Hydrogeological Investigation

Bayview Avenue and Royal Orchard Boulevard, Markham, ON

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1 Introduction

1.1 Project Description

Exp Services Inc. (**exp**) was retained by Tridel to prepare a Hydrogeological Investigation Report associated with the Proposed Condominium Development located at Bayview Avenue and Royal Orchard Boulevard in Markham, Ontario (hereinafter referred to as the 'Site'). The Site is located on the southwest corner of Bayview Avenue and Royal Orchard Boulevard intersection in the City of Markham, Ontario. The Site is currently part of the Ladies Golf Club Markham. The Site location plan is shown on Figure 1.

Based on the architectural drawings (Kirkor, 2017), the proposed development will comprise of a condominium complex, including a twelve (12) storey building in the north and a fourteen (14) storey building structure in the south with a common three (3) level basement (P3).

It is noted that a Geotechnical Investigation was completed by **exp** in conjunction with this report. The results of the Geotechnical Investigation are presented under a separate cover.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation are to:

- Establish the local hydrogeological settings within the Site;
- Estimate preliminary construction dewatering flow rates;
- Assess long term foundation sub-drain discharge volumes;
- Assess groundwater quality;
- Assess MOECC permitting requirements associated with the site dewatering activities;
- Assess potential impacts on the surrounding environment; and,
- Prepare a 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;
- Drill and install four (4) shallow 50-mm diameter monitoring wells to an approximate depth of eight (8) meters below ground surface (mbgs)
- Drill and install two (2) deep 50-mm diameter monitoring wells to an approximate depth of twenty (20) mbgs. Both are in a nested configuration with the sallow ones.
- Develop and conduct Single Well Response Tests (SWRT) on all monitoring wells to assess hydraulic properties of the saturated soils at the Site;
- Complete two (2) rounds of groundwater level measurements at all monitoring wells;

- Collect one (1) groundwater sample for laboratory testing of the York Region Sewer Use By-Law parameters, and two (2) general chemistry;
- Evaluate the information collected during the field investigation program, including borehole geological information, SWRT results, groundwater level measurements and groundwater water quality;
- Preparation of site plans, cross sections, geological mapping, and groundwater contour mapping for the Site;
- Provide preliminary estimates for construction dewatering flow rates (Short-Term) and the zone of influence;
- Provide preliminary estimates for foundation sub-drain flow rates (Long-Term); and,
- Prepare a Hydrogeological Investigation Report.

1.4 Review of Previous Reports

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

- **Kirkor Architecture and Planners** (September 5, 2017), *Architectural Drawings for Ladies Gulf Club of Toronto*, prepared for Tridel Corporation.
- **EXP** (August 31, 2017), *Geotechnical Investigation, Bayview Avenue and Royal Orchard Boulevard, Thornhill, Ontario*, prepared for Tridel Corporation.

2 Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography

The Site is located within a physiographic region known as the Peel Plain, and within the physiographic landform known as the Bevelled Till Plains. The Bevelled Till Plains lies to the north of the Drumlinized Till Plains located in the South Slope (Chapman & Putnam, 2007).

The Peel plain is a level-to-undulating tract of clay soils and was created along the shores of former Lake Iroquois, an ancient glacial lake.

The topography of the Peel Plain physiographic region is generally described as being level-to-undulating, with an overall gradual slope towards Lake Ontario in the south.

2.1.2 Regional Geology and Hydrogeology

The Quaternary geology of the Site and surrounding area can be described as fine-textured glaciolacustrine deposits, consisting of silt and clay associated with minor sand and gravel (Ministry of Northern Development and Mines, 2012). The Quaternary geology for the Site and surrounding areas is shown on Figure 2.

Bedrock in the region is predominantly the Upper Ordovician-aged shale of the Georgian Bay Formation. Shale bedrock is primarily grey-green to dark grey, interbedded with grey-green to dark grey shale and fossiliferous calcareous siltstone to bioclastic limestone. Bedrock is slightly weathered in the upper zones, becoming sound with depth (Ministry of Northern Development and Mines, 2012).

Regional groundwater flow across the area is expected to be directed generally south, towards Lake Ontario. 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 elven (11) well records within a 500-m radius of the Site.

The database indicated that all of the wells are located off Site, at a distance of approximately 68 m or greater from the Site centroid.

Two (2) WWRs are indicated as water supply wells, including one (1) domestic (10493560) and one (1) public (10493755) well. Majority of the wells (7) were identified as observation wells and a one (1) was listed as abandoned. Remaining one (1) well is reportedly listed with unknown use. The reported water levels ranged from depths of 12.8 to 31.4 mbgs.

It should be noted that one (1) irrigation well is located on-site labeled as TW5/03. The locations of the MOECC WWR within 500 m of the Site are shown on Figure 3 and the location of the noted irrigation well is shown on Figure 4. A summary of the available WWRs is included in Appendix A.

2.2 Site Setting

2.2.1 Site Topography

The Site is located in a highly-urbanized land use setting.

The topography is considered relatively flat to undulating, with an overall gradual southerly slope towards Lake Ontario.

As indicated on the borehole logs (Appendix B) the surface elevation of the Site varies between approximately 174.11 and 178.07 meters above sea level (masl).

2.2.2 Local Surface Water Features

The Site is located within the Lake Ontario drainage basin and the Don River Watershed.

No surface water features are located on-Site; however, two ponds in the golf course are approximately located 23 and 67 meters southwest of the Site, respectively. The nearest surface water feature is a tributary of the Don River, located approximately 300 metres southwest of the Site. The closest distance between the Site and the Lake Ontario is approximately 19 kilometers (km) towards southeast.

2.2.3 Local Geology and Hydrogeology

Based on the results of the Geotechnical Investigations, a brief description of the general sub-surface geology of the Site, in order of depth, is summarized in the following sections. The following stratigraphic descriptions are based on a total of eight (8) geotechnical boreholes, including BH 1 through BH 8. The borehole completion depths approximately range from 7.5 to 15.5 mbgs. Borehole locations and borehole logs are presented in Figure 4 and Appendix B, respectively.

Topsoil

Topsoil with an approximate thickness ranging from 220 to 400 mm was encountered at the surface of the Boreholes 1 through 8.

It should be noted that topsoil quantities should not be established from the information provided at the borehole locations only. If required, a more detailed analysis (involving shallow test pits) is recommended to accurately quantify the amount of topsoil that should be removed for construction purposes.

Fill

Fill material underlaid the surficial topsoil in Boreholes 1 and 2. The composition of the fill material ranges from clayey silt to sandy silt where it contains traces of rootlets and topsoil. The fill material extends to an approximate depth of 4.0 m below existing ground surface in both noted boreholes (El. ~176.0 to 175.9 m).

Clayey Silt Till

Clayey silt till deposit underlaid the fill material in Boreholes 3, 4, 5, 6, 7 and 8. This lithologic unit is brown to grey in colour where it contains traces of gravel along with trace to some sand seams and pockets. Moisture contents of the clayey silt till ranged from approximately 11 to 30 percent of dry mass. Based on recorded SPT 'N'-values of 10 to 88, the clayey silt till has a stiff to hard consistency. The clayey silt till extends to an approximate depth between 4 and 7 m below existing ground surface (El. ~172.5 to 167.2 m). A middle clayey silt till deposit was encountered below the sandy silt till in Borehole 2 and below the silty sand in Boreholes 3 and 5. This deposit exists in a moist condition and has a hard consistency (recorded SPT 'N'-values of 57 to over 100). The middle clayey silt till extends to depths of about 8.5 to 13 m below existing ground surface in Boreholes 2, 3 and 5 (El. ~166.6 to 163.5 m).

A lower clayey silt till underlaid the sandy silt till deposit in Boreholes 5 and 6 at an approximate depth of 14.5 m below existing grade. This lower till deposit is grey in colour with a moist condition where it has a hard consistency with recorded SPT 'N'-values of 31 to 95. Boreholes 5 and 6 were terminated in the lower clayey silt till deposit at an approximate depths between 15.7 and 15.8 m below existing ground surface (El. ~159.3 to 158.4 m).

Silty Sand

A silty sand deposit underlaid the fill material in Borehole 1, as well as the silt deposit in Boreholes 3 and 4, the clayey silt till in Boreholes 5 and 6, as well as the sandy silt till in Borehole 8. This lithologic unit is brown in colour and wet where it indicates a compact to very dense state (recorded SPT 'N'-values of 14 to 63). The silty sand extends to an approximate depth between 5.5 and 8.5 m below existing ground surface (El. ~172.6 to 165.6 m).

Silt

A silt deposit underlaid the sandy silt till unit in Borehole 1 , as well as the upper clayey silt till in Boreholes 3, 4 and 7. This deposit is grey in colour , which contains some clay and a trace of sand seams. Moisture contents of the silt ranged from approximately 16 to 22 percent of dry mass indicating a moist to wet condition. Based on recorded SPT 'N'-values of 27 to over 100, the silt indicates a compact to very dense state of compactness. The silt extends to an approximate depth between 5.5 and 15.8 m below existing ground surface in Boreholes 1, 3, 4 and 7 (El. ~171.0 to 162.3 m). Borehole 1 was terminated in the silt deposit at an approximate depth of 15.8 m below existing grade (El. ~162.3 m).

Sandy Silt Till

A sandy silt till deposit underlaid the silty sand in Boreholes 1, 4 and 6, as well as the fill material in Borehole 2, and the clayey silt till in Boreholes 3, 4 and 8, as well as the silt unit in Borehole 7. This lithologic unit is generally grey in colour, which contains traces of gravel along with traces of silt seams. Moisture contents of the sandy silt till ranged from approximately 4 to 19 percent of dry mass. Based on recorded SPT 'N'-values of 50 to over 100, the sandy silt till indicates a very dense state of compactness. The silty clay

extends to an approximate depth between 7 and 15.8 m below existing ground surface (El. ~168.2 to 158.8 m).

A lower sandy silt till unit underlaid the clayey silt till deposit in Borehole 2, as well as the silt deposit in Borehole 4, as well as the silty sand deposit in Borehole 8. This lower sandy silt till unit is grey in colour with a moist to wet condition, and it indicates a very dense state of compactness (recorded SPT 'N'-values of 68 to over 100). Boreholes 2, 3, 4, 7 and 8 were terminated in the sandy silt till deposit at an approximate depth between 15.3 and 15.7 m below existing ground surface (El. ~162.3 to 158.8 m).

3 Background

3.1 Monitoring Well Details

The monitoring well network installed for this study as part of the Geotechnical Investigation at the site consists of the following:

- A total of six (6) boreholes were instrumented with 50-mm diameter monitoring wells. These monitoring wells include four (4) shallow (BH 1-S, BH 2, BH 4, and BH 8-S) and two (2) deep (BH 1-D and BH 8-D) monitoring wells. The shallow and deep monitoring wells are completed to an approximate depth of 7.6 and 15.2 mbgs, respectively.
- Four (4) monitoring wells, including BH 1-S and BH 1-D as well as BH 8-S and BH 8-D are in a nested configuration.

The monitoring well locations are shown on Figure 4 and borehole completion logs and monitoring well details are included in Appendix B.

3.2 Water Level Monitoring

Static groundwater level measurements were recorded for all available monitoring wells as part of the Geotechnical and Hydrogeological Investigation. A summary of all static water level data as it relates to the elevation survey is summarized in Table 3-1.

Table 3-1: Summary of Groundwater Level Measurements

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+) / Stick Down (-) (m)	Approximate Full Well Depth (mbgs)	Depth	24-Aug-17	28-Aug-17
BH 1-S	178.07	-	6.7	mbTOP	-	-
				mbgs	3.06	4.42
				masl	175.01	173.65
BH 1-D	178.07	-	15.0	mbTOP	-	-
				mbgs	6.48	4.97
				masl	171.59	173.11
BH 2	177.96	0.914	7.5	mbTOP	-	5.38
				mbgs	4.89	4.47
				masl	173.07	173.49
BH 4	174.80	-	7.6	mbTOP	-	-
				mbgs	4.37	4.56
				masl	170.43	170.25
BH 8-S	175.20	-	7.6	mbTOP	-	-
				mbgs	7.59	7.59
				masl	167.61	167.61
BH 8-D	175.20	-	15.2	mbTOP	-	-
				mbgs	7.13	7.49
				masl	168.07	167.72
TW 5/03*	177.17	0.950	33.6	mbTOP	13.15	-
				mbgs	12.20	-
				masl	164.97	-

Notes: mbTop: meters below top of casing
mbgs: meters below round surface

masl: meters above mean seal level
***** TW5/03 – water supply well; water level might not be representative of the static condition as the pump in the well may have been operational

The lowest and highest groundwater elevations recorded for the monitoring wells were 167.61 (7.59 mbgs, as measured on August 24 and 28, 2017) and 175.01 (3.06 mbgs, as measured on August 24, 2017) masl at BH 8-S and BH 1-S, respectively.

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

Based on the groundwater contour map delineated for the shallow water-bearing zone, the inferred direction of groundwater flow across the Site is interpreted to be directed to the southwest, towards a tributary of the Don River. It should be noted that groundwater levels are expected to show seasonal fluctuations and vary in response to prevailing climate conditions; this may also affect the direction and rate of flow.

3.3 Hydraulic Conductivity Testing

Six (6) Single Well Response Tests (SWRTs) were completed on BH 1-S, BH 1-D, BH 2, BH 4, BH8-S, and BH 8-D on August 28, 2017. The SWRTs were completed to estimate the saturated hydraulic conductivity (K) of the water bearing zones at the well screen depth.

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. It should be noted that all wells were purged twice. 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) values estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well ID	Full Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened	Estimated Hydraulic Conductivity (m/s)
BH 1-S	6.7	3.7 – 6.7	Silty Sand / Sandy Silt Till	1.2×10^{-6}
BH 1-D	15	12 - 15	Silt	1.2×10^{-7}
BH 2	7.5	4.5 – 7.5	Sandy Silt / Clayey Silt Till	5.6×10^{-8}
BH 4	7.6	4.6 – 7.6	Silt/ Silty Sand / Sandy Silt Till	1.2×10^{-6}
BH 8-S	7.6	4.6 – 7.6	Clayey Silt Till / Sandy Silt Till / Silty Sand	6.7×10^{-6}
BH 8-D	15.2	12.2 – 15.2	Sandy Silt Till	1.7×10^{-8}
Geometric mean of the K-values estimated for the water-bearing zones associated with silty sand unit				2.1×10^{-6}
Geometric mean of the estimated K-values				3.2×10^{-7}

Notes: mbgs: meters below round surface;
m/s: meters per second

SWRT provides estimates of K for the geological formation in the immediate media zone surrounding the well screens. As shown in Table 3-2, the highest K value is estimated for a combination of clayey silt till, sandy silt, silty sand units. The geometric mean of the K values for the tested water-bearing zones is estimated to be 3.2×10^{-7} m/s and for the ones associated with silty sand unit is to be 2.1×10^{-6} m/s.

3.4 Groundwater Quality

To assess the suitability for discharge of pumped groundwater to the York Region Sanitary and Storm, two (2) unfiltered groundwater samples were collected from monitoring well BH 4 to be analysed for the By-Law parameters and the comprehensive general chemistry (RCAp), as well as one (1) unfiltered water sample was collected from monitoring well BH 8-D on August 28, 2017, to be analysed for selected parameters listed in the Provincial Water Quality Objectives (PWQO) using a low flow pump. Prior to collection of the samples, approximately three (3) standing well volumes of groundwater were purged from the well.

All groundwater samples 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 Sanitary and Storm-Discharge limits (By-Law No. 2011-056 of the York Region Municipal Code). The analytical results and the laboratory Certificate of Analysis (CofA) are enclosed in Appendix D.

When compared to the Sanitary Sewer Discharge limits (York and Markham), the laboratory CofA for the water sample collected from the noted monitoring well indicates that all parameters are detected at concentrations below the applicable guidelines.

When compared to the Storm Sewer Discharge limits, the concentrations of Total Suspended Solids (TSS), Total Aluminum (Al), Total Iron (Fe), Total Manganese (Mn), and Total Titanium (Ti) in the water sample collected from BH 4 above the applicable guidelines. It is noted that Aluminum, Iron and Titanium is not regulated by the City of Markham Storm Sewer By-Law; therefore, only TSS and Manganese exceeded the Markham Storm Sewer criteria.

A list of the parameters indicated exceedances are presented in Table 3-3. It should also be noted that the concentration of TSS is reflective of the suspended sediments in the monitoring well, and as such, it is not representative of the actual groundwater composition.

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 exceed 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.

Table 3-3: Summary of Analytical Results

Parameter	Region of York Sanitary Sewer Discharge Limit	Region of York Storm Sewer Discharge Limit	Concentration BH 4 August 28, 2017
Total Suspended Solids (TSS) (mg/L)	350 *	15 *	**190**
Total Aluminum (Al) (mg/L)	50 *	1 **	**1.7**
Total Iron (Fe) (mg/L)	50 **	1 **	**3.9**
Total Manganese (Mn) (mg/L)	5 *	0.15 *	**0.2**
Total Titanium (Ti) (mg/L)	5 *	0.05 **	**0.09**

Notes:
Bold: indicates concentration exceeds the Storm Sewer Discharge Limit. * Criteria is same as Markham By-Law. ** Criteria is not present in Markham By-Law.

4 Construction Dewatering Assessment

4.1 Construction Dewatering Rate Assumptions

Based on the architectural drawings (Kirkor, 2017), the proposed development will comprise of a condominium complex, including a twelve (12) storey building in the north and a fourteen (14) storey building structure in the south with a common three (3) level basement (P3).

Based on the geotechnical report, an open cut excavation with shoring extending to the Site boundaries consisting of soldier piles and lagging installed along the full perimeter of the building footprint is suggested. However, caisson walls can be considered if a stiffer system is required (**exp**, 2017). It should be noted that the shoring drawings were not available at the time of this report; however, **exp** should be retained to review the assumptions outlined in this section should the proposed shoring design change. It is imperative to note that the dewatering estimates are provided to allow for the drainage of the silty sand unit identified on the Site and mitigate potential basal heave during the construction. Potential basal heave should be assessed by the geotechnical engineer.

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

Input Parameter	Assumption	Notes
Highest surface elevation	178 masl	Based on the geotechnical report (**exp**, 2017)
Groundwater elevation	175 masl	Highest obtained water level at BH 1-S on August 24, 2017)
Lowest footing elevation	167.6 masl	Based on the revised geotechnical report, the footing elevation is anticipated to be at approx. 10.4 mbgs for P3 (**exp**, 2017).
Dewatered elevation target	166.6 masl	Assumed to be approx. 1 m below the lowest footing elevation.
Excavation area	149 m x 62 m	Based on the architectural drawings (Kirkor Architects, 2017).
Estimated K value used for P3	2×10^{-6} m/s	The geometric mean of the K values estimated for the water-bearing zones associated with silty sand unit.

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 calculations of 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)
The Site Extent	36	18

4.2.1 Dewatering Flow Rate Estimate

Flow from aquifer

The Dupuit equation for steady state conditions for linear flow to both sides 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 precipitation event was utilized for the estimate. Given that the total area of the excavation to be 9,238 m^2, the estimated maximum volume of direct rainwater to be collected in the excavation is approximately 92 m^3/event (rounded). 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 are summarized in Table 4-3 below:

Table 4-3 Summary of Dewatering Flow Rate Estimate

Location	Dewatering Flow Rate (m^3/day)	Notes
Site Extent	530	Representative hydraulic conductivity scenario-flow from overburden Aquifer (Sichardt)

These peak dewatering flow rates include a factor of safety of two (2) to account for accumulation of 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. This peak dewatering flow rate also provides additional capacity for the dewatering contractor.

Please note that it is the responsibility of the contractor to ensure dry conditions are maintained within the excavation at all times and at all costs.

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. This amount was added to the estimated dewatering flow rate. In the event of a two-year storm return or worse, the excavation may need to be dewatered over the course of a day or more before safe work condition can resume.

It should be emphasized that dewatering should commence before excavation and that potential for basal heave should be reviewed by the geotechnical engineer.

4.4 MOECC Water Taking Permit

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering will be more than 50 m^3/day but less than 400 m^3/day, application for the Environmental Activity and Sector Registry (EASR) with MOECC is required. If groundwater dewatering rates on-Site exceed 400 m^3/day, a Category 3- Permit To Take Water(PTTW) would be required from the MOECC.

It is recognized that the conservative flow estimate equation calculated with a geometric mean of the K values for the water-bearing zones associated with silty sand unit, provides a conservative estimate to account for higher than expected flow rates during the construction dewatering. Based on the dewatering estimate of approximately 530 m^3/day for this project, a Category 3 PTTW would be required to facilitate the construction dewatering program for the Site.

Based on the above estimates it is recommended to register the proposed construction dewatering activities at the Site for a dewatering rate of 600 m^3/day.

5 Preliminary Sub-Drain Discharge Estimate

5.1 Analytical Method

It is our understanding that the development plan includes a permanent foundation sub-drain system that will discharge to the municipal sewer system.

For the following assessment, two (2) long-term flow rate scenarios were considered. These scenarios are as follows:

1) Flow into the sub-drain without Caisson Walls
2) Flow into the sub-drain with Caisson Walls completed on three (3) sides of the excavation, including east, north, and west.

Scenario 1: The groundwater flow to the future sub-drain without using caisson walls can be estimated using the Dupuit equation applicable to the steady linear flow to the sides of a partially-penetrating excavation through an unconfined aquifer resting on a horizontal impervious surface was used. The Dupuit analytical solution is expressed as follow:

$$Q_w = \left[0.73 + 0.23\left(\frac{P}{H}\right)\right] xK(H^2 - h^2)/Lo$$

Where:

Q_w = Rate of pumping (m^3/sec)
x = Length of excavation (m)
P = Depth of penetration of drainage (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 (Ro/2) (m)

Scenario 2: The groundwater flow to the future sub-drain with caisson walls will be utilized for three sides of excavation where it is anticipated to be installed approximately 3.5 below the lowest elevation of the proposed sub-drain. To estimate the groundwater flow to the future sub-rain using caisson walls for three sides, the Kavvadas equation was utilized. The groundwater flow from the southern side was estimated using the Dupuit equation applicable to one side of an open-cut excavation.

The Kavvandas equation is expressed as follow:

$$Q_w = 0.85\,K(H - h_w)[1 - (0.2)^{\frac{s}{0.5b}}]\left(\frac{d}{0.5b}\right)^{-0.5}\left(\frac{d_1}{0.5b}\right)^{-0.125}$$

Where:
Q_w = Rate of pumping per unit length of excavation (m^3/sec)
K = Hydraulic conductivity (m/sec)

H = Height of static water table above the base of water-bearing zone (m)
h_w = Height of target water level above the base of water-bearing zone (m)
b = Distance between two cut-off walls (m)
s = Height of cut-off wall above the base of water-bearing zone (m)
d = Height of water contained between cut-off walls above the base of cut-off walls
d_1 = Drawdown in excavation (m)

The Dupuit equation applicable to one side of excavation is expressed as follow:

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

Where:
Qw = Rate of pumping (m^3/sec)
X = Width 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)

Preliminary Sub-Drain discharge estimates using the above noted equations are provided in Appendix F and G. Further, Table 5-1 presents the assumptions used to calculate the sub-drain discharge volumes.

Table 5-1 Dewatering Estimate Assumptions

Input Parameter	Assumption	Notes
Highest surface elevation	178 masl	Based on the geotechnical report (**exp**, 2017)
Groundwater elevation	175 masl	Highest obtained water level at BH 1-S on August 24, 2017)
Lowest slab elevation	168.5 masl	Based on the architectural drawings for P3 (Kirkor Architects, 2017).
Dewatered elevation	168	Assumed to be approx. 0.5 m below the lowest slab elevation
Excavation area	149 m x 62 m	Based on the architectural drawings (Kirkor Architects, 2017).
Estimated K value	2 x 10^{-6} m/s	The geometric mean of the K values estimated for the water-bearing zones associated with silty sand unit.

5.2 Preliminary Sub-Drain Discharge Volumes

Based on the assumptions provided in this report (outlined in Section 5.1), the results of the long-term discharge volume estimate are summarized in Table 5-2.

Table 5-2 Summary of Preliminary Sub-Drain Discharge Volume

Flow Rate	Long-Term Volume (m^3/day)	Notes
Site extent (Without using Caisson Wall)	200	Intermittent cycling of sump pumps and seasonal fluctuation in groundwater regimes should be considered for pump specifications.
Site extent (Using Caisson Wall on Three Sides)	80	

Seasonal fluctuations in the water level and precipitation events will affect the daily discharge volume and the estimate represents an average volume.

Please note that this preliminary estimate of sub-drain discharge volumes is based on the assumptions outlined in this report and includes a factor of safety of one and a half (1.5), and that any variations in hydrogeological conditions beyond those encountered as part of this investigation may significantly influence the sub-drain discharge volumes. As a result, the exact volume discharged will be confirmed once the system is operational. It is recommended that once the sub-drain system is in place, that a flow meter be installed at the sump(s) to record daily discharge volumes to provide more representative estimates during the commissioning stage of the system.

6 Environmental Impact

6.1 Surface Water Features

The Site is located within the Lake Ontario drainage basin and the Don River Watershed.

No surface water features are located on-Site. The nearest surface water feature is a tributary of the Don River, located approximately 300 metres southwest of the Site. The closest distance between the Site and the Lake Ontario is approximately 19 kilometers (km) towards southeast. As such, no impact on the surface water is anticipated during the construction and post-constriction phases.

The irrigation ponds located 23 and 67 meters southwest of the Site will fall within the zone of influence of the construction dewatering; however, it is in our understanding that these ponds are equipped with water-proof liners, and as such, the construction dewatering will not pose any negative impacts on the noted ponds.

6.2 Groundwater Sources

The area surrounding the Site is municipally serviced with water supply. Two (2) WWRs are indicated as water supply wells, including one (1) domestic (10493560) and one (1) public (10493755) well that are approximately located 500 m from the Site centroid. Further, one (1) irrigation well is located on-site labeled as TW5/03. It is anticipated that the noted irrigation well be decommissioned and reinstalled at a new location outside of the Site, and as such, the construction dewatering will not pose any negative impact on the noted well.

6.3 Water Quality

If treatment systems are considered for temporary discharge of the excavation, 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 City of Markham / Region of York and the TRCA will be required prior to discharging dewatering effluent.

6.4 Geotechnical Considerations

Under certain conditions, dewatering activities can cause settlements due to an increase in the effective stress in the dewatered soil. Based on the geotechnical report, an open cut excavation with shoring extending to the Site boundaries consisting of soldier piles and lagging installed along the full perimeter of the building footprint is suggestted. However, caisson walls can be considered if a stiffer system is required (**exp**, 2017).

Further, the conclusions of this study indicate that there is a potential for basal heave during the construction phase that may arise from dewatering the silty sand aquifer. As such, geotechnical assessments need to be implemented to mitigate such phenomenon.

A letter related to geotechnical issues (i.e. settlement) as it pertains to the Site is recommended to be completed under a separate cover.

7 Conclusions and Recommendations

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

- Based on the assumptions outlined in this report, the high dewatering flow rate for the proposed construction activities is estimated to be approximately 530 m^3/day, including the precipitation rate per event. It should be emphasized that dewatering should commence before excavation and that potential for basal heave should be reviewed by the geotechnical engineer.
- To provide the dewatering contractor with sufficient capacity to manage water inside the excavation during construction, it is recommended that a Category 3 PTTW application be submitted for water taking of 600 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.
- The estimated preliminary foundation sub-drain discharge rates in post-construction phase without using Caisson Wall is estimated to be approximately 200 m^3/day; whereas with using Caisson Wall completed on three sides of the excavation (north, east, west sides), the flow rate is estimated to be approximately 80 m^3/day.
- When compared to the Sanitary Sewer Discharge limits (York Region and Markham Sewer Use By-Laws), the laboratory CofA for groundwater samples collected indicates that all parameters analyzed are detected at concentrations below the applicable guidelines.
- When compared to the York Region and Markham Storm Sewer Use By-Law Discharge limits, the concentrations of Total Suspended Solids (TSS), Total Aluminum (Al), Total Iron (Fe), Total Manganese (Mn), and Total Titanium (Ti) in the water sample collected from BH 4 above the applicable guidelines. It is noted that Aluminum, Iron and Titanium is not regulated by the City of Markham Storm Sewer By-Law; therefore, only TSS and Manganese exceeded the Markham Storm Sewer criteria.
- It should also be noted that the concentration of TSS is reflective of the suspended sediments in the monitoring well, and as such, it is not representative of the actual groundwater composition. Further, the laboratory certificates provided in this report present partial results. The analytical results for the remainder of intended parameters will be provided once the laboratory procedures are complete.
- 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 to be elevated where they may 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.

- Based on the impact assessments, no impact on the surface water is anticipated during the construction and post-constriction phases. Further, a potential for basal heave during the construction phase is anticipated due to dewatering the silty sand aquifer during the construction. As such, geotechnical assessments need to be implemented to mitigate such phenomenon.
- It is noted that an agreement to discharge to the City of Markham and/or York Region sewer system will be required prior to discharging dewatering effluent.
- Monitoring wells should be decommissioned by licensed well contractor prior to start of construction as per O.Reg. 903.

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. The conclusions of this report are solely intended for the hydrogeological studies applicable to the dewatering construction and preliminary sub-drain discharge flow rates. Any changes to the design concept may result in a modification to the recommendations provided in this report.

8 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.

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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

Nataliya Tkach, M.Sc., P.Geo., PMP
Senior Hydrogeologist
Environmental Services

Francois Chartier, M.Sc., P.Geo.
Head of Hydrogeology Group
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9 References

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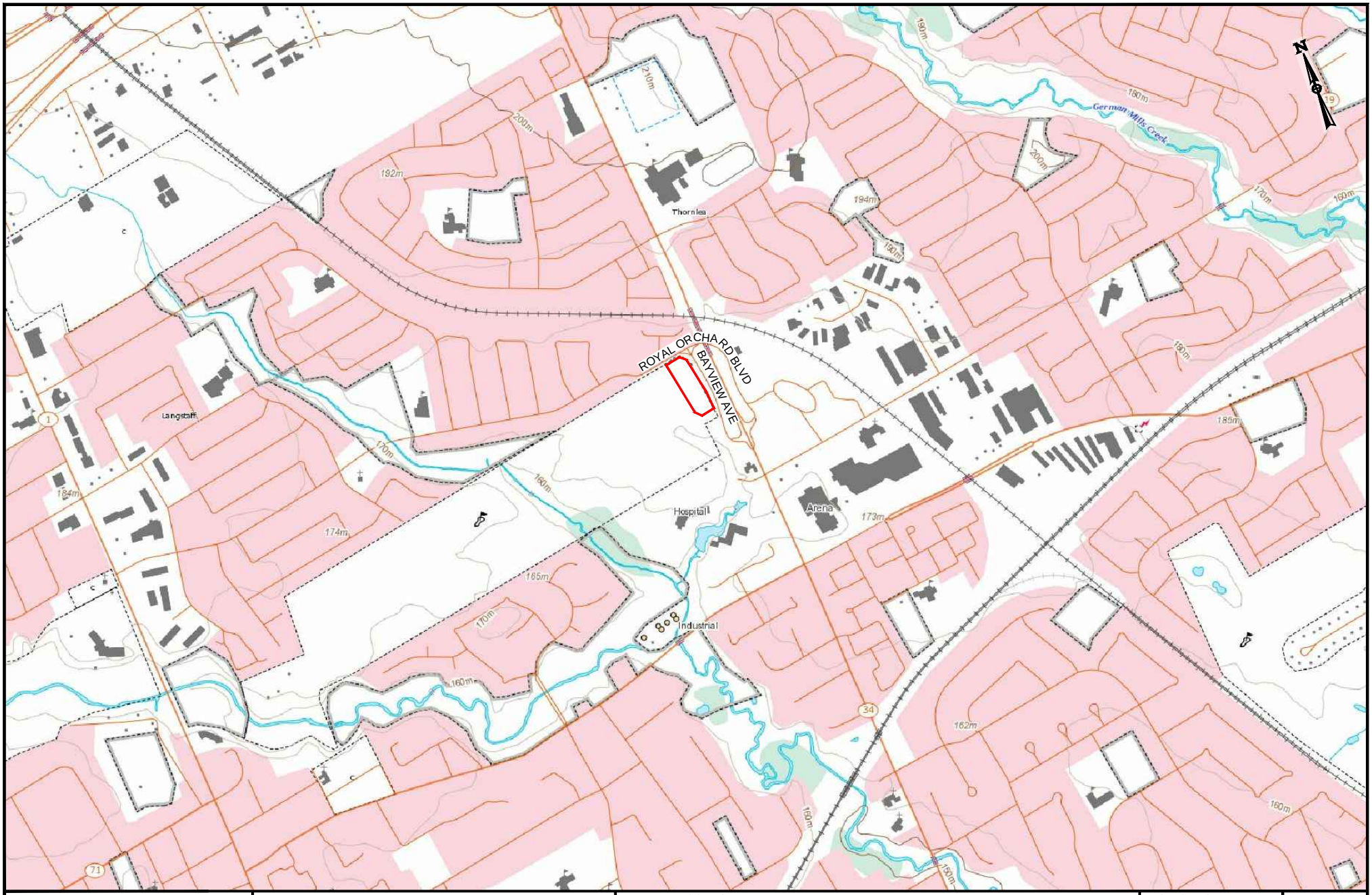
Figures



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LEGEND:

APPROXIMATE SITE BOUNDARY

SCALE

150 0 150 300 450 600 750m

TITLE AND LOCATION:

SITE LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

PROJECT NO.:	DWN.:
BRM-00607085-A0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
AUGUST 2017	1

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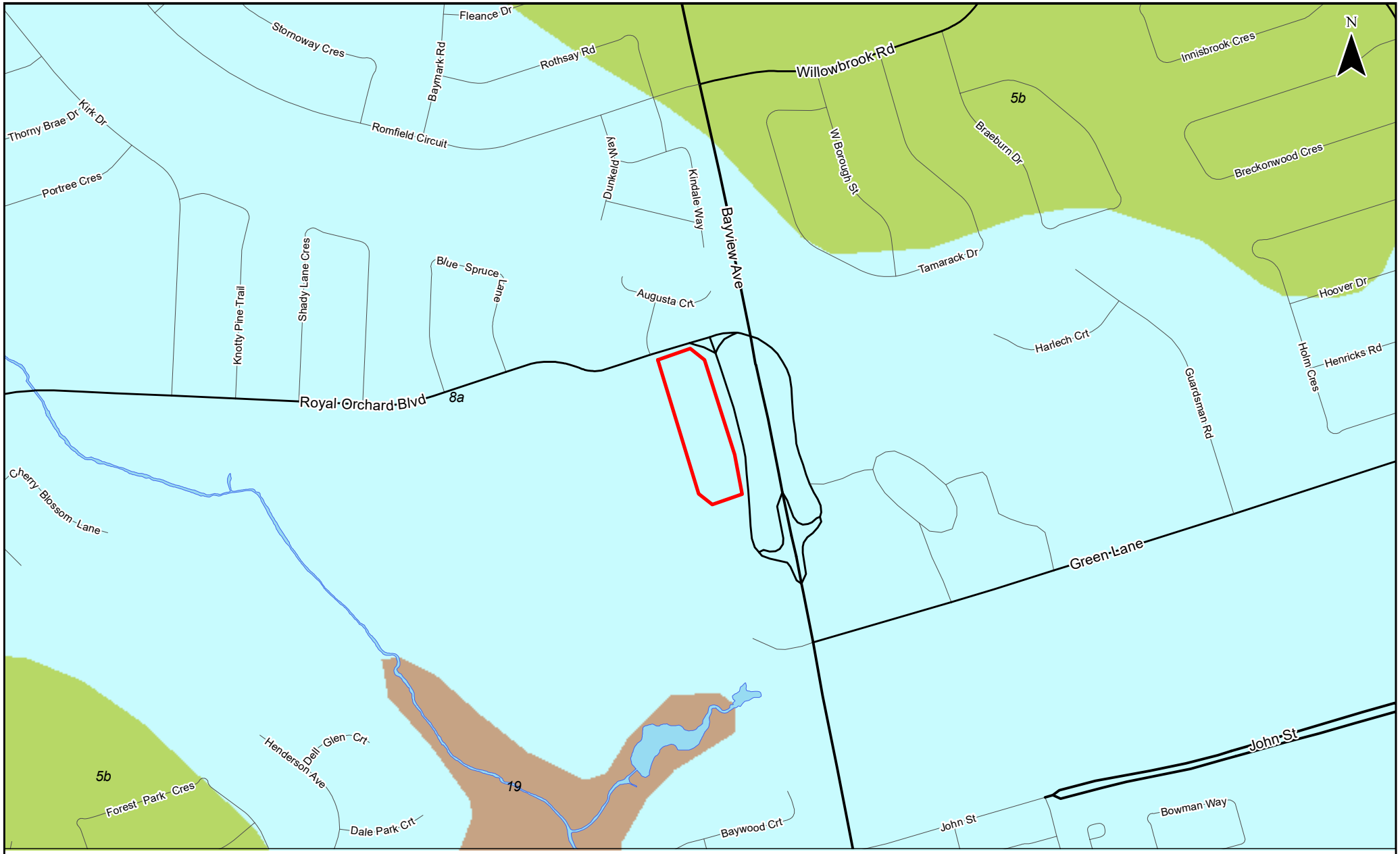

Legend

- Approximate Site Boundary
- 8a: Fine-textured glaciolacustrine deposits
- 19: Modern alluvial deposits
- 5b: Stone-poor, carbonate-derived silty to sandy till

0 50 100 200 300 400 500 m

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HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

DRAWING TITLE:
SURFICIAL GEOLOGY

PROJECT No.: BRM-00607085-A0	DWN: AC
SCALE: AS NOTED	CHKD: PS
DATE: AUGUST 2017	DWG. No.: 2

Legend

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

0 50 100 200 300 400 500 m

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HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

DRAWING TITLE:
MOECC WATER WELL RECORD MAP

PROJECT No.: BRM-00607085-A0	DWN: AC
SCALE: AS NOTED	CHKD: PS
DATE: AUGUST 2017	DWG. No.: 3

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (**exp**, 2017)
- BOREHOLE / MOINTORING WELL LOCATION (**exp**, 2017)
- EXISTING WATER SUPPLY WELL
- A-A' CROSS SECTION A-A' (SEE FIGURE 5)

TITLE AND LOCATION:

BOREHOLE / MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

PROJECT NO.:	DWN.:
BRM-00607085-A0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
AUGUST 2017	4

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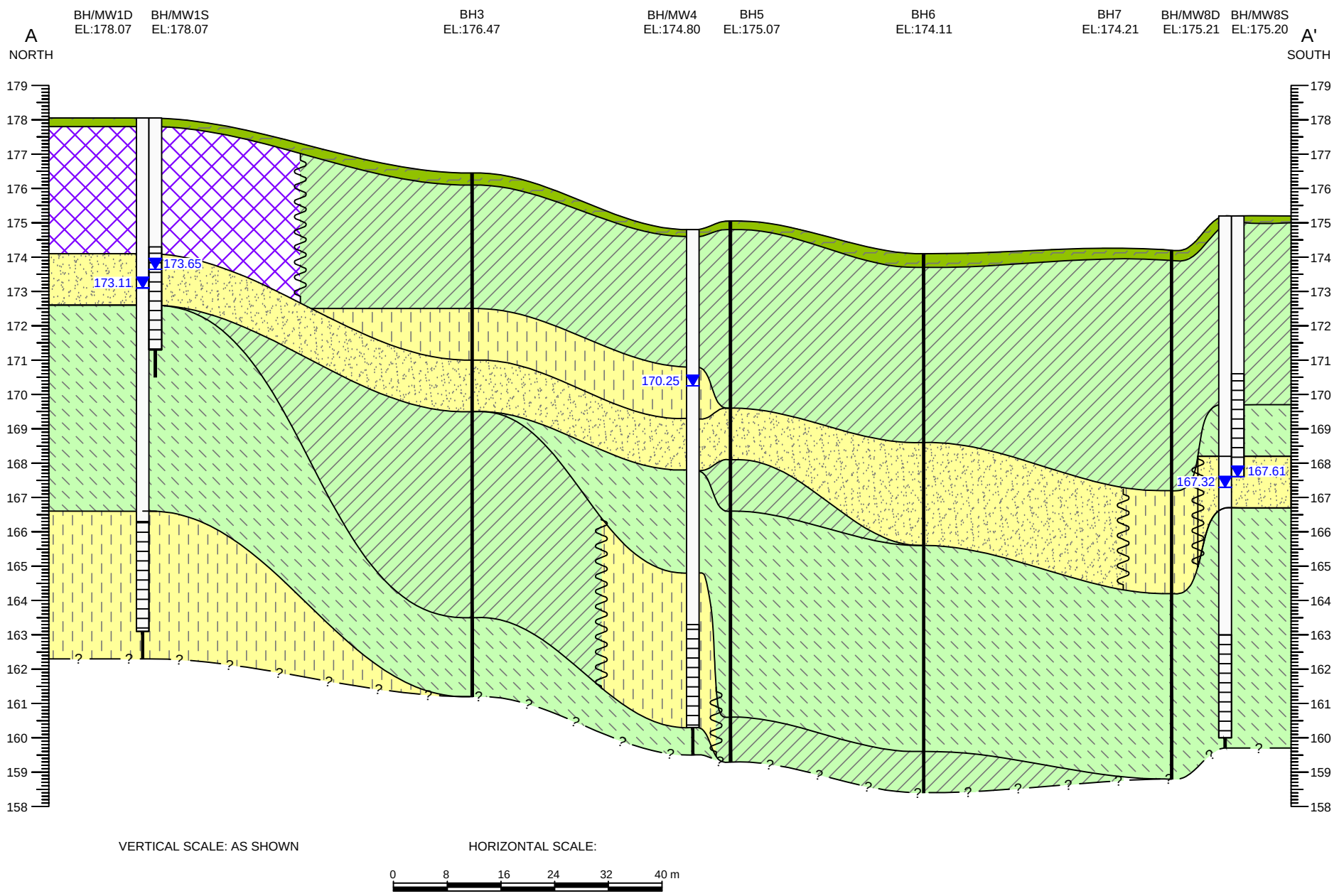

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LEGEND:

- TOPSOIL
- FILL
- SILT
- SILTY SAND
- SANDY SILT TILL / SILT TILL
- CLAYEY SILT TILL
- GROUNDWATER ELEVATION AS MEASURED ON AUGUST 28, 2017

TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

PROJECT NO.: BRM-00607085-A0	DWN.: AS
SCALE: AS NOTED	CK: PS
DATE: AUGUST 2017	FIG. NO.: 5

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- BOREHOLE LOCATION (**exp**, 2017)
- BOREHOLE / MOINTORING WELL LOCATION (**exp**, 2017)
- EXISTING WATER SUPPLY WELL
- GROUNDWATER CONTOURS
- [XX.XX] GROUNDWATER ELEVATION AS MEASURED ON AUGUST 28, 2017
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:

SHALLOW GROUNDWATER CONTOUR PLAN

HYDROGEOLOGICAL INVESTIGATION
BAYVIEW AVENUE AND ROYAL ORCHARD BOULEVARD
MARKHAM, ONTARIO

PROJECT NO.:	DWN.:
BRM-00607085-A0	AS
SCALE:	CK:
AS NOTED	PS
DATE:	FIG. NO.:
AUGUST 2017	6

Appendix A:
MOECC WWR Summary Table

Off-Site										
WELL ID	EASTING	NORTHING	BOREHOLE ID	DATE COMPLETED	STREET	CITY	DISTANCE TO SITE CENTROID (m)	WATER FOUND (m)	USE DESCRIPTION	FINAL STATUS
6902829	628257	4853026	10493560	11/2/1953			540	12.8	Public	Water Supply
6903026	628869	4853636	10493755	2/15/1950			503	31.4	Domestic	Water Supply
7202029	628858	4853666	1004311410	5/7/2013	15 HARLECH COURT	Markham	499		Monitoring and Test Hole	Test Hole
7202030	628858	4853666	1004311480	5/7/2013	15 HARLECH COURT	Markham	499		Monitoring and Test Hole	Test Hole
7202031	628858	4853666	1004311580	5/7/2013	15 HARLECH COURT	Markham	499		Monitoring and Test Hole	Test Hole
7207381	628900	4853582	1004558910	3/8/2013	7 HARLECH COURT	Markham	529		Monitoring	Test Hole
7208468	628435	4853579	1004582590	4/20/2013	ROYAL ORCHARD BLVD.	Vaughan	68			Abandoned-Other
7238013	628479	4853261	1005310620				312			
7238658	628774	4853733	1005315230	2/4/2015	20 HARLECH COURT	THORNHILL	440		Test Hole	Observation Wells
7238659	628789	4853711	1005315230	2/4/2015	20 HARLECH COURT	THORNHILL	446		Test Hole	Observation Wells
7238660	628815	4853678	1005315230	2/4/2015	20 HARLECH COURT	THORNHILL	460		Test Hole	Observation Wells

Appendix B: Borehole Logs

Log of Borehole 2

Project No. BRM-00607085-A0 | Drawing No. 4

Project: Preliminary Geotechnical Investigation & Hydrogeological Study | Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 23, 2017

Drill Type: Hollow Stem Augers

Datum: Geodetic

Auger Sample ☒ | Combustible Vapour Reading □

SPT (N) Value ○ ▨ | Natural Moisture ×

Dynamic Cone Test — | Plastic and Liquid Limit I—○

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
		~230 mm **TOPSOIL**	177.96 ~177.7	0	5			
		FILL - clayey silt, trace sand, trace gravel, trace rootlets and topsoil inclusions, brown, moist		1	9			19.9
				2	5			20.0
		FILL - sandy silt, traace clay, trace rootlets, brown, moist	~175.9	3	6			22.4
				4	6			21.6
		SANDY SILT TILL - trace gravel, some sand seams and silt layers, occasional clay pockets, brown, moist, very dense	~174.0	5	59			
		- becoming grey below ~5.5 m depth		6	69			
		CLAYEY SILT TILL - trace gravel, trace sand seams and pockets, grey, moist, hard	~171.0	7				
				8	99			
				9	57			21.0
				10				
				11	67			20.8
		SANDY SILT TILL - trace gravel, some sand seams and silt layers, occasional clay pockets, grey, moist, very dense	~166.0	12	50/25 mm			
				13				
				14	84			
				15				
					100			
		End of Borehole	~162.3					

LAGWGL02EXP 607085A_BH_LOGS.GPJ NEW.GDT 8/31/17

Notes:
1. Borehole advanced to completion at ~15.7 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

exp.

Brampton

Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	~14.9	~15.1
August 24, 2017	~4.9	Well
August 28, 2017	~5.4	Well

Log of Borehole 3

Project No. BRM-00607085-A0 Drawing No. 5

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 18, 2017

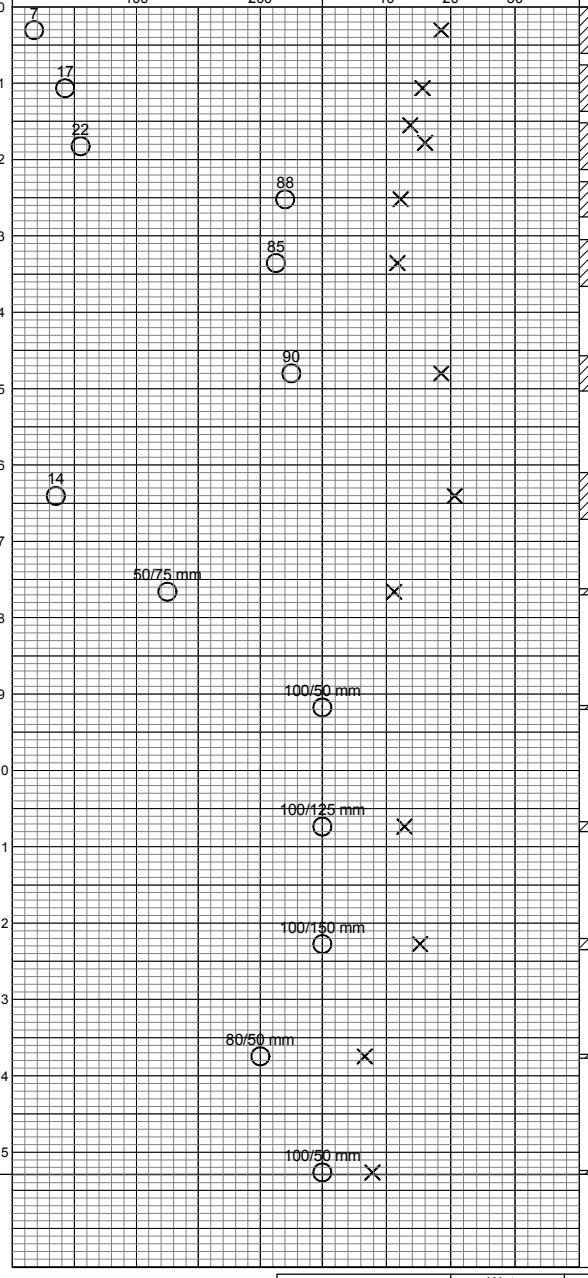
Drill Type: Solid Stem Augers

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
~380 mm **TOPSOIL**	176.47
CLAYEY SILT TILL - trace sand, trace gravel, trace oxidized zones, trace rootlets in upper level, brown, moist, very stiff to hard	~176.1
- becoming grey below ~3.3 m depth	
SILT - some clay, trace sand seams, grey, very moist, very dense	~172.5
SILTY SAND - brown, wet, compact	~171.0
CLAYEY SILT TILL - trace gravel, trace sand seams and pockets, grey, moist, hard	~169.5
- spoon bouncing	
- becoming more silty below ~10.5 m depth	
SANDY SILT TILL - trace gravel, some sand seams and silt layers, occasional clay pockets, grey, moist, very dense	~163.5
End of Borehole	~161.2



Sample	Natural Unit Weight kN/m³
	22.4
	22.4
	22.5
	21.0
	21.3
	21.9

Notes:
1. Borehole advanced to completion at ~15.3 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	~1.9	~2.0

LAGWGL02EXP 607085A_BH_LOGS.GPJ NEW.GDT 8/31/17

Log of Borehole 4

Project No. BRM-00607085-A0 Drawing No. 6

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

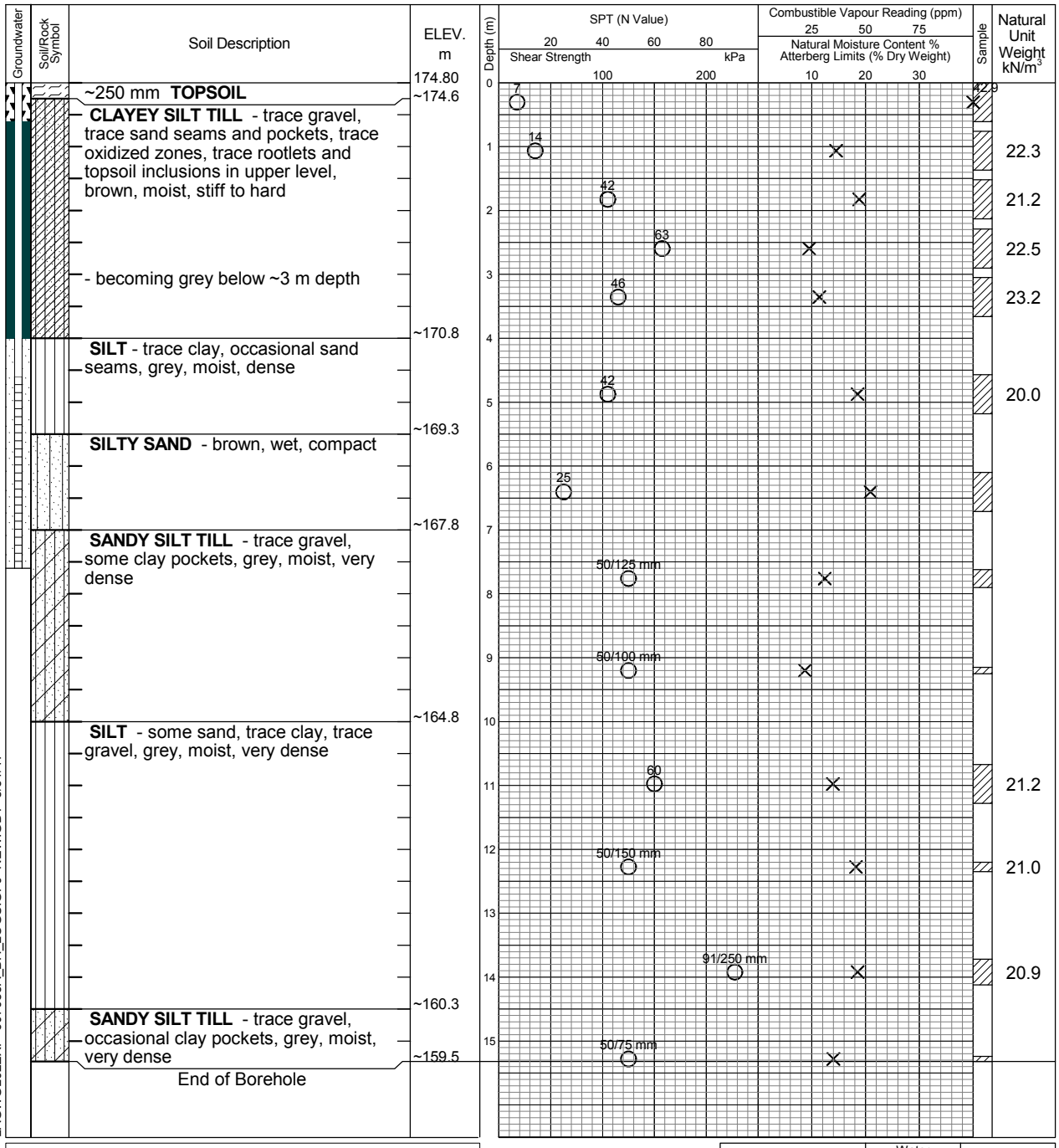
Date Drilled: August 24, 2017

Drill Type: Hollow Stem Augers

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 ▲



LAGWGL02EXP 607085A_BH_LOGS.GPJ NEW.GDT 8/31/17

Notes:
1. Borehole advanced to completion at ~15.3 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

exp.
Brampton

Elapsed Time	Water Level (m)	Hole Open to (m)
August 24, 2017	~4.4	Well
August 28, 2017	~4.6	Well

Log of Borehole 5

Project No. BRM-00607085-A0 Drawing No. 7

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 22, 2017

Drill Type: Hollow Stem Augers

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
~300 mm **TOPSOIL**	175.07 ~174.8	0	5		
CLAYEY SILT TILL - trace gravel, some sand seams and pockets, disturbed with trace rootlets and topsoil inclusions in upper level, brown, moist, stiff to hard		1	10		
		2	16		
		3	33		21.5
		4	33		22.5
- becoming grey and more silty below ~4.5 m depth		5	33		
	~169.6	6	63		
SILTY SAND - brown, wet, very dense		7			
	~168.1	8	50/125 mm		
CLAYEY SILT TILL - trace gravel, trace sand seams, grey, moist, hard		9	50/100 mm		
	~166.6	10			
SANDY SILT TILL - trace gravel, occasional clay pockets, grey, moist, very dense		11	55/150 mm		21.5
- silty zone		12	80/150 mm		
		13			
		14	50/125 mm		
	~160.6	15			
CLAYEY SILT TILL - trace gravel, trace sand seams, trace silt partings, grey, moist, hard			31 ▲>		20.6
	~159.3				
End of Borehole					

Notes:
1. Borehole advanced to completion at ~15.8 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	Wet Cave	~5.2

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Log of Borehole 6

Project No. BRM-00607085-A0 | Drawing No. 8

Project: Preliminary Geotechnical Investigation & Hydrogeological Study | Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 17, 2017

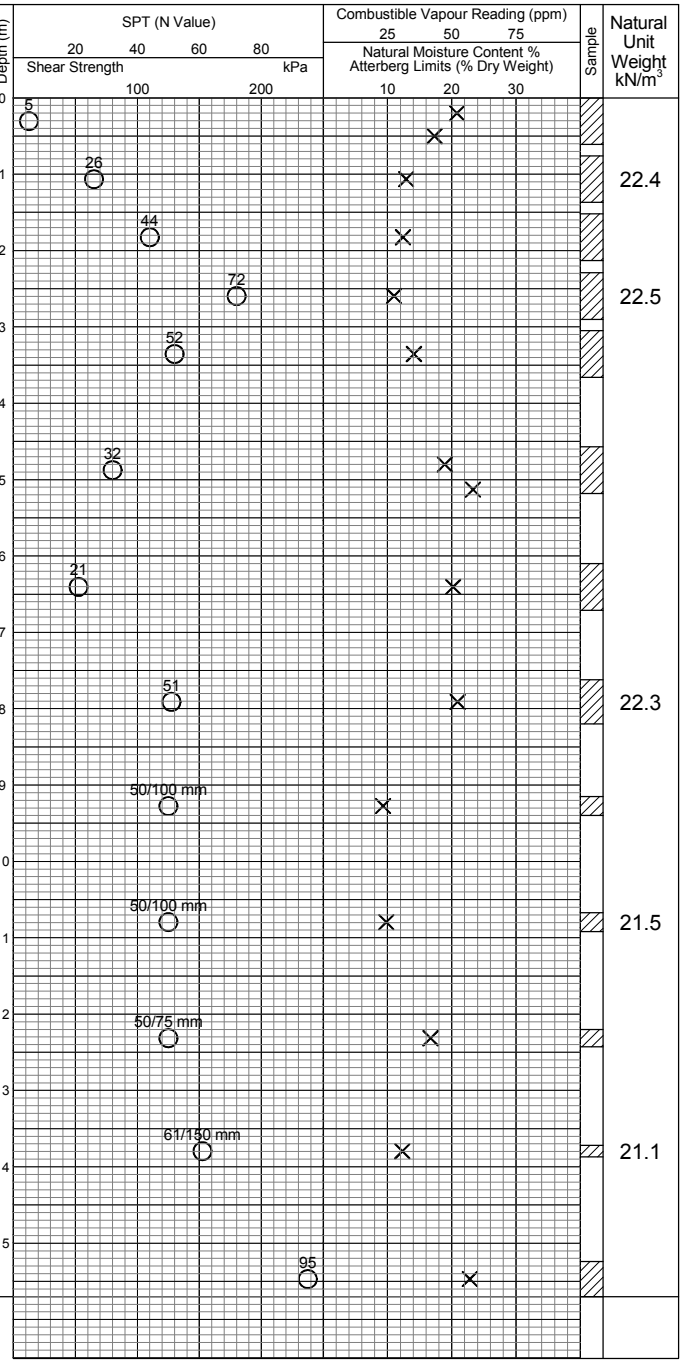
Drill Type: Solid Stem Augers

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
~400 mm **TOPSOIL**	174.11	
	~173.7	
CLAYEY SILT TILL - trace gravel, some sand seams and pockets, disturbed with trace rootlets and topsoil inclusions in upper level, trace oxidized zones, brown, moist to very moist, very stiff to hard		22.4
- becoming grey below ~3 m depth		22.5
- silty layer		
	~168.6	
SILTY SAND - brown, wet, compact to dense		22.3
	~165.6	
SANDY SILT TILL - trace gravel, occasional clay pockets, grey, moist, very dense		21.5
- silty zone		
	~159.6	
CLAYEY SILT TILL - trace gravel, trace sand seams, trace silt partings, grey, moist, hard		21.1
	~158.4	
End of Borehole		



Notes:
1. Borehole advanced to completion at ~15.7 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	~3.1	~5.2

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Log of Borehole 7

Project No. BRM-00607085-A0 Drawing No. 9

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 24, 2017

Drill Type: Solid Stem Augers

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
~280 mm **TOPSOIL**	174.21 ~173.9	
CLAYEY SILT TILL - trace gravel, trace sand seams and pockets, disturbed with trace rootlets and topsoil inclusions in upper level, brown, moist, stiff to very stiff		
- silty zone		19.4
		19.4
		22.8
- becoming grey below ~4 m depth		
		20.9
- silty zone		
	~167.2	
SILT - trace clay, trace sand, trace oxidized zones, brown to grey, wet, compact to very dense		
		22.2
	~164.2	
SANDY SILT TILL - trace gravel, occasional clay pockets, grey, moist, very dense		21.7
	~158.8	
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 7 8 9 10 11 12 13 14 15

7 11 15 18 13 11 30 27 53 97/250 mm 72/150 mm 75/50 mm 60/125 mm

Notes:
1. Borehole advanced to completion at ~15.4 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
On Completion	~7.0	~7.0

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Log of Borehole 1D

Project No. BRM-00607085-A0 Drawing No. 2

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 24, 2017

Drill Type: Solid Stem Augers

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
	178.07	0			
~280 mm **TOPSOIL**	~177.8				
FILL - clayey silt, trace sand seams, trace gravel, some oxidized zones, trace rootlets and topsoil inclusions, brown, moist		1	7, 12		19.3
		2	13		21.7
	~176.0				
FILL - silty sand, trace silt pockets, trace clay, some oxidized zones, brown, moist to wet		3	7		19.7
- spoon wet			7		
	~174.1	4			
SILTY SAND - fine grained, brown, wet, dense		5	37		
	~172.6				
SANDY SILT TILL - trace gravel, trace silt seams, grey, moist, very dense		6	79		22.8
		7	100/100 mm		
		8			
		9	50		23.3
		10			
		11	99		
	~166.6				
SILT - trace clay, trace gravel, grey, moist, very dense		12	104		21.3
		13			
		14	77		20.8
		15			
			62		
	~162.3				
End of Borehole					

Notes:
1. Borehole advanced to completion at ~15.8 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
August 24, 2017	~6.5	Well
August 28, 2017	~5.0	Well

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Log of Borehole 1S

Project No. BRM-00607085-A0 Drawing No. 3

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 24, 2017

Drill Type: Solid Stem Augers

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
			178.07	0	20 40 60 80 / 100 200	25 50 75 / 10 20 30		
		See Borehole 1D for Details		1				
				2				
				3				
				4				
				5				
				6				
				7				
			~170.5					
		End of Borehole						

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Notes:
1. Borehole advanced to completion at ~7.6 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
August 24, 2017	~3.1	Well
August 28, 2017	~4.4	Well

Log of Borehole 8D

Project No. BRM-00607085-A0 Drawing No. 10

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 23, 2017

Drill Type: Hollow Stem Augers

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)	Sample	Natural Unit Weight kN/m³
~220 mm **TOPSOIL**	175.20 ~175.0	0		
CLAYEY SILT TILL - trace gravel, trace sand seams and pockets, disturbed with trace rootlets and topsoil inclusions in upper level, brown, moist, stiff to hard		1		21.2
		2		21.8
- becoming more sandy below ~2.5 m depth		3		19.3
- becoming grey below ~4 m depth		4		
		5		23.0
	~169.7	6		
SANDY SILT TILL - trace clay, occasional sand seams, trace oxidized zones, grey, wet, dense		7		
	~168.2	8		
SILTY SAND - brown, wet, dense		9		22.1
	~166.7	10		
SANDY SILT TILL - trace gravel, trace sand seams, occasional clay pockets, trace oxidized zones, grey, moist to wet, very dense		11		22.1
		12		
		13		
		14		22.2
		15		21.2
End of Borehole	~159.7			

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: 9, 14, 14, 15, 87, 35, 49, 41, 68, 50/100 mm, 50/100 mm, 50/150 mm, 50/100 mm

Notes:
1. Borehole advanced to completion at ~15.5 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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Elapsed Time	Water Level (m)	Hole Open to (m)
August 24, 2017	~7.1	Well
August 28, 2017	~7.5	Well

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Log of Borehole 8S

Project No. BRM-00607085-A0 Drawing No. 11

Project: Preliminary Geotechnical Investigation & Hydrogeological Study Sheet No. 1 of 1

Location: SW Corner of Bayview Avenue & Royal Orchard Boulevard, Thornhill, Ontario

Date Drilled: August 23, 2017

Drill Type: Hollow Stem Augers

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
			175.20	0	20 40 60 80 / 100 200	25 50 75 / 10 20 30		
		See Borehole 8D for Details		1				
				2				
				3				
				4				
				5				
				6				
				7				
			~167.6					
		End of Borehole						

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Notes:
1. Borehole advanced to completion at ~7.6 m depth by conventional soil sampling methods using a specialist drilling subcontractor. For borehole definitions, see notes prior to logs.
2. This drawing forms part of and must be read in conjunction with the subject report (Ref. No.: BRM-00607085-A0); borehole data requires interpretation assistance by exp professional staff before use by others.

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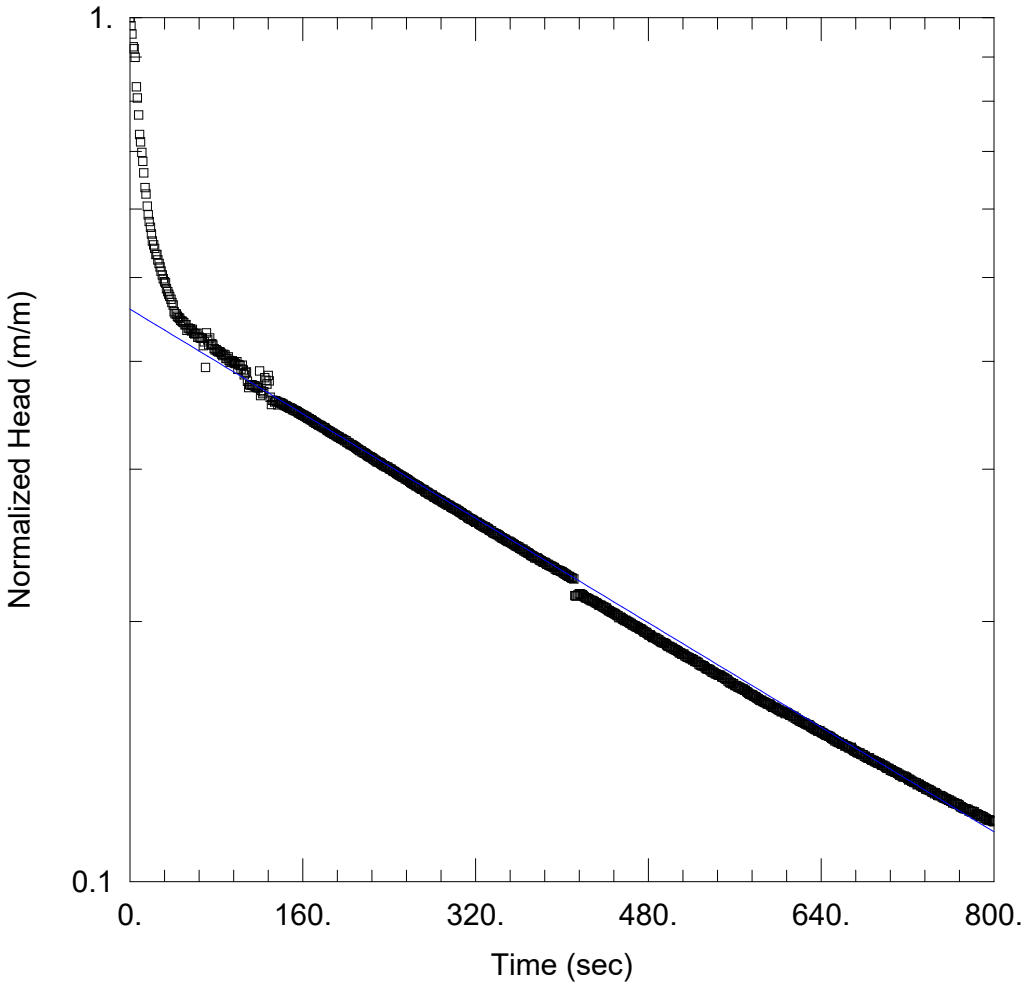
Elapsed Time	Water Level (m)	Hole Open to (m)
August 24, 2017	~7.6	Well
August 28, 2017	~7.6	Well

Appendix C:
SWRT Procedure and Results



FALLING HEAD - SWRT - BH 1-S

Data Set: \...\BH 1-S.aqt
Date: 08/31/17 Time: 11:40:22

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 1-S
Test Date: August 28, 2017

AQUIFER DATA

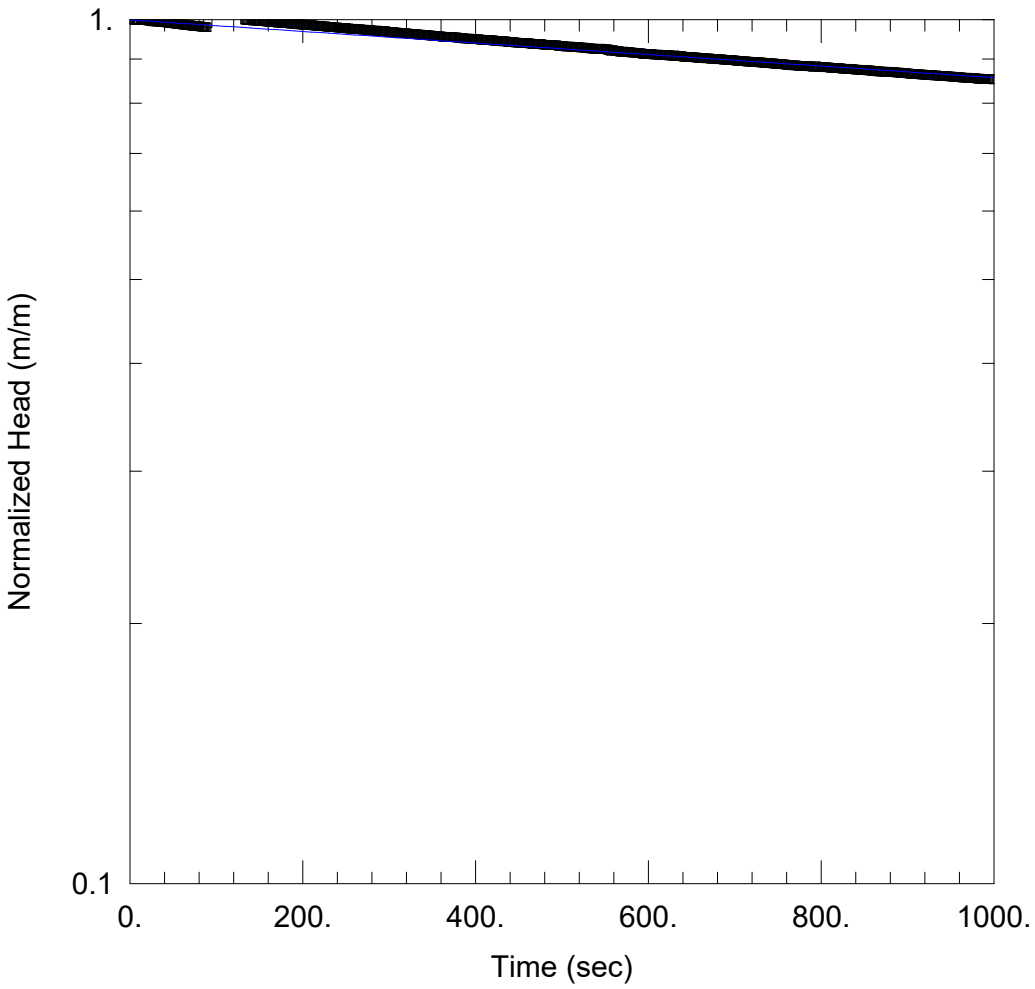
Saturated Thickness: 2.5 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 1-S)

Initial Displacement: 0.9224 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 2.28 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.19E-6 m/sec
y0 = 0.4239 m



RISING HEAD - SWRT - BH 2

Data Set: \...\BH 2.aqt
Date: 08/31/17 Time: 12:48:56

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 2
Test Date: August 28, 2017

AQUIFER DATA

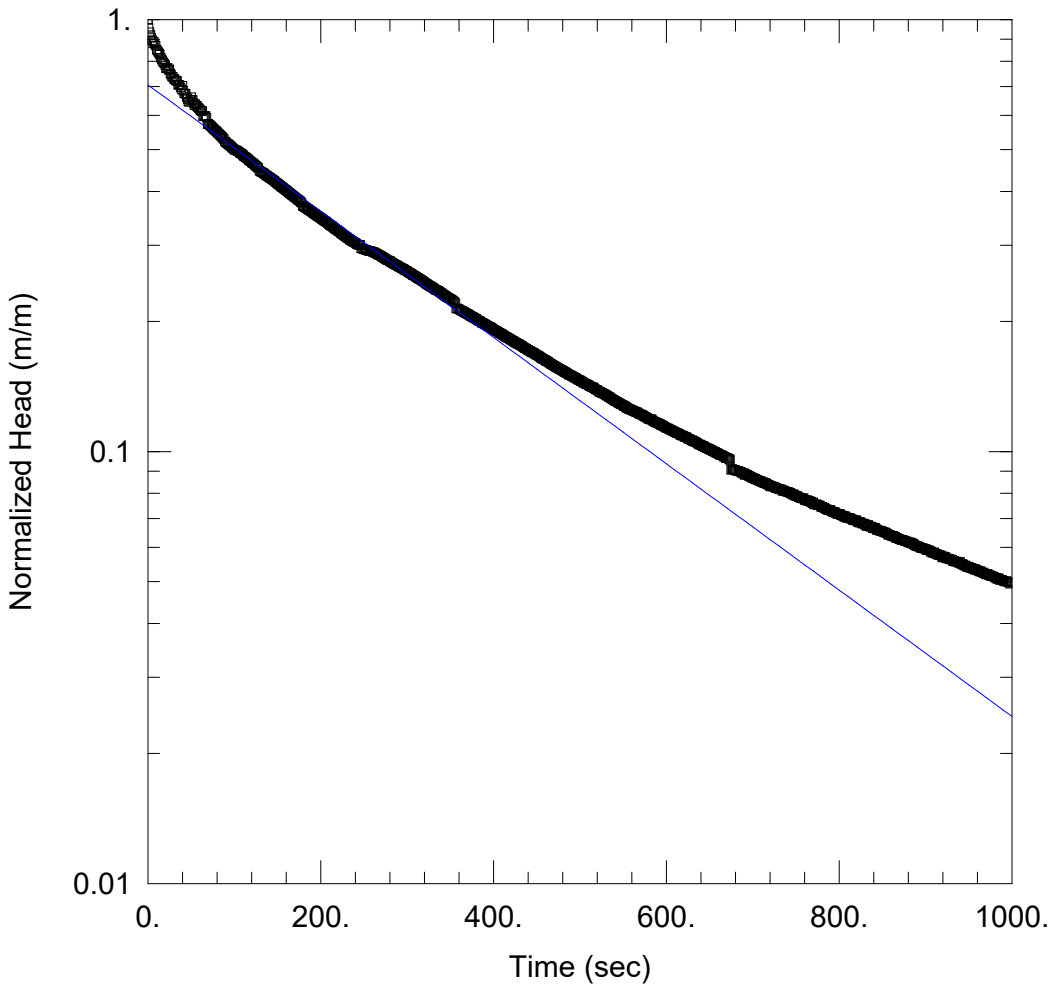
Saturated Thickness: 3.2 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 2)

Initial Displacement: 0.5624 m
Total Well Penetration Depth: 3.054 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.054 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 5.591E-8 m/sec
y0 = 0.5617 m



FALLING HEAD - SWRT - BH 4

Data Set: \...\BH 4.aqt
Date: 08/31/17 Time: 13:26:05

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 4
Test Date: August 28, 2017

AQUIFER DATA

Saturated Thickness: 3.2 m Anisotropy Ratio (Kz/Kr): 1.

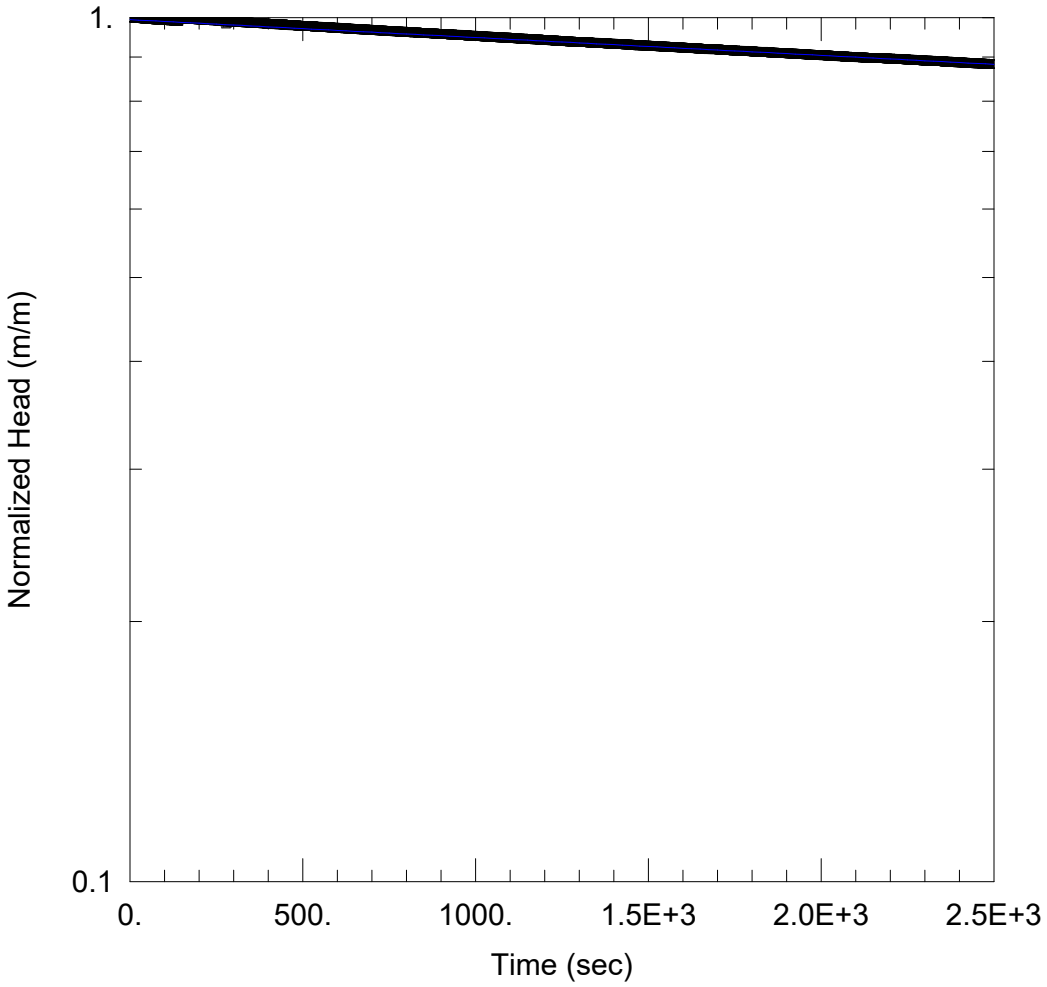
WELL DATA (BH 4)

Initial Displacement: 1.109 m
Total Well Penetration Depth: 3.045 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.045 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.226E-6 m/sec y0 = 0.7829 m



RISING HEAD - SWRT - BH 8-D

Data Set: \...\BH 8-D.aqt
Date: 08/31/17 Time: 14:17:07

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 8-D
Test Date: August 28, 2017

AQUIFER DATA

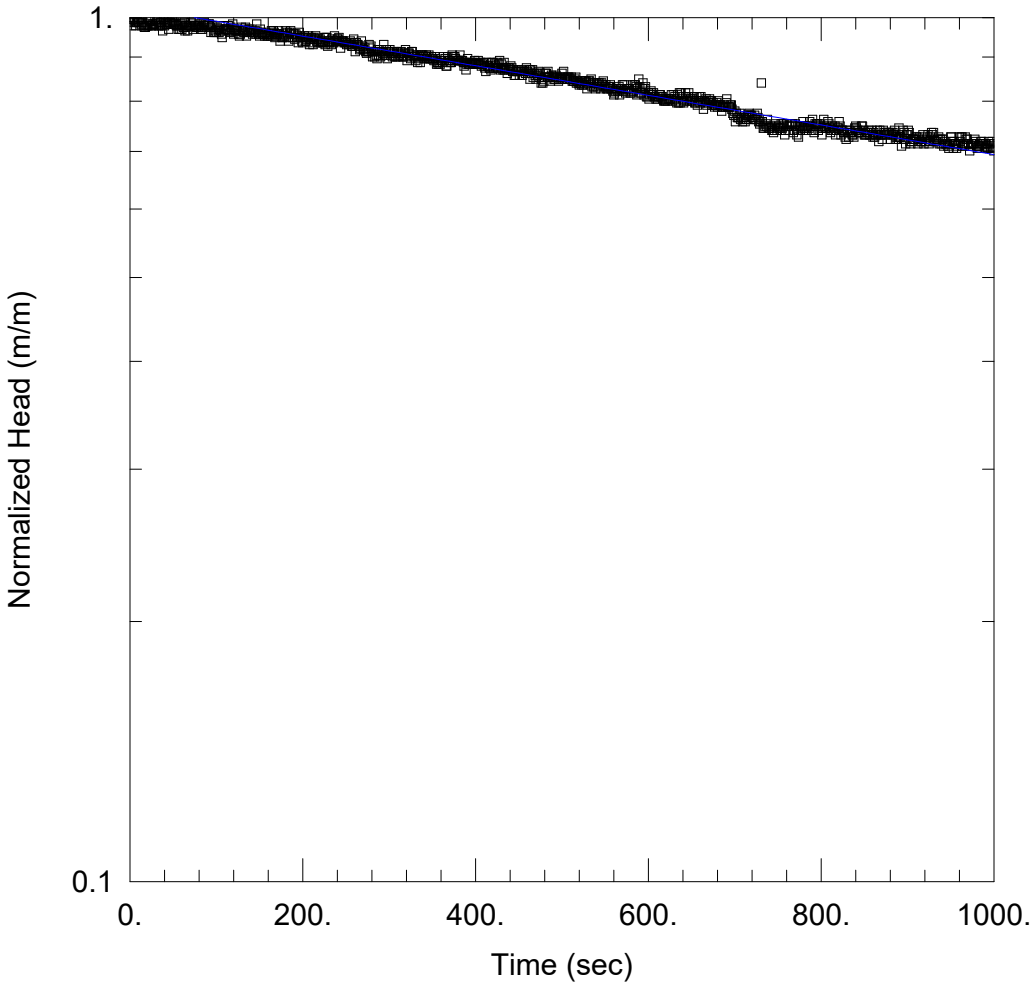
Saturated Thickness: 7.8 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 8-D)

Initial Displacement: 1.036 m
Total Well Penetration Depth: 7.705 m
Casing Radius: 0.0254 m
Static Water Column Height: 7.705 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.732E-8 m/sec
y0 = 1.03 m



FALLING HEAD

Data Set: \...\BH 8-S.aqt
Date: 08/31/17 Time: 13:44:21

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 8-S
Test Date: August 28, 2017

AQUIFER DATA

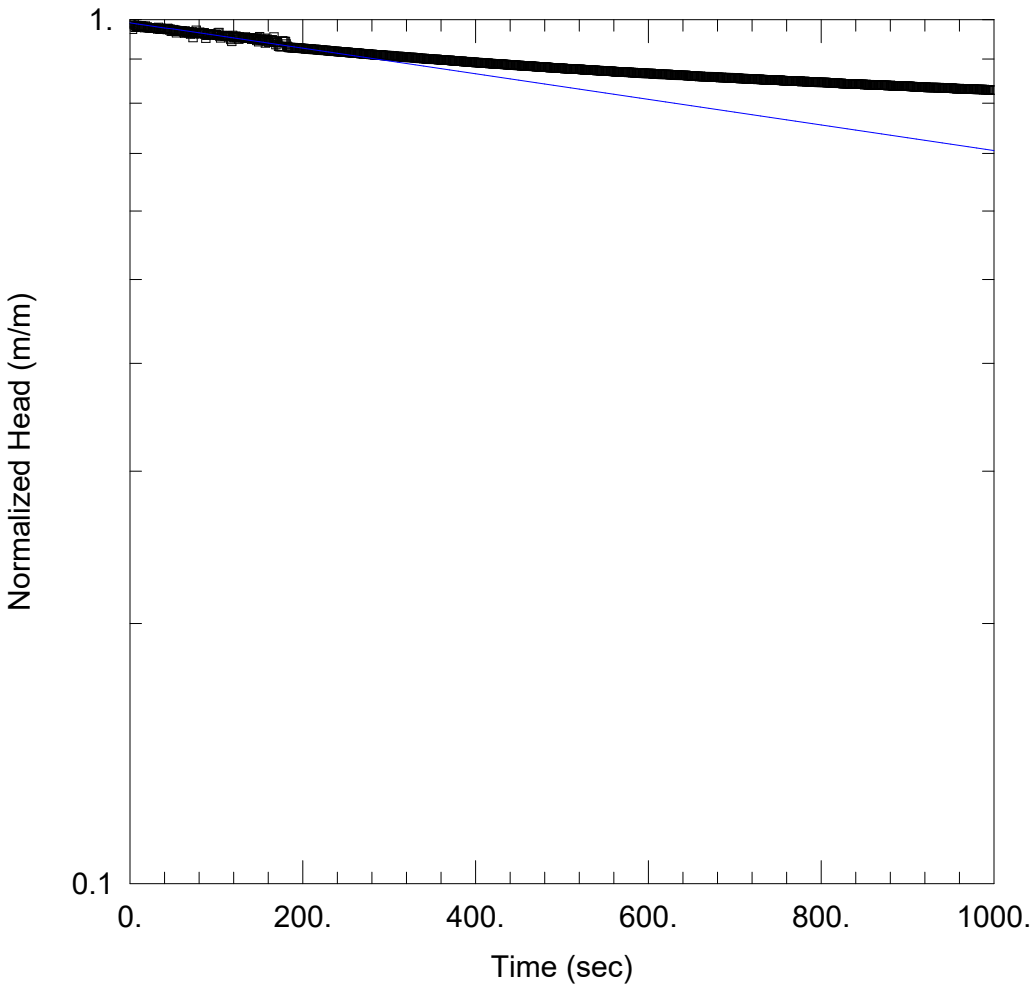
Saturated Thickness: 0.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 8-S)

Initial Displacement: 0.0231 m
Total Well Penetration Depth: 3. m
Casing Radius: 0.0254 m
Static Water Column Height: 0.035 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 6.748E-6 m/sec
y0 = 0.02379 m



FALLING HEAD - SWRT - BH 1-D

Data Set: \...\BH1-D.aqt
Date: 08/31/17 Time: 14:30:17

PROJECT INFORMATION

Company: Exp services
Client: Tridel
Project: BRM-00607085-A0
Location: Bayview & Royal Orchard Blvd
Test Well: BH 1-D
Test Date: August 28, 2017

AQUIFER DATA

Saturated Thickness: 10.1 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 1-D)

Initial Displacement: 1.753 m
Total Well Penetration Depth: 10.04 m
Casing Radius: 0.0254 m
Static Water Column Height: 10.04 m
Screen Length: 3. m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

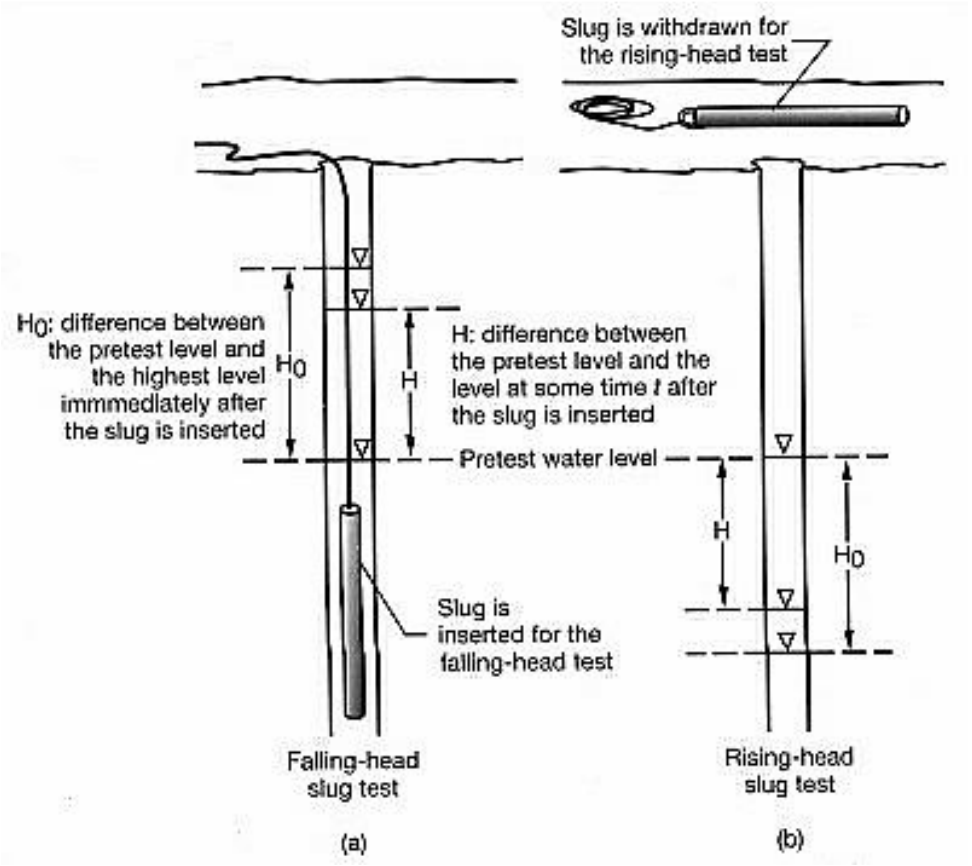
K = 1.24E-7 m/sec y0 = 1.738 m

Single Well Response Test Procedure

A Single Well Response Test (SWRT), also known as a bail test or a slug test, is conducted in order to determine the saturated hydraulic conductivity (K) of an aquifer. The method of the SWRT is to characterize the change of groundwater level in a well or borehole over time.

In order to ensure consistency and repeatability, all **exp** employees are to follow the procedure outlined in this document when conducting SWRTs.

The figure below depicts a schematic of a slug and bail test and the respective water level changes.



Initials ___

Slug Test Procedure

Equipment Required

- Copy of a signed health and safety plan
- Copy of the work program
- PPE as required by Site-Specific HASP
- Copy of the monitoring well location plan/site plan
- Waterproof pen and bound field note book
- SWRT field data Entry form
- Disposable gloves
- Duct tape
- Deionized water
- Alconox (phosphate free detergent)
- Spray bottles
- Electronic water level meter and spare batteries
- Solid PVC or stainless steel slug of known volume or clean water
- String (nylon)
- Water pressure transducer (data logger) and baro-logger
- Watch or stop watch with second hand
- Plastic sheeting

Testing Procedure

1. Remove cap from well and collect static water level
2. Remove waterra tubing/bailer and place in garbage bag. Record static water level measurement again.
3. Lower the slug into the well and record the dynamic water level.
4. Record the drawdown (for the slug test) at set five (5) second intervals for the first five (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown until 95% recovery is reached. To calculate this value: Find the difference between the dynamic water level and the static water level, then multiply by 95% (.95). Add the resulting value to the dynamic water level.

   (Static Water Level – Dynamic Water Level).95 + Static Water Level = 95% Recovery Value
6. Once complete, replace the waterra tubing/bailer and re-secure the well cap.

Note: If the well is deep, more than one slug may be inserted by attaching the slugs to a series.

Slugs must be washed with methanol, then lab grade soap, and then rinsed with de-ionized water after each use.

Based on the recorded observations, the hydraulic conductivity (in m/s) of the aquifer will be determined. In order to determine the hydraulic conductivity; the well diameter, radius of the borehole and length of the screen will also be required.

Bail Test Procedure

Equipment Required

- 20 L (5 gal) Graduated pail
- Stop watch or watch with seconds
- Garbage bags
- Water level meter
- Field sheets/log book
- Latex Gloves
- Bailer and Rope

Procedure

1. Remove cap from well and collect static water level.
2. If using a **bailer**:
    a. Affix the rope to the bailer.
    b. Remove the waterra tubing and place in garbage bag
    c. Record static water level measurement again.
    d. Record how much water was removed by either counting the number of full bailers or emptying removed water into a container.
    e. Quickly lower the bailer into the well and remove.
    f. Continue this process until the water level will reduce no further.
    g. Record the dynamic water level.
3. If using **waterra** to bail the water:
    a. Pump the water into graduated bucket until the water level will reduce no further.
    b. Record how much water has been removed.
    c. Record the dynamic water level.
4. Record the recovery at set five (5) second intervals for the first (5) minutes, then reduce to every one (1) minute.
5. Continue recording the drawdown/recovery until 95% recovery is reached.
6. Once complete, replace any waterra tubing that may have been removed from the well and re-secure the well cap.

Appendix D:
Groundwater Quality and Laboratory Certificates of Analysis

Maxxam
A Bureau Veritas Group Company

Your P.O. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-07-01

Attention:Francois Chartier

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

Report Date: 2017/09/05
Report #: R4687082
Version: 4 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6551
Received: 2017/08/28, 18:37

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
ABN Compounds in Water by GC/MS	1	2017/08/29	2017/08/29	CAM SOP-00301	EPA 8270 m
Carbonaceous BOD	1	2017/08/29	2017/09/03	CAM SOP-00427	SM 22 5210B m
Total Cyanide	1	2017/08/30	2017/08/30	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2017/08/29	2017/08/30	CAM SOP-00449	SM 22 4500-F C m
Mercury in Water by CVAA	1	2017/08/29	2017/08/30	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by Axial ICP	1	2017/08/29	2017/08/29	CAM SOP-00408	EPA 6010D m
Total Nonylphenol in Liquids by HPLC	1	2017/08/29	2017/09/01	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2017/08/29	2017/09/01	CAM SOP-00313	Maxxam Method
Animal and Vegetable Oil & Grease	1	N/A	2017/08/29	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2017/08/29	2017/08/29	CAM SOP-00326	EPA1664B m,SM5520A m
Polychlorinated Biphenyl in Water	1	2017/08/29	2017/08/30	CAM SOP-00309	EPA 8082A m
pH	1	N/A	2017/08/30	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2017/08/30	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry	1	N/A	2017/08/29	CAM SOP-00464	EPA 375.4 m
Total Kjeldahl Nitrogen in Water	1	2017/08/29	2017/08/29	CAM SOP-00938	OMOE E3516 m
TPH (Heavy Oil) (1)	1	2017/08/29	2017/08/29	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2017/08/29	2017/08/29	CAM SOP-00428	SM 22 2540D m
Volatile Organic Compounds in Water	1	N/A	2017/08/30	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 agreed in writing.

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
A Bureau Veritas Group Company

Your P.O. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-07-01

Attention:Francois Chartier

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

Report Date: 2017/09/05
Report #: R4687082
Version: 4 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6551
Received: 2017/08/28, 18:37

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.

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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

YORK SANITARY AND STORM SEWER BYLAW 2011 (WATER)

Maxxam ID				FAH077	FAH077		
Sampling Date				2017/08/28 14:40	2017/08/28 14:40		
COC Number				617366-07-01	617366-07-01		
	UNITS	SAN	STM	BH4	BH4 Lab-Dup	RDL	QC Batch
Calculated Parameters							
Total Animal/Vegetable Oil and Grease	mg/L	150	-	ND		0.50	5139144
Inorganics							
Total Carbonaceous BOD	mg/L	300	15	ND		2	5141541
Fluoride (F-)	mg/L	10	2	0.11		0.10	5141437
Total Kjeldahl Nitrogen (TKN)	mg/L	100	1	0.19		0.10	5140576
pH	pH	6.0:10.5	6.0:9.0	7.59			5141441
Phenols-4AAP	mg/L	1	0.008	ND		0.0010	5143458
Total Suspended Solids	mg/L	350	15	**190**		10	5140394
Dissolved Sulphate (SO4)	mg/L	1500	500	82		1.0	5138206
Total Cyanide (CN)	mg/L	2	0.020	ND		0.0050	5138714
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L	-	-	ND		0.50	5140226
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	ND		0.50	5140235
Miscellaneous Parameters							
Nonylphenol Ethoxylate (Total)	mg/L	0.200	-	ND		0.025	5141414
Nonylphenol (Total)	mg/L	0.020	-	ND		0.001	5141291
Metals							
Total Aluminum (Al)	mg/L	50	1	**1.7**	**1.6**	0.1	5141114
Total Antimony (Sb)	mg/L	5	0.05	ND	ND	0.02	5141114
Total Arsenic (As)	mg/L	1	0.020	ND	ND	0.01	5141114
Total Cadmium (Cd)	mg/L	0.7	0.008	ND	ND	0.002	5141114
Total Chromium (Cr)	mg/L	2	0.080	ND	ND	0.01	5141114
Total Cobalt (Co)	mg/L	5	0.05	ND	ND	0.002	5141114
Total Copper (Cu)	mg/L	3	0.050	ND	ND	0.01	5141114
Total Iron (Fe)	mg/L	50	1	**3.9**	**3.9**	0.02	5141114
Total Lead (Pb)	mg/L	1	0.120	ND	ND	0.01	5141114

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
SAN,STM: York Sanitary and Storm Sewer Use bylaws, respectively
Bylaw #S-0064-2005-009 November, 2011
ND = Not detected

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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

YORK SANITARY AND STORM SEWER BYLAW 2011 (WATER)

Maxxam ID				FAH077	FAH077		
Sampling Date				2017/08/28 14:40	2017/08/28 14:40		
COC Number				617366-07-01	617366-07-01		
	UNITS	SAN	STM	BH4	BH4 Lab-Dup	RDL	QC Batch
Total Manganese (Mn)	mg/L	5	0.150	**0.20**	**0.20**	0.001	5141114
Mercury (Hg)	mg/L	0.01	0.0004	ND		0.0001	5140284
Total Molybdenum (Mo)	mg/L	5	0.05	ND	ND	0.005	5141114
Total Nickel (Ni)	mg/L	2	0.080	ND	ND	0.005	5141114
Total Phosphorus (P)	mg/L	10	0.400	0.28	0.29	0.05	5141114
Total Selenium (Se)	mg/L	1	0.020	ND	ND	0.02	5141114
Total Silver (Ag)	mg/L	5	0.120	ND	ND	0.01	5141114
Total Tin (Sn)	mg/L	5	0.1	ND	ND	0.02	5141114
Total Titanium (Ti)	mg/L	5	0.05	**0.090**	**0.088**	0.005	5141114
Total Zinc (Zn)	mg/L	2	0.040	0.008	0.009	0.005	5141114
Semivolatile Organics							
Bis(2-ethylhexyl)phthalate	ug/L	12	8.8	ND		2.0	5140324
Di-N-butyl phthalate	ug/L	80	15	ND		2.0	5140324
Volatile Organics							
Benzene	ug/L	10	2	ND		0.10	5138947
Chloroform	ug/L	40	2	ND		0.10	5138947
1,2-Dichlorobenzene	ug/L	50	5.6	ND		0.20	5138947
1,4-Dichlorobenzene	ug/L	80	6.8	ND		0.20	5138947
cis-1,2-Dichloroethylene	ug/L	4000	5.6	ND		0.10	5138947
trans-1,3-Dichloropropene	ug/L	140	5.6	ND		0.20	5138947
Ethylbenzene	ug/L	160	2	ND		0.10	5138947
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	ND		0.50	5138947
Methyl Ethyl Ketone (2-Butanone)	ug/L	8000	-	ND		5.0	5138947
Styrene	ug/L	200	-	ND		0.20	5138947
1,1,2,2-Tetrachloroethane	ug/L	1400	17	ND		0.20	5138947
Tetrachloroethylene	ug/L	1000	0.44	ND		0.10	5138947
Toluene	ug/L	270	2	ND		0.20	5138947

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

RDL = Reportable Detection Limit
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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

YORK SANITARY AND STORM SEWER BYLAW 2011 (WATER)

Maxxam ID				FAH077	FAH077		
Sampling Date				2017/08/28 14:40	2017/08/28 14:40		
COC Number				617366-07-01	617366-07-01		
	UNITS	**SAN**	**STM**	**BH4**	**BH4 Lab-Dup**	**RDL**	**QC Batch**
Trichloroethylene	ug/L	400	8	ND		0.10	5138947
p+m-Xylene	ug/L	-	-	ND		0.10	5138947
o-Xylene	ug/L	-	-	ND		0.10	5138947
Total Xylenes	ug/L	1400	4.4	ND		0.10	5138947
PCBs							
Total PCB	ug/L	1	0.4	ND	ND	0.05	5140542
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	-	-	74			5140324
2-Fluorobiphenyl	%	-	-	56			5140324
2-Fluorophenol	%	-	-	22			5140324
D14-Terphenyl	%	-	-	94			5140324
D5-Nitrobenzene	%	-	-	50			5140324
D5-Phenol	%	-	-	21			5140324
Decachlorobiphenyl	%	-	-	87	83		5140542
4-Bromofluorobenzene	%	-	-	99			5138947
D4-1,2-Dichloroethane	%	-	-	105			5138947
D8-Toluene	%	-	-	97			5138947

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
SAN,STM: York Sanitary and Storm Sewer Use bylaws, respectively
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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FAH077
Sample ID: BH4
Matrix: Water

Collected: 2017/08/28
Shipped:
Received: 2017/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
ABN Compounds in Water by GC/MS	GC/MS	5140324	2017/08/29	2017/08/29	Anh Lieu
Carbonaceous BOD	DO	5141541	2017/08/29	2017/09/03	Frank Zhang
Total Cyanide	SKAL/CN	5138714	2017/08/30	2017/08/30	Xuanhong Qiu
Fluoride	ISE	5141437	2017/08/29	2017/08/30	Yogesh Patel
Mercury in Water by CVAA	CV/AA	5140284	2017/08/29	2017/08/30	Ron Morrison
Total Metals Analysis by Axial ICP	ICPX	5141114	2017/08/29	2017/08/29	Archana Patel
Total Nonylphenol in Liquids by HPLC	LC/FLU	5141291	2017/08/29	2017/09/01	Dennis Boodram
Nonylphenol Ethoxylates in Liquids: HPLC	LC/FLU	5141414	2017/08/29	2017/09/01	Dennis Boodram
Animal and Vegetable Oil & Grease	BAL	5139144	N/A	2017/08/29	Automated Statchk
Total Oil and Grease	BAL	5140226	2017/08/29	2017/08/29	Amjad Mir
Polychlorinated Biphenyl in Water	GC/ECD	5140542	2017/08/29	2017/08/30	Dawn Alarie
pH	AT	5141441	N/A	2017/08/30	Yogesh Patel
Phenols (4AAP)	TECH/PHEN	5143458	N/A	2017/08/30	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5138206	N/A	2017/08/29	Deonarine Ramnarine
Total Kjeldahl Nitrogen in Water	SKAL	5140576	2017/08/29	2017/08/29	Rajni Tyagi
TPH (Heavy Oil)	BAL	5140235	2017/08/29	2017/08/29	Amjad Mir
Total Suspended Solids	BAL	5140394	2017/08/29	2017/08/29	Arpan Shah
Volatile Organic Compounds in Water	P&T/MS	5138947	N/A	2017/08/30	Rebecca Schultz

Maxxam ID: FAH077 Dup
Sample ID: BH4
Matrix: Water

Collected: 2017/08/28
Shipped:
Received: 2017/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Metals Analysis by Axial ICP	ICPX	5141114	2017/08/29	2017/08/29	Archana Patel
Polychlorinated Biphenyl in Water	GC/ECD	5140542	2017/08/29	2017/08/30	Dawn Alarie

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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

GENERAL COMMENTS

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

Package 1	8.7°C

Criteria is included as requested.

Cooler custody seal was present and intact.

Results relate only to the items tested.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7I6551
Report Date: 2017/09/05

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			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
5138947	4-Bromofluorobenzene	2017/08/30	101	70 - 130	100	70 - 130	98	%				
5138947	D4-1,2-Dichloroethane	2017/08/30	101	70 - 130	101	70 - 130	103	%				
5138947	D8-Toluene	2017/08/30	99	70 - 130	98	70 - 130	98	%				
5140324	2,4,6-Tribromophenol	2017/08/29			89	10 - 130	79	%				
5140324	2-Fluorobiphenyl	2017/08/29			69	30 - 130	58	%				
5140324	2-Fluorophenol	2017/08/29			50	10 - 130	39	%				
5140324	D14-Terphenyl	2017/08/29			98	30 - 130	95	%				
5140324	D5-Nitrobenzene	2017/08/29			78	30 - 130	69	%				
5140324	D5-Phenol	2017/08/29			32	10 - 130	27	%				
5140542	Decachlorobiphenyl	2017/08/30	99	60 - 130	84	60 - 130	88	%				
5138206	Dissolved Sulphate (SO4)	2017/08/29	NC	75 - 125	100	80 - 120	ND, RDL=1.0	mg/L	1.2	20		
5138714	Total Cyanide (CN)	2017/08/30	100	80 - 120	98	80 - 120	ND, RDL=0.0050	mg/L	NC	20		
5138947	1,1,2,2-Tetrachloroethane	2017/08/30	112	70 - 130	111	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5138947	1,2-Dichlorobenzene	2017/08/30	101	70 - 130	103	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5138947	1,4-Dichlorobenzene	2017/08/30	105	70 - 130	107	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5138947	Benzene	2017/08/30	106	70 - 130	108	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	Chloroform	2017/08/30	100	70 - 130	102	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	cis-1,2-Dichloroethylene	2017/08/30	100	70 - 130	103	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	Ethylbenzene	2017/08/30	104	70 - 130	105	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	Methyl Ethyl Ketone (2-Butanone)	2017/08/30	105	60 - 140	104	60 - 140	ND, RDL=5.0	ug/L				
5138947	Methylene Chloride(Dichloromethane)	2017/08/30	94	70 - 130	97	70 - 130	ND, RDL=0.50	ug/L	NC	30		
5138947	o-Xylene	2017/08/30	107	70 - 130	107	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	p+m-Xylene	2017/08/30	110	70 - 130	109	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	Styrene	2017/08/30	108	70 - 130	109	70 - 130	ND, RDL=0.20	ug/L				
5138947	Tetrachloroethylene	2017/08/30	98	70 - 130	98	70 - 130	ND, RDL=0.10	ug/L	NC	30		
5138947	Toluene	2017/08/30	101	70 - 130	101	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5138947	Total Xylenes	2017/08/30					ND, RDL=0.10	ug/L	NC	30		
5138947	trans-1,3-Dichloropropene	2017/08/30	114	70 - 130	114	70 - 130	ND, RDL=0.20	ug/L	NC	30		
5138947	Trichloroethylene	2017/08/30	101	70 - 130	103	70 - 130	ND, RDL=0.10	ug/L	NC	30		

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7I6551
Report Date: 2017/09/05

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			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
5140226	Total Oil & Grease	2017/08/29			102	85 - 115	ND, RDL=0.50	mg/L	6.2	25		
5140235	Total Oil & Grease Mineral/Synthetic	2017/08/29			97	85 - 115	ND, RDL=0.50	mg/L	4.1	25		
5140284	Mercury (Hg)	2017/08/30	114	75 - 125	98	80 - 120	ND, RDL=0.0001	mg/L	NC	20		
5140324	Bis(2-ethylhexyl)phthalate	2017/08/29			95	30 - 130	ND, RDL=2.0	ug/L	1.1	40		
5140324	Di-N-butyl phthalate	2017/08/29			95	30 - 130	ND, RDL=2.0	ug/L	0.12	40		
5140394	Total Suspended Solids	2017/08/29					ND, RDL=10	mg/L	5.2	25	97	85 - 115
5140542	Total PCB	2017/08/30	83	60 - 130	89	60 - 130	ND, RDL=0.05	ug/L	NC	40		
5140576	Total Kjeldahl Nitrogen (TKN)	2017/08/29	110	80 - 120	106	80 - 120	ND, RDL=0.10	mg/L	NC	20	103	80 - 120
5141114	Total Aluminum (Al)	2017/08/29	NC	80 - 120	93	80 - 120	ND, RDL=0.1	mg/L	4.6	20		
5141114	Total Antimony (Sb)	2017/08/29	107	80 - 120	105	80 - 120	ND, RDL=0.02	mg/L	NC	20		
5141114	Total Arsenic (As)	2017/08/29	104	80 - 120	99	80 - 120	ND, RDL=0.01	mg/L	NC	20		
5141114	Total Cadmium (Cd)	2017/08/29	101	80 - 120	97	80 - 120	ND, RDL=0.002	mg/L	NC	20		
5141114	Total Chromium (Cr)	2017/08/29	95	80 - 120	94	80 - 120	ND, RDL=0.01	mg/L	NC	20		
5141114	Total Cobalt (Co)	2017/08/29	98	80 - 120	99	80 - 120	ND, RDL=0.002	mg/L	NC	20		
5141114	Total Copper (Cu)	2017/08/29	94	80 - 120	91	80 - 120	ND, RDL=0.01	mg/L	NC	20		
5141114	Total Iron (Fe)	2017/08/29	NC	80 - 120	93	80 - 120	ND, RDL=0.02	mg/L	0.34	20		
5141114	Total Lead (Pb)	2017/08/29	98	80 - 120	99	80 - 120	ND, RDL=0.01	mg/L	NC	20		
5141114	Total Manganese (Mn)	2017/08/29	103	80 - 120	100	80 - 120	ND, RDL=0.001	mg/L	0.060	20		
5141114	Total Molybdenum (Mo)	2017/08/29	99	80 - 120	97	80 - 120	ND, RDL=0.005	mg/L	NC	20		
5141114	Total Nickel (Ni)	2017/08/29	94	80 - 120	96	80 - 120	ND, RDL=0.005	mg/L	NC	20		
5141114	Total Phosphorus (P)	2017/08/29	103	80 - 120	99	80 - 120	ND, RDL=0.05	mg/L	1.8	20		
5141114	Total Selenium (Se)	2017/08/29	106	80 - 120	102	80 - 120	ND, RDL=0.02	mg/L	NC	20		
5141114	Total Silver (Ag)	2017/08/29	95	80 - 120	93	80 - 120	ND, RDL=0.01	mg/L	NC	20		
5141114	Total Tin (Sn)	2017/08/29	95	80 - 120	95	80 - 120	ND, RDL=0.02	mg/L	NC	20		

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7I6551
Report Date: 2017/09/05

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			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
5141114	Total Titanium (Ti)	2017/08/29	103	80 - 120	93	80 - 120	ND, RDL=0.005	mg/L	2.1	20		
5141114	Total Zinc (Zn)	2017/08/29	102	80 - 120	101	80 - 120	ND, RDL=0.005	mg/L	3.0	20		
5141291	Nonylphenol (Total)	2017/08/31	93	50 - 130	86	50 - 130	ND, RDL=0.001	mg/L	NC	40		
5141414	Nonylphenol Ethoxylate (Total)	2017/09/01	83	50 - 130	83	50 - 130	ND, RDL=0.025	mg/L	NC	40		
5141437	Fluoride (F-)	2017/08/30	102	80 - 120	101	80 - 120	ND, RDL=0.10	mg/L	1.4	20		
5141441	pH	2017/08/30			101	98 - 103			0.28	N/A		
5141541	Total Carbonaceous BOD	2017/09/03					ND,RDL=2	mg/L	NC	25	98	85 - 115
5143458	Phenols-4AAP	2017/08/30	97	80 - 120	99	85 - 115	ND, RDL=0.0010	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.

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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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

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 Service Specialist

Cristina Carriere, Scientific Service 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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Maxxam Job #: B7I6551
Report Date: 2017/09/05

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

Exceedence Summary Table – York Sewer (2011-56)

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.

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RUSH!

Maxxam Analytics International Corporation o/a Maxxam Analytics
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CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:	
Company Name:	#30554 exp Services Inc	Company Name:	SAA	Quotation #:	~~B45997~~ Stream 2
Attention:	Central Services	Attention:	Francois Chartier francois.chartier@exp.com; Nataliya Tkach nataliya.tkach@exp.com; Jeffrey Leon jeffrey.leon@exp.com	P.O. #:	ENV-BRM
Address:	1595 Clark Blvd, Brampton ON L6T 4V1	Address:		Project:	BRM-00607085-A0
Tel:	(905) 793-9800 x	Fax: (905) 793-0641 x	Fax:	Project Name:	LADIES GOLF
		Tel:		Site #:	
Email:	Karen.Burke@exp.com	Email:		Sampled By:	J.L.

Laboratory Use Only:

Maxxam Job #:	Bottle Order #:
	617366
COC #: C#617366-07-01	Project Manager: Deepthi Shaji

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: York Region

Special Instructions:

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC): Field Filtered (please circle): Metals / Hg / Cr VI; ~~[illegible]~~; YORK REGION SANITARY & STORM SEWER PACKAGE

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: 29/08/2017 Time Required: 6:30 ☑
Rush Confirmation Number: ______ (call lab for #)

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered / Metals / Hg / Cr VI		York Region Sanitary & Storm Sewer Package	# of Bottles	Comments
1		BH 4	28/08/17	2:40 PM	GW	No		✓	17	Please lab analyze for iron
2					GW					
3					GW					
4					GW					
5					GW					
6					GW					
7					GW					
8					GW					
9					GW					
10					GW					

28-Aug-17 18:37
Deepthi Shaji
B7I6551
TSP ENV-1122

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Jeffrey Leon	17/08/28	6:30 PM	[signature]	2017/08/28	18:37	

Laboratory Use Only

Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	7/10/9	Present	✓	
		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

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Your P.O. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-08-01

Attention:Francois Chartier

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

Report Date: 2017/08/29
Report #: R4681092
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6556
Received: 2017/08/28, 18:37

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	1	N/A	2017/08/29	CAM SOP-00448	SM 22 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2017/08/29	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	1	N/A	2017/08/29	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2017/08/29	CAM SOP-00414	SM 22 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2017/08/29	CAM SOP-00446	SM 22 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2017/08/29	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	1	2017/08/29	2017/08/29	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2017/08/29		
Anion and Cation Sum	1	N/A	2017/08/29		
Total Ammonia-N	1	N/A	2017/08/29	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	1	N/A	2017/08/29	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/08/29	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2017/08/29	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/08/29		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/08/29		
Sulphate by Automated Colourimetry	1	N/A	2017/08/29	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	1	N/A	2017/08/29		

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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Maxxam
A Bureau Veritas Group Company

Your P.O. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-08-01

Attention:Francois Chartier

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

Report Date: 2017/08/29
Report #: R4681092
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6556

Received: 2017/08/28, 18:37

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) 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

==========

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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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FAH122		
Sampling Date				2017/08/28 14:40		
COC Number				617366-08-01		
	UNITS	Criteria	Criteria-2	BH4	RDL	QC Batch
Calculated Parameters						
Anion Sum	me/L	-	-	12.2	N/A	5140012
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	320	1.0	5139549
Calculated TDS	mg/L	-	-	670	1.0	5139554
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	1.5	1.0	5139549
Cation Sum	me/L	-	-	12.5	N/A	5140012
Hardness (CaCO3)	mg/L	-	-	500	1.0	5139550
Ion Balance (% Difference)	%	-	-	1.26	N/A	5140011
Langelier Index (@ 20C)	N/A	-	-	0.853		5139552
Langelier Index (@ 4C)	N/A	-	-	0.606		5139553
Saturation pH (@ 20C)	N/A	-	-	6.83		5139552
Saturation pH (@ 4C)	N/A	-	-	7.08		5139553
Inorganics						
Total Ammonia-N	mg/L	-	-	ND	0.050	5139166
Conductivity	umho/cm	-	-	1200	1.0	5139417
Dissolved Organic Carbon	mg/L	-	-	1.5	0.20	5140223
Orthophosphate (P)	mg/L	-	-	ND	0.010	5140401
pH	pH	6.0:10.5	6.0:9.0	7.68		5140303
Dissolved Sulphate (SO4)	mg/L	1500	500	76	1.0	5140393
Alkalinity (Total as CaCO3)	mg/L	-	-	330	1.0	5140302
Dissolved Chloride (Cl)	mg/L	-	-	140	2.0	5140380
Nitrite (N)	mg/L	-	-	0.012	0.010	5140211
Nitrate (N)	mg/L	-	-	0.38	0.10	5140211
Nitrate + Nitrite (N)	mg/L	-	-	0.39	0.10	5140211

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: Regional Municipality of York By-Law No 2011-056 Limits for Sanitary Sewer Discharge
Criteria-2: Regional Municipality of York By-Law No 2011-56 Limits for Storm Sewer Discharge
N/A = Not Applicable
ND = Not detected

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FAH122		
Sampling Date				2017/08/28 14:40		
COC Number				617366-08-01		
	UNITS	Criteria	Criteria-2	BH4	RDL	QC Batch
Metals						
Dissolved Aluminum (Al)	ug/L	50000	-	ND	5.0	5138036
Dissolved Antimony (Sb)	ug/L	5000	-	ND	0.50	5138036
Dissolved Arsenic (As)	ug/L	1000	20	ND	1.0	5138036
Dissolved Barium (Ba)	ug/L	-	-	140	2.0	5138036
Dissolved Beryllium (Be)	ug/L	-	-	ND	0.50	5138036
Dissolved Boron (B)	ug/L	-	-	23	10	5138036
Dissolved Cadmium (Cd)	ug/L	700	8	ND	0.10	5138036
Dissolved Calcium (Ca)	ug/L	-	-	140000	200	5138036
Dissolved Chromium (Cr)	ug/L	2000	80	ND	5.0	5138036
Dissolved Cobalt (Co)	ug/L	5000	-	ND	0.50	5138036
Dissolved Copper (Cu)	ug/L	3000	50	ND	1.0	5138036
Dissolved Iron (Fe)	ug/L	-	-	ND	100	5138036
Dissolved Lead (Pb)	ug/L	1000	120	ND	0.50	5138036
Dissolved Magnesium (Mg)	ug/L	-	-	33000	50	5138036
Dissolved Manganese (Mn)	ug/L	5000	150	57	2.0	5138036
Dissolved Molybdenum (Mo)	ug/L	5000	-	2.6	0.50	5138036
Dissolved Nickel (Ni)	ug/L	2000	80	ND	1.0	5138036
Dissolved Phosphorus (P)	ug/L	-	-	ND	100	5138036
Dissolved Potassium (K)	ug/L	-	-	1900	200	5138036
Dissolved Selenium (Se)	ug/L	1000	20	ND	2.0	5138036
Dissolved Silicon (Si)	ug/L	-	-	8100	50	5138036
Dissolved Silver (Ag)	ug/L	5000	120	ND	0.10	5138036
Dissolved Sodium (Na)	ug/L	-	-	58000	100	5138036
Dissolved Strontium (Sr)	ug/L	-	-	340	1.0	5138036
Dissolved Thallium (Tl)	ug/L	-	-	ND	0.050	5138036
Dissolved Titanium (Ti)	ug/L	5000	-	ND	5.0	5138036

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: Regional Municipality of York By-Law No 2011-056 Limits for Sanitary Sewer Discharge
Criteria-2: Regional Municipality of York By-Law No 2011-56 Limits for Storm Sewer Discharge
ND = Not detected

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FAH122		
Sampling Date				2017/08/28 14:40		
COC Number				617366-08-01		
	UNITS	Criteria	Criteria-2	BH4	RDL	QC Batch
Dissolved Uranium (U)	ug/L	-	-	1.3	0.10	5138036
Dissolved Vanadium (V)	ug/L	-	-	0.91	0.50	5138036
Dissolved Zinc (Zn)	ug/L	2000	40	ND	5.0	5138036

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: Regional Municipality of York By-Law No 2011-056 Limits for Sanitary Sewer Discharge
Criteria-2: Regional Municipality of York By-Law No 2011-56 Limits for Storm Sewer Discharge
ND = Not detected

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FAH122
Sample ID: BH4
Matrix: Water

Collected: 2017/08/28
Shipped:
Received: 2017/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5140302	N/A	2017/08/29	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5139549	N/A	2017/08/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	5140380	N/A	2017/08/29	Deonarine Ramnarine
Conductivity	AT	5139417	N/A	2017/08/29	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5140223	N/A	2017/08/29	Azadeh Shahbazi
Hardness (calculated as CaCO3)		5139550	N/A	2017/08/29	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5138036	2017/08/29	2017/08/29	Prempal Bhatti
Ion Balance (% Difference)	CALC	5140011	N/A	2017/08/29	Automated Statchk
Anion and Cation Sum	CALC	5140012	N/A	2017/08/29	Automated Statchk
Total Ammonia-N	LACH/NH4	5139166	N/A	2017/08/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5140211	N/A	2017/08/29	Chandra Nandlal
pH	AT	5140303	N/A	2017/08/29	Yogesh Patel
Orthophosphate	KONE	5140401	N/A	2017/08/29	Deonarine Ramnarine
Sat. pH and Langelier Index (@ 20C)	CALC	5139552	N/A	2017/08/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5139553	N/A	2017/08/29	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5140393	N/A	2017/08/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5139554	N/A	2017/08/29	Automated Statchk

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

GENERAL COMMENTS

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

Package 1	8.7°C

Cooler custoday seal was present and intact.

Results relate only to the items tested.

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5138036	Dissolved Aluminum (Al)	2017/08/29	100	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Antimony (Sb)	2017/08/29	103	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Arsenic (As)	2017/08/29	97	80 - 120	101	80 - 120	ND, RDL=1.0	ug/L	NC	20
5138036	Dissolved Barium (Ba)	2017/08/29	100	80 - 120	103	80 - 120	ND, RDL=2.0	ug/L	0.00044	20
5138036	Dissolved Beryllium (Be)	2017/08/29	102	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Boron (B)	2017/08/29	99	80 - 120	101	80 - 120	ND, RDL=10	ug/L	0.16	20
5138036	Dissolved Cadmium (Cd)	2017/08/29	99	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	NC	20
5138036	Dissolved Calcium (Ca)	2017/08/29	NC	80 - 120	98	80 - 120	ND, RDL=200	ug/L	2.3	20
5138036	Dissolved Chromium (Cr)	2017/08/29	94	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Cobalt (Co)	2017/08/29	93	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Copper (Cu)	2017/08/29	97	80 - 120	104	80 - 120	ND, RDL=1.0	ug/L	NC	20
5138036	Dissolved Iron (Fe)	2017/08/29	98	80 - 120	103	80 - 120	ND, RDL=100	ug/L	2.1	20
5138036	Dissolved Lead (Pb)	2017/08/29	89	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Magnesium (Mg)	2017/08/29	NC	80 - 120	107	80 - 120	ND, RDL=50	ug/L	1.1	20
5138036	Dissolved Manganese (Mn)	2017/08/29	95	80 - 120	100	80 - 120	ND, RDL=2.0	ug/L	3.0	20
5138036	Dissolved Molybdenum (Mo)	2017/08/29	99	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L	7.7	20
5138036	Dissolved Nickel (Ni)	2017/08/29	92	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	16	20
5138036	Dissolved Phosphorus (P)	2017/08/29	100	80 - 120	107	80 - 120	ND, RDL=100	ug/L	NC	20
5138036	Dissolved Potassium (K)	2017/08/29	103	80 - 120	106	80 - 120	ND, RDL=200	ug/L	2.1	20
5138036	Dissolved Selenium (Se)	2017/08/29	93	80 - 120	96	80 - 120	ND, RDL=2.0	ug/L	NC	20
5138036	Dissolved Silicon (Si)	2017/08/29	100	80 - 120	102	80 - 120	ND, RDL=50	ug/L	2.5	20
5138036	Dissolved Silver (Ag)	2017/08/29	93	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20
5138036	Dissolved Sodium (Na)	2017/08/29	NC	80 - 120	107	80 - 120	110, RDL=100	ug/L	1.8	20
5138036	Dissolved Strontium (Sr)	2017/08/29	NC	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L	0.90	20
5138036	Dissolved Thallium (Tl)	2017/08/29	89	80 - 120	98	80 - 120	ND, RDL=0.050	ug/L	NC	20
5138036	Dissolved Titanium (Ti)	2017/08/29	100	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Uranium (U)	2017/08/29	94	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	3.5	20
5138036	Dissolved Vanadium (V)	2017/08/29	95	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Zinc (Zn)	2017/08/29	91	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20
5139166	Total Ammonia-N	2017/08/29	100	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	NC	20

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Maxxam Job #: B7I6556
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5139417	Conductivity	2017/08/29			102	85 - 115	ND, RDL=1.0	umho/cm	0.28	25
5140211	Nitrate (N)	2017/08/29	102	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	0.98	20
5140211	Nitrite (N)	2017/08/29	104	80 - 120	104	80 - 120	ND, RDL=0.010	mg/L	2.2	20
5140223	Dissolved Organic Carbon	2017/08/29	97	80 - 120	99	80 - 120	ND, RDL=0.20	mg/L	0.56	20
5140302	Alkalinity (Total as CaCO3)	2017/08/29			97	85 - 115	ND, RDL=1.0	mg/L	0.52	20
5140303	pH	2017/08/29			101	98 - 103			0.27	N/A
5140380	Dissolved Chloride (Cl)	2017/08/29	NC	80 - 120	103	80 - 120	ND, RDL=1.0	mg/L	2.3	20
5140393	Dissolved Sulphate (SO4)	2017/08/29	NC	75 - 125	106	80 - 120	ND, RDL=1.0	mg/L	0.31	20
5140401	Orthophosphate (P)	2017/08/29	85	75 - 125	99	80 - 120	ND, RDL=0.010	mg/L	NC	25

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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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

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 Service 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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Maxxam Job #: B7I6556
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

Exceedence Summary Table – York Sanitary SUB 2011

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 – York Storm SUB 2011

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.

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RUSH

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CHAIN OF CUSTODY RECORD

Page 1 of 1

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 #:
Attention:	Central Services	Attention:	François Charlier - francois.charlier@exp.com	P.O. #:	ENV-BRM		617366
Address:	1595 Clark Blvd	Address:	Nataliya Thach - nataliya.thach@exp.com	Project:	BRM-0160707085-A0		
	Brampton ON L6T 4V1		Jeffrey Leon - jeffrey.leon@exp.com	Project Name:	LADIES GOLF	COC #:	Project Manager:
Tel:	(905) 793-9800 x Fax: (905) 793-0641 x	Tel:	Fax:	Site #:		C#617366-08-01	Deepthi Shaji
Email:	Karen.Burke@exp.com	Email:		Sampled By:	J.L.		

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 YORK REGION	
☐ Table ___	☐ PWQO	
	☐ Other	

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

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: 29/08/2017 Time Required: 6:30 ☑
Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	RCAp - Comprehensive (Lab Filtered)	# of Bottles	Comments
1		BH4	28/08/17	1:40 PM	GW	No	✓	4	Please lab filter samples
2					GW				
3					GW				
4					GW				
5					GW				
6					GW				
7					GW				
8					GW				
9					GW				
10					GW				

28-Aug-17 18:37
Deepthi Shaji
B7I6556
TSP ENV-1122

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Jeffrey Leon / Jeffrey Leon	17/08/28	6:30 pm	[illegible]	2017/08/28	18:37	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Recei	Custody Seal	Yes	No
	7/10/9	Present		
		Intact	✓	

* 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

White: Maxxa Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam
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Your P.O. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-09-01

Attention:Francois Chartier

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

Report Date: 2017/08/29
Report #: R4681093
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6553
Received: 2017/08/28, 18:37

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity	1	N/A	2017/08/29	CAM SOP-00448	SM 22 2320 B m
Carbonate, Bicarbonate and Hydroxide	1	N/A	2017/08/29	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry	1	N/A	2017/08/29	CAM SOP-00463	EPA 325.2 m
Conductivity	1	N/A	2017/08/29	CAM SOP-00414	SM 22 2510 m
Dissolved Organic Carbon (DOC) (1)	1	N/A	2017/08/29	CAM SOP-00446	SM 22 5310 B m
Hardness (calculated as CaCO3)	1	N/A	2017/08/29	CAM SOP 00102/00408/00447	SM 2340 B
Lab Filtered Metals by ICPMS	1	2017/08/29	2017/08/29	CAM SOP-00447	EPA 6020B m
Ion Balance (% Difference)	1	N/A	2017/08/29		
Anion and Cation Sum	1	N/A	2017/08/29		
Total Ammonia-N	1	N/A	2017/08/29	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (2)	1	N/A	2017/08/29	CAM SOP-00440	SM 22 4500-NO3I/NO2B
pH	1	N/A	2017/08/29	CAM SOP-00413	SM 4500H+ B m
Orthophosphate	1	N/A	2017/08/29	CAM SOP-00461	EPA 365.1 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2017/08/29		
Sat. pH and Langelier Index (@ 4C)	1	N/A	2017/08/29		
Sulphate by Automated Colourimetry	1	N/A	2017/08/29	CAM SOP-00464	EPA 375.4 m
Total Dissolved Solids (TDS calc)	1	N/A	2017/08/29		

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. #: ENV-BRM
Your Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your C.O.C. #: 617366-09-01

Attention:Francois Chartier

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

Report Date: 2017/08/29
Report #: R4681093
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7I6553

Received: 2017/08/28, 18:37

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 #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FAH079	FAH079		
Sampling Date				2017/08/28 12:00	2017/08/28 12:00		
COC Number				617366-09-01	617366-09-01		
	UNITS	Criteria	Criteria-2	BH8-D	BH8-D Lab-Dup	RDL	QC Batch
Calculated Parameters							
Anion Sum	me/L	-	-	9.70		N/A	5140012
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	170		1.0	5139549
Calculated TDS	mg/L	-	-	560		1.0	5139554
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	1.5		1.0	5139549
Cation Sum	me/L	-	-	10.4		N/A	5140012
Hardness (CaCO3)	mg/L	-	-	280		1.0	5139550
Ion Balance (% Difference)	%	-	-	3.44		N/A	5140011
Langelier Index (@ 20C)	N/A	-	-	0.568			5139552
Langelier Index (@ 4C)	N/A	-	-	0.321			5139553
Saturation pH (@ 20C)	N/A	-	-	7.40			5139552
Saturation pH (@ 4C)	N/A	-	-	7.65			5139553
Inorganics							
Total Ammonia-N	mg/L	-	-	0.41		0.050	5139166
Conductivity	umho/cm	-	-	1100	1100	1.0	5139417
Dissolved Organic Carbon	mg/L	-	-	4.1	4.1	0.20	5140223
Orthophosphate (P)	mg/L	-	-	ND	ND	0.010	5140401
pH	pH	6.0:10.5	6.0:9.0	7.97	7.94		5140303
Dissolved Sulphate (SO4)	mg/L	1500	500	33	33	1.0	5140393
Alkalinity (Total as CaCO3)	mg/L	-	-	170	170	1.0	5140302
Dissolved Chloride (Cl)	mg/L	-	-	200	200	2.0	5140380
Nitrite (N)	mg/L	-	-	0.014	0.014	0.010	5140211
Nitrate (N)	mg/L	-	-	0.54	0.54	0.10	5140211
Nitrate + Nitrite (N)	mg/L	-	-	0.55	0.56	0.10	5140211
Metals							
Dissolved Aluminum (Al)	ug/L	50000	-	5.8		5.0	5138036
Dissolved Antimony (Sb)	ug/L	5000	-	ND		0.50	5138036

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: Regional Municipality of York By-Law No 2011-056 Limits for Sanitary Sewer Discharge
Criteria-2: Regional Municipality of York By-Law No 2011-56 Limits for Storm Sewer Discharge
ND = Not detected

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Maxxam Job #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

RCAP - COMPREHENSIVE (LAB FILTERED)

Maxxam ID				FAH079	FAH079		
Sampling Date				2017/08/28 12:00	2017/08/28 12:00		
COC Number				617366-09-01	617366-09-01		
	UNITS	Criteria	Criteria-2	BH8-D	BH8-D Lab-Dup	RDL	QC Batch
Dissolved Arsenic (As)	ug/L	1000	20	ND		1.0	5138036
Dissolved Barium (Ba)	ug/L	-	-	140		2.0	5138036
Dissolved Beryllium (Be)	ug/L	-	-	ND		0.50	5138036
Dissolved Boron (B)	ug/L	-	-	110		10	5138036
Dissolved Cadmium (Cd)	ug/L	700	8	ND		0.10	5138036
Dissolved Calcium (Ca)	ug/L	-	-	70000		200	5138036
Dissolved Chromium (Cr)	ug/L	2000	80	ND		5.0	5138036
Dissolved Cobalt (Co)	ug/L	5000	-	ND		0.50	5138036
Dissolved Copper (Cu)	ug/L	3000	50	ND		1.0	5138036
Dissolved Iron (Fe)	ug/L	-	-	ND		100	5138036
Dissolved Lead (Pb)	ug/L	1000	120	ND		0.50	5138036
Dissolved Magnesium (Mg)	ug/L	-	-	25000		50	5138036
Dissolved Manganese (Mn)	ug/L	5000	150	65		2.0	5138036
Dissolved Molybdenum (Mo)	ug/L	5000	-	8.7		0.50	5138036
Dissolved Nickel (Ni)	ug/L	2000	80	ND		1.0	5138036
Dissolved Phosphorus (P)	ug/L	-	-	ND		100	5138036
Dissolved Potassium (K)	ug/L	-	-	8300		200	5138036
Dissolved Selenium (Se)	ug/L	1000	20	ND		2.0	5138036
Dissolved Silicon (Si)	ug/L	-	-	6900		50	5138036
Dissolved Silver (Ag)	ug/L	5000	120	ND		0.10	5138036
Dissolved Sodium (Na)	ug/L	-	-	110000		100	5138036
Dissolved Strontium (Sr)	ug/L	-	-	460		1.0	5138036
Dissolved Thallium (Tl)	ug/L	-	-	ND		0.050	5138036
Dissolved Titanium (Ti)	ug/L	5000	-	ND		5.0	5138036
Dissolved Uranium (U)	ug/L	-	-	0.21		0.10	5138036
Dissolved Vanadium (V)	ug/L	-	-	ND		0.50	5138036
Dissolved Zinc (Zn)	ug/L	2000	40	ND		5.0	5138036

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: Regional Municipality of York By-Law No 2011-056 Limits for Sanitary Sewer Discharge
Criteria-2: Regional Municipality of York By-Law No 2011-56 Limits for Storm Sewer Discharge
ND = Not detected

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Maxxam Job #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

TEST SUMMARY

Maxxam ID: FAH079
Sample ID: BH8-D
Matrix: Water

Collected: 2017/08/28
Shipped:
Received: 2017/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5140302	N/A	2017/08/29	Yogesh Patel
Carbonate, Bicarbonate and Hydroxide	CALC	5139549	N/A	2017/08/29	Automated Statchk
Chloride by Automated Colourimetry	KONE	5140380	N/A	2017/08/29	Deonarine Ramnarine
Conductivity	AT	5139417	N/A	2017/08/29	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5140223	N/A	2017/08/29	Azadeh Shahbazi
Hardness (calculated as CaCO3)		5139550	N/A	2017/08/29	Automated Statchk
Lab Filtered Metals by ICPMS	ICP/MS	5138036	2017/08/29	2017/08/29	Prempal Bhatti
Ion Balance (% Difference)	CALC	5140011	N/A	2017/08/29	Automated Statchk
Anion and Cation Sum	CALC	5140012	N/A	2017/08/29	Automated Statchk
Total Ammonia-N	LACH/NH4	5139166	N/A	2017/08/29	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5140211	N/A	2017/08/29	Chandra Nandlal
pH	AT	5140303	N/A	2017/08/29	Yogesh Patel
Orthophosphate	KONE	5140401	N/A	2017/08/29	Deonarine Ramnarine
Sat. pH and Langelier Index (@ 20C)	CALC	5139552	N/A	2017/08/29	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	5139553	N/A	2017/08/29	Automated Statchk
Sulphate by Automated Colourimetry	KONE	5140393	N/A	2017/08/29	Deonarine Ramnarine
Total Dissolved Solids (TDS calc)	CALC	5139554	N/A	2017/08/29	Automated Statchk

Maxxam ID: FAH079 Dup
Sample ID: BH8-D
Matrix: Water

Collected: 2017/08/28
Shipped:
Received: 2017/08/28

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5140302	N/A	2017/08/29	Yogesh Patel
Chloride by Automated Colourimetry	KONE	5140380	N/A	2017/08/29	Deonarine Ramnarine
Conductivity	AT	5139417	N/A	2017/08/29	Yogesh Patel
Dissolved Organic Carbon (DOC)	TOCV/NDIR	5140223	N/A	2017/08/29	Azadeh Shahbazi
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5140211	N/A	2017/08/29	Chandra Nandlal
pH	AT	5140303	N/A	2017/08/29	Yogesh Patel
Orthophosphate	KONE	5140401	N/A	2017/08/29	Deonarine Ramnarine
Sulphate by Automated Colourimetry	KONE	5140393	N/A	2017/08/29	Deonarine Ramnarine

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Maxxam Job #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

GENERAL COMMENTS

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

Package 1	8.7°C

Cooler custody seal was present and intact.

Results relate only to the items tested.

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Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B7I6553
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5138036	Dissolved Aluminum (Al)	2017/08/29	100	80 - 120	102	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Antimony (Sb)	2017/08/29	103	80 - 120	103	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Arsenic (As)	2017/08/29	97	80 - 120	101	80 - 120	ND, RDL=1.0	ug/L	NC	20
5138036	Dissolved Barium (Ba)	2017/08/29	100	80 - 120	103	80 - 120	ND, RDL=2.0	ug/L	0.00044	20
5138036	Dissolved Beryllium (Be)	2017/08/29	102	80 - 120	102	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Boron (B)	2017/08/29	99	80 - 120	101	80 - 120	ND, RDL=10	ug/L	0.16	20
5138036	Dissolved Cadmium (Cd)	2017/08/29	99	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	NC	20
5138036	Dissolved Calcium (Ca)	2017/08/29	NC	80 - 120	98	80 - 120	ND, RDL=200	ug/L	2.3	20
5138036	Dissolved Chromium (Cr)	2017/08/29	94	80 - 120	98	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Cobalt (Co)	2017/08/29	93	80 - 120	101	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Copper (Cu)	2017/08/29	97	80 - 120	104	80 - 120	ND, RDL=1.0	ug/L	NC	20
5138036	Dissolved Iron (Fe)	2017/08/29	98	80 - 120	103	80 - 120	ND, RDL=100	ug/L	2.1	20
5138036	Dissolved Lead (Pb)	2017/08/29	89	80 - 120	100	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Magnesium (Mg)	2017/08/29	NC	80 - 120	107	80 - 120	ND, RDL=50	ug/L	1.1	20
5138036	Dissolved Manganese (Mn)	2017/08/29	95	80 - 120	100	80 - 120	ND, RDL=2.0	ug/L	3.0	20
5138036	Dissolved Molybdenum (Mo)	2017/08/29	99	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L	7.7	20
5138036	Dissolved Nickel (Ni)	2017/08/29	92	80 - 120	99	80 - 120	ND, RDL=1.0	ug/L	16	20
5138036	Dissolved Phosphorus (P)	2017/08/29	100	80 - 120	107	80 - 120	ND, RDL=100	ug/L	NC	20
5138036	Dissolved Potassium (K)	2017/08/29	103	80 - 120	106	80 - 120	ND, RDL=200	ug/L	2.1	20
5138036	Dissolved Selenium (Se)	2017/08/29	93	80 - 120	96	80 - 120	ND, RDL=2.0	ug/L	NC	20
5138036	Dissolved Silicon (Si)	2017/08/29	100	80 - 120	102	80 - 120	ND, RDL=50	ug/L	2.5	20
5138036	Dissolved Silver (Ag)	2017/08/29	93	80 - 120	99	80 - 120	ND, RDL=0.10	ug/L	NC	20
5138036	Dissolved Sodium (Na)	2017/08/29	NC	80 - 120	107	80 - 120	110, RDL=100	ug/L	1.8	20
5138036	Dissolved Strontium (Sr)	2017/08/29	NC	80 - 120	100	80 - 120	ND, RDL=1.0	ug/L	0.90	20
5138036	Dissolved Thallium (Tl)	2017/08/29	89	80 - 120	98	80 - 120	ND, RDL=0.050	ug/L	NC	20
5138036	Dissolved Titanium (Ti)	2017/08/29	100	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20
5138036	Dissolved Uranium (U)	2017/08/29	94	80 - 120	102	80 - 120	ND, RDL=0.10	ug/L	3.5	20
5138036	Dissolved Vanadium (V)	2017/08/29	95	80 - 120	97	80 - 120	ND, RDL=0.50	ug/L	NC	20
5138036	Dissolved Zinc (Zn)	2017/08/29	91	80 - 120	100	80 - 120	ND, RDL=5.0	ug/L	NC	20
5139166	Total Ammonia-N	2017/08/29	100	80 - 120	99	85 - 115	ND, RDL=0.050	mg/L	NC	20

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Maxxam Job #: B7I6553
Report Date: 2017/08/29

QUALITY ASSURANCE REPORT(CONT'D)

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

			Matrix Spike		SPIKED BLANK		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
5139417	Conductivity	2017/08/29			102	85 - 115	ND, RDL=1.0	umho/cm	0.28	25
5140211	Nitrate (N)	2017/08/29	102	80 - 120	104	80 - 120	ND, RDL=0.10	mg/L	0.98	20
5140211	Nitrite (N)	2017/08/29	104	80 - 120	104	80 - 120	ND, RDL=0.010	mg/L	2.2	20
5140223	Dissolved Organic Carbon	2017/08/29	97	80 - 120	99	80 - 120	ND, RDL=0.20	mg/L	0.56	20
5140302	Alkalinity (Total as CaCO3)	2017/08/29			97	85 - 115	ND, RDL=1.0	mg/L	0.52	20
5140303	pH	2017/08/29			101	98 - 103			0.27	N/A
5140380	Dissolved Chloride (Cl)	2017/08/29	NC	80 - 120	103	80 - 120	ND, RDL=1.0	mg/L	2.3	20
5140393	Dissolved Sulphate (SO4)	2017/08/29	NC	75 - 125	106	80 - 120	ND, RDL=1.0	mg/L	0.31	20
5140401	Orthophosphate (P)	2017/08/29	85	75 - 125	99	80 - 120	ND, RDL=0.010	mg/L	NC	25

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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Maxxam Job #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

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 Service 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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Maxxam Job #: B7I6553
Report Date: 2017/08/29

exp Services Inc
Client Project #: BRM-00607085-A0
Site Location: LADIES GOLF
Your P.O. #: ENV-BRM
Sampler Initials: JL

Exceedence Summary Table – York Sanitary SUB 2011

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 – York Storm SUB 2011

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.						

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RUSH!

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CHAIN OF CUSTODY RECORD

INVOICE TO:		REPORT TO:		PROJECT INFORMATION:		Laboratory Use Only:	
Company Name:	#30554 exp Services Inc	Company Name:	SAA	Quotation #:	~~B43537~~ Stream 2	Maxxam Job #:	Bottle Order #:
Attention:	Central Services	Attention:	Francois Chartier	P.O. #:	ENV-BRM		617366
Address:	1595 Clark Blvd Brampton ON L6T 4V1	Address:	Nataliya Tkach - nataliya.tkach@exp.com Jeffrey Leon - jeffrey.leon@exp.com	Project:	BRM-00607085-A0	COC #:	Project Manager:
Tel:	(905) 793-9800 x Fax: (905) 793-0641 x	Tel:	Fax:	Project Name:	LADIES GOLF	C#617366-09-01	Deepthi Shaji
Email:	Karen.Burke@exp.com	Email:	francois.chartier@exp.com	Site #:			
				Sampled By:	J.L.		

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 ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___	☐ CCME ☑ Sanitary Sewer Bylaw ☐ Reg 558 ☑ Storm Sewer Bylaw ☐ MISA Municipality YORK REGION ☐ PWQO ☐ Other	

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

ANALYSIS REQUESTED (PLEASE BE SPECIFIC):

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: 29/08/2017 Time Required: 6:30 ☑
Rush Confirmation Number: _____ *(call lab for #)*

	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	RCAp - Comprehensive (Lab Filtered)	# of Bottles	Comments
1		BH8-D	28/08/17	12:00	GW	NO	✓	4	Please lab filter metals.
2					GW				
3					GW				
4					GW				
5					GW				
6					GW				
7					GW				
8					GW				
9					GW				
10					GW				

28-Aug-17 18:37
Deepthi Shaji
B7I6553
TSP ENV-1122

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
Jeffrey Leon / Jeffrey Leon	17/08/28	6:30 PM		17/08/28	18:37	

Laboratory Use Only				
Time Sensitive	Temperature (°C) on Rece	Custody Seal	Yes	No
	7/10/9	Present	✓	
		Intact	✓	

* 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

White: Maxxa Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Appendix E:
Construction Dewatering Flow Calculations

APPENDIX E: Construction Dewatering Calculations

Bayview Ave & Royal Orchard Blvd, Markham, ON

BRM-00607085-A0

Table E-1: Flow all Sides of the Excavation

Parameters	Symbols	Unit	Value
Geological Formation	-	-	Glacial Deposit
Ground Elevation	-	mASL	178.00
Highest Groundwater Elevation	-	mASL	175.00
Top of the Water-Bearing Zone	-	mASL	175.00
Base of the Water-Bearing Zone	-	mASL	164.50
Height of Static Water Table Above the Base of the Water-Bearing Zone	**H**	m	10.50
Dewatered Elevation Target	-	mASL	166.60
Height of Target Water Level Above the Base of Water-Bearing Zone	**h_w**	m	2.10
Hydraulic Conductivity	**K**	m/s	2.00E-06
Length of Excavation	-	m	149.00
Width of Excavation	-	m	62.00
Method to Calculate Radius of Influence	-	-	**Sichardt**
Radius of Influence from Sides of Excavation	**Ro**	m	36
Distance to Linear Source from Sides of excavation	**Lo=Ro/2**	m	18
Dewatering Flow Rate (unconfined linear flow component)	**Q**	m^3/day	217
Factor of Safety	**FS**	-	2.00
Dewatering Flow Rate (multiplied by factor of safety)	**Q.FS**	m^3/day	433

Table E-2: Precipitation Estimate

Location	Assumed Precipitation Event (mm)	Length of Excavation (m)	Width of Excavation (m)	Rainwater Collection (m^3)
Site Extent	10	149	62	92

Table E-3: Total Flow Estimate

Parameters	Symbols	Unit	Value
Dewatering Flow Rate (including factor of safety and rainwater collection)	**Q (Total)**	m^3/day	526

Notes:

mASL - meters above sea level

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

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

(Based on the Dupuit Equation)

Where:

Q_w = Flow 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)

L_o=Distance of Influence (m)

x= Length of excavation

Appendix F:
Preliminary Long-Term Flow Calculations Without Using Caisson Wall

APPENDIX F: Long-Term Flow Rate Without Using Caisson Wall

Bayview Ave & Royal Orchard Blvd, Markham, ON
BRM-00607085-A0

Table F-1: Flow from Under-Slab Drain System

Parameters	Symbols	Unit	Value
Geological Formation	-	-	Glacial Deposit
Ground Elevation	-	mASL	178.00
Highest Groundwater Elevation	-	mASL	175.00
Top of the Water-Bearing Zone	-	mASL	175.00
Base of the Water-Bearing Zone	-	mASL	167.60
Height of Static Water Table Above the Base of the Water-Bearing Zone	**H**	m	7.40
Dewatered Elevation Target	-	mASL	168.00
Height of Target Water Level Above the Base of Water-Bearing Zone	**h_w**	m	0.40
Hydraulic Conductivity	**K**	m/s	2.00E-06
Length of Excavation	-	m	149.00
Width of Excavation	-	m	62.00
Method to Calculate Radius of Influence	-	-	**Sichardt**
Radius of Influence from Sides of Excavation	**Ro**	m	29.70
Distance to Linear Source from Sides of excavation	**Lo=Ro/2**	m	14.85
Dewatering Flow Rate (unconfined linear flow component)	**Q**	m^3/day	127.04
Factor of Safety	**fs**	-	1.50
Dewatering Flow Rate (multiplied by factor of safety)	**Q.fs**	m^3/day	191

Notes:
mASL - meters above sea level

Analytical Solution for Estimating Plane Flow from an Unconfined Aquifer to a Partially-Penetrating Excavation

$$\left[\qquad\qquad\left(-\right)\right]\quad\frac{\qquad\qquad}{\qquad\qquad}$$

(Based on the Dupuit Equation)

Where:

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

P = Depth of penetration of the excavation below the original water table (m)

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)

L_o=Distance of Influence (m)

x= Length of excavation

Appendix G:
Preliminary Long-Term Flow Calculations Using Caisson Wall

Appendix G: Long-Term Subdrain Flow Rate Estimate (With Caisson Walls Completed 3.5 meters Below Sub-Drain)

Bayview Ave & Royal Orchard Blvd, Markham, ON
BRM-00607085-A0

G-1: Input Data

Parameters	Units	Value	Notes
Estimated K Value	m/s	2.00E-06	Geometric mean of the estimate K values
Highest Groundwater Elevation	mASL	175.00	Highest obtained water level at BH 1-S on August 24, 2017
Base of the Water-Bearing Zone	mASL	164.50	Based on the geological cross-section
Lowest Slab Elevation	mASL	168.50	Anticipated for P3, Geotechnical report (**exp**, 2017)
Dewatering Elevation Target	mASL	168.00	Assumed to be at 0.5 m below the lowest slab elevation
Base of the Caisson Wall	mASL	165.00	Assumed to be at 3.5 m below the lowest slab elevation
Length of Excavation	m	149.00	
Width of Excavation	m	62.00	

Notes:
mASL - meters above sea level

G-2: Dewatering Flow Rate Estimates

Site Extent	Height of Water Level Above the Base of Water-Bearing Zone	Height of Target Water Level Above the Base of Water-Bearing Zone	Height of Caisson Wall above Base of Water-Bearing Zone	Distance Between Two Cut-Off Walls	Height of Water Contained Between Cut-Off Walls	Drawdown in Excavation
	H (m)	h_w (m)	s (m)	b (m)	d (m)	d1=H-H_w (m)
Longitudinal	10.5	3.5	0.5	149.0	3.0	7.0
Transversal	10.5	3.5	0.5	62.0	3.0	7.0

Site Extent	0.85 . K (H-H_w)	1 - (0.2) $^{s / 0.5.b}$	(d / 0.5.b)$^{-0.5}$	(d_1 / 0.5.b)$^{-0.125}$	Dewatering Estimate Per Unit Length	Perpendicular Length of Section (m)	Total Flow to Section (m^3/sec)	Total Flow to Section (m^3/day)
Longitudinal	1.19E-05	0.01	4.98	1.34	8.56E-07	62.0	5E-05	5
Transversal	1.19E-05	0.03	3.21	1.20	1.18E-06	149.0	2E-04	15

Zone of Influence (Ro) (m)	Distance to Linear Source Lo=Ro/2 (m)	Flow from South (Q_D) (m^3/day)	Flow from North, East and West (Q_K) (m^3/day)	Total Flow (Q_D+Q_K) (m^3/day)	Factor of Safety (F.S)	Total Flow (Q_D+Q_K) with F.S (m^3/day)
30	15	35	17	53	1.5	79

Analytical Solution for Estimating Groundwater Flow into Sub-Drain with Caisson Walls

$$Q_K = 0.85\,K(H-h_w)[1-(0.2)^{\frac{s}{0.5b}}](\frac{d}{0.5b})^{-0.5}(\frac{d_1}{0.5b})^{-0.125}$$ (Kavvadas et al., 1992)

where,
Q_k = Flow 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)
b = Distance between two cut-off walls (m)
s = Height of cut-off wall above the base of water-bearing zone
d= Height of water contained between cut-off walls above the base of cut-off walls (m)
d_1 = (H-h_w) Drawdown in excavation (m)

Analytical Solution for Estimating Groundwater Flow into Sub-Drain from One Side of Excavation

$$R_0 = 3000(H-h_w)\sqrt{K}$$ (Sichardt Equation)

Where

Ro=Radius of influence

$$Q_D = Kx\frac{H^2-{h_w}^2}{2L_o}$$ (Based on the Dupuit Equation Applicable to One Side of Excavation)

Where:
Q_D = Flow 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)
L_o=Distance of Influence (m) (Lo=Ro/2)
x = Width of excavation (m)