HYDROGEOLOGICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
7170 GOREWAY DRIVE, MISSISSAUGA, ON

Prepared for:

Rup Lal

C/O

Weston Consulting

Prepared By:

Orbit Engineering Limited

Project No. OE20373CG

June 18, 2021

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RE: Hydrogeological Investigation
Proposed Residential Development
7170 Goreway Drive, Mississauga, ON

Dear Mr. Lal,

Orbit Engineering Limited (Orbit) is pleased to provide the Hydrogeological Investigation Report for the above-mentioned project. The report presents Orbit's understanding of the hydrogeological setting of the study area based on exploratory drilling, data collection, analyses, and reviews.

We trust that this information meets your present requirements. If we can be of additional assistance in this regard, please contact this office

For and on behalf of Orbit Engineering Limited,

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LIST OF ACRONYMS AND DEFINITIONS

BH	Borehole
EASR	Environmental Activity and Sector Registry
STM	Storm
CB	Catch Basin
MH	Manhole
SAN	Sanitary
K	Hydraulic Conductivity
mbgs	Metres Below Ground Surface
MECP	Ontario Ministry of the Environment, Conservation, and Parks
O.Reg.903	Ontario's Wells Regulation
PTTW	Permit To Take Water
PHCs	Petroleum Hydrocarbons
VOCs	Volatile Organic Compounds
PAHs	Polycyclic Aromatic Hydrocarbons
WWIS	Water Well Information System
WWR	Water Well Record

1 INTRODUCTION

1.1 General

Orbit Engineering Limited (Orbit) was retained by Rup Lal c/o Weston Consulting to undertake a Hydrogeological Investigation for the proposed residential development located at 7170 Goreway Drive, Mississauga, Ontario (the Site). The approximate location of the proposed development is shown on **Drawing # 1**.

It is understood that the residential development project will consist of 15 residential units, roads, and sewers (**Appendix A**). It is our further understanding that each unit will consist of 3-storey townhouses with basements.

1.2 Purpose

The purpose of the hydrogeological investigation was to characterize the existing hydrogeological conditions at and in the vicinity of the Site, assess the groundwater regime, and provide assessment of groundwater control during construction of the project by means of four (4) exploratory boreholes (BH1/MW, BH2/MW, BH3/MW, and BH4), and to provide associated hydrogeological recommendations for construction activities. Three (3) boreholes from the four (4) exploratory boreholes were converted to groundwater monitoring wells for the hydrogeological investigation and water quality sampling.

Moreover, the hydrogeological investigation was required to evaluate the potential impacts on the local groundwater regime due to the proposed construction activities. The hydrogeological investigation was purposed to identify the appropriate mitigative measures, as necessary. This investigation will also act as a guideline in the assessment of the substructure and the perimeter drainage flow (permanent dewatering), if needed. The hydrogeological investigation was planned based on the design drawings and information provided to Orbit Engineering Limited by the Client.

2 METHOD OF INVESTIGATION

2.1 General

This hydrogeological study was conducted in conjunction with a geotechnical investigation completed by orbit at the Site. The hydrogeological investigation commenced with a review of available reports, mapping, and other published documentation pertaining to the Site area. Examples of information reviewed included: physiographic, surficial/Quaternary geology and bedrock geology mapping from the Ontario Geological Survey (OGS) and Geological Survey of Canada (GSC), watershed planning and monitoring reports produced by the Toronto and Region Conservation Authority (TRCA), and the Ministry of the Environment, Conservation and Parks (MECP) Water Well Information System (WWIS) database. Many of these documents are referred to throughout various sections of this report and their relevant details can be found in the Reference Section.
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In particular, the work completed in association with this hydrogeological study consisted of the following tasks:

- Revision and interpretation of the available reports and the publicly published data;
- Development of the Health and Safety and the Sampling and Analysis Plans for the work at the Site;
- Assessment of the current Site conditions, as well as the areas of interest and to confirm the planned borehole locations;
- Review of the water well records made available by the Ministry of the Environment, Conservation, and Parks (MECP);
- Development of the groundwater monitoring wells installed at the Site;
- Performance of the in-situ hydraulic conductivity tests (slug tests) at three (3) monitoring wells;
- Measurement of the groundwater levels in the monitoring wells located at the Site;
- Collection and analysis of the groundwater quality samples from the monitoring wells;
- Evaluation of the dewatering requirements for the proposed construction;
- Estimation of the permanent dewatering requirement for the subgrade and perimeter drainage flow; and,
- Preparation of this Hydrogeological Investigation Report on the findings of this investigation.

2.2 Boreholes and Monitoring Wells

Orbit Engineering Limited carried out the Geotechnical investigation at the Site on March 26, 2021 and drilled four (4) exploratory boreholes (BH1/MW, BH2/MW, BH3/MW and BH4). For the purpose of this hydrogeological investigation, three (3) boreholes from the four (4) exploratory boreholes were converted into monitoring wells in order to assess groundwater conditions at the Site.

The logs of the four (4) exploratory boreholes are provided in **Appendix B**. The approximate borehole locations are shown on **Drawing 1**.

The ground surface elevation at the borehole locations were interpreted by Orbit staff from the topographical survey provided by the Client. The borehole locations are also provided relative to the Universal Traverse Mercator geographic coordinate system (UTM Zone 17T).

The ground surface elevations of the boreholes are presented on the borehole logs attached in **Appendix B**. The borehole depths and the construction details of the monitoring wells are summarized in **Table 1**.

Table 1: Information of Boreholes/Monitoring Wells

Borehole/Monitoring Well IDs	Northing	Easting	Approximate Ground Surface Elevation (mASL)[1]	Depth of Borehole (mBGS)	Screened Geologic Unit
	NAD 83, UTM Zone 17T				
BH1/MW	4841320	609838.97	166.1	6.1	**Silt Till:** trace clay and gravel
BH2/MW	4841296.29	609863.05	166.5	5.2	**Clayey Silt to Silty Clay Till**: some sand, trace gravel, and **Sandy Silt Till**: some clay and some gravel
BH3/MW	4841279.09	609823.93	166.2	5.2	**Sandy Silt Till:** some clay, and trace gravel
BH4	4841261.75	609836.12	166.2	5.2	-

2.3 Groundwater Monitoring and Sampling

Orbit's staff visited the site on April 8, 2021 to collect groundwater samples to be analyzed under guidelines of the Region of Peel Sanitary and Storm Sewer Use By-Law. Before the sampling and hydraulic conductivity testing, the three (3) monitoring wells (BH1/MW, BH2/MW, and BH3/MW) were developed using a low-density polyethylene tubing and a 2-inch submersible portable pumps.

The development of the monitoring wells was conducted by purging and surging the water well to stress the formation around the well screen so that mobile particulates were removed. The purpose of the well development is to improve the hydraulic connection between the well and the geologic materials in the vicinity of the well, and to subsequently obtain a groundwater sample representative of the in-situ conditions. The groundwater level was measured in the monitoring after completing the development process.

The groundwater quality sample was obtained from borehole BH1/MW. The collected samples were submitted to Eurofins Laboratories, a member of the Canadian Association for Laboratory Accreditation (CALA), for chemical analysis. Copies of the laboratory certificates of the analysis are provided in **Appendix C**.

2.4 In-Situ Hydraulic Conductivity Testing

The rising and falling head hydraulic conductivity tests (slug tests) were conducted in three (3) monitoring wells and the collected data were analyzed to provide an estimate of the hydraulic conductivity (K) of the stratum surrounding each respective monitoring well screen. In-situ hydraulic conductivity testing was completed in wells BH1/MW, BH2/MW and BH3/MW.

A summary of the hydraulic conductivity testing (Slug Testing) methodology is as follows:

- At the start of the test, the static groundwater level in the monitoring well was initially measured and recorded;
- An electronic pressure transducer (datalogger) was installed in the well below the water level and configured to measure absolute pressure (water pressure + atmospheric pressure) on a regular interval (i.e., 1 to 60 seconds);

- Falling head tests were carried out using a solid slug of known volume introduced into the well, and the reverse technique was also carried out (i.e., slug removal) for a corresponding rising head test;
- The water level was then measured and recorded at regular time intervals and until the water level had recovered to a level close to the static water level measured before the start of the test.

The collected water level data from the monitoring wells was analysed using AQTESOLV Professional V4.5 to estimate the hydraulic conductivity (K) of the soil adjacent to the screened portion of the tested wells. The results of the completed in-situ hydraulic conductivity testing are provided in **Appendix D.**

3 SITE CONDITIONS

3.1 Physical Setting

The Site is located in the Peel Region at 7170 Goreway Drive, Mississauga, ON. The Site topography is relatively flat and located in an urban setting consisting primarily of urbanized residential and commercial development constructed in different years. The surrounding area is currently occupied by commercial developments in the north of the site and residential townhouses with and without basements on the other sides of the property. **Drawing 1** present a site plan and approximate boreholes and monitoring wells locations plan. According to the Oak Ridges Moraine Conservation Plan available online at (https://www.ontario.ca/page/oak-ridges-moraine) and the Niagara Escarpment Plan (NEP) Maps available online at (https://www.escarpment.org/home), the Site is not located within an area where either the Oak Ridges Moraine Conservation Plan or the Niagara Escarpment Plan would be applicable.

3.2 Climatic Conditions

The average monthly climate data from an Environment Canada climate station located at Toronto Lester B. Pearson International Airport (Station ID 6158733), approximately 4.7 km South of the Site, the data for the period between 1981 and 2010 has been provided in **Table 2.** (www.climate.weather.gc.ca/climate_normals/). The data indicates that the climate in the Site is typical continental with cold winters and warm summers and precipitation records showing local seasonal variation. As shown in **Table 2** below, the mean annual precipitation is 792.7 mm/year, with an annual mean rainfall of 684.6 mm/year (86.3 % of total precipitation). The average monthly precipitation ranged from 42.6 mm in February to 79.6 mm in August. The mean annual daily temperature is 7.5 degrees Celsius (°C), ranging from -0.4 °C in March to 20.8 °C in July.

Table 2: Climate Data Summary (1981 – 2010) – Toronto Lester B. Pearson International Airport

Month	Daily Average Temperature (°C)	Average Rainfall (mm)	Average Snowfall (cm)	Average Precipitation (mm)
January	-6.3	24.9	31.1	52.2
February	-5.4	22.3	22.1	42.6
March	-0.4	36.7	19.2	57.1
April	6.3	62.4	5.7	68.4
May	12.9	72.4	0.1	72.5
June	17.8	74.2	0.0	74.2
July	20.8	74.4	0.0	74.4
August	19.9	79.6	0.0	79.6
September	15.3	77.5	0.0	77.5
October	8.9	63.4	0.5	64.1
November	3.2	62.0	7.6	69.3
December	-2.9	34.7	29.2	60.9
Year	7.5	684.6	115.4	792.7
Note: Data was obtained from the Environment Canada website (Environment Canada 2020).				

3.3 Physiography and Drainage

The Site is located in the physiographic region known as the South Slope (Chapman and Putnam, 1984) as shown in **Drawing # 2**. The South Slope is characterized by low-lying, fine-grained, undulating ground moraine and knolls. The till is part of the Halton till layer and thin lake sediments are found in low-lying areas. The soils have low permeability and groundwater infiltration is limited. Localized pockets of sand and gravel exist amongst the moraines serving as areas of groundwater infiltration that feed local lakes and streams.

The Site is located within the Mimico Creek watershed which originates on the South Slope of the Oak Ridges Moraine near Caledon and flow southeast to Lake Ontario. A branch of the Mimico Creek watershed is located about 400 m south of the Site.

3.4 Geological Mapping

A review of available published surficial geology mapping from OGS (2010) indicates that silt and clay derived from fine-textured glaciolacustrine deposits occur in the immediate vicinity of the Site. As shown in **Drawing # 3**, three (3) primary surficial geologic unit are interpreted by OGS to occur within the vicinity of the Site, including (chronologically from older to younger units)

- Unit 8b: Fine-textured glaciolacustrine deposits consisting of silt and clay, minor sand, and gravel (interbedded silt and clay and gritty, pebbly flow till and rainout deposits).
- Unit 5d: Clay to silt-textured till (derived from glaciolacustrine deposits or shale).
- Unit 19: Modern alluvial deposits consisting of clay, silt sand, gravel and may contain organic remains associated with the Mimico Creek channel.

3.5 Subsurface Soil Conditions

The subsurface soil conditions encountered during boreholes advanced at the Site are shown on the borehole logs attached in **Appendix B**. A summary of the soil conditions is provided below. The soil materials encountered at the borehole locations consisted of Topsoil, Weathered/Disturbed Soil, Clayey silt to Silty Clay Till, and Sandy Silt to Silt Till.

3.5.1 Topsoil

The thickness of the topsoil explored in the boreholes generally ranged from 300mm to 450mm. The data provided here pertaining to the topsoil thickness is confirmed at the borehole locations only and may vary between and beyond the boreholes. This information is not considered to be sufficient for estimating topsoil quantities and associated costs.

3.5.2 Native Soils

The surficial topsoil layer was underlain by the following layers of native soils.

3.5.2.1 Weathered/Disturbed Soil

The Upper Weathered Zone extends to depths ranging from 0.6 m to 0.8 m below the existing grade. It was consisted of moist to very moist, soft to firm clayey silt to silty clay with trace to some topsoil inclusions and rootlets.

3.5.2.2 Glacial Till

The Middle clayey silt to silty clay till layer extending to depths ranging from 2.3 m to 3.7m was generally moist and firm to very stiff state. The clayey silt to silty clay till layer was generally greyish brown to brownish grey. The results indicate that the relative density of the till deposits can be described as firm to very stiff.

Typical grain size distribution curves of the samples from different depths in boreholes BH2/MW and BH3/MW shows the following gradation:

- Gravel: 0 – 1 %
- Sand: 2 – 18 %
- Silt: 38 – 58 %

- Clay: 23 – 60 %

3.5.2.3 Sandy Silt to Silt Till

- The Lower till deposits including sandy silt to silt till encountered in boreholes (BH1/MW at 2.3, BH2/MW at 3.7 m, BH3/MW at 2.3 m and BH4 at 2.3 m) which extended to maximum explored depth of 6.1 m were generally greyish brown to grey, moist to wet and in compact state.
- The measured moisture contents of the native deposits are shown on the borehole logs, which are generally less than 25 percent by weight.

The grain size distribution of the sandy silt to silt till deposits show the gradation as 1-12% gravel, 0-36% sand 42-93% silt and 3-19% clay.

4 GROUNDWATER CONDITIONS

4.1 Regional Groundwater Recharge

The recharge is the process by which groundwater is replenished and involves the vertical infiltration of water through the subsoil deposits and geologic materials to the saturated zone. The major sources of recharge in the Site are a result of precipitation and freshet. The amount of groundwater recharge in a particular area depends on surficial geology, topography, and the extent of land development in that area. Generally, regional groundwater recharge is irregularly distributed temporally and spatially as interpreted from specific climatic conditions, local geology, and land development status.

The Site is located in predominantly highly development area, surrounded by residential and commercial developments contained impermeable paved surfaces and rooftops. The groundwater recharge is expected to occur in the limited green open space encircling the Site and in the limited open and unpaved spaces. Generally, the area of the Site is expected to have a low groundwater recharge rate due to the presence of the fine-textured glaciolacustrine deposits consisting of silt and clay and low permeability pavement structure surrounding the site. The proposed Site is located in an unrestricted unpaved area and no major changes are expected in the groundwater recharge rate due to the new planned development.

4.2 Groundwater Level Fluctuations

The groundwater level data collected from the monitoring wells are provided in **Table 3** and also provided the borehole logs in **Appendix B**.

It should be noted that groundwater conditions vary depending on factors such as temperature, season, precipitation, construction activity and other situations, which may be different from those encountered at the time of the monitoring. The possibility of groundwater level fluctuations at the Site should be considered when designing and developing the construction plans for the project.

Regional groundwater flow in the area typically reflects the local topography and generally occurs from topographic highs to topographic lows. The dominant regional groundwater flow direction is expected to be to the South, towards Lake Ontario.

4.3 Inferred Hydro-stratigraphy

The subsurface investigations revealed that beneath the surficial materials, the subsurface conditions encountered in the monitoring wells consisted of Topsoil, Weathered/Disturbed native soil and till deposits. The till deposits were encountered at depths of 0.6 m to 0.8 m below the existing ground surface. The 50 mm diameter monitoring wells were installed in boreholes BH1/MW, BH2/MW, BH3/MW to monitor the groundwater level at the Site. Groundwater was encountered in the clayey silt to silty clay till and sandy silt to silt till in the monitoring wells BH1/MW, BH2/MW and BH3/MW. Conditions encountered in the monitoring wells indicated that the groundwater in these layers can be considered under an unconfined condition.

Table 3: Summary of Groundwater Level Observations in Monitoring Wells

Monitoring Well ID	Date of Construction	Date of Groundwater Level Measurement	Depth/Elevation of the tip of Monitoring well (m)	Depth/Elevation of Groundwater (m)
BH1/MW	Mar 26, 2021	During drilling	5.8/160.3	2.3/163.8
		29 Mar 2021		1.9/164.2
		07 Apr 2021		1.9/164.2
		08 Apr 2021		2.0/164.1
		16 June 2021		2.1/164.0
BH2/MW	Mar 26, 2021	During drilling	4.3/162.2	4.6/161.9
		29 Mar 2021		2.5/164.0
		07 Apr 2021		2.5/164.0
		08 Apr 2021		2.5/164.0
		16 June 2021		2.7/163.8
BH3/MW	Mar 26, 2021	During drilling	4.8/161.4	3.1/163.1
		29 Mar 2021		2.5/163.7
		07 Apr 2021		2.6/163.6
		08 Apr 2021		2.5/163.7
		16 June 2021		2.6/163.6

4.4 Results of In-Situ Hydraulic Conductivity Tests

Table 4 summarizes the results of the slug testing (hydraulic conductivity) results which was obtained by using AQTESOLV Pro. The hydraulic conductivity data analysis sheets are presented in **Appendix D**.

Table 4: Summary of Slug Test Results

MW ID	Analytical Method	Type of Slug Test	Hydraulic Conductivity (cm/Sec)	Screened Stratigraphic Unit(s)
BH1/MW	Bouwer Rice	Falling Head	$6.33X10^{-5}$	**Silt till:** trace clay and gravel
BH2/MW	Bouwer Rice	Falling Head	$4.04X10^{-5}$	**Clayey Silt to Silty Clay Till**: some sand, trace gravel, and **Sandy Silt Till**: some clay and some gravel
BH3/MW	Bouwer Rice	Falling Head	$2.52X10^{-5}$	**Sandy Silt Till:** some clay, and trace gravel

4.5 Groundwater Use in the Study Area

A review of the available data from the MECP Water Well Information System (WWIS) database was carried out to identify active wells near the Site. The database search was requested for the area located within 500 m around the Site boundaries. This search identified records for thirty-five (35) wells. **Drawing 4** presents the locations of the identified wells within a 500m around the Site. A detailed table showing water well record (WRR) information for these wells as well as the associated water use categories is provided in **Appendix E**.

The wells identified in the database search are considered most likely to be associated with recent construction activities and/or infrastructure upgrades in the area. It is assumed that one well installed during the period of 1951 was used for domestic purposes and most likely it was decommissioned. This is consistent with the expectation that potable water in the Site area is available from the Region of Peel's Lake Ontario-based water supply system.

Based on the hydrogeological information and data analysis in this report, the potential impacts to surface water and groundwater resources in the vicinity of the Site due to the proposed residential development at the Site are considered insignificant.

4.6 Groundwater Quality for Temporary Dewatering

Orbit understands that during construction, the groundwater pumped in conjunction with excavation dewatering (where required) may be discharged into the Region of Peel storm or sanitary sewer systems. In this case, the discharge water quality will have to conform to the discharge limits identified in the Region of Peel Sewer Use By-Law. As part of the hydrogeological investigation, Orbit collected selected water samples for chemical analysis. The purpose of the chemical analysis was to identify potential disposal options for excess water generated during construction. The water samples were examined in the field for aesthetic evidence of impacts (i.e. debris, staining, and odours). In accordance with the MECP sampling protocols, the water samples were placed directly into laboratory supplied containers for potential chemical analysis.

Eurofins Laboratories of Ottawa, Ontario conducted the chemical analyses. Eurofins is a member of the Canadian Association for Laboratory Accreditation Inc. (CALA) and meets the requirements of Section 47 of Ontario Regulation 153/04 (O. Reg. 153/04) certifying that the analytical laboratory be accredited in accordance with the International Standard ISO/IEC 17025 and with standards developed by the Standards Council of Canada. The results of the water samples submitted for chemical analyses were compared to the Region of Peel Sewer Use By-Law for Sanitary Sewer discharges.

The laboratory certificates of analysis are provided in **Appendix C**. These results showed that most concentrations of analyzed parameters were found to be below the Region of Peel sanitary sewer limits, except for the Total Suspended Solids, Aluminum, and Manganese. Table 5 summarizes the water quality exceedances from the Region of Peel Sanitary Sewer By-Law guidelines.

Based on these results, it is anticipated that groundwater removed for dewatering purposes during excavation can be discharged into the municipal sanitary sewer system, provided that a discharge permit is obtained from the Region of Peel. Care should be taken to prevent the movement of sediment with the groundwater, a proper filtration or sediment settlement tank should be used. In addition to that, care should be taken with regards to the Total Suspended Solids and the metals that were found to be exceeding the Region of Peel Sanitary Sewer Guidelines.

Table 5: Summary of The Water Quality Exceedances from the Region of Peel Sanitary Sewer Guidelines

Guideline	Group	Analyte
Region of Peel	General Chemistry	Total Suspended Solids
	Metals	Manganese
		Aluminum

5. GROUNDWATER DEWATERING ESTIMATES

5.1 Introduction

It is Orbit's understanding, according to the drawing provided by the client (**Appendix A**), that the project will consist of 15 residential units, roads, and sewers. It is our further understanding that each unit will consist of a 3-storey townhouse with basements.

Table 6 summarizes the preliminary assessment of dewatering requirements to lower the water table to 1 m below the bottom of the excavation level. The highest groundwater level measured in the monitoring wells installed at the Site was about 164.2 mASL measured in BH1/MW. The monitoring well that was found representative for the hydraulic conductivity value the soil at the Site was found to be BH1/MW.

Its is our understanding that the current proposed construction will have 15 residential units located in 3 blocks, supplied with watermain, storm, and sanitary sewer lines and each unit consists of three-storey townhouse. It was assumed that each block will be excavated at the same time. So, the excavated area for the all the proposed blocks were assumed to be approximately 57 m x 13 m, 20 m x 13 m, and 20 m x 13 m which corresponding to blocks 1, 2, and 3, respectively. The sizes of the excavated areas were calculated approximately from the drawing provided by the Client (**Appendix A**) and for the dewatering calculations, considering a clearance of 1 m from all sides was added for the proposed development. Assuming that the groundwater level would be reduced as necessary to 1 m below the base of the excavation, the approximate groundwater elevation during the construction is shown in **Table 6**. For the purpose of the calculations of the potential dewatering rates, the excavation was considered as an open cut. The thicknesses of the aquifer were assumed to be uniform.

Table 6: Summary of Preliminary Assessment of Dewatering Requirements

Planned Construction Information						Groundwater Information			Dewatering Information	
Structure Name	Length of Excavation (m)	Approx. Width of Excavation (m)	Ground Surface Elevation (mASL)	Elevation of Approx. Depth of Excavation [A] (mASL)	Approx. Depth of Excavation (m)	Rep. MW	Measured Highest Groundwater Level Elevation [B] (mASL)	Estimated Drawdown (m) [B-A+1[1]]	Construction Dewatering Needed? (Yes/No)	Hydraulic Conductivity (cm/s)
Block No.1	57	13	166.3	163.6	2.7	MW1	164.2	1.6	Yes	6.34E-5
Block No. 2	20	13	166.5	163.8	2.7	MW1	164.2	1.4	Yes	6.339E-5
Block No. 3	20	13	166.1	163.4	2.7	MW1	164.2	1.8	Yes	6.339E-5
150mm PVC Watermain	-	-	-	-	-	MW1	164.2	-	NO	6.339E-5
STM CB1 – STM CBMH1	6.4	2.1	167.0	165.2	1.8	MW1	164.2	1.6	Yes	6.339E-5
STM CBMH1 – STM CBMH2	17.4	2.2	167	164.8	2.2	MW1	164.2	0.4	Yes	6.339E-5
STM CBMH2 –STM MH1	9.6	2.2	167.2	164.9	2.3	MW1	164.2	0.3	Yes	6.339E-5
STM CB5 –STM MH1	2.8	2.1	167.2	164.9	2.3	MW1	164.2	0.3	Yes	6.339E-5
STM CBMH3 –STM MH1	2.3	2.2	167.2	164.9	2.3	MW1	164.2	0.3	Yes	6.339E-5
STM CBMH3 –STM CB5	11.7	2.1	166.7	165.1	1.6	MW1	164.2	0.1	Yes	6.339E-5
STM MH2 –STM MH3	27.3	2.2	166.5	163.7	2.7	MW1	164.2	1.5	Yes	6.339E-5
STM MH3 –STM MH4	8.6	2.2	166.6	163.6	3.0	MW1	164.2	1.6	Yes	6.339E-5
STM MH4 – STM MH5	24.9	2.2	166.4	163.4	3.0	MW1	164.2	1.8	Yes	6.339E-5
STM MH5 –STM MH6	8.8	2.2	166.1	163.3	3.2	MW1	164.2	1.9	Yes	6.339E-5
SAN MH1 – SAN MH3	20.6	2.1	167.0	164.2	2.8	MW1	164.2	1.0	Yes	6.339E-5
SAN MH3 – SAN MH4	26.2	2.1	167	164.2	2.8	MW1	164.2	1.0	Yes	6.339E-5
SAN MH2 – SAN MH3	30.3	2.1	167	164.2	2.8	MW1	164.2	1.0	Yes	6.339E-5
SAN MH4 – SAN MH5	24.1	2.1	166.6	164	2.6	MW1	164.2	1.2	Yes	6.339E-5
SAN MH5 – SAN MH6	24.1	2.1	166.3	163.9	2.4	MW1	164.2	1.3	Yes	6.339E-5

5.2 Dewatering Rate Estimation

The anticipated daily dewatering rates were estimated using the equations provided in the reference book "Construction Dewatering and Groundwater Control: New Methods and Applications - Third Edition. New York, New York: John Wiley & Sons (Powers et. al., 2007), for a trench excavation. Steady flow to the excavation was assumed for the purpose of the analysis. The "trench excavation" referred to herein is an excavation configuration of a rectangular, where the ratio of the length to the width is more than 1.5. The referred equation considers a total groundwater inflow rate (QT) to an excavation trench consisting of two (2) components, QM and QR, as follows:

$$Q_T = Q_M + Q_R$$

Where

- Q_M Linear flow rate for the trench section;
- Q_R Radial flow through the two ends of the excavated trench.

Using this equation and considering the proposed excavation area and based on the hydrogeological parameters of the formation expected to be encountered as well as the drawdown needed (assumed 1.0m below the invert of the trench excavation), the estimated daily pumping rate to achieve the required drawdown was calculated as follows:

- The linear flow component Q_M [m^3/d], represents groundwater inflow portion to the trench through the excavation length. The linear flow rate depends on the aquifer properties such as hydraulic conductivity, thickness, and static water level as well as excavation length and depth, and the zone of influence. The linear flow rate calculation equation is as follows:

$$Q_M = \frac{x K \left(H^2 - h^2 \right)}{L_o}$$

Where:

- x Length of the trench [m];
- K Hydraulic conductivity [m/d];
- H Distance from static water level to the bottom of the aquifer [m];
- h Distance from lowered water level to the bottom of the aquifer [m], and;
- L_o Distance from a point of greatest drawdown to a point where there is no drawdown (zone of influence) [m]. It was estimated approximately using the following empirical relationship developed by Sichart:

$$L_o = 3000(H - h)K^{0.5}$$ (K in m/s) (Powers et al., 2007).

- The radial flow component, Q_R [m^3/d], represents the groundwater inflow portion to the trench through the two ends of the excavated trench. The radial flow rate depends on aquifer properties such as hydraulic conductivity, thickness and static water level, as well as the excavation length, width, and depth, and the zone of influence. The radial flow rate calculation equation is as follows:

$$Q_R = \frac{\pi K \left(H^2 - h^2 \right)}{\ln \left(\frac{R}{r_e} \right)}$$

Where:

- K = Hydraulic conductivity [m/d];
- H = Distance from static water level to the bottom of the aquifer [m];
- h = Distance from lowered water level to the bottom of the aquifer [m];
- R = radius of the cone of depression (zone of influence) [m], estimated approximately using the following empirical relationship developed by Sichart

$R = r_e + 3000(H - h)K^{0.5}$ (K in m/s) and

- r_e equivalent radius, estimated to be equal to half the width of the trench (Cashman and Preene, 2001).

To lower the water table 1 m below the bottom of the excavation, it is estimated that the total dewatering rate for the whole Site with 100 % contingency to be approximately 164.5 m^3/day. The total flow at any time will depend on the length or the area of excavation that needs dewatering and the expected rate of progress. The zone of influence (R) is estimated zone of influence (R) for each structure in the project is provided in **Table 7**.

The calculated groundwater daily pumping rate for any structure (Table 7) in the project does not exceed the MECP threshold of 50 m^3/day for EASR registration if the excavation for each structure is carried out individually or grouped in a way that dewatering quantity does not exceed threshold. However, EASR will be applicable if the excavation for the whole project will be carried out at the same time as the total dewatering quantity for the project site (164.5 m3/day) exceeds MECP threshold for EASR registration. The maximum dewatering rate for an individual excavation segment within the project with a contingency 100% was estimated to be 18.8 m^3/day and the maximum zone of influence (R) was estimated to be 19.2 m.

Orbit understands that the Client plans it to limit the excavation works for one structure at each time or structures grouped in a way that dewatering quantity does not exceed threshold of 50 m^3/day. Then in this case ESAR registration is not required for this project.

It is expected that there will be variations and changes in the amount of groundwater that can be pumped from any part of the site, thus, allowing a **100%** contingency for the variability in hydraulic conductivity that could be experienced, the maximum expected pumping rate needed for the each excavation segment (Table 7) is anticipated to be **less than 20 m^3/day**.

In this calculation, water volume due to precipitation has not been considered and it was assumed that the contractor would prevent the surface water from entering the excavation. However, in an unlikely event, if the quantities more than 20 m^3/day was encountered during the construction for one structure, Orbit should be contacted for further advice.

It is important to address that the assumed excavation depths and areas for the dewatering volume estimation in this report are based on our understanding of the proposed development and the information provided by the Client. In the case of any modifications of the design or the assumed depths and areas are changed compared to the data provided by the client during report preparation time, Orbit must be consulted, and the dewatering estimation may need to be revised accordingly. It is known that the subsurface soil conditions may change significantly between and beyond the onsite boreholes. As the information obtained and assumptions made in this investigation report are based on the results obtained

from a limited number of investigated locations, unexpected water bearing zones with a hydraulic conductivity higher than that used in these calculations may be present. In addition, the above estimated dewatering volumes are based on the estimated hydraulic conductivities (K-value) from limited in-situ slug tests.

It should be noted that it is the responsibility of the contractor to ensure dry conditions are always maintained within the excavation works.

Table 7 summarizes the estimated groundwater dewatering requirements to lower the water table to 1 m below the bottom of the excavation.

Table 7: Summary of Estimated Groundwater Dewatering Requirements for Structures

Planned Construction Information			Wells and Groundwater Information			Dewatering Estimation Information		
Structure Name	Ground Surface Elevation (mASL)	Elevation of Approximate Depth of Excavation (mASL)	Representative Monitoring Well	Measured Highest Groundwater Level Elevation (mASL)	Hydraulic Conductivity (cm/s)	Estimated Dewatering Rate (m^3/day)	Estimated Dewatering Rate with 100% Contingency (m^3/day)	Zone of Influence (R) (m)
Block No. 1	166.3	163.6	MW1	164.2	6.339E-5	9.4	18.8	19.2
Block No. 2	166.5	163.8	MW1	164.2	6.339E-5	5.7	11.4	12.4
Block No. 3	166.1	163.4	MW1	164.2	6.339E-5	6.2	12.4	13.4
STM CB1 – STM CBMH1	167.0	165.2	MW1	164.2	6.339E-5	3.2	6.2	3.3
STM CBMH1 – STM CBMH2	167	164.8	MW1	164.2	6.339E-5	2.5	5.0	1.7
STM CBMH2 –STM MH1	167.2	164.9	MW1	164.2	6.339E-5	1.7	3.4	1.5
STM CB5 –STM MH1	167.2	164.9	MW1	164.2	6.339E-5	1.2	2.4	1.5
STM CBMH3 –STM MH1	167.2	164.9	MW1	164.2	6.339E-5	1.2	2.3	1.5
STM CBMH3 –STM CB5	166.7	165.1	MW1	164.2	6.339E-5	1.2	2.4	1.2
STM MH2 –STM MH3	166.5	163.7	MW1	164.2	6.339E-5	7	14.1	3.2
STM MH3 –STM MH4	166.6	163.6	MW1	164.2	6.339E-5	3.6	7.2	3.3
STM MH4 – STM MH5	166.4	163.4	MW1	164.2	6.339E-5	7.3	14.7	3.6
STM MH5 –STM MH6	166.1	163.3	MW1	164.2	6.339E-5	4.0	8.0	3.7
SAN MH1 – SAN MH3	167.0	164.2	MW1	164.2	6.339E-5	4.7	9.3	2.4
SAN MH3 – SAN MH4	167	164.2	MW1	164.2	6.339E-5	5.5	11.0	2.4
SAN MH2 – SAN MH3	167	164.2	MW1	164.2	6.339E-5	6.2	12.4	2.4
SAN MH4 – SAN MH5	166.6	164	MW1	164.2	6.339E-5	5.7	11.5	2.7
SAN MH5 – SAN MH6	166.3	163.9	MW1	164.2	6.339E-5	6.0	12.0	2.9

6. LONG-TERM DRAINAGE SYSTEM

Orbit understands that the foundation of the basements of the planned townhouses at the Site are designed to resist hydrostatic uplift using the sub-slab drainage system or foundation drainage in conjunction with a perimeter drainage system for long-term control of the groundwater level to avoid wet conditions in these basements. The permanent drainage is intended to collect passive groundwater seepage from the surrounding soils. It is important to address that no design of the sub-slab drainage system was provided when preparing this hydrogeological site assessment. The sub-drainage system is assumed to be at least 3.2 m below ground surface.

The estimated flow rate for perimeter and underfloor drains is expected to be similar to temporary dewatering rate as presented above. The zone of influence and long-term drainage of the permanent drainage system in each unit of townhouses are summarized in **Table 8**.

Table 8: **Summary of Estimated Groundwater Long-term Drainage**

Townhouse Type /Block No.	No. of Units	Estimated Excavation Size (m)	Assumed Depth of the Sub-drainage system (MBGS)	Estimated Radius of Influence (m)	Estimated Dewatering Rate for Each Unit (L/day)	Estimated Total Dewatering Rate (L/day)
Block No.1 (Start Corner Units)	1	8.1 X 12.7	3.20	9.5	4,090	4,090.00
Block No.1 (Interior Units)	7	8 8 X 12.7	3.20	9.5	4,071	28,497.00
Block No.1 (End Corner Units)	1	9.2 X 12.7	3.20	9.9	4,301	4,301.00
Block Nos. 2 and 3 (Corner Units)	4	8.1 X 12.7	3.20	9.5	4,090	16,360.00
Block Nos. 2 and 3 (Interior Units)	2	8 X 12.7	3.20	9.5	4,071	8,141.00

During and after storm events, significantly higher drainage rates are anticipated to accumulate from direct precipitation and runoff into the sub-slab drainage system. The highest recorded daily rainfall at a nearby Environmental Canada station (Station ID 6158733) is 79.6 mm (based on data from Environmental Canada). Assuming removal of a 79.6 mm storm event within 24 hours, the additional capacities for the sub-slab drainage system at the Site are estimated to be 100,380 L/day. Based on the conservative assumptions described above, the maximum long-term drainage rate of all the residential units would be more than 50,000 L/day, with consideration of storm events, and the maximum zone of influence was preliminary estimated to be 9.9 m.

The water can potentially be discharged into sanitary sewer as outlined in Section 4.6 of this report provided that a water discharge permit from the Region of Peel is obtained. In order to discharge to the Region of Peel sanitary sewer system, additional treatment would be required to reduce movement of sediment with the groundwater, a proper filtration or sediment settlement tank should be used. The Filtration system can potentially be filter bags and/or settlement tanks. Allowing for variations in grain size in the aquifer, specifically hydraulic conductivity and transmissivity, seepage through floor or from surface, it is expected that there will be variations in the amount of

groundwater that can be drained by foundation drainage systems. It is prudent to consider a contingency factor in designing the drainage capacity. It is recommended that the drainage capacity including sumps, pumps and related utilities is designed for minimum 115 L/min (30 gpm).

The long-term drainage rate of all the residential units (townhouses) in this project is anticipated to be more than 50,000 L/day, then PTTW from MECP for the long-term drainage is required.

6.1 Sub-structure Drainage Layer

A drainage layer consisting of at least 200 mm thick layer of well compacted 19 mm clear crushed stone is recommended to be placed directly under the floor slab. The stone bed would act as a barrier and prevent the capillary rise of moisture from the subgrade to the floor slab. This drainage layer has been proven to be effective for conventional floor surfaces such as carpet, vinyl tile and ceramic tile. However, if special floor coverings such as sheet PVC. with heat sealed seams, as used in gymnasiums, are considered, either a high efficiency vapour barrier or venting may be required to prevent moisture accumulation between the concrete floor and the PVC flooring.

In the areas with basement, the perimeter and underfloor drainage system is recommended for the basement walls where open cut excavations will be undertaken. The suggested perimeter drainage and underfloor drainage for shoring systems are (timber lagging and soldier piles) and (caisson wall), if required.

In order to minimize disturbance of the subgrade by construction traffic should they become saturated due to heavy rain; early placement of the drainage layer is recommended.

7. PREDICTED EFFECTS

Based on the hydrogeological information and data analysis in this report, the potential impacts to surface water and groundwater resources in the vicinity of the Site due to excavation dewatering for construction of the proposed development at the Site are described below.

7.1 Groundwater Use

As indicated in Section 4.5, the search of the MECP water well records indicated that 35 wells exist within approximately 500 m of the Site. It is assumed that one well installed during the period of 1951 used for domestic purposes and it was decommissioned. The area of the Site is currently serviced with a municipal water supply. Due to the estimated rate of dewatering and zone of influence (R), interference with off-Site groundwater use (if found) due to short-term construction-related dewatering for this project is not anticipated. Therefore, a water well survey is not recommended for this development project.

7.2 Surface Water Resources

No surface water within the zone of influence was observed. Based on this assessment, impacts to the surface water are not anticipated.

7.3 Potential Ground Settlement

Potential ground settlement/subsidence related to existing pavements, sidewalks, buildings, utilities, sewers, and other structures / infrastructure within the possible dewatering radius of influence (R_o) has not been assessed under this hydrogeological investigation. Orbit recommends that the construction contractor retain a qualified and an experienced engineer to complete this assessment based on the estimated dewatering R_o and the magnitude of drawdown required to allow for construction of the planned structures at the Site.

8. SUMMARY AND CONCLUSION

Based on the results of the subsurface investigation, hydrogeological assessment, and analysis of hydraulic conductivity testing and groundwater level monitoring data, the following summary of conclusions and recommendations is provided:

- The soil materials encountered at the borehole's location consisted of surficial topsoil, weathered/disturbed soil, clayey silt to silty clay till, sandy silty to silt till. The till deposits were encountered at the depth of 0.6 to 0.8 m below the existing ground surface.
- The depth groundwater table observed in the monitoring wells varies from 1.9 m to 2.6 m below the existing grade.
- The estimated total short-term dewatering quantity with a contingency 100 % for the whole project site is 164.5 m^3/day.
- The maximum short-term dewatering rate with a contingency 100% for any structures in the project was estimated to be 18.8 m^3/day and the maximum zone of influence (R_o) was estimated to be 19.2 m. The maximum estimated rate is below the MECP threshold of 50 m^3/day for the EASR registration if the excavation for each structure is carried out individually or grouped in a way that dewatering quantity does not exceed threshold. Then in this case EASR is not required. However, an EASR registration will be applicable if the excavation for the whole project site will be carried out at the same time as the total dewatering quantity for the project site (164.5 m^3/day) exceeds MECP threshold.
- Long-term dewatering system is recommended in this project to avoid wet conditions in the proposed basements. Long-term dewatering system can be installed using the sub-slab drainage system or foundation drainage in conjunction with a perimeter drainage system.
- The long-term dewatering of the foundation sub-drain is estimated to be 61.4 m^3/day and the zone of influence was estimated to be 9.9 m. The exact volume discharged can be confirmed once the system is operational. It is recommended that once the sub-drain system is in place, a flow meter be installed at each sump to record daily discharge volumes to provide more representative estimates during commissioning stage of the system.
- The maximum long-term drainage rate of all the residential units with consideration of storm events would be more than 50m^3/day. Therefore, PTTW from MECP will be required for long-term discharge.
- Both long-term and short-term dewatering volumes presented in this report are based on assumptions outlined in this report. Any variations of the hydrogeological conditions beyond those encountered as part of this preliminary investigation may significantly influence the respective discharge volumes.
- For the long-term dewatering discharge to the sanitary sewer system and based on the water quality test results, the water is suitable to discharge with a suitable treatment system.
- No surface water within the zone of influence was observed. Based on this assessment, impacts to the surface water are not anticipated.

- It is recommended that the temporary dewatering system be designed and evaluated by a qualified engineer and performed by a licensed dewatering contractor. The short-term dewatering engineer/contractor should be reminded that during the dewatering activities, care must be taken to prevent the removal of fine soil particles with the pumped water or to use proper filtration prior to discharge to the Region of Peel sanitary sewer system.

- Discharge from temporary dewatering during the construction can potentially be directed into the sanitary sewer system of the Region of Peel after filtration, and treatment for Total Suspended Solids (TSS) and metals provided that a water discharge permit from the Region is obtained and that ongoing monitoring indicates that the discharge quality meets the relevant municipal sewer use standards. The filtration system can potentially be filter bags and/or settlement tanks. The groundwater should be tested prior to discharge into the sanitary sewer for the parameters identified in the Region of Peel Sanitary Sewer Use By-Law.

- Orbit recommends the decommissioning of existing groundwater monitoring wells after completion of the construction of the project. In conformance with Ontario's Wells Regulation (O.Reg.903) of the Ontario Water Resources Act, the installation and eventual decommissioning of groundwater wells must be carried out by a licensed well contractor. If a well will be damaged/destroyed during the construction activities, then the well should be properly decommissioned in advance of that work.

- Potential ground settlement/subsidence related to existing pavements, sidewalks, buildings, utilities, sewers, and other structures / infrastructure within the possible dewatering radius of influence (R_o) has not been assessed under this hydrogeological investigation. Orbit recommends that the construction contractor retain a qualified and an experienced engineer to complete this assessment based on the dewatering R_o and magnitude of drawdown required to allow for construction of the planned project at the Site.

9. STATEMENT OF LIMITATIONS

The contents of this report are subject to the attached 'Limitations of Report' sheet attached to this report. The reader's attention is specifically drawn to these conditions as it is considered essential that they be followed for the proper use and interpretation of this report. The Statement of Limitations is not intended to reduce the level of responsibility accepted by Orbit, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

This report was prepared by Orbit exclusively for the account of (the CLIENT). Other than by the CLIENT, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Orbit. Any use, reliance on or decision made by any person other than the CLIENT based on this report is the sole responsibility of such another person. The CLIENT and Orbit make no representation or warranty to any other person with regard to this report and the work referred to in this report and the CLIENT and Orbit accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

10. CLOSURE

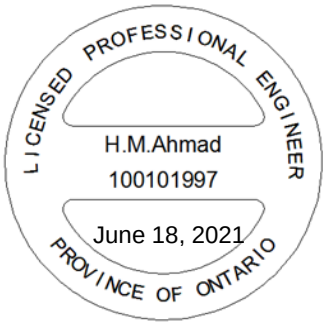
We trust that this information is satisfactory for your present requirements. Should you have any questions or require additional information, please do not hesitate to contact this office.

For and Behalf of Orbit Engineering Limited,

Mohammed Razeen, M.Eng
Hydrogeological and Geotechnical EIT

Reviewed by:

Aly Ahmed, Ph.D., P.Eng.
Senior Engineer



Hafiz Muneeb Ahmad, M.Sc., M.Eng., P.Eng., QP_{ESA}
Senior Principal Engineer

11.REFERENCES

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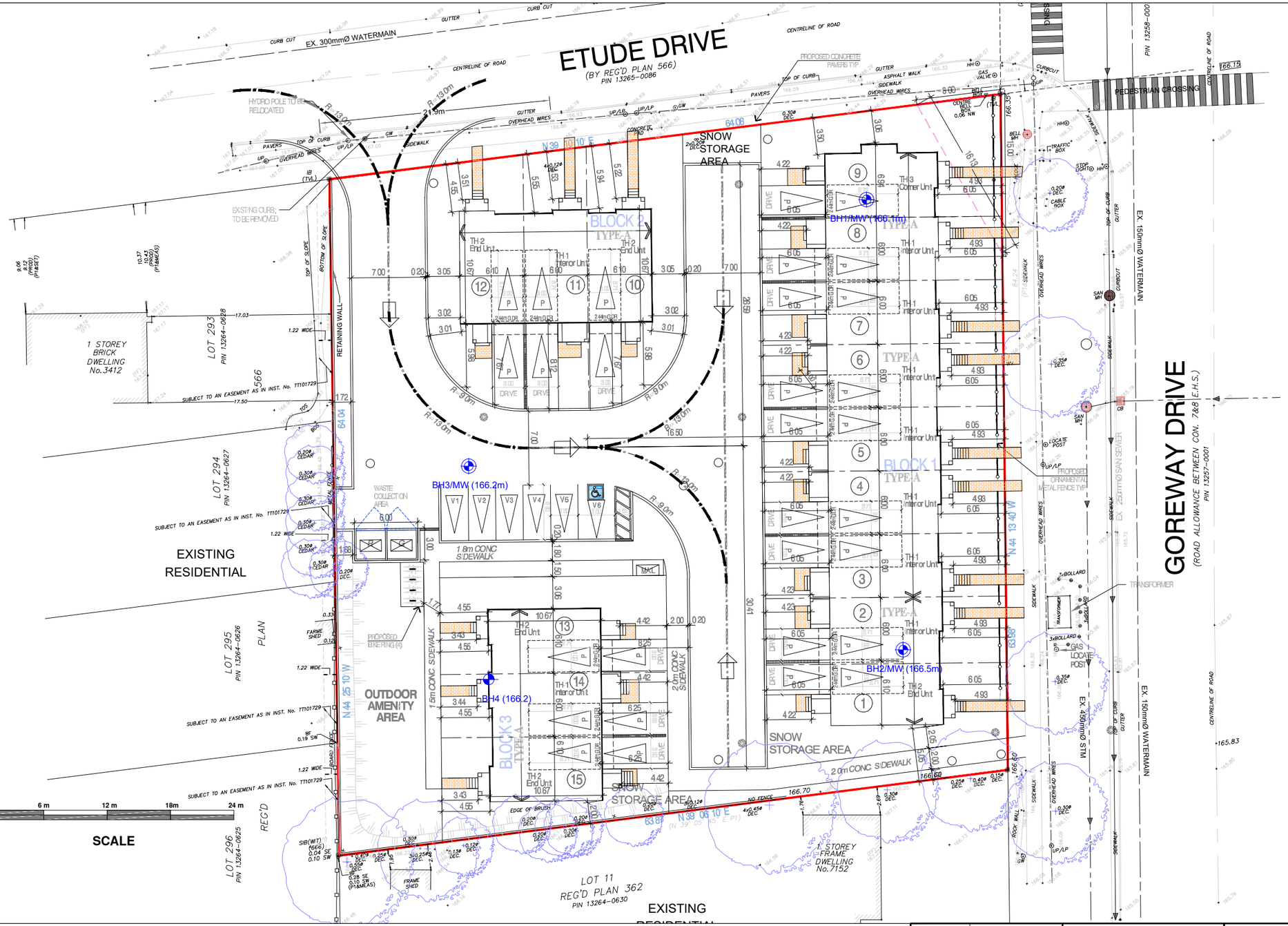
Drawings



NOTES:

1. The boundaries and soil types have been established only at borehole locations. Between boreholes they are assumed and may be subject to considerable error.
2. Soil samples will be retained in storage for three months and then destroyed unless the client advises an extended time period is required.
3. Granular base fill quantities should not be established from the information provided at the borehole locations.
4. Borehole elevations should not be used to design building(s) or floor slab(s) or parking lot(s) grades.
5. This drawing forms part of the report (project number as referenced) and should only be used in conjunction with this report.

LEGEND

- **Approximate Borehole Location**
- BH/MW **Approximate Borehole/Monitoring Well Location**
- 166.1 **Existing Grade Geodetic Elevation**

Drawn	TZ
Approved	HA
Date	MAY 2021
Scale	As Shown
Original size	TABLOID

ORBIT ENGINEERING
Consulting Engineers

Client: **RUP LAL C/O WESTON CONSULTING**

Project: **GEOTECH AND HYDROG INVESTIGATION OF PROPOSED RESIDENTIAL DEVELOPMENT 7170 GOREWAY DRIVE, MISSISSAUGA, ON**

Title: **APPROXIMATE BOREHOLE LOCATION PLAN**

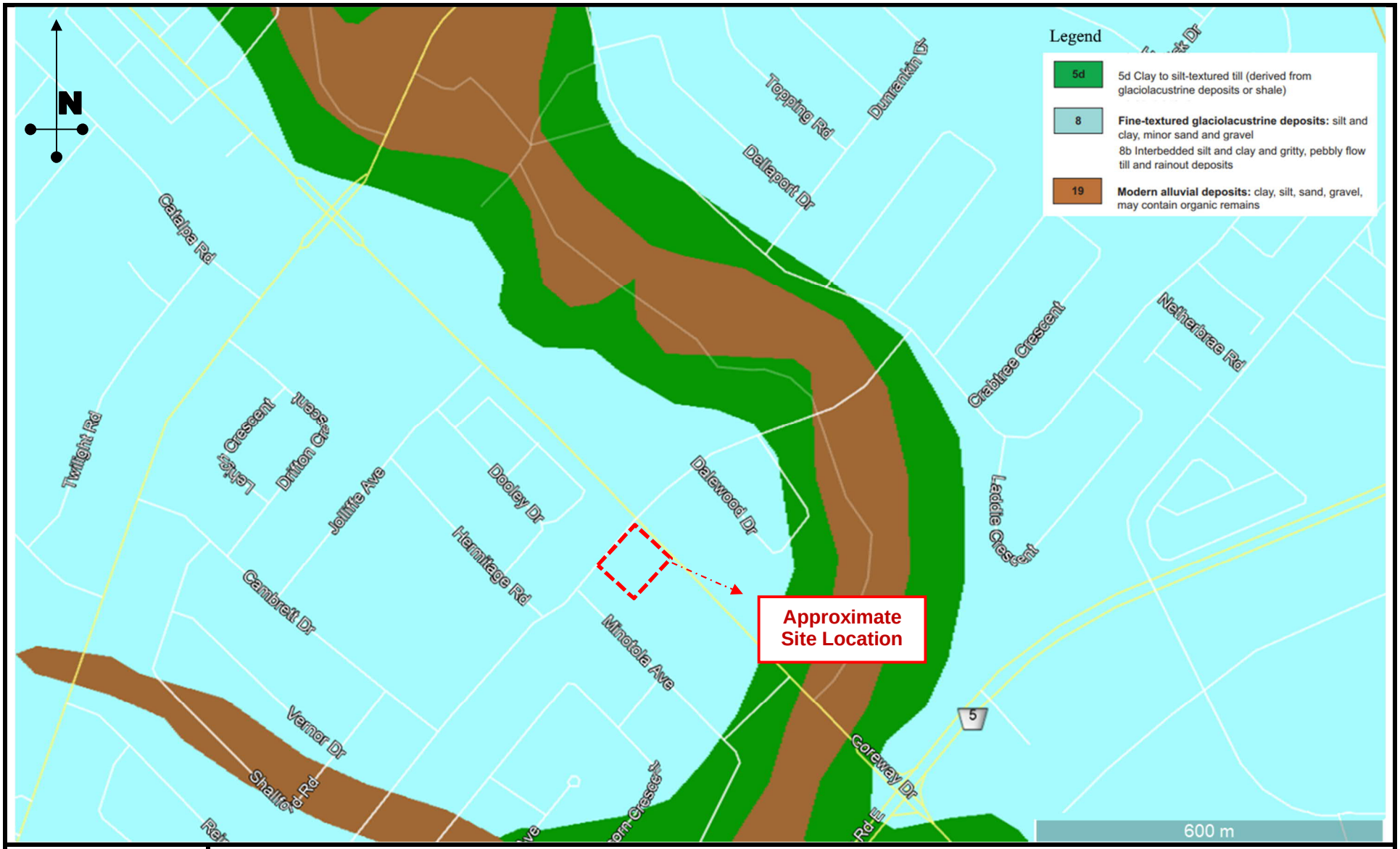
Project no: **OE20373CG**

Drawing no: **1**

Site Physiography

ORBITENGINEERING

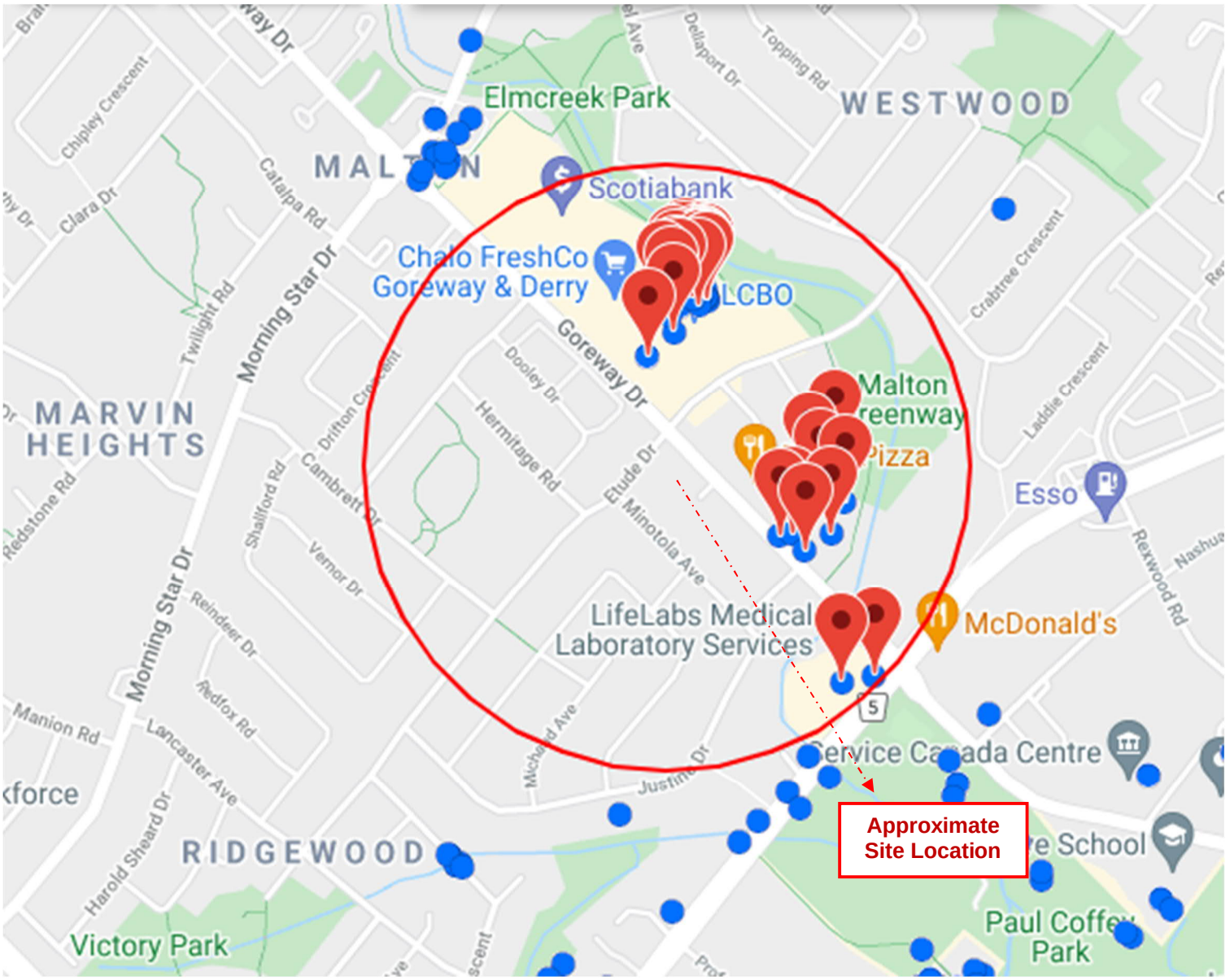
Date: **April 2021**	**Hydrogeological Investigation of Proposed Residential Development 7170 Goreway Drive, Mississauga, ON**	Prepared By: **T.Z.**
Project: **OE20373CG**	Prepared for: **Mr. Rup Lal c/o Weston Consulting**	Reviewed By: **H.A.**
		Drawing No.: **2**



Surficial Geology

ORBITENGINEERING

Date: **April 2021**	**Hydrogeological Investigation of Proposed Residential Development 7170 Goreway Drive, Mississauga, ON**	Prepared By: **T.Z.**
Project: **OE20373CG**	Prepared for: **Mr. Rup Lal c/o Weston Consulting**	Reviewed By: **H.A.**
		Drawing No.: **3**



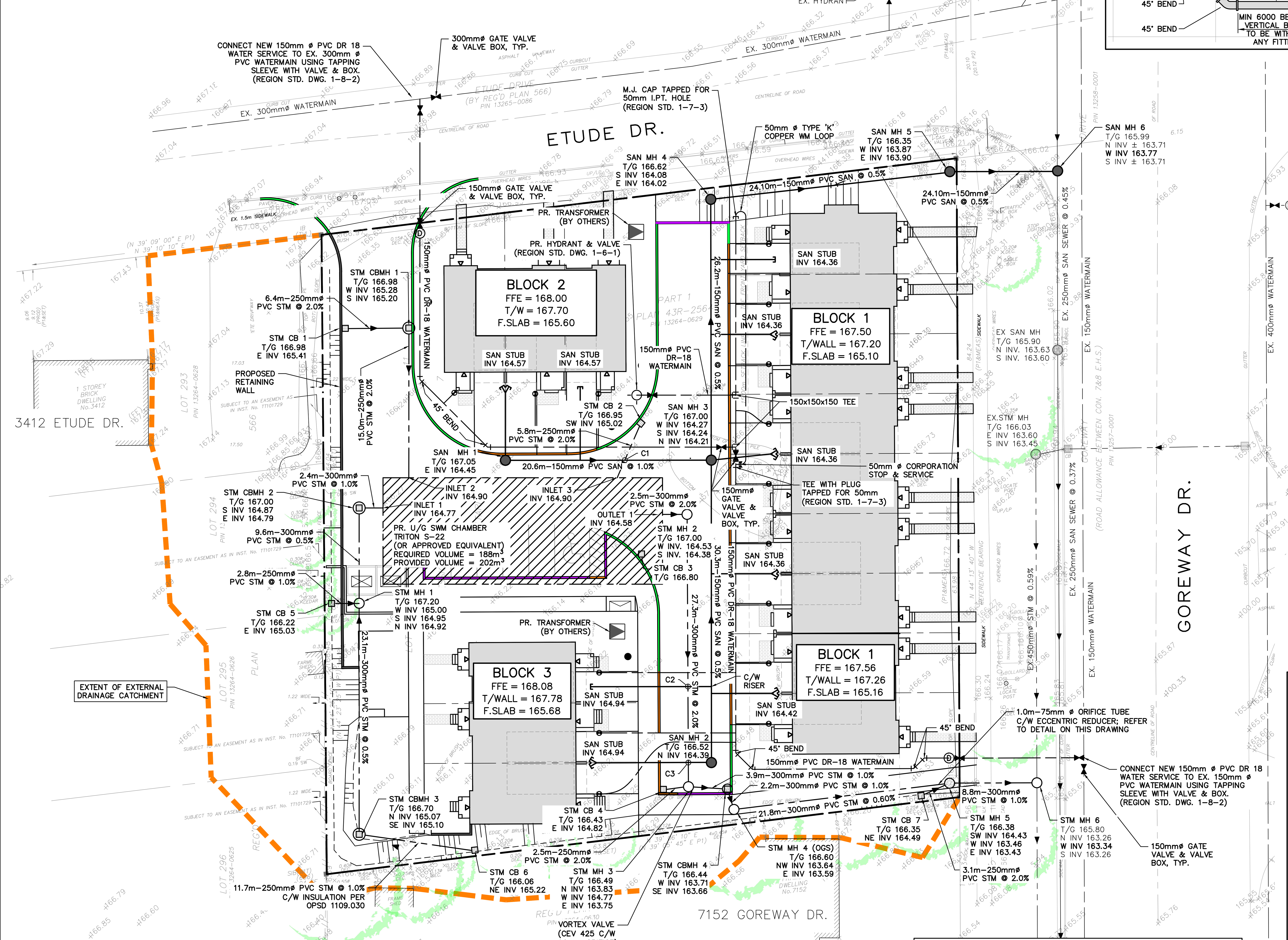
ORBITENGINEERING	**Well Records**		
	Date: **April 2021**	**Hydrogeological Investigation of Proposed Residential Development 7170 Goreway Drive, Mississauga, ON**	Prepared By: **T.Z.**
	Project: **OE20373CG**		Reviewed By: **H.A.**
		Prepared for: **Mr. Rup Lal c/o Weston Consulting**	Drawing No.: **4**

Appendix A

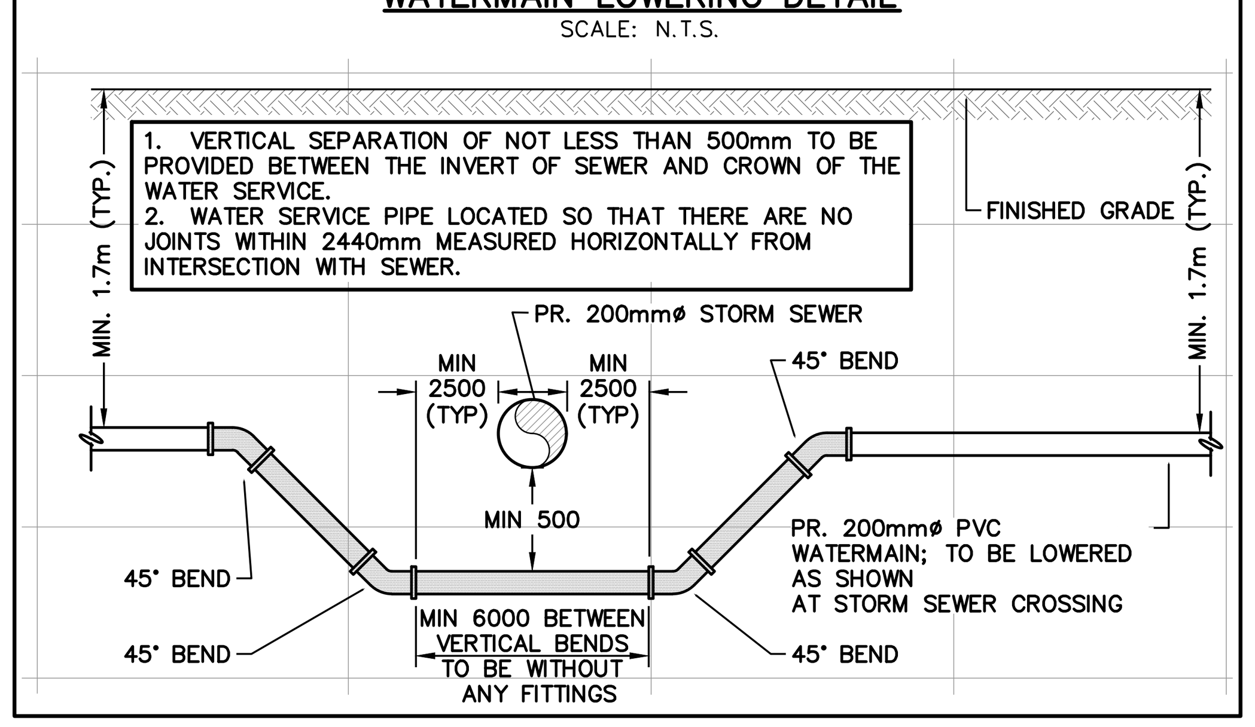
Drawings Provided by the Client

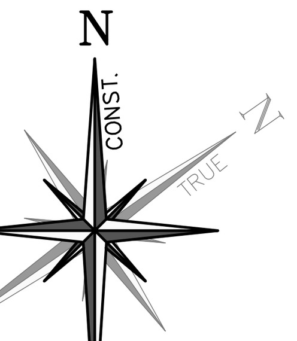
REGION OF PEEL NOTES:

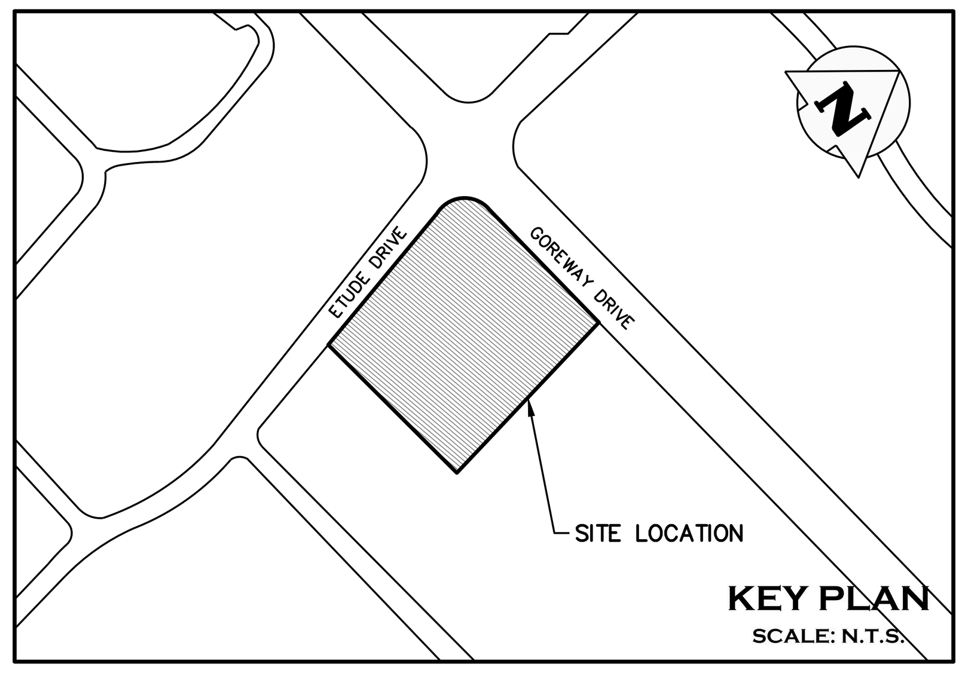
1. ALL MATERIALS AND CONSTRUCTION METHODS MUST CORRESPOND TO THE CURRENT PEEL PUBLIC WORKS STANDARDS AND SPECIFICATIONS.
2. WATERMAIN AND/OR WATER SERVICE MATERIALS 100mmø (4") AND LARGER MUST BE PVC DR-18 (AWWA C900-16). SIZE 50mmø (2") AND SMALLER MUST BE COPPER TYPE 'K' (ASTM-B88-49)
3. WATERMAINS AND/OR WATER SERVICES ARE TO HAVE A MINIMUM COVER OF 1.7m (5'6") WITH A MINIMUM HORIZONTAL SPACING OF 1.2m (4') FROM THEMSELVES AND ALL OTHER UTILITIES.
4. PROVISIONS FOR FLUSHING WATER LINE PRIOR TO TESTING, ETC., MUST BE PROVIDED WITH AT LEAST A 50mmø (2") OUTLET ON 100mmø (4") AND LARGER LINES. COPPER LINES ARE TO HAVE FLUSHING POINTS AT THE END, THE SAME SIZE AS THE LINE. THEY MUST ALSO BE HOSED OR PIPED TO ALLOW WATER TO DRAIN ONTO A PARKING LOT OR DOWN A DRAIN. ON FIRE LINES, FLUSHING OUTLET TO BE 100mmø (4") MINIMUM ON A HYDRANT.
5. ALL CURB STOPS TO BE 3.0m(10') OFF THE FACE OF THE BUILDING UNLESS OTHERWISE NOTED.
6. HYDRANT AND VALVE SET TO REGION STANDARD 1-6-1 DIMENSION 'A' & 'B', 0.7m (2') AND 0.9m (3') AND TO HAVE PUMPER NOZZLE.
7. WATERMAINS TO BE INSTALLED TO GRADES SHOWN ON APPROVED SITE PLAN. COPY OF GRADE SHEET MUST BE SUPPLIED TO INSPECTOR PRIOR TO COMMENCEMENT OF WORK, WHERE REQUESTED BY INSPECTOR.
8. WATERMAINS MUST HAVE A VERTICAL CLEARANCE OF 0.3m (12") OVER / 0.5m (20") UNDER SEWERS AND ALL OTHER UTILITIES WHEN CROSSING.
9. ALL PROPOSED WATER PIPING MUST BE ISOLATED FROM EXISTING LINES IN ORDER TO ALLOW INDEPENDENT PRESSURE TESTING AND CHLORINATING FROM EXISTING SYSTEMS.
10. ALL LIVE TAPPING AND OPERATION OF REGION WATER VALVES SHALL BE ARRANGED THROUGH THE REGIONAL INSPECTOR ASSIGNED, OR BY CONTACTING THE OPERATIONS AND MAINTENANCE DIVISION.
11. LOCATION OF ALL EXISTING UTILITIES IN THE FIELD TO BE ESTABLISHED BY THE CONTRACTOR.
12. THE CONTRACTOR(S) SHALL SHALL BE SOLELY RESPONSIBLE FOR LOCATES, EXPOSING, SUPPORTING AND PROTECTING OF ALL UNDERGROUND AND OVERHEAD UTILITIES AND STRUCTURESEXISTING AT THE TIME OF CONSTRUCTION IN THE AREA OF THEIR WORK. WHETHER SHOWN ON THE PLANS OR NOT AND FOR ALL REPAIRSAND CONSEQUENCES RESULTING FROMDAMAGE TO SAME.
13. THE CONTRACTOR(S) SHALL BE SOLELY RESPONSIBLE TO GIVE 72 HOURS WRITTEN NOTICE TO UTILITIES PRIOR TO CROSSING SUCH UTILITIES, FOR THE PURPOSE OF INSPECTION BY THE CONCERNED UTILITY. THIS INSPECTION WILL BE FOR THE DURATION OF THE CONSTRUCTION, WITH THE CONTRACTOR RESPONSIBLE FOR ALL COSTS ARISING FROM SUCH INSPECTION.
14. ALL PROPOSED WATER PIPING MUST BE ISOLATED THROUGH A TEMPORARY CONNECTION THAT SHALL INCLUDE AN APPROPRIATE CROSS-CONNECTION CONTROL DEVICE, CONSISTENT WITH DEGREE OF HAZARD, FOR BACKFLOW PREVENTION OF THE ACTIVE DISTRIBUTION SYSTEM, CONFORMING TO REGION OF PEEL STANDARDS 1-7-7 OR 1-7-8.



WATERMAIN LOWERING DETAIL
SCALE: N.T.S.







KEY PLAN
SCALE: N.T.S.

LEGEND

- PROPERTY LINE
- EXISTING WATERMAIN & GATE VALVE
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE
- EXISTING FIRE HYDRANT & GATE VALVE
- PROPOSED WATERMAIN & GATE VALVE
- PROPOSED WATER SERVICE LATERAL (25mmø)
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED DETECTOR CHECK VALVE IN CHAMBER INSTALLED PER REGION STD. 1-3-1
- PROPOSED STORM SEWER & MANHOLE
- PROPOSED SINGLE / DOUBLE CATCHBASIN
- PROPOSED SANITARY SEWER & MANHOLE
- PROPOSED SAN. SERVICE LATERAL (125mmø)
- PROPOSED LIGHT STANDARD (BY OTHERS)

CONTRACTOR TO ENSURE MINIMUM 0.50m VERTICAL CLEARANCE BETWEEN THE EXTERIOR OF THE WATERMAIN PIPE AND THE EXTERIOR OF SEWER PIPES.

IN CASE OF CONFLICT BETWEEN THE PROPOSED WATERMAIN AND THE PROPOSED SEWERS, CONTRACTOR TO LOWER THE WATERMAIN UNDER THE SEWER PIPE TO ENSURE MINIMUM 0.50m CLEARANCE BETWEEN THE EXTERIOR OF THE PIPES.

STORM STRUCTURE TABLE

STORM I.D.	SIZE	SPEC.
STM MH 1	1200mmø	OPSD 701.010
STM MH 2	1200mmø	OPSD 701.010
STM MH 3	1200mmø	OPSD 701.010
STM MH 4 (OGS)	STORMCEPTOR EF4 (OR APPROVED EQUIVALENT)	
STM MH 5	1200mmø	OPSD 701.010
STM MH 6	1200mmø	OPSD 701.010
STM CBMH 1	1200mmø	OPSD 701.010
STM CBMH 2	1200mmø	OPSD 701.010
STM CBMH 3	1200mmø	OPSD 701.010
STM CBMH 4	1200mmø	OPSD 701.010
STM CB 1	600mm x 600mm	OPSD 705.010
STM CB 2	600mm x 600mm	OPSD 705.010
STM CB 3	600mm x 600mm	OPSD 705.010
STM CB 4	600mm x 600mm	OPSD 705.010
STM CB 5	600mm x 600mm	OPSD 705.010
STM CB 6	600mm x 600mm	OPSD 705.010
STM CB 7	600mm x 600mm	OPSD 705.010

SANITARY STRUCTURE TABLE

SAN I.D.	SIZE	SPEC.
SAN MH 1	1200mmø	R.O.P. 2-5-3
SAN MH 2	1200mmø	R.O.P. 2-5-3
SAN MH 3	1200mmø	R.O.P. 2-5-3
SAN MH 4	1200mmø	R.O.P. 2-5-3
SAN MH 5	1200mmø	R.O.P. 2-5-3
SAN MH 6	1200mmø	R.O.P. 2-5-3

CROSSINGS

ID	UPPER		LOWER		SEP. (m)
	TYPE	EL.(m)	TYPE	EL.(m)	
C1	STM INV	164.94	SAN OBV	164.51	0.43
C2	SAN INV	164.84	STM OBV	164.34	0.50
C3	SAN INV	164.64	STM OBV	164.14	0.50

ALL CATCHBASIN GRATES WITHIIN ROAD TO BE OPSD 400.02

ALL CATCHBASIN GRATES WITHIN LANDSCAPED AREAS/ SWALE TO BE OPSD 400.12

No.	ISSUE / REVISION	YYYY/MMM/DD
B	ISSUED FOR COORDINATION - C102 & C103	2021/MAR/08
A	ISSUED FOR COORDINATION	2021/MAR/29

ELEVATION NOTE:

ELEVATIONS SHOWN HEREON ARE DERIVED FROM THE CANADIAN GEODETIC DATUM BENCHMARK No. 448

ELEVATION = 162.55m

SURVEY NOTES:

SURVEY COMPLETED J.H. GELBLOOM SURVEYING LIMITED. (2017/MAY/08) PROJECT No.: 17-089

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS UTM ZONE 17, NAD83 (GSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY JARDIN DESIGN GROUP INC. DRAWING No.: A-01a, REV.6 (2020/DEC/23) PROJECT No.: 17-18

DRAWING NOTES:

THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LEVELS, AND DATUMS ON SITE AND REPORT ANY DISCREPANCIES OR OMISSIONS TO THIS OFFICE PRIOR TO CONSTRUCTION.

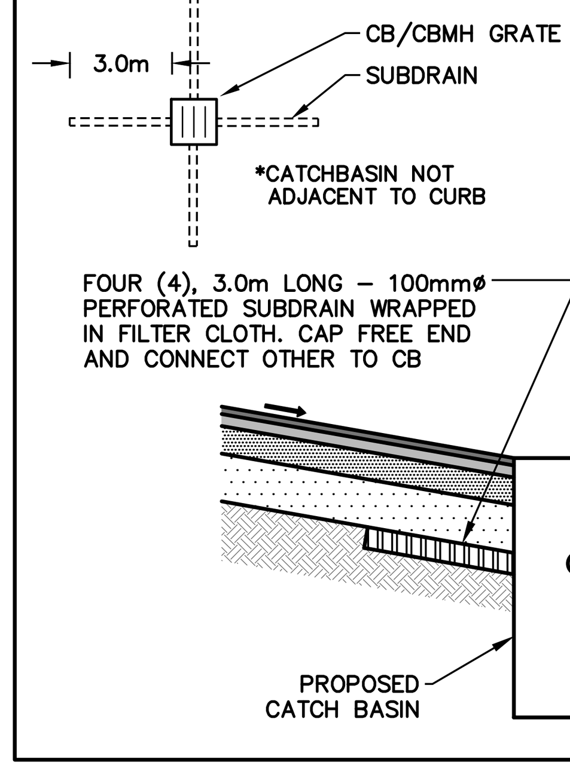
THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT. DO NOT SCALE THIS DRAWING.

ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
EXISTING INVERTS FROM AS-BUILT DRAWINGS 20065-D, 40529-D

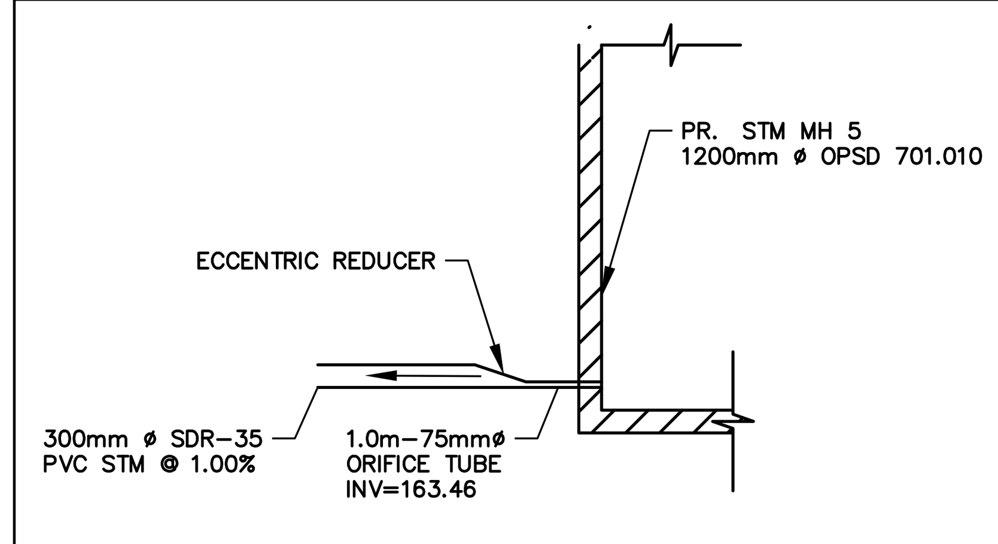
Region of Peel
Working for you

MISSISSAUGA

CATCHBASIN SUBDRAIN DETAIL
SCALE: N.T.S.



NOTES:
1. SUBDRAIN SHALL BE 100mmø PERFORATED PLASTIC WRAPPED IN GEOTEXTILE AND CLEARSTONE (UNLESS NOTED OTHERWISE).
2. SUBDRAIN SHALL BE PLACED WITHIN SUBGRADE AND HAVE POSITIVE DRAINAGE TOWARDS CATCHBASIN.



ORIFICE TUBE DETAILS
SCALE N.T.S.

NOT FOR CONSTRUCTION

PRELIMINARY

Project: 7170 GOREWAY DRIVE
CITY OF MISSISSAUGA

Drawing: SITE SERVICING PLAN

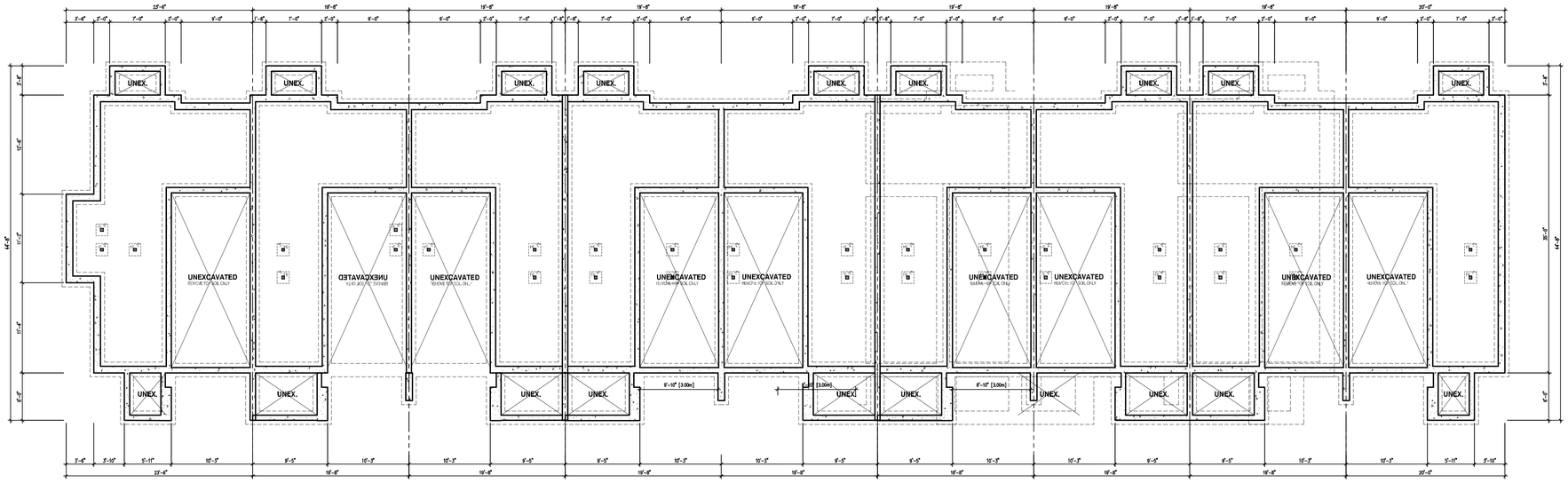
CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905.875.0026 T
905.875.4915 F
WWW.CFCROZIER.CA

Drawn	D.D.	Design	H.L. / N.R.S.	Project No.	1346-4573
Check	N.R.S.	Check	N.C.	Scale 1:250	Dwg. C 102

GOREWAY DRIVE & ETUDE DRIVE

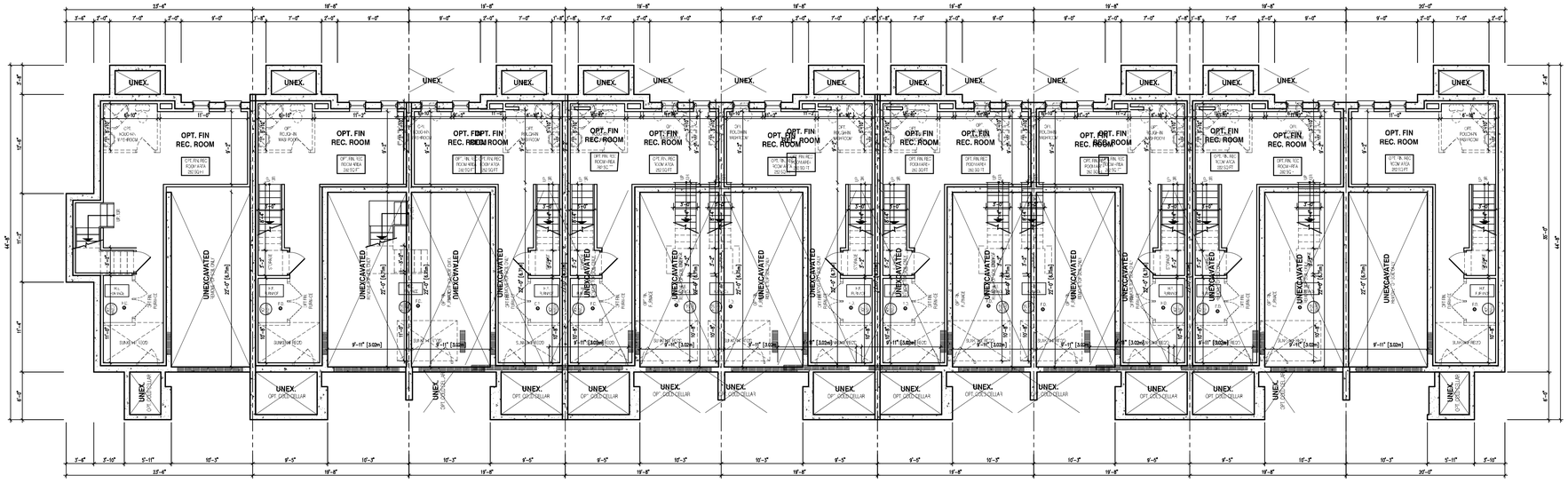
MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE



TH-3	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-2
Corner Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	End Unit
LOT 9	*LOT 8*	*LOT 7*	*LOT 6*	*LOT 5*	*LOT 4*	*LOT 3*	*LOT 2*	*LOT 1*

FOUNDATION PLAN



TH-3	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-2
Corner Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	End Unit
LOT 9	*LOT 8*	*LOT 7*	*LOT 6*	*LOT 5*	*LOT 4*	*LOT 3*	*LOT 2*	*LOT 1*

BASEMENT PLAN

BLOCK 1

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No	DATE	WORK DESCRIPTION
10		
9		
8		
7		
6		
5		
4		
3		
2	FEB. 16 '22	ISSUED FOR TOWER
1	SEPT. 3, 2021	ISSUED FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
TEL: 905.660.3377, FAX: 905.660.3713
EMAIL: info@jardindesign.ca

The undersigned has reviewed and takes responsibility for this design and has the qualifications and meets the requirements set out in the Ontario Building Code to be a designer

QUALIFICATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.5 of the building code

Walter Bottler — *21031*
NAME — SIGNATURE — BCIN

REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.4 of the building code

jardin design group inc. — *27763*
FIRM NAME — BCIN

FOUNDATION & BSMT. PLAN

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

BILD

TYPE	AREA
T	----

SCALE	
1/8"=1'-0"	

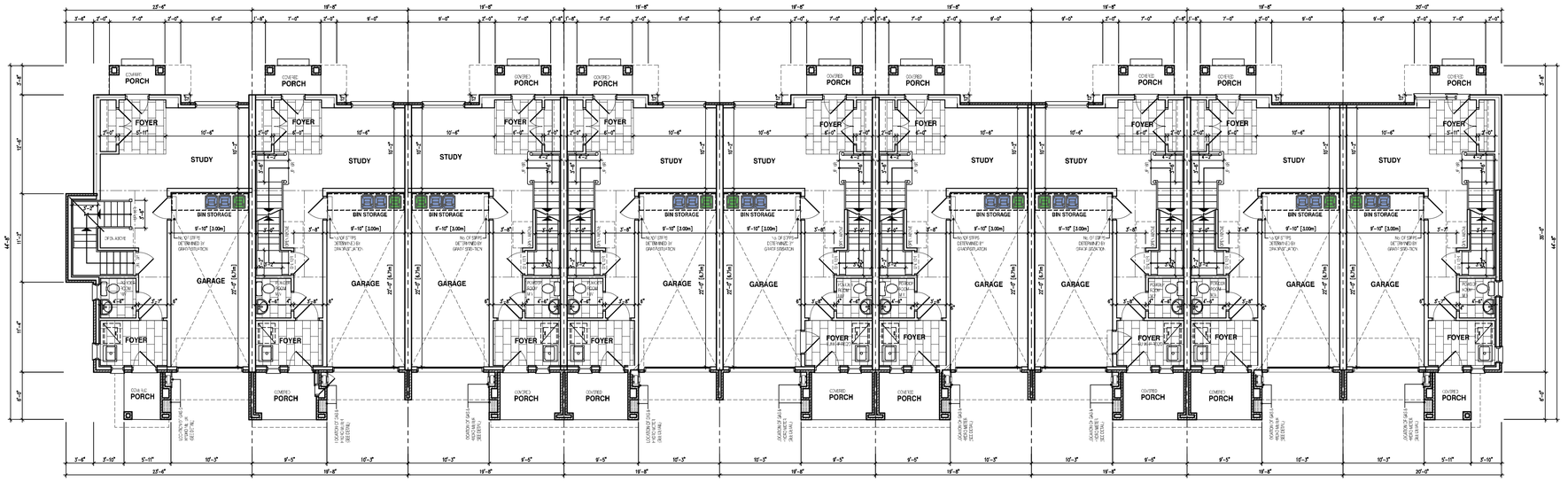
PROJ No.	DWG No.
17-18	1

DRAWN BY: | DRAWING NAME: ---

GOREWAY DRIVE & ETUDE DRIVE

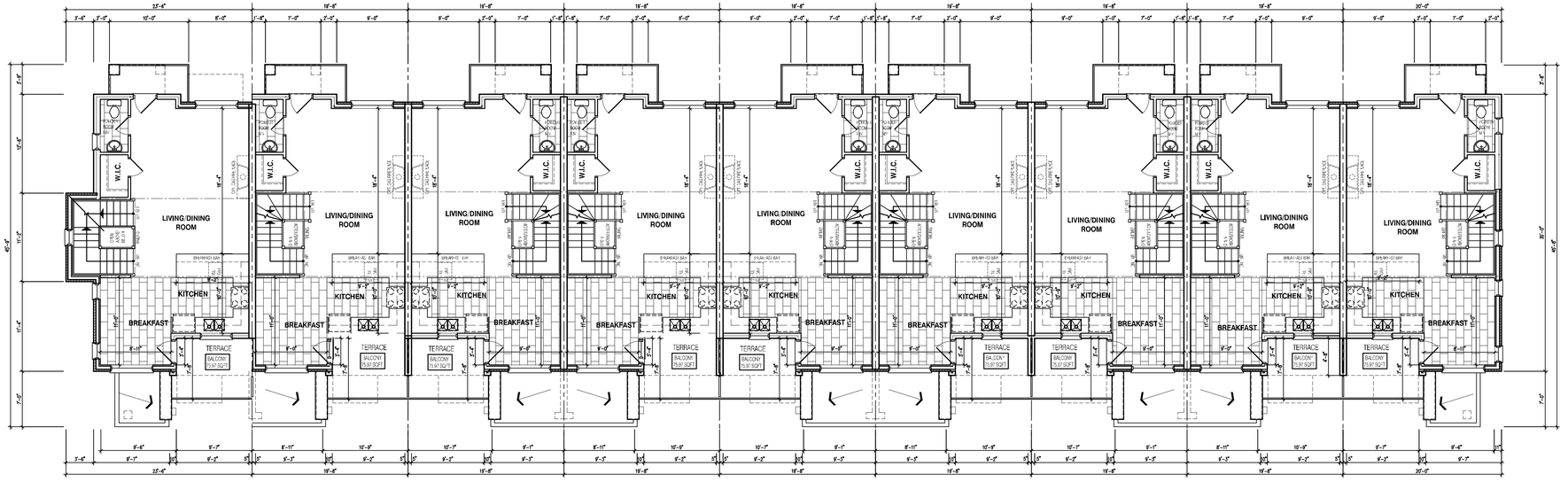
MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE



TH-3	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-2
Corner Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	End Unit
LOT 9	*LOT 8*	*LOT 7*	*LOT 6*	*LOT 5*	*LOT 4*	*LOT 3*	*LOT 2*	*LOT 1*

FIRST FLOOR PLAN



TH-3	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-1	TH-2
Corner Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	Interior Unit	End Unit
LOT 9	*LOT 8*	*LOT 7*	*LOT 6*	*LOT 5*	*LOT 4*	*LOT 3*	*LOT 2*	*LOT 1*

SECOND FLOOR PLAN

BLOCK 1

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No	DATE:	WORK/DESCRIPTION:
10		
9		
8		
7		
6		
5		
4		
3		
2	F.S. 16 2/2	60% SUBMISSION
1	SEPT. 5, 2012	ISSUED FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
TEL: 905 660-3377 FAX: 905 660-3713
EMAIL: info@jardindesign.ca

The undersigned has reviewed and takes responsibility for this design and has the qualifications and meets the requirements set out in the Ontario Building Code to be a designer

QUALIFICATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.5 of the building code

Walter Bottter — 21031
NAME — SIGNATURE — BCIN

REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.4 of the building code

jardin design group inc. — 27763
FIRM NAME — BCIN

MAIN & 2ND FLOOR PLAN

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

BILD

TYPE:	AREA:
T	----

SCALE: 1/8"=1'-0"

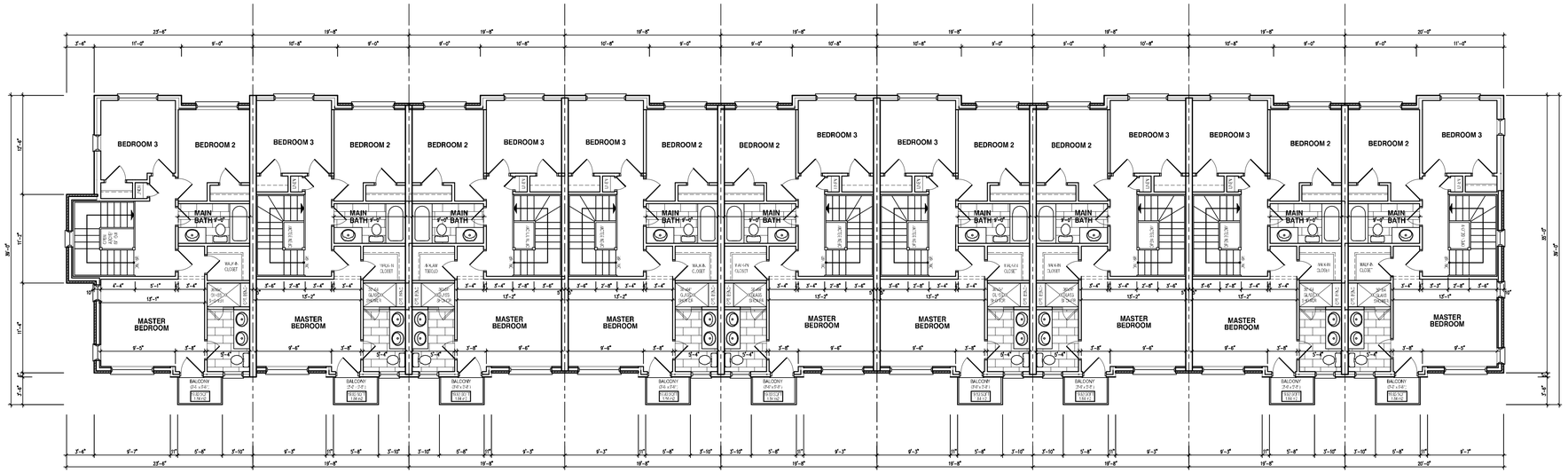
PROJ. No.: 17-18 — DWG. No.: 2

DRAWN BY: | DRAWING NAME: —

GOREWAY DRIVE & ETUDE DRIVE

MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE



TH-3
Corner Unit
LOT 9

TH-1
Interior Unit
LOT 8

TH-1
Interior Unit
LOT 7

TH-1
Interior Unit
LOT 6

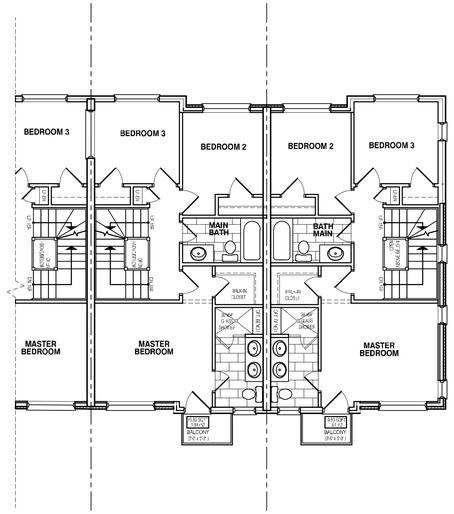
TH-1
Interior Unit
LOT 5

TH-1
Interior Unit
LOT 4

TH-1
Interior Unit
LOT 3

TH-1
Interior Unit
LOT 2

TH-2
End Unit
LOT 1

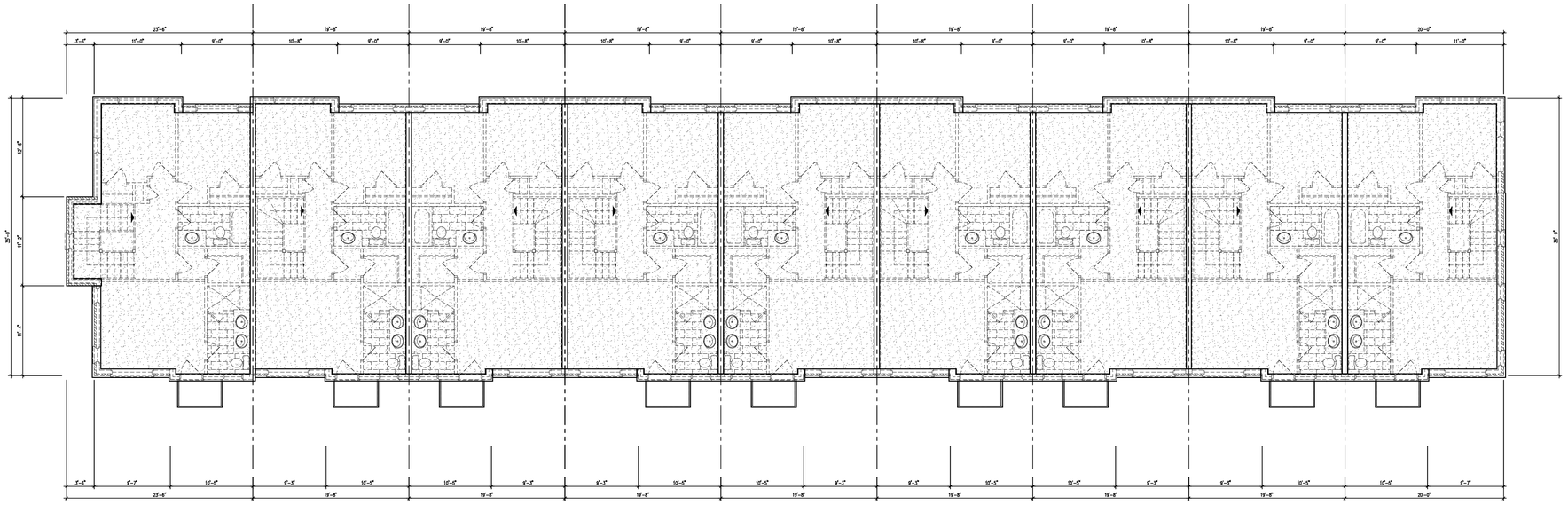


TH-1
Interior Unit
LOT 3

TH-1
Interior Unit
LOT 2

TH-2
End Unit
LOT 1

OPT. 3RD FLOOR - TO TERRACE



TH-3
Corner Unit
LOT 9

TH-1
Interior Unit
LOT 8

TH-1
Interior Unit
LOT 7

TH-1
Interior Unit
LOT 6

TH-1
Interior Unit
LOT 5

TH-1
Interior Unit
LOT 4

TH-1
Interior Unit
LOT 3

TH-1
Interior Unit
LOT 2

TH-2
End Unit
LOT 1

BLOCK 1

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No	DATE:	WORK DESCRIPTION:
10		
9		
8		
7		
6		
5		
4		
3		
2	FEB. 16 2022	ISSUED FOR TOWER
1	SEPT. 6 2021	ISSUED FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
TEL: 905 669-3377, FAX: 905 669-3713
EMAIL: info@jardindesign.ca

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Required unless design is exempt under Division C, Subsection 3.2.5 of the building code

Walter Bottter — *21031*
NAME — SIGNATURE — BCIN

REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 1.2.4 of the building code

jardin design group inc. — *27763*
FIRM NAME — BCIN

3RD FLOOR & ROOF PLAN

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

BILD

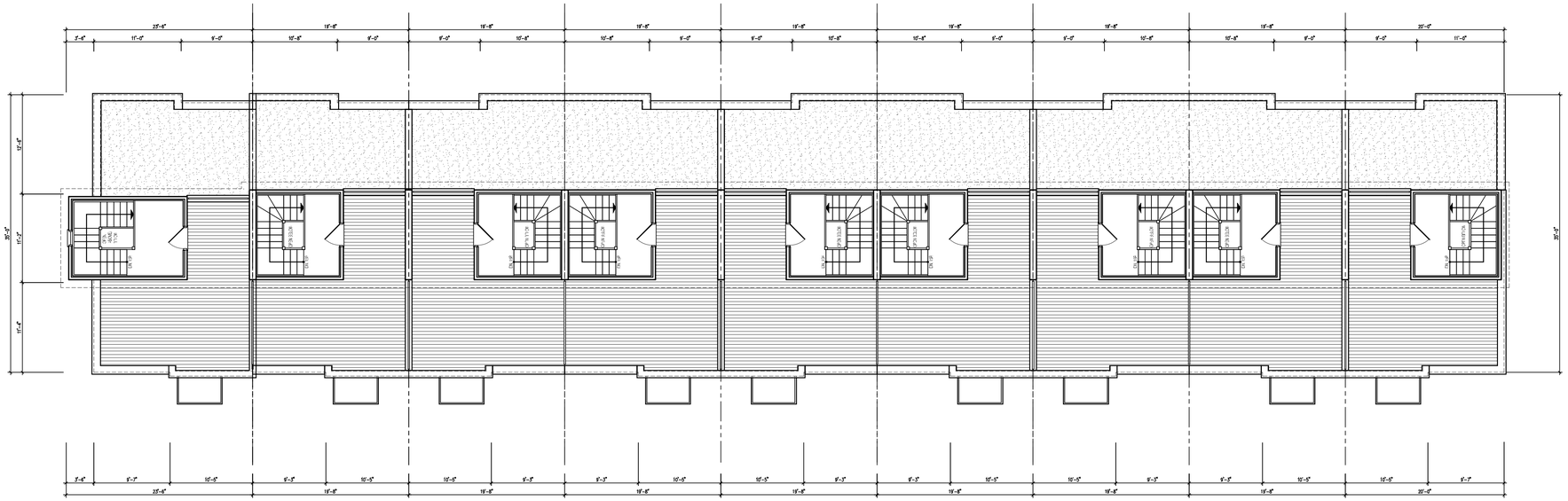
TYPE: T | AREA: ----
SCALE: 1/8"=1'-0"
PROJ No.: 17-18 | DWG No.: 3

DRAWN BY: | DRAWING NAME: —

GOREWAY DRIVE & ETUDE DRIVE

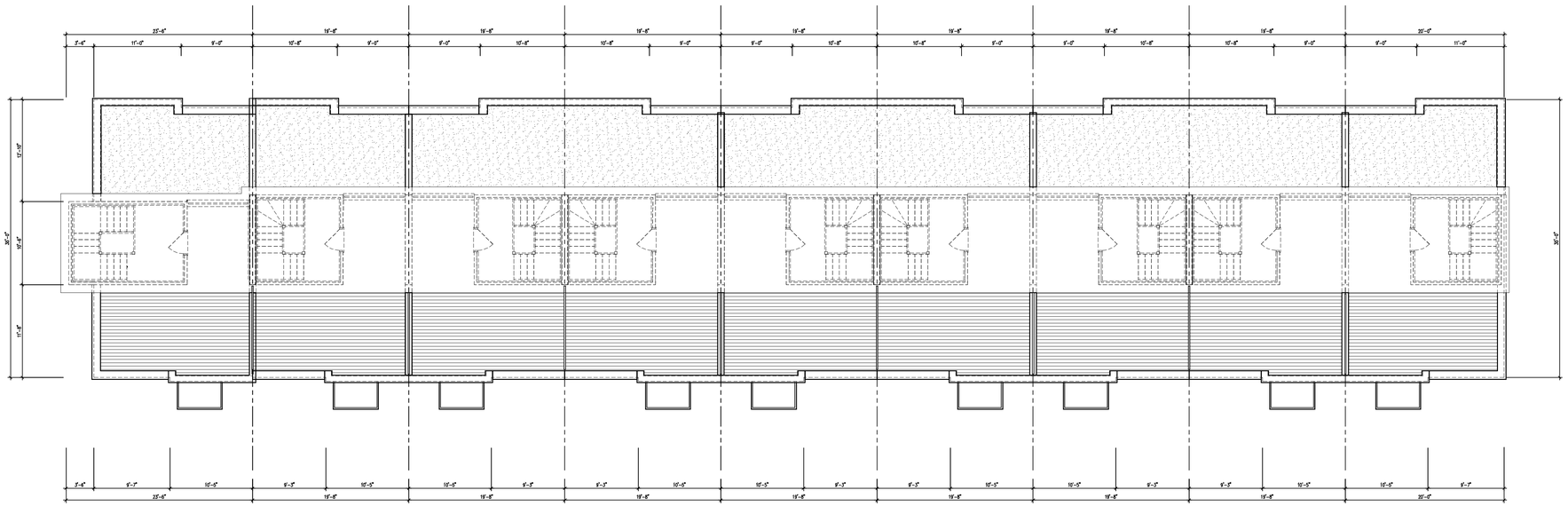
MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE



TH-3 Corner Unit *LOT 9*	TH-1 Interior Unit *LOT 8*	TH-1 Interior Unit *LOT 7*	TH-1 Interior Unit *LOT 6*	TH-1 Interior Unit *LOT 5*	TH-1 Interior Unit *LOT 4*	TH-1 Interior Unit *LOT 3*	TH-1 Interior Unit *LOT 2*	TH-2 End Unit *LOT 1*

ROOF TOP TERRACE



TH-3 Corner Unit *LOT 9*	TH-1 Interior Unit *LOT 8*	TH-1 Interior Unit *LOT 7*	TH-1 Interior Unit *LOT 6*	TH-1 Interior Unit *LOT 5*	TH-1 Interior Unit *LOT 4*	TH-1 Interior Unit *LOT 3*	TH-1 Interior Unit *LOT 2*	TH-2 End Unit *LOT 1*

BLOCK 1

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No	DATE	WORK DESCRIPTION
10		
9		
8		
7		
6		
5		
4		
3		
2	FEB. 16 2022	65L/65 FOR TOWER
1	SEPT. 1, 2021	65L/65 FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
TEL: 905 660-3377 FAX: 905 660-3713
EMAIL: info@jardindesign.ca

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Required unless design is exempt under Division C, Subsection 3.2.5 of the building code

Walter Bottler — NAME — SIGNATURE — *21031* — BCIN

REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.4 of the building code

jardin design group inc. — FIRM NAME — *27763* — BCIN

TERRACE FLOOR & ROOF PLAN

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

BILD

TYPE	AREA
T	----

SCALE	DWG No.
1/8" = 1'-0"	4

PROJ No. 17-18

DRAWN BY: | DRAWING NAME: —

GOREWAY DRIVE & ETUDE DRIVE

MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE

TH-2
End Unit
LOT 1

TH-1
Interior Unit
LOT 2

TH-1
Interior Unit
LOT 3

TH-1
Interior Unit
LOT 4

TH-1
Interior Unit
LOT 5

TH-1
Interior Unit
LOT 6

TH-1
Interior Unit
LOT 7

TH-1
Interior Unit
LOT 8

TH-3
Corner Unit
LOT 9

FRONT ELEVATION A
BLOCK 1

TH-3
Corner Unit
LOT 9

TH-1
Interior Unit
LOT 8

TH-1
Interior Unit
LOT 7

TH-1
Interior Unit
LOT 6

TH-1
Interior Unit
LOT 5

TH-1
Interior Unit
LOT 4

TH-1
Interior Unit
LOT 3

TH-1
Interior Unit
LOT 2

TH-2
End Unit
LOT 1

INT. VIEW OF
GAS AND
HYDRO METER

REAR ELEVATION A
BLOCK 1

DRAWN BY: | DRAWING NAME: —

BLOCK 1

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

No	DATE:	WORK DESCRIPTION:
10		
9		
8		
7		
6		
5		
4		
3		
2	FEB. 16 /22	ISSUED FOR REVIEW
1	SEPT. 1/2021	ISSUED FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JANCOR DR. SUITE 3A
VAUGHAN ONT. L4K 3P3
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Walter Botter — *21031*
NAME — SIGNATURE — BCIN

REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.4 of the building code

jardin design group inc. — *27763*
FIRM NAME — BCIN

SIDE ELEVATIONS

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

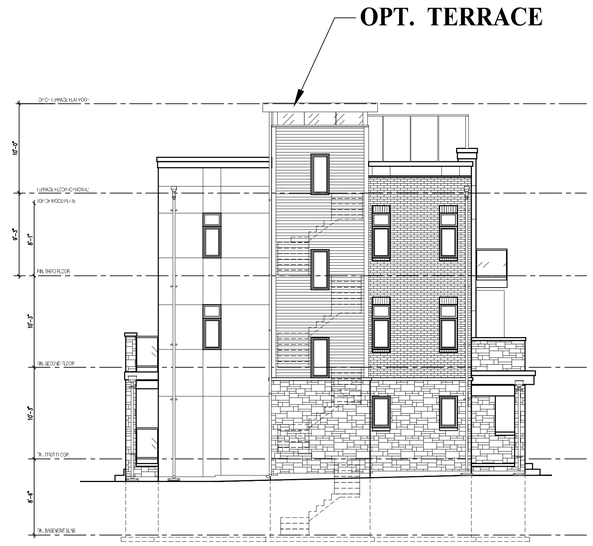
BILD

SYM:	T
DATA:	----
SCALE:	1/8"=1'-0"
PROJ. No.	17-18
DWG. No.	5

GOREWAY DRIVE & ETUDE DRIVE

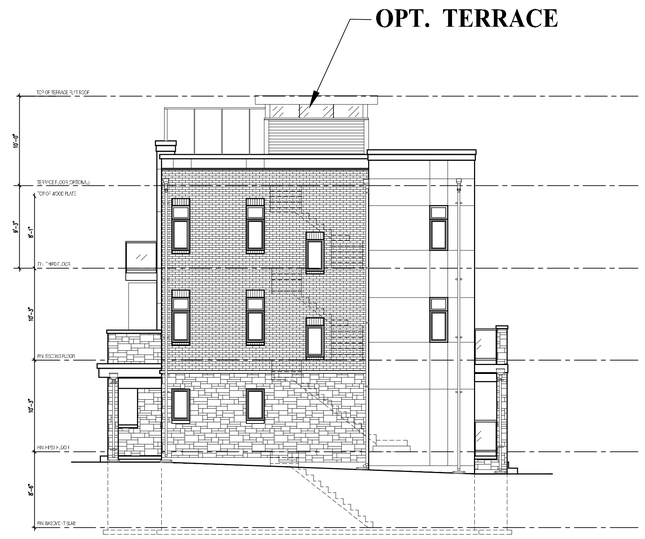
MISSISSAUGA

6.0m 3 STOREY STREET FACING TOWNHOUSE



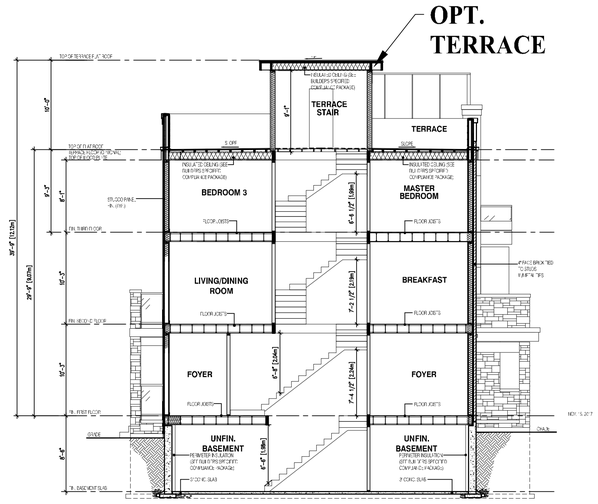
TH-3
Corner Unit
LOT 6

SIDE ELEVATION A
BLOCK 1



TH-1
End Unit
LOT 1

SIDE ELEVATION A
BLOCK 1



SECTION A-A

BLOCK 1

No	DATE	WORK DESCRIPTION
10		
9		
8		
7		
6		
5		
4		
3		
2	FEB. 16 '22	ISSUED FOR VOWEN
1	SEPT. 1 2021	ISSUED FOR PRE-APPLICATION MEETING

jardin
DESIGN GROUP INC
64 JARDIN DR. SUITE 3A
VAUGHAN ONT., L4K 3P3
TEL: 905 660-3317 FAX: 905 660-3713
EMAIL: info@jardindesign.ca

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QUALIFICATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.5 of the building code

Walter Botter — *21031*
NAME — SIGNATURE — BCIN
REGISTRATION INFORMATION
Required unless design is exempt under Division C, Subsection 3.2.4 of the building code
jardin design group inc. — *27763*
FIRM NAME — BCIN

SIDE ELEVATIONS

WESTON CONSULTING
7170 GORE ROAD (MISSISSAUGA)

BILD

TYPE	AREA
T	----
SCALE:	1/8"=1'-0"
PROJ. No.	DWG. No.
17-18	6

DRAWN BY: | DRAWING NAME: —

Appendix B

Borehole Logs

ORBITENGINEERING

LOG OF BOREHOLE BH1/MW

PROJECT: Geotech and HydroG of Proposed Residential Development

CLIENT: Rup Lal

PROJECT LOCATION: 7170 Goreway Drive, Mississauga, Ontario

DATUM: Geodetic

BH LOCATION: Refer to Borehole Location Plan (Drawing 1A) N 4841320 E 609838.97

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Mar-26-2021

PROJECT NO.: OE20373CG

DRAWING NO.: 2

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.1												
0.0	**Topsoil:** 450mm		1	SS	5		166					
165.6												
0.5	**Clayey Silt to Silty Clay:** weathered/disturbed, some topsoil and rootlets, trace sand, greyish brown, moist, firm											
165.3												
0.8	**Clayey Silt to Silty Clay till:** some sand, trace gravel, brownish grey, moist, stiff		2	SS	11		165					
1												
			3	SS	10	▽						0 10 49 41
2							W. L. 164.2 m Mar 29, 2021					
163.8							Aug 21, 2004					
2.3	**Sandy Silt Till:** some clay, trace gravel, grey, wet, compact		4	SS	20							
3												
163.0							163					
3.1	**Silt Till:** trace clay and gravel, grey, wet, compact		5	SS	10							4 31 51 14
4												
							162					
			6	SS	16							1 0 93 6
5												
							161					
6												
160.0							160					
6.1	**End of Borehole:**											

Notes:
Water Levels:
(i) During Drilling: 2.3m
(ii) At Completion: (50mm monitoirng well was installed)
(iii) (29 March 2021): 1.9m
(iv) (07 April 2021): 1.9m
(v) (08 April 2021): 2.0m
(vi) (16 June 2021): 2.1m

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

ORBITENGINEERING

LOG OF BOREHOLE BH2/MW

PROJECT: Geotech and HydroG of Proposed Residential Development

CLIENT: Rup Lal

PROJECT LOCATION: 7170 Goreway Drive, Mississauga, Ontario

DATUM: Geodetic

BH LOCATION: Refer to Borehole Location Plan (Drawing 1A) N 4841296.29 E 609863.05

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Mar-26-2021

PROJECT NO.: OE20373CG

DRAWING NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
166.5								20 40 60 80 100	10 20 30			
0.0 / 166.2	**Topsoil:** 300mm		1	SS	2							
0.3 / 165.9	**Clayey Silt to Silty Clay:** weathered/disturbed, some topsoil and rootlets, trace sand, brown, moist, soft to firm						166					
0.6	**Clayey Silt to Silty Clay Till:** some sand, trace gravel, greyish brown, moist, very stiff to stiff		2	SS	21							
1							165					
			3	SS	14							1 11 44 44
2												
			4	SS	14		164					
								W. L. 164.0 m Mar 29, 2021				
3	grey below 3.1m		5	SS	10							1 18 58 23
162.8							163					
3.7	**Sandy Silt Till:** some clay and gravel, greyish brown, moist, compact											
4							162					
	wet below 4.6m		6	SS	23							12 36 42 10
5												
161.3												
5.2	**End of Borehole:**											

Notes:
Water Levels:
(i) During Drilling: 4.6m
(ii) At Completion: (50mm monitoring well was installed)
(iii) (29 March 2021): 2.5m
(iv) (07 April 2021): 2.5m
(v) (08 April 2021): 2.5m
(vi) (16 June 2021): 2.7m

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

ORBITENGINEERING

LOG OF BOREHOLE BH3/MW

PROJECT: Geotech and HydroG of Proposed Residential Development

CLIENT: Rup Lal

PROJECT LOCATION: 7170 Goreway Drive, Mississauga, Ontario

DATUM: Geodetic

BH LOCATION: Refer to Borehole Location Plan (Drawing 1A) N 4841279.09 E 609823.93

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Mar-26-2021

PROJECT NO.: OE20373CG

DRAWING NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
166.2 / 0.0	**Topsoil:** 300mm				166
165.9 / 0.3	**Clayey Silt to Silty Clay:** weathered/disturbed, some topsoil and rootlets, trace sand, greyish brown, very moist, firm	1	SS	5	
165.4 / 0.8	**Clayey Silt to Silty Clay Till:** trace sand and gravel, greyish brown, moist, very stiff to stiff	2	SS	18	165
		3	SS	14	
163.9 / 2.3	**Sandy Silt Till:** some clay, trace gravel, grey, moist, compact	4	SS	10	164
	wet below 3.1m	5	SS	10	163
161.6 / 4.6	**Silt Till:** trace sand, clay and gravel, grey, wet, compact	6	SS	22	162
161.0 / 5.2	**End of Borehole:**				161

W. L. 163.7 m
Mar 29, 2021

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	0	2	38	60
	2	24	55	19
	1	7	89	3

Notes:
Water Levels:
(i) During Drilling: 3.1m
(ii) At Completion: (50mm monitoring well was installed)
(iii) (29 March 2021): 2.5m
(iv) (07 April 2021): 2.6m
(v) (08 April 2021): 2.5m
(vi) (16 June 2021): 2.6m

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

ORBITENGINEERING

LOG OF BOREHOLE BH4

PROJECT: Geotech and HydroG of Proposed Residential Development

CLIENT: Rup Lal

PROJECT LOCATION: 7170 Goreway Drive, Mississauga, Ontario

DATUM: Geodetic

BH LOCATION: Refer to Borehole Location Plan (Drawing 1A) N 4841261.75 E 609836.12

DRILLING DATA

Method: Solid Stem Auger

Diameter: 150mm

Date: Mar-26-2021

PROJECT NO.: OE20373CG

DRAWING NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
166.2							166
0.0 / 165.9	**Topsoil:** 300mm		1	SS	6		
0.3 / 165.5	**Clayey Silt to Silty Clay:** weathered/disturbed, some topsoil and rootlets, trace sand, greyish brown, very moist, firm						
0.7	**Clayey Silt to Silty Clay Till:** trace sand and gravel, greyish brown, moist, stiff		2	SS	11		165
1							
			3	SS	10		
2 / 163.9							164
2.3	**Sandy Silt Till:** some clay, trace gravel, grey, moist, compact		4	SS	18		
3	wet below 3.1m		5	SS	11		163
4							162
161.6							
4.6	**Silt Till:** trace sand, clay and gravel, grey, wet, compact		6	SS	14		
5 / 161.0							161
5.2	**End of Borehole:**						

Notes:
Water Levels:
(i) During Drilling: 3.1m

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

Appendix C

Water Quality Certificates of Analysis

Certificate of Analysis

Client: Orbit Engineering
1900 Clark Blvd
Brampton, ON
L6T 0E9
Attention: Mr Hafiz Ahmad
PO#:
Invoice to: Orbit Engineering

Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

Dear Hafiz Ahmad:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____
Addrine Thomas, Inorganics Supervisor

All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise indicated.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at: http://www.cala.ca/scopes/2602.pdf.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is licensed by the Ontario Ministry of the Environment, Conservation, and Parks (MECP) for specific tests in drinking water (license #2318). A copy of the license is available upon request.

Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) is accredited by the Ontario Ministry of Agriculture, Food, and Rural Affairs for specific tests in agricultural soils.

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline values listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official provincial or federal guideline as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Certificate of Analysis

eurofins | Environment Testing

Client: Orbit Engineering
1900 Clark Blvd
Brampton, ON
L6T 0E9
Attention: Mr Hafiz Ahmad
PO#:
Invoice to: Orbit Engineering

Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

				Lab I.D.	1551003
				Sample Matrix	WW
				Sample Type	
				Sampling Date	2021-04-08
				Sample I.D.	BH1 / MW
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Anions	F	0.10	mg/L	MAC 10	0.14
	SO4	1	mg/L	MAC 1500	149
General Chemistry	BOD5	1	mg/L	MAC 300	1
	Cyanide (total)	0.005	mg/L	MAC 2	<0.005
	pH	1.00		MAC 5.5-10.0	7.94
	Total Suspended Solids	2	mg/L	MAC 350	11100*
Mercury	Hg	0.0005	mg/L	MAC 0.01	<0.0005
Metals	Ag	0.01	mg/L	MAC 5	<0.01
	Al	0.1	mg/L	MAC 50	73.0*
	Aqua-Regia Digest				Y
	As	0.02	mg/L	MAC 1	0.04
	Cd	0.008	mg/L	MAC 0.7	<0.008
	Co	0.01	mg/L	MAC 5	0.07
	Cr	0.05	mg/L	MAC 5	0.13
	Cu	0.01	mg/L	MAC 3	0.20
	Mn	0.01	mg/L	MAC 5	7.79*
	Mo	0.01	mg/L	MAC 5	<0.01
	Ni	0.01	mg/L	MAC 3	0.14
	Pb	0.01	mg/L	MAC 3	0.05
	Sb	0.01	mg/L	MAC 5	<0.01
	Se	0.02	mg/L	MAC 1	<0.02
	Sn	0.1	mg/L	MAC 5	<0.1
	Ti	0.1	mg/L	MAC 5	<0.1
	Zn	0.04	mg/L	MAC 3	0.24
Microbiology	Escherichia Coli	0	ct/100mL		0

Guideline = Sanitary Sewer - Peel

*** = Guideline Exceedence**

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

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				Lab I.D.	1551003
				Sample Matrix	WW
				Sample Type	
				Sampling Date	2021-04-08
				Sample I.D.	BH1 / MW
Group	**Analyte**	**MRL**	**Units**	**Guideline**	
Nutrients	Total Kjeldahl Nitrogen	0.100	mg/L	MAC 100	3.24
	Total P	0.020	mg/L	MAC 10	9.93
Oil and Grease	Oil & Grease - Mineral	1	mg/L	MAC 15	<1
	Oil & Grease - Non-mineral	1	mg/L	MAC 150	<1
	Oil & Grease - Total	1	mg/L		<1
PCBs	Polychlorinated Biphenyls (PCBs)	0.1	ug/L	MAC 1	<0.1
Semi-Volatiles	Bis(2-ethylhexyl)phthalate	0.4	ug/L	MAC 12	<0.4
	Di-n-butylphthalate	1.3	ug/L	MAC 80	<1.3
Subcontract	Nonylphenol Ethoxalate (Total)	2	ug/L	MAC 200	<2.0
	Nonylphenols (Total)	1	ug/L	MAC 20	<1.0
Subcontract-Inorg	Phenols	0.001	mg/L	MAC 1.0	<0.001
VOCs Surrogates	1,2-dichloroethane-d4	0	%		124
	4-bromofluorobenzene	0	%		99
	Toluene-d8	0	%		102
Volatiles	1,1,1,2-tetrachloroethane	0.5	ug/L		<0.5
	1,1,2,2-tetrachloroethane	0.5	ug/L	MAC 1400	<0.5
	1,2-dichlorobenzene	0.4	ug/L	MAC 50	<0.4
	1,4-dichlorobenzene	0.4	ug/L	MAC 80	<0.4
	Benzene	0.5	ug/L	MAC 10	<0.5
	c-1,2-Dichloroethylene	0.4	ug/L	MAC 4000	<0.4
	Chloroform	0.5	ug/L	MAC 40	<0.5
	Dichloromethane	4.0	ug/L	MAC 2000	<4.0
	Ethylbenzene	0.5	ug/L	MAC 160	<0.5
	m/p-xylene	0.4	ug/L		<0.4
	Methyl Ethyl Ketone (MEK)	10	ug/L	MAC 8000	<10

Guideline = Sanitary Sewer - Peel

*** = Guideline Exceedence**

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Certificate of Analysis

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Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D. 1551003 WW 2021-04-08 BH1 / MW
Volatiles	o-xylene	0.4	ug/L		<0.4
	Styrene	0.5	ug/L	MAC 200	<0.5
	t-1,3-Dichloropropylene	0.2	ug/L	MAC 140	<0.2
	Tetrachloroethylene	0.3	ug/L	MAC 1000	<0.3
	Toluene	0.5	ug/L	MAC 270	<0.5
	Trichloroethylene	0.3	ug/L	MAC 400	<0.3
	Xylene; total	0.5	ug/L	MAC 1400	<0.5

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Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 398430 **Analysis/Extraction Date** 2021-04-16 **Analyst** C M **Method** B 625/P 8270			
Bis(2-ethylhexyl)phthalate	<0.4 ug/L	108	20-140
Di-n-butylphthalate	<1.3 ug/L	104	20-140
Run No 398561 **Analysis/Extraction Date** 2021-04-11 **Analyst** L V **Method** AMBCOLM1			
Escherichia Coli			
Run No 398662 **Analysis/Extraction Date** 2021-04-13 **Analyst** SKH **Method** EPA 365.1			
Total P	<0.020 mg/L	92	80-120
Run No 398664 **Analysis/Extraction Date** 2021-04-12 **Analyst** YH **Method** EPA 8260			
Tetrachloroethane, 1,1,1,2-	<0.5 ug/L	86	60-130
Tetrachloroethane, 1,1,2,2-	<0.5 ug/L	100	60-130
Dichlorobenzene, 1,2-	<0.4 ug/L	99	60-130
Dichlorobenzene, 1,4-	<0.4 ug/L	97	60-130
Benzene	<0.5 ug/L	96	60-130
Dichloroethylene, 1,2-cis-	<0.4 ug/L	96	60-130
Chloroform	<0.5 ug/L	100	60-130

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

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Date Reported: 2021-04-19
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COC #: 211967

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Methylene Chloride	<4.0 ug/L	117	60-130
Ethylbenzene	<0.5 ug/L	84	60-130
m/p-xylene	<0.4 ug/L	83	60-130
Methyl Ethyl Ketone	<10 ug/L	100	60-130
o-xylene	<0.4 ug/L	82	60-130
Styrene	<0.5 ug/L	81	60-130
Dichloropropene,1,3-trans-	<0.2 ug/L	94	60-130
Tetrachloroethylene	<0.3 ug/L	89	60-130
Toluene	<0.5 ug/L	92	60-130
Trichloroethylene	<0.3 ug/L	93	60-130
Xylene Mixture			
Run No 398731 **Analysis/Extraction Date** 2021-04-14 **Analyst** AET **Method** SM2320,2510,4500H/F			
F	<0.10 mg/L	102	90-110
pH		100	90-110
Run No 398786 **Analysis/Extraction Date** 2021-04-14 **Analyst** SKH **Method** M SM3112B-3500B			
Mercury	<0.0005 mg/L	131	76-123

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
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Certificate of Analysis

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Date Submitted: 2021-04-09
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COC #: 211967

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 398788 **Analysis/Extraction Date** 2021-04-14 **Analyst** SKH **Method** EPA 351.2			
Total Kjeldahl Nitrogen	<0.100 mg/L	102	70-130
Run No 398809 **Analysis/Extraction Date** 2021-04-15 **Analyst** EMM **Method** EPA 200.8			
Titanium	<0.1 mg/L	102	80-120
Run No 398815 **Analysis/Extraction Date** 2021-04-19 **Analyst** AET **Method** SM 5210B			
BOD5	<1 mg/L	86	75-125
Run No 398834 **Analysis/Extraction Date** 2021-04-15 **Analyst** AET **Method** SM4500-CNC/MOE E3015			
Cyanide (total)	<0.005 mg/L	100	61-139
Run No 398852 **Analysis/Extraction Date** 2021-04-15 **Analyst** R R **Method** SM 4110			
SO4	<1 mg/L	100	90-110
Run No 398884 **Analysis/Extraction Date** 2021-04-16 **Analyst** K B **Method** C SM2540			
Total Suspended Solids	<2 mg/L	96	90-110
Run No 398887 **Analysis/Extraction Date** 2021-04-16 **Analyst** R G **Method** MOE E3421			

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

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Brampton, ON
L6T 0E9
Attention: Mr Hafiz Ahmad
PO#:
Invoice to: Orbit Engineering

Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Oil & Grease - Mineral	<1 mg/L	80	60-120
Oil & Grease - Non-mineral	<1 mg/L		60-120
Oil & Grease - Total	<1 mg/L	100	60-120
Run No 398915 **Analysis/Extraction Date** 2021-04-16 **Analyst** Z S **Method** EPA 200.8			
Aqua-Regia Digest			
Run No 398919 **Analysis/Extraction Date** 2021-04-15 **Analyst** AET **Method** SUBCONTRACT P-INORG			
Phenols	<0.001 mg/L	96	69-132
Run No 398951 **Analysis/Extraction Date** 2021-04-16 **Analyst** Z S **Method** EPA 200.8			
Silver	<0.01 mg/L	120	70-130
Aluminum	<0.1 mg/L	106	70-130
Arsenic	<0.02 mg/L	103	70-130
Cadmium	<0.008 mg/L	122	70-130
Cobalt	<0.01 mg/L	119	70-130
Chromium Total	<0.05 mg/L	122	70-130
Copper	<0.01 mg/L	102	70-130
Manganese	<0.01 mg/L	119	70-130

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

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L6T 0E9
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Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Molybdenum	<0.01 mg/L	107	70-130
Nickel	<0.01 mg/L	117	70-130
Lead	<0.01 mg/L	117	70-130
Antimony	<0.01 mg/L	115	70-130
Selenium	<0.02 mg/L	113	70-130
Sn	<0.1 mg/L	77	70-130
Zinc	<0.04 mg/L	76	70-130
Run No 398972 **Analysis/Extraction Date** 2021-04-16 **Analyst** QL **Method** EPA 8081B/8082A			
Polychlorinated Biphenyls	<0.1 ug/L	112	50-120
Run No 398988 **Analysis/Extraction Date** 2021-04-13 **Analyst** AET **Method** SUBCONTRACT-A			
Nonylphenol Ethoxalate (Total)			
Nonylphenols (Total)	<1.0 ug/L	88	

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

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Report Number: 1950995
Date Submitted: 2021-04-09
Date Reported: 2021-04-19
Project: OE20373CG
COC #: 211967

Sample Comment Summary

Sample ID: 1551003	BH1 / MW	Mercury MRL elevated due to matrix interference. Metals analysis was performed on an aqua-regia digest of the sample material, except for titanium.

Guideline = Sanitary Sewer - Peel *** = Guideline Exceedence**

Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

eurofins 211967

STANDARD CHAIN-OF-CUSTODY

146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1 - Phone: 613-727-5692, Fax: 613-727-5222

Eurofins Workorder #: 1950995

CLIENT INFORMATION

Company: Orbit Engineering Ltd.
Contact: Hafiz Ahmad
Address: 9-1900 Clark Blvd, Brampton, L6T 0E9
Telephone: 905 494 0074 Cell: 647 608 6448
Email: #1: hafiz.ahmad@orbitengineering.ca
Email: #2: staff@orbitengineering.ca
Project: OE20373CG Quote #:

INVOICE INFORMATION (SAME AS CLIENT INFORMATION: YES ☐ NO ☐)

Company: Fax:
Contact: Email: #1:
Address: Email: #2:
Telephone: PO #:

TURN-AROUND TIME (Business Days)

☐ 1 Day* (100%) ☐ 2 Day** (50%) ☐ 3-5 Days (25%) ☑ 5-7 Days (Standard)

Please contact Lab in advance to determine rush availability.
*For results reported after rush due date, surcharges will apply: before 12:00 - 100%, after 12:00 - 50%.
**For results reported after rush due date, surcharges will apply: before 12:00 - 50%, after 12:00 - 25%.

REGULATION/GUIDELINE REQUIRED

☑ Sanitary Sewer, City: Peel / Mississauga
☑ Storm Sewer, City: Peel / Mississauga
☐ ODWSOG
☐ PWQO
☐ O. Reg 347/558
☐ Other: _____
☐ None

☐ O. Reg 153
Table # ___, Course / Fine, Surface / subsurface.
Type: Com-Ind / Res-Park / Agri / GW / All Other / Sediment
☐ Excess Soil, Table: _____ Type: _____

The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04
☐ Yes ☐ No

The optimal temperature conditions during transport should be less than 10°C. Sample(s) cannot be frozen, unless otherwise indicated or agreed upon with the Laboratory. Note that this COC is not to be used for drinking water samples. The COC must be complete upon submission of the samples, there will be a $25 surcharge if required information is missing (required fields are shaded in grey).

Sample Details / Sample Analysis Required

Sample ID	Date/Time Collected	Sample Matrix	# of Containers	O.Reg.153 parameters: PHC F1 - F4	BTEX	VOCs	PAHs	PCBs	Metals + Inorganics	Metals only	Sanitary	Storm	RN# (Lab Use Only)
BH1/MW	April 8th/12:00PM		14								✓	✓	1551003

PRINT / SIGN / DATE/TIME / TEMP (°C)

	PRINT	SIGN	DATE/TIME	TEMP (°C)
Sampled By:	Tony Zhao		Apr 8th 12:00PM	
Relinquished By:				
Received By:	Victor Gallant		04/09/21 11:32am	8.8°C

COMMENTS:

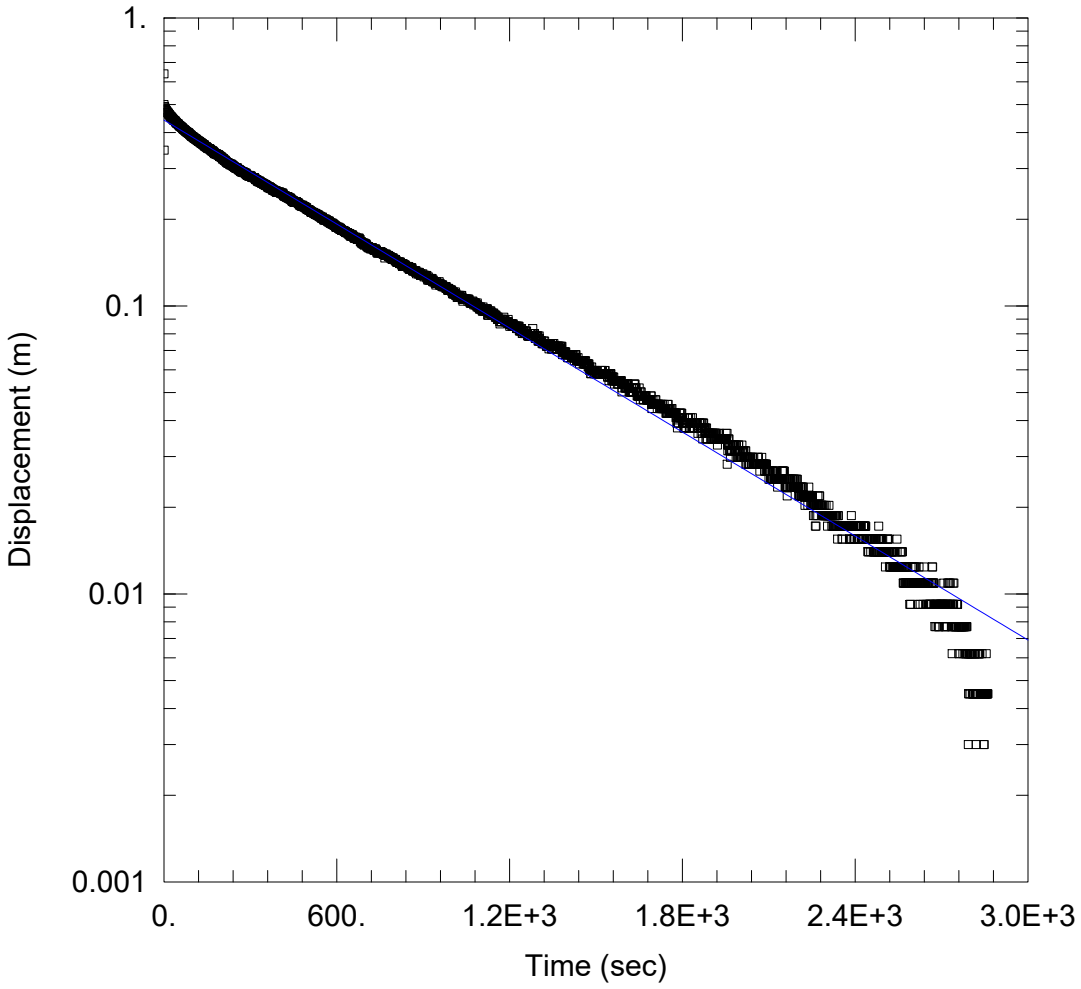
CUSTODY SEAL: ☐ YES ☐ NO Ice packs submitted: ☑ Yes ☐ No

401 Magnetic Drive, Unit #1, North York, ON, M3J 3H9 - Telephone: 416-661-5287 • 380 Vansickle Road, Unit #630, St. Catharines, ON, L2S 0B5 - Telephone: 905-6[illegible]-8887 • 608 Norris Court, Kingston, ON, K7P 2R9 - Telephone: 613-634-9307

Copies: White - Laboratory, Yellow - Sampler

Appendix D

Single Well Testing Results



BH1/MW_FALLING HEAD_TEST ANALYSIS

Data Set:
Date: 05/04/21 Time: 16:00:04

PROJECT INFORMATION

Company: Orbit Engineering Limited
Client: Rup Lal c/o Weston Consulting
Project: OE20373CG
Location: 7170 Goreway Drive
Test Well: BH1/MW
Test Date: 30 April 2021

AQUIFER DATA

Saturated Thickness: 4. m Anisotropy Ratio (Kz/Kr): 1.

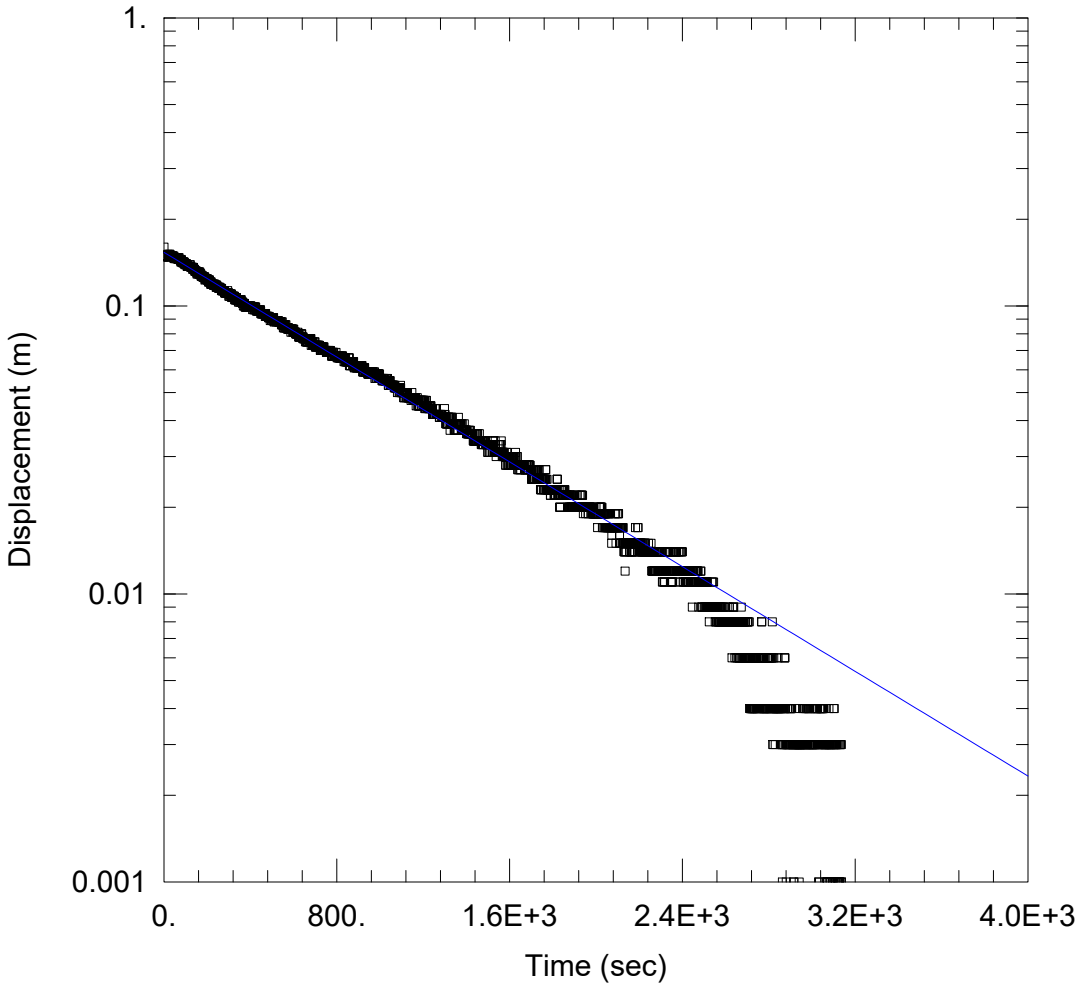
WELL DATA (BH1/MW)

Initial Displacement: 0.5 m Static Water Column Height: 3.8 m
Total Well Penetration Depth: 3.8 m Screen Length: 1.52 m
Casing Radius: 0.025 m Well Radius: 0.1 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 6.339E-7 m/sec y0 = 0.4419 m



BH2/MW_FALLING HEAD_TEST ANALYSIS

Data Set:
Date: 05/07/21 Time: 13:12:54

PROJECT INFORMATION

Company: Orbit Engineering Limited
Client: Rup Lal c/o Weston Consulting
Project: OE20373CG
Location: 7170 Goreway Drive
Test Well: BH2/MW
Test Date: 30 April 2021

AQUIFER DATA

Saturated Thickness: 2. m Anisotropy Ratio (Kz/Kr): 1.

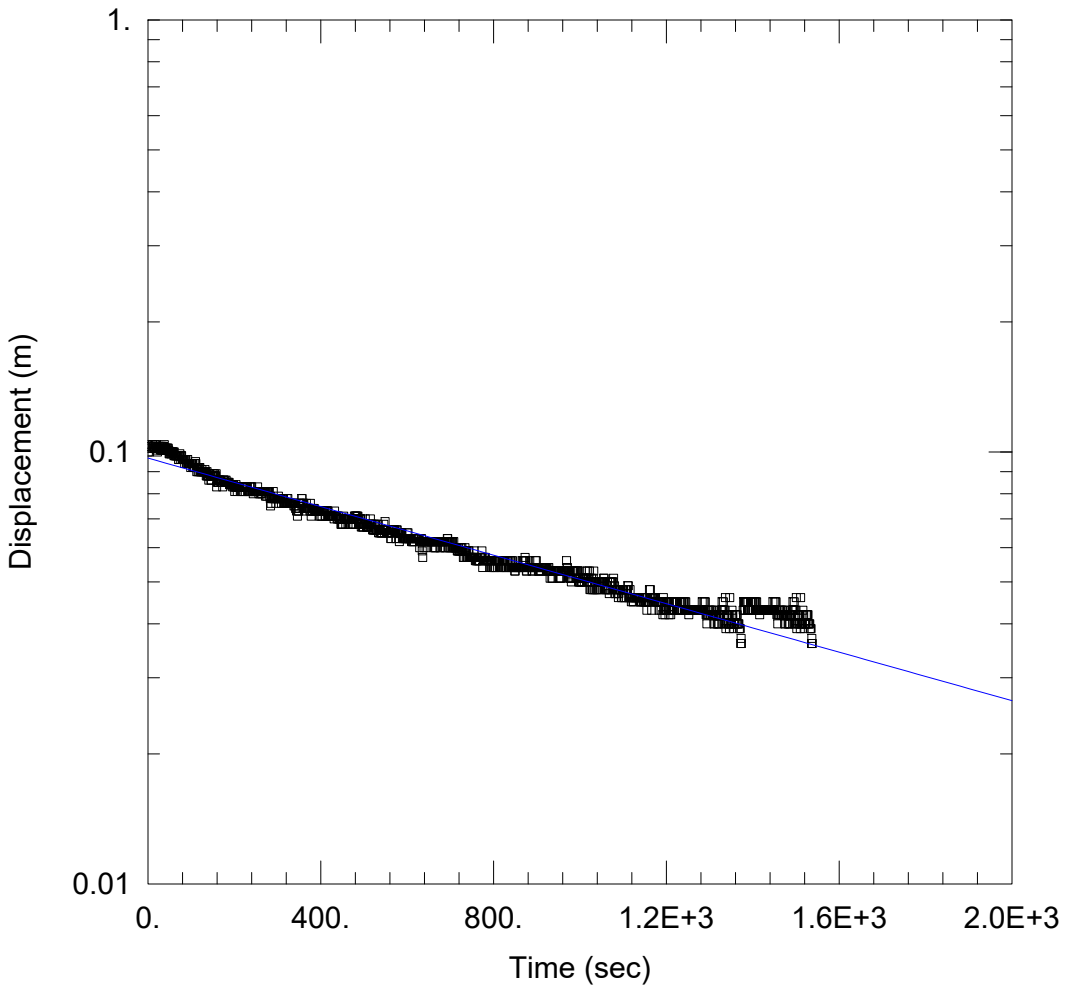
WELL DATA (New Well)

Initial Displacement: 0.16 m
Total Well Penetration Depth: 1.77 m
Casing Radius: 0.025 m
Static Water Column Height: 1.77 m
Screen Length: 1.52 m
Well Radius: 0.1 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 4.041E-7 m/sec y0 = 0.1535 m



BH3/MW_FALLING HEAD_TEST ANALYSIS

Data Set:
Date: 05/07/21 Time: 14:10:19

PROJECT INFORMATION

Company: Orbit Engineering Limited
Client: Rup Lal c/o Weston Consulting
Project: OE20373CG
Location: 7170 Goreway Drive
Test Well: BH3/MW
Test Date: 30 April 2021

AQUIFER DATA

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

WELL DATA (New Well)

Initial Displacement: 0.104 m Static Water Column Height: 2.04 m
Total Well Penetration Depth: 2.04 m Screen Length: 1.52 m
Casing Radius: 0.025 m Well Radius: 0.1 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 2.515E-7 m/sec y0 = 0.09675 m

Appendix E

Information on Water Well Records Received from MECP

Well ID	Well Record Information	Well Tag # (since 2003)	Audit #	Contractor Lic#	Well Depth (m)	Date of Completion (MM/DD/YYYY)
4902467	PDF | HTML	N/A	N/A	4823	14.6	01/17/1952
4902470	PDF | HTML	N/A	N/A	4823	16.2	10/17/1951
7147719	PDF | HTML	A100062	Z116304	7215	4.6	06/14/2010
7220544	HTML	A149660	Z180533	7147	3.7	05/01/2014
7223061	HTML	A162727	C26061	7215	N/A	04/23/2014
7232442	HTML	N/A	Z198906	7148	N/A	10/01/2014
7232443	HTML	N/A	Z198907	7148	N/A	10/01/2014
7232446	HTML	N/A	Z198910	7148	N/A	10/01/2014
7232447	HTML	N/A	Z198911	7148	N/A	10/01/2014
7232448	HTML	A162727	Z198912	7148	N/A	10/01/2014
7232449	HTML	N/A	Z198913	7148	N/A	10/01/2014
7232450	HTML	N/A	Z198998	7148	N/A	10/31/2014
7232451	HTML	N/A	Z198999	7148	N/A	10/31/2014
7283582	HTML	A221216	Z251842	7360	9.1	12/22/2016
7283583	HTML	A221261	Z251835	7360	9.1	12/22/2016
7283584	HTML	A221262	Z251841	7360	9.1	12/20/2016
7283585	HTML	A221263	Z251840	7360	9.1	12/20/2016
7284365	HTML	N/A	Z255974	7360	N/A	01/26/2016
7284366	HTML	N/A	Z255973	7360	N/A	01/26/2016
7284367	HTML	N/A	Z255972	7360	N/A	01/26/2016

7284369	HTML	N/A	Z255975	7360	N/A	01/26/2016
7284370	HTML	N/A	Z255978	7360	N/A	01/26/2016
7284371	HTML	N/A	Z255977	7360	N/A	01/26/2016
7284372	HTML	N/A	Z255976	7360	N/A	01/26/2016
7284373	HTML	N/A	Z251844	7360	N/A	01/26/2017
7284374	HTML	N/A	Z251845	7360	N/A	01/26/2016
7321298	HTML	A218143	C38234	7437	N/A	12/23/2016
7360625	HTML	A293198	4BJMVQL9	6607	17.0	06/10/2020
7360632	HTML	A293352	535OXSTY	6607	6.7	06/11/2020
7360645	HTML	A293346	9VJ82FRU	6607	7.6	06/12/2020
7360665	HTML	A293158	BICF6BI2	6607	15.0	06/01/2020
7360672	HTML	A293339	DORSOMZS	6607	4.5	06/15/2020
7360679	HTML	A293154	HTJSHISO	6607	15.0	06/02/2020
7360717	HTML	A293366	WEAOG2AC	6607	10.7	06/11/2020
7360719	HTML	A293192	XAXXGKRM	6607	18.2	06/04/2020

Appendix F

Dewatering Calculations

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation -
Unconfined Aquifer - Square or Rectangular Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CG
Client Rup Lal c/o Weston Consulting
Station: BLOCK 1

Orbit Engineering Limited
1900 Clark Boulevard, Unit 9
Brampton, ON, L6T 0E9
Tel: +1 905 494 0074
Fax: +1 855 666 3355
www.orbitengineering.ca, info@orbitengineering.ca

Excavation is evaluated using the following numerical solution for square or rectangular excavations (x/a < 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = [(\pi K(H^2 - h^2))/ln(Ro/rs)]$$

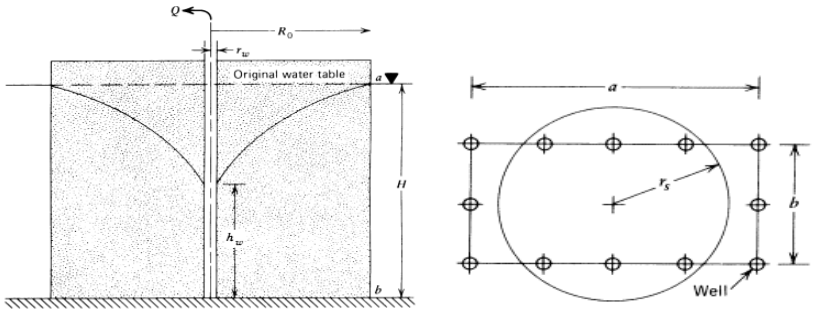


Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer.

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.6	m
h	3	m
R_o	19.2	m
a	13.0	m
x	57	m
r_s	15.4	m
C	3000.0	
Ln R_o/r_s	0.222	
π =	3.1416	

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q	9.42	m^3/d
	9,416	L/d

18,831 L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- R_o = radius of influence (m)
- r_s = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \sqrt{ax/\pi}$$

Where:
- r_s = equivalent well radius (m)
- a = excavation width (m)
- x = excavation length (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- R_o = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- r_s = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation -
Unconfined Aquifer - Square or Rectangular Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CG
Client Rup Lal c/o Weston Consulting
Station: BLOCK 2

Orbit Engineering Limited
1900 Clark Boulevard, Unit 9
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Fax: +1 855 666 3355
www.orbitengineering.ca, info@orbitengineering.ca

Excavation is evaluated using the following numerical solution for square or rectangular excavations (x/a < 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = [(\pi K(H^2 - h^2))/ln(Ro/rs)]$$

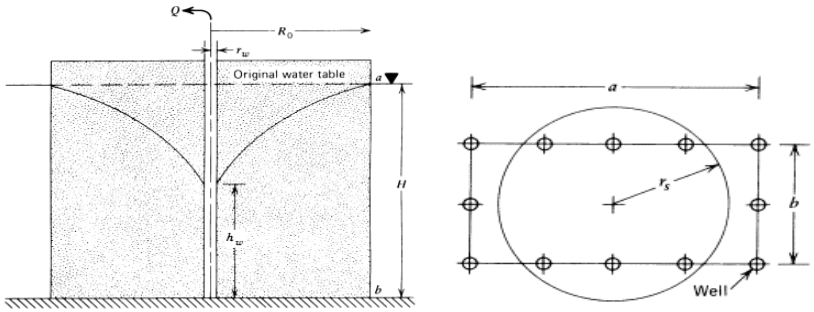

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer.

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.4	m
h	3	m
R_o	12.4	m
a	13.0	m
x	20	m
r_s	9.1	m
C	3000.0	
Ln R_o/r_s	0.313	
π =	3.1416	

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q	5.69	m^3/d
	5,694	L/d

11,389 L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- R_o = radius of influence (m)
- r_s = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \sqrt{ax/\pi}$$

Where:
- r_s = equivalent well radius (m)
- a = excavation width (m)
- x = excavation length (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- R_o = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- r_s = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation -
Unconfined Aquifer - Square or Rectangular Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CG
Client Rup Lal c/o Weston Consulting
Station: BLOCK 3

Orbit Engineering Limited
1900 Clark Boulevard, Unit 9
Brampton, ON, L6T 0E9
Tel: +1 905 494 0074
Fax: +1 855 666 3355
www.orbitengineering.ca, info@orbitengineering.ca

Excavation is evaluated using the following numerical solution for square or rectangular excavations (x/a < 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = [(\pi K(H^2 - h^2))/ln(Ro/rs)]$$

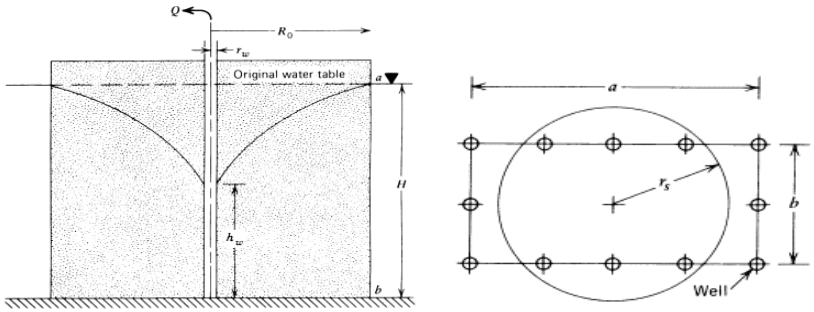

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer.

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.8	m
h	3	m
R_o	13.4	m
a	13.0	m
x	20	m
r_s	9.1	m
C	3000.0	
Ln R_o/r_s	0.387	
π =	3.1416	

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q	6.24	m^3/d
	6,242	L/d

12,484 L/d **Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- R_o = radius of influence (m)
- r_s = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \sqrt{ax/\pi}$$

Where:
- r_s = equivalent well radius (m)
- a = excavation width (m)
- x = excavation length (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- R_o = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- r_s = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CGAG
Client Rup Lal c/o Weston Consulting
Station: STM CB1 – STM CBMH1

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www.orbitengineering.ca, info@orbitengineering.ca

Excavation is evaluated using the following numerical solution for Long Narrow Excavation (x/a > 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

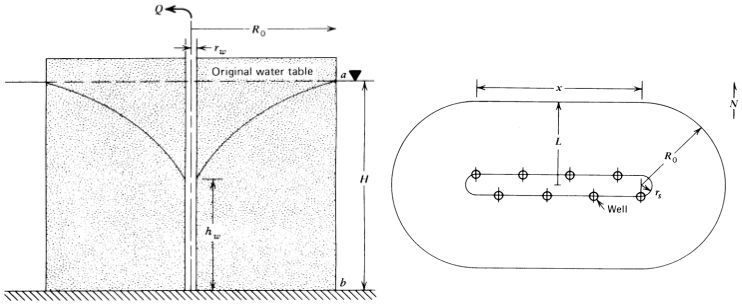

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.6	m
h	3	m
R_o	3.3	m
a	2.1	m
x	6.4	m
r_s	1.05	m
log R_o/r_s	0.495	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.84	m^3/d
Q_R	1.30	m^3/d
Q_T	3	m^3/d
	3,137	L/d

Q_C

6,274	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CGAG
Client Rup Lal c/o Weston Consulting
Station: STM CBMH1 – STM CBMH2

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Excavation is evaluated using the following numerical solution for Long Narrow Excavation (x/a > 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

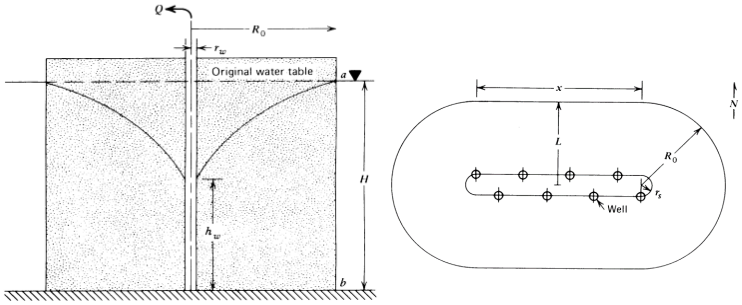

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	3.4	m
h	3	m
R_o	1.7	m
a	2.2	m
x	17.4	m
r_s	1.10	m
log R_o/r_s	0.178	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.07	m^3/d
Q_R	1.47	m^3/d
Q_T	3	m^3/d
	2,547	L/d

Q_C

5,093	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CGAG
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Excavation is evaluated using the following numerical solution for Long Narrow Excavation (x/a > 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

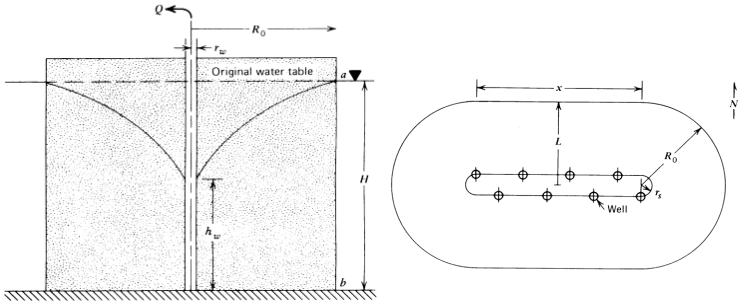

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	3.3	m
h	3	m
R_o	1.5	m
a	2.2	m
x	9.6	m
r_s	1.10	m
log R_o/r_s	0.140	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.01	m^3/d
Q_R	0.65	m^3/d
Q_T	2	m^3/d
	1,664	L/d

Q_C

3,328	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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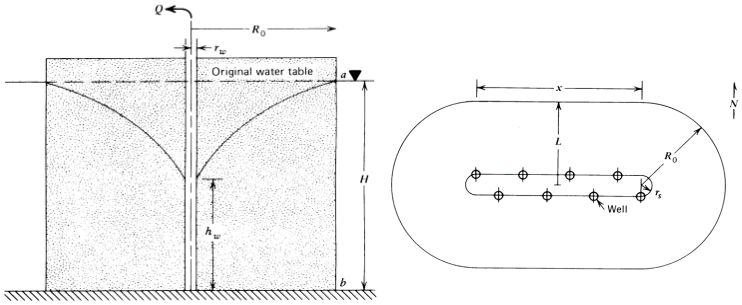

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	3.3	m
h	3	m
R_o	1.5	m
a	2.1	m
x	2.8	m
r_s	1.05	m
log R_o/r_s	0.146	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	0.97	m^3/d
Q_R	0.20	m^3/d
Q_T	1	m^3/d
	1,168	L/d

Q_C

2,336 L/d **Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

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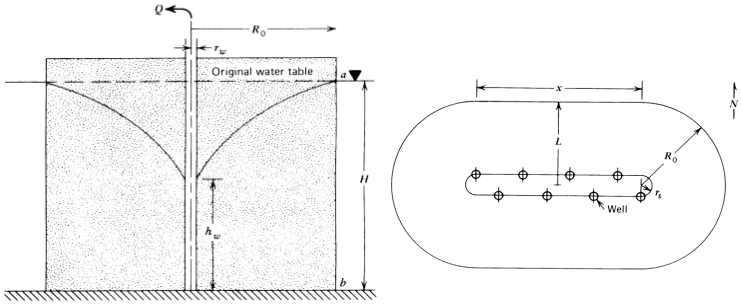

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	3.3	m
h	3	m
R_o	1.5	m
a	2.2	m
x	2.3	m
r_s	1.10	m
log R_o/r_s	0.140	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.01	m^3/d
Q_R	0.16	m^3/d
Q_T	1	m^3/d
	1,166	L/d

Q_C

2,333 L/d **Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- R_o = radius of influence (m)
- r_s = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- r_s = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- R_o = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- r_s = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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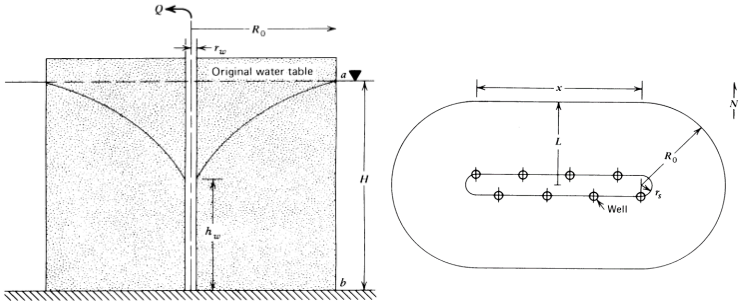

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	3.1	m
h	3	m
R_o	1.2	m
a	2.2	m
x	11.7	m
r_s	1.10	m
log R_o/r_s	0.052	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	0.88	m^3/d
Q_R	0.32	m^3/d
Q_T	1	m^3/d
	1,195	L/d

Q_C

2,391	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

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OE Project Number: OE20373CGAG
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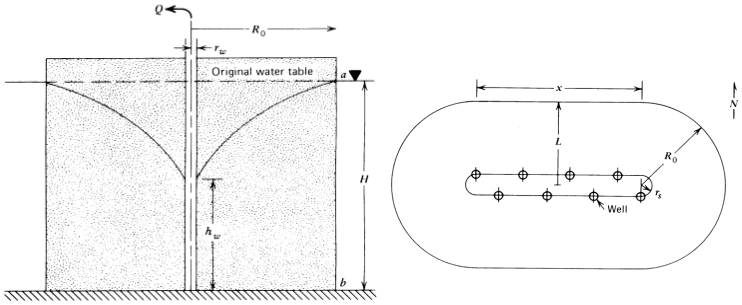

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.5	m
h	3	m
R_o	3.2	m
a	2.2	m
x	27.3	m
r_s	1.10	m
log R_o/r_s	0.462	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.82	m^3/d
Q_R	5.27	m^3/d
Q_T	7	m^3/d
	7,091	L/d

Q_C

14,182	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

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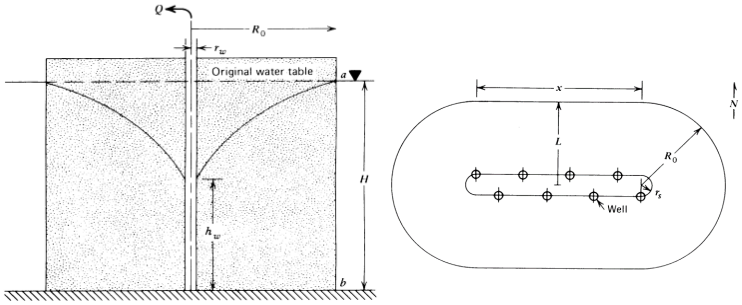

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.6	m
h	3	m
R_o	3.3	m
a	2.2	m
x	8.6	m
r_s	1.10	m
log R_o/r_s	0.481	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.89	m^3/d
Q_R	1.72	m^3/d
Q_T	4	m^3/d
	3,609	L/d

Q_C

7,219	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

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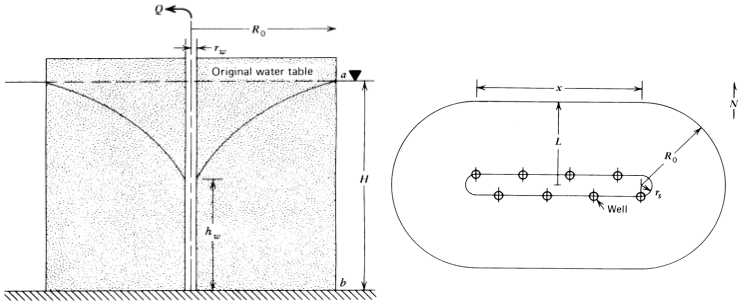

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.8	m
h	3	m
R_o	3.6	m
a	2.2	m
x	24.9	m
r_s	1.10	m
log R_o/r_s	0.516	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	2.03	m^3/d
Q_R	5.31	m^3/d
Q_T	7	m^3/d
	7,340	L/d

Q_C

14,681	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

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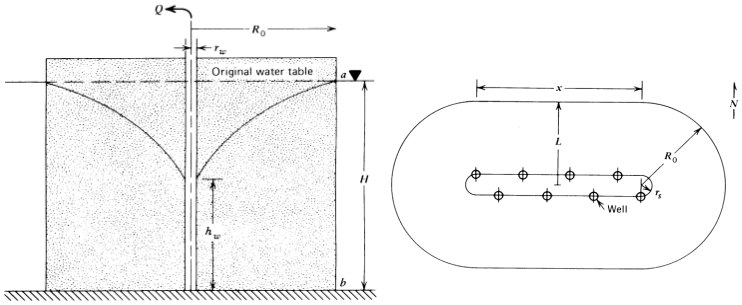

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.9	m
h	3	m
R_o	3.7	m
a	2.2	m
x	8.8	m
r_s	1.10	m
log R_o/r_s	0.532	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	2.11	m^3/d
Q_R	1.93	m^3/d
Q_T	4	m^3/d
	4,037	L/d

Q_C

8,075 L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
OE Project Number: OE20373CGAG
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Excavation is evaluated using the following numerical solution for Long Narrow Excavation (x/a > 1.5) in an unconfined aquifer (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

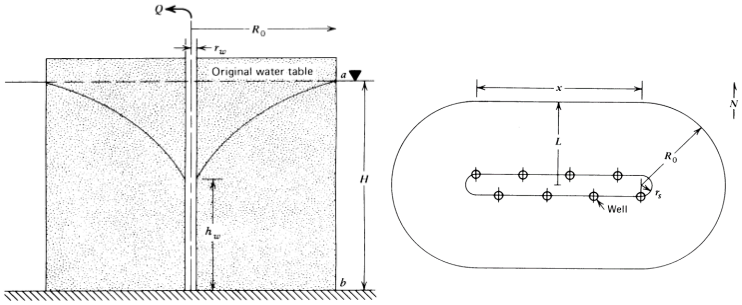

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4	m
h	3	m
R_o	2.4	m
a	2.1	m
x	20.6	m
r_s	1.05	m
log R_o/r_s	0.367	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.43	m^3/d
Q_R	3.23	m^3/d
Q_T	5	m^3/d
	4,658	L/d

Q_C

9,317	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

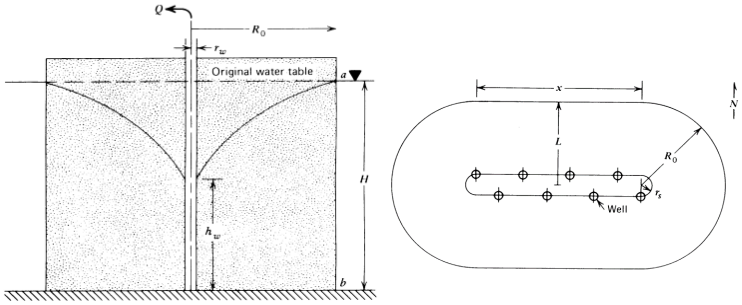

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4	m
h	3	m
R_o	2.4	m
a	2.1	m
x	26.2	m
r_s	1.05	m
log R_o/r_s	0.367	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.43	m^3/d
Q_R	4.11	m^3/d
Q_T	6	m^3/d
	5,537	L/d

Q_C

11,074	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

Powers, J.P, Corwin, A.B., Schmall, P.C., Kaeck, W.E., and Herridge, C.J., 2007. Construction Dewatering and Groundwater Control: New Methods and Applications, 3rd Ed. John Wiley and Sons Inc.

Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

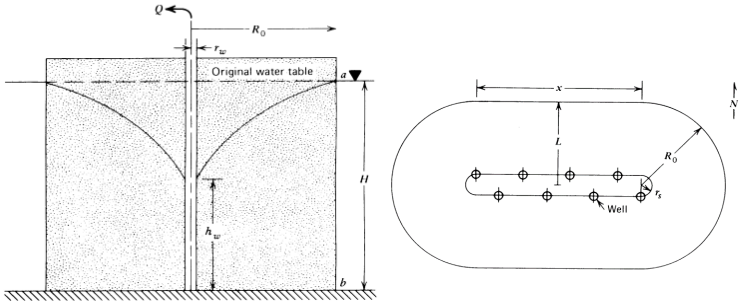

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4	m
h	3	m
R_o	2.4	m
a	2.1	m
x	30.3	m
r_s	1.05	m
log R_o/r_s	0.367	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.43	m^3/d
Q_R	4.75	m^3/d
Q_T	6	m^3/d
	6,180	L/d

Q_C

12,361	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

REFERENCES:

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \qquad (6.10b)$$

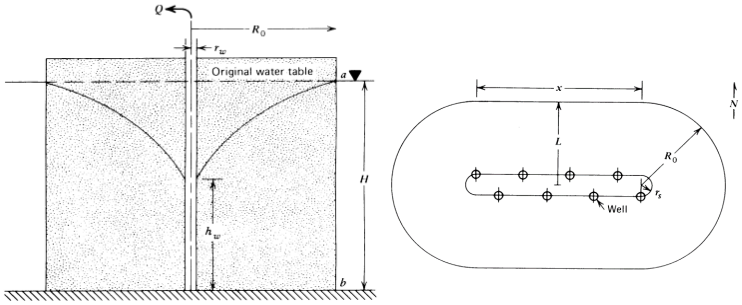

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.2	m
h	3	m
R_o	2.7	m
a	2.1	m
x	24.1	m
r_s	1.05	m
log R_o/r_s	0.414	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.56	m^3/d
Q_R	4.19	m^3/d
Q_T	6	m^3/d
	5,750	L/d

Q_C

11,500	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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Radius of Influence (R_o) and Groundwater Inflow Rate (Q) Calculation - Unconfined Aquifer - Long Narrow Excavation

Project: Hydrogeological Investigation - Proposed Residential Development - 7170 Goreway Drive, Mississauga, ON
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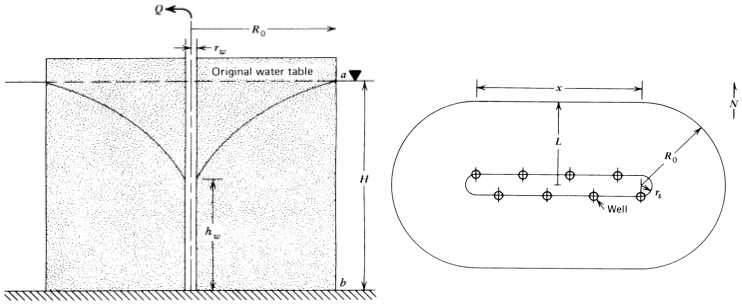

Figure 6.3 Equilibrium radial flow to a frictionless well in a water table aquifer

Parameter		Units
K	0.000063	cm/sec
K	0.055	m/d
H	4.3	m
h	3	m
R_o	2.9	m
a	2.1	m
x	24.1	m
r_s	1.05	m
log R_o/r_s	0.435	
D	0.0	m

Legend:

	Fill in
	Leave alone calculated number
	Copy numbers to the table

Q_M	1.63	m^3/d
Q_R	4.38	m^3/d
Q_T	6	m^3/d
	6,006	L/d

Q_C

12,013	L/d	**Expected Pumping Rate with contingency**

Where:
- Q = groundwater inflow (m^3/sec)
- K = hydraulic conductivity (m/sec)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- x = length of excavation (m)
- a = width of excavation (m)
- L = line source distance (m)
- Ro = radius of influence (m)
- rs = equivalent well radius (m)

100.0% Contingency for the variability in hydraulic conductivity that could be experienced and to provide flexibility to address additional drainage needed as a result of precipitation events.

$$r_s = \frac{a}{2} + D$$

Where:
- rs = equivalent well radius (m)
- a = excavation width (m)
- D = dewatering system setback distance (m)

$$R_o = r_s + C(H - h)\sqrt{K}$$

Where:
- Ro = radius of influence (m)
- C = is a constant (unitless; 3,000 for radial flow to pumped wells and between 1,500 and 2,000 for line flow to trenches or to a line of wellpoints)
- rs = equivalent well radius (m)
- H = saturated thickness of the aquifer before pumping (m)
- h = saturated thickness of the aquifer after pumping (m)
- K = hydraulic conductivity (m/sec)

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