750 Mapleview Drive East, Barrie, Ontario

Proposed Development Complex
Hydrogeological Investigation and Water Balance Assessment

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1. Introduction

EXP Services Inc. (EXP) was retained by Mapleview Developments Ltd. on behalf of Pace Development Corporation to complete the Hydrogeological Investigation and Water Balance Assessment for the property located at 750 Mapleview Drive East in Barrie, Ontario (hereinafter referred to as the 'Site').

It is EXP understanding that a 750 Mapleview Drive East property is located in the centre of a current landholding located at 700 Mapleview Drive East. The 750 Mapleview Drive East project involves the development of a residential townhouse complex, anticipated to consist of seven (7) blocks of slab-on-grade townhouses (no basements), with a total of eighty-one (81) residential units. Full site servicing and paved access roads and parking will also be provided.

This Hydrogeological Investigation and Water Balance Assessment presents findings of previous and additional hydrogeological investigations that have been consolidated in one comprehensive report which combines the previous reports and technical memorandum prepared in support of the Category 3 Permit to Take Water (PTTW) applications for the amendment of the PTTW 4767-ASGKAA and alteration of the PTTW No. 2312-B4AP29 to the Ministry of the Environment, Conservation and Parks (MECP), responses to agencies comments (MECP, LSRCA) and results of additional hydrogeological investigation completed in conjunction with the geotechnical and environmental investigations (EXP, 2017-2021).

It should be noted that the Category 3 Permit To Take Water No. 4788-C2ZKMP is issued by MECP on May 14, 2021. This permit authorizes water takings for construction dewatering for the Site and is valid until October 31, 2023. PTTW 4788-C2ZKMP cancels and replaces Permit Number 2312-B4AP29, issued on October 26, 2018.

1.1 Project Description

The Site is a rectangular shaped land parcel with an area of approximately 1.3 hectares (3.3 acres) located on the north side of Mapleview Drive East and east of Yonge Street in the City of Barrie, Ontario. The site is currently undeveloped with medium density vegetation located across the site. An abandoned residence located at the southwest cornet of the site was demolished recently. Figure 1 presents the property and Site location plan.

Based on the information provided to EXP, it is understood that the proposed development would consist of townhouse blocks. It is further understood that the proposed townhouse blocks will be slab-on-grade structures with no basement. The development will be serviced with roads, watermains, storm and sanitary sewers.

The hydrogeological investigation and water balance assessment is completed in conjunction with a preliminary geotechnical investigation (EXP, July 23, 2020), Phase Two Environmental Site Assessment (EXP, February 5, 2021), and technical memorandum PTTW alteration (EXP, April 23, 2021), reported under separate covers.

1.2 Project Objectives

The main objectives of the Hydrogeological Investigation and Water Balance Assessment are to :

- Further refine the local (shallow) hydrogeological settings within the Site;
- Evaluate construction dewatering flow rates for shallow installations;
- Evaluate the 0.5 m separation between the invert of floor slab and groundwater levels;
- Update pre- and post development water balance in accordance with site plans;
- Assess groundwater quality; and,

- Prepare a Hydrogeological Investigation and Water Balance Assessment Report.

1.3 Scope of Work

To achieve the project objectives, EXP completed the following scope of work:

- Reviewed available geological and hydrogeological information for the Site;
- Installed three (3) shallow 50 mm diameter monitoring wells around the proposed development. All wells installed in environmental boreholes during the Phase Two Environmental Site Assessment;
- Conducted an elevation survey at monitoring well locations;
- Completed groundwater level measurements at all available on-site monitoring wells;
- Evaluated the information collected during the field investigation program, including borehole geological information, SWRT results, groundwater level measurements and groundwater water quality;
- Prepared an updated site plans, site specific cross section and groundwater contour mapping for the Site;
- Estimated construction dewatering flow rates for shallow works;
- Updated the pre-and post-development water balance (site specific water balance); and
- Prepared a Hydrogeological Investigation and Water Balance Assessment Report.

1.4 Review of Previous Reports and Documents

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

- Terraprobe (July 29, 2015). Preliminary Geotechnical Investigation, Proposed Mapleview Residential Development, Mapleview Drive East Near Yonge Street, Barrie, Ontario.
- Terraprobe (August 6, 2015). Hydrogeological Assessment, Proposed Mapleview Residential Development, Mapleview Drive East Near Yonge Street, Barrie, Ontario.
- Terraprobe (May 18, 2016). Additional Geotechnical Subsurface Investigation, Proposed Mapleview Residential Development, 700 Mapleview Drive East, Barrie, Ontario.
- EXP (July 31, 2017). Hydrogeological Investigation, Proposed Residential Complex 700 Mapleview Drive East, City of Barrie, Ontario.
- EXP (September 18, 2017) Baseline Residential Water Well Survey, 700 Mapleview Drive East, Barrie, Ontario.
- Category 3 PTTW No. 2312-B4AP29.
- EXP (January 26, 2018) Seasonal Groundwater Monitoring Report.
- EXP (February 6, 2018) Pre- and Post-Development Infiltration Water Balance Assessment Proposed Residential Complex 700 Mapleview Drive East, City of Barrie, Ontario.
- EXP (July 12, 2018) Scoped Water Balance LSRCA e-mail dated April 24, 2018 and Response to Natural Heritage Comments dated April 26, 2018.
- EXP (September 21, 2018) Addendum Hydrogeological Investigation Report, Proposed Residential Development 700 Mapleview Drive East, Barrie, ON.
- Dewatering Plans (October 10, 2018) prepared by EMAC and by Schaeffers Consulting Engineers (October 16, 2018).

- Engineering Drawings (February 13, 2019), 700 Mapleview Drive East Residential Subdivision Phase -1 prepared by Schaeffers Consulting Engineers (SC1 to SC 6 and SC9).
- EXP (October 24, 2018) Additional Information - Safe Excavation Depth (SED), 700 Mapleview Drive East, Barrie, Ontario.
- EXP (revised October 11, 2018) Preliminary Geotechnical Investigation, Proposed Residential Complex 700 Mapleview Drive East, City of Barrie, Ontario.
- EXP (October 30, 2018) Geotechnical Assessment on Dewatering Impacts, Proposed Residential Development 700 Mapleview Drive East, City of Barrie, Ontario.
- Hydrogeological correspondence and response to additional information requests prepared in support of the November 2018 Submission to LSRSA.
- EXP (November 21, 2018) Addendum Hydrogeological Investigation Report, Proposed Residential Development 700 Mapleview Drive East, Barrie, ON.
- EXP (March 28, 2019) Draft Geotechnical Investigation, Proposed Hewitt's Creek Crossing 700 Mapleview Drive East, City of Barrie, Ontario.
- EXP (June 24, 2019) Supplementary Geotechnical Investigation, Proposed Residential Complex 700 Mapleview Drive East, City of Barrie, Ontario.
- EXP (July 29, 2019) Supplemental Hydrogeological Investigation Report, Proposed Development Complex 700 Mapleview Drive East, Barrie, Ontario.
- EXP (July 23, 2020) Preliminary Geotechnical Investigation, 750 Mapleview Drive East, Barrie, Ontario.
- EXP (February 5, 2021) Phase Two Environmental Site Assessment, 750 Mapleview Drive East, Barrie, Ontario.
- EXP (April 23, 2021) Technical Memorandum Permit to Take Water (PTTW) 2312-B4AP29 - permit alteration application Short-Term Dewatering Assessment for Servicing at 750 Mapleview Drive East.
- Category 3 Permit To Take Water No. 4788-C2ZKMP.

Relevant information from these documents was reviewed and utilized for this Hydrogeological Investigation and Water Balance Assessment Report.

2. Hydrogeological Setting

2.1 Regional Setting

2.1.1 Regional Physiography and Drainage

The Site is located within the physiographic region known as Peterborough Drumlin Field (Chapman and Putnam, 2007). The Peterborough Drumlin Field physiographic region lying between the Oak Ridges Moraine and the area of shallow overburden on the limestones of the Gull River Formation. The topography of the Peterborough Drumlin Field physiographic region is generally described as a rolling till plain which contains drumlins, drumlinoid hills and surface flutings of the till sheet (Chapman and Putnam, 2007).

The Site is entirely within the Lake Simcoe Watershed and within the Hewitt's Creek Subwatershed. The Hewitt's Creek flows approximately 300 m east of the site boundary, eventually discharging into Lake Simcoe approximately 3 kilometers (km) north of the Site.

2.1.2 Regional Geology and Hydrogeology

The surficial soil of the Site has been mapped as Late Wisconsinan-aged fine textured (massive-well laminated silt dominated rhythmites) glaciolacustrine deposits and glacial deposits (stone-poor, carbonate-derived silty to sandy till) (Ministry of Northern Development and Mines, 2012). The surficial geology for the Site and surrounding areas is shown on Figure 2.

Bedrock in the region is predominantly the Middle Ordovician-aged dark grey to black organic-rich, calcareous shale and limestone of the Lindsay and Verulam Formations (Trenton Group) (OGS, 2010; Ministry of Northern Development and Mines, 2012). The bedrock in the area is expected to be in the general elevation range of approximately 121 to 123 masl (approximately 127 to 134 m below ground surface).

Regionally, there are two main overburden water bearing zones in the area: the shallow system (coarse textured glaciolacustrine deposits and discontinuous granular lenses in glacial till) and the Oak Ridges Aquifer Complex (ORAC). The Majority of shallow overburden wells reportedly obtain water between approximately 15 and 30 mbgs and between 31 and 46 mbgs (Groundwater probability map, County of Simcoe, MECP Map 3135).

Regional groundwater flow within the aquifers is expected to be directed east to northeast, towards Lake Simcoe. Local deviation from the regional groundwater flow path may occur in response to changes in topography and/or soils, as well as the presence of surface water features and/or existing subsurface infrastructure and/or dewatering activities in the area.

2.1.3 Existing Water Well Survey

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

The MECP WWR database indicated total of thirty-three (33) WWRs in the 500 m zone. These included two (2) records of wells reportedly located on Site and thirty-one (31) off Site well records. From two (2) on Site wells, one (1) is reported as domestic water supply well (Well ID 5701489). The domestic wells were reportedly installed in 1967, with water found at depths of 3.7 m. The remaining on Site well was reported as a monitoring/ test hole installed in 2018.

The remaining thirty-one (31) off Site wells include, fourteen (14) wells reportedly used for domestic supply (Well ID 5701410, 5701416, 5701477, 5701488, 5708032, 5709663, 5710551, 5713067, 5717401, 5722622, 5723084, 5732723, 5732836 and 5722464), one (1) for industrial water supply (Well ID 5709605), and one (1) for commercial water supply (Well ID 7146493).

Eight (8) wells were reportedly used for monitoring/ test hole, and the remaining eight (8) wells were reportedly identified as either abandoned or unclassified. Reported depth to water (where available) ranged from approximately 3.0 to 29.3 mbgs.

It is noted that some of residents located in 500 m area of the Site use their wells for a water supply. The results of domestic well survey and on-going monitoring presented in sections below.

It should be noted that according to the MECP Source Water Protection information, the Site is not located within a wellhead protection area (WHPA), but the most northern and western portions of the Site are located within intake protection zone 3 (IPZ-3). Intake protection zones are assigned to areas of 1 km surrounding a municipal surface water intake location and IPZ-3, typically, covers a part of the watershed that may be impacted by an extreme event such as a storm, strong winds or high waves (SPP).

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

2.1.4 PTTW Database Searches

Based on review of Permit to Take Water (PTTW) MECP database search results, there are reportedly twenty-eight (28) PTTWs within a 5 km radius of the Site. These PTTW reportedly include seven (7) water supply water takings, five (5) commercial (golf coarse irrigation) and sixteen (16) for construction dewatering. The surface and groundwater water taking volumes vary between 150,000 and 6,520,000 L/day and are located approximately 0.1 to 4.6 km away from the Site.

The Category 3 PTTW No. 4788-C2ZKMP, which authorizes water taking for construction dewatering up to 1,130,400 L/day at the Site, was issued by MECP on May 14, 2021. This PTTW 4788-C2ZKMP cancels and replaces PTTW 2312-B4AP29 and is valid until October 31, 2023.

2.2 Site Setting

2.2.1 Climate and Precipitation

The subject Site is located in the climatic region identified as the Peterborough Drumlin Field (Brown et al, 1980). Climatic data for the study area was obtained from the Environment Canada. The climatic data for the Shanty Bay climate station is considered representative of the climate (daily precipitation) in the area. The Shanty Bay climate station (ID 6117684) is at elevation of 250 m and is located approximately 7.7 km northeast of the Site.

Based on data from Shanty Bay climate station (Climatic Normals 1981-2010), the historical average annual precipitation for the area is approximately 968 mm and the average annual temperature is about 6.8^{0}C. Commonly, August and September are the wettest months, and January and February are the driest.

2.2.2 Site Topography

The Site is located at the southeastern fringe of the City of Barrie in a highly-urbanized land use setting. Based on the borehole elevations, the grading of the site is relatively flat, with elevation between 248.53 and 251.27 m. The site is currently mostly undeveloped with medium density vegetation located across the site. An abandoned residence located at the southwest cornet of the site was demolished recently.

Regional topography is considered roiling, with an overall gradual northerly slope toward Lake Simcoe. Instances of easterly slopes also are noted to occur locally, being associated primarily with local surface water features (Hewitt's Creek).

The Site is neither within the Oak Ridges Moraine area nor in the Niagara Escarpment Planning Area.

2.2.3 Local Surface Water Features

The Site is located within the Lake Simcoe drainage basin and the Lake Simcoe Watershed.

Hewitt's Creek is located approximately 0.21 km to the east of the Site and it flows north towards Lake Simcoe. Lake Simcoe is located approximately 2.2 km north of the Site. Over half of the Hewitt's Creek subwatershed is occupied by agriculture; and natural heritage features and urban land both occupy close to 20% (respectively) of the subwatershed area (Barrie Creeks, Lovers Creek, and Hewitt's Creek Subwatershed Plan).

Most northern portion of the Site is located within LSRCA Ontario Regulation 179/06 area (https://maps.lsrca.on.ca/EH5Viewer/index.html?viewer=LSRCARegulations). The O.Reg. 179/06 mapping as it relates to the Site is appended to this report (Appendix J).

The available data suggests that the most northern and western portions of the Site area are located within woodland (MNRF Natural Heritage Area mapping). The regional mapping further suggests that the northern portion of the site is located within unevaluated wetland area (https://www.lioapplications.lrc.gov.on.ca/Natural_Heritage/index.html?viewer=Natural_Heritage.Natural_Heritage&locale=en-CA).

2.2.4 Local Geology and Hydrogeology

Based on the results of the previous preliminary geotechnical, environmental investigations and this Hydrogeological Investigation, a brief description of the general surficial geology at the Site, in order of depth, is summarized in the following sections.

The detailed profiles encountered in each borehole and the results of laboratory moisture are indicated on the attached borehole logs (Appendix B). It should be noted that the soil boundaries indicated on the borehole logs are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for the purpose of the hydrogeological study and should not be interpreted as exact planes of geological change. The "Notes on Sample Description" preceding the borehole logs are an integral part of and should be read in conjunction with this report.

Based on the results of the geotechnical investigation, the stratigraphy as revealed in boreholes, generally comprised surficial topsoil or fill, over a local peat layer, over native deposits of silty sand till, sand, silty fine sand and silty clay.

A brief description of the soil profiles, in order of depth, follows:

Topsoil

Surficial topsoil was encountered in Boreholes 101 and 102, being 700 and 75 mm in thickness, respectively. The topsoil comprised dark brown sand with some silt and was moist (water content of 21%.

It should be noted that topsoil measurements were carried out at the borehole location only. A much more detailed analysis (i.e. test pits) is required to accurately quantify the amount of topsoil to be removed for construction purposes. Consequently, topsoil quantities should not be established from the information provided at the borehole locations.

Fill

Fill was encountered at the surface or below the topsoil in all boreholes, extending to 1.0 to 1.6 m depth (elevation 246.9 to 249.9). The fill graded as sand, silt, silty sand or sandy silt. Trace gravel, clay and organics were noted. Asphalt pieces were noted in Borehole 102. Moisture contents ranged from 4 to 18% (typically moist).

Peat

A peat layer was observed below the fill in Borehole 104, extending to 1.6 m depth (elevation 248.4) The layer was wet with a water content of 75%.

Silty Sand Till

A silty sand till layer was encountered below the fill or peat in Boreholes 102 to 105, extending to 2.1 to 5.5 m depth (elevation 243.0 to 247.9). A sample of the material was submitted for gradation. The till contained some clay and trace gravel. Cobbles and boulders were noted. The stratum existed in a loose to dense state of compactness (N-Values of 4 to 42). Moisture contents typically ranged from 9 to 14%, locally as high as 20%, with the material being typically moist, locally wet in seams.

Sand

A sand deposit was encountered beneath the sand or till in Boreholes 101 and 103 to 105, extending to 2.1 to 7.0 m depth (elevation 242.0 to 249.2). The sand deposit contained some silt and trace gravel. The soil was typically compact, locally dense, with N-Values of 14 to 42. Moisture contents were 7 to 21%, indicating a moist to wet conditions.

Silty Fine Sand

Below the sand or till, a silty fine sand deposit was encountered in all boreholes. The layer continued to the 11.3 m depth of exploration in Boreholes 102, 103 and 105 and was penetrated at 6.0 m (elevation 245.3) and 10.0 m (elevation 240.0) in Boreholes 101 and 104, respectively. The deposit contained trace clay. The layer was compact to very dense (N-Values of 13 to 68) and was typically wet (water contents of 19 to 29%), locally moist (water content of 5%).

Silty Clay

Silty clay with trace sand was observed at the base of Boreholes 101 and 104 in the southwest quadrant of the site, extending to the 11.3 m depth of exploration. A sample of the material from Borehole 101 was submitted for gradation. Accompanying Atterberg Limits testing results are displayed on the borehole log. The material was revealed to have a plastic limit of 14% and a liquid limit of 25%, with a corresponding plasticity index of 11%. The silty clay was revealed to be stiff to very stiff, with N-Values of 10 to 27. Moisture contents ranged from 20 to 29%, and the material was about the plastic limit.

The borehole and monitoring well locations are shown on Figure 4. Geological cross-section was generated based on the available borehole logs completed as part of the previous and current investigations and shown on Figure 5 (Cross section A-A'). The seasonal high water levels are also shown on Figure 5, as measured on April 5, 2021.Borehole logs used to generate the cross-section are provided in Appendix B.

2.2.5 Current Groundwater Use

2.2.5.1 Door to Door Well Condition Survey

To verify results of the MECP WWR search, a baseline residential water well inventory (door to door survey) was completed on September 11, 2017 followed by a confirmatory residential water well inventory on October 5, 2018 (EXP, July 29, 2019). To

begin the survey, introductory letters were prepared and delivered to residences in the study area. The letter explained the purpose of the study and requested the participation of the residents in monitoring program.

During the survey, EXP staff visited each house within 500 m of the 700 Mapleview site and, if a resident was home, interviewed the resident and completed the well survey to document the current condition and use of their well(s). The survey included questions about the wells (e.g. type of well, location, age, depth, etc.), the quantity of water (water levels, usage) and quality of water (clarity, odour, treatment types, etc.). If no one was home or residents declined to be interviewed, a copy of the well survey letter and water well survey forms were left at each location, and the resident was requested to contact EXP for survey completion.

A total of twenty-five (25) properties were visited during the door-to-door survey on September 11, 2017. During confirmatory water well survey total of seventy-six (76) letters were distributed on October 5, 2018. These resulted in total of eight (8) completed baseline surveys. From these, seven (7) authorizations from well owners to include their well(s) in the monitoring program were received, including five (5) for water quality sampling and water level monitoring and two (2) for water quality monitoring only. At some locations, the initial water level in the well was collected, where accessible.

Based on well survey results, seven (7) well owners agreed to participate in the monitoring program and one (1) rejected the opportunity. Among those, four (4) well owners are within 500 m from 750 Mapleview Site boundary. The well survey results, including background water levels and water quality, are summarized in Table 2-1 below.

Table 2-1: Summary of Baseline and Confirmatory Residential Water Well Surveys Results

No	MECP WWR ID	LOCATION	WATER LEVEL (Sept. 11, 2017) (mbgs)	WATER QUALITY ANALYSIS (September 11, 2017)			
				E. coli CFU/100 mL	Total Coliforms CFU/100 mL	Nitrate (mg/L)	Nitrite (mg/L)
1	No WWR ID	72 St. Paul's Crescent	-	0	0	<0.01	10
2	No WWR ID	105 St. Paul's Crescent	2.44	0	0	<0.01	**11.8**
3	No WWR ID	33 St. Paul's Crescent	3.66	-	-	-	-
4	No WWR ID	820 Mapleview Drive East	-	-	-	-	-

Notes: **Bold** – exceeds Ontario Drinking Water Standards (ODWS)

Based on well survey results, two (2) domestic wells are bored / dug wells and two (2) are drilled wells as per well information provided by well owners. These wells are completed at depths varying between 6.10 m (3) and 18.19 m (1). At the time of well survey, the water levels measured in wells, where accessible, ranged between 2.13 mbgs (4) and 3.66 mbgs (3).

The findings of the door to door well survey presented under separate cover (EXP, September 18, 2017). Appendix C provides all well surveys completed during the baseline water well survey (September 11, 2017) and the additional well surveys completed during the confirmatory water well inventory (October 5, 2018).

It should be noted that continuous domestic well monitoring is in place and currently ongoing as a part of PTTW monitoring for the 700 Mapleview project. It should also be noted that two (2) properties (33 St. Paul's Crescent (3) and 820 Mapleview Drive East (4)) are provided with municipal water supply since 2020.

2.2.5.2 Groundwater Quality

To establish groundwater baseline conditions total of four water samples were collected from private water well locations 1 and 2 on September 11, 2017. Regular water quality sampling is conducted as a part of ongoing PTTW monitoring for all authorized domestic well locations since March 4, 2020 to present. All samples were submitted to a CALA accredited laboratory (BV labs , former MAXXAM) for parameters listed in Ontario Drinking Water Standards (ODWS) including bacteriological analyses (Escherichia coli and Total Coliforms) and Nitrates. The results of the well survey water quality sampling can be seen in Table 2-1.

It should be noted that all samples were collected from untreated (raw) sources. It is noted that the well at location 1 is not used for drinking purposes; however, it is used for washing.

Based on the results, all parameters were below ODWS standards except Nitrate (locations 2). Since this well is used for domestic water supply, the results above ODWS standards were reported to the City of Barrie Health unit and to the well owner.

3. Methodology

3.1 Monitoring Well Details

As part of the EXP Hydrogeological, Geotechnical and Environmental investigations a total of three (3) of the eleven (11) boreholes advanced on the Site were instrumented with monitoring wells. The monitoring well network on Site consists of the following:

- Three (3) shallow overburden monitoring wells (BH/MW-1, BH/MW-3 and BH/MW-6) were installed to various depths between 2.44 and 2.56 mbgs;

The diameter of all monitoring wells is 50 mm. Each monitoring well was instrumented above ground protective casing and 1.5 m long well screen.

The borehole and monitoring well locations are shown on Figure 4. Geological cross-section is shown on Figure 5 (Cross section A-A'). Borehole logs used to generate the cross-section are provided in Appendix B. Monitoring well construction details are summarized in Table 3-1 below.

Table 3-1: Monitoring Well Installation Details

Well ID	Ground Elevation (masl)	Construction Date	Total Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened
BH/MW-1	250.97	June 1, 2020	2.4	0.9 – 2.4	Fill/Sand
BH/MW-3	249.76	June 1, 2020	2.4	0.9 – 2.4	Fill/Till
BH/MW-6	249.38	June 2, 2020	2.5	1.0 – 2.5	Fill/Till/Sand

Notes:
mbgs- meters below ground surface;
masl- meters above sea level.

3.2 Water Level Monitoring

Static water levels were recorded at all available monitoring wells on various dates for previous and current investigations. The long-term groundwater monitoring (PTTW monitoring) including water level measurements in all available monitoring wells across the site completed between June 3, 2020 and June 25, 2021 and is currently ongoing. It is interpreted that April 1, 2021 monitoring event can be considered as representative of highest water levels encountered on site to date.

A summary of all water level monitoring data to date as it relates to the elevation survey is summarized in Appendix D. Figure 4 shows the monitoring well location plan.

Based on monitoring results, the highest groundwater elevation of 249.16 masl (1.81 mbgs) was observed in BH/MW-1, as measured on April 1, 2021. The lowest groundwater elevation of 247.12 masl (2.26 mbgs) was observed in BH/MW-6, as measured on June 30, July 3, and November 30, 2020.

The water level hydrograph for all monitoring wells is presented in Appendix D. The precipitation data is also plotted on the hydrograph. The Hydrograph shows the fluctuations in water levels and the influence, or lack of influence, from the precipitation events.

3.3 Groundwater Contour Maps

Figure 6 presents the interpreted shallow groundwater contour map for the overburden flow system as measured on April 5, 2021. Based on the water level measurements obtained, the inferred direction of shallow groundwater flow across the Site is interpreted to be north-easterly, towards Hewitt's Creek and Lake Simcoe.

It should be noted that groundwater levels are subject to seasonal fluctuations and can vary in response to prevailing climate conditions; this may also affect the direction of groundwater flow.

It should also be noted that prior to, or during construction it is necessary to ensure that all wells within the development footprint have been located and that inactive wells are properly decommissioned by a licensed water well contractor, in accordance with Ontario Regulation 903. This regulation also applies to the groundwater observation wells installed for this and previous investigations after they are no longer needed for monitoring throughout and after construction.

3.4 Hydraulic Conductivity Testing

Total of four (4) Single Well Response Tests (SWRT) were conducted at 700 and 750 Mapleview properties between March 18, 2019 and June 29, 2021. Three (3) SWRTs were completed during the 700 Mapleview supplemental hydrogeological investigation (EXP, 2019). These SWRTs were conducted at shallow monitoring wells BH2-2019, BH5-2019 and BH14-2019 on March 18, 2019. Additionally, one rising head SWRT was competed for 750 Mapleview investigation at BH/MW-6 on June 29, 2021. All SWRTs were completed to estimate the hydraulic conductivity (K) of the soils at the well screen depths. Based on the similar geological conditions between 700 Mapleview Site and 750 Mapleview Site, the SWRT's results from shallow monitoring wells at 700 Mapleview Site are utilized for 750 Mapleview Site.

The static water level within each monitoring well was measured prior to the start of testing. In advance of performing SWRTs, each monitoring well underwent development to remove fines introduced into the screens following construction. The development process involved purging of the monitoring wells to induce the flow of fresh formation water through the screen. Each monitoring well was permitted to fully recover prior to performing SWRTs.

Hydraulic conductivity values were calculated from the SWRT data as per the Hvorslev's solution included in the AQTESOLV V.4.50.002 software package. The semi-log plots for normalized head versus time analytical results (h/h0) and the standard operating procedures (SOP) for SWRTs are included in Appendix E.

A summary of the hydraulic conductivity (K) values estimated from the SWRTs are provided in Table 3-2.

Table 3-2: Summary of Hydraulic Conductivity Testing

Monitoring Well ID	Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened	Estimated Hydraulic Conductivity (m/s)
BH2-2019	4.0	2.5 - 4.0	Sand and Silt	4.8×10^{-6}
BH5-2019	7.0	5.5 - 7.0	Gravely Sand, Sand and Silt	8.8×10^{-6}

Monitoring Well ID	Well Depth (mbgs)	Screened Interval (mbgs)	Formation Screened	Estimated Hydraulic Conductivity (m/s)
BH14-2019	6.1	4.6 - 6.1	Silty Sand and Sand	7.1×10^{-6}
BH/MW-6	2.3	0.8-2.3	Fill/Silt Sand Till/ Sand	3.4×10^{-7}
Highest K estimate for the shallow native Sand and Silt Layer (rounded up)				8.8×10^{-6}
Geometric Mean Estimated for the shallow native Sand and Silt Layer (rounded up)				6.7×10^{-6}

Note: Monitoring well installation details were obtained from the borehole logs (Appendix B).

SWRTs provide estimates of K for the geological formation in the immediate media zone surrounding the well screens. As shown in Table 3-2, the highest measured K estimate for the shallow native sand and silt layer is 8.8×10^{-6} m/s and the geometric mean K value is calculated as 6.7×10^{-6} m/s.

3.5 Water Quality

One (1) groundwater sample was collected from BH/MW-6 on June 30, 2020. The monitoring well was sampled using low-flow groundwater sampling techniques with a peristaltic pump and Hanna 991300 water quality meter. Water was purged from the well until temperature, pH and conductivity had stabilized.

Upon completion of purging, groundwater was collected into pre-cleaned laboratory-supplied vials or bottles provided with analytical test group specific preservatives, as required. The samples were placed in an insulated cooler pre-chilled with ice immediately upon collection. Field quality assurance and quality control (QA/QC) samples collected during groundwater sampling included duplicate samples for each parameter group and a trip blank for VOCs. The samples were submitted to a CALA certified independent laboratory, Bureau Veritas Laboratory, in Mississauga, Ontario for analysis.

The sample results were compared against two sets of criteria within the Ontario Drinking Water Standards (ODWS); Maximum Acceptable Concentration (MAC), and Aesthetic Objective (A/O). Sample results were also compared to the Ontario Provincial Water Quality Objectives (PWQO) criteria. The BV lab custom report is provided in Appendix F.

Reporting detection limits (RDL) were below the Ontario Drinking Water Standards (ODWS). The RDL of Anthracene, Benzo(a)anthracene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(a,h)anthracene and Fluoranthene were above the PWQO criteria. Based on ESA study completed it is our interpretation that there is no reason for these parameters to be present on site.

Analytical results are provided in Appendix F. A summary of the pertinent results is provided in Table 3-3 below.

Table 3-3: Summary of Analytical Water Quality Results

Parameter	ODWS (MAC) (Table 1)	ODWS (A/O) (Table 4)	PWQO	BH/MW6	BH/MW6DU
Dissolved Cobalt (Co) (ug/L)	-	-	0.9	1.2	1.0

Parameter	ODWS (MAC) (Table 1)	ODWS (A/O) (Table 4)	PWQO	BH/MW6	BH/MW6DU
Dissolved Sodium (Na) (ug/L)	20,000	200,000	-	**25,000**	**24,000**

Notes:
ODWS - Ontario Drinking Water Standards
A/O - Aesthetic Objective (ODWS 2002)
MAC - Maximum Acceptable Concentration (ODWS 2002)
PWQO - Ontario Provincial Water Quality Objective
DU - duplicate
Bold - Exceeds A/O Criteria
Bold - Exceeds MAC Criteria
Red - Exceeds PWQO Criteria

The construction dewatering monitoring is currently on-going for the 700 Mapleview project. Based on continuous ongoing water quality sampling for the dewatering, which is currently directed to the newly constructed SWM pond, no elevated concentrations of Cobalt above PWQO levels detected in any of that water discharged from the Site.

It should be noted that, during construction, it is anticipated that TSS levels and associated metals concentrations (for example, Total Metals), in the pumped groundwater may remain elevated and may continue to exceed the PWQO. Therefore, it is recommended that a suitable treatment method be implemented (filtration or decantation facilities and/ or any other applicable treatment system) during construction dewatering and groundwater control activities. The specifications of the treatment system will need to be adjusted to the water quality by the treatment contractor/process engineer.

Approval to discharge water to municipal sewers and / or environment during construction will be required from the City of Barrie and Lake Simcoe Region Consternation Authority (LSRCA) prior any discharge.

4. Water Balance Assessment

4.1 Pre- and Post-Development Infiltration Water Balance (Site Specific)

4.1.1 Methodology

The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. This methodology was used to complete the pre-construction (existing conditions) and post development water balance. Inputs to the model are monthly temperature, precipitation and site latitude. Outputs include monthly potential and actual evapotranspiration, soil moisture storage, soil moisture storage change, surplus, infiltration and runoff.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table including an interflow component, or evapotranspire (ET) from the earth's surface and vegetation. The difference between total precipitation (P) and the total of evaporation and evapotranspiration (ET) is defined to be the water surplus (S) which is available for both infiltration (recharge to the groundwater system including interflow) and for run-off. When long-term averages of P, R, I, and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST.

The annual water budget can be stated as follows:

$$P = ET + R + I + ST$$

Where:

P = precipitation
ET = evapotranspiration
R = surface water run-off
I = infiltration
ST = change in groundwater storage

For this assessment, the Thornthwaite and Mather method was used to estimate average infiltration rates. Based on the site conditions, as no recharge/infiltration to deep aquifer occurs, the component for infiltration in the Thornthwaite and Mater model was used to estimate infiltration, which corresponds to lateral movement of water in the unsaturated zone in the shallow sub-surface (first few meters, if present) which discharges to surface water features.

Infiltration is governed by the surficial soil types, topography and land cover. Areas where shallow water table as measured in shallow monitoring wells, is at surface, then the percolation rate of precipitation into the shallow soils is considered negligible.

For ease of calculation, a spreadsheet model was used for the computation. The Thornthwaite and Mather Model was based on the United Stated Geological Survey (USGS) graphical user interface (Thornthwaite Monthly Water-Balance program, 2007).

4.1.2 Meteorological Data

Meteorological data including average monthly precipitation and average temperatures were obtained from the National Climate Data and Information Archive (Environment Canada) for the City of Barrie (Station ID No. 6110557).

Meteorological data for 30 years from 1978 to 2006 was utilized for the assessment. Summary of input data is provided in Appendix G (Attachment 1).

4.1.3 Pre- and Post-Development Site Characteristics

4.1.3.1 Pre-Development Site Characteristics

Generally, the property is currently comprised open lands, woodlots and a recently demolished abandoned residence house with some paved area around.

A summary of the existing (pre-development) landscape features is provided in Table 4-1 below.

Table 4-1: Pre-Development (Existing) Land Use

Description	Impervious Areas (including Buildings, Roads) m^2	Total Areas Pre - Construction (Existing) m^2
Building	100	100
Paved Area	200	200
Open Lands	0	6,900
Woodlot	0	6,200
Site Area Available Contribution to for Infiltration	NA	13,100
Total Site Area	300	13,400

It should be noted that the areas provided in Table 4-1 above were determined based on a review of available Site plans and these estimates are considered appropriate for the purpose of estimating the water balance.

As evident from the information provided in Table 4-1, under pre-development conditions, almost the full property area is pervious under pre-development conditions.

4.1.3.2 Post-Development Site Characteristics

Table 4-2 provides a summary of the post development site characteristics.

Table 4-2: Post Development Site Characteristics

Description	Impervious Areas (including Buildings, Roads) m^2	Total Areas Post Construction (Proposed) m^2
Landscape	0	7,000
Building	3,600	3,600
Road	1,900	1,900
Sidewalk	900	900
Totals	6,400	13,400

Under post-development conditions, the total pervious area is reduced to approximately 52% of the total Site area.

4.1.4 Pre-Development Water Balance Estimates

4.1.4.1 Climate Data Analysis

The mean annual water surplus was calculated using the Thornthwaite and Mather (1955) method. Monthly average precipitation values were obtained for 30 years from 1978 to 2006.

Soil moisture storage of 200 mm/yr was assumed for soils, and considered representative of the preconstruction site conditions. The closest Latitude to the Site is 43^0, which was used in the USGS model (2007).

Table 4-3 provides a summary of the climatic water balance analysis. In Appendix G, Attachment 1 provides a summary of model input. Attachment 2 provides a summary of the model output.

Table 4-3: Summary of Climatic Water Balance Analysis in Pre-Development Conditions

Soil Moisture Storage (mm/yr)	Precipitation (mm/yr)	Potential ET (mm/yr)	Actual ET (mm/yr)	Surplus (mm/yr)
200 mm/yr Silt/Clayey soils	933.0	566.7	556.3	376.7

The results of climatic water balance analysis for the Site suggest that a surplus of approximately 376.7 mm/year of water is available for surface run-off and infiltration.

4.1.5 Infiltration

The infiltration is expected to be controlled by soil type, topography, and soil cover type. Surplus water is portioned between run-off and infiltration based on the controlling factors provided by MECP (1995). It is noted that the controlling factors provided by the MECP for estimating infiltration were used to estimate the controlling factors for infiltration.

Using this method, a total infiltration factor for the Site was estimated using the individual sub-factors representative of the topography, soil type and land cover conditions (Appendix G - Figures 1, 2, 3; and Figure 2).

In Appendix G, Attachment 3 provides a summary of the sub factors and total factor evaluation based on the Site conditions.

The estimated pre-development total infiltration factor of 0.47 represents the fraction of the water surplus available for infiltration. Therefore, the fraction of the available water for run-off is 0.53.

The infiltration factor is utilized to calculate the amount of infiltration (in units of m^3/yr) at the Site by multiplying it by the average yearly water surplus estimate by the site area available for infiltration.

Using the infiltration factor of 0.47 and a water surplus of 376.7 mm/yr, the pre- development infiltration rate for the entire Site is estimated to be approximately 175.9 mm/yr.

Infiltration sub-factors were determined for the purpose of estimating pre-development infiltration rates.

4.1.6 Pre-Development Water Balance Analysis

The water balance analysis is based on available information on a regional scale, and considered consistent for the Site. Table 4-4 below provides a summary of pre-development water balance analysis for the Site.

Table 4-4: Summary of Overall Pre-Development Water Balance Results

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/y)	Actual Evapo-transpiration (m^3/y)	Run-off (m^3/y)	Infiltration (m^3/y)
Total Site	13,400	13,100	12,502	7,288	2,910	2,305
Percentage of Total Precipitation			100%	58%	23%	18%

The total Site area was used to estimate the total volume of annual precipitation for the Site. As summarized in Table 4-4, the pre-development water balance is as follows: approximately 58% of the total precipitation will be subjected to evapotranspiration, 23% to run-off and 18% to infiltration.

The predevelopment water balance, on a weighted average depth basis (in mm) is as follows:

$$P\ (933.0) = ET\ (556.3) + R\ (200.8) + I\ (175.9) + ST\ (0)$$

4.1.7 Post-Development Water Balance Estimates

4.1.7.1 Post Development Water Balance

Based on the proposed development plans, the total area of impervious surfaces under the post-development conditions is approximately 6,400 m^2 representing approximately 48% of the Site area (total area: 13,400 m^2), (Table 4-2). The remaining 7,000 m^2 is available to contribute to infiltration during post development stage (52% of the total land area), not considering areas of shallow water table.

Lot level post development infiltration sub-factors were determined based on the method recommended by MECP (1995), similar to the method used for estimating infiltration sub-factors for pre-development site conditions.

For post-development infiltration sub-factors, the landscaped areas were assumed to be consistent with cultivated cover with an infiltration sub-factor of 0.1 (Appendix G - Attachment 3).

Table 4-5 provides a summary of the overall post development water balance assessment.

Table 4-5: Summary of Overall Post Development Water Balance Forecast

Location	Total Site Area (m^2)	Area Available for Infiltration (m^2)	Precipitation (m^3/y)	Evapo-transpiration (m^3/y)	Run-off (m^3/y)	Infiltration (m^3/y)
Total Site	13,400	7,000	12,502	3,894	7,501	1,107
Percentage of Total Precipitation			100%	31%	60%	9%

The total Site area was used to estimate the total volume of annual precipitation for the Site. As summarized in Table 4-5, the post-development water balance is as follows: approximately 31% of the total precipitation will be subjected to evapotranspiration, 60% to run-off and 9% to infiltration.

4.1.8 Infiltration Rate

To assess the infiltration rate of the surficial soil in vicinity of the proposed underground storm water storage tank (drawing 4867-TA-1 – Storm Tributary Plan by Schaeffers), results of the SWRT at BH/MW - 6 were utilized.

Based on the BH/MW - 6 testing results, the infiltration rate for the tested soil layers is calculated at 10 mm/hr. Using a safety factor of 2.5 (Appendix C, Low Impact Development (LID) Stormwater Management Planning and Design Guide, Appendix C, CVC – TRCA, 2010), the design infiltration rate was calculated as 4 mm/hr for BH/MW - 6.

4.1.9 Impact Assessment and Proposed Mitigation Measures

It is expected that infiltration will be reduced from approximately 2,305 m^3/yr to 1,107 m^3/yr in post development for the entire Site (Appendix G - Attachments 4 and 5). Therefore, there is a reduction in infiltration in post development conditions.

The infiltration within areas of a high-water table conditions that are known to occur within a property where groundwater is observed close or at ground surface is considered negligible.

To mitigate the infiltration deficit of approximately 1,197 m^3/yr within development limits, which is approximately 9.5% of total precipitation, in post-development conditions, mitigation measures should be implemented to maintain these infiltration levels. The best effort approach to mimic natural existing outlets is also recommended to be adapted across the entire Site to protect the adjacent wetland. This approach includes but not limited to harvesting rainwater and redirecting the rear roof areas to rear yards, and infiltration using Low Impact Development (LIDs).

Therefore, using the design infiltration rate of 4 mm/hr, the area of LID (feasible LIDs) that is required to offset the water balance deficit is approximately 195 m^2 with a storage of 37.4 m^3/week (Attachment 6, Appendix G). The implementation of LID mitigation techniques to be considered based on-site constraints, depth to water table and soil conditions. It is recommended to conduct *in-situ* infiltration tests at specific locations and depths of proposed LIDs to confirm the site-specific infiltration rates.

5. Construction Dewatering

It is EXP understanding that 750 Mapleview Drive East property is located in the centre of a current landholding located at 700 Mapleview Drive East. The construction dewatering for both properties located at 700 and 750 Mapleview Drive East is under Category 3 PTTW No. 4788-C2ZKMP (Appendix H), issued by MECP on May 14, 2021 (Appendix H). The PTTW 4788-C2ZKMP expires on October 31, 2023. It should be noted that active construction dewatering involving number of well educator systems was active between March 2020 and December 2020, and started again on May 6, 2021 at the 700 Mapleview site. As per previous PTTW 2312-B4AP29 and current PTTW 4788-C2ZKMP conditions, the PTTW monitoring program is currently ongoing and carried out by EXP.

EXP conducted a pre-consultation meeting with the Technical Support Section of the Ministry of Environment, Consideration and Parks (MECP) on January 29 and February 5, 2021. Based on meeting outcome, it is EXP understanding that the PTTW 2312-B4AP29 alteration is required to include additional water taking source for the 750 Mapleview Site, which is a property located inside the area currently under conditions of the existing PTTW.

Based on construction schedule update provided by the Client to EXP, it is understood that dewatering for the sources listed in Table A of the PTTW 2312-B4AP29 are expected to be completed in spring 2021 and that construction dewatering associated with the property at 750 Mapleview Drive East (new Site) may begin shortly after. It should also be noted that the depth of excavation for sewers on the new Site will be shallower resulting in no changes to the previously estimated zone of influence. The proposed residential development will be completed as slab on grade and that the current PTTW Monitoring, Contingency and Mitigation Plan will continue to include new Site at 750 Mapleview Drive East.

EXP had previously conducted geotechnical and hydrogeological investigations (EXP, 2017-2020). Artesian and above ground flowing conditions were encountered in both shallow and deeper water bearing zones across the 700 Mapleview Dr. E. Site. This section includes a Short-Term Dewatering Assessment for Servicing for the 750 Mapleview Drive East property.

5.1 Construction Dewatering Rate Assumptions

The overall topography of the new Site is relatively flat, with about 2 m of relief observed across the property, being highest at the southwest corner and lowest at the northeast. The ground surface elevations vary between 248.53 and 251.27 m, based on borehole logs (EXP, 2020). The 750 Mapleview Drive East project involves the development of a residential townhouse complex, anticipated to consist of seven (7) blocks of slab-on-grade townhouses (no basements), with a total of eighty-one (81) residential units. Full site servicing and paved access roads and parking will also be provided. Although, details regarding the servicing invert levels have not been provided, following assumptions were made to assess the short-term construction dewatering for servicing installations within 750 Mapleview Drive East Site. Figure 9 shows the proposed discharge and monitoring location plan. Figure 7 shows the proposed development plan.

Table 6-1 presents the assumptions used to calculate the dewatering rate for the Services installations.

Table 6-1 Dewatering Estimate Assumptions (Servicing #7)

Input Parameter	Assumption	Notes
Excavation area	400 m x 10 m	Assumed area for two dewatering manifolds of ~200 m long each will be operated simultaneously for servicing segments trench openings at any given time along Private Roads

Input Parameter	Assumption	Notes
Ground surface elevation (lowest)	248.53 masl	Based on borehole logs (EXP, 2020).
Groundwater elevation	248.07 masl	The highest groundwater elevation measured on Site in upper sand layer (BH/MW6) on April 12, 2021
Lowest Inv Elev. for Sewer Installations	244.5 masl	Assumed 3.0 to 4.0 m depth below existing site grades
Lowest excavation depth	244.0 masl	Assumed 0.5 m below the lowest Inv Elev. for service connections.
Dewatered elevation target	243.0 masl	Assumed to be approx. 1 m below Lowest excavation depth
Hydraulic conductivity (K)	8.8×10^{-6} m/s	Highest K value for Gravely Sand, Sand and Silt (BH5-2019) was used (EXP, Supplemental Hydrogeological Investigation BRM-00604678-H0, July 29, 2019)

5.2 Dewatering Flow Rate Estimate and Zone of Influence

The Dupuit equation for steady flow to a linear flow for both sides of an excavation through an unconfined aquifer resting on a horizontal impervious surface was used to obtain a dewatering rate It is expressed as follows:

$$Q_w = xK(H^2 - h^2)/\mathrm{Lo}$$

Where:

Q_w = Rate of pumping (m3/sec)
x = Length of excavation in m
K = Hydraulic conductivity (m/sec)
H = Head beyond the influence of pumping (static groundwater elevation) (m)
h = Head above base of aquifer at the excavation (m)
L_o = Distance of Influence (m)

It is expected that the initial dewatering rate will be higher to remove stored groundwater from within the overburden formation. The dewatering rates are expected to decrease once the target water level is achieved in the excavation footprint as groundwater will have been removed, primarily from storage resulting in lower seepage rates into the excavation.

5.3 Radius of Influence

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

The estimated radius of influence (R_o) of pumping based on the Sichardt formula is described as follows:

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

Where:

R_o = Estimated radius of influence (m)
H = Hydraulic head in aquifer (static water level or saturated depth (m)
h = Dynamic water level (m)
K = Hydraulic conductivity (m/sec)
C = Constant (3000)

Based on Sichardt's formula and the highest K-value, the calculated maximum theoretical zone of influence (L_o = Ro/2) would be approximately 22 m from the sides of the excavation and the radius of ZOI (R_o) is approximately 45 m (50 m rounded) for the servicing installations. Since the maximum anticipated ZOI is approximately 45 m (50 m rounded), the proposed monitoring and mitigation plan will apply within 50 m of dewatering system.

The radius of influence calculations are provided in Appendix I.

5.4 Rainfall

Additional pumping capacity may be required to maintain dry conditions within the excavation during and following significant precipitation events. Therefore, the dewatering rates at the Site should also include removing direct input of rain water into the excavation.

A 15 mm precipitation event was utilized for the estimate. This estimate corresponds to a two (2) year storm with a duration of 15 min. Given that the total area of the excavation for servicing is 150 m^2 (30 m x 5 m) for, the estimated volume of direct precipitation to be collected in the excavations is 2.3 m^3 for a 15-mm precipitation event. The calculations for the water volume estimate from rainfall is included in Appendix I.

It is noted that a two (2) year storm event over a 24-hour period is approximately 57.8 mm. During such events, the water should be retained onsite to not exceed the allowable water taking and discharge limits, as necessary.

5.5 Estimated Construction Dewatering Rates

Based on the assumptions provided in this report, the results of the dewatering rate estimate are summarized in Table 6-2 as follows:

Table 6-2 Summary of Construction Dewatering Rates

Extent of servicing trench	Peak Dewatering Rate			Notes
	Dewatering Flow Rate Without Safety Factor (including rainwater collection) (m^3/day)	Rainfall (15 mm precipitation event) (m^3/day)	Dewatering Flow Rate With Safety Factor (including rainwater collection) (m^3/day)	
400 x 10 m Assumed area two dewatering manifolds of ~200 m long each will be operated simultaneously for servicing segments for trench opening at any given time along Private Roads	565	2.3	1,130 (rounded)	The estimated dewatering flow is based on highest K value for Gravely Sand, Sand and Silt layer.

Preliminary construction dewatering rates for each option are provided in Appendix I. The calculations of the water volumes from precipitation are also included in Appendix I.

The maximum flow estimate is based on a highest measurement of the bulk hydraulic conductivity, and as such it provides conservative construction dewatering rate evaluation. These peak dewatering flow rates include a factor of safety of 2. The dewatering volumes estimated for construction dewatering should be considered as potential peak volumes and will likely decline over time. This peak dewatering flow rate also provides additional capacity for the dewatering contractor.

The actual dewatering volumes will vary over time subject to reaching steady state conditions, accumulation of precipitation, seasonal fluctuations in the groundwater table, flow from bedding materials of existing sewers, variation in hydrogeological properties beyond those encountered during previous investigations, and construction sequence.

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

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

To prevent trench bedding acting as preferential pathway for groundwater flow at the Site the use of 'trench plugs' in the granular around the pipe should be considered. Where the granular bedding is below water table, the typical spacing between the 'trench plugs' should be approximately 100 m along the full length of the trench.

5.6 Construction MECP Water Taking Permit Alteration

In accordance with the Ontario Water Resources Act, if the water taking for the construction dewatering will be more than 50 m^3/day but less than 400 m^3/day, then an online registration in the Environmental Activity and Sector Registry (EASR) with MECP is required. If groundwater dewatering rates exceed 400 m^3/day, a Category 3 PTTW would be required from the MECP.

Since the expected dewatering rates can reach to approximately 1,130,400 L/day, a PTTW 4788-C2ZKMP was obtained from MECP to facilitate the construction dewatering program for the proposed development on May 14, 2021 (Appendix H).

The construction dewatering rates include the anticipated groundwater control needs and additional capacity to address precipitation events.

Based on the assumptions and analysis provided in this assessment, the alteration to Table A of the PTTW is presented in Table 6-3 as follows:

Table 6-3: Table A –Authorized Water Takings PTTW 4788-C2ZKMP for 750 Mapleview Drive East

	Source Name / description:	Source Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hours Taken per day:	Max. Taken per Day (litres):	Max. No. of Days Taken per Year:	Zone Easting/ Northing:
9	Servicing 7 - well points	Well Sand Point	Construction	Dewatering Construction	785	24	1,130,400	365	17T 609869 / 4911738

As per PTTW conditions and since the theoretical ZOI is anticipated to be significantly smaller than for the 700 Mapleview Drive East site, the current PTTW Monitoring, Contingency and Mitigation Plan will continue for 750 Mapleview Drive East Site.

6. Predicted Impacts

Based on the findings of this report, an assessment of potential impacts of the proposed development is provided below.

6.1 Surface Water Resources

The dewatering system is designed to temporarily lower the water table and maintain relatively dry stable soil conditions in the completed excavation prior construction. The dewatering process designed to limit drawdown in areas away from the pumping system. The anticipated maximum theoretical zone of influence (ZOI) was calculated to be approximately 22 m from the sides of the excavation.

The Site is located within the Lake Simcoe drainage basin and the Lake Simcoe Watershed.

Hewitt's Creek is located approximately 210 m east of the Site and flows north towards Lake Simcoe. Lake Simcoe is located approximately 2.2 km north of the Site. Due to the limited extent of zone of influence and the wide distance to the nearest surface water feature, no detrimental impacts on surface water features are expected during construction activities.

It is anticipated that the typical dewatering system will operate at maximum of 400 m length at any time (Appendix I). As such, the anticipated typical dewatering volume will be approximately 1,130 m^3/day (0.013 m^3/s) (rounded) including precipitation (15 mm). It should be noted that since the predicted radius of ZOI from dewatering system from all sides of excavation can reach up to 45 m, the proposed monitoring and mitigation plan will apply within 50 m of dewatering system.

Based on historical information available from the Lake Simcoe Region Conservation Authority (LSRCA) data portal for river levels at the Hewitt's Creek Camelot Sq. surface water monitoring station (LSO202), the calculated river flow is reportedly 1.91 m^3/s or 165,024 m^3/day (January 2018). The long-term river data available suggests that Hewitt's Creek is a perennial stream, as observed between July 2009 and January 2018 (LSRCA data portal).

The flood plain information provided by Schaeffers Consulting Engineers further suggests that the 2-year flows in the Hewitt's Creek reach within the site area is approximately 7.4 m^3/s or 639,360 m^3/day.

Considering all information available for this part of the Hewitt's Creek, it is reasonable to assume that the 1/3 of the river flow is a baseflow. Therefore, the baseflow in the Creek is assumed to vary between approximately 0.64 and 2.47 m^3/s or 55,000 and 213,120 m^3/day. As such, the maximum construction dewatering rate of 0.013 m^3/s or 1,130 m^3/day, which is also approximately 0.2 % of 2-year Creek flow, will result in approximately 0.5 to 2.1% of the potential Creek's baseflow. Since this range is well within 0-5% of variance limitations for flooding and erosion assessments for the watershed analysis studies, no negative impacts are predicted to Hewitt's Creek as a results of construction dewatering.

In accordance with conditions of the Category 3 PTTW issued by MECP, the monitoring, mitigation and contingency plan including monitoring frequencies, triggers for mitigation and contingency measures (Section 7 of this report) will be implemented prior, during and after active construction dewatering on site. The Plan includes but not limited to the quality and quantity controls for groundwater and surface water, the quality and quantity controls at each discharge location, and erosion control and turbidity inspection at each point of discharge. Figure 8 presents the proposed discharge and monitoring location plan.

6.2 Groundwater Resources

According to the MECP Water Well Records database, there are approximately seventeen (17) water supply wells within 500 meters of the Site. One (1) is reported on site as domestic water supply well. The off-site wells include fourteen (14) domestic water supply wells, one (1) industrial water supply well, and one (1) commercial water supply well.

Although, most of the area adjacent to the Site is anticipated to be serviced with municipal water and sewer systems, there is a potential for some interference with wells used for domestic water supply during dewatering program. Based on baseline water well survey (September 11, 2017) and confirmatory water well inventory (October 5, 2018) results, seven (7) well owners agreed to participate in the monitoring program and one (1) rejected the opportunity. Among those, four (4) well owners are within 500 m from 750 Mapleview Site boundary. These private wells were added to the proposed monitoring program.

From those four wells, two (2) are bored / dug wells and two (2) are drilled wells as per well information provided by well owners. These wells are completed at depths varying between 6.10 and 18.19 m. At the time of well survey, the water levels measured in wells, where accessible, ranged between 2.13 and 3.66 mbgs.

Given that the estimated hydraulic conductivity of the geological strata to a depth of approximately 8 m in the area surrounding the Site is moderate, the dewatering related impacts are anticipated to be restricted to a limited area. Overall, no change in the general direction of groundwater flow at the Site is expected as a result of groundwater control and depressurization activities during construction.

As requested, additional monitoring wells were installed around the perimeter of the site during supplemental geotechnical and hydrogeological investigations to further assess the shallow groundwater system. Monitoring, mitigation and contingency plans have been approved by MECP and form conditions of the Category 3 PTTW (PTTW 4788-C2ZKMP) and is presented in Section 7 of this report. As required by conditions of PTTW 4788-C2ZKMP, the monitoring and mitigation plan will be implemented prior, during and after construction within 50 m of dewatering activities. If the monitoring demonstrates that the Zone of Influence is larger than predicted, the monitoring and mitigation plans will be extended to 100 m beyond the dewatering system.

To prevent trench bedding acting as preferential pathway for groundwater flow at the Site the use of ‘trench plugs’ in the granular around the pipe should be considered. Where the granular bedding is below water table, the typical spacing between the ‘trench plugs’ should be approximately 100 m along the full length of the trench.

6.3 Aquifer and Recharge Areas

The MECP and LSRCA has mapped aquifer and groundwater recharge areas (SGRA) and highly vulnerable aquifer (HVA) areas within the City of Barrie limits (Appendix J). Reportedly, the identified highly vulnerable aquifer areas (HVA) are located along western and central limits of the Site. Considering the artesian conditions encountered in shallow groundwater system across the majority of the site, the groundwater rechange areas have very limited extend. Thus, it is unlikely that short-term dewatering related impacts are expected on the recharge areas within the Site area.

Furthermore, the pre-development levels of infiltration within a site with a high-water table conditions that occur within this property where groundwater is observed close or at ground surface is difficult to achieve. The infiltration in such conditions (high water table) is negligible. Some solutions to minimize the potential for adverse impacts on downgradient surface and groundwater resources and encourage the interflow across the site were examined. These include raising final grades (up to 1 m) over portions of the site in order to minimize or completely eliminate the interference with the shallow groundwater system across the site. As noted, infiltration within an area with a high groundwater table is negligent; therefore, the LSPP

policies regarding significant recharge areas are not applicable due to high groundwater table and artesian conditions encountered on site.

To mitigate the infiltration deficit in post development scenario, the best effort approach to mimic natural existing outlets will be adapted across the entire Site to protect the adjacent wetlands and Hewitt's Creek. This approach includes but not limited to implementing slab on grade development to allow shallow groundwater to continue to flow across the site; to filtering and detaining stormwater; to harvesting rainwater and redirecting the rear roof areas to rear yards; to implementing such LIDs as bioswales in areas with low groundwater table to encourage interflow; to outleting some of the stormwater towards adjacent wetlands to mimic the pre-development conditions.

6.4 Identification of Vulnerable Areas

The Site is within the South Georgian Bay-Lake Simcoe Source Protection Region and the Lake Simcoe and Couchiching / Black River Source Protection Area (SPP). Based on LSRCA and MECP mapping available, the majority of Site are located within a Highly Vulnerable Aquifer (HVA) area with intrinsic vulnerability score of 6 (Appendix J). The north and west portions of the Site are located within intake protection zone 3 (IPZ-3) with vulnerability score of 5.6 (Figure 8b-2, SPP).

6.5 Geotechnical Considerations

As per the MECP technical requirement for PTTW and EASRs, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required. The water taking should not have unacceptable interference on soils and underground structures (foundations, utilities, etc.).

A letter related to geotechnical issues as it pertains to the Site is required to be completed under a separate cover.

6.6 Point of Discharge

It is our understanding that the potential discharge from the dewatering system during the construction will be directed to the environment. As such, the quality of groundwater discharge will have to conform to the applicable Provincial Water Quality Objectives (PWQO) and / or City of Barrie Sewer Use By-Law standards.

It is anticipated that levels of TSS and associated metals in the pumped groundwater may become elevated and may exceed the PWQO / By-Law limits. During construction, a treatment system, such as decantation tanks or any other applicable treatment system, will likely be required to lower sediment contents in the dewatered water. Prior discharge, the written approval to discharge the groundwater must be obtained from applicable agencies.

The specifications of the treatment system will need to be adjusted to the water quality by the treatment specialist/process engineer.

It should be noted that during construction dewatering, the mitigation measures to support function of existing wetlands is proposed. The details are provided on LSRCA approved erosion and sediment control plans include installation of double silt fence within development limits with straw bales in-between and a perforated discharge pipe on the top. This allows to redirect and disperse equally the discharge water to the wetlands after the treatment (sediment tank, silt fence and straw bales) and will help to minimize any potential impact to adjacent wetlands due to temporary construction dewatering activities.

6.8 Quality Control and Conservation

To determine whether the discharge meets the required standards and the effects of the dewatering are not widespread, a monitoring program is recommended in sections below. This should include both water quality and water level monitoring for discharge and groundwater. If the monitoring wells constructed as a part of this investigation remain functional, they can be used for the water level monitoring purposes. The monitoring will confirm the water quality compliance with applicable standards, the zone of influence from the dewatering system, assist in documenting changes over the time and help to evaluate whether any changes are result of construction dewatering. In the event that the water quality of discharge does not comply with applicable PWQO and /or Sewer Use By-Law standards, the collected groundwater must be treated prior discharge.

Based on groundwater testing completed for the shallow groundwater system, the baseline sampling results indicated some elevated levels of Dissolved Cobalt (Co) and Dissolved Sodium (Na). During construction, this is being achieved through on-site sedimentation ponds, further sedimentation within enviro tanks and filtration of the effluent through filter bags (envirobags), sand filters as conditions warrant, double-row sediment fencing around the site perimeter, and broad dispersal of treated discharge through vegetated areas downgradient of the development area; those measures will ensure phosphorus levels in Hewitt's Creek are not impacted, with daily turbidity monitoring during any periods of groundwater or surface water pumping to provide evidence of the success of such measures, and a feedback mechanism should any improvements be required.

For discharge to be directed to the natural environment, the turbidity of the effluent should be below 8 NTU within 30 m of surface water body and Total Suspended Solids (TSS) below 25 mg/L. Therefore, the continuous monitoring of TSS and turbidity of the discharge is recommended during construction dewatering.

It is recommended that the discharge plan be maintained on site accompanied by the hydrogeological reports and PTTW for the entire duration of construction dewatering. It is noted that a permit to discharge from the LSRCA and/or City of Barrie will be required prior to discharging dewatering effluent.

Figure 8 presents the proposed Discharge Location and Monitoring Location Plan.

6.9 Potential Contaminant Sources and Transport

The construction dewatering should have no effect on the potential for contaminant transport. Situations whereby the dewatering or drainage systems might collect contaminated water include cases where a potential contaminant is already in the groundwater and within the dewatering 'capture zone' (i.e. within ZOI = 45 m of the excavation during construction dewatering). Therefore, only contaminant sources close to the area of influence for the dewatering system represent a potential source.

6.10 Well Decommissioning

In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use. It is noted that due to the artesian conditions on site, additional precautions are required for proper decommissioning of wells.

7. Monitoring Program

For the construction dewatering, monitoring and mitigation program must be implemented prior, during and after construction. This will include both water quality and water quantity monitoring. The monitoring will confirm the zone of influence from the dewatering system, assist in documenting changes over the time and help to evaluate whether any changes are a result of construction dewatering.

The confirmatory water well survey for all properties within 500 m zone was carried out by EXP on October 5, 2018. The results of this confirmatory survey are added to the baseline groundwater conditions. During construction, the monitoring of water levels and water quality will be conducted on all wells within 500 m of the site. If the monitoring wells constructed as a part of this and previous investigations remain functional, they can be used for water level monitoring purposes. Post construction monitoring of water levels and groundwater quality will be conducted again about 1 month after construction dewatering is completed. The monitoring results will be compiled and presented in a summary report that documents the work done, the results, any interference complaints and the mitigation completed.

It is also recommended that the quality of groundwater from dewatering system be monitored for suspended solids, metals and inorganic parameters listed in PWQO, once weekly for the first month of construction dewatering. If the results demonstrate that groundwater consistently meets the applicable standards, the monitoring frequency can be reduced to monthly thereafter.

During the construction dewatering, all discharges after the treatment will be directed to the discharge perforated pipe located inside the double fence structure surrounding the entire construction zone. This mitigation measure will facilitate infiltration, dissipate energy and provide equal distribution of groundwater effluent to mitigate any potential impacts to the wetland features and Hewitt's Creek.

The dewatering pump will operate on a maximum length of 400 m of the Dewatering System at any given time.

Figure 8 shows the proposed water taking sources, discharge locations and monitoring locations

Table 8-1 below presents the monitoring, mitigation and contingency plan including monitoring frequencies, triggers for mitigation and contingency measures. This monitoring program is a condition in PTTW No. 4788-C2ZKMP.

Table 7-1: Recommended Monitoring, Mitigation and Contingency Plan

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
WATER LEVELS AND PUMPING RATES / VOLUMES					
Pre-Construction	Neighboring private wells (if permitted to enter) within 300 m of dewatering system location.	Daily water level monitoring for 5 days before construction dewatering begins.	Manual / Data logger	None	Baseline monitoring and condition survey of private wells prior to construction (completed) and additional confirmatory private well survey (completed October 2018)

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
	On-site monitoring wells or replacements / new monitoring wells	Daily for one week before construction dewatering begins at all available wells within 50 m of dewatering system location.	Manual	None	To develop baseline water level hydrographs (completed)
	One Surface water monitoring station #2 (one staff gauge) – Figure 8	Daily for one week before construction dewatering begins within 300 m of dewatering system location.	Manual / Data logger	None	To develop baseline water level hydrograph (completed)
During Construction	Neighboring private wells within 300 m of dewatering system location.	Weekly water level monitoring during construction dewatering	Manual / Data logger	Owner claim or complaint of interference	Investigate complaint if interference deemed a result of dewatering. If lowering of the static water level or change in water quality noted in a local private drinking water supply well, the water level measurements frequency will be increased to daily and a groundwater sample will be collected and analyzed for comparison with baseline conditions. Provide alternative drinking water supplies to impacted well owners until such time as the dewatering activities have been completed and monitoring confirms that the water level in the well has returned to static conditions.

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
	On-site monitoring wells or replacements / new monitoring wells	Daily during active construction dewatering within 300 m of dewatering system location.	Manual / Data logger	Water levels approaching 3 m of drawdown at distance of 300 m away of active dewatering system location.	Should drawdown of 3 m attributable to the on-site dewatering be noted at on-site well located 300 m away of active dewatering system location, more frequent monitoring will be considered, and mitigation will include reduced pumping. Water level recorders will be downloaded weekly and the pattern of water level fluctuations compared against the records of dewatering and surface water flows
	Discharge volume at each point of discharge (Figure 8)	Daily	Manual with totalizing flow meter in-line.	Flow approaches PTTW limits	Reduce discharge to maintain flow below PTTW limit
	Surface water monitoring station #2	Daily visual inspection during active construction dewatering within 300 m of dewatering system location.	Visual observations to monitor surface water depth and stream flow conditions	Significant water level drop observed Flooding observed during severe precipitation evens	Treated discharge water will be returned to creek if significant water level drop is observed In the event excess water due to unusual storm events and/or higher than expected groundwater inflow causes flooding to the creek, use of additional erosion controls including third raw silt fence and straw bales in the area between the excavation and the creek will be increased to prevent turbid water from entering the watercourse. In the event of significant flooding, the dewatering will temporarily stop until the flooding issue is resolved. If sediment discharge to the creek is observed, alteration or improvement of the sediment control and water discharge practices is required to ensure

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
					no adverse impacts to the existing creek occur during the construction period. Contingency mitigation measures will include the installation of additional straw bales or silt fences. As another contingency mitigation measure, an additional settlement tank may be brought on-line in the system. In the event dewatering discharge is causing unacceptable impacts to water quality, turbidity or erosion of the watercourse, mitigation actions will be triggered to improve the sediment control systems an will include increased frequency of maintenance activities such as clean out of the sumps and sediment control tanks and the repair of berms or ditches to control surface water runoff into the excavation, and/or provide alternate overland flow routes to the creek to prevent erosion.
During Construction	On-site Wetland Areas downgradient from proposed development within 300 m of dewatering system location	Daily visual inspection during active construction dewatering within 300 m of dewatering system location.	Visual observations to monitor surface water depth and flow conditions	Significant water level drop observed Flooding observed during severe precipitation evens	Treated discharge water will be returned to wetlands through energy dissipation of discharge effluent in perforated discharge pipe inside the double raw silt fence and straw bales In the event excess water due to unusual storm events and/or higher than expected groundwater inflow will cause flooding to the wetland area, use of additional erosion controls including third raw silt fence and straw bales in the area between the excavation and the wetland will be increased to prevent turbid water from entering the wetland. In the event of significant flooding, the dewatering will temporarily stop until the flooding issue is resolved. In the event dewatering discharge is causing unacceptable impacts to water quality, turbidity or erosion of the

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
					wetland, mitigation actions will be triggered to improve the sediment control systems an will include increased frequency of maintenance activities such as clean out of the sumps and sediment control tanks and the repair of berms or ditches to control surface water runoff into the excavation, and/or provide alternate overland flow routes to the creek to prevent erosion.
Post Construction	Neighboring private wells within 300 m of dewatering system location.	Once at one month after construction dewatering is completed.	Manual	Water levels do not recover to 80% baseline levels.	If an impact attributable to the dewatering is detected post construction, a modified monitoring program will continue until impacts no longer deemed significant.
	On-site monitoring wells or replacements / new monitoring wells	Once about one month after construction dewatering ends within 300 m of dewatering system location.	Manual	Water levels do not recover to within 80% of expected post construction static levels.	If an impact attributable to the dewatering is detected post construction, a modified monitoring program will continue until impacts no longer deemed significant.
WATER QUALITY					
During Construction	Neighboring private wells within 300 m of dewatering system location.	One Sample - once at start of dewatering at each private well (if permitted) and bi-monthly thereafter until	Sample analyzed for parameters listed In ODWS standards	Owner claim or complaint of interference	In the event that results exceed applicable standards, confirmatory monitoring will be done.

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
		dewatering is ceased.			
	Discharge from dewatering to construct SWM pond directed to environment (overland) 30 m away from the watercourse	Two Confirmatory Samples: -one sample after onsite treatment is set up and -one sample before dewatering starts (or before any batch discharge); -daily for the first week of dewatering; -weekly for the remainder of the dewatering at that location, if water quality is suitable and stable.	Discharge analyzed for parameters listed in PWQO standards To establish TSS/turbidity correlation To confirm to PWQO standards prior redirecting discharge to the creek and / or wetland	Discharge quality exceeds PWQO standards. TSS guideline is 25 mg/L or a correlated Turbidity level	In the event that results exceed applicable standards, confirmatory monitoring will be done. Additional treatment will be considered and implemented depending on the water quality testing results (e.g. additional filtration to reduce TSS/turbidity do acceptable levels)
	Discharge from dewatering (servicing) - monitoring station #1 SWMP outlet and sediment tank	One Sample - once at start of dewatering at each point of discharge (or before any batch discharge);	Discharge analyzed for parameters listed in PWQO standards To establish TSS/turbidity correlation	Discharge quality exceeds PWQO standards. TSS guideline is 25 mg/L or a correlated	In the event that results exceed PWQO, confirmatory monitoring will be done, and additional treatment will be considered (e.g. additional filtration to reduce TSS/turbidity do acceptable levels). Frequency of maintenance activities will be increased such as clean out of the sumps and sediment control tanks and the repair of berms or ditches to control

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
		-daily for the first week of dewatering; -weekly for the remainder of the dewatering at that location, if water quality is suitable and stable.	To confirm to PWQO standards prior redirecting discharge towards the creek and / or wetland	Turbidity level	surface water runoff into the excavation, and/or provide alternate overland flow routes to the creek to prevent erosion.
	Discharge inspection at each point of discharge	Daily inspections for duration of active construction dewatering at this location including photographic record of discharge effluent.	Visual observations for presence of sheen and odour in dewatering effluent	Sheen and / or odour observed	In the event of observed sheen and /or odour, collect one water sample for analysis of VOC and BTEX If results exceed applicable standards, treatment will be considered and implemented depending on the water quality testing results.
	Erosion control, flooding and turbidity inspection at each point of discharge	Daily for the first week of dewatering	Field monitoring of TSS/turbidity to establish correlation between on-site and laboratory TSS and turbidity.	TSS/turbidity level approaches 25 mg/L	Enhance filtration / sedimentation measures to maintain TSS/turbidity levels below limit. Frequency of maintenance activities will be increased such as clean out of the sumps and sediment control tanks and the repair of berms or ditches to control surface water runoff into the excavation, and/or provide alternate overland flow routes to the creek to prevent erosion.
		Daily for the remainder of the dewatering at that location.	Field monitoring of turbidity	Site specific Turbidity Level established from correlation	In the event that turbidity results exceed TSS/Turbidity correlation, increase monitoring frequency to twice a day and enhance filtration / sedimentation measures.

Period	Monitoring Location	Monitoring Frequency	Method	Triggers for Mitigation	Mitigation/Contingency
				between on-site and laboratory analysis of TSS and turbidity. TSS guideline is 25 mg/L or a correlated Turbidity level	In the event dewatering discharge is causing unacceptable impacts to water quality, turbidity or erosion, mitigation actions will be triggered to improve the sediment control systems an will include increased frequency of maintenance activities such as clean out of the sumps and sediment control tanks and the repair of berms or ditches to control surface water runoff into the excavation, and/or provide alternate overland flow routes to the creek to prevent erosion. Additional treatment will be considered and evaluated depending on the results (e.g. additional filtration to reduce TSS/turbidity do acceptable levels).

8. Conclusions and Recommendations

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

- The Site is a part of Lake Simcoe Basin (Hewitt's Creek Subwatershed), which is located in the physiographic region known as Peterborough Drumlin Field (Chapman and Putnam, 2007).
- Thickness of overburden sediments in the area has been mapped to be between 127 and 134 m (MNR, 2012).
- Hewitt's Creek is located approximately 210 m east of the Site and flows north towards Lake Simcoe. Lake Simcoe is located approximately 2.2 km north of the Site. Due to the limited extent of zone of influence and the wide distance to the nearest surface water feature, no detrimental impacts on surface water features are expected during construction activities.
- The results of the on-going water level monitoring (June 3, 2020 to June 25, 2021) suggest that the highest groundwater elevation of 249.16 masl (1.81 mbgs) was observed in BH/MW-1, as measured on April 1, 2021. The lowest groundwater elevation of 247.12 masl (2.26 mbgs) was observed in BH/MW-6, as measured on June 30, July 3, and November 30, 2020. As anticipated, the highest water levels occurring during the spring to early summer periods.
- The inferred direction of shallow groundwater flow across the Site is interpreted to be north-easterly, towards Hewitt's Creek and Lake Simcoe.
- The main overburden soil type encountered during drilling was surficial topsoil or fill, over a local peat layer, over native deposits of silty sand till, sand, silty fine sand and silty clay.
- The highest estimated hydraulic conductivity for the shallow sand and silt layer is approximately 8.8×10^{-6} m/s, with a geometric mean of 6.7×10^{-6} m/s.
- Based on water balance assessment for the Site there will be an infiltration deficit in post-development. To mitigate the infiltration deficit of approximately 1,197 m^3/yr, which is approximately 9.5% of total precipitation, in post-development conditions, the best effort approach to mimic natural existing outlets will be adapted across the entire Site to protect the adjacent wetland.
- The area of LID (feasible LIDs) that is required to offset the water balance deficit of 1,197 m^3/yr is approximately 195 m^2 with a storage of 37.4 m^3/week.
- The long-term mitigation to replicate existing conditions and to mitigate the infiltration deficit include but not limited to:
    - Completing slab on grade development to allow shallow groundwater movement beneath the site;
    - Harvesting of rainwater and redirecting rear roof areas to rear yards;
    - Filtering and detaining stormwater through SWM facilities;
    - Increasing final grades by raising the majority of the Site up to 1 m to minimize / eliminate the interference, if any, with localized artesian conditions in the shallow groundwater system.
- The depressurization, construction dewatering and groundwater control will be required for servicing installations.
- During the construction dewatering, all discharges after the treatment will be directed to the discharge perforated pipe located inside the double fence structure surrounding the entire construction zone. This mitigation measure will facilitate infiltration, dissipate energy and provide equal distribution of groundwater effluent to mitigate any potential impacts to the wetland features and Hewitt's Creek.

- It is expected that majority of the proposed construction at the Site involves excavation to depths below ground water table for servicing installation. Additionally, depressurization of underlying permeable soil deposits will be required where base of excavations is unstable due to underlying hydrostatic pressures. It is anticipated that the construction of different portions of the site will be completed simultaneously. The maximum predicted water takings for the construction dewatering can reach up to 1,130 m^3/day. Thus, PTTW 4788-C2ZKMP is obtained from MECP on May 14, 2021 to facilitate the construction dewatering program for the proposed development.
- The temporary and localized construction dewatering activities (short-term) are not expected to have an effect on any of the potential receptors including surrounding residential wells, surface water features and existing residential development surrounding the Site.
- No change in regional groundwater flow direction is anticipated and groundwater flows will sustain across the site towards the Hewitt's Creek valley land through the shallow water bearing system (long-term).
- To ensure that discharge meets the required standards and the effects of the dewatering are not widespread, both water quantity and water quality of surface and groundwater must be documented and monitored during the pre-construction, construction and post-construction periods.
- A monitoring and mitigation plan is presented. The monitoring will confirm the zone of influence from the dewatering system(s), assist in documenting changes over the time and help to evaluate whether any changes are a result of construction dewatering. Monitoring of the daily pumping volumes at each water taking source is a standard condition on the PTTW.
- As per the MECP technical requirement for PTTW, the geotechnical assessment of the stability of the soils due to water taking (ex: settlement, soil loss, subsidence, etc.) is required.
- To prevent trench bedding acting as preferential pathway for groundwater flow at the Site the use of 'trench plugs' in the granular around the pipe should be considered. Where the granular bedding is below water table, the typical spacing between the 'trench plugs' should be approximately 100 m along the full length of the trench.
- In conformance with Regulation 903 of the Ontario Water Resources Act, the installation and eventual decommissioning of any dewatering system wells or monitoring wells must be completed by a licensed well contractor. This will be required for all wells that are no longer in use.

It should be noted that these conclusions and recommendations should be read in conjunction with the entirety of the report and are based on the assumption that the present design concept described throughout the report will proceed to construction. Any changes to the design concept may result in a modification to the recommendations provided in this report.

9. Limitations

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

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

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

Sincerely,

EXP Services Inc.

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Senior Hydrogeologist
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EXP (March 28, 2019) Draft Geotechnical Investigation, Proposed Hewitt's Creek Crossing 700 Mapleview Drive East, City of Barrie, Ontario.

EXP (June 24, 2019) Supplementary Geotechnical Investigation, Proposed Residential Complex 700 Mapleview Drive East, City of Barrie, Ontario.

EXP (July 29, 2019) Supplemental Hydrogeological Investigation Report, Proposed Development Complex 700 Mapleview Drive East, Barrie, Ontario.

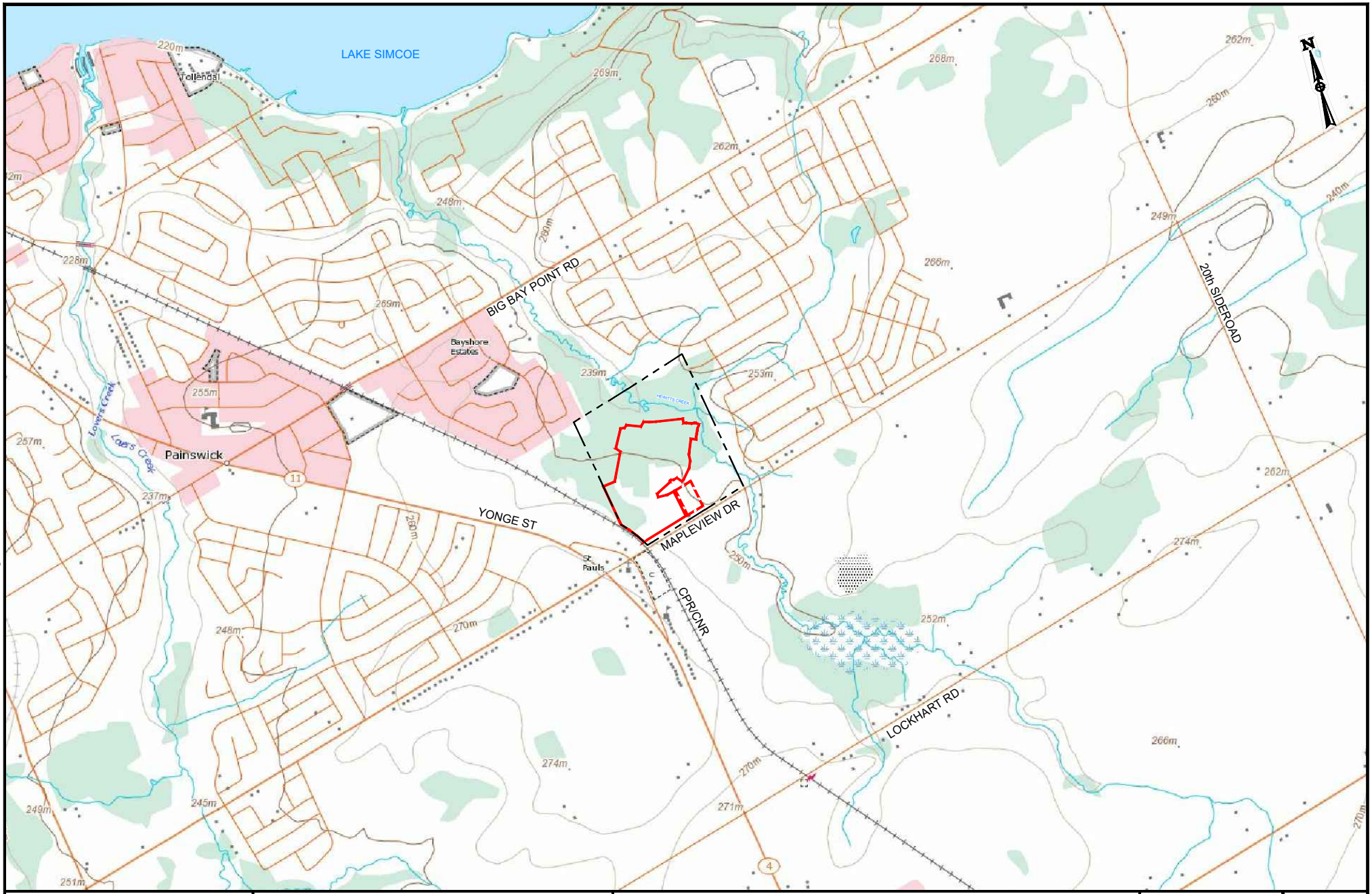
EXP (July 23, 2020) Preliminary Geotechnical Investigation, 750 Mapleview Drive East, Barrie, Ontario.

EXP (February 5, 2021) Phase Two Environmental Site Assessment, 750 Mapleview Drive East, Barrie, Ontario.

EXP (April 23, 2021) Technical Memorandum Permit to Take Water (PTTW) 2312-B4AP29 - permit alteration application Short-Term Dewatering Assessment for Servicing at 750 Mapleview Drive East.

Category 3 Permit To Take Water No. 4788-C2ZKMP.

Figures



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LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SITE BOUNDARY (700 MAPLEVIEW Dr E)
- APPROXIMATE SITE BOUNDARY (750 MAPLEVIEW Dr E)

SCALE

200 0 200 400 600 800 1000m

TITLE AND LOCATION:

SITE LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO.:	DWN.:
BRM-00604678-T0	WG
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
APRIL 2021	1

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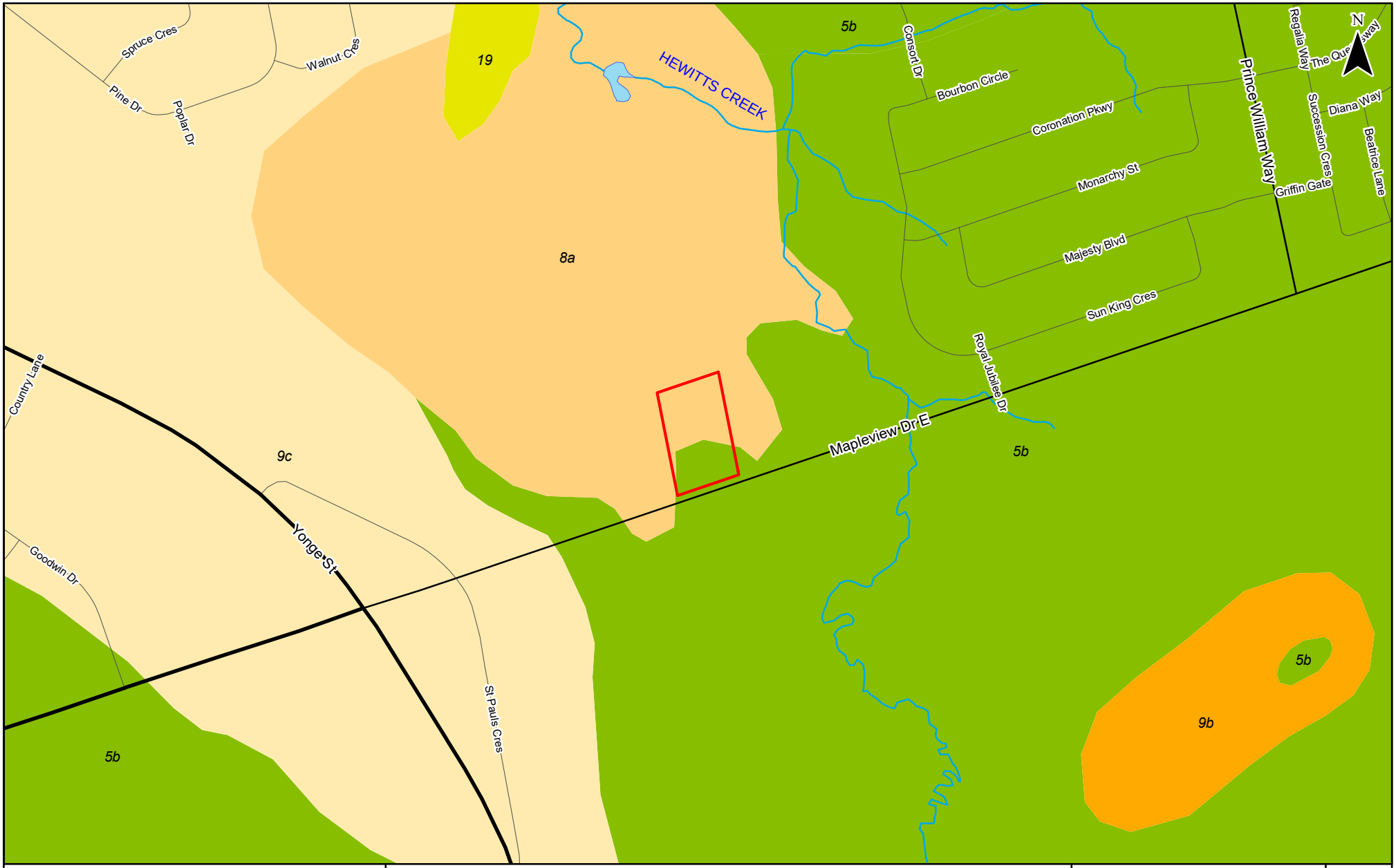


SCALE:

0 100 200 300 400 500 m

SOURCE:

BASED ON ONTARIO GEOLOGICAL SURVEY DATA PUBLISHED IN 2010

exp.

DRAWN BY:	CHECKED BY:
AC	WG

LEGEND:

- APPROXIMATE SITE BOUNDARY
- 19: MODERN ALLUVIAL DEPOSITS
- 9B: COARSE-TEXTURED GLACIOLACUSTRINE DEPOSITS (LITTORAL-FORESHORE DEPOSITS)
- 9C: COARSE-TEXTURED (FORESHORE-BASINAL) GLACIOLACUSTRINE DEPOSITS
- 8A: FINE-TEXTURED GLACIOLACUSTRINE DEPOSITS
- 5B: STONE-POOR, CARBONATE-DERIVED SILTY TO SANDY TILL

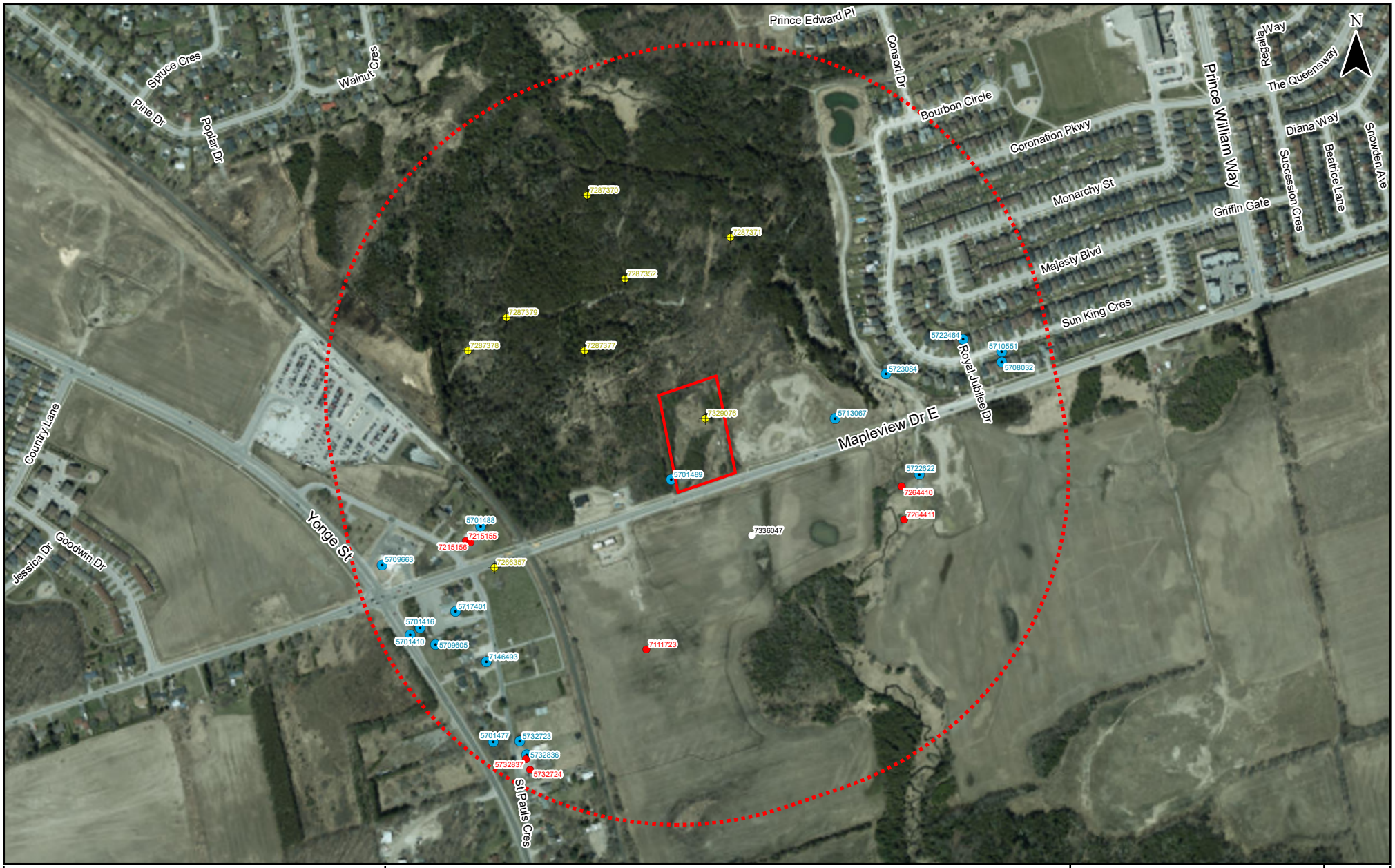
SURFICIAL GEOLOGY

FIGURE: 2

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

PROJECT NUMBER: BRM-00604678-T0

DATE: APRIL 2021



SCALE:

0 70 140 210 280 350 m

SOURCE:

BASED ON GOOGLE EARTH IMAGERY DATED 2018,
AVAILABLE WELL RECORD INFORMATION AS OF SEPTEMBER 2019

exp.

DRAWN BY:	CHECKED BY:
AC	WG

LEGEND:

- MONITORING WELL / TEST HOLE
- WATER SUPPLY WELL
- ABANDONED WELL
- UNCLASSIFIED / UNFINISHED WELL
- APPROXIMATE SITE BOUNDARY
- 500 m ZONE

MECP WATER WELL RECORDS MAP

FIGURE: 3

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST
BARRIE, ONTARIO

PROJECT NUMBER: BRM-00604678-T0

DATE: APRIL 2021

EXP Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SITE BOUNDARY (700 Mapleview Dr E)
- APPROXIMATE SITE BOUNDARY (750 Mapleview Dr E)
- CROSS SECTION A-A' (SEE FIGURE 5)
- BOREHOLE LOCATION (EXP Preliminary Geotechnical Investigation, 2020)
- BOREHOLE LOCATION (EXP Phase II ESA, 2020)
- BOREHOLE / MONITORING WELL LOCATION (EXP Phase II ESA, 2020)

TITLE AND LOCATION:

BOREHOLE / MONITORING WELL LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO.:	DWN.:
BRM-00604678-T0	WG
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
APRIL 2021	4

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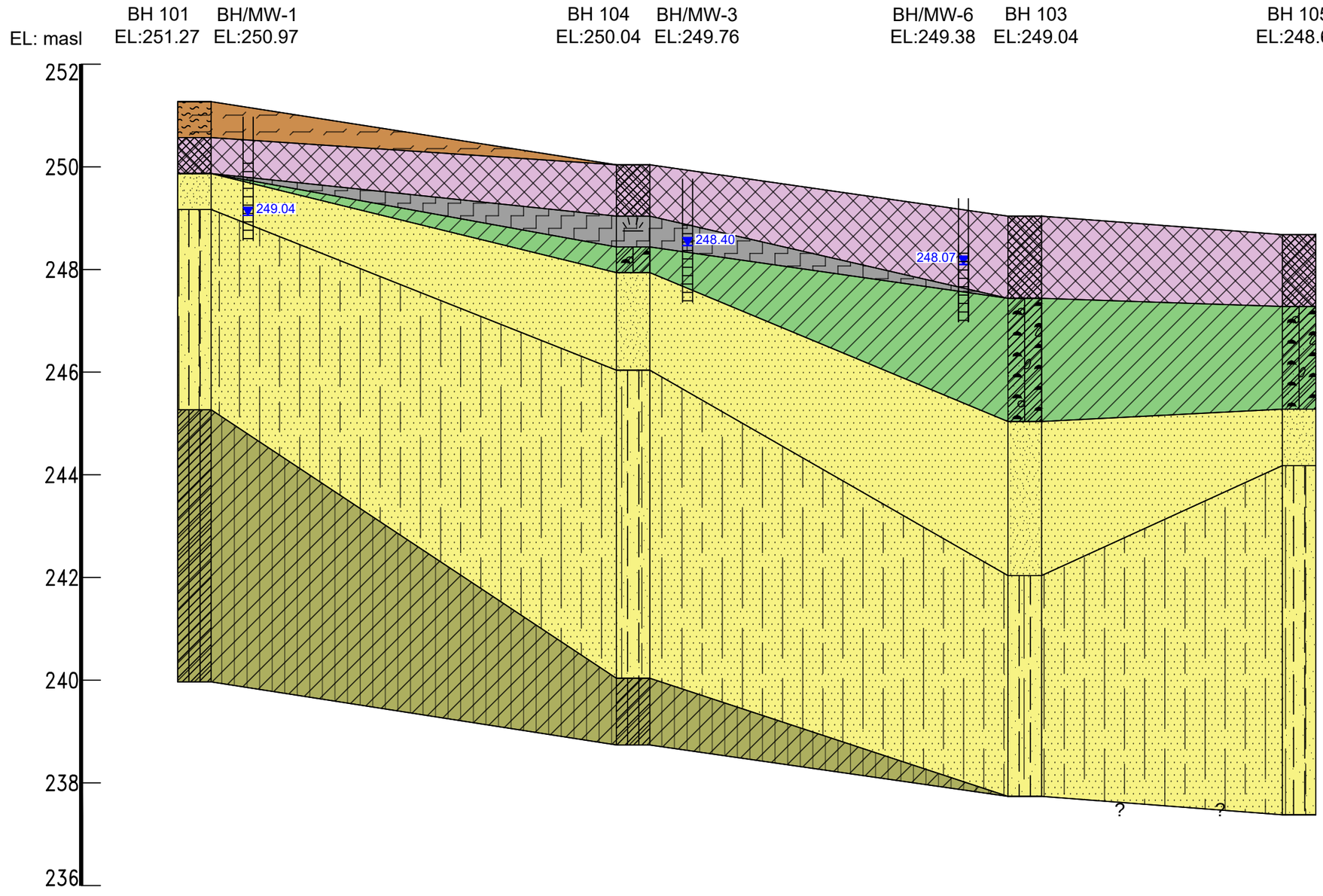
A

SOUTH

A'

NORTH



LEGEND:

- TOPSOIL
- FILL
- PEAT
- TILL
- SAND
- SILTY FINE SAND
- SILTY CLAY
- xx.xx GROUNDWATER LEVEL AS MEASURED ON APRIL 5, 2021

VERTICAL SCALE: AS SHOWN

HORIZONTAL SCALE:

0 10 20 30 40 m

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TITLE AND LOCATION:

CROSS SECTION A-A'

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

JOB NO.:	DRAWN BY:
BRM-00604678-T0	WG
SCALE: AS NOTED	CHECKED BY: NT
DATE: APRIL 2021	FIG NO.: 5

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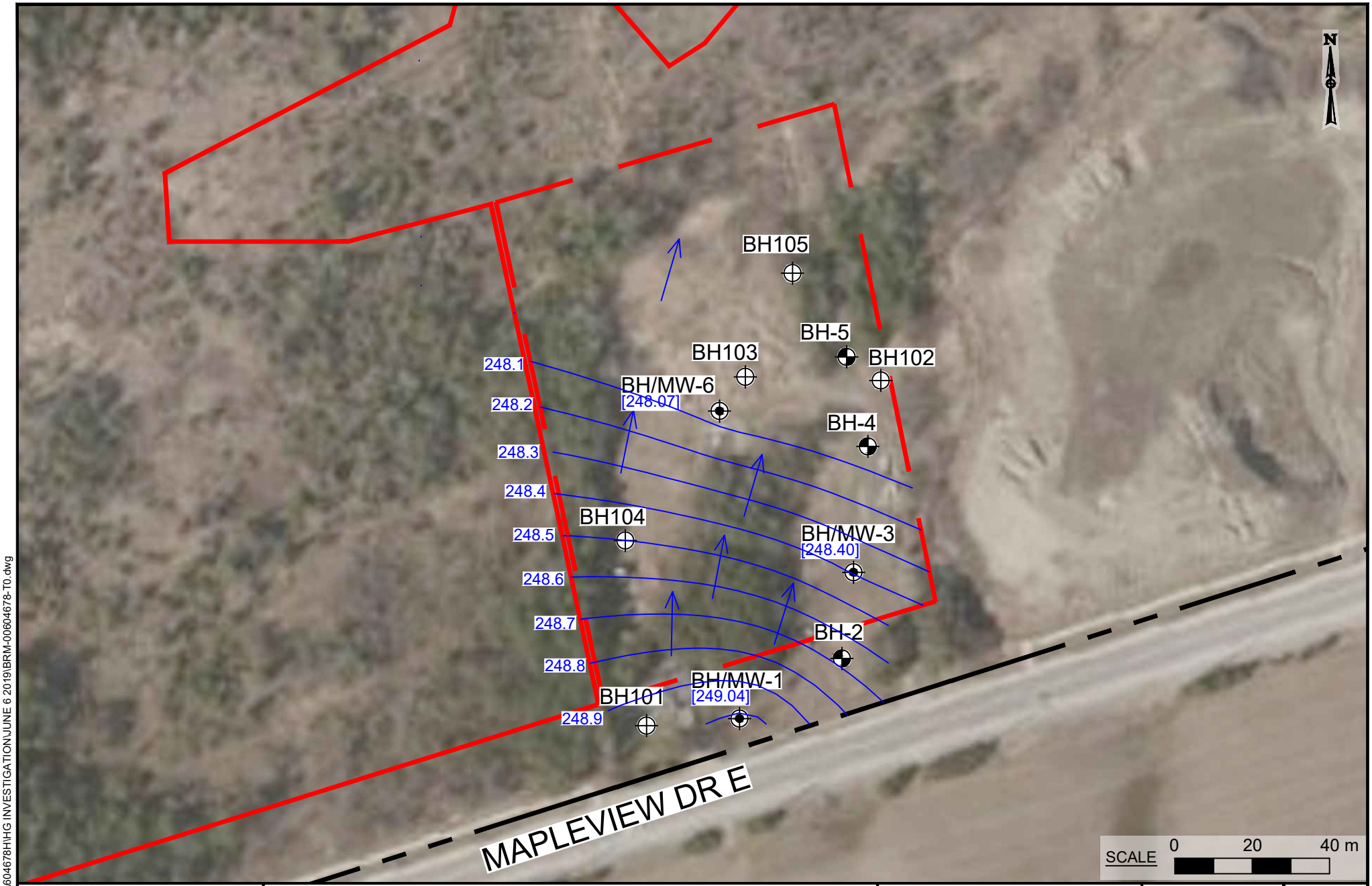

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LEGEND:

- APPROXIMATE PROPERTY BOUNDARY
- APPROXIMATE SITE BOUNDARY (700 Mapleview Dr E)
- APPROXIMATE SITE BOUNDARY (750 Mapleview Dr E)
- BOREHOLE LOCATION (EXP Preliminary Geotechnical Investigation, 2020)
- BOREHOLE LOCATION (EXP Phase II ESA, 2020)
- BOREHOLE / MONITORING WELL LOCATION (EXP Phase II ESA, 2020)
- GROUNDWATER CONTOURS
- [xx.xx] GROUNDWATER ELEVATION AS MEASURED ON APRIL 5, 2021
- GROUNDWATER FLOW DIRECTION

TITLE AND LOCATION:

GROUNDWATER CONTOUR MAP

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO.:	DWN.:
BRM-00604678-T0	WG
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
APRIL 2021	6

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LEGEND:

APPROXIMATE PROPERTY BOUNDARY

APPROXIMATE SITE BOUNDARY

NOTE: THIS DRAWING WAS SOURCED FROM SITE PLAN - DRAWING NUMBER SP100 BY RNDESIGN, SEPTEMBER 2020

TITLE AND LOCATION:

PROPOSED DEVELOPMENT PLAN

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO.:	DWN.:
BRM-00604678-T0	WG
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
JUNE 2021	7

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- WATER TAKING SOURCE
- PROPOSED DISCHARGE MONITORING LOCATION
- DOMESTIC WELL LOCATION (WATER LEVELS AND QUALITY)
- DOMESTIC WELL LOCATION (QUALITY)

TITLE AND LOCATION:

DISCHARGE AND MONITORING LOCATION PLAN

HYDROGEOLOGICAL INVESTIGATION
750 MAPLEVIEW DRIVE EAST,
BARRIE, ONTARIO

PROJECT NO.:	DWN.:
BRM-00604678-T0	AS
SCALE:	CK:
AS NOTED	NT
DATE:	FIG. NO.:
APRIL 2021	8

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Appendix A – MECP WWR Summary Table

On-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE TO SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
1007387942	7329076	8/1/2018	609889	4911763		margin of error : 30 m - 100 m	750 Mapleview Drive East	Barrie	26	Boring	5.3			Monitoring		Monitoring and Test Hole
10379382	5701489	5/9/1967	609838	4911671	255.1	margin of error : 100 m - 300 m			79	Boring	4.9	3.7		Domestic		Water Supply

Off-Site

BORE_HOLE_ID	WELL_ID	DATE	EAST83	NORTH83	ELEVATION (m ASL)	LOCATION ACCURACY	STREET	CITY	DISTANCE TO SITE BOUNDARY (m)	CONSTRUCTION METHOD	WELL DEPTH (m bgs)	WATER FOUND (m bgs)	CASING DIAMETER (cm)	1st USE	2nd USE	FINAL STATUS
10379303	5701410	7/26/1956	609446	4911438	269.2	UTM very unreliable			526	Cable Tool	20.1	16.5		Domestic		Water Supply
10379309	5701416	1/22/1966	609461	4911448	268.4	margin of error : 100 m - 300 m			508	Cable Tool	20.7	20.7		Domestic		Water Supply
10379370	5701477	1/25/1963	609571	4911277	269.7	UTM very unreliable			554	Boring	7.6	5.5		Domestic		Water Supply
10379381	5701488	5/11/1967	609552	4911601	263.0	margin of error : 100 m - 300 m			353	Boring	9.1	5.5		Domestic		Water Supply
10385869	5708032	5/6/1971	610334	4911848	251.9	margin of error : 30 m - 100 m			470	Boring	9.4	8.5		Domestic		Water Supply
10387425	5709605	1/4/1973	609484	4911423	268.6	margin of error : 30 m - 100 m			504	Boring	6.1	5.2		Industrial		Water Supply
10387483	5709663	1/11/1973	609404	4911543	268.1	margin of error : 30 m - 100 m			512	Cable Tool	15.5	10.4		Domestic		Water Supply
10388367	5710551	4/16/1973	610334	4911863	251.8	margin of error : 30 m - 100 m			474	Boring	12.5	9.8		Domestic		Water Supply
10390820	5713067	2/11/1976	610084	4911763	249.5	margin of error : 100 m - 300 m			209	Cable Tool	33.2	29.3		Livestock	Domestic	Water Supply
10395094	5717401	9/8/1980	609514	4911473	266.4	margin of error : 100 m - 300 m			450	Cable Tool	14.0	12.2		Domestic		Water Supply
10400240	5722622	9/15/1987	610210	4911679	249.1	margin of error : 100 m - 300 m			339	Boring	8.5	3.0		Domestic		Water Supply
10400695	5723084	12/20/1987	610160	4911830	247.0	margin of error : 100 m - 300 m			297	Cable Tool	21.0	19.2		Domestic		Water Supply
10410255	5732723	5/10/1997	609611	4911278	268.4	margin of error : 100 m - 300 m			533	Cable Tool	15.8	12.8		Domestic		Water Supply
10410368	5732836	6/21/1997	609621	4911258	268.5	margin of error : 100 m - 300 m			545	Cable Tool	15.2	14.0		Domestic		Water Supply
1003019599	7146493	4/16/2010	609561	4911397	266.7	margin of error : 30 m - 100 m	3272 ST. PAULS CRES	Innisfil	466	Rotary (Air)	17.1	9.1		Commerical		Water Supply
1004692730	7215155	11/15/2013	609530	4911579	263.8	margin of error : 30 m - 100 m	43 ST PAULS CRES	BARRIE	382	Digging				Domestic		Abandoned-Other
1004692733	7215156	11/15/2013	609537	4911577	263.5	margin of error : 30 m - 100 m	43 ST PAULS CRES	BARRIE	377	Cable Tool				Domestic		Abandoned-Other
10400082	5722464	4/17/1987	610276	4911882	250.2	margin of error : 100 m - 300 m			424	Rotary (Convent.)	31.1			Domestic	Livestock	Water Supply
1001803819	7111723	6/18/2008	609801	4911416	260.6	margin of error : 10 - 30 m	2229 MAPLEVIEW DR.	Barrie	332							Abandoned-Other
1006135751	7266357	6/9/2016	609573	4911539	264.2	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST BETWEEN YONGE ST. AND RAILWAY TRACKS	BARRIE	364	Boring	6.1			Monitoring		Observation Wells
1006486476	7287352	3/3/2017	609769	4911973	251.1	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	257	Boring	10.7			Monitoring		Observation Wells
1006487259	7287370	3/3/2017	609712	4912099	247.3	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	395	Boring	10.7			Monitoring		Observation Wells
1006487275	7287371	3/3/2017	609927	4912036	246.7	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	301	Boring	10.7			Monitoring		Observation Wells
1006491777	7287377	3/7/2017	609708	4911865	253.8	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	210	Boring	12.2			Monitoring		Observation Wells
1006491780	7287378	3/7/2017	609533	4911865	257.4	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	366	Boring	12.2			Monitoring		Observation Wells
1006491783	7287379	3/7/2017	609591	4911915	255.5	margin of error : 30 m - 100 m	MAPLEVIEW DRIVE EAST & ST. PAUL'S CRESCENT	Barrie	335	Boring	10.7			Monitoring		Observation Wells
1007500347	7336047		609959	4911587		margin of error : 30 m - 100 m	573 MAPLEVIEW DR E	Barrie	173	Boring	2.0					Other Status
1006040383	7264410	3/29/2016	610184	4911661	247.5	margin of error : 30 m - 100 m			317							Abandoned-Other
1006040410	7264411	3/31/2016	610188	4911611	247.9	margin of error : 30 m - 100 m			337							Abandoned-Other
10410256	5732724	5/10/1997	609626	4911235	268.9	margin of error : 100 m - 300 m			563	Other Method	11.0			Domestic		Abandoned-Supply
10410369	5732837	6/21/1997	609620	4911251	268.7	margin of error : 100 m - 300 m			552	Other Method	9.1			Domestic		Abandoned-Quality

Appendix B – Borehole Logs

Log of Borehole 101

Project No. BAR-00604678-T0 | Drawing No. 1

Project: Hydrogeological Investigation - 750 Mapleview Drive East | Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911660 609853

Date Drilled: June 2, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Natural Unit Weight kN/m³
TOPSOIL : Sand, Some Silt, Trace Gravel, Dark Brown, Moist	251.27	0	8	1.0
	~250.6			
FILL : Sand, Trace Silt, Trace Gravel, Trace Organics, Brown, Moist		1	8	2.0
	~249.9			
SAND : Some Silt, Trace Gravel, Brown, Moist [Compact]		2	14	3.0
	~249.2			
SILTY FINE SAND : Trace Gravel, Brown, Wet [Compact]		2	13	4.0
		3	16	5.0
Becoming Grey		4		
		5	27	6.0
	~245.3	6		
SILTY CLAY : Trace Sand, Grey, APL [Stiff to Very Stiff]		6	21	7.0
		7		
		8	24	8.0
		9		
		9	10	9.0
		10		
		11	27	10.0
	~240.0			
BOREHOLE TERMINATED AT 11.3 m				

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

Date	Water Level (m)	Hole Open to (m)
Upon Completion	3.6	8.8

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 102

Project No. BAR-00604678-T0 | Drawing No. 2

Project: Hydrogeological Investigation - 750 Mapleview Drive East | Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911749 609914

Date Drilled: June 3, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)
	248.53	0
TOPSOIL : Sand, Some Silt, Trace Gravel, Dark Brown, Moist	~248.5	
FILL : Sandy Silt to Silty Sand, Trace Clay, Trace Gravel, Trace Organics, Asphalt Pieces, Brown, Moist		1
	~246.9	2
TILL : Silty Sand, Some Clay, Trace Gravel, Cobbles and Boulders, Brown, Moist [Loose to Dense]		3
	~243.0	4
SILTY FINE SAND : Trace Gravel, Grey, Wet [Dense to Very Dense]		5
	~237.2	6
BOREHOLE TERMINATED AT 11.3 m		7
		8
		9
		10
		11

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

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

SPT N values: 39, 4, 4, 6, 37, 42, 34, 59, 42, 68

Natural Unit Weight kN/m³: 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0

Date	Water Level (m)	Hole Open to (m)
Upon Completion	3.6	9.1

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 103

Project No. BAR-00604678-T0 | Drawing No. 3

Project: Hydrogeological Investigation - 750 Mapleview Drive East | Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911747 609872

Date Drilled: June 2, 2020

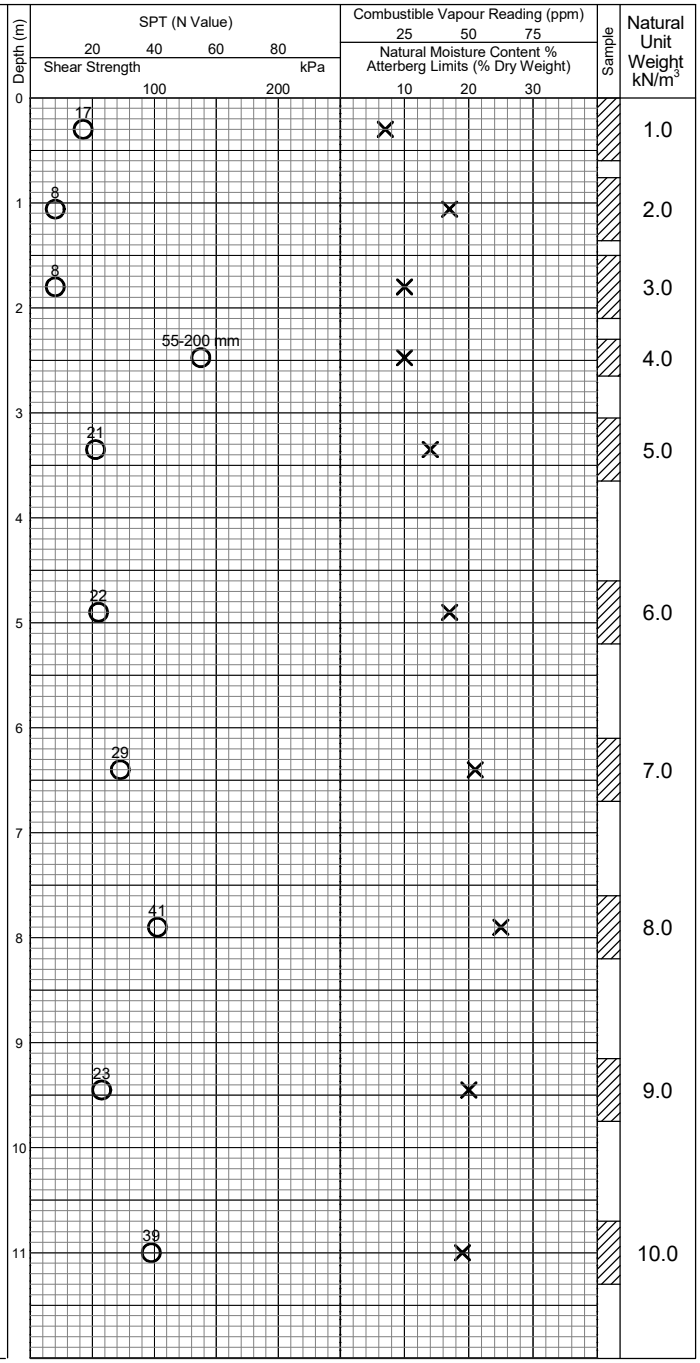
Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m
FILL : Silt, Trace Sand, Trace Gravel, Trace Organics, Dark Brown, Moist	249.04
	~247.4
TILL : Silty Sand, Some Clay, Trace Gravel, Cobbles and Boulders, Brown, Moist [Loose to Compact]	
	~245.0
SAND : Some Silt, Trace Gravel, Brown, Wet [Compact]	
	~242.0
SILTY FINE SAND : Trace Gravel, Grey, Wet [Compact to Dense]	
	~237.7
BOREHOLE TERMINATED AT 11.3 m	



Date	Water Level (m)	Hole Open to (m)
Upon Completion	3.1	3.1

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 104

Project No. BAR-00604678-T0 | Drawing No. 4

Project: Hydrogeological Investigation - 750 Mapleview Drive East | Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911709 609850

Date Drilled: June 2, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Natural Unit Weight kN/m³
FILL : Silty Sand, Trace Gravel, Trace Organics, Dark Brown, Moist	250.04	0	10		1.0
PEAT : Trace Sand, Black, Wet	~249.0	1	2	75	2.0
TILL : Silty Sand, Some Clay, Trace Gravel, Cobbles and Boulders, Brown, Moist [Loose]	~248.4	2	6		3.0
SAND : Some Silt, Trace Gravel, Brown, Wet [Compact]	~247.9	2	17		4.0
		3	15		5.0
SILTY FINE SAND : Trace Gravel, Brown, Wet [Compact to Dense]	~246.0	4			
		5	37		6.0
		6			
		6	33		7.0
Becoming Grey		7			
		8	34		8.0
		9			
		9	32		9.0
SILTY CLAY : Trace Sand, Grey, APL [Very Stiff]	~240.0	10			
		11	26		10.0
BOREHOLE TERMINATED AT 11.3 m	~238.7				

Date	Water Level (m)	Hole Open to (m)
Upon Completion	3.1	3.1

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 105

Project No. BAR-00604678-T0 | Drawing No. 5

Project: Hydrogeological Investigation - 750 Mapleview Drive East | Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911770 609903

Date Drilled: June 3, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)	Natural Unit Weight kN/m³
FILL : Sand, Some Silt, Trace Gravel, Trace Organics, Brown, Moist	248.68	0	1.0
	~247.3	1	2.0
TILL : Silty Sand, Some Clay, Trace Gravel, Cobbles and Boulders, Brown, Moist [Loose to Compact]		2	3.0
	~245.3	3	4.0
SAND : Some Silt, Trace Gravel, Brown, Wet [Compact to Dense]		4	5.0
	~244.2	5	6.0
SILTY FINE SAND : Trace Gravel, Brown, Wet [Compact to Dense]		6	7.0
Becoming Grey		7	8.0
		8	9.0
		9	10.0
		10	11.0
	~237.4	11	
BOREHOLE TERMINATED AT 11.3 m			

SPT (N Value): 18, 6, 5, 16, 12, 42, 29, 27, 17, 38, 26

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

Combustible Vapour Reading (ppm): 25 50 75

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

Date	Water Level (m)	Hole Open to (m)
Upon Completion	3.1	7.9

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 1

Project No. BAR-00604678-T0

Drawing No. 6

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911665 609874

Date Drilled: June 1, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		FILL : Sand, Trace Silt, Trace Gravel, Trace Organics, Brown, Moist	250.97	0	6			1.0
				1	13			2.0
			~249.6					
		SAND : Some Silt, Trace Gravel, Brown, Moist to Wet [Compact]		2	34			3.0
					26			4.0
			~248.1					
		BOREHOLE TERMINATED AT 2.9 m INSTALLED 50 mm DIA. MONITORING WELL						

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

Date	Water Level (m)	Hole Open to (m)
Upon Completion	2.8	No Cave
June 3, 2020	Dry	-

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 2

Project No. BAR-00604678-T0

Drawing No. 7

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911682 609900

Date Drilled: June 1, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		FILL : Sand, Some Silt to Silty, Trace Gravel, Trace Organics, Dark Brown, Moist	250.13	0				1.0
			~248.6	1				
		BOREHOLE TERMINATED AT 1.5 m						

Date	Water Level (m)	Hole Open to (m)
Upon Completion	No Water	No Cave

exp.

Log of Borehole 3

Project No. BAR-00604678-T0

Drawing No. 8

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911702 609902

Date Drilled: June 1, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
FILL : Sand, Trace Silt, Trace Gravel, over Silt, Trace Sand, Trace Gravel, Trace Organics, Dark Brown to Brown, Moist	249.76	0	9			1.0
		1	11			2.0
	~247.7	2	12			3.0
TILL : Silty Sand, Trace Gravel, Cobbles and Boulders, Brown, Wet [Loose]			7			4.0
	~246.9					
BOREHOLE TERMINATED AT 2.9 m INSTALLED 50 mm DIA. MONITORING WELL						

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

Date	Water Level (m)	Hole Open to (m)
Upon Completion June 3, 2020	No Water 1.8	No Cave -

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 4

Project No. BAR-00604678-T0

Drawing No. 9

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911727 609910

Date Drilled: June 2, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) 20 40 60 80 / Shear Strength kPa 100 200	Combustible Vapour Reading (ppm) 25 50 75 / Natural Moisture Content % Atterberg Limits (% Dry Weight) 10 20 30	Sample	Natural Unit Weight kN/m³
		FILL : Silty Sand, Some Gravel, Organic Pockets, Dark Brown to Grey, Moist	248.78	0				1.0
			~247.3	1				
		BOREHOLE TERMINATED AT 1.5 m						

Date	Water Level (m)	Hole Open to (m)
Upon Completion	No Water	No Cave

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 5

Project No. BAR-00604678-T0

Drawing No. 10

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911749 609907

Date Drilled: June 2, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Groundwater	Soil/Rock Symbol	Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
		FILL : Silty Sand, Some Gravel, Organic Pockets, Dark Brown to Grey, Moist	248.58	0	20 40 60 80 / 100 200	25 50 75 / 10 20 30		1.0
			~247.1	1				
		BOREHOLE TERMINATED AT 1.5 m						

Date	Water Level (m)	Hole Open to (m)
Upon Completion	No Water	No Cave

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 6

Project No. BAR-00604678-T0

Drawing No. 11

Project: Hydrogeological Investigation - 750 Mapleview Drive East

Sheet No. 1 of 1

Location: 750 Mapleview Drive East, Barrie, ON

17T 4911742 609869

Date Drilled: June 2, 2020

Drill Type: Hollow Stem Augers

Datum: Geodetic

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

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

Soil Description	ELEV. m	Depth (m)	SPT (N Value) / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	Sample	Natural Unit Weight kN/m³
FILL : Sand, Some Gravel, Trace Silt, Brown, Moist	249.38 / ~248.9	0	11			1.0
TOPSOIL : Silt, Some Sand, Trace Gravel, Dark Brown, Moist	~248.5					
FILL : Silty Sand, Trace Gravel, Brown, Moist	~248.0	1	6			2.0
TILL : Silty Sand, Trace Gravel, Cobbles and Boulders, Brown, Moist [Compact]	~247.3		13			3.0
SAND : Sand, Some Silt, Trace Gravel, Brown, Wet [Compact]	~246.5	2	15			4.0
BOREHOLE TERMINATED AT 2.9 m INSTALLED 50 mm DIA. MONITORING WELL						

Date	Water Level (m)	Hole Open to (m)
Upon Completion	2.1	No Cave
June 3, 2020	1.2	-

EXPLOGBRAMPTON BRM-00604678-T0 BOREHOLE LOGS.GPJ NEW.GDT 4/30/21

Log of Borehole 2

Project No. BRM-00604678-C2 Drawing No. 3

Project: Proposed Residential Complex Sheet No. 1 of 1

Location: 700 Mapleview Drive East, City of Barrie, Ontario

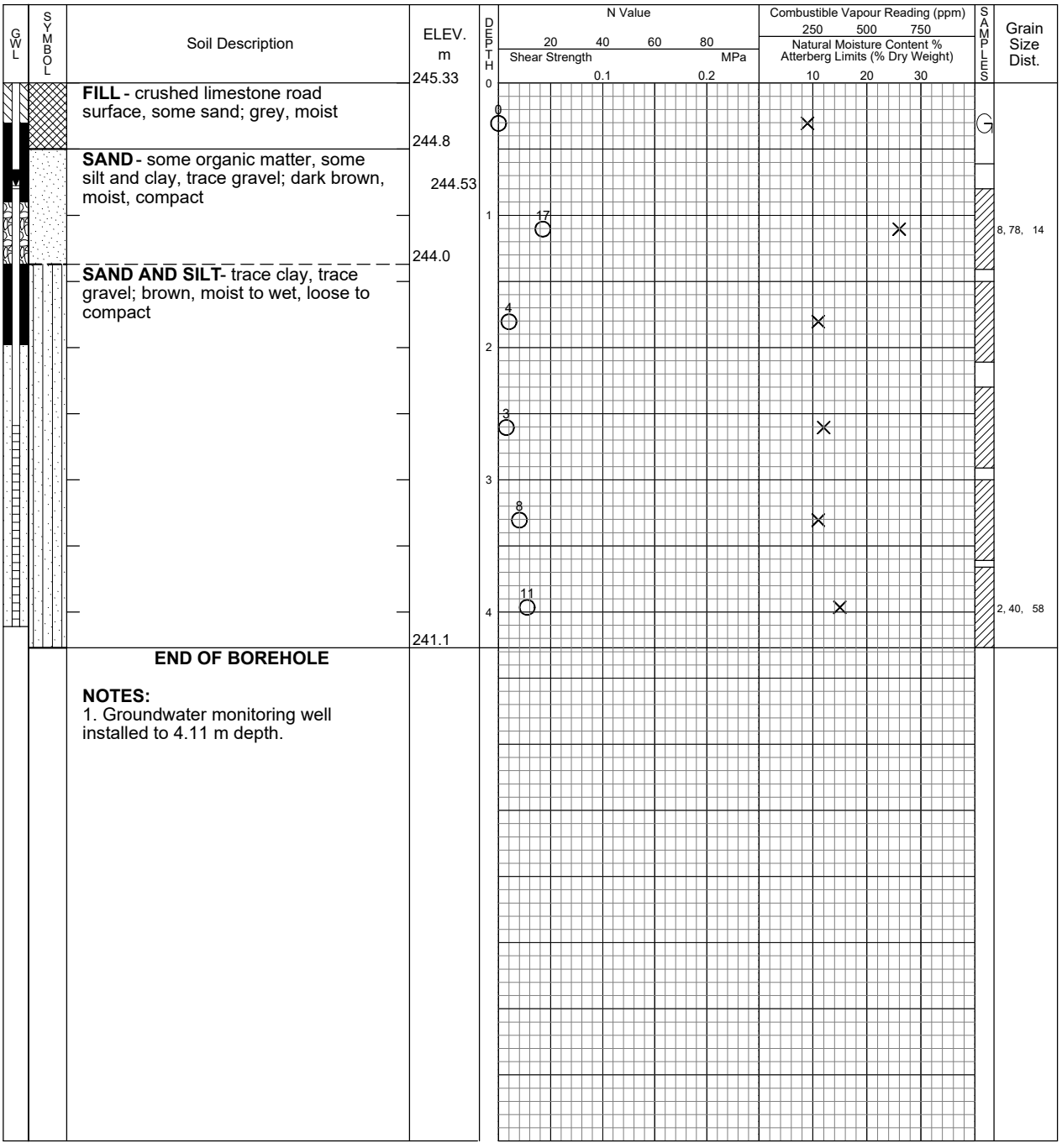
Date Drilled: February 27, 2019

Drill Type: Solid Stem

Datum: Geodetic

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

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



LAGWGL02 15 BOREHOLES LOGS.GPJ NEW.GDT 4/2/19

Time	Water Level (m)	Depth to Cave (m)
February 27, 2019	1.45	Well
March 13, 2019	1.13	Well
March 22, 2019	0.80	Well

Log of Borehole 5

Project No. BRM-00604678-C2 Drawing No. 6

Project: Proposed Residential Complex Sheet No. 1 of 2

Location: 700 Mapleview Drive East, City of Barrie, Ontario

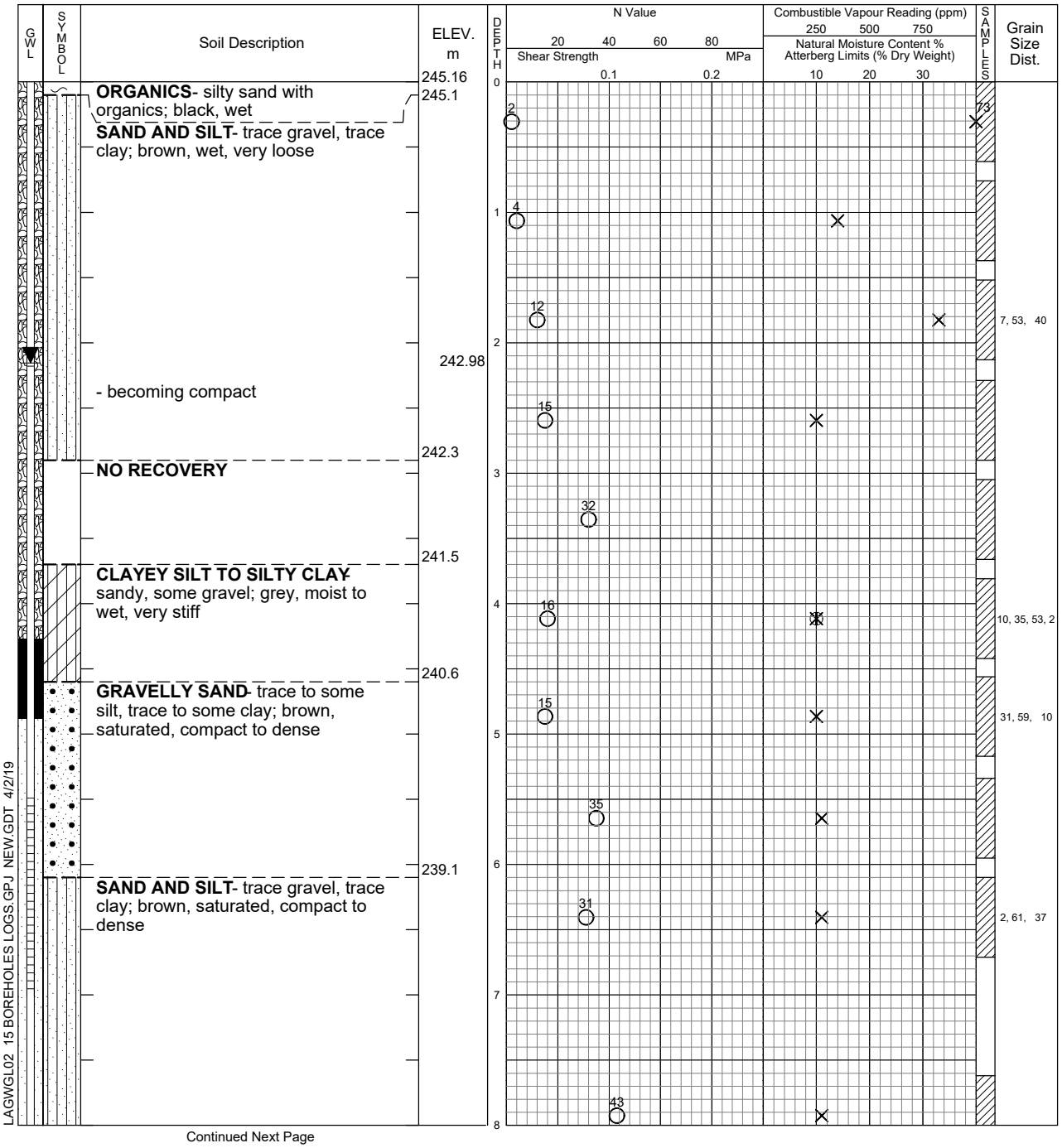
Date Drilled: February 26, 2019

Drill Type: Hollow Stem, Rotary

Datum: Geodetic

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

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



Continued Next Page

Time	Water Level (m)	Depth to Cave (m)
February 26, 2019	4.57	Well
March 13, 2019	2.64	Well
March 22, 2019	2.18	Well

Log of Borehole 5

Project No. BRM-00604678-C2 Drawing No. 6

Project: Proposed Residential Complex Sheet No. 2 of 2

GWL	SYMBOL	Soil Description	ELEV. m	DEPTH
			237.16	8
				9
			235.4	
		END OF BOREHOLE		

NOTES:
1. Groundwater monitoring well installed to 7.62 m depth.

N Value
20 40 60 80
Shear Strength MPa
0.1 0.2

Combustible Vapour Reading (ppm)
250 500 750
Natural Moisture Content %
Atterberg Limits (% Dry Weight)
10 20 30

SAMPLES

Grain Size Dist.

60

LAGWGL02 15 BOREHOLES LOGS.GPJ NEW.GDT 4/2/19

Time	Water Level (m)	Depth to Cave (m)
February 26, 2019	4.57	Well
March 13, 2019	2.64	Well
March 22, 2019	2.18	Well

Log of Borehole 14

Project No. BRM-00604678-C2 Drawing No. 15

Project: Proposed Residential Complex Sheet No. 1 of 1

Location: 700 Mapleview Drive East, City of Barrie, Ontario

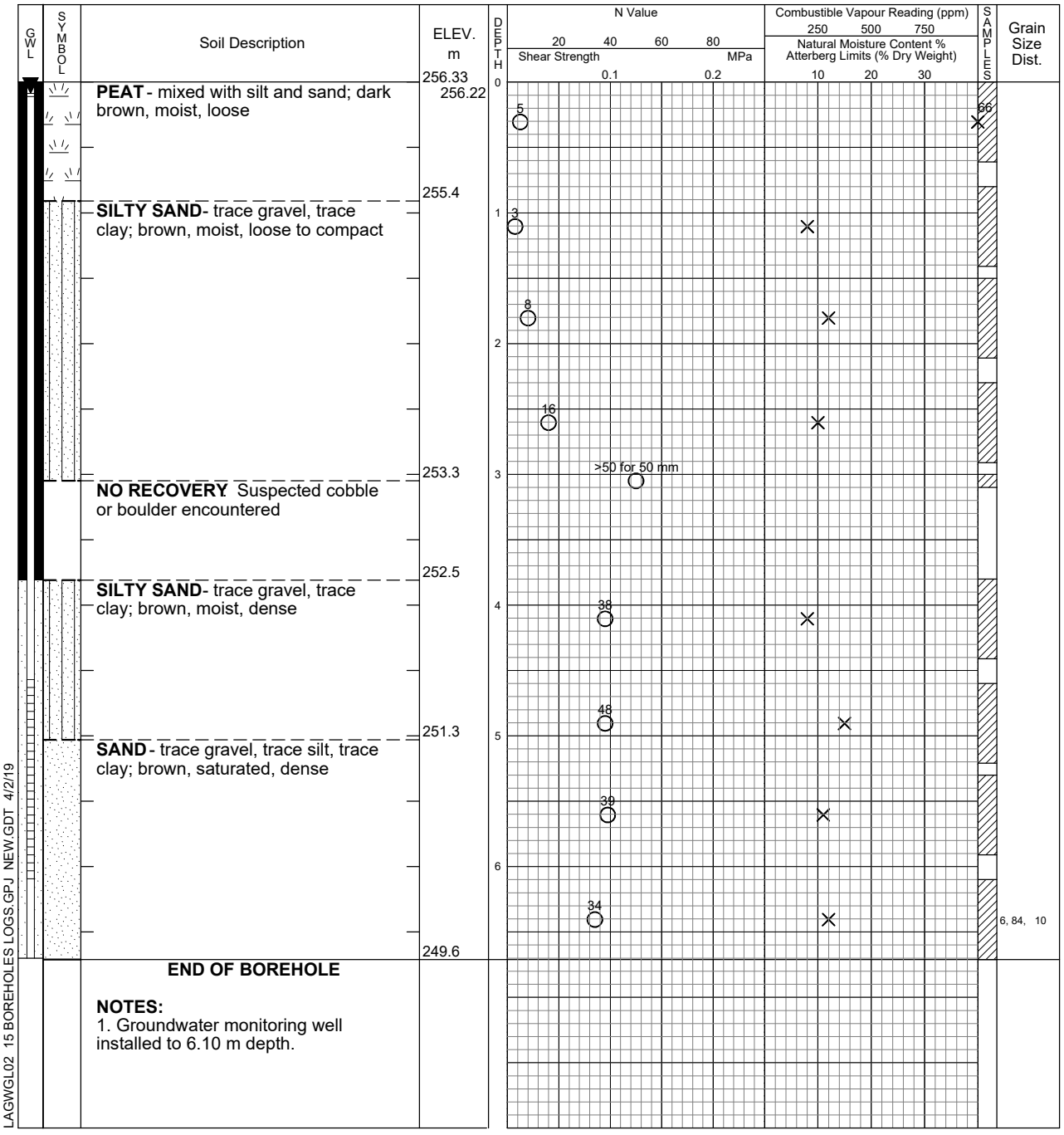
Date Drilled: March 5, 2019

Drill Type: Solid Stem

Datum: Geodetic

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

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



LAGWGL02 15 BOREHOLES LOGS.GPJ NEW.GDT 4/2/19

Time	Water Level (m)	Depth to Cave (m)
March 5, 2019	1.52	Well
March 13, 2019	0.30	Well
March 22, 2019	0.11	Well

Appendix C – Water Well Inventory Results

WATER WELL SURVEY FORM

ADDRESS: 320 Mapleview Dr. East DATE: Oct. 16 /18
(Lot, Con., Twp., Street & No., etc.) OWNER: Michael Brunner / Kristina Luescher

TELEPHONE NO.(Cell).: 705-627-9179 (Home): 705-737-5452 MOE WELL NO.:

EMAIL: mbrunner@tnrdoors.com PROJECT NO.: 00604678

WELL INFORMATON

Is there a well on your property? Yes ☑ No ☐
Is the well in use? Yes ☑ No ☐
Installation: Drilled ☐ Dug or Bored ☑ Combination ☐
Date Completed: 7 Depth: 30'± Casing: Precast sections
Diameter*: 36"
Well Type: Overburden ☐ **OR** Bedrock ☐
Static Water Level: Original _____ Present 7' below grade.
Pumping Water Level: Original _____ Present _____
Has well ever been dry? Yes ☐ No ☑
Has the well been completed by a previous owner? Yes ☑ No ☐

WATER QUALITY (if previously tested)

pH*: _____ Temp.: _____ Conductivity*: _____
Chloride*: _____ Iron*: _____
Hardness*: _____ Alkalinity*: _____
Bacterial*: _____ Clear: Yes ☐ No ☐
Sand-free: Yes ☐ No ☐ Colour: Yes ☐ No ☐
Sulfurous: Yes ☐ No ☐ Odour: Yes ☐ No ☐

Any water treatment? _____

*Provide laboratory results with chain of custody if available

SKETCH (location & construction - use back of page)

PUMP INFORMATION (if known)

Make ECO-FLO Age 6 mo HP 1
Type: Jet ☑ Submersible ☐ Shallow Well ☐
Deep Well ☐ Other _____
Pump Capacity (GPM)* 17.3 per manual
* All dimensions: indicate estimated or measured

WATER CONSUMPTION (if known)

Domestic: No. of persons 4
Livestock: (specify) _____
Other uses: Car wash, gardens, lawn, pool
Daily consumption (litres, gallons): _____
Other sources: _____

MONITORING PROGRAM

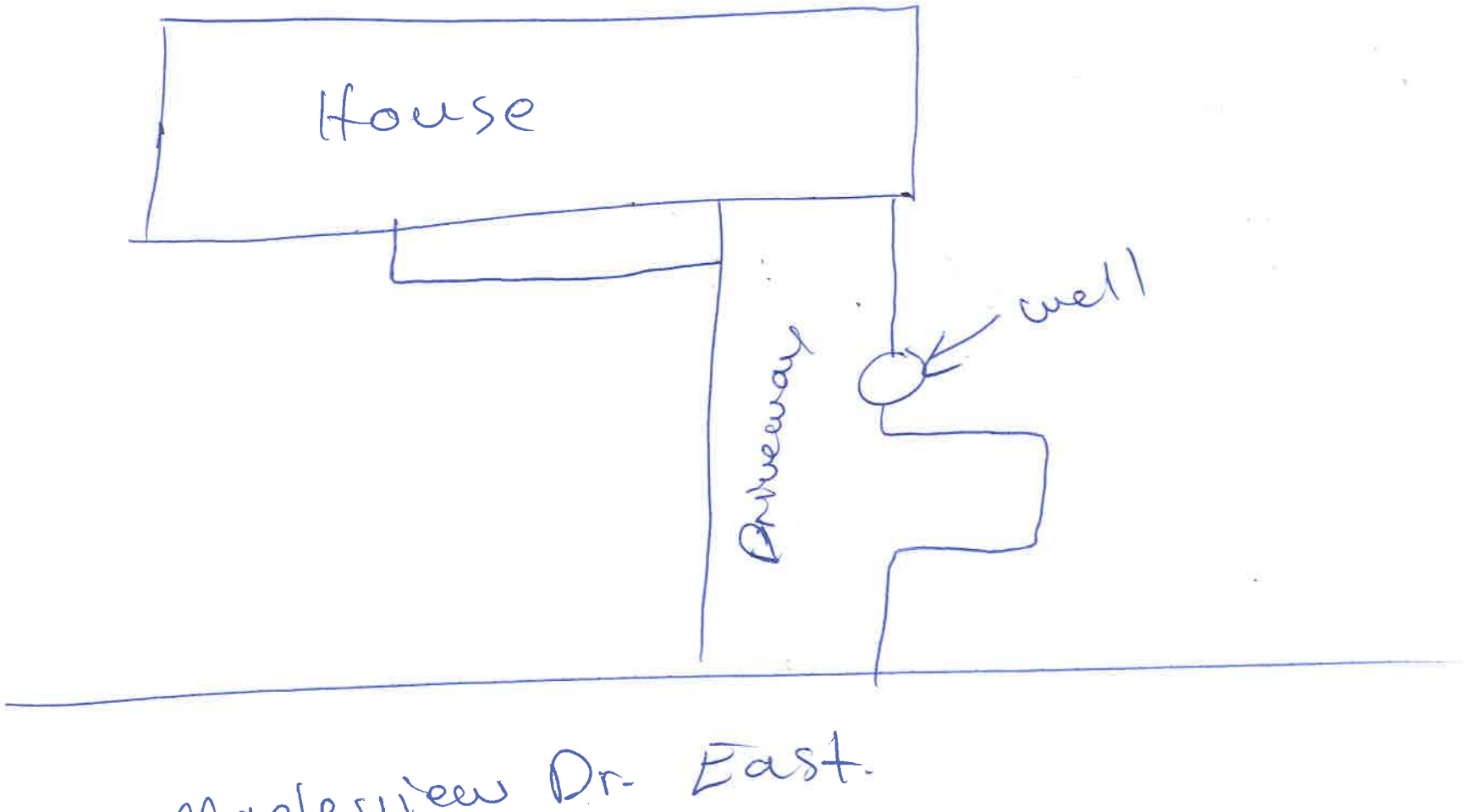
Do you grant exp Services permission to:
Collect a manual water level (dug wells only) ☑
Collect a water sample (tap only) ☑

Notes:
Water levels can only be measured if open/clear access to water in dug wells is available and pumps are turned off. Water levels from drilled wells may not be conducted, subject to well conditions.

OWNER'S ACKNOWLEDGEMENT:
I Michael Brunner, hereby authorize exp Services Inc. to include my well(s) in the well monitoring program and permit such access or actions as reasonably necessary to conduct water level measurements and collect a water sample from the tap connected to the water well supply line.

Authorization signature [signature] Date Oct. 20, 2018

Please sign and return this authorization form to the attention of Tomson Hecky by email (Tomson.Hecky@exp.com) or by mail to exp Services Inc. at 1595 Clark Boulevard, Brampton, ON, L6T4V.


House
Driveway
well
Mapleview Dr. East.

PAUL'S AUTO BODY

Paul Kapteyn
Collision & Body Repair

72 St. Paul's Crescent
Barrie, Ontario L9J 0E2
www.paulsautobodybarrie.com

Phone: 705-735-4444
Fax: 705-735-4449
paulsautobody@bellnet.ca

WATER WELL SURVEY FORM

(Lot, Con., Twp., Street & No., etc.) DATE: 11 Sept 2017

OWNER: Paul Kapteyn PROJECT NO.: 604678

TELEPHONE NO.: 705-735-4444 WELL NO.: —

EMAIL: paulsautobody@bellnet.ca

GPS Coordinate: 0609551 4911393

WELL INFORMATON

Is the well in use? Yes ☐ No ☐
Installation: Drilled ☑ Dug or bored ☐ Combination ☐
Date completed 2009. Depth 60 ft
Casing diameter* _____ Seal _____

Well Type (Circle): Overburden **OR** Bedrock

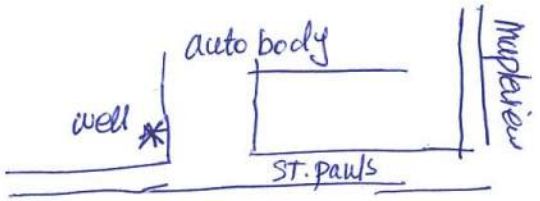
No information on sticker or depth of the pump

Static Water Level: Original — Present* —
Pumping Water Level: Original ✓ Present* _____
Has well ever been dry? Yes ☐ No ☑
Was well completed by a previous owner? Yes ☐ No ☐

WATER QUALITY (if previously tested)

pH: _____ Temp.: _____ Conductivity: _____
Chloride : _____ Iron: ✓
Hardness: _____ Alkalinity: _____
Bacterial: _____ Clear: Yes ☐ No ☐
Sand-free: Yes ☐ No ☐
Sulfurous: Yes ☐ No ☐ Odour: Yes ☐ No ☐
Any water treatment? No.

SKETCH (location & construction - use back of page if necessary)



PUMP INFORMATION

Make _____ Age 2009. HP _____
Type: Jet ☐ Submersible ☑ Shallow well ☐
Deep well ☐ Other _____
Depth to intake* —
Centre of pump (shallow well) measured from ground level* _____
Pump capacity * ✓
Condition : good ☑ fair ☐ poor ☐
* All dimensions: indicate estimated or measured

WATER CONSUMPTION

Domestic: No. of persons washing.
Livestock: (specify) No use for drinking
Other uses: _____
Estimated daily requirement: _____
Other sources: _____

MONITORING PROGRAM

Do you grant exp Services permission to:
Collect a manual water level ☑
Collect a water sample (tap or well) ☑

OWNER'S ACKNOWLEDGEMENT:

I _____, hereby authorize exp Services Inc. to include my well(s) in the well monitoring program and permit to conduct water level measurements and collect a water sample from the tap connected to the water well supply line.

Authorization signature _____ Date Sept 11/2017

Please sign and return this authorization form to the attention of Nataliya Tkach by email (Nataliya.tkach@exp.com) or by mail to exp Services Inc. at 1595 Clark Boulevard, Brampton, ON, L6T4V.

WATER WELL SURVEY FORM

ADDRESS: 105 St. Pauls Crescent DATE: 11/09/2017
(Lot, Con., Twp., Street & No., etc.) OWNER: _____ PROJECT NO.: 604678

TELEPHONE NO.: _____ WELL NO.: _____

EMAIL: _____

WELL INFORMATON

Coordinate.
- 0609632.
- 4911203

Is the well in use? Yes ☑ No ☐
Installation: Drilled ☑ Dug or bored ☐ Combination ☐
Date completed 2 years Depth 53 ft
Casing diameter* _____ Seal _____

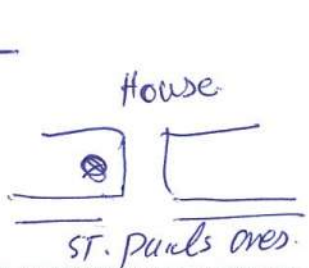
Well Type (Circle): Overburden **OR** Bedrock

Static Water Level: Original _____ Present* 8 ft
Pumping Water Level: Original _____ Present* _____
Has well ever been dry? Yes ☐ No ☑
Was well completed by a previous owner? Yes ☐ No ☐

WATER QUALITY (if previously tested)

HAD SAMPLE TESTED → GOOD QUALITY
pH: _____ Temp.: _____ Conductivity: _____
Chloride : - Iron: -
Hardness: _____ Alkalinity: _____
Bacterial: _____ Clear: Yes ☐ No ☐
Sand-free: Yes ☐ No ☑
Sulfurous: Yes ☐ No ☑ Odour: Yes ☐ No ☑
Any water treatment? No

SKETCH (location & construction - use back of page if necessary)



PUMP INFORMATION

Make _____ Age 2 yrs HP _____
Type: Jet ☐ Submersible ☑ Shallow well ☐
Deep well ☐ Other _____
Depth to intake* At the bottom of the well
Centre of pump (shallow well) measured from ground level* _____
Pump capacity * _____
Condition : good ☑ fair ☐ poor ☐
* All dimensions: indicate estimated or measured

WATER CONSUMPTION

Domestic: No. of persons 2-5
Livestock: (specify) Chickens
Other uses: Minor Irrigation
Estimated daily requirement: _____
Other sources: _____

MONITORING PROGRAM

Do you grant exp Services permission to:
Collect a manual water level ☐ NO
Collect a water sample (tap or well) ☑

- This owner does not like to be contacted.
- For next sampling just come.
- He does not like to open his well.

OWNER'S ACKNOWLEDGEMENT:

I _____, hereby authorize exp Services Inc. to include my well(s) in the well monitoring program and permit to conduct water level measurements and collect a water sample from the tap connected to the water well supply line.

Authorization signature _____ Date _____

Please sign and return this authorization form to the attention of Nataliya Tkach by email (Nataliya.tkach@exp.com) or by mail to exp Services Inc. at 1595 Clark Boulevard, Brampton, ON, L6T4V.

1595 Clark Boulevard, Brampton, ON L6T 4V1, Canada
T: +1.905.793.9800 • F: +1.905.793.0641• www.exp.com

WATER WELL SURVEY FORM

ADDRESS: 33 ~~MANCHESTER~~ ST. PAUL'S DATE: 09/11/2017
(Lot, Con., Twp., Street & No., etc.) OWNER: Vladimir Zdvorak PROJECT NO.: 604678

TELEPHONE NO.: (705) 733-4620 WELL NO.: _____

EMAIL: vlzdvorak@gmail.com

WELL INFORMATON

GPS: 0609507
4911625

Is the well in use? Yes ☑ No ☐
Installation: Drilled ☐ Dug or bored ☑ Combination ☐
Date completed 1970s Depth 20 ft
Casing diameter* _____ Seal _____

Well Type (Circle): Overburden **OR** Bedrock

Static Water Level: Original _____ Present* ~12ft
Pumping Water Level: Original _____ Present* _____
Has well ever been dry? Yes ☐ No ☑
Was well completed by a previous owner? Yes ☑ No ☐

WATER QUALITY (if previously tested)

pH: _____ Temp.: _____ Conductivity: _____
Chloride : _____ Iron: _____
Hardness: Some Alkalinity: _____
Bacterial: _____ Clear: Yes ☑ No ☐
Sand-free: Yes ☐ No ☑
Sulfurous: Yes ☐ No ☑ Odour: Yes ☐ No ☑
Any water treatment? Softener

SKETCH (location & construction - use back of page if necessary)

PUMP INFORMATION

Make _____ Age 16 HP 1/3 - 1/2
Type: Jet ☐ Submersible ☑ Shallow well ☐
Deep well ☐ Other _____
Depth to intake* ~17 ft
Centre of pump (shallow well) measured from ground level*

Pump capacity * _____
Condition : good ☑ fair ☐ poor ☐
* All dimensions: indicate estimated or measured

WATER CONSUMPTION

Domestic: No. of persons 2
Livestock: (specify) –

Other uses: –

Estimated daily requirement:

Other sources: –

MONITORING PROGRAM

Do you grant exp Services permission to:
Collect a manual water level ☐
Collect a water sample (tap or well) ☑

OWNER'S ACKNOWLEDGEMENT:

I VLADIMIR ZDVORAK, hereby authorize exp Services Inc. to include my well(s) in the well monitoring program and permit to conduct water level measurements and collect a water sample from the tap connected to the water well supply line.

Authorization signature _____ Date SEP 11/2017

Please sign and return this authorization form to the attention of Nataliya Tkach by email (Nataliya.tkach@exp.com) or by mail to exp Services Inc. at 1595 Clark Boulevard, Brampton, ON, L6T4V.

1595 Clark Boulevard, Brampton, ON L6T 4V1, Canada
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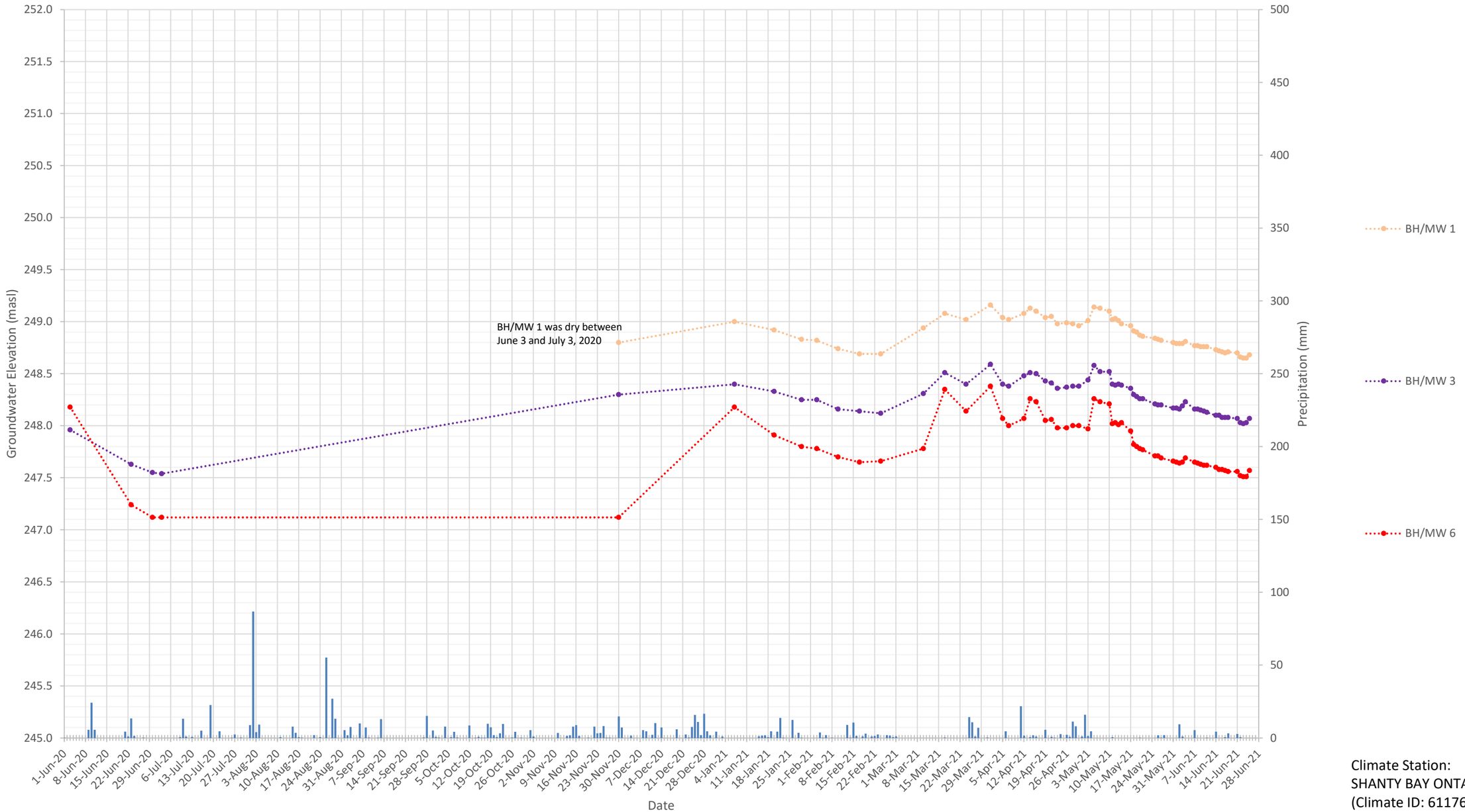
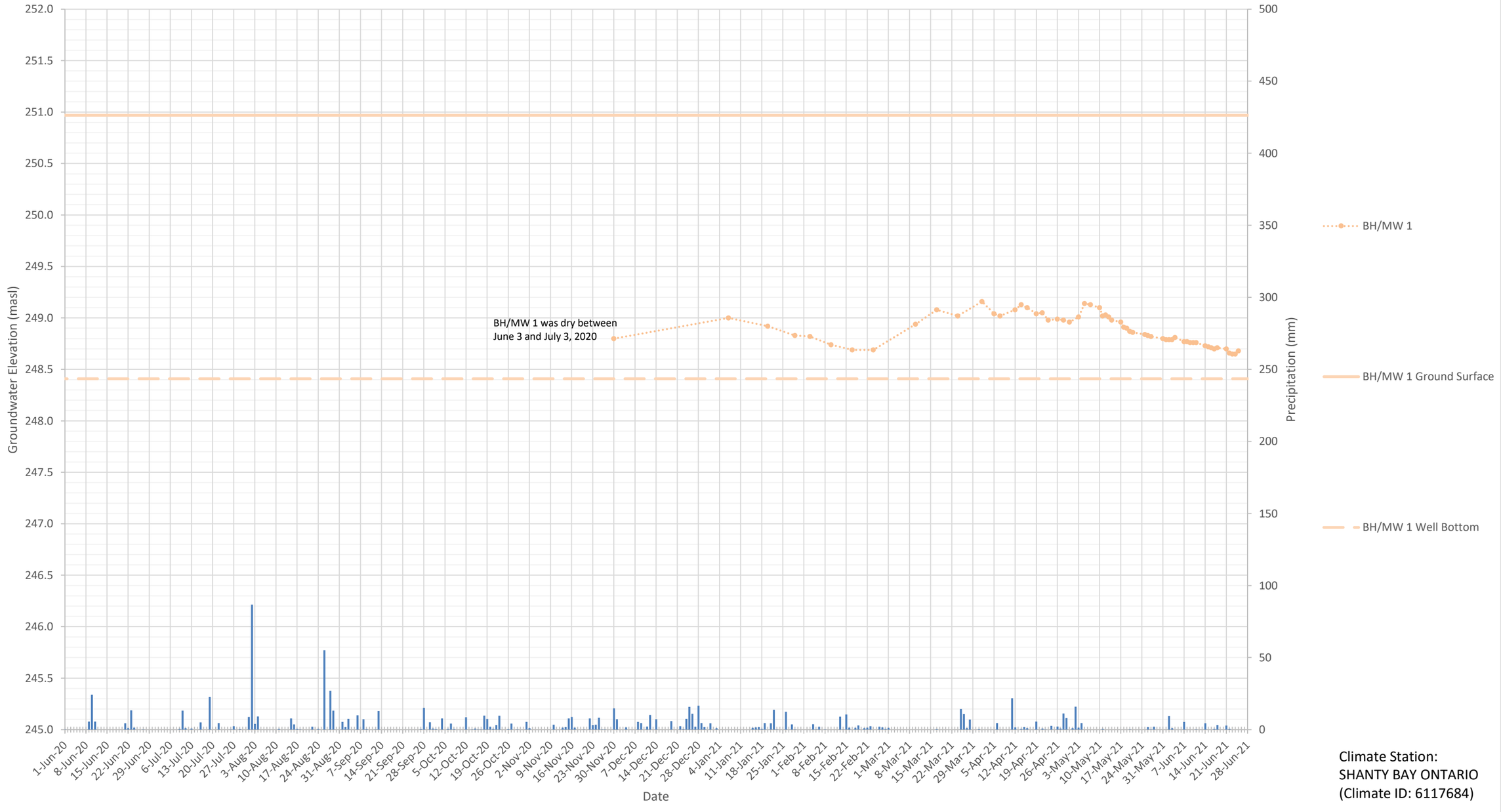
Appendix D – Water Levels and Hydrographs

Figure D-2 Hydrograph



Climate Station:
SHANTY BAY ONTARIO
(Climate ID: 6117684)

Figure D-3 BH/MW1 Hydrograph



Climate Station:
SHANTY BAY ONTARIO
(Climate ID: 6117684)

Figure D-4 BH/MW 3 Hydrograph

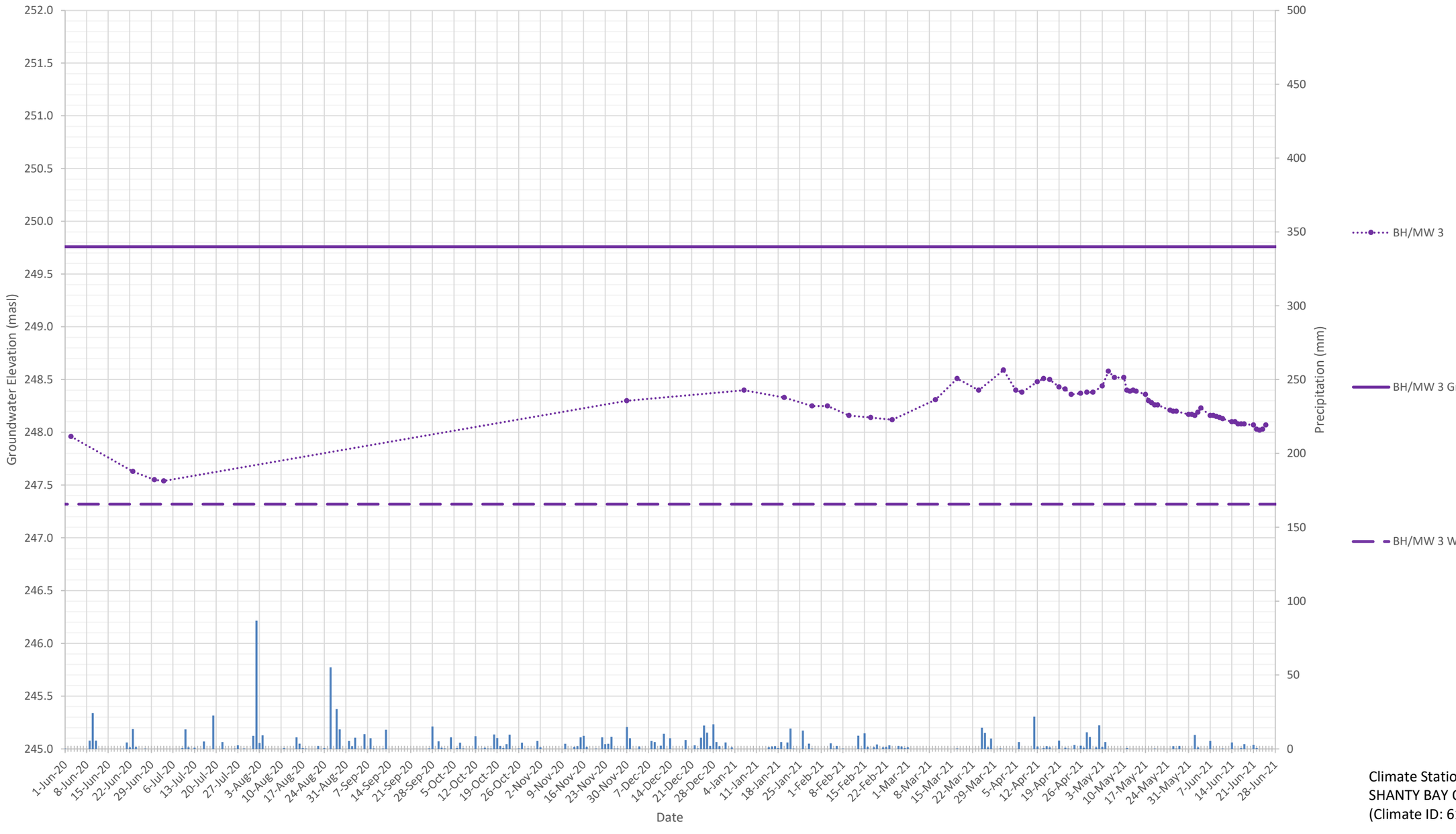
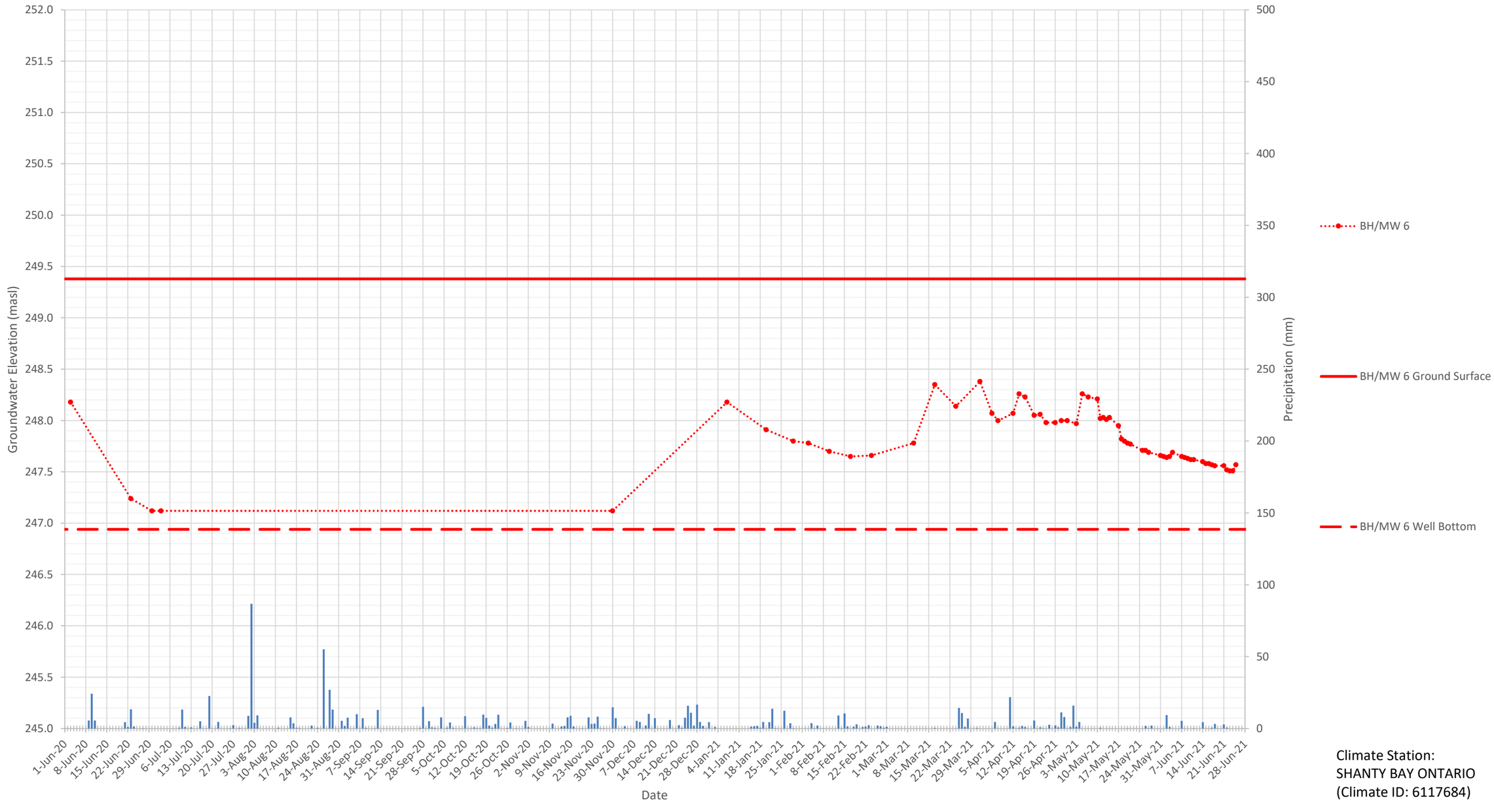


Figure D-5 BH/MW 6 Hydrograph



Climate Station:
SHANTY BAY ONTARIO
(Climate ID: 6117684)

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	3-Jun-20	23-Jun-20	30-Jun-20	3-Jul-20	30-Nov-20	7-Jan-21	20-Jan-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	Dry	Dry	Dry	Dry	3.05	2.85	2.93
				mbgs	Dry	Dry	Dry	Dry	2.17	1.97	2.05
				masl	Dry	Dry	Dry	Dry	248.80	249.00	248.92
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.42	2.75	2.83	2.84	2.08	1.98	2.05
				mbgs	1.80	2.13	2.21	2.22	1.46	1.36	1.43
				masl	247.96	247.63	247.55	247.54	248.30	248.40	248.33
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	1.83	2.77	2.89	2.89	2.89	1.83	2.10
				mbgs	1.20	2.14	2.26	2.26	2.26	1.20	1.47
				masl	248.18	247.24	247.12	247.12	247.12	248.18	247.91

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	29-Jan-21	3-Feb-21	10-Feb-21	17-Feb-21	24-Feb-21	10-Mar-21	17-Mar-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	3.02	3.03	3.11	3.16	3.16	2.91	2.77
				mbgs	2.14	2.15	2.23	2.28	2.28	2.03	1.89
				masl	248.83	248.82	248.74	248.69	248.69	248.94	249.08
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.13	2.13	2.22	2.24	2.26	2.07	1.87
				mbgs	1.51	1.51	1.60	1.62	1.64	1.45	1.25
				masl	248.25	248.25	248.16	248.14	248.12	248.31	248.51
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	2.21	2.23	2.31	2.36	2.35	2.23	1.66
				mbgs	1.58	1.60	1.68	1.73	1.72	1.60	1.03
				masl	247.80	247.78	247.70	247.65	247.66	247.78	248.35

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	24-Mar-21	1-Apr-21	5-Apr-21	7-Apr-21	12-Apr-21	14-Apr-21	16-Apr-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	2.83	2.69	2.81	2.83	2.77	2.72	2.75
				mbgs	1.95	1.81	1.93	1.95	1.89	1.84	1.87
				masl	249.02	249.16	249.04	249.02	249.08	249.13	249.10
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	1.98	1.79	1.98	2.00	1.90	1.87	1.88
				mbgs	1.36	1.17	1.36	1.38	1.28	1.25	1.26
				masl	248.40	248.59	248.40	248.38	248.48	248.51	248.50
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	1.87	1.63	1.94	2.01	1.94	1.75	1.78
				mbgs	1.24	1.00	1.31	1.38	1.31	1.12	1.15
				masl	248.14	248.38	248.07	248.00	248.07	248.26	248.23

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	19-Apr-21	21-Apr-21	23-Apr-21	26-Apr-21	28-Apr-21	30-Apr-21	3-May-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	2.81	2.80	2.87	2.86	2.87	2.89	2.84
				mbgs	1.93	1.92	1.99	1.98	1.99	2.01	1.96
				masl	249.04	249.05	248.98	248.99	248.98	248.96	249.01
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	1.95	1.97	2.02	2.01	2.00	2.00	1.94
				mbgs	1.33	1.35	1.40	1.39	1.38	1.38	1.32
				masl	248.43	248.41	248.36	248.37	248.38	248.38	248.44
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	1.96	1.95	2.03	2.03	2.01	2.01	2.04
				mbgs	1.33	1.32	1.40	1.40	1.38	1.38	1.41
				masl	248.05	248.06	247.98	247.98	248.00	248.00	247.97

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	5-May-21	7-May-21	10-May-21	11-May-21	12-May-21	13-May-21	14-May-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	2.71	2.72	2.75	2.83	2.82	2.84	2.87
				mbgs	1.83	1.84	1.87	1.95	1.94	1.96	1.99
				masl	249.14	249.13	249.10	249.02	249.03	249.01	248.98
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	1.80	1.86	1.86	1.98	1.99	1.98	1.99
				mbgs	1.18	1.24	1.24	1.36	1.37	1.36	1.37
				masl	248.58	248.52	248.52	248.40	248.39	248.40	248.39
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	1.75	1.78	1.80	1.99	1.98	2.00	1.98
				mbgs	1.12	1.15	1.17	1.36	1.35	1.37	1.35
				masl	248.26	248.23	248.21	248.02	248.03	248.01	248.03

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	17-May-21	18-May-21	19-May-21	20-May-21	21-May-21	25-May-21	26-May-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	2.89	2.94	2.95	2.98	2.99	3.01	3.02
				mbgs	2.01	2.06	2.07	2.10	2.11	2.13	2.14
				masl	248.96	248.91	248.90	248.87	248.86	248.84	248.83
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.02	2.08	2.10	2.12	2.12	2.17	2.18
				mbgs	1.40	1.46	1.48	1.50	1.50	1.55	1.56
				masl	248.36	248.30	248.28	248.26	248.26	248.21	248.20
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	2.06	2.19	2.21	2.23	2.24	2.30	2.30
				mbgs	1.43	1.56	1.58	1.60	1.61	1.67	1.67
				masl	247.95	247.82	247.80	247.78	247.77	247.71	247.71

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	27-May-21	31-May-21	1-Jun-21	2-Jun-21	3-Jun-21	4-Jun-21	7-Jun-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	3.03	3.05	3.06	3.06	3.06	3.04	3.08
				mbgs	2.15	2.17	2.18	2.18	2.18	2.16	2.20
				masl	248.82	248.80	248.79	248.79	248.79	248.81	248.77
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.18	2.21	2.21	2.22	2.19	2.15	2.22
				mbgs	1.56	1.59	1.59	1.60	1.57	1.53	1.60
				masl	248.20	248.17	248.17	248.16	248.19	248.23	248.16
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	2.32	2.35	2.36	2.37	2.36	2.32	2.36
				mbgs	1.69	1.72	1.73	1.74	1.73	1.69	1.73
				masl	247.69	247.66	247.65	247.64	247.65	247.69	247.65

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	8-Jun-21	9-Jun-21	10-Jun-21	11-Jun-21	14-Jun-21	15-Jun-21	16-Jun-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	3.08	3.09	3.09	3.09	3.12	3.13	3.14
				mbgs	2.20	2.21	2.21	2.21	2.24	2.25	2.26
				masl	248.77	248.76	248.76	248.76	248.73	248.72	248.71
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.22	2.23	2.24	2.25	2.28	2.28	2.30
				mbgs	1.60	1.61	1.62	1.63	1.66	1.66	1.68
				masl	248.16	248.15	248.14	248.13	248.10	248.10	248.08
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	2.37	2.38	2.39	2.39	2.41	2.43	2.43
				mbgs	1.74	1.75	1.76	1.76	1.78	1.80	1.80
				masl	247.64	247.63	247.62	247.62	247.60	247.58	247.58

Notes:

mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

TABLE D1: Groundwater Elevation Summary

750 Mapleview Drive E, Barrie, ON

Monitoring Well ID	Ground Surface Elevation (masl)	Stick Up (+)	Approximate Full Well Depth (mbgs)	Depth	17-Jun-21	18-Jun-21	21-Jun-21	22-Jun-21	23-Jun-21	24-Jun-21	25-Jun-21
BH/MW 1	**250.97**	**0.88**	**2.56**	mbTOP	3.15	3.14	3.15	3.19	3.20	3.20	3.17
				mbgs	2.27	2.26	2.27	2.31	2.32	2.32	2.29
				masl	248.70	248.71	248.70	248.66	248.65	248.65	248.68
BH/MW 3	**249.76**	**0.62**	**2.44**	mbTOP	2.30	2.30	2.31	2.35	2.36	2.35	2.31
				mbgs	1.68	1.68	1.69	1.73	1.74	1.73	1.69
				masl	248.08	248.08	248.07	248.03	248.02	248.03	248.07
BH/MW 6	**249.38**	**0.63**	**2.44**	mbTOP	2.44	2.45	2.45	2.49	2.50	2.50	2.44
				mbgs	1.81	1.82	1.82	1.86	1.87	1.87	1.81
				masl	247.57	247.56	247.56	247.52	247.51	247.51	247.57

Notes:

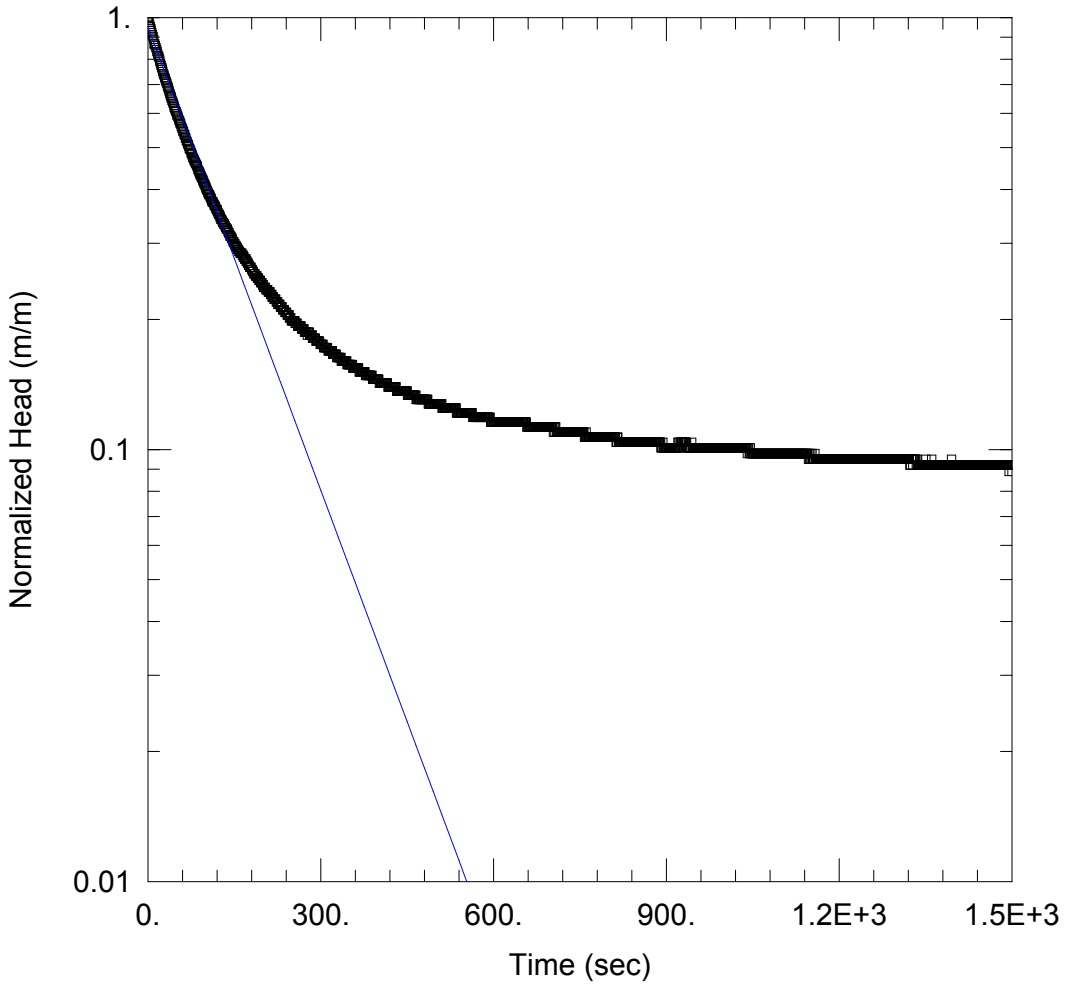
mbTOP - meters below top of the pipe

mbgs - meters below ground surface

masl - meters above mean sea level

NA - not available or not drilled

Appendix E – SWRT Procedures and Results



RISING HEAD - SWRT - BH 2

Data Set: I:\...\BH2 R.aqt
Date: 06/26/19 Time: 15:18:20

PROJECT INFORMATION

Company: EXP Service Inc.
Client: Mapleview Developments Ltd
Project: BRM-00604678
Location: 700 Mapleview Ave, Barrie, ON
Test Well: BH 2
Test Date: March 18, 2019

AQUIFER DATA

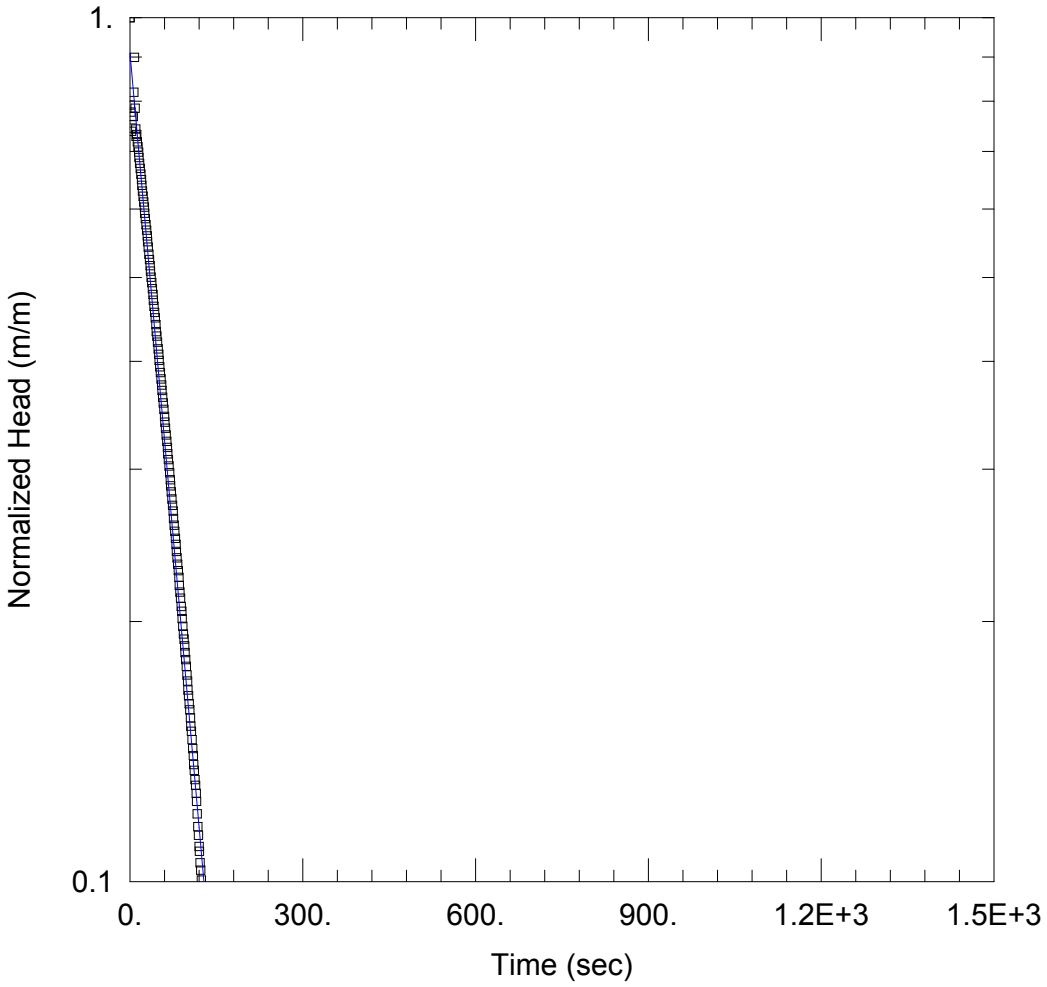
Saturated Thickness: 3.231 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 2- 2019)

Initial Displacement: 1.011 m
Total Well Penetration Depth: 3.231 m
Casing Radius: 0.0254 m
Static Water Column Height: 3.231 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 4.834E-6 m/sec
y0 = 0.9597 m



RISING HEAD - SWRT - BH 5

Data Set: I:\...\BH5-R.aqt
Date: 06/26/19 Time: 15:15:31

PROJECT INFORMATION

Company: EXP Service Inc.
Client: Mapleview Developments Ltd
Project: BRM-00604678
Location: 700 Mapleview Ave, Barrie, ON
Test Well: BH 5
Test Date: March 18, 2019

AQUIFER DATA

Saturated Thickness: 4.565 m Anisotropy Ratio (Kz/Kr): 1.

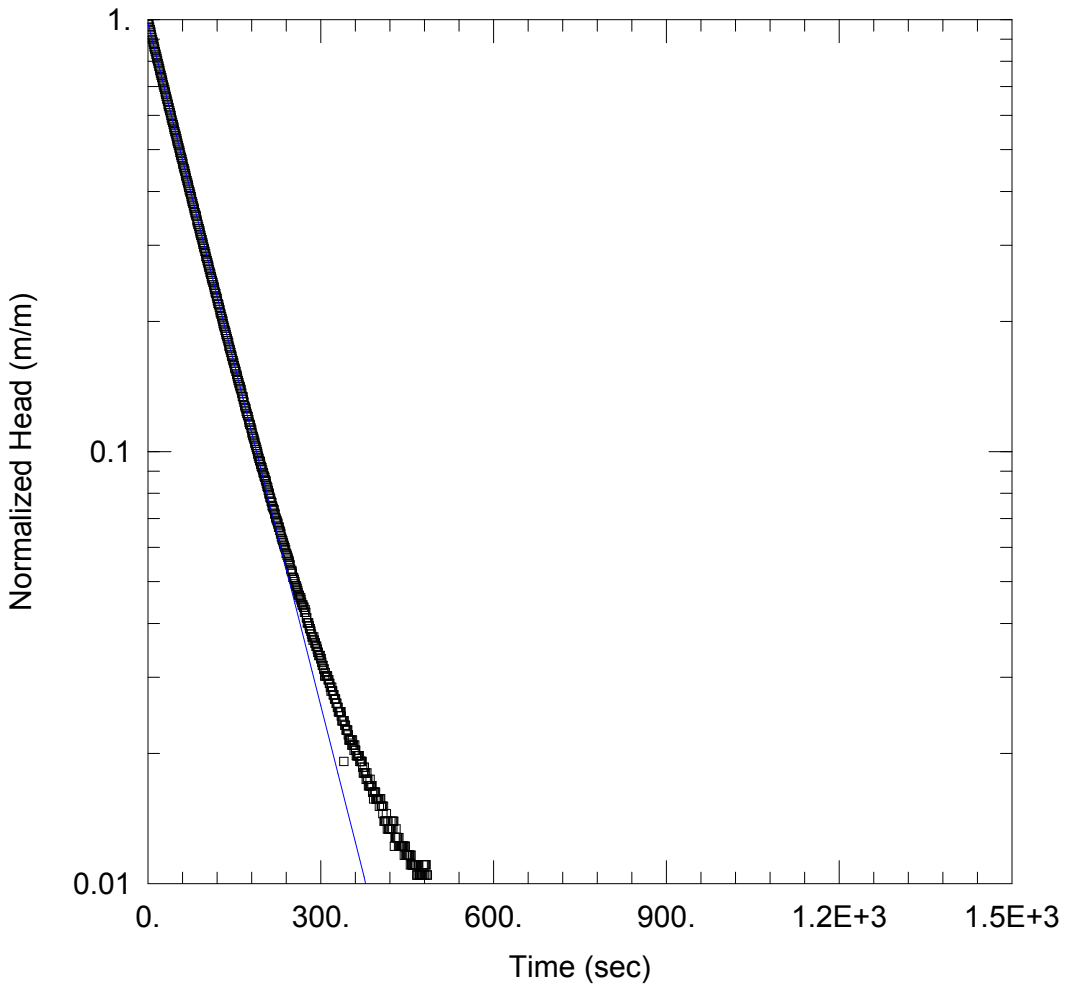
WELL DATA (BH 5-2019)

Initial Displacement: 1.494 m
Total Well Penetration Depth: 4.565 m
Casing Radius: 0.0254 m
Static Water Column Height: 1.565 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 8.818E-6 m/sec y0 = 1.358 m



RISING HEAD - SWRT - BH 14

Data Set: I:\...\BH14-R.aqt
Date: 06/26/19 Time: 15:17:20

PROJECT INFORMATION

Company: EXP Service Inc.
Client: Mapleview Developments Ltd
Project: BRM-00604678
Location: 700 Mapleview Ave, Barrie, ON
Test Well: BH 14
Test Date: March 18, 2019

AQUIFER DATA

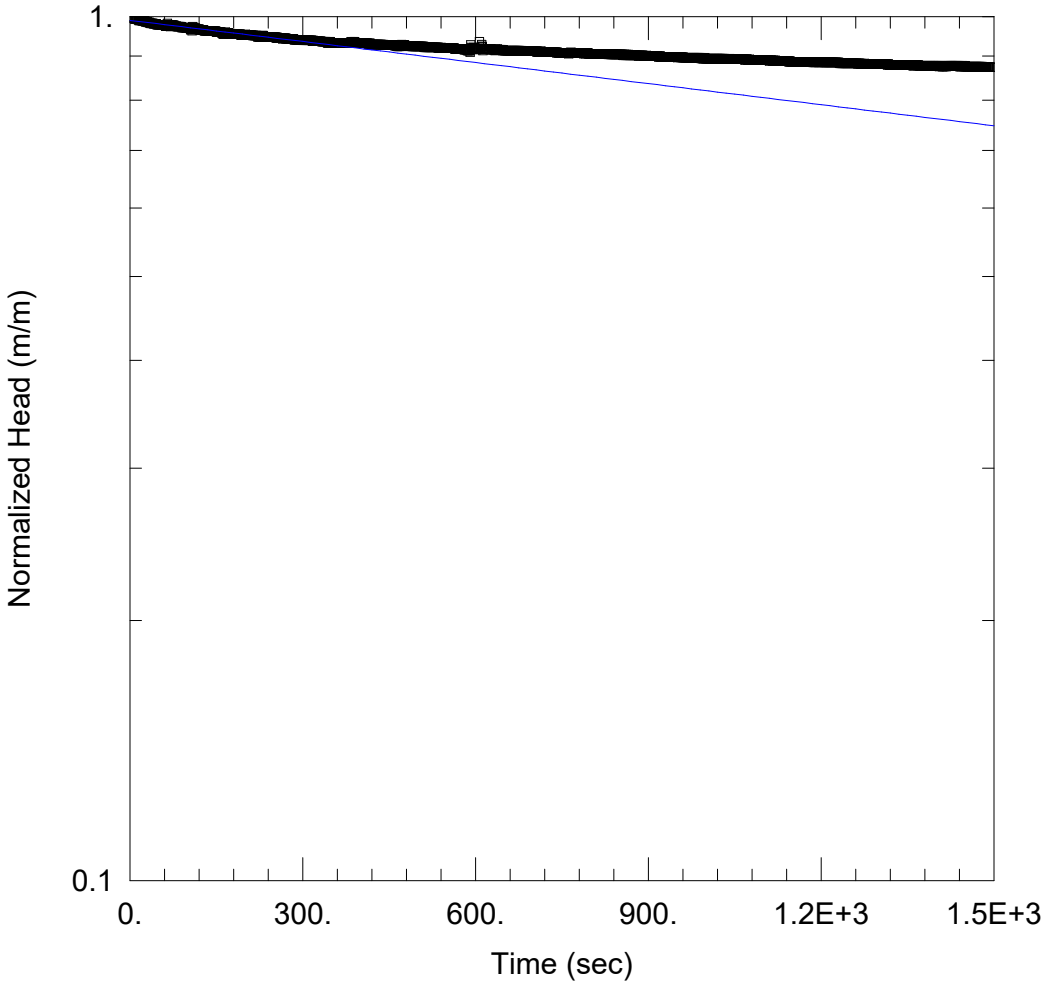
Saturated Thickness: 5.645 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH 14 - 2019)

Initial Displacement: 1.721 m
Total Well Penetration Depth: 5.645 m
Casing Radius: 0.0254 m
Static Water Column Height: 5.645 m
Screen Length: 3. m
Well Radius: 0.0254 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 7.126E-6 m/sec
y0 = 1.688 m



SWRT BH/MW-6

Data Set: C:\Users\TkachN\Desktop\BHMW-6 R.aqt
Date: 06/30/21 Time: 13:50:18

PROJECT INFORMATION

Company: EXP Services Inc.
Client: Mapleview Development Ltd.
Project: BRM-00604678-T0
Location: 750 Mapleview Dr E, Barrie, ON
Test Well: BH/MW-6
Test Date: June 29 2021

AQUIFER DATA

Saturated Thickness: 0.94 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH/MW-6)

Initial Displacement: 0.783 m
Total Well Penetration Depth: 1.5 m
Casing Radius: 0.0254 m
Static Water Column Height: 0.94 m
Screen Length: 1.5 m
Well Radius: 0.1016 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 3.404E-7 m/sec
y0 = 0.775 m

Appendix F – Water Quality Certificate of Analyses

REPORT FILTERS	750
Received Date From	04/30/20
Received Date To	04/30/21
Projects	BRM-00604678-Q0,BRM-00604678-L0
Jobs	Multiple
Samples	NAU473,NAU474,NAU475
Analytes	Multiple
Criteria 1	Prov. Water Quality Obj.
Criteria 2	ODWS (MAC/IMAC & AO/OG) - M/I
Criteria 3	ODWS (MAC/IMAC & AO/OG) - A/O

Site Location	750 MAPLEVIEW DR,BARRIE	750 MAPLEVIEW	750 MAPLEVIEW
Project #	BRM-00604678-Q0	BRM-00604678-Q0	BRM-00604678-Q0
Site #			
PO #			
COC#	738194-06-01	738194-06-01	738194-06-01
BV Labs Job #	C0G7612	C0G7612	C0G7612
Sample ID	TRIP BLANK #3668	BH/MW6	BH/MW6DU
BV Labs Sample ID	NAU475	NAU473	NAU474
Matrix	Water	Water	Water
Sampled By	RK	RK	RK
Sampling Date	06/30/20	06/30/20	06/30/20
Sampling Time		12:30 PM	12:30 PM

Report Group	*Parameter Name*	*Criteria 1*	*Criteria 2*	*Criteria 3*	*Units*	*Result*	*DL*	*Result*	*DL*	*Result*	*DL*
Volatile Organics by GC/M	1,3-Dichloropropene (cis+trans)				ug/L			<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Acetone (2-Propanone)				ug/L	<10	10	<10	10	<10	10
Volatile Organics by GC/M	Benzene	100	5		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Bromodichloromethane	200			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Bromoform	60			ug/L	<1.0	1	<1.0	1	<1.0	1
Volatile Organics by GC/M	Bromomethane	0.9			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Carbon Tetrachloride		2		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Chlorobenzene	15	80	30	ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Chloroform				ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Dibromochloromethane	40			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,2-Dichlorobenzene	2.5	200	3	ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,3-Dichlorobenzene	2.5			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,4-Dichlorobenzene	4	5	1	ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Dichlorodifluoromethane (FREON 12)				ug/L	<1.0	1	<1.0	1	<1.0	1
Volatile Organics by GC/M	1,1-Dichloroethane	200			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	1,2-Dichloroethane	100	5		ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,1-Dichloroethylene	40	14		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	cis-1,2-Dichloroethylene	200			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	trans-1,2-Dichloroethylene	200			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,2-Dichloropropane	0.7			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	cis-1,3-Dichloropropene				ug/L	<0.30	0.3	<0.30	0.3	<0.30	0.3
Volatile Organics by GC/M	trans-1,3-Dichloropropene	7			ug/L	<0.40	0.4	<0.40	0.4	<0.40	0.4
Volatile Organics by GC/M	Ethylbenzene	8		2.4	ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Ethylene Dibromide	5			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Hexane				ug/L	<1.0	1	<1.0	1	<1.0	1
Volatile Organics by GC/M	Methylene Chloride(Dichloromethane)	100	50		ug/L	<2.0	2	<2.0	2	<2.0	2
Volatile Organics by GC/M	Methyl Ethyl Ketone (2-Butanone)	400			ug/L	<10	10	<10	10	<10	10
Volatile Organics by GC/M	Methyl Isobutyl Ketone				ug/L	<5.0	5	<5.0	5	<5.0	5
Volatile Organics by GC/M	Methyl t-butyl ether (MTBE)	200			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Styrene	4			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,1,1,2-Tetrachloroethane	20			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	1,1,2,2-Tetrachloroethane	70			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Tetrachloroethylene	50	30		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Toluene	0.8	60	24	ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	1,1,1-Trichloroethane	10			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	1,1,2-Trichloroethane	800			ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Trichloroethylene	20	5		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Trichlorofluoromethane (FREON 11)				ug/L	<0.50	0.5	<0.50	0.5	<0.50	0.5
Volatile Organics by GC/M	Vinyl Chloride	600	1		ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	p+m-Xylene	2			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	o-Xylene	40			ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	Total Xylenes			300	ug/L	<0.20	0.2	<0.20	0.2	<0.20	0.2
Volatile Organics by GC/M	F1 (C6-C10)				ug/L	<25	25	<25	25	<25	25
Volatile Organics by GC/M	F1 (C6-C10) - BTEX				ug/L	<25	25	<25	25	<25	25
Semi-Volatile Organics by (	Methylnaphthalene, 2-(1-)				ug/L			<0.071	0.071	<0.071	0.071
Semi-Volatile Organics by (	Acenaphthene				ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Acenaphthylene				ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Anthracene	0.0008			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Benzo(a)anthracene	0.0004			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Benzo(a)pyrene		0.01		ug/L			<0.0090	0.009	<0.0090	0.009
Semi-Volatile Organics by (	Benzo(b/j)fluoranthene				ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Benzo(g,h,i)perylene	0.00002			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Benzo(k)fluoranthene	0.0002			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Chrysene	0.0001			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Dibenzo(a,h)anthracene	0.002			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Fluoranthene	0.0008			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Fluorene	0.2			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Indeno(1,2,3-cd)pyrene				ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	1-Methylnaphthalene	2			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	2-Methylnaphthalene	2			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Naphthalene	7			ug/L			<0.050	0.05	<0.050	0.05
Semi-Volatile Organics by (	Phenanthrene	0.03			ug/L			<0.030	0.03	<0.030	0.03
Semi-Volatile Organics by (	Pyrene				ug/L			<0.050	0.05	<0.050	0.05
Petroleum Hydrocarbons (	F2 (C10-C16 Hydrocarbons)				ug/L			<100	100	<100	100
Petroleum Hydrocarbons (	F3 (C16-C34 Hydrocarbons)				ug/L			<200	200	<200	200
Petroleum Hydrocarbons (	F4 (C34-C50 Hydrocarbons)				ug/L			<200	200	<200	200
Petroleum Hydrocarbons (	Reached Baseline at C50				ug/L			YES	N/A	YES	N/A
Elements by Atomic Spectr	Chromium (VI)	1			ug/L			<0.50	0.5	<0.50	0.5
	WAD Cyanide (Free)	5	200		ug/L			<1	1	<1	1
	Dissolved Chloride (Cl-)			250	mg/L			7.2	1	6.6	1
Elements by Atomic Spectr	Dissolved Antimony (Sb)	20	6		ug/L			<0.50	0.5	<0.50	0.5
Elements by Atomic Spectr	Dissolved Arsenic (As)	100	10		ug/L			<1.0	1	<1.0	1
Elements by Atomic Spectr	Dissolved Barium (Ba)		1000		ug/L			270	2	290	2
Elements by Atomic Spectr	Dissolved Beryllium (Be)	11			ug/L			<0.40	0.4	<0.40	0.4
Elements by Atomic Spectr	Dissolved Boron (B)	200	5000		ug/L			21	10	20	10
Elements by Atomic Spectr	Dissolved Cadmium (Cd)	0.2	5		ug/L			<0.090	0.09	<0.090	0.09
Elements by Atomic Spectr	Dissolved Chromium (Cr)		50		ug/L			<5.0	5	<5.0	5
Elements by Atomic Spectr	Dissolved Cobalt (Co)	0.9			ug/L			**1.2**	0.5	**1**	0.5
Elements by Atomic Spectr	Dissolved Copper (Cu)	5		1000	ug/L			1.8	0.9	1.3	0.9
Elements by Atomic Spectr	Dissolved Lead (Pb)	5	10		ug/L			<0.50	0.5	<0.50	0.5
Elements by Atomic Spectr	Dissolved Molybdenum (Mo)	40			ug/L			1.7	0.5	1.7	0.5
Elements by Atomic Spectr	Dissolved Nickel (Ni)	25			ug/L			1.3	1	1.2	1
Elements by Atomic Spectr	Dissolved Selenium (Se)	100	50		ug/L			<2.0	2	<2.0	2
Elements by Atomic Spectr	Dissolved Silver (Ag)	0.1			ug/L			<0.090	0.09	<0.090	0.09
Elements by Atomic Spectr	Dissolved Sodium (Na)		20000	200000	ug/L			**25000**	100	**24000**	100
Elements by Atomic Spectr	Dissolved Thallium (Tl)	0.3			ug/L			<0.050	0.05	<0.050	0.05
Elements by Atomic Spectr	Dissolved Uranium (U)	5	20		ug/L			0.69	0.1	0.7	0.1
Elements by Atomic Spectr	Dissolved Vanadium (V)	6			ug/L			<0.50	0.5	<0.50	0.5
Elements by Atomic Spectr	Dissolved Zinc (Zn)	30		5000	ug/L			6	5	<5.0	5
Elements by Atomic Spectr	Mercury (Hg)	0.2	1		ug/L			<0.10	0.1	<0.10	0.1

LEGEND	
"TBA"	To Be Announced
"N/A"	Not Applicable
Bold & Red	Exceeds Criteria 1
Bold & Blue	Exceeds Criteria 2
Highlighted	DL > Criteria

Appendix G - Water Balance Assessment (Site Specific)

750 Mapleview Barrie
Attachment 1 - Model Input

Year	Month	Mean Temp (°C)	Total Precip (mm)
1978-2006	1	-7.76	91.86
1978-2006	2	-7.05	59.48
1978-2006	3	-1.82	55.36
1978-2006	4	5.48	63.44
1978-2006	5	12.33	80.20
1978-2006	6	17.78	84.02
1978-2006	7	20.75	76.87
1978-2006	8	19.76	88.70
1978-2006	9	15.26	91.34
1978-2006	10	8.58	80.24
1978-2006	11	2.71	84.66
1978-2006	12	-3.60	76.84

750 Mapleview Barrie
Attachment 2 - Model Output

Year	Month	PET	P	P-PET	Soil Moisture	AET	PET-AET	Snow Storage	Surplus
1978-2006	January	7.8	91.9	13.3	196.5	7.8	0.0	105.2	13.8
1978-2006	February	9.3	59.5	21.4	196.3	9.2	0.1	133.3	21.7
1978-2006	March	18.4	55.4	58.9	200.0	18.4	0.0	109.7	55.2
1978-2006	April	35.8	63.4	79.2	200.0	35.8	0.0	55.0	79.2
1978-2006	May	68.3	80.2	35.4	196.8	68.3	0.0	27.5	38.6
1978-2006	June	101.3	84.0	-7.6	179.6	101.2	0.2	13.6	9.7
1978-2006	July	120.4	76.9	-39.2	142.4	116.3	4.1	5.4	2.1
1978-2006	August	96.4	88.7	-7.9	136.5	91.0	5.3	1.3	3.3
1978-2006	September	55.7	91.3	32.3	156.6	55.0	0.7	0.0	13.0
1978-2006	October	29.1	80.2	47.1	180.5	29.1	0.0	0.0	23.2
1978-2006	November	15.1	84.7	63.7	197.0	15.1	0.0	1.9	47.3
1978-2006	December	9.2	76.8	32.5	198.7	9.2	0.0	35.2	30.7
	Annual Rate (mm/yr)	566.7	933.0	329.2	2181.1	556.3	10.4	488.2	337.8

750 Mapleview Development - Pre and Post Development Water Balance
Attachment 3
Lot-level Average Infiltration Factors

1. Average Infiltration Factor – Pre Development Conditions

Category	Weighted Infiltration Factor
Topography/Slope	0.12
Soil Type 60% Fine-textured Glaciolacustrine Deposits 40% Stone-poor, Carbonated-derived Silty to Sandy Till	0.20
Cover 46% Woodlots (0.2) 54% *Cultivated Lands (0.1)	0.15
Total weighted infiltration factor	**0.47**

2. Average Infiltration Factor – Post Development Conditions

Category	Weighted Infiltration Factor
Topography/Slope	0.12
Soil Type 60% Fine-textured Glaciolacustrine Deposits 40% Stone-poor, Carbonated-derived Silty to Sandy Till	0.20
Cover 100% *Cultivated Lands (0.1)	0.10
Total weighted infiltration factor	**0.42**

Notes:

*Landscaped area considered equivalent to Cultivated Cover

750 Mapleview Development - Pre and Post Development Water Balance
Attachment 4
Summary of Pre-Development Water Balance Estimates (development limits)

1. Climate Data

Precipitation	933.00 mm/a
Evapotranspiration	556.30 mm/a
Water Surplus	376.70 mm/a
Infiltration Rate	175.92 mm/a
Runoff	200.78 mm/a

2. Pre-Developed Study Area Statistics

Open Lands	6,900 sq.m.
Woodlot	6,200 sq.m.
Building	100 sq.m.
Paved	200 sq.m.
TOTAL	13,400 sq.m.

3. Annual Pre-Development Water Balance

Land Use	**Area (sq.m.)**	**Precipitation (cu.m.)**	**Actual Evapotranspiration (cu.m.)**	**Infiltration (cu.m.)**	**Run-off (cu.m.)**
Total Impervious	300	280	0	0	280
Undeveloped	13,100	12,222	7,288	2,305	2,630
Total	13,400	12,502	7,288	2,305	2,910

Note: *Infiltration volume corrected for areas were water table is at existing grade, and contribution to infiltration is considered negligible

750 Mapleview Development - Pre and Post Development Water Balance
Attachment 5
Summary of Post-Development Water Balance (development limits)

1. Climate Data

Precipitation	933.00	mm/a			
Evapotranspiration	556.30	mm/a			
Water Surplus	376.70	mm/a			
Infiltration Rate (Pre-Dev)	175.92	mm/a	Infiltration Rate (Post-Dev)	158.21	mm/a
Runoff	200.78	mm/a	Runoff (Post-Dev)	218.49	mm/a

2. Pre-Developed Study Area Statistics

Open Lands	6,900	sq.m.
Woodlot	6,200	sq.m.
Building	100	sq.m.
Paved	200	sq.m.
TOTAL	13,400	sq.m.

3. Annual Pre-Development Water Balance

Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Infiltration (cu.m.)	Run-off (cu.m.)
Total Impervious	300	280	0	0	280
Undeveloped	13,100	12,222	7,288	2,305	2,630
Total	13,400	12,502	7,288	2,305	2,910

4. Annual Post-Development Water Balance

Land Use	Area (sq.m.)	Precipitation (cu.m.)	Actual Evapotranspiration (cu.m.)	Infiltration (cu.m.)	Run-off (cu.m.)
Landscape	7,000	6,531	3,894	1,107	1,529
Buildings	3,600	3,359	0	0	3,359
Road	1,900	1,773	0	0	1,773
Sidewalk	900	840	0	0	840
TOTAL	13,400	12,502	3,894	1,107	7,501

Note: *Infiltration volume corrected for areas were water table is at proposed grade, and contribution to infiltration is considered negligible

750 Mapleview Development - Pre and Post Development Water Balance
Attachment 6
Estimate of Infiltration Area of LID System

1. Design Infilteration Rate

Item	Value	Unit
Design infiltration rate	4	mm/h
	96	mm/day
	0.1	m/day/m^2
	0.7	m/week/m^2

2. Climate Data

Total precipitation based on weather station records	933.00	mm/yr
Total rain in an eight (8) month precipitation period	622.00	mm/yr
Based on a 32-week precipitation period	19.44	mm/week
	0.02	m/week

3. Roof and Resulted Runoff Volume

Total roof area	3,600	m^2
Rooftop runoff volume in an eight (8) month precipitation period	2,239	m^3/yr
Total rooftop runoff volume per week	70	m^3/week

3. Estimated Deficit Volume

Estimated deficit based on water balance calculations	1,197	m^3/yr
Deficit over available water (roof runoff) for infiltration	53%	-
Storage to infiltrate to meet deficit	37.4	m^3/week

Area of infiltration system required to mitigate infiltration deficit in 48 hrs	**194.8**	m^2

Note: only roof water to be infiltrated (clean water)

Appendix H – PTTW 4788-C2ZKMP

AMENDED PERMIT TO TAKE WATER

Ground Water
NUMBER 4788-C2ZKMP

Pursuant to Section 34.1 of the Ontario Water Resources Act, R.S.O. 1990 this Permit To Take Water is hereby issued to:

Mapleview Developments Ltd.
30 Wertheim Court Building "A", Unit 3
Richmond Hill, Ontario, L4B 1B9
Canada

For the water taking from: SWMP - well points/eductors, Hewitt's Creek Crossing - well points/sumps, Servicing 1 - well points, Servicing 2 - well points, Servicing 3 - well points, Servicing 4 - well points, Servicing 5 - well points, Servicing 6 - well points, Servicing 7 - well points

Located at: 700 Mapleview Dr E South Half of Lot 16 Concession 12
Barrie, County of Simcoe

750 Mapleview Dr E
Barrie, County of Simcoe

For the purposes of this Permit, and the terms and conditions specified below, the following definitions apply:

DEFINITIONS

(a) "Director" means any person appointed in writing as a Director pursuant to section 5 of the OWRA for the purposes of section 34.1, OWRA.

(b) "Provincial Officer" means any person designated in writing by the Minister as a Provincial Officer pursuant to section 5 of the OWRA.

(c) "Ministry" means Ontario Ministry of the Environment, Conservation and Parks.

(d) "District Office" means the Barrie District Office.

(e) "Permit" means this Permit to Take Water No. 4788-C2ZKMP including its Schedules, if any, issued in accordance with Section 34.1 of the OWRA.

(f) "Permit Holder" means Mapleview Developments Ltd..

(g) "OWRA " means the *Ontario Water Resources Act,* R.S.O. 1990, c. O. 40, as amended.

You are hereby notified that this Permit is issued subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. Compliance with Permit

1.1 Except where modified by this Permit, the water taking shall be in accordance with the application for this Permit To Take Water, dated July 21, 2018 and signed by Dino Sciavilla, and all Schedules included in this Permit.

1.2 The Permit Holder shall ensure that any person authorized by the Permit Holder to take water under this Permit is provided with a copy of this Permit and shall take all reasonable measures to ensure that any such person complies with the conditions of this Permit.

1.3 Any person authorized by the Permit Holder to take water under this Permit shall comply with the conditions of this Permit.

1.4 This Permit is not transferable to another person.

1.5 This Permit provides the Permit Holder with permission to take water in accordance with the conditions of this Permit, up to the date of the expiry of this Permit. This Permit does not constitute a legal right, vested or otherwise, to a water allocation, and the issuance of this Permit does not guarantee that, upon its expiry, it will be renewed.

1.6 The Permit Holder shall keep this Permit available at all times at or near the site of the taking, and shall produce this Permit immediately for inspection by a Provincial Officer upon his or her request.

1.7 The Permit Holder shall report any changes of address to the Director within thirty days of any such change. The Permit Holder shall report any change of ownership of the property for which this Permit is issued within thirty days of any such change. A change in ownership in the property shall cause this Permit to be cancelled.

2. General Conditions and Interpretation

2.1 Inspections
The Permit Holder must forthwith, upon presentation of credentials, permit a Provincial Officer to carry out any and all inspections authorized by the OWRA, the *Environmental Protection Act* , R.S.O. 1990, the *Pesticides Act* , R.S.O. 1990, or the *Safe Drinking Water Act,* S. O. 2002.

2.2 Other Approvals

The issuance of, and compliance with this Permit, does not:

(a) relieve the Permit Holder or any other person from any obligation to comply with any other applicable legal requirements, including the provisions of the *Ontario Water Resources Act* , and the *Environmental Protection Act* , and any regulations made thereunder; or

(b) limit in any way any authority of the Ministry, a Director, or a Provincial Officer, including the authority to require certain steps be taken or to require the Permit Holder to furnish any further information related to this Permit.

2.3 Information

The receipt of any information by the Ministry, the failure of the Ministry to take any action or require any person to take any action in relation to the information, or the failure of a Provincial Officer to prosecute any person in relation to the information, shall not be construed as:

(a) an approval, waiver or justification by the Ministry of any act or omission of any person that contravenes this Permit or other legal requirement; or

(b) acceptance by the Ministry of the information's completeness or accuracy.

2.4 Rights of Action

The issuance of, and compliance with this Permit shall not be construed as precluding or limiting any legal claims or rights of action that any person, including the Crown in right of Ontario or any agency thereof, has or may have against the Permit Holder, its officers, employees, agents, and contractors.

2.5 Severability

The requirements of this Permit are severable. If any requirements of this Permit, or the application of any requirements of this Permit to any circumstance, is held invalid or unenforceable, the application of such requirements to other circumstances and the remainder of this Permit shall not be affected thereby.

2.6 Conflicts

Where there is a conflict between a provision of any submitted document referred to in this Permit, including its Schedules, and the conditions of this Permit, the conditions in this Permit shall take precedence.

3. Water Takings Authorized by This Permit

3.1 **Expiry**

This Permit expires on **October 31, 2023**. No water shall be taken under authority of this Permit after the expiry date.

3.2 Amounts of Taking Permitted

The Permit Holder shall only take water from the source, during the periods and at the rates and amounts of taking specified in Table A. Water takings are authorized only for the purposes

specified in Table A.

Table A

	Source Name / Description:	Source: Type:	Taking Specific Purpose:	Taking Major Category:	Max. Taken per Minute (litres):	Max. Num. of Hrs Taken per Day:	Max. Taken per Day (litres):	Max. Num. of Days Taken per Year:	Zone/ Easting/ Northing:
1	SWMP - well points/eductors	Well Sand Point	Construction	Dewatering Construction	1,476	24	2,125,000	365	17 609920 4912103
2	Hewitt's Creek Crossing - well points/sumps	Well Sand Point	Construction	Dewatering Construction	105	24	150,000	365	17 610016 4912105
3	Servicing 1 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609756 4911673
4	Servicing 2 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609725 4911845
5	Servicing 3 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609531 4911853
6	Servicing 4 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609550 4912012
7	Servicing 5 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609691 4912119
8	Servicing 6 - well points	Well Sand Point	Construction	Dewatering Construction	3,097	24	4,460,000	365	17 609882 4911957
9	Servicing 7 - well points	Well Sand Point	Construction	Dewatering Construction	785	24	1,130,400	365	17 609869 4911738
						Total Taking:	4,460,000		

3.3 Notwithstanding Table A, the daily combined maximum water taking from all sources listed in Table A shall not exceed 4,460,000 L/day.

3.4 Prior to the taking of water under the authorization of this Permit, the Permit Holder shall submit to the Director a geotechnical assessment of the potential for ground settlement as a result of the proposed taking, and the potential for any subsequent adverse effects related to such settlement. This assessment is required to be signed and sealed by a professional engineer licensed to practice in the province of Ontario, who through a combination of education and experience, is adequately qualified to assess geotechnical matters of this nature. The assessment may also include recommendations for monitoring and/or mitigation, if so warranted.

4. Monitoring

4.1 The Permit Holder shall maintain a record of all water takings. The Permit Holder shall, on each day water is taken under the authorization of this Permit, record the date, the volume of water taken on that date and the rate at which it was taken. The daily volume of water taken shall be measured by a flow meter or calculated in accordance with the method described in the application for this Permit, or as otherwise accepted by the Director. The Permit Holder shall keep all required records up to date and available for inspection by a Provincial Officer upon his or her request. The Permit Holder shall submit, on or before March 31st in every year, the daily water taking data collected and recorded for the previous year to the ministry's Water Taking Reporting System.

4.2 The Permit Holder shall implement the monitoring and mitigation program as described in Section 7 of Item 2 and Items 4 and 5 of Schedule A of this Permit. The Permit Holder shall keep all monitoring records available for inspection and review upon request by the Ministry.

5. Impacts of the Water Taking

5.1 Notification

The Permit Holder shall immediately notify the local District Office of any complaint arising from the taking of water authorized under this Permit and shall report any action which has been taken or is proposed with regard to such complaint. The Permit Holder shall immediately notify the local District Office if the taking of water is observed to have any significant impact on the surrounding waters. After hours, calls shall be directed to the Ministry's Spills Action Centre at 1-800-268-6060.

5.2 For Groundwater Takings

If the taking of water is observed to cause any negative impact to other water supplies obtained from any adequate sources that were in use prior to initial issuance of a Permit for this water taking, the Permit Holder shall take such action necessary to make available to those affected, a supply of water equivalent in quantity and quality to their normal takings, or shall compensate such persons for their reasonable costs of so doing, or shall reduce the rate and amount of taking to prevent or alleviate the observed negative impact. Pending permanent restoration of the affected supplies, the Permit Holder shall provide, to those affected, temporary water supplies adequate to meet their normal requirements, or shall compensate such persons for their reasonable costs of doing so.

If permanent interference is caused by the water taking, the Permit Holder shall restore the water supplies of those permanently affected.

6. Director May Amend Permit

The Director may amend this Permit by letter requiring the Permit Holder to suspend or reduce

the taking to an amount or threshold specified by the Director in the letter. The suspension or reduction in taking shall be effective immediately and may be revoked at any time upon notification by the Director. This condition does not affect your right to appeal the suspension or reduction in taking to the Environmental Review Tribunal under the *Ontario Water Resources Act* , Section 100 (4).

The reasons for the imposition of these terms and conditions are as follows:

1. Condition 1 is included to ensure that the conditions in this Permit are complied with and can be enforced.

2. Condition 2 is included to clarify the legal interpretation of aspects of this Permit.

3. Conditions 3 through 6 are included to protect the quality of the natural environment so as to safeguard the ecosystem and human health and foster efficient use and conservation of waters. These conditions allow for the beneficial use of waters while ensuring the fair sharing, conservation and sustainable use of the waters of Ontario. The conditions also specify the water takings that are authorized by this Permit and the scope of this Permit.

In accordance with Section 100 of the Ontario Water Resources Act, R.S.O. 1990, you may by written Notice served upon me and the Environmental Review Tribunal within 15 days after receipt of this Notice, require a hearing by the Tribunal. Section 101 of the Ontario Water Resources Act, R.S.O. 1990, as amended, provides that the Notice requiring the hearing shall state:

1. The portions of the Permit or each term or condition in the Permit in respect of which the hearing is required, and;
2. The grounds on which you intend to rely at the hearing in relation to each portion appealed.

In addition to these legal requirements, the Notice should also include:

a. The name of the appellant;
b. The address of the appellant;
c. The Permit to Take Water number;
d. The date of the Permit to Take Water;
e. The name of the Director;
f. The municipality within which the works are located;

This notice must be served upon:

The Secretary
Environmental Review Tribunal
655 Bay Street, 15th Floor
Toronto ON
M5G 1E5
Fax: (416) 326-5370
Email: ERTTribunalsecretary@ontario.ca

AND

The Director, Section 34.1,
Ministry of the Environment, Conservation and Parks
Floor 1, 135 St Clair Ave W
Toronto, ON
M4V 1P5

Further information on the Environmental Review Tribunal's requirements for an appeal can be obtained directly from the Tribunal:

by Telephone at	by Fax at	by e-mail at
(416) 212-6349	(416) 326-5370	www.ert.gov.on.ca
Toll Free 1(866) 448-2248	Toll Free 1(844) 213-3474	

This Permit cancels and replaces Permit Number 2312-B4AP29, issued on 2018/10/26.

Dated at Toronto this 17th day of May, 2021.

Gregory Meek
Director, Section 34.1
Ontario Water Resources Act , R.S.O. 1990

Schedule A

This Schedule “A” forms part of Permit To Take Water 4788-C2ZKMP, dated May 17, 2021.

1. Permit to Take Water Application, dated July 21, 2018 and signed by Dino Sciavilla.

2. Exp Services Inc.: Category 3 Permit To Take Water Application for Amendment of PTTW 4767-ASGKAAA (MOECC Ref. Number 8652-B38MFG), Proposed Residential Development, 700 Mapleview Drive East, Barrie, Ontario, Addendum Hydrogeological Investigation, dated September 21, 2018 and signed by Ryan Smith and Natliya Tkach of Exp Services Inc..

3. Exp Services Inc., Letter "Response to Additional Information Request, PTTW Amendment Application to Permit No. 4767-ASGKAA, Proposed Residential Development, 700 Mapleview Drive East, Barrie, Ontario", dated August 24, 2018 and signed by Ryan Smith and Natalya Tkach of Exp Services Inc..

4. Exp Services Inc., Letter "Additional Information, PTTW Amendment Application to Permit No. 4767-ASGKAA, Proposed Residential Development, 700 Mapleview Drive East, Barrie, Ontario", dated 4:34pm October 24, 2018 and signed by Ryan Smith and Natalya Tkach of Exp Services Inc..

5. Email from Nataliya Tkach of Exp: "RE: MOECC Ref. Number 8652-B38MFG - PTTW Amendment Application to Permit No. 4767-ASGKAA - Proposed Residential Development – 700 Mapleview Drive East, Barrie ON - additional information request" dated October 26, 2018 12:32pm.

Appendix I - Construction Dewatering Flow Rate Calculations

APPENDIX I: Construction Dewatering Calculations

750 Mapleview Drive East, Barrie, Ontario

BRM-00604768-T0

Table J-1: Flow all Sides of the Excavation

Value	Unit	Servicing #7 (High K Senario)
Geological Formation	-	Overburden
Ground Elevation (lowest)	mASL	248.53
Approx. WL Elev.	mASL	248.07
Top of Overburden Aquifer	mASL	248.07
Bottom of Overburden Aquifer	mASL	241.53
Thickness of Overburden Aquifer	m	6.54
H (above base of aquifer)	m	6.54
Dewatered elevation target in overburden	mASL	243.03
h_w (dewatered water table above aquifer substratum)	m	1.50
Hydraulic Conductivity	m/s	8.80E-06
Transmissivity	m^2/s	5.76E-05
Length of Excavation	m	400
Width of excavation	m	10
Method to Calculate Radius of Influence, Ro		Sichardt
Radius of Influence from Sides of Excavation, Ro	m	45
Distance to Linear Source from Sides of excavation (Lo = Ro/2)	m	22
Dewatering Flow Rate (unconfined linear flow component)	m^3/day	563
Factor of Safety	-	2.0
Dewatering flow rates multiplied by factor of safety	m^3/day	1,127

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

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

Where: (Based on the Dupuit Equation)

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

K = Hydraulic conductivity (m/s)

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

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

L_o=Distance of Influence (m)

Table J-2: Precipitation Estimate

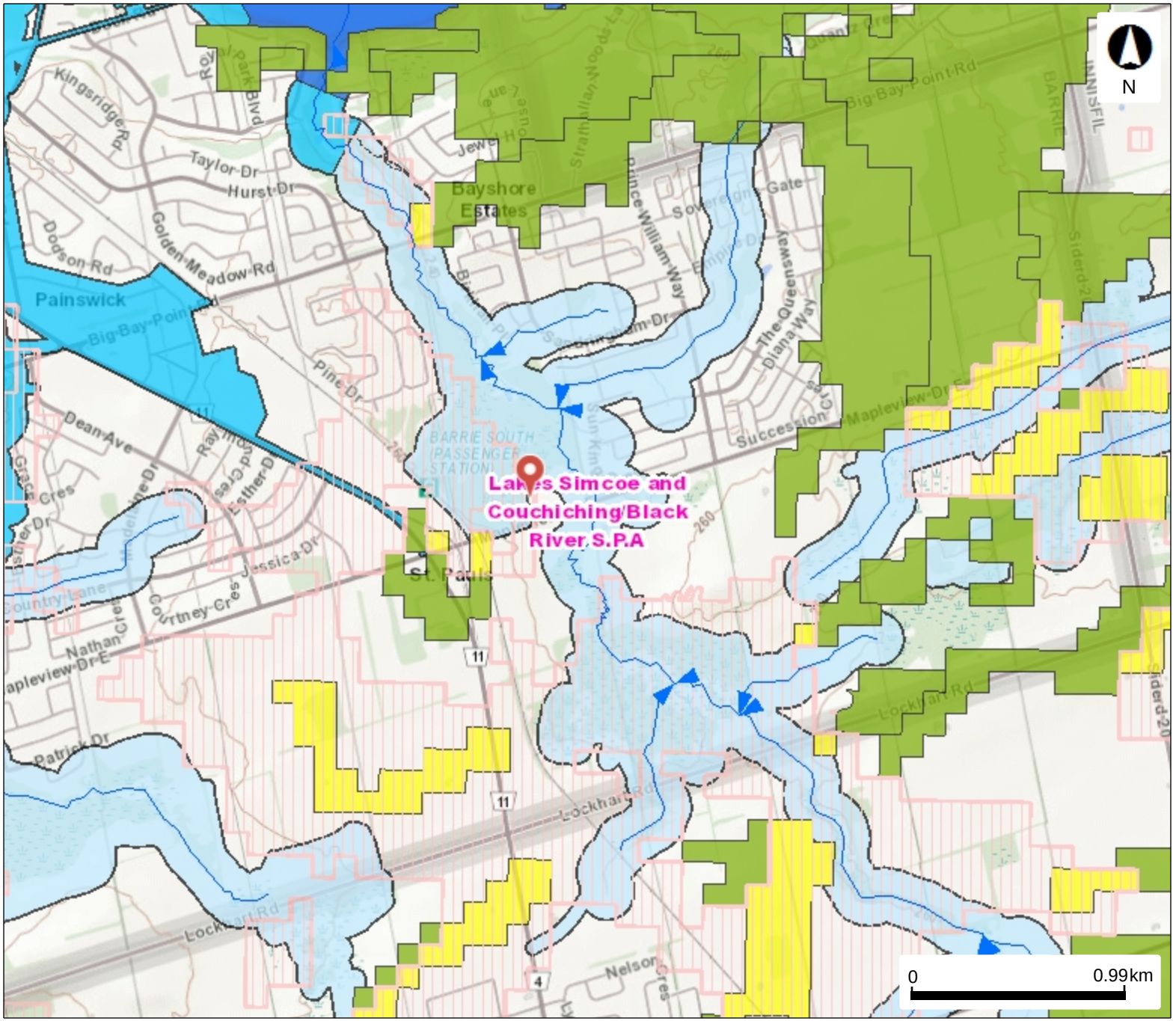
Location	Assumed Precipitaiton Event (mm)	Length of Excavation (m)	Width of Excavation (m)	Rainwater Collection (m^3)
Servicing #7 (High K Senario)	15	30	5	2

Notes:

mASL - meters above sea level

Appendix J - Significant Ground Water Recharge (SGWRA) and HVA Map

Significant Groundwater Recharge Area (SGWRA) and HVA Map



Legend

- Source Protection Areas
- Watercourse Direction
- Intake Protection Zone Name
- Highly Vulnerable Aquifers
- Significant Groundwater Recharge Area
  - 0
  - 2
  - 4
  - 6
- Intake Protection Zone 1
- Intake Protection Zone 2
- Intake Protection Zone 3
- Vulnerable Scoring Area - Surface Water
  - 0 - 3.9
  - 4 - 7.9
  - 8 - 8.9
  - 9 - 10
- Assessment Parcel

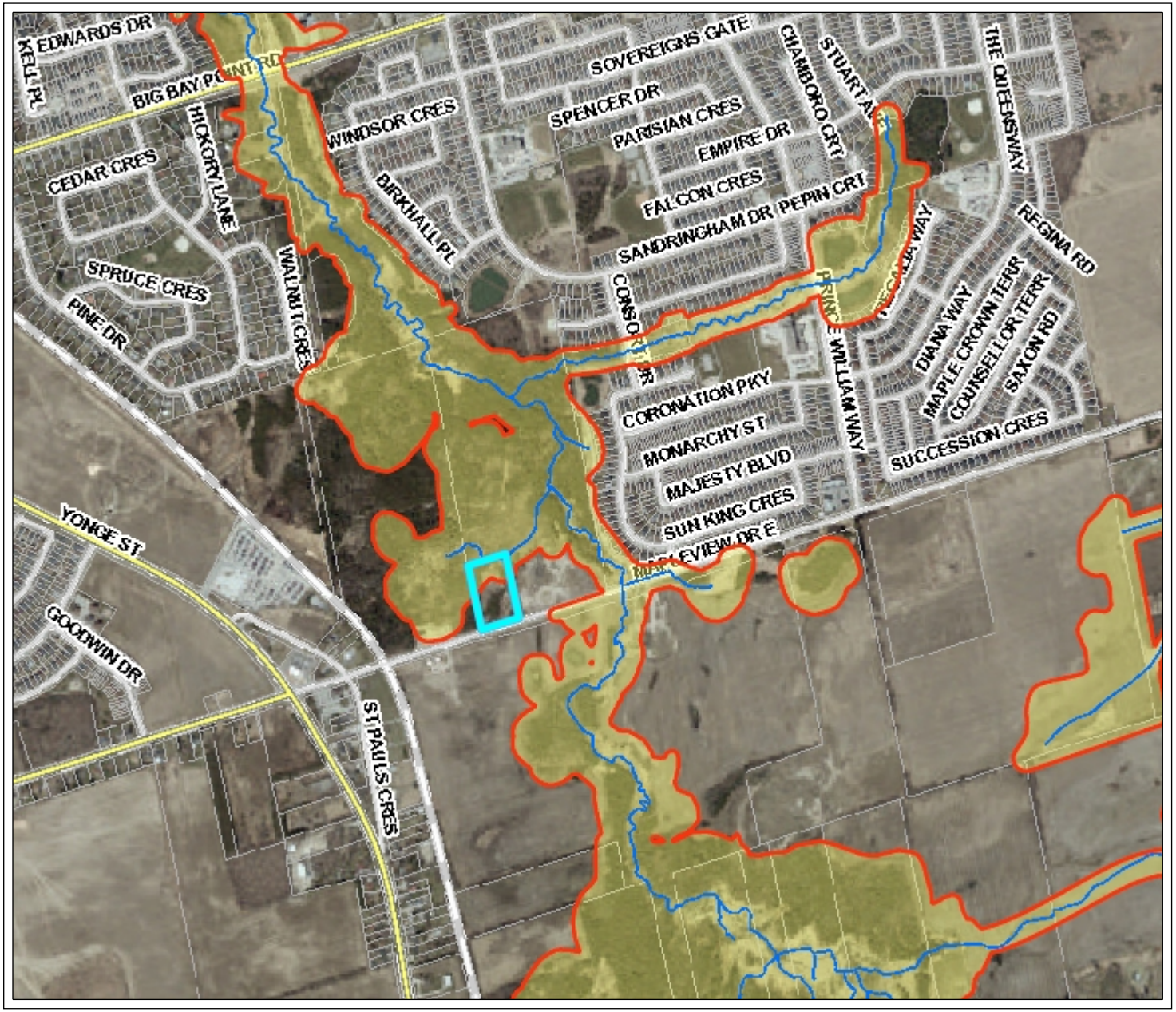
This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

Map Created: 9/28/2021
Map Center: 44.35024 N, -79.61813 W

Lake Simcoe Region conservation authority

O. Reg 179/06 Map



Features

- LSRCA Watershed Boundary
- Lake Simcoe
- Watercourse
- Regulated Area Boundary
- Regulated Area
- Road Labels
- Assessment Parcel
- Roads
  - Hwy 400 Series
  - Highway, Arterials
  - Local Road
- Railway

Printed On:
9/28/2021

WGS_1984_Web_Mercator_Auxiliary_Sphere

Mapped By: NT

Scale 1: 14,154

Meters

719 0 360 719