* 15717 Airport Road*,* prepared for the Town of Caledon, Schaeffers $ Associated Ltd., May 2017.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is located within a physiographic region known as the Niagara Escarpment and a landform known as the Till Moraines. The Niagara Escarpment lies to the north of the South Slope and the Till Plains (Drummlinized) landform (Chapman & Putnam, 1984).

The Plain stretches between Georgian Bay in the north and Lake Ontario in the south. The Niagara Escarpment is primarily composed of variety of sediments ranging in size from boulderers to fine-grained deposits.

2.1.2 Regional Geology and Hydrogeology

The surficial (Quaternary) geology can be described as Till consisting of clay to silt derived from glaciolacustrine deposits or shale (Ministry of Northern Development and Mines, 2012). The surficial geology of the Site and surrounding areas is shown on Figure 2.

Bedrock of the region corresponds with the Upper Ordovician age Queenston Formation, primarily composed of shale, siltstone, minor limestone, and sandstone. (Ministry of Northern Development and Mines, 2012).

Regional groundwater flow across the area is expected to be directed south-easterly. Local deviation from the regional groundwater flow path may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure.

2.1.3 Existing Water Well Survey

Well Records from the MOECC Water Well Record (WWR) Database were reviewed to determine the number of water wells present within a 500 m radius of the Site boundaries.

The MOECC WWR database indicated one hundred and fifty (50) records within a 500 m radius of the Site.

The database indicated that four (4) records are located within the Site perimeter. Three (3) out of the four (4) are indicated as water supply wells and one (1) is shown as abandoned well located in the southwest of the Site. The rest of the wells are indicated as water supply wells, dewatering wells, and observations wells, as well as monitoring wells and test holes or abandoned wells. All the recorded wells are approximately located at three-hundred fourteen (314) m or greater from the Site centroid.

It should be noted that twenty-four (24) of the total records are indicated as water supply wells and two (2) as dewatering wells. Five (5) out of total water supply wells are defined as livestock and three (3) as municipal wells. The dewatering wells are all defined as unused.

The reported water levels ranged from depths of 0.8 mbgs to 96 mbgs. The properties in the vicinity of the Site are apparently serviced by the municipal water supply.

The locations of the MOECC WWR within 500 m of the Site are shown on Figure 3. A summary of the WWR is included in Appendix A.

2.2 Site Setting

2.2.1 Site Topography

The Site is located within a nonurbanized land use setting.

The topography is considered relatively flat, with an overall gradual east slope towards Innis Lake.

2.2.2 Local Surface Water Features

There are a few natural ponds located east of the Site. The closest and distinctive surface water feature is Innis Lake which is approximately located 240 meters east of the Site. The largest surface water feature near to the Site is Lake Ontario, which is located approximately 40 km south of the Site.

2.2.3 Local Geology and Hydrogeology

Based on the results of the Geotechnical Investigations, a brief description of the general surficial geology at the Site, in order of depth, is summarized in the following sections. The borehole/monitoring well location plan is shown on Figure 4 and the borehole logs are presented in Appendix B. The inferred geological cross-sections are presented in Figures 5A and 5B.

Top Soil/ Ploughed Soil

A surficial layer of topsoil 75 to 450 mm thick was encountered in all Boreholes. However, given use of the property for agricultural purposes disturbed (ploughed) soil should be expected to typical ploughing depths of up to 600 to 800 mm.

It should be noted that topsoil and disturbed (ploughed) soil measurements were carried out at the borehole locations only and could differ at other locations on the site. Consequently, topsoil and disturbed (ploughed) soil quantities should not be established from the information provided at the borehole locations. If required, a more detailed test pit program should be carried out to more accurately quantify the amount of topsoil and disturbed (ploughed) soil to be removed for construction purposes.

Fill

Fill underlies the topsoil in Boreholes 1, 7, 9 to 11, 15 to 17, 23 to 27, 31 to 33, 36, 38, 43 to 46, 49 to 52, 56 to 58, 60, 61 and 65. Fill was not encountered in Boreholes 66 and 67 drilled at the toes of the slopes off the south-central and northeastern portions of the property. The fill extends to depths of approximately 1.0 to 4.1 m (~Elevation 292.5 to 310.2 m). Typically the thickness of fill ranged from approximately 1.0 to 2.2 m except in Boreholes 10, 27, 43 and 58 where the fill extends to approximately 4.1 m depth. The fill typically comprises various combinations of brown sand, sandy silt and clayey silt with trace gravel. Locally, topsoil stained pockets, rock fragments and rootlets were observed in the fill. Moisture contents in the fill ranged from approximately 10 to 27 %.

Native Soils

The native soils were intersected below the topsoil or fill at all borehole locations. The native soils comprise sand, silty sand, clayey silt, clayey silt till, sandy silt till, sand and gravel and peat and exist in various

thicknesses, sequences, degrees of compactness and consistencies depending on location. Moisture contents in the native soils were recorded as follows:

- Sand/Silty Sand - approximately 3 to 23 %
- Clayey Silt – approximately 13 to 24 %
- Clayey Silt Till – approximately 11 to 26 %
- Sandy Silt Till – approximately 6 to 26 %
- Sand and Gravel – approximately 10 to 12 %
- Peat – approximately 270 and 450 %

Peat

Peat was encountered locally in Boreholes 16 and 24 in the southeastern portion of the site.

Wet Sand

Wet sand was interpreted to be present in boreholes in the northern and southern portions of the site.

3 Background

3.1 Monitoring Well Details

The monitoring well network installed on Site as part of the Geotechnical Investigation (**exp**, 2017) consists of the following:

- A total of nineteen (19) boreholes are instrumented with 50 mm diameter monitoring wells where five (5) of them are in a nested configuration. In overall, twenty-four (24) monitoring wells are installed at the Site, including fifteen (15) shallow, two (2) intermediate, and seven (7) deep.

- Fourteen (14) out of nineteen (19) boreholes are instrumented with individual monitoring wells, including ten (10) shallow, two (2) intermediate, and two (2) deep wells. The shallow monitoring wells include BH20, BH23, BH25, BH36, BH39, BH41, BH56, BH61, BH66, and BH67. The intermediate wells include BH2 and BH6. The deep wells include BH7 and BH 59. The maximum depths of completion for the shallow, intermediate, and deep wells are approximately 6, 8, and 18 mbgs, respectively.

Five (5) out of nineteen (19) boreholes are instrumented with nested monitoring wells where one shallow (S) and one deep (D) are installed at each of the noted locations. The nested monitoring wells include BH8 (S and D), BH18 (S and D), BH47 (S and D), BH51 (S and D), and BH64 (S and D). The depths of completion for the shallow and deep wells are approximately 6 and 12 mbgs, respectively. The monitoring well locations are shown on Figure 4 and borehole completion logs are presented in Appendix B.

3.2 Water Level Monitoring

Static groundwater level measurements were recorded for the monitoring wells as part of the Hydrogeological Investigations on May 24, and May 26, 2017. A summary of all static water level data as it relates to the geodetic survey is summarized in Table 1 (enclosed).

Based on the recorded data, the stabilized shallow groundwater elevations ranged from 283.42 masl (0.74 meter above ground surface) at BH66 to 304.17 masl (5.86 mbgs) at BH51-S on May 24 and 26 ,2017, respectively. Seven (7) out of ten (10) shallow wells installed in a nested configuration are indicated as dry wells in both monitoring events. These include BH-8S, BH23, BH56, BH61, BH64-S, and BH67.

In contrast, the stabilized deep groundwater elevations ranged from 284.78 masl (10.43 mbgs) at BH8-D to 300.04 masl (12.24 mbgs) at BH-64-D on May 26 and 24, respectively.

Based on the groundwater elevations measured in the nested wells, the groundwater flow is suggested to have a downward gradient from shallow to deep water-bearing zones.

The interpreted shallow and deep groundwater flow maps are presented in Figure 6 and Figure 7, respectively. Based on the obtained water level measurements on May 26, 2017, the inferred directions of groundwater flows in both shallow and deep water-bearing zones are interpreted to be approximately east towards Innis Lake

3.3 Hydraulic Conductivity Testing

Eleven (11) Single Well Response Tests (SWRT's) were completed on monitoring wells, including BH2, BH6, BH7, BH8-D, BH18-D, BH20, BH25, BH47-S, BH47-D, BH64-D, BH66 on May 26 and 29 of 2017.

The static water level within the monitoring well was measured prior to the start of testing. In advance of performing SWRT, the monitoring well underwent development to remove fine grained sediments introduced into the screen following the well construction. The development process involved purging of the monitoring well to induce the flow of fresh formation water through the screen. The monitoring well was later permitted to fully recover prior to performing SWRT.

Hydraulic conductivity value was calculated from the SWRT data as per the Hvorslev solution included in the AQTESOLV Pro Version 4.50.002 software package. The semi-log plot for drawdown versus time is included in Appendix C.

A summary of the hydraulic conductivity (K) value estimated from the SWRT is provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well ID	Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened	Estimated Hydraulic Conductivity (m/s)
BH2	8.96	5.96 - 8.96	Silty Sand	7.5×10^{-5}
BH6	7.60	4.6 – 7.6	Silty Sand	1×10^{-6}
BH7	15.26	12.26 - 15.26	Silty Sand	4.5×10^{-7}
BH8-D	12.12	9.12 - 12.12	Silty Sand	3.1×10^{-6}
BH18-D	12.23	9.23 -12.23	Silty Sand	8.7×10^{-6}
BH20	6.00	3 - 6	Sandy Silt Till/ Silty Sand	2.3×10^{-7}
BH25	5.01	2.01 – 5.01	Sandy Silt Till/ Silty Sand	3.7×10^{-7}
BH47-S	6.27	3.27 – 6.27	Clayey Silt Till / Sand and Gravel	2.2×10^{-7}
BH47-D	11.63	8.63 – 11.63	Sandy Silt Till/ Silty Sand	3.3×10^{-7}
BH64-D	12.37	9.37 – 12.37	Sandy Silt Till	1×10^{-7}
BH-66	6.10	3.1 – 6.1	Clayey Silt	1.1×10^{-7}
Highest estimated K-value				7.5×10^{-5}
Geometric mean of the estimated K-values				7.8×10^{-7}

SWRT provides estimates of K for the geological formation in the immediate zone surrounding the well screen. As shown in Table 3-2, the highest K-value is estimated to be 7.5×10^{-5} m/s and the geometric mean of the K-values is estimated to be 7.8×10^{-7} m/s.

3.4 Groundwater Quality

To assess the suitability for discharge of pumped groundwater to the Regional Municipality of Peel Sanitary and Storm Sewers during dewatering activities, one (1) groundwater sample was collected from monitoring well BH41 on May 26, 2017, using a bailer. Prior to collecting the water sample, approximately three (3) standing well volumes of groundwater were purged from the noted well.

The sample was collected unfiltered and placed into pre-cleaned laboratory-supplied vials and/or bottles provided with analytical test group specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted to an independent laboratory named Maxxam Analytics Inc., in Mississauga, Ontario, for analysis.

For assessment purposes, the analytical results were compared to the Limits for Sanitary and Combined Sewers Discharge, as well as Limits for Storm Sewer Discharge of the Regional Municipality of Peel Codes.

A summary of the analytical results and the laboratory Certificate of Analysis (CofA) are enclosed in Appendix D. The laboratory CofA shows that all parameters were detected at concentrations below the Sanitary and Combined Sewer By-Law limits (Table 1).

The laboratory analytical results also show that the concentrations of Total Suspended Solids (TSS), Total Manganese (Mn), and Total Zinc (Zn) exceed the Storm Sewer Discharge criteria. Analytical results for the filtered water sample collected from the noted monitoring well also show that the concentration of Dissolved Manganese (Mn) exceeds the Storm Sewer Discharge criteria. A summary of the pertinent results is provided in Table 3-3. It should be noted that elevated concentration of TSS are reflective of suspended sediments in the water well and not to actual groundwater.

Table 3-3 below provides a summary of exceedances of the sewer use By-Law.

Table 3-3: Summary of Analytical Results

Parameter	The Peel Region Sanitary and Combined Sewer Discharge Limit	The Peel Region Storm Sewer Discharge Limit	Concentration
Total Suspended Solids (TSS) (mg/L)	350	15	**110**
Total Manganese (Mn) (µg/L)	5000	50	**1600**
Dissolved Manganese (Mn) (µg/L)			**61**
Total Zinc (Zn) (µg/L)	3000	40	**98**

Notes:
Bold indicates concentration exceeds the Storm Sewer limits.

It should also be noted that, during construction, it is anticipated that TSS levels and associated contaminants (for example Metals), in the pumped groundwater may remain above the by-Law limits. Therefore, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering activities.

Approval to discharge water to municipal sewer system during construction will be required from the Regional Municipality of Peel prior to any discharge.

If treatment systems are considered, the specifications of the treatment system(s) will need to be provided/adjusted by the treatment specialist/process engineer during the pre-design and commissioning stage of the system.

4 Construction Dewatering Assessment

4.1 Construction Dewatering Rate Assumptions

It is our understanding that the development plan consists of a residential development, including single family dwelling, one (1) storm water management pond, a neighborhood park, and several parkettes. The development will be provided with municipal roads and services, including sewers and watermains.

The Geotechnical Investigation indicates that the sewer and watermain invert levels have not yet been determined at the time of the investigation, but they are expected to extend to the typical depths of approximately 6 m below existing grades on the southern portion of the site and up to approximately 10 m below existing grades on the north portion of the site. Based on the results of the noted investigation, excavation will generally be carried out within the fill material and into the native deposits of sandy silt till, clayey silt till and silty sand.

A proposed stormwater management pond is being considered for the southeastern corner of the site. Based on a supplied engineering drawing, the base elevation of the pond is anticipated to be set at an approximate elevation of 295.5 masl.

Exp should be retained to review the assumptions outlined in this section should the proposed shoring design change.

Table 4-1 presents the assumptions used to calculate the dewatering rate. Calculations for the construction dewatering assessment are included in Appendix E.

Table 4-1: Dewatering Estimate Assumptions for the Construction of the Sewer Services

Input Parameter		Assumption	Notes
Surface elevation	Southern Portion of the Proposed Residential Development	305 masl	Approximate average of the surface elevations
	Northern Portion of the Proposed Residential Development	310 masl	
	Stormwater Management Pond	304 masl	
Lowest excavation elevation	Southern Portion of the Proposed Residential Development	298 masl	Based on the Geotechnical Investigation report, the maximum depth of excavation for the southern and northern portions of the development are 6 and 10 mbgs, respectively.
	Northern Portion of the Proposed Residential Development	300 masl	
	Stormwater Management Pond	295 masl	Based on the engineering drawing
Static groundwater elevation	Proposed Residential Development	304.2 masl	Highest obtained groundwater elevations.
	Stormwater Management Pond	293.2 masl	Based on the water level measurement at BH2 on May 2017
Dewatered elevation target	Southern Portion of the Proposed Residential Development	297 masl	Assumed to be approx. 1.0 m below the lowest excavation elevation
	Northern Portion of the Proposed Residential Development	299 masl	
Excavation Area	Proposed Residential Development	60 m x 5 m	Based on the Geotechnical Investigation report.
	Stormwater Management Pond	100 m x 50 m	Based on the engineering drawings.
Estimated K value for the tested water-bearing zone		7.5×10^{-5} m/s	Highest K value estimated for the silty sand unit

It should be noted that groundwater elevation (293.2 masl) in the area of the proposed stormwater management pond is approximately two (2) meters below the proposed depth of excavation (295.5 masl). Therefore, based on the groundwater level information collected no groundwater dewatering is expected at this location and only stormwater management will be required for the SWM pond. However, some minor seepage from perched water and precipitation should be expected.

4.2 Radius of Influence During Construction

The radius of influence (ROI) for the construction dewatering was calculated based on the empirical Sichardt equation. The equation is used to predict the distance at which the drawdown resulting from pumping is negligible. This empirical equation was developed to provide representative flow rates using the steady state flow dewatering scenarios, as discussed below.

It is noted that in steady state conditions, the radius of influence of pumping extends until boundary flow conditions are reached and provide sufficient water inputs to the aquifer, such as recharge from surface water bodies. It is noted that the Sichardt's model is unable to precisely estimate the actual radius of influence by pumping. On the other hand, the noted empirical equation was primarily developed for the coarse grained (sand and gravel) aquifers, and as such, it can only generate more conservative values for other types of aquifers.

The Ro of pumping based on the Sichardt formula is described as follows:

$$\mathrm{R_o} = 3000\times(H-h)\times\sqrt{K}$$

Where:
H = Water level above the base of the aquifer prior to dewatering
h = water level at the equivalent radius of the excavation
K = Hydraulic Conductivity in m/sec

Based on the Sichardt empirical model and the highest K value, the estimated radius of influence (Ro) for the radial flow and the distance to line source (Lo = Ro/2) for the linear flow are presented in Table 4-2. The estimated values are presented in Appendix E.

Table 4-2 Estimated Radius of Influence and Distance to Line Source

Location		Ro (m)	Lo (m)
Excavation	Southern Portion of the Proposed Residential Development	186	93
	Northern Portion of the Proposed Residential	134	67

4.2.1 Dewatering Flow Rate Estimate

Flow from aquifer

The Dupuit equation for steady state conditions for linear flow to one side of an excavation in an unconfined aquifer resting on a horizontal impervious surface was used to obtain a flow rate estimate while dewatering is expressed as follows:

$$Q_w = xK(H^2 - h^2)/Lo$$

Where:
Qw = Rate of pumping (m^3/sec)
X = Length of excavation in m
K = Hydraulic conductivity (m/sec)
H = Head beyond the influence of pumping (static groundwater elevation) (m)
h = Head above base of aquifer at the excavation (m)
Lo = Distance of Influence (m)

It is expected that the initial dewatering rate will be higher in order to remove groundwater from aquifer.

The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, locally from storage resulting in lower seepage rates into the excavation.

Rainfall

The dewatering rates at the Site should also include removing direct input of rain water into the excavation.

A 10 mm rain event was utilized for the estimate. Given that the total areas of the excavations is, the estimated maximum volume of direct rainwater to be collected in the excavation for the services and stormwater management pond is approximately 3 and 50 m^3/event, respectively. In the event of significant precipitation events, the excavation may need to be dewatered over the course of a day or more before safe work conditions can resumed.

4.3 Results of Construction Dewatering Rate Estimate

Based on the assumptions provided in this report, the results of the dewatering rate estimate can be summarized as follows:

Table 5 Summary of Dewatering Flow Rate Estimate

Location		Dewatering Flow Rate (m^3/day)	Notes
Excavation	Southern Portion of the Proposed Residential Development	465	The estimated dewatering flow is based on a single hydraulic conductivity measurement.

Location		Dewatering Flow Rate (m^3/day)	Notes
	Northern Portion of the Proposed Residential Development	340	

The maximum flow estimate is based on a single measurement for hydraulic conductivity, and as such it provides only a preliminary estimate of expected flow rates during the construction dewatering. These peak dewatering flow rates include a factor of safety of two (2) to account for some accumulation of precipitation, seasonal fluctuations in the groundwater table, some flow from beddings of existing sewers, and variation in hydrogeological properties beyond those encountered during the course of this study. This peak dewatering flow rate also provides additional capacity for the dewatering contractor.

It is imperative to note that the contractors are solely responsible to ensure dry conditions are maintained within the excavation zone during the construction process at all costs. Safety measures must be taken into account when planning for pit construction, especially during the wet seasons. In the events of heavy rainfalls or snow melting seasons, it is advised to implement an appropriate drainage system to divert the storm water runoffs and maintain the excavation zone free of water at all time.

4.4 MOECC Water Taking Permit

In accordance with the Ontario Water Resources Act, if the water taking will be more than 50 m^3/day but less than 400 m^3/day, the construction water taking can be registered under the Environmental Activity and Sector Registry (EASR) registration process.

The expected dewatering rates for the proposed constructions is estimated to be approximately 465 m^3/day. As such, a Permit to Take Water (PTTW) is required to facilitate the construction dewatering program for the Site. A maximum peak flow rate of 500 m^3/day will be submitted for the permit to allow for the dewatering contractor sufficient capacity to lower the groundwater table during the construction activities.

5 Conclusions and Recommendations

Based on the findings of the Hydrogeological Investigation, the following summary of conclusions and recommendations are provided:

- The laboratory CofA shows that all parameters were detected at concentrations below the Sanitary and Combined Sewer By-Law limits (Table 1). However, the laboratory analytical results show that the concentrations of Total Suspended Solids (TSS), Total Manganese (Mn), and Total Zinc (Zn) exceed the Storm Sewer Discharge criteria. Analytical results for the filtered water sample collected from the noted monitoring well show that the concentration of Dissolved Manganese (Mn) exceeds the Storm Sewer Discharge criteria.
- Based on the assumptions outlined in this report, the estimated high dewatering flow rate for the proposed excavations in the southern and northern portions of the proposed residential development, are estimated to be 465 and 335 m^3/day, respectively, using a factor of safety of two (2) to account for accumulation of some precipitation, seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, and variation in hydrogeological properties beyond those encountered during the course of this study.
- To allow for the dewatering contractor sufficient capacity to manage water inside the excavation during construction, it is recommended that a PTTW be submitted for water taking of approximately 500 m^3/day.
- The construction dewatering volumes estimated should be considered as potential peak volumes and may decline or vary subject to reaching steady state conditions, accumulation of precipitation, seasonal fluctuations in the groundwater table, flow from beddings of existing sewers, variation in hydrogeological properties beyond those encountered during the course of this study, and construction sequence.
- It should be noted that, during construction and in post construction, it is anticipated that TSS levels and associated contaminants (for example, Total Metals) in the pumped groundwater may remain elevated and may continue to exceed the By-Law limits. Therefore, it is recommended that a suitable treatment method be implemented during construction dewatering activities.
- If treatment systems are considered for construction and/or for permanent discharge of the sub-drain system, the specifications of the treatment system(s) will need to be provided/adjusted by the treatment specialist/process engineer during the pre-design and commissioning stage of the system.
- It is noted that an agreement to discharge to the Region of Peel will be required prior to discharging dewatering effluent.
- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

It should be noted that the comments and recommendations in this report are based on the assumption that the present design concept described throughout the report will proceed to construction and that the report should be reviewed in its entirety. Any changes to the design concept may result in a modification to the recommendations provided in this report.

6 Limitations

This report is based on a limited investigation designed to provide information to support an assessment of the current hydrogeological conditions within the study area. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the assessment. **exp** must be contacted immediately if any unforeseen Site conditions are experienced during the dewatering activities. This will allow **exp** to review the new findings and provide appropriate recommendations to allow the construction to proceed in a timely and cost effective manner.

Our undertaking at **exp**, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the geoscience/engineering profession. No other warranty or representation, either expressed or implied, is included or intended in this report.

This report was prepared for the exclusive use of Triple Crown Development Inc. c/o DG Group Inc. This report may not be reproduced in whole or in part, without the prior written consent of **exp**, or used or relied upon in whole or in part by other parties for any purposes whatsoever. Any use which a third party makes of this report, or any part thereof, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. **exp** Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We trust that this information is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Sincerely,

exp Services Inc.

Peyman Sayyah, M.Sc., P.Geo.
Senior Hydrogeologist
Environmental Services

Ryan Smith, M.Sc., P.Geo.
Senior Hydrogeologist
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Francois Chartier, M.Sc., P.Geo.
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7 References

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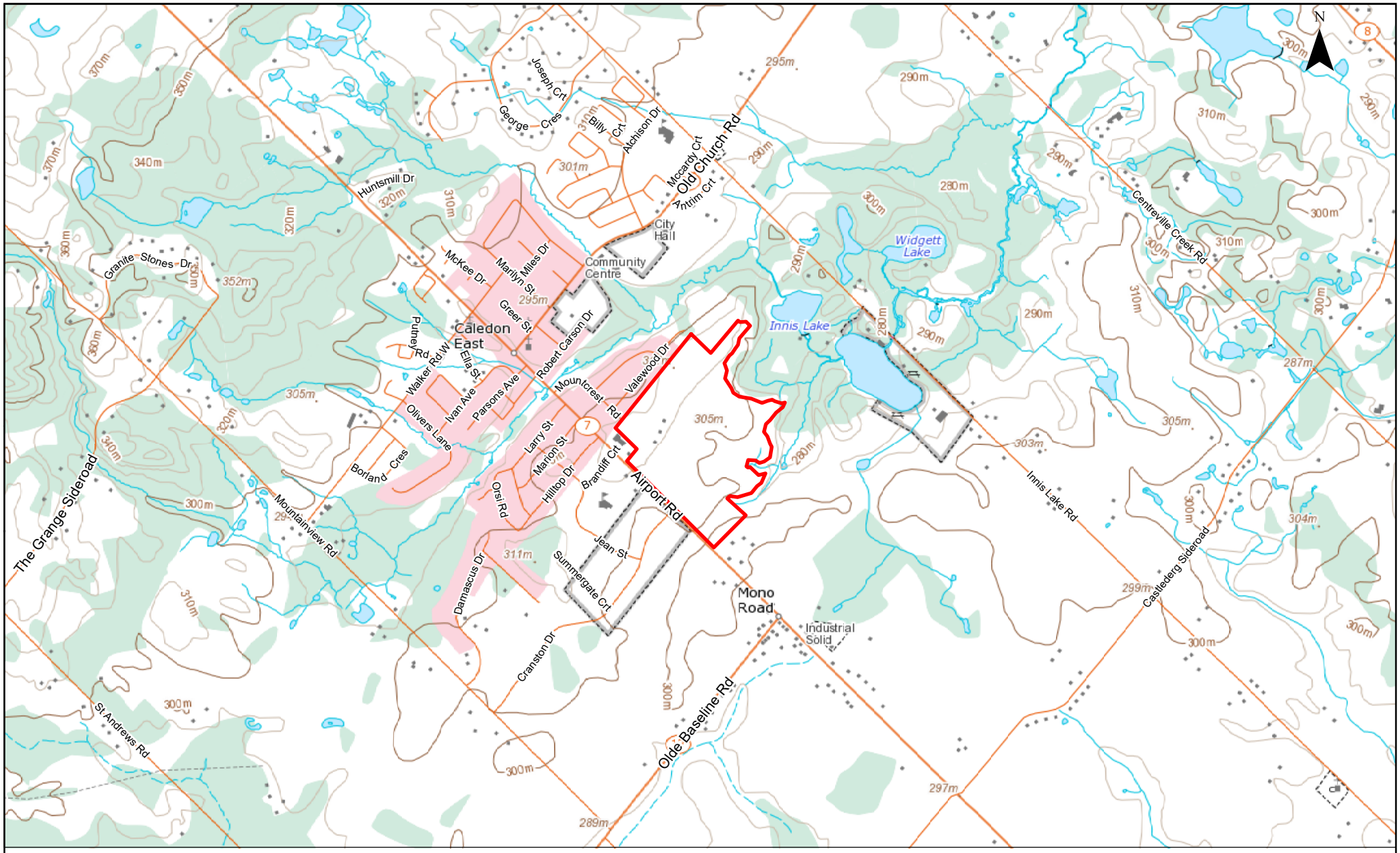
Geotechnical Investigation, Proposed Residential Development, Airport Road and Cranston Drive, Caledon East, Ontario*,* prepared for Triple Crown Line Development Inc., **EXP**, May 29, 2016.

Engineering Drawings, Residential Subdivision, 15717 Airport Road*,* prepared for the Town of Caledon, Schaeffers $ Associated Ltd., May 2017.

Figures



Legend

Approximate Site Boundary

0 150 300 600 900 1,200 1,500 m

exp Services Inc.
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Phone: +1.905.793.9800
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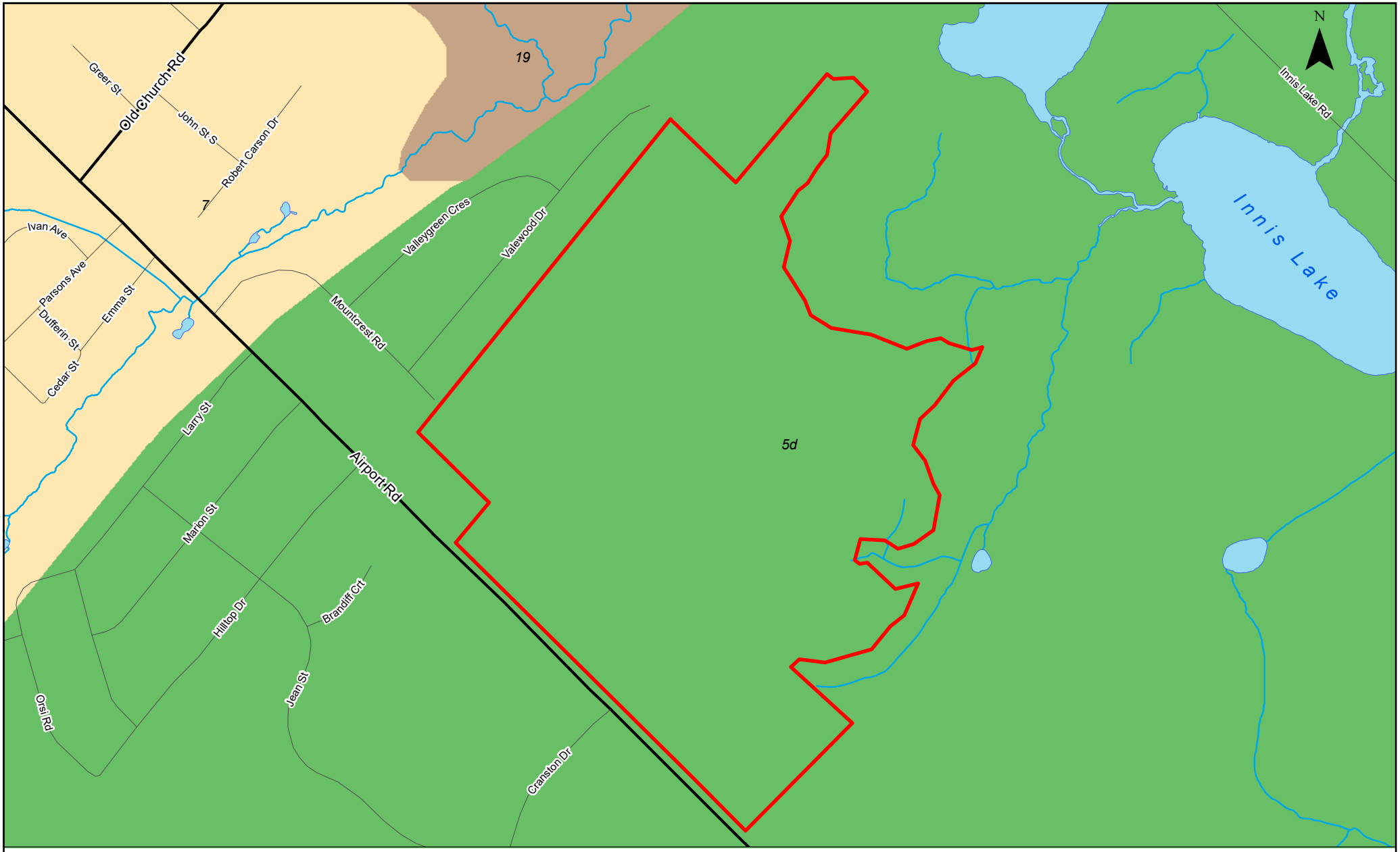
PROJECT TITLE:

HYDROGEOLOGICAL INVESTIGATION
AIRPORT ROAD AND CRANSTON DRIVE
CALEDON EAST, ONTARIO

DRAWING TITLE:

SITE LOCATION PLAN

PROJECT No.: BRM-00235186-E0	DWN: AC
SCALE: AS NOTED	CHKD: PS
DATE: JUNE 2017	DWG. No.: 1



Legend

- Approximate Site Boundary
- 7: Glaciofluvial deposits
- 19: Modern alluvial deposits
- 5d: Glaciolacustrine-derived silty to clayey till

0 50 100 200 300 400 500 m

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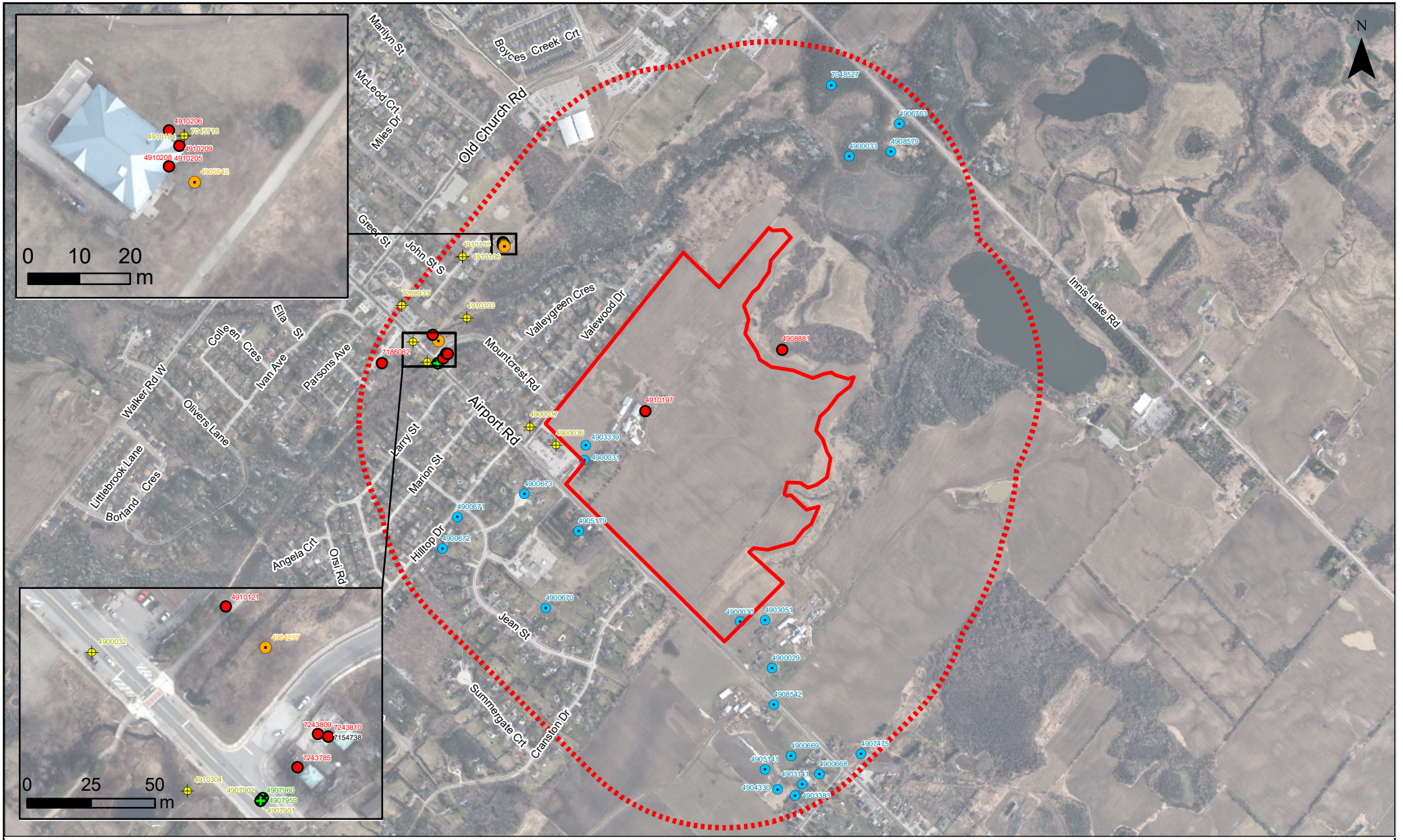
PROJECT TITLE:
HYDROGEOLOGICAL INVESTIGATION
AIRPORT ROAD AND CRANSTON DRIVE
CALEDON EAST, ONTARIO

DRAWING TITLE:
SURFICIAL GEOLOGY

PROJECT No.: BRM-00235186-E0	DWN: AC
SCALE: AS NOTED	CHKD: PS
DATE: JUNE 2017	DWG. No.: 2



Legend

- Approximate Site Boundary
- 500 m Zone
- Abandoned Well
- Monitoring Well / Test Hole
- Dewatering Well
- Water Supply Well
- Public / Municipal Water Supply Well
- Unknown / Unfinished Well

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AIRPORT ROAD AND CRANSTON DRIVE
CALEDON EAST, ONTARIO

DRAWING TITLE:
MOECC WATER
WELL RECORDS MAP

PROJECT No.: BRM-00235186-E0	DWN: AC
SCALE: AS NOTED	CHKD: PS
DATE: JUNE 2017	DWG. No.: 3

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (exp, 2017)
- MONITORING WELL LOCATION (exp, 2017)
- NESTED MONITORING WELL LOCATION (exp, 2017)
- A-A' CROSS SECTION A-A' (SEE FIGURE 5A)
- B-B' CROSS SECTION B-B' (SEE FIGURE 5B)

TITLE AND LOCATION:

BOREHOLE / MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
RESIDENTIAL SUBDIVISION
15717 AIRPORT ROAD,
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-00235186-E0	AS
SCALE: AS NOTED	CK: PS
DATE: JUNE 2017	FIG. NO.: 4

X:\DRAWINGS\235000\235100\235186\235186AIHG INVESTIGATIONMAY 25 2017\BRM-00235186-E0.dwg

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LEGEND:

- FILL
- SILTY SAND
- SANDY SILTY TILL
- CLAYEY SILT TILL
- GROUNDWATER LEVEL AS MEASURED ON MAY 26, 2017

TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
RESIDENTIAL SUBDIVISION
15717 AIRPORT ROAD,
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-00235186-E0	AS
SCALE: AS NOTED	CK: PS
DATE: JUNE 2017	FIG. NO.: 5A

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LEGEND:

- FILL
- SILTY SAND
- SANDY SILTY TILL
- CLAYEY SILT TILL
- CLAYEY SILT
- GROUNDWATER LEVEL AS MEASURED ON MAY 26, 2017

TITLE AND LOCATION:

CROSS SECTION B-B'

HYDROGEOLOGICAL INVESTIGATION
RESIDENTIAL SUBDIVISION
15717 AIRPORT ROAD,
CALEDON, ONTARIO

PROJECT NO.: BRM-00235186-E0	DWN.: AS
SCALE: AS NOTED	CK: PS
DATE: JUNE 2017	FIG. NO.: 5B

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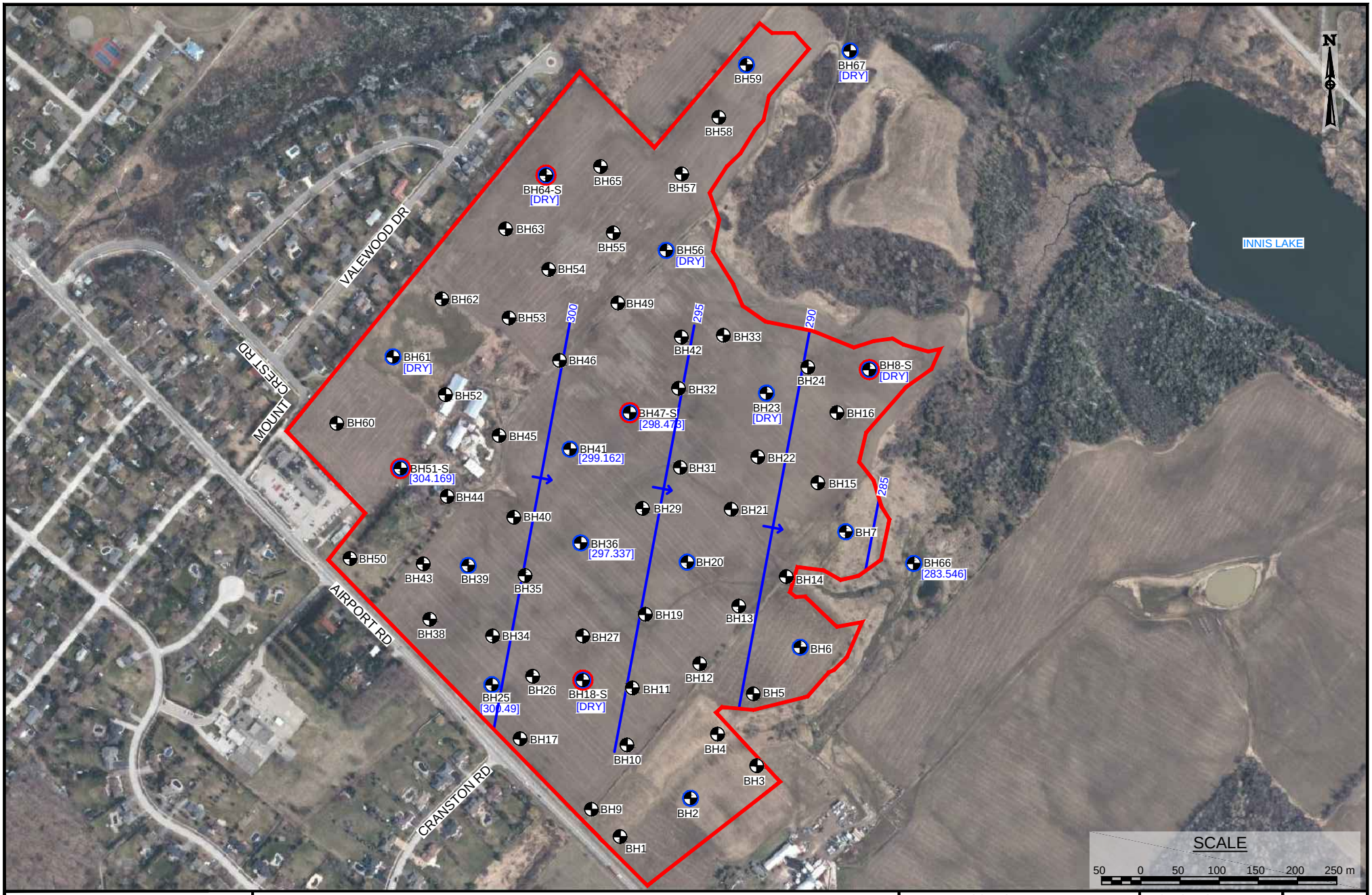

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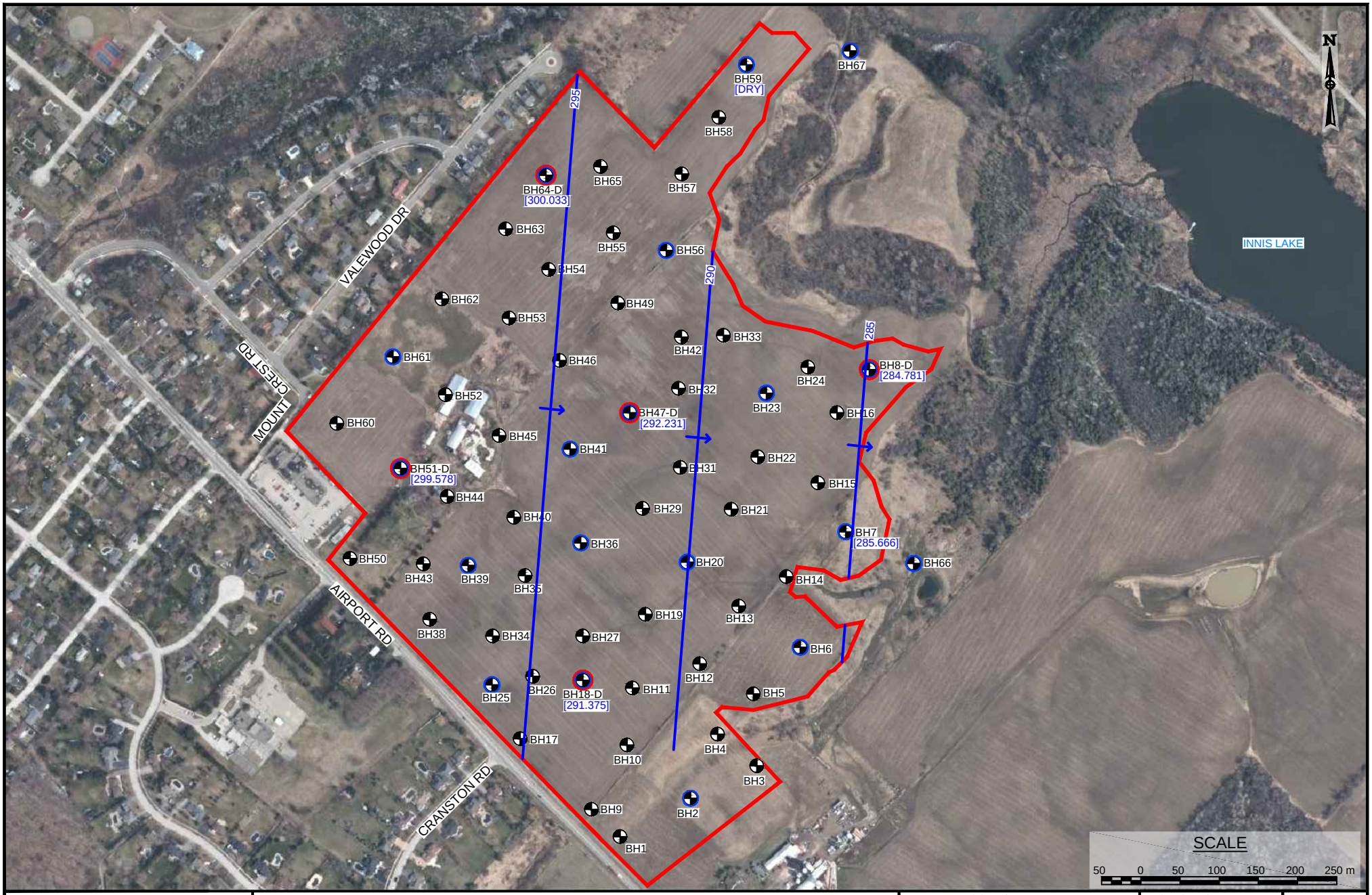
LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (exp, 2017)
- MONITORING WELL LOCATION (exp, 2017)
- NESTED MONITORING WELL LOCATION (exp, 2017)
- SHALLOW GROUNDWATER CONTOURS
- [XX.XX] GROUNDWATER ELEVATION AS MEASURED ON MAY 26, 2016
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:
SHALLOW GROUNDWATER CONTOUR MAP
HYDROGEOLOGICAL INVESTIGATION
RESIDENTIAL SUBDIVISION
15717 AIRPORT ROAD,
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-00235186-E0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
JUNE 2017	6

X:\DRAWINGS\235000\235100\235186\235186A\HG INVESTIGATION\MAY 25 2017\BRM-00235186-E0.dwg



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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (exp, 2017)
- MONITORING WELL LOCATION (exp, 2017)
- NESTED MONITORING WELL LOCATION (exp, 2017)
- DEEP GROUNDWATER CONTOURS
- [XX.XX] GROUNDWATER ELEVATION AS MEASURED ON MAY 26, 2016
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:
DEEP GROUNDWATER CONTOUR MAP
HYDROGEOLOGICAL INVESTIGATION
RESIDENTIAL SUBDIVISION
15717 AIRPORT ROAD,
CALEDON, ONTARIO

PROJECT NO.:	DWN.:
BRM-00235186-E0	AS
SCALE: AS NOTED	CK: PS
DATE: JUNE 2017	FIG. NO.: 7

X:\DRAWINGS\235000\235100\235186\235186A\HG INVESTIGATION\MAY 25 2017\BRM-00235186-E0.dwg

Appendix A:
MOECC WWR Summary Table

On-Site										
WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
4900030	592048	4857169	10314878	11/6/1964				12.5	Livestock	Water Supply
4900031	591630	4857603	10314879	5/2/1961				18.9	Livestock	Water Supply
4903339	591635	4857643	10318176	11/1/1969				54.3	Livestock	Water Supply
4910197	591794	4857734	11555431	5/8/2006	15717 AIRPORT RD	CALDEDON EAST				Abandoned-Other

Off-Site										
WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
4900029	592134	4857045	10314877	10/29/1960			670	11.6	Livestock	Water Supply
4900032	591172	4857921	10314880	1/25/1959			797	14.0	Not Used	Test Hole
4900033	592340	4858419	10314881	8/1/1967			841	5.8	Domestic	Water Supply
4900036	591555	4857643	10314884	4/18/1960			380	1.2	Not Used	Test Hole
4900037	591485	4857693	10314885	4/5/1960			448	4.3	Not Used	Test Hole
4900668	592261	4856760	10315516	11/1/1959			981	14.0	Domestic	Water Supply
4900669	592185	4856809	10315517	12/8/1962			911	10.4	Domestic	Water Supply
4900670	591527	4857206	10315518	11/9/1955			627	14.9	Domestic	Water Supply
4900671	591290	4857451	10315519	12/11/1956			683	16.5	Domestic	Water Supply
4900672	591250	4857365	10315520	11/26/1957			753	11.3	Domestic	Water Supply
4900673	591470	4857512	10315521	10/6/1959			493	16.5	Domestic	Water Supply
4903051	592115	4857173	10317892	10/17/1968			543	17.4	Livestock	Water Supply
4903141	592215	4856733	10317981	6/28/1968			992	6.1	Domestic	Water Supply
4903383	592195	4856703	10318219	11/5/1969			1016	11.9	Domestic	Water Supply
4904257	591240	4857923	10319045	8/16/1972			733	13.4	Municipal	Water Supply
4904330	592149	4856719	10319118	11/3/1973			989	16.8	Domestic	Water Supply
4905141	592115	4856773	10319897	6/14/1977			929	11.0	Domestic	Water Supply
4905179	591615	4857413	10319934	6/29/1977			417	14.9	Domestic	Water Supply
4906763	592475	4858507	10321324	31946			986	24.4	Domestic	Water Supply
4907475	592372	4856814	10322034	11/17/1990			975	96.0	Domestic	Water Supply
4907901	591238	4857863	10322460	8/19/1994			717	12.8	Not Used	Observation Wells
4907902	591238	4857863	10322461	8/19/1994			717	12.2	Not Used	Observation Wells
4907959	591239	4857864	10322518	9/26/1994			716	12.5	Not Used	Dewatering
4907960	591238	4857863	10322519	8/31/1994			717	12.5	Not Used	Dewatering
4908542	592139	4856947	10323077	11/29/1999			765	5.5	Domestic	Water Supply
4908579	592452	4858432	10323114	3/6/2000			911	63.4	Domestic	Water Supply
4908881	592161	4857899	10520801	11/27/2001			314		Domestic	Abandoned-Other
4910104	591415	4858187	11555338	7/25/2005	ROBERT CARSON DR	EAST CALEDON	721	11.0	Not Used	Observation Wells
4910105	591304	4858150	11555339	7/28/2005	ROBERT CARSON DR	EAST CALEDON	782	36.6	Not Used	Observation Wells
4910106	591304	4858150	11555340	7/28/2005	ROBERT CRASON DR	EAST CALEDON	782	10.4	Not Used	Observation Wells
4910121	591224	4857939	11555355	2/15/2006	AIRPORT ROAD @ CENTERVILLE CREEK	CALEDON EAST	753	0.8	Not Used	Abandoned-Other
4910205	591412	4858181	11555439	5/23/2006	ROBERT CARSON DR	CALEDON EAST	719	8.0	Not Used	Abandoned-Other
4910206	591412	4858188	11555440	5/23/2006	ROBERT CARSON DR	CALEDON EAST	724	6.0	Not Used	Abandoned-Other
4910208	591412	4858181	11555442	5/23/2006	ROBERT CARSON DR	CALEDON EAST	719	8.0	Not Used	Abandoned-Other
4910209	591414	4858185	11555443	5/23/2006	ROBERT CARSON DR	CALEDON EAST	721	6.0	Not Used	Abandoned-Other
4910303	591316	4857985	11694184	8/31/2006	AIRPORT ROAD & MOUNTCREST RD	CALEDON EAST	686		Not Used	Observation Wells
4910304	591209	4857867	11694185	8/31/2006	AIRPORT ROAD @ S. OF EMMA ST	CALEDON EAST	746		Not Used	Observation Wells
7045718	591415	4858187	11768157	7/25/2005	ROBERT CARSON DR	EAST CALEDON	721	38.4	Not Used	Observation Wells
7048527	592292	4858611	23048527	7/18/2007	15831 INNIS LAKE RD	CALEDON	994	4.3	Domestic	Water Supply
7154738	591264	4857888	1003411130	3/9/2010			698			
4905642	591417	4858178	1003446000	5/24/1979			714	32.6	Municipal	Water Supply
7186062	591088	4857863	1004141210	8/21/2012	8 EMMA ST	CALEDON	863			Abandoned-Other
7208933	591141	4858018	1004591960	9/13/2013	15955 AIRPORT RD.	Caledon	859		Monitoring and Test Hole	Monitoring and Test Hole
7243785	591252	4857876	1005445690	6/26/2015	AIRPORT RD & MONTENEST RD	CALEDON EAST	707		Municipal	Abandoned-Other
7243809	591260	4857889	1005445860	6/15/2015	AIRPORT RD & MOUNTCREST RD	CALEDON EAST	703		Monitoring	Abandoned-Other
7243810	591264	4857888	1005445860	6/15/2015	AIRPORT RD. & MOUNTCREST RD	CALEDON EAST	698		Monitoring	Abandoned-Other

Appendix B: Borehole Logs

Log of Borehole 1

Project No. BRM-00235186-D0 | Drawing No. 2

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 26, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~125 mm Topsoil over **FILL:** Sandy silt, trace clay, trace gravel, clayey silt pockets, brown, moist.	300.85	
		21.0
		20.4
SANDY SILT TILL: Trace gravel, trace clay, brown oxidized fissures, moist to wet, compact to loose.	~298.9	
		21.5
		21.3
SILTY SAND: Medium grained, brown, moist, very dense.	~296.1	
END OF BOREHOLE.	~292.8	

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m) 0 1 2 3 4 5 6 7

SPT values: 7, 7, 7, 13, 6, 7, 84, 46

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.16

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 2

Project No. BRM-00235186-D0 | Drawing No. 3

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

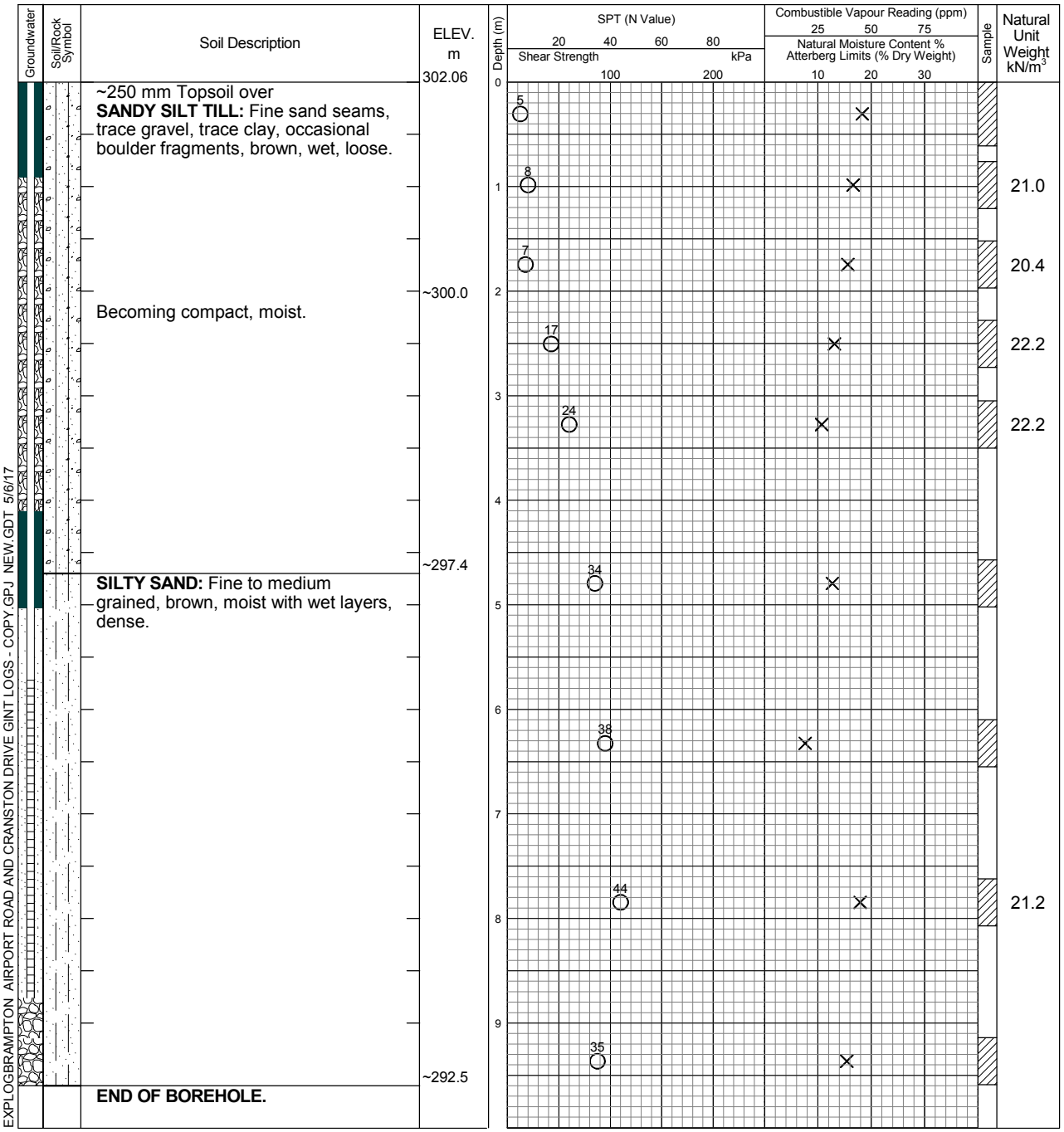
Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	9.14
May 15, 2017	8.82	
May 19, 2017	8.77	

Log of Borehole 3

Project No. BRM-00235186-D0

Drawing No. 4

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
~125 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder and shale fragments, brown, moist, compact.	300.99	0	
		1	21.5
		2	21.6
Becoming dense to very dense.	~298.9		
		3	22.2
		4	22.5
SILTY SAND: Fine grained, brown, moist, very dense.	~297.0		
		5	
Becoming compact, wet.	~295.4		
		6	
Becoming dense, moist.	~293.9	7	
END OF BOREHOLE.	~292.9		

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 6, 10, 12, 31, 69, 80, 29, 47

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.47

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 4

Project No. BRM-00235186-D0 | Drawing No. 5

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~100 mm Topsoil over **SANDY SILT TILL:** Trace gravel, brown, wet, loose.	296.65	0	6	×	
		1	5	×	
		2	3	×	18.9
	~294.6				
SILTY SAND: Fine to medium grained, brown, moist, loose.		2	7	×	
		3	4	×	
		4			
		5	5	×	
Becoming wet, compact.	~291.7				
		6	21	×	
	~290.1				
END OF BOREHOLE.					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.79

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 5

Project No. BRM-00235186-D0 | Drawing No. 6

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, brown, wet, compact.	301.33	0	3	×		
				1	12	×		20.9
					15	×		21.5
		Becoming moist, compact to dense.	~299.2	2	31	×		22.6
				3	27	×		22.3
				4				
				5	41	×		22.3
		Becoming wet.	~295.7					
				6	44	×		
		SILTY SAND: Fine grained, brown, black pockets, moist, very dense.	~294.2	7	65	×		
			~293.2					
		END OF BOREHOLE.						

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	8.07

exp.

Log of Borehole 6

Project No. BRM-00235186-D0

Drawing No. 7

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~200 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, moist to wet, loose.	298.04	0	6		
		1	8		21.4
		1	8		21.7
Becoming moist, dense.	~295.9	2	35		22.2
		3	44		
SILTY SAND: Fine grained, brown to reddish brown, moist, dense.	~294.0	4	49		
		5			
		6	44		
		7	37		
END OF BOREHOLE.	~289.9				

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	8.07
May 15, 2017	7.58	
May 19, 2017	7.55	

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 7

Project No. BRM-00235186-D0 | Drawing No. 8

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 4, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~350 mm Topsoil over **FILL:** Sand, fine grained, brown, black stained pockets, wet.	293.85	
	~292.5	20.9
CLAYEY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, hard.		21.6
Becoming wet.	~291.0	22.9
	~288.3	
SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, compact to very dense.		22.2
	~285.4	22.0
SILTY SAND: Medium grained, grey, wet, very dense.		

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

SPT values: 1, 9, 20, 24, 20, 26, 28, 50 for 150mm, 55

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	12.19	15.69
May 15, 2017	8.18	
May 19, 2017	8.2	

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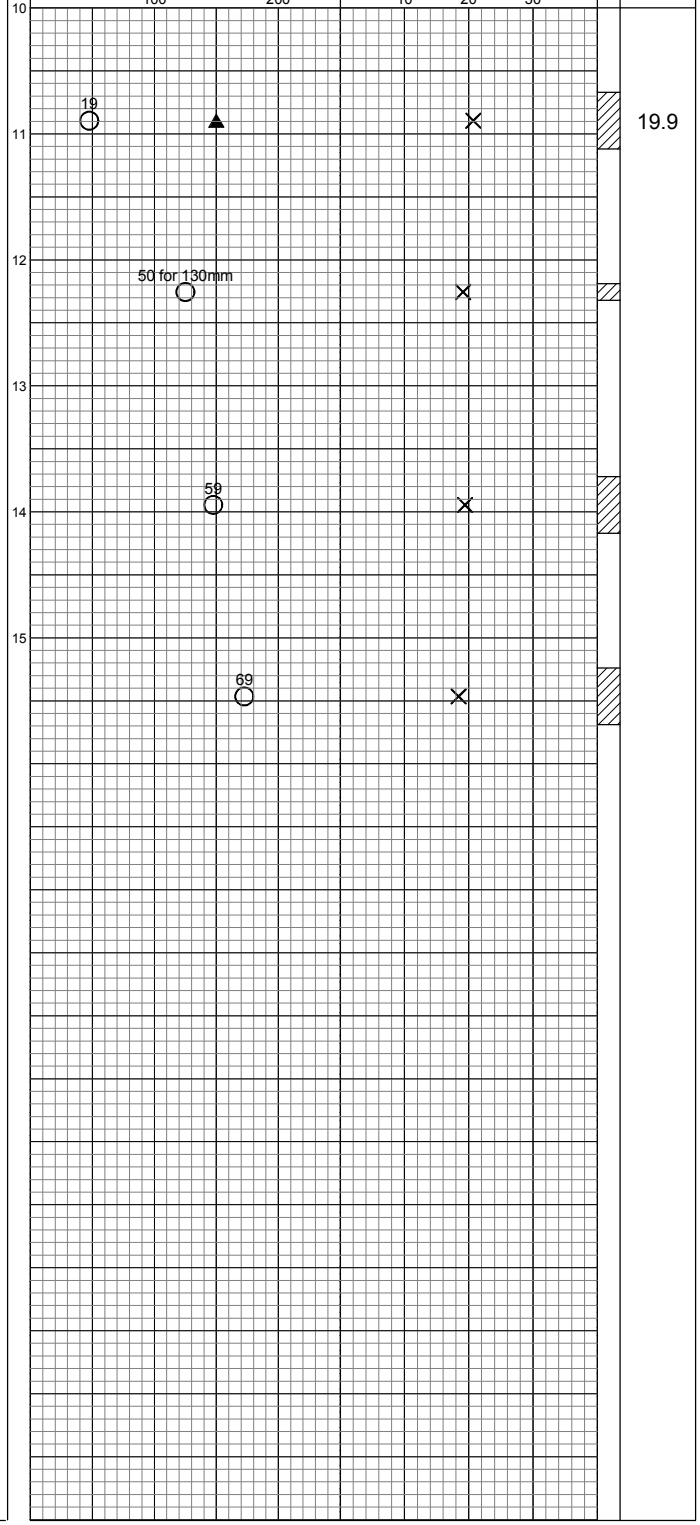
Log of Borehole 7

Project No. BRM-00235186-D0 Drawing No. 8

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
			283.85
			~283.7
		CLAYEY SILT: Brown to grey, wet, stiff.	
			~282.2
		SILTY SAND: Fine grained, brown and grey, wet, very dense.	
			~278.2
		END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	12.19	15.69
May 15, 2017	8.18	
May 19, 2017	8.2	

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Log of Borehole 8D

Project No. BRM-00235186-D0 | Drawing No. 9

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

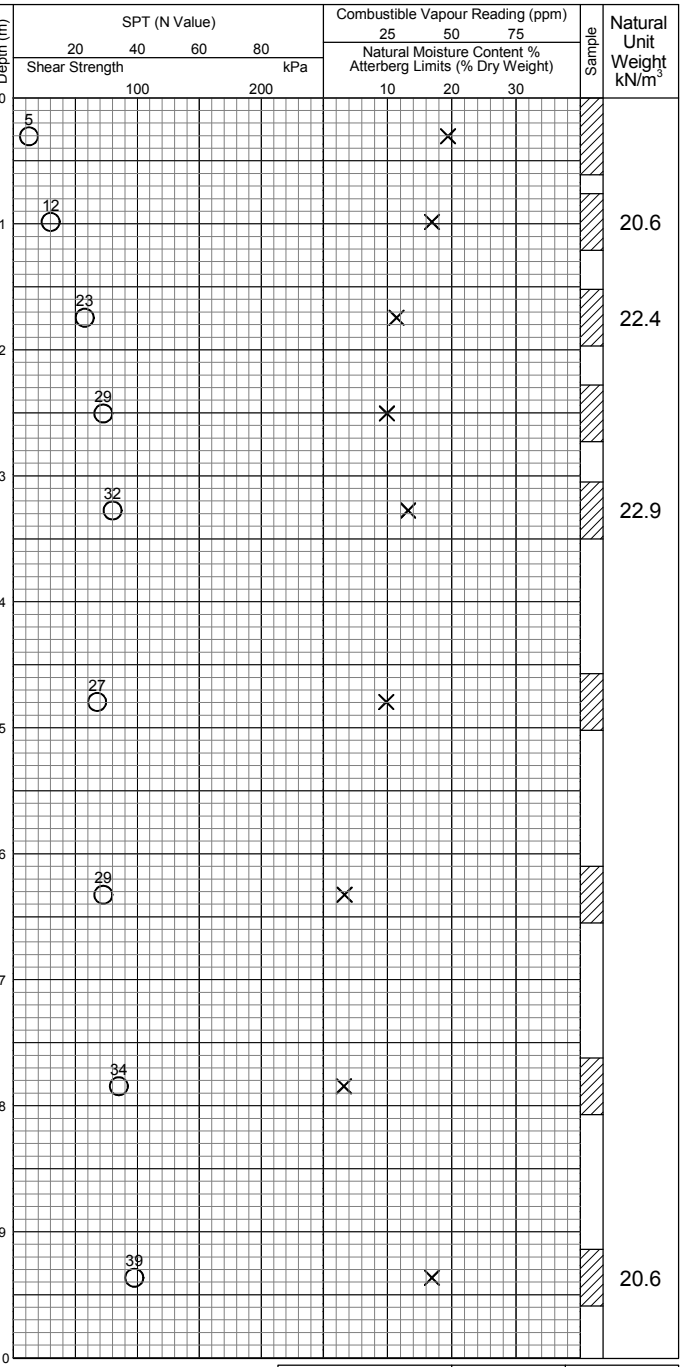
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit —○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, occasional rock fragments, brown, oxidized pockets, moist, compact to dense.	295.23
SILTY SAND: Fine grained, brown, moist, compact to dense.	~291.1



Sample	Natural Unit Weight kN/m³
	20.6
	22.4
	22.9
	20.6

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	10.53	12.65
May 15, 2017	10.49	
May 19, 2017	10.49	

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Log of Borehole 8D

Project No. BRM-00235186-D0 Drawing No. 9

Project: Geotechnical Investigation Sheet No. 2 of 2

Soil Description	ELEV. m
	285.23
Becoming wet, compact.	~285.0
	~282.5
END OF BOREHOLE.	

SPT (N Value) 20 40 60 80

Shear Strength kPa 100 200

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m) 10 11 12

25

28

Sample

Natural Unit Weight kN/m^3

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	10.53	12.65
May 15, 2017	10.49	
May 19, 2017	10.49	

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Log of Borehole 8S

Project No. BRM-00235186-D0

Drawing No. 9A

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample

SPT (N) Value

Dynamic Cone Test

Shelby Tube

Field Vane Test (S)

Combustible Vapour Reading

Natural Moisture

Plastic and Liquid Limit

Undrained Triaxial at % Strain at Failure

Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, occasional rock fragments, brown, oxidized pockets, moist, compact to dense.	295.23	20.6
		22.4
		22.9
	~291.1	
SILTY SAND: Fine grained, brown, moist, compact to dense.		
	~288.7	
END OF BOREHOLE.		

SPT (N Value) 20 40 60 80

Shear Strength kPa 100 200

Depth (m) 0 1 2 3 4 5 6

SPT values: 5, 12, 23, 29, 32, 27, 29

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 15, 2017	Dry	
May 19, 2017	Dry	

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Log of Borehole 9

Project No. BRM-00235186-D0 | Drawing No. 10

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 26, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~225 mm Topsoil over **FILL:** Silty sand to sandy silt, trace gravel, clayey silt pockets, brown, moist.	302.38	0	7		
		1	6		21.8
	~300.5	2	7		18.3
SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized fissures, moist, compact.		2	13		21.7
		3	15		
		4			
		5	22		22.0
	~297.3				
SILTY SAND: Fine to medium grained, scattered gravel, brown, moist.		6	19		
	~295.8				
END OF BOREHOLE.					

SPT (N Value): 20 40 60 80
Shear Strength kPa: 100 200
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.79

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Log of Borehole 10

Project No. BRM-00235186-D0 | Drawing No. 11

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~150 mm Topsoil over **FILL:** Sandy silt, trace gravel, trace clay, scattered rock fragments, brown, moist.	302.16	0	5			
				1	7			19.7
				2	9			21.9
					28			22.6
		Layer of dark brown silt, sand and gravel.	~299.0	3	7			
		SANDY SILT TILL: Fine sand seams and layers, trace gravel, moist, loose to dense.	~298.1	4				
				5	8			22.3
				6	39			
		END OF BOREHOLE.	~295.6					

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.79

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Log of Borehole 11

Project No. BRM-00235186-D0 | Drawing No. 12

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~225 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown, moist to wet.	301.41	0	4		
		1	5		21.7
	~300.0				
SANDY SILT TILL: Fine sand seams, trace gravel, occasional shale and boulder fragments, brown, moist, compact to very dense.		2	23		21.7
			26		21.9
		3	39		22.5
		4			
		5	51		20.9
Becoming wet.	~295.8				
	~295.2	6	46		
SILTY SAND: Fine grained, brown, moist, dense.	~294.8				
END OF BOREHOLE.					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.94

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Log of Borehole 12

Project No. BRM-00235186-D0 | Drawing No. 13

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~200 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragements, brown, moist, compact.	301.37	0	5			
				1	10			22.4
				2	16			22.1
		Sand and gravel layer ~225 mm thick.	~298.9		29			22.3
				3	21			22.0
		Find sand layers.	~297.4	4				
				5	27			21.9
		SILTY SAND: Fine grained, brown, moist, dense.	~295.8	6	35			20.8
		END OF BOREHOLE.	~294.8					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.94

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Log of Borehole 13

Project No. BRM-00235186-D0 | Drawing No. 14

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~300 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown, topsoil stained pockets, moist to wet.	297.44	0
		SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, brown, moist, dense to very dense.	~295.2	2
		SILTY SAND: Fine grained, silt seams, brown, moist, dense to very dense.	~293.3	4
		END OF BOREHOLE.	~290.8	6

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 6 (0.5 m), 9 (1.0 m), 4 (1.5 m), 30 (2.5 m), 51 (3.5 m), 50 for 130mm (4.5 m), 44 (6.0 m)

Sample | Natural Unit Weight kN/m³

21.9 (1.0 m)
21.7 (1.5 m)
22.6 (3.5 m)
21.7 (6.0 m)

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.55

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Log of Borehole 14

Project No. BRM-00235186-D0 | Drawing No. 15

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

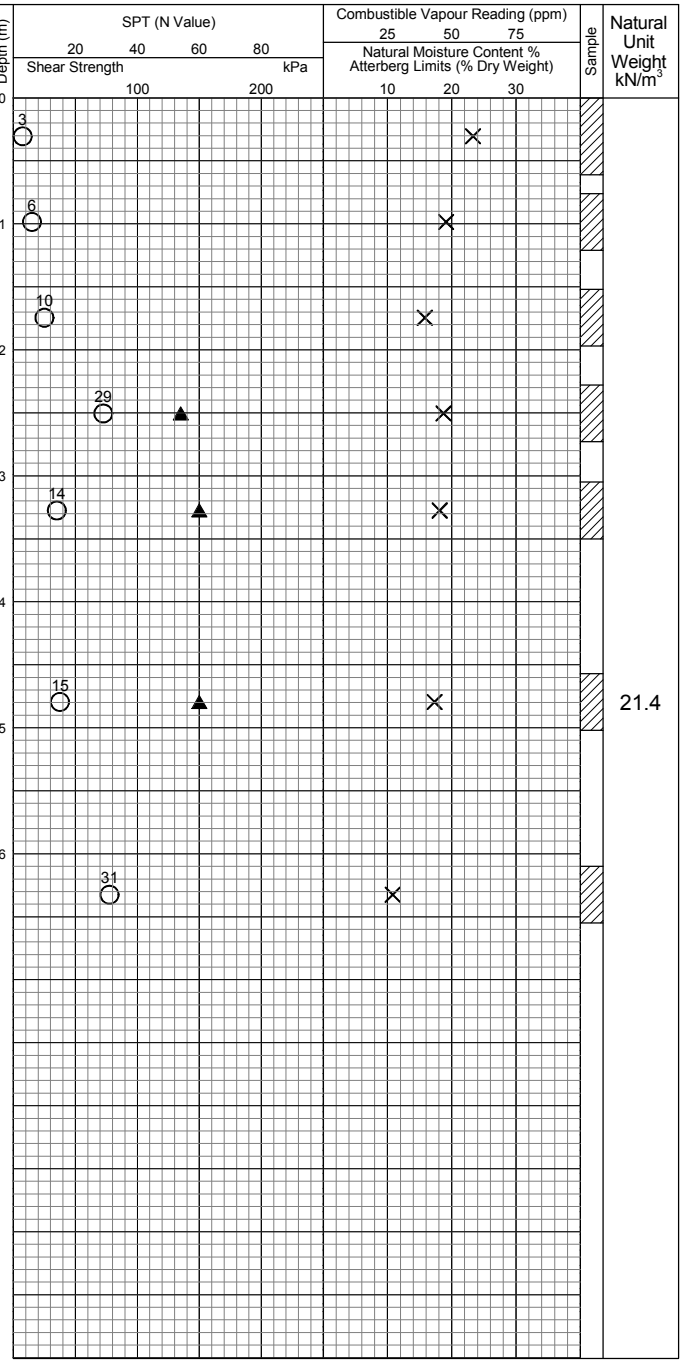
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~450 mm Topsoil over **SAND:** Medium to coarse grained, trace gravel, brown, wet, loose to compact.	294.85
	~292.7
CLAYEY SILT TILL: Fine sand seams, trace gravel, brown, wet, stiff to very stiff.	
Becoming grey, wet.	~290.9
	~289.3
SANDY SILT TILL: Medium grained sand seams, trace gravel, brown, wet, dense.	
	~288.3
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.55

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Log of Borehole 15

Project No. BRM-00235186-D0 | Drawing No. 16

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 3, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~250 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace rootlets, trace gravel, brown, moist.	299.46	0
				1
				2
			~297.3	
		SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized partings, moist, compact to dense.		3
				4
				5
		Becoming wet, compact.	~293.9	6
			~292.9	
		END OF BOREHOLE.		

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5; >50lb for 12"; 8; 26; 45; 26; 22

Sample | Natural Unit Weight kN/m³: 20.1; 20.2; 22.3; 22.5; 21.9

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	6.10	6.55

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Log of Borehole 16

Project No. BRM-00235186-D0 | Drawing No. 17

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 3, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit ⊢○

Shelby Tube ■ | Undrained Triaxial at % Strain at Failure ⊕

Field Vane Test S | Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~250 mm Topsoil over **FILL:** Clayey silt, trace gravel, brown to grey, oxidized pockets, moist.	294.92	0	5			
		PEAT: Fibrous decayed vegetation, wood fragments, black, wet, very loose.	~293.9	1	2			10.1
				2	1	398.8		10.3
		SILTY SAND: Fine grained, clayey silt and gravel layers, grey, wet, loose.	~292.4	3	2	450		
			~290.8	4	9			
		CLAYEY SILT TILL: Silt seams, trace gravel, grey, moist, stiff to hard.		5	16			22.0
			~288.6	6	50 for 150mm			
		END OF BOREHOLE.						

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Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.25

Log of Borehole 17

Project No. BRM-00235186-D0 | Drawing No. 18

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 26, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit ⊢○

Shelby Tube ■ | Undrained Triaxial at % Strain at Failure ⊕

Field Vane Test ✚ S | Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~225 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown, moist.	302.81	0	6	×		
				1	7	×		19.9
			~301.5					
		SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, oxidized pockets, moist, compact.		2	15	×		22.3
					29	×		22.7
				3	28	×		22.6
		Becoming dense.	~298.8	4				
				5	43	×		22.3
		SILTY SAND: Fine grained, brown, moist, very dense.	~297.2	6	50 for 150mm	×		
			~296.5					
		END OF BOREHOLE.						

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.04

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Log of Borehole 18D

Project No. BRM-00235186-D0 | Drawing No. 19

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~150 mm Topsoil over **CLAYEY SILT TILL:** Trace to some gravel, fine sand seams, brown, moist with wet seams, stiff to very stiff.	302.71	
		21.3
		22.2
	~300.5	
SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, dense to very dense.		22.3
	~298.7	
SILTY SAND: Fine grained, brown, moist, dense to very dense.		21.7
		20.7

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

SPT values: 7, 11, 26, 38, 57, 49, 70, 40, 45

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.58	12.19
May 15, 2017	11.46	
May 19, 2017	11.34	

Log of Borehole 18D

Project No. BRM-00235186-D0 Drawing No. 19

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
			292.71	10
				11
		Becoming wet, compact.	~291.0	
				12
			~290.1	
		END OF BOREHOLE.	~290.1	

SPT (N Value) 20 40 60 80

Shear Strength kPa 100 200

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m^3

32

26

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.58	12.19
May 15, 2017	11.46	
May 19, 2017	11.34	

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Log of Borehole 18S

Project No. BRM-00235186-D0 | Drawing No. 19A

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~150 mm Topsoil over **CLAYEY SILT TILL:** Trace to some gravel, fine sand seams, brown, moist with wet seams, stiff to very stiff.	302.71	
		21.3
		22.2
	~300.5	
SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, dense to very dense.		
		22.3
	~298.7	
SILTY SAND: Fine grained, brown, moist, dense to very dense.		
		21.7
	~296.2	
END OF BOREHOLE.		

SPT (N Value): 7, 11, 26, 38, 57, 49, 70

Shear Strength (kPa)

Combustible Vapour Reading (ppm)

Natural Moisture Content % / Atterberg Limits (% Dry Weight)

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 15, 2017	5.88	
May 19, 2017	5.83	

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Log of Borehole 19

Project No. BRM-00235186-D0 | Drawing No. 20

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 27, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~200 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown oxidized pockets and silt partings, moist, compact.	300.26	0	6			
				1	12			22.4
				2	17			
					19			21.9
				3	26			22.0
				4				
				5	29			22.7
		Becoming wet, dense.	~294.7	6	42			21.6
		END OF BOREHOLE.	~293.7					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.03	5.79

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Log of Borehole 20

Project No. BRM-00235186-D0 | Drawing No. 21

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

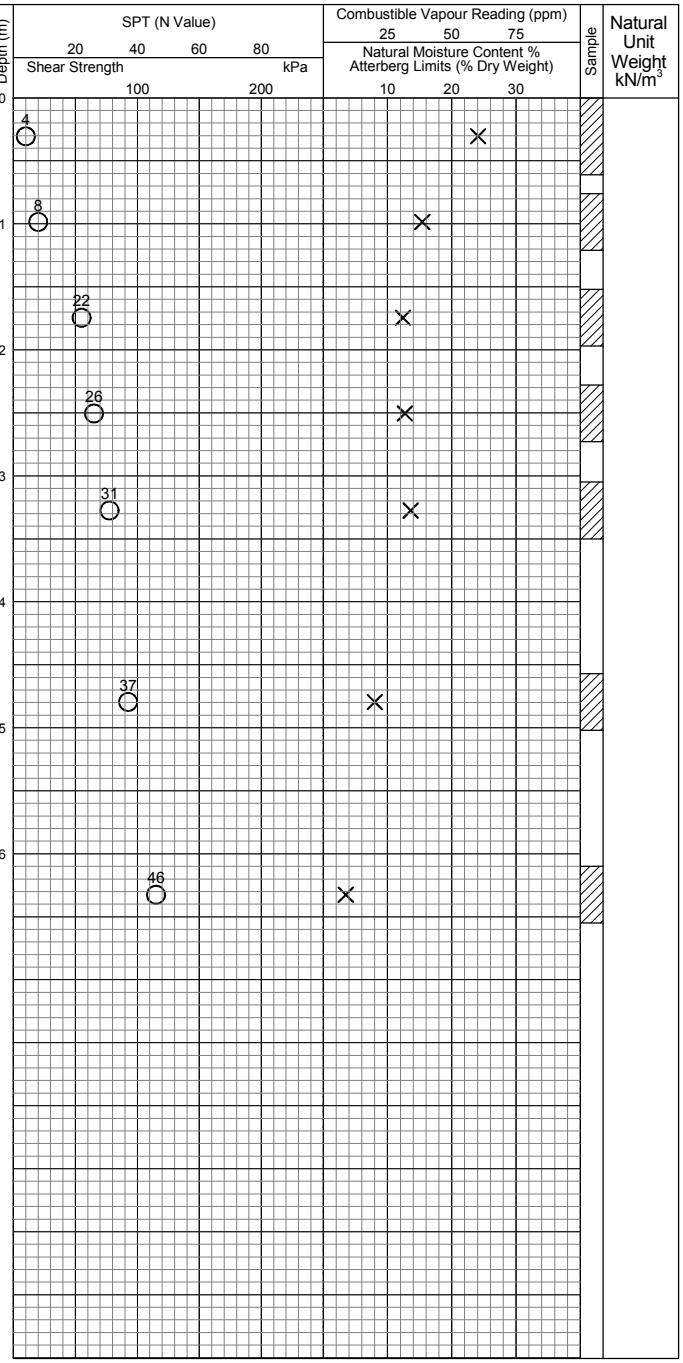
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m
~250 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, moist, loose to dense.	300.12
	~296.0
SILTY SAND: Fine grained, brown, moist, dense.	
	~293.5
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 15, 2017	5.85	
May 19, 2017	5.82	

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Log of Borehole 21

Project No. BRM-00235186-D0 | Drawing No. 22

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~450 mm Topsoil over **SANDY SILT TILL:** Trace gravel, brown, moist to wet, loose.	298.77
	~297.4
SILTY SAND: Stratified, fine grained, brown, moist, loose to very loose.	
	~293.2
Becoming cemented, compact.	
	~292.2
END OF BOREHOLE.	

Depth (m): 0, 1, 2, 3, 4, 5, 6

SPT (N Value): 20, 40, 60, 80
Shear Strength kPa: 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

SPT values: 6, 5, 4, 3, 4, 8, 11

Natural Unit Weight kN/m³

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10

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Log of Borehole 22

Project No. BRM-00235186-D0 | Drawing No. 23

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

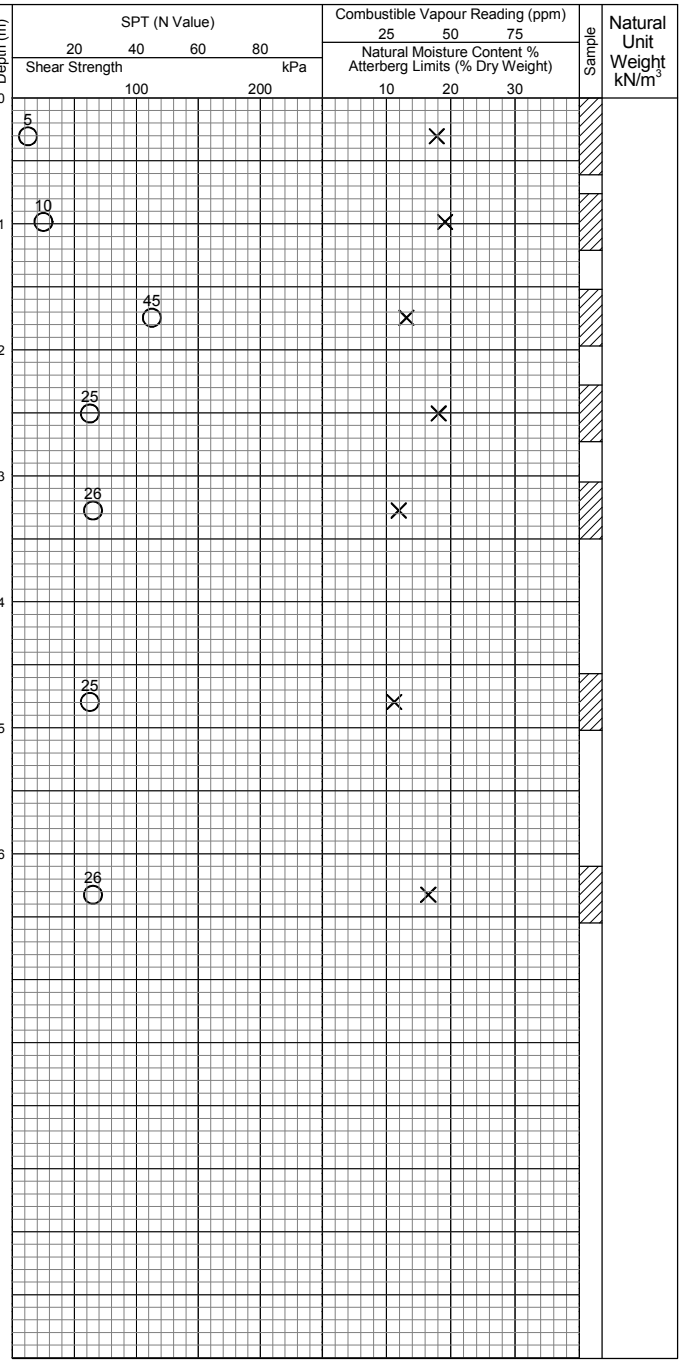
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
	303.22
~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, compact to dense.	
Becoming wet.	~301.0
	~299.1
SILTY SAND: Fine grained, brown, moist, compact.	
	~296.6
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.49	6.10

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Log of Borehole 23

Project No. BRM-00235186-D0 | Drawing No. 24

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
~300 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown to dark brown, moist.	301.81	0	5	×		
		1	4	×		
SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, brown, moist, compact to dense.	~300.4		14	×		22.1
		2	37	×		22.4
SILTY SAND: Fine grained, brown, moist, dense to very dense.	~298.9	3	50 for 150mm	×		
		4				
		5	50	×		
		6	38	×		
END OF BOREHOLE.	~295.2					

SPT (N Value): 20 40 60 80
Shear Strength kPa: 100 200
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 15, 2017	Dry	
May 19, 2017	Dry	

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Log of Borehole 24

Project No. BRM-00235186-D0 | Drawing No. 25

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit ⊢○

Shelby Tube ■ | Undrained Triaxial at % Strain at Failure ⊕

Field Vane Test ✚ S | Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~300 mm Topsoil over **FILL:** Clayey silt, trace gravel, trace black decayed vegetation, brown, wet.	295.53	0	6			
				1	4			
				2	7	43.4		18.5
		PEAT: Fibrous decayed vegetation, wood fragments, black, wet, very loose.	~293.4		4	52.9		
				3	3	27.2		
		SILTY SAND: Fine to medium grained, grey, wet, loose.	~291.5	4				
		CLAYEY SILT TILL: Trace gravel, grey, moist, stiff.	~290.7	5	5			
				6	11			22.6
		END OF BOREHOLE.	~288.9					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	1.52	1.83

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Log of Borehole 25

Project No. BRM-00235186-D0 | Drawing No. 26

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 26, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~175 mm Topsoil over **FILL:** Silt to clayey silt, trace gravel, brown, moist to wet.	303.63	0
		SANDY SILT TILL: Trace gravel, occasional boulder fragments, brown, moist, compact.	~301.5	2
		SILTY SAND: Medium grained, trace gravel, brown, wet, compact.	~300.7	3
		SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, dense to very dense.	~299.6	4
		END OF BOREHOLE.	~297.0	6

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5 (0.5 m), 6 (1.0 m), 6 (1.5 m), 27 (2.5 m), 18 (3.5 m), 45 (4.5 m), 75 (6.0 m)

Natural Unit Weight kN/m³: 21.8 (1.0 m), 20.0 (1.5 m), 22.4 (4.5 m), 22.9 (6.0 m)

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	3.66	4.42
May 15, 2017	2.53	
May 19, 2017	2.92	

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Log of Borehole 26

Project No. BRM-00235186-D0 | Drawing No. 27

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 28, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~150 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown, moist to wet.	303.38	0
				1
				2
			~301.3	
		SANDY SILT TILL: Fine sand seams and layers, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, compact to very dense.		3
				4
				5
			~297.8	
		SILTY SAND: Fine grained, brown, moist, very dense.		6
			~297.2	
		END OF BOREHOLE.		

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5, 6, 5, 15, 21, 77, 50 for 130mm

Sample	Natural Unit Weight kN/m³
	20.1
	22.4
	22.2

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.33	5.87

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Log of Borehole 27

Project No. BRM-00235186-D0 | Drawing No. 28

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~150 mm Topsoil over **FILL:** Clayey silt, trace to some gravel, sand pockets, brown, moist to wet.	301.92	0	8	×		
				1	11	×		
				2	5	×		19.8
				3	6	×		
				4	4	×		
		SILTY SAND: Fine to medium grained, widely scattered rock fragments, brown, moist, very dense.	~297.9	5	98	×		
				6	85	×		
		END OF BOREHOLE.	~295.3					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.13	5.18

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Log of Borehole 29

Project No. BRM-00235186-D0 | Drawing No. 30

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample | Combustible Vapour Reading

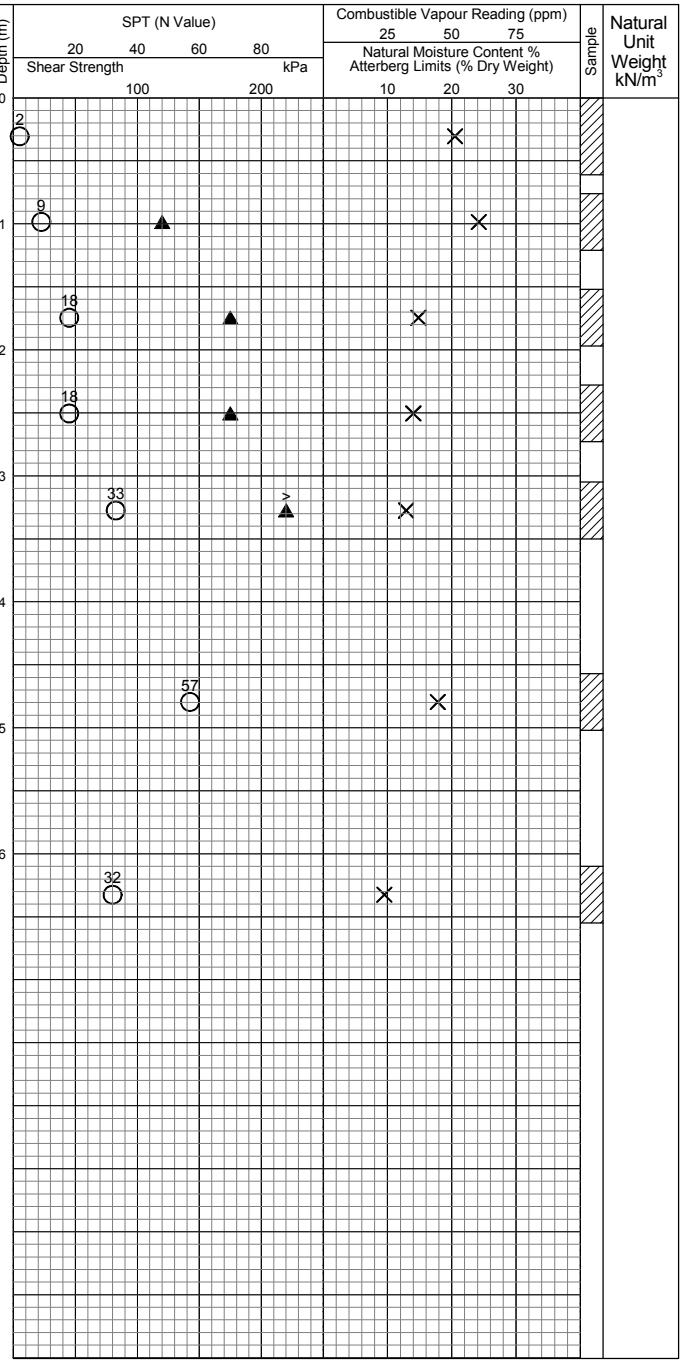
SPT (N) Value | Natural Moisture

Dynamic Cone Test | Plastic and Liquid Limit

Shelby Tube | Undrained Triaxial at % Strain at Failure

Field Vane Test (S) | Penetrometer

Soil Description	ELEV. m
~300 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, wet, stiff to hard.	302.68
SANDY SILT TILL: Fine sand seams, trace gravel, brown, wet, very dense.	~298.7
SILTY SAND: Fine grained, stratified, brown, moist, dense.	~297.1
END OF BOREHOLE.	~296.1



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	3.35	6.10

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Log of Borehole 31

Project No. BRM-00235186-D0 | Drawing No. 32

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Depth (m)
~300 mm Topsoil over **FILL:** Clayey silt to sandy silt, trace gravel, brown, wet.	300.71	0
	~299.3	1
CLAYEY SILT TILL: Fine sand seams, trace gravel, brown, moist, very stiff to hard.		2
	~296.7	3
SILTY SAND: Fine grained, silt seams, brown, moist, dense.		4
	~294.1	5
END OF BOREHOLE.		6

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample | Natural Unit Weight kN/m³

SPT values: 4, 3, 13, 21, >, 34, >, 30, 41

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	1.83	3.96

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Log of Borehole 32

Project No. BRM-00235186-D0 | Drawing No. 33

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~400 mm Topsoil over **FILL:** Silty sand changing to clayey silt, trace gravel, brown and grey, wet.	302.35
	~301.0
CLAYEY SILT TILL: Fine sand and silt seams, trace gravel, occasional boulder fragments, brown and grey, oxidized partings, moist, stiff to hard.	
Becoming grey.	~298.4
	~296.8
SANDY SILT TILL: Fine sand seams, trace gravel, grey, moist, compact.	
	~295.8
END OF BOREHOLE.	

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
Depth (m): 0 1 2 3 4 5 6

SPT N values: 6, 6, 12, 15, 23, >, 23, >, 25

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10

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Log of Borehole 33

Project No. BRM-00235186-D0 | Drawing No. 34

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~250 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown, wet.	301.89	0
			~300.8	1
		SANDY SILT TILL: Fine sand seams, sand and gravel layers, trace gravel, brown, moist, compact.		2
				3
		Becoming grey, occasional boulder fragments.	~297.9	4
				5
				6
		END OF BOREHOLE.	~295.3	

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Sample | Natural Unit Weight kN/m³

SPT values: 2, 3, 9, 25, 18, 15, 15

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10

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Log of Borehole 34

Project No. BRM-00235186-D0 | Drawing No. 35

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 28, 2017

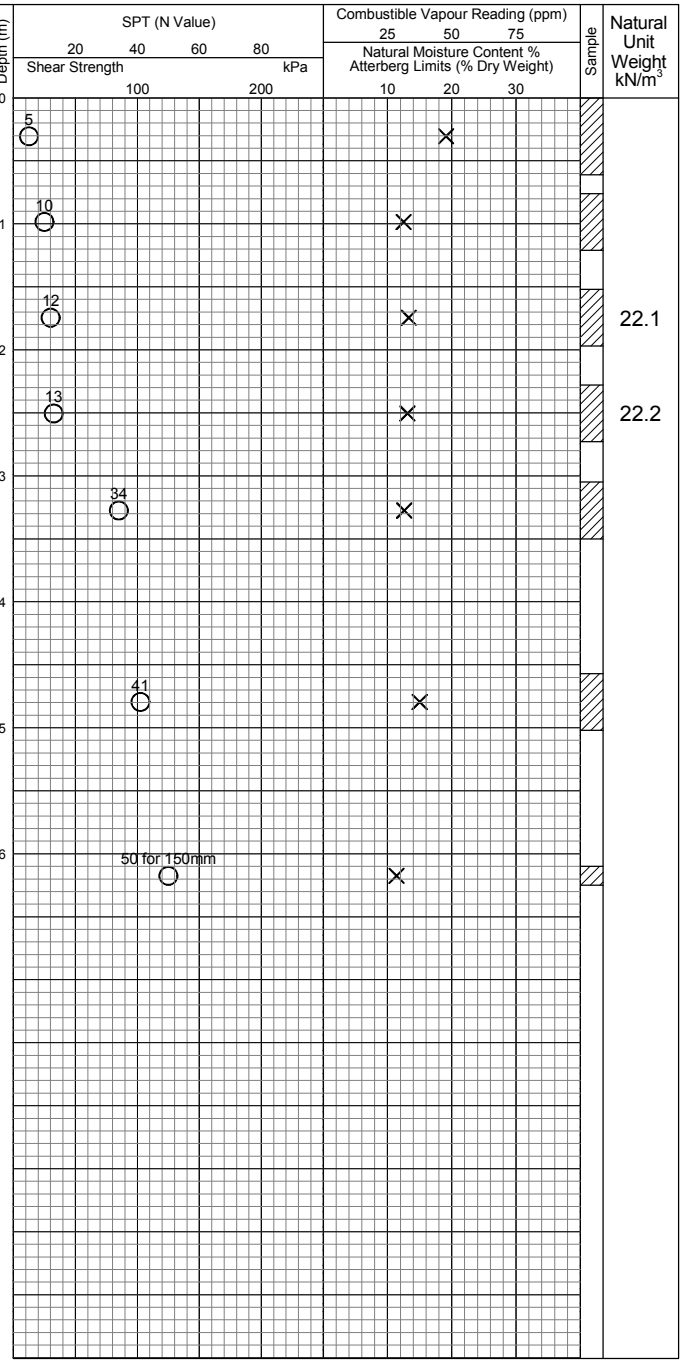
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~250 mm Topsoil over **SANDY SILT TILL:** Fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, compact to dense.	303.78
			~298.2
		SILTY SAND: Fine grained, trace gravel and shale fragments, brown, moist, very dense.	~297.6
		END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	4.5	5.11

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Log of Borehole 35

Project No. BRM-00235186-D0 | Drawing No. 36

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		~150 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, scattered clayey silt seams, brown, wet, loose to dense.	303.11	0	5	×		
				1	7	×		21.6
				2	27	×		20.2
					41	×		22.2
				3	34	×		22.1
		Becoming grey, occasional boulder fragments.	~299.1	4				
				5	24	×		22.8
		Becoming very dense.	~297.6					
		END OF BOREHOLE.	~296.9	6	50 for 100mm	×		

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	0.91	0.91

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Log of Borehole 36

Project No. BRM-00235186-D0 | Drawing No. 37

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 2, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~225 mm Topsoil over **FILL:** Clayey silt, some sand, trace gravel, brown, wet.	303.04	0
		SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, brown, moist, compact to very dense.	~301.6	1
				2
				3
				4
				5
		SILTY SAND: Fine to medium grained, brown, moist, very dense.	~297.4	6
		END OF BOREHOLE.	~296.4	

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5, 4, 14, 27, 35, 100, 65

Sample	Natural Unit Weight kN/m³
	22.0
	21.9
	22.6
	21.9

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.44	5.64
May 15, 2017	5.88	
May 19, 2017	5.81	

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exp.

Log of Borehole 38

Project No. BRM-00235186-D0 | Drawing No. 39

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 26, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~200 mm Topsoil over **FILL:** Sandy silt, trace gravel, trace clay, rock fragments, brown, moist to wet.	304.43
			~302.3
		SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, compact.	
			~299.6
		Black sand pockets and oxidized zones.	
			~298.8
		Becoming dense.	
			~297.8
		END OF BOREHOLE.	

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa
Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Depth (m): 0 1 2 3 4 5 6

SPT values: 4, 9, 9, 19, 25, 20, 41

Sample | Natural Unit Weight kN/m³: 22.0, 22.0, 22.4, 22.4, 21.2, 22.3

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.03	5.79

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Log of Borehole 39

Project No. BRM-00235186-D0 | Drawing No. 40

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

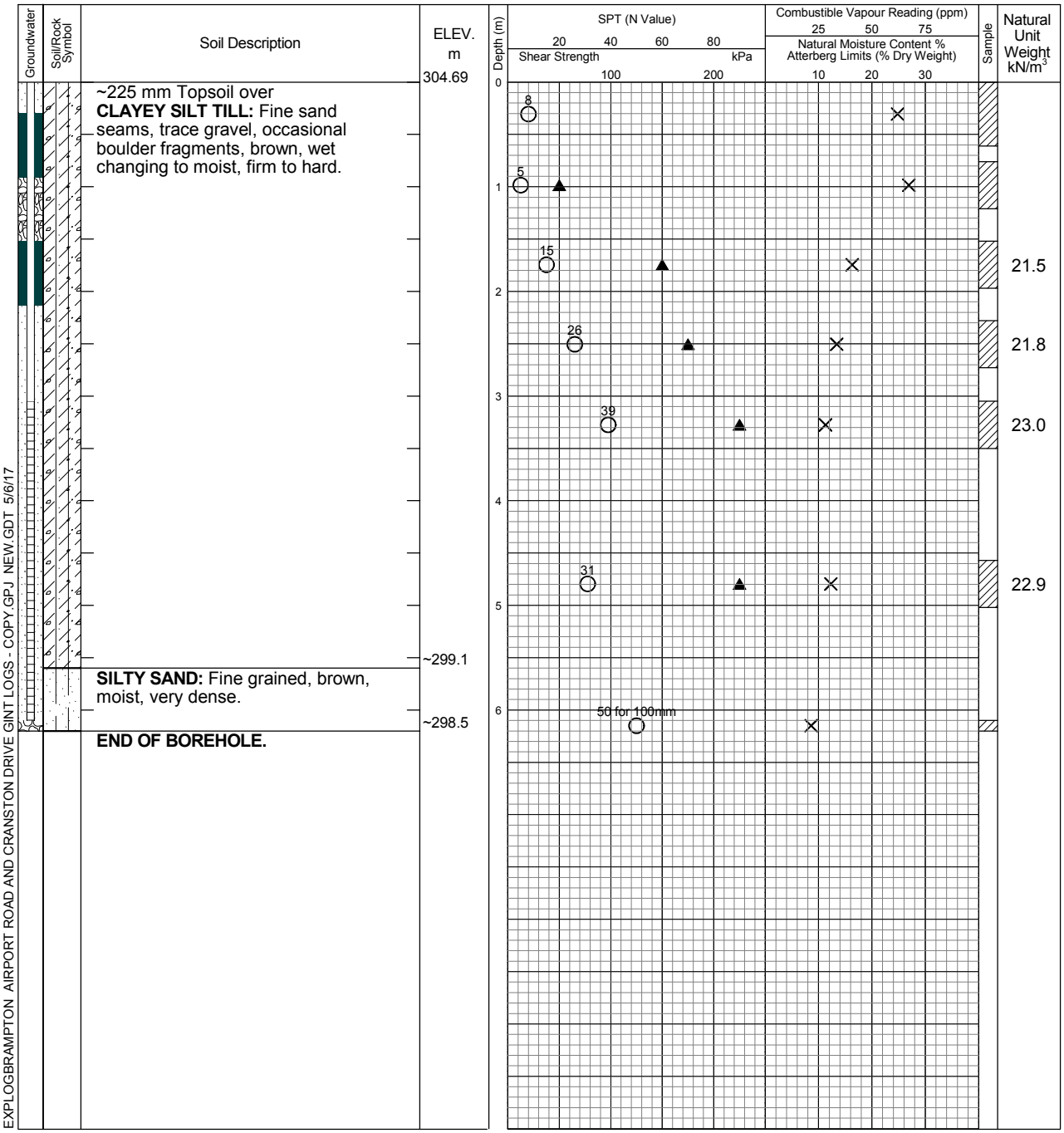
Date Drilled: May 2, 2017

Drill Type: D-90-Tire

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.94	6.10
May 15, 2017	5.99	
May 19, 2017	5.99	

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Log of Borehole 40

Project No. BRM-00235186-D0 | Drawing No. 41

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 28, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
		~250 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, compact.	304.72	0
		Becoming dense.	~300.7	4
		SILTY SAND: Fine grained, silt seams, brown, moist, very dense.	~299.1	
		END OF BOREHOLE.	~298.5	6

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample	Natural Unit Weight kN/m³
	21.6
	21.9
	22.4
	22.4

5
16
14
19
23
36
50 for 125mm

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	3.96	5.03

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exp.

Log of Borehole 41

Project No. BRM-00235186-D0 | Drawing No. 42

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

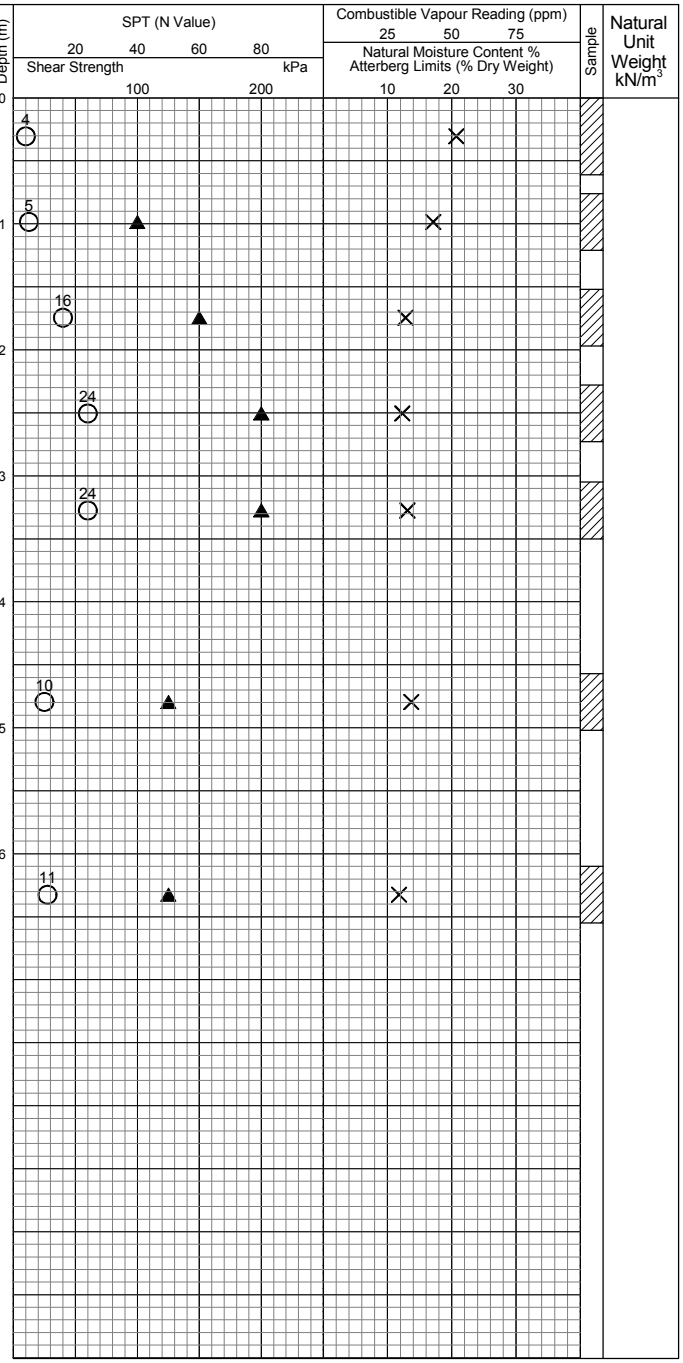
Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m
~300 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, brown, moist to wet, stiff to very stiff.	304.21
Becoming grey, wet, stiff.	~300.2
END OF BOREHOLE.	~297.6



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	1.67	6.10
May 15, 2017	1.82	
May 19, 2017	2.05	

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Log of Borehole 42

Project No. BRM-00235186-D0 | Drawing No. 43

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 9, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m
~300 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, stiff to hard.	303.39
Becoming grey.	~297.8
END OF BOREHOLE.	~296.8

SPT (N Value): 20 40 60 80 | Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 | Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Depth (m): 0 1 2 3 4 5 6

SPT values: 2, 7, 10, 14, 20, >, 30, >, 24, >

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	1.22	1.22

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Log of Borehole 43

Project No. BRM-00235186-D0 | Drawing No. 44

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: April 28, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~200 mm Topsoil over **FILL:** Silty sand, fine to medium grained, brown, reddish brown and grey, moist with wet zones.	306.39	0	3			
				1	3			
				2	2			
				2	8			
				3	5			
		SILTY SAND: Fine grained, brown, wet, compact.	~302.4	4				
				5	25			
		SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, compact.	~300.8	6	22			21.7
		END OF BOREHOLE.	~299.8					

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	0.05	4.57

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Log of Borehole 44

Project No. BRM-00235186-D0 | Drawing No. 45

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~225 mm Topsoil over **FILL:** Sandy silt to silty sand, trace clay, brown, moist to wet.	308.19	0	4	×		
				1	4	×		19.9
				2	8	×		21.9
		SILTY SAND: Fine grained, brown, moist, compact to dense.	~306.0		39	×		21.6
				3	25	×		
		Becoming wet, compact.	~304.1	4				
				5	14	×		21.5
				6	25	×		
		SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, dense.	~301.2	7	37	×		22.3
		END OF BOREHOLE.	~300.1					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.5

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Log of Borehole 45

Project No. BRM-00235186-D0

Drawing No. 46

Project: Geotechnical Investigation

Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		~150 mm Topsoil over **FILL:** Sandy silt, trace gravel, trace clay, brown, topsoil stained pockets, moist, loose.	308.82	0	7			
				1	8			21.5
				2	5			
		SILTY SAND: Fine to medium grained, brown, grey seams, wet, compact.	~306.6		14			
				3	14			
				4				
				5	20			
		CLAYEY SILT TILL: Silt seams, trace gravel, brown, wet, stiff.	~303.2	6	12			20.3
		END OF BOREHOLE.	~302.2					

SPT (N Value): 20 40 60 80
Shear Strength kPa: 100 200
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.89	2.89

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Log of Borehole 46

Project No. BRM-00235186-D0 | Drawing No. 47

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~330 mm Topsoil over **FILL:** Silty sand, clayey silt pockets, brown to dark brown, moist.	307.10
		SILTY SAND: Fine grained, stratified, brown, wet, loose.	~305.7
		SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, moist, compact to very dense.	~303.1
		END OF BOREHOLE.	~299.0

Depth (m)

SPT (N Value) 20 40 60 80
Shear Strength kPa 100 200

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

0 1 2 3 4 5 6 7

5 7 9 7 9 12 85 98

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.89	2.89

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exp.

Log of Borehole 47D

Project No. BRM-00235186-D0 | Drawing No. 48

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 11, 2017

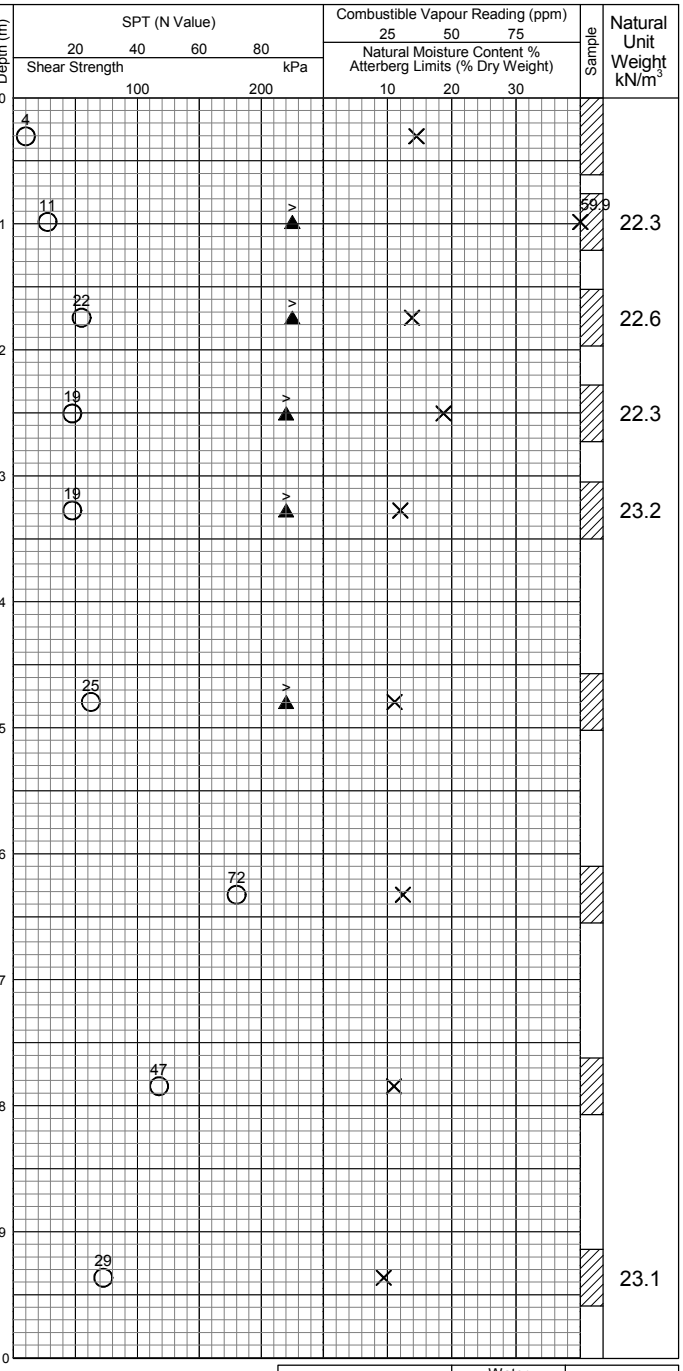
Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~230 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized seams and fissures, moist, hard.	303.35
Becoming grey, shale fragments, wet.	~299.4
SAND AND GRAVEL: Clayey silt layers, brown, moist, very dense.	~297.8
SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, moist, dense.	~296.3
Becoming grey, compact.	~294.7



Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.73	11.89
May 15, 2017	10.14	
May 19, 2017	10.44	

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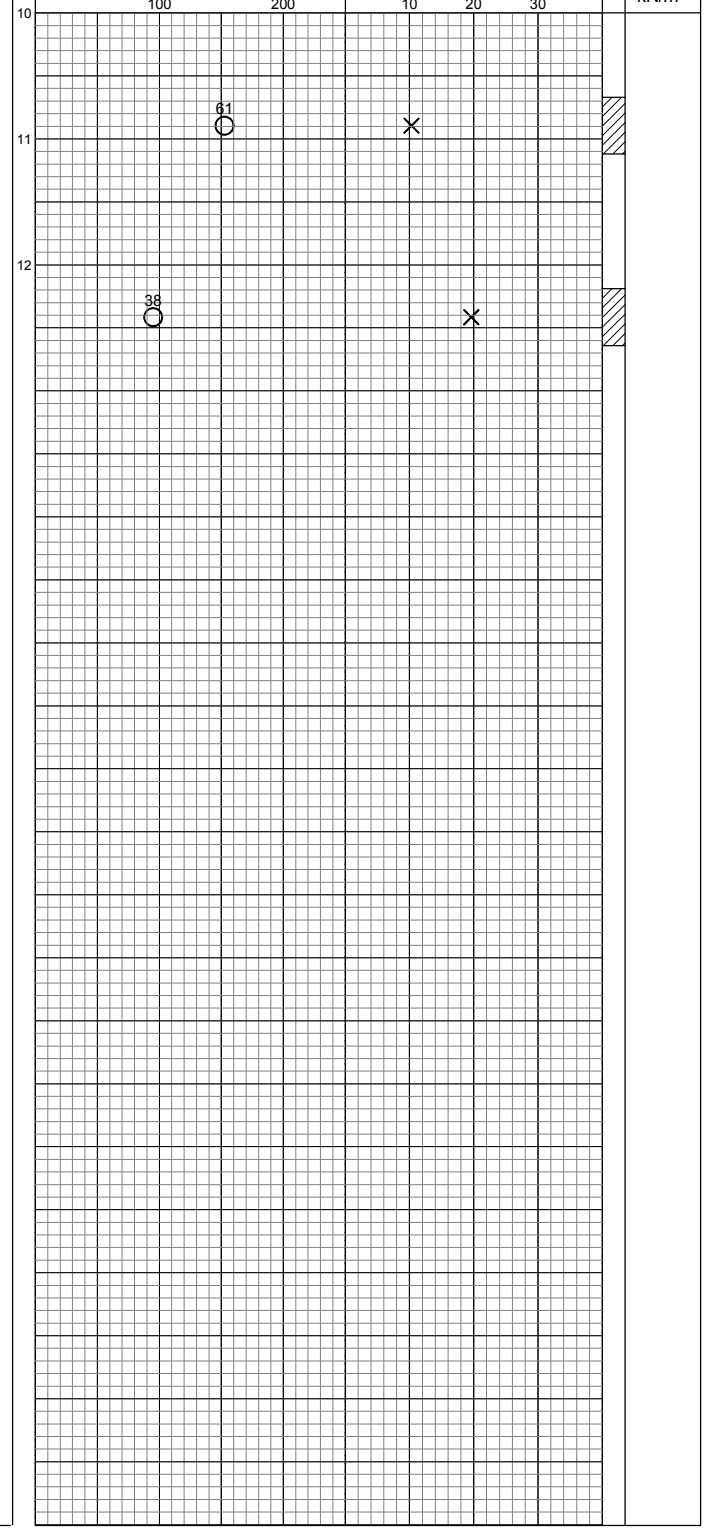
Log of Borehole 47D

Project No. BRM-00235186-D0 Drawing No. 48

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
			293.35
		SILTY SAND: Fine grained, brown, moist, very dense.	~293.3
		Becoming wet, dense.	~291.7
		END OF BOREHOLE.	~290.7



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.73	11.89
May 15, 2017	10.14	
May 19, 2017	10.44	

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Log of Borehole 47S

Project No. BRM-00235186-D0 | Drawing No. 48A

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 11, 2017

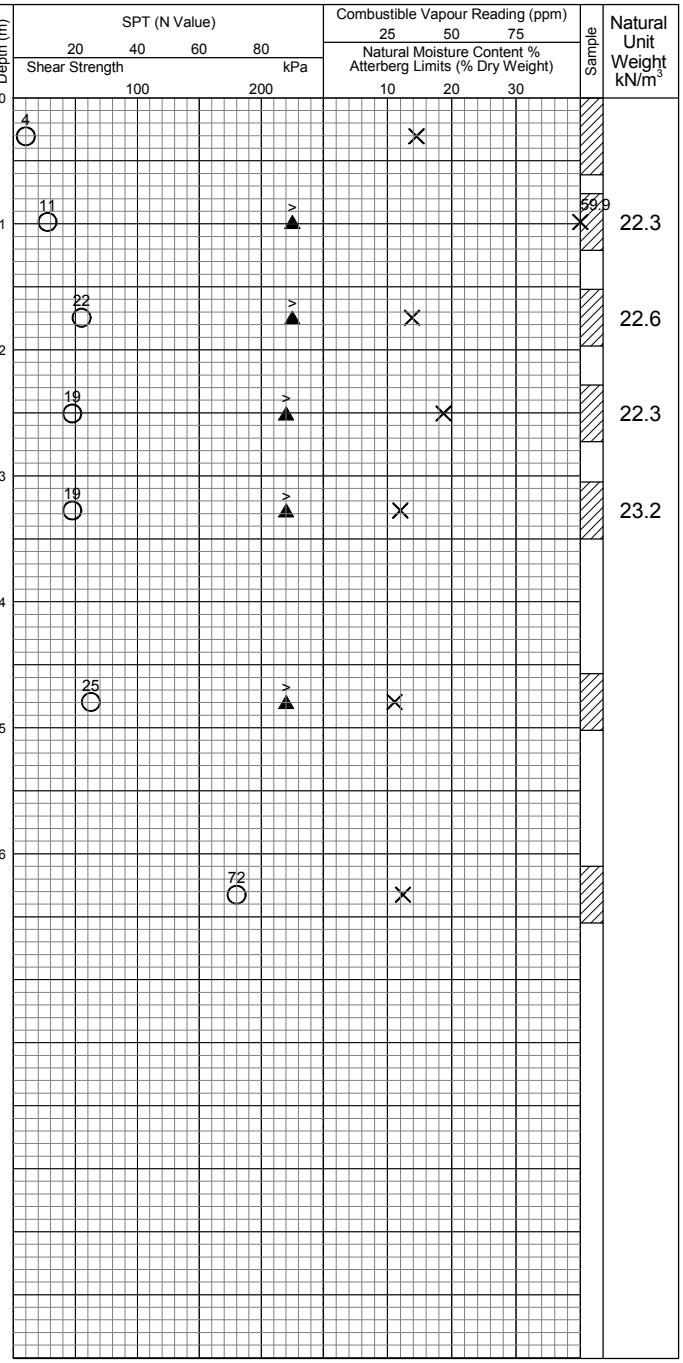
Drill Type: CME 55- Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~230 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized seams and fissures, moist, hard.	303.35
Becoming grey, shale fragments, wet.	~299.4
SAND AND GRAVEL: Clayey silt layers, brown, moist, very dense.	~297.8
END OF BOREHOLE.	~296.8



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 15, 2017	3.93	
May 19, 2017	4.37	

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Log of Borehole 49

Project No. BRM-00235186-D0 | Drawing No. 50

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~330 mm Topsoil over **FILL:** Clayey silt to sandy silt, trace gravel, brown, wet.	306.06
		CLAYEY SILT TILL: Fine sand seams, trace gravel, occasional gravel pockets, brown, moist, firm to very stiff.	~304.7
		SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, compact.	~302.0
		SILTY SAND: Medium grained, widely scattered gravel, brown, moist, very dense.	~299.9
		END OF BOREHOLE.	~299.5

Depth (m) 0 1 2 3 4 5 6

SPT (N Value) 20 40 60 80
Shear Strength 100 200 kPa

SPT N values: 5, 4, 4, 4, 11, 23, 91

Combustible Vapour Reading (ppm) 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample

Natural Unit Weight kN/m³

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.74	2.89

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Log of Borehole 50

Project No. BRM-00235186-D0 | Drawing No. 51

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

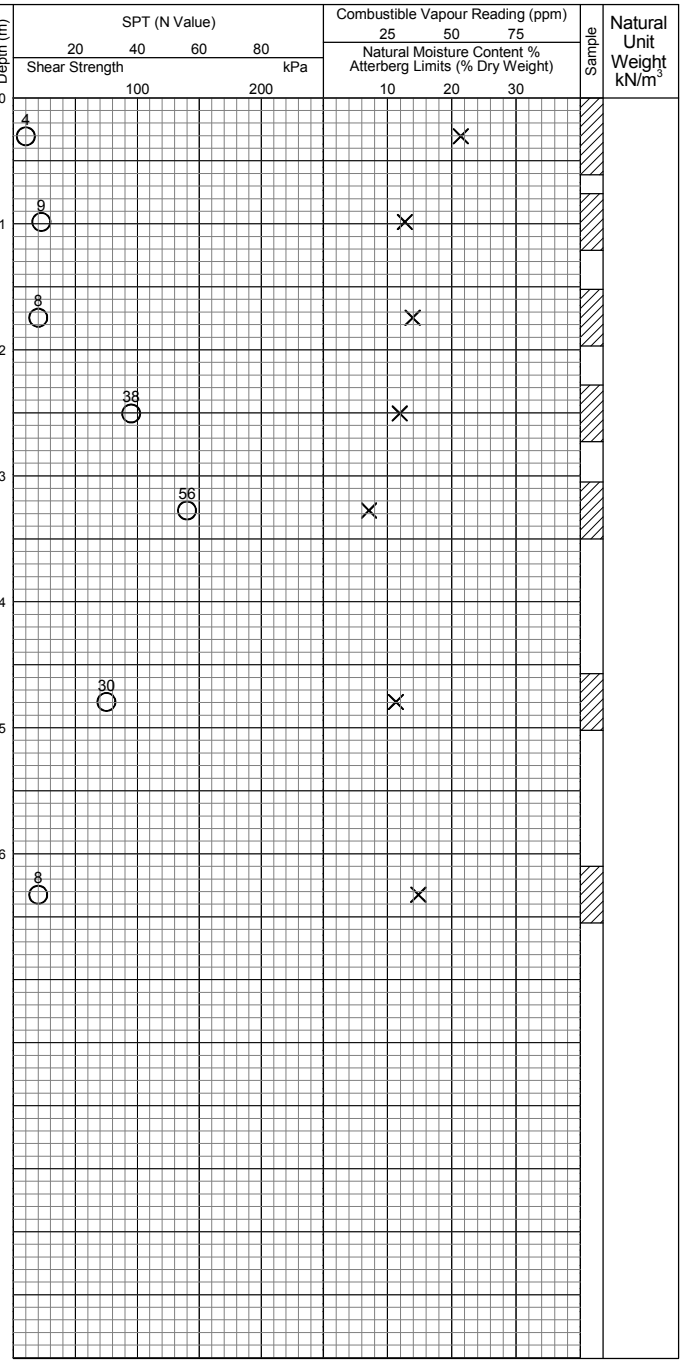
Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~150 mm Topsoil over **FILL:** Sandy silt to clayey silt, trace gravel, brown to dark brown, moist.	309.19
		SANDY SILT TILL: Fine sand seams, trace gravel, sand and gravel layer, brown, moist, loose.	~308.2
		SILTY SAND: Fine grained, widely scattered gravel, brown, moist, dense to very dense.	~307.1
		Increased silt content, becoming wet, loose.	~303.6
		END OF BOREHOLE.	~302.6



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.72

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Log of Borehole 51D

Project No. BRM-00235186-D0 | Drawing No. 52

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 15, 2017

Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
FILL: Sandy silt to clayey silt, trace gravel, brown to dark brown, topsoil stained pockets, moist.	310.01	0	4			
		1	4			20.8
		2	5			
	~307.8					
SILTY SAND: Fine grained, silt seams and layers, brown, moist, compact to dense.		2	25			
		3	38			
		4				
		5	33			
	~304.4					
Becoming wet, increased silt content.		6	32			
		7				
		8	39			
		9				
		10	25			

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

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Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.73	12.19
May 17, 2017	9.53	
May 19, 2017	9.45	

Log of Borehole 51D

Project No. BRM-00235186-D0 Drawing No. 52

Project: Geotechnical Investigation Sheet No. 2 of 2

Soil Description	ELEV. m
	300.01
	~299.8
SANDY SILT TILL: Silt seams, trace gravel, brown, moist, very dense.	
	~297.7
END OF BOREHOLE.	

Depth (m): 10, 11, 12

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

60 for 100mm

60 for 100mm

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10 20 30

Sample

Natural Unit Weight kN/m³

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	11.73	12.19
May 17, 2017	9.53	
May 19, 2017	9.45	

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Log of Borehole 51S

Project No. BRM-00235186-D0 | Drawing No. 52A

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 15, 2017

Drill Type: CME 55-Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		FILL: Sandy silt to clayey silt, trace gravel, brown to dark brown, topsoil stained pockets, moist.	310.01	0	4	×		
				1	4	×		20.8
				2	5	×		
		SILTY SAND: Fine grained, silt seams and layers, brown, moist, compact to dense.	~307.8		25	×		
				3	38	×		
				4				
				5	33	×		
		Becoming wet, increased silt content.	~304.4					
				6	32	×		
		END OF BOREHOLE.	~303.5					

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 17, 2017	5.87	
May 19, 2017	5.87	

exp.

Log of Borehole 52

Project No. BRM-00235186-D0 | Drawing No. 53

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 12, 2017

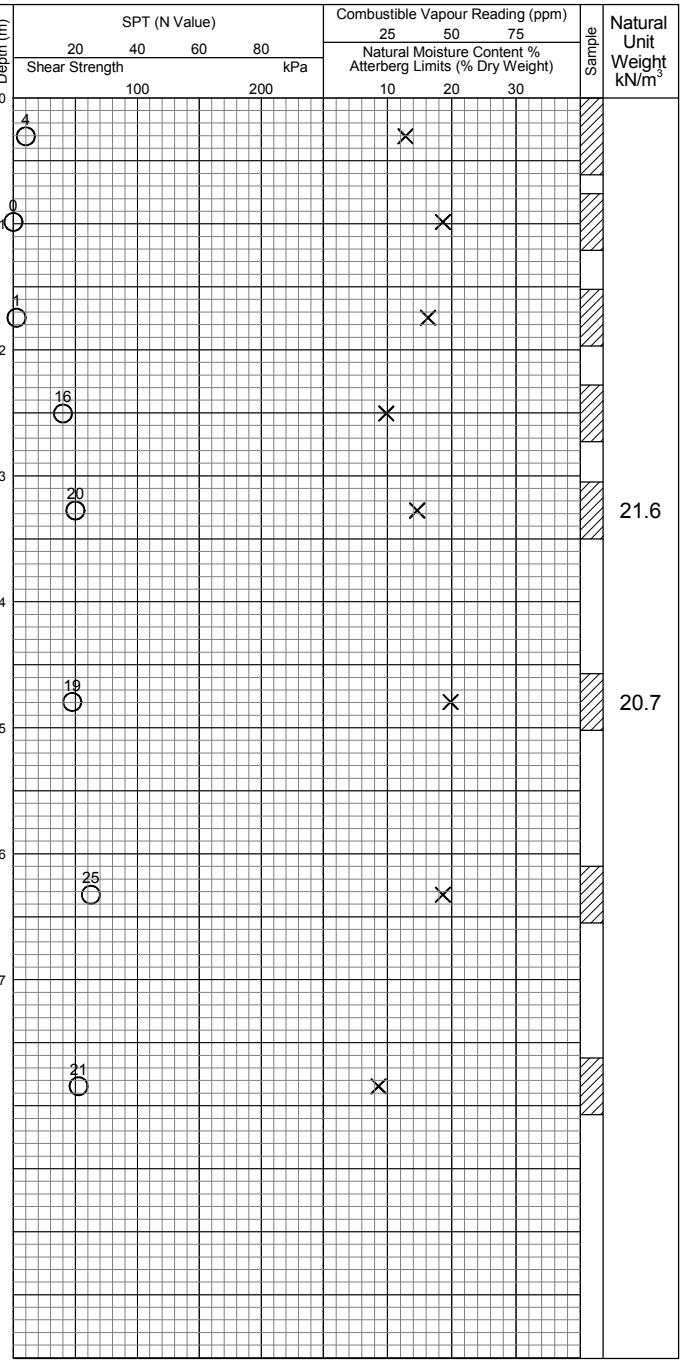
Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~150 mm Topsoil over **FILL:** Silty sand, trace gravel, trace clay, brown, wet.	310.64
SANDY SILT TILL: Fine sand seams, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, compact.	~308.4
SILTY SAND: Fine grained, stratified, brown, wet, compact.	~306.6
END OF BOREHOLE.	~302.5



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	6.25	6.25

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 53

Project No. BRM-00235186-D0 | Drawing No. 54

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 12, 2017

Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~100 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, brown, moist, loose.	310.73	0	4		
		1	6		22.3
		2	6		21.7
	~308.6				
SILTY SAND: Fine grained, cemented zones, brown, moist, compact.		2	24		
		3	18		
Becoming wet, increased silt content.	~306.6	4			
		5	13		19.7
Becoming dense.	~305.1	6			
		6	31		
	~303.5	7			
SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, brown, wet, compact.		8	15		21.4
Becoming moist, very dense.	~302.1				
	~301.5	9	50 for 80mm		22.1
END OF BOREHOLE.					

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	7.32

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Log of Borehole 54

Project No. BRM-00235186-D0 | Drawing No. 55

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 12, 2017

Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~180 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, brown, moist to wet, compact.	311.23	21.7
SILTY SAND: Fine grained, brown, moist, dense.	~309.0	
SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, moist, dense to very dense.	~307.2	23.1
Wet sand layer.	~304.9	22.8

SPT (N Value): 20 40 60 80 — Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

SPT values: 3, 11, 12, 35, 40, 61, 41, 50 for 130mm, 50 for 100mm

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.69	5.79

Log of Borehole 54

Project No. BRM-00235186-D0 Drawing No. 55

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
			301.23	10				
			~300.4		50 for 80mm			
		END OF BOREHOLE.						

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	5.69	5.79

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Log of Borehole 55

Project No. BRM-00235186-D0 | Drawing No. 56

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 12, 2017

Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
SILTY SAND: Fine grained, brown, moist, loose to compact.	309.13	0	5		
		1	9		
Becoming wet, cemented.	~307.7	2	13, 16		
		3	19		
SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, compact to very dense.	~305.0	4			
		5	19		21.9
		6	34		22.2
		7	56 for 230mm		22.0
END OF BOREHOLE.	~301.3				

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	3.81	4.27

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Log of Borehole 56

Project No. BRM-00235186-D0 | Drawing No. 57

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

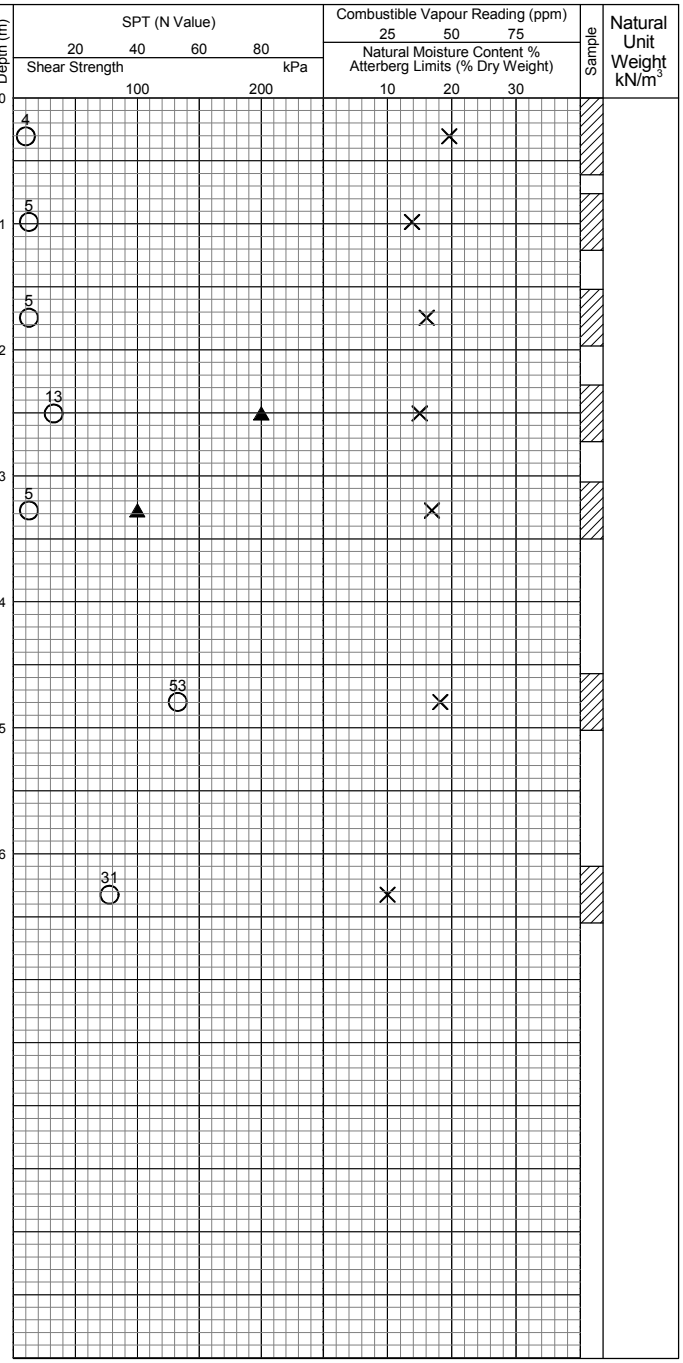
Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m
~200 mm Topsoil over **FILL:** Clayey silt, trace sand, trace gravel, brown, wet.	305.93
	~303.8
CLAYEY SILT TILL: Fine sand seams, trace gravel, brown, moist, very stiff changing to firm.	
	~301.9
SANDY SILT TILL: Fine sand seams, trace gravel, brown, wet, very dense.	
	~300.3
SILTY SAND: Fine grained, brown, moist, dense.	
	~299.3
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.94
May 15, 2017	Dry	
May 19, 2017	Dry	

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Log of Borehole 57

Project No. BRM-00235186-D0 | Drawing No. 58

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

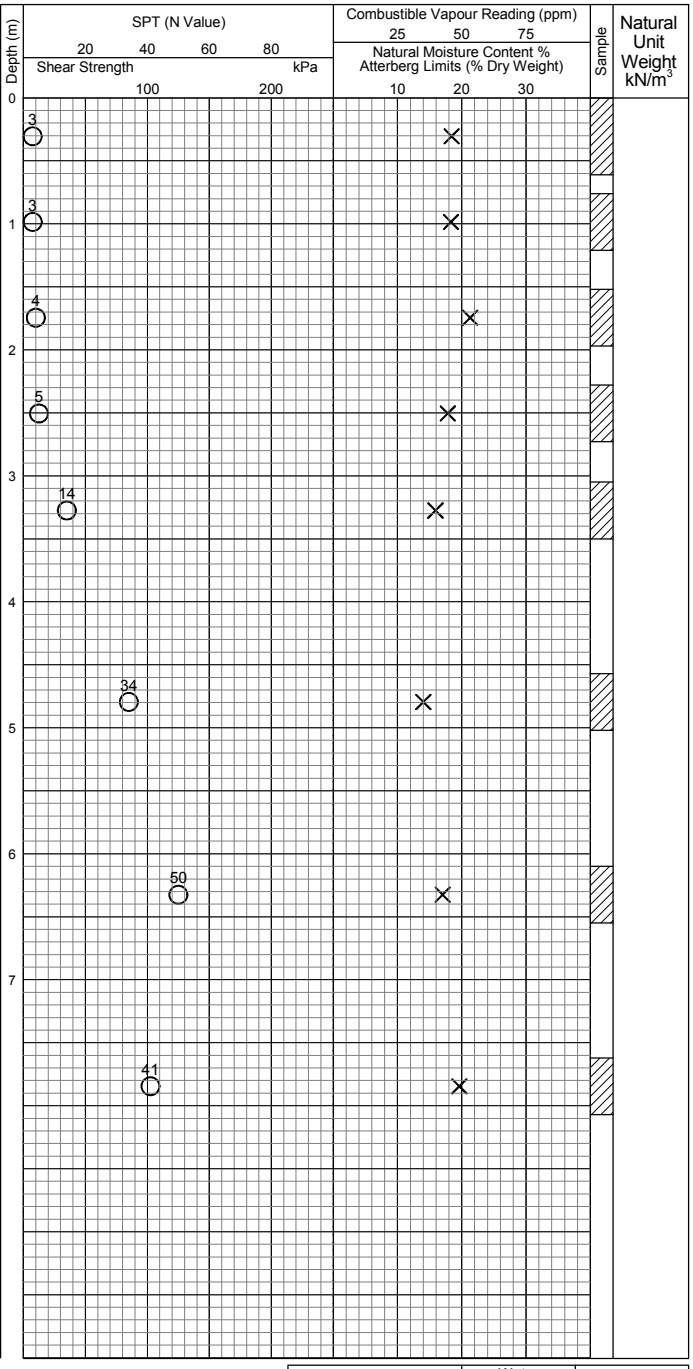
Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~180 mm Topsoil over **FILL:** Clayey silt, trace sand, trace gravel, brown to dark brown, wet.	308.31
	~306.2
CLAYEY SILT TILL: Fine sand seams, trace gravel, brown, moist, stiff to hard.	
	~302.7
SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, wet, dense to very dense.	
	~300.2
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	2.44	2.44

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Log of Borehole 58

Project No. BRM-00235186-D0 | Drawing No. 59

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 8, 2017

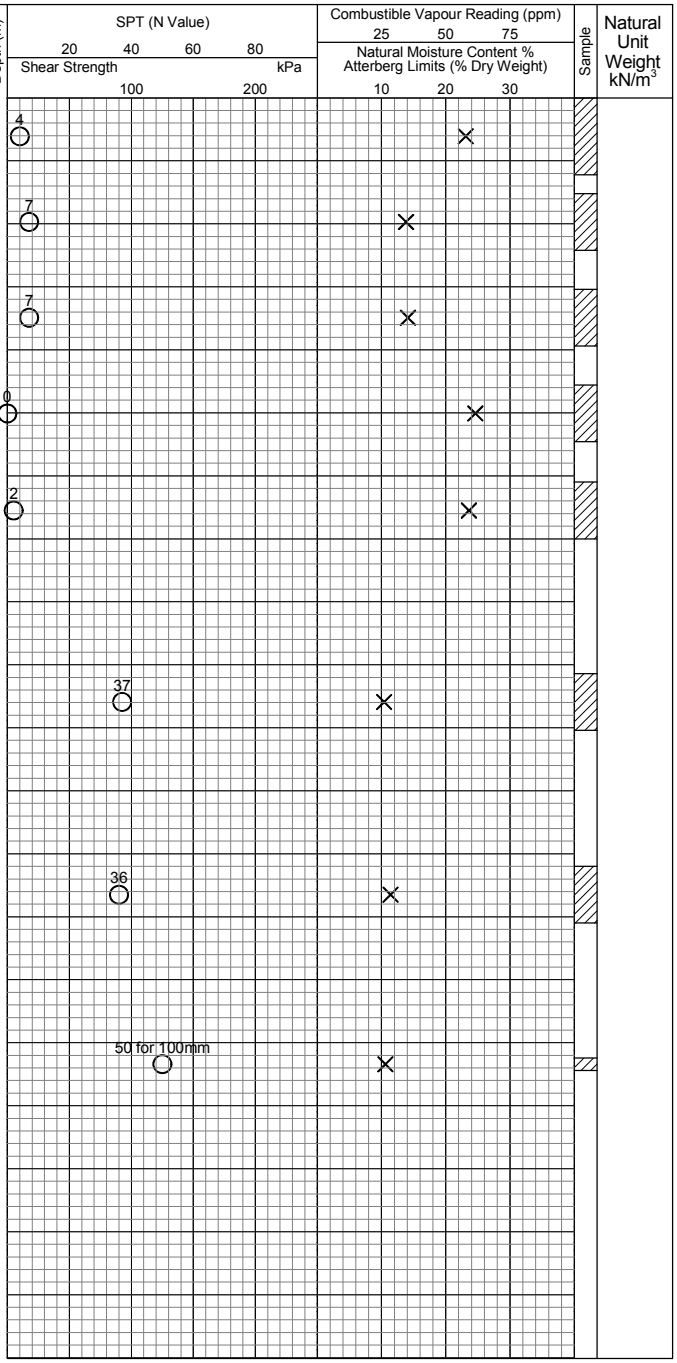
Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test ——
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m
		~180 mm Topsoil over	308.38
		FILL: Sandy silt to clayey silt, trace gravel, brown, moist.	
		Becoming mainly sandy silt, trace gravel, brown, wet.	~306.2
		SILTY SAND: Fine grained, brown, moist, dense.	~304.3
		SANDY SILT TILL: Fine sand seams, trace gravel, trace clay, brown, moist, dense.	~302.8
		SAND AND GRAVEL: Brown, wet, very dense.	~301.3
		END OF BOREHOLE.	~300.7



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	1.98	2.59

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Log of Borehole 59

Project No. BRM-00235186-D0 | Drawing No. 60

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 10, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~150 mm Topsoil over **SANDY SILT TILL:** Fine sand seams and layers, trace gravel, trace clay, occasional boulder fragments, brown, moist, compact to dense.	309.42	0	6		
		1	14		22.3
		2	11		22.3
			43		21.8
	~306.2	3	40		
SILTY SAND: Fine grained, sandy silt layers, cemented zones, widely scattered gravel, brown, moist, dense.		4			
		5	43		
		6			
			43		
		7			
		8	45		22.0
		9			
		10	34		

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	18.29
May 15, 2017	Dry	
May 19, 2017	Dry	

Log of Borehole 59

Project No. BRM-00235186-D0 Drawing No. 60

Project: Geotechnical Investigation Sheet No. 2 of 2

Soil Description	ELEV. m
	299.42
Becoming wet, increased silt content.	~293.2
Becoming compact.	~291.6
END OF BOREHOLE.	~290.6

SPT (N Value) 20 40 60 80 — Shear Strength 100 200 kPa

Combustible Vapour Reading (ppm) 25 50 75 — Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Natural Unit Weight kN/m^3: 20.6

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	18.29
May 15, 2017	Dry	
May 19, 2017	Dry	

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Log of Borehole 60

Project No. BRM-00235186-D0 | Drawing No. 61

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 16, 2017

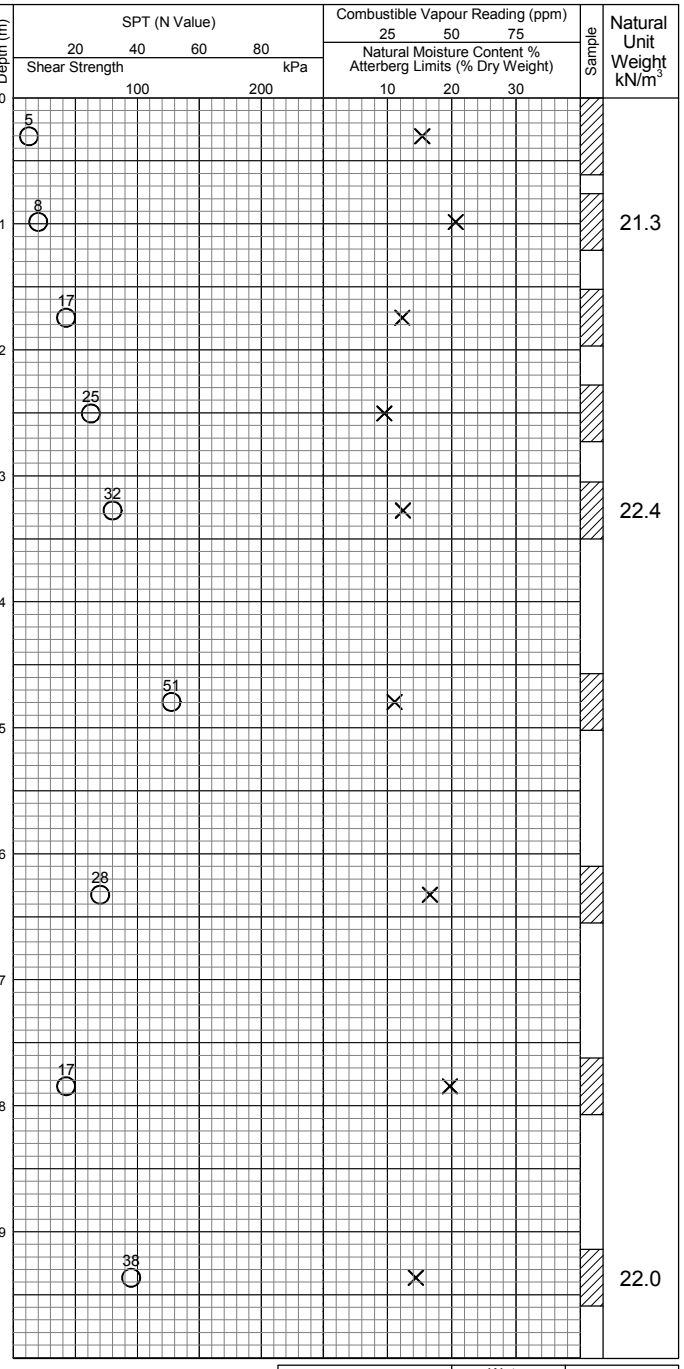
Drill Type: CME-55 Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~150 mm Topsoil over **FILL:** Sandy silt, sand pockets, trace clay, brown, wet.	309.97
SANDY SILT TILL: Fine sand seams and layers, trace gravel, occasional boulder fragments, brown, oxidized pockets, moist, compact to dense.	~308.6
SILTY SAND: Fine grained, silt seams and layers, brown, wet, compact.	~305.2
SANDY SILT TILL: Fine sand seams, trace gravel, brown, moist, dense.	~301.3
END OF BOREHOLE.	~300.4



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	8.23	8.84

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Log of Borehole 61

Project No. BRM-00235186-D0 | Drawing No. 62

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 16, 2017

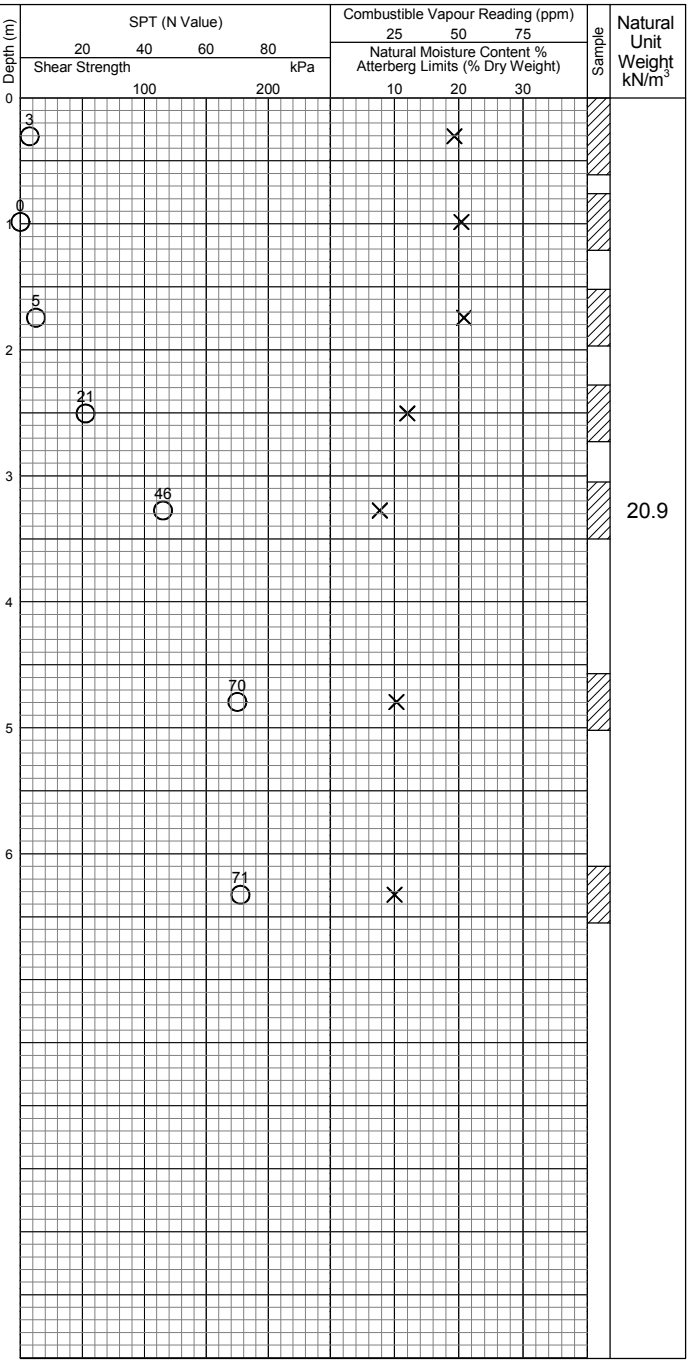
Drill Type: CME 55-Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit |—○—|
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m
~75 mm Topsoil over **FILL:** Silty sand, trace clay, dark brown, wet.	306.60
	~304.7
SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, moist, compact.	
	~303.7
SILTY SAND: Fine grained, cemented zones, silt seams and layers, brown, moist, dense to very dense.	
	~300.0
END OF BOREHOLE.	



Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.99
May 17, 2017	Dry	
May 19, 2017	Dry	

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Log of Borehole 62

Project No. BRM-00235186-D0 | Drawing No. 63

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 16, 2017

Drill Type: CME 55- Rubber Track

Datum: Geodetic

Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit ⊢○

Shelby Tube ■ | Undrained Triaxial at % Strain at Failure ⊕

Field Vane Test S | Penetrometer ▲

Soil Description	ELEV. m	Sample	Natural Unit Weight kN/m³
~200 mm Topsoil over **SILTY SAND:** Fine grained, silt layers, brown, wet, compact.	307.21		
SANDY SILT TILL: Fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, dense to very dense.	~303.2		
SILTY SAND: Fine grained, cemented zones, brown, moist, very dense.	~300.1		22.4
	~297.6		22.4
END OF BOREHOLE.			

Depth (m): 0 1 2 3 4 5 6 7 8 9

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

SPT values: 3, 11, 13, 19, 14, 31, 78, 75 for 250mm, 79

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	3.05

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Log of Borehole 63

Project No. BRM-00235186-D0 | Drawing No. 64

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 17, 2017

Drill Type: CME 55-Rubber Track

Datum: Geodetic

Auger Sample | SPT (N) Value | Dynamic Cone Test | Shelby Tube | Field Vane Test (S)

Combustible Vapour Reading | Natural Moisture | Plastic and Liquid Limit | Undrained Triaxial at % Strain at Failure | Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~130 mm Topsoil over **SANDY SILT TILL:** Fine sand seams and layers, trace gravel, brown, moist, compact to very dense.	312.56	
		22.6
		22.5
		22.9
	~307.0	
SILTY SAND: Fine grained, silt seams and layers, widely scattered gravel, brown, moist to compact.		
Becoming wet, dense.	~305.5	
	~304.0	
SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, moist, dense to very dense.		
		22.3

Depth (m): 0 1 2 3 4 5 6 7 8 9 10

SPT (N Value): 20 40 60 80

Shear Strength: 100 200 kPa

Combustible Vapour Reading (ppm): 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5, 16, 17, 19, 35, 81, 21, 45, 30

Sample

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	10.61

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Log of Borehole 63

Project No. BRM-00235186-D0 Drawing No. 64

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
			302.56	0
				10
			~301.8	
		END OF BOREHOLE.		

SPT (N Value) 20 40 60 80

Shear Strength kPa 100 200

50 for 100mm

Combustible Vapour Reading (ppm) 25 50 75

Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30

Sample	Natural Unit Weight kN/m^3
	22.7

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	10.61

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Log of Borehole 64D

Project No. BRM-00235186-D0 | Drawing No. 65

Project: Geotechnical Investigation | Sheet No. 1 of 2

Location: Airport Road and Cranston Drive

Date Drilled: May 17, 2017

Drill Type: CME 55-Rubber Track

Datum: Geodetic

Auger Sample ☒
SPT (N) Value ○ ▨
Dynamic Cone Test —
Shelby Tube ■
Field Vane Test ✚ S

Combustible Vapour Reading □
Natural Moisture ×
Plastic and Liquid Limit ⊢○
Undrained Triaxial at % Strain at Failure ⊕
Penetrometer ▲

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, moist, compact.	312.27	0	5		
		1	14		22.3
		2	14		22.6
		2	17		
		3	18		22.6
Becoming very dense.	~308.3	4			
		5	54		22.8
		6	92 for 280mm		21.2
SILTY SAND: Fine grained, silt seams and layers, brown, wet, compact.	~305.3	7			
		8	21		
SANDY SILT TILL: Fine sand seams and layers, trace gravel, brown, moist, compact to very dense.	~303.7	9			
		9	16		22.3
		10			

Continued Next Page

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	12.19
May 19, 2017	12.05	

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Log of Borehole 64D

Project No. BRM-00235186-D0 Drawing No. 65

Project: Geotechnical Investigation Sheet No. 2 of 2

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)
			302.27	10
				11
				12
			~300.0	
		END OF BOREHOLE.		

SPT (N Value)
20 40 60 80
Shear Strength kPa
100 200

84

50 for 80mm

Combustible Vapour Reading (ppm)
25 50 75
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
10 20 30

Sample

Natural Unit Weight kN/m^3

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	12.19
May 19, 2017	12.05	

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Log of Borehole 64S

Project No. BRM-00235186-D0 | Drawing No. 65A

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 17, 2017

Drill Type: CME 55-Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
~300 mm Topsoil over **SANDY SILT TILL:** Fine sand seams, trace gravel, trace clay, occasional boulder fragments, brown, moist, compact.	312.27	0	5		
		1	14		22.3
		2	14		22.6
		2	17		
		3	18		22.6
Becoming very dense.	~308.3	4			
		5	54		22.8
		6	92 for 280mm		21.2
END OF BOREHOLE.	~305.9				

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	6.10
May 19, 2017	Dry	

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 65

Project No. BRM-00235186-D0 | Drawing No. 66

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 11, 2017

Drill Type: CME 55 - Rubber Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
~165 mm Topsoil over **FILL:** Clayey silt, trace gravel, brown to dark brown, moist.	311.56	0	
		1	19.9
SANDY SILT TILL: Fine sand seams and layers, trace gravel, occasional boulder fragments, brown, moist, compact to dense.	~310.2	2	21.8
		3	22.8
	~307.6	4	22.7
SILTY SAND: Fine grained, brown, wet, dense.		5	
	~306.0	6	22.7
CLAYEY SILT TILL: Fine sand seams, trace gravel, brown, moist, hard.		7	
	~303.5		22.2
END OF BOREHOLE.			

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30

SPT values: 5, 5, 10, 31, 23, 37, 21, 39

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	8.53

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 66

Project No. BRM-00235186-D0 | Drawing No. 67

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 3, 2017

Drill Type: CME 55-Track

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~250 mm Topsoil over **CLAYEY SILT TILL:** Fine sand seams, trace gravel, occasional boulder fragments, brown, moist, hard.	283.48	
		21.7
		22.9
Becoming grey, very stiff.	~281.4	
Vane >50lb for 12"		22.5
CLAYEY SILT: Fine sand seams and layers, brown, wet, stiff.	~280.6	
END OF BOREHOLE.	~276.9	

SPT (N Value): 20 40 60 80
Shear Strength: 100 200 kPa
Combustible Vapour Reading (ppm): 25 50 75
Natural Moisture Content % Atterberg Limits (% Dry Weight): 10 20 30
Depth (m): 0 1 2 3 4 5 6

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	6.10	6.55
May 15, 2017	-0.6	
May 19, 2017	-0.6	

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Log of Borehole 67

Project No. BRM-00235186-D0 | Drawing No. 68

Project: Geotechnical Investigation | Sheet No. 1 of 1

Location: Airport Road and Cranston Drive

Date Drilled: May 10, 2017

Drill Type: CME 75-Marooka

Datum: Geodetic

Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Field Vane Test (S)

Combustible Vapour Reading
Natural Moisture
Plastic and Liquid Limit
Undrained Triaxial at % Strain at Failure
Penetrometer

Soil Description	ELEV. m	Natural Unit Weight kN/m³
~180 mm Topsoil over **CLAYEY SILT TILL:** Trace sand, trace gravel, brown, moist, stiff to very stiff.	296.43	
		21.4
		21.0
		22.7
		22.5
	~292.4	
SILTY SAND: Fine grained, silt seams, widely scattered gravel, brown, moist, compact.		
	~289.8	
END OF BOREHOLE.		

Depth (m): 0, 1, 2, 3, 4, 5, 6

SPT (N Value): 20, 40, 60, 80
Shear Strength kPa: 100, 200

Combustible Vapour Reading (ppm): 25, 50, 75
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 10, 20, 30

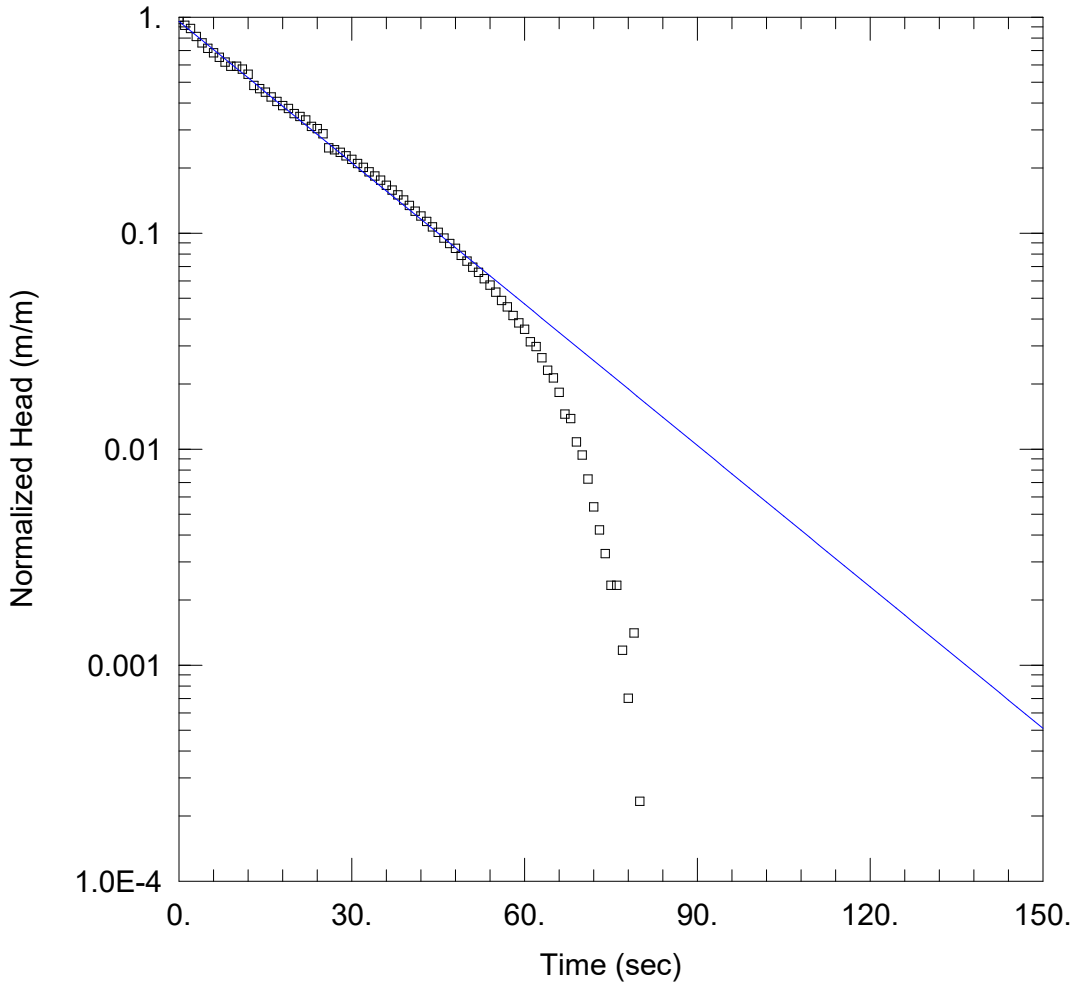
Sample

SPT values: 5, 6, 8, 11, 20, 17, 16

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Dry	5.69
May 15, 2017	Dry	
May 19, 2017	Dry	

EXPLOGBRAMPTON AIRPORT ROAD AND CRANSTON DRIVE GINT LOGS - COPY.GPJ NEW.GDT 5/6/17

Appendix C:
SWRT Procedures and Results



BH2 (FALLING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH2.aqt
Date: 06/06/17 Time: 14:07:57

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH2
Test Date: 2017/05/26

AQUIFER DATA

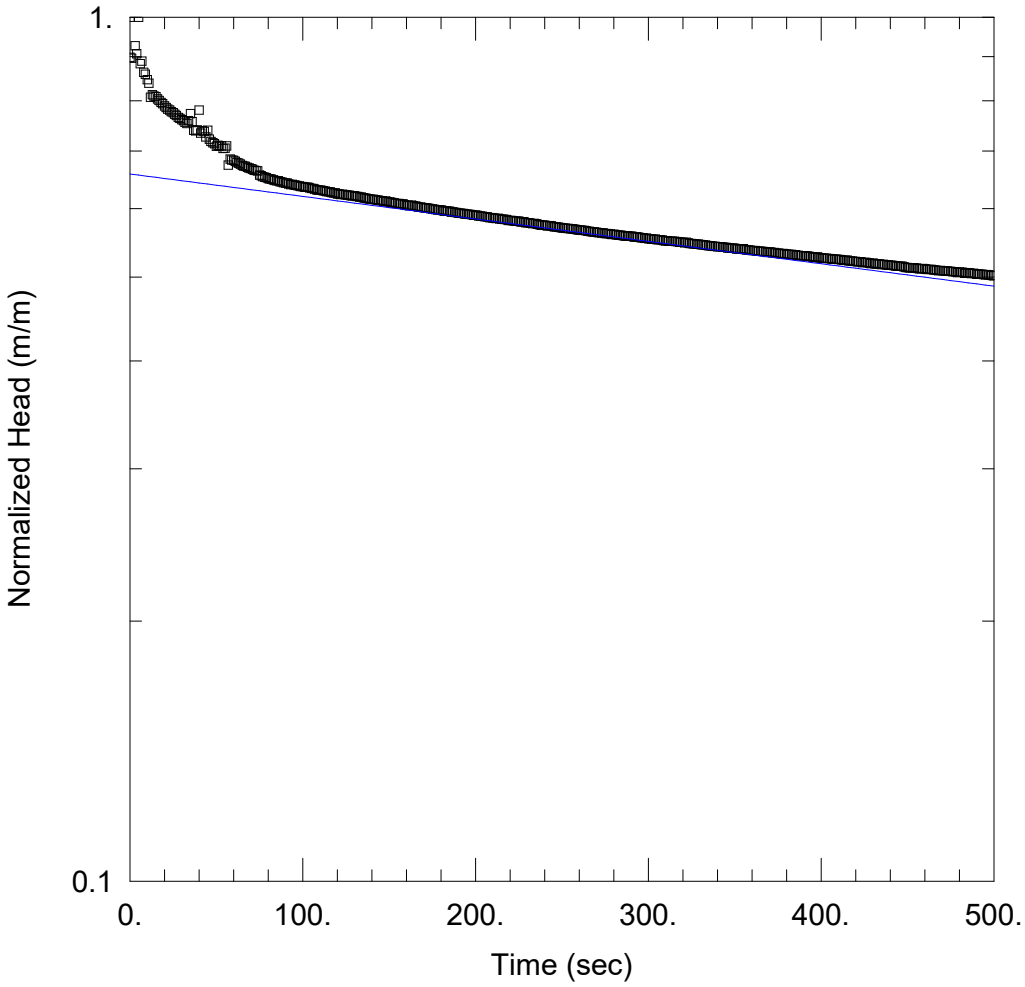
Saturated Thickness: 1.145 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH2)

Initial Displacement: 0.4263 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.145 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 7.5E-5 m/sec
y0 = 0.4076 m



BH6 (FALLING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH6.aqt
Date: 06/06/17 Time: 14:08:31

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH6
Test Date: 2017/05/26

AQUIFER DATA

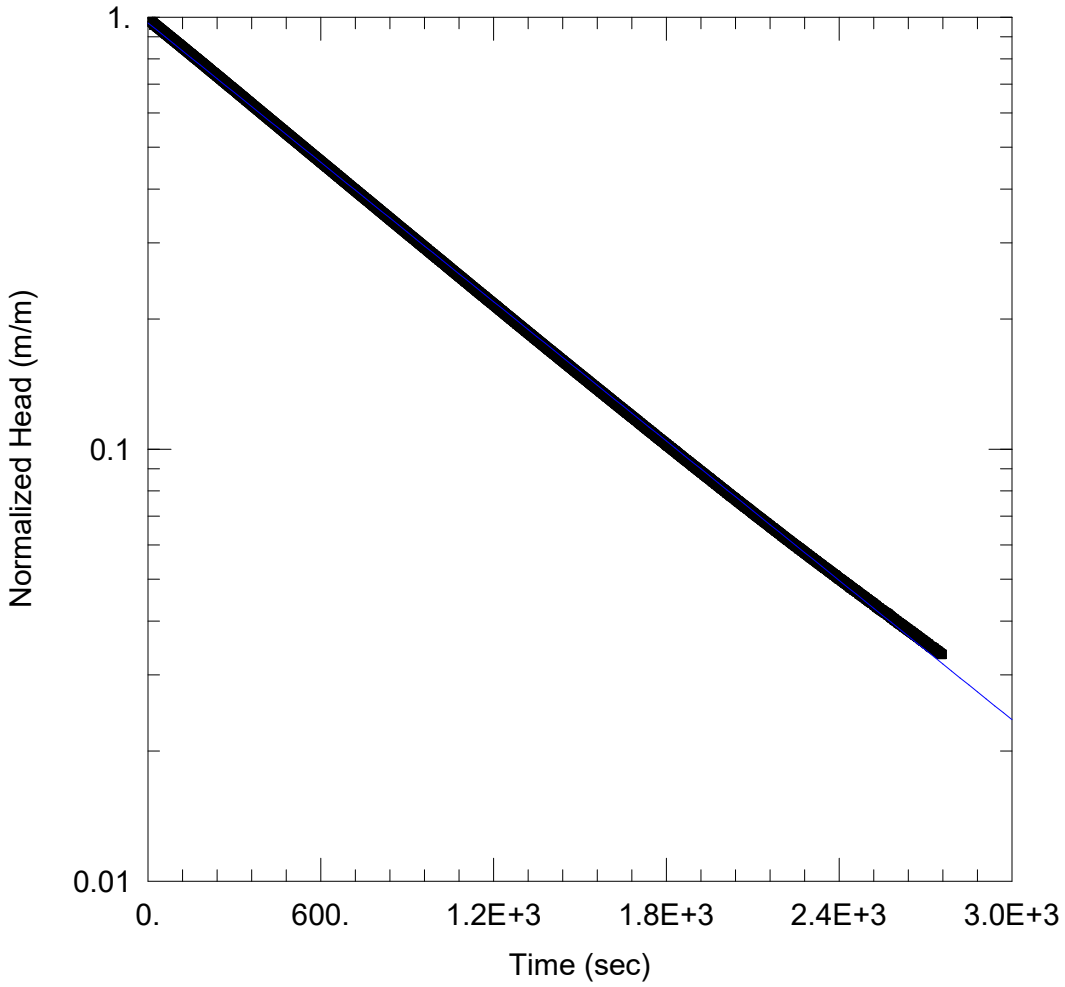
Saturated Thickness: 1.01 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH6)

Initial Displacement: 0.5207 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.01 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.012E-6 m/sec
y0 = 0.3428 m



BH7 (RISING HEAD TEST)

Data Set: I:\...\BH7.aqt
Date: 06/08/17 Time: 13:15:23

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH8-D
Test Date: 2017/05/26

AQUIFER DATA

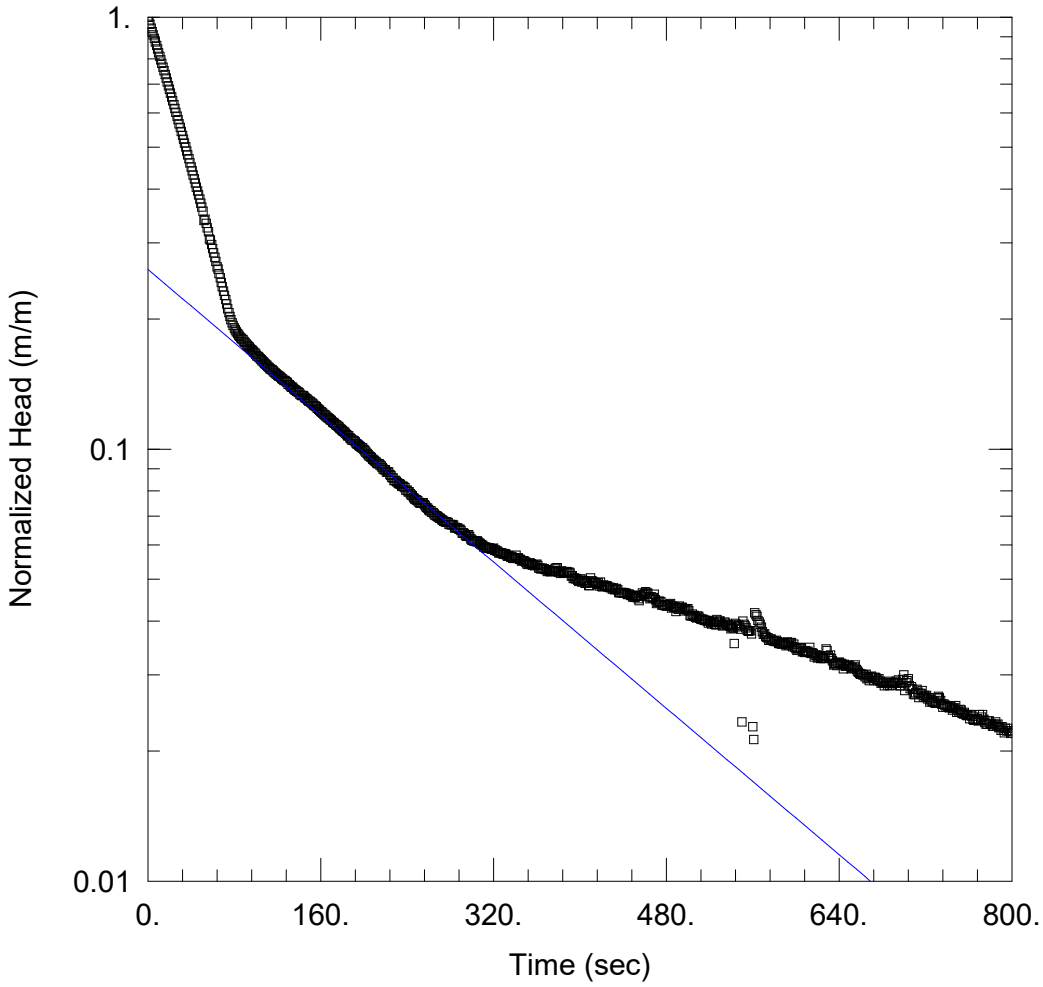
Saturated Thickness: 4.68 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH8-D)

Initial Displacement: 4.029 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.68 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 4.508E-7 m/sec
y0 = 3.906 m



BH8-D (RISING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH8-D.aqt
Date: 06/08/17 Time: 14:14:23

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH8-D
Test Date: 2017/05/26

AQUIFER DATA

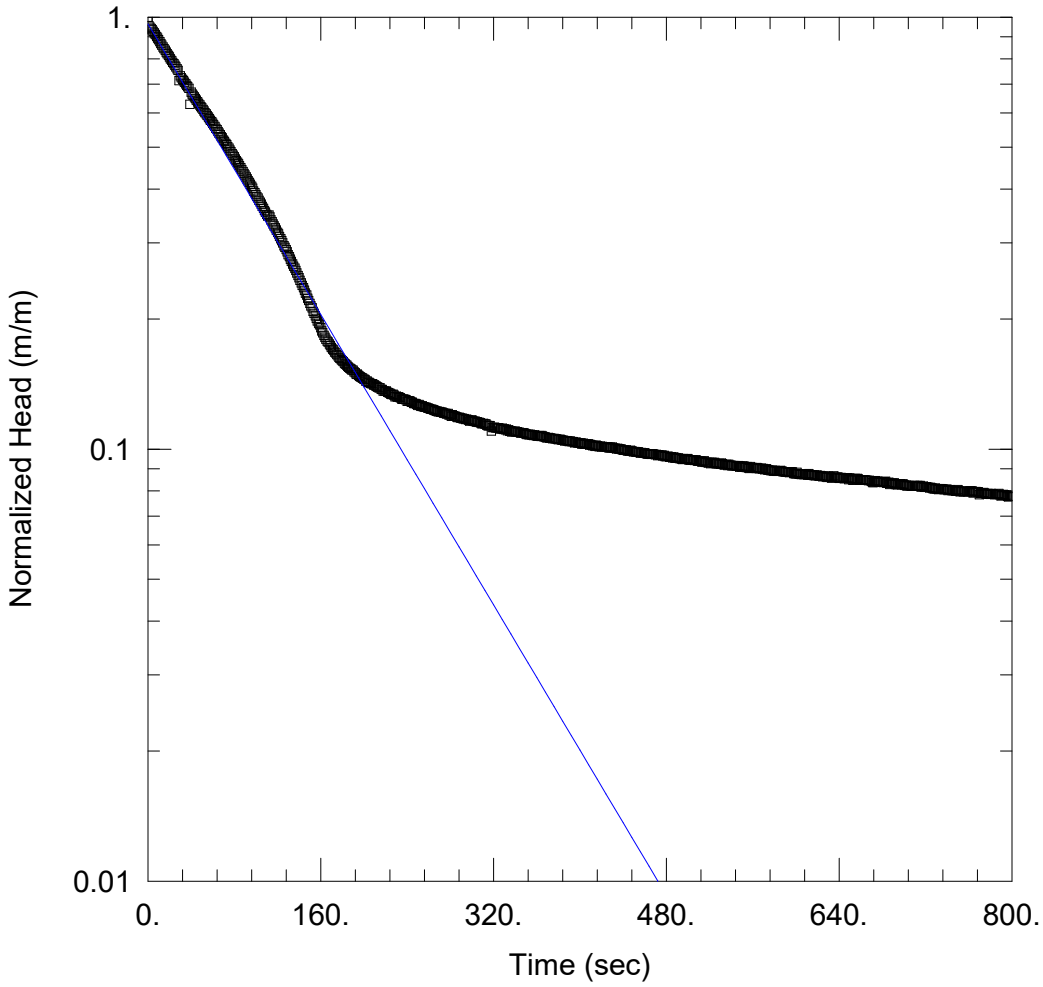
Saturated Thickness: 2.675 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH08-D)

Initial Displacement: 0.9927 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.675 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.113E-6 m/sec
y0 = 0.2586 m



BH18-D (RISING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH18-D.aqt
Date: 06/06/17 Time: 14:09:50

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH18-D
Test Date: 2017/05/26

AQUIFER DATA

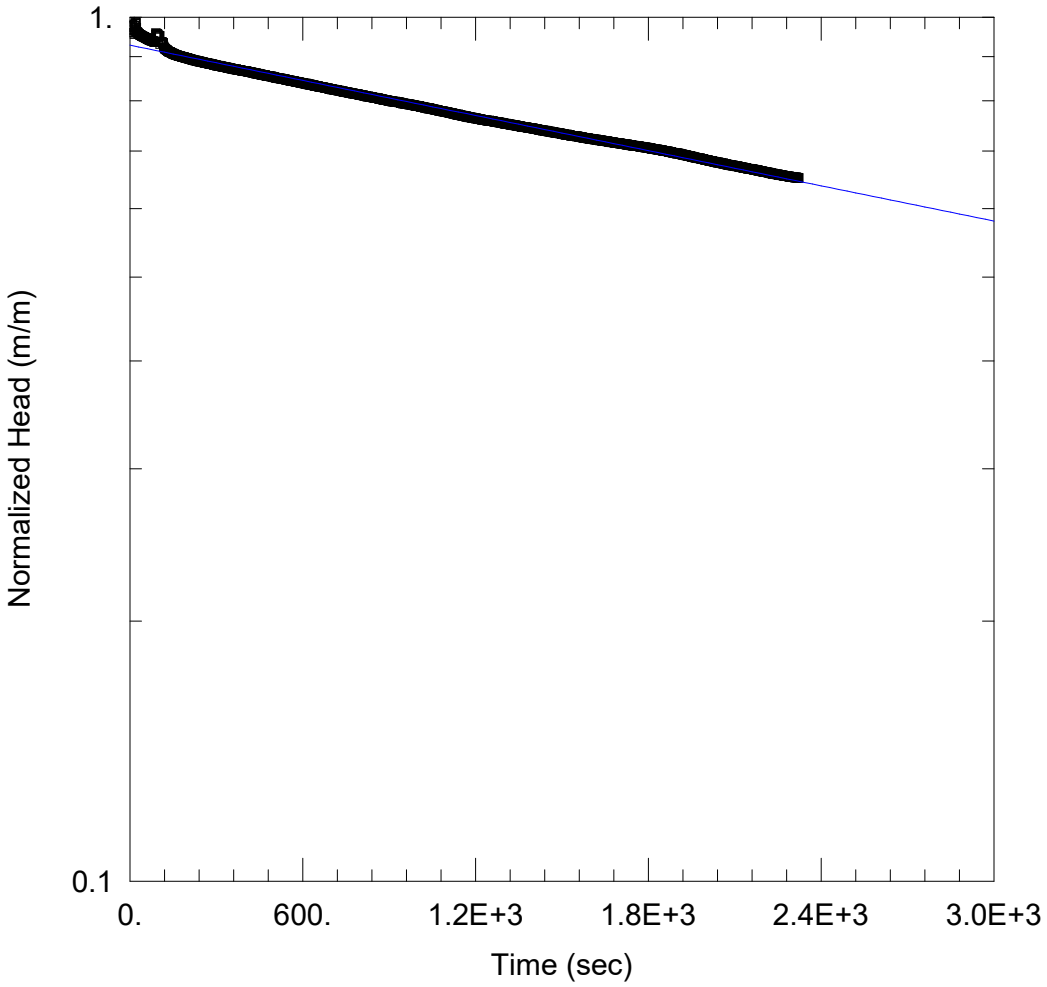
Saturated Thickness: 1.896 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH18-D)

Initial Displacement: 0.6057 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.896 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 8.723E-6 m/sec
y0 = 0.5838 m



BH20 (FALLING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH20.aqt
Date: 06/06/17 Time: 14:08:53

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH20
Test Date: 2017/05/26

AQUIFER DATA

Saturated Thickness: 1.157 m Anisotropy Ratio (Kz/Kr): 1.

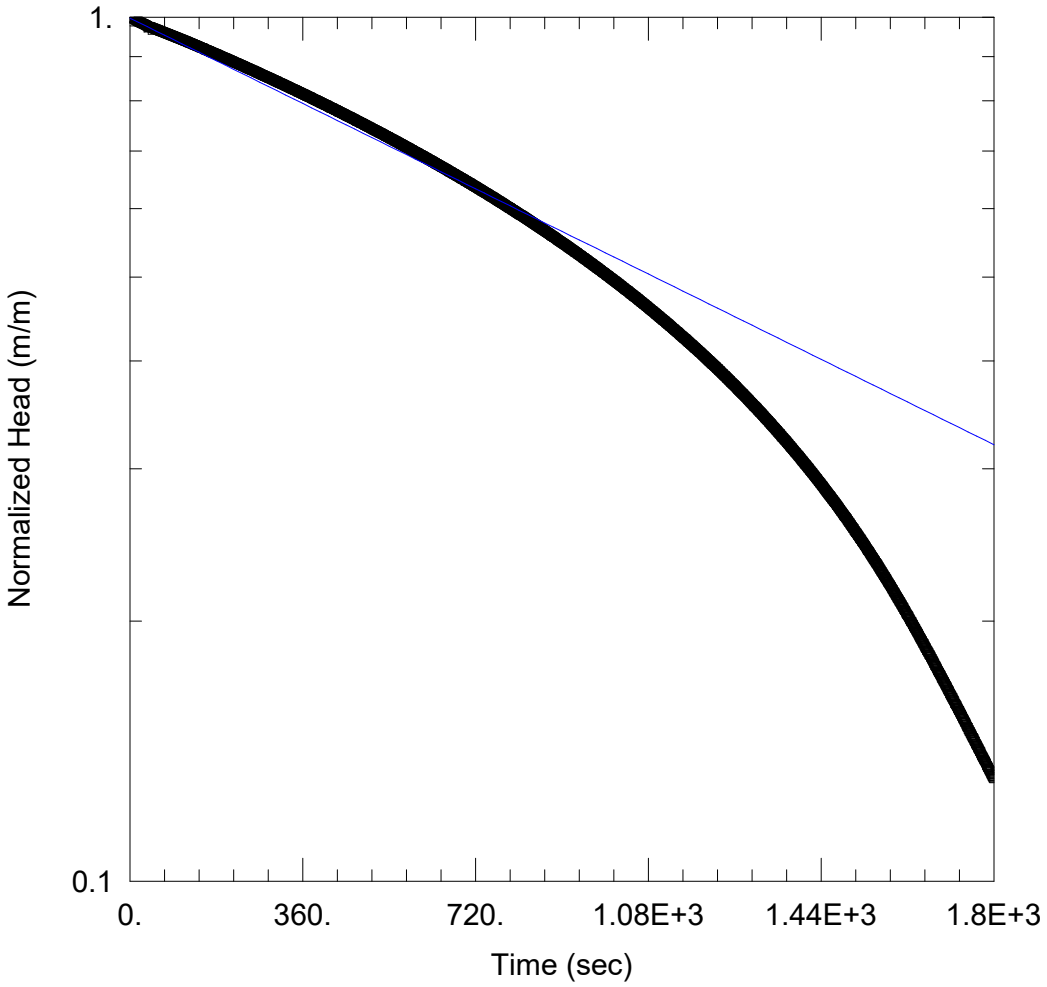
WELL DATA (BH20)

Initial Displacement: 0.579 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.157 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 2.308E-7 m/sec y0 = 0.5373 m



BH25 (RISING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH25.aqt
Date: 06/06/17 Time: 14:09:14

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH25
Test Date: 2017/05/26

AQUIFER DATA

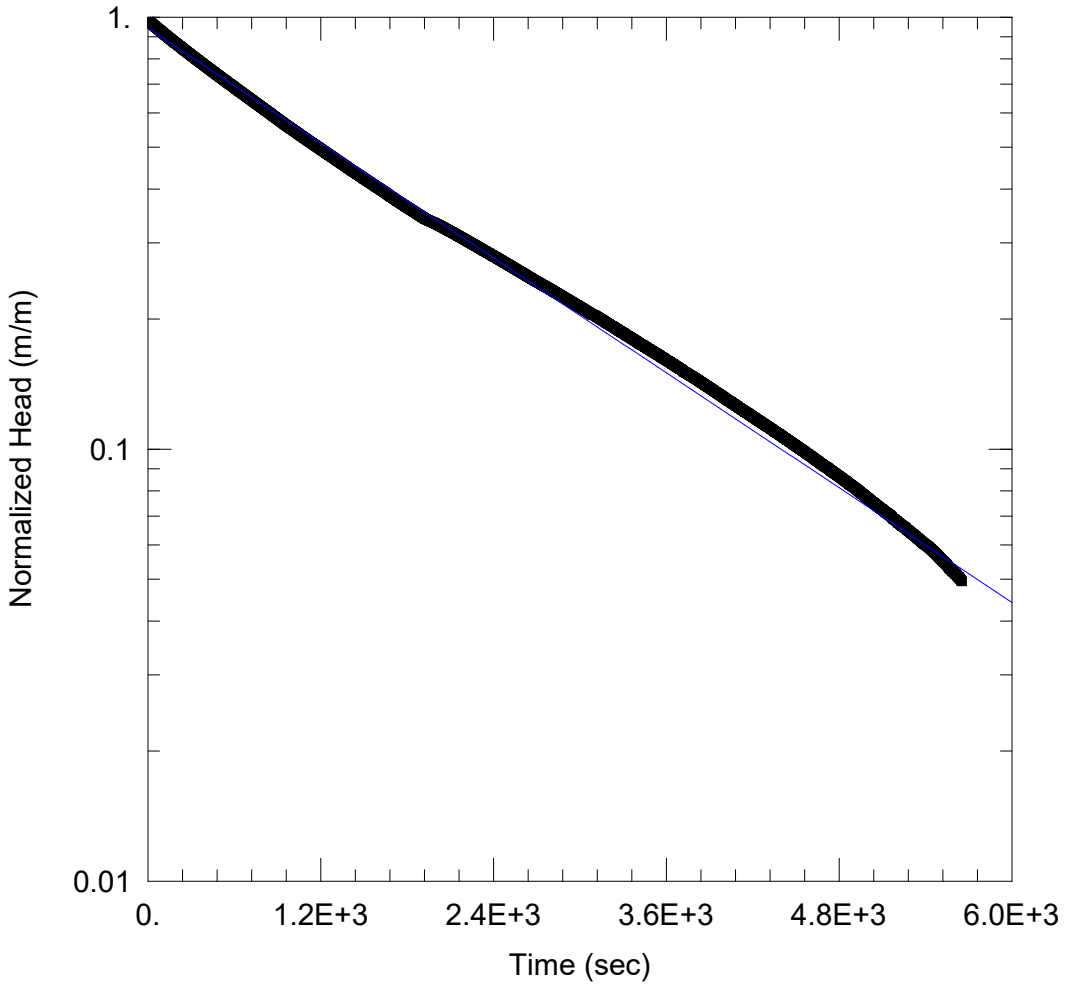
Saturated Thickness: 2.866 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH25)

Initial Displacement: 1.697 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.866 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.766E-7 m/sec
y0 = 1.692 m



BH47-D (FALLING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH47-D.aqt
Date: 06/06/17 Time: 11:12:28

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH47-D
Test Date: 2017/05/26

AQUIFER DATA

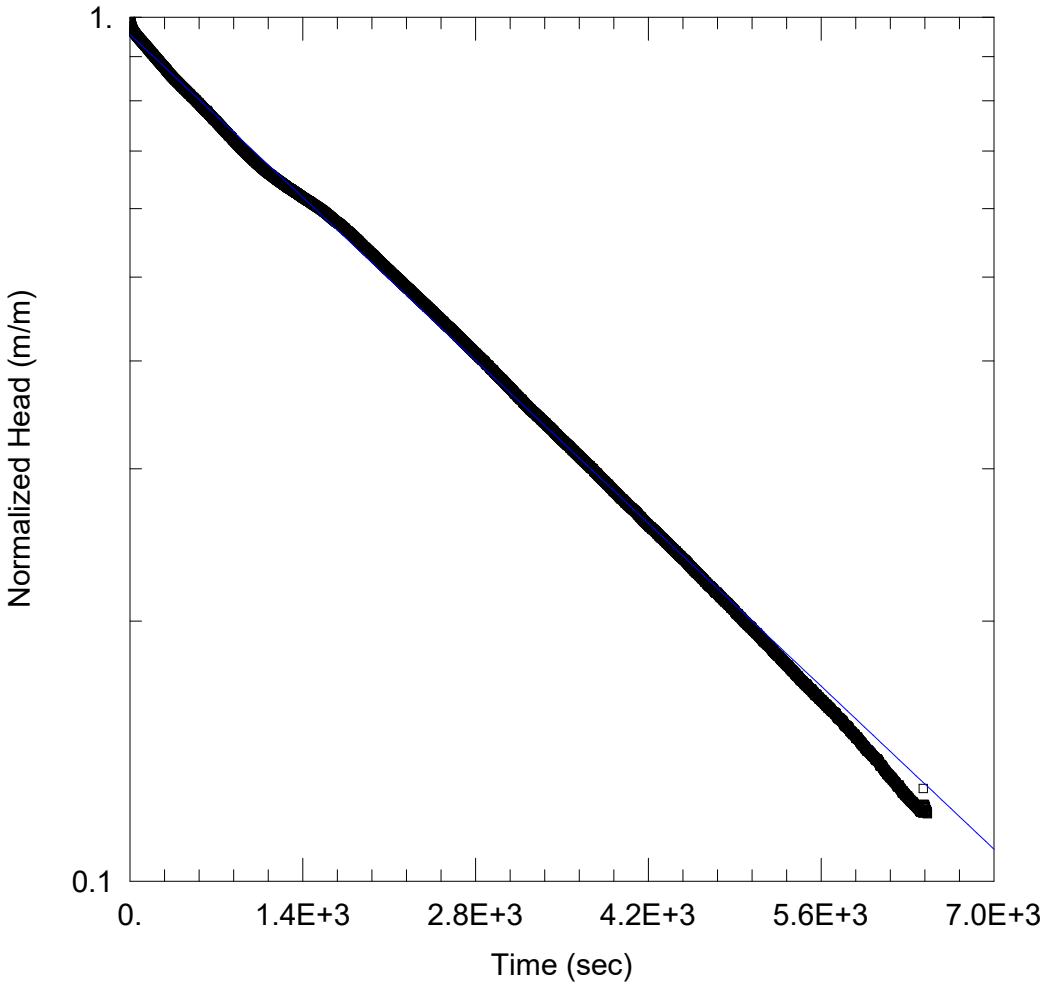
Saturated Thickness: 2.647 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH47-D)

Initial Displacement: 2.647 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.515 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.294E-7 m/sec
y0 = 2.494 m



BH47-S (RISING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH47-S.aqt
Date: 06/06/17 Time: 11:21:05

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH47-S
Test Date: 2017/05/26

AQUIFER DATA

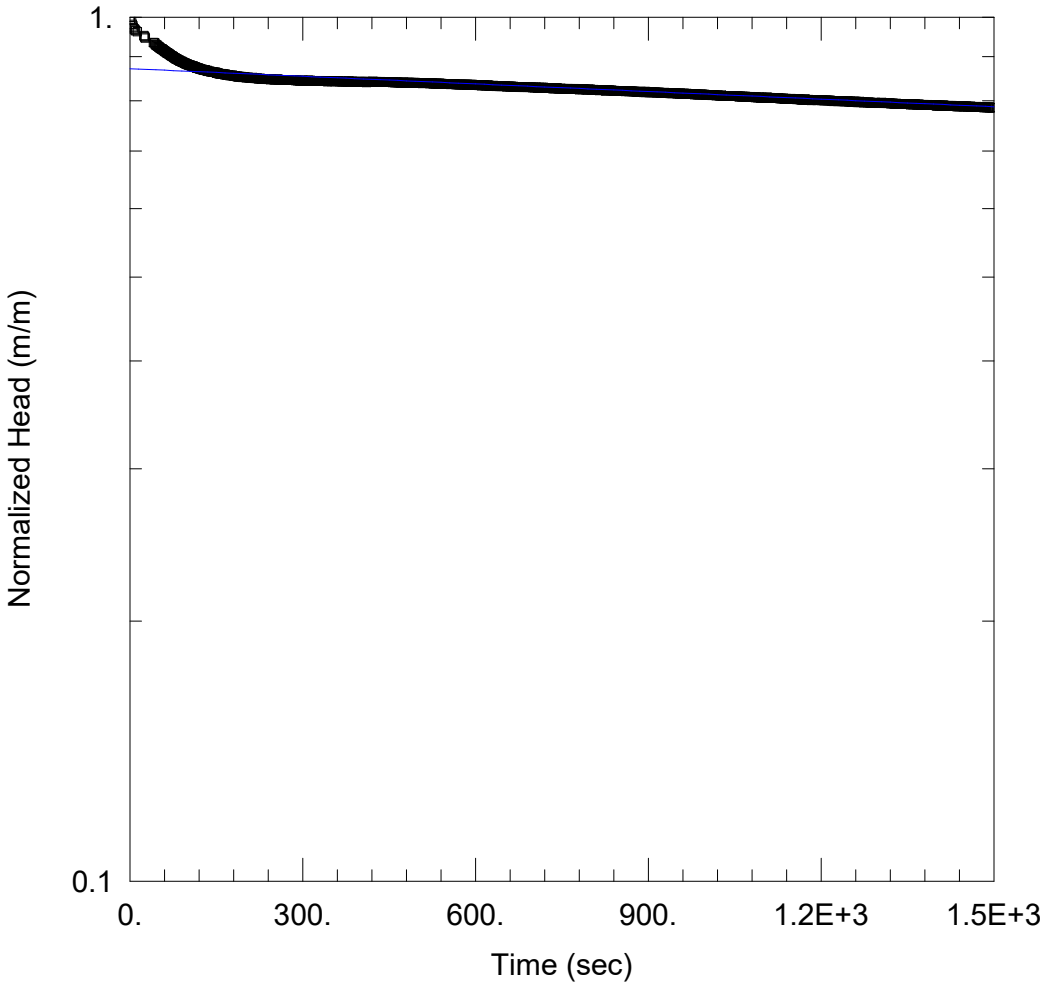
Saturated Thickness: 2.394 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH47-S)

Initial Displacement: 1.262 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 1.394 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 2.214E-7 m/sec
y0 = 1.205 m



BH64-D (FALLING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH64-D.aqt
Date: 06/06/17 Time: 13:52:07

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH64-D
Test Date: 2017/05/26

AQUIFER DATA

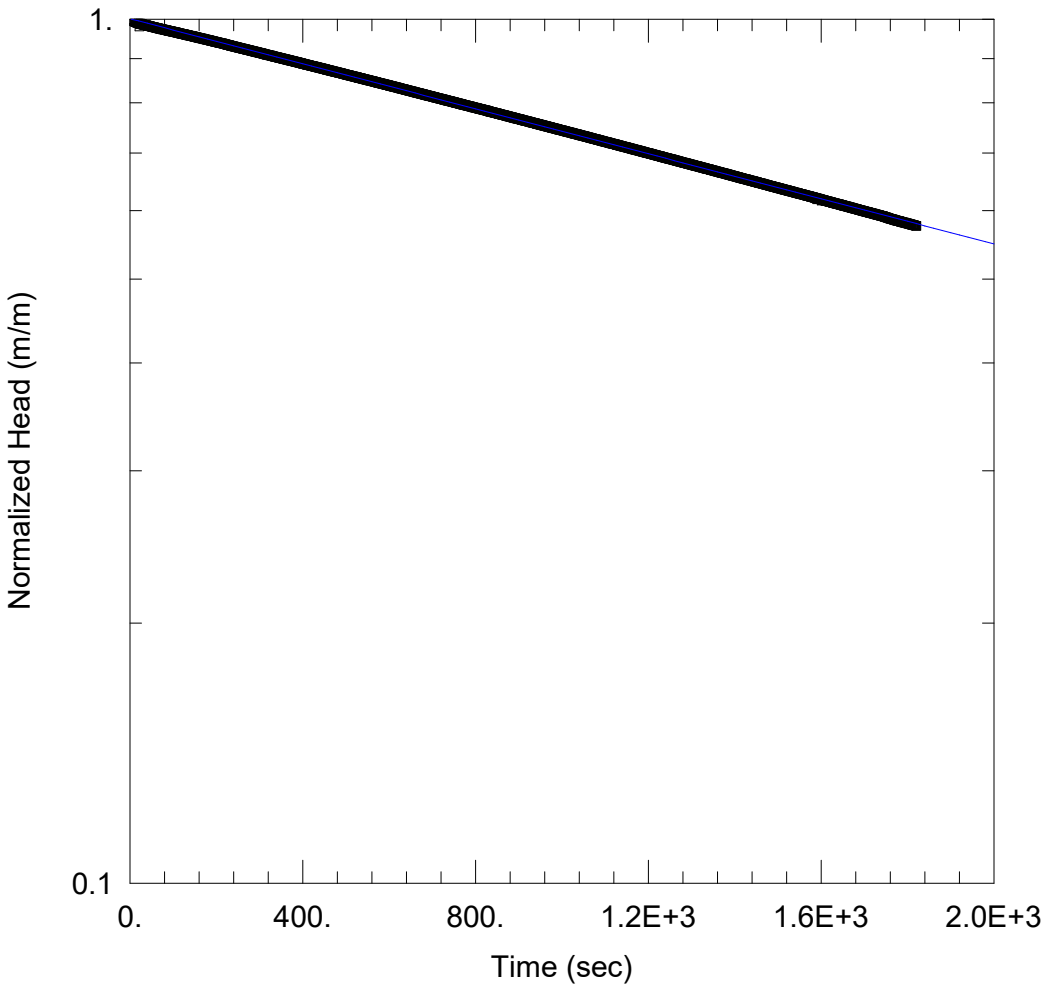
Saturated Thickness: 1.137 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH64-D)

Initial Displacement: 0.3463 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.137 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.017E-7 m/sec
y0 = 0.3018 m



BH66 (RISING HEAD TEST)

Data Set: C:\Users\SayyahP\Desktop\BH66.aqt
Date: 06/06/17 Time: 12:08:58

PROJECT INFORMATION

Company: Exp Services Inc.
Client: Triple Crown Line Residential
Project: BRM-00235186-E0
Location: Airport Rd & Cranston Dr.
Test Well: BH66
Test Date: 2017/05/26

AQUIFER DATA

Saturated Thickness: 7.836 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH66)

Initial Displacement: 5.445 m
Total Well Penetration Depth: 6.836 m
Casing Radius: 0.0254 m
Static Water Column Height: 6.836 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.092E-7 m/sec
y0 = 5.45 m

Appendix D: Groundwater Analysis and Laboratory Certificates of Analysis

Maxxam
A Bureau Veritas Group Company

Your P.O. #: BRM-ENV
Your Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your C.O.C. #: 612400-01-01

Attention:Nathan Orr

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/06/06
Report #: R4500628
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A8091
Received: 2017/05/26, 18:59

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
ABN Compounds in Water by GC/MS	1	2017/06/01	2017/06/04	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	1	2017/05/27	2017/06/01	CAM SOP-00427	SM 22 5210B m
Total Cyanide	1	2017/05/30	2017/05/30	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2017/05/30	2017/05/31	CAM SOP-00449	SM 22 4500-F C m
Mercury in Water by CVAA	1	2017/05/31	2017/06/01	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2017/06/01	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2017/05/26	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2017/05/29	2017/06/02	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2017/05/29	2017/06/02	CAM SOP-00313	Maxxam Method
Animal and Vegetable Oil & Grease	1	N/A	2017/06/01	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2017/05/30	2017/06/01	CAM SOP-00326	EPA1664B m,SM5520A m
Polychlorinated Biphenyl in Water	1	2017/05/30	2017/05/31	CAM SOP-00309	EPA 8082A m
pH	1	N/A	2017/05/31	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/05/31	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2017/06/02	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2017/05/30	2017/06/02	CAM SOP-00938	OMOE E3516 m
TPH (Heavy Oil) (1)	1	2017/05/30	2017/06/01	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2017/05/29	2017/05/29	CAM SOP-00428	SM 22 2540D m
Volatile Organic Compounds in Water	1	N/A	2017/05/31	CAM SOP-00226	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Your P.O. #: BRM-ENV
Your Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your C.O.C. #: 612400-01-01

Attention:Nathan Orr

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/06/06
Report #: R4500628
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A8091
Received: 2017/05/26, 18:59
agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Deepthi Shaji, Project Manager
Email: dshaji@maxxam.ca
Phone# (905)817-5700 Ext:5807
==========
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B7A8091
Report Date: 2017/06/06

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

PEEL SANITARY & STORM PKG (53-2010)

Maxxam ID				ELH795	ELH795		
Sampling Date				2017/05/26 09:00	2017/05/26 09:00		
COC Number				612400-01-01	612400-01-01		
	UNITS	Criteria	Criteria-2	BH41	BH41 Lab-Dup	RDL	QC Batch
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	150	-	ND		0.50	5001507
Inorganics							
Total Carbonaceous BOD	mg/L	300	15	ND	ND	2	5001844
Fluoride (F-)	mg/L	10	-	0.19		0.10	5005214
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1	ND (1)		1.0	5005026
pH	pH	5.5:10.0	6.0:9.0	8.11			5005229
Phenols-4AAP	mg/L	1	0.008	ND		0.0010	5007573
Total Suspended Solids	mg/L	350	15	**110**		10	5002859
Dissolved Sulphate (SO4)	mg/L	1500	-	50	49	1.0	5007251
Total Cyanide (CN)	mg/L	2	0.02	ND		0.0050	5005476
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	-	-	ND		0.50	5004372
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	ND		0.50	5004390
Miscellaneous Parameters							
Nonylphenol Ethoxylate (Total)	mg/L	0.2	-	ND	ND	0.025	5003255
Nonylphenol (Total)	mg/L	0.02	-	0.001	0.001	0.001	5003399
Metals							
Mercury (Hg)	mg/L	0.01	0.0004	ND		0.0001	5006834
Total Aluminum (Al)	ug/L	50000	-	26000		25	5007141
Total Antimony (Sb)	ug/L	5000	-	ND		0.50	5007141
Total Arsenic (As)	ug/L	1000	20	11		1.0	5007141
Total Cadmium (Cd)	ug/L	700	8	0.20		0.10	5007141
Total Chromium (Cr)	ug/L	5000	80	39		5.0	5007141

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.
ND = Not detected
(1) Due to a high concentration of NOx, the sample required dilution. The detection limit was adjusted accordingly.

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Maxxam Job #: B7A8091
Report Date: 2017/06/06

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

PEEL SANITARY & STORM PKG (53-2010)

Maxxam ID				ELH795	ELH795		
Sampling Date				2017/05/26 09:00	2017/05/26 09:00		
COC Number				612400-01-01	612400-01-01		
	UNITS	Criteria	Criteria-2	BH41	BH41 Lab-Dup	RDL	QC Batch
Total Cobalt (Co)	ug/L	5000	-	18		0.50	5007141
Total Copper (Cu)	ug/L	3000	50	45		1.0	5007141
Total Iron (Fe)	ug/L	-	-	39000		100	5007141
Total Lead (Pb)	ug/L	3000	120	21		0.50	5007141
Total Manganese (Mn)	ug/L	5000	50	**1600**		2.0	5007141
Total Molybdenum (Mo)	ug/L	5000	-	19		0.50	5007141
Total Nickel (Ni)	ug/L	3000	80	36		1.0	5007141
Total Phosphorus (P)	ug/L	10000	-	1900		100	5007141
Total Selenium (Se)	ug/L	1000	20	2.2		2.0	5007141
Total Silver (Ag)	ug/L	5000	120	ND		0.10	5007141
Total Tin (Sn)	ug/L	5000	-	2.9		1.0	5007141
Total Titanium (Ti)	ug/L	5000	-	250		5.0	5007141
Total Zinc (Zn)	ug/L	3000	40	**98**		5.0	5007141
Semivolatile Organics							
Bis(2-ethylhexyl)phthalate	ug/L	12	8.8	ND		2.0	5012088
Di-N-butyl phthalate	ug/L	80	15	ND		2.0	5012088
Volatile Organics							
Benzene	ug/L	10	2	ND		0.10	5000695
Chloroform	ug/L	40	2	ND		0.10	5000695
1,2-Dichlorobenzene	ug/L	50	5.6	ND		0.20	5000695
1,4-Dichlorobenzene	ug/L	80	6.8	ND		0.20	5000695
cis-1,2-Dichloroethylene	ug/L	4000	5.6	ND		0.10	5000695
trans-1,3-Dichloropropene	ug/L	140	5.6	ND		0.20	5000695
Ethylbenzene	ug/L	160	2	ND		0.10	5000695
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	ND		0.50	5000695

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Lab-Dup = Laboratory Initiated Duplicate

Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.

Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.

ND = Not detected

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PEEL SANITARY & STORM PKG (53-2010)

Maxxam ID				ELH795	ELH795		
Sampling Date				2017/05/26 09:00	2017/05/26 09:00		
COC Number				612400-01-01	612400-01-01		
	UNITS	Criteria	Criteria-2	BH41	BH41 Lab-Dup	RDL	QC Batch
Methyl Ethyl Ketone (2-Butanone)	ug/L	8000	-	ND		5.0	5000695
Styrene	ug/L	200	-	ND		0.20	5000695
1,1,2,2-Tetrachloroethane	ug/L	1400	17	ND		0.20	5000695
Tetrachloroethylene	ug/L	1000	4.4	ND		0.10	5000695
Toluene	ug/L	270	2	ND		0.20	5000695
Trichloroethylene	ug/L	400	8	ND		0.10	5000695
p+m-Xylene	ug/L	-	-	ND		0.10	5000695
o-Xylene	ug/L	-	-	ND		0.10	5000695
Total Xylenes	ug/L	1400	4.4	ND		0.10	5000695
PCBs							
Total PCB	ug/L	1	0.4	ND		0.05	5004747
Microbiological							
Escherichia coli	CFU/100mL	-	200	<10		10	5001652
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	-	-	36			5012088
2-Fluorobiphenyl	%	-	-	56			5012088
2-Fluorophenol	%	-	-	16			5012088
D14-Terphenyl	%	-	-	100			5012088
D5-Nitrobenzene	%	-	-	80			5012088
D5-Phenol	%	-	-	20			5012088
Decachlorobiphenyl	%	-	-	86			5004747
4-Bromofluorobenzene	%	-	-	95			5000695
D4-1,2-Dichloroethane	%	-	-	97			5000695
D8-Toluene	%	-	-	100			5000695

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.
Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.
ND = Not detected

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Maxxam Job #: B7A8091
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Sampler Initials: CS

TEST SUMMARY

Maxxam ID: ELH795
Sample ID: BH41
Matrix: Water

Collected: 2017/05/26
Shipped:
Received: 2017/05/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	5012088	2017/06/01	2017/06/04	Daniel Kim
Carbonaceous BOD	DO	5001844	2017/05/27	2017/06/01	Prakash Piya
Total Cyanide	SKAL/CN	5005476	2017/05/30	2017/05/30	Lantian Jin
Fluoride	ISE	5005214	2017/05/30	2017/05/31	Surinder Rai
Mercury in Water by CVAA	CV/AA	5006834	2017/05/31	2017/06/01	Ron Morrison
Total Metals Analysis by ICPMS	ICP/MS	5007141	N/A	2017/06/01	Prempal Bhatti
E.coli, (CFU/100mL)	PL	5001652	N/A	2017/05/26	Riddhi Bayal
Total Nonylphenol in Liquids by HPLC	LC/FLU	5003399	2017/05/29	2017/06/02	Tonghui (Jenny) Chen
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	5003255	2017/05/29	2017/06/02	Tonghui (Jenny) Chen
Animal and Vegetable Oil & Grease	BAL	5001507	N/A	2017/06/01	Automated Statchk
Total Oil and Grease	BAL	5004372	2017/05/30	2017/06/01	Amjad Mir
Polychlorinated Biphenyl in Water	GC/ECD	5004747	2017/05/30	2017/05/31	Li Peng
pH	AT	5005229	N/A	2017/05/31	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5007573	N/A	2017/05/31	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5007251	N/A	2017/06/02	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	5005026	2017/05/30	2017/06/02	Rajni Tyagi
TPH (Heavy Oil)	BAL	5004390	2017/05/30	2017/06/01	Amjad Mir
Total Suspended Solids	BAL	5002859	2017/05/29	2017/05/29	Arpan Shah
Volatile Organic Compounds in Water	P&T/MS	5000695	N/A	2017/05/31	Dina Wang

Maxxam ID: ELH795 Dup
Sample ID: BH41
Matrix: Water

Collected: 2017/05/26
Shipped:
Received: 2017/05/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Carbonaceous BOD	DO	5001844	2017/05/27	2017/06/01	Prakash Piya
Total Nonylphenol in Liquids by HPLC	LC/FLU	5003399	2017/05/29	2017/06/02	Tonghui (Jenny) Chen
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	5003255	2017/05/29	2017/06/02	Tonghui (Jenny) Chen
Sulphate by Automated Colourimetry	KONE	5007251	N/A	2017/06/02	Deonarine Ramnarine

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Maxxam Job #: B7A8091
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exp Services Inc
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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.3°C
Package 2	4.3°C
Package 3	5.3°C

PEEL SANITARY & STORM PKG (53-2010)

Total Nonylphenol in Liquids by HPLC: The recovery in the matrix spike was not calculated (NC). Because of the high concentration of this analyte in the parent sample, the relative difference between the spiked and unspiked concentrations is not sufficiently significant to permit a reliable recovery calculation.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
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			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5000695	4-Bromofluorobenzene	2017/05/31	96	70 - 130	97	70 - 130	94	%				
5000695	D4-1,2-Dichloroethane	2017/05/31	92	70 - 130	95	70 - 130	97	%				
5000695	D8-Toluene	2017/05/31	102	70 - 130	99	70 - 130	100	%				
5004747	Decachlorobiphenyl	2017/05/31	86	60 - 130	92	60 - 130	97	%				
5012088	2,4,6-Tribromophenol	2017/06/04	116	10 - 130	111	10 - 130	68	%				
5012088	2-Fluorobiphenyl	2017/06/04	60	30 - 130	61	30 - 130	82	%				
5012088	2-Fluorophenol	2017/06/04	39	10 - 130	42	10 - 130	28	%				
5012088	D14-Terphenyl	2017/06/04	101	30 - 130	102	30 - 130	102	%				
5012088	D5-Nitrobenzene	2017/06/04	60	30 - 130	66	30 - 130	78	%				
5012088	D5-Phenol	2017/06/04	27	10 - 130	29	10 - 130	26	%				
5000695	1,1,2,2-Tetrachloroethane	2017/05/31	95	70 - 130	105	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	1,2-Dichlorobenzene	2017/05/31	94	70 - 130	100	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	1,4-Dichlorobenzene	2017/05/31	95	70 - 130	100	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	Benzene	2017/05/31	95	70 - 130	103	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	Chloroform	2017/05/31	89	70 - 130	96	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	cis-1,2-Dichloroethylene	2017/05/31	97	70 - 130	104	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	Ethylbenzene	2017/05/31	95	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	Methyl Ethyl Ketone (2-Butanone)	2017/05/31	88	60 - 140	100	60 - 140	ND, RDL=5.0	ug/L	NC	30		
5000695	Methylene Chloride(Dichloromethane)	2017/05/31	87	70 - 130	94	70 - 130	ND, RDL=0.50	ug/L	NC	30		
5000695	o-Xylene	2017/05/31	91	70 - 130	97	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	p+m-Xylene	2017/05/31	91	70 - 130	98	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	Styrene	2017/05/31	95	70 - 130	101	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	Tetrachloroethylene	2017/05/31	87	70 - 130	95	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5000695	Toluene	2017/05/31	94	70 - 130	99	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	Total Xylenes	2017/05/31					ND, RDL=0.10	ug/L	NC	30		
5000695	trans-1,3-Dichloropropene	2017/05/31	89	70 - 130	97	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5000695	Trichloroethylene	2017/05/31	89	70 - 130	96	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5001844	Total Carbonaceous BOD	2017/06/01					ND,RDL=2	mg/L	NC	25	89	85 - 115
5002859	Total Suspended Solids	2017/05/29					ND, RDL=10	mg/L	13	25	97	85 - 115

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Maxxam Job #: B7A8091
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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5003255	Nonylphenol Ethoxylate (Total)	2017/06/02	110	50 - 130	97	50 - 130	ND, RDL=0.025	mg/L	NC	40		
5003399	Nonylphenol (Total)	2017/06/02	NC	50 - 130	105	50 - 130	ND, RDL=0.001	mg/L	10	40		
5004372	Total Oil & Grease	2017/06/01			98	85 - 115	ND, RDL=0.50	mg/L	3.9	25		
5004390	Total Oil & Grease Mineral/Synthetic	2017/06/01			94	85 - 115	ND, RDL=0.50	mg/L	1.8	25		
5004747	Total PCB	2017/05/31	84	60 - 130	79	60 - 130	ND, RDL=0.05	ug/L	NC	40		
5005026	Total Kjeldahl Nitrogen (TKN)	2017/06/02	104	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	6.7	20	100	80 - 120
5005214	Fluoride (F-)	2017/05/31	98	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	11	20		
5005229	pH	2017/05/31			102	98 - 103			1.4	N/A		
5005476	Total Cyanide (CN)	2017/05/30	104	80 - 120	102	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
5006834	Mercury (Hg)	2017/06/01	100	75 - 125	106	80 - 120	ND, RDL=0.0001	mg/L	NC	20		
5007141	Total Aluminum (Al)	2017/06/01	104	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L				
5007141	Total Antimony (Sb)	2017/06/01	101	80 - 120	98	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5007141	Total Arsenic (As)	2017/06/01	103	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5007141	Total Cadmium (Cd)	2017/06/01	102	80 - 120	98	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5007141	Total Chromium (Cr)	2017/06/01	100	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5007141	Total Cobalt (Co)	2017/06/01	105	80 - 120	104	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5007141	Total Copper (Cu)	2017/06/01	102	80 - 120	101	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5007141	Total Iron (Fe)	2017/06/01	101	80 - 120	99	80 - 120	ND, RDL=100	ug/L	2.3	20		
5007141	Total Lead (Pb)	2017/06/01	103	80 - 120	98	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5007141	Total Manganese (Mn)	2017/06/01	100	80 - 120	97	80 - 120	ND, RDL=2.0	ug/L				
5007141	Total Molybdenum (Mo)	2017/06/01	105	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L	NC	20		
5007141	Total Nickel (Ni)	2017/06/01	100	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L	NC	20		
5007141	Total Phosphorus (P)	2017/06/01	99	80 - 120	98	80 - 120	ND, RDL=100	ug/L				
5007141	Total Selenium (Se)	2017/06/01	105	80 - 120	103	80 - 120	ND, RDL=2.0	ug/L	NC	20		
5007141	Total Silver (Ag)	2017/06/01	100	80 - 120	95	80 - 120	ND, RDL=0.10	ug/L	NC	20		
5007141	Total Tin (Sn)	2017/06/01	100	80 - 120	97	80 - 120	ND, RDL=1.0	ug/L				
5007141	Total Titanium (Ti)	2017/06/01	101	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L				

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QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5007141	Total Zinc (Zn)	2017/06/01	104	80 - 120	101	80 - 120	ND, RDL=5.0	ug/L	NC	20		
5007251	Dissolved Sulphate (SO4)	2017/06/02	NC	75 - 125	106	80 - 120	ND, RDL=1.0	mg/L	1.4	20		
5007573	Phenols-4AAP	2017/05/31	103	80 - 120	103	85 - 115	ND, RDL=0.0010	mg/L	NC	20		
5012088	Bis(2-ethylhexyl)phthalate	2017/06/04	91	30 - 130	91	30 - 130	ND, RDL=2.0	ug/L	3.2	40		
5012088	Di-N-butyl phthalate	2017/06/04	NC	30 - 130	101	30 - 130	ND, RDL=2.0	ug/L	NC	40		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Specialist

Cristina Carriere, Scientific Services

Riddhi Bayal

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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CHAIN OF CUSTODY RECORD

Page 1 of 1

MICRO

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name	#30554 exp Services Inc	Company Name	SAA	Quotation #	~~B45997~~ STREAM 2	Maxxam Job #:	Bottle Order #: 612400
Attention	Central Services	Attention	Nathan Orr	P.O. #	ENV-BRM		
Address	1595 Clark Blvd, Brampton ON L6T 4V1	Address	chantel.simon@exp.com, francois.chartier@exp.com	Project	BRM-00235186-EO	COC #: C#612400-01-01	Project Manager: Deepthi Shaji
Tel	(905) 793-9800 x Fax (905) 793-0641 x	Tel / Fax		Project Name	15717 AIRPORT RD		
Email	Karen.Burke@exp.com	Email	nathan.orr@exp.com	Site #			
				Sampled By	CS.		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011)	Other Regulations	Special Instructions
☐ Table 1 ☐ Res/Park ☐ Medium/Fine	☐ CCME ☒ Sanitary Sewer Bylaw	
☐ Table 2 ☐ Ind/Comm ☐ Coarse	☐ Reg 558 ☒ Storm Sewer Bylaw	
☐ Table 3 ☐ Agri/Other ☐ For RSC	☐ MISA Municipality PEEL	
☐ Table ___	☐ PWQO	
	☐ Other	

Include Criteria on Certificate of Analysis (Y/N)? Y

ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Field Filtered (please circle): Metals / Hg / Cr VI; PEEL Sanitary & Storm Sewer Package; ~~REAP Comprehensive~~

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered	PEEL Sanitary & Storm Sewer Package	# of Bottles	Comments
1		BH 41	26/05/17	0900	GW	N	X	19	IRON ANALYSIS PLEASE
2									
3									
4									
5									
6									
7									
8									
9									
10									

Turnaround Time (TAT) Required: Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified)
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ______ Time Required: ______
Rush Confirmation Number: ______ (call lab for #)

26-May-17 18:59
Deepthi Shaji
B7A8091
HG2 ENV-1232

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Chantel / Chantel Simon	17/05/26	18:50	MARIYAM NIDDA	2017/05/26	18:59	

Laboratory Use Only: Time Sensitive | Temperature (°C) on Receipt | Custody Seal Present: Yes ✓ | Intact: ✓

White: Maxxa Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

10/7/5 / 5/4/4 / 4/7/5

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Job #: B7A8091
Report Date: 2017/06/06

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

Exceedence Summary Table – Peel Region Sanitary 2010

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedence Summary Table – Peel Region Storm 2010

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
BH41	ELH795-09	Total Manganese (Mn)	50	1600	2.0	ug/L
BH41	ELH795-06	Total Suspended Solids	15	110	10	mg/L
BH41	ELH795-09	Total Zinc (Zn)	40	98	5.0	ug/L

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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Maxxam
A Bureau Veritas Group Company

Your P.O. #: BRM-ENV
Your Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your C.O.C. #: 612400-02-01

Attention:Nathan Orr

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/06/01
Report #: R4495205
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A8115
Received: 2017/05/26, 18:59

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	1	N/A	2017/05/31	CAM SOP-00448	SM 22 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2017/06/01	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	1	N/A	2017/05/30	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2017/05/31	CAM SOP-00414	SM 22 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2017/05/29	CAM SOP-00446	SM 22 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2017/05/30	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	1	2017/05/29	2017/05/30	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2017/06/01		
Anion and Cation Sum	1	N/A	2017/06/01		
Total Ammonia-N	1	N/A	2017/05/31	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	1	N/A	2017/05/31	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/05/31	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2017/05/30	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/06/01		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/06/01		
Sulphate by Automated Colourimetry	1	N/A	2017/05/30	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	1	N/A	2017/06/01		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

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Your P.O. #: BRM-ENV
Your Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your C.O.C. #: 612400-02-01

Attention:Nathan Orr

exp Services Inc
1595 Clark Blvd
Brampton, ON
L6T 4V1

Report Date: 2017/06/01
Report #: R4495205
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7A8115

Received: 2017/05/26, 18:59

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Dissolved Organic Carbon (DOC) present in the sample should be considered as non-purgeable DOC.

(2) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Deepthi Shaji, Project Manager
Email: dshaji@maxxam.ca
Phone# (905)817-5700 Ext:5807

==========

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				ELH855		
Sampling Date				2017/05/26 09:00		
COC Number				612400-02-01		
	UNITS	Criteria	Criteria-2	BH41	RDL	QC Batch
Calculated Parameters						
Anion Sum	me/L	-	-	8.75	N/A	5000463
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	270	1.0	5001384
Calculated TDS	mg/L	-	-	520	1.0	5000397
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	3.4	1.0	5001384
Cation Sum	me/L	-	-	8.71	N/A	5000463
Hardness (CaCO3)	mg/L	-	-	260	1.0	5001331
Ion Balance (% Difference)	%	-	-	0.210	N/A	5001385
Langelier Index (@ 20C)	N/A	-	-	0.972		5000395
Langelier Index (@ 4C)	N/A	-	-	0.725		5000396
Saturation pH (@ 20C)	N/A	-	-	7.16		5000395
Saturation pH (@ 4C)	N/A	-	-	7.40		5000396
Inorganics						
Total Ammonia-N	mg/L	-	-	0.059	0.050	5006175
Conductivity	umho/cm	-	-	840	1.0	5003678
Dissolved Organic Carbon	mg/L	-	-	3.0	0.20	5003215
Orthophosphate (P)	mg/L	-	-	ND	0.010	5004246
pH	pH	5.5:10.0	6.0:9.0	8.13		5003691
Dissolved Sulphate (SO4)	mg/L	1500	-	47	1.0	5004244
Alkalinity (Total as CaCO3)	mg/L	-	-	280	1.0	5003675
Dissolved Chloride (Cl)	mg/L	-	-	16	1.0	5004243
Nitrite (N)	mg/L	-	-	0.118	0.010	5003210
Nitrate (N)	mg/L	-	-	25.2	1.0	5003210
Nitrate + Nitrite (N)	mg/L	-	-	25.3	1.0	5003210

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.

Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.

N/A = Not Applicable

ND = Not detected

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				ELH855		
Sampling Date				2017/05/26 09:00		
COC Number				612400-02-01		
	UNITS	Criteria	Criteria-2	BH41	RDL	QC Batch
Metals						
Dissolved Aluminum (Al)	ug/L	50000	-	5.2	5.0	5003742
Dissolved Antimony (Sb)	ug/L	5000	-	ND	0.50	5003742
Dissolved Arsenic (As)	ug/L	1000	20	1.0	1.0	5003742
Dissolved Barium (Ba)	ug/L	-	-	82	2.0	5003742
Dissolved Beryllium (Be)	ug/L	-	-	ND	0.50	5003742
Dissolved Boron (B)	ug/L	-	-	28	10	5003742
Dissolved Cadmium (Cd)	ug/L	700	8	ND	0.10	5003742
Dissolved Calcium (Ca)	ug/L	-	-	75000	200	5003742
Dissolved Chromium (Cr)	ug/L	5000	80	ND	5.0	5003742
Dissolved Cobalt (Co)	ug/L	5000	-	ND	0.50	5003742
Dissolved Copper (Cu)	ug/L	3000	50	ND	1.0	5003742
Dissolved Iron (Fe)	ug/L	-	-	ND	100	5003742
Dissolved Lead (Pb)	ug/L	3000	120	ND	0.50	5003742
Dissolved Magnesium (Mg)	ug/L	-	-	18000	50	5003742
Dissolved Manganese (Mn)	ug/L	5000	50	**61**	2.0	5003742
Dissolved Molybdenum (Mo)	ug/L	5000	-	18	0.50	5003742
Dissolved Nickel (Ni)	ug/L	3000	80	ND	1.0	5003742
Dissolved Phosphorus (P)	ug/L	10000	-	ND	100	5003742
Dissolved Potassium (K)	ug/L	-	-	3500	200	5003742
Dissolved Selenium (Se)	ug/L	1000	20	ND	2.0	5003742
Dissolved Silicon (Si)	ug/L	-	-	4000	50	5003742
Dissolved Silver (Ag)	ug/L	5000	120	ND	0.10	5003742
Dissolved Sodium (Na)	ug/L	-	-	78000	100	5003742
Dissolved Strontium (Sr)	ug/L	-	-	450	1.0	5003742
Dissolved Thallium (Tl)	ug/L	-	-	ND	0.050	5003742
Dissolved Titanium (Ti)	ug/L	5000	-	ND	5.0	5003742

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.

Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.

ND = Not detected

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				ELH855		
Sampling Date				2017/05/26 09:00		
COC Number				612400-02-01		
	UNITS	**Criteria**	**Criteria-2**	**BH41**	**RDL**	**QC Batch**
Dissolved Uranium (U)	ug/L	-	-	6.2	0.10	5003742
Dissolved Vanadium (V)	ug/L	-	-	0.79	0.50	5003742
Dissolved Zinc (Zn)	ug/L	3000	40	ND	5.0	5003742

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

Criteria: The Regional Municipality of Peel Sanitary Sewer Discharge. By-Law Number 53-2010.

Criteria-2: The Regional Municipality of Peel Storm Sewer Discharge. By-Law Number 53-2010.

ND = Not detected

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

TEST SUMMARY

Maxxam ID: ELH855
Sample ID: BH41
Matrix: Water

Collected: 2017/05/26
Shipped:
Received: 2017/05/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5003675	N/A	2017/05/31	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5001384	N/A	2017/06/01	Automated Statchk
Chloride by Automated Colourimetry	KONE	5004243	N/A	2017/05/30	Alina Dobreanu
Conductivity	AT	5003678	N/A	2017/05/31	Surinder Rai
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5003215	N/A	2017/05/29	Azadeh Shahbazi
Hardness (calculated as CaCO3)		5001331	N/A	2017/05/30	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5003742	2017/05/29	2017/05/30	Thao Nguyen
Ion Balance (% Difference)	CALC	5001385	N/A	2017/06/01	Automated Statchk
Anion and Cation Sum	CALC	5000463	N/A	2017/06/01	Automated Statchk
Total Ammonia-N	LACH/NH4	5006175	N/A	2017/05/31	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5003210	N/A	2017/05/31	Chandra Nandlal
pH	AT	5003691	N/A	2017/05/31	Surinder Rai
Orthophosphate	KONE	5004246	N/A	2017/05/30	Alina Dobreanu
Sat. pH and Langelier Index (@ 20C)	CALC	5000395	N/A	2017/06/01	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5000396	N/A	2017/06/01	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5004244	N/A	2017/05/30	Alina Dobreanu
Total Dissolved Solids (TDS calc)	CALC	5000397	N/A	2017/06/01	Automated Statchk

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	7.3°C
Package 2	5.3°C
Package 3	4.3°C

Results relate only to the items tested.

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5003210	Nitrate (N)	2017/05/31	NC	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	4.0	20
5003210	Nitrite (N)	2017/05/31	101	80 - 120	99	80 - 120	ND, RDL=0.010	mg/L	15	20
5003215	Dissolved Organic Carbon	2017/05/29	95	80 - 120	98	80 - 120	ND, RDL=0.20	mg/L	1.2	20
5003675	Alkalinity (Total as CaCO3)	2017/05/31			96	85 - 115	ND, RDL=1.0	mg/L	1.1	20
5003678	Conductivity	2017/05/31			101	85 - 115	ND, RDL=1.0	umho/cm	0.41	25
5003691	pH	2017/05/31			101	98 - 103			0.052	N/A
5003742	Dissolved Aluminum (Al)	2017/05/30	103	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L		
5003742	Dissolved Antimony (Sb)	2017/05/30	107	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L		
5003742	Dissolved Arsenic (As)	2017/05/30	100	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	NC	20
5003742	Dissolved Barium (Ba)	2017/05/30	99	80 - 120	101	80 - 120	ND, RDL=2.0	ug/L	0.32	20
5003742	Dissolved Beryllium (Be)	2017/05/30	103	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L		
5003742	Dissolved Boron (B)	2017/05/30	105	80 - 120	102	80 - 120	ND, RDL=10	ug/L	2.3	20
5003742	Dissolved Cadmium (Cd)	2017/05/30	102	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20
5003742	Dissolved Calcium (Ca)	2017/05/30	NC	80 - 120	98	80 - 120	ND, RDL=200	ug/L	0.040	20
5003742	Dissolved Chromium (Cr)	2017/05/30	100	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20
5003742	Dissolved Cobalt (Co)	2017/05/30	99	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L		
5003742	Dissolved Copper (Cu)	2017/05/30	103	80 - 120	102	80 - 120	ND, RDL=1.0	ug/L	2.9	20
5003742	Dissolved Iron (Fe)	2017/05/30	100	80 - 120	99	80 - 120	ND, RDL=100	ug/L	NC	20
5003742	Dissolved Lead (Pb)	2017/05/30	99	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20
5003742	Dissolved Magnesium (Mg)	2017/05/30	98	80 - 120	100	80 - 120	ND, RDL=50	ug/L	1.6	20
5003742	Dissolved Manganese (Mn)	2017/05/30	NC	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L	2.4	20
5003742	Dissolved Molybdenum (Mo)	2017/05/30	105	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L		
5003742	Dissolved Nickel (Ni)	2017/05/30	97	80 - 120	98	80 - 120	ND, RDL=1.0	ug/L		
5003742	Dissolved Phosphorus (P)	2017/05/30	107	80 - 120	109	80 - 120	ND, RDL=100	ug/L		
5003742	Dissolved Potassium (K)	2017/05/30	NC	80 - 120	101	80 - 120	ND, RDL=200	ug/L	1.8	20
5003742	Dissolved Selenium (Se)	2017/05/30	100	80 - 120	99	80 - 120	ND, RDL=2.0	ug/L		
5003742	Dissolved Silicon (Si)	2017/05/30	99	80 - 120	99	80 - 120	ND, RDL=50	ug/L		
5003742	Dissolved Silver (Ag)	2017/05/30	99	80 - 120	98	80 - 120	ND, RDL=0.10	ug/L		
5003742	Dissolved Sodium (Na)	2017/05/30	NC	80 - 120	100	80 - 120	ND, RDL=100	ug/L	2.6	20
5003742	Dissolved Strontium (Sr)	2017/05/30	NC	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L		

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Maxxam Job #: B7A8115
Report Date: 2017/06/01

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00235186-E0
Site Location: 15717 AIRPORT RD
Your P.O. #: BRM-ENV
Sampler Initials: CS

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5003742	Dissolved Thallium (Tl)	2017/05/30	98	80 - 120	99	80 - 120	ND, RDL=0.050	ug/L		
5003742	Dissolved Titanium (Ti)	2017/05/30	102	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L		
5003742	Dissolved Uranium (U)	2017/05/30	102	80 - 120	101	80 - 120	ND, RDL=0.10	ug/L		
5003742	Dissolved Vanadium (V)	2017/05/30	100	80 - 120	99	80 - 120	ND, RDL=0.50	ug/L		
5003742	Dissolved Zinc (Zn)	2017/05/30	98	80 - 120	97	80 - 120	ND, RDL=5.0	ug/L	NC	20
5004243	Dissolved Chloride (Cl)	2017/05/30	101	80 - 120	105	80 - 120	ND, RDL=1.0	mg/L	0.66	20
5004244	Dissolved Sulphate (SO4)	2017/05/30	96	75 - 125	103	80 - 120	ND, RDL=1.0	mg/L	0.53	20
5004246	Orthophosphate (P)	2017/05/30	99	75 - 125	100	80 - 120	ND, RDL=0.010	mg/L	NC	25
5006175	Total Ammonia-N	2017/05/31	93	80 - 120	95	85 - 115	ND, RDL=0.050	mg/L	NC	20

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brad Newman, Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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CHAIN OF CUSTODY RECORD

Page 1 of 1

IMMEDIATE TEST

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#30554 exp Services Inc	Company Name:	SAA	Quotation #:	~~B45887~~ STREAM 2	Maxxam Job #:	Bottle Order #:
Attention:	Central Services	Attention:	Nathan Orr	P.O. #:	ENV- BRM		612400
Address:	1595 Clark Blvd	Address:	chantel.simon@exp.com	Project:	BRM-00235186-E0	COC #:	Project Manager:
	Brampton ON L6T 4V1		Francois.chartier@exp.com	Project Name:	1517 AIRPORT RD	C#612400-02-01	Deepthi Shaji
Tel:	(905) 793-9800 x Fax: (905) 793-0641 x	Tel:	Fax:	Site #:			
Email:	Karen.Burke@exp.com	Email:	nathan.orr@exp.com	Sampled By:	CS.		

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Reg 558 ☐ MISA ☐ PWQO ☐ Other ___ ☒ Sanitary Sewer Bylaw ☒ Storm Sewer Bylaw Municipality: PEEL

Special Instructions:

Include Criteria on Certificate of Analysis (Y/N)? Y

ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Field Filtered (please circle): Metals / Hg / Cr VI; ~~Peel/Halton Sanitary & Storm Sewer Package~~; RCAp - Comprehensive

Turnaround Time (TAT) Required: Please provide advance notice for rush projects

Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.

Job Specific Rush TAT (if applies to entire submission)
Date Required: ___ Time Required: ___
Rush Confirmation Number: ___ (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered / Metals / Hg / Cr VI	Peel/Halton Sanitary & Storm Sewer Package	RCAp - Comprehensive	# of Bottles	Comments
1		BH41	26/05/17	0900	GW	N		X	4	
2										26-May-17 18:59
3										Deepthi Shaji
4										B7A8115
5										HG2 ENV-1232
6										
7										
8										
9										
10										

RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted	Time Sensitive	Temperature (°C) on Receipt	Custody Seal	Yes	No
Chantel Simon	17/05/26	18:50	MARIYAM NIDA	2017/05/26	18:59				Present / Intact	✓	

White: Maxxam Yellow: Client

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

10/7/5 5/4/4 4/7/5

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Job #: B7A8115
Report Date: 2017/06/01

exp Services Inc
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Sampler Initials: CS

Exceedence Summary Table – Peel Region Sanitary 2010

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
No Exceedences						

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

Exceedence Summary Table – Peel Region Storm 2010

Result Exceedences

Sample ID	Maxxam ID	Parameter	Criteria	Result	DL	Units
BH41	ELH855-01	Dissolved Manganese (Mn)	50	61	2.0	ug/L

The exceedence summary table is for information purposes only and should not be considered a comprehensive listing or statement of conformance to applicable regulatory guidelines.

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Appendix E:
Groundwater Flow Calculations

APPENDIX E: Construction Dewatering Calculations

Airport Road and Cranston Drive, Caledon East, ON

BRM-00235186-E0

Table E-1: Flow all Sides of the Excavation

Value	Unit	Southern Portion	Northern Portion
Geological Formation	-	Glacial Deposit	Glacial Deposit
Ground Elevation	mASL	305	310
Approx. WL Elev.	mASL	304.2	304.2
Top of Overburden Aquifer	mASL	304.2	304.2
Bottom of Overburden Aquifer	mASL	297.0	299.0
Thickness of Overburden Aquifer	m	7.2	5.2
H (above base of aquifer)	m	7.2	5.2
Dewatered elevation target in overburden	mASL	297	299
h_w (dewatered water table above aquifer substratum)	m	0	0
Hydraulic Conductivity	m/s	7.50E-05	7.50E-05
Transmissivity	m^2/s	5.38E-04	3.88E-04
Length of Excavation	m	60	60
Width of excavation	m	5	5
Method to Calculate Radius of Influence, Ro		Sichardt	Sichardt
Radius of Influence from Sides of Excavation, Ro	m	186	134
Distance to Linear Source from Sides of excavation (Lo = Ro/2)	m	93	67
Radius of Influence of both Radial and Linear Flows (R'=Ro+Lo)	m	279	201
Dewatering Flow Rate (unconfined linear flow component)	m^3/day	232	168
Factor of Safety	-	2	2
Dewatering flow rates multiplied by factor of safety	m^3/day	465	335

Analytical Solution for Estimating Groundwater Flow from an Unconfined Aquifer to a Fully-Penetrating Excavation

$$Q_w = Kx\frac{H^2 - {h_w}^2}{Lo}$$

(Based on the Dupuit Equation)

Where:

Q_w = Fow rate per unit length of excavation (m^3/s)

K = hydraulic conductivity (m/s)

H = height of static water table above base of water-bearing zone (m)

h_w = height of target water level above the base of water-bearing zone (m)

Lo=Distance of Influence (m)

Table E-2: Precipitation Estimate

Location	Assumed Precipitaiton Event (mm)	Length of Excavation (m)	Width of Excavation (m)	Rainwater Collection (m^3)
Site Extent	10	60	5	3

Notes:

mASL - meters above sea level

SWMP: Storm Water Management Pond