Hydrogeological Study in Support of Draft Plan

Di Poce Management Inc.
Barrie, Ontario

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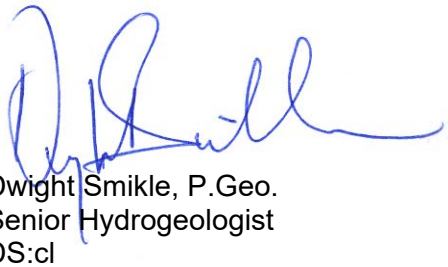

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1.0 Introduction

R.J. Burnside & Associates Limited (Burnside) has been retained by Di Poce Management Inc. (Di Poce) to complete a hydrogeological assessment for lands located within the OPA 39 Salem Secondary Plan Area (SPA) in Barrie. The lands associated with the assessment, herein referred to as the subject lands are located at the east side of County Road 27, west side of Essa Road and north side of Salem Road in the City of Barrie, Ontario (Figure 1). The subject lands are located within the Barrie Annexed Lands and the OPA 39 Salem Secondary Plan Area (SPA) located on the southern boundary of the City of Barrie. In 2016, a Subwatershed Impact Study (SIS) for the Salem SPA was completed for the Salem Secondary Plan Landowners Group that included an assessment of regional hydrogeology (Burnside, 2016). The current assessment is aimed at updating information contained in the regional hydrogeological assessment and providing more detailed site-specific information for the subject lands in support of an application for draft plan approval.

1.1 Scope of Work

The scope of work completed for the hydrogeological study was developed to build upon the regional work completed for the Salem SIS (Burnside, 2016) and to address requirements for hydrogeological studies in support of draft plan approval. The scope of work for the hydrogeological assessment included the review of available regional information as well as the completion of the following site-specific tasks:

1. Review of published geological and hydrogeological information: A review of background material for the area, including topography, surficial geology and bedrock geology mapping and existing geotechnical and hydrogeological reports was completed to assess the regional hydrogeological setting.

2. Review of the Ministry of the Environment, Conservation and Parks (MECP) water well records: The MECP maintains a database that provides geological records of water supply wells drilled in the province. A list of the available MECP water well records for local wells is provided in Appendix A and the well locations are plotted on Figure 5. It is noted that the well locations listed in the MECP records are approximations only and may not be representative of the precise well locations in the field. These well data were compiled and mapped to characterize the local groundwater resources.

3. Establish groundwater monitoring network: Groundwater monitoring wells were constructed to characterize seasonal variations in the water table. In addition to the new monitoring wells, existing wells from previous studies were selected for inclusion in the monitoring program. One drive-point piezometer nest (one shallow and one deep piezometer driven into the ground at the same location)

was installed near a watercourse on the subject lands to determine the nature of potential groundwater/surface water interactions. The locations of the monitoring wells and piezometers are shown on Figure 2. The monitoring well construction details are provided on the borehole logs in Appendix B.

4. Hydraulic conductivity testing: Burnside conducted single well response tests in order to determine hydraulic conductivity. Single well response tests were completed at four groundwater monitoring wells (BH7, BH23, BH120 and BH129) in 2018. The hydraulic conductivity field testing results are provided in Appendix C.

5. Monitoring of groundwater levels: Groundwater monitoring has been completed to measure the depth to the water table and assess the horizontal and vertical groundwater flow conditions. Groundwater level monitoring was completed from May 2018 to August 2019 in monitoring wells and piezometers. The groundwater monitoring data and hydrographs are provided in Appendix D.

6. Surface water monitoring: Surface water monitoring was completed along the tributary to Bear Creek that flows across the subject lands. The surface water monitoring locations were inspected monthly for water depth and flow from May 2018 to August 2019. The surface water monitoring data are summarized in Appendix E.

7. Water quality testing: Water quality data was collected from selected monitoring locations to typify the groundwater and surface water quality in the vicinity of the subject lands. Samples were collected in 2018 from two monitoring wells (MW3d and BH120). A surface water sample was collected at SSF-7 in 2019. The water samples were submitted to a certified laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality at the property. The laboratory water quality data are provided in Appendix F.

8. Water balance calculations: Pre and post-development water balance calculations have been completed to assess the groundwater infiltration volumes for the subject lands. The local climate data and detailed water balance calculations are provided in Appendix G.

9. Data compilation, assessment of site conditions and reporting: The above data were all compiled reviewed and assessed to develop an understanding of the site-specific hydrogeological conditions. The results of the assessment are presented in the current report.

2.0 Physical Setting

2.1 Topography and Drainage

The topography of the subject lands slopes regionally in a north-northwest direction. The topography can be described as generally flat to gently rolling with elevations ranging from 310 metres above sea level (masl) in the southeast corner to 287 masl, along the tributary of Bear Creek where it crosses County Road 27 (Figure 3). The topography along the northeastern edge of the subject lands shows a sharp drop off to the main valley of the Bear Creek which is approximately 15 m below the elevation at the northeast corner of the subject lands.

The subject lands are located within the jurisdiction of the Nottawasaga Valley Conservation Authority (NVCA) and the Bear Creek subwatershed. A tributary of Bear Creek which originates on south side of Salem Road from a wetland and open water pond conveys intermittent flows in a north to northwest direction across the western portion of the subject lands (Figure 3). The southern portion of the subject lands is covered by a woodland/unevaluated wetlands mosaic (Michalski Nielsen, 2019).

2.2 Geology

The subject lands are located in the physiographic region known as the Peterborough Drumlin Field. The region is characterized as a rolling drumlinized till plain. The drumlins through the region are comprised of highly calcareous till (Chapman & Putnam, 1984).

The overburden within the Peterborough Drumlin Field was deposited as a series of advances and retreats of the Simcoe glacial ice lobe. This has resulted in drumlinized sheets of glacial till (Newmarket till), stratified glaciolacustrine deposits of sand and gravel, littoral-foreshore deposits and massive-well laminated deposits of sand and gravel being common in this area. A review of the quaternary geology mapping for the area (OGS, 2003) indicates that the overburden sediments of the subject lands consist primarily of silty to sandy glacial till and ice contact stratified deposits (Figure 4).

The bedrock in the area is mapped as consisting primarily of Paleozoic limestone of the Middle Ordovician Simcoe Group. Underlying the subject lands is the Lindsay Formation which consists mainly of fine to coarse grained, fossiliferous, commonly nodular, argillaceous limestone (OGS, 2007).

2.3 Regional Hydrostratigraphy

The overburden deposits of the subject lands influence groundwater occurrence and flow. The overburden has been interpreted by regional studies such as the Tier 3 Water Balance (AquaResource, 2011) and Source Water Protection Assessment Report (LSRCA, 2012) to consist of alternating sequences of coarser-grained permeable layers

(aquifers) and finer-grained less permeable areas (aquitards) of varying thicknesses. The basic hydrostratigraphic sequence that was modelled in the regional studies (AquaResource, 2011) consists of four main aquifer areas (A1-A4) and four main aquitards (C1 to C4) with a confining layer (UC) over the uppermost aquifer (A1).

A description of the interpreted regional hydrostratigraphic framework is provided below (LSRCA, 2012):

- Surficial Geology Layer – This layer represents coarse grained sediments in stream beds and at surface surficial geology areas that overly the UC. The thickness ranges from 0.1 m to 3 m.
- UC – Upper Confining Layer – Represents smaller areas of less permeable surficial material. The upper confining layer has been mapped as coarse-grained lacustrine deposits which are part of a regionally extensive sand plain (LSRCA, 2012). Regional studies such as the AquaResource (2011) report indicate that the confining layer (UC) is patchy in the area of the study area.

- A1 – Represents the uppermost aquifer. Frequently exists as a surficial unconfined aquifer and is stratigraphically equivalent to the Oak Ridges Moraine. It is generally associated with coarse grained glacial and interglacial sediments mapped as ice contact stratified drift. The majority of the local domestic wells are completed within this area. The upper aquifer A1 is reported to be present throughout the larger Barrie area, and has been interpreted to occur extensively in the study area.

- C1 – Upper aquitard. Described as varved clay and silt (LRSCA, 2012).

- A2 – Intermediate aquifer which is stratigraphically equivalent to areas within the Northern Till. The aquifer is generally described as being composed of sand with some clast rich portions (LRSCA, 2012). This area is used for the Innisfil Heights water supply.

- C2 – Intermediate aquitard.

- A3 – This area constitutes the main Barrie municipal aquifer and is the source of the Stroud water supply; it is stratigraphically equivalent to the Thorncliffe deposits in the Upland regions.

- C3 – Lower aquitard.

- A4 – Lower aquifer, thin and sometimes combined with A3 where C3 is thin or absent.

- C4 – Lower aquitard but may also represent weathered bedrock.

The above regional hydrostratigraphic sequence was supported by the work completed by Burnside in the SIS and is thought to represent the sequences encountered in the vicinity of the subject lands.

2.4 Local Stratigraphy

Boreholes were drilled across the subject lands as part of geotechnical investigations conducted by Terraprobe and GeoPro Consulting in 2018. A total of 32 boreholes were completed with 16 of the boreholes being completed as monitoring wells. The locations of the boreholes and monitoring wells are shown on Figure 5 and the borehole logs are provided in Appendix B.

The geological information from the boreholes indicated that the overburden is generally composed of layers of glacial till and sand. The till deposits were generally composed of sandy silt to silty sand with varying amounts of clay and gravel. Some lenses of finer grained sediments were encountered in the boreholes and these lenses were interpreted to be discontinuous. Surficial sand, corresponding to the mapped ice-contact stratified deposits (Figure 4) was encountered with thicknesses up to 8 m. The information provided by the borehole logs confirms the surficial geology mapping for the area.

To illustrate the shallow hydrostratigraphic sequence of the subject lands, schematic geologic cross-sections have been prepared (Figures 6 and 7) using the MECP well records (Appendix A) and the soils information collected during drilling of boreholes (Appendix B). The locations of the cross-sections are illustrated on Figure 5 along with the locations of water wells and boreholes used in the construction of the cross-sections.

The cross-sections update the information contained in the SIS and illustrate that the subject lands are underlain by surficial sand and silt with thickness ranging from 2 to 14 m. There are variations in lithology within this layer with occasional low permeability layers occurring within the surficial sand and silt. Underlying the surficial sand is a clay silt till layer with thickness ranging from 8 to 25 m. The clay silt till is interpreted to be exposed at surface to the east of the subject lands and has occasional layers of sand and gravel. Underlying the clay silt till layer is a deeper layer of sand. The deeper sand layer is interpreted to form the local aquifer where most private supply wells are completed (Figures 6 and 7). Based on cross-sections produced in the Salem SIS (Burnside, 2016), the sand layer extends from an elevation of approximately 275 masl to below 230 masl. The deeper sand aquifer is separated from the surface by the silty clay till which is interpreted to act as an aquitard and is up to 25 m thick.

3.0 Hydrogeology

The hydrogeology of the subject lands was investigated in order to determine site specific conditions and features that impact the occurrence and movement of groundwater at the local scale. Various parameters were evaluated in order to develop a full understanding and interpretation of hydrogeological conditions on the subject lands. Conceptually, the information was all combined to create an understanding of the hydrogeological conditions of the subject lands that is referred to as the conceptual model. The following sections provides additional information on the interpreted conceptual model for the subject lands.

3.1 Hydraulic Conductivity

There are various methods that can be used to assess soil hydraulic conductivity, i.e., the ability of the soil to transmit groundwater. Grainsize data and soil characteristics can be used to provide a general estimate of hydraulic conductivity. In situ bail-down or slug-testing methods are used in groundwater monitoring wells to assess site-specific hydraulic conductivity. These methods have been used to estimate the hydraulic conductivity of the soils encountered on the subject lands as discussed below.

3.1.1 Grainsize Analysis

Grainsize analysis from geotechnical investigations on the subject lands (GeoPro, 2018 and Terraprobe, 2011) were reviewed (data provided in Appendix C).

Grainsize analyses results indicate that the sediments within the overburden range in composition from sand (9% fines) to silt and clay (82% fines). The amount of fines within a deposit impacts the ability of the material to transmit water and generally a greater amount of fines lowers the overall hydraulic conductivity. Groundwater flow is therefore generally limited by fine grained sediments with lower hydraulic conductivity.

To estimate hydraulic conductivity based on grainsize analysis, an empirical formula known as the Hazen estimation is used. This method is an approximation of hydraulic conductivity based on grainsize curves for sandy soils. The approximation does not strictly apply to finer grained materials, however, it is still considered useful to provide a general indication of the range of the hydraulic conductivity values.

Hydraulic conductivity values were derived empirically using the Hazen method for twelve of the samples collected on the subject lands. The grainsize distribution graphs are provided in Appendix C and the calculated hydraulic conductivity values are provided in Table 1.

Table 1: Summary of Grainsize Analyses and Hydraulic Conductivity

Sample ID	Depth of Sample (mbgs)	% Fines	Hydraulic Conductivity (cm/s)
BH2-SS5	3.05	26.2	$1.96E^{-04}$
BH3-SS2	0.61	56.6	$4.00E^{-06}$
BH4-SS3	1.22	23.1	$1.00E^{-04}$
BH6-SS3	1.22	42.9	$4.00E^{-06}$
BH7-SS4	2.29	35.5	$3.60E^{-05}$
BH7-SS8	7.62	12.2	$4.90E^{-03}$
BH8-SS5	3.05	22.6	$6.40E^{-05}$
BH9-SS5b	3.2	11.6	$4.90E^{-03}$
BH11-SS3	1.22	30.8	$6.40E^{-05}$
BH12-SS3	1.22	11.2	$4.90E^{-03}$
BH20-SS4	2.29	39.9	$1.00E^{-06}$
BH25-SS3	1.22	9	$5.93E^{-03}$

The hydraulic conductivities based on grainsize analyses are estimated in the range of 10^{-3} to 10^{-6} cm/sec.

3.1.2 Single Well Response Tests

To assess the in situ hydraulic conductivity of the sediments, single well response tests (bail-down tests) were conducted at four monitoring wells. The results from the tests were plotted (Appendix C) and analyzed to calculate hydraulic conductivity of the sediments screened. A summary the calculated hydraulic conductivities is provided below in Table 2.

Table 2: Single Well Response Testing Results

Monitoring Well	Screen Interval (mbgs)*	Formation Screened	Hydraulic Conductivity (cm/sec)
BH7	13.1 - 14.8	Sand and Silt to Silty Sand	6.8×10^{-3}
BH23	4.0 - 6.1	Sand and Silt to Silty Sand	4.4×10^{-2}
BH120	4.0 - 7.5	Silty Sand	1.2×10^{-5}
BH01	4.5	Silty Sand	6.5×10^{-3}

*metres below ground surface

The single well response test analyses resulted in hydraulic conductivities ranging from 10^{-2} to 10^{-5} cm/sec. The wells tested were screened across sand and in the surficial silty sand till which forms the area to be impacted by development. Overall, the hydraulic

conductivity of the overburden sediments on the subject lands consisting of sand and silt till is interpreted to range from 10^{-2} cm/sec (high) to 10^{-5} cm/sec (moderate).

3.2 Local Groundwater Use

The City of Barrie obtains its water from a combination of groundwater and surface water based supplies. Municipal servicing is assumed to be available for lands within the municipal city boundary which includes lands north of the subject lands (Figure 1). Homes along Country Road 27 and Salem Road outside of the previous municipal limits however are likely to have private water supply wells.

A review of the MECP water well records indicated that there are approximately 17 water supply well records within 500 m of the subject lands. The locations of the MECP water well records are shown on Figure 5. The wells are located in the overburden at depths ranging from 5.2 to 72.5 m. Based on our interpretation of local stratigraphy and the interpreted geological cross-sections it is interpreted that most of the water supply wells are in the regional sand aquifer that occurs at elevations approximately between 210 masl and 275 masl (Figures 6 and 7). These wells would be separated from activities on the subject lands by a layer of low hydraulic conductivity silty clay till.

The City of Barrie groundwater supply wells are located in deep aquifers (A3 and A4 in the regional hydrostratigraphy). These aquifers are interpreted to be found at elevations of 150 masl to 195 masl and 115 masl to 160 masl respectively and are therefore significantly below the surficial layer found on the subject lands and separated from any potential impact due to the proposed development (AquaResource et al., 2011). There are no municipal water supply wells located close to the subject lands; the municipal water supply wells are located on the west and northern sides of the City more than 5 km from the subject lands. The subject lands do not fall within any wellhead protection areas or intake protection zones associated with the City of Barrie water supply systems (LSRCA, 2012).

3.3 Water Level Monitoring Results

Groundwater levels were monitored at the on-site monitoring wells between May 2018 and August 2019. Groundwater level data is provided in tables and hydrographs in Appendix D. Groundwater elevations are plotted with daily precipitation data obtained from a nearby climate station – Barrie-Oro (Climate Station ID# 6117700) which is the closest station with daily precipitation values for the period under review. Automatic water level recorders were installed in September 2018 in monitoring wells BH23 and BH120 to collect continuous hourly water level data. The wells were chosen for instrumentation based on initial water level data with the intention to record short term water table responses. Wells with low water levels were not chosen as they have the potential to go dry.

Groundwater level data collected by Terraprobe as part of the geotechnical study (Terraprobe, 2019b) has also been incorporated into the hydrographs (Figures D-12 to D-16, Appendix D).

The groundwater monitoring data show the following (refer to Figure 2 for the monitoring locations and the data tables and hydrographs in Appendix D):

- Typically, in shallow wells in southern Ontario, a seasonal groundwater level pattern is apparent with highest levels occurring in the spring, declining throughout the summer and early fall and then rising again in the late fall/early winter. This seasonal pattern is evident at monitoring wells BH18, BH23, BH120 and MW3s/d with seasonal variations ranging from 1.2 m to 3.0 m (Figures D-1 to D-10, Appendix D).

- It is interpreted that a perched groundwater table exists within the surficial sands at BH18, BH23, BH120, BH01 and MW3 with water levels ranging from 0.5 m to 6.0 meters below ground surface. The perched conditions are interpreted to be due to local layers of low permeability occurring within the surficial sands. The water table is considered to be perched as unsaturated conditions exist below the low permeability layer that causes the perched conditions. This is illustrated at BH14, where a perched water table was encountered during drilling but the well was eventually screened below the surficial sand layer. Monitoring data has indicated that this well is dry and that unsaturated conditions exist confirming that the above water table represents perched conditions.

- Where perched conditions were not encountered it is interpreted that the low permeability layer is not present and shallow groundwater was encountered at depths ranging from 5.5 mbgs to 14.3 mbgs. Monitoring wells interpreted to be screened in the shallow groundwater system include BH7, BH122 and BH203 (Figure D-1, Figure D-7 and Figure D-16). During low water table conditions BH7 and BH122 were dry.

- Water levels at BH14 ranged from 1 cm to 9 cm above the bottom of the well screen (Figure D-2, Appendix D) and BH21 was consistently dry (Figure D-4, Appendix D). These wells are interpreted to be screened above the shallow groundwater table.

- Water levels at BH130 were consistently dry during monitoring between February 2018 and June 2019 (Terraprobe, 2019b) indicating that groundwater was consistently below the bottom of the well screen (285 masl).

- Water levels in BH123 are consistently 0.08 m above the bottom of the well (Figure D-8). This is interpreted to be water trapped in the bottom of the well cap

and not a reflection of the water table. BH123 is screened below the perched water table that adjacent wells MW3s/d are screened in.

- Water levels in piezometer nest DP-PZ1s/d ranged from ground surface to 0.4 m below ground surface. Water levels in the deep piezometer were lower than the shallow well indicating recharge conditions except during July where discharge conditions are observed (Figure D-11, Appendix D).

3.4 Interpreted Groundwater Flow Pattern

Groundwater flow on the subject lands has been interpreted based on groundwater elevations obtained from monitoring wells. Seasonal high groundwater elevations from April 2019 are shown on Figures 8 and 9 along with interpreted groundwater elevation contours and arrows perpendicular to the groundwater elevation contours illustrate the interpreted direction of the groundwater movement.

The observed groundwater elevations have been contoured based on their interpreted system as influenced by the underlying stratigraphy and screened formation. Monitoring wells with groundwater levels interpreted to be part of a perched groundwater system are shown on Figure 8. These wells are screened within sediments that are underlain by fine grained and low permeability layers which form pockets or layers of groundwater above the shallow groundwater flow system. These pockets or layers of groundwater are considered to be perched systems as they are not continuous and exist above the more continuous shallow system and are underlain by unsaturated conditions. Groundwater flow within the perched system is interpreted to follow the local topography and be in a northwest direction with some convergence along the tributary of Bear Creek. Where no low permeability layer exists, it is interpreted that the perched system also does not exist.

A shallow groundwater table is interpreted in areas where a fine grained layer is not present and therefore there is no perched water table. Elevations from monitoring wells within this shallow groundwater table are 5 to 10 m deeper than the perched water table as shown on Figure 9. The shallow groundwater table is interpreted to be influenced by the surface topography with groundwater flow from the topographically higher areas towards topographically lower areas moving in a northeast direction.

The mapped wetlands located on the southern portion of the subject lands are located upgradient of the subject lands in the groundwater flow path and are therefore expected to receive any groundwater contributions before that groundwater gets to the subject lands.

3.5 Recharge and Discharge Conditions

Areas where water from precipitation infiltrates into the ground and moves downward (i.e., areas of downward hydraulic gradients) are known as recharge areas. These areas are generally found at relatively higher topographic elevation. Areas where groundwater moves upward (i.e., areas of upward hydraulic gradients) are discharge areas and these generally occur in areas of relatively lower topographic elevation, such as along watercourses. When evaluating groundwater recharge or discharge conditions, nested wells (two wells screened at different depths at the same location) can be used to determine vertical hydraulic gradients in the subsurface.

At monitoring well nest MW3s/d, the shallow well is screened from 0.9 m to 6 m in sand and the deep well is screened from 5.1 m to 7.5 m in sand and sand and silt. Since the screens overlap a gradient cannot be calculated for the wells. BH123 is also located beside the wells. BH123 is screened from 10.6 m to 13.6 m and as discussed in Section 3.2, shows groundwater to below its screen. The water table exhibited at MW3 is interpreted to be a perched water table. Underlying unsaturated sediments screened by BH123 would create a downward gradient and is interpreted to form recharge conditions at this location.

Piezometer nest DP-PZ1s/d is located near the wooded area along the tributary of Bear Creek (Figure 2). The hydrograph of DP-PZ1s/d (Figure D-11) indicates recharge conditions with water levels in the deep piezometer lower than the shallow piezometer. A reversal of gradient and groundwater discharge conditions was observed in July 2018 during the seasonal groundwater low. Water levels in the shallow and deep piezometer decrease by 1.5 m over July and August 2019. The decrease in water levels is much lower than lows recorded in summer of 2018 suggesting that there may be some external activities impacting the ground water levels at the piezometers.

There were no other nested wells on the subject property however, several wells that were dry or seasonally dry wells (BH7, BH14, BH21, BH130 and BH123) support the interpretation that recharge conditions are present on the subject lands.

3.6 Significant Groundwater Recharge Areas and Ecologically Significant Groundwater Recharge Areas

Significant Groundwater Recharge Areas (SGRAs) can be described as areas that can effectively move water from the surface through the unsaturated soil zone to replenish available groundwater resources (LSRCA, 2012). SGRAs were mapped by the Source Water Protection Assessment Report (LSRCA, 2012) as a requirement of the Clean Water Act, 2006 and based on guidance provided by the MECP. The delineation of these areas was completed using numerical models and analyses that included the evaluations of numerous factors including precipitation, temperature and other climate

data along with land use, soil type, topography and vegetation to predict groundwater recharge, runoff and evapotranspiration.

SGRAs represent areas where the annual recharge rate is greater than 115% of the average recharge of 164 mm/year across the Lake Simcoe watershed (or greater than the threshold recharge rate of 189 mm/year) (LSRCA, 2012). SRGRAs are mapped in the topographically high areas along the southern portion of the subject lands (Figure 10). The mapping corresponds to where the regional surficial geology mapping for ice contact stratified deposits (Figure 4). Monitoring data and borehole logs support this classification. Groundwater flow data indicates that recharge occurring in these areas flows northwest (Figures 8 and 9).

Ecologically Significant Groundwater Recharge Areas (ESGRAs) were delineated for the Barrie Creek, Lover's Creek and Hewitt's Creek subwatersheds by Earthfx (2012) using the groundwater model developed by AquaResources for the Source Protection studies. ESGRAs were identified as areas of land that are assumed to support groundwater systems or environmentally sensitive features like lakes, cold water streams and wetlands (Earthfx, 2012). ESGRAs were delineated by identifying pathways in which recharge, if it occurred, would reach an ecologically significant feature. Ecologically significant features used for the delineation of the ESRGAs included headwater streams, cold water fisheries, wetlands, and brook trout and sculpin capture sites. There are no ESGRAs mapped on the subject lands (Figure 10).

3.7 Aquifer Vulnerability

Aquifer vulnerability refers to the susceptibility of the aquifer to potential contamination. Some degree of protection for aquifers is offered by the nature of the soil above the water table. The degree of protection is dependent on the depth to water table or the depth to the aquifer and the type of soil above the water table or aquifer. Generally greater depths provide better protection and finer deposits (clays and silts) provide better protection than sands and gravels.

The subject lands fall within the jurisdiction of the Nottawasaga Valley Conservation Authority (NVCA). Aquifer vulnerability in the NVCA was calculated using the Aquifer Vulnerability Index (AVI). This approach calculated an AVI for each delineated aquifer to produce a map of regional groundwater vulnerability across the landscape expressed as high, medium or low (South Georgian Bay Lake Simcoe Source Protection Region, 2017). The available mapping indicates that the subject lands is mapped as a highly vulnerability aquifer (HVA) area.

Depending on land use, runoff from urban developments may contain a variety of dilute contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, bacteria and viruses. For groundwater, generally, with the exception of the dissolved constituents such as nitrogen and salt, most contaminants are

attenuated by filtration during groundwater transport through the soils. The potential for effects on local groundwater quality from infiltration in the urban areas is therefore expected to be limited.

4.0 Surface Water Monitoring

Surface water monitoring was completed along the tributary of Bear Creek that flows through the subject lands at two monitoring locations (Figure 3). Flow was measured at SSF-8 where the tributary flows north under Salem Road towards the subject lands. Within the subject lands the tributary flows north through a forested wetland then through a vegetated channel that borders agricultural fields. Flow was also measured at SSF-7 where the tributary leaves the subject lands under County Road 27.

Flow monitoring as part of this study was completed from May 2018 to June 2019 (Table E-1, Appendix E). Flow ranging from <0.5 L/s to 8.6 L/s were observed in May 2018, October 2018, April 2019 and June 2019. The stations were dry during monitoring events from June to September 2018 and frozen/snow covered during monitoring events from November to April. During the flow events, flow was greater upstream at SSF-8 compared to SSF-7 suggesting a losing stream (recharge conditions). Surface water monitoring was also completed at SSF-7 and SSF-8 as part of the Salem SIS report (Burnside, 2016) from December 2014 to December 2017 (Table E-2, Appendix E). The monitoring data supports that the drainage feature is intermittent with the potential for some seasonal contributions of groundwater. Groundwater monitoring at DP-PZ1s/d showing seasonal discharge conditions would support this conclusion (Figure D-11, Appendix D).

5.0 Water Quality

5.1 Groundwater Quality

Water quality data was collected from selected monitoring wells to typify the groundwater quality on the subject lands. Groundwater sampling was completed on September 27 and 28, 2018 at two groundwater monitoring wells (MW3d and BH120). The water samples were submitted to a certified laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality. The groundwater testing results from the analytical laboratory are provided in Table F-1, Appendix F and discussed below.

- The results showed that the water generally met the Ontario Drinking Water Quality Standards (ODWQS).

- Both samples exceeded the ODWQS for total hardness (100 mg/L) with values ranging of 136 mg/L (MW3d) and 447 mg/L (BH120). Hardness in groundwater is caused by dissolved calcium and magnesium and is typically related to the geologic material of the subsurface.

- Samples exceeded the ODWQS for turbidity (5 NTU) with values of 213 NTU (MW3d) and 384 NTU (BH120). This is likely a result of high silt content in the samples caused by a lack of well development. Groundwater is not intended for potable uses as part of the development and hence this exceedance is not regarded as an issue of concern.

- At BH120, high concentrations of sodium and chloride were detected. Sodium at BH120 was 298 mg/L compared to a ODWQS of 200 mg/L. Chloride was 654 mg/L compared to an ODWQS of 250 mg/L. In contrast, MW3d had very low concentrations of sodium and chloride, 1.2 mg/L and 1.0 mg/L respectively. BH120 is located close to Country Road 27. The elevated concentrations are likely a result of road salt runoff.

5.2 Surface Water Quality

To typify the surface water quality on the subject lands, a surface water sample (SSF-7) was collected on May 6, 2019 from the tributary of Bear Creek that traverses the subject lands. The water sample was submitted to an accredited laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality. The surface water quality testing results from the analytical laboratory are provided in Table F-2, Appendix F and have been compared to the Provincial Water Quality Objective (PWQO).

The results show that the surface water sample met all of the PWQO. Elevated sodium and chloride were reported at concentrations of 92.2 mg/L and 161 mg/L respectively suggesting impacts from road salt application along County Road 27. There was no nitrate or phosphorus detected in the samples.

6.0 Water Balance

In order to assess potential land development impacts on the local groundwater conditions, a detailed water balance analysis has been completed to determine the pre-development recharge volumes (based on existing land use conditions). The detailed water balance calculations are provided in Appendix G.

6.1 Water Balance Components

A water balance is an accounting of the water resources within a given area. As a concept, the water balance is relatively simple and may be estimated from the following equation:

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

Where:
- P = precipitation
- S = change in groundwater storage
- ET = evapotranspiration/evaporation
- R = surface water runoff
- I = infiltration

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). Runoff, for example, occurs particularly during periods of snowmelt when the ground is frozen, or during intense rainfall events. Precise measurement of the water balance components is difficult and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important input considerations for the water balance calculations.

The groundwater balance components for the subject area are discussed below:

Precipitation (P)

The long-term average annual precipitation for the area is 933 mm based on data from the Environment Canada Barrie WPCC (Station 6110557, 44°22'33.012" N, 79°41'23.010" W, elevation 221.0 masl) for the period between 1981 and 2010. The climate station is located 7.5 km northeast of the subject lands. Average monthly records of precipitation and temperature from this station have been used for the water balance calculations in this study (Appendix G).

Storage (S)

Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero so this term is dropped from the equation.

Evapotranspiration (ET)

Evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of

surfaces, etc.). Potential evapotranspiration (PET) refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of evapotranspiration (AET) is generally less than the PET under dry conditions (i.e., during the summer when there is a soil moisture deficit). In this report, the PET and AET have been calculated using a soil-moisture balance approach.

Water Surplus (R + I)

The difference between the mean annual P and the mean annual ET is referred to as the water surplus. Part of the water surplus travels across the surface of the soil as surface or overland runoff (R) and the remainder infiltrates the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to the groundwater table (referred to as recharge) and a second component that moves laterally through the topsoil profile or shallow soils as interflow that re-emerges locally to surface (i.e., as runoff) at some short time following cessation of precipitation. As opposed to the “direct” component of surface runoff that occurs during precipitation or snowmelt events, interflow becomes an “indirect” component of runoff. The interflow component of surface runoff is not accounted for in the water balance equation cited above since it is often difficult to distinguish between interflow and direct (overland) runoff, however both interflow and direct runoff together form the total surface water runoff component.

6.2 Approach and Methodology

The analytical approach to calculate the water balance involves monthly soil-moisture balance calculations to determine the pre-development (based on existing land use) infiltration volumes. A soil-moisture balance approach assumes that soils do not release water as potential recharge while a soil moisture deficit exists. During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

A soil moisture storage capacity of 150 mm was used for the agricultural lands with predominantly short to moderate-rooted vegetation (Table G-1, Appendix G). A soil moisture storage capacity of 300 mm was used for wooded areas within the subject lands (Table G-2, Appendix G). Tables G-1 and G-2 in Appendix G detail the monthly potential evapotranspiration calculations accounting for latitude and climate, and then calculate the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions.

The MECP SWM Planning and Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used and a corresponding runoff component was calculated for the soil moisture storage conditions. The

calculated water balance components from this table are then used to assess the pre-development and post development volumes for runoff and infiltration as presented on Table G-3 in Appendix G.

6.3 Water Balance Component Values

The detailed monthly calculations of the water balance components are provided in Tables G-1 and G-2 in Appendix G. For these calculations, it has been assumed that sandy loam soils are representative for the subject lands for estimating the soil infiltration factor. The calculations show that a water surplus is generally available from November to May. The monthly water balance calculations illustrate how infiltration occurs during periods when there is sufficient water available to overcome the soil moisture storage requirements. The monthly calculations are summed to provide estimates of the annual water balance component values (Tables G-1 and G-2, Appendix G). A summary of these values is provided in Table 3.

Table 3: Water Balance Component Values

Water Balance Component	Agricultural Lands	Wooded Areas
Average Precipitation	933 mm/year	933 mm/year
Actual Evapotranspiration	593 mm/year	593 mm/year
Water Surplus	340 mm/year	340 mm/year
Infiltration	238 mm/year	272 mm/year
Runoff	102 mm/year	68 mm/year

6.4 Pre-Development Water Balance (Existing Conditions)

The pre-development water balance calculations are presented in Table G-3 in Appendix G. As summarized on Table G-3, the total area of the subject lands is about 25.8 ha. The water balance component values from Table G-1 and Table G-2 were used to calculate the average annual volume of infiltration across the subject lands. Based on these component values, the pre-development infiltration volume for the subject lands is calculated to be about 53,000 m^3/year (Table G-3, Appendix G).

6.5 Potential Urban Development Impacts to Water Balance

Development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (i.e., roads, parking lots, driveways, and rooftops). Impervious surfaces prevent infiltration of water into the soils and the removal of the vegetation removes the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to be 10% to 20% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (about 64% of

precipitation across the subject lands). The net effect of the construction of impervious surfaces is that most of the precipitation that falls onto impervious surfaces becomes surplus water and direct runoff. The natural infiltration components (interflow and deep recharge) are reduced.

A water balance calculation of the potential water surplus for impervious areas is shown at the bottom of Table G-1 in Appendix G. There is an evaporation component from impervious surfaces and this is typically estimated to be between about 10% and 20% of the total precipitation. For the purposes of the calculations in this study, the evaporation has been estimated to be 15% of precipitation. The remaining 85% of the precipitation that falls on impervious surfaces is assumed to become runoff. Therefore, assuming an evaporation/loss from impervious surfaces of 15% of the precipitation, there is a potential water surplus from impervious areas of 793 mm/year.

It is noted that the proposed development will be serviced by municipal water supply and waste water services. Therefore, there will be no impact on the water balance and local groundwater or surface water quantity and quality conditions related to any on-site groundwater supply pumping or disposal of septic effluent.

6.6 Post-Development Water Balance with No Mitigation

To assess potential development impacts on infiltration, the post-development infiltration volumes have been calculated for the subject lands on Table G-3 in Appendix G. The total areas for the proposed land uses and the associated percentage impervious factors were provided by Schaeffers Consulting Engineers.

The infiltration and runoff components for the post-development land uses have been calculated using the MOE SWM Planning and Design Manual (2003) methodology based on topography, soil type and land cover as shown on Tables G-1 and G-2 in Appendix G. In summary from these appendix tables, the average calculated post-development infiltration volume (without mitigation) is about 28,000 m^3/year.

Comparing the pre- and post-development infiltration volumes, shows that development has the potential to reduce the average infiltration on the subject lands from 53,000 m^3/year to 28,000 m^3/year, i.e., a reduction of about 25,000 m^3/year or 47%. These calculations assume no low impact development (LID) measures for stormwater management are in place.

6.7 Recommended Mitigation Strategies for Infiltration

The water balance calculations suggest that, without mitigation, the subject lands will receive about 50% of the current amount of average annual groundwater infiltration after development. It is recommended to minimize the potential development impacts to infiltration through the use of ‘low impact development’ (LID) measures for stormwater

management to ensure the post-development groundwater infiltration volume is maintained as close to the pre-development infiltration volume as possible.

Where feasible, measures to promote infiltration and minimize development impacts on the water balance should be incorporated into the development design. There, as outlined in the MOE SWM Design Manual (2003), a number of mitigation techniques that can be used to increase the potential for post-development infiltration and mitigate the reductions in infiltration that occur with land development. Techniques to maximize the water availability in pervious areas such as designing grades to direct roof runoff towards lawns, side and rear yard swales, boulevards, parks, and other open space areas throughout the development where possible and increasing the topsoil thickness (i.e., from typical thicknesses of about 15 cm up to 20 cm or 30 cm) can increase the potential for infiltration in developed areas. These types of surface LID techniques promote natural infiltration by providing additional water volumes in the pervious areas. This may be particularly effective in the summer months, when natural infiltration would not generally occur because the additional water overcomes the natural soil moisture deficit. Other LID measures that may be considered to reduce runoff volumes include bioswales, rain gardens, perforated pipe systems, infiltration trenches and facilities, permeable pavements, tree boxes, and rainwater harvesting techniques, such as cisterns and rain barrels.

The Functional Servicing Report (FSR) for the subject lands (Schaeffers, 2018) discusses potential LID measures to mitigate the infiltration deficit which includes an infiltration area within a stormwater management pond. The FSR provides that the proposed measures will provide adequate water to offset the infiltration deficit, however the impact of LID measures on infiltration should be confirmed at detailed design.

7.0 Development Considerations

7.1 Construction Below the Water Table

Based on groundwater level data collected as part of this study water table on the subject lands ranges from 0.8 m to 14 m below ground surface. Should excavations during construction of servicing extend below the water table the local soils may need to be dewatered. Significant groundwater flows may be encountered in areas where high permeability sand and gravel layers are encountered.

The construction of buried services below the water table has the potential to capture and redirect groundwater flow through more permeable fill materials typically placed in the base of excavations. Groundwater may also infiltrate into joints in storm sewers and manholes. Over the long-term, these impacts can lower the groundwater table across the development area. To mitigate this effect, services to be installed below the water table should be constructed to prevent redirection of groundwater flow. This will involve the use of anti-seepage collars or clay plugs surrounding the pipes to provide barriers to

flow and prevent groundwater flow along granular bedding material and erosion of the backfill materials.

Due to the potential for encountering the water table during construction, the dewatering of local aquifers may be required in order for services to be installed below the water table. The undertaking of dewatering according to industry standards and in accordance with a MECP processes will ensure that adequate attention is paid to potential adverse impacts to the environment. Currently the MECP allows for construction dewatering of less than 400,000 L/d to proceed under the Environmental Activity Sector Registry (EASR) process. If dewatering is to be above this threshold, then the standard Permit to Take Water (PTTW) process applies. In both cases, a scientific study is required in support of EASR registration or PTTW application.

An assessment of dewatering requirements for the subject lands was completed by Terraprobe (Terraprobe, 2019a). The assessment which included estimated daily water takings, zone of influence and a proposed monitoring and mitigation plan concluded that an EASR registration will be required.

7.2 Local Groundwater Supply Wells

The area surrounding the subject lands is not currently serviced and residences are supplied by private wells. Based on the MECP well records, the majority of wells located in the vicinity of the subject lands are drilled wells more than 13 m deep (Table A-1, Appendix A). There are three dug wells with depths less than 13 m and screened in the surficial sand layer. These wells would be more vulnerable to impacts during construction as they are completed in the shallow subsurface for which is most likely to be impacted by construction dewatering activities. It should however be noted that the potential impact to the shallow aquifers and water supply wells would be of limited spatial extent and duration. No long-term adverse impacts are expected. Although no long-term impacts are not anticipated, a targeted monitoring and mitigation program is recommended as part of due diligence and a conservative approach to implementation. This monitoring and mitigation program would include targeting the three dug wells for monitoring during the construction process.

7.3 Well Decommissioning

Prior to or during construction, it is necessary to ensure that all inactive wells within the development footprint have been located and properly decommissioned by a licensed water well contractor according to Ontario Regulation 903. This regulation applies to private domestic wells and to the groundwater observation wells installed for this study unless they are maintained throughout the construction for monitoring purposes.

8.0 Monitoring and Mitigation

The dewatering assessment completed by Terraprobe (Terraprobe 2019a) indicates that groundwater control (dewatering) is expected to be required for the short term only. It is noted that treatment of discharge water may be required in order to meet discharge standards. The discharge monitoring plan proposed by Terraprobe includes:

- Implementation of a sediment and erosion control plan for the duration of dewatering;
- Visual inspections of discharge;
- Sampling at regular frequency to ensure that discharged water meets the Provincial Water Quality Objectives; and
- Monitoring at available monitoring wells to confirm the area of extent of groundwater response;

It is noted that the area of influence calculated by Terraprobe is 16 m and hence there are no off-site impacts that are expected.

9.0 References

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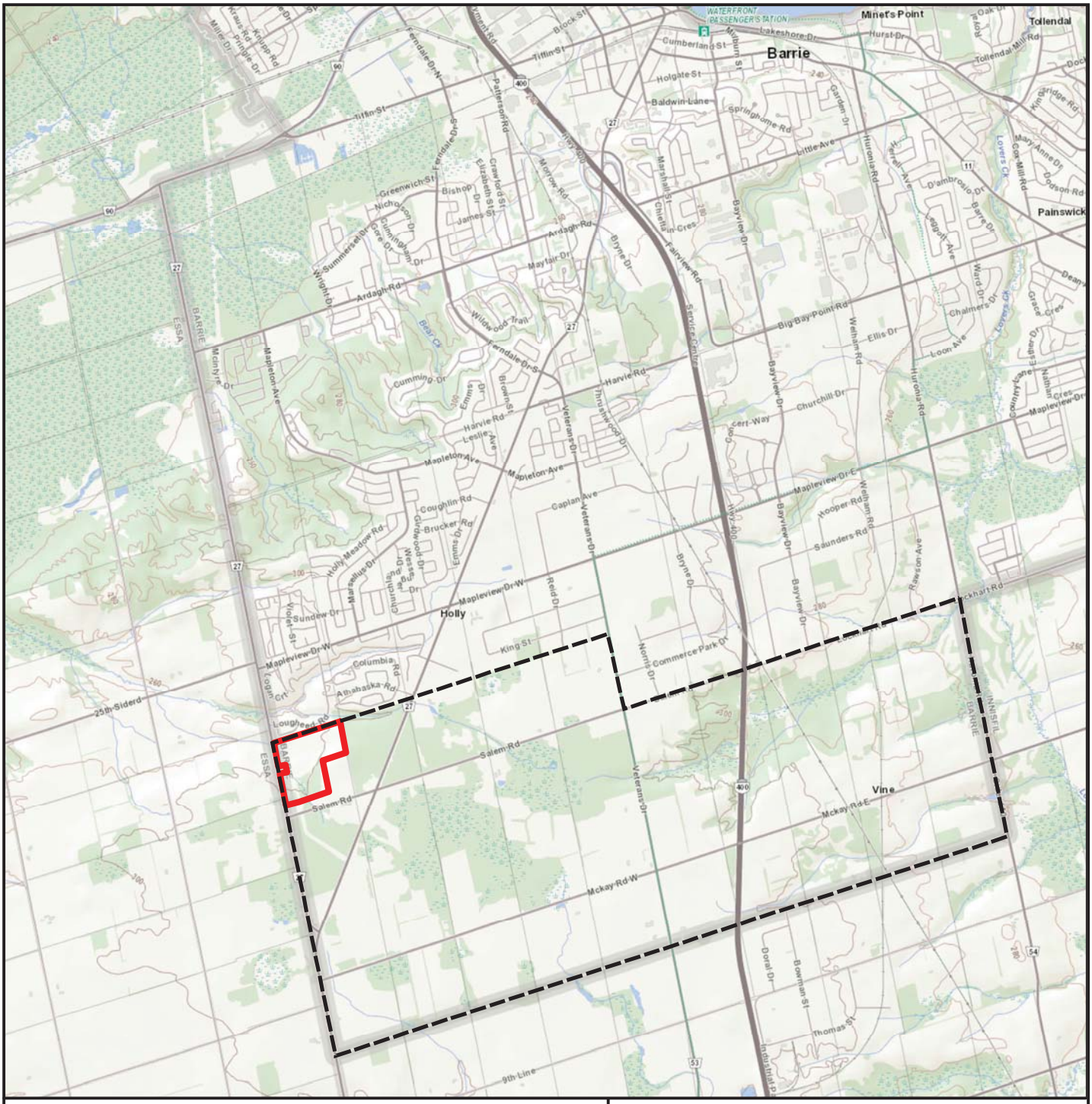
[THE DIFFERENCE IS OUR PEOPLE]

Figures



LEGEND

SUBJECT LANDS

SETTLEMENT AREA BOUNDARY

0 250 500 1,000 1,500 2,000 2,500 3,000 3,500 4,000

Meters

N

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title:

SITE LOCATION

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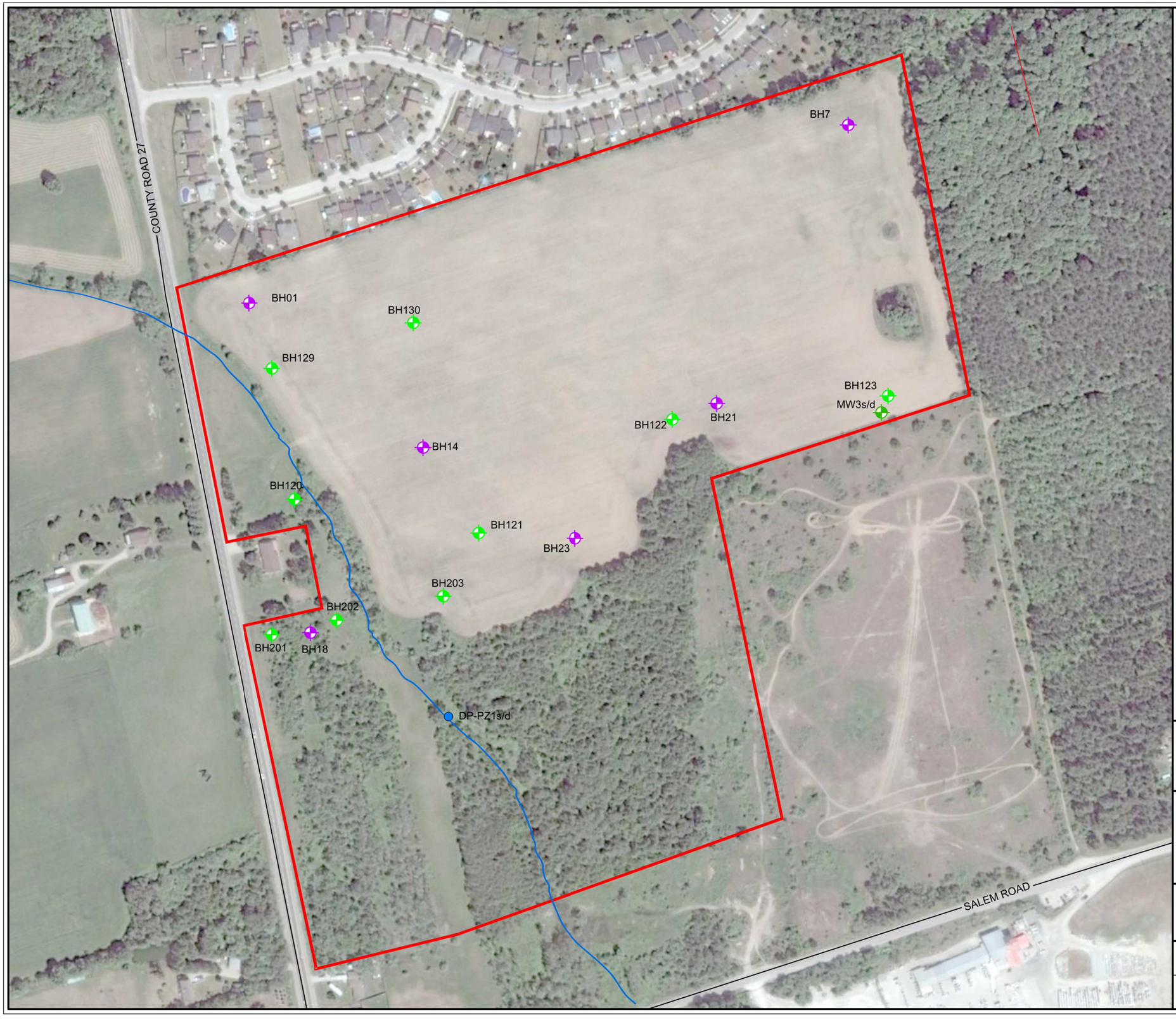

LEGEND

- SUBJECT LANDS
- WATERCOURSE
- MONITORING WELL (GEOPRO CONSULTING, 2018)
- MONITORING WELL (TERRAPROBE, 2011)
- MONITORING WELL (TERRAPROBE, 2018)
- DRIVE POINT PIEZOMETER (RJB, 2018)

N

0 60 120 180 240

Metres

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

MONITORING LOCATIONS

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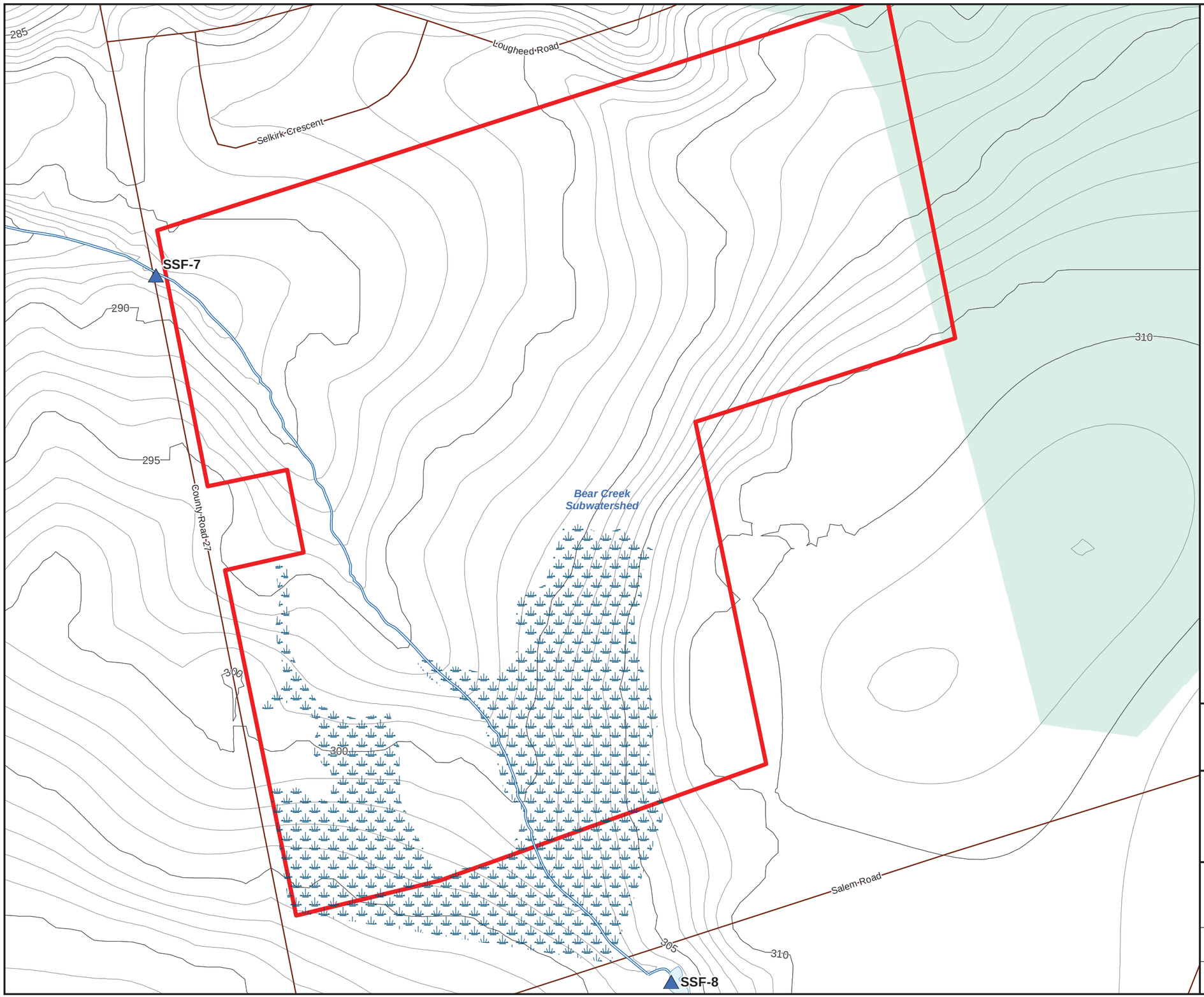

LEGEND

- SUBJECT LANDS
- WATERCOURSE
- ROADWAY
- WETLAND (MBHC Draft Plan, 2019)
- PROVINCIALLY SIGNIFICANT WETLAND
- SUBWATERSHED BOUNDARY
- NATURAL HERITAGE SYSTEM BOUNDARY
- WATERBODY
- WOODED AREA
- CONTOUR (5m intervals - masl)
- CONTOUR (1m intervals)
- SURFACE WATER MONITORING LOCATION

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.

N

0 50 100 150 200

Metres

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HYDROGEOLOGICAL STUDY
IN SUPPORT OF DRAFT PLAN

Figure Title

TOPOGRAPHY AND DRAINAGE

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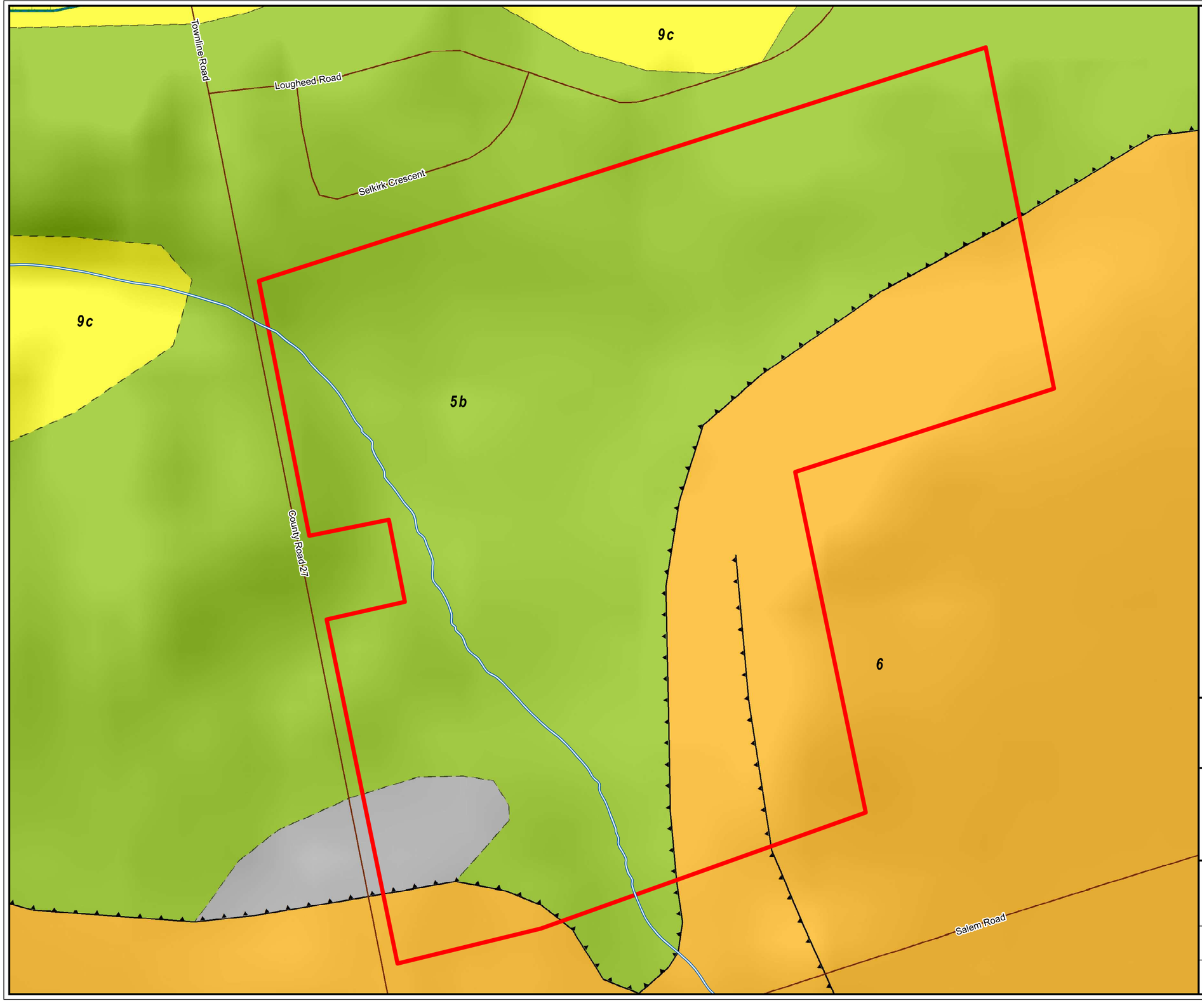

LEGEND

- SUBJECT LANDS
- ROADWAY
- WATERCOURSE
- Ice-Contact Slope
- 5b: Stone-poor, carbonate-derived silty to sandy till
- 6: Ice-contact stratified deposits
- 9c: Coarse-textured glaciolacustrine deposits: Foreshore-basinal deposits
- 20: Organic deposits

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. Ontario Geological Survey 2003, Surficial Geology of Southern Ontario; Ontario Geological Survey, Miscellaneous Release--Data 128.

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Metres

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HYDROGEOLOGICAL STUDY
IN SUPPORT OF DRAFT PLAN

Figure Title

SURFICIAL GEOLOGY

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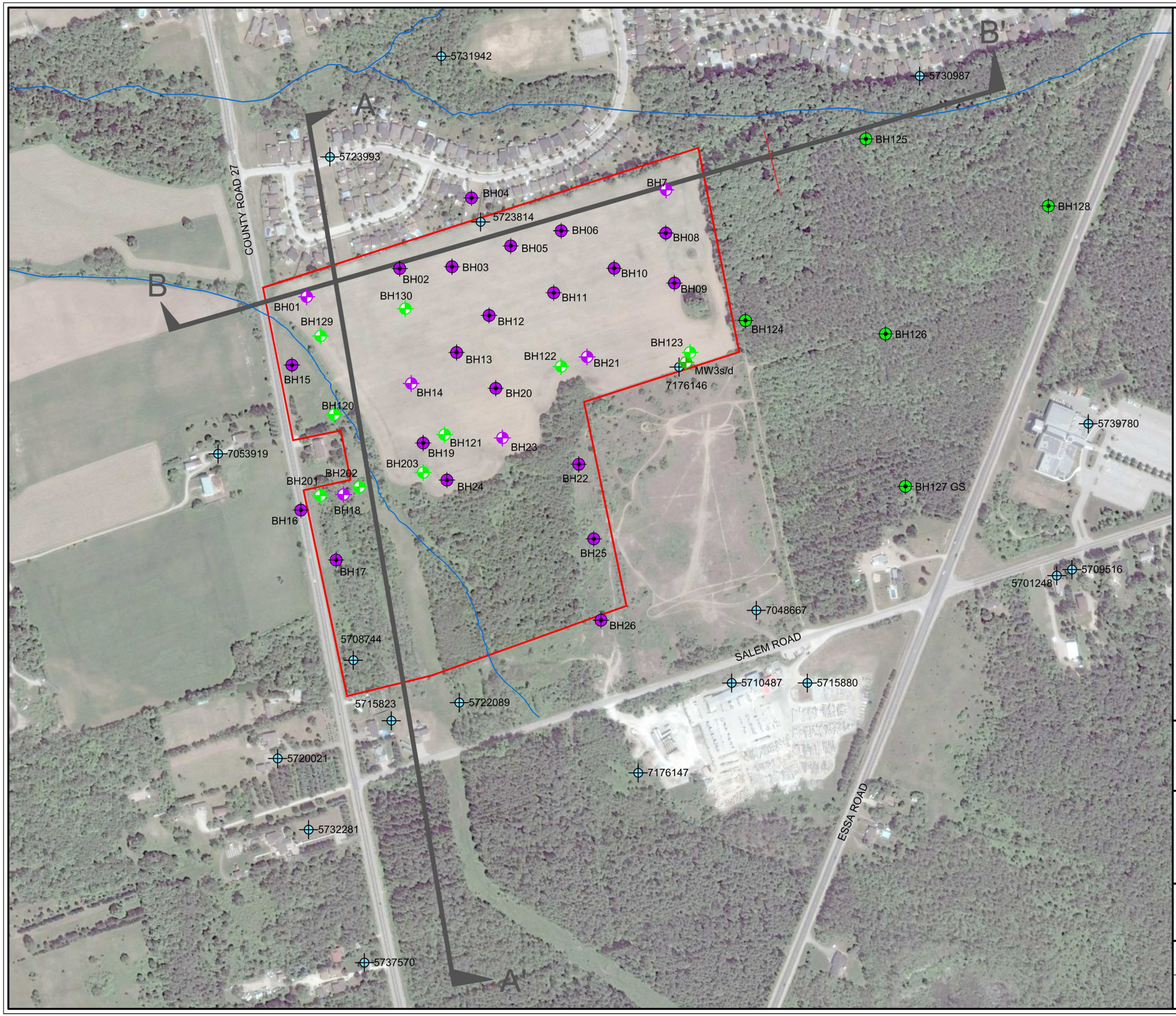

LEGEND

- SUBJECT LANDS
- WATERCOURSE
- MONITORING WELL (GEOPRO CONSULTING, 2018)
- MONITORING WELL (TERRAPROBE, 2011)
- MONITORING WELL (TERRAPROBE, 2018)
- BOREHOLE (GEOPRO CONSULTING, 2018)
- BOREHOLE (TERRAPROBE, 2018)
- MECP WELL RECORD LOCATION
- A A' CROSS-SECTION LOCATION KEY

N

0 50 100 200 300 400

Metres

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

BOREHOLE AND WELL LOCATION PLAN

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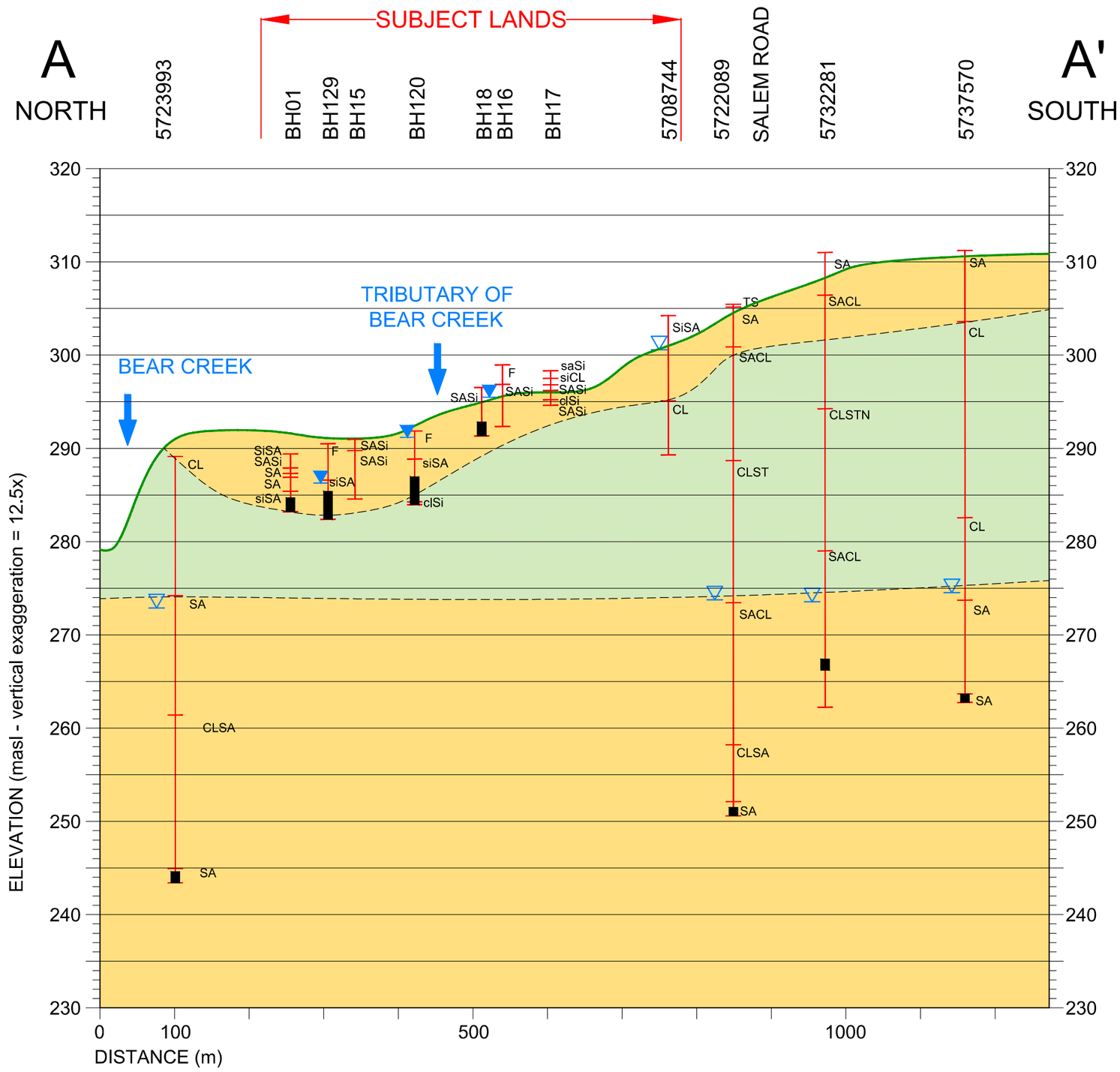

LEGEND

4901807
BH18

- WELL NUMBER
- MOECC WELL RECORD NUMBER
- WELL
- GEOLOGICAL STRATIGRAPHY (CLGR)
- STATIC WATER LEVEL (REPORTED ON MOECC WELL RECORD)
- MEASURED WATER LEVEL (April 25, 2019)
- WELL SCREEN
- CLAY / SILT / TILL
- SAND / GRAVEL
- INTERPRETED GEOLOGICAL CONTACT
- WATERCOURSE CROSSING

si	SILTY
cl	CLAYEY
sa	SANDY
F	FILL
T	TILL
SA	SAND
Si	SILT
GR	GRAVEL
CL	CLAY
PRDG	PREDUG

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

INTERPRETED GEOLOGICAL CROSS-SECTION A-A'

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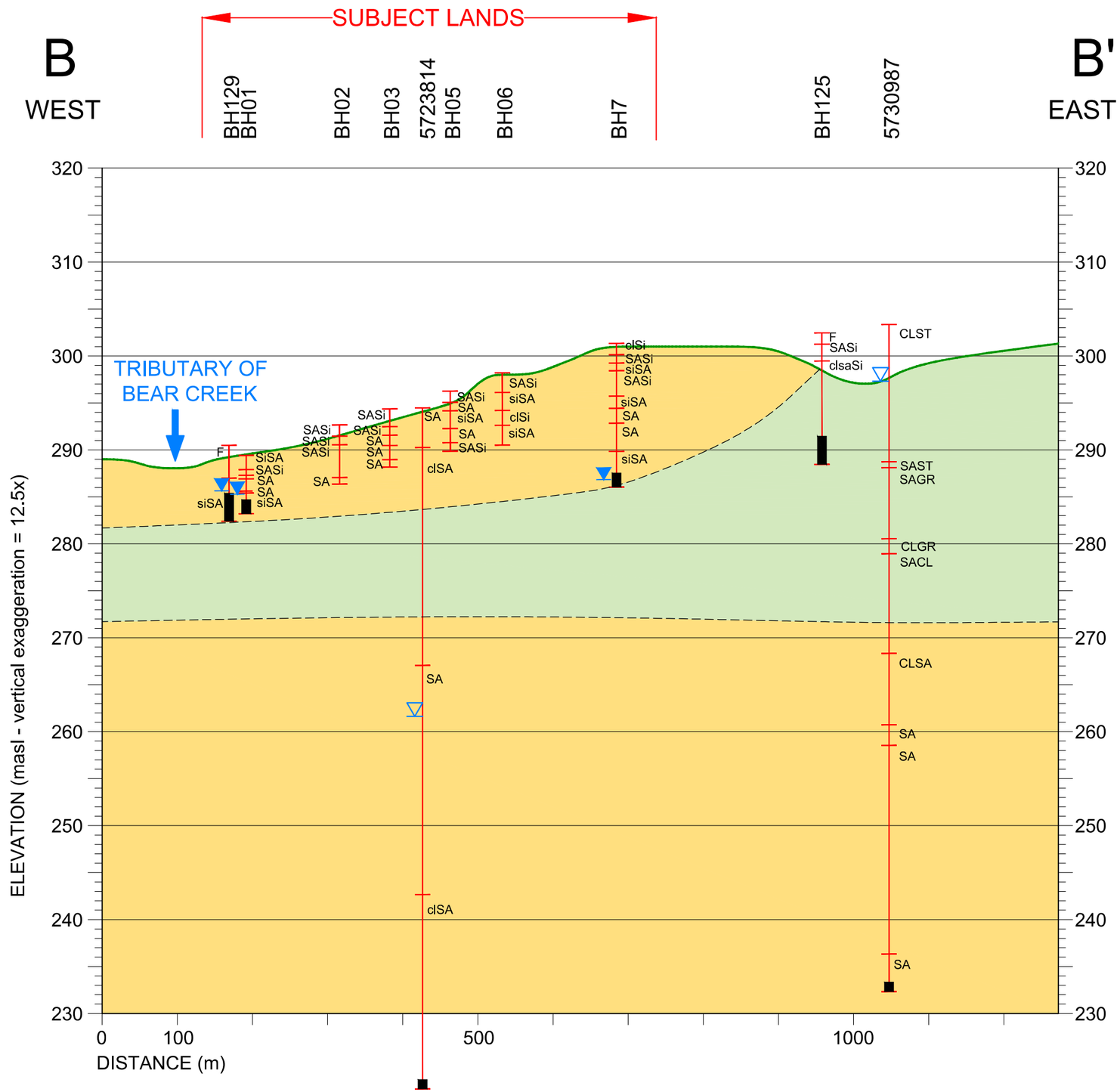

LEGEND

4901807
BH18

- WELL NUMBER
- MOECC WELL RECORD NUMBER
- WELL
- CLGR — GEOLOGICAL STRATIGRAPHY
- STATIC WATER LEVEL (REPORTED ON MOECC WELL RECORD)
- MEASURED WATER LEVEL (April 25, 2019)
- WELL SCREEN

- CLAY / SILT / TILL
- SAND / GRAVEL
- INTERPRETED GEOLOGICAL CONTACT
- WATERCOURSE CROSSING

si	SILTY
cl	CLAYEY
sa	SANDY
F	FILL
T	TILL
SA	SAND
Si	SILT
GR	GRAVEL
CL	CLAY
PRDG	PREDUG

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

INTERPRETED GEOLOGICAL CROSS-SECTION B-B'

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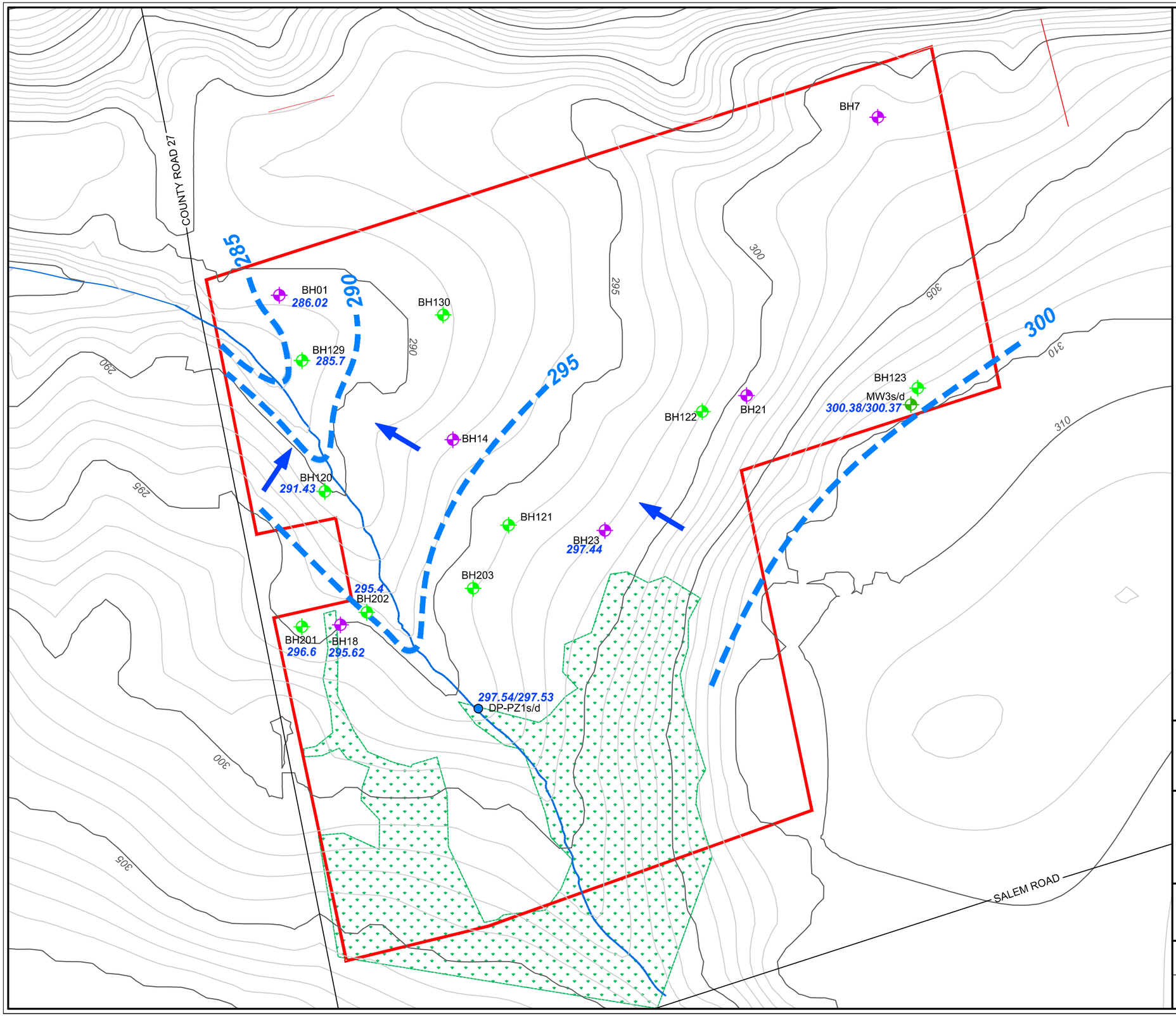

LEGEND

- SUBJECT LANDS
- WATERCOURSE
- WETLAND (MBHC Draft Plan, 2019)
- MONITORING WELL (GEOPRO CONSULTING, 2018)
- MONITORING WELL (TERRAPROBE, 2011)
- MONITORING WELL (TERRAPROBE, 2018)
- DRIVE POINT PIEZOMETER
- INTERPRETED GROUNDWATER CONTOUR (masl)
- 267.45 MEASURED WATER LEVEL (April 25, 2019)
- INTERPRETED GROUNDWATER FLOW

N

0 60 120 180 240
Metres

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HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

INTERPRETED GROUNDWATER FLOW (PERCHED WATER TABLE)

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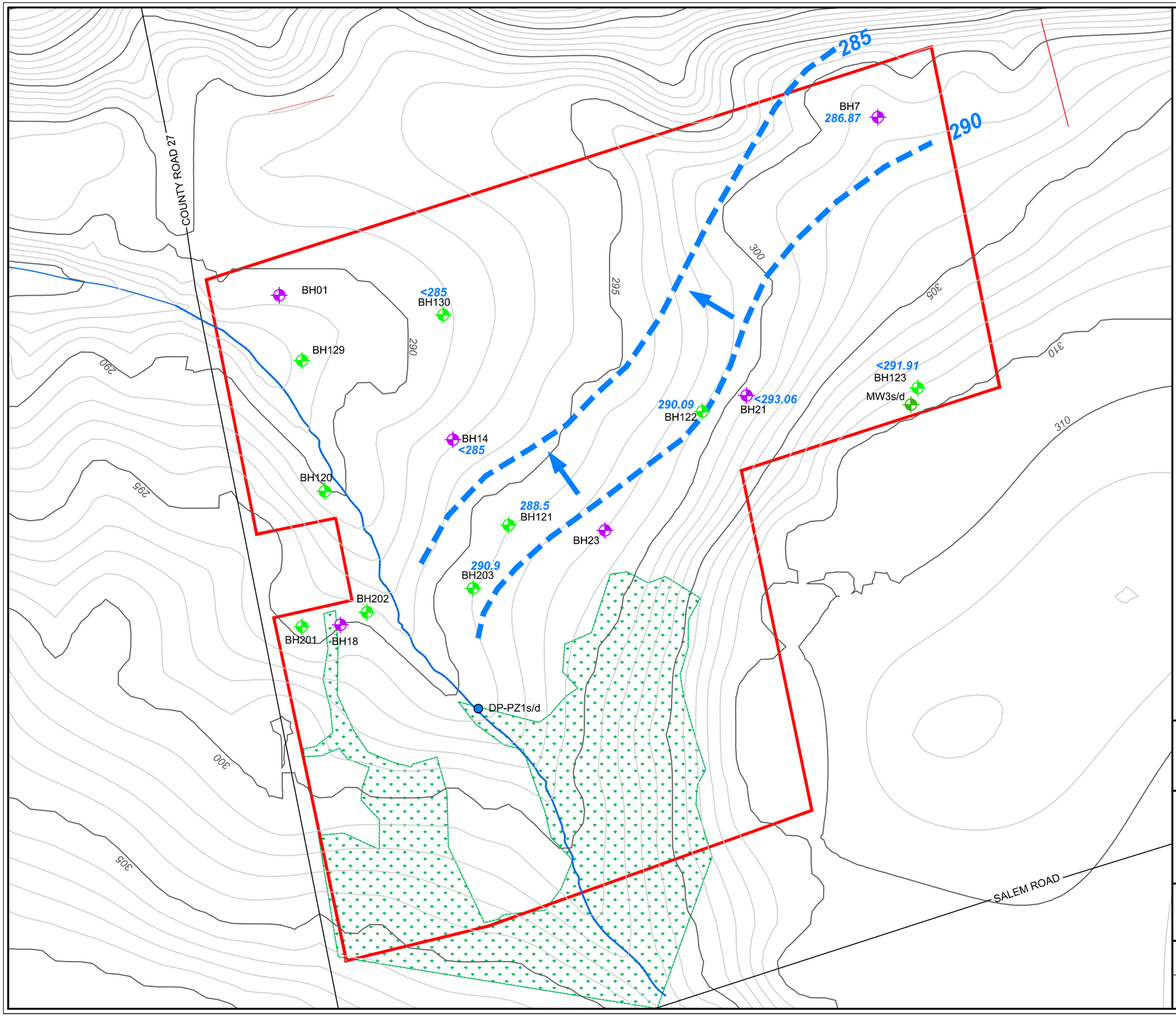

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- SUBJECT LANDS
- WATERCOURSE
- WETLAND (MBHC Draft Plan, 2019)
- MONITORING WELL (GEOPRO CONSULTING, 2018)
- MONITORING WELL (TERRAPROBE, 2011)
- MONITORING WELL (TERRAPROBE, 2018)
- DRIVE POINT PIEZOMETER
- INTERPRETED GROUNDWATER CONTOUR (masl)
- 267.45 MEASURED WATER LEVEL (April 25, 2019)
- INTERPRETED GROUNDWATER FLOW

N

0 60 120 180 240

Metres

BURNSIDE

Client / Report

DI POCE MANAGEMENT INC,
BARRIE, ONTARIO

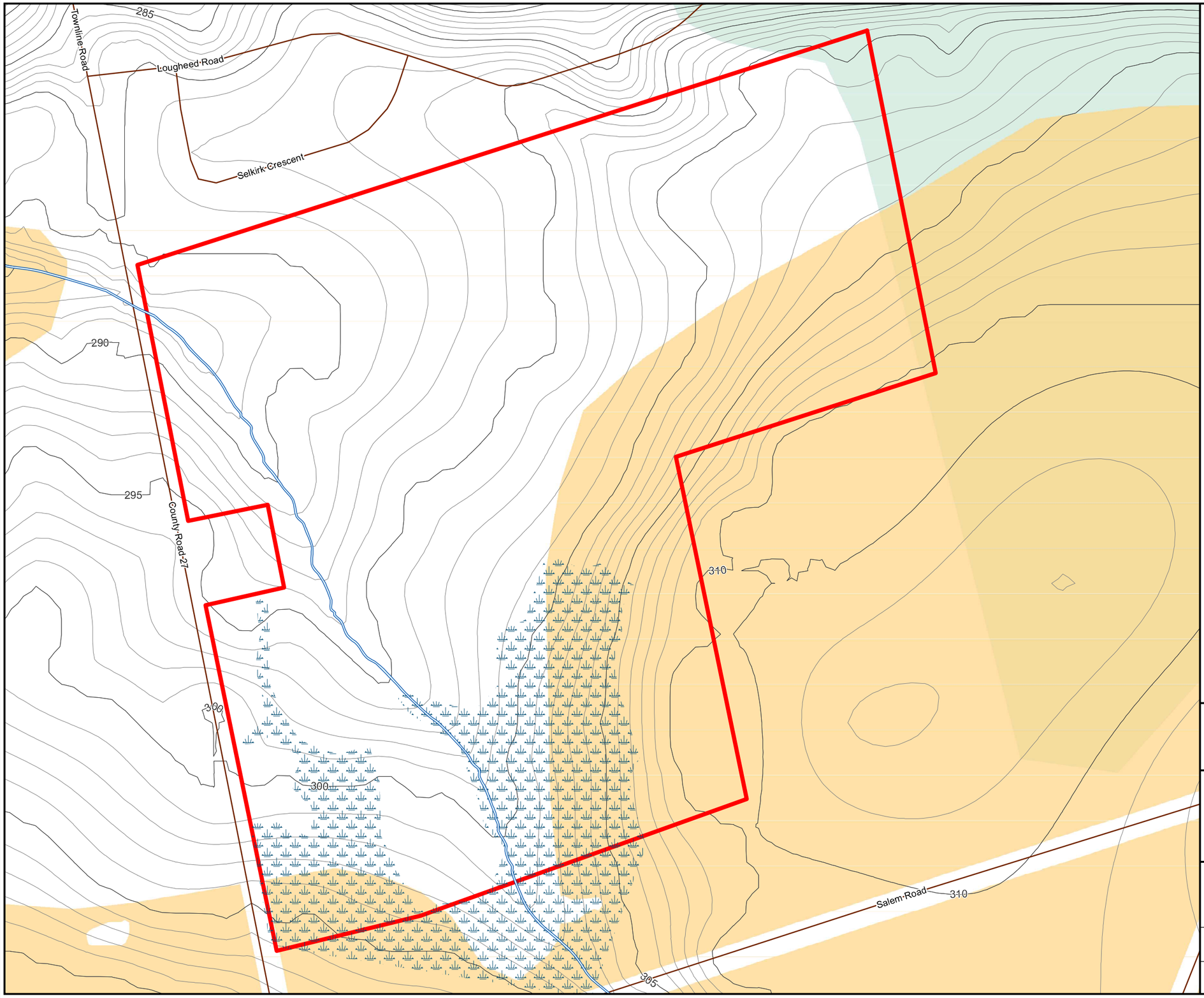
HYDROGEOLOGICAL ASSESSMENT IN SUPPORT OF DRAFT PLAN

Figure Title

INTERPRETED GROUNDWATER FLOW (SHALLOW WATER TABLE)

Drawn	Checked	Date	Figure No.
SK	SC	OCTOBER 2019	9
Scale		Project No.	
1:3,000		300041886	

File Name:Nigel/Shared Work Areas/014886 Di Poce/ 041886 HG Study Drawing Set.dwg Date Plotted: October 22, 2019 - 2:28 PM



LEGEND

- SUBJECT LANDS
- WATERCOURSE
- ROADWAY
- WETLAND (MBHC Draft Plan, 2019)
- PROVINCIALLY SIGNIFICANT WETLAND
- NATURAL HERITAGE SYSTEM BOUNDARY
- CONTOUR (5m intervals - masl)
- CONTOUR (1m intervals)
- WATERBODY
- WOODED AREA
- SIGNIFICANT GROUNDWATER RECHARGE AREAS (SGRA, LSRCA)

Sources:

1. Ministry of Natural Resources, © Queen's Printer for Ontario
2. Natural Resources Canada © Her Majesty the Queen in Right of Canada.
3. SGRA mapping obtained for Lake Simcoe Conservation Authority, 2018

N

0 50 100 150 200

Metres

BURNSIDE

Client / Report

DI POCE MANAGEMENT INC.
BARRIE, ONTARIO
HYDROGEOLOGICAL STUDY
IN SUPPORT OF DRAFT PLAN

Figure Title

RECHARGE AREAS

Drawn	Checked	Date	Figure No.
SK	SC	OCTOBER 2019	10
Scale		Project No.	
1:3,000		300041886	

File Path: gis://(ELMO)/A:\041886 Di Poce\041886 Recharge Areas.mxd Print Date: 2019/10/23 Time: 02:02 PM

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Appendix A

MECP Water Well Records

Table A-1: MECP Water Well Record Summary

MECP WELL #	Well Use	Well Depth (m)	Well Construction	Date Completed
5701248	Well: Supply	12.2	Dug Well	8/12/1964
5701369	Well: Abandoned	29.0	N/A	8/2/1966
5708744	Well: Supply	14.9	Drilled Well	1/28/1972
5709516	Well: Supply	50.9	Drilled Well	8/14/1972
5710183	Well: Supply	27.1	Drilled Well	8/15/1973
5710487	Well: Supply	8.5	Dug Well	10/7/1973
5715823	Well: Supply	5.2	Dug Well	5/6/1978
5715880	Well: Supply	47.2	Drilled Well	1/31/1979
5720021	Well: Supply	46.0	Drilled Well	5/17/1985
5722089	Well: Supply	54.9	Drilled Well	4/14/1987
5723814	Well: Supply	72.5	Drilled Well	8/30/1988
5723993	Well: Supply	45.7	Drilled Well	9/7/1988
5723994	Well: Supply	72.8	Drilled Well	9/1/1988
5730987	Well: Abandoned	71.3	N/A	7/28/1994
5731026	Well: Supply	21.3	Drilled Well	7/28/1994
5731942	Well: Supply	37.8	Drilled Well	6/12/1995
5732281	Well: Supply	48.8	Drilled Well	5/18/1995
5737570	Well: Supply	48.5	Drilled Well	1/5/2003
5738084	Well: Abandoned	0.0	N/A	8/4/2003
5739780	Well: Supply	48.8	Drilled Well	1/4/2005
7048667	Well: Monitoring	25.6	Drilled Well	8/2/2007
7053919	Well: Abandoned	5.4	N/A	11/14/2007
7176146	Well: Monitoring	7.6	Drilled Well	10/19/2011
7176147	Well: Monitoring	4.6	Drilled Well	10/18/2011

Water Well Records

Thursday, October 25, 2018

2:10:12 PM

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
ESSA TOWNSHIP 11 024	17 600885 4907776 W	2007/11 5528	35.4			NU		7053919 (Z48268) A	
ESSA TOWNSHIP CON 11	17 601079 4907103 W	2003/01 2513	6	FR 0159	120/140/20/1:30	DO	0156 3	5737570 (254052)	LOAM 0001 YLLW SAND SILT STNS 0025 GREY CLAY SAND 0094 BRWN CLAY SAND BLDR 0123 YLLW FSND 0156 YLLW MSND 0159
ESSA TOWNSHIP CON 11 023	17 601005 4907279 W	1995/05 2431	6	FR 0143	122//15/2:30	DO	0143 4	5732281 (160505)	BRWN FSND 0007 GREY CLAY SLTY GRVL 0031 GREY CLAY TILL 0136 BRWN FSND MSND 0147 BRWN FSND 0160
ESSA TOWNSHIP CON 11 023	17 600964 4907373 W	1985/05 3660	5	FR 0144	122/125/10/2:0	DO	0147 3	5720021 ()	BLCK LOAM 0001 BRWN SAND 0010 GREY CLAY SAND 0055 BLUE CLAY 0096 BRWN SAND 0144 MSND WBRG 0151
ESSA TOWNSHIP CON 11 024	17 600507 4907645 L	1994/07 4919	30	UK 0040 UK 0050 UK 0060	30/50/10/1:0	DO		5731026 (125652)	BRWN LOAM HARD 0001 BRWN CLAY HARD 0020 GREY CLAY SAND PCKD 0070
ESSA TOWNSHIP CON 11 025	17 600382 4908244 L	2003/08 7088				NU		5738084 (265253) A	
ESSA TOWNSHIP CON 11 025	17 600784 4908378 W	1973/08 1204	5	FR 0024 FR 0066 FR 0078	51/59/7/1:40	DO	0083 3	5710183 ()	BLCK CLAY 0024 GREY GRVL 0025 GREY SILT CLAY 0066 GREY SAND 0068 GREY SAND SILT CLAY 0078 BLCK SAND 0089
INNISFIL TOWNSHIP	17 601597 4907569 W	2007/08 6809	2		///:	MO		7048667 (Z63332) A059618	BRWN SAND GRVL 0045 GREY SAND SILT DNSE 0080 GREY SILT CLAY 0084
INNISFIL TOWNSHIP	17 601441 4907354 W	2011/10 7190	2	UT 0002		MO	0015 10	7176147 (Z133800) A076132	BRWN SAND GRVL DNSE 0015
INNISFIL TOWNSHIP CON 10 001	17 601564 4907473 W	1973/10 4608	30	FR 0015	13///0:30	DO		5710487 ()	LOAM 0001 SAND 0005 GREY CLAY 0028
INNISFIL TOWNSHIP CON 10 002	17 601664 4907473 W	1979/01 4816	6	FR 0130	109//5/3:0	IN	0131 5	5715880 ()	SAND GRVL 0004 MSND 0015 CLAY GRVL SAND 0052 GREY CLAY 0099 FSND 0139 FSND SILT 0155
INNISFIL TOWNSHIP CON 10 002	17 601994 4907615 W	1964/08 1631	30	FR 0028	12//2/:	DO		5701248 ()	LOAM MSND 0010 GREY CLAY 0040
INNISFIL TOWNSHIP CON 10 002	17 602014 4907623 W	1972/08 3203	4	FR 0140	20/140/6/1:15	DO	0164 3	5709516 ()	YLLW CLAY SAND 0014 GREY SAND CLAY 0022 GREY CLAY 0060 GREY SAND CLAY 0066 GREY CLAY 0120 BRWN SAND 0155 GREY SAND 0167
INNISFIL TOWNSHIP CON 11 001	17 601064 4907503 W	1972/01 1204	5	FR 0049	12/36/2/6:0	DO		5708744 ()	BRWN FILL 0004 GREY SILT SAND 0030 GREY CLAY 0049
INNISFIL TOWNSHIP CON 11 001	17 601232 4908083 L	1988/09 2662	6	UK 0235	107/225/10/3:15	DO	0236 3	5723994 (29976)	BRWN SAND 0018 GREY CLAY SNDY 0120 BRWN SAND DRY 0190 GREY CLAY SNDY WBRG 0235 GREY SAND 0239
INNISFIL TOWNSHIP CON 11 001	17 601141 4908622 W	1966/08 4608						5701369 () A	GRVL 0060 MSND 0095

TOWNSHIP CON LOT	UTM	DATE CNTR	CASING DIA	WATER	PUMP TEST	WELL USE	SCREEN	WELL	FORMATION
INNISFIL TOWNSHIP CON 11 001	17 601114 4907423 W	1978/05 4608	30	FR 0008	9///:	DO		5715823 ()	SAND 0017
INNISFIL TOWNSHIP CON 11 001	17 601232 4908083 L	1988/08 2662	6	UK 0234	108/225/10/4:0	DO	0235 4	5723814 (29977)	BRWN SAND 0014 GREY CLAY SNDY 0090 BRWN SAND DRY 0170 GREY CLAY SNDY 0238
INNISFIL TOWNSHIP CON 11 001	17 601033 4908169 W	1988/09 2662	6	UK 0145	60/140/10/3:20	DO	0146 4	5723993 (29982)	BRWN CLAY 0049 BRWN SAND 0091 GREY CLAY SNDY 0145 GREY SAND 0150
INNISFIL TOWNSHIP CON 11 001	17 601495 4907891 W	2011/10 7190	2	UT 0013		MO	0025 10	7176146 (Z133895) A076094	BRWN FSND 0015 GREY FSND 0025
INNISFIL TOWNSHIP CON 11 002	17 601180 4908302 W	1995/06 1583	6 5	FR 0123	72/85/12/2:0	DO	0099 4	5731942 (140621)	FILL CLAY 0006 BRWN CLAY 0012 BRWN SAND CLAY SOFT 0049 FSND 0100 BRWN FSND CGRD 0124
INNISFIL TOWNSHIP CON 11 002	17 602036 4907816 W	2005/01 2513	6.25	FR 0144	115/138/20/1:0	DO	0150 10	5739780 (Z14907) A014858	GREY SAND GRVL 0022 GREY CLAY BLDR 0078 GREY SAND CLAY 0093 YLLW SAND 0139 BRWN CLAY SAND 0142 YLLW SAND 0160
INNISFIL TOWNSHIP CON 11 002	17 601813 4908276 L	1994/07 6782		GS 0234	20/230/1/4:0	DO	0230 4	5730987 (144587) A	BLCK LOAM 0001 GREY CLAY STNS 0048 GREY SAND STNS 0050 GREY SAND GRVL 0075 GREY CLAY GRVL 0080 BRWN SAND CLAY 0115 GREY CLAY SAND 0140 GREY SAND 0147 GREY SAND WDFR SLTY 0220 BRWN CSND WDFR 0234

Notes:
UTM: UTM in Zone, Easting, Northing and Datum is NAD83; L: UTM estimated from Centroid of Lot; W: UTM not from Lot Centroid
DATE CNTR: Date Work Completedand Well Contractor Licence Number
CASING DIA: .Casing diameter in inches
WATER: Unit of Depth in Fee. See Table 4 for Meaning of Code
PUMP TEST: Static Water Level in Feet / Water Level After Pumping in Feet / Pump Test Rate in GPM / Pump Test Duration in Hour : Minutes
WELL USE: See Table 3 for Meaning of Code
SCREEN: Screen Depth and Length in feet
WELL: WEL (AUDIT #) Well Tag . A: Abandonment; P: Partial Data Entry Only
FORMATION: See Table 1 and 2 for Meaning of Code

1. Core Material and Descriptive terms

Code	Description	Code	Description	Code	Description	Code	Description	Code	Description
BLDR	BOULDERS	FCRD	FRACTURED	IRFM	IRON FORMATION	PORS	POROUS	SOFT	SOFT
BSLT	BASALT	FGRD	FINE-GRAINED	LIMY	LIMY	PRDG	PREVIOUSLY DUG	SPST	SOAPSTONE
CGRD	COARSE-GRAINED	FGVL	FINE GRAVEL	LMSN	LIMESTONE	PRDR	PREV. DRILLED	STKY	STICKY
CGVL	COARSE GRAVEL	FILL	FILL	LOAM	TOPSOIL	QRTZ	QUARTZITE	STNS	STONES
CHRT	CHERT	FLDS	FELDSPAR	LOOS	LOOSE	QSND	QUICKSAND	STNY	STONEY
CLAY	CLAY	FLNT	FLINT	LTCL	LIGHT-COLOURED	QTZ	QUARTZ	THIK	THICK
CLN	CLEAN	FOSS	FOSILIFEROUS	LYRD	LAYERED	ROCK	ROCK	THIN	THIN
CLYY	CLAYEY	FSND	FINE SAND	MARL	MARL	SAND	SAND	TILL	TILL
CMTD	CEMENTED	GNIS	GNEISS	MGRD	MEDIUM-GRAINED	SHLE	SHALE	UNKN	UNKNOWN TYPE
CONG	CONGLOMERATE	GRNT	GRANITE	MGVL	MEDIUM GRAVEL	SHLY	SHALY	VERY	VERY
CRYS	CRYSTALLINE	GRSN	GREENSTONE	MRBL	MARBLE	SHRP	SHARP	WBRG	WATER-BEARING
CSND	COARSE SAND	GRVL	GRAVEL	MSND	MEDIUM SAND	SHST	SCHIST	WDFR	WOOD FRAGMENTS
DKCL	DARK-COLOURED	GRWK	GREYWACKE	MUCK	MUCK	SILT	SILT	WTHD	WEATHERED
DLMT	DOLOMITE	GVLY	GRAVELLY	OBDN	OVERBURDEN	SLTE	SLATE		
DNSE	DENSE	GYPS	GYPSUM	PCKD	PACKED	SLTY	SILTY		
DRTY	DIRTY	HARD	HARD	PEAT	PEAT	SNDS	SANDSTONE		
DRY	DRY	HPAN	HARDPAN	PGVL	PEA GRAVEL	SNDY	SANDYOAPSTONE		

2. Core Color

Code	Description
WHIT	WHITE
GREY	GREY
BLUE	BLUE
GREN	GREEN
YLLW	YELLOW
BRWN	BROWN
RED	RED
BLCK	BLACK
BLGY	BLUE-GREY

3. Well Use

Code	Description	Code	Description
DO	Domestic	OT	Other
ST	Livestock	TH	Test Hole
IR	Irrigation	DE	Dewatering
IN	Industrial	MO	Monitoring
CO	Commercial	MT	Monitoring TestHole
MN	Municipal		
PS	Public		
AC	Cooling And A/C		
NU	Not Used		

4. Water Detail

Code	Description	Code	Description
FR	Fresh	GS	Gas
SA	Salty	IR	Iron
SU	Sulphur		
MN	Mineral		
UK	Unknown		

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Appendix B

Borehole Logs

LOG OF BOREHOLE BH01

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-30

REF. NO.: 17-2099GE

ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
289.7						
0.0 / 289.4	**TOPSOIL:** (300 mm)					
0.3 / 289.0	**REWORKED SILTY SAND TO SAND AND SILT:** trace organics, trace rootlets, dark brown to brown, moist, loose	1	SS	4		
0.6	**SILTY SAND TO SAND AND SILT:** trace clay, trace gravel, organic stain, brown, wet, loose to compact	2	SS	8		289
1		3A	SS	18		
288.1		3B	SS			288
1.5 / 287.6	**SAND AND SILT:** trace clay, trace gravel, brown, moist to wet, compact				Bentonite	
2						
2.1 / 287.1	**SAND:** some silt, trace gravel, containing cobbles and boulders, brown, moist, dense	4A	SS	36		
2.5	---auger grinding	4B	SS			287
3	**FINE SAND TO SILTY FINE SAND:** brown, moist to wet, dense to very dense	5	SS	69 / 280 mm	286.4/May 11	
285.6	--- layers of clayey silt till					286
4.0	**SILTY SAND:** trace to some gravel, trace clay, containing cobbles and boulders, brown, wet, very dense	6	SS	50 / 100 mm	Sand	285
5	--- containing cobbles and boulders				Screen	
6						284
283.4		7	SS	50 / 140 mm	Natural pack	
6.2	**END OF BOREHOLE**					

DYNAMIC PENETRATION TEST: SPT / Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20, 40, 60, 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10, 20, 30, 40

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Notes:
1) Water was encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 3.0 mBGS upon completion of drilling.
3) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	3.23

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH02

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-24

REF. NO.: 17-2099GE

ENCL. NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
292.7 / 0.0	**TOPSOIL:** (310 mm)				
292.4 / 0.3	**REWORKED SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose to compact	1	SS	8	
		2	SS	17	292
291.5 / 1.2	**NO SAMPLE RECOVERY:** likely sand and silt to silty sand	3	NR	30	
290.7 / 2.1	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, layers/zones of sandy silt, containing cobbles and boulders, brown, moist, dense to very dense				291
	--- auger grinding	4	SS	49	
					290
		5	SS	39	
					289
		6	SS	62	288
287.2 / 5.6	**SAND:** trace to some silt, trace gravel, brown, moist, very dense				
286.5 / 6.3	**END OF BOREHOLE**	7	SS	50 / 150 mm	287

Note:
1) Borehole was open and dry upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P) — Natural Moisture Content (w) — Liquid Limit (w_L)

WATER CONTENT (%) (10, 20, 30, 40)

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
5	69	23	3

GROUNDWATER ELEVATIONS

Measurement: 1st ▽, 2nd ▼, 3rd ▼, 4th ▼

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

LOG OF BOREHOLE BH03

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: RR | DATE: 2018-04-26

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 4

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone blows/0.3m)	SHEAR STRENGTH (kPa)	WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
294.3										
0.0 / 294.1	**TOPSOIL:** (280 mm)									
0.3 / 293.7	**REWORKED SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, pockets of topsoil, brown, moist, loose	1	SS	4						
0.6	**SAND AND SILT:** trace to some gravel, trace clay, organic stain, containing cobbles and boulders, brown, moist to wet, loose to very dense	2	SS	10						3 41 48 8
1	---layers of sand	3	SS	50 / 150 mm	293	> >100				
292.4										
1.9	**SAND AND SILT TO SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense	4	SS	93 / 230 mm	292	> >100				
291.5										
2.8	**SAND:** some silt, trace gravel, layers of sandy silt, brown, moist, very dense	5	SS	50 / 80 mm	291	> >100				
290.4										
3.9	**GRAVELLY SAND:** some silt to silty, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	6	SS	50 / 50 mm	290	> >100				
5										
289.0					289					
5.4	**SAND:** some silt, trace to some gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense									
6										
288.2	---auger grinding	7	SS	50 / 80 mm		> >100				
6.2	**END OF BOREHOLE**									

Note:
1) Borehole was open and dry upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH04

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-30

REF. NO.: 17-2099GE

ENCL. NO.: 5

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
295.0 / 0.0	**TOPSOIL:** (230 mm)					
294.7 / 0.2	**FILL:** sand and silt to silty sand, trace clay, trace gravel, containing red brick fragments, brown, moist, compact	1	SS	16		
294.4 / 0.6	**SILTY SAND TO SAND:** trace to some gravel, containing cobbles and boulders, brown, moist, compact to very dense	2	SS	29	294	
	--- auger grinding	3	SS	67		10 67 18 5
	--- auger grinding	4	SS	64	293	
	--- auger grinding	5	SS	50 / 50 mm	292	
291.1 / 3.9	**SILTY FINE SAND:** pockets of sandy silt, containing cobbles and boulders, brown, moist, very dense				291	
	--- auger grinding	6	SS	50 / 100 mm	290	
289.5 / 5.5	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense					
	--- auger grinding	7	SS	50 / 130 mm	289	
	--- auger grinding					
288.0 / 6.9	**SAND:** some gravel, trace to some silt, containing cobbles and boulders, brown, moist, very dense				288	
287.2 / 7.7	**END OF BOREHOLE**	8	SS	50 / 100 mm		

Note:
1) Borehole caved at a depth of 4.1 m below ground surface (mBGS) upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH05

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-26

REF. NO.: 17-2099GE

ENCL. NO.: 6

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
296.3 / 0.0	**TOPSOIL:** (330 mm)				
295.9 / 0.3	**REWORKED FINE SAND AND SILT TO SILTY FINE SAND:** trace organics, trace rootlets, pockets of sandy silt, brown, moist, very loose	1	SS	3	296
295.7 / 0.6		2A	SS	4	
295.4 / 0.9	**REWORKED SAND AND SILT TO SANDY SILT:** trace to some clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose	2B	SS		
295.0 / 1.2	**SAND AND SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, loose	3	SS	35	295
294.2 / 2.1	**SAND:** trace to some gravel, layers/zones of sandy silt, containing cobbles and boulders, brown, moist, dense	4	SS	61	294
	SILTY SAND: trace to some gravel, layers/zones of sandy silt, seams of silt, layers of sand, containing cobbles and boulders, brown, moist, very dense	5	SS	75	293
	--- auger grinding				
292.2 / 4.0	**SAND:** some gravel, trace to some silt, brown, moist, very dense				292
	--- auger grinding	6	SS	50 / 130 mm	
290.8 / 5.5	**SAND AND SILT TO SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense				291
289.9 / 6.4	**END OF BOREHOLE**	7	SS	50 / 100 mm	290

Note:
1) Borehole was open and dry upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L)

WATER CONTENT (%) (10, 20, 30, 40)

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε_f=3% Strain at Failure

01 - GEOPRO SOIL LOG GEOPRO 17-2099 BH LOG PROJECT DATA 20180529-DC -DX.GPJ 2018-05-29 17:03

LOG OF BOREHOLE BH06

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-26

REF. NO.: 17-2099GE

ENCL. NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.6						
0.0 / 298.3	**TOPSOIL:** (245 mm)					
0.2	**REWORKED SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist to wet, very loose to compact	1	SS	2	298	
297.7		2A	SS	11		
0.8	**SAND AND SILT TO SILTY SAND:** trace to some clay, trace gravel, organic stain, containing cobbles and boulders, brown, moist, compact	2B	SS			
1		3	SS	11	297	2 55 32 11
296.5						
2.1	**SILTY SAND:** trace gravel, layers/zones of sand and silt, containing cobbles and boulders, brown, moist, very dense	4	SS	67	296	
3	--- auger grinding	5	SS	82		
294.5					295	
4.0	**CLAYEY SILT:** some sand to sandy, trace gravel, zones/layers of silty sand, containing cobbles and boulders, brown, moist, hard					
	--- auger grinding	6	SS	49	294	
5						
293.0					293	
5.6	**SAND TO SILTY SAND:** trace to some gravel, containing cobbles and boulders, brown, moist, very dense					
6		7	SS	50 / 130 mm		
	--- auger grinding				292	
7						
290.9		8	SS	50 / 80 mm	291	
7.7	**END OF BOREHOLE**					

Note:
1) Borehole was open and dry upon completion of drilling.

DYNAMIC PENETRATION TEST: SPT / Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane (20, 40, 60, 80)

WATER CONTENT (%): Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L) (10, 20, 30, 40)

UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ε_f=3% Strain at Failure

LOG OF BOREHOLE BH07

PROJECT: Geotechnical Investigation for Slope Stability Assessment and Geotechnical Setback Study

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 205 mm

DATE: 2018-04-25

REF. NO.: 17-2099GE

ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
301.4 / 0.0	**TOPSOIL:** (360 mm)	1	SS	5	301
301.0 / 0.4	**REWORKED SANDY SILT TO SAND AND SILT:** trace to some clay, trace gravel, trace organics, trace rootlets, layers of clayey silt, dark brown to brown, moist, loose	2	SS	11	
300.8 / 0.6	**CLAYEY SILT:** some sand, trace organics, brown, moist, stiff				
300.2 / 1.2	**SAND AND SILT:** trace clay, trace gravel, pockets of organics, brown, moist, loose	3	SS	6	300
299.3 / 2.1	**SILTY SAND:** trace clay, trace gravel, layers of sand, containing cobbles and boulders, brown, moist, dense	4	SS	40	299
298.5 / 2.9	**FINE SAND AND SILT TO SILTY FINE SAND:** trace gravel, layers/zones of silt, brown, moist, dense to very dense	5	SS	34	298
	--- auger grinding ---layers of clayey silt	6	SS	85 / 260 mm	297
295.8 / 5.6	**SILTY SAND:** trace to some gravel, layers of sand and silt, containing cobbles and boulders, brown, moist, very dense	7	SS	50 / 150 mm	296
294.4 / 6.9	--- auger grinding **SAND:** some silt, some gravel, containing cobbles and boulders, brown, moist, very dense	8	SS	50 / 130 mm	295
292.9 / 8.5	**FINE SAND:** trace to some silt, trace gravel, brown, moist, very dense	9	SS	50 / 80 mm	294
					293
					292

Bentonite

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	1	63	31	5
	15	73	12	

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

PROJECT: Geotechnical Investigation for Slope Stability Assessment and Geotechnical Setback Study **DRILLING DATA**

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI | METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 205 mm

PROJECT LOCATION: County Road 27, Barrie, Ontario | FIELD ENGINEER: RR | DATE: 2018-04-25

DATUM: Geodetic | SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

BH LOCATION: See Borehole Location Plan | CHECKED: DL | ENCL. NO.: 2

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
	FINE SAND: trace to some silt, trace gravel, brown, moist, very dense(Continued)					291
11		10	SS	50 / 80 mm		
289.9						290
11.5	**SAND AND SILT TO SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense					
12		11	SS	50 / 80 mm		289
13	--- auger grinding				Sand	288
14		12	SS	50 / 50 mm		
					Screen	287
15					286.6/May 11	
286.1					Natural Pack	
15.3	**END OF BOREHOLE**	13	SS	50 / 80 mm		

Note:
1) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	14.83

DYNAMIC PENETRATION TEST — ○ SPT ≳ Cone blows/0.3m — 20 40 60 80

SHEAR STRENGTH (kPa) — ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane — 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%) — 10 20 30 40

> >100

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH08

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 9

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
301.8					
0.0 / 301.5	**TOPSOIL:** (330 mm)	1	SS	11	
0.3 / 301.2	**REWORKED SILTY SAND:** trace gravel, trace organics, trace rootlets, pockets of organic silt, brown, moist to wet, compact				
0.6	**SILTY SAND:** trace gravel, organic stain, dark brown to brown, wet, loose to compact	2	SS	6	
		3	SS	4	
299.4		4A	SS		
2.4 / 298.9	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, brown, moist to wet, compact	4B	SS	29	
2.9	**SAND:** trace to some silt, trace to some gravel, containing cobbles and boulders, brown, moist, compact to very dense	5	SS	43	12 65 16 7
	--- auger grinding	6	SS	97 / 260 mm	
	---zones of silty sand	7	SS	24	
294.0		8	SS	50 / 80 mm	
7.9	**END OF BOREHOLE**				

Notes:
1) Borehole was dry upon completion of drilling.
2) Borehole caved at depth of 7.3 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20 40 60 80

WATER CONTENT (%): Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L); 10 20 30 40

ELEVATION: 301, 300, 299, 298, 297, 296, 295, 294

> >100

UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH09

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 10

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
302.9 / 0.0	**TOPSOIL:** (330 mm)				
302.6 / 0.3	**REWORKED SILTY FINE SAND:** trace organics, trace rootlets, dark brown to brown, moist, loose	1	SS	4	
302.3 / 0.6	**SILTY SAND TO SANDY SILT:** trace organics, organic stain, brown, moist to wet, loose	2	SS	5	302
301.7 / 1.2	---zones of clayey silt **SILTY SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, compact to very dense	3	SS	20	
		4	SS	48	301
299.7 / 3.2	**SAND AND GRAVEL:** trace silt, containing cobbles and boulders, brown, moist, very dense	5A 5B	SS SS	50 / 100 mm	300
298.9 / 4.0	**SAND AND SILT TO SILTY SAND:** trace to some gravel, containing cobbles and boulders, brown, moist, very dense	6	SS	50 / 80 mm	299
					298
296.7 / 6.2	**END OF BOREHOLE** Note: 1) Borehole caved at a depth of 5.0 m below ground surface (mBGS) upon completion of drilling.	7	SS	50 / 100 mm	297

GROUND WATER

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
42	46	12	

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH10

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 11

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
300.8 / 0.0	**TOPSOIL:** (310 mm)			
300.5 / 0.3	**REWORKED SAND AND SILT TO SILTY SAND:** trace organics, trace rootlets, dark brown to brown, moist to wet, very loose	1	SS	3
0.6	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, organic stain, dark brown to brown, moist to wet, very loose to compact	2	SS	2
299.3		3A	SS	11
1.5	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, pockets of sand, containing cobbles and boulders, brown, moist, compact	3B	SS	
298.8 / 2.1	**SAND:** some silt, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	4	SS	53
297.9 / 2.9	**SILTY SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	5	SS	80 / 280 mm
295.5 / 5.4	**SILTY FINE SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	6	SS	50 / 100 mm
294.5 / 6.4	**END OF BOREHOLE**	7	SS	50 / 100 mm

Notes:
1) Borehole was dry upon completion of drilling.
2) Borehole caved at a depth of 5.9 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit w_P — Natural Moisture Content w — Liquid Limit w_L

WATER CONTENT (%) (10, 20, 30, 40)

GROUND WATER

ELEVATION: 300, 299, 298, 297, 296, 295

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε_f=3% Strain at Failure

LOG OF BOREHOLE BH11

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 12

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST (SPT / Cone, blows/0.3m) / SHEAR STRENGTH (kPa) (Unconfined, Field Vane & Sensitivity, Quick Triaxial, Penetrometer, Lab Vane)	Plastic Limit / Natural Moisture Content / Liquid Limit — WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.9										
0.0 / 298.6	**TOPSOIL:** (310 mm)									
0.3 / 298.3	**REWORKED SAND AND SILT:** trace clay, trace organics, trace rootlets, brown, moist, very loose	1	SS	2						
0.6 / 297.8	**SAND AND SILT:** trace to some clay, trace gravel, containing cobbles and boulders, brown, moist, loose	2A	SS	9		298				
297.7		2B	SS							
1.2	**SAND:** trace to some silt, trace gravel, layers of sandy silt, brown, moist, loose	3	SS	51						4 65 24 7
	SAND AND SILT TO SILTY SAND: trace clay, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense					297				
		4	SS	69						
						296				
		5	SS	82 / 280 mm			> >100			
						295				
294.2	--- auger grinding	6A	SS	50 / 80 mm			> >100			
4.7	**SAND:** trace to some silt, trace gravel, brown, moist, very dense	6B	SS			294				
						293				
292.5		7	SS	50 / 130 mm			> >100			
6.4	**END OF BOREHOLE**									

Note:
1) Borehole caved at a depth of 5.2 m below ground surface (mBGS) upon completion of drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH12

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: RR | DATE: 2018-04-23

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 13

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
295.3 / 0.0	**TOPSOIL:** (290 mm)				
295.0 / 0.3	**REWORKED SANDY SILT TO SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose	1	SS	4	295
294.7 / 0.6		2A	SS	4	
1 / 294.2	**SAND AND SILT:** trace clay, trace gravel, organic stain, brown, moist to wet, loose	2B	SS		
294.1 / 1.2	**SAND AND SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, loose	3	SS	47	294
2 / 293.2	**SAND:** some gravel, some silt, containing cobbles and boulders, brown, moist, dense				
2.1	**SILTY SAND:** trace gravel, layers/zones of sand and silt, brown, moist, very dense	4	SS	72	293
292.4					
3 / 2.9	**SILTY FINE SAND:** seams/pockets of silt, brown, moist, very dense	5	SS	60	292
291.3					
4.0	**SAND AND SILT TO SILTY SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	6	SS	77 / 260 mm	291
5	--- auger grinding				
6		7	SS	50 / 140 mm	290
	--- auger grinding				289
7					
287.6	--- containing cobbles and boulders	8	SS	50 / 130 mm	288
7.8	**END OF BOREHOLE**				

Note:
1) Borehole caved at a depth of 6.3 m below ground surface (mBGS) upon completion of drilling.

GROUND WATER

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit | Natural Moisture Content | Liquid Limit
w_P | w | w_L
WATER CONTENT (%)
10 20 30 40

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
15	74	11	

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

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

LOG OF BOREHOLE BH13

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-24

REF. NO.: 17-2099GE

ENCL. NO.: 14

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
294.6 / 0.0	**TOPSOIL:** (170 mm)				
294.5 / 0.2	**REWORKED SANDY SILT:** trace to some clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, very loose	1	SS	3	
294.0 / 0.6	**SAND AND SILT TO SANDY SILT:** some clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist, compact	2	SS	11	294
		3	SS	17	293
292.6 / 2.1	**SAND AND SILT TO SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense	4	SS	64	292
291.7 / 2.9	**FINE SAND:** trace to some silt, trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense --- auger grinding	5	SS	59	291
290.6 / 4.0	**SILTY FINE SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	6A	SS	69	290
289.8 / 4.9	**SAND AND SILT:** trace clay, trace gravel, containing cobbles and boulders, brown, moist, very dense	6B	SS		
289.1 / 5.6	**SILTY SAND:** trace gravel, layers of sandy silt, containing cobbles and boulders, brown, moist, very dense	7	SS	50 / 140 mm	289
288.4 / 6.2	**END OF BOREHOLE**				

Note:
1) Borehole caved at a depth of 5.4 m below ground surface (mBGS) upon completion of drilling.

GROUND WATER

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	39	42	18

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

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

LOG OF BOREHOLE BH14

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: RR | DATE: 2018-04-24

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 15

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
293.3					
0.0 / 293.0	**TOPSOIL:** (340 mm)	1	SS	3	293
0.3 / 292.7	**REWORKED SANDY SILT TO SAND AND SILT:** trace to some clay, trace gravel, trace organics, trace rootlets, dark brown, moist, very loose	2	SS	5	
0.6 / 292.1	**SAND AND SILT:** trace to some clay, trace gravel, trace rootlets, pockets of organics, organic stain, brown, wet, loose	3	SS	14	292
1.2	**SAND AND SILT TO SILTY SAND:** trace to some clay, trace gravel, pockets of sand, containing cobbles and boulders, moist to wet, compact to very dense	4	SS	14	291
		5	SS	12	290
		6	SS	70	289
287.1		7	SS	50 / 150 mm	288
6.3	**END OF BOREHOLE**				

Bentonite

Sand

Screen

287.4/May 11

Natural pack

Notes:
1) Water was encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 4.0 mBGS upon completion of drilling.
4) 51 mm dia. monitoring well was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	5.94

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20, 40, 60, 80

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane; 20, 40, 60, 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10, 20, 30, 40

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH15

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: HR | DATE: 2018-04-30

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 16

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
291.3					
0.0 / 291.0	**TOPSOIL:** (330 mm)	1	SS	2	291
0.3 / 290.7	**REWORKED SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, dark brown, wet, very loose	2	SS	9	
0.6 / 290.1	**SAND AND SILT:** trace clay, trace gravel, organic stain, brown, wet, loose				
1.2	**SAND AND SILT TO SILTY SAND:** trace to some clay, trace gravel, layers of silty sand, pockets of sand, brown, moist to wet, loose to very dense	3	SS	7	290
		4	SS	9	289
		5	SS	11	288
		6	SS	10	287
		7	SS	50 / 100 mm	286
285.0					285
6.4	**END OF BOREHOLE**				

Notes:
1) Water was encountered at a depth of 2.1 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 5.5 mBGS upon completion of drilling.
3) 51 mm dia. monitoring well was installed upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	1.51

GROUND WATER: 289.8/May 11

Bentonite

Sand

Screen

Natural pack

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
3	56	27	14

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH16

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-30

REF. NO.: 17-2099GE

ENCL. NO.: 17

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
299.0 / 0.0	**PAVED SHOULDER ASPHALT:** (60 mm)				
298.9 / 0.1	**GRANULAR BASE/SUBBASE:** (780 mm)	1	AS		
298.1 / 0.8	**FILL:** gravelly sand, trace silt, containing rock fragments, brown, moist, compact	2	SS	15	298
297.7 / 1.2	**FILL:** organic sandy silt to organic silt, trace clay, trace gravel, dark brown, wet, loose	3A	SS	6	
297.2 / 1.8	**FILL:** sandy silt to sand and silt, trace to some clay, trace organics, brown, wet, loose	3B	SS		297
296.8 / 2.1	**SAND AND SILT:** trace clay, trace gravel, brown to grey, wet, loose to compact	4	SS	7	
		5	SS	11	296
					295
	---grey	6	SS	29	294
					293
292.4 / 6.6	**END OF BOREHOLE**	7	SS	11	

Notes:
1) Water was encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 5.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 6.0 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH17

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Split Spoon

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 51 mm

DATE: 2018-05-02

REF. NO.: 17-2099GE

ENCL. NO.: 18

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
298.4								
0.0 / 298.1	**TOPSOIL:** (320 mm)				298.2/May 11			
0.3 / 297.6	**REWORKED SANDY SILT:** some clay, trace to some organics, trace rootlets, brown, wet, very loose	1	SS	1		298		
0.8 / 296.9	**SILTY CLAY:** sandy, trace gravel, trace organics, organic stain, sand pockets, brown, wet, very soft to soft	2	SS	2	Bentonite	297		1 29 27 43
1.5 / 296.3	**SANDY SILT:** some clay, trace gravel, layers/seams of clayey silt, brown, wet, loose to compact	3	SS	10				
2.1 / 295.3	**CLAYEY SILT TO SILTY CLAY:** trace to some sand, trace gravel, seams of silty sand, layers of sandy silt, brown, wet, stiff	4	SS	9	Sand / Screen	296		
3.1 / 294.7	**SAND AND SILT:** trace clay, trace gravel, containing cobbles and boulders, brown to grey, moist to wet, compact	5	SS	27		295		
3.7	**END OF BOREHOLE**							

Notes:
1) Water was encountered at a depth of 0.8 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 0.2 mBGS upon completion of drilling.
3) 38 mm dia. monitoring was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	0.23

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P), Natural Moisture Content (w), Liquid Limit (w_L)

WATER CONTENT (%) (10, 20, 30, 40)

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

LOG OF BOREHOLE BH18

PROJECT: Geotechnical Investigation for Proposed Residential Developments
CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI
PROJECT LOCATION: County Road 27, Barrie, Ontario
DATUM: Geodetic
BH LOCATION: See Borehole Location Plan

DRILLING DATA
METHOD: Continuous Split Spoon
FIELD ENGINEER: RR
SAMPLE REVIEW: DX
CHECKED: DL
DIAMETER: 51 mm
DATE: 2018-05-01
REF. NO.: 17-2099GE
ENCL. NO.: 19

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	GROUND WATER	ELEVATION
296.6 / 0.0	**TOPSOIL:** (300 mm)					
296.3 / 0.3	**REWORKED SAND AND SILT:** trace clay, trace gravel, brown, moist to wet, very loose	1	SS	2		
295.8 / 0.8	**SAND AND SILT:** trace clay, trace gravel, trace rootlets, layers/seams /pockets of sand, containing cobbles and boulders, brown, moist to wet, loose to compact	2	SS	6	295.4/May 11	296
		3	SS	8	Bentonite	295
		4	SS	9		294
		5	SS	17		293
		6	SS	13	Sand	
		7	SS	10	Screen	292
291.4 / 5.2	**NO SAMPLE RECOVERY:** likely silty sand	8	NR	19	Natural pack	291
290.7 / 5.9	**END OF BOREHOLE:**					

Notes:
1) Water was encountered at a depth of 2.3 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.5 mBGS upon completion of drilling.
3) Borehole caved at a depth of 5.3 mBGS upon completion.
4) 38 mm dia. monitoring was installed in borehole upon completion of drilling.

Water Level Reading
Date W. L Depth (mBGS)
May 11, 2018 1.20

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH19

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-24

REF. NO.: 17-2099GE

ENCL. NO.: 20

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
295.3 / 0.0	**TOPSOIL:** (290 mm)			
295.0 / 0.3	**REWORKED FINE SAND AND SILT:** trace organics, trace rootlets, pockets of organics, dark brown to brown, moist, loose	1	SS	4
294.7 / 0.6	**CLAYEY SILT:** trace to some sand, trace organics, trace rootlets, zones of silty fine sand, organic stain, dark brown to brown, moist, soft to firm	2A	SS	4
294.4 / 0.9		2B	SS	
294.1 / 1.2	**SAND AND SILT:** trace to some clay, trace gravel, brown, moist to wet, loose	3	SS	9
293.3 / 2.1	**SANDY SILT TO SAND AND SILT:** trace to some clay, trace gravel, layers of clayey silt, containing cobbles and boulders, brown, moist to wet, loose	4	SS	17
292.4 / 2.9	**SAND AND SILT TILL:** trace clay, trace gravel, layers of sand and silt, containing cobbles and boulders, brown, moist, compact	5	SS	16
	SAND AND SILT: trace clay, trace gravel, containing cobbles and boulders, brown, moist, compact to very dense			
	--- auger grinding	6	SS	87 / 260 mm
289.8 / 5.6	**SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense			
288.9 / 6.4	**END OF BOREHOLE**	7	SS	50 / 150 mm

Note:
1) Borehole caved at a depth of 5.3 m below ground surface (mBGS) upon completion of drilling.

GROUND WATER

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

UNIT WT (kN/m³)

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

ELEVATION: 295, 294, 293, 292, 291, 290, 289

> >100

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH20

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: RR | DATE: 2018-04-24

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 21

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
297.3							
0.0 / 297.0	**TOPSOIL:** (280 mm)						
0.3 / 296.7	**REWORKED SANDY SILT TO SAND AND SILT:** trace clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose	1	SS	4	297		
0.6	**SAND AND SILT TO SILTY SAND:** trace to some clay, trace gravel, layers/pockets of sand, containing cobbles and boulders, brown, moist, compact to very dense	2	SS	14			
	---auger grinding	3	SS	64	296		
	---auger grinding	4	SS	82	295		1 59 28 12
		5	SS	93	294		
	--- auger grinding	6	SS	50 / 100 mm	293		
291.0		7	SS	50 / 150 mm	292		
6.3	**END OF BOREHOLE**						

Note:
1) Borehole caved at a depth of 5.6 m below ground surface (mBGS) upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%): 10 20 30 40

> >100

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BH21

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 22

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
302.0					
0.0 / 301.8	**TOPSOIL:** (240 mm)				
0.2 / 301.4	**REWORKED FINE SAND AND SILT TO SILTY FINE SAND:** trace clay, trace gravel, trace organics, trace rootlets, dark brown, wet, very loose	1	SS	2	
0.6 / 300.8	**SAND AND SILT:** trace clay, trace gravel, trace rootlets, organic stain, dark brown to brown, moist to wet, loose	2	SS	5	301
1.2	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, pockets of sand, containing cobbles and boulders, brown, moist, very dense	3	SS	61	
		4	SS	89	300
299.1					
2.9 / 298.6	**FINE SAND:** trace to some silt, trace gravel, brown, moist, very dense	5A	SS	87 / 280 mm	299
3.5 / 298.0	**SANDY SILT:** trace clay, trace gravel, layers of silt, brown, moist, very dense	5B	SS		
4.0	**SAND AND SILT TO SILTY SAND:** trace gravel, containing cobbles and boulders, brown, moist, very dense	6	SS	50 / 100 mm	298
	--- auger grinding				297
296.5					
5.5	**SAND:** trace to some silt, trace gravel, brown, moist, very dense	7	SS	50 / 80 mm	296
295.1					
6.9	**SAND AND SILT TO SILTY SAND:** trace gravel, pockets of sand, containing cobbles and boulders, brown, moist, very dense	8	SS	50 / 50 mm	295
293.6					294
8.4	**SILTY FINE SAND:** brown, moist, very dense				
292.7		9	SS	50 / 140 mm	293
9.3	**END OF BOREHOLE**				

Notes:
1) Borehole caved at a depth of 7.9 m below ground surface (mBGS)

Bentonite

Sand

Screen

Natural pack

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%)
10 20 30 40

> >100

UNIT WT (kN/m³)

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

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH21

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: RR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-23

REF. NO.: 17-2099GE

ENCL. NO.: 22

SOIL PROFILE			SAMPLES			GROUND WATER	ELEVATION	DYNAMIC PENETRATION TEST / SHEAR STRENGTH (kPa)	Plastic Limit / Natural Moisture Content / Liquid Limit / WATER CONTENT (%)	UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS/0.3m			○ SPT, ≈ Cone, blows/0.3m; 20 40 60 80 ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane 20 40 60 80	w_P w w_L 10 20 30 40		GR SA SI CL
	upon completion of drilling. 2) 51 mm dia. monitoring was installed in borehole upon completion of drilling. Water Level Reading Date W. L Depth (mBGS) May 11, 2018 Dry										

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BH22

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-30

REF. NO.: 17-2099GE

ENCL. NO.: 23

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
305.1				
0.0 / 304.9	**TOPSOIL:** (230 mm)			
0.2	**FINE SAND:** trace to some silt, trace gravel, containing cobbles and boulders, brown, moist to wet, loose to dense	1	SS	8
		2	SS	40
		3	SS	36
303.0				
2.1	**SILTY FINE SAND:** brown, saturated, loose to compact	4	SS	10
302.2				
2.9	**FINE SAND:** trace to some silt, brown, saturated, compact	5	SS	15
301.1				
4.0	**SAND AND SILT:** trace to some clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist to wet, very dense	6	SS	59
299.5				
5.6	**SAND:** some silt, trace gravel, brown, wet, very dense	7	SS	50 / 100 mm
298.9				
6.2	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 0.3 m below ground surface (mBGS) during drilling.
2) Borehole caved at a depth of 0.6 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Plastic Limit w_P | Natural Moisture Content w | Liquid Limit w_L

WATER CONTENT (%): 10 20 30 40

ELEVATION: 305 304 303 302 301 300 299

> >100

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH23

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: RR | DATE: 2018-04-24

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 24

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m
299.2				
0.0 / 298.9	**TOPSOIL:** (240 mm)	1A	SS	4
0.2 / 298.7	**REWORKED FINE SAND AND SILT:** trace organics, trace rootlets, dark brown, moist, loose	1B	SS	
0.6 / 298.6	**REWORKED SANDY SILT:** some clay, trace gravel, trace organics, trace rootlets, dark brown to brown, moist, loose	2	SS	4
1.2 / 298.0	**SANDY SILT:** some clay, trace organics, trace rootlets, organic stain, layers of sand, dark brown to brown, moist, loose	3	SS	17
2.1 / 297.1	**SAND AND SILT:** trace clay, trace gravel, organic stain, brown, moist to wet, compact			
	SAND AND SILT TO SILTY SAND: trace to some clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist to wet, dense to very dense	4	SS	44
		5	SS	53
	---auger grinding	6	SS	50 / 150 mm
5.5 / 293.7	**FINE SAND AND SILT TO SILTY FINE SAND:** trace gravel, containing cobbles and boulders, brown, wet, very dense	7	SS	50 / 120 mm
6.2 / 293.0	**END OF BOREHOLE**			

Notes:
1) Water encountered at a depth of 3.1 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 3.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 5.9 mBGS upon completion of drilling.
4) 51 mm dia. monitoring was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	2.20

Bentonite

297.0/May 11/17

Sand

Screen

Natural pack

ELEVATION: 299, 298, 297, 296, 295, 294, 293

DYNAMIC PENETRATION TEST
○ SPT ≳ Cone blows/0.3m
20 40 60 80

SHEAR STRENGTH (kPa)
● Unconfined ✕ Field Vane & Sensitivity
▲ Quick Triaxial ⊠ Penetrometer + Lab Vane
20 40 60 80

Plastic Limit (w_P) | Natural Moisture Content (w) | Liquid Limit (w_L)

WATER CONTENT (%)
10 20 30 40

> >100 (SPT)

> >100 (Cone)

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
4	64	21	11

GROUNDWATER ELEVATIONS

Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

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

01 - GEOPRO SOIL LOG GEOPRO 17-2099 BH LOG PROJECT DATA 20180529-DC -DX.GPJ 2018-05-29 17:04

LOG OF BOREHOLE BH24

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 155 mm

DATE: 2018-04-24

REF. NO.: 17-2099GE

ENCL. NO.: 25

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
297.5 / 0.0	**TOPSOIL:** (280 mm)				
297.2 / 0.3	**REWORKED FINE SAND AND SILT TO SILTY FINE SAND:** trace organics, trace rootlets, dark brown to brown, moist, loose	1	SS	5	
296.8 / 0.6	**CLAYEY SILT:** some sand to sandy, trace organics, trace rootlets, organic stain, dark brown to brown, moist, firm	2	SS	6	
296.2 / 1.2	**SAND AND SILT:** trace clay, trace gravel, organic stain, brown, wet, loose	3	SS	9	
295.4 / 2.1	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, sand pockets, containing cobbles and boulders, brown, moist to wet, compact to very dense	4	SS	21	
		5	SS	52	
	---auger grinding	6	SS	69	
291.9 / 5.6	**FINE SAND AND SILT TO SILTY FINE SAND:** brown, wet, very dense	7	SS	69 / 290 mm	
290.9 / 6.5	**END OF BOREHOLE**				

Notes:
1) Water encountered at a depth of 4.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 5.2 mBGS upon completion of drilling.
3) Borehole caved at 5.8 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

WATER CONTENT (%): Plastic Limit w_P, Natural Moisture Content w, Liquid Limit w_L (10, 20, 30, 40)

UNIT WT (kN/m³)

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

GROUNDWATER ELEVATIONS

Measurement: 1st, 2nd, 3rd, 4th

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BOREHOLE BH25

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer

FIELD ENGINEER: HR

SAMPLE REVIEW: DX

CHECKED: DL

DIAMETER: 205 mm

DATE: 2018-04-30

REF. NO.: 17-2099GE

ENCL. NO.: 26

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
305.8					
0.0 / 305.6	**TOPSOIL:** (200 mm)				
0.2 / 305.2	**GRAVELLY SAND:** trace silt, containing cobbles and boulders, brown, moist to wet, compact	1	SS	12	305.4/May 11
0.6	**SAND TO FINE SAND:** trace to some silt, trace gravel, brown, wet, compact	2	SS	24	305
		3	SS	18	
					304
		4	SS	23	
302.9					303
2.9	**FINE SAND TO SILTY FINE SAND:** brown, wet, compact	5	SS	22	
					302
		6	SS	24	301
					300
299.3		7	SS	12	
6.6	**END OF BOREHOLE**				

Bentonite

Sand

Screen

Natural pack

Notes:
1) Water encountered at a depth of 0.3 m below ground surface (mBGS) during drilling.
2) 51 mm dia. monitoring was installed in borehole upon completion of drilling.

Water Level Reading

Date	W. L Depth (mBGS)
May 11, 2018	0.48

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m (20, 40, 60, 80)

SHEAR STRENGTH (kPa): ● Unconfined, ✕ Field Vane & Sensitivity, ▲ Quick Triaxial, ⊠ Penetrometer, + Lab Vane (20, 40, 60, 80)

Plastic Limit (w_P) — Natural Moisture Content (w) — Liquid Limit (w_L)

WATER CONTENT (%) (10, 20, 30, 40)

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	91	9	

GROUNDWATER ELEVATIONS

Measurement: 1st ▽, 2nd ▼, 3rd ▼, 4th ▼

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

LOG OF BOREHOLE BH26

PROJECT: Geotechnical Investigation for Proposed Residential Developments

CLIENT: Di Poce Management Inc. c/o Oksana Vialykh, BBA, AACI

PROJECT LOCATION: County Road 27, Barrie, Ontario

DATUM: Geodetic

BH LOCATION: See Borehole Location Plan

DRILLING DATA

METHOD: Continuous Flight Auger - Auto Hammer | DIAMETER: 155 mm

FIELD ENGINEER: HR | DATE: 2018-04-30

SAMPLE REVIEW: DX | REF. NO.: 17-2099GE

CHECKED: DL | ENCL. NO.: 27

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS/0.3m	ELEVATION
306.5 / 0.0	**TOPSOIL:** (300 mm)				
306.2 / 0.3	**SAND AND SILT TO SILTY SAND:** trace clay, trace gravel, trace to some organics, trace rootlets, layers of peats, dark brown, moist, compact	1	SS	14	306
305.9 / 0.6	**FINE SAND:** trace to some silt, trace gravel, brown, wet, compact to very dense	2	SS	33	
		3	SS	18	305
		4	SS	37	304
		5	SS	54	303
301.8 / 4.7	**SILTY SAND TILL TO SAND AND SILT TILL:** some clay to clayey, trace gravel, layers of clayey silt, zones/layers of sand and silt, containing cobbles and boulders, brown, moist to wet, dense to very dense	6A	SS		302
		6B	SS	47	
		7	SS	57	301
300.0 / 6.6	**END OF BOREHOLE**				300

Notes:
1) Water encountered at a depth of 0.6 m below ground surface (mBGS) during drilling.
2) Water was at a depth of 0.7 mBGS upon completion of drilling.
3) Borehole caved at a depth of 0.7 mBGS upon completion of drilling.

DYNAMIC PENETRATION TEST: ○ SPT, ≳ Cone, blows/0.3m; 20 40 60 80

SHEAR STRENGTH (kPa): ● Unconfined ✕ Field Vane & Sensitivity ▲ Quick Triaxial ⊠ Penetrometer + Lab Vane; 20 40 60 80

Natural Moisture Content: Plastic Limit w_P | w | Liquid Limit w_L

WATER CONTENT (%): 10 20 30 40

UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
2	50	27	21

GROUNDWATER ELEVATIONS

Measurement: 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^{3}$, $\times^{3}$: Numbers refer to Sensitivity; ▲ ε=3% Strain at Failure

LOG OF BH 120

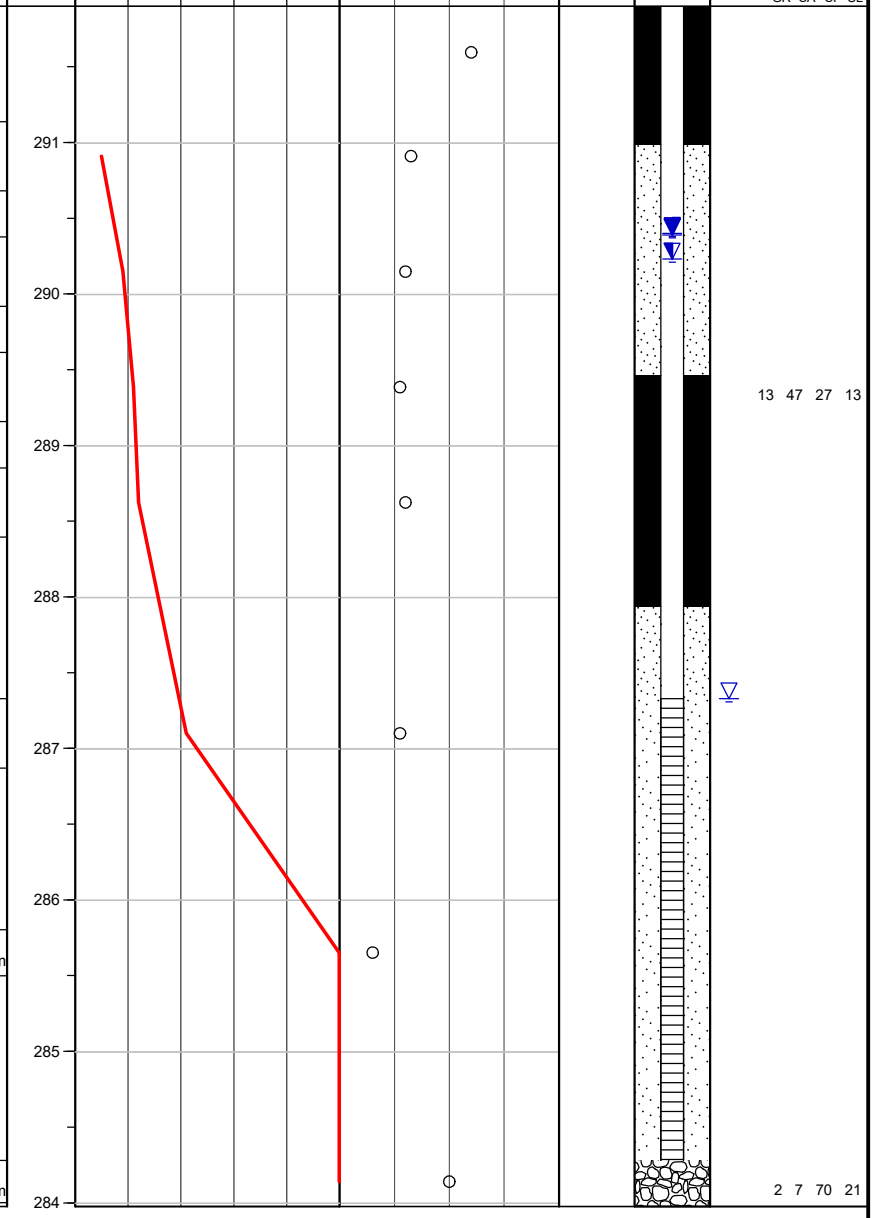
Terraprobe

Project No.	: 3-17-0047-03	Client	: PRATT DEVELOPMENT INC.	Originated by	: BH
Date started	: January 24, 2018	Project	: BEAR CREEK RIDGE	Compiled by	: BH
Sheet No.	: 1 of 1	Location	: Barrie	Checked by	: SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	**291.9**	**GROUND SURFACE**				
	291.6 / 0.3	280mm **TOPSOIL**		1	AS	
		FILL, silty sand and sandy silt, trace gravel, trace clay, loose, brown, moist to wet		2	SS	5
1				3	SS	9
2	289.9 / 2.0	**SILTY SAND**, some gravel, some clay, compact to very dense, brown, moist to wet (GLACIAL TILL)		4	SS	11
3				5	SS	12
4		...wet seams between 3.7m to 4.6m.		6	SS	21
5						
6				7	SS	50 / 150mm
7	284.3 / 7.6					
	284.0 / 7.9	**CLAYEY SILT**, trace sand, trace gravel, very dense, brown, moist (GLACIAL TILL)		8	SS	50 / 125mm



END OF BOREHOLE

Unstabilized water level measured at 4.6 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	1.7	290.2
Feb 20, 2018	1.5	290.4
Feb 22, 2018	1.5	290.4

file: 3170047 bh.gpj

LOG OF BH 121

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 29, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	295.5	**GROUND SURFACE**				
	295.2	300mm **TOPSOIL**				
	0.3	**FILL**, silty sand, trace clay, trace organics, very loose, brown, moist to wet		1	AS	
1				2	SS/AS	3
2				3	SS	2
				4	SS	3
	292.5					
3	3.0	**SILTY SAND**, trace gravel, trace clay, cobble and boulder inclusions, very dense, brown, moist (GLACIAL TILL)		5	SS	55
4						
				6	SS	50 / 150mm
5						
6		...wet seam at 6m.		7	SS	50 / 150mm
7						
	287.7			8	SS	50 / 150mm
	7.8	**END OF BOREHOLE**				

Elevation Scale (m): 295, 294, 293, 292, 291, 290, 289, 288

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10 20 30 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40 80 120 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

	GR	SA	SI	CL
1	0	64	29	7
7	8	59	25	8

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	dry	n/a
Feb 20, 2018	dry	n/a
Feb 22, 2018	dry	n/a

file: 3170047 bh.gpj

LOG OF BH 122

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 29, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	299.7	**GROUND SURFACE**				
0	299.4	300mm **TOPSOIL**		1	AS	
	0.3	**FILL**, silty sand, trace gravel, trace organic to 0.6m, loose, brown, moist		2	SS	6
1						
				3	SS	5
2	297.7					
	2.0	**SAND**, trace silt, trace gravel, dense to very dense, brown, moist		4	SS	30
3				5	SS	50 / 150mm
4						
	294.8			6	SS	50 / 150mm
5	4.9	**SILTY SAND**, trace clay, trace gravel, cobble and boulder inclusions, very dense, brown, moist (GLACIAL TILL)		7	SS	50 / 150mm
6						
7				8	SS	50 / 75mm
8						
	290.1			9	SS	50 / 100mm
9	9.6	**SAND AND SILT**, trace clay, very dense, greyish brown, wet				
10	289.5			10	SS	50 / 100mm
	10.2	**END OF BOREHOLE**				

Elevation Scale (m): 299, 298, 297, 296, 295, 294, 293, 292, 291, 290

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

2 91 7 0

0 52 45 3

Unstabilized water level measured at 9.8 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed. 3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	dry	n/a
Feb 20, 2018	dry	n/a
Feb 22, 2018	dry	n/a

file: 3170047 bh.gpj

LOG OF BH 123

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 30, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
	309.3	**GROUND SURFACE**				
0		200mm **TOPSOIL**		1	AS	
		FILL, sand, trace to some silt, trace organics, loose, brown, moist				
1	308.1			2	SS	7
	1.2	**SAND**, trace to some silt, trace to some gravel, dense to very dense, brown, moist to wet		3	SS	40
2				4	SS	50 / 125mm
3				5	SS	50 / 150mm
4						
5				6	SS	32
6	303.2					
	6.1	**SILTY CLAY**, some sand, trace gravel, stiff, greyish brown, moist to wet		7	SS	8
7	301.7					
	7.6	**SAND**, trace to some silt, very dense, brown, wet		8	SS	82
8						
9	300.2					
	9.1	**SILTY SAND**, trace gravel, trace clay, very dense, brown, moist (GLACIAL TILL)		9	SS	50 / 150mm
10	298.6					
	10.7	**SAND**, some silt, trace gravel, very dense, brown, moist		10	SS	50 / 125mm
11						
12	297.1					
	12.2	**SILT AND SAND**, some clay, trace gravel, very dense, brown, wet to moist (GLACIAL TILL)		11	SS	50 / 125mm
13	295.4					
	13.9			12	SS	50 / 125mm

END OF BOREHOLE

Unstabilized water level measured at 9.8 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed. 3.0m screen installed.

Penetration Test Values (Blows / 0.3m) — Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane (40, 80, 120, 160)

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) (10, 20, 30)

Lab Data and Comments — GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

4 19 34 43

4 40 44 12

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	13.5	295.8
Feb 20, 2018	13.4	295.9
Feb 22, 2018	13.4	295.9

file: 3170047 bh.gpj

LOG OF BH 124

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 31, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *851 Essa Road* — Elevation Datum : Geodetic

Rig type : CME 55, track-mounted — Drilling Method : Hollow stem augers

Depth (m)	Elev (m)	Description	Graphic Log	Sample No.	Type	SPT 'N' Value
0	308.4	**GROUND SURFACE**				
	307.9	460mm **TOPSOIL**		1	AS	
	0.5	**FILL**, sand, trace silt, trace organics, loose, brown, moist		2	SS	7
1	307.2					
	1.2	**SAND**, trace silt, loose to very dense, brown, moist to wet		3	SS	6
2				4	SS	10
3				5	SS	53
4		...at 4.2 m, wet seam at 4.2m.				
5				6	SS	24
	302.4					
6	6.0	**SILT AND SAND**, some clay, trace gravel, cobbles and boulder inclusions, very dense, brown, moist (GLACIAL TILL)		7	SS	50 / 50mm
7						
8				8	SS	50 / 150mm
9				9	SS	50 / 125mm
10				10	SS	50 / 125mm
11				11	SS	50 / 100mm
12						
	294.7					
	294.5	**SAND**, trace to some silt, very dense, brown, moist		12	SS	50 / 125mm
	13.9	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m): Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane (40, 80, 120, 160)

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) (10, 20, 30)

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

0 94 6 0

8 60 22 10

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed. 3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	dry	n/a
Feb 20, 2018	dry	n/a
Feb 22, 2018	dry	n/a

file: 3170047 bh.gpj

LOG OF BH 125

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : February 6, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *851 Essa Road* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	302.5	**GROUND SURFACE**				
		FILL, silty sand, trace organics, trace clay, trace gravel, loose, brown, moist		1	AS	
				2	SS	8
1	301.3					
	1.2	**SAND AND SILT**, some clay, trace gravel, dense, brown, moist (GLACIAL TILL)		3	SS	38
				4	SS	33
2	299.5					
3	3.0	**CLAYEY SANDY SILT**, some clay, trace to some sand, trace gravel, dense to very dense, brown, moist (GLACIAL TILL)		5	SS	36
				6	SS	40
4						
5				7	SS	37
6						
7				8	SS	69
8						
9				9	SS	56
10						
				10	SS	61
11						
				11	SS	64
12						
13						
				12	SS	50 / 150mm
14	288.5					
	14.0	**END OF BOREHOLE**				

Elevation Scale (m): 302, 301, 300, 299, 298, 297, 296, 295, 294, 293, 292, 291, 290, 289

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

8 42 36 14

6 32 35 27

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	12.2	290.3
Feb 20, 2018	12.2	290.3
Feb 22, 2018	11.9	290.6

file: 3170047 bh.gpj

LOG OF BH 126

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : February 6, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *851 Essa Road* — Elevation Datum : Geodetic

Rig type : CME 55, track-mounted — Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	309.1	**GROUND SURFACE**				
	308.9 / 0.2	200mm **TOPSOIL**				
		SAND, trace silt, trace gravel, trace organic to 0.6m, loose and compact, brown, moist		1	AS	
1				2	SS	5
2				3	SS	13
				4	SS	14
3				5	SS	7
4	304.5 / 4.6					
		SILTY SAND, some gravel, trace silt, cobble and boulder inclusions, loose to very dense, brown, moist (GLACIAL TILL)		6	SS	9
5						
6				7	SS	50 / 150mm
7	302.1 / 7.0					

Elevation Scale (m): 309, 308, 307, 306, 305, 304, 303

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

	GR	SA	SI	CL
Sample 2	1	97	2	0
Sample 7	19	43	28	10

END OF BOREHOLE
Auger refusal on inferred bedrock and/or boulders

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	dry	n/a
Feb 20, 2018	dry	n/a
Feb 22, 2018	dry	n/a

file: 3170047 bh.gpj

LOG OF BH 127

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : February 7, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *851 Essa Road* — Elevation Datum : Geodetic

Rig type : CME 55, track-mounted — Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	**312.0**	**GROUND SURFACE**				
	311.8	200mm **TOPSOIL**				
	0.2 / 311.4	**FILL**, silty sand, some organics, trace gravel, brown, moist		1	AS	
	0.6	**SILTY SAND**, trace gravel, compact to dense, brown, moist to wet		2	SS	14
1				3	SS	37
2				4	SS	31
3				5	SS	45
4				6	SS	32
5				7	SS	20
6	305.3					
	6.7	**SILTY SAND**, some clay, stratified, compact, brown, wet		8	SS	11
7	303.9					
8	8.1	**END OF BOREHOLE**				

Elevation Scale (m): 311, 310, 309, 308, 307, 306, 305, 304

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

	GR	SA	SI	CL
1	2	69	29	0
8	0	56	26	18

Unstabilized water level measured at 6.7 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	7.2	304.8
Feb 20, 2018	7.0	305.0
Feb 22, 2018	7.3	304.7

file: 3170047 bh.gpj

LOG OF BH 128

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : February 5, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *851 Essa Road* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	**304.8**	**GROUND SURFACE**				
		FILL, silty sand, some organics, brown, moist		1	AS	
	304.2 / 0.6	**SILTY SAND**, trace to some gravel, trace to some clay, compact to dense, brown, moist to wet (GLACIAL TILL)		2	SS	11
				3	SS	24
				4	SS	20
				5	SS	37
	300.5 / 4.3	**SAND**, some gravel, trace silt, trace clay, dense, brown, wet		6	SS	44
	299.8 / 5.0	**SILTY GRAVELLY SAND**, some clay, dense to very dense, brown to grey, moist (GLACIAL TILL)		7	SS	40
	296.7 / 8.1	**END OF BOREHOLE**		8	SS	54

Elevation Scale (m): 304, 303, 302, 301, 300, 299, 298, 297

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm): 51

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR SA SI CL

17 72 8 3

21 38 26 15

Unstabilized water level measured at 0.6 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	0.9	303.9
Feb 20, 2018	0.2	304.6
Feb 22, 2018	0.3	304.5

file: 3170047 bh.gpj

LOG OF BH 129

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 24, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	**290.6**	**GROUND SURFACE**				
	290.4	250mm **TOPSOIL**				
	0.2	**FILL**, silty sand and sandy silt, trace gravel, trace clay, trace organics to 0.6m, loose to compact, brown, moist to wet		1	AS	
1				2	SS	11
2				3	SS	13
				4	SS	9
3				5	SS	12
	287.1					
	3.5	**SILTY SAND**, trace gravel, trace clay, very dense, brown, wet to moist (GLACIAL TILL)				
4				6	SS	85
5						
6				7	SS	50 / 150mm
7						
8	282.5			8	SS	57
	8.1					

Elevation Scale (m): 290, 289, 288, 287, 286, 285, 284, 283

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) 10, Natural Water Content (MC) 20, Liquid Limit (LL) 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

Borehole was dry upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	5.5	285.1
Feb 20, 2018	5.4	285.2
Feb 22, 2018	5.4	285.2

file: 3170047 bh.gpj

LOG OF BH 130

Terraprobe

Project No. : 3-17-0047-03	Client : PRATT DEVELOPMENT INC.	Originated by : BH
Date started : January 26, 2018	Project : BEAR CREEK RIDGE	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie	Checked by : SO

Position : *Dipoce Property* Elevation Datum : Geodetic

Rig type : CME 55, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev / Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	292.6	**GROUND SURFACE**				
	292.1	460mm **TOPSOIL**		1	AS	
	0.5	**FILL**, sandy silt, trace organics, very loose, brown, moist to wet		2	SS	4
1	291.4					
	1.2	**SILTY SAND**, trace clay, trace gravel, cobble and boulder inclusions, compact to very dense, brown, moist (GLACIAL TILL)		3	SS	19
2				4	SS	19
3				5	SS	50 / 125mm
4				6	SS	50 / 125mm
5						
6				7	SS	50 / 125mm
7	285.0					
	284.8	**SAND**, some silt, trace gravel, very dense, brown, moist		8	SS	50 / 50mm
	7.8	**END OF BOREHOLE**				

Elevation Scale (m): 292, 291, 290, 289, 288, 287, 286, 285

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

GR	SA	SI	CL
6	57	27	10

Unstabilized water level measured at 7.6 m below ground surface upon completion of drilling.

50 mm dia. monitoring well installed.
3.0m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Feb 15, 2018	dry	n/a
Feb 20, 2018	dry	n/a
Feb 22, 2018	dry	n/a

file: 3170047 bh.gpj

LOG OF BH 201

Terraprobe

Project No. : 3-17-0047-07	Client : Pratt Development Inc.	Originated by : BH
Date started : September 27, 2018	Project : DiPoce Suplementary Geotechnical Investigation	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : BG

Position : E: 601006, N: 4907722 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : D50, track-mounted Drilling Method : Hollow stem augers

Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
297.1 0	**GROUND SURFACE**				
296.8 0.3	300mm **TOPSOIL**		1	SS	5
	SILTY SAND, trace to some gravel, trace to some clay, loose to compact, brown to grey, moist to wet		2	SS	2
			3	SS	11
			4	SS	12
			5	SS	12
			6	SS	13
	...grey below 5.5m		7	SS	11
			8	SS	24
	...wet sand seam, trace silt, some gravel, below 6.7m		9A	SS	
			9B	SS	9
			10	SS	12
			11	SS	11
287.1 10.0	**FINE SAND**, some silt, trace to some clay, dense, grey, wet		12	SS	41
285.6 11.5	**SILT**, trace sand, some clay, dense, grey, wet		13	SS	37
284.5 12.6	**END OF BOREHOLE**				

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) 10 20 30

Lab Data and Comments: GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

10 48 29 13

14 65 16 5

0 3 80 17

Unstabilized water level measured at 1.8 m below ground surface upon completion of drilling.

32 mm dia. piezometer installed.
3 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 10, 2018	3.6	293.5

file: 3170047-7, bh logs.gpj

LOG OF BH 202

Terraprobe

Project No. : 3-17-0047-07	Client : Pratt Development Inc.	Originated by : BH
Date started : September 27, 2018	Project : DiPoce Suplementary Geotechnical Investigation	Compiled by : BH
Sheet No. : 1 of 1	Location : Barrie, Ontario	Checked by : BG

Position : E: 601062, N: 4907727 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : D50, track-mounted Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
0	296.5	**GROUND SURFACE**				
		SILTY SAND, trace to some gravel, trace to some clay, sand seams, loose to compact, brown to grey, moist to wet		1	SS	6
1				2	SS	8
2				3	SS	8
3				4	SS	10
4				5	SS	18
5				6	SS	10
6		...grey below 6m		7	SS	14
				8	SS	11
7				9	SS	10
8				10	SS	12
9	287.2			11A	SS	
	9.3	**FINE SAND**, some silt, trace to some clay, very dense, grey, wet		11B	SS	61
10	286.0					
	10.5	**SILT**, trace sand, trace to some clay, dense, grey, wet		12	SS	46
11	285.4					
	11.1	**END OF BOREHOLE**				

Elevation Scale (m): 296, 295, 294, 293, 292, 291, 290, 289, 288, 287, 286

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

	GR	SA	SI	CL
5	5	50	33	12
9	0	64	25	11

Unstabilized water level measured at 5.8 m below ground surface upon completion of drilling.

32 mm dia. piezometer installed.
1.5 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 10, 2018	2.0	294.5

file: 3170047-7, bh logs.gpj

LOG OF BH 203

Terraprobe

Project No.	: 3-17-0047-07	Client	: Pratt Development Inc.	Originated by	: BH
Date started	: September 28, 2018	Project	: DiPoce Suplementary Geotechnical Investigation	Compiled by	: BH
Sheet No.	: 1 of 1	Location	: Barrie, Ontario	Checked by	: BG

Position : E: 601152, N: 4907751 (UTM 17T) Elevation Datum : Geodetic (NAD83)

Rig type : D50, track-mounted Drilling Method : Hollow stem augers

Depth (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	296.4	**GROUND SURFACE**				
	296.2	250mm **TOPSOIL**		1	SS/AS	5
	0.2	**SILT**, some clay, trace to some sand, firm to stiff, brown, moist		2	SS	6
2				3	SS	12
	294.3					
	2.1	**SILTY SAND**, trace to some gravel, trace to some clay, compact to very dense, brown, moist		4	SS	16
3				5	SS	19
4						
5				6	SS	50 / 150mm
				7	SS	54
6						
				8	SS	45
7				9	SS	55
8				10	SS	41
	287.9					
	8.5	**FINE SAND**, some silt, trace to some clay, trace gravel, very dense, brown, wet		11	SS	58
9	286.9					
	9.5	**SILT**, some sand, trace to some clay, trace gravel, very dense, brown, moist to wet				
10						
	285.4			12	SS	50 / 150mm
	11.0					

Elevation Scale (m): 296, 295, 294, 293, 292, 291, 290, 289, 288, 287, 286

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)

	GR	SA	SI	CL
294	8	48	30	14
289	15	54	21	10
287	2	71	19	8

END OF BOREHOLE

Unstabilized water level measured at 10.1 m below ground surface upon completion of drilling.

32 mm dia. piezometer installed.
3 m screen installed.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Oct 10, 2018	8.0	288.4

file: 3170047-7, bh logs.gpj

Terraprobe

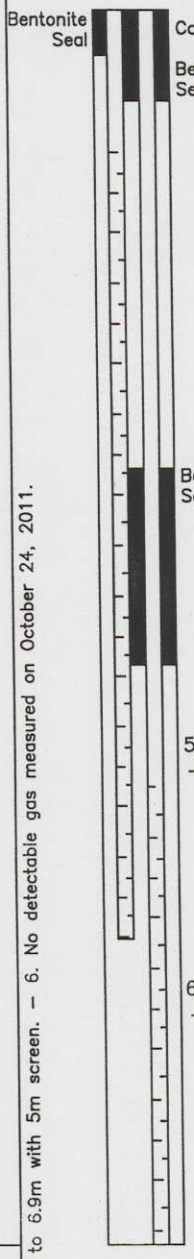
LOG OF BOREHOLE ..MW3..

PROJECT NAME: Annex Lands, Barrie
PROJECT No.: 33-11-7130
CLIENT: Pratt Development
BORING DATE: October 19, 2011
LOCATION: Barrie, Ontario
ELEVATION DATUM:

BORING METHOD: D-50T Crawler-mounted Drill Rig / Hollow Stem Augers

DEPTH SCALE IN METRES	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	"N" VALUE	PENETRATION RESISTANCE PLOT (20 40 60 80) / SHEAR STRENGTH kPa (nat.V – +, rem.V – ⊕, Q – ●, U – ○) (20 40 60 80)	WATER CONTENT (%) (10 20 30)
0	GROUND SURFACE							
	150mm – Topsoil		0.0					
	Orange to Brown; Compact to Dense; Moist to Wet			1	AS			
1	SAND, fine to medium, trace to some gravel, trace to some silt			2	SS	5	x	
				3	SS	12	x	
2				4	SS	55	x	
3				5	SS	50/150mm		
4								
5				6	SS	61	x	
6								
	Grey; Compact; Wet		6.4	7	SS	25	x	
7	SAND & SILT							
	Brown; Very Dense; Wet		7.1					
	SAND, fine, some silt			8	SS	50/150mm		
8	End of Borehole		8.1					
9								

INSTALLATION INFORMATION



5. gas probe well depth to 6.9m with 5m screen. – 6. No detectable gas measured on October 24, 2011.

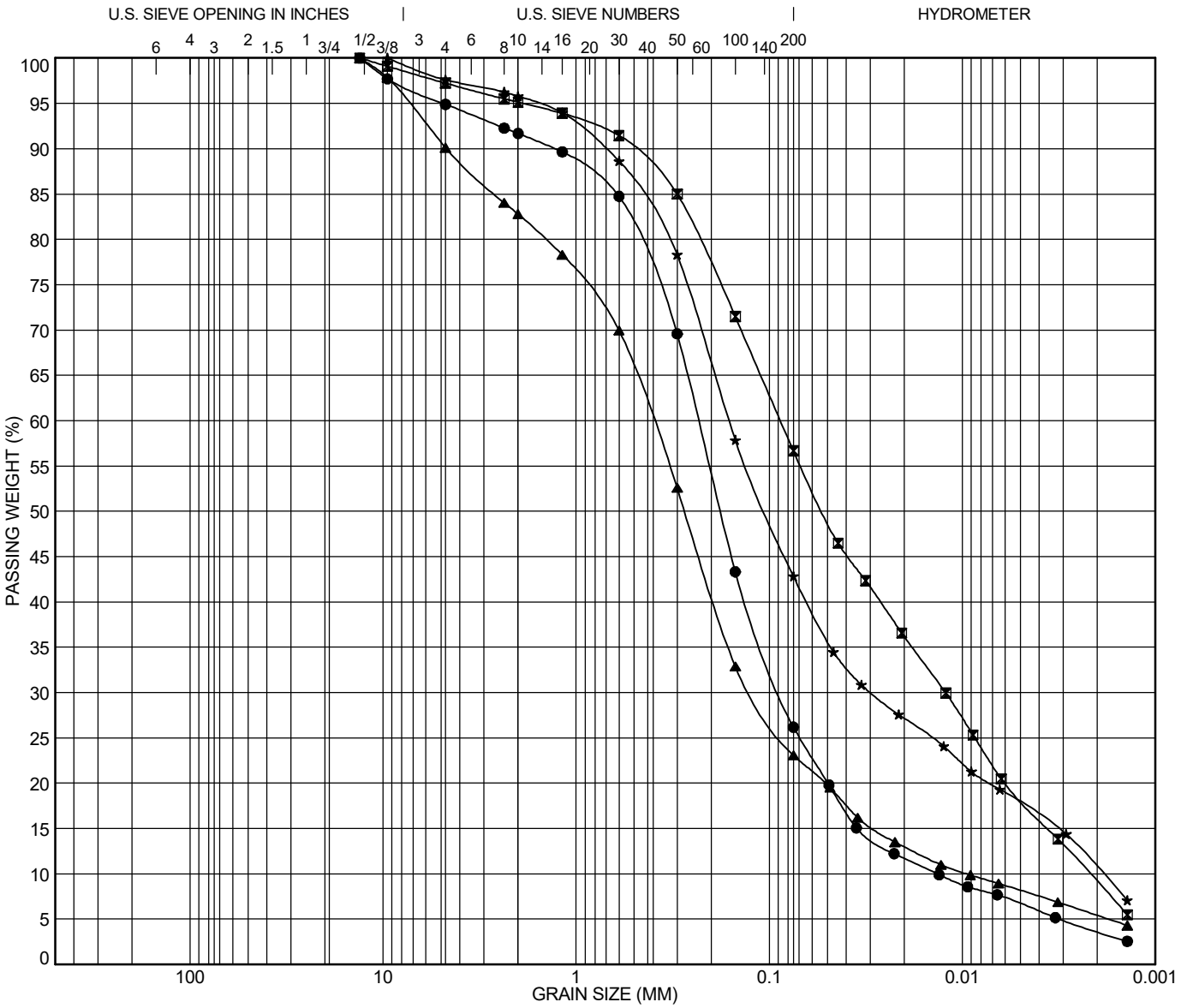
1. Borehole caved at 5.5m during drilling. – 2. Water level noted at 5.0m upon completion of drilling.
3. Schedule 40, 50mm diameter monitoring well installed with 3m screen tip at 8.1m. – 4. Water level measured on October 24, 2011 at 6.6m.

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix C

Hydraulic Conductivity Data



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BH02	SS5	3.05					2.43	17.20
⊠	BH03	SS2	0.61					0.78	40.03
▲	BH04	SS3	1.22					3.91	42.36
★	BH06	SS3	1.22					2.93	86.12

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH02	SS5	3.05	13.2	0.233	0.088	0.014	5.1	68.7	22.5	3.6
⊠	BH03	SS2	0.61	13.2	0.088	0.012	0.002	2.8	40.6	47.6	9.1
▲	BH04	SS3	1.22	13.2	0.403	0.122	0.01	9.9	67.0	17.7	5.4
★	BH06	SS3	1.22	9.5	0.161	0.03	0.002	2.4	54.8	32.2	10.7

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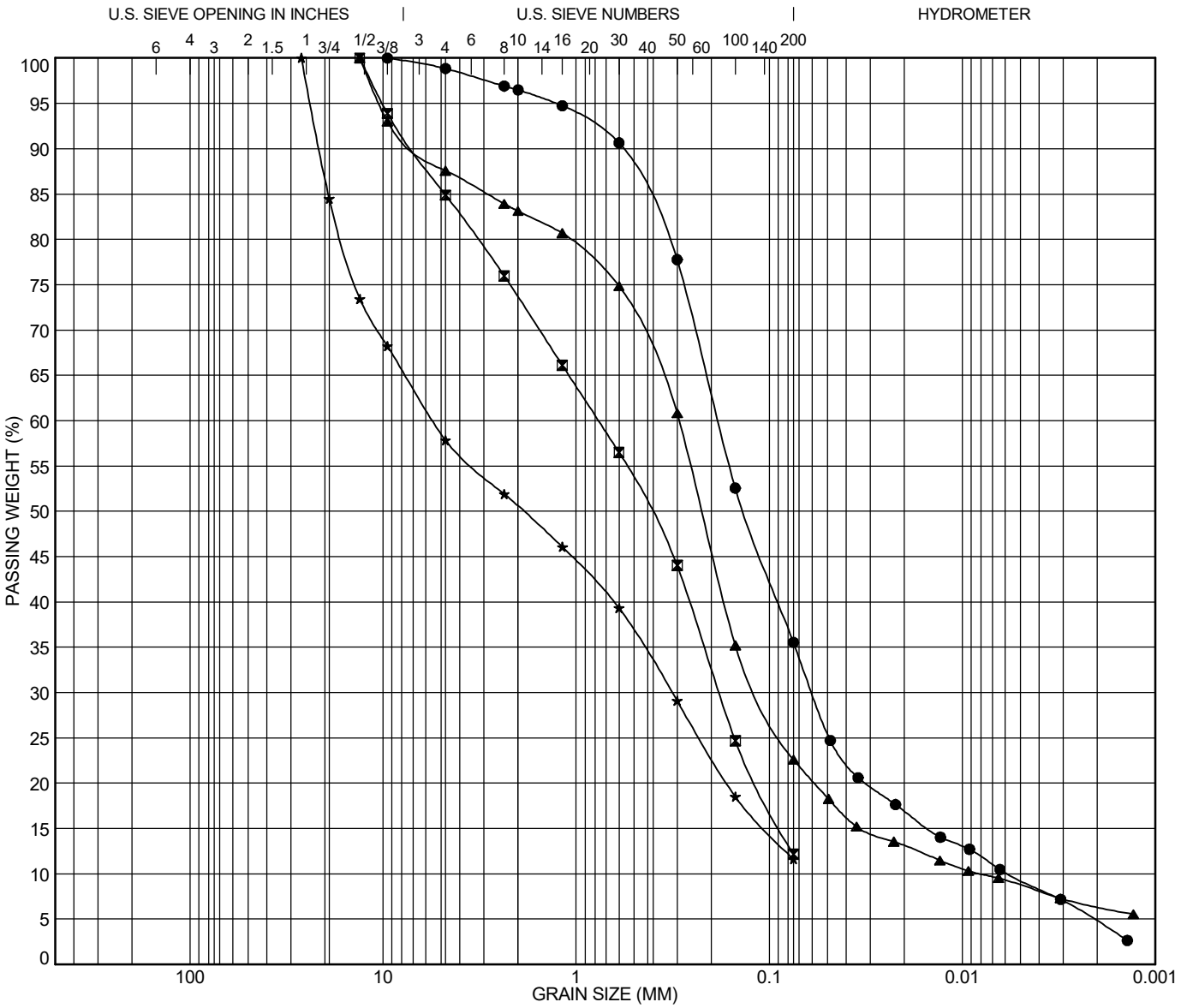
GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE | SAMPLED ON: 2018-04-26

FIGURE NO.: 1 | TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BH07	SS4	2.29					3.38	31.91
⊠	BH07	SS8	7.62					0.64	11.54
▲	BH08	SS5	3.05					5.33	36.13
★	BH09	SS5B	3.20					0.29	86.23

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH07	SS4	2.29	9.5	0.184	0.06	0.006	1.2	63.3	30.9	4.7
⊠	BH07	SS8	7.62	13.2	0.768	0.181		15.1	72.7	12.2	
▲	BH08	SS5	3.05	13.2	0.293	0.113	0.008	12.4	65.0	16.2	6.4
★	BH09	SS5B	3.20	26.5	5.487	0.319		42.2	46.2	11.6	

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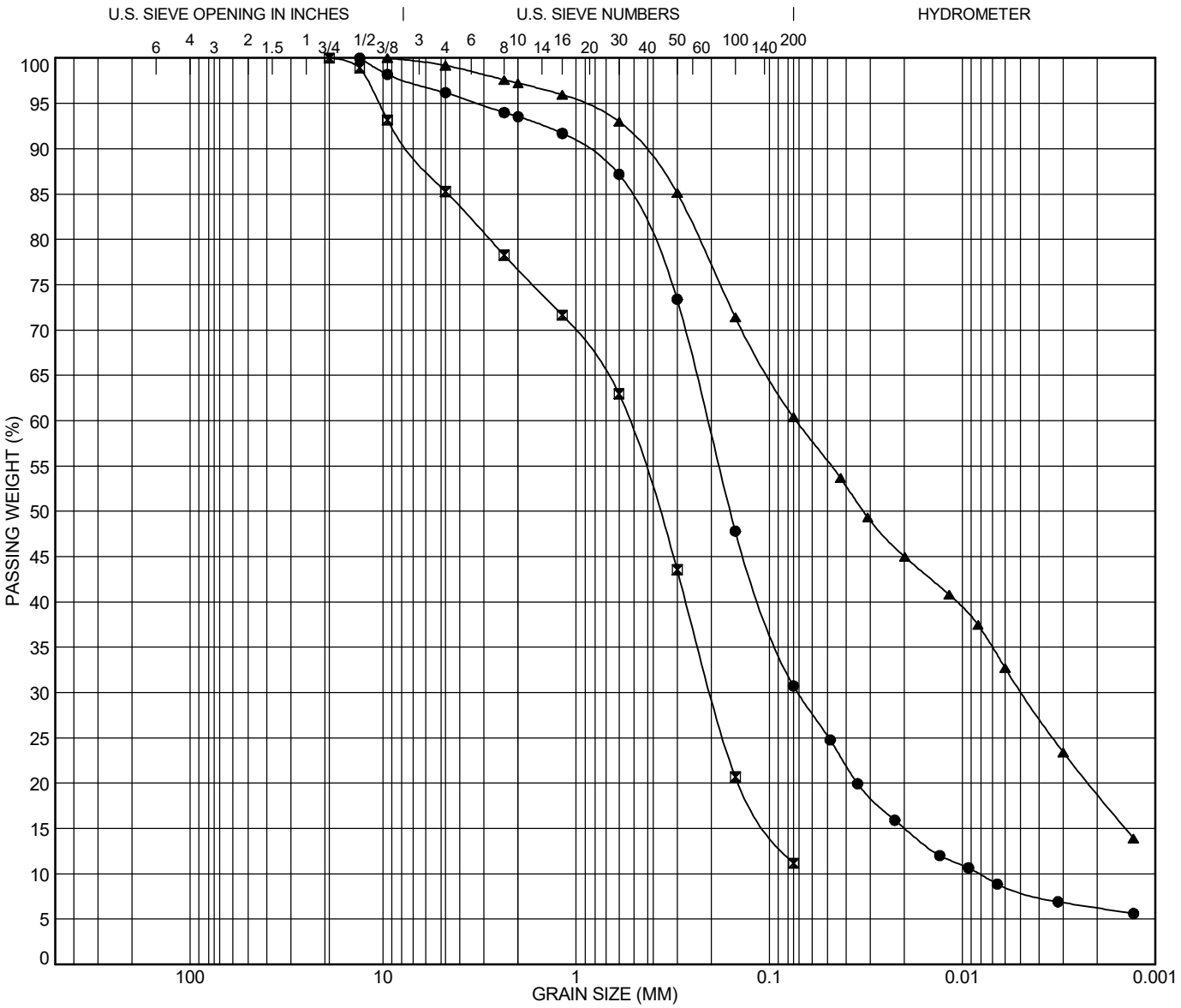
GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE | SAMPLED ON: 2018-04-23

FIGURE NO.: 2 | TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BH11	SS3	1.22					2.94	25.41
⊠	BH12	SS3	1.22					1.06	7.84
▲	BH13	SS2	0.61						

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH11	SS3	1.22	13.2	0.209	0.071	0.008	3.8	65.4	24.5	6.2
⊠	BH12	SS3	1.22	19	0.54	0.199		14.7	74.1	11.2	
▲	BH13	SS2	0.61	9.5	0.073	0.005		0.8	38.8	41.6	18.8

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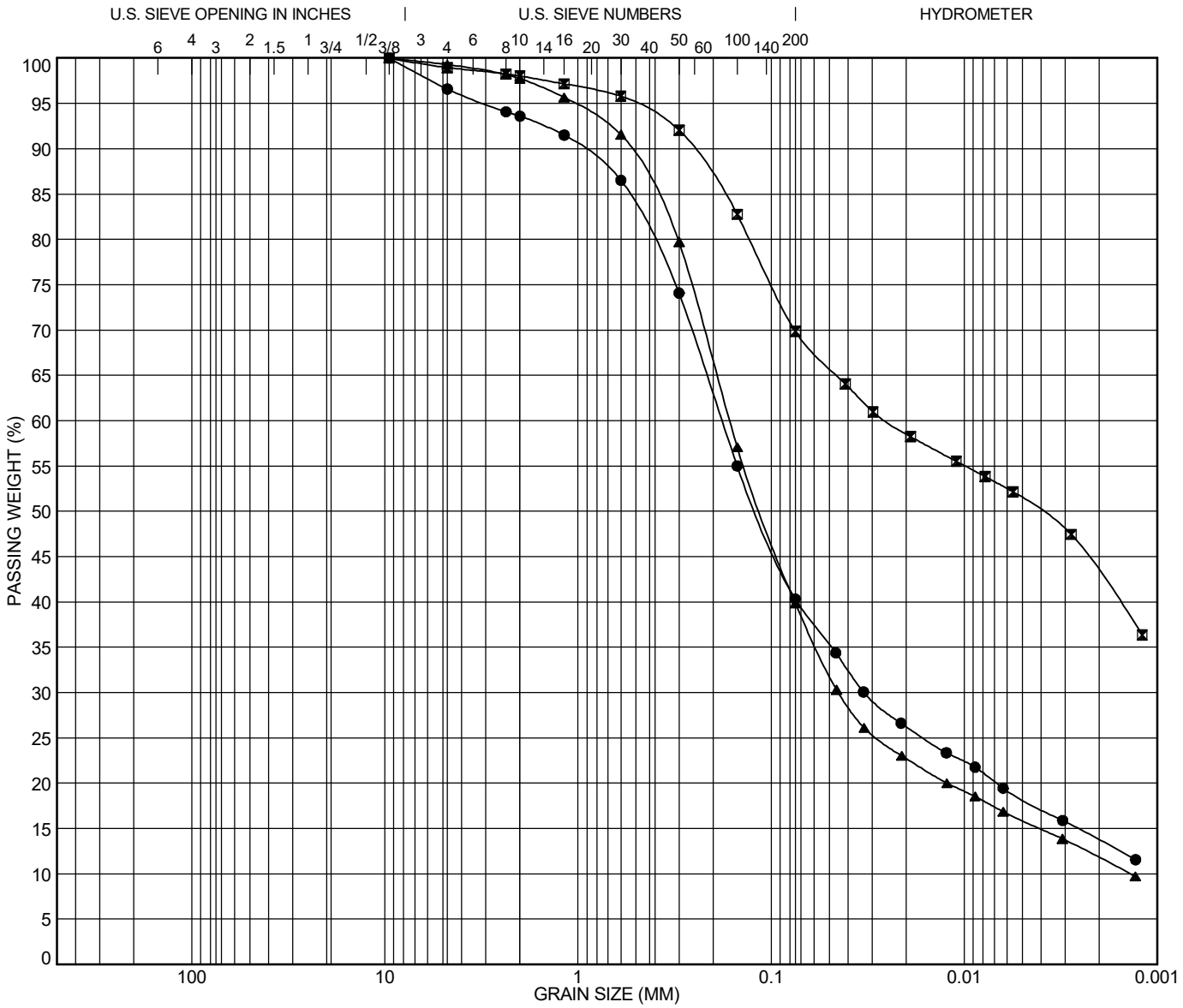
GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE | SAMPLED ON: 2018-04-24

FIGURE NO.: 3 | TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

	Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	BH15	SS4	2.29						
⊠	BH17	SS2	0.76						
▲	BH20	SS4	2.29					8.85	118.54

	Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH15	SS4	2.29	9.5	0.18	0.033		3.4	56.3	26.6	13.7
⊠	BH17	SS2	0.76	9.5	0.025			1.0	29.1	26.8	43.0
▲	BH20	SS4	2.29	9.5	0.164	0.045	0.001	0.7	59.4	28.1	11.8

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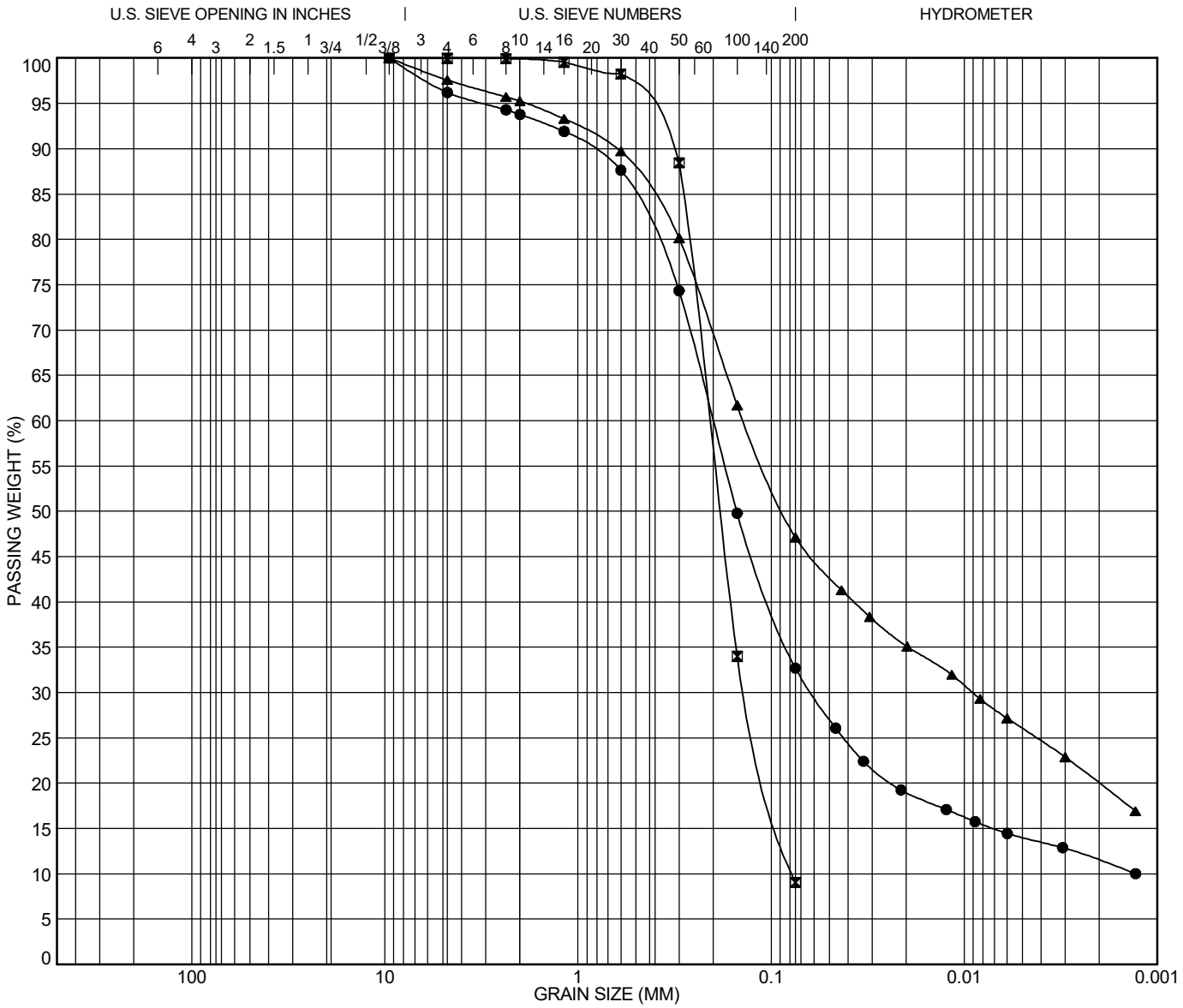
GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE | SAMPLED ON: 2018-04-24

FIGURE NO.: 4 | TESTED ON: 2018-05-15



COBBLES	GRAVEL		SAND			SILT	CLAY
	coarse	fine	coarse	medium	fine		

Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	**BH23**	**SS6**	**4.57**					
⊠	**BH25**	**SS3**	**1.22**				**1.12**	**2.71**
▲	**BH26**	**SS6B**	**4.70**					

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH23**	**SS6**	**4.57**	**9.5**	**0.2**	**0.062**		**3.8**	**63.5**	**21.3**	**11.4**
⊠	**BH25**	**SS3**	**1.22**	**9.5**	**0.209**	**0.134**	**0.077**	**0.0**	**90.9**	**9.0**	
▲	**BH26**	**SS6B**	**4.70**	**9.5**	**0.138**	**0.009**		**2.4**	**50.5**	**27.2**	**20.0**

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Tel: 905-237-8336 Fax: 905-248-3699
office@geoproconsulting.ca www.geoproconsulting.ca

GRAIN SIZE DISTRIBUTION

PROJECT: Proposed Phase One Environmental Site Assessment (ESA) and Geotechnical Investigation

LOCATION: County Road 27, Barrie

PROJECT NO.: 17-2099GE | SAMPLED ON: 2018-04-30

FIGURE NO.: 5 | TESTED ON: 2018-05-15

Terraprobe

WASH SIEVE ANALYSIS TEST REPORT

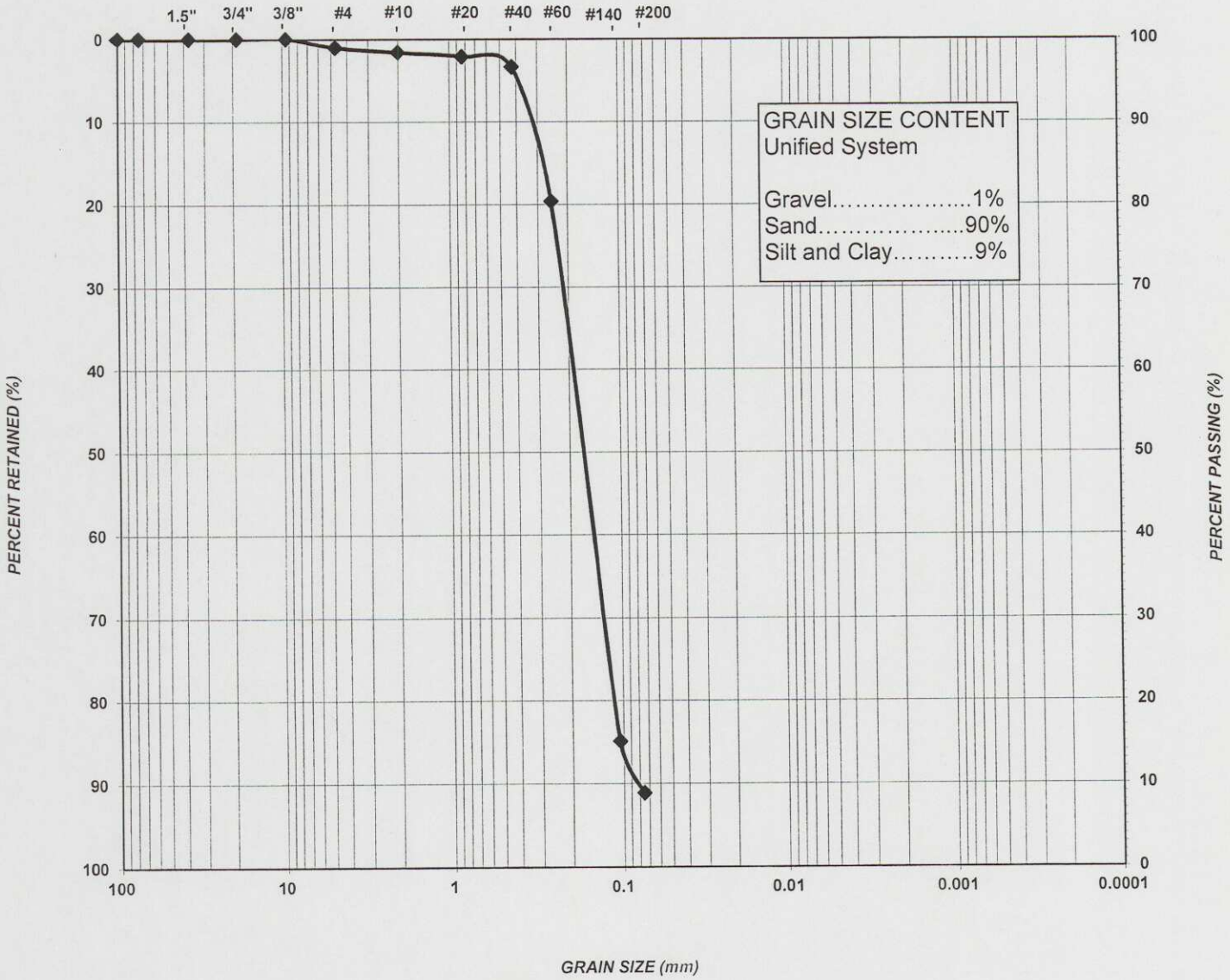
PROJECT: **Annex Lands**
LOCATION: **Barrie, ON**
CLIENT: **Pratt Development**

FILE NO.: **33-11-7130**
LAB NO.: **1126a**
SAMPLE DATE: **Oct-19-11**
SAMPLED BY: **B.H.**

TEST HOLE NUMBER: **2**
SAMPLE DEPTH: **25 to 26.5'**
SAMPLE NUMBER: **8**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Sand, trace silt, trace gravel**

GRAIN SIZE DISTRIBUTION

U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY
			SAND				
UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY	
	GRAVEL		SAND				

Terraprobe

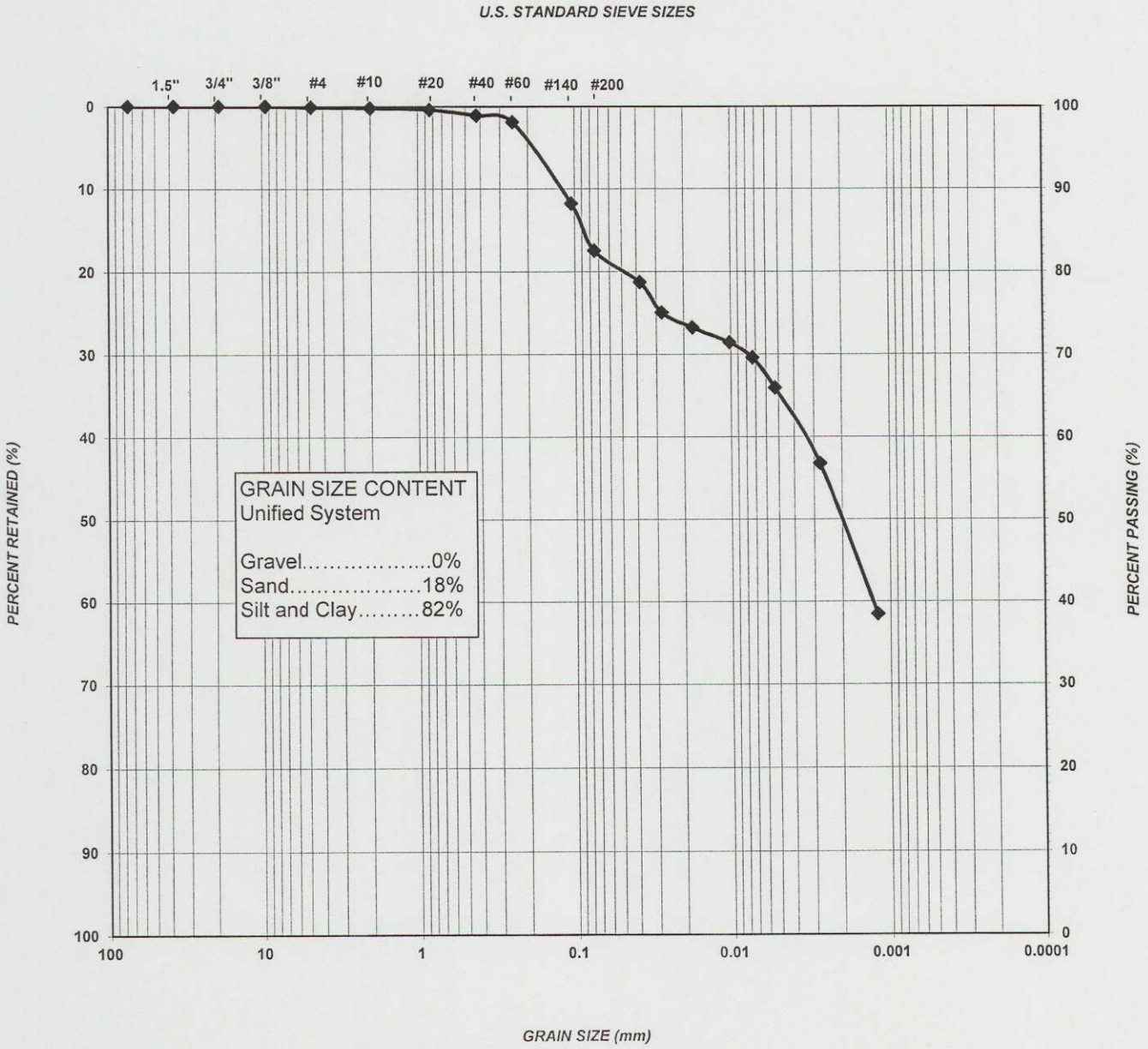
SIEVE AND HYDROMETER ANALYSIS TEST REPORT

PROJECT: **Annex Lands**
LOCATION: **Barrie, ON**
CLIENT: **Pratt Development**

FILE NO.: **33-11-7130**
LAB NO.: **1126b**
SAMPLE DATE: **Oct-19-11**
SAMPLED BY: **B.H.**

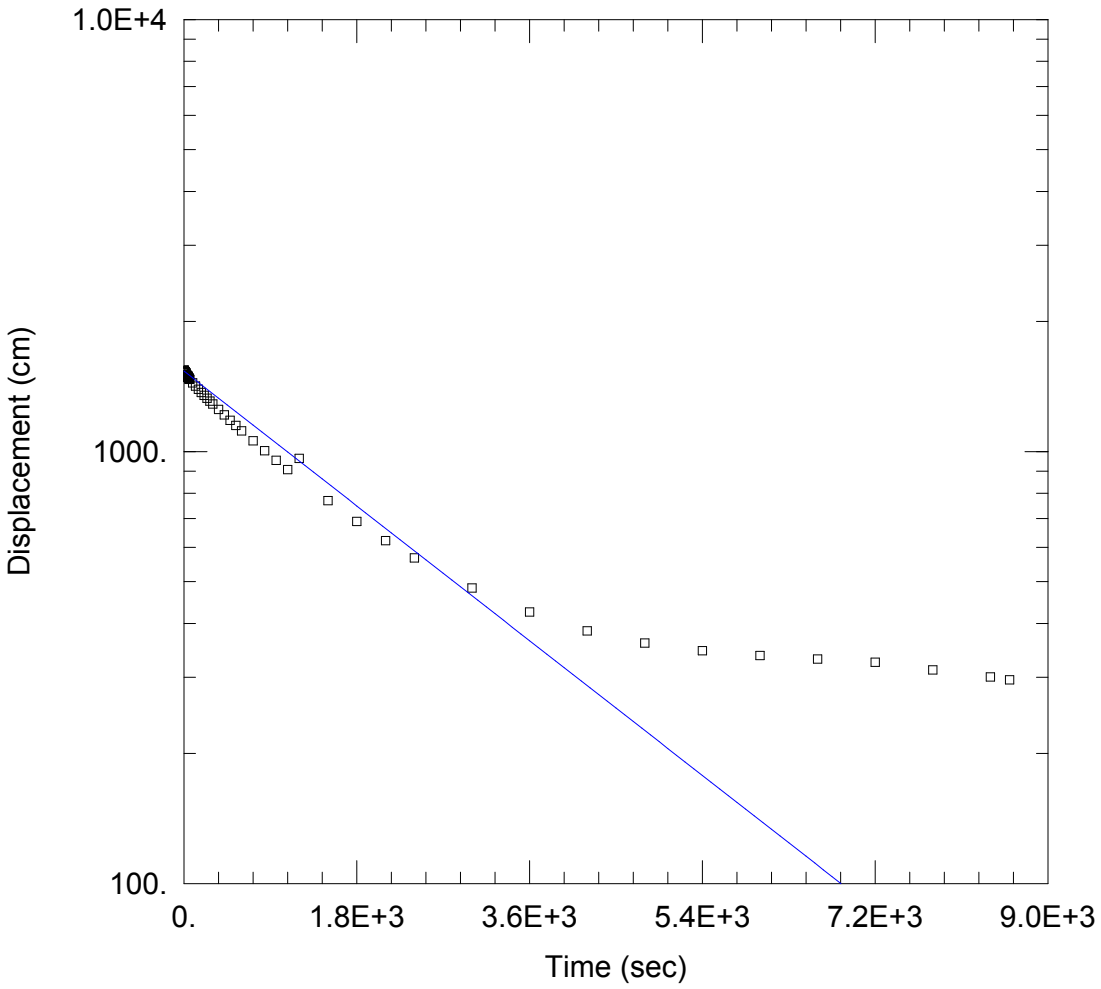
BOREHOLE NUMBER: **4**
SAMPLE NUMBER: **6**
SAMPLE DEPTH: **15 to 16.5'**
SAMPLE LOCATION: **as above**
SAMPLE DESCRIPTION: **Silt and clay, some sand**

GRAIN SIZE DISTRIBUTION



MIT SYSTEM	GRAVEL	COARSE	MEDIUM	FINE	SILT	CLAY
		SAND				

UNIFIED SYSTEM	COARSE	FINE	COARSE	MEDIUM	FINE	SILT AND CLAY
	GRAVEL		SAND			



HYDRAULIC CONDUCTIVITY TEST AT BH7 "SCREENED IN SAND AND SILTY TO SILTY SAND"

PROJECT INFORMATION

Company: R.J Burnside
Client: Di Poce
Project: 300041886
Location: Barrie
Test Well: BH7
Test Date: Sept 27, 2018

AQUIFER DATA

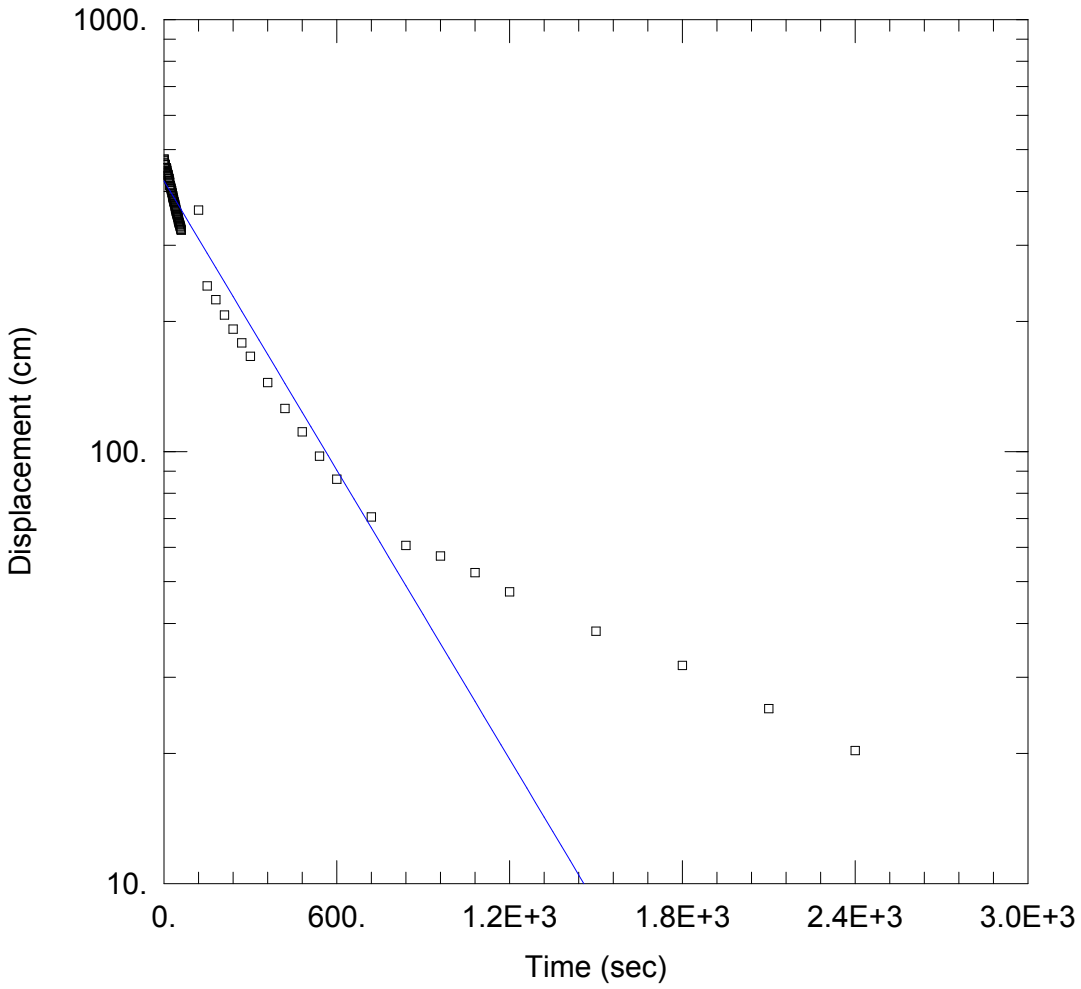
Saturated Thickness: 1. cm
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DP-BH7)

Initial Displacement: 1544.5 cm
Total Well Penetration Depth: 152. cm
Casing Radius: 2.54 cm
Static Water Column Height: 0. cm
Screen Length: 152. cm
Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined
K = 0.00682 cm/sec
Solution Method: Hvorslev
y0 = 1534.6 cm



HYDRAULIC CONDUCTIVITY TEST AT BH23 "SCREENED IN SAND AND SILT TO SILTY SAND"

PROJECT INFORMATION

Company: R.J Burnside
Client: Di Poce
Project: 300041886
Location: Barrie
Test Well: BH23
Test Date: Sept 27, 2018

AQUIFER DATA

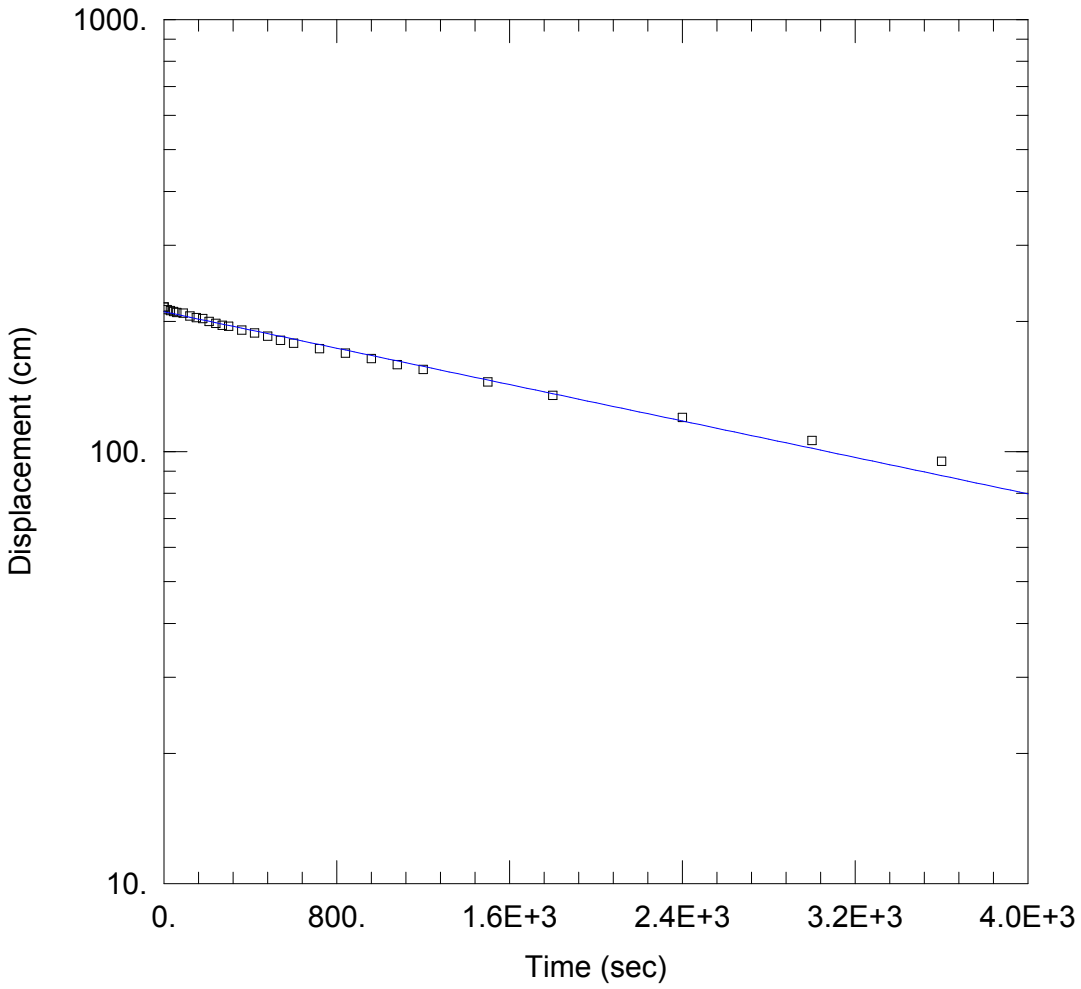
Saturated Thickness: 1. cm
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (BH23)

Initial Displacement: 475.1 cm
Total Well Penetration Depth: 152. cm
Casing Radius: 2.54 cm
Static Water Column Height: 0. cm
Screen Length: 152. cm
Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 0.0439 cm/sec
y0 = 422.9 cm



HYDRAULIC CONDUCTIVITY TEST AT BH120 "SCREENED IN SILTY SAND"

PROJECT INFORMATION

Company: R.J Burnside
Client: Di Poce
Project: 300041886
Location: Barrie
Test Well: BH120
Test Date: Sept 27, 2018

AQUIFER DATA

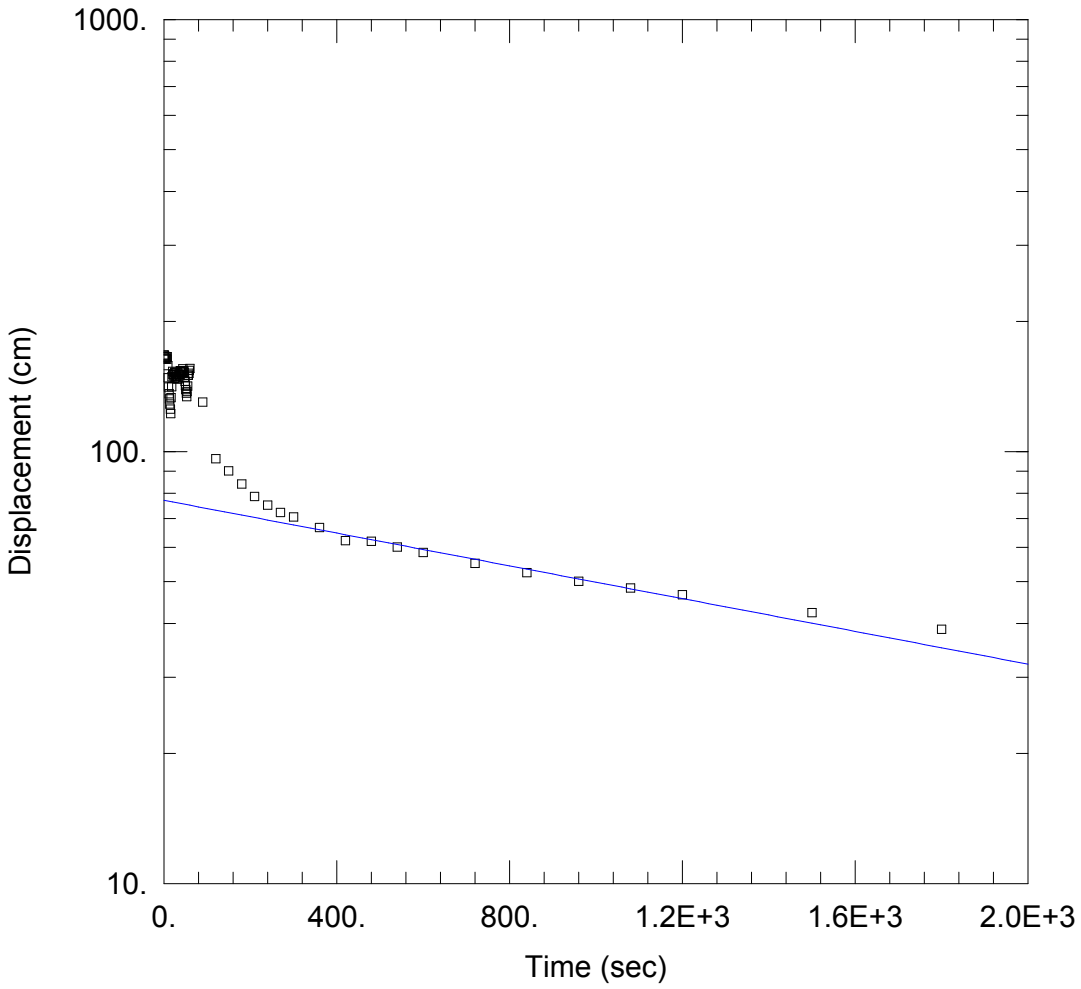
Saturated Thickness: 480. cm
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DP-BH120)

Initial Displacement: 216. cm
Total Well Penetration Depth: 628. cm
Casing Radius: 2.57 cm
Static Water Column Height: 480. cm
Screen Length: 300. cm
Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 1.166E-5 cm/sec
y0 = 210.6 cm



HYDRAULIC CONDUCTIVITY TEST AT BH129 "SCREENED IN SILTY SAND"

PROJECT INFORMATION

Company: R.J Burnside
Client: Di Poce
Project: 300041886
Location: Barrie
Test Well: BH129
Test Date: Sept 27, 2018

AQUIFER DATA

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

WELL DATA (BH129)

Initial Displacement: 167.3 cm
Total Well Penetration Depth: 300. cm
Casing Radius: 2.54 cm
Static Water Column Height: 0. cm
Screen Length: 300. cm
Well Radius: 7.62 cm

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev
K = 0.007461 cm/sec
y0 = 77.08 cm

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

Appendix D

Groundwater Level Data

Table D-1
Groundwater Elevations

Well Name	Well Depth (mbgs)	Ground Surface Elevation (masl)*	17-May-2018		28-Jun-2018		27-Jul-2018		14-Aug-2018	
			Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)
BH01	**4.51**	**289.70**	3.32	286.38	3.86	285.84	4.33	285.37	4.33	285.37
BH7	**14.79**	**301.40**	14.42	286.98	14.26	287.14	14.47	286.93	14.63	286.77
BH14	**6.07**	**293.30**	5.98	287.32	6.01	287.29	6.02	287.28	6.03	287.27
BH18	**4.10**	**296.60**	1.26	295.34	1.96	294.64	2.51	294.09	2.56	294.04
BH21	**8.94**	**302.00**	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
BH23	**6.08**	**299.20**	2.35	296.85	3.83	295.37	4.42	294.78	4.60	294.60
BH120	**7.50**	**291.90**	0.78	291.12	1.59	290.31	2.46	289.44	2.58	289.32
BH122	**9.81**	**299.70**	9.39	290.31	9.62	290.08	9.71	289.99	9.73	289.98
BH123	**13.59**	**305.50**	13.50	292.00	13.51	291.99	13.51	291.99	13.51	291.99
MW3s	**6.04**	**305.50**	Dry	Dry	5.00	300.50	5.18	300.32	5.29	300.21
MW3d	**7.47**	**305.50**	4.73	300.77	5.02	300.48	5.19	300.31	5.30	300.20
DP-PZ1s	**1.24**	**297.50**	-0.03	297.53	0.23	297.27	0.54	296.96	0.29	297.21
DP-PZ1d	**1.85**	**297.50**	0.02	297.48	0.32	297.18	0.33	297.17	0.36	297.14

Notes

"-" denotes data unavailable

mbgs - meters below ground surface

masl - metres above sea level

*** Ground elevations from geotechnical reports (GeoPro 2018, Terraprobe 2018)**

Table D-1
Groundwater Elevations

Well Name	Well Depth (mbgs)	Ground Surface Elevation (masl)*	27-Sep-2018		24-Oct-2018		29-Nov-2018		17-Dec-2018	
			Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)
BH01	**4.51**	**289.70**	4.34	285.36	4.34	285.36	4.34	285.36	4.08	285.62
BH7	**14.79**	**301.40**	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
BH14	**6.07**	**293.30**	6.05	287.25	Dry	Dry	Dry	Dry	Dry	Dry
BH18	**4.10**	**296.60**	2.49	294.11	1.78	294.82	1.11	295.49	1.21	295.39
BH21	**8.94**	**302.00**	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
BH23	**6.08**	**299.20**	4.74	294.46	4.67	294.53	4.11	295.10	3.56	295.64
BH120	**7.50**	**291.90**	2.68	289.22	2.54	289.36	1.26	290.64	0.79	291.11
BH122	**9.81**	**299.70**	9.75	289.95	9.76	289.94	9.76	289.94	9.76	289.94
BH123	**13.59**	**305.50**	13.51	291.99	13.52	291.98	13.52	291.98	13.52	291.98
MW3s	**6.04**	**305.50**	5.47	300.03	Dry	Dry	5.59	299.91	5.39	300.11
MW3d	**7.47**	**305.50**	5.54	299.96	5.78	299.72	5.95	299.55	5.42	300.08
DP-PZ1s	**1.24**	**297.50**	0.25	297.25	0.03	297.47	-0.04	297.54	-0.01	297.51
DP-PZ1d	**1.85**	**297.50**	0.25	297.25	0.12	297.38	0.02	297.48	0.07	297.43

Notes

"-" denotes data unavailable

mbgs - meters below ground surface

masl - metres above sea level

*** Ground elevations from geotechnical reports (GeoPro 2018, Terraprobe 2018)**

Table D-1
Groundwater Elevations

Well Name	Well Depth (mbgs)	Ground Surface Elevation (masl)*	1-Feb-2019		1-Mar-2019		2-Apr-2019		25-Apr-2019	
			Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)
BH01	**4.51**	**289.70**	4.06	285.64	4.05	285.65	4.34	285.36	3.68	286.02
BH7	**14.79**	**301.40**	Dry	Dry	14.55	286.85	14.41	286.99	14.53	286.87
BH14	**6.07**	**293.30**	6.02	287.28	6.04	287.26	6.06	287.24	6.06	287.24
BH18	**4.10**	**296.60**	1.43	295.17	1.40	295.20	1.05	295.55	0.98	295.62
BH21	**8.94**	**302.00**	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
BH23	**6.08**	**299.20**	3.75	295.45	4.01	295.19	3.39	295.81	1.76	297.44
BH120	**7.50**	**291.90**	1.06	290.84	1.01	290.89	0.61	291.29	0.47	291.43
BH122	**9.81**	**299.70**	9.61	290.09	9.64	290.06	9.71	289.99	9.61	290.09
BH123	**13.59**	**305.50**	13.53	291.97	13.52	291.98	13.51	291.99	13.51	291.99
MW3s	**6.04**	**305.50**	-	-	-	-	-	-	5.12	300.38
MW3d	**7.47**	**305.50**	5.18	300.32	5.16	300.34	5.22	300.28	5.13	300.37
DP-PZ1s	**1.24**	**297.50**	Frozen	Frozen	Frozen	Frozen	0.02	297.48	-0.04	297.54
DP-PZ1d	**1.85**	**297.50**	Frozen	Frozen	0.10	297.40	0.09	297.41	-0.03	297.53

Notes

"-" denotes data unavailable

mbgs - meters below ground surface

masl - metres above sea level

*** Ground elevations from geotechnical reports (GeoPro 2018, Terraprobe 2018)**

Table D-1
Groundwater Elevations

Well Name	Well Depth (mbgs)	Ground Surface Elevation (masl)*	24-Jun-2019		26-Aug-2019	
			Water Level (mbgs)	Water Elevation (masl)	Water Level (mbgs)	Water Elevation (masl)
BH01	**4.51**	**289.70**	3.68	286.02	4.34	285.36
BH7	**14.79**	**301.40**	14.28	287.12	14.69	286.71
BH14	**6.07**	**293.30**	6.01	287.29	6.05	287.25
BH18	**4.10**	**296.60**	Removed	Removed	Removed	Removed
BH21	**8.94**	**302.00**	Removed	Removed	Removed	Removed
BH23	**6.08**	**299.20**	3.24	295.96	4.60	294.60
BH120	**7.50**	**291.90**	1.01	290.89	2.86	289.04
BH122	**9.81**	**299.70**	9.46	290.24	9.66	290.04
BH123	**13.59**	**305.50**	13.51	291.99	13.51	291.99
MW3s	**6.04**	**305.50**	4.82	300.68	5.22	300.28
MW3d	**7.47**	**305.50**	4.83	300.67	5.23	300.27
DP-PZ1s	**1.24**	**297.50**	-0.02	297.52	1.02	296.48
DP-PZ1d	**1.85**	**297.50**	-0.01	297.51	1.40	296.10

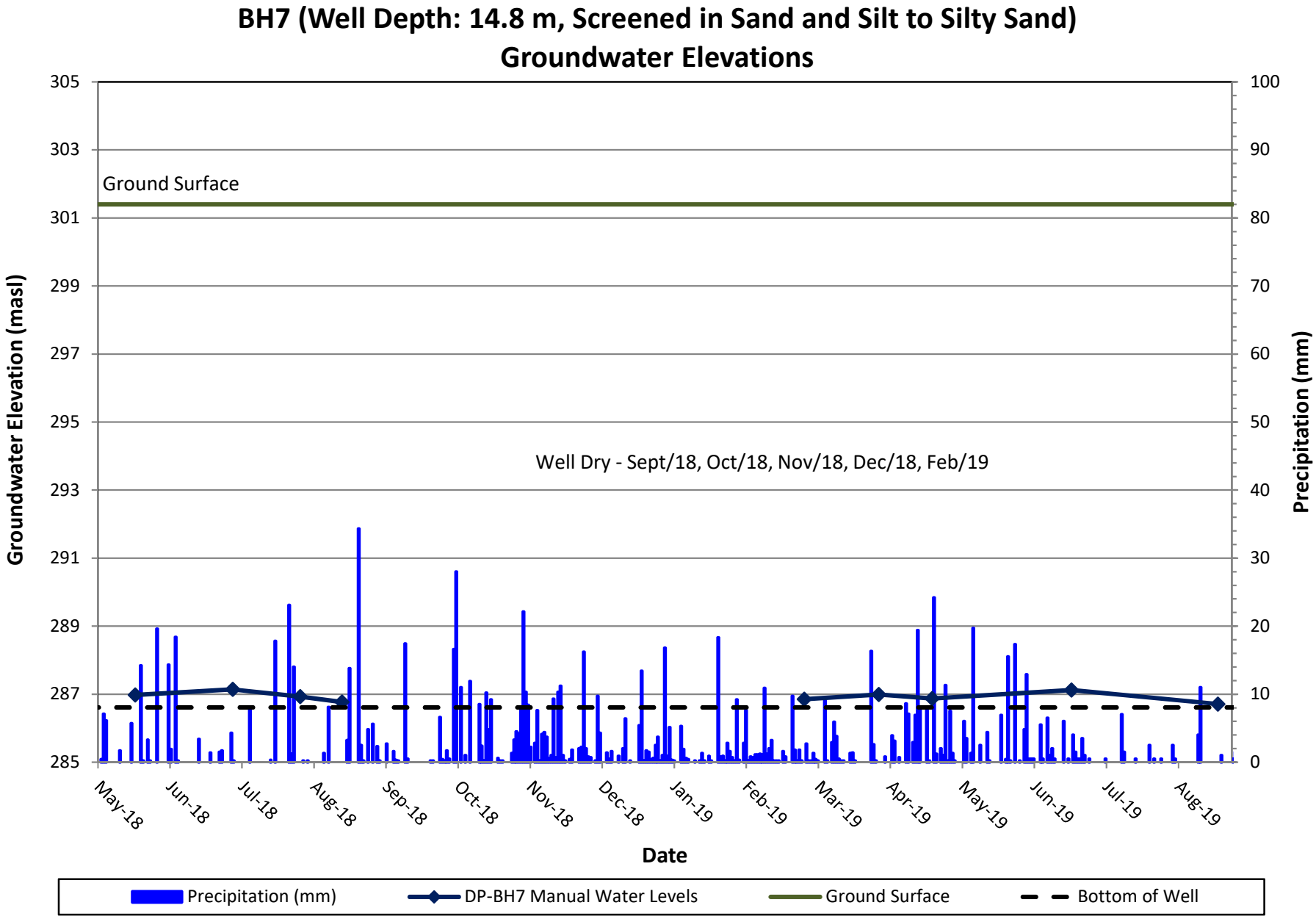
Notes

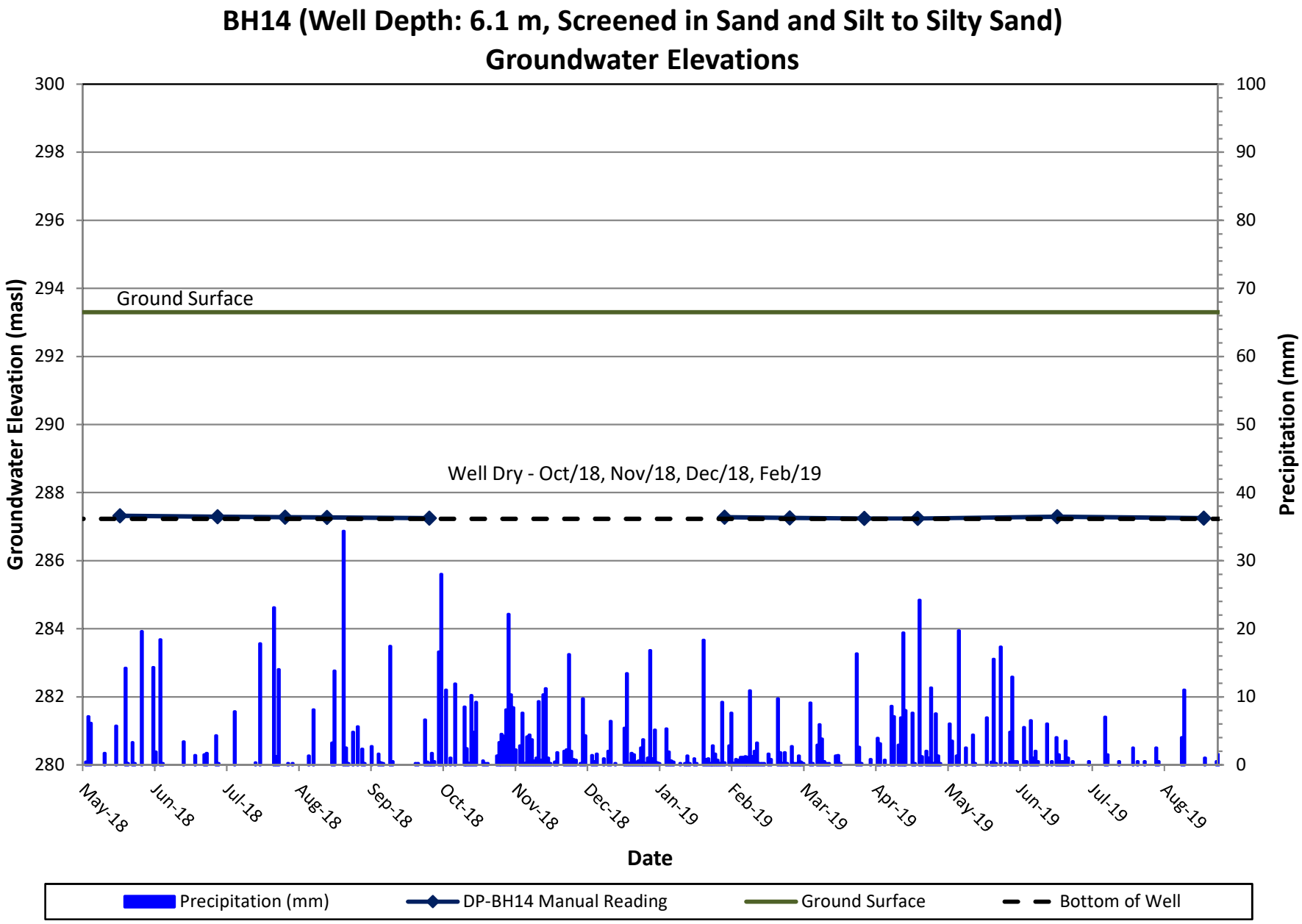
"-" denotes data unavailable

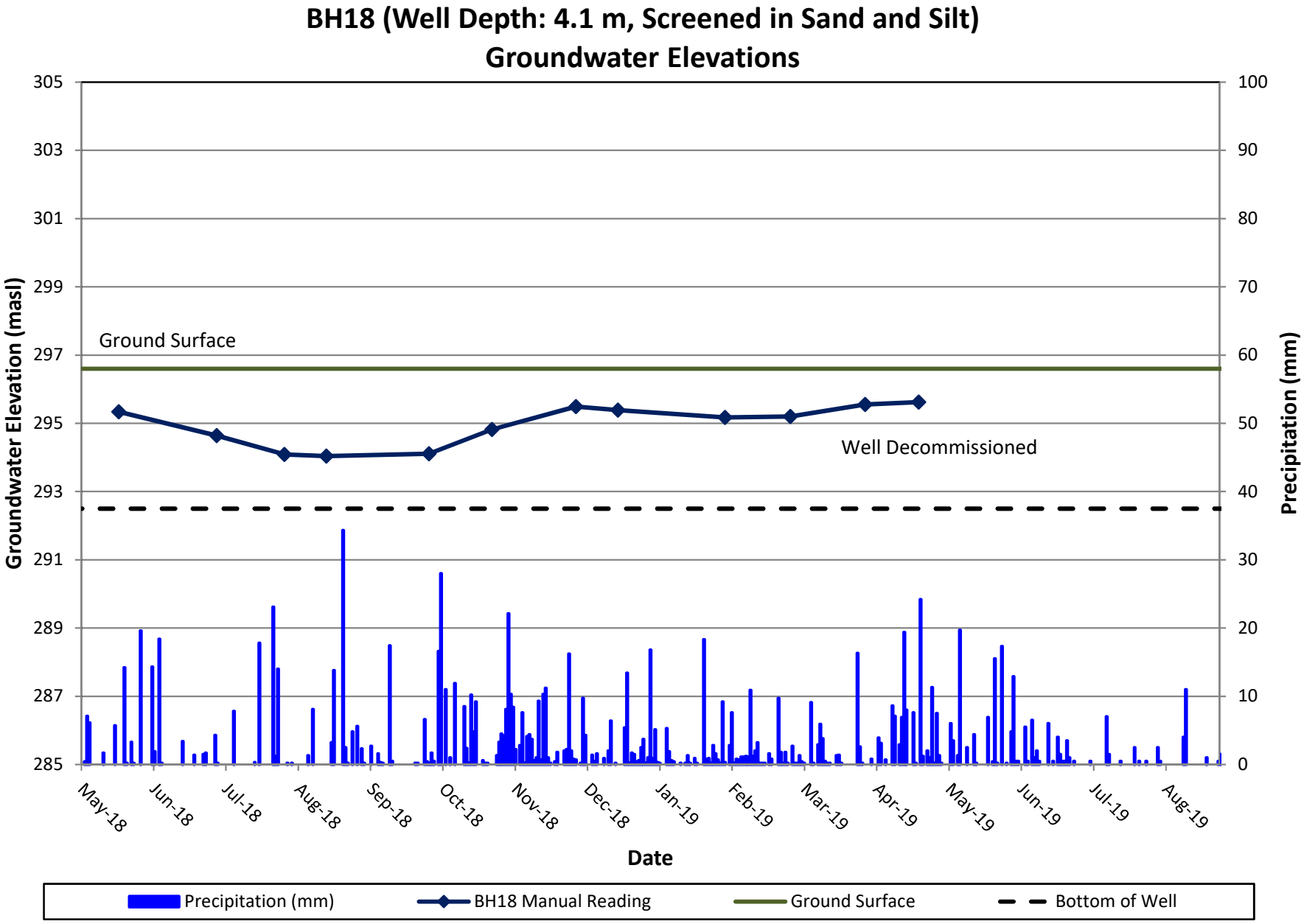
mbgs - meters below ground surface

masl - metres above sea level

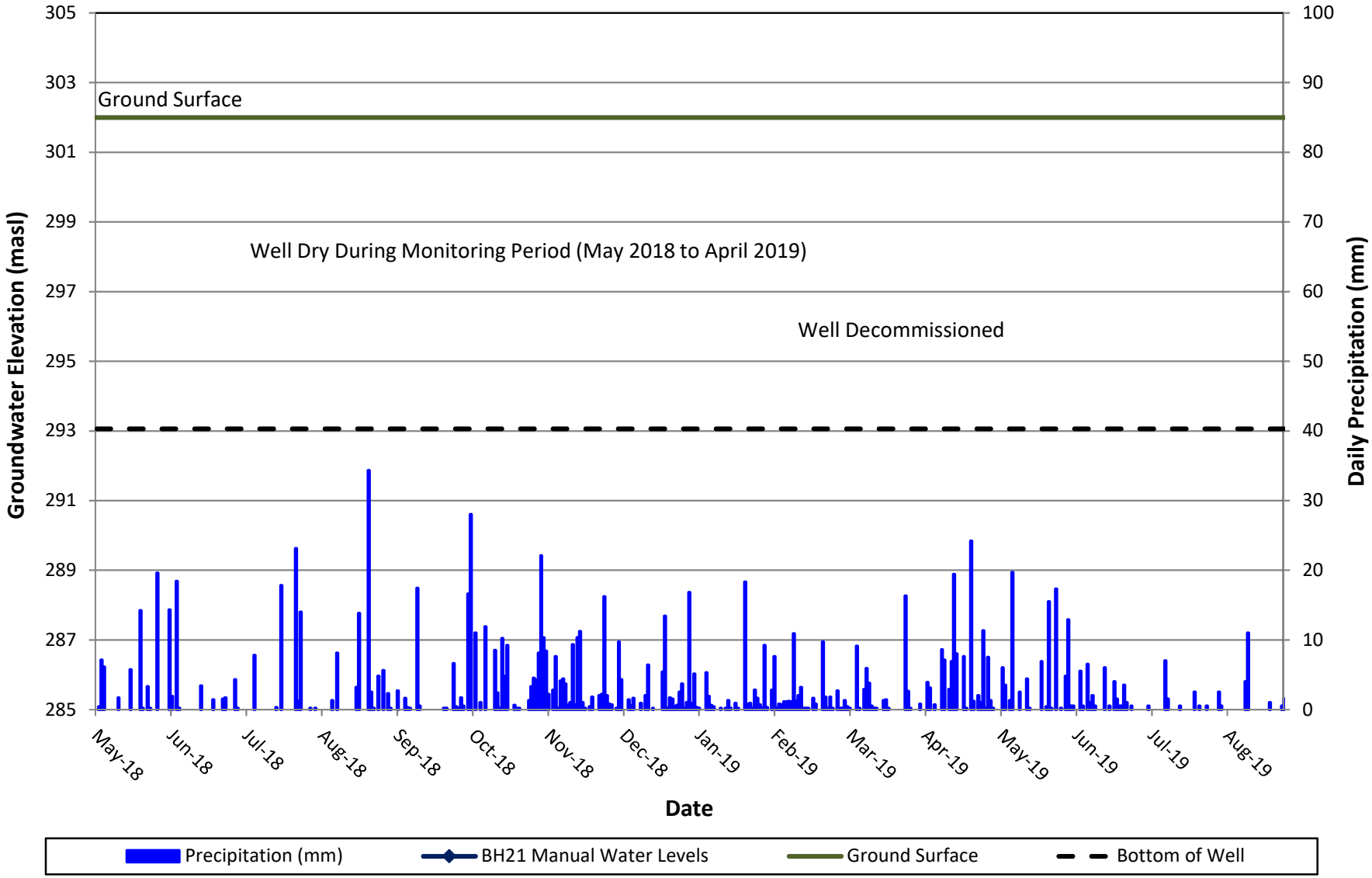
*** Ground elevations from geotechnical reports (GeoPro 2018, Terraprobe 2018)**

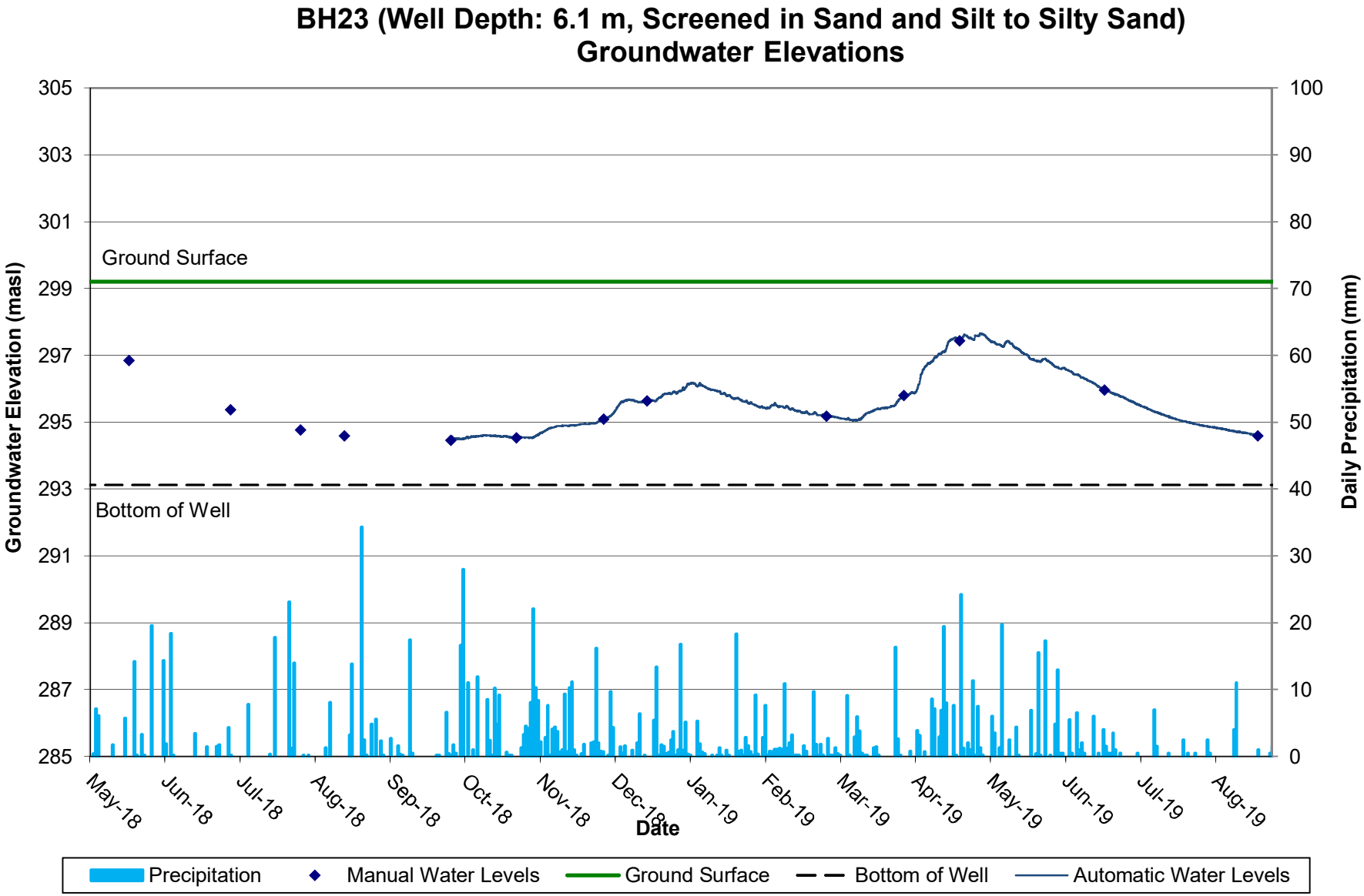

BH7 (Well Depth: 14.8 m, Screened in Sand and Silt to Silty Sand)
Groundwater Elevations
Ground Surface
Well Dry - Sept/18, Oct/18, Nov/18, Dec/18, Feb/19
Groundwater Elevation (masl)
Precipitation (mm)
Date
305
303
301
299
297
295
293
291
289
287
285
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation (mm)
DP-BH7 Manual Water Levels
Ground Surface
Bottom of Well

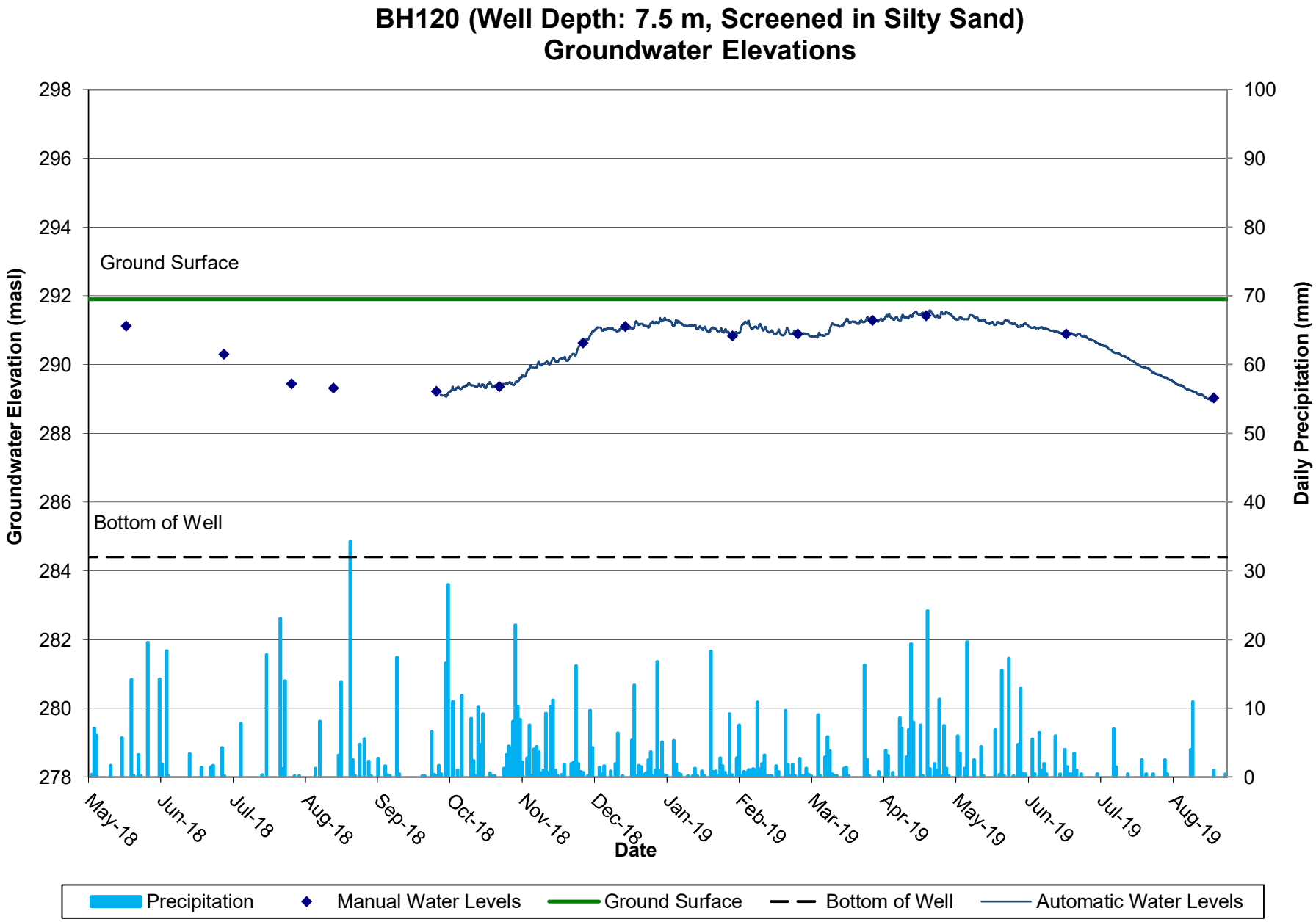

BH14 (Well Depth: 6.1 m, Screened in Sand and Silt to Silty Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Precipitation (mm)
Ground Surface
Well Dry - Oct/18, Nov/18, Dec/18, Feb/19
300
298
296
294
292
290
288
286
284
282
280
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
DP-BH14 Manual Reading
Ground Surface
Bottom of Well

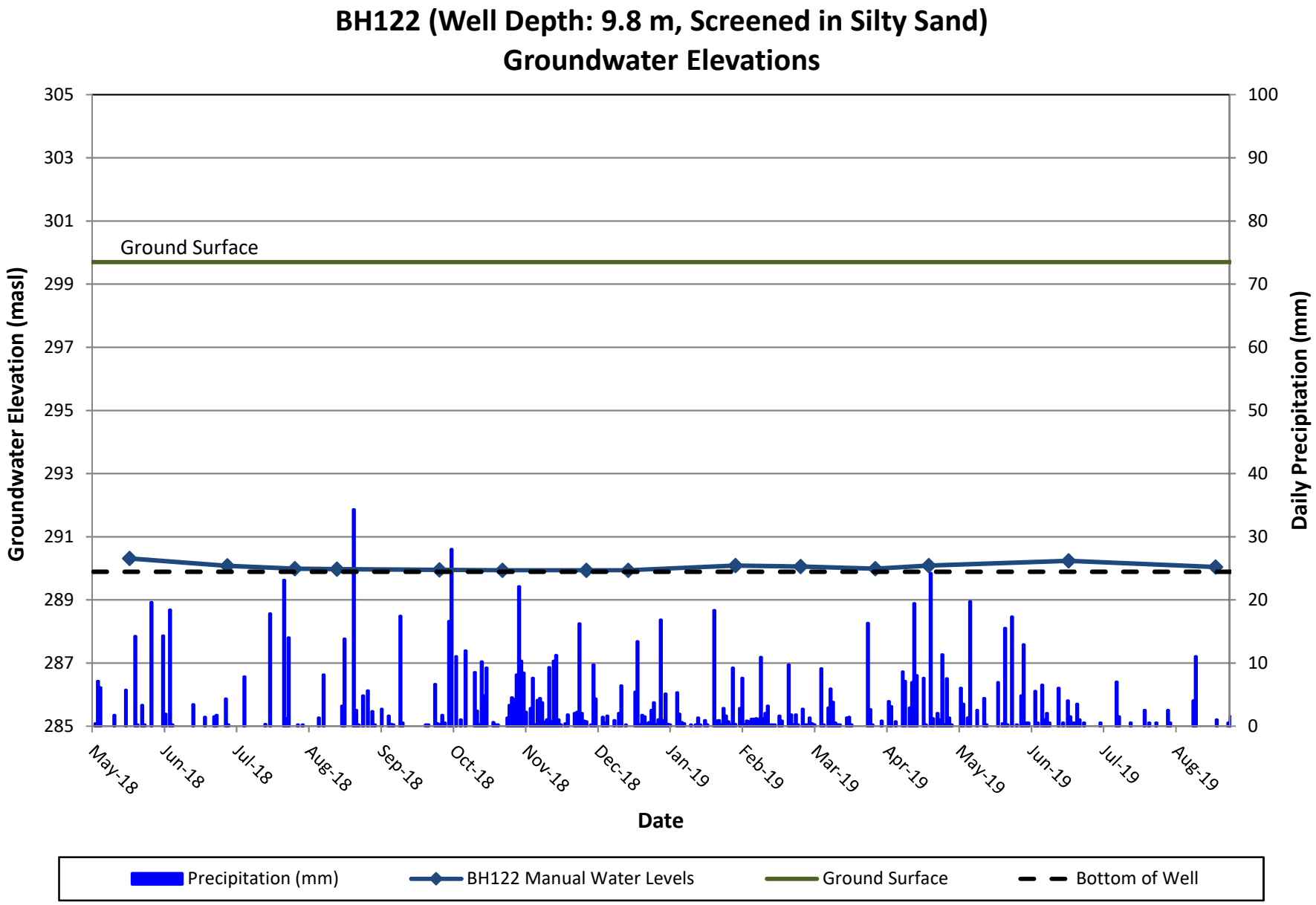

BH18 (Well Depth: 4.1 m, Screened in Sand and Silt)
Groundwater Elevations
Groundwater Elevation (masl)
Precipitation (mm)
Ground Surface
Well Decommissioned
305
303
301
299
297
295
293
291
289
287
285
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
BH18 Manual Reading
Ground Surface
Bottom of Well

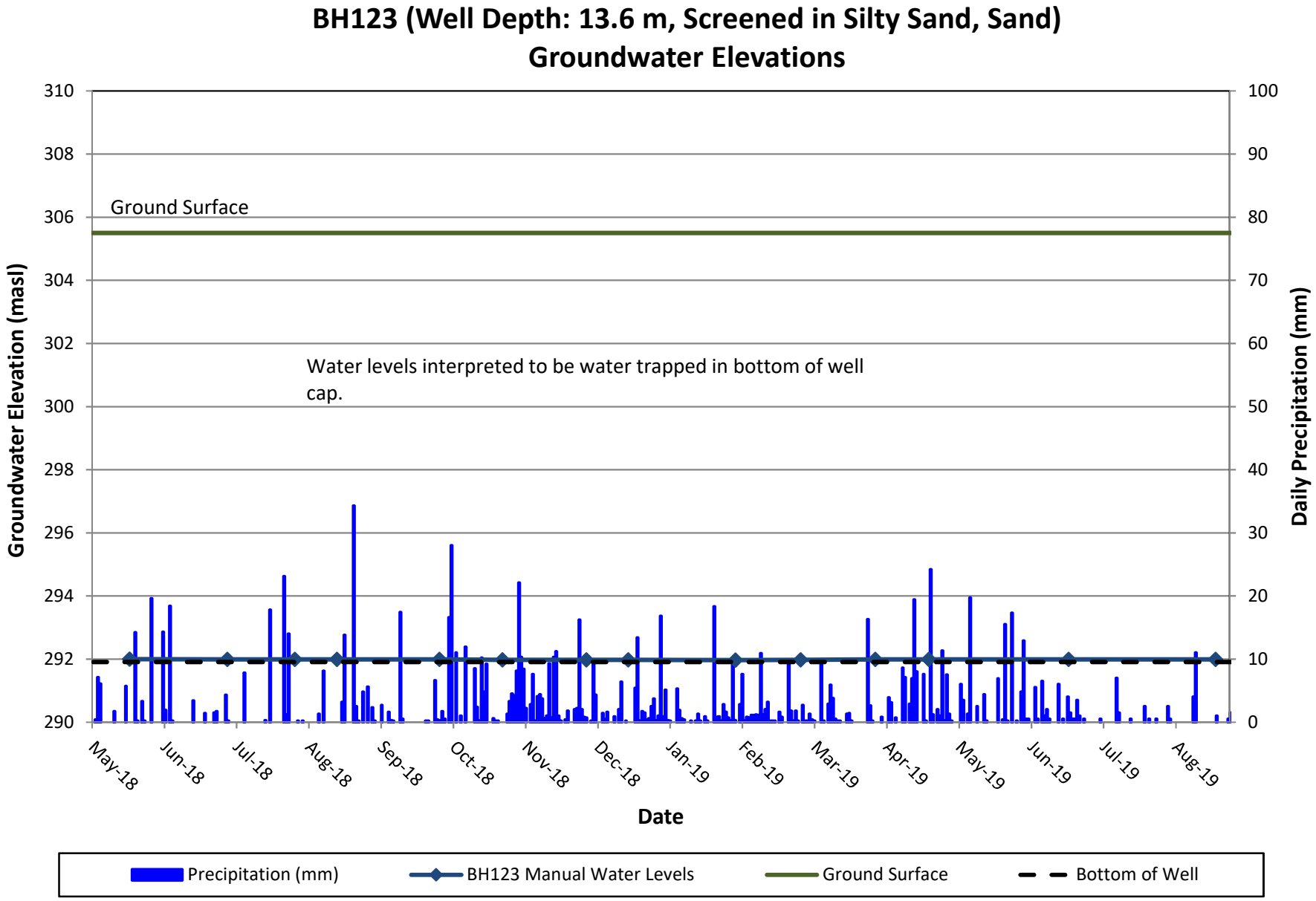
BH21 (Well Depth: 8.9 m, Screened in Sand and Silt to Silty Sand)
Groundwater Elevations




BH23 (Well Depth: 6.1 m, Screened in Sand and Silt to Silty Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Daily Precipitation (mm)
Ground Surface
Bottom of Well
305
303
301
299
297
295
293
291
289
287
285
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation
Manual Water Levels
Ground Surface
Bottom of Well
Automatic Water Levels


BH120 (Well Depth: 7.5 m, Screened in Silty Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Daily Precipitation (mm)
298
296
294
292
290
288
286
284
282
280
278
100
90
80
70
60
50
40
30
20
10
0
Ground Surface
Bottom of Well
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation
Manual Water Levels
Ground Surface
Bottom of Well
Automatic Water Levels


BH122 (Well Depth: 9.8 m, Screened in Silty Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Daily Precipitation (mm)
Ground Surface
305
303
301
299
297
295
293
291
289
287
285
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
BH122 Manual Water Levels
Ground Surface
Bottom of Well


BH123 (Well Depth: 13.6 m, Screened in Silty Sand, Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Daily Precipitation (mm)
Ground Surface
Water levels interpreted to be water trapped in bottom of well cap.
310
308
306
304
302
300
298
296
294
292
290
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
BH123 Manual Water Levels
Ground Surface
Bottom of Well

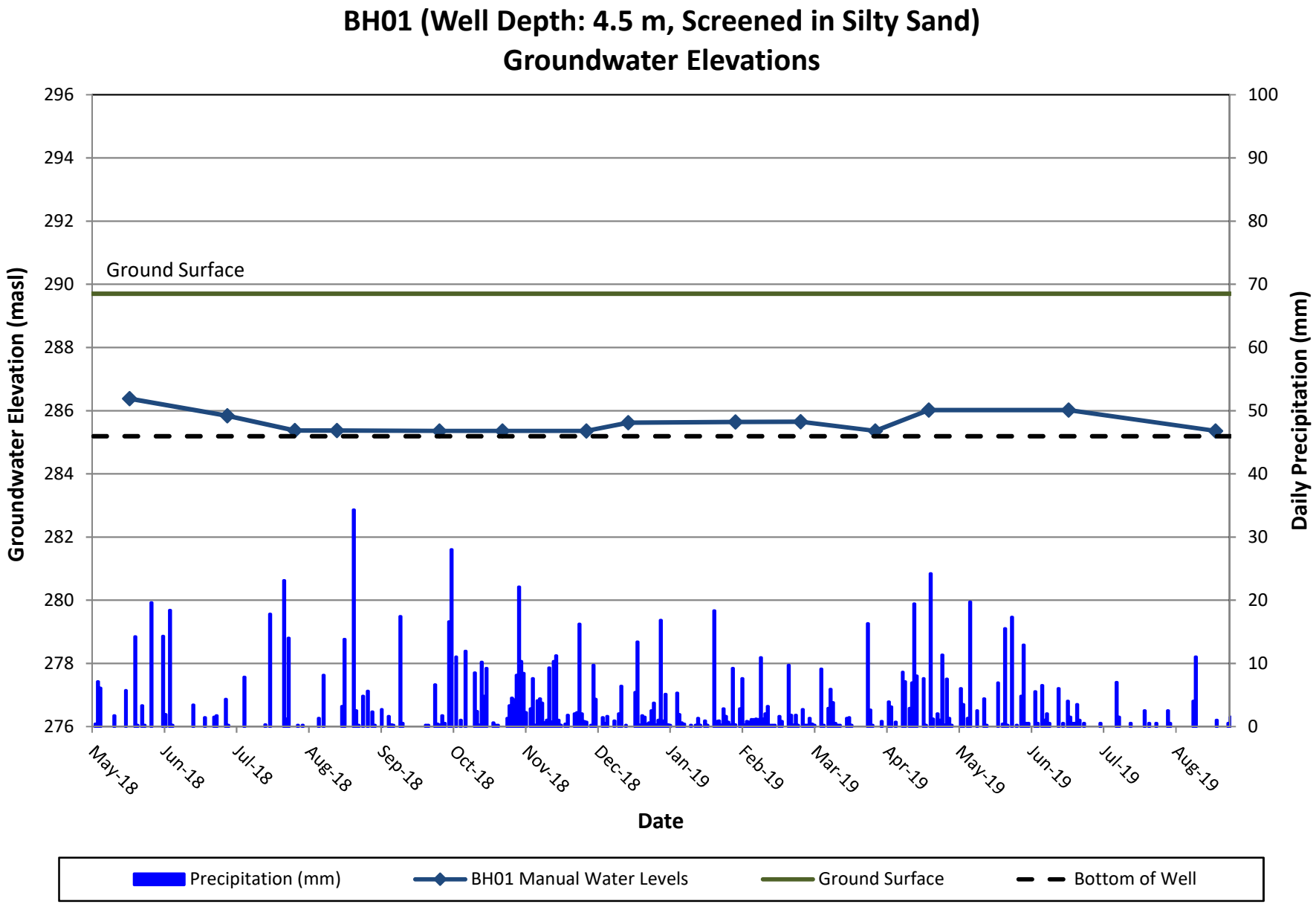
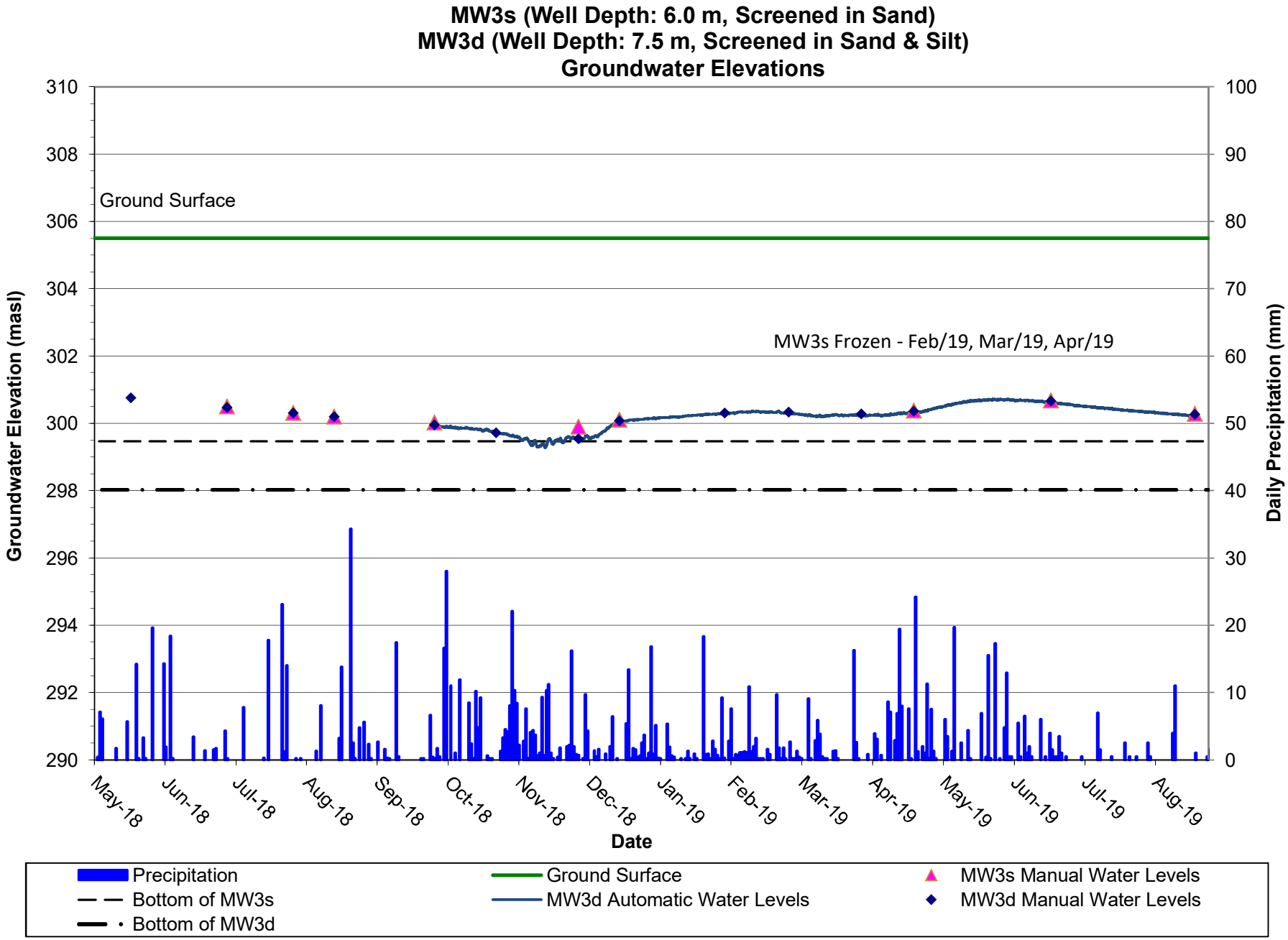
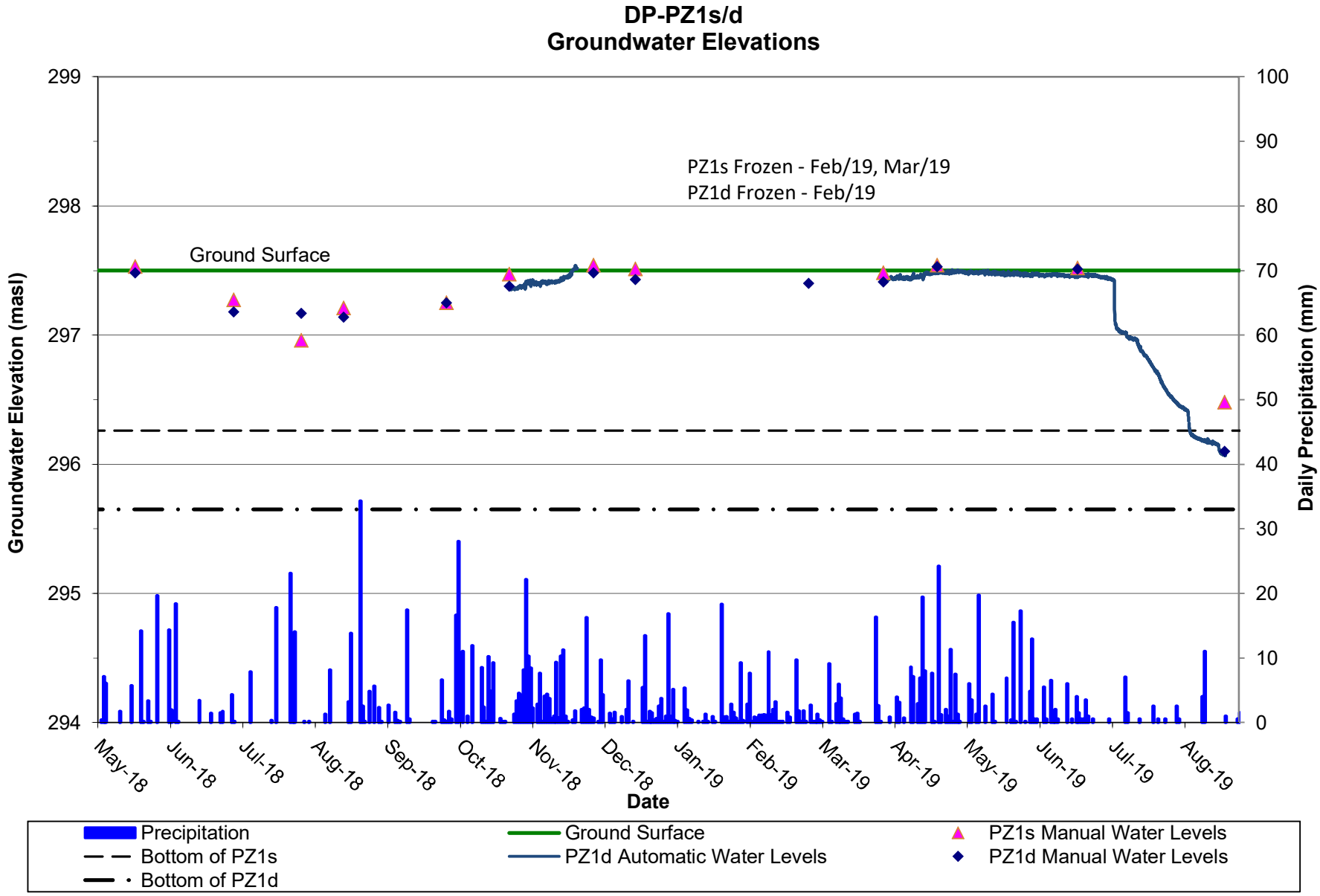

BH01 (Well Depth: 4.5 m, Screened in Silty Sand)
Groundwater Elevations
Groundwater Elevation (masl)
Daily Precipitation (mm)
Ground Surface
296
294
292
290
288
286
284
282
280
278
276
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
BH01 Manual Water Levels
Ground Surface
Bottom of Well

Figure D-9


MW3s (Well Depth: 6.0 m, Screened in Sand)
MW3d (Well Depth: 7.5 m, Screened in Sand & Silt)
Groundwater Elevations
Ground Surface
MW3s Frozen - Feb/19, Mar/19, Apr/19
Groundwater Elevation (masl)
Daily Precipitation (mm)
Date
310
308
306
304
302
300
298
296
294
292
290
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation
Ground Surface
MW3s Manual Water Levels
Bottom of MW3s
MW3d Automatic Water Levels
MW3d Manual Water Levels
Bottom of MW3d


DP-PZ1s/d
Groundwater Elevations
PZ1s Frozen - Feb/19, Mar/19
PZ1d Frozen - Feb/19
Ground Surface
Groundwater Elevation (masl)
Daily Precipitation (mm)
Date
299
298
297
296
295
294
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation
Ground Surface
PZ1s Manual Water Levels
Bottom of PZ1s
PZ1d Automatic Water Levels
PZ1d Manual Water Levels
Bottom of PZ1d

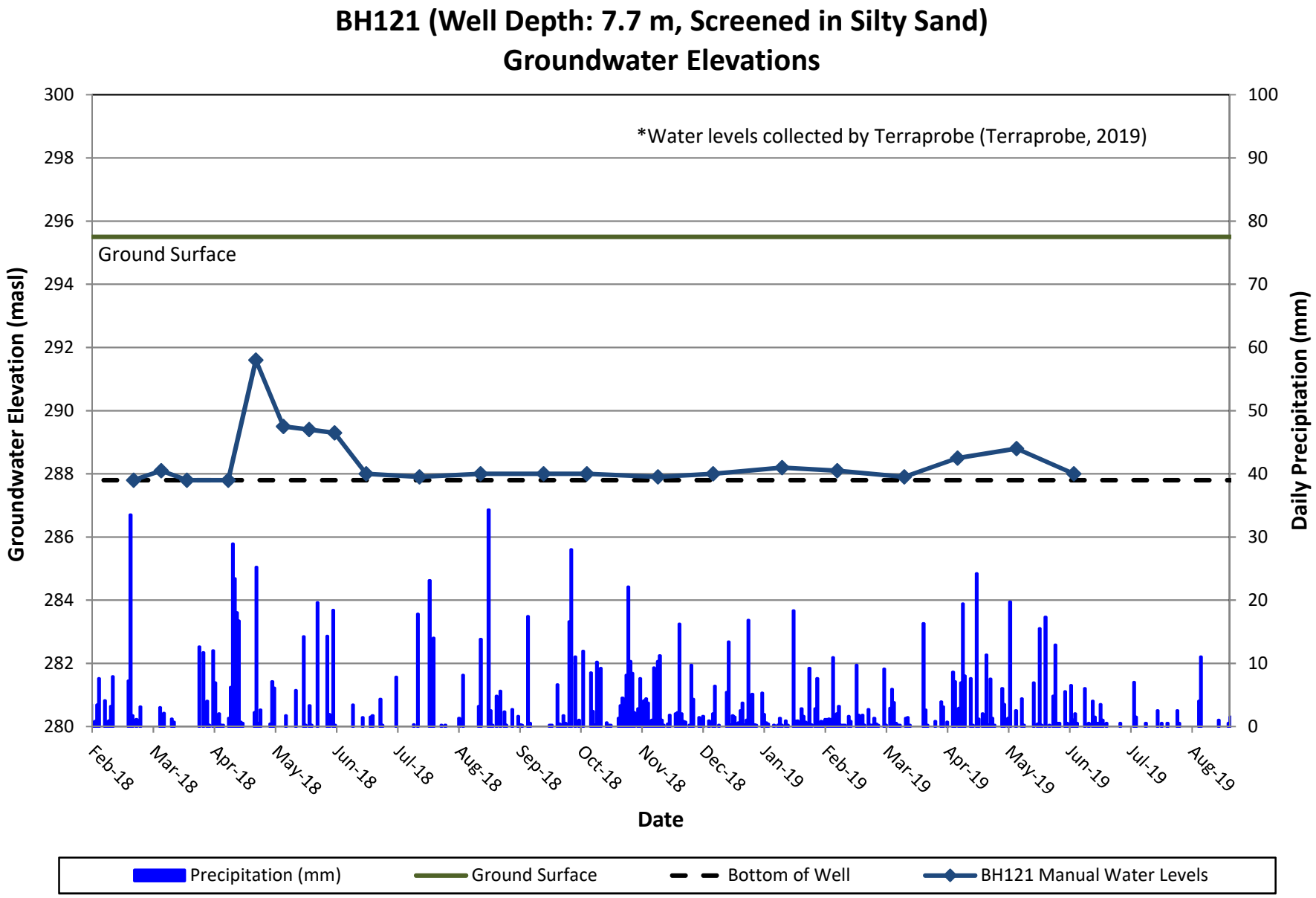

BH121 (Well Depth: 7.7 m, Screened in Silty Sand)
Groundwater Elevations
*Water levels collected by Terraprobe (Terraprobe, 2019)
Ground Surface
Groundwater Elevation (masl)
Daily Precipitation (mm)
300
298
296
294
292
290
288
286
284
282
280
100
90
80
70
60
50
40
30
20
10
0
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Date
Precipitation (mm)
Ground Surface
Bottom of Well
BH121 Manual Water Levels

Figure D-12

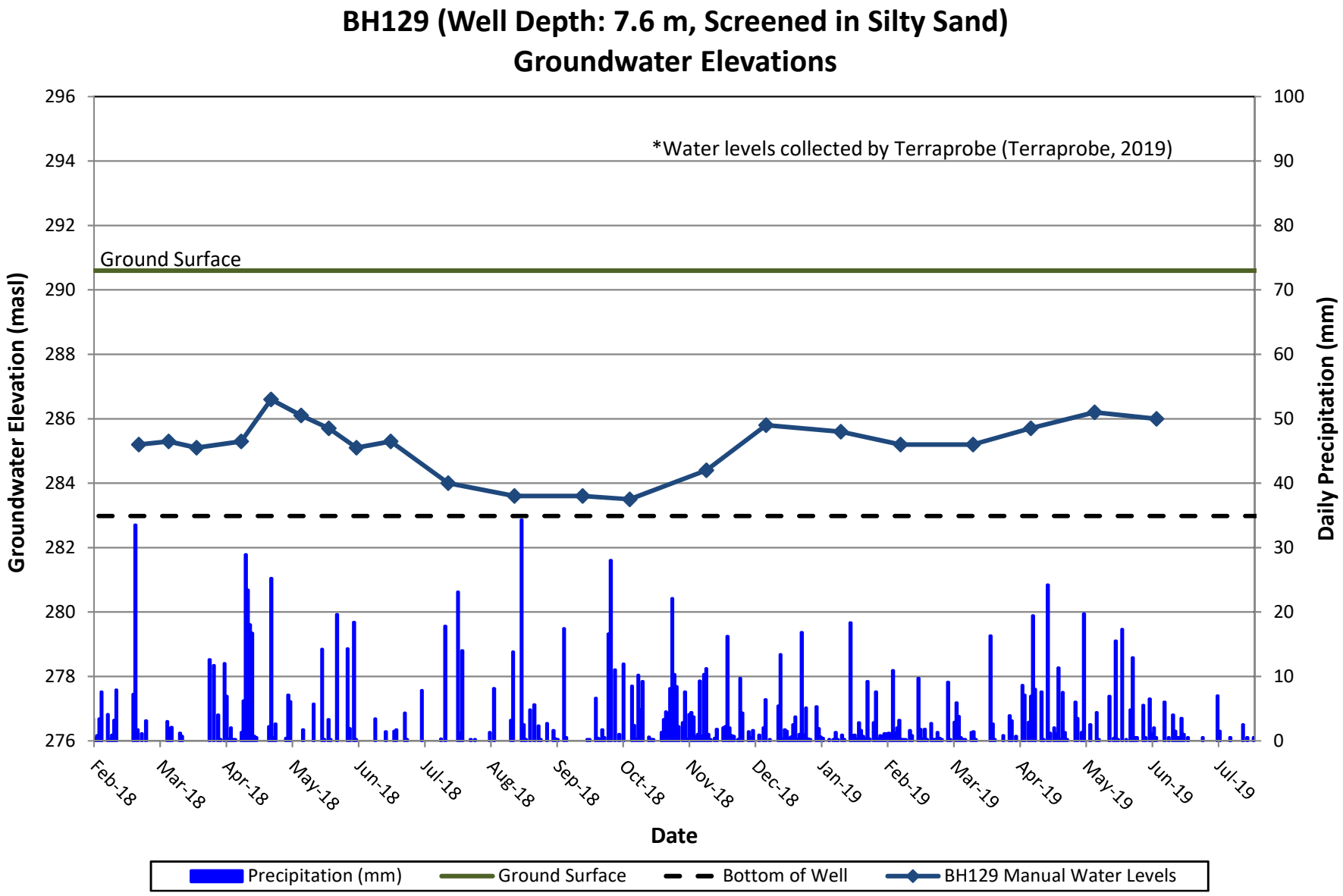
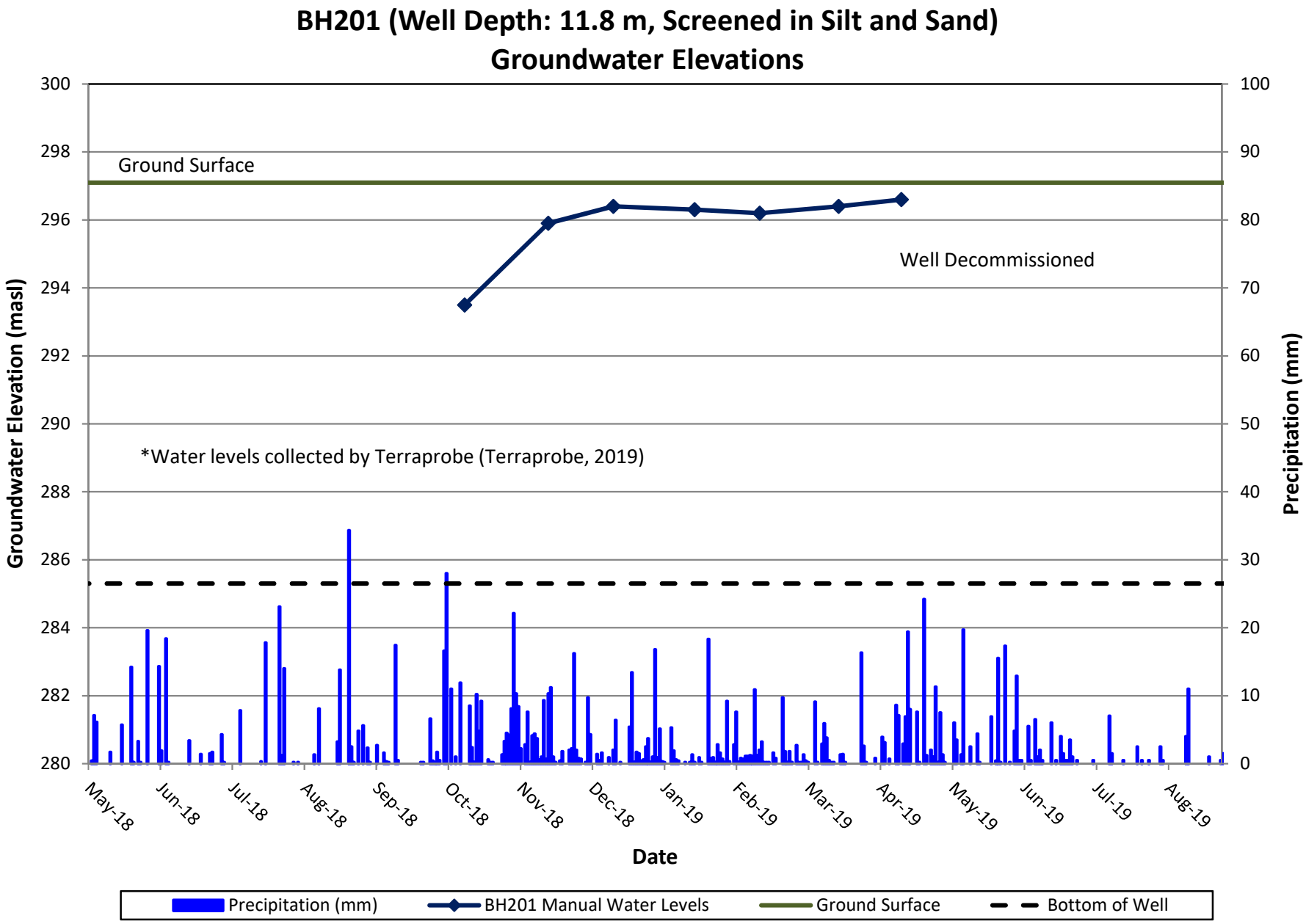
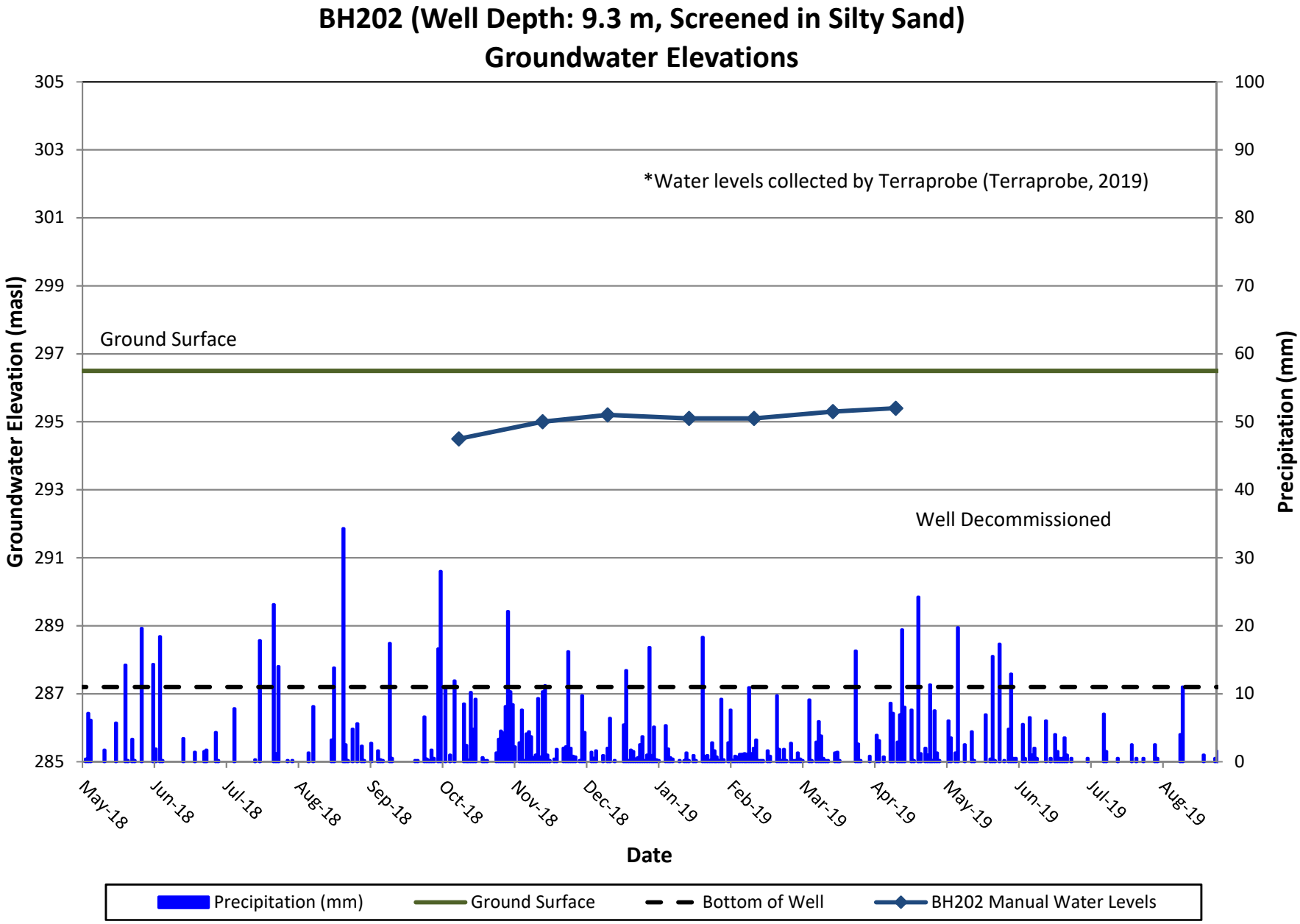
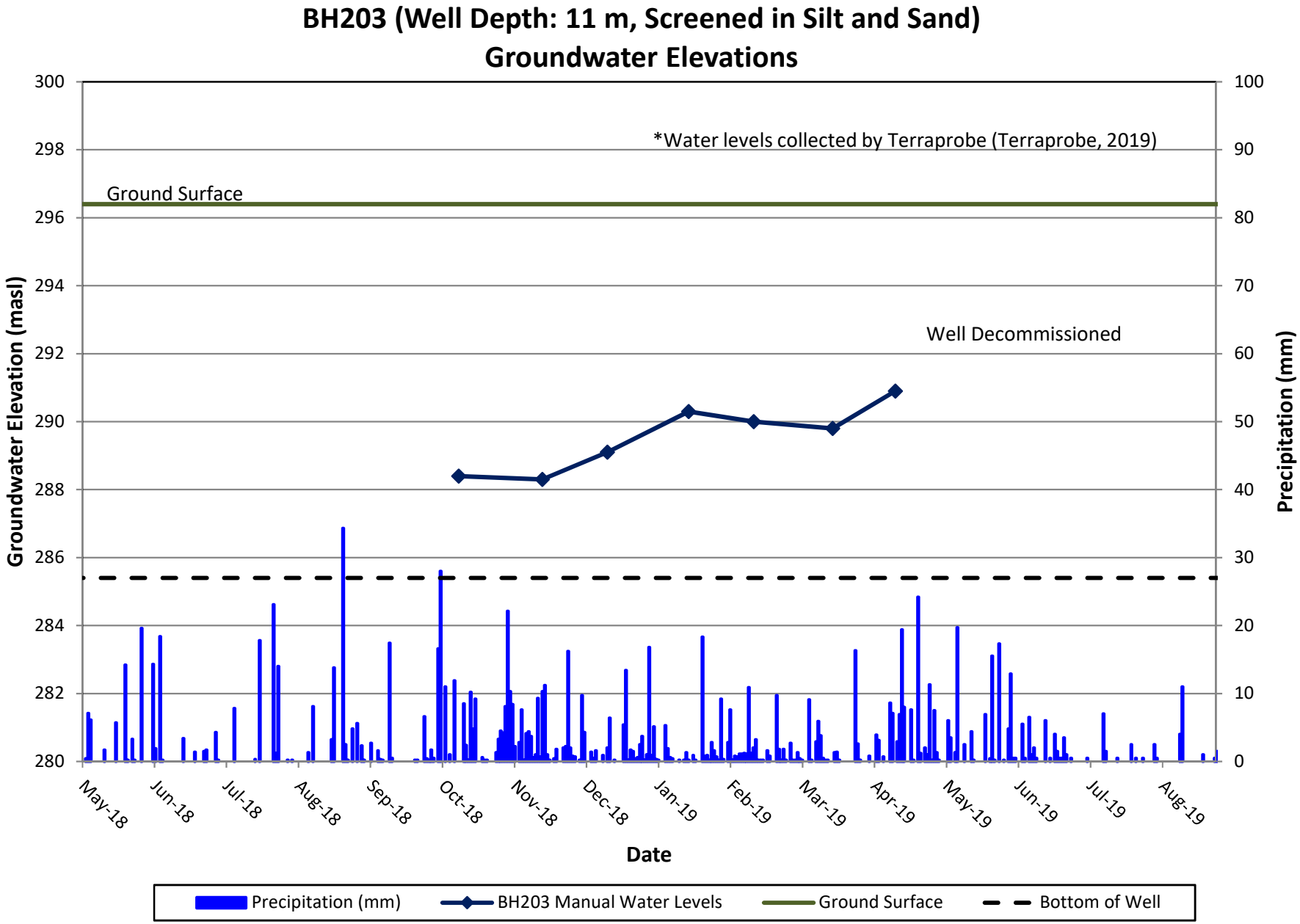

BH129 (Well Depth: 7.6 m, Screened in Silty Sand)
Groundwater Elevations
*Water levels collected by Terraprobe (Terraprobe, 2019)
Ground Surface
Groundwater Elevation (masl)
Daily Precipitation (mm)
296
294
292
290
288
286
284
282
280
278
276
100
90
80
70
60
50
40
30
20
10
0
Feb-18
Mar-18
Apr-18
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Date
Precipitation (mm)
Ground Surface
Bottom of Well
BH129 Manual Water Levels

Figure D-13


BH201 (Well Depth: 11.8 m, Screened in Silt and Sand)
Groundwater Elevations
Ground Surface
Well Decommissioned
*Water levels collected by Terraprobe (Terraprobe, 2019)
Groundwater Elevation (masl)
Precipitation (mm)
Date
300
298
296
294
292
290
288
286
284
282
280
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation (mm)
BH201 Manual Water Levels
Ground Surface
Bottom of Well


BH202 (Well Depth: 9.3 m, Screened in Silty Sand)
Groundwater Elevations
*Water levels collected by Terraprobe (Terraprobe, 2019)
Ground Surface
Well Decommissioned
Groundwater Elevation (masl)
Precipitation (mm)
Date
305
303
301
299
297
295
293
291
289
287
285
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation (mm)
Ground Surface
Bottom of Well
BH202 Manual Water Levels


BH203 (Well Depth: 11 m, Screened in Silt and Sand)
Groundwater Elevations
*Water levels collected by Terraprobe (Terraprobe, 2019)
Ground Surface
Well Decommissioned
Groundwater Elevation (masl)
Precipitation (mm)
Date
300
298
296
294
292
290
288
286
284
282
280
100
90
80
70
60
50
40
30
20
10
0
May-18
Jun-18
Jul-18
Aug-18
Sep-18
Oct-18
Nov-18
Dec-18
Jan-19
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
Precipitation (mm)
BH203 Manual Water Levels
Ground Surface
Bottom of Well

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Appendix E

Surface Water Monitoring Data

Table E-1
Surface Water Flow

Date	Days since rain:	Flow Rate (L/s)	
		SSF-7	SSF-8
17-May-18	2	<0.5	<0.5
28-Jun-18	0	Dry	Dry
27-Jul-18	3	Dry	Dry
14-Aug-18	6	Dry	Dry
27-Sep-18	0	Dry	Dry
24-Oct-18	1	<0.5	1
29-Nov-18	0	Snow Covered	Snow Covered
17-Dec-18	1	Snow Covered	Partially Frozen
1-Feb-19	0	Snow Covered	Snow Covered
1-Mar-19	1	Snow Covered	Snow Covered
2-Apr-19	1	Snow Covered	Partially Frozen
25-Apr-19	1	2.5	8.6
24-Jun-19		Minimal Flow	Minimal Flow

Notes:
"<0.5" minimal flow not measurable with equipment (estimated)
"-" not measured

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Appendix F

Water Quality Data

Table F-1
Groundwater Quality

Monitoring Well				**MW3d**	**BH120**
Date Sampled				**27-Sep-18**	**28-Sep-18**
Parameter	**Unit**	**RDL**	**ODWQS**		
Electrical Conductivity	µS/cm	2		269	2280
pH	pH Units	NA	(6.5-8.5)	7.85	7.68
Saturation pH				7.53	6.65
Langelier Index				0.32	1.03
Total Hardness (as CaCO3)	mg/L	0.5	(80-100)	136	447
Total Dissolved Solids	mg/L	20	500	156	1320
Alkalinity (as CaCO3)	mg/L	5	(30-500)	148	402
Bicarbonate (as CaCO3)	mg/L	5		148	402
Carbonate (as CaCO3)	mg/L	5		<5	<5
Hydroxide (as CaCO3)	mg/L	5		<5	<5
Fluoride	mg/L	0.05	1.5	<0.05	<0.5
Chloride	mg/L	0.10	250	1.00	654
Nitrate as N	mg/L	0.05	10.0	1.41	1.5
Nitrite as N	mg/L	0.05	1.0	<0.05	<0.5
Bromide	mg/L	0.05		<0.05	<0.5
Sulphate	mg/L	0.10	500	2.28	34.9
Ortho Phosphate as P	mg/L	0.10		<0.10	<1.0
Reactive Silica	mg/L	0.05		4.88	14.4
Ammonia as N	mg/L	0.02		<0.02	<0.02
Total Phosphorus	mg/L	0.02		<0.02	<0.02
Total Organic Carbon	mg/L	0.5		1.7	2.4
Colour	TCU	5	5	<5	<5
Turbidity	NTU	0.5	5	213	384
Calcium	mg/L	0.05		49.4	150
Magnesium	mg/L	0.05		3.09	17.7
Sodium	mg/L	0.05	20 (200)	1.20	**298**
Potassium	mg/L	0.05		0.60	2.05
Aluminum	mg/L	0.004	0.1	0.007	0.013
Antimony	mg/L	0.003	0.006	<0.003	<0.003
Arsenic	mg/L	0.003	0.025	<0.003	<0.003
Barium	mg/L	0.002	1	0.010	0.091
Beryllium	mg/L	0.001		<0.001	<0.001
Boron	mg/L	0.010	5	<0.010	0.025
Cadmium	mg/L	0.001	0.005	<0.001	<0.001
Chromium	mg/L	0.003	0.05	<0.003	<0.003
Cobalt	mg/L	0.001		<0.001	<0.001
Copper	mg/L	0.003	1	<0.003	0.004
Iron	mg/L	0.010	0.3	<0.010	<0.010
Lead	mg/L	0.001	0.01	<0.001	<0.001
Manganese	mg/L	0.002	0.05	<0.002	0.017
Mercury	mg/L	0.0001	0.001	<0.0001	<0.0001
Molybdenum	mg/L	0.002		<0.002	<0.002
Nickel	mg/L	0.003		<0.003	<0.003
Selenium	mg/L	0.004	0.01	<0.004	<0.004
Silver	mg/L	0.002		<0.002	<0.002
Strontium	mg/L	0.005		0.082	0.422
Thallium	mg/L	0.006		<0.006	<0.006
Tin	mg/L	0.002		<0.002	<0.002
Titanium	mg/L	0.002		<0.002	<0.002
Tungsten	mg/L	0.010		<0.010	<0.010
Uranium	mg/L	0.002	0.02	<0.002	<0.002
Vanadium	mg/L	0.002	3	<0.002	<0.002
Zinc	mg/L	0.005	5	0.005	0.020
Zirconium	mg/L	0.004		<0.004	<0.004
% Difference/ Ion Balance	%	NA		5.83	10.9

ODWQS - Ontario Drinking Water Quality Standards
RDL - Reported Detection Limit
Bold indicates an exceedence of the ODWQS

Table F-2
Surface Water Quality

Monitoring Well				**SSF-7**
Date Sampled				**6-May-19**
Parameter	**Unit**	**RDL**	**PWQO**	
Electrical Conductivity	µS/cm	2		917
pH	pH Units	NA	(6.5-8.5)	7.86
Saturation pH				7.13
Langelier Index				0.73
Total Hardness (as CaCO3)	mg/L	0.5		218
Total Dissolved Solids	mg/L	20		486
Total Suspended Solids	mg/L	10		<10
Alkalinity (as CaCO3)	mg/L	5		244
Bicarbonate (as CaCO3)	mg/L	5		244
Carbonate (as CaCO3)	mg/L	5		<5
Hydroxide (as CaCO3)	mg/L	5		<5
Fluoride	mg/L	0.25		<0.25
Chloride	mg/L	0.50		161
Nitrate as N	mg/L	0.25		<0.25
Nitrite as N	mg/L	0.25		<0.25
Bromide	mg/L	0.25		<0.25
Sulphate	mg/L	0.50		12.8
Ortho Phosphate as P	mg/L	0.50		<0.50
Ammonia as N	mg/L	0.02		<0.02
Total Phosphorus	mg/L	0.01	0.03	<0.01
Total Organic Carbon	mg/L	0.5		5.8
Colour	TCU	5		<5
Turbidity	NTU	0.5		0.9
Calcium	mg/L	0.05		78.7
Magnesium	mg/L	0.05		5.3
Sodium	mg/L	0.05		92.2
Potassium	mg/L	0.05		2.92
Aluminum	mg/L	0.004	0.075	<0.004
Antimony	mg/L	0.001		<0.001
Arsenic	mg/L	0.003	1	<0.003
Barium	mg/L	0.002		0.031
Beryllium	mg/L	0.0005		<0.0005
Boron	mg/L	0.010	2	0.011
Cadmium	mg/L	0.0001	0.0002	<0.0001
Chromium	mg/L	0.003	0.009	<0.003
Cobalt	mg/L	0.0005		<0.0005
Copper	mg/L	0.001	0.005	<0.001
Iron	mg/L	0.010	0.3	<0.010
Lead	mg/L	0.001	0.001	<0.001
Manganese	mg/L	0.002		0.018
Mercury	mg/L	0.0001	0.0002	<0.0001
Molybdenum	mg/L	0.002	0.04	<0.002
Nickel	mg/L	0.003	0.025	<0.003
Selenium	mg/L	0.004	0.01	<0.004
Silver	mg/L	0.0001	<0.002	<0.0001
Strontium	mg/L	0.005		0.220
Thallium	mg/L	0.0003	0.0003	<0.0003
Tin	mg/L	0.002		<0.002
Titanium	mg/L	0.002		<0.002
Tungsten	mg/L	0.010		<0.010
Uranium	mg/L	0.002	0.005	<0.002
Vanadium	mg/L	0.002		<0.002
Zinc	mg/L	0.005	0.03	<0.005
Zirconium	mg/L	0.004		<0.004

RDL - Reported Detection Limit
PWQS - Provincial Water Quality Standards
Bold indicates an exceedence of the PWQS

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Appendix G

Water Balance Calculations

WATER BALANCE CALCULATIONS
DiPoce Management Inc.
Barrie, ON

PROJECT No.300041886

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TABLE G-1

Water Balance Components

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 150 mm (moderate rooted crops in sandy loam soils)

Precipitation data from Barrie WPCC Climate Station (1981 - 2010)

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
WATER BALANCE COMPONENTS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	**0**
Soil Moisture Storage max 150 mm	150	150	150	150	150	121	64	37	53	92	150	150	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
Soil Moisture Deficit max 150 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	**340**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	58	43	41	24	5	0	0	0	0	0	16	52	**238**
Potential Direct Surface Water Runoff (independent of temperature)	25	19	17	10	2	0	0	0	0	0	7	22	**102**
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage
Soil Moisture Storage 150 mm <-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003

*MOE SWM infiltration calculations
topography - rolling to hilly land 0.2 <-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
soils - sandy loam 0.4 <-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
cover - predominantly cultivated land 0.1 <-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
Infiltration factor **0.7**

Latitude of site (or climate station) 44 ° N.

WATER BALANCE CALCULATIONS
DiPoce Management Inc.
Barrie, ON

PROJECT No.300041886

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TABLE G-2

Water Balance Components

Based on Thornthwaite's Soil Moisture Balance Approach with a Soil Moisture Retention of 300 mm (wooded areas in sandy loam soils)

Precipitation data from Barrie WPCC Climate Station (1981 - 2010)

Potential Evapotranspiration Calculation	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Average Temperature (Degree C)	-7.7	-6.6	-2.1	5.6	12.3	17.9	20.8	19.7	15.3	8.7	2.7	-3.5	**6.9**
Heat index: $i = (t/5)^{1.514}$	0.00	0.00	0.00	1.19	3.91	6.90	8.66	7.97	5.44	2.31	0.39	0.00	**36.8**
Unadjusted Daily Potential Evapotranspiration U (mm)	0.00	0.00	0.00	25.18	58.76	88.02	103.48	97.59	74.33	40.47	11.47	0.00	**499**
Adjusting Factor for U (Latitude 44° 20' N)	0.81	0.82	1.02	1.13	1.27	1.29	1.3	1.2	1.04	0.95	0.8	0.76	
Adjusted Potential Evapotranspiration PET (mm)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
WATER BALANCE COMPONENTS	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**	**NOV**	**DEC**	**YEAR**
Precipitation (P)	83	62	58	62	82	85	77	90	94	78	89	74	**933**
Potential Evapotranspiration (PET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
P - PET	83	62	58	34	8	-29	-57	-27	17	39	80	74	**340**
Change in Soil Moisture Storage	0	0	0	0	0	-29	-57	-27	17	39	58	0	**0**
Soil Moisture Storage max 300 mm	300	300	300	300	300	271	214	187	203	242	300	300	
Actual Evapotranspiration (AET)	0	0	0	28	75	114	135	117	77	38	9	0	**593**
Soil Moisture Deficit max 300 mm	0	0	0	0	0	29	86	113	97	58	0	0	
Water Surplus - available for infiltration or runoff	83	62	58	34	8	0	0	0	0	0	22	74	**340**
Potential Infiltration (based on MOE metholodogy*; independent of temperature)	66	49	46	27	6	0	0	0	0	0	18	59	**272**
Potential Direct Surface Water Runoff (independent of temperature)	17	12	12	7	2	0	0	0	0	0	4	15	**68**
IMPERVIOUS AREA WATER SURPLUS													
Precipitation (P)	933	mm/year											
Potential Evaporation (PE) from impervious areas (assume 15%)	140	mm/year											
P-PE (surplus available for runoff from impervious areas)	793	mm/year											

Assume January storage is 100% of Soil Moisture Storage
Soil Moisture Storage 300 mm <-- See "Water Holding Capacity" values in Table 3.1, MOE SWMPDM, 2003

*MOE SWM infiltration calculations

topography - rolling to hilly land	0.2	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
soils - sandy loam	0.4	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
cover - woodlands	0.2	<-- Infiltration Factors from the bottom section of Table 3.1, MOE SWMPDM, 2003
Infiltration factor	**0.8**	

Latitude of site (or climate station) 44 ° N.

WATER BALANCE CALCULATIONS
DiPoce Management Inc.
Barrie, ON

PROJECT No.300041886

BURNSIDE

TABLE G-3

Water Balance for Pre- and Post-Development Land Use Conditions (with no SWM/LID measures in place)

Land Use Description	Approx. Land Area* (m^2)	Estimated Impervious Fraction for Land Use*	Estimated Impervious Area (m^2)	Runoff from Impervious Area** (m/a)	Runoff Volume from Impervious Area (m^3/a)	Estimated Pervious Area (m^2)	Runoff from Pervious Area** (m/a)	Runoff Volume from Pervious Area (m^3/a)	Infiltration from Pervious Area** (m/a)	Infiltration Volume from Pervious Area (m^3/a)	Total Runoff Volume (m^3/a)	Total Infiltration Volume (m^3/a)
Exising Land Use												
Mixed Forest	33,700	0.00	0	0.793	0	33,700	0.068	2,290	0.272	9,159	2,290	9,159
Wetlands	40,500	1.00	40,500	0.793	32,115	0	0.068	0	0.272	0	32,115	0
Agricultural	184,000	0.00	0	0.793	0	184,000	0.102	18,752	0.238	43,755	18,752	43,755
TOTAL PRE-DEVELOPMENT	**258,200**		**40,500**		**32,115**	**217,700**		**21,042**		**52,914**	**53,157**	**52,914**
Post-Development Land Use (with no LID measures in place)												
Residential (Medium Density)	28,800	0.75	21,600	0.793	17,128	7,200	0.102	734	0.238	1,712	17,862	1,712
Residential (Townhouse)	49,800	0.69	34,362	0.793	27,248	15,438	0.102	1,573	0.238	3,671	28,821	3,671
Commercial	2,700	0.71	1,917	0.793	1,520	783	0.102	80	0.238	186	1,600	186
School	22,000	0.71	15,620	0.793	12,386	6,380	0.102	650	0.238	1,517	13,036	1,517
Stormwater Management Area	12,500	0.50	6,250	0.793	4,956	6,250	0.102	637	0.238	1,486	5,593	1,486
Park	24,700	0.07	1,729	0.793	1,371	22,971	0.102	2,341	0.238	5,463	3,712	5,463
Pipeline	9,000	0.00	0	0.793	0	9,000	0.102	917	0.238	2,140	917	2,140
Open Space	34,654	0.00	0	0.793	0	34,654	0.068	2,355	0.272	9,418	2,355	9,418
Wetlands	38,846	1.00	38,846	0.793	30,804	0	0.068	0	0.272	0	30,804	0
Walkway	800	1.00	800	0.793	634	0	0.102	0	0.238	0	634	0
Drainage	800	0.00	0	0.793	0	800	0.102	82	0.238	190	82	190
Right of Way	33,600	0.75	25,200	0.793	19,983	8,400	0.102	856	0.238	1,998	20,839	1,998
TOTAL POST-DEVELOPMENT	**258,200**		**146,324**		**116,030**	**111,876**		**10,225**		**27,781**	**126,254**	**27,781**
									% Change from Pre to Post		238	47
									Effect of development (with no mitigation)		2.4 times increase in runoff	47% reduction of infiltration

* data provided by Schaeffers & Associates Ltd.

** figures from Tables G-1 and G-2

To balance pre- to post-,
the infiltration target (m^3/a)= **25,133**